Small-Scale

Grain Raising

By

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Introduction

This book is written for gardeners and country homesteaders interested in increasing both the quantity and quality of their homegrown food supply in the most reliable way: by growing and using whole grains. The book is not meant for the commercial grower. I would hope the commercial grower would find ideas he could use, especially if he is an organic farmer. But the methods I describe do not promise what agricultural experts have been calling "top profits," while millions of farmers were being forced off the land.

Rather, I intend this book for people who realize the danger of depending absolutely on politically motivated governmental processes for food, clothing, and shelter. In the world we must live in from now on, to produce our own food is the beginning of independence and to accept that responsibility is the first step toward real freedom.

Chapter 1

Homegrown Grains:

The Key to Food Security

I remember the first year we grew grains in our garden. A good gardening buddy dropped by one day early in July just when our wheat was ripe and ready to harvest. He didn't know that though. His reason for stopping was to show me two splendid, juicy tomatoes picked ripe from his garden. After a few ritual brags—and knowing full well that my tomatoes were still green—he asked me in a condescending sort of way what was new in my garden. I remembered the patch of ripe wheat. "Oh, nothing much," I answered nonchalantly, "except the pancake patch."

"The *pancake patch?"* he asked incredulously.

"Yeah. Sure. Until you've tasted pancakes fresh from the garden, you haven't lived."

"And where might I find these pancakes growing?" he queried sarcastically, to humor my madness.

"Right up there behind the chicken coop in that little patch of wheat. All you have to do is thresh out a cupful or two, grind the grain in the blender, mix up some batter and into the skillet. Not even Aunt Jemima in all her glory can make pancakes like those."

My friend didn't believe me until I showed him, step by step. We cut off a couple of armloads of wheat stalks, flailed the grain from the heads onto a piece of clean cloth (with a plastic toy ball bat!), winnowed the chaff from the grain, ground the grain to flour in the blender, made batter, and fried pancakes. Topped them with real maple syrup. Sweet ecstasy. My friend forgot all about his tomatoes.

The next year, he invited me over for grain sorghum cookies, proudly informing me that grain sorghum flour made pastries equal to if not better than whole wheat flour. Moreover, grain sorghum was easier to thresh. I had not only made another convert to growing grains in the garden, but one who had quickly taught me something.

Grow Your Own Grains

The reason Americans find it a bit weird to grow small plots or rows of grain in gardens is that they are not used to thinking of grains as food

directly derived from the plant, the way they view fruits and vegetables. The North American, unlike most of the world, especially Asians and Africans, thinks grain is something manufactured in a factory somewhere. Flour is to be purchased, like automobiles and pianos. Probably the attitude came from the practice of hauling grains to the gristmill. Without the convenience of small power grinders and blenders of today, overworked housewives of earlier times were only too glad to have hubby haul the grain to the gristmill. And that gave him an excuse to sit around all day at the mill talking to his neighbors.

But even with the advent of convenient kitchen aids to make grain cookery easier, the American resists. He will work hard at the complex task of making wine—seldom with success—but will not grind whole wheat or corn into nutritious meal, a comparatively easy task. I know, because I was that way myself. Until I saw with my own eyes how practical a good 10-speed blender was for flour-making, I hesitated. Now it boggles my mind to remember that for most of my life I lived right next to acres and acres of amber waves of grain, where combines made the threshing simplicity itself, and yet our family always bought all our meal and flour.

The real tragedy of that ignorance was that the flour we purchased usually was the kind that had been degerminated and debranned too. Most of the nutrition had been taken out of that flour to give the American housewife what she seemed to want: a pure white powder that would last indefinitely on the shelf and make pastries of fluffy, empty calories.

The nutrition picture for whole grains is getting better all the time, thanks to the progress being made by plant geneticists. One of the more dramatic developments has been OPAQUE-2 or high lysine corn, corn with almost twice the normal amount of the proteins, lysine, and tryptophan in it. The other is tritcale, a cross between wheat and rye which outyields wheat, oats, rye, and barley and has more protein than ordinary corn. New varieties of oats, long known as the grain with the highest protein (excluding legume seeds like soybeans) range as high as 17 percent protein content. But studies of new buckwheat varieties have prompted the Agricultural Research Service to announce that this traditional crop, now making a comeback, has an amino acid composition nutritionally superior to all cereals, including oats.

Almost all the grains can be sprouted to make delicious salads in some ways more nutritious than the dried grain. Beans, clover (especially alfalfa), and wheat make the best sprouts for humans. But oats and barley in addition to wheat, can be sprouted and fed to chickens and livestock as top farmers used to do. With that kind of feed supplement, they could grow healthy animals even in winter without today's expensive all-vitamins-included commercial feed.

Corn sprouts win no prize for taste, but corn makes up for that lack with other advantages. Sweet corn and popcorn are two of our most popular foods, but corn can also be parched, pickled (corn salad), or made into hominy.

Pioneers in the cornbelt survived some winters almost totally on corn. They cracked, ground, grated, boiled, parched, squeezed, flaked, and baked it into porridges, cakes, muffins, dodgers, and "pone."

I don't like whiskey much, but the best I ever tasted was moonshine "made right" from fermented corn mash. That bourbon easily surpassed in mellowness the most expensive firewater you can buy. Of course, other grains make other kinds of whiskey, and malt from malting barley, a leading crop in the northernmost states, is used for beer and other malt foods and drinks.

Whole Grains for Your Livestock

But the use of whole grains directly in your own diet is only half the reason for growing them. The other half, just as important I think, is to assure yourself and your family an economical, steady supply of milk, meat, and eggs, and possibly cheese, wool, or other animal products you need or desire as part of your goal of home-grown security. If you have to go to the store to buy the grains you need for your livestock, your own home-raised milk, meat, and eggs will cost you nearly as much as if you bought them from a farmer or the store. Furthermore if you have to buy your grains in the marketplace, you may have to settle for less nutritional quality than what you could grow on rich organic soil and dry by natural methods. Protein and trace element content vary significantly with the variety of grain and where and how it is grown. *Your eggs, milk, and meat can't be any better than the grains that produce them.*

The By-products

There's another advantage to growing grains, a dimension you don't usually find in fruits and vegetables. Grain plants often give you other important products besides the grain. Wheat and oats and barley give you straw—the dried stalks left after the grain is threshed. Straw makes excellent bedding for animals and mulch for the garden. It can be woven into baskets too. Corn leaves dried or silaged are good roughage feed for cows. Corn husks can be plaited into strong rope, fashioned into dolls and decorations or used to fill a mattress in a pinch. Cane sorghum makes good syrup; buckwheat and clovers provide the bees with abundant honey. And not to be outdone, oats provide the hulls that the Rolls-Royce people used to use to polish the cylinder sleeves of their expensive cars. Maybe they still do.

Cultural Pros and Cons

Finally, the special advantage of grains for the organic gardener and farmer is that you can grow them more easily with organic methods than you can fruits and vegetables. All grains except corn will withstand low fertilization better than vegetables. Field beans, especially soybeans, will add nitrogen in the soil. Corn is easier to cultivate mechanically than fruits and vegetables. Fungal disease is less of a threat in grains than in fruit. Grains have their share of insect enemies, but control is not nearly so critical as it can be in fruits and vegetables.

The one disadvantage of growing grains may be their space requirements. A very small garden is no place for grains. But some grains can be grown in large or even in moderate-sized gardens. Soybeans and buckwheat can be planted as late as July 10 except in the far north, so they can be double-cropped behind peas, early beans, lettuce, or strawberries. A late sweet corn patch may work out well as a second crop too. Barley and wheat can be planted in the fall after other crops are finished and harvested the next summer in time to double-crop that soil to late vegetables.

How Much Grain?

Even a peck of grain will make a lot of meals, believe me. Excess ears of sweet corn needn't go to waste. Dry the corn, shell it, and make cornmeal in the blender. Or parch the corn over the fireplace on a winter evening.

Once you become familiar with whole grain cookery, you may want to pursue it, even if you don't grow your own grains, you'll not find a better way to make your food dollar pay. And you'll soon find how much grain you need or want to use for a year. It won't be as much as you think, unless you bake all your own bread and pastries.

We don't bake a lot of bread, but my wife makes a variety of cookies, cakes, pancakes, shortcakes, pie crusts, and cooked dishes with our whole grains. If the grain is ground fine enough, it makes good bread without the addition of any white flour.

From experience I can say that the following amounts of grain will be all a typical family will want to use yearly for cooking and sprouting.

Wheat, four pecks (one bushel); corn, two pecks; popcorn, two pecks; soybeans, four pecks; grain sorghum, two pecks; buckwheat, one peck; oats, one peck; triticale or rye or barley, one peck; navy or other soup beans, two pecks; alfalfa for sprouting, one or two quarts; lentils, field peas, cane sorghum (for flour), be your own judge. We don't grow and eat that much yet, but could if we wished, without increasing our production labor noticeably.

You can gauge your own family's consumption by estimating how much flour, cornmeal, and other grain products you use now. A cup of wheat will make a little more than a cup of whole wheat flour, and that holds roughly true for all grains.

Grain Cooking Chart

Grain	Amount Uncooked	Amount of Water	Cooking Method [1] and Time	Amount of Cooked Grain
Barley	1 Cup	4 Cups	Boil 30-40 min.	4 Cups
Buckwheat	1 Cup	2-5 Cups	Boil 20 min.	3 Cups
Cornmeal	1 Cup	4-5 Cups[2]	Doubler Boiler 30-40 min.	4 Cups
Millet	1 Cup	4 Cups	Boil or Double Boiler 25-30 min.	4 Cups
Oatmeal	1 Cup	2 Cups	Boil 10 min.	4 Cups
Rice (Brown)	1 Cup	2-2½ Cups[3]	Boil 35-45 min.	2½ Cups
Rye	1 Cup	4 Cups	Boil 1 hour	2-2/3 Cups
Soybeans	1 Cup	3-4 Cups	Boil 2-3 hours	2½-3 Cups
Triticale	1 Cup	4 Cups	Boil 1 hour	2½ Cups
Wheat	1 Cup	3-4 Cups	Boil 1 hour	2½ Cups
Wild Rice	1 Cup	4 Cups	Boil 40 min.	3-3½ Cups

NOTES:

1. All the above grains except soybeans may be cooked by the thermos method. Bring required amount of grain and water to a boil, pour into a wide-mouthed thermos, close and leave for 8-12 hours.

Another method for cooking grains is the "pilaf" method. This involves sautéing the grain, usually with minced onion, in oil and then adding stock or water, approximately twice as much liquid as grain, and cooking it, covered over medium-low heat until the liquid is absorbed and the grain is tender. The time is about the same as above. Brown rice, barley, millet, and wild rice are especially good cooked this way. Buckwheat is traditionally cooked in this way, but a raw egg is stirred into the dry grains before adding the stock or water. This replaces the need for sautéing the buckwheat in oil, and is done to keep the grains separate throughout the cooking. The required amount of water is two cups for the "egg" method of cooking buckwheat, and five cups when cooking it to be eaten as a cereal.

The hard grains such as wheat, rye, and triticale, may be brought to a boil in the required amount of water, boiled for 10 minutes, then left to soak for 8-12 hours in this same water. After the long soaking, they may be cooked for 15-20 minutes and will be tender enough to eat. This is one way to shorten the cooking time.

The pressure-cooker method offers the advantages of cutting the cooking time in the above chart, in half. In general, use twice as much water as grain when cooking in the pressure cooker, although more water--four times the amount of grain--is needed for the harder grains, such as rye, triticale, and wheat.

2. When adding cornmeal to boiling water, it is best to first combine it with one cup of cold water and then stir this into the remaining three or jour cups of boiling water. The lesser amount of water is to be used when you wish to have a stiff cooked cornmeal, as for cornmeal mush.

3. The lesser amount of water is required for short- or medium-grain rice, the larger amount for long-grain rice.

A further tip on cooking grains:
To enhance the flavor and shorten cooking time, toast grains in a dry, medium-hot iron skillet, stirring constantly, until they have a pleasant fragrance and take on a darker color. This also enables the grain to be "cracked" or coarsely ground in an electric blender.

Figuring Space Requirements

In other words, you don't need much space to raise at least some grains. A normal yield of wheat grown organically would be about 40 bushels to the acre. So you'd need only 1/40th of an acre to produce a bushel. That would be a plot of ground 10 feet wide by about 109 feet long. A really good wheat grower with a little luck could get a bushel from a plot half that size. Wheat yields have been recorded as high as 80 bushels per acre and even higher.

But using the same kind of average calculations as above, here's the amount of space you'd need to grow a bushel of the following grains:

field corn:	10 feet by 50 feet
sweet corn:	10 feet by 80 feet
popcorn:	10 feet by 80 feet (for the larger-eared varieties. I don't know per-acre yields for the small varieties, like strawberry popcorn.)
oats:	10 feet by 62 feet
barley:	10 feet by 87 feet
rye:	10 feet by 145 feet
buckwheat:	10 feet by 130 feet
grain sorghum:	10 feet by 60 feet
wheat:	10 feet by 109 feet

Don't hold me too tightly to these figures. They're estimates to give you an idea of how big the playing field is. Weather, fertility, variety, and know-how could alter the figures. All I'm trying to show really is that nine bushels of assorted grains might be raised on l/6 of an acre and provide you with the major portion of your diet.

The amount of grain necessary to support a few livestock is not large either. You need about 12 bushels of corn to fatten a feeder pig to butchering weight. A ewe and her lamb need approximately a bushel of grain a year, if pasture and hay are abundant. A hen needs about a bushel a year, a milk cow along with hay and pasture, perhaps five or six bushels, beef steer, a little more than that. In other words, an acre could easily fill the grain requirements for one pig, one milk cow, one beef steer, and 30 chickens. A top grower might provide the grain for more than twice that number of animals on an acre.

What *is* necessary to raise grains successfully in the large garden or on the small farm is an understanding of planting, harvesting, and processing methods that are no longer common in commercial farming. In many instances, the right way in commercial grain farming won't be the right way for small homestead growers. In some instances, the right way for you requires a use of the latest technologies; in other cases it requires a reaching back for knowledge now almost lost. It takes both to make grain growing and grain eating the cottage industry it once was, and the key to food security it must become if personal independence is to be maintained and personal freedom preserved.

Chapter 2

Corn:

America's Amazing Maize

In the language of the marketplace, commercial grains are usually divided into "feed grains" and "food grains." Feed grains are those raised primarily for animals to produce meat, milk, eggs, and other animal by-products. The primary feed grains are corn, oats, barley, and grain sorghum (milo). Soybeans, while not technically a grain, are often considered a feed grain since they are the principle protein feed for animals.

Food grains, on the other hand, are those primarily grown for human consumption directly, mainly wheat and rice, but also white corn, buckwheat, malting barley, some oats, and some rye.

The line of distinction between feed and food grains is rather hazy. Oats, barley, and rye are grown commercially for both markets. Almost all the commercial white corn in the mid-South is for human consumption as meal, breakfast food, snack foods, hominy, or cornstarch. Soybeans are already used extensively for human food, especially as extenders in meat or for wholly artificial "meats." On the other hand, wheat, a food grain, is often fed to animals if the price falls low enough to make it competitive with corn for that purpose.

In the market, you will often hear the term "small grains" too. The small grains are the "cereal" grains: wheat, oats, barley, rice, and rye. The seeds are "small" compared to corn and the term serves to distinguish them from corn and soybeans. But grain sorghum seed is smaller than the "small grains," yet is not usually considered a small grain.

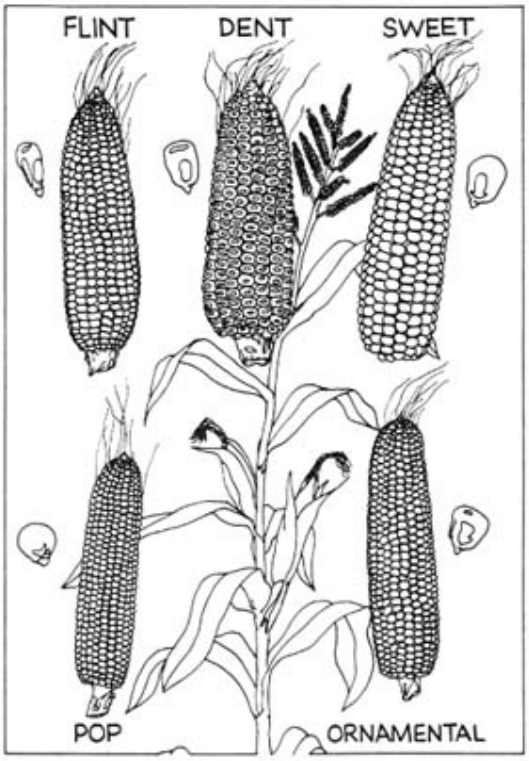
Even the word "corn" is something of a misnomer. Our corn is more correctly called maize and if you are travelling in another country, particularly Europe, you have to be careful. If you use the word "corn" the people may think you mean wheat or barley or whatever happens to be the principle grain of the region. Our corn is maize to them.

More than one civilization in North and South America (where corn originated) was built on maize. The Mayans who in some respects were more advanced than modern cultures and went down the drain for the same reason we might—poor and wasteful soil practices—depended almost entirely on maize for their lifestyle. When population increases and soil depletion resulted in inadequate supplies of maize for food, the Mayan civilization began to crumble.

Our own civilization is much more a maize culture than we realize, or at least it was before the soybean ascended to the commercial importance it enjoys today. Ever since the Indians showed pioneers how to roast corn, we've been hooked on the stuff. It produced so much more food per acre, and more dependably, than other grains that it soon became our major crop in the eastern two-thirds of the nation. I don't know how many dollars worth of business our billions of tons of corn annually engender, but it dwarfs the combined totals of General Motors and U.S. Steel easily.

Varieties

Because of corn's overwhelming economic importance, man has put much effort over the years into breeding varieties that develop amazing yields, remarkable disease and insect resistance, and recently, exceptional nutritional value. The most common commercial corn is the standard yellow dent hybrid, which is capable of producing consistent yields of over 150 bushels per acre and as high as 300 bushels per acre. Next in commercial importance are the white hybrids of the south and central states. Some open-pollinated white and yellow dent varieties are still grown. Of increasing importance are waxy maize, a kind of corn first grown for its starch (a substitute for tapioca), and high lysine com, a type with more than the usual protein content. Waxy corns now seem to have feeding advantage in that they are more easily digestible.



For the gardener and commercial vegetable grower, there are many varieties of sweet corn, not to mention popcorn. Livestock-men can plant special varieties of corn for silage. Decorative "Indian" corn is available in a rainbow of colors. There is even a special corn that grows extra-large cobs for the corncob pipe industry!

Yellow Hybrid Corn

Yellow hybrid corn varieties may be simple crossbred hybrids, or single-cross hybrids, or three-way crosses. Some mature as early as 85 days, some as late as 120 days, but most are in the 90- to 110-day range. The farther north, the earlier maturing your corn must be to beat the frost dates. Longer maturing hybrids invariably yield more, as is true with most any crop. The old rule of thumb prevails: plant the varieties that the seed companies sell for your geographical region. In normal years you won't have any trouble finding seed. (1975 was an exception!) I'm beginning to think every tenth farmer in our country is a seed corn salesman on the side, since so many of them have signs by their mailboxes announcing the availability of seed at their farms. You can buy from these farmers. Or you can buy seed from any farm supply and feed store. Or by mail. Here's just a partial listing of some major and not so major seed corn companies:

Acco Seed, Belmond, Iowa 50421
The Andersons, Maumee, Ohio 43537
Asgrow Seed Co., Des Moines, Iowa 50371
Bailey Seed Farm, Portland, Indiana 47371
Bo-Jac Hybrid Corn Co., Mt. Pulaski, Illinois 62548
Cargill, Inc., Minneapolis, Minnesota 55402
DeKalb Ag Research, Inc., London, Ohio 43140
Crow's Hybrid Corn Co., Milford, Indiana 46542
Funk Seeds International, Inc., Bloomington, Illinois 61701
Garno Seed Co., Inc., Palmyra, Michigan 49268
Taylor-Evans Seed Co., Tulia, Texas 79088
Columbiana Seed Co., Eldred, Illinois 62027
Hulting Hybrids, Div. Ferry Morse Seed Co., Geneseo, Illinois 61254
McNair Seed Co., Laurinburg, North Carolina 28352
Moews Seed Co., Granville, Illinois 61326
Muncy Chief Hybrids, Muncy, Pennsylvania 17756
Northrup King & Co., Minneapolis, Minnesota 5 5402
P-A-G Seeds, Minneapolis, Minnesota 55402
Pfister Hybrid Corn Co., El Paso, Illinois 61738
Pioneer Hi-Bred, Inc., Tipton, Indiana 46072
Stull Hybrids, Inc., Sebree, Kentucky 42455
Trojan Seed Co., Olivia, Minnesota 56277
Whitney-Dickinson Seeds, Inc., Buffalo, New York 14240
Robson Seed Farms, Hall, New York 14463

Open-pollinated Field Corn

A few farmers still prefer to grow non-hybrid corn. They think it has better feed value than the hybrids. There is another reason why you might want to consider non-hybrids, especially on small acreage where top yields are not so terribly important to you as lower costs are. You can save the seed from your crop to plant the next year, which you can't do with hybrids. Thus you don't have to rely on seed companies. In years when commercial hybrid seed is short, as it was in the spring of 1975, having your own seed saves you a lot of worry, not to mention money.

Reid's YELLOW DENT is the old standby variety of open-pollinated field corn. Shumway Seedsmen, Rockford, Illinois 61100 has it. Other sources: Gordon Neal & Son, Route 2, Mt. Vernon, Iowa 52314; Steinbronn Seed Farm, Route 2, Fairbank, Iowa 50629; Joseph Borries, Teutopolis, Illinois, 62467.

Flint corn is another yellow, open-pollinated corn. Unlike dent, flint corn kernels do not become dented on top when mature. Flint corn contains little soft starch and does not shrink when dried. The kernels are harder than dent corn, and not as easily digested. Ears of the LONGFELLOW variety (sold by Shumway) are very long and skinny, fun to grow for its unusualness, but hard to shell. Gurney Seeds, Yankton, South Dakota 57078 sells another yellow flint called MINNESOTA 13, which I have not grown. Gurney also sells a RAINBOW FLINT that is similar to Indian corn, itself a flint corn. Flint corn used to be called Yankee corn and is better acclimated to colder northern short seasons. Most flints mature in 90 days or less.

If you grow either of the aforementioned open-pollinated varieties, you will no doubt notice more variation in the plants than you would with hybrids. If you are going to save seed, save only the nicest ears from the sturdiest, healthiest stalks. Don't select for size only. The biggest ear may also carry low-yielding traits. Better to collect seed from a number of larger ears, saving only the largest kernels from the middle of each ear selected.

Specialized Hybrids

Waxy maize is a special type of corn with a high starch content. During World War II, when U.S. supplies of root starches, especially tapioca, were cut off, corn breeders developed waxy maize as a substitute. Farmers in a few counties of Iowa, Indiana, and Illinois produced all the commercial waxy maize under contract. Lately, farmers are finding that some waxy corns produce gains in cattle and hogs superior to regular corn. Predictions call for more widespread demand for this "soft" corn.

The name "waxy" comes from the appearance of the kernels and not from internal content. The best waxy hybrids are closely related to yellow dent hybrids. Waxy maize does not usually yield as well as regular corn, but

special premium prices are paid for it, so the farmer usually does as well as or better than his neighbor raising regular corn. The waxy grower's costs are higher, however. The fields have to be isolated from regular corn or else the outside rows may be pollinated by the regular corn, lessening the starch content. A single corn tassel sheds several million pollen grains, so the danger of cross-pollination from nearby fields is very real.

High lysine or high protein corn, mentioned earlier as one of the most significant achievements in the fight against world hunger, must also be isolated from other corns to prevent cross-pollination. Yields of high protein corns have generally been lower than regular hybrids, but the higher feed value makes up for the lower yield to some extent. An organic farmer I talked to recently told me that when he started feeding high lysine corn to his hogs, he could tell the difference almost immediately. The pigs gained weight faster on less corn, he said, and he intends to feed only high lysine corn from now on.

In developing nations short on protein for human consumption, there's no question that the high lysine corns are nutritionally better. Minor miracles in combatting nutritional deficiencies were reported in South America when the new corns were substituted for native varieties. But the corn was not accepted there at first because people were used to a hard, shiny flint corn, not a softer, dull-colored grain. And the new corn was not resistant to diseases. Improvements have been made every year, however, and it seems only a matter of time now, when perhaps all corn will have the high protein gene bred into it, not only in South America but perhaps the United States too.

Homesteaders who can isolate a small patch of high lysine from other corn should definitely be interested. Problems of storage with the softer corn, which can plague big growers, won't affect the small grower as much. Nor will slightly lower yields since he's not critically concerned about obtaining the highest possible yield anyway. Ask seed corn dealers about any high lysine varieties they have for sale. When they have one which they describe as being particularly resistant to corn diseases, or at least nearly as resistant as their standard hybrids, try some.

Seed corn companies have successfully crossed high lysine with waxy maize. As far as I know, the seed is not generally available yet. In tests, the more easily digestible starch of waxy maize combined with the higher protein of high lysine corn made an excellent feed grain for hogs. There's no reason why it shouldn't be an outstanding food grain for humans too. The amylopectin-type starch in waxy maize contains much more simple sugar glucose than regular yellow dent corn, and the proteins in high lysine are not only better quantitatively, but qualitatively too. Lysine cannot be reproduced in the body from other amino acids.

White Field Corn

White corn is grown in the South and the southern Cornbelt. Seed corn companies that serve the South should all have the seed, though I don't have a complete listing. Though no one raises white corn commercially in my usual stomping grounds, much of the white corn seed is grown near Lake Erie by the Schlessman Seed Co. of Milan, Ohio 44846. The proximity to the lake allows the longer frost-free growing season that the corn needs, while the northern latitude does not have the disease problems that would affect a seed growing operation in the South.

The Asgrow Seed Co., headquartered in Des Moines, Iowa 50371 is one of the principle retailers of white corn seed. Variety RX 123W is adapted to the East, Southeast, and the Southern Corn-belt; RX 125 for the Southwest, the San Joaquin Valley of California, and the white corn areas of Kansas and Missouri; RX 153W for the Texas high plains and the central Cornbelt.

At least one open-pollinated variety, SILVER KING, is available from Gurney Seed & Nursery Co., Yankton, South Dakota 57078. The catalog says the variety is adapted to as far north as central South Dakota.

White corn grows much taller than yellow corn, especially the non-hybrid varieties, with ears occasionally six feet from the ground, not the corn a short man would want to harvest by hand!

Sweet Corn

The operator of a pick-your-own vegetable farm near Chicago tells me that a surprising number of people who come out from the city for his fresh vegetables prefer field corn over sweet corn for roasting ears. A couple of generations ago, many farmers ate field corn instead of sweet corn too, and I suppose some of the older ones still do. Sweet corn is far superior for the human palate, I say, but there is no arguing taste, and the food a man is raised up on, like his religion, is hard to spurn. Having eaten field corn roasted, I can say only that it will keep you alive when you are hungry. Very hungry.

However, sweet corn has many similarities with field corn even if flavor is not one of them. The two are grown almost exactly the same way and the varietal differences roughly parallel one another. In sweet corn, you can grow yellow or white kernelled corn, hybrid or open-pollinated, early or late maturing, special varieties with higher sugar glucose content, and some real old-timers too, just as with field corn. The only difference in the culture of the two corns—in practical terms anyway—is that sweet corn seems more fragile. Not only are the stalks smaller and the ears shorter, but in my experience, sweet corn has less sturdiness and fortitude. Field corn seems to germinate and surge out of the soil faster than sweet corn, even when

planted when the weather is still on the cool side. Wind will blow more sweet corn down than it will field corn.

In selecting sweet corn varieties for home use include an early, a midseason, and a late-maturing corn. You want a little corn throughout the whole season, rather than a whole lot at one time. Plant a 70-day corn early (when the soil has warmed to at least 55° to 60° F.). Wait five to 10 days, and plant some midseason corn. Wait another week and plant your late variety. The three plantings will then ripen more or less continuously through late summer. If you plant all three kinds of corn on the same day, the three harvests tend to bunch and overlap more than the maturity dates would lead you to believe. As a normal rule, corn planted early in the year will take a little longer to ripen than the maturity date stated on the packet; planted late in the season, the corn will mature sooner than the stated time.

As a general rule, the earliest corns are small-eared, yellow varieties. The early to midseason varieties include the combination white and yellow corns. Midseason varieties are the larger-eared, yellow corns, and the late varieties, white corn. If you want an opinionated assessment of the four kinds of corn, here's mine. The extra-early corn is okay for that first taste of the season, but it is the lowest quality of the four. The white and yellow combination varieties taste best of all to me. The yellow midseason varieties yield better, however, and are better for canning or freezing. And you'll enjoy the change in taste of the whites coming at the end of the season when you are tiring of the taste of yellow corns. The older white varieties, in my opinion, aren't as tender, sweet, or tasty as the yellows, but the newer varieties, like SILVER QUEEN equal or exceed the yellows in quality. Ears are bigger and kernels deeper too, so production is greater. The "extra-sweet" yellow varieties developed over the last few years evidently appeal to some gardeners, but not me. The extra sweetness is supposed to keep the corn flavorful even after it's been picked for over a day. Not in my opinion.

Here's a sampling of varieties in the various categories:

Extra Early Yellow Hybrids:	EARLY SUNGLOW
	GOLDEN BEAUTY
White and Yellow Hybrids:	HONEY AND CREAM
	BUTTER AND HONEY
	SUGAR AND GOLD
Midseason Yellow Hybrids:	GOLDEN CROSS BANTAM
	HONEYCROSS
	CARMELCROSS
	SENECA CHIEF
	IOCHIEF
	ILLINI CHIEF
	STYLEPAK
	TENDERSWEET

White Hybrids:	SILVER QUEEN
	HYBRID STOWELL'S EVERGREEN
	HYBRID COUNTRY GENTLEMAN
	COMET
Extra-sweet Varieties:	EARLY XTRA-SWEET
	ILLINI XTRA-SWEET
	HI-SUGAR HYBRID (white)
Open-pollinated Varieties:	GOLDEN BANTAM (yellow)
	COUNTRY GENTLEMAN
	WHITE EVERGREEN
	STOWELL'S EVERGREEN
	BLACK MEXICAN

The last-mentioned corn is a very old variety and a novelty. When ready to eat, the corn will quickly turn a deep bluish-black in the late milk stage. Still sold by Gurney if not others. Fun to try once, but no great shakes for taste or yield. Growers who want to save seed and also grow open-pollinated varieties are probably better off sticking with GOLDEN BANTAM, and COUNTRY GENTLEMAN or WHITE EVERGREEN.

Popcorn

Surprising even to long-time gardeners and farmers, there is more variety in size and kernel color in popcorn than in any other kind of corn. Besides the usual white popcorn and several kinds of yellow popcorn, there are tiny red ears, large black-kernelled ears and even popcorn that looks like ornamental Indian corn.

White Popcorn: Often called "hull-less," white corn is usually smaller than yellow when popped, but more tender. WHITE CLOUD, BURPEE PEPPY, and GIANT WHITE are three hybrids. JAPANESE HULLESS is a non-hybrid.

Yellow Popcorn: GIANT YELLOW, CREME-PUFF, SOUTH AMERICAN MUSHROOM are three of many, many varieties.

Red Popcorn: The ubiquitous STRAWBERRY ORNAMENTAL popcorn makes a unique decorative corn and is sold as such in most seed catalogs. But it pops too. Tied by the husks, three ears to a bunch, the corn is much in demand for fall decoration.

Other novelty popcorns: Gurney sells BLACK BEAUTY popcorn and CALICO popcorn, the first, jet black in color, the second, speckled white, yellow, blue, and red.

All popcorns require from 95 to 120 days to mature. Plant them when you'd plant your field corn or right after your early sweet corn.

Ornamental Corn

All seed houses sell ornamental or "Indian" corn seed. The varieties are usually non-hybrids, so you can save the seed. One exception is PURPLE HUSK HYBRID. Indian corn with purple rather than white husks is not new, but demand for it is up so seed companies are producing more of it.

Ornamental corn needn't be wasted on decoration alone. When you no longer want it for the centerpiece on the table, you can feed it to chickens or livestock.

The Economics of Small Corn Plantings

An accepted principle of agricultural economics states that the more corn (or any grain) produced with a given amount of time and labor, the lower the per-unit cost of production. The more acres farmed, the more acres to spread the cost of farming over. The larger the operation, therefore, the more "efficient" it can be.

The soundness of this principle is no longer taken for granted. There seem to be limits to the so-called economies of size, above which bigger means more cost per unit, not less. Ask New York City's managers, or the administrators of any large high school. In agriculture, economists are now talking about "optimum-sized" farms, above which per-unit cost tends to rise rather than decline. The optimum-sized corn farm today is around 900 acres, according to the experts.

But the economic tunes the commercial farmer must dance to have a far different beat than the songs the homesteader sings. In commercial farming in the mid-70s, the cost of growing corn commercially is reckoned at about $300 per acre, Ohio State says $320. That's *all* costs, the way a businessman figures them, including a charge to management of about $40 which most farmers, at least the more traditional kind, would not count as a cost at all. Also included in that figure is a land charge of $65 per acre, the average rental fee on corn land. That may seem high until you remember that many farmers today are paying over $100 per acre in interest on $2,000 per acre land they borrowed money to buy.

Obviously, the small homesteader whose major source of income is from a job or business off the farm, much less the gardener growing small amounts of grain, is not affected by either of these major costs in commercial farming, or if so, only in a very minor way. Nor will he be particularly concerned by the $7 per acre cost of operating capital in grain production

since he certainly would be foolish to borrow money for his food-raising projects. What does matter to him are the out-of-pocket cash outlays necessary to grow and harvest his grain. Even here, all the commercial costs will not apply to the homestead situation:

1975 per acre costs in corn production as estimated by Ohio State economists:

1. Seed corn . . . . . $16 (1/3 bushel per acre). If you grow your own open-pollinated corn and save your own seed, you won't have this cost.
2. Chemical fertilizer (for 140 bushels per acre yield) . . . . . $87.50 (150 pounds N, 50 pounds P, 150 pounds K) If you raise your corn organically, you can spend that much for organic fertilizers, but you need not necessarily do so. If you have your own manure—enough for a 10 ton per acre application—or can get sterilized sewage sludge for free, or have other home sources of fertilizer-like green manures, you can reduce your per-acre fertilizer bill considerably. But you will also have to add some cost (depreciation on the manure spreader, etc.) for hauling manure to the field.
3. Lime $3
4. Herbicides . . . . . $14.78 (2 pounds of 80W Atrazine at $3 a pound and 2 quarts of Lasso at $17.55 a gallon) The organic grower won't have this cost either, but he will usually have to cultivate for weed control more often so his cost for that operation will be higher (see below).
5. Crop insurance . . . . . $1.25 per acre. Not necessary for homestead projects.
6. Land levelling and/or drainage $6.25
7. Plowing $8
8. Fitting $5
9. Planting $5
10. Cultivation . . . . . $6 Make that $12 on a farm where herbicides aren't used.
11. Spraying . . . . . $2.50 Spraying operations can apply even to organic farms sometimes where nontoxic materials like liquid seaweed are used.
12. Harvesting . . . . . $15 If you raise an acre of corn and harvest it by hand like I do, this cost won't apply to you. If you pay a farmer to combine the corn for you, it obviously will.
13. Trucking . . . . . $16.80 Not applicable to most homesteads. You'll probably use your pickup truck or a wagon and tractor to haul your corn to the barn, but it won't cost you anything like that figure, which counts the cost of highway trucking to the grain terminal.
14. Drying corn . . . . . $12 Not applicable to homesteads since you don't need to dry corn artificially.
15. Miscellaneous supplies, etc $10

Of these abovementioned costs, nearly $200 per acre, the homesteader could get by for around $90 or less. More than likely he would not get the 140 bushels per acre those $200 are supposed to "buy" the commercial grower. However, the necessity of getting top yield is not critical for the homesteader, as it is for the commercial farmer. A homesteader with one acre of corn may be quite content with a 90-bushel yield; that may be all the corn he wants. The commercial grower, under the onus of over $300 total cost per acre, might find a 90-bushel-per-acre yield catastrophic. With 800 acres of corn yielding 140 bushels per acre and a price of $2.50 per bushel, he grosses $280,000 at a cost of a little over $240,000 or a well-earned net before taxes and living expenses of between $30,000 and $40,000. At 90 bushels per acre and the same costs, he loses $60,000.

So the farm activities that may mean ulcers for the commercial farmer can spell relaxation for the homesteader. For that very reason, it is questionable whether labor should be figured as a cost to the homesteader at all. Gardening and homesteading are two of the very few pastimes (I hesitate to call them "leisure" activities) which can actually save you money. In fact, compared to money spent on golf, travelling, skiing, or flying, raising your own food can be profitable even if you only break even!

I emphasize the noncommercial aspects of home grain production for a particular reason. Some of the methods and ideas I suggest in this book a commercial farmer would consider "wrong" because his "right" way is based only on economic considerations. Some farmers will spray insecticides on corn even though there is no evidence of a harmful bug's presence. Such farmers (and their bankers) call this "protecting the investment they have in the crop." Certainly a homesteader, whether organic or not, does not have to resort to such extremes. A commercial farmer might consider a plant population per acre of 25,000 to be "correct." The homesteaders would be wise to plant no more than 18,000 plants per acre and take a slightly lower yield, than he would to pump on the high-priced, here-today-and-gone-tomorrow chemical fertilizers a high plant population demands for high yields.

It is at least sad, if not alarming, that commercial agriculture has become so strait jacketed by economics. "It's no fun to farm anymore," my neighbor sighed recently. "It's all business and banking and being efficient 24 hours a day. Inhuman." Time was when a fellow who was willing to accept a somewhat lower standard of living (by urban definition) could raise a family happily on the farm even if he were a somewhat mediocre businessman. Not anymore. He can't afford to farm "inefficiently" even if he is willing to accept poverty as a trade-off. Economics will brook no mediocrity and few mistakes. And the man who "succeeds" finds himself on a treadmill. He must always keep on expanding, keep on borrowing money, and live with the risks and gambles of perpetual debt. For each pound of gold, economics demands a pound of flesh.

The "laws" of economics have placed a burden on agriculture that the latter's natural processes have no way to cope with. Economics assumes that agriculture responds to financial dictums in the same way that the more controlled types of manufacturing respond. Economics assumes that a "good" farm operation on "good" land will return enough money above operating costs to pay six to 10 percent return on investment, plus a good living wage for the people who do the work on that farm, plus a nice return to management for the farmer-owner-manager. The successful farmer today is expected to pay eight to 10 percent for the money he borrows, pay his hired help a salary competitive with industry, and have enough money left over to live in a fine house, drive an expensive car, and vacation in Florida every winter.

I have never in 20 years found a farm that can meet all three, or hardly ever even two of these objectives. The fact that farms steadily grow larger every year is itself proof that there's never enough profit in the occupation to accomplish these ends. Wherever a farm seems to be economically "successful," there is either money being pumped in from another source— and that money taking advantage of underpriced fossil energy or underpriced labor— or you will find the soil of that farm being depleted of fertility at a very rapid rate. Nature never heard of eight percent interest. What you take from her you must eventually put back. The farm is not a "factory in the field."

The whole underpinning of what seems to be profit in agriculture today is inflation. The land continues to rise dramatically in price no matter how you farm it, or if you farm it at all. I have heard more than one farmer admit that in many cases, he would have been just as far ahead to buy a farm, let it lay or "rent it to some other sucker" while he worked at a salaried job, then sold the place when he retired.

The truly profitable farms are those managed for three or four generations under a consistent policy of frugality and conservation, and upon which some high-quality livestock breeding program is carried out along with crop production. The small family dairy farm is the best example. The traditional dairy farm, by its nature, is semi-self-subsistent in the sense that it is a self-renewing kind of agriculture which requires the least amount of commercial inputs from outside sources. Most of the feed for the animals is raised on the farm. The operation is labor intensive, employing the farmer and his family fully every day of the year. Older, smaller machinery is often utilized. Few luxuries are indulged in. Debt is, and has been, avoided like leprosy, and expansion has come only out of savings, not from borrowing. This kind of expansion hasn't been difficult, however, because it was natural expansion: an increase in the number of dairy cows in the herd. In a good breeding program, this natural increase has had a value equal to the increase in the value of land. Good cows today can cost $1,000-$2,000 per head, a value equivalent to the value of land per acre. And each cow can produce $2,000 of milk per year plus a valuable calf.

The dairy farmer can become richer over the years three ways. Because of clover in rotations and the return of ample amounts of manure to the land, soil fertility and organic matter increases. Secondly, frugality puts some money in the bank nearly every year. In 50 to 100 years this savings amounts to a considerable amount of money upon which to expand without borrowing or to invest. Thirdly, the dairy herd expands and improves, as already mentioned.

Building a rich farm this way is too slow for all but the real farming people, of which there have never been enough. You won't often hear about this kind of farming from bankers because they cannot make any money from such an operation. Rarely will you hear it praised by agribusiness either because one way the traditional dairy farmer can save money is by refraining from the allurements of the biggest tractor and the latest equipment agribusiness would have him buy. But if you have dreams of turning your homestead experience into becoming an independent farmer, this is the model you should follow. You will find it a good life if you love the work. And if you study the history of this kind of farm, you will find that often it started with a homesteader, who originally paid for his land out of off-farm earnings, just as you are doing.

Providing the Necessary Fertility

Fertilizing a corn crop is not something you start to think about the day you plant. Fertility is a year-round and lifelong building program on an organic farm, its peaks coinciding with the corn crop in your three-, four-, or five-year rotation. You build your rotation around corn because it is the most voracious feeder on soil nutrients, especially nitrogen. Fertilize properly for corn and you'll take care of most of the nutrition for soybeans and small grains in your rotation.

Rotation of crops is important, whether you are planning a few rows of corn in the garden or several acres on your homestead, or several fields of a farm. Corn should follow a legume, either beans or clover on an organic farm. Clover, especially alfalfa, can fix up to as much as 100 pounds of nitrogen in the soil, all free from the air. That nitrogen alone will go a long way towards making your corn crop successful. Rotations also insure insect and disease control. If shrewdly planned, rotations can take advantage of double-cropping techniques, see suggested rotation plans on chart below.

Some Suggested Crop Rotations

Grains and strawberries

1st year:	Strawberries
2nd year:	Strawberries; plow under after harvest, and plant buckwheat for late crop
3rd year:	Soybeans; plant to wheat in the fall
4th year:	Wheat, sowed to clover in spring
5th year:	Clover, plowed under in spring, plant corn, then sow rye in late summer while corn is still standing
6th year:	Plow under rye, plant strawberries

Grains and vegetables

1st year:	Corn; sow rye in late summer while corn is still standing
2nd year:	Plow under rye, plant peas, double-crop to late fall cole vegetables
3rd year:	Tomatoes
4th year:	Beans: string, lima, dry beans; plant wheat in the fall
5th year:	Wheat; sow clover in spring
6th year:	Clover plowed under; plant corn

Grains and hay for livestock

1st year:	Corn, sow half to barley in fall after corn harvest
2nd year:	Sow oats on other half; plant soybeans after barley harvest in June; plant wheat in fall after oat and soybean harvests
3rd year:	Wheat; sow alfalfa in spring
4th year:	Alfalfa for hay
5th year:	Corn or, more hay
1st year:	Corn; plant wheat in fall
2nd year:	Wheat; sow alfalfa in spring
3rd year:	Alfalfa
4th year:	Alfalfa
5th year:	Corn

These rotations are only a few you can follow. With experience, you'll want to vary them. Notice though, how the ground is used fully, often double-cropped, and hardly ever left completely bare over winter.

All plant residues should be carefully worked into the soil either after the harvest directly, or after they have been used for bedding or feed and turned into manure. A green manure crop every fourth year in rotation, an annual treatment if possible of five to 10 tons of manure, lime at the rate of half-a-

ton per acre every five years or as needed, two tons of rock phosphate per acre every four years, if needed, plus a legume in regular rotation, and your corn should get the nourishment it needs for an adequate crop. Heavily manured ground will get enough potash generally speaking, but this element may be the one shortest in supply on an organic farm. An application of potash rock or greensand will add more potash to the soil if the soil is high in organic matter and dynamic with microbial life. Often, though, some of the potash in greensand and potash rock remains unavailable to the plant for long periods of time.

Where more potash is needed than you can get from traditional organic sources, you might want to investigate special fertilizers natural farmers use and accept as organic fertilizers. Some seaweed and sea product fertilizers contain potash, as do some special mineral and organic blends, for example, the special potash blend Shurgro, from Canton Mills, Inc., Minnesota City, Minnesota 55959. Some of these fertilizers contain sulfur and chlorine in very slight amounts and so are not wholeheartedly approved by all organicists. There are now many kinds of fertilizer and soil conditioners for natural or eco-farmers on the market. The best place to find the sources of most of them right now is through the pages of a publication called *Acres U.S.A.* (10227 East 6lst St., Raytown, Missouri 64133). So much controversy rages about these soil amendments and fertilizers that I refuse to comment on any of them. Find out what's in them and be your own judge.

Sewage sludge is another possibility for fertilizing corn economically, as by now thoroughly discussed and reviewed in many books and magazines. More and more farmers are hauling sludge from hometown sewage plants. Unless sludge is sterilized don't use it where it will come in contact with plant parts that will be eaten. The danger of doing so is very small with corn. And many scientists seem to think there is little danger of contracting disease pathogens in this manner anyway, but better safe than sorry. Some sludges have enough heavy metal content to cause a possibly dangerous buildup in the soil, and some don't. This kind of information can be obtained from modern sewage disposal plants, and you can have the sludge tested by competent labs or soil consulting services and follow their direction. In my area, for instance, I know that Brookside Labs (headquartered at New Knoxville, Ohio 45871), a farm and soil consulting firm, guides farmers in its program in the use of sludge as a fertilizer.

Raising the Corn

To get the greatest possible fertility in the soil for a corn crop, an organic farmer will plow or disk in a green manure crop as the first step in preparing the soil for planting corn. In the garden, the procedure is the same, only you would usually use a rotary tiller. On a very small plot, you may even spade under the green manure and work the soil into a fine seedbed with a steel rake. The organicist will follow at least two general rules in planting corn

that chemical farmers would dispute. First, the organic grower should always prepare a fine seedbed; and second, he should plant a little late in the season.

Chemical growers are leaning more toward "minimum tillage" or even "no-tillage" where corn is planted with very little seedbed preparation, using specialized machinery and herbicides to kill the excessive weed growth that would otherwise result from not working the soil well. Organic growers who don't use herbicides, must control weeds the way farmers did for centuries, by mechanical cultivation.

There are two reasons why the organic grower with only a small planting should wait a little longer to plant his corn. First of all, he will usually be plowing or disking down a green manure crop. The longer he can allow that to grow before incorporating it into the soil, the more organic matter there will be.

When to Plant

But early planting is risky anyway. Sure, the chemical farmers all believe in it and say that yields average a little higher than on late planted corn. But commercial farmers have no choice. They must start planting as soon as possible so they get finished before the end of the planting season. I have checked records, and many years corn planted May 20 did as well as or better than corn planted April 25. But willy nilly, early planted corn is almost always followed by rain and heavy weed growth before the land dries enough to cultivate. Once the weeds get a head start, it's very difficult to bring them under control with mechanical cultivation. Late planting with a good disking right ahead of the planter, means seed set in warm soil. The seed germinates quickly and is off to a fast start ahead of the weeds. And with less early disease and insect problems too. With only one or a few acres, what's the use of a noncommercial organic grower rushing the season anyway? Go to the woods and pick wild flowers while you're waiting.

The proper time to plant corn is when oak leaves are as big as squirrel ears. That's very old wisdom but wisdom nonetheless. About the time oak leaves are as big as squirrel ears, the soil temperature will be around 60°F. or about right to germinate corn. But you won't hurt a thing (unless it turns out to be an exceptionally dry summer) by waiting a little longer, say until soil temperature hits 65°-70°F. three inches down. (I make an exception for dry summers because in the event of dry weather, late planting can't take advantage of spring moisture to get roots going, the way early planted seedlings can. Better though for you to take the dry weather risk than the weed, disease, poor germination, and insect risks described in the preceding paragraph.

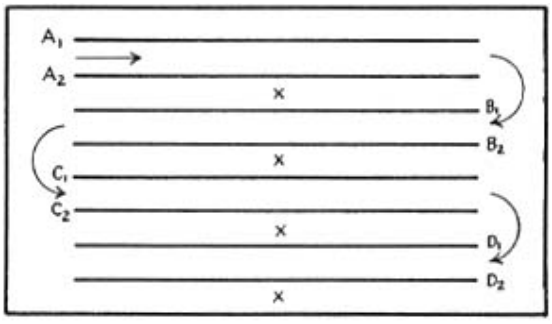
How to Plant

To plant more than a quarter-acre of corn, you are going to need some sort of mechanical help, since hand planting gets to be too slow and tedious for above that size plot. Several hand-pushed mechanical planters are available. For an acre or more you should consider planters that attach to either a garden and lawn tractor or to a larger farm tractor. Any dealer who sells garden tractors should be able to get you a planter, too. Brinly-Hardy in Louisville, Kentucky 40200, makes them for small tractors. Almost every farm tractor company makes planters, but getting a new one- or two-row planter (which is ideal for small plantings of an acre or more) is not so easy. Cole Manufacturing, Charlotte, North Carolina 28200 makes such a single-row seeder. John Deere has come up with the "unit planter" idea. You can buy one unit or 12 or more. The planters can be purchased with the very latest in precision planting equipment for large and small seeds. One unit alone sells in the neighborhood of $225 right now. The single-row planters for small tractors cost over $100. (See the glossary of grain equipment.)

Remember that if you plant two rows at a time (with a two-row planter) then you can cultivate two rows at a time. But you can't use a two-row cultivator on a field that has been planted with a one-row planter. The two-row planter obviously plants two rows that are *always* the same distance apart. But no one could guide a one-row planter so perfectly as to make twin rows with constant, uniform space between them.

Don't forget to set the row marker when you are planting, so you have a guide to follow for the next row. You must keep your rows as parallel and equidistant from each other as is humanly possible, especially when using a two-row planter to be followed by a two-row cultivator. I think I can illustrate the reason better than I can write it.

Here's the pattern of rows planted with a two-row planter: You start at A:



You know that rows A-A are always the same distance apart as are B-B, C-C, and D-D, but the distance between the sets of two rows—marked by X—will be the same only if you plant very straight rows and follow the row marker very assiduously. If the X distances are too close, the outside cultivators will cut into the next row. If, for example, A_2 is too close to B_1

the outside cultivating shovel may dig into B1 as you are cultivating down rows A-A. Nobody can plant the rows perfectly, just don't get them too crooked.

Commercial hybrid corn can be planted as thick as 30,000 kernels per acre if plenty of fertilizer and moisture are available, but don't you do it. Organically, you'd need at least 25 tons of good manure per acre to support that kind of plant population. Moreover you'd have to plant the corn in rows not more than 30 inches apart, a move that will facilitate neither hand harvesting nor sowing a cover crop in the corn in late summer.

If you are going to plant an acre of corn organically, you'll be better off to shoot for a plant population of from 15,000 to 18,000 kernels. That means a spacing of about eight to nine inches between stalks in the row, with rows 40 inches apart. Such widely spaced plants will make good use of normal, natural fertility of green manure crops and manure, and produce big ears, easy to handle by hand.

If you plan to plant pole limas or pole string beans to climb the cornstalks (saves having to put up poles) the corn plants in the row should be even more widely spaced, one stalk every 12-15 inches. When the corn is six inches high, plant a bean on each side of it about six inches away. If moisture is normal, both corn and bean will grow well, the latter fixing a little nitrogen in the soil for the corn to feed on.

In the garden, you will want to plant your sweet corn more thickly than described above. Rows need be only 30 inches apart—even closer if you are going to cultivate by hand—with plants in the row six inches to eight inches apart. It may be better to plant thicker than that even, then thin out weaker plants. But if you want to grow pole beans up the cornstalks, the same rules apply as described in the preceding paragraph, or else grow the beans only on the outside rows.

Popcorn and ornamental corn should be planted as you do sweet corn.

Depth of planting is the same for all corns and is determined more by the time of year and available moisture. Early in the planting season, plant shallow: one-and-a-half inches for sweet corn, two inches for field corn. Later in the planting season, as soil warms and moisture decreases, plant a little deeper. Late planting, when the ground is dry, you ought to go in three to four inches down where there's some moisture.

Weed Control

Weed control should begin almost immediately after planting. In two or three days, weed seeds will be germinating, and cultivation even before you can see the weeds (or the corn) is necessary. Go over the ground lightly with a rake, if you're working a small garden plot, or with a spike tooth harrow or

rotary hoe on larger plots. If you use the harrow, set the teeth very shallow so they don't dig the corn out of the ground. If using a rotary hoe for the first time, (see glossary of grain equipment) you will think the steel points are hurting the sprouting corn. Have no fear. The rotary hoe kills only very small germinating weeds and will harm only a very few germinating corn plants. It can be used, in fact, until the corn is two inches high without hurting the plants to any appreciable degree.

Once the corn is tall enough so you can "row" it easily by eye across the garden or field, you can start cultivating with shovel cultivators or with a rotary tiller if you are very careful. Go too fast or too deep and you will bury the small corn plants with dirt. Regular corn cultivators come equipped with shields that keep dirt away from the plants. But even with shields in place you have to be careful because clods may lift the shields, allowing the dirt to fall in on the plant.

Keep cultivating even when you can't see many weeds. Remember that it is far easier to kill weeds when they are first germinating than after they are well established. As the corn grows taller, you can start cultivating faster, remove shields if any, and let the dirt "roll" into the row of corn, burying little weeds growing there. This is where cultivating becomes a real art. Since there is no way to cultivate in the row, but only between the rows, the more weeds you can bury in the row (without burying the corn) by controlling the roll of dirt off the cultivator shovels, the cleaner your corn rows will be and the less laborious hand hoeing or weeding you'll have to do.

You should aim to cultivate the corn at least three times before it is knee high. When the corn reaches that height, quit cultivating so as not to harm the roots that are now spreading out underground between the rows. Better a few weeds left than severed corn roots.

On sweet corn, you will notice, especially if your soil is fertile, that second and third stalks or "suckers" grow out from the base of the main stalk. These are called tillers, and some folks like to pull them off, reasoning that the tillers sap energy going into the main bearing stalk. Experiments have not born this out: pruning tillers has not increased yields enough to make the work worthwhile.

After cultivation there's nothing more to do with the corn until harvest except worry over it. On small patches, you can mulch the corn to good advantage. In early fall you may want to sow a cover crop of rye grass in the field. The grass helps prevent erosion through the winter, provides a nicer surface to walk on in wet fall weather, can be pastured and/or plowed under for green manure in the spring.

Enemies of Corn

If I were to list all the diseases and insects that attack corn, you'd wonder how we ever get a crop. The fact is that corn is a very hardy and reliable grain in the area it is best adapted to (the Cornbelt). Unless the insect or disease reaches epidemic proportions, corn may be bowed but rarely beaten entirely. In other words, don't let all the bugs and blights scare you away.

Borers and Earworms

The European corn borer poses, or at least posed at one time, the worst threat to corn in the insect world. When it first struck—savagely—many years ago, the agricultural world nearly panicked. Dire predictions of the end of the corn industry were made wherever podiums and afterdinner speakers got together. If they had been available, chemicals of great toxicity would have been hurled into the fray, but fortunately (in the long run) few were available.

Instead corn growers learned how to control the borer with resistant varieties and good cultural practices. But the borers are still out there and no variety is completely resistant to them. Fall disking or plowing and stalk shredding all help control the pest since it overwinters in stalks. Natural predators and its own diseases have contributed to corn borer control too. Some farmers still spray insecticides to control it, especially the second generation that attacks the silks and hinders pollination, but for the most part, the practice does not pay in field corn. Damage is not that bad.

In sweet corn, commercial growers will often spray for the borer—and the earworm—because the consumer won't tolerate an occasional worm in the corn he buys. He'd rather have corn with poisons on the husk than a harmless worm. The organic grower on small plantings can alleviate the worm problem a little by putting a drop of mineral oil on the silk of each ear. Worms can often be spotted burrowing in the stalk right beneath the tassel. You'll see a little pile of sawdust-like material beside a small hole. Squeeze the stalk and smash the varmint inside before he has time to crawl down and eat his way into the ear.

On large plantings, the only organic control of borer and earworm damage on the ears of corn is to alternate plantings so that your main crop matures between the first and second worm generations. You'll have to experiment to find out the proper timing in your own locale and keep notes. Eventually, you can determine which of three plantings of corn is freest of damage. Make that your main crop, if you intend to sell corn.

Earworms are more of a problem in the south and central states. Where temperatures fall below zero, most overwintering earworms die. New infestations come in the spring from the South.

Root-worms

Corn rootworm (southern rootworm, northern rootworm, and western rootworm, all distinct) is a serious pest of corn where commercial growers insist on planting corn on the same land, year after year. Now that the cheaper chemicals used to control root-worm and other soil insects in continuous corn are banned there may be a return to the sanity of crop rotation by all corn farmers. All the rootworms feed on the roots as the name indicates, causing wilting, weakening, and even death of the plant. The southern corn rootworm is the least dangerous, but as an adult beetle, it becomes the striped cucumber beetle, a painful thorn in the side of organic melon, pumpkin, squash, and cucumber growers.

Wire-worms

Wireworms like to dine on young corn roots too, and the seed itself. Rotations won't control them either, but fortunately, they rarely get to epidemic proportions. Growers have discovered that wireworms rarely move out of the row they attack, which is kind of a mystery. You can replant a new row down between two rows that have been attacked by wireworms, and the new corn will remain unscathed. The timing probably has something to do with this phenomenon.

Cultivation controls wireworms somewhat. They thrive better in poorly drained soils and cool, wet springs. That is the case with rootworms too. Neither pest causes as many problems in light, sandy soils.

Seed Beetles and Maggots

Seed corn beetles and seed corn maggots eat the germ out of the seed but are not serious threats. Treated seed controls them, if necessary. Organicists can treat with coal oil or tar for some control.

Birds

Tar-coated seed won't be bothered as much by crows, pheasants, and other birds who love germinating seeds. Birds are, by far, the worst threat to my corn, and I've found no way yet to birdproof a new planting. Tar on the seed helps, but when you do that, you have to sow the sticky seeds by hand. There's no way you can run them through planter plates. Newer preparations are available from garden stores to treat seeds so crows, pheasants, and blackbirds won't eat them. I've not tried them, but others report success.

Army-worms

Armyworms can harm corn sometimes, but here even many chemical farmers do not believe spraying pays. It kills too many predators of the armyworm. Corn leaf aphids may appear in great numbers some years, but

even to chemical farmers, spraying is questionable. Corn aphids come and go, don't seem to hurt corn yields, and spraying them kills too many ladybugs and other predators.

Chinch Bugs

If you should see thousands of small black bugs swarming up the stalks of corn around the outside of your field, that's the chinch bug. Infestation is seldom severe, though the bugs will weaken or kill plants they feed on in great numbers. They seldom penetrate more than the outer rows of a field.

Corn Diseases and Blights

The seven deadliest threats in this category are southern corn leaf blight, which scared the wits out of corn producers in 1970, northern corn leaf blight, northern corn leaf spot, maize dwarf mosaic, diplodia rot, gibberella rot, and bacterial wilt. A picture of a serious infection of any of these diseases is enough to make you ill. And in fact, some of the molds that rot corn *can* make you ill. Don't ever eat moldy corn. Or feed it to livestock. In addition to poisoning that might result, especially from gibberella, there's always that chance in a thousand that moldy corn, especially moldy white corn in the South, might be infected with aflatoxins known to be carcinogenic.

Fortunately, plant breeders have been able to outmanuever all the seven diseases named above with at least partially resistant varieties. Sometimes the outmanuevering backfires. For instance the devastating effect of southern corn leaf blight in 1970 can be blamed at least partially on the corn industry's own carelessness. Because it made very desirable single-cross corn, Texas male-sterile cytoplasm was being used to produce almost *all* hybrid seed corn, even though this meant that any disease to which this kind of cytoplasm would be susceptible would have the potential for wiping out almost the whole crop. The fungus that causes southern corn leaf blight was well known and thought not to be a threat. What was not so readily recognized was an earlier report from the Phillipines that showed the disease seemed to be particularly vim-lent there against corn with Texas male-sterile cytoplasm. Scientists assumed it was only weather conditions in the Phillipines that were responsible.

As a matter of fact, what had erupted there was a hitherto unknown race or strain of the disease, now known as Race T. When Race T inevitably reached the United States and our vast fields of corn, humid weather sent it racing through the farmlands like a forest fire. Plant breeders found themselves almost literally in a race with potential starvation to breed enough seed corn without Texas male-sterile cytoplasm for the 1971 planting season. About the only people who could breathe easily at that time were the handful of growers who raised non-hybrid corn.

Blights

Hybrids are being developed with resistance to both southern and northern leaf blight. The newly discovered northern corn leaf spot is related to the other two blights, but attacks both normal and male-sterile cytoplasm. Fortunately, it has not caused serious damage yet, and plantsmen hope that plowing under plant debris, rotations, and other clean culture practices will control the disease until resistant inbred lines can be developed.

Mosaic

Maize dwarf mosaic (MDM) is a serious corn disease wherever corn is grown in the proximity of Johnson grass, one of the worst weeds of the mid-South, and a host for the disease. Lately, however, another strain of MDM has been found in the East which doesn't seem to be connected with Johnson grass. Aphids transfer the virus from weeds to corn. It can even be carried in clothing or on farm machinery from field to field. The leaves of infected corn become finely stippled and the plant stunted. Sometimes there's a proliferation of shoots from the base of the plant too. Your only defense is to plant genetically resistant varieties and get rid of Johnson grass, if you can.

Rots

Diplodia rot strikes stalks and ears, especially in early corn varieties. If nitrogen levels are too high in relation to potassium, stalk rot is more likely to occur. Then even if the ears are good, the stalks fall over, making harvest difficult if not impossible. When diplodia attacks the ears, they become covered with a whitish mold and do not mature properly. A very dry early season followed by wet weather later on increases the chances for a diplodia infestation, but seldom is the disease severe.

Gibberella rot, like diplodia, attacks a plant as it matures, not when it is young and growing. Resistant varieties and clean plowing are standard controls. Gibberella can be distinguished from diplodia because the former infection almost always has a reddish color to it, both in the stalk and on the ear. Gibberella-infected corn should not be fed to swine but "may be" fed to chickens or cows. Not my chickens or cows.

Wilts

Bacterial wilt or Stewart's wilt or Stewart's disease you are more apt to find in your sweet corn, especially in the Northeast. Yellow lesions appear in late spring on young corn plants, running parallel to the leaf veins along the length of the leaves. The infection looks like a number of other corn diseases, or nutritional deficiencies, so you'll probably need an expert to identify it. But if your ground is reasonably fertile and well drained and the

season is normal, long yellow lesions on the corn leaves strongly suggest wilt in the East and Northeast.

The disease is caused by bacteria which survive over winter in the bodies and mouthparts of the hibernating corn flea beetle. Corn flea beetles are shiny black, about one-tenth-of-an-inch long, and hop like fleas. Severe winters will kill hibernating beetles and therefore reduce the bacteria too.

Otherwise, the best defense is to use resistant hybrids. There are many good wilt-resistant sweet corn varieties for the East, especially among newer varieties. For instance, Seedway, Inc. (Hall, New York 14463) sells a new yellow corn, COMMANCHE, and a white, COMET, both of which are resistant to wilt. Also BRAVO, which is not so new. If wilt is a problem in your area, you probably shouldn't grow GOLDEN CROSS BANTAM; it unfortunately is quite susceptible.

Harvesting Your Corn

About 75 days after a sweet corn variety that is supposed to mature in 75 days is planted, the corn should be ready to pick. Notice all those conditionals. The only way to know when the corn is actually ready is to pull down a sliver of husk and take a peek. Jam your thumbnail against a kernel. If it pops and the milk squirts out, the corn is just right. If your fingernail goes through the skin of the kernel easily, the corn is a little green yet; if you must press quite hard to penetrate the kernel, it's too old. After you've picked corn awhile, you'll be able to tell by the condition of the silk and the fullness of the ear.

To harvest small plots of popcorn, it's best to jerk the ears from the stalk, leaving the husks attached. Peel the husks back and use them to tie five or six ears together. The ears can then be draped over a wire by the husks to hang and dry in the barn or attic. To keep mice from getting to the corn, poke a hole in tops of tin cans with a nail, then slide the tops on the wire, one on each end about a foot from the wall. The mouse may be able to walk a wire, but it can't pass the tin lid blocking the way.

Commercial farmers begin combining field corn when the moisture content gets below 30 percent. Then they must dry the grain down to about 13 percent artificially, so that it can be safely stored.

You will harvest your acre of organic corn by hand as ears, and shell off the kernels only when you need to. Hogs can be fed ear corn, they'll eat the kernels off the cob. So will chickens. Cows and horses will eat kernels and cob both. At any rate, you'll store your corn on the cob and the drying process is completed in the crib without artificial heat. Therefore, the longer you can let the corn dry in the field, the better.

Harvesting Just the Ears

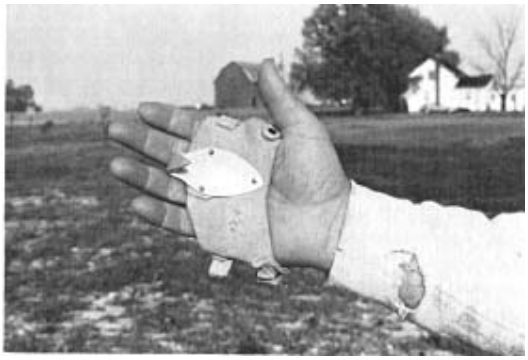
The easiest way to harvest corn by hand is to allow it to hang on the stalk until the plant is dead and brown. Then move down one row after another, husking the ears and tossing them onto a wagon, cart, or pickup truck. Breaking the ear of corn out of the husk is a skill you will develop as you go along. The way I do it is to grab the ear at the base with my left gloved hand, while my right hand strips down the husk and bends the ear back between the thumb and forefinger of my left hand, snapping the ear free at the stem. The drier and riper the corn, the easier the ear will snap out of its husk.

In the past, farmers used many kinds of husking "pegs" strapped to their fingers or the palm of one hand, the purpose of which was to rip the husk loose from the ear with one swift downward motion. The original husking peg was a simple piece of wood or bone about a quarter-inch in thickness, sharpened to a point at one end, and held in the middle joint of the fingers of the right hand. A string or leather thong held it to the fingers. Grasping the peg the way you would grasp a knife if you were slicing potatoes, the husker would slash open the husk with the point of the peg, grab a section of husk between thumb and peg and tear it off the ear. You can do the same with your fingers, but it takes longer and is hard on fingers.

Improvements came to the husking peg, the ultimate being a sort of leather, fingerless glove with a steel plate riveted to it. The plate had a steel hook on it which ripped open the husk when the husker ran the palm of his hand down the ear of corn. A good husker could perform this operation with amazing speed and skill, and could in fact, husk a bushel of corn from the stalks in less than a minute.

Husking pegs are still being made and used, as of 1976, as I write. I always check at rural hardware stores and often pegs are in stock and the owner says he sells a couple every year. Terry's Specialties, 817 Fairlane Drive, Chillicothe, Missouri 64601 makes and sells huskers. (Mr. Terry writes that his wife has been showing their 10-year-old grandson how to make the huskers, "so we are into the fifth generation of corn huskers.")

Harvesting ears of corn by hand is most easily accomplished with the help of a husking peg. The device comes in a variety of styles, but the purpose is to rip open the husks quickly, with a minimum of wear on the fingers. Free of the husks, the ears are tossed in a wheelbarrow, wagon or pickup for transport to the corn crib.



Once husked, the corn is stored in cribs especially designed to continue the drying process. I'll discuss that later.

Harvesting the Whole Plant

After you husk the ears from the standing stalks, you break up the stalks with disk or stalk shredder and incorporate them directly into the soil for organic matter. A different method of harvesting corn by hand is followed when you want to use the stalks and leaves (fodder) of the corn plant for feed too. Instead of husking the ears from the stalk, you cut the whole stalks and arrange them into bundles and the bundles into shocks. Shocks are what you see in pretty calendar pictures but rarely anyplace else these days.

A total harvest by hand involves whacking the stalks off at the ground with a corn knife or machete. Tied into bundles, the stalks are shocked until used, the ears and foliage as livestock feed, the stalks as bedding.

For cutting corn by hand you need a corn knife. Corn knives look just a little bit like swords and old ones sell at almost every farm sale. They still sell

cheap, but someday will probably be treasured antiques. Not yet however, because you can buy them brand-new too. Every rural hardware store should be able to order them, and if the store manager says he can't, tell him to check with Belknap, the big hardware distributor headquartered in Louisville, Kentucky.

You cut the cornstalk off about four inches above the ground with a short downward stroke, after having grabbed the stalk up high with your left hand. (If you're left-handed, reverse hands.) Continue down the row, gathering each stalk in your left arm, and cutting it off with the knife in your right hand, one-two, one-two. A definite rhythm will assert itself as you swing along. Just be careful not to get overwhelmed by the spirit of the thing and hit your leg with the knife.

When your arm is full of stalks, drop them in a neat bundle on the ground. Later you will tie the bundles with twine and set them up into a shock.

Some farmers didn't tie all the stalks into bundles. Instead, they'd tie maybe six bundles for the nucleus of each shock. Once the shock was started with these bundles, they'd set armfuls of cut stalks not tied into bundles against the shock. When the shock was large enough, they then tied the whole together with twine. This method saves much time over tying all the bundles.

Setting up a shock requires some practice too. First lean two bundles against each other, then two more against the first two but on opposite sides, so that all four exert more or less equal pressure on each other from all four directions without falling down. All should slant inward a little, but not too much, from bottom to top. Think tipi. Once you get the first four bundles standing, it is fairly easy to lean the rest around that central core. After you have stood up about eight bundles, the shock will be fairly steady and you can sock more bundles against it firmly without fear of the whole thing falling over. But until you catch on, your shocks will fall over in the early stages of building, and you will be tempted to use language that could dry corn faster than artificial heat.

Size of a shock is up to you; 15 to 20 bundles makes a solid-standing structure. Tie the whole thing together then with a piece of twine. First I throw a rope around the shock, pull it as tight as I can, then tie the twine around and release the rope.

Once you tie the whole shock together, it will stand all winter and shed water if you have placed the bundles evenly around the shock. Indeed, the shock becomes a "crib" in reality. Inside, the ears are still on the stalks, and dry out nicely.

After the rush of fall harvest work is past, take the shocks apart—one at a time—and husk the corn out of it. The corn can be cribbed or fed, the shock fed to sheep, cows, or horses. The leaves inside the shock will be still

somewhat green, though very dry, and are relished by livestock. The tougher stalk parts animals won't eat, but they make good bedding. Bundles of stalks make good insulation to keep farm buildings, especially chicken coops, warmer in winter. Simply lean the bundles up around the building.

Letting the Livestock Do It

The easiest way of all to harvest corn is to let your animals do it all. Old-timers would turn lambs into standing corn in August and the lambs would "graze" off the lower leaves without bother to the corn or knocking down the stalks. After the corn was ripe, (and the lambs sold) the hogs were turned into corn and the field "hogged off." The hogs ate and fattened on the corn, knocking it down themselves. After the hogs went to market, beef cows or steers could be turned in to eat up the stalks and any corn the pigs missed. Some corn might have been wasted with this kind of harvest, but the low labor involved more than made up for it.

Post-harvest Tillage

After harvest—of whatever kind of corn you grow—you will have the stalks in the field to contend with unless you shocked the corn. Even then, you will have the heavy root system of the corn plants still in the ground. Heavy plows or disks will work these stalks and roots up nicely. Smaller plows and disks, the kind you will most likely be using if you've planted only an acre or two of corn, will handle the roots, but not the stalks too well. If possible, shred the stalks with a stalk shredder or any rotary mower. Do the same on garden plots before you rotary till the ground for next year's crop. Shredding not only makes tillage easier and increases rate of decomposition, but also helps control any insect pests harbored in the stalks. Heavier rotary tillers for farm tractors, like the Howard Rotovator, will chop and incorporate stalks into the soil too. You can plow under, disk in, or incorporate stalks in the fall or spring when the soil is fit to work. If you have sown a cover crop on the field—which you should have—you won't plow of course, until spring. Farmers often used to sow fall wheat after corn, in which case they plowed or disked the ground immediately after the corn was off, and then planted wheat in October. Instead of bare ground all winter, the field would be carpeted with wheat. If you are going to plant oats the spring following corn, it's best to fall plow the field. Oats have to be planted early the next spring, and the more seedbed preparation you can get done in the fall, the better.

Many organic farmers do not believe plowing is the best method of cultivation. They claim the offset disk incorporates organic matter throughout the topsoil whereas the plow buries plant residues too far below the soil surface. Besides, plowed ground erodes worse than disked ground, and that few soil experts will disagree with. (The argument over the plow is at least two centuries old.) I'm not sure the criticism of the plow should

concern small organic farmers because they will be using the plow (if they do) mostly in late spring to turn under green manure crops. Late spring plowing followed by planting does not cause much erosion; fall plowing does. As for burying the plant residues too deeply, *small* plows, one or two bottom plows of lighter weight, won't do it to the degree modern large plows will. In the garden, the dispute is of less importance since the rotary tiller or perhaps the Gravely rotary plow will be used almost exclusively.

Which tool compacts the soil most? All tools compact soil: plow, disk, rotary tiller, according to who's championing which implement. With light equipment and good soil practices that keep organic matter up around the five percent level you aren't going to have compaction problems no matter what tool you use.

Storing and Using Your Corn

Weevils will attack corn, or so I've been given to understand, but I've never observed them in ear corn (corn not shelled off the cob yet) stored for just a year in traditional, slatted cribs. And I've observed an awful lot of corn stored that way. If weevils do harm corn, the problem is far less critical than it is with cereal grains, another reason why corn is the best homestead grain for you to grow. Because of the way corn is stored you will, however, have to contend with some rodent damage. But rats in grain bins are far easier to control than bugs.

Like everything else in agriculture, there's no one right way to store corn. You can approach "rightness" in agriculture in direct relationship to the amount of time or money you want to spend. If it's "right" to drive a Ford, it's "righter" to drive a Rolls.

Storing Corn in Shocks

The most primitive and cheapest method to store corn is to cut and tie the stalks, ears attached, into bundles, set the bundles into shocks and leave them in the field until needed, as previously described. The shock becomes the storage building, so to speak, effectively keeping rain off the unhusked ears inside, while at the same time, the grain dries down to proper moisture content (about 13 percent) for long-term keeping.

The bundles of stalks, ears still attached, can be fed to livestock. They'll eat the grain and the dried leaves (fodder) off the stalks. The ears can be husked from the bundles and fed, shelled or unshelled, to hogs, chickens, horses, and cows. The bundles, divested of their grain, make good fodder feed for sheep, goats, even rabbits. (Incidentally, our rabbits like an ear of corn every day too. They prefer it to the commercial pellets we have tried to feed them.)

The disadvantage of storing corn in the shock in the field is that you can't haul it out when the ground is muddy in winter. And when the ground is frozen, the butts of the shocks freeze in the mud and are devilishly hard to kick loose. In great-grandfather's time, farmers found at least one way to circumvent the problem to their own advantage. They hauled the bundles to the barn in late fall, and husked the corn out at their leisure during the long winter evenings.

That practice led to what surely was one of the most pleasant customs on yesterday's farms: husking bees. Young and old would gather together, first at one farm, then another, and husk the corn. Actually, the husking was merely a by-product of a social evening.

The husker who found a red ear in his bundle was allowed a kiss from boyfriend or girlfriend, and of course, what more motivation does one need to keep husking? And in those days, before hybridization standardized corn into dull sameness, there were quite a few ears that would turn up red. And quite a few more that were tinged reddish enough to pass in favor of a kiss any day.

I keep asking myself if the "old days" weren't really better after all. There were no sharply drawn distinctions between work and play, between manual and intellectual labor, between business and social life. There was more chance for people of different ages to mingle and understand each other. In this one instance—and one can name many other examples—the work of food-getting was turned into fun; neither love nor labor was lost. We could do far worse today.

When the corn was shucked at the old husking bees, the husks were not always broken off the ears of corn. Often they were braided together in most artistic ways. As much as a bushel of corn could be thus tied together, then hung up where rodents couldn't get to it.

There's no reason why the small homesteader could not do the same today. I'm romantic enough to believe that the time spent would be far more rewarding than watching television, especially if there were a few good friends sitting there in the light of the open barn door, talking good talk with me. Or even more especially, if a pretty girl were showing me how to braid the corn husks. I have a notion we have lost some of our ability to enjoy life to its fullest today, but that notion is supposed to be a sign of old age. Still, I'll keep watching for red ears of corn.

Corn Crib Storage

You might braid and hang up your popcorn—and sweet corn for parching—away from rodents, but most homesteaders will require a crib to store their corn for livestock. There are several ways to build one, again depending on whether you want a Model T Ford or a Rolls-Royce.

A Rudimentary Crib

The first crib I built was made of saplings cut from the woods, and some junk lumber and roofing tin. I needed only a small crib, one that would store about 75 bushels. A cubic foot equals about 4/5 of a bushel, so a crib six feet by four feet by six feet tall was adequate. Using saplings from two to four inches in diameter, I tried to duplicate roughly the requirement of the old traditional crib: slatted walls for good air circulation to dry the corn and walls slanted outwards as they rise so rainwater striking the slatted sides would drip down and out of the crib. (Rain wets a little of the corn through the slats, but not enough to harm it as long as the grain can dry out quickly after the rain stops.)

The author peeks at his handywork: a homemade crib filled with homegrown corn.

For a floor, I recycled a four foot by eight foot panel of 5/8-inch plywood that had been previously used for a sign. Six old cement blocks scrounged from a junk pile became the foundation under the floor, one block at each corner and one on each side midway between the corners.

First I set four oak posts into the ground at what would be the corners of the future crib. The posts were about five inches in diameter and I sank them about two feet into the ground, leaving some seven feet of length aboveground. The space between the posts measured a little less than four feet widthwise, and a bit over six feet apart lengthwise. Then I wedged the four-foot by eight-foot panel between the posts, which pushed them slightly outward to give the slant I wanted to the future walls.

Across the top of the cornerposts, both widthwise and lengthwise, I nailed 2 x 4s to hold the posts rigid and to form support for the roof. That's all the nailing I had to do except for the tin roofing I applied later.

Then I started building up the walls from the floor in a manner similar to laying up logs for a log cabin. The only difference was that my sapling logs had to be cut continually longer as I progressed upward so that they lapped the slanting cornerposts. To make sure the saplings would be long enough to lock in place against the cornerposts all the way up, I cut them extra long. Then when the walls were finished, I sawed off the excess lengths with a chain saw. When filled with com, the log walls became tight and immovable; the pressure of the corn inside the crib held the sapling ends firmly against the uprights more securely than any nailed wall could do.

The space between the logs ideally should have been about two inches, but even in the straightest saplings, there were crooks and curves that occasionally left a space wide enough for an ear of corn to slip through. But no matter. When you fill a crib like this one, the ears of corn will flow against the walls and eventually block the wide gaps. You have to pick up a few ears that fall to the ground, but not many.

However, sometimes you may have to notch a sapling end into another as you would in a log cabin, to narrow the gap between the saplings sufficiently so the corn won't fall through too easily. Also be sure to alternate a butt end and a top end at the corners as you lay the wall up to keep it fairly even and level with the world.

At the top of the crib at one end, I left an opening for filling. I haul corn in from the field in my pickup and stand on the pickup bed to shovel the corn into the crib. At that height I can easily toss the corn into the opening.

To take corn out of the crib, I remove from the top and take down the saplings as the crib empties.

I built the crib in one afternoon. Its only fault is that it is not animal or bird proof. Squirrels, chipmunks, jays, and mourning doves feast all year long. Coons are the worst. So far there's enough corn there for both my wild and domestic animals, but I'm going to have to do something about the coons.

Rats? Not yet. The cats and the dog which are always hanging around, have discouraged them so far. I could line the inside of the crib with hardware cloth to ratproof it.

For the saplings, any kind of wood will do. The cornerposts ought to be a type of wood that resists rot in the ground: white oak, burr oak, locust, cedar, tamarack, or catalpa.

A Snow-fence Crib

Another low-cost crib you can build is with snow fence or picket fence. It doesn't require a whole lot of skill either. First you build a solid floor about six inches off the ground, boards over planks or posts or old telephone poles laid right on the ground in a level spot. The floor should be big enough to accommodate a circle about 15 feet in diameter. Then make a circle of snow fence or picket fence approximately 14 feet in diameter so it will fit nicely on your floor. You'll need 154 feet of fence to complete the circle. In the very center of the enclosure set another piece of fencing measuring a foot in diameter. This small middle piece becomes a ventilating shaft allowing air to penetrate to the middle of the corn you will be piling around it.

Once the enclosure is full of corn, you can add another circle of fencing on top of the corn, a foot or two smaller in diameter than the first. Set another small piece in the center to extend the ventilation shaft up through what will be your second layer of corn. I've seen third layers stacked onto some of these makeshift cribs, but that's risky. A crib can get top-heavy if constructed this way, and topple over.

Whether you build a one-, two-, or three-layered snow-fence crib, you will want to cover the corn. Bundles of cornstalks laid closely together over the corn, tops all together in the center and raised slightly so water will run down to the butt ends and off onto the ground, not the corn, will give the grain adequate protection. I've seen pieces of roofing tin laid on top and weighted down with posts. A sheet of plastic film weighted down with old tires works too. You don't need anything elaborate.

Getting the corn out of a snow-fence crib isn't easy. You usually have to knock a hole in the fence at floor level big enough to accommodate a scoop shovel. Standing outside the crib, you shovel as much of the corn as will spill down and out your hole. Sometimes the corn will bridge over above your hole and you have to ram a crowbar through the fence into the corn to jar it loose. When the crib is emptied to the point where you can't shovel from the outside anymore, you crawl inside and pitch the corn over to your outlet hole.

Farmers usually use small, motor-driven grain conveyors to make unloading the cribs easier. The conveyor hopper is placed right outside the exit hole of the cribs. Corn is shovelled into the hopper and elevated to a waiting truck or wagon.

A Pole-crib

Another low-cost, but more permanent type of crib can be built out of telephone poles or large posts. Quite large cribs can be built with the former, but you'll need mechanical help, at least a tractor forklift, to lift the heavy

poles into place. For most homesteads, 15-foot creosoted posts from the lumberyard will make a crib sufficiently large for your purposes.

The pole crib can be built as long as you wish to make it. The limiting factor is width; don't make it wider than four feet, so as to allow for good air penetration. Simply set the posts solidly in the ground, a pair of them four feet apart every six feet. Nail boards (1 x 6-inch boards are okay, but 2 x 4s are better) around the top of the posts for extra strength to keep the posts from sagging.

Nail 2 x 4-inch crosspieces between every pair of posts about a foot above ground level, then nail boards to the crosspieces to form the floor of your crib.

Then staple a strong, close-meshed wire fencing to the insides of the posts to form an enclosure for the corn. Top off with a simple slant roof of corrugated steel or aluminum.

A door should be framed into one if not both ends of the crib for filling and unfilling.

The wire mesh ideally should be closely woven so as to exclude all rodents, but that limits you to hardware cloth which is terribly expensive anymore. What we call turkey wire is strong enough to hold the corn and closely meshed enough to keep out rats at least. The fact that rain will fall on the corn in a wire crib is no more critical than with a slatted wood crib. The rain will not hurt it much if the corn is used up within a year.

Traditional Cribs

If you want a crib that preserves the corn better, you can build the type traditionally found on American farms. Thousands of them are still standing, though often empty. You can get a good idea of how to build one by taking a ride through the country and observing them from the road.

Common to all of these cribs is the four-foot width and the spaced slats of the walls for ventilation. The cribs may have a simple slant roof or common double-truss roof. Sometimes the walls are perpendicular to the ground; other models may angle slightly outward from the ground to the roof line. The purpose of angled walls, as I mentioned earlier, is to allow water striking the wall to fall down and away from the crib, minimizing the amount of corn that gets wet due to the open slats.

There's a proper way to make a door in a corn crib. You can get by with an ordinary hinged door, but if you intend to fill the crib full you have to have that door closed; that is, you will have to have another opening through which to fill. Moreover, once the crib is full, you won't be able to open the door because if you do, the corn will come rolling out.

So farmers long ago learned how to solve the problem. On the sides of the door frame, they nailed small pieces of wood, angled downward from outside to inside of the crib. These wooden strips form slots into which 1 x 4 inch boards the width of the door opening, can be slipped. When all the boards are in place, closing in the door opening, they look like a set of shelves tipped upward rather than level. The boards are close enough together and so hold in the corn, but they can be easily slipped up and out of the slots. Because of their angle of repose, the weight of the corn does not pinch them tight. When you want to take corn out of the crib, you remove the top board, then keep removing boards from the top down until the crib is empty enough so that corn no longer rolls against the door.

You can also buy steel corn cribs. Used ones, now obsolete, dot the countryside, and if you can hire the machinery to move one of them you can often purchase them reasonably.

Whatever kind of crib you choose, some rodent damage is inevitable, though in the steel cribs and well-constructed pole or traditional crib, you can keep it at a minimum. But it pays to keep a cat or two around the corn crib.

Shelling and Grinding Corn

Use your corn up every year. Don't let a pile of it lie in the corner of a crib indefinitely. If you have just a few bushels of com left, or need only a few bushels, it's better to keep them in clean steel barrels after the corn has been dried to 12-13 percent moisture and shelled off the cob. Any corn you wish to grind into meal for yourself or use for other kinds of table food, you have to shell anyway.

Shelters can be purchased new if not used. The Nasco Farm & Ranch catalog (Fort Atkinson, Wisconsin 53538 or Princeton Ave., Modesto, California 95352) lists a hand-cranked model (about $15) capable of shelling 10 bushels an hour, and a small hand sheller (about $2) you might find adequate for shelling a few ears of popcorn for an evening. Larger, tractor-powered shellers are still available. Some searching of used farm machinery lots might locate a good used one, since shellers are obsolete in commercial farming. The corn combines shell corn as it is harvested, so shellers are no longer needed on most farms.

Small gristmills, either hand or motor powered, are on the market in increasing numbers to meet increasing demand. Montgomery Ward offers them in its farm catalog. So does Sears. Hammer mills, for grinding corn into feed for livestock and chickens, either with electric motors or powered by tractors, are manufactured by a number of short-line agricultural equipment companies. Also available through Sears.

You can also take corn to be ground into animal feed to commercial feed mills and/or elevators and get it ground for animals for a small fee.

Livestock Feeding

Corn is the principal grain feed for animals. Grinding it to a mealy powder increases digestibility and utility of its nutrients. For cows and steers, the whole ear—grain and cob—can be ground and fed. For hogs and chickens, the corn is shelled first and then ground. Often it is mixed with oats, wheat, and soybeans for a more complete feed. A good ratio is about two-thirds corn, and the other third oats and soybeans. The soybeans provide the protein supplement. Mixing feeds for various animals has become a science in itself, and sometimes a pseudo-science manipulated by feed salesmen to their own best advantage. I used to think modern commercial livestock feeds were worthy of every praise, but my animals do not agree with that opinion and have changed my mind for me. My chickens prefer home-grown grain every time they are given the choice. They will not eat the commercial stuff unless there is nothing else to eat.

And why not. After a lifetime of talking to people in all phases of agricultural production, I have gotten a significant number of them to admit that artificially dried corn at the elevator is often dried too fast and too hot, hurting nutritive quality of the kernels. Furthermore, corn coming into commercial channels varies widely in nutritional content, especially in protein. If you have worked hard to grow high-quality grain in soil of high organic content, you will be very far ahead on a small homestead to dry that corn naturally and feed it rather than purchase feed. If you want 100 percent organic meat, milk, and eggs, you must feed with your own corn, or some from another organic farm.

I believe a little compromise is best for my livestock. When the chickens or whatever are running free over a large enough area that they can pick and choose their own diet, I don't bother with commercial feed, the chickens will hardly eat it anyway under those conditions.

When they are penned up for any length of time, I feed them a little commercial ration along with my own grain, hoping the array of vitamins and trace minerals the label bears witness to will make up for whatever might be lacking in my home-grown grains. But I worked for several years on a farm where all livestock feeds were raised and processed on the farm and no commercial ration was ever used. I rarely saw a sick animal on that farm, and livestock reached marketing weight only a little slower than those belonging to the super-duper big-time farmers around us. The real reason large farms buy their feed is because of convenience and saved labour. They pay a high price. On a small homestead, making up your own feed rations isn't that difficult or time consuming.

Corn Silage

Another way to store corn is in the form of silage. Corn silage is green corn chopped, stalks and all, when the grain is just beginning to harden. The chopped material is packed tight in a pile so oxygen can't get to it freely enough to decay it. Storage buildings can be the upright silos you see on most livestock farms, or "trench silos" or nothing more than huge plastic bags of the chopped ensilage closed tight to keep out oxygen. On a small homestead, silage is not a very practical idea unless you happen to have bought a farm with a small silo already on it, or if you live so far north that your corn in some particular year does not have time to ripen before frost.

To make silage you need some kind of ensilage chopper to chop up the corn, stalks and all. Also you need a blower if you intend to put it in an upright silo. To avoid the cost of a silo, some livestock feeders and dairymen bulldoze a trench in a hillside and fill that with silage, packing it down tight with tractors. The silage on top of the trench—about a foot down into the pile—may spoil from contact with air.

Silage is not very good livestock feed in my opinion, but you should be aware of this method of using corn, anyway.

You can at least use as feed the sweet corn stalks from which you have already harvested ears. If you have any livestock, and your pasture has dried up in late summer, you can feed some green corn, stalks and all. Don't feed much at any one time however. Cows can bloat on fresh green corn.

Feeding Yourself

If you don't get all your sweet corn eaten fresh, or canned, or frozen, you can save it for winter parching. Hang it up to dry along with your popcorn and put a handful of it in the popper along with the latter. One of the joys of eating popcorn is working your way to the bottom of the bowl and crunching that parched corn.

There's more than one way to get good popcorn, by the way. Harvest when corn is hard ripe, but try to get it out of the garden or field before rainy fall weather. You can strip back the husks and tie several ears together for hanging and drying, as already mentioned, or you can take the husks completely off and put the ears in mesh bags for hanging and curing. Nylon stockings work just as well as mesh bags. Allow the ears to hang three to four weeks in a dry, well-ventilated garage, basement, or attic. Then shell the corn off the cobs and store kernels in quart glass jars. Fill jars three-fourths full, seal, and store in refrigerator or any other cool dry area. Properly dried and sealed, the corn will retain its popping quality for at least three years, according to the Home Horticulture Center at Ohio State.

If you store the popcorn unshelled, try to hang it in an unheated building where temperatures are 31°-32°F. and relative humidity around 85 percent. That means possible rodent damage, so hang the corn on a wire, as previously recommended. At each end of the wire, push a tin can lid in the center of which you have poked a hole. Mice can walk a wire, but can't get around a metal disk blocking the way.

If your corn doesn't pop well, it is probably too dry. If the unpopped grains are dark and scorched, with a lot of partly split kernels, and if a muffled pop during the popping is the best noise the corn can muster, the corn's too dry. Add a tablespoon of water per quart jar, seal again, and shake well twice a day for a couple of days. Try popping again. If the corn is still too dry, repeat the treatment. When corn is too moist, it will pop with a relatively loud explosion. Popped kernels may be small, jagged, and tough.

Real popcorn gourmets say you can't pop decent corn in an electric popper. Too slow. The corn gets tough. You have to use a hand-cranked popper. Get your burner red hot. Set the popper on it and quickly pour enough oil to cover the popper bottom thinly. Household cooking oil is preferred by most people, but try olive oil or peanut oil sometime. The oil is smooth on the surface when you first pour it in. When you can see broken lines sifting across the surface of the oil, and smoke is beginning to rise, add the corn and quickly spread popcorn salt over the corn, one tablespoon per ½ cup of corn. Immediately start rotating the stirrer.

The corn will begin popping quite soon, and will pop very fast. The real impresario will have put enough corn in his popper to raise the lid at least two inches above the brim of the pan, and will dump it into the eating pan even as the last kernels pop. Waiting for every last grain to pop over the stove reduces tenderness.

Add butter and, oh mama, what a treat.

Kitchen Mills

Small kitchen corn mills are coming back on the market, both hand and electric models. Although you can grind corn into meal with your blender, the process is hard on the blender blades and you'll probably graduate quickly to one of these mills. Sears and Montgomery Ward carry them; Burrows Equipment Co., 1316 Sherman Avenue, Evanston, Illinois 60204 handles them; other models are advertised almost monthly in *Organic Gardening and Farming*® magazine. You can make meal from either yellow or white field corn. And believe me, you'll see a difference in your own freshly ground product, white or yellow. In the future, we'll probably eat more cornmeal from high lysine (high protein) corn and/or waxy corn (high starch).

HIGH LYSINE CORN AND FRESH SOYBEAN SUCCOTASH

2 cups high lysine corn, freshly cut off cob
2 cups fresh soybeans, shelled salt to taste
1-2 cups boiling water
1 tablespoon butter
Stir corn and soybeans into salted boiling water, turn heat down, cover, and simmer until vegetables are tender, about 10 minutes. Drain, reserving broth for soup. Add butter to vegetables and serve.
Yield: six-eight servings

HASTY PUDDING

1 cup nonfat dry milk
3 cups water
½ cup cornmeal
3 tablespoons oil
½ cup molasses
1 teaspoon salt
½ teaspoon nutmeg 1
cooking apple, pared and diced
Preheat oven to 250°F.
Oil a 2-quart baking dish, with cover. Combine nonfat dry milk and water with a wire whisk.
In a medium-sized saucepan, bring 1-1/3 cups of the milk and water mixture to a boil; gradually add the cornmeal, stirring constantly.
Remove saucepan from the heat and add the oil, molasses, salt, and nutmeg. Stir in the diced apple. Mix well and add the remaining milk.
Pour the mixture into prepared baking dish and cover. Bake in a slow oven for 3¼ hours.
Remove from oven and cool slightly before serving. Serve plain or with yogurt in whipped topping.
Yield: six servings

CORN PONE OR CORN CRACKERS

3 cups cornmeal
¼ cup peanut flour (peanuts may be ground in electric blender ½ cup at a time)
1 teaspoon salt 14 cup peanut oil
1 cup boiling water, plus 2 tablespoons or more until batter holds together
Parmesan cheese (optional)
Preheat oven 325°F.
Combine dry ingredients.
Stir in oil gradually.
Add boiling water slowly, mixing with spoon and finally kneading dough. Keep adding water until dough holds together.
With your fingers, flatten rounded teaspoonsfuls of batter on an oiled cookie sheet. If a cracker is desired, flatten it as thin as possible. If a thicker, larger corn pone is desired, use more dough and don't press it quite as thin.
Bake in oven for 40 minutes, or until it is slightly golden around the edges.

Remove from pan while still warm. Cool on a rack and store in an airtight container. Note: Parmesan cheese can be sprinkled on top of crackers before baking them, if desired.
Yield: Approximately five-and-a-half dozen crackers or three dozen corn pones

CORN PUDDING

2 cups frozen corn (approximately 2/3 package)
1 cup boiling water (approximately)
2 tablespoons butter
2 tablespoons whole wheat flour
1 cup water
¼ cup nonfat dry milk
¼ cup chopped green pepper
2 egg yolks
½ teaspoon salt
¼ teaspoon paprika
2 egg whites
Preheat oven to 350°F.
Cook corn in boiling water until tender. Blend corn and liquid together briefly in electric blender to mash it, but not long enough to puree it.
In large saucepan, melt butter and stir in flour gradually, until blended. Combine water and nonfat dry milk with a wire whisk, and add gradually, cooking over low heat until sauce is thickened.
Add corn mixture to sauce and then the chopped green pepper.
In a small bowl, beat egg yolks and pour a small amount of the com mixture over them, stirring constantly, and then return it to the corn mixture. Stir and cook over low heat for several minutes to allow egg yolks to thicken slightly.
Add salt and paprika.
Beat egg whites until stiff but not dry and fold them lightly into the corn mixture.
Bake in oven for 30 minutes.
Yield: four-six servings

CORN BREAD

4 teaspoons dry yeast
1 cup lukewarm water
1 cup cornmeal, white or yellow
½ cup oat flour
¼ cup soy flour
¼ cup nonfat dry milk
¾ teaspoon salt
2 tablespoons nutritional yeast (optional)
2 tablespoons honey
3 tablespoons oil
2 eggs, beaten
Preheat oven to 350°F.
Soften dry yeast in lukewarm water and allow to stand for 10 minutes.

Combine in a mixing bowl: cornmeal, oat and soy flours, nonfat dry milk, salt, and nutritional yeast, if desired.
Combine honey, oil, and beaten eggs and add to dry ingredients, mixing well.
Gradually add yeast mixture, blending well into other ingredients.
Pour batter into a well-oiled (9 x 9-inch) square pan. Place pan in warm area and allow corn bread to rise 30 to 40 minutes. Bake in oven for 30-35 minutes.
Yield: six-eight servings

POLENTA CHEESE SQUARES

5 cups cold water
1 teaspoon salt
1½ cups white or yellow cornmeal
1-2 tablespoons oil
1 cup sharp Cheddar cheese, grated
1/3 cup Parmesan cheese, grated
In a large, heavy saucepan, bring 5 cups cold water and 1 teaspoon salt to a boil. Add cornmeal very slowly, stirring constantly with wire whisk or long wooden spoon until mixture is thick and free from lumps.
Transfer cornmeal mixture to top of double boiler. Place over boiling water and cook, covered, for 30 minutes, stirring occasionally. Cornmeal is finished when it leaves sides of pan.
Remove from heat and turn cornmeal mixture into lightly oiled 9 x 9 x 2-inch baking pan; cool, refrigerate until stiff enough to cut (3 to 4 hours or overnight).
Preheat oven to 400°F. Cut polenta into 16 squares. Arrange in an oiled baking dish. Sprinkle with Cheddar and Parmesan cheese*, place in preheated oven, and bake for 15 minutes or until cheese is melted and nicely browned. Serve immediately.
Note: Serve with beef stew or Italian meatballs.
* Polenta may also be prepared by adding Cheddar cheese to cornmeal mixture just before removing from heat. Proceed as above. Sprinkle with Parmesan cheese before placing in oven.
Yield: six-eight servings

Chapter 3

Wheat:

The Source of the Staff of Life

Wheat is the tastiest grain and the easiest to prepare for table use, which alone ought to make it desirable to both small farmer and gardener. Moreover, wheat is an attractive plant that can add beauty and satisfaction to your gardening and homestead efforts in addition to fiber and nutrition to your diet. Particularly winter wheat. Planted in the fall, it stays green until early winter and begins growing again immediately in the spring. In fact, with a patch of wheat in your garden, your gardening season fills the whole year, even winter, since in late February you should be broadcasting clover seed onto your wheat to become the cover crop or green manure crop after the wheat is harvested the following summer.

There are few landscapes more beautiful than wheat fields in November against a backdrop of brown-leaved woodland. Our county here in Ohio, like hundreds of others, resembles in late fall an almost unending series of golf courses, with wheat fields shimmering like huge emeralds in the slanting sun. You can achieve the same effect on a small scale in the garden where marigolds and mums, defying frost, can form a golden border to the rich green of November wheat.

Early in spring, the wheat, which has turned brown and dormant over winter, stages its green carpet show all over again. The plants then "stool" and send their stalks three to four feet high in rapid response to warm weather and days of longer sunlight. Within two months after the plants begin spring growth, they head out, and those acres and acres of heads bowing in the wind turn fields into rippling green seas. As the heads ripen, the plants turn yellow, then golden brown. I just don't know where you can find a picture prettier than waves of golden, windswept wheat on a sidehill in June. Van Gogh thought so too.

Wildlife love the cover of the standing wheat, (and the eating of it too): rabbit, quail, pheasant, partridge, raccoon, muskrat, and groundhog. And why is it that the fireflies seem to flicker heaviest in June over the wheat fields?

Varieties

There are five commercially important wheats grown in the United States: hard red winter, hard red spring, soft red winter, white, and durum. The hard red wheats are grown mostly west of the Mississippi and are used commercially for making bread; soft red winter wheat mostly east of the Mississippi and is used principally for pastries. White wheat you'll find chiefly in the Pacific Northwest (sometimes too in New York and New England) and is used for bread too. Durum, grown almost exclusively in North Dakota and surrounding states, makes the flour for macaroni, spaghetti, and similar foods.

Spring wheat is planted in the spring for late summer harvest. It is grown where winters are too severe for winter wheat. The latter is planted in the fall, grows awhile, lapses into dormancy, renews growth as I've described, and is harvested in midsummer. Spring wheat does not yield as well as winter wheat, all things being equal, nor does it grade as high.

You should plant the kind of wheat that is grown successfully in your area. You can use soft red for bread, and in home cooking even if that is not done commercially. Bread from the soft wheats is just as good as from the hard wheats. The latter make bread more "efficiently"—at lower cost per pound of flour—so are favored by commercial breadmakers.

There are dozens of varieties of wheat of every kind, and new ones are developed almost yearly. Find out from neighboring farmers, the local feed store, or your local extension agent which varieties are recommended for your particular area.

WALDRON and OLAF are two newer spring wheat varieties developed for the Great Plains. Older ones: SELKIRK, HENRY, and LATHROP.

Hard red winter varieties are legion: SCOUT, BUCKSKIN, HIPLAINS, HOMESTEAD, SAGE, SENTINEL, CHEYENNE, TRIUMPH, GADDO, PAWNEE, OTTOWA, KAW, GAINES, NUGAINES.

Soft red winter wheats include: ABE, ARTHUR, ARTHUR 71, BLUEBOY, MACNAIR, OASIS, RULER, COKER, HOLLEY, and REDCOAT.

White wheats: MARKED, TWIN, WS-1, MCDERMID.

Hybrids

Cereal grains are much more difficult to hybridize than corn and results are not as satisfactory so far. But hybrid wheats (DEKALB 505 and DEKALB 851) are being developed which show promise for the West from Texas to Montana. Hybrid wheat will probably continue to be of interest in the dryland wheat country where yields average lower than in the soft red winter wheat area of the East. But where new, non-hybrid soft red wheats like RULER in Ohio attain yields of over 70 bushels per acre consistently, growers are hardly going to be interested in higher priced hybrid seed.

Despite disagreement from the seed trade, I must persist in pointing out that hybrid seed is not always or necessarily the greatest thing in the world of agriculture, especially in cereal grains. Hybrids increase the farmers' dependence on the seed producer. You can't save your own seed from hybrids. Responsibility of providing seed for our annual food supply falls into the hands of fewer people, which increases the risks. And as plant breeders have proven with cereal grains, it is possible and practical to improve yields, adaptability, and disease resistance without hybridization.

Newer wheats in both the East and West are shorter in height than older varieties. And the straw is stiffer. These wheats resist lodging (falling over) better, even with high rates of nitrogen fertilizer. Organic growers may prefer the older taller wheats, if they desire large quantities of straw for

mulching or bedding. However, even the shorter wheats produce a good amount of straw.

Selecting Seed

Should you plant certified seed, germination-tested and weed-free? I have to answer yes, because that's the "right" way. If you are growing wheat commercially you'd be foolish not to use certified seed because where profits are important, why be half-safe? The newer certified varieties are more highly disease resistant too. ARTHUR 71 has excellent resistance to Hessian fly and leaf rust; OASIS to septoria leaf blight. ABE and ARTHUR 71 mature in time to use in a double-cropping system as far north as the southern Cornbelt. When you buy certified seed, you know what you're getting. And even when protected by patent, certified seed can be saved and planted on your own place or sold to your neighbors.

But I also have to point out that in a year when the wheat is generally of high quality (weighing close to 60 pounds per bushel like it should), you can save money by going up to the grain elevator and buying a couple bushels of wheat or however much you need, just as it comes in from the field.

Invariably it will grow all right, though you won't know what variety you have.

Organic growers who want untreated seed won't have much of a problem getting it. Just order that way. (Or buy as I just described in the preceding paragraph).

About half the seed wheat is not treated anyway, processors tell me, because many dealers want an "out." If the wheat doesn't sell as seed, they can at least sell it as feed if it's untreated.

The most economical way to "buy" seed is to save your own from good certified seed. If you harvest your crop with a combine that has good cleaning capacity, most of the weed seed and chaff will be separated out in harvesting. With older combines your wheat may be full of weed seed, bugs, and chaff. To remove, small amounts of grain can be winnowed clean by hand in front of a fan or stiff breeze. Or you can get a seed cleaner, which used to be standard equipment on every farm. Older cleaners are rapidly becoming collector's items, though you can still purchase them at farm auctions for under $25 occasionally.

New seed cleaners are available for around $200 and up, pretty steep. Sears sells one. So does Nasco (Fort Atkinson, Wisconsin 53538 or 1524 Princeton Ave., Modesto, California 95352). Commercial models for seedsmen are available in many brands, at much higher prices. If interested, you might write for the catalog from Burrows Equipment Co. (1316

Sherman Ave., Evanston, Illinois 60204). In fact, if you want to find out what is going on in the whole arena of seed processing, the easiest way is to subscribe to the Seed Trade Buyers Guide and Directory (434 S. Wabash Ave., Chicago, Illinois 60605). Most of the equipment advertised there is far beyond the price range for homestead use, but for $5 (1975 price) you get a wealth of information about the seed business hard to find elsewhere.

Growing Wheat

Wheat is not difficult to grow. You can plant a small plot of it as easily and as simply as you would plant a small plot of lawn, because that's what wheat is, a grass. Work up a fine seedbed with rotary tiller, rake, disk or harrow, broadcast the seed on the soil surface, rake or harrow lightly to cover it. That's about all the work there is until harvesttime.

The time of planting winter wheat in the fall is important. Because of a pest, Hessian fly, you should wait until after the "fly date" in your area usually around September 15, before planting. Ask any farmer for the proper fly date, after which Hessian fly is not active. Plant too early and you run the risk of an infestation. With new, Hessian-fly resistant varieties, the risk is not great, but why plant too early anyway? You've got plenty of other things to do in the first half of September. If you don't, go fishing awhile. I've seen wheat planted as late as November 5 barely come up in the fall, and still make a crop the next year.

If you do plant early, or if the weather remains unusually warm late in the fall, your wheat may begin to "stool," develop a stalk, which means it could more easily winter-kill later on.

In some areas, like Kansas, farmers graze their wheat which will control stooling. In spring, grazing can be continued until warm weather with grain harvested from the same plants a couple of months later.

Fertilization

Wheat is not nearly as demanding of fertilizer as corn is Keep your pH for wheat as close to 6.4 as you can and plant in well-drained soil, and half your growing problems are avoided. Wheat doesn't like acid soil and hates wet soil.

A typical low-nitrogen treatment for wheat on chemical farms might be 30 pounds of actual nitrogen per acre at planting and another 30 pounds top-dressed on the wheat in early spring.

Organic growers can equal that application with several tons of manure per acre. In a fairly fertile soil that has been green manured in the recent past and in soybeans the preceding year, that much manure contains enough

nitrogen. Any more and the stalks might lodge. You'll need phosphorus though. A two-ton application per acre of finely ground rock phosphate every four years should be your standard program. Wheat does not seem to respond to potassium very much, but it needs some. Manure, green manure, greensand, or any labelled organic fertilizer like those mentioned in the last chapter are fine, though the latter two are somewhat expensive for larger acreages.

In the garden, manure, rock phosphate, and either greensand, alfalfa hay mulch, tobacco stems, or wood ashes will give wheat all the nourishment it needs.

Wheat provides a good example of what the agronomist means by balanced fertility. If you put 40 pounds of actual nitrogen per acre on wheat where there is not an adequate amount of phosphorus, you will fail to get a good crop, at least not a yield like you'd get by putting on 40 pounds of nitrogen and 40 pounds of phosphorus. (A balance does not necessarily mean the same amount, it just happens to work out that way with wheat.) Without the phosphorus, the wheat can't use the nitrogen. Likewise, supplying that much nitrogen and phosphorus, but not 15 to 20 pounds of potassium to balance it can result in the crop lodging. It needs the potassium for building strong enough stalks to handle the extra growth from the added nitrogen and phosphorus. This is not so much a problem with organic fertilizers in which the comparatively low amounts of N-P-K are fairly balanced. But with chemicals, a farmer can more easily get one nutrient out of whack with the others. At best, he's wasting money.

Trace element deficiency has not been a problem with wheat yet. Certainly with an organic fertility program as outlined above, you won't have to worry about trace elements.

Sowing the Seed

I've mentioned broadcasting as one way to plant the seed. A grain drill will do a better and more precise job. Older grain drills are fairly easy to buy from dealers in used farm machinery. With a drill, the seed is placed at whatever depth you desire (two to three inches is about right) in rows just a few inches apart. With a drill, you plant about a bushel per acre. Broadcasting requires more than that for a comparable stand, five to six pecks per acre.

But broadcasting is adequate for wheat and certainly cheaper. On a homestead or small farm, you can sow four acres easily by hand with no more of a tool than a hand-cranked broadcaster, Cyclone is the brand sold most places. The broadcaster is a canvas bag with a wooden bottom to which a spinner is attached. The bag is filled with the seed, the opening in the wood bottom set at the desired rate of seeding, and with the whole apparatus slung over his shoulder, the sower walks at a steady pace, hand

cranking the spinner which throws the grain out evenly on both sides of him. The opening through which the seed falls onto the spinner has numbers at the various notched settings, but whether you actually sow two pecks per acre at the "2" setting depends entirely on how fast you walk and how fast you turn the crank and what kind of seed you are sowing. Those numbers have to be calibrated to your pace and cranking speed, so to speak. Don't get too uptight about it. Just concentrate on walking at a steady pace and cranking at more or less the same speed. Then if you know how big the area is you want to plant, you can ascertain pretty quickly if you are getting the proper amount of seed on. A little experience goes a long way. Better to put on too little seed the first time. You can always go over the ground twice.

Walk straight across the field as you crank. If the seed falling on the ground seems to be about the rate of one seed per square inch, that is about right. Note how far out the seed is thrown from where you walk. Then on your return trip you'll know how far to walk from your first path so that you don't miss any ground and don't overlap either.

Larger broadcasters on the market operate off the power take-off axle on farm tractors and sow just about as accurately as drills. On very small plots, you can toss the seed on with your hand.

Before seeding, the ground should be worked, as already mentioned. I advise planting wheat, if possible, after soybeans in the fall, though other rotations may be satisfactory, too. However, if you do plant after soybeans, or any legume crop that fixes nitrogen in the soil, disk the ground in preparation for planting only lightly several times. Try not to turn up the old bean roots on which there may be attached nodules of nitrogen. Exposed to air, the nodules lose nitrogen that would otherwise be available for the wheat. Pulling a harrow behind the disk will help level the field, though the bean straw may plug up in the harrow too much.

In the garden, the rotary tiller can be used to work the soil lightly. Follow with a good raking to level the surface.

After broadcasting, go over the field or plot again with harrow or rake. That will cover most of the wheat seed. Don't worry that some of the seed is not covered. At five to six pecks per acre planting rate, you'll have enough seed germinate for a crop. The seed on top of the ground may grow anyway, if rain falls after planting.

Grazing the Young Plants

If you would like to use your wheat for the dual purpose of grain and graze, the most practical way as a homesteader would be to let chickens peck at it late in the fall. Be sure to let the wheat grow for about a month before grazing it, so that roots develop well before the chickens peck the green blades away. A light grazing by sheep or a cow would be okay too, but if

the ground is muddy, as it usually is in late fall in the East and Midwest, the animals will trample and pack the soil too much.

A half-dozen chickens could be turned on a 20' x 60' patch of wheat in the spring and left there. The chickens' consumption will cut your total yield, especially if you let them go on eating the wheat after it grows up and heads out, but you have to feed the chickens anyway. You can't do it any cheaper than letting them harvest their meals themselves.

Problems with Wheat

The most common problem is lodging. When wheat is heavy and high yielding, wind may knock it flat on the ground, making harvest exceedingly difficult. This is called lodging. Shorter, stiffer-strawed wheats have solved the problem to some extent. But too much nitrogen, producing rank, succulent growth, may still cause lodging. Lack of potassium, which is the nutrient that strengthens the stalks, will also cause lodging.

Rusts and blights have been problems with wheat traditionally, but continual breeding of resistant varieties has held these diseases at bay. Smut, black heads of rotted wheat, used to dot wheat fields when I was a child. Today, if you say smut, everyone thinks you're talking about that stuff you're supposed to pretend you don't read.

"Take-all" is the common name for an old and serious disease that has recently reared its ugly head in the eastern Cornbelt region. The disease is caused by a soil-born fungus which grows best in wet conditions. Symptoms are stunting, premature ripening, and lodging. Roots rot and stem bases disintegrate. Stems often blacken near the crown, and then the plant breaks off at ground level. Losses can be total, hence the name "take-all."

Once infected, the wheat can't be saved by any means at man's disposal. But control is not difficult. The disease seems to strike wheat most frequently on poor soil, and is rarely seen on fertile soil. Low nitrogen, say the experts, favors disease development. Another control, say the experts, is to avoid planting wheat after wheat, proving again the pest-prevention powers of crop rotation.

Don't use straw from a field known to be infected with "take-all" as the fungus can be carried to another field in that way.

Weed Control

The worst problem in raising wheat organically is weed control. Because wheat is planted "solid" rather than in rows, you can't weed it, so without very good management, you can get too many weeds. Chemical farmers spray herbicides to control most weeds in wheat fairly easily.

Organically, you have to get those weeds by clever rotations. The crop before wheat should always be a row crop that has been cultivated intensively for weed control. That way you at least start off ahead of the weeds. Then, because wheat is sown in

the fall after most weeds quit growing, it gets even a better jump on weeds; it makes a good stand and is off and growing in the spring, choking out most weeds that try to come up later.

But don't plant solid-stand wheat in a weedy field. Grief if you do. Better than do that, plant your wheat in rows and cultivate it like the Chinese do. Americans may laugh at you, but the Chinese have forgotten more about raising food than we yet know.

Crop Rotations

In your rotation of crops either in the field or in the garden, wheat will (or should) be followed immediately by clover for nitrogen and green manure. The reason it follows immediately is because it's handy to plant the clover in the wheat before the latter starts growing in the spring. The wheat then acts as a "nurse" crop for the alfalfa which comes on to heavy growth after the wheat is harvested. More on that and clover in a later chapter.

Since corn should be the first crop to follow the clover, the basis of your organic grain rotation will be either wheat, clover, field corn, or wheat, clover, sweet corn. Since it is good to follow corn with another nitrogen-fixing legume, soybeans in the field, or peas, snap beans, or limas in the garden are fine. And wheat following any of these legumes works well too. Potatoes, wheat, clover, back to potatoes is an excellent rotation where potatoes are a main crop. A five-year garden rotation would be: wheat, clover, sweet corn, peas, and beans double-cropped to fall vegetables, tomatoes, then back to wheat. But almost any variation will work well if you maintain the basic wheat-legume-corn rotation unbroken and don't follow two vegetables of the same kind or family in successive years.

The Harvest

Winter wheat begins to ripen in the South about June 1, and harvesttime moves northward to Canada where it begins about August 1. Ripe wheat turns a flat yellow to almost a dead brownish red, depending on locality and variety. On most varieties, the heads crook over and point to the ground when the wheat is ripe. Pull a few heads, rub the kernels out in the palm of your hand, blow away the chaff like a pro, and chew a few grains. If crunchy hard, the grain is ripe, if at all chewy soft, it is not yet ripe. Moisture content should be 12 to 13 percent before grain can be safely stored. If you want to be real scientific about it all, you can use a moisture

tester to determine the fitness of your grain for harvest and storage. Grain elevators all have the testers. Take a half-bucket sample for testing.

The best and easiest way to harvest your grain if you have half-an-acre or more, is to rent a custom combiner to do it. He'll look pretty silly pulling his monstrous machine into your small patch, in fact he may refuse to come for anything less than 10 acres or so. But a nearby farmer who owns a combine can usually be persuaded to harvest a little patch of grain, after he finishes his own.

Here's how the Logsdons harvested their small wheat plots several years back. Gene would cut the wheat with a scythe, then tie it into bundles, which were shocked until the wheat was ready for threshing. Then the wheat was flailed with old flails, toy baseball bats or whatever else seemed to work. The wheat berries were winnowed from the chaff with the help of a large window fan. These days, the wheat they grow is combined by a neighboring farmer.

Hand Harvesting

On small plots, you can harvest by hand. We have, on occasion, made a sort of party out of the harvest; everyone has fun and the children learn something.

For hand threshing, the grain is cut, tied into bundles and shocked first. For this operation, you do not wait until the wheat is completely ripe, but cut it a little green, when the wheat is still in the doughy stage. The stalks will be yellow, but you will still discern streaks of green in some of them.

Cut the wheat with a scythe, leaving perhaps a three- or four-inch stubble. Cut a swath about two feet wide, whatever constitutes a natural, easy swing of the scythe for you. Actually you should use a grain cradle if you know where to find one outside of museums. The grain cradle is a scythe with a set of wooden tines above the blade that catch the wheat as the blade severs it on your forward swing. At the farthest reach of the cradle's forward swing, the wheat on the tines falls into a neat pile, ready to be tied into a bundle.

But grain cradles are antiques now, so you'll probably have to use a scythe (which will be an antique someday too). I can't tell you how to swing a scythe. You just have to learn by doing. If you grab the handles and swing the blade into the standing wheat ahead of you, the scythe will sort of teach you how to fall into the proper motion and rhythm. The only advice I can give with a typewriter is to try not to take too big a "bite" of wheat at each cut. Instead, cut a narrow swath, letting the blade of the scythe slide against the wheat stalks at a more or less 45° angle, rather than whacking into them squarely from a 90° angle. And take your time. Remember the old German farmers' saying: "Slow and steady goes far into the day."

Tying the bundles can be a tedious task unless you've invited friends over for a picnic and/or party. Then while the men try to show their prowess with the scythe, the gals and the kids can tie bundles. We use baling twine. In the old days, farmers knew how to tie bundles using pieces of the straw itself. I've never mastered the trick though shown on several occasions. A bundle should measure about eight inches in diameter in the middle where it's tied.

When the bundles are all bound, you either set them up into shocks, or stack them in the barn out of the rain. About 14 bundles make a good shock. Over the top of the shock one bundle can be flattened and bent to make a cap to deflect rain from the grain.

Grain will ripen in the shock and remain virtually unharmed by rain for about a month. If you have only a few shocks, as I'm assuming, it's best to get them into the barn as soon as possible after the grain is ripe—or even before—since rain is always somewhat harmful to the straw, if not the grain.

Hand Threshing

Once the wheat ripens in the shock—two weeks at the longest—you can thresh your grain. Lay out a large clean cloth (an old bedsheet is fine) on a hard surface, such as a sidewalk or patio or wood floor. Lay a bundle of wheat on the sheet, and whack the daylights out of it with an old broom handle, plastic toy bat, or other appropriate club. A friend of ours uses a length of rubber hose. You won't have to strike the wheat heads hard, as the grain will shatter out quite easily onto the sheet. Not every grain will fall out. Throw the bundles already flailed to the chickens. They'll pick out any grains you missed, and the straw becomes their bedding.

Each bundle will have a cup or two of wheat in it. After you have flailed several, pull the corners of the sheet together and dump the grain, chaff, and bits of straw into a bucket.

Then you winnow the grain, which means separating out the chaff with some kind of forced air. If a strong breeze is blowing, you can pour the contents of your bucket into a second bucket from a height of three or four feet and the wind will blow away much of the foreign matter. I use a big window fan, which gives a steadier and more reliable blow.

In front of the fan, I must pour the grain from one bucket to the other six to 10 times before all the chaff and straw winnows out. The heavier grain falls nearly straight down into the receiving bucket and the fan blows all lighter material beyond the bucket's rim. (Do the job outside!) You won't get the grain perfectly clean unless you really work at it, but no matter. The few bits of wheat hull that persist in sticking to the grain won't hurt a thing.

It all grinds up to flour and makes the fiber content that much better. But the longer you winnow, the smarter you get about it, noting that you can vary the height of your pour or the distance away from the fan to get rid of nearly all the foreign matter. If you want grain winnowed completely clean, you can use a seed cleaner described earlier.

There are other harvesting alternatives for small plot growers. Threshers and hullers are still very much used by the seed processing trade, but the machines are too expensive to be practical for homesteaders. The cheapest I've seen is a $600 model in the NASCO catalog.

Rodale Press's Research and Development Group has devised a small, homemade thresher that will do a servicable job on most grains. (Details and construction information in the glossary.)

Shredders will do a crude job of threshing grain too. With modifications, they might do even better. Try taking out every other blade. Or remove the screen completely. Gear the motor down so it will run the shredder slower. With a little imagination, you might perfect a good thresher at no cost at all.

I've even threshed wheat with my lawn mower, with a board to one side to block the grain from being scattered too far by the blade. If you have a horse, you might want to try threshing by trampling. Let the horse walk on the bundles on a clean wood floor. Grain is still threshed this way in many countries. But you would have to winnow the grain because all these crude methods of threshing leave much straw and chaff mixed with the grain.

Storing Wheat

It's easy enough to tell you to store grain in insect-proof containers, and easy enough advice to follow. But keeping the moths of grain beetles or weevils out of your dried grain and beans is not the main problem. What causes the trouble is when the eggs or larvae are already on or in the grain when it is harvested or binned for shipment or packaging: you can put the grain in a tightly lidded container and it will still be destroyed, given enough time. This situation is most always true with dried beans.

Assume that weevils or weevil eggs are present in the grain at harvest. Kill them by heating the grain to 140° F. for half-an-hour. Freezing at 0° F. for three to four days is supposed to work too, but I'm doubtful. Nevertheless, cold storage—below 40° F.— will arrest any weevil activity and so preserve the grain. We don't heat our grain but keep it for table use in plastic bags three pounds to the bag in the refrigerator or freezer. The bags are not the best containers but none have burst on us yet. You can't store very much grain in a refrigerator and freezer, unless you have an extra one. But 10 sacks of three pounds each will serve a lot of breakfasts.

Dry ice is another method advised for "fumigating" weevils out of grain. It's considered an organically safe way to protect grain, but I wonder. I'm not so sure the carbon dioxide from dry ice is much safer than malathion, one of the less toxic chemicals that is quite effective in weevil control. A container of dry ice not properly handled can blow up too. Above all, don't use dry ice in a glass container. Use a metal, five-gallon can, spreading two ounces of crushed dry ice on the bottom and putting the wheat on top of the ice. Allow sufficient time—about half-an-hour—for the dry ice to evaporate before placing the lid on the can. If the can starts to bulge, remove the lid cautiously for a couple of minutes and then replace it.

For larger amounts of grain stored in bins in a barn, weevil control starts before the grain is put in the bin. Clean the floor and walls thoroughly. If rats or mice have gnawed holes in the bin, patch them over with pieces of tin securely nailed with roofing nails. Then dust the bin with a pyrethrum preparation or with diatomaceous earth. The wheat is then treated with diatomaceous earth too, at the rate of one measuring cup worth to 25 pounds of grain. Thorough mixing is necessary.

Diatomaceous earth is the fossilized shells of tiny one-celled plants called diatoms. Deposits of these fossils are quarried, milled, finely ground and screened into a talc-like powder that can dehydrate and kill insects. It is considered harmless to humans, plants, and animals unless inhaled in very large amounts. There is some controversy over the practicality of diatomaceous earth as an insecticide; even the USDA reports conflict. However, the USDA recommends the material for weevil control right along with chemicals—something that august organization rarely does with organic controls—so it must be effective.

If you don't have wooden bins to store your wheat in and you are storing only 10 to about 20 bushels, steel drums are far better than wooden bins for protecting the grain. At least rodents can't get in them. Nor chickens or birds. I usually keep a barrel of grain right in the chicken coop, or right outside the door with a tin cover over it weighted with a heavy stone. Don't use a barrel that had oil or some insecticide in it. Even after cleaning, the barrel will carry the odor of what was previously in it, which deters weevils and other bugs perhaps, but may hurt the taste.

There are several kinds of weevils that infest grain. The larvae are all very small, golden white to brown in color. Almost every housewife has had at least one episode with weevils in flour. Need I say more?

Eating Wheat

I don't intend to describe the hundreds of ways wheat can be turned into human food. There are many good whole grain cookbooks, and there are a number of wheat-based recipes included with this chapter.

I've observed that using whole grains is not a matter of availability of recipes. Cooks collect cookbooks predaceously and never use them. So for those of you who, like myself, develop a severe case of laziness at the thought of cooking anything complicated, here are the ways we use our wheat, ways which require very little time or skill.

Every week I grind up a cup or two of wheat in the blender. This is my breakfast cereal. Just plain, raw, coarsely ground wheat. It has a husky, nutty flavor that goes well with cream, milk, and honey. I may sprinkle the ground wheat over oatmeal or dry cereal. Good either way, or alone.

I like the raw wheat taste, but if you don't, there's a very easy way to "cook" wheat. Pop it in a shallow pan as you would popcorn. You don't need a cover on the pan as the popping wheat won't fly about. You don't need oil in the pan either, though you must keep the pan agitated so the wheat won't burn. The kernels "pop" only slightly, but the wheat is then crunchy and easy to chew and quite delicious, salted, and/or buttered. An excellent and healthful party snack food.

If you then grind the popped wheat in the blender and eat with cream and honey, the roasted-nut flavor is even more pronounced and more to some peoples' liking than the raw taste. The popped wheat can be cooked for a hot cereal, too. Cooking wheat otherwise involves a long overnight soaking, an effort way beyond my devotion to any breakfast.

To make pancakes, grind the raw wheat and sift it to make it a little finer. Then mix it into your batter and then into the frying pan as usual. Sorry, Pillsbury, you just can't equal the result. And so easy even I can do it.

My wife makes wheat cookies and a marvelous pie crust with the wheat, and bread, but I must refer you to the mysteries of a cookbook for directions. All I know is that if you only use the wheat my easy ways, you'll be well paid for the time you spend growing it.

Feeding Wheat to Livestock

I discovered today another use for my blender-ground wheat. Mother hen up at the barn is hatching a clutch of eggs. Two chicks are up and about while the rest of the eggs remain uncracked. Mother doesn't want to leave the eggs, but the two chicks are hungry and need momma to forage a little food for them. Rather than run to town for some prepared chick feed, I took a saucer of ground wheat up and sat it in front of mother's nest. As soon as I backed away she began to cluck like crazy, grabbing a pinch of ground grain in her beak and dropping it under her for the chicks. She didn't even have to get up. In a few moments, the chicks came out from under her and ate the wheat with obvious gusto.

I think our blender is going to wear out before most blenders should. What I need is a heavy-duty electric mill to grind the grain in. Or even a hand-operated one. There are several of both kinds on the market. Many are advertised in *Organic Gardening and Farming*® magazine. Sears sells them too.

What you really need of course is a regular hammer mill that grinds grains for animals (or for yourself as far as that goes). Sears sells one of those too, in its farm catalog. Often old ones sell cheap at farm auctions or are left rusting away in the back of barns. Older ones are all powered by tractors via the power take-off shaft or belt and pulley; new ones more often by electric motor.

For animals, wheat does not have to be ground, though crushing usually increases the digestibility and utility of nutrients in it. Young chicks can eat corn only if the kernels are cracked, but they can manage the whole kernel of wheat by the time they are three weeks old.

Wheat has more protein in it than corn but not the carbohydrates and other nutrients. It takes about one-and-one-third times as much wheat as corn to produce the same increase in weight. In other words corn is more fattening. And since wheat is worth more as human food than as animal feed, it is not widely used to fatten animals. But it can be, so long as you remember to feed more of it than you would corn. Wheat and corn mixed half and half makes a good scratch feed for chickens.

I've mentioned that I like to feed my chickens wheat in the bundle so the chickens, instead of me, do the threshing. The drawback to this method is that in the bundle, the grain is more vulnerable to rodent and weevil attack than stored as grain only in bin or barrel. My solution is to feed all the wheat bundles from July till corn is ready, before the weevils have a chance to do much harm.

In ground animal feed, oats are probably more efficient than wheat in combination with corn. But for feeding whole, most animals (except horses) and especially chickens, prefer wheat to oats. Chickens will eat whole oats if there is nothing else around, but the tight hulls on the kernels are not much to their liking.

Straw

Wheat is an extremely versatile crop, food for both animals and man, and able to be grazed too. But it provides another important commodity after the grain is harvested, the straw. Straw is commercially valuable, worth anywhere from $20 to $40 a ton in any given year. It's used in the production of some paper products and as livestock bedding. Though modern livestock housing systems don't use straw anymore, plenty of the more traditional farms still do.

No smart farmer should sell off his straw as it is worth more to him as organic matter than the cash he gets from selling it. Even if he doesn't keep livestock and so doesn't need bedding, he will plow that straw right back into the soil. Or use it as mulch around other plants. Otherwise he has to use the money he gets from selling the straw to buy fertilizer he'll need to replace the loss.

The straw from my little plots of wheat has always become bedding for the chickens first, and then returned as manure to the land. I feed the wheat by the bundle to the chickens. That way they do the threshing—instead of me—by pecking the grains out of the heads, then scratch the straw into their bedding. I feed a few stalks to the rabbits too. They like to chew the straw, even eat a little of it along with the grains in the heads. The bits of straw they bite off then drop through their pens to form bedding in the manure pits below.

If you need larger amounts of straw and have harvested a large field of wheat with a combine, you can clip the stubble down close to the soil surface and then rake up all the straw into windrows for baling. Better though, if you don't need all the straw, to leave the stubble stand at least eight inches tall, as the combine left it, for erosion control and wildlife cover. Rake up just the straw that went through the combine.

If you do not have access to a baler, you can load the straw on wagon or truck with pitchforks and haul it into your barn out of the rain for use as bedding.

Or you could make a strawstack outside, as in the old days. I cannot think of strawstacks without getting sentimental, but I believe the strawstack's value goes far beyond sentiment. The strawstack was the real symbol of agriculture, even more so than the pitchfork, from about 1880 to 1930, the period of agricultural dominance in America. And I think with reason. We lost a lot more than cheap straw when the stacks disappeared from the landscape.

Each of those strawstacks represented a commitment by the community. I remember vividly the threshing rig that blew the threshed straw into those big, round-topped stacks. You needed at least a dozen farmers—the threshing ring—to use the machine efficiently. One man tended the steam engine that ran the thresher, two handled the threshed grain, one or two "built" the stack, and at least six to eight men loaded and hauled bundles to the thresher and fed them into the threshing cylinder. And a dozen farmers needed at least that many women to prepare food. Every straw-stack was an expression of faith between farmers.

Happenstance allowed me to work as part of a threshing ring in my 20s, long after threshing had died out as the normal harvesting method. It just so happened that a group of farmers in Minnesota where I lived in the 1950s were "backward" enough to save money and enjoyment by sticking to their old thresher rather than buy combines like everyone else was doing. I loved those threshing days. I loved the look of all those rolling acres of wheat and oat shocks; the wagons and teams of horses hauling the bundles to the thresher, men bantering each other, men uncommonly proud of their horses hauling the bundles to the thresher, or their skill at loading, or their strength. Women clucking and gossiping over their cooking, long tables of food, huge pots and trenchers of it. Food you could not buy with all the gold in the world.

Threshing was not all fun and games. The work was hard to take unless you were used to it. And not all the farmers got along with each other. Threshing compelled them to work together, whether they liked the idea or not, and now I realize that was a good thing. There was a closeness between men in those days that is lost now that each farmer goes his own way, alone in his tractor cab.

The strawstacks were rallying points on each individual farm, too, a place where life flocked and frolicked all through the rural winter. The barnyard around a strawstack was always very alive. The farmer had to be there every day to take great gobs of straw inside the barn for bedding. His children tumbled and slid down the stack, though not always with father's approval. The cows snuggled in close around the stack, wearing the straw off where they rubbed until the stack resembled a huge mushroom with a thick stem and overhanging cap. Against the "stem," under the overhanging straw, the animals could huddle, snug from the snow and rain. Sometimes, a cow or horse would chew on the greener straws, eating—literally—a hole into the stack big enough to accommodate half its body.

The hogs had their own stack. A frame of logs or rails was first constructed and the straw then heaped over the frame. The room thus created inside the frame was warm and cozy enough even for piglets.

All winter long, organic life teemed around the stacks. Manure droppings were covered quickly by fresh straw, and the composting process began in the dead of winter. Livestock could lie on the straw-covered manure pack and stay warm because the bacteria and microorganisms were already heating up the manure in their work of decomposition.

Chickens fluttered around the stack too, seeking grains of wheat still in the straw or a place to lay eggs. Pigs nosed about, eating the undigested grain from the manure of the cows.

There was a chorus of mooing, neighing, squealing, clucking, and laughing, presided over by a farmer who, if he thought no other human was about, might very well be singing.

A year after the stack was gone, all that was left where it stood was a storehouse of nitrogen, phosphorus, potassium, and humus. Certainly, as my grandfather often proved, there was no better place to plant watermelons, even in the North where watermelons aren't supposed to grow so well.

But the strawstacks are gone now. And on too many farms, the animals are gone too. In winter, the barn lot is an empty, windswept, forlornly cold place to be. The old barns stand as silent as mausoleums, replaced by modern stinking, chemicalized, electrified, cemented "systems" where animals are crammed together like fistfuls of maggots.

The strawstacks have disappeared, the barns stand empty, and the farmers are all going to Florida for the winter. Their children have gone away too. You will find them sitting stolid and impassive before television sets. Watching Walt Disney show them how children used to learn about life: caring for animals and sliding down strawstacks.

CRUSTY OVEN-BAKED FISH

2 pounds haddock or flounder fillets
½ cup wheat germ
½ cup peanut flour (raw peanuts ground in blender or nut grinder)
¼ cup sesame seeds
½ cup bran flakes or whole grain bread crumbs
1 teaspoon salt
½ teaspoon black pepper
½ teaspoon oregano
½ teaspoon marjoram
½ teaspoon paprika
½ teaspoon garlic powder
1 egg, beaten
½ cup oil
½ cup lemon juice

Preheat oven to 400 ° F.
Rinse fish. Cut into portions and leave to drain.
Combine all dry ingredients to make crumb mixture and set aside.
Combine egg, oil, and lemon juice in a blender or use an egg beater to obtain an emulsion.
Dip portions of fish into egg dip and then into crumb mixture.
Lay on shallow baking pan which has been lightly oiled. Bake in oven approximately 20 minutes, until tender.
Yield: six-eight servings

APPLE WALNUT LOAF

½ cup oil
1 cup honey
2 large eggs
1 teaspoon vanilla
4 tablespoons yogurt
1 teaspoon baking soda
½ teaspoon salt
2 cups whole wheat flour
1 cup walnuts, coarsely chopped
1 medium apple, unpeeled
In a large bowl, mix together well the oil, honey, eggs, vanilla, and yogurt.
Add the soda and salt and mix very well.
Stir in the flour, until thoroughly mixed. Stir in the walnuts.
Wash and core, but do not peel the apple. Cut the apple into largish chunks and add it to the batter.
Pour batter into two well-greased 7½-inch loaf pans. Starting in a cold oven, bake at about 350° F. for about 50 minutes.

NO-KNEAD WHOLE WHEAT BREAD
FROM COUNTY CORK, IRELAND
(Myrtle Alien Bread)

4 teaspoons dry yeast
2/3 cup lukewarm water
2 teaspoons honey
5 cups whole wheat flour
3 tablespoons molasses (unsulphured)
2/3 cup lukewarm water
½ tablespoon salt
1/3 cup wheat germ
1-1/3cups lukewarm water
½ tablespoon butter
1 tablespoon unhulled sesame seeds

Sprinkle yeast over lukewarm water. Add 2 teaspoons honey. Leave to "work" while preparing the dough.

Warm whole wheat flour by placing it in a 250° F. oven for about 20 minutes.

Combine molasses with 2/3 cup lukewarm water.

Combine yeast mixture with molasses mixture. Stir this into the warmed flour, then add the salt and wheat germ and finally the 1-1/3cups lukewarm water. The dough will be sticky.

Butter loaf pan (9¼ x 5¼ x 2¾), taking care to grease the corners of the pan well. Turn the dough into the pan. No kneading is necessary. Smooth dough in pan with spatula which has been held under cold water to prevent stickiness. Sprinkle sesame seeds over top of loaf. Leave to rise to top of pan in warm, draft-free place. Meanwhile preheat oven to 400°F.

Bake in oven for 30-40 minutes or until crust is brown and sides of loaf are firm and crusty. Set pan on rack to cool for about 10 minutes, then remove loaf from pan and cool completely on rack before slicing.

Yield: one loaf

CHEESE WHEAT GERM BISCUITS

3 tablespoons oil
¾ cup yogurt
¼ pound sharp Cheddar cheese
½ teaspoon salt
¾ teaspoon baking soda
¼ cup raw wheat germ
1¼ cups whole wheat flour

Preheat oven to 400 °F.

Mix the oil and yogurt together in mixing bowl.

Grate the Cheddar cheese into the same bowl. Add the salt and mix.

Mix the baking soda in very well.

Add the wheat germ and flour and mix both in until well distributed.

Pat out dough and cut into ¾-inch-thick rounds. Place on oiled baking sheet and bake in oven for 20 to 25 minutes.

Yield: eight biscuits

BEEF AND WHEAT BERRY CASSEROLE

1 cup whole wheat berries
3 cups water
½ teaspoon salt
1 pound ground beef
1 onion, chopped
5 tablespoons oil
1/3 cup whole wheat flour
2 teaspoons parsley, chopped
½ teaspoon sweet basil
½ teaspoon salt
4 medium-sized potatoes, cooked and mashed

Preheat oven to 350° F.

In a saucepan which has a very tight-fitting lid, combine wheat berries, water, and salt. Bring to a boil, cover, and remove from heat. Wrap pot in newspapers or a heavy woolen blanket and allow to stand overnight in a warm place. Drain and reserve liquid.

Sauté the beef and onions in 2 tablespoons of oil and set aside. Drain and discard excess fat.

Heat remaining 3 tablespoons oil in skillet, stir in whole wheat flour, and cook for a minute or so. Then add 1½ cups of the reserved wheat berry liquid and cook, stirring constantly, until mixture is thick and smooth. Add herbs and salt.

Butter a 2½-quart casserole and put the wheat berries in the bottom, then a layer of meat covered with half of the sauce. Top casserole with mashed potatoes and pour remaining sauce over them.

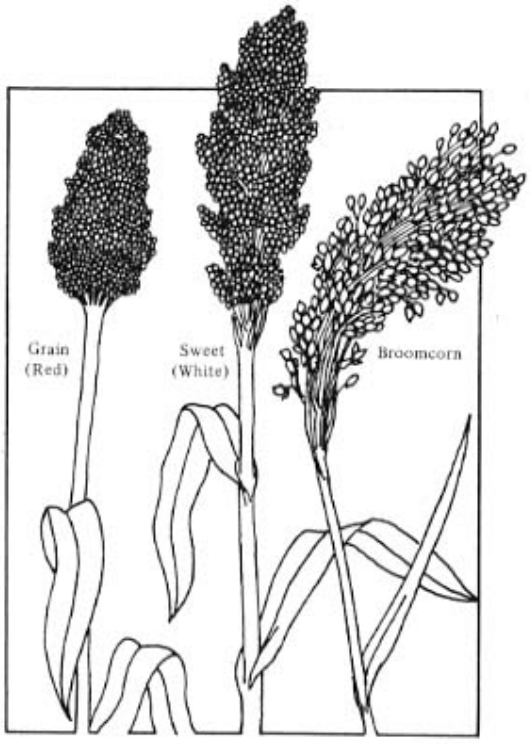
Bake in oven for about 30 minutes, or until casserole is hot and bubbling.

Yield: eight servings

Chapter 4

The Sorghum Family

When it comes to the feed grains, corn gets all the glory. Point out that grain sorghum is almost equal to corn in nutrient value and that it will outproduce corn in dry climates, and in fact, will grow in dry climates where corn won't, and you are met with silent disbelief. Point out furthermore that grain sorghum makes a fine flour for human diets and the silent disbelief may turn to not so silent snickers. A great many people have never even heard of grain sorghum.



If you are driving down a highway in Texas and see a field of what looks like knee-high corn only the leaves are narrower, that's grain sorghum that has not headed out yet. If you spot a field anywhere from the Cornbelt to Louisiana that looks like the tallest corn you ever saw but doesn't have any ears—only clusters of small seeds on top—that's sweet sorghum. And if you notice a field of cornlike plants with bushy, whiskbroom tops where the tassels should be, that's broomcorn. All three plants belong to the sorghum family, and all three can have a place on your homestead, or in your garden.

Grain Sorghum

Of the three, grain sorghum is the most extensively grown in this country. It's the principle feed grain grown in Texas, Oklahoma, and parts of the dry Great Plains all the way to California. Grain sorghum grows well through the South too, and competes with corn in some parts of the Cornbelt, though it is very doubtful sorghum will ever take the place of corn in humid climates.

Grain sorghum reaches a height of about four-and-one-half feet with the seed clusters forming at the top of the stalk. In commercial plantings, the grain is harvested with a combine just like wheat is harvested. Yields are comparable to corn, about 100 bushels to 180 bushels per acre on unirrigated land, depending on fertility. But where corn will only yield 80 bushels per acre in dryland western conditions, sorghum can yield 100 bushels.

Varieties

Grain sorghum seed is brownish with yellow and red coloration mixed in. The browner the seed, the more tannin is present, generally speaking, and the lighter the seed, the less tannin. The higher the tannin content, the less palatability the grain has for cattle and presumably for human consumption. Lighter colored varieties, especially those labelled "yellow endosperm" varieties are the most palatable. Also tannin content seems to be related to crude protein digestibility, the higher the former, the less the latter. So although grain sorghum usually contains more crude protein than conventional corn, less of it is digestible. All of which would seem to direct you to select yellow endosperm varieties, especially the homesteader looking for alternate kinds of whole grains for table use.

But if birds are a problem where you live, that choice may be a bad one. Birds are the fly in the ointment to growing yellow endosperm sorghum because they love the stuff. Out West, in a 1,000-acre sorghum field, the birds might wipe out several acres worth and no one would know the difference. But in Georgia, or Ohio, or similar areas, where birds are more numerous and fields smaller, grain can be a mighty poor business. When a friend of mine grew . a couple of rows of yellow endosperm grain sorghum in his garden for flour, the birds literally wiped out all clusters he didn't cover with paper bags.

So plant breeders, who are certainly a resourceful lot, have developed bird-resistant varieties of grain sorghum. It was noted that the higher the tannin content, the less birds ate the grain, at least if there was anything else around to eat. So breeders developed grain sorghums which have a high tannin content when the grain is in the milk stage—which is when the birds really like to gobble it—but in which tannin content decreases at maturity, for

better palatability. These sorghums can be planted even in the Lake Erie region where the red-winged blackbirds resemble a plague of locusts.

The palatability of bird-resistant sorghums evidently affects only livestock. Chickens relish grain sorghum of any kind, and I can vouch for that. I save seed, even from sweet sorghum, which is not considered a feed grain, and the chickens love it. So do we.

Growing Grain Sorghum

Grain sorghum seed certainly doesn't look like corn seed; the former is smaller than peppercorns and roundish. But when you plant your grain sorghum, think corn. You raise them both about the same, though there's more variability in sorghum culture than corn. Sorghum has been planted successfully in everything from seven-inch rows to 40-inch rows. A happy medium, 30-inch rows, is your best bet. In the row, you should maintain no more than three plants per running foot, and in dry climates less than that. The amount of seed planted per acre varies all over the place too, depending on climate, row spacings, and fertility. Some farmers in dry areas plant less than two pounds per acre and in humid areas as much as 16 pounds. Again, strike a happy medium: eight pounds is plenty. You don't want to get sorghum too thick or you'll have thin, weak stalks that lodge.

Plant grain sorghum about 10 days after the proper corn planting dates. Because sorghum can be planted later than com, southern farmers can plant it after combining wheat in June and so get two crops from the same field in the same year. They couldn't do that with corn. Also the later planting date of sorghum gives the small farmer or homesteader greater flexibility. If your corn planting gets delayed by bad weather, or your old equipment (or primitive hand-tool methods) is too slow to get the corn you need out on time, you can always go ahead and plant the rest of the acreage to grain sorghum. For instance, if you have only weekends for homestead work and it rains on two weekends in May so that you are facing June only half finished, grain sorghum to the rescue!

Cultivate as you would corn, which means as soon as possible after planting. Sorghum looks more like grass when it first comes up, and you'll probably have it too thick, so if your early cultivation buries a few of the plants with dirt, don't worry about it.

Diseases

Grain sorghum diseases include bacterial leaf spot, bacterial streak, anthracnose, grey leaf spot, helminthosporium blight (don't try that one if you lisp), rough spot, rust, sooty strips, target spot, and zonate leaf spot. In the drier regions west of the Mississippi, such leaf diseases are seldom a problem of major proportions. In humid areas, they can cause trouble in a wet year. Crop rotation, sanitation, and the use of resistant varieties are the

best way to avoid bacterial and fungal diseases, as is true of most grains most of the time. But I always feel that such standard advice is no advice at all.

Downy Mildew

Three kinds of downy mildew attack sorghum. Two of them, popularly called "crazy-top" and "green-ear" are rare and of little concern to the homesteader. The third kind of downy mildew, however, is causing severe problems along the Texas Gulf Coast, has spread throughout the South, and has been discovered as far north as Indiana. Diseased seedlings show a white "down" on the underside of leaves. The down releases more spores, which cause lesions on plants. The leaves first become striped, then shred.

Fortunately, hybrids are available with a high degree of resistance. Be sure you get one if you decide to grow sorghum in the humid South.

Also avoid growing Sudan grass or sorghum-Sudan hybrid grasses where downy mildew is a problem. These close relatives of sorghum can become heavily diseased and contaminate the soil for years.

Mosaic

Maize dwarf mosaic (MDM) strikes grain sorghum worse than it does corn, at least where grown in the proximity of Johnson grass. Johnson grass serves as a reservoir for the virus, especially over winter. Then aphids feed on the Johnson grass and carry the virus to sorghum and corn. A typical symptom on sorghum is a light and dark green mottling of the leaves, discoloration of the heads, and stunted growth.

Eradicating Johnson grass would eliminate much of the problem, but that seems to be an impossibility. Cut down a Johnson grass shoot, and 14 come up to take its place. Cut two and 28 appear. A really energetic cutter can create a jungle in two days. And the stuff grows so fast you can't afford to leave a tractor in the middle of a field overnight. You might not be able to get it out until winter. If cows would eat the stuff, we could solve any food shortages in a hurry.

I exaggerate only a little.

No sorghum hybrid is completely resistant to MDM, but some varieties are quite tolerant of it. Unless weather conditions turn unusually cool, an infection doesn't seem to make much headway. Hot weather seems to hold it in check.

Rots

A number of stalk and root rots damage grain sorghum: charcoal rot, fusarium stalk rot, red stalk rot, and some others of minor significance. The only control is to use recommended resistant varieties sold in your area. But remember that sometimes nutritional problems look like diseases. Iron deficiency in sorghum is a good example. It causes leaves to turn yellow with dark green veins and leaf tips to turn white. Looks like any number of diseases, but it isn't.

If planted too early in cold wet soil, sorghum seed is prone to rot, more so than corn. Nonorganic growers treat seed with a fungicide but the best defense is to not plant until the soil has warmed properly. One rule of thumb says to plant when the soil surface (two-inch depth) at noon registers at least 70°F.

The Harvest

Harvesting grain sorghum is easier than harvesting wheat. When the seed heads are ripe and dry, the grain comes out of them easily enough; in fact, it will shatter out if left in the field very long after ripening. Go down the row after the seeds are hard, but not dead, falling-off ripe, and cut the seed heads off with about a foot of stalk. Pretend you are cutting a bouquet of seed clusters for display in a large vase or urn, which, by the way, is an excellent thing to do with the seed clusters; the brown-red-yellow seeds make an attractive fall table decoration. Tie the stalk heads together into bundles and hang in the barn, or spread no more than two or three bundles deep in a clean out-of-the-way corner. Hanging or laying, the clusters can dry until you need them.

I should mention too that in the North, grain sorghum grown commercially must often be harvested before it is completely mature, then artificially dried, because of the shortness of the season. If you allow the crop to stand in the field and the fall is wet, you might have trouble getting it harvested at all before it molds. Therefore, on the small homestead, cutting the heads before they are completely ripe and hanging the bundles in a dry barn is a doubly good idea.

Larger plots of grain sorghum should be harvested with a grain combine. A quarter of an acre seems to be the most to try to harvest by hand unless you are a real glutton for work and want to tackle more. But sorghum will not be one of your "main grains" and a little will go a long way on a homestead. Since the grain will yield 100 bushels to the acre without too much trouble, you ought to get 25 bushels from a quarter-acre, or 12 bushels from an eighth of an acre, or at least six from a sixteenth of an acre. Six bushels is certainly adequate for a small homestead. Some for you and some for the chickens.

After chewing on the stub of my pencil here for 15 minutes, my calculations say that a row of grain sorghum 200 feet long can be expected to yield at least one bushel of grain. And that might be the right amount for your first venture into grain sorghum.

Storing Seed

Storing the seed (threshed or in the bundles) poses no insect problems in the North, at least not in my experience. But in the South especially, (or I suppose anywhere grain sorghum has been stored over a number of years) both the rice weevil and the angoumois grain moth can be problems. Like the bean weevil and some wheat weevils, these two characters can infest the grain before it leaves the field, which means that all those directions about storing in insect-proof cans are out the window. The insects are in the grain already. (For ways to solve the dilemma, turn to the chapter on wheat where I talk about storage.)

Feeding Livestock

Feeding grain sorghum to small homestead animals is supremely easy. Just toss a few seed clusters to the animals each day. With chickens, for example, serve up one seed cluster per six hens per day along with an equal amount of corn or other grain. Most nutritionists do not recommend feeding only grain sorghum unless you feed supplemental plant protein like soybean meal. University of Georgia tests show that cattle on grain sorghum alone didn't do as well as on corn because the crude proteins in the sorghum weren't utilized well enough by the animals. When soybean meal was added, the sorghum feeding resulted in admirable gains of about three pounds per day. Nonplant protein like urea won't produce the same good gains, report the scientists. Who says organic protein is chemically all the same?

Sorghum Flour

For flour for your own use, go to the barn and thresh out a couple of measuring cups full when you need them. I take one seed cluster at a time, hold it over a bucket between the palms of my hands and rub back and forth vigorously, as if I were rolling out a ball of clay. Wear gloves. The seed will thresh out easily, and you will get your two cupfuls quickly. You'll also get some hulls and stem bits which you can winnow out in front of a fan (see chapter on wheat). You won't get your grain completely clean, but no matter. Ground up, that fiber from hull and stems will do you good.

We grind the grain sorghum in the blender, like we do wheat, and use it two-thirds sorghum to one-third wheat flour. We think the sorghum flour alone is too heavy especially for bread. You be your own judge. For cookies you can see the sorghum flour alone with good results.

Sorghum is excellent feed . for chickens, if only because there's a minimum of processing necessary. The birds will peck the grains from the unthreshed heads.

But it is not easy to find grain sorghum recipes yet. Arrowhead Mills, the well-known Texas organic food grower and distributor has recipes to go with the sorghum grain and flour they sell. The Grain Sorghum Producers Association (1708-A 15th Street, Lubbock, Texas 79401) can be contacted for recipe information and for advice on availability of varieties suitable for growing in various parts of the United States.

SORGHUM PANCAKES

l½ cups of sorghum flour (We use either grain sorghum or sweet sorghum seeds which we grind in our blender.)
2 tablespoons brown sugar
1 teaspoon salt
3 teaspoons baking powder
2 egg yolks
3 tablespoons melted butter
1¼ cups milk
2 egg whites, beaten

Sift and mix dry ingredients well. Beat egg yolks, add the melted butter and milk. Fold in the beaten egg whites and bake on a hot greased griddle, turning once when the pancakes are all bubbly on top.

Serve with maple syrup if you have it, or any other syrup or fruit jam you like.

Sweet Sorghum

Sweet sorghum looks just like grain sorghum at maturity except that it is about three times taller. It is grown for the juice in its stalk from which is made sorghum syrup and sorghum molasses. I call it the four-in-one plant, however, because it actually produces four foods. The seed clusters on top I use just like grain sorghum, for flour and for chicken feed. The leaves, stripped off before the stalks are pressed, can be fed to livestock. Then there's the distinctively flavored syrup. And the crushed stalks left over make good mulch.

In fact, now that scientists in the Agricultural Research Service have discovered how to remove starch from sweet sorghum syrup, sweet sorghum can be processed into sugar in a conventional sugar processing factory. That gives sorghum another use, and perhaps the most significant, since it could make every homestead free of dependence on stores for sugar.

An acre of sorghum will produce about 400 gallons of syrup, which at a retail price of $8 a gallon is a nice sideline income for a small homesteader and two weeks of work. Traditionally, that's how most of the sorghum syrup has been produced, and still is. A man can handle an acre or two mostly with hand work, haul the stalks to the neighborhood sorghum mill which processes the syrup for him for a fee.

Unfortunately, sorghum mills have all but disappeared in most northern states. But if there's not one around, you don't have to call it quits. You can process small amounts of syrup using the primitive methods I've adapted in place of a real sorghum mill. But if you intend to replace sugar with sweet sorghum in your diet, you'll need a mill.

Varieties

The longer-season varieties make the best syrup: WILEY, BRANDES, HONEY, and SART are recommended for the South. In the North, you have to go to a shorter-season variety. DALE and TRACY are recommended varieties for central to northern regions. Farther north, I've grown an old variety "SUGAR DRIP" from R.H. Shumway Seeds. That's the only variety I've found easily available here.

Cultivation

The cultivation of sweet sorghum is much like that of corn. One exception is that sorghum doesn't require as much extra fertilization to get adequate yields, as does corn. That goes for grain sorghum too. Recent research in Texas has shown that sorghum fertilized with manure at the rate of 10 tons per acre for five years yielded just as well or better than sorghum on which chemical fertilizers were applied for maximum yield. University of

Mississippi tests suggest that 40 pounds of actual nitrogen, plus 20 pounds of actual potassium is sufficient for sweet sorghum, and a five-ton application of manure should provide that. A green manure crop plowed under ahead of the sorghum crop and a couple of tons of finely ground rock phosphate every three or four years will provide all the phosphorus and other nutrients the sorghum needs. Soil pH should be held nearly neutral—6.5 to 7—as for corn.

Cottonseed meal and tankage, both quite high in nitrogen and phosphorus used to be the favorite fertilizers of sweet sorghum growers. But competition for these products from the feed industry and the advent of cheaper chemicals pushed the price of these materials too high except for very small plantings. But some small growers still use these organic fertilizers insisting that organically fertilized sorghum makes a better tasting syrup.

You can plant sweet sorghum in rows or in hills. In hills, plant four seeds per hill with hills 24 inches apart. In a continuous row, keep plants at least six inches apart. Any thicker, and the stalks will be weak and blow over.

Rows are generally 42 inches apart. Some growers like to plant in a slightly raised ridge that they make with a kind of plow called a middle-buster, ahead of planting. Right before planting, they scrape the top off the ridge, which effectively kills the weeds germinating there. The raised ridge warms up a little faster in springtime, too, to enhance germination of the sorghum. Sweet sorghum, like grain sorghum, will rot rather than germinate in cold wet soil. Soil temperature at planting depth (two inches) should be nearly 70°F. on a sunny day. You need at least 100 days to mature sweet sorghum in the North, so the sooner you can get it growing, the better. The best sorghums take longer than 100 days to mature, which is why the best syrup comes from the South.

Insects

Some of the same insects that attack corn can also harm both grain sorghum and sweet sorghum, though the damage will rarely be serious: lesser cornstalk borer, corn leaf aphid, fall armyworm, corn earworm, and wireworms. In addition, the sugarcane borer will tunnel into sweet sorghum in the deep South. The sorghum midge occurs over most of the Gulf Coast and South Atlantic states, and feeds on the heads of sweet sorghum, grain sorghum, broomcorn, and Sudan grass. But its depredations don't seem to hurt syrup production. Where you are saving sorghum seed for seed or for food, however, and the midge is on the prowl, you can tie paper bags over the heads of plants during the blooming season. But, says the USDA, remove the bags shortly after the blooming period because they provide conditions favorable for the corn ear-worm and the corn leaf aphid, which also attack the seed heads.

The Harvest

You can judge the proper harvesting time for the juice by the condition of the seed. When the seeds are no longer milky, but still in the tough doughy stage, it's time to cut. When your thumbnail will no longer cut the hardening seed easily, the ideal harvesting time for syrup has passed.

First, strip the leaves from the stalks, and feed to rabbits or goats. Then cut the stalks off close to the ground, using a corn knife as I described when cutting a bundle of cornstalks. When I can hold no more stalks in my left arm, I drop them neatly in a bundle and proceed to cut another bundle. There's no real need to tie the bundles, though that makes them easier to handle.

With the stalks in neat bundles, I can sever the seed clusters from the stalks with one stroke of the corn knife. Then I tie the clusters together and hang in the barn for further drying.

Processing Molasses

The stalks are run through the sorghum press that squeezes out the juice the same way the old clothes-wringers squeeze out water. The juice that makes the syrup is held in the soft inner stalk and is easily pressed out once the tough outer stalk is cracked open by crushing. The rollers are powered by reduction gears running off a gasoline or electric motor, or by a horse or mule walking round and round on the end of a long sweep.

Sorghum mills have become scarce, and there are few places in the North where you can take your "cane" to be pressed and boiled down as in days gone by. Before I found one I had to improvise another way to squeeze out the juice. My method was not very practical, but maybe it will give you a better idea. On my first try, I chopped up the stalks with the corn knife into little pieces on a makeshift chopping board, sort of the way you would dice carrots. Then I squeezed the choppings in a cider press. It worked okay, but the chopping was slow and arduous. So I ran the stalks through a leaf shredder and squeezed the shreddings. That was faster, but the press was not heavy enough to produce enough pressure to get out all the juice.

The liquid from the pressing is a cloudy green in color. When boiled, heat coagulates the nonsugar materials in the juice, and they float to the top. These "skimmings" as they are called, have to be skimmed off or the syrup will taste too bitter.

We heated ours in a pot on the stove and skimmed off the green stuff with a ladle. The syrup reaches the proper density at a temperature of 226° to 230°F. If you are using a syrup hydrometer, syrup of good density should give a reading of 35° to 36° Baumé on the hydrometer. Before filling small containers, let the syrup cool to at least 190°F., 180°F. for larger containers.

Traditional sorghum making is a far more picturesque and romantic procedure than I have described. As the horse or mule walks round his endless circle on the sweep, the mill rollers squeeze out the juice which runs through several strainers into a barrel. From the barrel, a hose or pipe gravity-feeds the juice into the steaming evaporator pans which rest over a long, low fireplace with a high smoke pipe at one end. The fires underneath are fed with slabwood and kept at as constant and even a flame as possible.

The evaporator pan usually is separated into three or four compartments by baffles which allow the sap to flow from one section to another very slowly. As the syrup flows from one end of the long tray to the other around the baffles, the "cook" skims off the green scum. When everything is moving as it should be, the syrup is ready by the time it reaches the last compartment. If you lift the ladle out of it, the syrup should "string," showing that it has the proper density. It is ready then, to run off into the waiting container, to be cooled and bottled.

One secret of sorghum making is to cool it as quickly as possible. That's why in the past, homesteaders liked to locate their sorghum mills near a good cold spring.

Weather can be a factor too. A clear, crisp autumn day is ideal. Rainy weather makes bitter molasses, says folklore. Maybe that explains why one batch of our sorghum turned out delicious and the other had a taste like licking an old piece of tin siding.

Using the Seed

The seed clusters dry in the barn and can be fed to chickens as described for grain sorghum. The seed can likewise be threshed for flour. I think it tastes about the same as grain sorghum, and we use it the same way. Sorghum pancakes and sorghum molasses, there's real poetry for gourmets.

As to which kind of sweet sorghum makes the best or most seed for flour, I don't know. I use SUGAR DRIP and have not heard of anyone else making flour from another kind of sweet sorghum. From the appearance of the seed clusters of other varieties, I'd say they would all serve the purpose except maybe HONEY, which doesn't seem to have as much seed in its head.

Broomcorn

There are still quite a few people around who make and sell brooms for sideline income. And still a number of small factories that make brooms, though the managers tell me that they fear broomstraw is on its way out, to be replaced by cheaper synthetic straws. Real broomstraw makes a far better broom, but in these days who cares about the finer skills of housekeeping?

Why pay $2 more for a good broom, when a poor one will suffice? Who sweeps much anymore anyway, except with an electric sweeper?

But brooms are still made and sold and will continue to be made and sold, especially if the energy crunch gets worse. Then natural broomstraws could become far more economical than plastic ones, or electric ones.

I haven't yet found one cottage industrialist who grows his own broomstraw. You can make a thousand brooms from an acre of broomcorn, and that takes a lot of work to harvest it. But so do strawberries. Something to think about, anyway.

Making Brooms at Home

We have been growing a little broomcorn, mostly for fun. The chickens don't even seem to like the seeds, though wild birds do. Last year we made several short brooms, the old "round" brooms, the kind you see witches riding around Halloween time, or the kind of broom now called a fireplace broom. They hang from the mantels in fine houses and are hardly ever used to sweep up any ashes. They make nice decorations.

That kind of broom you can make fairly easily without special broom-making machinery. We give them as Christmas presents in place of some $10 store-bought item, and that sounds pretty practical to me.

For handles, we select young straight hickory or ash saplings from the woods, shave them down, and point them at one end. We comb the seeds out of the broomcorn tassels, leaving about four to six inches of stem on each tassel. Then we soak the tassels in boiling water and while still wet, tie them very tightly around the end of the handle. A couple of nails driven through the handle will help anchor the tassels while you tie them. We tie two courses of tassels around the handle, one a little lower than the other, and then trim the straws even. As the wet stems dry, they shrink around the handle.

The best brooms are made with the seed head tassels of broomcorn. Harvesting the broomstraws is all hand work, but a lot of brooms can be grown in a small plot.

We enjoy giving something that represents our own labor and our own homestead 100 percent. And recipients of our brooms seem delighted so far. We think everybody with a homestead ought to grow a few brooms.

Cultivation

Broomcorn is not difficult to grow. Being a member of the sorghum family and related to corn, it will grow where corn will, and by the same cultural methods. Follow the directions I gave for sweet sorghum: about one plant every six inches in rows 30 to 40 feet wide. You will almost always get the seed planted too thick because it is small so be sure to thin with a hoe after the plants are up. Cultivate as often as necessary to control weeds.

Where corn tassels, broomcorn produces the efflorescence of seed head that makes the broomstraws. For best quality, the brushy heads should be cut when the plants are in late bloom stage (before the seeds have developed fully). Cut the top brush leaving six inches of stalk below the brush. Dry these brushes for three weeks before using them for broom-making.

If you let the plants mature before cutting the heads, the straws turn yellow and many seeds form. The brushy seed clusters make attractive dried flower arrangements.

Broomcorn Commerce

Broomcorn is still grown in Oklahoma, Texas, New Mexico, and Colorado on a commercial scale. Formerly much was grown in Illinois and Kansas too, and in earliest years, all over the Midwest. Most broomcorn is now grown in Mexico and other areas of cheap labor.

No machine was ever contrived to harvest broomcorn heads satisfactorily. That's why I think the crop might have potential for small homesteaders. Workers go through the standing stalks and break over the heads. Later the heads are cut or jerked off, the seed threshed out, the broomstraw cured for several weeks, then baled and shipped to factories. In older times, the seed was scraped out of the heads, instead of threshed, and I have found it necessary to scrape out some seeds in my little broom-making experiments.

The broomstraw used to be classified "Insides and Covers," "Self-working," and "Hurl." Insides and Covers (short straws) were used for underwork in the broom, though a good broom has almost all long straws. Hurl was, and is, the long straw. Self-working was broomcorn that contained no waste, all the Hurl and Insides and Covers needed to work into brooms with nothing left over. Self-working was what everyone hoped to get, but seldom did.

If you want more information about brooms, you should write to the National Broom Council, which at this writing is headquartered at 333 North Michigan Avenue, Chicago, Illinois 60601. Or inquire about who makes the broom you buy and go visit the factory. A number of them are still around. I visited one at Hamburg, Pennsylvania, and found the people most cordial and considerate. Or there may very well be a broommaker in your community. You could learn something from him, perhaps a new cottage industry. Let's see, 1,200 brooms per acre at $4 per broom is. . . .

Chapter 5

Oats:

The High-protein Cereal Grain

The Scots did not think Samuel Johnson was so cute when he defined oats in his dictionary as "a grain which in England is generally given to horses but in Scotland supports the people." Snide remark Johnson may have intended, but he was actually paying the Scots a high compliment. They had not only discovered a food very high in nutrition and very low in cost of production, but one that grew well in their climate.

Of all the cereal grains, oats ranks highest in protein and runs neck and neck with wheat as the all-around most nutritive cereal grain. The 1950 USDA handbook on grains rates oats at 14.5 percent protein, while whole wheat runs second with 13.4 percent. These figures are somewhat outdated now, especially in regard to oats. The average of 287 varieties selected from the World Oat Collection recently averaged 17 percent in protein content. More significantly, two new varieties, DAL from Wisconsin and OTEE from Illinois, contain over two percent more protein than that average, and can go as high as 22 percent on a dry basis. That could make oats almost

competitive with soybeans in protein (soybeans contain about 35 percent protein but yield less per acre than oats) and most plant scientists express belief in a bright future for oats as human food.

Part of their reasoning is based on the character as well as the quality of oat protein. It has a bland taste, is soluble under acidic conditions, is stable in emulsions with water and fat, and holds moisture, thus making it an ideal protein to supplement other foods. At the USDA laboratory in Peoria, Illinois, researchers are using oat protein to make nutritious refreshment beverages, meat extenders, and high-protein baked goods.

Oats also outscore other cereal grains in thiamine, calcium, iron, and some say, phosphorus, though the USDA tables from 1950, below, give whole wheat a slight edge in that department.

Thiamine

oatmeal	.82
whole wheat flour	.55
wild rice	.45
yellow cornmeal	.38
brown rice	.32
rye flour	.15
barley	.12
buckwheat	.08
unenriched white flour	.06

Iron

oatmeal	4.1
whole wheat flour	3.3
yellow cornmeal	2.4
brown rice	2.0
barley	2.0
rye flour	1.1
buckwheat	1.0
unenriched white flour	.8
white rice	.08
wild rice	0.

Riboflavin

wild rice	.63
oatmeal	.19
whole wheat flour	.12
yellow cornmeal	.11
barley	.08
rye flour	.07
brown rice	.05
unenriched white flour	.05
buckwheat	.04
white rice	.03

Phosphorus

whole wheat flour	3.72
oatmeal	3.50
wild rice	3.39
brown rice	3.03

yellow cornmeal	2.56
barley	1.89
rye flour	1.85
white rice	1.36
buckwheat	.88
unenriched white flour	.87

Calcium

oatmeal	1.60
whole wheat flour	.41
brown rice	.39
white rice	.24
rye flour	.22
wild rice	.19
barley	.16
unenriched white flour	.16
buckwheat	.11
yellow cornmeal	.10

Calories per 100 grams

oatmeal	396
wild rice	364
white enriched flour	364
white rice	362
brown rice	360
rye flour	356
yellow cornmeal	355
barley	349
buckwheat	348
whole wheat	338

Niacin

wild rice	6.2
brown rice	4.6
whole wheat flour	4.3
barley flour	3.1
yellow cornmeal	2.0
oatmeal	1.9
white rice	1.6
unenriched white flour	.9
rye flour	.6
buckwheat	.4

Fat

oatmeal	7.0
yellow cornmeal	3.9
whole wheat flour	2.0
brown rice	1.7
buckwheat flour	1.2
barley	1.0
rye flour	1.0
unenriched white flour	1.0
wild rice	.7
white rice	.3

Carbohydrates

buckwheat	79.5
white rice	79.4
barley	78.8

rye flour	77.9
brown rice	77.7
unenriched white flour	76.1
wild rice	75.3
yellow cornmeal	73.7
whole wheat flour	71.0
oatmeal	70.2

If you keep horses, sheep, or rabbits, it will pay you to grow oats. Even a small patch in the garden will save money on your rabbit feed bill. You don't even have to thresh the grain out, just feed it stalks and all to these animals or other kinds of livestock.

Oats are good feed when ground or rolled and mixed with ground corn, too. That's the standard dairy cow ration on most U.S. farms. Whole oats are excellent food for poultry too; the hulls help prevent cannibalism. Chickens will eat more oats if they are rolled and mixed with milled corn and wheat. Given a choice between wheat and oats in their whole grain scratch feed, they will invariably eat up all the wheat first. The oat hull that covers the grout so tightly on each grain may be good for them, but I suspect—as in the case with humans—the taste is not.

Oats make excellent hay too. Cut them when the grain is in the early milky stage, just beginning to fill out and the plant is entirely green yet. Yields of eight tons per acre are possible or 600 pounds of plant protein per acre, not as good as alfalfa but remember that you have to wait a whole year to harvest alfalfa after you plant it. You wait only two months for hay from oats.

Types and Varieties

Common white oats, *Avena sativa,* are by far the most widely grown oats. They are planted in spring for midsummer harvest. Red oats, *Avena byzantina,* are the southern and south-central type, sown in the fall where winters are mild for harvest the following summer. Hull-less or naked oats, *A. nuda,* are a rarely grown third type. In addition, there are the kinds young men are supposed to sow before settling down to responsible adulthood. It's a matter of opinion whether men cause the world more anguish before or after attaining "responsible adulthood" but all agree that real wild oats are nasty weeds.

The distinction between white and red oats is often hazy except for the difference in planting time. White oats are more yellow than white, and red oats are often greyish in color. Many of the common white oat varieties have red oat parentage somewhere in their background. CLINTON, one of the more successful white oat varieties over the years, is actually a cross between white and red. CHEROKEE and ANDREW are red varieties

marketed as white, and MISSOURI O-205 and KANOTA are quite similar varieties marketed as red.

Many varieties of both white and red oats are available, but it's not necessary for you to know many of them. That's true of all cereal grains. The life of any one variety is apt to be quite short, limited to the five to 10 years it takes for a disease pathogen to adjust to that variety's inbred resistance. That's why plant breeders have to constantly develop new varieties with new resistances to disease.

Some southern varieties still performing well in research station tests include COKER, FLORIDA 501, GEORGIA 7199, TAM O-301, and TAM O-312. In the North, newer varieties from various midwestern sources include CLINTFORD, OTEE, NOBLE, STOUT, DAL, ORBIT, GARLAND, ASTRO, MARINER, and PENN-FIELD. DAL and OTEE are particularly desirable because of their higher than normal protein content, as I've already mentioned. Older varieties that have the proven reliability you can never be sure of in a new one include CHEROKEE, CLINTON, and BONDA. I mention those three in particular because they enjoy a reputation for good milling quality: producing a high amount of oatmeal per total weight. However, no one particular variety of oats seems more suitable for oatmeal than others. Quaker Oats goes right to the marketplace for its supply, selecting high-quality grain of whatever variety.

Fertilization

Oats require more water than other cereal crops to make a good yield. They like fertile soil too (what doesn't?) but will perform satisfactorily without high additions of fertilizer. In fact, you can get too much nitrogen in the ground for oats, if the soil is naturally rich. If a previous oat crop possessed a dark green color and much of it fell over on the ground before harvest, add no nitrogen at all to the next crop and only 10 pounds of phosphorus per acre. If oats seldom lodge and maintain a healthy green color, add no more than 30 pounds of nitrogen and 10 pounds of phosphorus and potassium per acre. If oats are short and light green in color, ripening to a flat tan rather than a solid yellow, the soil needs about 60 pounds of nitrogen, 15 pounds of phosphorus, and 20 to 30 pounds of potassium.

Such low amounts of fertilizer can be supplied organically at reasonable cost even on large fields. Legumes will fix that much nitrogen in the soil naturally. So a green manure crop with some manure added along with two tons of rock phosphate applied per acre every three years and lime, should result in yields of 60 to 70 bushels per acre. Yields of 90 to 100 bushels per acre are possible on good ground.

Fertilizer balance is the key. Either after applications of organic fertilizer or inorganic chemicals, soil tests may show a field contains 150 pounds of

available nitrogen and only 30 pounds of potassium. That could spell trouble for a cereal crop like oats. It would grow big and heavy and fall over so flat on its strawy back as to be virtually unharvestable. If you have 150 pounds of nitrogen available, you ought to have at least 60 pounds of potassium available too, to give the stalks enough strength to match the heavy growth the nitrogen will cause.

Insects and Diseases

Oats have fewer enemies than corn or wheat: no Hessian fly, no chinch bug. Sometimes greenbugs, a type of aphid, will attack oats, but in many years a small wasplike insect, *Adhidius testaceipes,* keeps them in check. But don't allow volunteer oats, wheat, or barley to grow around your place. They could encourage greenbug buildup.

Of the diseases that attack oats, crown rust is probably the most important, especially in south and central areas. There's no cure, just preventive maintenance. Plant resistant varieties and cut out any buckthorn bushes near fields or gardens. The disease uses buckthorn as a host plant during part of its life cycle.

Septoria leaf blight is another fungal disease that reoccurs in cereal crops including oats. Again crop rotation and resistant varieties are your best defense.

Quality Standards

Quality in grain is based on a number of attributes: the grain must be clean of insects, mold, and any other foreign matter. But just as important, it must meet certain weight standards to qualify as good grain, and this is especially true of oats. A bushel of oats is supposed to weigh around 38 pounds but only plump, healthy, well-grown oats will actually weigh that much. Test weights of 36 and 37 pounds per bushel are considered very good; when test weight falls below 30, you are handling poor oats, shriveled grains that contain little food value and low germination potential. (For comparison, wheat is supposed to weigh 60 pounds per bushel.) Weight can also be an indication of moisture. The drier the grain, the more it will weigh, everything else being equal. That may surprise you, but the moisture that swells the grains so that fewer of them fit into a bushel weighs less than the grains themselves. Removing the moisture allows more grains per bushel.

In choosing a variety, the best advice is the usual: find someone in your area growing good oats and ask him what variety he uses.

Oats Culture

Whether you plant in fall or spring, oats culture proceeds in similar fashion. Since my experience has been only with spring oats, I'll describe that process. Southern growers can adjust what I say to their own fall planting conditions, or proceed in a manner similar to what I described for planting wheat in the fall.

Planting

For spring oats, the earlier you can plant the better. I have planted oats in Minnesota when there were still snowdrifts melting in the woods. Oats like cool weather and can get along just as well with cloudy weather as with constant sun. That's why they are adapted so well to a place like Scotland. In the North and East in the United States, oats are a good crop to grow wherever potatoes grow well: the two seem to like a similar environment.

There's an old folk saying that advises the farmer to "mud in your oats and dust in your wheat" to get good crops of both, referring to spring oats and fall wheat. The saying is more accurately a description of what usually happens rather than good advice. When you plant oats in the spring, you are battling wet weather, and when you plant wheat in the fall, you are contending with dry weather, whether you like it or not. Be that as it may, whenever the mud dries enough in spring to be workable, plant your oats. The longer you wait, the poorer your subsequent crop is likely to be.

If you have gardened a long time, you have noticed, I'm sure, that almost every year, there is a short period of dry weather in early spring when the ground does dry out enough to till. The temptation, which most of us give in to, is to plant some early vegetables. About half the time this planting amounts to very little because the ground is still too cold for good germination, and more cold weather is going to come anyway. So instead of planting vegetables at that time, plant a patch of oats and you'll be ahead on both counts.

Working the Soil and Seeding

The ground you intend to plant oats on you will probably have plowed or disked or rotary-tilled the preceding fall. Fall-worked ground dries out faster than spring-plowed and so you can get on it earlier. The finer the seedbed the better, but for oats you can be a little less finicky and get away with it. Invariably you are going to get more rain shortly, which will insure at least a fairly good stand of oats even if planted on roughly worked soil.

In the garden, you can do it all with a rotary tiller. Work the ground up, but not too finely, broadcast the seed by hand, scattering it as evenly as you can over the plot, then run over it lightly again with your tiller. The second time

over, the grain gets covered with dirt (at least partially, you don't have to cover every single grain) and the soil gets worked a little finer.

On a larger plot or field, you disk, harrow, then plant; either broadcast or with a drill as described in the chapter on wheat. Seeding rate for oats is two-and-one-half bushels per acre. The drill puts the grain in the ground and covers it automatically. Set it to plant the seed not more than two inches deep. Early in spring you can plant even shallower. If you broadcast the seed, cover it by going over the ground with a disk or a harrow. You will get some seed planted deeper than two inches, and some barely covered at all, but don't worry. Sometimes seed will sprout and grow even lying on top of the ground. You won't get as good a stand as with a drill. That's why most broadcasters will plant at a three- -bushel-per-acre rate, a little higher than normal.

Weed Control

Weeds will be a problem in oats unless you follow a good year-round, year-in and year-out program of weed prevention. Once the oats are planted, you can't get into them to cultivate, though on a small patch you can walk through and hoe out some weeds. A good stand of oats will shade out some weeds itself. But if the field you plant in was weedy last year, you can be sure your oats will be weedy too. The weeds won't necessarily "take the crop" and might not even hurt your yield much, but they make harvesting more difficult and increase the problem of getting weed seed and weed chaff out of the grain.

Other than commiserating about the weeds, you have nothing to do in your oats patch until harvest.

Harvesting

You can harvest your oats as grain, as hay, or even as silage, though I don't recommend the silage. It's unnecessary on a homestead. For grain, wait until the crop is dead ripe for harvesting with a grain combine. Or cut it and windrow it when not quite ripe. The stalks then ripen in the windrow and are combined with a special pickup attachment on the combine. In the more northerly states, this latter method is still often used because farmers believe the grain ripens too slowly and unevenly on the stalk. By cutting and windrowing, they can often get the grain harvested with less risk, since if left standing to ripen, the grain may be knocked flat on the ground by a hard storm. (Of course, if it rains too long on the windrowed oats, part of the crop can be lost too. Farming is all gamble.)

A small patch of oats, in my opinion, is best harvested by handling it almost as if it were hay. Cut it before the dead-ripe stage either with a scythe or sickle-bar mower, and let it dry on the ground. Then stack it. Cover with a

piece of plastic film or "comb" the surface of the stack with a fork until it is smooth and the surface straws all run longitudinally toward the ground (like a thatched roof) so that rainwater will mostly run off instead of soaking in. Then feed the oats, stalks, grain, and all, to cattle, horses, chickens, rabbits, even pigs.

For Grain

If you are reluctant to mow the grain down to dry on the ground for fear of rain ruining it, you can wait until the standing oats is dead ripe and dry, then mow and stack immediately. Or even less risky (but more laborious), you can cut the oats when the grain is just beginning to harden, and the stalks have still a little green in them, tie the stalks into bundles as described in the chapter on wheat, and place the bundles into shocks where the oats can finish ripening and drying somewhat protected from rain. Then rank the bundles in a barn or even outside like a double stack of wood with the butts of the bundles to the outside and the heads inside to protect them from rain. Feed the oats by the bundle as needed.

You won't find this precise manner of harvesting, storing, and feeding oats advised anywhere else that I know of anymore. It's a method out of the past, which fortunately fits the homesteader of the future. I was pleased to learn that as late as 1963 (and without doubt still true somewhere, USDA officials observed small homestead plots of oats being harvested in the central states with grain cradles and [more often] with old-fashioned binders, the oats then fed by the bundle unthreshed to livestock). I'm not surprised in the least, but am glad I can now point to experience other than my own to substantiate what I know is a very economical and practical way to feed grain to animals, though the method is unquestionably obsolete in modern, commercial agriculture. Not only do the animals "harvest" the grain as they eat it, but they clean up most of the straw too. Any old-timer will tell you that cows and horses like oats straw. They will sometimes eat it for roughage as well as they eat hay. It isn't as good for them as hay, we say, but who's to argue with a cow? At least they consume more total roughage that way, which is all to the good.

Storage

Rodent control is vital if you stack oats over winter in the manner described. Several cats will suffice, if you can train them to be happy living in and around the stack, not in your kitchen. A little trick we have found very helpful in this regard is to pile our stacks of hay, straw, or whatever over small wooden frames which, in effect, form low, cozy rooms inside the stacks. The cats and dogs (and kids) love to sleep and/or play in these small "rooms" and of course, the structures take away the place in the center base of the stack where rodents would normally nest.

For framing these "rooms," we use wooden pallets obtainable at low cost or free from a variety of small factories. We just stand several of them together to make a room perhaps four or five feet square, open on one (east) side, and wire them together. Another pallet or two goes over the frame, being careful to leave the east-facing side open for entrance and exit. Stacks, to be effective, should be at least 12 feet tall, conical, with a base diameter of about 14 feet. Larger stacks work better.

This type of shelter would make an ideal pen for a sow and her newborn pigs or for a fattening pig too, if the porkers were not confined.

Making Hay

Oats make good hay, cut when the grain is in the early milk stage. Where you need hay fast—for the coming winter rather than waiting for a regular legume-hay crop you can't harvest until the year after planting—oats are your answer. Plant in April, make hay in June.

Making hay is not a mysterious nor difficult process. Small amounts can be cut with a scythe or larger amounts with a sickle-bar mower and allowed to lay on the ground to cure in the sun for a day or two. When nearly dry, rake into windrows or pile into very small stacks for further drying, then haul into the barn or pile into a large conical stack outside. We make meadow hay simply by mowing it, waiting two days, then loading it in the pickup truck with pitchforks. Then we haul it to where we want to build a stack of it, and pile it up carefully and solidly so water will run off its conical sides. The outer layer is usually ruined by the weather, but six inches inside, the hay remains nice and green.

For larger amounts of hay, there are umpteen dozen old and new pieces of machinery to use: mower-windrowers; mower-crimpers that cut and crimp or smash the hay stalks so they dry faster; all manner of rakes and tedders to windrow the hay; old-time hay loaders that pick the hay out of the windrow and push up into the hay wagon for the farmer to distribute into the picturesque tall loads of hay; balers that pick the hay out of the windrow and compress it into wire- or twine-tied bales; and now the new kind of balers that roll the windrow up into cylinders of hay that weigh a ton.

If you have more than an acre of hay to make, you need a mower and a rake, both of which can be purchased used quite reasonably. There must be thousands of obsolete side-delivery rakes rusting away on farms today. The even older dump rakes are handy for small hay fields if you can find one. Once hay is raked into windrows or piles, it is just about as easy on less than four acres to load it with a pitchfork as with a hayloader. On more acreage, hire a custom baler.

All of which may not be apropos to this book. On the small amount of oats I envisage a homesteader growing for hay or grain, he can handle the job entirely by hand except perhaps for mowing.

Oats for the Table

The oats you want for your own use you can thresh and winnow in the same way you would thresh wheat by hand. Thirteen-and-a-half bushels of good oats makes a barrel (180 pounds) of rolled oats, so you would hardly want more than a bushel's worth, assuming you are using other grains too. If you are harvesting your oats with a combine, or more likely are having it combined by a farmer, you can, of course, just take the grain from the combine bin and winnow it clean.

I'm not sure you would want to process your own oats for table use yet. Oats are more difficult to prepare than wheat, as. yet I have found no one who has devised or who makes a dehuller that is really practical for home use. But I'm just as sure that when homesteaders understand the basic process and problem involved, they'll find an answer. Until then, for your own use, you might just as well buy rolled oats. They're certainly one of the best food values for the cost that you can buy in the supermarket.

On the other hand, if you've gone to the trouble of growing high-protein oats on soil of high organic matter content, you are going to be feeding your animals a better grain than you are feeding yourself, which seems kind of stupid. Here's what you have to do to get that hull off the oat groat so you can make your own oatmeal and oat flour.

Commercial oat processors have found that heating the grain for one-and-a-half hours at a temperature of 180°F. makes the hulls brittle and easier to remove. The heating also dries the grain down to around eight percent moisture from storage moisture of about 12 percent, this reduction is necessary for quality oatmeal production. You can certainly roast your own oats in your oven.

The old method of removing the hulls after roasting was to grind them lightly between two large carborundum or emery-stone disks. The disks had to be set very precisely, so that the space between them was just small enough for the stones to tear and scrape loose the hulls of the oats without pulverizing the groats.

Much faster dehullers are used now. The Quaker Oats folks dehull oats in a centrifugal, impact-type huller where a high-speed rotor throws the oats against a rubber liner hard enough to knock the hull loose and blow it away.

The steamed groats are then passed through steel rollers for flaking and dried for old-fashioned oatmeal. Nowadays, when no one has time to enjoy

a leisurely breakfast, we have for our convenience "three-minute" oats or something like that. To cut the time of cooking oats, the processors "steel-cut" the oat groats. All that means is that the oats are partially ground. Each groat is cut approximately into three parts.

Your blender will cut up the groats to any size you want but it cuts up the hulls too. All that fiber may be healthful, but not tasteful. You can run the blender just a little and sift out some of the hulls and get finally to something approximating good oat flour.

You can set the threshing cylinder on a grain combine (the concaves, as we always called them) so close that about a third of the groats will be knocked right out of the hulls. If roasted oats were run back through a combine adjusted that way, I believe de-hulling would be nearly complete, but I've never tried such a trick and doubt it would be very practical.

A method that would be practical, I'm assured, (though I haven't had a chance to test the idea yet) is to run the roasted grain through a small roller-type feed mill. Sears sells one for about $250. If you need a roller mill for cracking grain for livestock anyway, that cost might not be out of line even on a homestead.

Oats Potpourri

A couple of other interesting tidbits about oats may be of interest to you. A common practice among strawberry growers (which I believe began in England) used to be to grow oats in the strawberry patch for mulch. Instead of having to buy straw and transport it to the garden, gardeners bought oats and broadcast-sowed them over the entire strawberry patch *in the early fall or late summer.* The grain would grow tall but not have enough time to produce seed before frost killed it. Dead, the oat plants fell over and maintained a protective mulch over the berry plants. The oat plants would not come to life again in the spring. There's no reason why the practice still wouldn't work.

On a more modern note, the University of Minnesota about six years ago, was experimenting with new ways to grow edible mushrooms. They reported that the mushrooms grew quite well in a "soil" composed almost entirely of oat grains.

Oat hulls, as a by-product of the oatmeal industry, are used to produce furfural, an important industrial solvent. That's a nice detail you can use to impress your friends as you feed them a homemade oat cake.

PEANUT BUTTER SESAME BALLS

¾ cup peanut butter
½ cup honey
1 teaspoon pure vanilla extract
¾ cup nonfat dry milk
1 cup oatmeal
¼ cup toasted sesame seeds *
2 tablespoons boiling water
chopped nuts or toasted sesame seeds for coating balls
Preheat oven to 200° F.
In a medium-sized bowl, combine peanut butter, honey, and vanilla extract; blend thoroughly.
Mix nonfat dry milk and oatmeal together. Gradually add to the peanut butter-honey mixture, blending thoroughly, using hands if necessary to mix as dough begins to stiffen. Blend in the toasted sesame seeds.
Add 2 tablespoons boiling water to mixture, blending well.
Shape in 1-inch balls. Roll in finely chopped nuts or toasted sesame seeds. For variety, roll half the mixture in chopped nuts and the other half in toasted sesame seeds.
* Toast sesame seeds in oven for about 20 minutes or until lightly browned.
Yield: approximately three dozen balls

SESAME CRISP CRACKERS

1 cup oat flour (oatmeal may be ground in electric blender)
¾cup soy flour
¼ cup sesame seeds
¾teaspoon salt
¼ cup oil
½ cup water
Preheat oven to 350° F.
Stir together flours, seeds, and salt. Add oil and blend well. Add water and mix to pie dough consistency.
Roll dough on greased baking sheet, to 1/8-inch thickness. Cut into squares or triangles and bake in oven until the crackers are crisp and golden brown, about 15 minutes.
Yield: three-four dozen crackers

ALMOND CRUNCH CEREAL

3 cups oatmeal
1½ cups coconut, unsweetened
½ cup wheat germ or soy grits, if preferred
1 cup sunflower seeds
¼ cup sesame seeds
½ cup honey
¼ cup oil
½ cup cold water
1 cup slivered, blanched almonds

½ cup raisins (optional)
Preheat oven to 250° F.
In a large mixing bowl, combine oatmeal, coconut, wheat germ or soy grits, sunflower seeds, and sesame seeds. Toss ingredients together thoroughly.
Combine honey and oil. Add to dry ingredients, stirring until well mixed. Add the cold water, a little at a time, mixing until crumbly.
Pour mixture into a large, heavy, shallow baking pan which has been lightly brushed with oil. Spread mixture evenly to edges of pan.
Place pan on middle rack of the oven and bake for 2 hours, stirring every 15 minutes. Add 1 cup slivered almonds and continue to bake for ½ hour longer, or until mixture is thoroughly dry and light brown in color. Cereal should feel crisp to the touch.
Turn oven off and allow cereal to cool in oven. If raisins are to be added to cereal, do so at this point.
Remove cereal from oven, cool and put in a lightly covered container. Store in a cool, dry place.
Serve plain or with fresh fruit.
Yield: five-six cups

TRADITIONAL IRISH OATMEAL BREAD

8 teaspoons dry yeast
1 cup lukewarm water
1 tablespoon honey
¼ cup nonfat dry milk
1 cup water
½ cup oil
1½ teaspoons salt
4 tablespoons honey
2 eggs, well beaten
2 cups oatmeal
6½ cups whole wheat flour
1 cup currants
1 egg, slightly beaten
½ teaspoon water
Dissolve yeast in 1 cup lukewarm water. Add 1 tablespoon honey.
Combine nonfat dry milk and 1 cup water with wire whisk, and heat almost to scalding point. Add oil, salt, and honey. Cool to lukewarm.
In a large mixing bowl, combine milk mixture, 2 well-beaten eggs, and yeast mixture. Mix in oatmeal and 6 cups of the whole wheat flour, 3 cups at a time, reserving ½ cup for the second kneading.
Knead until smooth and elastic, for 5 minutes.
Put into an oiled bowl. Cover with damp cloth and let rise in a warm place until double in bulk, 1½ hours (approximately).
Stir dough down and knead with remaining ½ cup whole wheat flour, gradually working in currants. Shape into 3 round loaves. Brush with beaten egg to which ½ teaspoon water has been added. Put loaves on oiled cookie sheets to rise. Let rise 1 hour in draft-free spot. Meanwhile preheat oven to 375°F.

Bake in oven for 25 minutes until golden brown. Remove from pan and cool before slicing.
Yield: three round loaves

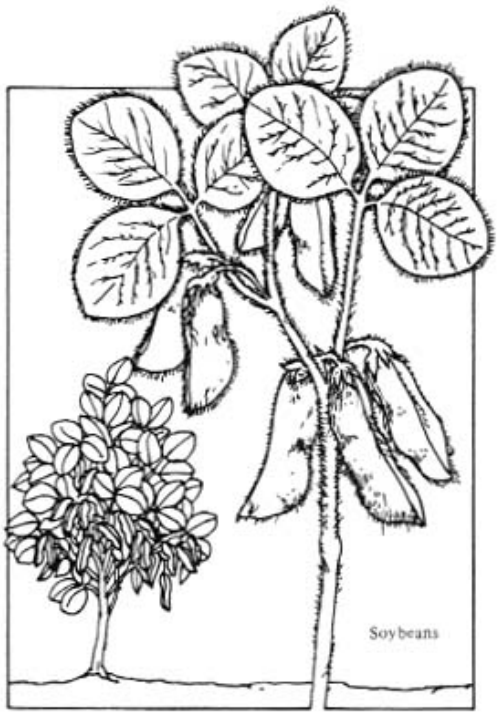
Chapter 6

The Soybean:

Key to An Independent Food and Fertilizer Supply

Technically, the soybean is a legume, not a grain, but that is almost beside the point. It should merit first place in any book on grains, just as it now is the number one cash "grain" crop in the United States. For all practical purposes, the soybean is planted, grown, and harvested like the small grains. Its peculiar characteristics as a legume only enhance its value, especially to organic gardeners and farmers.

Spell soybean p-r-o-t-e-i-n. Over 40 percent of the soybean is protein essential to healthy life. High-protein oats, next in line after soybeans, have less than half that amount. Ground into meal, the soybean becomes our most widely used protein supplement in animal feeds, allowing the farmer and homesteader to produce meat faster and with less grain than otherwise would be possible.



In the future, the soybean could become as important in human diets as it is today in the animal meat industry. Already it supplies half of the total vegetable fats and oils consumed in the United States, and is used

extensively as a meat extender. Properly textured and cooked, the soybean can become a meat substitute difficult to distinguish from the real thing.

Vegetarians and many nutritionists agree that the soybean makes meat unnecessary in the human diet. What few proteins it doesn't contain can be picked up in edible nuts, grains, and other foods.

Soybean Foods

Homesteaders can process a variety of nutritious foods from the soybean. Soybean milk doesn't quite have the food value of cow's milk, but is valuable for people allergic to the latter, and is far cheaper to produce. After soaking the beans overnight, grind very fine. Put the ground beans in a cheesecloth bag in a big bowl or bucket in which you have poured three quarts of water for each pound of beans. Knead the bag of beans in the water for 10 minutes, then squeeze out all the liquid from the bag, wringing it as dry as you can. Boil the milk for 30 minutes. Stir frequently while the milk is heating up as it will scorch easily. Add salt and sugar or honey to taste and keep in a cold place. Soybean milk will sour just about like cow's milk will.

Soy flour can be milled with or without the seed coating and blended many ways with grain flours or cornmeal. Cookbooks like *The Rodale Cookbook* contain many recipes for casseroles, meat loaves, patties, tofu, and other delights made with low-cost soybeans.

Nitrogen Fixation

But the soybean is not content just to supply the world with protein. At the same time the soybean feeds us, it can also feed the soil in which it grows. Like other legumes, the soybean draws nitrogen from the air and "fixes" it in the soil for succeeding crops, as much as 100 pounds of nitrogen per acre! Research has found that a cereal grain crop following a crop of soybeans in a rotation will produce 20 percent more than when following a crop of corn. With the high price of nitrogen fertilizers made from fossil fuels today, no farmer, and certainly no organic farmer and gardener, can afford to ignore this easy and cheap source of plant nutrition. Scientists are hustling now to determine just how plants fix nitrogen in the soil. What they hope for, but dare not yet predict, is a soybean that can put into the soil *all* the nitrogen fertilizer needed for good production.

Nitrogen fixation is an extremely complex process that is not totally understood. In the air there is an almost unlimited supply of nitrogen. During photosynthesis, some plants are able to draw in some of that nitrogen and convert it to ammonia, the vital ingredient of protein. *Rhizobia* bacteria in the soil form nodules on the plant roots that the plant and others

around it can use. In their symbiotic relationship, the bacteria and the plant both prosper better than they do apart from each other.

The higher the *Rhizobia* population, the more numerous, or at least the larger, the root nodules are. You can pull up a soybean plant and see them. The nodules range in size from a pinhead on up to a little larger than a peppercorn. Scientists think that a comparatively small number of larger nodules produce nitrogen more effectively than a large cluster of small nodules. Cut a nodule open and examine it. The best nitrogen producers will be reddish or pinkish inside.

New strains of *Rhizobia* are being discovered, some of which produce nitrogen better than others. Some strains work better with certain legumes than with others, too. Scientists hope to improve strains of bacteria for better nitrogen production much as the plant breeder improves plant varieties.

Other Soybean Surprises

The soybean, inscrutable as the Orient from which it sprang, keeps other secrets. It does not respond to chemical fertilizers the way other crops do, yet seems to be able to find nutrients in the soil other plants can't. Says Dr. David Johnson who is probing the secrets of the soybean at the University of Missouri: "Research shows that the soybean is able to fix about 100 pounds of nitrogen per acre plus about 50 pounds of nitrogen from its organic matter decomposing in the soil. The other 150 pounds it needs to produce a 50-bushel-per-acre yield, it can get even though no other nitrogen fertilizer has been applied and when apparently there is no residual nitrogen in the soil. It must be getting that nitrogen from the soil, but we don't know how."

The soybean is full of surprises. It possesses, more than any other farm crop, the characteristic botanists call "compensation." Plant soybeans thin and they will spread out and fill the open spaces between plants. Plant them thick and they will thin themselves, and in either case, all other conditions being equal, the yield will be about the same. Cut off pods at the base of the stalk and the plant will produce more at the top. Grow soybeans in wide rows or drill them solid like wheat, and again yields will be about the same if other conditions are the same. You can even pull off half the leaves from a plant without hurting its yield appreciably.

The soybean grows north and south, in a variety of soils, early planted or late. Besides its food value as a bean, it makes fairly good hay and is excellent for green manure. To top it all, the soybean has few dangerous insect enemies in the North. No wonder it is one of the sacred crops in China! At over $5 a bushel now on the American grain market, the soybean is pretty sacred in the United States, too.

Growing Soybeans

After the foregoing, I hardly need to say that soybeans are fairly easy to grow. Beans have been drilled carefully into finely worked seedbeds, no-tilled directly into sod or wheat stubble with special planters, broadcast by hand and disked roughly into the soil, even dropped on top of the ground from airplanes into standing wheat with no tillage at all. In all four situations the beans have grown successfully. In other words, if you make a mistake with soybeans, just say you did it on purpose. The beans will compensate, if soil and moisture conditions are good.

One hard and fast rule you must observe: plant soybeans only after the soil has warmed up in late spring. Where the best corn planting date is May 5, figure May 12 for beans. In other words, optimum bean planting time should be at least a week later than optimum corn planting. You don't have to be in a big hurry to plant. Though later plantings may suffer yield loss because of drier weather, beans can be planted all through June and even in July below the 40th parallel, and still reach maturity before frost.

Varieties

Of the many varieties of soybeans, several are designated as "edible," meaning that they have less of the oily taste of regular soybeans when eaten raw. (All soybeans are edible.) The two edible varieties offered most often in seed catalogs are KANRICH and DISOY. EARLY GREEN BUSH is another one, developed in Japan, somewhat earlier maturing than KANRICH. On any of these bean plants you can expect 50 pods of three beans each to grow, and often many more. A 50-foot row should yield a bushel of pods or about 15-20 pounds of beans. The "edibles" are brown just like other soybeans.

The number of varieties of regular soybeans are legion. When I was a boy and farmers first started to grow soybeans, the beans had exotic Oriental names like MANDARIN and MANCHOO. These have (unfortunately I think) given way to no-nonsense sturdy American names like CLARK, WAYNE, and BEESON, or to advertising names like MERIT. Lately soybean names have reflected the computer age: XK 140, SRF 69-691, and the like, labels thought to appeal to the farmer's all too mathematical mind and to give the ring of late-breaking scientific wizardry.

Midwestern varieties include AMSOY, WAYNE, HARASOY, BEESON, CLARK, and CALLAND; southern kinds include HILL, LEE, HOOD, and DANE; for the far North, PORTAGE, MERIT, TRAVERSE, and CHIPPEWA 64. PERRY is a middle-state variety said by Pennsylvania researchers to withstand poor growing conditions better than others.

Newer varieties will be replacing these I've mentioned perhaps even before you read this book. New ones will no doubt be shorter and stiffer to keep the plants from lodging, which is still somewhat a problem in soybeans.

When planting, pay attention to maturity dates. You don't want a long-maturing bean for late planting. If you intend to plant wheat after the beans are harvested in the fall, you will probably not want a late-maturing variety either.

Planting

Soybeans do best where soil pH is between 6.5 and 7 or nearly neutral. They like well-drained soil, but I have seen them respond with good yields on heavy, tight clay soils, too. My grandfather's farm had several low bog-like depressions in some of his fields that had been drained. We called them pot holes though they are not the usual kind. Around the edges of these drained bogs was a margin of bluish clay that could all but stop a tractor when we plowed through it. The soybeans always grew best over that blue clay.

The organic grower should plant soybeans in rows wide enough so he can cultivate between them. In the row, the normal planting rate is about eight beans per foot of row.

If you want to plant more than just a garden row or two and don't have a bean drill or row planter, you can broadcast the seed on well-worked soil and then cover with disk or harrow. You run the risk of weedy beans by planting solid this way rather than in rows. But if you plant later than normal after disking the soil repeatedly up until planting time, the beans stay fairly clean.

Plant the beans about the same depth you would corn, about one-and-a-half inches early in the planting season, three to four inches late in the season if the ground is dry. Broadcasting the seed and covering shallowly with a disk or harrow will work fine too, if the soil has adequate moisture.

Seed Inoculation

Most farmers inoculate bean seed with *Rhizobia* bacteria mentioned earlier before planting. Though the bacteria is almost always present in healthy soil naturally, farmers long ago found that adding more bacteria could increase yields slightly. Some scientists think inoculation can be overdone. They say a field that has been regularly planted with inoculated legume seed may not need further inoculation at every planting. Other agronomists disagree, demonstrating that *Rhizobia* populations tend to decline, especially under intensive cultivation and dry weather. The higher the *Rhizobia* population, the better the chances for higher yields, they say. Since inoculation costs only about $1 an acre, the extra effort seems worth it, especially for organic

growers who are as much interested in the increase in nitrogen fixation that could take place as in an increase in yield.

You can buy special strains of bacteria for soybeans, or for alfalfa, or for garden beans and peas, and so forth. But most often you find offered for sale just a general inoculant for all legumes. The inoculant comes in powder or liquid form, and in some cases, as frozen liquid. Gardeners and small farmers will find the powdered kind available from most garden and farm stores most suitable to their purposes. The "powder" is humus made from reconstituted peat soil. Packed in moisture-sealing plastic, the humus nurtures the bacteria in it and keeps them healthy if the inoculant is stored out of direct sun in temperatures of not over 70° F.

Enough moisture remains in the plastic-packed humus to make it stick to the seed when the two are mixed together. Follow application directions on the label. Usually all you have to do is sprinkle the powder over the seeds, then stir and mix in until at least a speck or two adheres to each seed. If the inoculant doesn't want to stick to the seeds, sprinkle a little water over the seeds first, then stir in the powder.

The bacteria will stay alive on exposed seed for about two or three weeks, if it is stored in a cool, dark place. But try to plant the inoculated seed as soon as possible—preferably right away—so that the bacteria get into the ground in vigorous condition.

Fertilization

Fertilizing soybeans is a hit-miss affair. Some chemical farmers claim soybeans respond to application of fertilizer directly and some claim just the opposite. Not a few agronomists just plain don't advocate fertilizer on soybeans, contending that the general fertility of the soil and the fertilizer the farmer may have applied to preceding crops might affect the soybeans, but not the NPK applied at planting time.

On some intensively farmed soils, trace element deficiency is showing up in soybeans. Manganese and boron are the two micro-nutrients the beans usually are short of. Both deficiencies cause yellowing of the beans or often a pale greening. My neighbors are adding manganese to their fertilizer as a matter of course, applying it to the crop that precedes soybeans in their rotations.

Organic growers shouldn't have problems with trace elements ordinarily. Regular green manuring, and especially animal manuring, usually prevents micronutrient deficiency. The fact that soybeans don't seem to need high, direct application of fertilizer to make decent yields will not be lost on the organic grower either. Soybeans are *his* crop.

Weed Control

Soybeans will endure a few weeds, but the cleaner you keep them, the better they'll do. Mechanical cultivation will keep the row middles clean, but even the most skillful operation will leave a few weeds mingled with the beans in the row. It is best (though not absolutely necessary) to begin cultivation before the beans emerge from the ground with the rotary hoe pulled at a fairly fast speed behind a farm tractor. On small garden plots, you can use the rotary tiller by letting it run only lightly over the ground just barely digging in. This type of cultivation kills weeds just germinating, weeds you cannot really see yet. The beans then get a head start on the weeds. The rotary hoe can be operated even when the beans are coming up. It will pull a few of them out, but not many, and because of the many weeds killed, is well worth the few beans lost.

Begin cultivation with a regular cultivator as soon as possible. In the garden with a push-type cultivator or rotary tiller, you can cultivate as soon as the beans are up because you can manipulate your hand cultivator or tiller so that it will not cover the beans. With a tractor cultivator, even with shields to protect the beans from covering, you usually have to wait until the beans are about four inches high, and then you will have to drive very slowly.

As the beans grow, you should adjust your cultivator so that it rolls dirt around the base of the beans, covering small weeds growing up there. With a tractor/shovel cultivator, you can accomplish this simply by raising the shields slightly and increasing speed. Don't speed up too much though, because then the cultivation shovels will ridge dirt up in the row too high. If the ridge is too high the combine's cutter bar will scrape in the dirt when cutting the beans at harvesttime.

Stop cultivating when the beans are about knee high. After that time, the cultivator may knock over plants that are beginning to spread out, or injure roots.

Herbicides supposedly have solved the weed problem for farmers, but I can say without fear of too much contradiction that the chemicals usually don't control weeds any better than cultivation. I can look out the windows of my home and see acres and acres of soybeans in any direction, all with herbicides applied. They are all weedy. I would love to know where the manufacturers of herbicides find those long weedless rows of soybeans they use in their advertising illustrations. The only field of beans in our neighborhood that looked like those advertisements was my Uncle Carl's 40 acres up the road. He never used herbicides. But all of his 70-odd years, he cultivated assiduously and then patrolled the rows all summer, hoeing by hand those weeds that escaped his tractor cultivator. Farmers from all over stopped to marvel when they passed his beans. They seldom believed us when we said the only herbicide Carl used was a hoe.

If the rains come exactly right to activate the herbicides, chemicals will often work well, I hasten to add. But many chemical farmers are seriously wondering if the practice is worth the gamble. In our county this year, herbicides not only didn't kill the weeds, but they severely injured many acres of beans. Some fields had to be replanted and others should have been. This is a matter of record that the county agent in Wyandot County will be glad to substantiate. You won't find the report written up in any farm magazines however. I wonder sometimes what crime a chemical would have to commit before a magazine that lives off the advertising of that chemical would report it fully.

Insects

Fortunately, insects cause only minor damage to soybeans in this part of the country, another good reason why organicists should grow them. In the mid-Atlantic states, the Mexican bean beetle seems to be acquiring a taste for soybean leaves. If it continues, a serious problem could develop. In the South, the velvet-bean caterpillar can be harmful. In the Northeast, Japanese beetles may take a liking to your soybeans. Traps and milky spore disease give about as much control of this peskiest of pests as chemicals. The bean leaf beetle, cutworms, wireworms, white grubs, grasshoppers, leafhoppers, and armyworms may occasionally be troublesome, but seldom present a serious problem.

Harvesting Soybeans

Soybeans begin to blossom about two months after planting. You won't notice the blooms unless you look closely because they are not showy. Sometimes the blossoms will dry up and fall off, but most of them will form pods that eventually grow two inches in length and normally contain three beans. Depending on the fertility of the soil, moisture, and variety of bean, your plants will grow to a height of between two-and-a-half to three-and-a-half feet, sometimes more, sometimes less.

For Table Use

Harvesttime depends upon how you intend to use your beans. For table use, soybean lovers will harvest half or more of their beans in the green pod stage, when the beans are fully formed, but still soft, green, and pea-like. Since the pods are thick on the plants, you can grab a fistful at a time and pull them loose, as if you were picking peas.

The green plants, with or without pods, can be cut and dried for hay. Bean hay is good for all animals, but hand harvesting by this method is hardly practical except on small patches or short rows. Just the thing to do if you have a couple of rabbits.

To get the beans out of the pods, steam heat the pods in a pan with a little water for about 10 minutes. Pour off the water. Then if you squeeze the pods gently between your fingers (one at a time), the beans will pop out. It's slow going but pleasant work, especially if you've got an interesting conversation going with a helper.

Prepare the beans as you would peas. The cooking takes away the oily taste I associate with raw soybeans. The beans can also be frozen, like peas, for winter use.

Harvesting green soybeans can be stretched over several weeks, as the beans don't all mature at the same time. Like snap beans, the pods are ready at the base of the plant before the ones at the top.

As Hay

Larger patches or fields of beans can be harvested as hay. Before soybeans became so readily marketable as meal and oil that's about the only reason they were grown. Bean hay is harder to cure than clover, and needs a longer drying period. During August when you usually make bean hay, the weather is normally dry and the risk of rain less.

As Green Manure

You can harvest soybeans as green manure. Plowing the green plants under may not strike you as "marketing" but the fertility you put in the soil in this manner may well be worth as much as you net from the beans if you sold them. Back when green manuring was a common practice, traditional wisdom on the farm stated that the farmer got back in higher yields of succeeding crops all the money he "lost" by plowing under the beans.

Plow the beans under when the bean pods are just beginning to form or at least before the beans are far enough along that they would reseed. Growth will be heaviest at pod-forming time, and give you the largest possible amount of organic matter.

In your garden you can plow down the beans with your rotary tiller. Mow first with your rotary lawn mower, then work the shreddings into the ground with your tiller. Any ground that you had planted to early vegetables and that would otherwise lie idle from July on can be profitably planted to beans and plowed down in the fall before frost. If you are going to plant wheat or rye on the plowed-down beans, wait a few days if possible, after plowing before planting. Heavy organic matter when first plowed under can form ethylene gases which inhibit germination.

As a Grain

Most soybeans are, of course, harvested as fully ripened beans, with a grain combine. The plants are allowed to stand in the field until the beans are dry enough to harvest. As fall approaches, the plants turn yellow and the leaves drop off (forming a wonderful layer of mulch on the soil). Finally all that is left standing are the stems and the pods, both a dead brown color. The beans thresh out easily then, and with moisture content of 13 percent or less, can be safely stored.

Small amounts of beans can be threshed by hand. I cut the plants off, stuff them in burlap bags, then tramp and beat the bags. Most of the beans fall to the bottom and I pull the straw and stems out and return them to the garden for mulch. The beans are still full of chaff and small stem bits, which can be winnowed out by pouring from one bucket to another in a stiff breeze or before a fan.

For rabbits and chickens, I sometimes cut the bean plants earlier, when the pods are fully formed but some leaves still remain. These plants I tie into bundles and pile in some inside corner to dry. In the winter, I feed the plants, beans and all. The chickens seem to like a few whole soybeans when they can peck them out of the pods this way. They won't eat many whole soybeans stored awhile in bins, not in my experience anyway. The rabbits chew on the pods and the stems and eat the beans too. It's a cheap way to give them extra protein. Raw soybeans contain a substance that interferes with the digestion and absorption of proteins in the bean, particularly tryptophan. For that reason, feeding too many raw soybeans to animals is not advisable. Cooking makes the inhibitor disappear. However, that does not mean that raw soybeans cannot be fed or that, especially when ground raw and mixed with other grains, they are not a good source of protein. How much is too much? Goat raisers have substituted whole soybeans for up to one-half of the processed soybean meal in a ration with satisfactory results. Cattle and hog feeders used to regularly grind raw soybeans with other grains, though most of them now prefer to buy processed, roasted soybean meal.

Farmers sometimes roast their own soybeans (there are advantages to roasting all grains to make animals gain faster, but there is still vigorous debate over whether the advantages are worth the extra cost) to make them more digestible and, hopefully, to save money. There are on the market, farm-sized, grinder-extruders, which grind the beans with such friction in an auger-like extruder that the beans are cooked or "roasted" intensely enough to get rid of the tryptophan inhibitor. The disadvantage is that the heated ground beans, very oily after the process, become rancid in a matter of days and are very difficult to store. Also you almost need a mechanical mixer to mix the oily meal in with the rest of the grain ration. The extruders work off the power take-off of larger farm tractors and cost about $2,000 for the smallest models. They are probably practical only for commercial feeders,

who may share an extruder. More often, one farmer will custom-grind for his neighbors.

Threshing soybeans is accomplished with the aid of a burlap sack. Place very dry soybean plants inside, then flail it against a wall, beat it with a broom, stomp on it with your feet. Pull out the stems, and winnow the beans from the remaining chaff.

Storage

Soybeans can be stored like grain, in any dry, clean bin. Weevils and rodents are not as much a problem as they are in wheat. No hybrid soybeans are available yet, so any variety you have you can save for next year's seed. For seed, the beans should be plump, not shriveled, with a minimum of split beans present. For animals, the soybeans should be mixed right into the grain you are feeding. The beans can be milled and added to ground grain feed. About 200 pounds of meal per ton of corn and oats makes an adequate ration.

A Farm Proposal

Because the soybean is particularly suited to organic methods and commands a relatively high price in the marketplace, it is tempting to

consider it in the light of a commercial, organic cash grain enterprise. I do not generally encourage gardeners, homesteaders, or small sideline farmers to try commercial farming, let alone organic commercial farming. But there are specific instances where certain farm operations could be both organically and commercially viable enterprises. In other books I've already argued the case for dairy farming and for berry farming. I would suggest now that if any organic cash grain enterprise might be profitable, it would be one built on a rotation of wheat, red clover, and soybeans.

I don't like to suggest a commercial enterprise I have not tried myself or seen accomplished by others sucessfully. Yet I have seen enough partial examples of an organic wheat, red clover, and soybean rotation to feel that at present market prices, such an enterprise might be profitable.

Corn is the big feeder on soil nutrients, the grain most demanding of extra fertilizer. That's why I'd leave it out of a rotation strictly set up to make a profit organically. Wheat requires some extra fertilizer, but with the nitrogen-giving advantages of both the clover and soybeans, the smaller amount of extra fertility necessary could be obtained from organic sources at a cost the farmer could afford.

The wheat is planted in the fall, following two years of legumes. A top dressing of manure or an equivalent amount of plant nutrients in other forms, plus lime, rock phosphate, and some special type of fertilizer containing organic potassium (greensand or perhaps a commercial organic fertilizer like Shurgro's Special K with a high potassium content) should suffice to make a normally good wheat crop. A normally good yield in this fertile part of Ohio would be 50 bushels to the acre (this year much of the wheat produced 70 bushels to the acre). Wheat is about $3 a bushel right now.

In early spring, you would sow red clover into the wheat. (I specify red clover because it can be grown successfully throughout the Cornbelt, the Northeast, plus parts of the South and West, and is the only clover we can grow from which, in the same year, we can get both a crop of hay and a crop of seed.) The wheat you harvest in summer, with a straw chopper on the combine to chop and spread the wheat straw back on the ground as mulch for the coming clover crop. If you can apply even five tons of manure per acre after the wheat is off, so much the better. If you have access to 10 tons to apply per acre, you are going to be the most successful farmer in the county. You do nothing more that year except sell your wheat.

The next June, the clover will make at least a three-ton-per-acre crop, and perhaps more on good ground. Current hay prices for good quality hay not rained out while curing, are $60 to $70 a ton. So that's at least $180 gross per acre.

The clover grows right back after haymaking and in the fall, you can combine it for clover seed. Some combines are better adapted to harvesting

clover seed than others. The old Allis Chalmers six footer, no longer made, is considered one of the best for clover. I've seen it garner two bushels of clover seed per acre where some other combines were getting only one bushel. But even if you harvest only one bushel per acre, clover seed right now is selling for $65 a bushel. That figure, combined with the hay figure adds up conservatively to $245 per acre. And in the meantime the clover is fixing over 100 pounds of nitrogen per acre in the soil. And in the combining of the seed, the rest of the plants go back on the field for mulch, organic matter and additional nutrients. The following spring, let the clover grow again until the middle of May, then plow it under for green manure and plant soybeans. They should do very well without any added fertilizer. ' Following a year of clover, the beans should not get too weedy either, with normal mechanical cultivation. Certainly you won't need expensive herbicides. A normally good yield in normally good ground is 40 bushels per acre. At $5 per bushel, current price, that's $200 per acre.

When the beans are harvested in the fall (again only the beans come off, the stalks and leaves return to the soil), plant wheat and fertilize organically as you did the former wheat crop.

At these prices, in a good year, on good soil, 100 acres would gross about $20,000 a year. But don't get stars in your eyes over that. Gross in farming is a far cry from net. But certainly when there is profit in a corn, bean, and wheat rotation for a chemical farmer, there will be profit too, in a wheat, clover, and bean rotation for an organic farmer. And the organic farmer's land will be improving steadily, year by year.

COOKING SOYBEANS

Wash soybeans, then remove any foreign particles. Cover soybeans with cold water. Refrigerate or freeze overnight. Freezing will lessen the amount of cooking time needed.

Next day put the soybeans and their soaking water on to cook, using a large enough pot and leaving the lid slightly to one side so that the soybeans will not boil over. Bring soybeans to a boil, then turn heat down and simmer until they are tender, 2 to 3 hours. (They will never be as soft as navy beans, for example, but they will get tender, when done.)

Soaking, or cooked soybeans ferment very quickly, so should never be left very long at room temperature. They will keep quite long in the freezer, but not more than a few days in the refrigerator.

One cup of dry soybeans will swell during soaking to 2½ to 3 cups. One pound of dry soybeans is about 2¼ cups.

BASIC SOY MILK *

2/3 cup soybeans
4 cups water
1/3cup oil
¼ teaspoon salt
¼ cup honey

Soak soybeans in cold water overnight. If the weather is hot, refrigerate them.

Drain soaked soybeans and discard.

Put soybeans and 2 cups water into container of an electric blender. Blend at medium-low speed for about 3 minutes.

Put soybean mixture into the top of a double boiler. Stir in 2 more cups water and cook over rapidly boiling water for 30 minutes.

Strain soybean mixture through a cheesecloth-lined strainer. Rinse out top of double boiler and return strained soy milk to it. Cook 30 minutes over rapidly boiling water.

Strain soy milk through cheesecloth-lined strainer.

Pour 2/3 cup hot soy milk into container of electric blender, add oil, and blend on medium-low speed for 5 minutes. (The full time is necessary in order to obtain an emulsion.)

Add remaining soy milk, salt, and honey and blend about 2 minutes longer. Cool. Store in a covered jar in the refrigerator. Shake vigorously before using. Keeps well for a week.

* Note: Use as you would milk, over cereal, in cooking, and beverages.

Yield: About one quart

BLENDER-SOYBURGERS

1 medium-small onion
4 tablespoons vegetable oil
2 cups soybeans, cooked
1 cup potato, cooked
¼ cup fresh bean sprouts
1-1½ teaspoons sea salt
½ teaspoon dried dill weed
1 teaspoon dried parsley
1 teaspoon dried basil
few dashes of powdered sage
1 teaspoon oregano
vegetable oil

Peel, chunk, and grind the onions at medium speed. Leave in the container. Add 2 tablespoons vegetable oil and 1 cup soybeans, a tablespoon at a time through the blender cap. Scrape out into a bowl. Grind the rest of the beans with another 2 tablespoons of vegetable oil, and scrape out.

Drop half the potato into the blender and whirl at low speed until it forms an elastic mass; scrape this mass over the beans.

Repeat. (Cooked potato doesn't mash in the blender, it forms this starchy elastic stuff that will help hold the burgers together.)

Add the sprouts, salt, and herbs, and stir well. If you have the time, let stand for half-an-hour, to allow the herbs to soak in. Taste for salt.
Spoon onto a lightly oiled baking sheet, and broil (starting with a cold oven) at highest heat for 15 minutes on the first side and 5 minutes on the second.
Yield: 10-12 large burgers

BARBECUED SOYBEANS

6 cups cooked soybeans (approximately 2¼ cups uncooked)
the water soybeans were cooked in, or stock
½ cup onion, chopped
1 clove garlic, minced
2 tablespoons oil
½ cup tomato juice
½ cup catsup
1 tablespoon molasses
½ cup green pepper, chopped
2 tablespoons honey
1½ teaspoons dry mustard
¼ cup parsley, freshly chopped
1/8 teaspoon cayenne pepper
Preheat oven to 350° F.
Put cooked soybeans with their liquid into a lightly oiled casserole.
Sauté chopped onion and minced garlic in 2 tablespoons oil until golden but not brown.
Remove from heat and add to cooked soybeans. Add the tomato juice, catsup, molasses, chopped green pepper, honey, dry mustard, chopped parsley, and cayenne pepper. Mix together thoroughly.
Place in oven and bake 1½ hours or until soybeans are tender.
Yield: six-eight servings

SWEDISH SOYBEAN SOUP

2 cups soybeans
water to cover
1 medium-szed meaty beef bone
3 quarts cold water
salt to taste
½ teaspoon paprika
1 cup chopped celery, with leaves
1 cup onions, chopped
3 medium-sized turnips, diced
¼ cup parsley, chopped
1/8 teaspoon cayenne pepper
1 cup tomato puree or canned tomatoes
chopped parsley for garnish
Wash soybeans and discard beans with imperfections. Cover soybeans with water and place in refrigerator, covered, overnight.
The following day, place soaked soybeans in a large, heavy soup kettle. (Be sure to use a large enough pot and leave partially uncovered, so as to avoid

soybeans cooking over. This can happen very easily.) Add beef bone and 3 quarts of cold water. Place over medium heat and bring to a boil, uncovered, removing any foam from surface as it accumulates. Reduce heat; add salt and paprika. Cover partially and allow to simmer for 3 hours, stirring occasionally.

Add the chopped celery, onions, turnips, parsley, cayenne, and tomato puree or canned tomatoes. Cover partially and allow to simmer for another hour or until soybeans are tender. Continue to stir occasionally while cooking. Taste and correct seasoning. Garnish with chopped parsley.

Yield: Approximately three quarts

ORANGE MUFFINS

2/3 cup oat flour
½ cup brown rice flour
1/3 cup soy flour
½ teaspoon salt
3 tablespoons wheat germ
2 teaspoons dry yeast
2 egg yolks
3 tablespoons honey
2 tablespoons oil
¼ cup nonfat dry milk
1 cup water
¼ teaspoon mace
1 tablespoon orange rind, grated
¼ cup raisins
2 egg whites

Prepare a 12-cup muffin pan by brushing with oil. (2½-inch size cups)

Sift together flours and salt into a medium-sized bowl. Add wheat germ and dry yeast; mix together.

In a mixing bowl, beat egg yolks until thick. Add honey and oil. Combine nonfat dry milk and water with a wire whisk, and add to egg mixture. Stir in flour mixture. Add mace, orange rind, and raisins.

Beat egg whites until soft peaks form. Gently fold beaten egg whites into batter until well combined.

Spoon batter into prepared muffin-pan cups, filling two-thirds full. Place in a warm area or over a shallow pan of hot water, cover, and allow to rise for 30 minutes. Meanwhile, preheat oven to 375°F.

Place raised muffins on middle of rack in oven and bake 30 minutes or until nicely browned.

Remove from oven and loosen edge of each muffin with a spatula: remove and serve immediately.

Yield: 12 medium-size muffins

GROUND BEEF STUFFED PEPPERS (WITH SOY GRITS)

6 medium-sized green peppers
½ cup onion,chopped
1 clove garlic, minced

¼ cup olive oil
1 pound ground beef
½ cup soy grits
1 cup brown rice, cooked
1 teaspoon Tamari soy sauce
½ teaspoon salt
1½ cups tomato juice
¾ cup parsley, chopped
3 tablespoons wheat germ
3 tablespoons Parmesan cheese, grated
Preheat oven to 350°F.
Wash and drain green peppers. Remove stem ends from peppers and carefully remove seeds and ribs. Set aside.
Saute onion and garlic in olive oil until tender. Stir in the ground beef and continue to saute only until it is no longer red. Add the soy grits, cooked rice, Tamari soy sauce, and salt. Mix together to blend ingredients. Stir in ½ cup tomato juice and the chopped parsley. Cook for 5 minutes.
Remove from heat and allow mixture to cool slightly. Stuff the peppers with the meat mixture. Place in a baking dish and pour 1 cup of tomato juice around the stuffed peppers. Cover and place in oven and bake 45 to 50 minutes or until peppers are tender. Baste occasionally with pan liquid. Remove cover after first 30 minutes of baking. Top peppers with wheat germ combined with cheese, and brown slightly.
Yield: six servings

Chapter 7

Rye and Barley

Rye

Rye is not a particularly impressive grain either in yield or nutritional value, except perhaps to lovers of the whiskey distilled from it. But rye's popularity continues because of its amazing tolerance to cold weather, which makes it an ideal winter cover crop and a desirable pasture for livestock in fall and spring when other pasture is not growing. Rye can actually begin to germinate when the temperature is only 33°F., although it prefers a much warmer 55° to 65°F. Once established, the plant will continue to grow in the fall until the temperature drops below 40°F., and resumes growth when the temperature rises above 40°F. in the spring. Even during the winter on sunny days when the temperature in the shade barely rises above freezing, rye in the sun may grow a little. It is the most hardy of all grains and won't winter-kill at 40 below 0°F. On the other hand, rye doesn't like hot weather and won't germinate when the temperature is above 85°F.

Rye's second advantage is that it will produce a crop on land too poor for wheat. In the cold climate of northern Europe, where soil is poor, rye is an important and dependable source of bread flour.

In the United States, rye is more important as green manure and pasture than as grain. The crop can, however, be grazed and then harvested for grain, like wheat. Dairymen like to grow a little rye strictly for late fall and early spring pasture, then plow under the residue. If allowed to mature, rye grows much taller than other small grains, taller than a man.

Growing Rye

Grow rye like you would winter wheat. It can be sown any time between late summer and late fall, preferably during the earlier half of that period so that it can be pastured in the late fall. Later plantings, for spring plowdown or grain, should not be postponed so long that they can't establish themselves before cold weather arrives in force. In Ohio, sowings for graze are completed ideally before September 15; for grain, before the end of October. Adjust those dates to fit your own climate.

For grain, plant about one-and-a-half bushels of seed per acre; for grazing, two to two-and-a-half bushels per acre. Halve those rates in semi-arid climates. Plant either with a drill or by broadcasting as described earlier.

Rye will ripen just ahead of winter wheat. It yields poorly by comparison, perhaps 30 bushels (or less) to the acre where wheat will produce 50 bushels per acre. That means there is not much economic incentive to grow rye for grain if you can grow wheat unless you have a special market for it as seed, or to distilleries, or to horse farms. In the latter case, horsemen prefer rye straw to wheat for bedding race horses. When cut in the soft dough stage, the straw is brighter and of course longer than wheat straw. Rye straw looks showier and is not apt to cling to the horse like shorter, chaffier straw might.

Using Rye Grain

Rye grain is not as palatable as other grains for livestock and it's harder for animals to chew. It should be mixed with other grains. Rye doesn't make very good hay either.

But if you like homemade rye bread as well as I do, you might want to grow a patch in the garden. Harvest just as I have described for wheat, and grind in blender or mill. Mix rye flour at least half-and-half with wheat flour for rye bread. Most Americans prefer it that way anyhow.

Varieties

The best varieties for grain in the South are FLORIDA BLACK, ABRUZZI, WESER, EXPLORER, GATOR, and others. DAKOLD is a far northern variety of long standing and BALBO has been favorite in the Cornbelt since 1933. The latter is even better as pasture. ADAMS, CARIBOU, and PIERRE are grown in the North; KUNG is an Oregon variety. Newer ones are available periodically.

Green Manuring

Rye is usually more profitable as a green manure than as a food grain in this country. Certainly the organic gardener will profit more from rye used this way. A new development in this regard has given rye even more significance to organic farmers and gardeners always concerned about better green manuring alternatives. That development is tetraploid rye, rye with double the number of chromosomes as ordinary varieties, a process perfected first with rye grass. (Rye grass incidentally can be used as a cover crop or nurse crop with other grasses and legumes, but is perhaps more practical for lawn seed mixtures to give lawns a quick start. Rye grass grows only a foot tall, has no grain value at all, and produces much less tonnage of grass for grazing or green manure.) The tetraploid characteristic gives the plant more vigor and hence, faster growth and better yields. Michigan State released the first tetraploid rye in 1973, calling it WHEELER rye and seed is now available. In addition to being an excellent green manure crop, WHEELER is considered a source of high-quality silage, which most ryes aren't. Another tetraploid variety available—from Germany—is TETRA-PEKTUS. Tetraploid ryes should not be grown with other varieties. Cross-pollination may cause sterile seed. That's what happens when you start monkeying around with chromosomes.

Farmers concerned with soil erosion, (unfortunately not all farmers are) will broadcast rye in standing corn in late summer sometimes. Enough sun can get through the corn as it matures and dries to allow the rye to grow and cover the bare ground between the rows with a carpet of green. By the time the corn is ready for harvest, the rye not only is helping to control erosion, but provides a firmer soil surface for machinery when the ground is muddy. The following spring, the rye is plowed under for green manure and soybeans planted.

You can follow the same procedure in your garden, as many organic gardeners do. Rye sown between rows of late fall vegetables will keep you from having to wade through mud to harvest them. Rather than allow the plots where summer vegetables grew to lay idle, till and plant rye. Before it heads out the following spring, mow it with a rotary mower and till in the shreddings. You will be adding vital nitrogen and organic matter for almost no cost at all.

Insects and Diseases

Insects that attack other cereal grains will occasionally show an interest in rye, but rarely to any serious extent. Rye is a good organic crop for that reason. It is, however, susceptible to ergot disease, a fungus which produces black growths called sclerotia that replace the kernels in the rye heads. Ergot is poisonous to humans and livestock. All rye used for seed should be clean and ergot-free. If you use seed that is over a year old, you may

automatically control ergot because the sclerotia lose viability after a year's time and hopefully won't carry the disease over to a new crop.

Ergot may be removed from grain by soaking infested rye in a 20 percent solution of common salt in water. Stir until the ergot bodies float to the surface and skim them off. You'll have to wash the salt off the seed before planting it. (I label the whole process NWTE, not worth the effort. Throw ergot-infected rye away.)

Rye is afflicted with certain stem rots or smuts, but crop rotation and newer, resistant varieties solve that problem. The smut spores will not survive in soil much beyond a year, so rotations that space rye plantings at longer intervals than one year should avoid infestations.

Anthracnose is a problem, especially in the humid South on poorer land. The disease is associated with poorer soils and seldom is severe on organic soils where well-balanced fertility is maintained.

SOURDOUGH RYE BREAD (WHEATLESS)

1 cup sourdough starter
1½ cups water
2 cups rye flour
1 tablespoon molasses
½ cup lukewarm water
1 tablespoon dry yeast
2 tablespoons oil
2 teaspoons salt
4 cups rice flour
2 cups rye flour
1/3 cup (approximately) oat flour (oatmeal coarsely ground in electric blender)

Preheat oven to 375°F.

To make the "sponge," combine first three ingredients in a large bowl, cover and set in a warm, draft-free place overnight. (A cold oven is a good place.)

Next morning, dissolve molasses in lukewarm water and sprinkle yeast over the surface. Set aside for 5 minutes to activate. Stir down the "sponge," add oil, salt, activated yeast mixture, and all of the rice flour.

Mix in as much of the remaining rye flour by hand as possible, then turn out dough onto board or counter which has been well floured with the rye flour. Knead dough briefly, to incorporate all the flour and finish with the oat flour to reduce stickiness of dough. Place in oiled bowl, turning dough to oil surface.

Cover and put in warm place to rise for about 1 hour, or until double in bulk. Form dough into 1 large loaf and 1 small loaf, place in well-buttered bread pans and leave to rise to the top of the pans (approximately 1½ hours). Bake in oven for 35 minutes or until done. Remove loaves from pans, cool on rack. Yield: one large and one small loaf

HERBED BATTER BREAD

(An All-Rye, No-Knead, Casserole Bread)

¼ cup nonfat dry milk
1 cup lukewarm water
1 tablespoon honey
1½ tablespoons salt
1 cup lukewarm water
4 teaspoons dry yeast
3 tablespoons parsley, chopped
2 tablespoons chopped fresh basil, or 1 teaspoon dried crushed basil
1 tablespoon chives, freshly snipped
1 teaspoon oregano, dried, crushed
½ teaspoon fresh chopped thyme or ¼ teaspoon dried thyme leaves
½ teaspoon freshly snipped marjoram or ¼ teaspoon dried marjoram leaves
4½ cups rye flour
2 tablespoons oil

Combine nonfat dry milk and warm water in a small bowl, using a wire whisk. Add honey and salt.

In a larger mixing bowl, place the lukewarm water and sprinkle the yeast over the top, stirring until dissolved.

Add the milk mixture to the dissolved yeast. Stir in the fresh and dried herbs. Add 2 cups of rye flour. Beat for 2 minutes on medium speed of electric mixer, scraping sides of bowl frequently; or beat vigorously with a wooden spoon, about 200 strokes, until batter looks satiny. Using a wooden spoon, blend in the additional 2½ cups rye flour.

Scrape batter from sides of bowl. Cover with a clean towel and set in a warm place (85°F.), away from drafts, to rise until light and doubled in size, about 45 to 50 minutes. (Do not allow batter to over-rise.)

Stir the batter down. Turn into a well-oiled 1½-quart casserole or souffle dish. (Batter will be sticky. Smooth out top of loaf by flouring hand and patting into shape.) Again, allow to rise in a warm place, covered, for 20 minutes. Preheat oven to 375°F.

Place in oven and bake for 45 to 50 minutes or until bread is golden brown.

Remove from oven and brush top of bread lightly with oil. Cool for 10 minutes. Turn bread out onto wire rack to cool.

Yield: one round loaf

RYE AND LENTIL PILAF

1 small onion, minced
½ cup carrot, diced
½ cup celery, diced
2 tablespoons oil
1½ cups cooked whole or cracked rye (approximately ½ cup uncooked)
1½ cups cooked lentils (approximately 2/3 cup uncooked)
1 teaspoon caraway seeds (optional)
¼ teaspoon thyme
¼ teaspoon sage
¼-½ cup chicken stock or tomato juice

salt and pepper to taste
Sauté onion, carrot, and celery in oil until tender. Combine with cooked rye and lentils, add herbs, and chicken stock or tomato juice. Season to taste, cover, and steam for 10 minutes, or until hot. Serve.
Yield: four servings

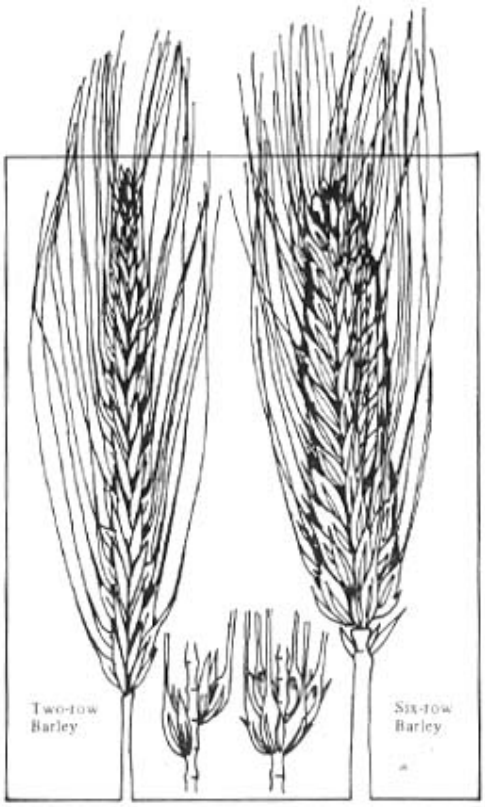
Barley

If barley isn't the oldest cultivated grain as some historians believe, it certainly is the most widely adapted. There is barley that grows in the Arctic Circle and barley that grows in the tropics. There are varieties for Montana and Arizona, New York and Georgia, Tennessee and Minnesota. And all points in between. Barley likes a long, cool ripening season and moderate moisture best, but will adapt to hotter conditions. Since it uses most of the water it needs in winter and spring months, barley is a welcome crop on irrigated land to rotate with cotton, alfalfa, sorghum, and other summer growing crops in the South. Moreover, barley is more tolerant of salt than other small grains and adapts well to saline western soils.

Barley makes good feed for all livestock. It contains almost as much energy as corn and three percent more protein on the average. It can replace corn pound for pound in cattle rations. In the Northwest beyond the Cornbelt, where the largest barley acreages are found, beef and pork are produced with barley instead of corn. Northwesterners believe the barley imparts a distinctive flavor to the meat which they prefer to corn-fed beef or pork.

De gustibus non disputandum est, we learned Cornbelters would reply.

However you like your steaks, barley makes good soups and cereals in the dehulled (pearl barley) form. Alone, barley does not have enough gluten to make bread and must be mixed with other flours. Sprouted barley, dried and crushed, is the principal malt used in brewing beer, distilling alcohol, and making malt syrup for other food purposes. Some 30 percent of the barley grown is used for malting.



Varieties

To achieve so much versatility with barley, good old *Homo sapiens* has developed varieties from two botanically distinct types of barley: six-row and two-row. The six-row varieties are more common and they are divided into three distinct families:

Group one contains the malting barleys of the upper Midwest, tall, awned (bearded), spring planted, and tracing to Manchurian origin, the name by which the group is sometimes identified.

Group two is called the coast group, the barley usually grown in California and Arizona as winter or fall barley. It is North African in origin.

Group three is the Tennessee winter group, the true winter barleys grown east of the Mississippi principally for livestock feed.

Two-row barleys are grown in the Pacific Northwest, the Intermountain region, and the northern half of the Great Plains. They are spring planted both for cattle feed and malting.

Any kind of barley can be grazed, like wheat, the practice more likely occurring in the South than in the North.

Because of the different purposes barley is grown for, there are more varieties than you can shake a stick at, and new ones are offered continuously. In most varieties, breeders are seeking a stiffer-strawed plant, like BARTEL in the Southwest. Most states have new barleys on test and are probably available by the time you read this. Also breeders are learning how to hybridize barley for higher yields. This development may or may not intrigue you as a homesteader for reasons already mentioned under hybrid wheat. Since high yields of barley in non-hybrid varieties are possible—80 to 100 bushels per acre common on fertile soil—the homesteader, if not the commercial farmer, may have little to gain from expensive hybrid varieties that he cannot use for seed the following year.

Bearded or Beardless

Barley varieties may have bearded heads or be beardless depending on whether each seed possesses a slender bristle usually about three inches long, called an awn. Farmers who grow barley for forage generally prefer beardless varieties, since horses may not eat the awns, especially if they are rough or barbed as is often true. But for that very reason, bearded varieties in Pennsylvania have been found to be resistant to deer foraging. The deer don't like the beards either.

I have my own small adventure to tell about bearded grain and to pass on as a word to the wise. In my wandering youth, I worked several summers on Minnesota farms where grain was still threshed the old-time way, with a threshing machine. Despite the scratching straw and rough, bearded grain heads, I worked the first day shocking the bundles without a shirt on. Each shock when finished, had to be "capped" to keep out rain. The cap was just another bundle fitted over the shock to make an inverted V "roof." To bend the bundle, or break it as we said, I'd clasp the butt end against my stomach with my left arm and bend the straws over that arm with my right hand, almost as if I were folding a blanket. The bundle could then be set over the shock.

To make a long story short, that night I woke up with a nagging pain in my stomach. By the third awakening, I decided that I had been stung severely on the navel though I could find no break in the skin. The fourth time I awoke from a nightmare in which I had been stabbed in the stomach. Subsequent examination revealed that a barbed barley awn was literally working its way inside me via the navel. The barbs of the awn faced outwards: the awn could slide forward into me with the movement of my torso, but the barbs prevented it from sliding backwards. I wonder how far the blamed thing would have gone. Moral: When shocking grain, keep your shirt on.

Growing Barley

Grow barley almost exactly like you'd grow wheat. Some is spring planted and some fall planted. Fall-planted winter barley may winter-kill where winter temperature averages less than 20°F. As a general rule, plant winter barley where winter wheat is planted; spring barley where spring wheat is grown.

Planting

Prepare and plant as you would wheat. Fertility requirements are similar. Barley ripens sooner than wheat, spring barley in 60 to 70 days, winter barley about 60 days after growth begins in the spring. Because barley ripens quicker than wheat, it fits into a double-cropping system better. A second crop planted after barley has longer to mature than when planted after wheat. The homesteader seeking to make his small acreage as productive as possible, could plant soybeans after barley even in the North or sorghum in the South with good chance of success.

The first experience I had seeding barley brought me into conflict with those blasted beards again. I was just a boy at the time, and my father was planting barley from which the awns had not been removed. The awns caused a problem in the old drill we were using. They'd bridge over and plug the tubes that fed the grain from the planter boxes down into the ground. It fell to my unlucky lot to keep all 18 tubes open so that the drill planted the seed evenly with no missed spots. That was not an easy job and that's why I remember. And pass on the word. I doubt you'll come across seed as rough as that today, but if you do, don't try to run it through a planting drill. Broadcast it . . . and itch a lot.

Rotations

In the field or in the garden, you can put barley in your rotation as a replacement for wheat. Where you have potatoes in the rotation, barley can follow wheat or oats or soybeans in place of corn. Scab disease in potatoes can carry over on corn but not on barley, I understand. Where "take-all" disease (already mentioned under wheat) became serious among wheat fields in California, farmers began planting barley instead since the disease doesn't attack barley so seriously. In dry climates, a rotation of sorghum, barley, fallow, and wheat has been found profitable. Sometimes the barley is grown right on the summer fallow. In the South, barley is often rotated with cotton. The cotton yield is improved, and the barley lessens winter and early spring wind erosion.

Planting in Rows

Experiments with commercially grown, irrigated barley in Arizona have application for homesteaders and gardeners. Researchers there have found

that barley grown in rows 14 inches apart on beds 40 inches apart produced as good a crop as solid-planted barley even though much less seed was used, 25 pounds vs. 100 pounds. The plants in rows had more room to tiller and the greater number of tillers not only gave comparable yield, but anchored the plants better and kept them from lodging. What's more, researchers reported much greater efficiency in fertilizer use and weeds could be controlled by cultivation, if necessary.

For the homesteader or gardener, planting grains in rows, however untraditional in America, makes sense. He, too, can use less seed, can use his precious compost and organic fertilizers more efficiently, and can cultivate for weed control instead of using herbicide in solid plantings where cultivation would be impossible. Also, if he is going to harvest by hand, having the grain in rows will make bunching the cut stalks into bundles easier.

Feeding Livestock

Barley can be fed whole to rabbits, chickens, hogs, or livestock. Chickens don't seem to like it as well as wheat on account of the hulls and all animals will consume more if the barley is ground. Better than grinding, I think, is to sprout the barley, at least for feeding to a small number of chickens or other animals. After all, most organic growers are already well aware of the value of sprouts in their own diets. Sprouted oats and other grains were standbys for chicken feed in the good old days. Why not utilize barley that way now, since its sprouting ability is so well documented? The sole hitch is that you must store the barley four to six weeks before trying to sprout it. The process is called "after-ripening," and it is necessary for prompt germination.

An easy way to sprout barley is to soak the grain heads when they are still attached to the stalks in tied bundles. Do a bundle at a time. It should sprout in about five days in 60°F. temperature. Eventually, you'll know how much barley to begin soaking so as to keep a steady ration coming for the hens every day. The barley will sprout right in the head and you can toss the whole bundle or part of it to the chickens. They get excellent feed, the stalks make excellent bedding, and you don't have to thresh the barley.

Malting Barley

Speaking of sprouting barley, if you should get the notion to make your own malt for beer or malt syrup, don't think you're the first one to try it. A friend of mine did, and though his barley mildewed during the sprouting process, he is confident that next time around the venture will be successful.

Making Beer

I have never made beer myself, but from remembering my father doing it years ago, and listening to other amateur brewers talking, and from gleaning advice from various printed sources, here's a rough idea of how it goes.

First you sprout your barley (you can do it the easy way and buy malt extract). That isn't difficult if you've done any grain sprouting. You need to keep the grains moist but not let them mold, at a temperature of around 65°F. Any way you accomplish that will suffice. You allow the barley to sprout only until the plant sprout—not the root sprout—is two-thirds of the length of the grain itself. The sprout will not have emerged yet, but is plainly visible in the swelling grain. As soon as it reaches the prescribed length, which should be in about 10 days, dry the grains at a temperature of 130°F., and never more than 140°F. When dry, the grains should be brittle and crack sharply between your teeth.

To make beer, you need at this point, some kind of barrel or container (wood or copper in the old days, though I think plastic would be okay if it is a kind that can take boiling water) that has an outlet near the bottom. A wooden barrel with a spigot near the bottom as for cider would be fine.

Okay, first you crack your malt barley. A coffee grinder, blender, or rolling pin will do the job. Crack the grain, don't grind it to a powder. Next, mix water with the cracked malt into a thoroughly wet, heavy mash. The water needs to be boiled and then cooled to 150°F. before using to make the wet mash. Let the mash stand overnight.

Next morning, pour boiling water on the mash. The water soaks down through the mash and is drawn off through the bottom spigot or whatever arrangement your ingenuity has devised. Your formula to follow is 10 gallons of boiling water to one bushel of mash to which later you will add one pound of hops. So half-a-bushel takes five gallons of water and one-half pound of hops, and so forth.

After you have poured the proper amount of boiling water through the mash and drawn off the liquid, the latter is strained to take out any pieces of grain in it and then boiled with the hops, the hops in a cloth bag in the liquid. The mash left over is still very nutritious feed for livestock, more important to me than the beer. Nothing is wasted.

Boil your beer and hops for about an hour. Then pour it into another container and get it cooled as fast as you can. If it cools too slowly, it may spoil. A good way to cool is to run cold water through coiled copper pipe immersed in the beer. (Cooling in a bulk milk tank would be perfect, but don't let your milk inspector know.)

While the beer cools, take a gallon of it and cool it down quickly to body temperature, add yeast, and let it work. When the rest of the brew has cooled to about 60°F., dump in the gallon of yeasted liquid, cover the whole with a cloth so insects can't get to it, and let the brew ferment for a week anyway.

But after three days, watch for yeast floating up to the top of the brew. Skim it off before it sinks again. Save the skimmings for the next batch or to lend to other would-be brewers or bakers in need of live yeast. Kept in a lidded, glass jar in a cool place, yeast will keep at least a month.

I understand that beer made this way is pretty potent stuff. You can add corn to it to lighten it, or sugar to darken it. Other grains will make beer too.

At any rate, I've given you only the bare bones of the process and you should know more or be ready to employ a lot of trial and error.

Failures are many, but a faint heart ne'er won fair beer, I suppose. I take a dim view of the whole thing, remembering my father's beer. Bottles of it in our cellar had the peculiar habit of exploding occasionally. It was like living above a time bomb.

Hulling Barley

For barley soup or other table food, barley should be hulled. The blender will do a fair job if you winnow or sift the hulls out. You can't get them all, just some. Since I have begun asking country people how to hull various grains, I've learned some rather novel methods. It seems that any hard striking action will work. As I have mentioned earlier, a combine with the beaters that strike the grain set overly close to the concaves, will knock hulls loose on oats and barley. Some farmers tell me that if you blow grain through a grain blower against a wall, the considerable force of grain striking wall will loosen about 60 percent of the hulls, be it barley or oats. Another method of dehulling is to use a hammer mill, take out the screen, and slow down the RPMs to nearly half grinding or milling speed. Roasting the grains before dehulling greatly increases the efficiency of any method you use.

Insects and Diseases

Like all the grains which have endured for so many centuries, barley is not a plant to roll over and play dead every time a disease or bug enemy comes along. Yellow dwarf virus may come close to destroying a field of barley occasionally if it attacks the plants at the seedling stage. Older plants will be less stunted, but the top leaf will be yellowed and the grains in the lower parts of the heads blasted. An aphid carries the disease but even insecticide applications have not helped control the disease. The aphid transmits the virus before it can be killed. Fortunately, the disease is not common.

Many fungal diseases bother barley, as they do other cereal grains, especially in the humid South. In Georgia, spot blotch has been severe in recent years and farmers are advised to plant only the more resistant varieties like FLORIDA 102 there. VOLBAR has good resistance too, and to leaf rust and powdery mildew. BARSOY is good against mildew but it's not so good against leaf rust, and the same for KEOWEE. The moral of the story is to check out which varieties are more resistant to the diseases encountered in your area.

Greenbugs are aphids that may attack barley if they can't find any wheat or sorghum. They've been around since 1882 at least, and have not overwhelmed us because of a host of predators including lacewing flies, ladybug beetles, wasps, nabids, and syrphid flies. On occasion, the greenbugs still get out of hand and wreck some grain, but even from the viewpoint of a nonorganic commercial farmer, using an insecticide can do more harm than good.

Corn leaf aphids will feed on barley and other cereal grains in the South, curling leaf tips and turning them brown. I will quote what the Arizona extension researchers say about control, so you don't think I'm just giving some nutty organic opinion of my own: "Infestations are greatest around the edges of the field. Thus, it is best to check throughout the field before deciding upon chemical control procedures. In most instances, lady beetles and other predators provide sufficient control. After heading, an infestation seldom warrants control."

Storage

In storing barley, follow the same precautions as I gave for wheat. Though insect infestation problems with barley aren't as critical as with wheat, you still have to take care. The small amount you will want for your own use can be protected by heating or cold storage as with wheat. Dried sprouts can be stored with no problem from insects. Grain stored for animals should be put in clean, tight bins. For a small number of animals, use metal barrels to keep out rodents.

One reason I think the homesteader should grow a variety of grains is because it helps control or avoid altogether, weevils and other storage insects. If you feed up your barley from harvest-time in June until late summer, you aren't going to have bugs in it. They don't get a chance to become entrenched, so to speak. Then you can feed up your wheat and oats in the fall, then go to your corn and soybeans until the following summer, since weevils don't bother them much. If you have little harvested grain sitting around in bins for longer than six months, and the grains are of a variety so that one kind of weevil may not like one grain as well as another, and if you clean the bins or barrels out well when empty, you just aren't going to have a lot of insect damage.

In fact, on a small scale you could get by with very little storage at all. Feed rye and barley right out of the field in early summer, wheat and oats in late summer, buckwheat and sorghum in fall, and corn out of the shock or off the stalk all winter. You'd have some loss from weather, but it could work. Homesteaders haven't begun to innovate commercial agriculture to their own purposes yet. We've all got a lot to learn. As an old English folk song that dates to the Middle Ages puts it:

"Neither you nor I nor anyone knows
How oats and beans and barley grows."

HIGHLAND FLING

2 pounds stewing lamb
½ cup split peas
1 cup barley
1 teaspoon marjoram
¾ cup carrots, chopped
¾ cup potatoes, diced
1 onion, chopped
chopped parsley
paprika

Cook 2 pounds stewing lamb until it is just tender, seasoning as you like it. Have the split peas and barley soaking in cold water the last ½ hour or so of the meat cooking time. Add the split peas, barley, marjoram, and vegetables and cook until the vegetables are tender.

The last thing before serving, salt to taste. Add chopped parsley and a sprinkle of paprika.

Yield: six-eight servings

HAMBURGER PUFF

1 pound ground beef
2 eggs, beaten
1½ cups cooked barley
1 small onion, grated fine
1 teaspoon salt

Preheat oven to 350°F.

Mix, put in casserole and bake about 40 minutes or until done.

Yield: four-six servings

BARLEY PANCAKES

4 teaspoons dry yeast
½ cup lukewarm water
1-2 tablespoons honey
2 eggs
1/3 cup soy milk powder
¼ cup nonfat dry milk
1 cup water
1 cup barley flour

2 tablespoons oil
1 cup wheat germ
Sprinkle the yeast over the surface of ½ cup warm water in a mixing bowl. Stir in honey and allow mixture to "work" in a warm place for about 25 minutes.
Gradually blend in eggs. Combine soy milk powder and nonfat dry milk with water, using wire whisk, add to mixture; then add barley flour, oil, and wheat germ.
Bake (¼ cup batter for each pancake) on lightly greased griddle, over medium heat. When bubbles form on surface, turn pancake and cook about 2 minutes longer, or until nicely browned on underside.
Yield: about five servings

Chapter 8

Buckwheat and Millet

Buckwheat

People often learn what is good for them long before science figures out why. Buckwheat is an example. Traditionally, buckwheat was the ail-American breakfast: the school boy's fortification against a snowy, two-mile walk to school and the ax-man's fuel as he chopped his way across the frontier. The early American farmer, having stuffed himself with buckwheat cakes oozing maple syrup and surrounded by smoked sausage (how my mouth waters at the thought), could head for the barn with a whistle on his lips no matter how cold and cheerless the January morn.

And yet ... and yet I have grown buckwheat and eaten buckwheat cakes made from it, and as good as they are, I have to wonder a little. Oats and wheat make cereals and pancakes just as good, and these grains yield better and more reliably. Why was the hard-headed early American so enamoured of buckwheat? Why did he go right on eating it until "progress" made the hearty breakfast obsolete? And why, now, when eating breakfast is again fashionable, is buckwheat back in the limelight?

The Department of Agriculture has the answer. I quote from the monthly publication *Agricultural Research* of September, 1974: "Agricultural Research Services analyses indicate that buckwheat has an amino acid composition nutritionally superior to all cereals, including oats." Buckwheat's claim to such an honored status rests principally on its high content of lysine, a protein our bodies need but can't make and which is hard to come by in most other grains. That's why scientists are working so hard to perfect high lysine corn.

The Gambler's Crop

Why don't they work just as hard to improve buckwheat? A good question. The answer is that buckwheat has, at least presently, disadvantages for the commercial grower. In Pennsylvania and New York, where considerable buckwheat is still grown commercially, the grain is often called "the gambler's crop." Given a good market such as 1973 and 1974, you may hit it big. Or you may strike out. Buckwheat is not a heavy yielder at best; 30 bushels per acre is good. The stems are brittle when mature and will break over in a hard wind and rain storm, leaving you with zilch. Buckwheat is naturally cross-pollinating and, until recently, could not be inbred because of self-incompatibility. Without inbred lines, better varieties were difficult to develop. Furthermore, the plant has indeterminate growth; the seed does not ripen all at the same time. When the first grains are mature, there will still be more green grains further up the stem, and flowering buds at the tip of the stems. If you thresh early, you will lose the seed just developing; if you thresh late, you may lose some of the early maturing seed which can quickly shatter and fall to the ground after it is ripe.

But breeders are beginning to solve these problems. The Agricultural Research Service has developed a tetraploid buckwheat called PENNQUAD which has more uniform seed size and thicker stems to resist lodging. Some growers who have tried PENNQUAD haven't gotten appreciably better yields, however.

Breeders have also discovered a buckwheat flower type that is self-compatible and inbred lines are being developed, which should lead to better varieties.

The Homesteader's Crop

But buckwheat, even common buckwheat, has advantages, particularly for organic homesteaders, that make it a grain you'll want to consider on your place, even in the garden.

First of all, you can plant it about anytime during the growing season and get some good out of it. Earlier farmers could plant buckwheat whenever they got around to it, and that's usually when they did. Today's homesteaders, spending 40 hours at an outside job, can appreciate this

advantage buckwheat gives them. If a series of rainy weekends gets you behind, and here it is July already and an acre left to plant, buckwheat is the answer. Planted in July, it will still make a crop. The grain matures in 70 days, and sometimes in 60 if planted late in the year.

Because it can be planted so late, buckwheat makes an ideal second crop in a double-cropping arrangement. Plant it after strawberries or wheat, or early garden vegetables.

Sometimes spring plantings yield poorly because buckwheat will not flower well in very hot weather, when a spring planting would reach that stage. That's why buckwheat is called a cool weather crop and why production is greatest in northern states and Canada.

A Green Manure

Buckwheat is a good green manure crop despite the fact that it does not fix nitrogen in the soil. It has the ability to use phosphates in the soil unavailable to most other grains, according to the University of Minnesota. Since buckwheat will grow in hard clay, it has the reputation of loosening such soils and making them more friable. But buckwheat roots do not grow deep in the soil, and the loosening effect probably comes more from the organic matter produced. As green manure, buckwheat will make *three* crops in one growing season.

Buckwheat, growing rankly in midsummer to fall, will smother weeds well. Observing my own patch of buckwheat, I've often suspected that buckwheat gives off a toxin to inhibit weed growth around it, but science says not. In fact, early plantings of buckwheat will not control weeds very well, say the experts.

Insects and Diseases

Buckwheat has few disease or bug problems, which is another plus for organic growers.

Planting

Plant it like you would any other small grain, with a drill or broadcast. No need to grow in rows for weed cultivation; in fact, you don't want to. Solid stands of buckwheat, as I already mentioned, will more than compete with most weeds. I work the soil with my tiller (I only plant a small patch of buckwheat) in July, scatter the seed rather thickly over the ground, and rototill lightly once more. A seeding rate of about a bushel-and-a-half per acre is adequate.

In the garden I have grown buckwheat after early peas, and added no other fertilizer. Two years ago, I tried a patch on a hillside where clay was leather

tough. In a year of one of our worst droughts, I planted the buckwheat there without fertilizer of any kind on one of the hottest days in July. Amazing results: the buckwheat grew luxuriant despite the adverse conditions. We harvested some, the birds ate some, and enough fell to the ground to give me a volunteer crop this year as good as last!

Harvesting

Buckwheat is best harvested with a combine, using the same adjustments and screens you use for oats. Wait until after frost has killed the plants and the mature seeds have had time to dry. Most growers harvest at about 17 percent moisture, then dry down to the necessary 12 to 13 percent with artificial heat.

Small amounts in the garden can be harvested by hand. Cut the stalks with a scythe (or sickle-bar mower); tie into bundles, allow to dry well under cover, then proceed as with threshing wheat by hand. Buckwheat threshes easily. You can shake much of the seed out of the bundles when it is dry. Or rap each bundle over the edge of a bucket or the edge of a pickup truck bed. Or put the bundle in a sack and trample. Or flail as described earlier. Winnowing must then be done to separate the chaff and stem bits out.

With our garden patch of buckwheat, I often gather just a cup or two at a time from the standing plants, stripping the dark brown, pyramidal-shaped grains off the stems with my fingers.

Chickens (not to mention deer) love buckwheat. Rabbits do too. I just feed them the grain, straw and all. There's no way you can let a crop go to waste, because if you let the unharvested plants stand through winter, the wild birds will get most of the grains. And leave enough to make another crop the next year, as I have mentioned.

Buckwheat Honey

And why do I let my buckwheat patch go its merry way? I haven't mentioned what is, in my estimation, one of buckwheat's important contributions to my homestead. Buckwheat is an excellent source of honey for bees. And bees are important for pollination of all my crops. My beehive is a wild one in a big oak tree in my woodlot. The buckwheat can give them a honey source they love, and one that produces nectar in the fall when bees have to hunt much harder for flowers. Since buckwheat honey is such a delicacy, I'd like to have some of the honey those bees are storing in the tree. But I feel lucky to have a free hive and as long as they keep on pollinating, they can have all the honey they make.

Buckwheat For the Table

Processing buckwheat for table use is not so simple a task. The buckwheat grain, which looks like a tiny beechnut (from which word, beech, the "buck" of buckwheat derives, by the way) is mostly hull. The flour inside is nearly pure white. The ground-up hulls are good for you, but like oat hulls, you can easily get too much of a good thing. I like whole buckwheat pancakes, but I prefer to have at least some of the hulls removed from the flour. With a commercial dehuller this is no problem, but at home, using a blender or kitchen mill, dehulling is more difficult. We use our blender to grind all grains and have found that if the buckwheat is toasted or at least heat-dried well before grinding, the hulls will shatter off better and many of them can be sifted out in a flour sifter.

Well worth the trouble. But do yourself a favor. Get some real maple syrup and some good homemade sausage to go with your buckwheat cakes. Instead of eating this breakfast when you first arise in the morning, go outside and work awhile first. Then you've set the stage for a truly great adventure in eating.

Hulls

Buckwheat hulls make a neat mulch, but one that's expensive to buy. Unless you grow a large field of buckwheat, you won't get enough hulls to do you any good for mulch. But there's always a chance that some imaginative grower might see an opportunity in going seriously into the business of putting buckwheat cakes on every breakfast table, or at least most breakfast tables in his locality. If that person is you, don't forget to figure in the extra income from selling the hulls.

Let's muse on that awhile. A bushel of buckwheat weighs 48 pounds, or about 30 pounds of flour and 18 pounds of hulls when separated. A hundred acres of buckwheat producing a conservative 25 bushels to the acre equals 2,500 bushels or approximately 75,000 pounds of flour and 45,000 pounds of hulls. Now multiply those figures by the price of a pound of buckwheat flour in your local grocery store and the price per 50-pound bag of buckwheat hulls at your local garden store. Buckwheat flour at our nearby country store sells for approximately 45¢ a pound right now. Need I say more? Of course, you'd need a commercial dehuller and a mill, not to mention the land and a combine. But the market is there. Whole grain flours sell at a brisk pace today.

In case you think I've run out of nice things to say about buckwheat, here's one more. Buckwheat is a good source of rutin, a substance with medical value in the treatment of certain types of hemorrhaging. A ton of buckwheat plants makes one million rutin tablets.

BUCKWHEAT-SESAME BREAD

¼ cup molasses
1 cup lukewarm water
2 teaspoons dry yeast
2 cups buckwheat flour
2 cups rye flour
2 cups whole wheat flour
1 cup sesame seeds
¼ cup oil
1 cup water

Mix ¼ cup molasses and 1 cup lukewarm water. Add yeast. Let soak a few minutes.

Combine the flours and sesame seeds in a bowl.

Add ¼ cup oil and 1 cup water, blending well.

Add molasses-yeast mixture and work it into dough with hands. It will be sticky.

Form dough into a ball. Place in oiled bowl, then turn dough over, so top is coated with oil. Cover bowl with damp cloth and let rise in warm place for 3 hours until double in bulk.

Knead dough and form into 2 round loaves on cookie sheets. Let rise an additional 45-60 minutes. Meanwhile, preheat oven to 350°F.

Bake in oven for 40 minutes or until done.

Yield: two round loaves

BUCKWHEAT BLINI
(Pancakes)

¼ cup nonfat dry milk or soy milk powder
1 cup water
2 teaspoons dry yeast
4 egg yolks
1 teaspoon honey
4 tablespoons oil
1½ cups buckwheat flour, sifted
4 egg whites

Combine nonfat dry milk or soy milk powder with water, using wire whisk. Heat over medium heat until bubbles form on sides of saucepan. Remove from heat and cool to lukewarm. Add yeast and stir until softened.

In mixing bowl, beat egg yolks until thick. Blend the yeast mixture into beaten yolks. Stir in honey and oil.

Sift buckwheat flour and gradually blend it into batter, mixing thoroughly.

Set bowl over a pan of warm water, cover, and let rise until double in bulk, about 1¼ hours.

Beat egg whites until soft peaks form when beater is raised. Fold gently but thoroughly into batter.

Preheat a lightly oiled griddle, on medium heat, until it is hot. Using 1 tablespoon of batter for small pancakes and 2 tablespoons batter for medium pancakes and 3 tablespoons batter for larger pancakes, bake on griddle until

bubbles form on edge, and pancake is golden brown; turn pancake and bake 2 minutes longer. If pancakes begin to stick to the griddle, oil it lightly again.
Yield: eight-twelve pancakes

GROATS AND MUSHROOMS

1 egg
1 cup buckwheat groats (ground medium)
2 tablespoons oil
1-2 cups mushrooms, sliced
2 cups chicken broth
1 teaspoon salt

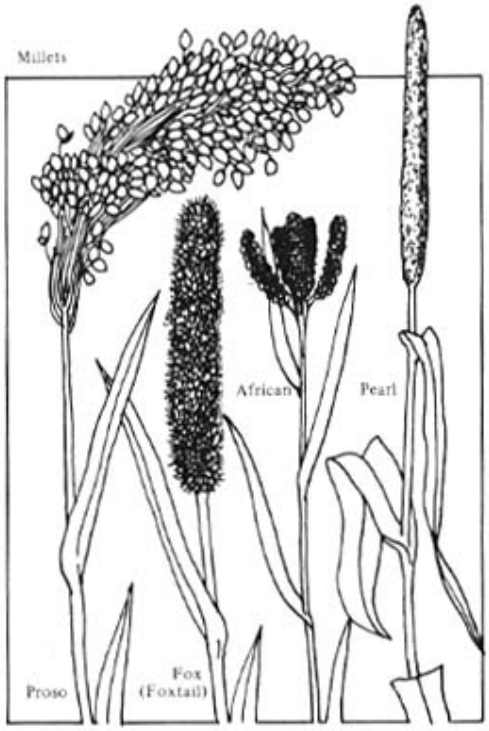
Beat egg well and add groats. Mix this very well to coat all the grains. Brown mixture in oil in a heavy skillet. Add sliced mushrooms. Bring to a boil the chicken broth and add to the mixture together with the salt. Mix well and cook very slowly, covered, until all liquid is absorbed and kasha is nice and fluffy, adding a little more broth if necessary.
Yield: four servings

Millet

Millet is grown in the United States almost exclusively for pasture and hay although some of the grain is used in birdseed mixtures. Birds love millet, which proves that they are smarter than most Americans when it comes to nutrition. Millet is nutritionally superior to many of our common grains, containing more essential amino acids than wheat, oats, rice, barley, and rye. It lacks only lysine, the amino acid buckwheat is high in, making buckwheat and millet a good combination in your diet. Also, while most grains form acids in your stomach, millet, with its high alkaline mineral content, counteracts acids and is more easily digested. Millet, not rice, is the basic carbohydrate food in China, especially northern China. The Hunzas, whose reputation for health and longevity is well known, use millet regularly.

Varieties

The word, millet, is used to label plants in four different families, and therefore leads to a tremendous amount of confusion. Sellers of field seed in the United States talk about JAPANESE, German, Hungarian, African, common, BROWNTOP, proso, pearl, and foxtail millets, and variations thereof. And these terms do not necessarily refer to the same plant in different parts of the country, either. So, armed with my ever-faithful *Taylor's Encyclopedia of Gardening, Horticulture, and Landscape Design,* 4th ed., (Norman Taylor, Riverside Press, Boston, Massachusetts, 1961.) and supported by innumerable phone calls to seedsmen throughout the United States, I shall attempt to identify all the millets and colloquial names thereof. But mind you, I won't claim infallibility for my categorization. One man's colloquialism is another man's slang.



There are three different families of millets and a fourth kind so-called, which is not really millet at all. Let's dispatch with this fourth one first. If you are in Texas or surrounding states, you can buy and grow what is called "African millet." This plant is really a sorghum, a tall form of kafir with a proper name of *Sorghum vulgare, var. caffrorum.* It is grown for pasture and/or hay, though not extensively. African millet might also be referred to as a mock-orange cane, orange sorghum, or even sumac, in Texas.

The real millets:

1. Broomcorn millet, proso, or millet, *Panicum miliaceum.* It gets its name from the open heads of the plant, which resemble small broomcorn heads, rather than the foxtail and cattail shapes of other millets. So far as I know, no millet is sold under the name "broomcorn millet" anymore. Instead, seedsmen sell improved varieties of proso millet. This family of millets is the one used from earliest times for grain and flour, especially in India, China, Japan, Manchuria, and Russia. Proso millets are the ones used for birdseed, and sometimes for cattle feed. And should be used more for human food and flour. Proso should be ground for livestock but not necessarily for chickens. Proso seed is either red, yellow, or white. EARLY FORTUNE and TURGHAI are older red varieties. WHITE is a white variety. CROWN is an off-white, grey-colored seed, which therefore won't sell to the birdseed market very well. But it's just as good nutritionally.

2. "Foxtail" millets, *Setaria italica,* are grown for emergency hay, silage, and pasture throughout the United States. They make better forage than

proso because they are finer stemmed and not hairy stemmed. Foxtail matures later than proso. HUNGARIAN, SIBERIAN, and MANTA are more northerly varieties. MANTA has orange seeds, SIBERIAN orange and yellow, and HUNGARIAN mixed black, brown, and yellow. EMPIRE is grown more in midcountry and southward.

JAPANESE and BROWNTOP varieties are not always included with the foxtail family but are listed as separate varieties. JAPANESE or barnyard is grown more widely in the North, BROWNTOP in the South.

JAPANESE millet will make twice as much silage as oats, and nearly as much as corn. It grows to a height of five feet or more, will regrow after cutting, and yields more tonnage of forage than any other millet. It is finer leaved than sorghum-Sudan grass and dries faster. BROWNTOP is used in the South for cover and feed for quail and other game birds, but a Georgia farmer I once talked to said he considered it good hay for dairy cows, too.

"Common" millet could be about anything as millet goes, including meadow foxtail. Giant foxtail is a pernicious weed of the *Setaria* family.

3. The third group of millets is the pearl millets, botanical name: *Pennisettum glaucum*. Pearl millet, rather than resembling a small foxtail like Foxtail, looks more like a cattail reed head, and is in fact, often called cattail millet in the Southeast. Pearl millet is grown almost totally in the South. It threshes free from the hulls, which would make it more desirable for the homesteader processing millet for table use.

Otherwise, for grain or flour, any of the red, yellow, or white proso millets should be adequate. For hay, JAPANESE seems to be the best open-pollinated variety for the North. In addition, there are now hybrid forage millets for the North like MILLEX and PEARLEX, which overcome some of the low palatability and feed value of the more common foxtail millets. In the South, newer hybrid pearl millets like GAHI, STARR, and SOUTHGRAZE would certainly be the best seed investment in millets.

Planting and Harvesting

Seed can be planted either broadcast or by drill, about 35 pounds per acre for all kinds of millet, a little more if broadcast. Don't worry about getting it a little deep, as it will come up from four inches to five inches down. But one inch to three inches is better. Millet, like buckwheat, can be planted late, and will control weeds even better than buckwheat.

Millet won't compete, pound for pound with legumes in nutritional value, but it has other advantages. Thirty days after you plant it you can be using it. No legume can make that claim. It has good insect resistance, and is relatively free of disease, which together with its ability to grow on rather poor land (it likes fertile land better though) makes it a desirable crop for

any organic grower. As hay it can produce over five tons per acre in three months, and as seed, 50 bushels per acre or more. It's a good emergency forage when things go wrong and you need forage fast. And of course, the same would be true of the grain. Chickens will do well on it; just toss them the whole stalks and let them peck out the seeds. And researchers, particularly in the drier parts of the Great Plains, keep up ongoing programs at the land grant colleges on millet improvement. As one of them told me: "If we ever run out of irrigation water, millet could become a very valuable food source as it is in other dry regions of the world."

Millet does better than most grains on poor soil. It can be planted late in the season after regular planting time is past. For forage, millet is usually planted solid, though the big tall varieties would be better off in rows. If you plant a little for your own grain, it's best to plant in regular garden rows rather thickly. Harvest as I have described for buckwheat, but cut the stalks before they are dead ripe, and allow to dry in some protected place. Otherwise, the birds may get more seed than you do. Leave some for the birds, I say.

The only millet crop I have grown was a small patch in the garden which didn't amount to much. I fed it all to the chickens, not even knowing at the time that it was good for me too.

Millet For the Table

Here's what Organic Living Editor, Ray Wolf, writes in *Organic Gardening and Farming*® magazine about using millet in the kitchen: "Millet is highly adaptable to almost any recipe, as it has an almost bland taste, with just a slightly nutty flavor. You can easily use millet by itself or in combination with other grains in casseroles, breads, stews, souffles, stuffings, cereals, or eaten plain with butter, gravy, or a vegetable sauce.

"To prepare millet for use in a dish with other ingredients, brown it first in a skillet with a small amount of oil, then use it as you would any grain. Browning enhances the nutty flavor.

"You can prepare a cereal that will serve a dual purpose by adding one part millet, one part sesame seed meal and five parts water to a baking casserole, or a double boiler and cook until done, about 45 minutes. This can be eaten as a cereal, or allowed to cool and congeal and sliced or prepared as patties which can be used as a type of (cornmeal) mush. This can later be heated and served with cheese melted on top."

MILLET BREAD

2/3 cup millet flour
1/3 cup barley flour
1 cup raw carrots, grated
1 tablespoon honey

1 teaspoon salt
2 tablespoons oil
¾ cup boiling water
3 egg yolks
3 egg whites
Preheat oven to 350°F.
Combine millet flour, barley flour, grated carrots, honey, salt, and oil in a bowl; mix well. Gradually add the boiling water, mixing thoroughly.
Beat egg yolks until light and lemon-colored. Stir into the flour and carrot mixture.
Beat egg whites until they peak, but are not dry. Fold carefully into batter.
Oil 8 x 8-inch pan or 9 x 5 x 3-inch loaf pan. Line bottom with brown paper and oil again. Spoon mixture into prepared pan and bake for 30 to 40 minutes in preheated oven or until done.
Remove from oven: set pan on wire rack and allow to cool for about five to 10 minutes. Remove from pan. Serve warm.
Yield: 5-6 servings

CASHEW-MILLET CASSEROLE

2 cups water
1 teaspoon salt
½ cup millet meal (whole millet which has been ground in blender)
3 tablespoons oil
1 medium-sized onion, chopped
1 cup unsalted raw cashew nuts (ground in electric blender, ½ cup at a time)
3 eggs, slightly beaten
2/3 cup wheat germ
½ cup nonfat dry milk
¼ cup parsley, chopped
¼ cup pimento, chopped
½ cup water
1/8 teaspoon of the following herbs: ground mace, sage, rosemary, ground marjoram
Preheat oven to 325°F.
Prepare millet meal: in saucepan, bring 2 cups of water to a boil; add salt and millet meal to rapidly boiling water very slowly, stirring constantly with wire whisk to avoid lumping. Place in top of double boiler and continue to cook 15 to 20 minutes, or until millet has absorbed all water. Remove from heat and cool slightly.
Heat oil in skillet and saute onion.
Combine cooked millet and ground cashew nuts in mixing bowl. Add slightly beaten eggs, wheat germ, nonfat dry milk, sauteed onion, chopped parsley, and pimento. Add ½ cup water, blending together thoroughly. Stir in herbs. Adjust seasoning according to taste.
Turn mixture into an oiled 1½-quart casserole and bake in preheated oven, uncovered, for 45 minutes or until firm and lightly browned. Serve immediately.
Yield: six-eight servings

MILLET SOUFFLE

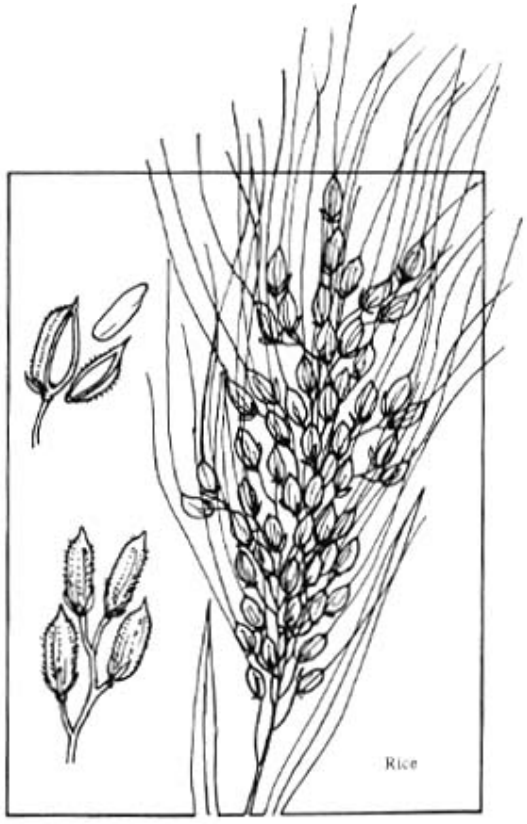
4 cups boiling water½ teaspoon salt2 tablespoons oil
1 cup millet meal (whole millet which has been ground in blender)
4 egg yolks
¼ cup nonfat dry milk
1 cup water
½ teaspoon crushed dill seeds (optional)
3 tablespoons minced chives or grated onion
1 cup sharp cheese, grated or shredded
4 egg whites
Preheat oven to 350°F.
In saucepan, bring 4 cups water to a boil, add salt and oil. Gradually add millet meal to boiling water, stirring constantly with a wire whisk until all of it has been incorporated. Place in top of double boiler and cook for about 20 to 30 minutes, or until all water has been absorbed. Stir mixture occasionally. Remove from heat and cool slightly.
In large mixing bowl, beat egg yolks until thick. Combine nonfat dry milk with water, using a wire whisk, and beat gradually into yolk mixture.
With beater set at medium speed, blend cooked millet into yolk mixture until thoroughly combined. Stir in dill seeds, chives, or grated onion. Add grated cheese.
Beat egg whites until soft peaks form; gently fold into millet mixture.
Pour mixture into an ovenproof casserole (2-quart size) and bake in a preheated oven for 35 to 45 minutes. Remove from oven and serve immediately.
Yield: six servings

Chapter **9**

Rice:

The Oldest "Garden" Grain

In the western world, rice is not considered a major grain, either commercially or for home production. However, rice is, worldwide, the oldest and most successful garden grain of all, and affords ample proof that the production of grain for direct home use is valid and practical. In Asia, rice has been a garden crop for at least 4,000 years. The typical oriental farmer may grow a hectare or two at the most, and millions—literally millions—of families are able to live a fairly comfortable life because of rice plots far smaller than that. One could say without exaggeration that the culture of most of Japan, China, India, and Southeast Asia is built on—and survives because of—a cottage rice industry. We Americans may not possess the keen oriental taste for rice, or may live where rice cannot be grown, but we can learn from rice the economies of grain gardens and how to develop a technology that serves such economies rather than a technology that forces grain production into the hands of a few human land hogs, some of whom already tell me they would rather not be called farmers anymore. (I have honored their request.)



Agriculturists might argue about which grain, rice or wheat, is the most important in the world at the present time. Certainly more people eat rice than eat wheat, but more wheat is consumed. Rice is not nearly as "commercial" as wheat. The bulk of the former is produced at home for home use. The best proof of that indirectly comes from the United States, which produces only about one percent of the world's rice, yet is the leading exporter of the grain! The simple reason for this is that Americans do not eat much rice while some orientals eat very little else. A comparison between rice growing in America and Japan can be almost soul shattering. A father-son team in Texas may handle 500 acres of rice or more, but barely make a good living by our standards. That many acres of rice in Japan could support 100 families comfortably, by their standards. And yet we insist that we are the efficient ones.

The Culture of Rice

Whether grown with western machinery or oriental backbone, rice is not the easiest grain to cultivate. It prefers a long growing season and warm humid weather. It is grown profitably in our country only in the South, mostly in Arkansas, Louisiana, Texas, and California. However rice could probably be grown farther north, at least for home use. The Japanese have learned how to grow it successfully as far north as Haikaido, which has a climate similar to our southern New England. Upland rice—varieties that grow without flood irrigation—will produce a crop in Thailand at 4,500 feet above sea level, and twice that in the Himalayas.

Upland rice does not yield as well as irrigated rice, though improved varieties show more promise. Upland rice is grown about like spring-planted wheat. Where level land or marshland is available for wet rice production, upland rice is usually discouraged.

Wet rice, or irrigated rice, can be direct-seeded in the paddy or field or started in a bed and transplanted. With direct hand seeding, the number of hours to raise a crop can be reduced by about two-thirds. Most seeding in the United States is done by airplane.

Mechanization

The typical Asian farmer has been loathe to switch to direct seeding despite the labor-saving advantages. He seems to prefer longer working hours to the higher cost of chemicals and machinery that would be necessary in place of labor. Agricultural experts seem to think his position is stupid. But the Asian farmer knows he is not going to gain a whole lot in net profits anyway by adapting new technology and he runs the risk of becoming much more vulnerable to financial disaster when he substitutes cash and chemicals for labor. The American hasn't yet learned that lesson. When technology offered the American farmer the bait, he swallowed. Technology said: "All

you farmers are farming 500 acres and barely making it. I can make it possible for you to farm 1,000 acres and get rich." The farmers believed technology, not understanding that the one thing technology couldn't do was to make more land. There was only so much of it, and for every 500-acre farmer who went to 1,000 acres, some other farmer had to give up his 500 and go to work at something else. When the 1,000-acre farmers find they aren't doing a whole lot better than when they farmed 500 acres, the technological answer is to farm 2,000 acres. And again the farmers will all believe it.

The Art of Farming

I suppose the Japanese farmer grumbles about the backbreaking aspect of his hand methods sometimes, but like true farmer-gardeners the world over, he seems to like it too. At least there is ample evidence that he derives satisfaction from it. He makes an art of his agriculture as anyone who has seen well-tended, terraced rice paddies on an oriental hillside can appreciate. It *is* art. Kusum Naizi, in *The Lonely Furrow: Farming In The United States, Japan, and India* (University of Michigan Press, Ann Arbor, Michigan, 1969), points out that while the Japanese farmer's yard may be weedy, "never his fields. Yet he knows full well that those last blades of grass that he pulls out of his paddy so laboriously do not affect his production by an ounce. The transplanting of rice seedlings is done with similar excessive care. It is neat, precise, and meticulous, like an embroidery on silk."

Agriculture for art's sake is not limited to the oriental. Ronald Blythe in his excellent portrait of English rural life, *Akenfield,* (Penguin Press, New York, 1969), emphasizes the same propensity for art at the expense of economics in English farmers before industrialization. They too would row, hoe, cut, bind, and rank in precise patterns and spacings so that fields took on the order and geometry of a formal garden.

The same sensitivity to art in agriculture marked the American farmer before industrialization. Farmsteads were built with an eye to beauty as well as utility. The farmstead scenes that find their way into picture frames today are all derived from an era before high technology engulfed farming. Today no farmer builds art into his workaday world. He can't afford to if he did want to. Old implements were always decorated with painted swirls, stencils, engravings. That took time, and now technology has decreed that time is a commodity to be priced, bought, and sold on the same callous basis that slaves were priced, bought, and sold. Technology has taken away the farmer's time from him and time is the most precious possession a man owns. So today the banks are built of marble and a taste for art; the barns, if built at all, are simply large, hideous collectors and storers of manure from overcrowded animals.

My close neighbors would understand the Japanese farmer very well. They are of the old school of farming. One of them still walks the rows of his

large soybean field, cutting weeds with his hoe. He spurns the herbicides he could use because he knows they will not keep his fields nearly as clean as his hoe. He cultivates with his tractor, but it will not get all the weeds either. Like the Japanese rice farmer, he is not satisfied until he removes all the weeds. His motives have nothing to do with profit, which a few weeds will not hurt. He does not have to" make a profit anyhow. He has been a good and successful farmer all his life. He hoes the weeds because he wants his field to look beautiful. And to farmer eyes, his weedless field *is* art. In all this county full of herbicides and monstrous cultivators, only his field is without weeds. And farmers stop along the road to admire it and admire the work that made it so. He leans on his hoe and admires it too. He shares with "old-fashioned" farmers a wisdom the new technologists can't comprehend. He has raised his daily work to the level of art, while the technologist slaves away all his days hoping to reserve a little time in the end for art. Whose "economies" are the wiser?

Rice Growing, Japanese Style

While the experts preach the advantages of direct seeding to him, the Japanese farmer goes about making his nursery bed where he first "roughs out" the work of art which will also be his livelihood. He presses the seeds into the ground carefully. They must not be completely covered with soil, though he might cover them lightly with mulch. The bed is then flooded. When the primary leaves emerge, the bed is drained. Only very gradually though, so the tender sprouts are not too quickly exposed to air and direct sunlight. More floodings and irrigations may follow, depending upon temperature, moisture, weeds, diseases, insects, the alternate irrigation and drainage serving to control too much of one problem or too little of a countering solution. The process is scientific, but its application to the realities of *this* nursery bed, in *this* year; that is pure art. In about 40 days, the young rice seedlings are transplanted into the paddy at precise spacings; close enough together for maximum number of plants, but still allowing enough space for a man to walk while weeding. Again the field is flooded and drained alternately on a schedule based on the needs of that climate and that soil and that particular season. When ripe, the grain is cut by hand, the sheaves bound, dried, and then threshed using small hand- or motor-operated threshers. Output per man, by our standards is extremely low, but efficiency in terms of number of people fed per unit of fossil energy used is extremely high.

Rice Growing, American Style

Growing rice by the hundreds of acres, as in the United States, is a very different and expensive operation. Seed and chemicals are most often sprayed by plane now, followed by a light irrigation. Then after the plants

are about six to eight inches tall, standing water is kept in the fields until the crop begins to ripen. The very large fields laid out with levees on the contour are a marvelous feat of engineering, at least to my eyes.

Scientists are now trying to cut down the use of some chemicals in commercial rice production, not only to cut expenses but because the chemicals sometimes become nearly useless. For instance, because the fields stand in water a good portion of the summer, rice land is a haven for mosquitoes. But bombarding them with insecticides has resulted in immune mosquitoes. Newer, more biological controls are now being tested, with some success. In Arkansas, mosquito fish stocked in rice fields at rates over 100 fish per acre gave "very good to excellent control" after 72 hours. Insect growth regulators also are showing promise in controlling the rice-field mosquito.

Weeds are difficult to control in rice fields without chemicals, but simplistic herbicide applications are no longer thought to be the solution. Researchers are working with a fungus that attacks northern jointvetch, a serious weed in rice. If successful, the venture would be a real breakthrough in biological weed control.

Varieties

In the United States, three kinds of rice are grown: long-, medium-, and short-grained rice. Long and medium are mostly southern rices; short-grained is grown largely in California. As with any grain, many varieties exist of each type. If you want to try a small plot of rice as described at the end of this chapter, use a variety suggested for your area. If none are, proceed at your own risk.

Rice from the field has a tight hull on it like oats and must be dehulled. Rolling or abrasion easily removes the hull. Once de-hulled, rice is processed as brown rice, white rice, or parboiled rice. Humans historically have preferred refined white rice for eating, which is unfortunate, since white rice is the least nutritious of all. Brown rice is largely unrefined and therefore contains almost all the nutritious bran. White rice is polished rice, that is, the bran has all been abraded away. The supposedly "practical" reason the bran is taken out of rice (or wheat or whatever) is that the bran contains a high oil content, and if milled into the flour, soon causes rancidity. In other words, milled brown rice won't keep very long and should be milled only as needed. Parboiled rice is a kind of compromise between brown and white. The rice is cooked and dried before polishing away most of the bran. The cooking drives some nutrients, particularly B vitamins, on into the grain, thus preserving them in the flour even though the bran is removed.

White rice is about 90 to 94 percent starch and six to 10 percent protein. In removing the bran, 85 percent of the oil, 10 percent of the protein, 80 percent of the thiamine, 70 percent of the minerals and crude fiber, 50

percent of the riboflavin, and 65 percent of the niacin are lost, according to the USDA. A comparison of vitamin content of the three kinds of rice, tells the story.

Rice	Thiamine	Riboflavin	Niacin
White	.60	.25	18.1
Brown	3.69	.50	53.8
Parboiled	2.57	.36	39.8

Quantities given are micrograms per gram.

From USD *A Yearbook of Agriculture,* 1950-51.

Organic Rice Growing

Rice has been grown organically on a commercial basis, however, and profitably when demand for brown rice is good enough to support a high market price. During the brown rice boom around 1970, Wehah Farms in California turned over its large commercial rice operation to organic methods. As reported in *Organic Gardening and Farming*® magazine in 1971, Wehah found that rice could be grown organically, though yields were less than those produced normally with chemicals. Instead of using pesticides to control tadpole shrimp, Wehah followed a carefully timed schedule of raising and lowering water levels in the fields to overcome, at least in part, the difficulties caused by this pest. Good sanitation and close attention to intervals between irrigations helped control seedling diseases, rice water weevil, and rice leaf miner. Crop rotation controlled weeds to some extent, and fish stocked in the fields kept the mosquitoes at bay. Instead of burning old rice straw, Wehah returned it to the soil. Chicken manure and green manure crops were plowed into the soil for more fertility.

A Homestead Rice Grower

While few commercial rice growers would consider operating that way, the small homesteader and gardener can achieve success with rice using organic methods. David Spiekerman, writing in *Organic Gardening and Farming*® in December, 1975, gave this excellent step-by-step account which anyone in the proper climate should be able to follow successfully:

We love to eat short-grain brown rice, so we decided to grow a small rice paddy to enhance our understanding of the life cycle of this ancient cereal of mankind. Living in Chico, California, in the rich Sacramento River Valley, we were in the heart of one of the world's large, commercial, rice-growing areas. The giant green paddies of rice have been an inspiration for us to grow our own rice. Chico is a location that offers two essentials necessary to grow rice: a minimum of 40 days with temperatures above 70°F. and an abundant supply of fresh water. The summers in Chico are long, hot, and

dry, with the highs around 100°F. every day. Low and fluctuating temperatures decrease the resistance of rice plants to disease. Nighttime temperatures below 60°F. retard its growth. The great Sierra Nevada Mountains, flanking the eastern side of the Sacramento Valley, receive enormous amounts of snow and rain in the winter. Our wells never run dry.

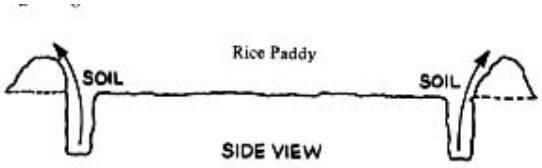
The technique we used to grow our rice is basically the method Japanese farmers have used for centuries. We used no chemicals, poisons, or machines to grow our rice. My partner, Junsei Yamazaki, grew up among rice paddies in Japan, and showed me traditional, organic, hand methods from start to finish. The whole effort was simple and smooth. Any healthy person can do it.

The Paddy

The plot of land we chose for our paddy had two assets. First, the soil had been under grass for countless years, and it was clean and naturally fertile. Second, the location was right next to our water well, so we conveniently used a short, rubber hose to pump the water into the paddy. However, the best water for irrigating rice is stream water because it contains more oxygen and minerals than well water.

Two disadvantages of this location did not appear to us until after we had planted. First, the paddy was situated on the north side of a row of large, leafy almond trees and therefore did not receive full sunlight until the afternoon. Secondly, we had no space to dig a small, warming basin for the cold well water. Ideally, the water entering the rice paddy should be warm to promote maximum growth and health of the rice plants. Our water emerged cold from the well and travelled a mere four feet to the paddy. Consequently, our rice grew slower than usual because we did not give it full sunlight nor warm water all day.

Our rice paddy was 10 x 18 feet. Because our ground was level, we shaped the paddy into a rectangle. On uneven, sloping ground, it is advisable to contour the shape of the paddy as the ground dictates. We created the paddy a few days before transplanting by an ingenious technique. First, we turned over the soil with a spade, working it loose and friable to a depth of one foot. The top soil was a deep, clay loam in excellent health. Around the perimeter of the 10 x 18-foot plot, using a special spade with a long, narrow head, we dug a trench one-and-a-half feet deep and six inches wide. The soil dug out was placed along the tops of the four outer sides of the trench to form four dikes, each one foot high. Figure 1 shows this:



Next taking sheets of black plastic, we placed them against the outer walls of the trenches and over the dikes. Figure 2 shows this:

The plastic retarded seepage of water from the paddy into the bone-dry ground surrounding it. Then we levelled the soil between the trenches which lowered the paddy bottom. See Figure 2. We used a long, flat board and our eyes to level the paddy bottom. It was essential for the paddy bottom to be flat so that water would stand at an equal depth over the paddy. We tested our paddy by flooding it before planting.

Preparing ths Seed

Preparing the seed for planting was fascinating and unusual. We used seed Yamazaki had brought from Japan years ago. Taking two pounds of seed, placing it in a bucket, adding cool water three-quarters of the way to the top of the bucket, and then adding a few tablespoons of unrefined sea salt, we swirled the seed, water, and salt around and around with our hands. When we stopped swirling, the viable, strong seeds sank to the bottom, while the weak seeds floated to the top. We removed the weak seeds by hand and swirled again, repeating the process until no more seeds floated on top of the water. Then we poured the strong seeds into a wire strainer and washed the seeds with cool water to clean away the salt.

The next step in preparing the seed was soaking it outdoors. The day after selecting viable seed, March 28, we placed the seed in a small, cotton bag and tied it closed with string. Placing the bag full of seed in a bucket, we set a three-pound stone on top of the bag. Then we filled the bucket to the brim with water. Keeping a hose in the bucket, we ran just enough fresh water in the pail to keep a very slight dribble of water falling down the outside of the bucket. This amount of overflow was an indication that water was circulating through the bucket at a slow, gentle rate. We checked the overflow a few times daily. The seed spent 23 days soaking outdoors in the bucket. Rice can soak in water for up to 30 days this way. The water was cool and never warm. This long soaking starts the germinating process and indicates the unique strength of rice. Soaking also kills weak seed which means that only strong seed will be planted in the ground.

On the 20th of April, we took the bag out and opened it. Each strong seed had a tiny, white sprout at one end. For one day, the seed lay in the bag on top of a stump out in the sunlight and air, which dried it slightly.

Sprouting the Seed

The following day we planted the soaked seed, but not in the paddy; our technique required transplanting. So we prepared a small, seedling bed two feet by four feet in a sunny, warm spot of soil. The bed was slightly raised above the surrounding ground which made it easier for us to remove the young rice plants for transplanting. Adding rich leaf compost, sand, and water to the bed, we planted the sprouted seeds by broadcasting them over the ground. The seeding density was thick enough to cover the ground almost completely.

Next we covered the seed lightly with sand. It is important not to cover the seeds with too much sand which can cake and crust, making it difficult for the sprouts to break through to sunlight. On top of the entire bed, we laid a thin layer of rice straw and tied string across the straw lengthwise to prevent the wind from blowing the seeds and straw away.

It may be necessary to screen the bed from birds that like to eat the tender rice sprouts.

Every two days, we watered the seedlings by hand. Sometimes it rained, but rain is not common or dependable in late April and May in Chico. One week after planting the seeds, tiny green shoots appeared. We weeded every day to allow the rice maximum opportunity to utilize the soil nutrients. A seedling bed is a very fertile, concentrated plot of soil. The quality of the rice harvested is influenced by the soil condition of the seedling bed. Our young rice plants grew for 35 days in this bed to a height of four to five inches. About 40 days is ideal for developing strong rice plants suitable for transplanting.

Transplanting

On May 26th on a hot afternoon, we transplanted into our rice paddy. Wetting the soil to a muddy condition, we removed the seedlings from their bed by hand, being careful not to damage their roots. We carried them over to the paddy. There we had marked off 14 rows lengthwise, eight inches apart. Planting the seedlings in rows allowed us room to walk and to hand-weed during the growing season. Planting by airplane or by broadcasting provides no open space to walk and weed. Commercial rice growers must resort to poisonous weedicides sprayed by airplane. Rice paddies attract a wide variety of weeds which grow faster than rice. It is best to pull the weeds out of the soil and then plunge the top of the weed plant back into the mud where it will decompose and feed the rice.

Three of us bent over with a handful of seedlings and firmly pushed them into the mud, two or three plants in clumps six inches apart down each row. It took us 20 minutes to complete the transplanting. It would take two healthy people one day to transplant an acre of rice. For the first 20 days

after transplanting, we kept water at a depth of one inch in the paddy all day long. Our pump steadily fed water into the paddy at a slow rate. We turned the water off at night, and the water in the paddy seeped slowly into the depths of the soil. After one hour, no water would be standing in the paddy. Freeing the soil of water during the night allowed more oxygen to enter the root zones of the rice plants. Incidentally, no mosquitoes could breed in the paddy without a continuous, standing body of water. In the morning, it took roughly one hour to fill the empty paddy to a one inch depth with the pump turned on fully.

The seedlings took one week to establish their roots in the wet mud and to stand straight. Occasionally, a seedling would lose its hold and float on the water but would not die. We simply picked it up and pushed it down in the mud again. The commercial rice growers flood their paddies to depths of six inches or more. Our technique flooded the paddy to a depth of no more than one inch of water. The slow circulation of oxygen-rich water to the roots of the rice plant is the essential point to irrigating rice. Maintaining a depth of one inch of water allows this to happen.

After 20 days passed, we watered only in the morning because we wanted the warm, afternoon sun to hit the soil directly around each rice plant. The sun's rays stimulated new rice shoots to grow from the base of each plant. The fecundity of this seed was amazing to watch. Each plant was capable of producing 12 new stalks in a season, all capable of bearing heads under optimum conditions. From the middle of June to the 1st of August, the rice plants grew nearly two feet in height. New shoots continued to appear. During this time, a Great Dane chewed about one foot off the tops of 30 plants on his stroll through the paddy. The injured rice was strong enough to recover the lost growth in a week and assume the same height as the rest of the rice. Frogs were living and playing in the paddy at night. Grasshoppers, dragonflies, butterflies, and other small insects frolicked among the deep green leaves. Our cats slept in the cool, wet paddy during the hot afternoons. Once a gopher dug a hole in the paddy, and the water leaked out. We placed two mothballs down the hole and filled it with soil. The gopher never bothered us again.

Only twice in the five months the rice was in the ground did we weed. (Commercial growers use a formidable arsenal of chemical poisons to eliminate weeds and pests; next to cotton, rice receives the heaviest dose of chemicals in American agriculture.) Our experience never suggested such a need. The paddy was a thriving ecosystem. Our role as farmers consisted primarily of regulating the water. The paddy took care of itself.

During the first week of August, plants at the sunnier, north end of the paddy began to head. Keeping the paddy covered all day with one inch of water is critical during the heading stage. Excessive rain and wind, which we did not have at that time, can retard the flowering and self-pollination of rice. The heading moved from the north end to the south slowly because of

the shade of the almond trees. All the plants headed by the second week of September. Some plants were barren, others were part fertile, part barren. Seeds which appeared white were either insect damaged or barren. These may have been five percent of the total seed production.

Harvesting

The rice started to yellow by mid-September, and the heavy, maturing heads bent downward. One week later on September 21st, we stopped flooding the paddy. We permitted the rice to dry for a month in the paddy, two weeks longer than the necessary two weeks. On October 19th, we eagerly harvested the golden grain. Cutting with sickles and bundling it by hand took us one hour. Then we threshed the rice for another hour.

Threshing was easy. We built a wooden frame two feet tall with a metal grate on top. Beating a bundle of rice against the grate a dozen times released the seed from the stalk. Placing the seed on a plastic sheet, we cleaned it by throwing it up in the windy air. For one week, we dried the rice in the sun.

Milling the rice to eat is a real chore. The husk adheres firmly to the grain and offers excellent protection for it. The commercial mills crack about 20 percent of the grain in the husking process. A hand machine sold in Japan is available to the small rice farmer. The most primitive method of removing the husk is to place the grain in a stump with a depression carved out of it and then hammer the rice with a wooden mallet. The force of hitting rubs the grain against the stump and scratches and loosens the husk. This breaks a lot of the grain and does require you to separate the grain from the husk with a fan or with the wind. It is best to mill the rice in small quantities as it stores well in its husk and removing the husk begins the slow process of nutrient loss.

The Rewards

In appearance, our rice had fewer green seeds than commercial rice; it matured to a greater degree, had fewer blemishes, and unlike commercial rice, was hard and could not be easily crushed. Concentrated attention and organic methods produced an excellent quality rice.

Our yield was 30 pounds of paddy rice. We planted approximately 1,550 seedlings in the paddy which amounted to three ounces of seed rice. Our paddy was roughly 1/215 of an acre, so to get an idea of how much rice one acre will produce using our method, multiply 30 times 215. The yield would be 6,450 pounds per acre from 40 pounds of seed. The commercial, organic rice growers get a yield of 2,500 pounds per acre. Chemical growers of rice get 5,000 pounds per acre but must plant 100 to 200 pounds of seed per acre. The rice straw we cut from the paddy has multiple uses. It is a valuable feedstuff for livestock. It makes excellent mulch. It can be woven into

matting. In comparison with other growers, we did well. But our true pleasure was assisting the growth of a truly remarkable plant. The enjoyment we got watching our rice grow cannot be measured.

GREEK LEMON SOUP
(Avgalemono)

6 cups chicken stock
½ cup raw, brown rice
salt to taste
1 egg
2 egg yolks
¼ cup lemon juice
2 tablespoons parsley, freshly snipped
1/8 teaspoon cayenne
Fresh dill to garnish

Put chicken broth into a heavy saucepan and bring to a boil. Add rice to soup, season with salt and cook until rice is tender, 15 to 20 minutes.

Put whole egg and two egg yolks into medium-sized bowl; beat with rotary beater or wire whisk until light and frothy. Slowly add the lemon juice, beating together thoroughly.

Just before serving: dilute the egg-lemon mixture with 1 cup hot broth, beating constantly with wire whisk until well blended. Gradually add the diluted mixture to the remaining hot soup, stirring constantly. Bring almost to the boiling point, *do not boil or the soup will curdle.* Stir in the parsley and cayenne; adjust seasoning.

Remove from heat and serve immediately, garnished with freshly chopped dill.

Yield: Approximately six cups

CHEESE QUICHE IN BROWN RICE SHELL

1½ cups brown rice, cooked 3 eggs
¼ cup nonfat dry milk
1 cup water
¼ teaspoon salt
dash of pepper, freshly ground
dash nutmeg
1 tablespoon whole wheat flour
1¼ cups sharp Cheddar cheese (or part natural Swiss and part Cheddar),shredded

Preheat oven to 375°F.

Press cooked rice into oiled, 9-inch pie plate. Bake in oven just until dry (about 5 minutes); cool.

Using medium-sized bowl, beat eggs until light and fluffy. Combine nonfat dry milk and water with a wire whisk and add to eggs, along with salt, pepper, and nutmeg.

Add whole wheat flour to shredded cheese; toss lightly but thoroughly. Put into cooled rice shell, spreading to edges of crust. Pour egg-milk mixture

over all. Place in oven and bake 10 minutes. Reduce heat to 325°F. and continue to bake 25 to 30 minutes longer, or until filling puffs up and is golden brown.
Remove from oven; allow to set for about 5 minutes; cut in wedges and serve.
Yield: six servings

SPROUTED LENTILS, BEAN, AND RICE SALAD

½ pound pinto beans or kidney beans
1 pound fresh green beans, cooked
2 cups brown rice, cooked
1 cup celery, diced
½ green pepper, diced
¼ cup pimento, chopped
¼ cup lentils, sprouted
½ cup oil
½ cup wine vinegar
1 tablespoon honey
1 teaspoon salt
1 teaspoon pepper
1 medium-sized red onion for garnish, sliced thin
Soak pinto or kidney beans overnight in water to cover. Do not drain. Using soaking water, cook the beans until just tender. Don't overcook. Drain. Save broth for soup.
Combine green beans and pinto or kidney beans, rice, celery, green pepper, pimento and lentil sprouts.
Combine oil, vinegar, honey, and seasonings. Toss salad in dressing with the onion rings.
Yield: 10 servings

BRAZIL NUT COOKIES

½ cup soy flour
2 cups brown rice flour
½ teaspoon salt
½ cup nonfat dry milk
1 cup oil
10 tablespoons honey
2 eggs, slightly beaten
1 teaspoon pure vanilla extract
1½ cups Brazil nuts, ground or finely chopped
Preheat oven to 400°F.
Sift flours, salt, and nonfat dry milk together.
In large mixing bowl, combine oil, honey, slightly beaten eggs, and vanilla extract. Using electric beater set at medium speed, beat mixture until ingredients are thoroughly blended.
Gradually beat in sifted flours and nonfat dry milk. Stir in Brazil nuts. Refrigerate dough for 1 to 2 hours.

Take rounded teaspoonfuls of cookie dough and roll into 1-inch balls. Place 2 inches apart on oiled cookie sheet; flatten with a glass. Bake in oven for 8 to 10 minutes or until golden brown around the edges. Remove from oven and place cookies on a wire rack to cool.
Yield: about five dozen

Chapter 10

Some Uncommon Grains, Old and New

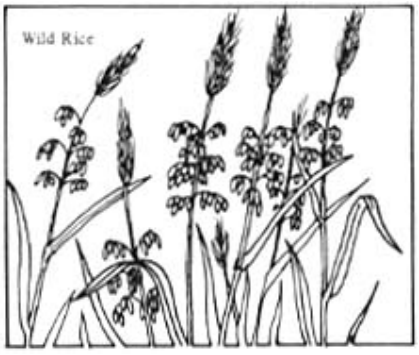
Wild Rice

Unless you live in northern Minnesota or certain parts of the upper Great Lakes and Canada, wild rice probably means little more to you than something gourmets eat or that you order at a restaurant when you feel rich. And most likely, you leave the table wondering why anyone would pay that kind of money to eat the stuff regularly. You didn't really think it was that good tasting, did you?

Wild rice is ill-named. It is not rice and it is becoming less wild every year. Wild rice belongs to a different genus of grasses *(Zizania)* than rice *(Oryza)* and resembles the latter more because of the way it grows than in appearance. Wild rice grows much taller (up to nine feet) than real rice, and its leaves are much wider, about two inches compared to half-an-inch for rice.

The Domestication of Wild Rice

Moreover, wild rice is in the process of being domesticated into a commercial farm crop, what the agribusiness community proudly calls another example of modern technology making a once esoteric, costly food available to every consumer. With apologies to the Wild Rice Institute, I think the domestication of wild rice is absurd. Rapacious man has found one more enclave of nature to exploit for profit, but this time the endeavor may be self-defeating.



Domestication of wild rice first involves making fields out of marshes, fields that can be flooded and drained at will. Goodbye marsh. Getting enough water then to flood the paddy becomes a problem. So much water is

needed that growers often have to obtain permits to use it, and some have been charged with violating water-use laws and antipollution regulations.

To raise yields from about 50 pounds per acre (in a natural stand) to a profitable 500 to 700 pounds per acre means a large infusion of chemical fertilizers. To control leaf spot, the paddies have to be burned or sprayed. Rice worm is controlled by spraying insecticides. Weeds must be controlled, too. Birds, deer, muskrat, and other wildlife will harm the crop. Get out of the way, nature. Man must make the North safe for domesticated wild rice, that terribly essential food for a hungry world.

Then the rice is harvested by big combines. But wild rice shatters very badly and too much is lost. Solution? Why, new strains, of course. These have been provided, and more on the way. So we will have a wild rice that is not wild, with a taste that doubtless will not please the gourmets who buy it now.

By the rice growers' own admission, there is not now a real market for expanded production of wild rice, but the growers assume that the consumer can be persuaded to buy it. If production expands, dragging the market behind it, the price will fall. Already some growers fear that big increases in production could destroy the market. In the meantime, the Indians and the working-class whites who have traditionally depended on the natural wild rice harvest for extra or essential cash will see their business go to pot too. Who wins?

Wild Wild Rice

Natural wild rice production is a fascinating, even romantic story, a frail life system held together in modern times by a colossal program of government protection. For centuries the Indians could harvest wild rice by primitive methods that insured the continuity of the rice crop and a goodly supply for migrating waterfowl that depend heavily on the grain. When the white man took over, he generously left the Indian with the sole right to harvest wild rice.

Like all his other promises, the white man soon broke this one. There was a little money to be made in wild rice, and it was unfair that the Indian should get it all, he said. American business decided that this was a "monopoly," if you can imagine a pot calling a kettle blacker than that. The law was changed so everyone could harvest wild rice except on Indian reservations and certain other areas left to the Indians. You can rest assured that if the price of wild rice should climb very high, the Indian will lose those exceptions too.

The rules and regulations that wild rice harvesters must abide by are unbelievable. But perhaps fortunately so, because man being the greedy creature that he is, the wild rice would soon disappear without heavy

protection. In years when the price is high, a group of wild rice poachers can glean $100 in one night's work.

Harvesting time is set by regulation, usually from about 10:00 AM to 2:00 PM every other day during a season set so that migratory fowl are insured enough of the grain on their journey south. Game wardens and sheriff deputies mobilize like a small army all up and down the upper regions of the Mississippi: boats, cars, planes, helicopters roar up and down the rice stands keeping everyone honest. The cost of the protection is probably higher than the worth of the crop.

But anyhow, at the sound of a siren, harvest begins. It must be done exactly like the Indians did it who knows how long ago. Two people to a canoe or flat-bottomed rowboat. One must pole the boat along while the other harvests. The harvester uses two wooden sticks, one on each hand. With one stick, he or she pulls a bunch of wild rice stalks to the boat, bending the heads over the gun-whale. With the other stick, he or she strikes the heads a swift blow, shattering the seed into the bottom of the boat. It's hard work. And hardly efficient. But enough seed falls into the water for next year's crop. And when the price is over $1 a pound, everybody makes a little money. And at least the crop is not inundated with chemicals, nor is the ecology of the marshes destroyed as in the commercial paddies.

According to the books, wild rice can be found from the mouth of the St. Lawrence to central Manitoba, south to Kansas and Virginia, and even around the coast to Louisiana. But the eastern variety is somewhat different and is not harvested. No wild rice will grow in sea water. If you live where it does grow, you can establish plantings that will draw birds better than almost any plant. And wild animals. Waterfowl, songbirds, upland game birds, deer, moose, muskrat. And some nutritious, high-protein, truly organic grain for you. But if you buy it in a gourmet shop, just remember: just because it's "wild," it ain't necessarily organic. It could come from the thousands of acres of commercial, chemicalized paddies.

If you intend to plant wild rice in a new location, take special care of the seed. If it dries out, it will not germinate. Commercial growers store it all winter in bags in water at a temperature of about 35°F. Better to harvest the seed from one plot and carry it immediately to the new marsh or backwater and toss it in.

The plant grows best in water from six to 12 inches deep, but will tolerate water depth up to about three feet. In summer, before the growing plants break above the surface, they can turn a river or marsh to a beautiful lacy green color. By September, the tall plants hide the water almost completely and turn yellow with maturity.

In 1974 and 1975, bad weather hurt the wild rice crop seriously. Some areas allowed no harvest at all so that there would be enough seed for next year.

The domestic crop was not too plentiful either. But wildlife authorities say the wild grain will prevail, if man exercises caution.

WILD RICE AND SQUASH SOUP

½ cup uncooked wild rice (approximately 1½ cups cooked)
2 tablespoons oil
1 medium-sized summer squash or zucchini
1 green onion, including tops
½ clove garlic
1 tablespoon parsley, chopped
¼ cup mushrooms, chopped
1/8 teaspoon thyme
1/8 teaspoon basil
1½ cups chicken stock
3 cups chicken stock

Sauté rice in oil until all grains are well coated. Chop all vegetables very fine or put through electric blender. Add vegetables to rice and continue to saute for a few minutes. Add seasonings and then 1½ cups chicken stock and bring to a boil.

Cover, lower heat and simmer for 40 minutes. Add an additional three cups stock, bring to a boil and serve.

Yield: four cups

GOLDEN HERBED WILD RICE

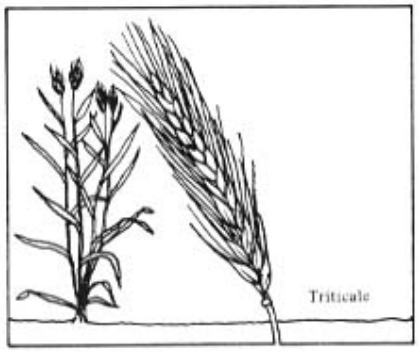
1½ cup uncooked wild rice (approximately 4½ cups cooked)
¼ cup butter
2 medium-sized onions, finely chopped
1 shallot, finely chopped (optional)
½ teaspoon basil
½ teaspoon tarragon
½ teaspoon dried chives
pinch of thyme
1 tablespoon parsley, chopped
3 cups chicken stock
1 tablespoon tomato paste
½ teaspoon turmeric

Sauté rice in butter until all grains are well coated. Add onions, shallot, and herbs and continue to saute for a few minutes. Add stock, tomato paste, and turmeric, bring to a boil, cover and simmer for about 25 minutes or until rice is tender and all liquid is absorbed.

Mold the rice in buttered custard cups or a fluted mold. Cover mold and keep warm until serving time. Unmold onto platter around meat or in the center, or serve separately.

Yield: four-six servings

Note: This recipe can also be used as a stuffing for fowl or a filling for steamed summer or winter squash.



Triticale

Wild rice may be our newest domesticated grain, but triticale is our newest grain without qualification of any kind. It is also the first grain crop made by man rather than by natural processes.

Triticale is a cross between wheat and rye, the name deriving from the Latin for wheat, *triticum,* and for rye, *secale.* Triticale is not a new idea; for a long time plant breeders have tried to cross the two plants to team the productivity of wheat with the hardiness of rye. But though thousands of crosses, even millions, were made, the offspring were infertile or of such poor quality as to be valueless. Finally in 1967, in the midst of a full-scale program of triticale breeding initiated between the International Maize and Wheat Improvement Center in Mexico and the University of Manitoba, a chance pollination occurred in a research plot that was fortunately observed by researchers. From that catch, the modern and sometimes sensational triticale crosses eventually were developed.

In the late 1960s, triticale became the agricultural journalist's darling. He could call the grain everything from "miracle crop" to "solution to world hunger" and get away with it. The grain was high in protein, and compared to most grains, it was productive where wheat was not always productive, could be pastured, contributed more nutrition to bread, and was not hard to grow. I remember how excited we all were on the staff of Farm Journal magazine. We procured a few seeds which one of the editors planted in his backyard. We watched them grow through the summer with the kind of wonderment one feels when he first walks up to a 747 jet.

Alas, as is often the case with new varieties, triticale has not always lived up to its pre-game statistics. Near Bowling Green, Ohio, I have seen excellent triticale grown by natural farming methods that yielded 55 bushels per acre, nearly five feet tall, and without lodging. The crop was sold at quite a good price to specialty markets. But at the same time I have seen poor stands not three counties away. The data from college test plots comparing triticale and wheat invariably indicates much higher yields from wheat. While livestock feeding tests show the value of triticale--it can be used to replace nearly half

the corn in feed rations--the yields of improved wheats are high enough to outscore triticale in total protein per acre.

In the East, Southeast, North, Northwest, and particularly Northeast, triticale still suffers occasionally from low fertility. Not enough of its flowers fruit. This condition not only results in low yields, but it contributes to the development of ergot, a very toxic fungus. Farmers I know who have grown triticale say it winter-kills easier than wheat too.

When asked, plant breeders across the Cornbelt will point out these present disadvantages, but will then proceed to sing the praises of triticale for some future time. Maybe so. But improvements in wheat, oats, and barley may continue to outdistance triticale development. If you want to try a row or two for fun in the garden, fine. Especially for your own family's diet, triticale will give you a better mix of amino acids used along with wheat. Grow the grain exactly as you would grow wheat.

Seed is available for gardeners from Gurney. If you try to make bread from it, be aware that like rye, available varieties of triticale contain little gluten.. You'll have to mix in some wheat flour. Better varieties, or some more suitable to your area should be available from local farm seed salesmen. At least they can steer you in the right direction.

TRITICALE NUT DROPS

2 eggs, beaten
½ cup oil
½ cup honey
½ teaspoon vanilla
2½ cups triticale flour
½ teaspoon salt
1 teaspoon cinnamon
¼ teaspoon crushed anise seeds
½ cup chopped walnuts
butter for greasing cookie sheet
Preheat oven to 375°F.
Combine eggs, oil, honey, and vanilla. Combine flour, salt, spices, and nuts and add to liquid ingredients. Drop by teaspoonful onto a greased cookie sheet, press flat with the bottom of a glass which has been dipped in water and top with a walnut piece if desired. Bake in oven for 12 to 15 minutes or until golden brown. Cool on rack.
Yield: four dozen

TRITICALE EGG BREAD

2 tablespoons honey
½ cup lukewarm water
2 tablespoons dry yeast

2 teaspoons vinegar
1 cup milk
2 teaspoons salt
2 tablespoons oil
2 cups triticale flour
4 cups whole wheat flour
Dissolve honey in lukewarm water. Sprinkle yeast over surface and set aside for 5 minutes to activate. Add vinegar to milk, heat just to lukewarm temperature, stirring constantly, until the milk curdles. Remove from heat and pour into large bowl.
Add salt, oil, eggs, and triticale flour to soured milk.
Add yeast mixture, stirring in well, then add the whole wheat flour, reserving about 1 cup for kneading.
Turn dough out onto board or counter which has been well floured, and knead for a full 5 minutes.
Place dough in oiled bowl, turning it to oil surface. Cover and put in warm place to rise for about 1¼ hours or until double in bulk.
Punch down dough. Let rise again for ½ hour or so.
Form into 1 large loaf and 1 small loaf, place in buttered bread pans and let rise for another ½ hour or until dough is slightly rounded over the top of the pan. Preheat oven to 350°F. and bake for 30-35 minutes or until done. Remove loaves from pans and cool on rack.
Yield: one large and one small loaf

NO-KNEAD TRITICALE BREAD

4 teaspoons dry yeast
2/3 cup lukewarm water
2 teaspoons honey
3 cups whole wheat flour
2 cups triticale flour
3 tablespoons molasses, unsulphured
2/3 cup lukewarm water
½ tablespoon salt
1/3 cup wheat germ
1-1/3 cups lukewarm water
½ tablespoon butter
1 tablespoon sesame seeds unhulled
Sprinkle yeast over lukewarm water. Add 2 teaspoons honey. Leave to "work" while preparing the dough.
Warm flours by placing them in a 250°F. oven for about 20 minutes.
Combine yeast mixture with molasses mixture. Stir this into the warmed flour, then add the salt and wheat germ and finally the 1-1/3 cups lukewarm water. The dough will be sticky.
Butter loaf pan (9¼ x 5¼ x 2¾), taking care to grease the corners of the pan well. Turn the dough into the pan. No kneading is necessary. Smooth dough in pan with spatula which has been held under cold water to prevent stickiness. Sprinkle sesame seeds over top of loaf. Let it rise to top of pan in warm, draft-free place. Meanwhile preheat oven to 400°F.

Bake in oven for 30-40 minutes or until crust is brown and sides of loaf are firm and crusty. Set pan on rack to cool for about 10 minutes, then remove loaf from pan and cool completely on rack before slicing.
Yield: one loaf

Spelt

I don't know that they have a society, but if the spelt growers of America formed one, it would certainly be one of the most exclusive clubs in the country. I know of only one farmer who raises this old grain but he seems dedicated to it as a hardy, reliable green manure crop, pasture, and grain.

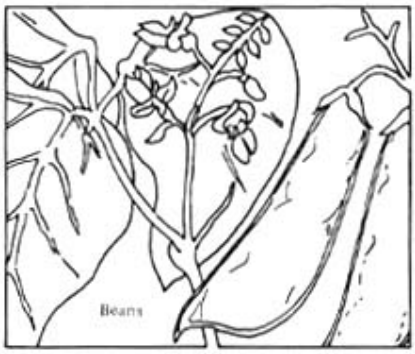
A spelt grower would have to be dedicated because all the evidence available indicates that the grain is inferior in every way to our commonly grown grains. Spelt is cultivated like wheat, and is similar to it. Fall and spring varieties exist, I'm told. Unlike wheat, spelt will not thresh out cleanly. Each kernel is surrounded by a tight glume that won't shatter loose easily. Spelt is generally taller than wheat and therefore lodges easily on good soil. Heads are long, like rye. Planting rate is about two-and-a-half bushels per acre.

Authorities say good spelt seed is hard to find. It is difficult to clean because of the glumes, and so seed often contains much weed seed. Also the seed is often contaminated with smut.

And if spelt isn't scraping the bottom of the grain barrel, contemplate the ancient grain, emmer. You can find emmer in a very large dictionary, but hardly anyplace else.

Beans

This book stretched the definition of grain a bit out of shape so as to include a chapter on soybeans, for reasons abundantly stated and abundantly clear. To stay consistent, if not logical, I'm bound to say something about other types of beans which are extremely suitable for homestead production and which, like soybeans, are grown and processed in ways similar to those used in small-time grain production.



I'm speaking of dry beans: mung beans, navy beans, horticultural beans, kidney beans, lentils, field peas, black-eyed peas, marrow beans, and many rarer kinds. Baked, souped, or especially sprouted, these beans rank among American favorites, and for once, favorites that are healthful for you.

With the exception of the delicious black-eyed pea or crowder pea of the South, most beans for baking are grown in the North where they seem to do better. But evidence suggests that most of these beans can be grown equally well, north, south, east, or west. Recent experiments at the University of Arkansas Experiment Station indicate that many dry bean varieties could be commercially successful in the northwestern part of that state at least. That means that they'd do all right noncommercially even in the southern part of the state, and most likely on down to the Gulf Coast if planted early enough.

The reverse is true too. I've had good luck here in the North growing Southern black-eyed peas, as well as Northern whites. I grow them all in rows 30-40 inches apart about two plants per feet or less in the row and keep them weeded. They seem to produce with no extra care as to fertility. The crucial part is harvesting. I like to let the beans dry in the pod on the stalk completely, if possible. But if the weather is wet in September the beans are very apt to mold in the pod. The black-eyed peas seem to be worst in this respect.

I harvest by cutting the dry, dead plants and stuffing them in a sack. I tramp and beat the sack which shatters the beans out into the bottom. Then I pull out the stems and toss them back on the garden, and then winnow the beans.

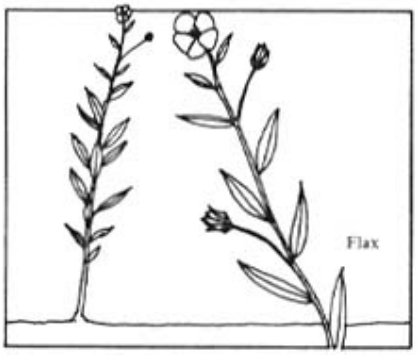
If I must harvest before beans are completely dry, I spread them out in a very thin layer in the house someplace, or dry them in the stove where you can run the temperature up high enough to kill any bean weevil eggs that might be present. A small, solar-heat box such as you'd use to dry fruit or vegetables in, would make a good bean dryer too.

Best results are obtained by planting early (middle of May here) though I have planted as late as late June. You run the risk of moldy beans in the later case, if the fall is wet.

Dry beans can be combined, of course, or threshed in small grain threshers. They thresh easily. You can do a fair job by running the mature, dried plants through a shredder at very slow speed. If the beans are real dry, they may split while being threshed. That is only good for split pea soup.

Flax

Flax is not technically a cereal grain, though its protein-rich seeds are used in livestock feed, are added to bird feed, and would be good human food as the ancient Greeks well understood. But whether grain or not, flax deserves some mention in any book written for gardeners and homesteaders primarily interested in self-subsistence. For two centuries at least, flax, from which linen is obtained, was one of the main sources of fabric for American clothing. Now that interest has so greatly revived in homespun wool and cotton, we are only a step away from a renewed enthusiasm in homemade linen and linsey-woolsey. Making linen from flax is not really that much more difficult than making your own cotton or wool yarn, and even if most of us will never try it, we need to be aware of the practical possibility of homespun linen.



Man has grown flax for thousands of years. Mummies in Egyptian tombs are wrapped in fine linen, indeed a much finer linen than we know how to make now. Some climates and soils have proved historically more suitable for producing fine linen than others, Belgium being perhaps the most famous. Flax seems to do better in cool, dry climates and today is grown mostly in the more northerly areas: Canada, Russia, and our northernmost Plains states. Flax production has been on a decline in our country. None is grown for linen anymore, but all for linseed oil, the fibers from the straw being utilized for cigarette paper and other fine papers. Acreage in our northern states was something like 1.4 million in 1976, down from 1.8 million in 1975, mostly because the current higher wheat prices have lured farmers into shifting land formerly used for flax into wheat. But the rise of water- and rubber-based paints has been the long-range cause of flax decline, though recently the demand for linseed oil (or at least its price) has taken an upturn.

Growing Flax

Flax can be grown in just about any state, though perhaps not commercially; some varieties have flourished at different times in Oregon, California, Texas, even Georgia. Before 1900, Kentucky and Ohio were the leading producers. Wilt disease, against which earlier varieties had little resistance, was a common reason why acreage in flax kept shifting to new untainted soil.

Flax is grown much like wheat, drilled (or broadcast) about an inch deep, at a rate of two to three pecks per acre, or even up to a bushel in humid climates. If you want to grow flax for the fiber, plant at the heavier rate, as thick stands discourage branching and therefore make longer, smoother stalks for longer fibers. Plant flax early in the planting season. Normally good soil should not need extra fertilizer for flax; nitrogen would only encourage weeds which flax competes with poorly. Never plant flax in a weedy field, the old government bulletins say, and don't plant it after sorghum, millet, or Sudan grass. When the roots of these crops are rotting in the soil, they can cause injury to the growing flax.

Flax grows fairly fast and by June in the North, it begins to bloom. The blossoms are blue to very pale blue. Dr. C. D. Dybing, flax specialist at the University of South Dakota, who so kindly answered my questions about flax, says that a field of it at bloom time looks like a beautiful lake eddying in the breeze. In Canada, he says, where rape, flax, and wheat are grown in rotation, you can see huge rolling fields of yellow rape, blue flax, and at that time of year, grey-green wheat next to each other and the scene is breathtakingly beautiful.

Harvesting

Flax keeps on blooming somewhat like buckwheat does, but later blossoms do not develop mature seed and so in the North, there is no reason to wait for them to mature. When most of the seed is about ripe, the crop is cut and swathed, and ripening is completed in the swath. Then it is harvested with a combine for the Average yield is about 10 bushels per acre, but as high as 25 to 30 bushels with a selling price in 1976 of around $8 per bushel.

If you wanted to make linen, you would not cut the stalks, but would pull them so that you could obtain longer fibers. Pulling by hand was the age-old way, though mechanical pullers were developed by the end of the 19th century. CUTHBERT is a new variety of flax outstanding for wilt and rust resistance, but it was bred mainly for seed production. For fiber production, ARNY might be a better variety to try. You can expect at least a ton of straw per acre from which to extract fiber, and usually more, perhaps twice as much. A tenth of an acre would give a hobbyist about all the fiber he or she would want to spin the first time around.

Making Linen

The Goshenhoppen historians at East Greenville, Pennsylvania keep alive the craft of linen-making and I was lucky enough to observe the whole process performed at their Goshenhoppen Folk Festival several years ago. You almost need to watch such a demonstration to learn the craft of linen-making. The flax plants, which have been pulled, allowed to dry, and the seed heads cut or combed out, are soaked in water or left on the ground exposed to the weather for several weeks to rot the woody stems around the fibers. The rotting process is called retting. When the stems have sufficiently deteriorated, the plants are dried. Then the flax, a bunch at a time, is passed through a tool called a flaxbrake, which breaks the stems in several places. The flaxbrake is about the size of a sawhorse, which it somewhat resembles. The flax stems are laid across three (usually) fixed wooden boards or bars, and a set of other boards or bars, hinged at one end of the sawhorse affair, are lowered or dropped between the fixed lower boards. As the top boards or bars pass between the bottom, the flax stems are broken.

Next, the broken stems are scraped or "scutched" with a swingling knife. The worker holds a bunch of broken flax in one hand and scrapes or swingles with the knife in the other hand. The knife looks about like a corn knife but is made entirely of wood. While swingling, the worker rests the bunch of stems on the sharpened edge of a perpendicular board that measures an inch or so thick and six or so inches across and stands about belt high. The woody stem pieces surrounding the fibers fall to the ground under the onslaught of the swingling knife. Next the worker passes his handful of fibers through a hetchel or hacksel. The hetchel looks like a large brush, only with steel teeth (or combs) spaced widely apart. This step, called hackling, straightens the fibers and pulls out all remaining stem pieces caught in them. The processor has left in his hand what looks quite a bit like the end of a horse tail, only the "hairs" are much finer and fluffier. When you are watching the process, this appearance of a swatch of fibers at the end seems rather sudden and a bit magical. It takes about as long to describe the process as to do it.

The fiber then is ready to be spun into yarn, and quite nice yarn, too, that would make very durable clothing. Incidentally, craft historians tell me that flax can be spun on either the smaller "flax" wheel or the larger "wool" wheel. I use the quote marks because the experts are by no means agreed that the smaller, popularly called flax wheels, were used exclusively for flax. At any rate, once you have the flax fibers, spinning proceeds as with any other material.

If you are experimenting with flax, you might also like to know that the raw oil pressed from the seeds is much sought after by violin makers to finish the wood of their finest instruments.

Seed

If you don't live in flax country, getting a small amount of seed may be difficult for you. Distributors of birdseed might be able to get it for you. Gurney is the only garden seedhouse I know that handles flax but I believe the variety they sell is the ornamental kind. Associated Producers, Inc., 285 E. Fillmore Ave., St. Paul, Minnesota 55107 wholesales flax seed. An inquiry to the Department of Agriculture, Division of Agronomy Services, State Office Building, St. Paul, Minnesota ought to produce results.

Cotton, Sunflowers, and Safflower

Having talked about flax, I feel obliged to mention the obvious, that cotton in the South provides or can provide a homesteader the same needs that flax does in the North, including the excellent protein value of cottonseed and cottonseed cake. And having said that, you should also be aware of the protein and oil value of field-grown sunflowers and more esoteric oil seeds like safflower. But I have to draw the line somewhere, so I will draw it along the boundary between the blue flax fields and the yellow rape fields, hoping that we will all get to see that sight some time, in Canada, if not in our own homestead acres.

Chapter 11

Legumes, Grains, and Vegetables:

Partners on Organic Acres

A farm or garden, even the best ecological farm or garden, is essentially an assault on nature. You carve out a plot of ground and grow upon it what you want to grow, not what nature would have naturally provided there. Lessening the impact of that assault to allow the greatest number of "all creatures great and small" to live and die in mutual beneficence on that plot of ground is the goal of the organic farm or garden.

Nature's virtues, toward the attainment of that end, are balance and variety. The more varied the animal, mineral, and vegetative life that exists on a farm, the greater the interaction and, therefore, balance they can achieve. For example, quail will proliferate naturally on your farm if provided brushy cover for nesting and protection. The quail control the chinch bugs who might otherwise ruin the outer rows of your cornfield. The farmer cuts down his brushy fencerows to gain four more rows of corn and then must spend money to spray chinch bugs. When he sprays he may also destroy predators of armyworms, thereby bringing on a plague of these pests.

Each life and death up and down the food chain directly or indirectly supports the others while at the same time prevents any one variety from dominating the rest for long. Nature abhors an excess as much as she abhors a vacuum. She obeys, unerringly if blindly, the basic dictum of self-preservation: In equilibrium lies survival. This is the essential principle of organics. So when you think of grains, don't isolate them in the modern image of large corn and wheat fields foreign to your homestead or doorstep garden. Think of grains as just another link in the food and fiber chain leading from the smallest microbe in your soil to the healthiest mind and body in your family. And understand that you are not just increasing the variety and balance of your garden or field by the number of grains you grow, but exponentially, by an increase in all the species of plants and animals that feed your grains or feed upon them. Since grains are cereals and cereals are grasses, their introduction leads rightfully, almost inevitably, to legumes with which grasses have a symbiotic nutritional relationship. This relationship is best illustrated by the way grass and clover grow together in a pasture field or lawn. Given proper moisture and soil pH, white clover will grow almost anywhere, successfully foraging nutrients from even poorer soils. As it grows, the clover puts nitrogen in the soil beyond what it needs itself. As the soil becomes richer, bluegrass is encouraged to grow, thriving on the nitrogen supplied by the clover. Eventually, the grass chokes out much of the clover, uses up the nitrogen supply, and recedes. The clover comes on strong again until sufficient nitrogen is available to

initiate another lush crop of bluegrass. If not overgrazed, the grass and clover maintain a dense enough cover to compete well with weeds. The natural rotation, dominant grass to dominant clover and back again prevents diseases and insects that thrive on one or the other plant from overpopulating since they necessarily must subside with their host plant. In other words, a certain natural, dynamic equilibrium is established. Add grazing animals in moderate numbers, and an almost permanent equilibrium can be maintained because livestock will control volunteer tree seedlings that would, in humid areas, finally turn the pasture into woodland.

Rotations

The natural rotation between white clover and bluegrass can be used as a model for your managed rotation of grains, legumes, and vegetables. In fact, rotation is so important to organic food production, I do not see how you can operate long without it. Legumes in rotation can:

1. Supply 100 pounds or more of nitrogen per acre per year to your soil through nitrogen fixation.
2. Add to the soil as green manure as much as four or five tons of organic matter per acre per year, and in some cases 50 or more pounds of potash per acre per year.
3. Act as sanitary agents by interrupting disease and insect cycles of grains and vegetables.
4. Choke out weeds that become established in previous row crop vegetables and grains.
5. Provide an abundance of protein food for you, your animals, and your soil microbes while they are accomplishing the first four tasks.
6. Spread your available hours for work over a longer season. Instead of having too much to do for three months of the year, legumes in rotation with grains and vegetables will allow you to stretch the same number of hours over a longer portion of the year. In other words you produce more at an easier pace.

Legumes in Rotations

Legumes can be divided into two classes for convenience's sake: clovers and beans. Clovers for purposes here are mainly alfalfa, red clover, sweet clover, white clover (or ladino which is just a bigger version of the small Dutch white clover), and perhaps mammoth clover and crimson clover. There are others, of course, perhaps even one that would fit a specific area better than what I have mentioned. But these are the main types for rotations.

In the bean group, we're talking about soybeans already discussed, plus all the garden beans and all the dry field beans like navy beans, kidney beans, etc. Also included are garden peas and field peas, and in the South especially, cowpeas and black-eyed peas. I do not intend to go into detail on

the growing of these vegetables, most of which are so familiar to gardeners already. But for purposes of rotation of your food crops, remember that all these foods are legumes, with the advantages of legumes, and should be fit into your rotation with that in mind.

This clover, sprouting amongst the wheat stubble, will produce excellent hay while charging the soil with nitrogen and choking out weeds. It is one of the best crops to be included in long-term rotations.

For rotation purposes, think of clovers as long-term plants for crop rotation and the bean legumes as short term. And with that in mind, let's review specific legumes as they relate to the previously mentioned six advantages.

Nitrogen Fixation

The amount of nitrogen any particular legume can fix in the soil varies, depending on many factors, and even experts do not like to use explicit figures. But in general, with all conditions right for good microbial action, with healthy plants, and with good weather, soybeans or cowpeas can make 100 or more pounds of nitrogen available for a following crop as I have

pointed out. Alfalfa, which is certainly the king of clovers, if not of all the legumes, has been rated on occasion even higher; over 180 pounds per acre per year, though usually 100 to 150 pounds would be excellent. Other clovers can be counted on for 100 pounds at least when conditions for bacterial action are good. When planting clovers or other legumes, inoculating the seed with *Rhizobium* bacteria will often enhance nitrogen production. And when conditions are right for vigorous clover growth (when soils are not acid) *Azotobacter* bacteria, which fix nitrogen on their own—without legumes—will also be more active.

At any rate, the 100 to 150 pounds of nitrogen you gain saves you the cost of that much nitrogen you'd have to buy, and organic nitrogen fertilizers are generally even more expensive than chemical kinds. Legumes also save you the considerable labor and cost of applying fertilizer.

Green Manure Value

Alfalfa in a year's time, can produce four to five tons of organic matter per acre if all the hay is mulched and returned to the land rather than fed. And that's not counting the roots which can penetrate deep into the soil and bring back up to the surface minerals and trace elements previously leached away. Also, alfalfa plowed under returns to the soil at least another 100 pounds per acre of nitrogen and nearly that much potassium. Sweet clover produces even heavier tonnages of organic matter and from the standpoint of green manure only is considered the best plowdown crop where it will grow well. Sweet clover grows so tall and rank you need a heavy plow to turn it under. Red clover is an excellent green manure crop and is easier to handle.

Both soybeans and cowpeas, as we have seen, are good plow-down crops, though the former is so commercially valuable as a harvested bean that it seldom is used for plowdown. Beans and peas will give you a green manure crop in two months. Clovers take a year at least.

Insect and Disease Control

Continuous cropping of the same or similar crop is risky business for the organic grower, for the chemical grower too, as far as that goes.

You can avoid some disease and gain some control just by rotating vegetables of different families among themselves or with grains. But legumes give you even longer time lapses between the other crops. Since they are totally different botanically from the cereal grain grasses and the vegetables, much better sanitation is obtained with them than without them.

Weed Control

Clovers are the only legumes that will give you weed control. Beans and peas won't. Sweet clover simply grows so rank it blots out most weeds that

attempt to grow. With alfalfa, the control of weeds comes mostly from repeated mowing for hay. Each hay cutting cuts back any weeds that are growing too, and because the alfalfa recovers so much faster than most weeds, it chokes the latter out. When the alfalfa crop is cut three or four times a year for hay, and that practice followed for two years, excellent control of most weeds is obtained, so that a following crop is as free of weeds as if herbicides had been used previously. The more fertile the soil, and the lusher the alfalfa, the more complete the weed control. If, however, alfalfa grows three or more years on the same field continuously, it will thin out, and weeds and grasses will gain a footing.

Red clover if rank enough will control weeds to some extent, but it will last vigorously for only one year of haying, and will become infested with wild carrot, if allowed to grow another year.

Legumes for Food

Jane Jacobs in her interesting book *The Economy of Cities* (Vintage Books, New York, 1969), observed that alfalfa was grown in French city gardens in the Middle Ages probably a century before it was adapted in rural agriculture. It is believed the Moors, even earlier than the Middle Ages recognized the ability of alfalfa to make land more fertile. But alfalfa was no doubt grown primarily in gardens for its herbal value, and again herbal folklore seems to have basis in fact. Alfalfa is rich in nitrolosides which are thought by some nutrition scientists to inhibit cancer. Red clover tea—made from blossoms dried in summer—is a blood "purifier" and a folk remedy for cancer.

Be that as it may, alfalfa is very rich in protein. Good alfalfa hay can supply all the protein a cow needs. Many people seeking to vary the kinds of protein in their diet take alfalfa tablets. Futurists believe that alfalfa could be one of the more practical solutions to a world protein shortage.

On a practical, here-and-now level, alfalfa seeds are easy to sprout, nutritious, and tasty. Sprout them just as you would beans; it takes a little longer—about six days—before they are ready.

Stretching Your Labor

The best way to appreciate the economies of labor gained by rotations with legumes is to consider some actual examples. The rotation I'm presently following may not be the best one, and I may change it as my needs change, but it will serve as a good model here.

First you want to define exactly what you want your rotation to do for you in terms of kinds and amounts of food. That goal will govern the way you design your rotation plan. Mine is set up to supply all our own vegetables (except those grown in our little green-garden near the house), plus grain

and hay for at least one cow, one hog, 30 chickens, and 15 rabbits per year, while at the same time maintaining a soil fertility level that requires only a minimum amount of additional purchased organic fertilizers.

The Logsdon Plan

With my rotation plan fully operative, the area that is maintained in the rotation measures approximately two acres, split into six quarter-acre plots. In the fall of 1976 it looked like this:

Rotation Plan

Fall 1976					
A--1/4 acre	**B--1/4 acre**	**C--1/4 acre**	**D--1/4 acre**	**E--1/4 acre**	**F--1/4 acre**
Second year alfalfa	First year alfalfa	Plant winter wheat; apply lime	Fall plow for next year's vegetables and soybeans	Fall plow for next year's corn	sod
Spring 1977					
Second year alfalfa	Apply potash on firstyear alfalfa in April	Broadcast clover early in March; apply rock phosphate in April	Plant garden; mulch tomatoes, potatoes. etc. plant soybeans in late June	Manure, if available, or organic 5-5-5, if affordable; plant corn early May	Plow down green manure; plant corn late May
Summer 1977					
Make hay	Make hay	Harvest wheat; gather some straw; clip clover seedlings	Plow under beans for Green manure in late August; harvest garden produce	Cultivate corn	Cultivate corn
Fall 1977					
Make hay	Let late alfalfa grow; do not make hay	Let alfalfa seedlings grow	Plow under remaining vegetable resi due and mulch and plant wheat; apply lime	Harvest corn early, removing both fodder and corn for feed	Harvest corn late, leave stalks on ground for organic matter
Spring 1978					
Plow under alfalfa for green manure; plant corn in late May	Second year alfalfa	First year alfalfa; apply potash in April	Broadcast Clover seed early in March; apply rock phosphate as wheat greens up in April	Beans and vegetables; manure or mulch tomatoes, potatoes, etc., in June	Plant corn in early May; apply nitrogen before or after

The rotation moves from A to F and back to A again as you can see. In other words, what happens one year on plot A will happen the next year on plot B. What I have is a six-year rotation, an unusually long one even in traditional agriculture. Agronomists would formulize the rotation as corn, corn, bean-vegetables, wheat, hay, hay, or C-C-B-W-H-H.

Getting It Started

Obviously, however, I did not start with a full-bloom six-year rotation. One must start somewhere, and the usual situation on a homestead is to start with a field that has been in sod. In my case, the first year I plowed all the plots except F and planted them to corn interspersed with a few rows of garden produce. The first fall

I harvested the corn early from plot A and planted it to wheat, interplanting in spring to alfalfa. Plots C, D, and E went that spring to corn, again interspersed with garden. F remained in sod. I planted B to soybeans in June, plowed under in August, and planted wheat in the fall. This plot was seeded to alfalfa the next spring, as plot A was the previous spring. By fall of 1976, with the wheat crop removed from plot B and the alfalfa seedlings making a good stand, the scene is set for the beginning of the rotation schedule as shown above.

Variations

My six-year rotation could as easily be a five-year rotation. I added another year of corn (plot F) because I foresee needing more corn. I could get the same amount of corn on a five-year rotation by reducing the amount of hay in the rotation. If instead of alfalfa, I grow red clover, I would necessarily reduce the amount of hay in the rotation because red clover will not produce a good yield of hay the second bearing year and should be plowed up. With red clover, the rotation would be corn, corn, beans, wheat, clover, and then back to corn.

I could also achieve the same total production of food by making the plots larger but fewer in number, thus corn, beans-vegetables, wheat, hay, and back to corn. I prefer six smaller plots to four larger ones to spread the work load more and to allow myself the prerogative of working other crops conveniently into the rotation.

Managing the Rotation

My rotation is easy to manage for fertility. In any given year, two plots will be in alfalfa, one plot in beans plus heavily composted vegetables, and the other three in grains. Three plots are adding more fertility than they are taking out, and three are taking out more than they are adding. A sort of natural equilibrium is established, and I can build over-all fertility by adding manure and small, economical doses of additional fertilizer I can afford. Organic fertilizers with guaranteed analysis of nitrogen, phosphorus, and potassium are available and ideal for my situation, but too expensive for me to use in large amounts.

To understand how conveniently a rotation spreads your work load, I will describe in some detail how I managed mine. (I'm not all as efficient as this

may sound, however; sometimes I simply stand and stare into space instead of working.) Any year will suffice for an example, but let's go through 1977 hypothetically, keeping one eye on the schedule for that year given above.

My work year begins in plot C in March, as yours will if you live in the same latitude as I do. Farther south, you start earlier of course. I try to pick a quiet morning when the ground has frozen just slightly, and hopefully for the last time. With a plot size of ¼ acre, I need about four pounds of alfalfa seed in my seeder hanging from my shoulder. The wheat is still dormant on the plot and the clover seed flying from the spinner of the seeder easily finds its way to bare soil, falling most often into the tiny surface fissures created by the frozen soil crust. Later in the day . . . or tomorrow, or very soon at any rate, the soil will thaw, flow together and give the tiny seeds all the cover they need. My first planting of the season, and the easiest, is completed in about an hour. It would be less but I stop often in March to listen for spring bird songs.

In early April, or whenever the ground has thawed and firmed enough so I can walk on it without slopping mud up to my elbows, I apply potash to plot B and rock phosphate to plot C. I just walk along with a bucketful and hurl it on the ground by the handful, as evenly as I can. By now the wheat is beginning to green up and I can hear the birds singing without having to stop and listen so hard.

Next I move to plot D as soon as the soil is dry enough to work, disk it (it was plowed the previous fall), and plant peas and potatoes. Then on to plot E in early May to work the soil and plant early sweet corn and field corn. If I have manure or other fertilizer I'm not going to need for vegetables in plot D, I'll apply it here before planting the corn.

Next I plow under the green manure on plot F and plant late corn and sweet corn. If the weather has been normal, it should be about May 25. Then I hurry to plot D, plant garden beans, tomato plants, possibly more peas, and dry beans. The rest of plot D I keep disking to keep down weeds. Later I will plant soybeans here for green manure.

By now it is June, which I spend in plots D, E, and F, cultivating and mulching. In late June, I move to plots A and B and take off the first cutting of hay. I try to mow the alfalfa just as it begins to bloom, when its nutritional value is highest. When the hay is dry, I rake and haul it to the barn or stack it in the field. It makes excellent mulch too, if I have more than I need for feed.

In early July, the wheat is ripe in plot C. I harvest and gather some of the straw for bedding or mulch. I clip the stubble with a rotary mower and let the straw lay right on the ground for fertility, organic matter, and a mulch cover for the alfalfa seedlings. It doesn't hurt to clip those seedlings. Seems to make them grow back healthier and stronger.

Next I plant the soybeans in plot D, and continue weeding whenever I can't think of an excuse not to.

In late July, the alfalfa should be harvested again. If I wouldn't need it all for hay or mulch (I always do) I would mow with a rotary mower which will shred the plants back on the ground for excellent mulch and fertilizer value. This would be rather wasteful of a good protein feed, but in an organic sense, nothing returned to the soil is wasteful.

August is harvest month in the garden (plot D). I will also want to go fishing and sit in the shade a lot.

In early September, I plow under the soybeans and other spent beans in plot D. After frost, I plow up the rest of the plot and towards the end of the month, plant the whole thing to wheat. Meanwhile in plot E, I cut the corn, stalks and all, tie it into bundles and shock the bundles together. I want not only the corn but the fodder for rabbit and livestock feed, and for bedding.

From the corn in plot F, I harvest only the grain. The fodder is returned to the soil for organic matter. In October, I shuck the ears by hand from the stalks and toss the ears in the truck. Afterwards, I shred the stalks with a rotary mower, and plow them under in the fall to control corn borers.

Meanwhile, before hard frost, I could take another cutting of alfalfa from plots A and B. I probably will, from plot A at least since I will plow it under the following spring rather than keep it for another year of hay. Plot B, on the other hand, will be in hay next year, so I want it to winter over in good shape. Not cutting the last crop means leaving a good cover of dead alfalfa on the soil surface over winter, protecting the roots from heaving (and giving quail and other wild things a place to hide).

In November, I lime the new wheat on plot D.

With this rotation, I can produce quite a bit of food with my spare time labor and mostly primitive hand methods. Long-term fertility management sort of takes care of itself. Every year one plot receives extra potash; one, rock phosphate; one, lime; two, green manure; and at least one, manure, compost, and purchased nitrogen.

More Variations

There are many variations in homestead rotations. One of the corn plots could as easily be oats in mine. Barley could substitute for wheat. Buckwheat could be grown after oats or after early peas. Strawberries could be worked into the rotation on a two-year basis, as part of one of the corn or alfalfa plots. By using temporary electric fencing, I could put a pasture into the rotation too, planting a fescue-red clover pasture or a bromegrass-ladino

clover pasture instead of alfalfa and letting livestock graze it instead of making hay. Or make hay off one plot and graze another.

High value cash crops can be worked into a homestead rotation where the plots are small in size. Where tobacco is grown, a quarter-acre allotment could be part of a rotation like mine. Or a quarter-acre of tomatoes. Or potatoes. Or strawberries even. Or melons. With the price of good clover hay soaring out of sight (in 1975 anyway) even your alfalfa begins to take on the glow of a high value crop. At nearly $100 a ton now, good alfalfa is worth $500 an acre a year!

Planting Clovers

Clovers can be sown broadcast or by drill on top of the soil as I do or about an inch deep in tilled soil later in April or May. In some parts of the country clovers are sown in August if moisture is plentiful. Where winters are severe, August plantings can be risky and later plantings impractical. Seed that sprouts in September is highly likely to winter-kill.

On the other hand, if clover seed doesn't germinate, it can lay in the soil for years and still remain viable. Properly limed and fertilized (red clover and ladino like a nearly neutral soil and alfalfa demands it) the clover will suddenly germinate and grow. In my part of Ohio, a poor, overgrazed pasture can come alive with white clover as if by magic when lime and phosphorus are supplied.

By the same token, clover seed can be stored for years and still give good germination when planted. At farm sales, clover seed that has been hanging in a dry barn for years will bring a good price because farmers know it will grow. Not so grass seed.

When clover seed is broadcast in dormant barley or wheat or drilled in with oats or by itself in spring planting season, it grows perhaps only five inches by the middle of the summer. You can barely notice it if the wheat or oats crop is heavy. But after the grain is harvested, the clover spurts up to about a foot tall. It is a good idea to clip it after grain harvest to get late summer weeds. The clover seems to be invigorated by the clipping if done no later than early August.

Haying

The year after planting, alfalfa can be cut for hay at least three times. Properly fertilized, it will go on producing three cuttings for at least five more years. Heavy pure stands of alfalfa should not be grazed by livestock, as lush green clover can easily cause bloat. Pigs, however, will do very well

allowed the run of an alfalfa patch. Dry hay, of course, can be fed generously to livestock, all they'll eat.

Red clover is really good for only two crops a year. One cutting is taken in summer and the fall cutting can be made as hay, or threshed for seed. Hand threshing is fairly difficult, though done just as for wheat or any other grain. If you want to seed a very small plot, I would suggest harvesting that second crop as hay, then spreading the hay as a thick mulch over the plot the next spring. The seeds in the hay will sprout and grow, though perhaps not as evenly as if you planted pure seed.

Harvesting Seed

Alfalfa is harvested for seed in dry, western regions. It is not practical to combine it in the humid East, though you could seed over small areas as I described for red clover in the preceding paragraph. It's best to buy seed though from a local dealer who has the new varieties resistant to various weevils and disease.

Red clover can be harvested mechanically anywhere it will make a fall crop, as this late crop has time to mature and dry even in humid regions. Many clover growers believe that smaller, older combines do a better job of threshing out the seed than the big ones of today. The older models thresh more slowly, the straw is beaten and shaken inside the combine for a longer period of time, and so fewer seeds go on through with the straw, they say.

When clover seed is threshed with a combine, it still contains much chaff and often weed seeds. If not run through a regular seed cleaner and then dried, the seed will heat and deteriorate to the point where much of it won't germinate.

After cleaning the seed, spread it out—no more than inch thick if possible—and allow to dry for a month. Then it should be safe to bag.

To obtain small amounts of alfalfa or red clover seed for sprouting, pick mature, dry blossoms of either, let hang by the stems in some warm dry place for a few months (or as needed), then rub out the seed between the palms of your hand, winnow, and sprout.

Clover Economy

The economics of clover as a money saver and cash crop seem particularly enticing at this time, due to the good market for seed, hay, and the nitrogen fertilizer the legume fixes in the soil. Even chemical farmers are returning to seeding red clover in their small grains simply to save money on fertilizer. And the fact that clover can be interplanted right with small grains adds to its efficiency. It takes up no field space for itself during the first, nonproductive year of growth.

Red clover will, in its second year, produce about three tons of hay that this year (1975) is worth around $100 per ton in some parts of the country. Between one and two bushels of seed— usually closer to the first amount— are produced per acre from the second crop, with clean seed selling anywhere from $65 to $85 per bushel and sometimes more.

In the meantime, the clover is fixing in the soil around 100 pounds of nitrogen, or perhaps $30 worth at today's prices. Also returned to the soil, when the regrowth of clover is plowed under for green manure the following spring, is about $10 worth of potash and perhaps another $30 worth of nitrogen. To all this add the incalculable value of the organic matter the roots, stems, and leaves provide. In addition, while the field is in clover, it is not subject to wind or water erosion. Nor can I fail to point out that clover honey is the best there is.

Not counting intangible profits, the fertility, seed, and hay value of the crop in 1975 comes to somewhere between $450 and $500 gross per acre. That's equal to corn without corn's high cost to produce. It's a fact that even commercial, chemical grain growers are taking a long hard look at. For the organic homesteader, there's simply no other way as practical as clover rotations.

Chapter 12

Feeding Grain to Animals

At the risk of repeating a few things mentioned elsewhere in this book, I should discuss grain feeding in more detail. In a way, I hate to broach the subject, because in doing so there is no way to avoid the subject of animal nutrition. If you think there is a decided difference of opinion among experts over human nutrition, just multiply that difference to the fourth or fifth power in the field of animal nutrition. The best way to understand the problem is to recall the last 32 dog and cat food ads you have watched in anguish on TV and tell me the best way to feed my cat and dog.

The Animal Feeding Business

The same selling game colors the whole animal feeding business. Not only are there many commercial feed sellers, all with certified nutritionists on their staffs proclaiming their own feed is the best, but there are hundreds of other farmers and feeders all self-proclaimed experts with theories of their own on the best feed formulas for animals. Since all farm animal feeds use the same basic ingredients, all manufacturers speak with a measure of truth. Just remember that dogs and cats and cows and pigs lived a great many centuries without benefit of any of them.

Another way to look at feeding livestock on your homestead is to compare it with feeding babies, crude as that might sound. Some folks believe it is more convenient to buy a variety of canned baby foods at the supermarket, and believe, at the same time, that they are reasonably assured that baby is getting nutritious fruits and vegetables. But that does not mean, as commercial baby food manufacturers would like for us to believe, that mother cannot prepare her own baby food as nutritionally good or better than she can buy.

The Commercial Situation

If grain grinders for animal feeds were as inexpensive and easy to operate as baby food grinders, there would be little reason at all for the homesteader to buy commercial feeds, except to save him the time and labor of doing the work himself. Despite innuendos from feed salesmen to the contrary, farmers used to (and some still do) grind their own grains, add their own supplements and minerals, even vitamins if necessary, with quite satisfactory results.

Yet the first time you go to a feed store to try to buy feed or to get some advice on feeding your animal, most often the man in charge will seem to

believe (I'm convinced some really do believe it) that an almost mystical health value attaches itself to the sack of feed simply because it comes from a commercial feed company, or because it has been run through a commercial grinder; a mystical value that homegrown whole grains and homegrown processed feeds lack. It is as if the animal nutritionists who work for the commercial feed mills hold secrets of healthful food that the rest of us are not privy to.

Within the framework of modern confinement feeding of farm animals, that mystic faith has some justification. If hogs live their entire lives on cement and are fed through augers one diet of ground hog feed, then that feed better contain every known mineral, vitamin, protein, and carbohydrate that the hog needs, because the poor thing isn't going to get anything else to eat! And the fact that confinement-fed animals still do suffer disorders and disease directly related to nutritional imbalances proves that the scientists haven't yet solved all the mysteries involved.

The Homestead Difference

But more important for the homesteader, his hog lives an entirely different kind of life. The homestead hog may have the freedom to roam a field or large lot where by rooting in fertile soil and eating a variety of weeds, legumes, and grasses, the animal balances its own nutritional needs quite well. If the homestead hog is confined to a smaller lot, as mine is, it still receives a wide variety of feed including our table scraps, food which contains nearly all the nutrition my family seems to need, so why not Mr. Hog? He also gets a fistful of fresh alfalfa or alfalfa hay, the most complete natural food the farm produces, according to Ohio State agronomists. Some days I feed him a little soybean meal or meat scrap meal, which I have on hand mainly for organic fertilizer. In addition to corn and wheat and all kinds of garden residues, the hog gets an occasional acorn or hickory nut, an apple or a melon rind, and he can always root in his lot for worms, grubs, and roots. Does this lucky animal need the magic potions from Purina, Wayne, Agway, etc.? Hardly.

Why Grind Feed?

Grains are ground for animals primarily to put the feed in a form the animals can chew and digest faster; the same reason you grind up baby foods. If the animal eats faster in a given period of time, he will eat more and gain weight faster, and that's the name of the commercial game. But it need not apply to the homestead situation except where the animal can't eat the whole grain. Small chicks have to have their corn at least cracked before they can swallow it; the whole kernel is too large. Young pigs may get sore mouths biting hard corn off the cob and chewing it up. Lambs and colts—and even adults of some of any species—may refuse to eat oats because of the tastelessness of the oat hull, until the grain is rolled or ground.

On the other hand, a hen will just as readily consume whole grains as ground ones, and the grit in her crop will do the grinding and digesting. The only difference is she will not eat as much (her crop will hold more ground feed than it will hold whole grains and therefore more total food nutrients). Since in a homestead situation hens are more often overfed than underfed anyway, the homesteader can feed mostly whole grains with satisfactory results. My own 12 laying hens receive only a pint of ground feed every other day when they are penned up; when they are allowed to roam outside in summer, they will hardly eat commercial feed in favor of our own whole grains, greens, and what they glean from the woods and field.

I'm more inclined to use commercial feeds for baby animals, especially right after they are weaned. At that age, intake of vitamin A and iron is critical, and not necessarily available in sufficient quantity because of the small amount of rough homestead foods they eat at that time. Commercial "creep" feeds contain proper amounts of vitamin A and iron, and usually extra molasses or another tasty ingredient to lure the young, newly weaned animal to solid foods. But if I had my own grinder, I would certainly make my own creep feed, and if I thought my home-raised feeds lacked enough vitamins and minerals, I could buy them separately and mix them in. When I was a boy, we put a trough full of loam from the woods (soil that had not been farmed and therefore not depleted of natural fertility) in the pen with baby pigs. They rooted in that dirt and got their iron from it. Or so we thought, anyway. At least we seldom had anemic pigs. Commercial growers today give the pigs iron shots as a matter of course, although some veterinarians tell me that on farms operated according in the organic, balanced-fertility program espoused by "natural" farmers, iron shots can eventually be discontinued because the pigs get enough through sows' milk and foraging on their own from healthy soils.

Animal Nutrition

Animals need carbohydrates, proteins, fiber, vitamins, minerals: everything you need. They will eat all the grains mentioned in this book, all legumes and grasses and most weeds, especially young, succulent weeds. Some wild plants contain medicinal ingredients the animals instinctively know more about than we do, and such animals will generally be healthier in a slightly weedy pasture than in one where only one type of grass or two are allowed to grow. Variety is the key to feeding animals in the natural environment of the homestead. If your livestock has access to many kinds of food, you can rest assured they get a pretty balanced diet.

The only exception is if you live where soils are deficient in certain essential trace elements, like zinc or selenium. Where organic matter is high in the soil, trace element deficiency is extremely rare, but under intensive farming, zinc, boron, selenium, and other trace elements may be lacking. It has become necessary in some parts of the Cornbelt to add selenium to feeds

where once there was no such necessity. Some soils of the northern plains naturally contain too much selenium, too. But the likelihood of such deficiencies or surpluses being critical in your homestead situation is extremely unlikely. Check with your local nutritionists and agricultural advisers if you are in doubt.

Feedstuffs

Though grains will be the basic animal feed on your homestead, alfalfa, and to a lesser degree, other clover legumes, are the "best" all-around feed you can provide, not only grazing animals like cows, sheep, goats, and horses, but also hogs and chickens. Alfalfa experts point out that this legume comes close to being a complete animal feed. It contains high amounts of vitamins and protein and carbohydrates and even minerals.

Cows and sheep, don't forget, will sometimes bloat if they have free access to unlimited quantities of fresh, lush alfalfa or clover, or green corn or even kernels of mature corn. A cow, sheep, or horse, unlike a hog or chicken, has no sense about eating, and will keep on stuffing itself on food it really likes. So cows bloat on fresh clover and horses founder on too much grain. Clover or alfalfa for pasturing ought to contain grass to help control bloat. Turn the animals on it gradually, after filling them with hay first. And never turn them on a pure lush stand of clover. Birdsfoot trefoil is an exception; it is the one clover that animals won't bloat on, say the exeperts.

Corn is the principal grain in animal feeds, though barley, grain sorghum, even wheat can be substituted for it in larger quantities. Corn provides more energy per pound than the other grains, but is low in protein. In ground feeds, a little oats may be added to the corn, along with alfalfa meal, soybean meal, meat scrap meal, linseed meal, or cottonseed meal for protein, and bone meal (or other phosphate compound) for calcium and phosphorus. Trace mineral salt is added to commercial feeds, which is the main reason I continue to feed just a bit of them whether I really need to or not. You can also provide minerals and salts for your animals with blocks that the animals lick, available from feed stores.

Soybean meal is the principle protein supplement, though it doesn't contain the range of proteins some of the other meals enjoy. All can be purchased separately at feed stores if you wish to make your own feed mixture. Incidentally, commercial feeders stress protein—particularly soybean meal for hogs—because it speeds up the fattening process considerably. But you don't have to feed out a hog in four-and-a-half months on a homestead. If your hogs don't reach 200 pounds until they are six months old, what's the difference to you? That won't mean losing money as it would mean to the big commercial grower. It could mean saving money for you, but not using as much expensive protein supplement. Connoisseurs of pork, especially of smoked hams, maintain that hogs fattened more slowly produce better tasting meat anyway.

The next most important thing to remember (if not the first thing) when feeding grains, is that nutritional value varies considerably in any grain, depending on the soil in which it was raised, the weather, the variety, and the way it was handled and processed. This fact is what makes advising people on animal nutrition so difficult. Corn, for example, is not a standard, packaged item off an assembly line. Some corn contains more protein than other corn, *even within the same variety.* In recent tests, normal hybrid corns sometimes contained more protein than special high protein varieties, the difference being the soil, culture, and weather conditions. In processing, almost everyone today will admit that heat-dried corn is often less nutritious than naturally dried corn. And some feeders believe that old, open-pollinated corns are pound for pound more nutritious than the highly specialized hybrids of today. All of which means that the identical feed formula on two different farms might have a different nutritional value.

Feed Formulas

With that in mind, here are a few standard feed formulas for different animals.

Chickens

A ton of mash for laying hens can be made from 1,250 pounds of ground corn, 200 pounds of wheat, 100 pounds of alfalfa meal; 240 pounds of soybean meal; 100 pounds of meat scraps; 50 pounds of bone meal, 40 pounds of ground oyster shell, 10 pounds of salt, plus vitamins, if you think necessary. In my opinion, this is a better feed than if all the protein supplements were provided by one source, say soybean meal. With the variety you get a broader range of proteins, which to my way of thinking not only means a healthier animal, but more protein-rich eggs and meat, and a manure nitrogen capable of producing plants with a broader range of proteins in them. But you can make an adequate feed with just one of the protein sources mentioned, or two. If two, choose when possible one plant source (for example, soybean meal) and one animal source (for example, meat scraps).

For broilers a similar mix is fine. Usually in fattening poultry of any kind an all-mash diet will do a quicker job, as already noted. Not necessarily better, but faster. I feed my layers and broilers the same feed: whole corn, whole wheat, whole sweet sorghum grain, whole grain sorghum grains, some whole soybeans (the hens won't eat many), some broomcorn seeds (hens don't relish them either), millet, and buckwheat, if occasionally available; alfalfa hay, some grass hay: seeds, stalks and all; weeds gone to seed, sourgrass (high in vitamin C) when the hens are penned up and I think to pull some; eggshells, oyster shells, a little bone meal sometimes, table scraps, garden wastes of all kinds, and a little commercial mash as already

mentioned. They can forage outside about half the days of the year from spring to fall. I have had only one sick chicken in 12 years.

I feed new chicks bread and milk, fresh clover when they are about a week old onward, and keep commercial pelleted feed beside them at all times, for reasons mentioned earlier. I don't get chicks until June, and can let them run on the lawn and chase bugs and worms as soon as they are a week old.

Rabbits

Rabbits can be raised on very little grain, although rabbits being fattened for meat will produce a better quality carcass if at least half the ration is grain. Commercial rations in pelleted form contain alfalfa and other roughages, oats, wheat middlings, corn, or barley. I feed very little commercial feed and only to weaned, young animals to be butchered. Even they (eight of them at this writing) live mainly on top quality alfalfa hay, which they love, and a little whole wheat and corn. The corn is a little too hard for them to manage well and they drop some of it through the cage. Hard flint corns should not be fed to rabbits at all unless ground. They're too hard. I have fed oats, soybeans, millet and sorghum seeds to rabbits with good luck too, giving it to them stem and all. The rabbits nibble the grains out of the hulls themselves and like to chew on the straw. With tough fibrous material like that to chew on, rabbits do much less gnawing on their nest boxes, I have observed.

Cows

A dairy cow's grain ration can be very simple if her hay is high quality alfalfa. (In fact in some tests, cows fed a very high quality alfalfa hay did fine without any grain at all!) To every 1,000 pounds of ground corn and cob, add 10 pounds of bone meal and 10 pounds of salt. Instead of all corn, you can mix 700 pounds of it with 280 pounds of ground or rolled oats and add 200 pounds of soybean meal to get the necessary protein in the mix. A more nutritional concentrate for calves, if not cows, would be a formula of 21 percent corn and cob, 20 percent oats, 15 percent wheat bran, 11 percent soybean meal, 10 percent linseed meal, 5 percent alfalfa meal, 10 percent dried whey, 5 percent molasses (calves like candy just like kids do), 2 percent bone meal, and 1 percent salt. To that mix a commercial dairyman might add 2,500 I.U. of vitamin A and 300 I.U. of vitamin D. If you want calves as healthy as your children, and you think your children need vitamins, then you will probably want to give vitamins to your animals too.

After a calf is six months old, it should be able to thrive on a ration of good pasture or hay with very little grain. If the pasture or hay is not so good, give three pounds of grain daily. Two months before the heifer calves, start increasing grain ration up to eight pounds per day at calving.

Milking cows should be fed grain (along with roughage) according to how much milk they give. A cow producing 30 pounds of milk a day needs about 10 pounds of grain; if 40 pounds of milk, 15 pounds of grain; 60 pounds of milk, 25 pounds of grain; 80 pounds of milk, 35 pounds of grain. This is NOT a hard and fast rule.

Beef animals can be fed grain much like dairy animals, only more so. However, a beef steer or heifer for fattening can run on good pasture for eight to 10 months, with only a little grain fed on the side, increasing the grain in the last month (at 900 to 1,100 pounds weight or so) to give the meat a solid, higher quality. Beef animals have been finished almost entirely on grass and still dress out good meat, even when our weird grading system won't give it a Choice rating because grass feeding makes the fat yellow. If anything, yellow fat means the meat is higher in carotene and therefore more nutritional.

Years ago, a good neighbor farmer told me he finished out a carload of beef on hay and corn in shocks—feeding the shocks, ears, stalks, husks, and all—and he received an excellent market price for the animals. Again, the lesson is that there are no hard and fast rules.

Hogs

A standard formula for a ton of hog feed is 1,500 pounds of ground shelled corn (you don't grind the cob in for hog feed, but do for cow feed) and 500 pounds of protein supplement, in the form of mostly soybean meal plus a few meat scraps and some alfalfa meal. Another mixture, especially for younger pigs, would be 1,200 pounds of corn and 50 pounds of oats and 400 pounds of soybean meal; or 1,700 pounds of corn and 300 pounds of barley, either mix with trace minerals added if necessary. A little bone meal or other source of calcium and phosphorus is good for pigs too.

To feed a hog to 200-220 pounds butchering weight takes about 10 bushels of corn or its equivalent in other grains plus the supplement. I feed my fattening hog about one-third ground feed like that described above, and the other two-thirds whole corn, wheat, and other homegrown feeds as previously described.

Sheep

On good pasture, sheep require very little if any grain at all. Feed ewes a little oats daily for a week before breeding them. During the last third of her pregnancy a ewe can be given about ½ pound of corn or oats per day, starting at about ¼ pound and working up to a pound by lambing time. February and March lambs can be fed a mixture of 60 percent cracked shelled corn, 20 percent bran, and 20 percent soybean or linseed meal. At about 50 pounds of weight the lamb should receive a ration of about 90 percent corn and 10 percent supplement.

Lambs born in April and May (as I would advise all homesteaders to arrange) do not need early grain feeding. The lamb will get all the feed it needs from good pasture and milk.

Goats

Goats can be fed similarly to sheep, except for lactating does, whose needs more closely resemble those of a cow. The amount of homegrown grains you can use vs. commercial feeds follows the same guidelines as I have given for other animals with a decided bias in favor of the homegrown whole grains. In this regard, the *Gopher Goat Gossip,* a newsletter of the Minnesota Dairy Goat Association supports my experience. The newsletter reported last year a feed formula used successfully on a Minnesota goat farm as follows: 16 pounds of whole shelled corn, 16 pounds of whole oats, eight pounds of whole wheat, four pounds of soybean meal, and three pounds of molasses. Feed ½ pound daily to adult goats plus ½ pound for every pound of milk the goat is producing. Feed kids ¼ to ½ pound daily. In summer, with decent pasture, cut the ration by half. If you have good hay in winter, you can cut the ration accordingly.

Speaking of good hay, it is conceivably possible (though not very probable) that you could feed *nonlactating* goats (or other farm animals) too much high quality alfalfa. Alfalfa—good alfalfa—has a high calcium content. Male animals and dry females may not be able to handle all that calcium if fed a diet of too much alfalfa for a long period of time. Use common sense, and don't overfeed.

Horses

The usual danger especially in the case of teenagers and their pet horses, is feeding too much grain rather than too little. This can also happen and usually does, with pet cows, sheep, rabbits, and chickens. A saddle horse will do fine on good pasture with a little oats on the side. In winter, feed daily six pounds of oats, one pound of corn, ½ pound of linseed meal, and hay. Rolled oats, rolled barley, and wheat bran are other good horse feeds.

A mare with a colt needs six to eight pounds of grain daily—eight parts oats, one part corn, one part wheat bran—and mixed grass-clover hay. I quote from the sixth edition of the Midwest Farm Handbook (published by Iowa State University, Ames, Iowa, 1964): "When horses are fed a variety of feeds, including a legume hay, the mineral content of the ration is usually adequate."

That is usually true for most animal feeds in organic homestead situations, and it should relieve you of the fear that you aren't feeding your animals correctly if you aren't spending a lot of money on commercial feeds.

Turkeys

I think I'll continue to advise homesteaders against turkeys even though some reviewers of an earlier book considered me negative in attitude for doing so. Turkeys are touchy to raise indoors and risky to raise outdoors. But if you want to try it, you'll get a lot of laughs out of this clown of the poultry family, if it stays healthy. Feed turkeys the way you would chickens, more grain if destined for Thanksgiving dinner than if kept for breeding. Turkeys are tremendous foragers if allowed to run loose, and that is part of the problem. They voraciously eat insects that harm your garden, but they like vegetables equally as well.

Geese and Ducks

As long as they have access to green plants and some water, geese and ducks will get through a summer without any grain at all, but a little extra shelled corn won't hurt them either. When fattening the birds for market or building them up for a season of egg laying, feed more grain, as you would chickens. Goslings and ducklings can be fed chick feed to start them off in spring. Then after a summer of foraging, they'll need shelled corn in late fall and into winter. In January or February, in anticipation of the coming egg-laying season (or to fatten for eating if you did not do so in the fall) start them on a mixture of ground corn, ground oats, and ground alfalfa hay with soybean meal added to make a 16 to 20 percent ration. Follow formulas for hens or broilers.

Cats and Dogs

Both these animals are by nature carnivorous, and don't ordinarily eat plain grains. I have noticed our cats occasionally eat a bit of chicken mash, I think because they see the chickens eating it and believe they are missing out on something. Certainly, cats and dogs could derive nearly all their nutritional needs from a vegetarian-type diet, if balanced carefully. They like cooked grains—corn pone, mush, oatmeal, bread—but whether you want to spend the time cooking for them is another question.

The traditional farm feeding of cats and dogs was efficient and nutritionally complete. At milking time, the pets got a pan of milk fresh from the cow, daily. When hogs, beef, chickens, and rabbits or whatever were butchered, they got parts of the carcass the farmer didn't want. They caught rats, mice, and other rodents to the farmer's great benefit. And there were always table scraps to paw through. When I was a kid, buying commercial feeds was unheard of on our farm, and we always seemed to have about a dozen cats and at least one dog around all the time.

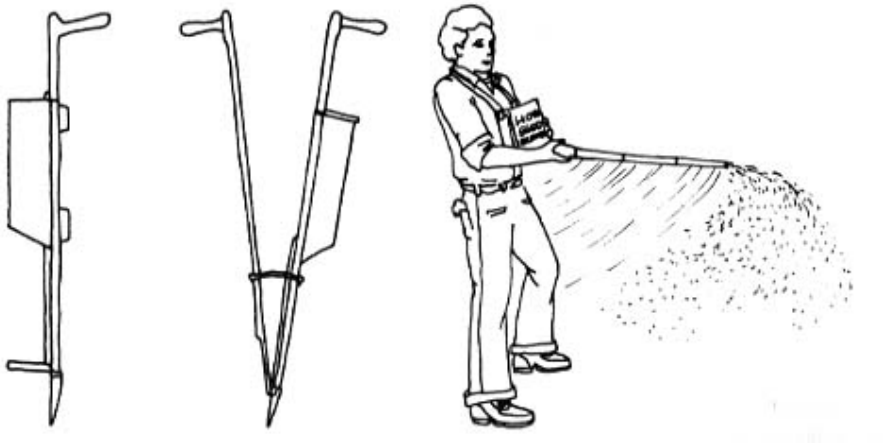
If you live the traditional farm way, you won't have to worry about feeding your cats and dogs. But if you don't raise your own milk and meat, you will

either have to cook your pets high-protein foods and grains or buy pet food to supplement table scraps and the occasional rodent the pets may catch.

An Illustrated Glossary of Grain Equipment and Terms

Planting

The Hand-operated, Hill-drop Jab Planter



For at least a century, most of the corn in this country was planted with this type of planter. Two variations on the same idea were built, but both of them (above) are basically glorified dibble sticks. The lower steel blade of the planter was jabbed into the ground and then by moving the handles, three or four kernels of corn dropped from the planting box through a planting tube into the ground opened up by the blades. When the point of the planter was pulled out of the ground, the dirt fell around the seed.

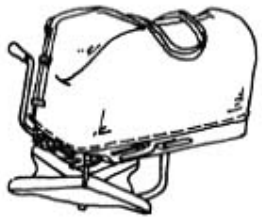
Even after these planters were more or less obsolete, farmers used them to replant hills of corn skipped by the horse-drawn planter. As a child, one of my less welcome chores was to replant with the hand planter, which by that time we always called the "replanter." I still have one in good working order. It is very handy for interplanting. For example if you have a row of corn up and growing and want to plant pole beans beside the cornstalks, the hand planter is just the ticket. You can walk along the row, plant the seeds where you will, and not disturb the soil around the already growing corn.

Fancy, new models of the jab planter are still available, and are used in research plot planting. They are available from manufacturers and suppliers of the seed industry equipment, such as Burrows Equipment Co., 1316 Sherman Ave., Evanston, Illinois 60204. Old, used jab planters sell commonly at farm sales. You might pay $5 for one, or you might pay $35. You can never tell at an auction.

The Horn Seed Sower

A picture is worth at least a thousand words to show you what this ancient invention looks like. It can be used to broadcast any seed you want to grow in a solid stand, and gives, in the hands of someone who knows how to use it, a more even distribution of seed than you would normally achieve just using your hand. Available from Nasco (Fort Atkinson, Wisconsin 53538, or Princeton Ave., Modesto, California 95352).

The Hand-cranked Broadcast Seeder



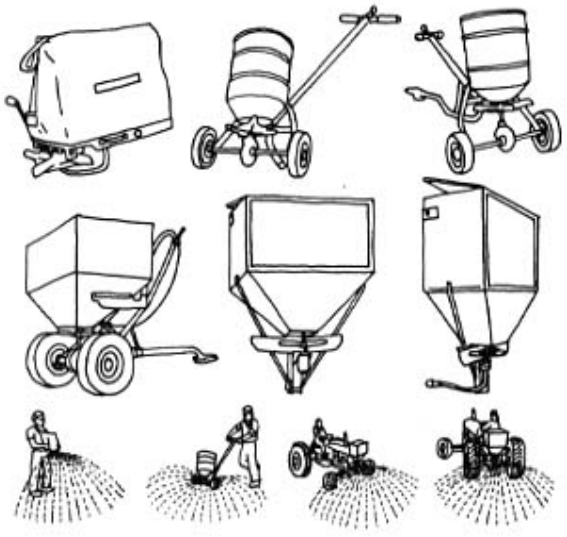
A further refinement of the horn, the broadcast seeder hangs by a strap over your shoulder. Seed in the canvas bag (or metal hopper) flows through an adjustable hole in the bottom onto a fan powered by hand cranking. The fan spreads the seed evenly over the ground. Adjustments let you alter your seeding rate to suit the crop. But remember that the speed with which you walk and turn the crank will also vary seeding rate considerably. You have to learn to walk and crank uniformly and then match the seeder's adjustments to your motions. Cyclone and Universal are the two brand names I'm aware of, available at or through most hardware stores and country catalogs. Models are light or heavy duty, the former for sowing seed only, the latter for spreading fertilizer and lime too. Don't try to spread fertilizer with the lighter models.

There is no more pleasant job on the farm than sowing a couple of acres of clover seed on a calm March morning with a hand broadcaster. The loudest sound you hear is the gentle whirr of the fan, and the birds singing. It is so

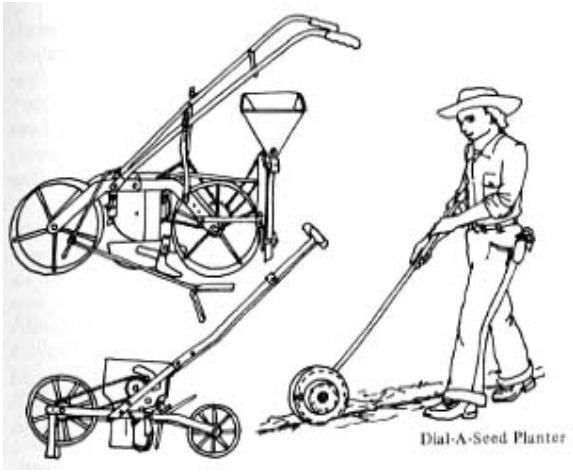
quiet you can hear the tiny clover seeds strike the ground. And the machine becomes so much a part of your body, matching its action to the motion of your arms and legs, that you feel more like you are playing a musical instrument like a guitar than operating a machine. In fact early broadcasters were powered by a bow and string rather than a crank, and the similarity to playing a violin, though crude, is hard to ignore.

Much larger broadcasters are powered by tractor PTO, and are capable of sowing many acres a day. The "ultimate" in broadcasters today is the airplane, which farmers are using increasingly to plant grasses and small grains. A far, harsh cry from the lovely quiet mornings of hand sowing with a Cyclone broadcaster over your shoulder. Ain't technology wonderful?

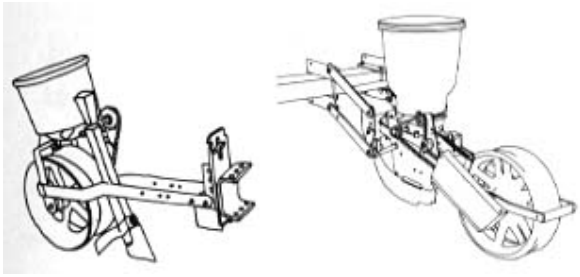
Hand-pushed Row Seeders



Small row planters mount the seed box on wheels (or wheel). The wheel not only carries the seed box but activates a disk or plate, as it is called, in the bottom of the seed hopper. As the plate moves around, it allows the seeds to fall through the planting tube into the soil at regular, uniform spacings. In the simplest row seeder of all, for example the Plant-Rite and Dial-A-Seed planters, the wheel *is* the planting disk. The smallest two-wheel seeder with changeable disks for different planting intervals is the light Esmay seeder, regularly advertised and sold through catalogs and garden stores.



A little larger and heavier, with a larger choice of planting depth and plates, are the Lambert, the Planet Jr., and one from Danville Manufacturing Co., Danville, Indiana 46122 sold by Sears. There are probably others. Lambert is headquartered at 519 Hunter Ave., Dayton, Ohio 45400; Planet Jr., Division of International Fastener, 4910 S. Boyle Ave., Los Angeles, California 90058.

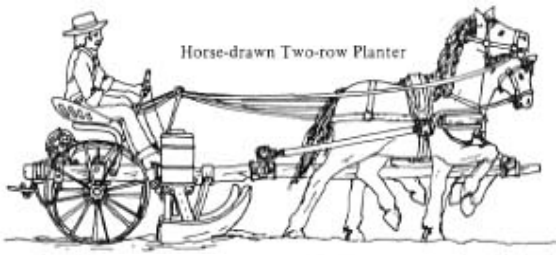


All these planters can be purchased in models that will attach to garden tractors and be pulled during the planting operation. Larger, heavier planters, like the Brinly-Hardy (Louisville, Kentucky 40200) and the Cole (Charlotte, North Carolina 28200) are designed for tractor use only, the Brinly for horsepower from eight to 18, and the Cole on up to perhaps 15-25 horsepower. These seeders attach to three-point hitch arrangements or other hydraulic lift systems.

Larger and heavier commercial farm planters of great precision can now be purchased as single-row planters if you desire. The new planters, like those now available from John Deere are called "unit" planters: each planting unit is powered by its own drive wheel, so you can use one alone or 20 together as big farmers do. You will have to make your own hitch arrangement to attach one of these units to your garden tractor, but the small commercial grower may find it quite practical to do so since these planters will do, generally speaking, a better job of planting than the smaller garden planters.

Two-row Planters

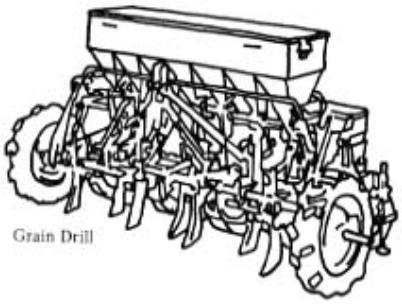
It may be practical with the unit planters mentioned above, to go to a two-unit planter if you are row cropping more than four or five acres. The smaller Cole is sort of a unit planter; two units can be put together quite easily. Old, obsolete two-row planters originally for horses or smaller farm tractors, also make fine tools for homesteaders with just a few acres to plant. But they are becoming scarce now. Old four-row planters are now easier to find, but are a little large for the typical homestead. However, you can modify one to a two-row model, or if you are mechanically equipped, can take a single unit from a four-row or two-row planter and convert it into a single-row seeder. It means, on four-row models especially, converting the press wheel that presses the dirt down on top of the planted seed, into a drive wheel to turn the planting plates. Older four- and six-row planters do not have a drive wheel for each unit.



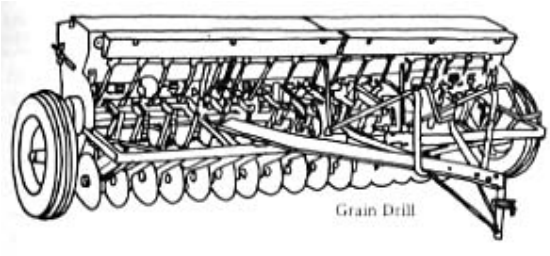
Normally, you can save quite a bit of money buying an old planter if it is still in running order. Be sure the planting plates come with it or can be purchased. This is not usually a problem now because very cheap plastic plates are made to fit most planter boxes. In fact, the plates are given away by seed corn dealers when they sell a farmer his seed. The seed dealer wants a satisfied customer and the plastic plates he has are made specifically for the size kernels he sells, and a different one for whatever plant population the farmer wants. But it is possible that on old and rare planters which you might chance to find, the plates would not be standard size so you would have to make sure it has plates with it or know where to obtain them.

Grain Drills

For planting seed in solid stands rather than in rows, the drill is used. (Small acreages can use small broadcasters much more efficiently even counting the light disking or harrowing necessary to cover the seed.) The drill gives more precise planting depths than broadcasting and harrow covering, and will result in better germination especially if dry weather follows planting. The drill puts seed into the ground more or less continuously rather than a precise number of seeds at precise spacings the way a row seeder does. It is used for cereal grains and grasses, and sometimes for soybeans if a solid stand is desired. Essentially, the drill is a long planting box with openings every six inches or so, from which planting tubes lead to the disk "openers" that run in the ground at planting depth. The disks open a shallow trench for the seed to fall in, and close the trench on the seed after it falls. On old drills, a small length of chain drags behind each disk to help cover the seeds too. The seeds are actually planted in rows, just inches apart, and when the grain gets up to six inches high the plants grow together giving the impression of a solid stand. The most common older drills plant a swath of seven feet in one pass, and this is about the right size for a homestead.


Grain Drill

Seeding rates can be regulated by controls under the seed box. The seed box may be divided into two compartments actually, and each side has its own control. Charts on the inside of the hinged box lids give instructions on how to set the adjustments for different seeding rates. On old drills you will have to experiment by putting a certain amount of grain in the box, then planting a known specified acre or portion thereof, and then see if the actual planting rate corresponds to what you have the drill set for. Compare and compensate accordingly. Those old cogs are worn and don't work as precisely as when the drill was new.


Grain Drill

Many drills, even old ones, have fertilizer boxes just in front of the seed boxes. Unless well taken care of, the fertilizer boxes may be badly corroded. Or completely ruined. This will not necessarily stop you from using the drill; you just won't be able to fertilize as you plant. In addition, some older and newer drills have special smaller boxes for clover seed so that when planting spring cereal crops like oats, the farmer can sow clover right along with it.

Seeding Rates

Charts make a book look impressive so I'm going to include a couple against my better judgment. There is some general agreement on "correct" seeding rates but they should not be looked upon as ironclad, infallible directives. Sometimes standard seeding rates are too high for a particular situation. (Rarely are they too low, because the rate-makers are almost always the same people who are selling the seed.) Seed producers have told me, privately, that in many instances, lower seeding rates allow the plants to grow more seed heads and so give a yield approximate to the heavier, prescribed seeding rate at less cost. This is especially true of soybeans. Plant them thin and they'll bush out more and throw more seed pods per plant. Plant wheat thin in good ground and it will tiller more and throw more heads. Corn planted for an 18,000 plant per acre population will produce larger ears albeit fewer perhaps, than at a rate of 26,000 plants per acre. Or produce more stalks with two ears. If you are farming organically without the intensively high fertilizer application of chemical farmers, you will get a better crop at 17,000 to 18,000 plant population than at the 22,000 to 28,000 rate. So use the following rate chart as a guide only.

Crop	Seeding rate per acre in pounds	Weight per bushel in pounds
Alfalfa	15	60
Barley	100	48
Buckwheat	50	50
Cane (sweet) Sorghum	10	50
Red Clover	10	60
Sweet Clover	10	60
Ladino Clover	2	60
White Clover	2	60
Field Corn	6-8 (for organic growing)*	56
Cowpeas	75	60
Flax	50	56
Golden Millet	45	50
Hungarian Millet	45	48
Japanese Millet	30	40
Oats	75	32
Field Peas	100	60
Rye	100	56
Rye Grass	25	24
Soybeans broadcast	100	60
Soybeans row seeded	40	
Soybeand drilled solid	60-80	
Spelt	65	40
Sunflower	6	24
Wheat	100	60

* On corn, better to use plant population as a guide. See below.

Don't be afraid to vary it up or down a little (especially down) if your experience, common sense, or necessity dictates doing so.

Plant Population per Acre

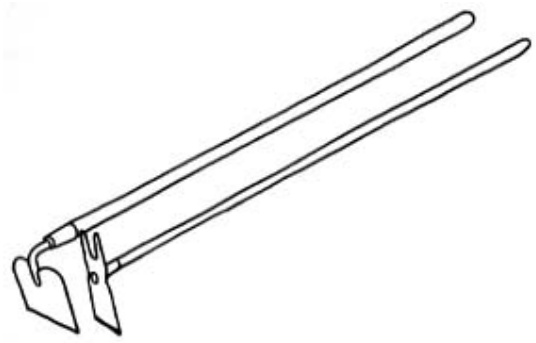
To determine the number of plants to the acre, multiply the distance between plants by the distance between rows in feet and divide that number into 43,560, the number of square feet in an acre. So in corn rows 40 inches (33 feet) apart, and plants in the row nine inches (.75 feet) apart, the number you get from multiplying the two is 2.47. Dividing that into 43,560, you get a plant population of a little over 17,600. That, in my opinion, is about right for organically grown corn. If you are using open-pollinated seed, or seed more than one year old, or planting early in the season, you might want to plant closer to 19,000 population to allow for kernels that don't germinate, or don't grow for whatever reason. On my acre or two of corn, I sometimes plant at that rate or a little more and then thin out to eight to nine inches between plants where necessary.

On other grains, plant population is not an issue. Seed rates are reckoned only by weight. But remember, the bushel weights of grain given above are only for good, dry, premium grain. An actual bushel of wheat may weigh less than 60 pounds, indicating that some of the grains are light, chaffy, and won't germinate. If you plant such wheat, use a heavier seeding rate.

Weed Control

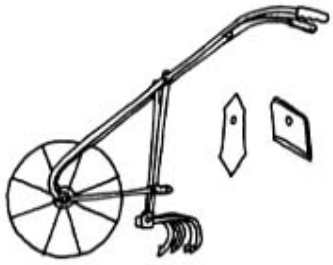
Hoe

This is still the best tool for weeding small plots of row crops, especially between plants in the row.



Hand-pushed Wheel Cultivators

A tool to cultivate between the rows faster than hoeing, the wheel hoe is practical on small up to medium-sized gardens. Several brands are marketed and are widely available. The high-wheel types push more easily. A variety of tine and shovel blades are available for them.

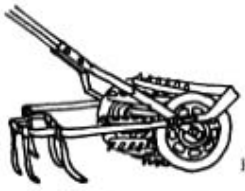


Rotary Tiller

Though thought of as mainly a soil preparation tool, the tiller makes a dandy weed cultivator too. Don't let it dig in but an inch or three when cultivating. Roto-Hoe is a power tiller with blades that take out weeds better than normal tiller blades. But many tillers now have different interchangeable blades for various purposes including weeding. The tiller made for the walking Gravely tractor is primarily a weed-cultivating tool.

Rotary Hoe

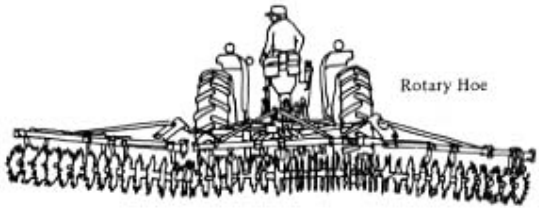
This is a wheel (or drum) of slightly curved, spiked teeth which when run through the soil at a fairly rapid speed, neatly toss very small, just germinating weeds out of the ground. Small, hand-pushed types are sold at garden stores or through catalogs, but the really effective kinds are large, tractor-pulled models that until recently were standard on all farms. (Herbicides are making them obsolete, at least temporarily.)



Ro-Ho Cultivator

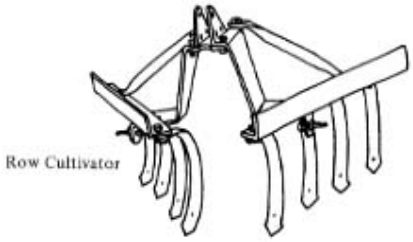
The rotary hoe is divided into sections each of which will weed a swath about three feet wide in one pass. It pulls easily and even the smallest farm tractor can tow two sections at the fairly rapid rate of speed necessary to do a good job, eight to 10 mph. The rotary hoe should be run over corn and soybean crops about three days after planting, before the grain is up. Millions of weeds are sprouting, and the rotary hoe will kill many of them.

The rotary hoe can be run over corn even after it is an inch above ground. You may throw out a stalk here or there, but no matter. (The harrow can be used to weed in this manner but it does not do as good a job as the rotary hoe.) This early pre-emergence cultivation is extremely important for organic growers. It is very important that corn get a head start on the weeds, and rotary hoeing insures that it does.



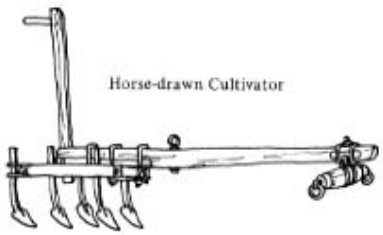
Row Cultivators for Garden Tractors

Many varieties here too, though perhaps the Brinly-Hardy and the Cole are better known. Incidentally, there aren't any Brinly-Hardy dealers as such. Or Cole either, I don't believe. Such lines of equipment are handled by various farm and garden machine retailers. Often, retailers in smaller towns do not keep such implements in stock and you will not find them in their stores. Ask for them. Sometimes the dealer (or his assistant) is unaware of a particular type of small farm equipment till you tell him to look it up in one of his catalogs. Believe me, I've had that happen.



Horse-drawn Cultivators

Even if you don't have a horse, some old horse cultivators can be modified to pull behind your garden or farm tractor, and if so, can save you money. I've got a one horse cultivator I bought at a farm sale for $12. The same or similar kind, through the Cumberland General Store Wish Book, Crossville, Tennessee 38555, costs many more dollars new. I can pull this cultivator behind my garden tractor.



Farm Tractor-mounted Cultivators

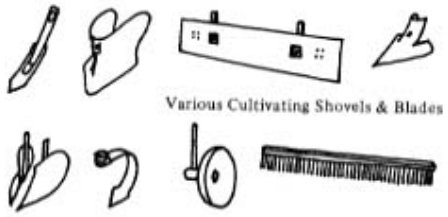
These cultivators, which weed two or more rows at a time, mount either to the front or rear (or both) of smaller farm tractors. Each tractor model has its own particular cultivator. The ones that mount on front or front and rear are usually devils to attach and take off. Unless you can afford to keep an older tractor around with the cultivators on it all the time, I don't advise going to all the trouble of locating cultivators for your particular tractor from used equipment lots.

Rather, look for the totally rear mounted, three-point hitch systems, which are comparatively easy to back up to, attach, and go to the field. Perfect for homesteaders is the old two-row cultivator made by Ferguson, Ferguson-Ford, and Ford companies for their little tractor of yesteryear. These cultivators will fit any three-point hitch, not just these particular tractors.

For small farm tractors, the Cole has a cultivator particularly designed to go with its planter. It works off a three-point hitch too.

There are four-, six-, and eight-row, rear-mounted cultivators, all somewhat too large for homesteads. But it might not be too ridiculous to buy an old four-row cheap and cut the outside cultivator gangs off so you can use it where you planted with a two-row planter. For instance, I may do that since my Allis Chalmers tractor has its own hydraulic lift system different from the three-point hitch. Four-row cultivators were made to fit the AC, and when I find one, I plan to buy it and cut it down to my size. The essential rule is: you can cultivate in one pass no more rows than the number of rows you plant in one pass. A two-row planter can be cultivated with a one- or a two-row cultivator. Not a four-row. A one-row planter can only be followed by a one-row cultivator.

Shields: All cultivators for tractors have shields that fasten to the cultivating shovels that ride nearest to the plant. The shields keep the dirt sliding off the side of the shovels from rolling on and burying small plants. You can even get shields for your rotary tiller, if you want to use it to cultivate close to plants.



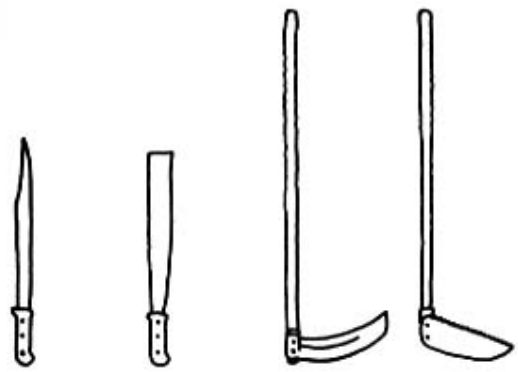
Various Cultivating Shovels & Blades

Shovel and Tine Cultivating Blades: Blades on cultivators come in many sizes and shapes. Shovel blades may be narrow and long, wide and short, diggers or sweeps. You can spend days fiddling around with various kinds to see which dig out weeds best and leave the least amount of furrow behind. I'm not about to tell you where and when to use sweeps because I'm not convinced that it matters. What does matter is that when using gangs of cultivators, each with its own depth adjustment, be sure all dig approximately the same level and none too deep. If too deep, a shovel can harm roots or leave a big rut in the middle of the rows. If too shallow, it won't get the weeds. Shovels should be adjusted deeper as the plants grow taller, and shields removed after plants are six inches tall or thereabouts. Then the dirt rolling off shovels will cover small weeds growing in the row and save much hand weeding.

Harvesting

Corn Knife

A corn knife is a long sword-like blade for cutting cornstalks by hand, or a long-handled cutter with a short sicklelike blade.



Husking Peg

Any of a variety of handheld tools called husking pegs are used to strip husks from ears of corn in the act of husking the ear. Some are very simple wood or steel pegs with a leather thong to hold the peg to the husker's hand. Others are steel hooks attached to a piece of leather that straps around the hand. I have one made entirely of brass that clamps to the fingers in a way that reminds me of brass knuckles.

Corn Binder

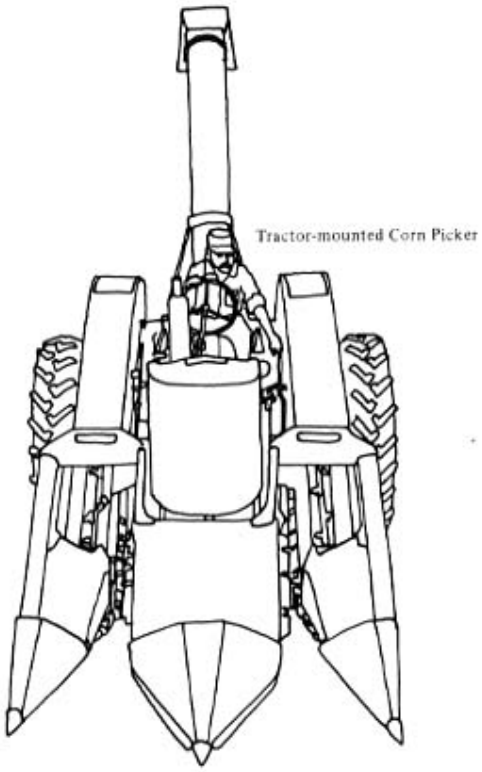
Rarely used anymore, a corn binder could still be handy on a homestead, if you can find one in running order. The binder cuts the stalks of corn with a small reciprocating sickle bar, bunches, and binds the stalks into bundles with an automatic tier. They were made for both horses and tractors, and some were powered by the tractor's power take-off. I have very intimate knowledge of the latter, since one such machine nearly killed me once and on another occasion nearly succeeded in breaking open my rib cage. Be careful around machinery; it is dangerous. Be especially careful to keep shields over power take-off shafts IN PLACE. I didn't. Another picture out of my past I will never forget: my mother singing and driving the horses and binder down the corn rows, while I rode one of the horses and my baby brother slept in a wooden box bolted to the binder tongue.

Grain Sickle

A grain sickle is a short-handled, long-bladed sickle used for centuries to cut cereal grains planted in solid stands, and still used in some parts of the world.

Corn Picker

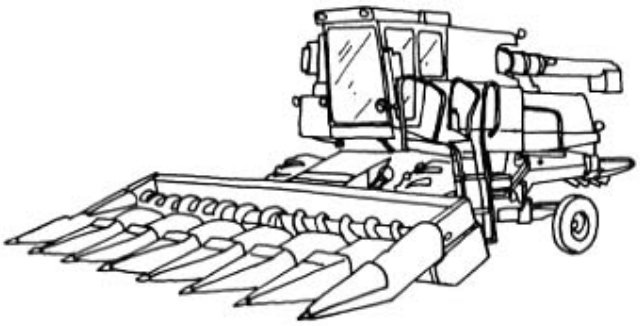
The commonly accepted colloquial name for the machine that replaced binders and the whole old method of harvesting corn is a corn picker. The picker did not (does not) cut the corn stalk off, but merely strips the ear off as the machine moves down the row, husks the ear, and tosses it into a trailing wagon. Old one-row pickers are commonly available in the Cornbelt and would suit many small homestead operations.



Tractor-mounted Corn Picker

Corn Combine

Now simply referred to as combine, since the same machine with a different header and screens harvests the other grains too, the picker-sheller is replacing the picker on most commercial farms. In addition to doing everything the picker does, this modern machine shells the corn too. For the all-grain farmer, this is one modern machine that really does improve the soil organically, since even the cobs are left in the field along with the stalks, all to rot back into humus. The machines are terribly expensive and out of the question on small farms, but if you hire someone to harvest your corn, which is often the most practical thing for you to do, this is the method and machine that will be used. So if you want to feed the corn plants to livestock and return them to the field as manure, you don't want to harvest with a combine obviously.

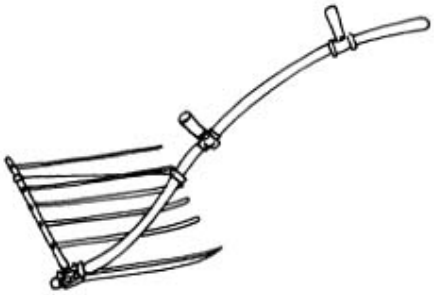


Grain Flail

Connect two sticks by a leather thong and you have a grain flail for beating grain from seed heads. A plastic toy bat works pretty well too, and a friend of mine says a piece of rubber hose works even better. Though obsolete, flails are practical enough for small garden plots of grain raised for your own consumption.

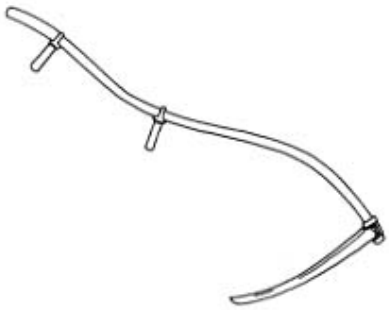
Grain Cradle

This is a special scythe with wooden fingers over the blade to catch the cut stalks and bunch them for easy tying. The cradle made the sickle obsolete in many parts of the world beginning about the 17th century, but curiously, not everyone adopted it. There was probably as much grain cut in this country in early days with a sickle as with a cradle. The latter was a good deal faster. Use of the cradle on small southern holdings was reported by USDA as late as the 1950s, believe it or not, and I suppose a few are still in use for harvesting small plots. I'd use one if I had it.



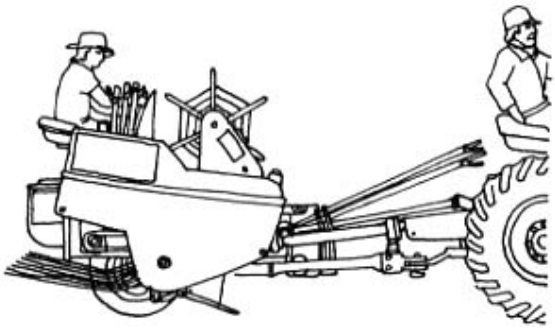
Scythe

Meant for cutting weeds and grass by hand, the scythe can be used to cut small patches of wheat for table use.



Grain Binder

A tool similar to the corn binder is the grain binder. It automatically cuts and binds small grains into bundles for shocking. Although usually pulled by horses, some late models were adapted to tractors. The grain binder is all but out of use now, except by farmers of particular religious sects who keep up the old ways because they are a lot smarter than we think they are. I used one as late as 1954 in Minnesota and know they are practical for small fields even today, if you have a machine thresher to go with it.

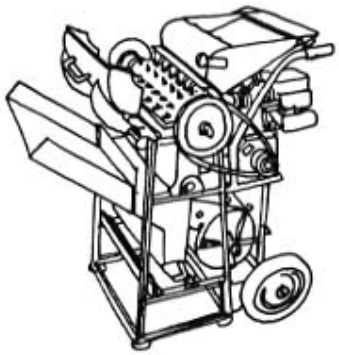


Winnower (or Separator)

Any system that separates grain from chaff, usually (or always) by wind power is a winnower. Grain can be winnowed by letting it fall from one bucket to another in a stiff breeze. Any type of fan works too. I use a big window fan. Mechanical threshers have built-in fans to blow away the chaff.

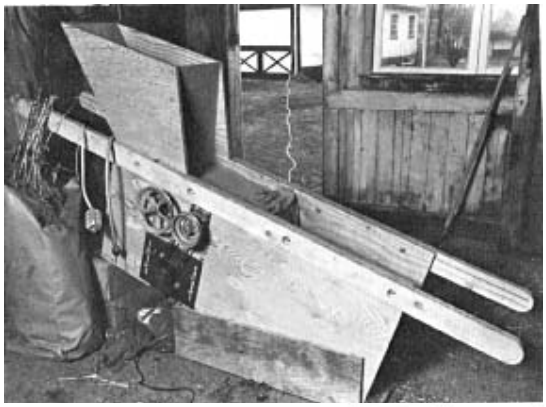
Grain Thresher

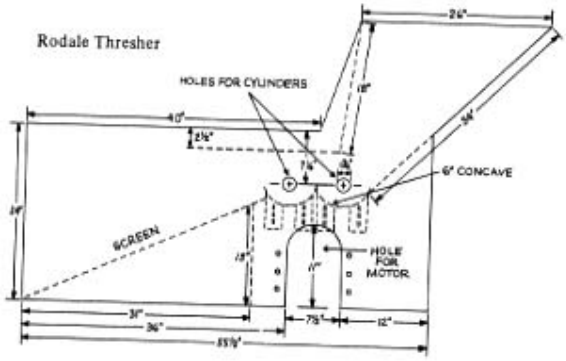
Any machine that combines the beating action of the flail and the winnowing action of the separator mechanically is a grain thresher. The huge stationary threshers on yesterday's farms also blew the straw into a large stack for winter bedding. These old threshers are seldom used anymore except in historical exhibitions.



Small threshers are still made and sold by the seed equipment industry. They are used to thresh seed in research and experimental plots. (See the chapter on wheat.)

Rodale Press's Research and Development folks have devised a homestead-scale thresher, which has been used at the New Organic Gardening Experimental Farm to thresh crops ranging from soybeans to amaranth. The machine is not fully refined, so a certain amount of hand-winnowing may be necessary. But it is an inexpensive alternative to the sophisticated and expensive seed threshers and cleaners on the market. It will separate most any cereal crop into seed and straw and can be operated by only one or two people. Different pulley sizes let you alter the threshing speed as best suits each crop.



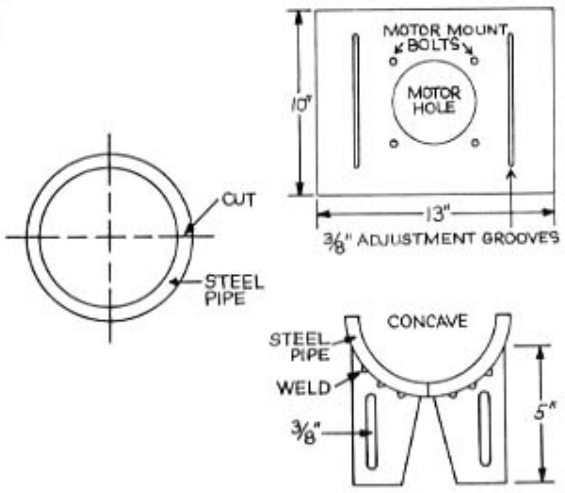


Materials:

2-4' x 8' sheets of ¾" exterior plywood or
2 sides (see diagram)
1 pc. 12" x l8"
1 pc. 12" x 34"
1 pc. 12" x 21"
1 pc. 11¾" x 5"
2 pc. 5 x 2½"
1 pc 10" x 13"
1' length of 6" steel pipe 3/16" steel plates
4 pillar blocks for ¾" shaft
14½' length of #1305/16" steel coil chain or
26 sets, 3 links each, 6½ "long
2-1½' steel shafts
misc. #10 wood screws
5/16" or 3/8" hex bolts and nuts
1½ horsepower motor with step sheaves
2-4" pulleys
1-6" pulley
1-8" pulley

Construction: Cut all the plywood parts for the thresher body as indicated on the materials list. The sides are formed as shown, and each must have a 7½-inch-wide cutout for the motor and two 1¾-inch holes for the flail shafts. Fasten the parts together with 2-inch #10 screws.

To make the flail shafts, cut the l4½ feet of chain into 26 three-link sets. Weld the cuts shut and mount the middle chain link on the steel bars. Arrange the three-link sets so they fit snugly together at 90° angles to the link next to them. Now weld them to the shaft. Once 13 links have been fixed to each steel shaft, then secure the shafts in place with pillar blocks, bolting them to the side of the thresher.



The next job can be done with a hacksaw but if you have access to an oxyacetylene torch, use it. Divide the 1-foot-long 6-inch steel pipe into quarters lengthwise. Then cut supporting plates from scrap steel with grooves for a sliding adjustment, as shown. Weld the steel supports to each pipe section and mount them below the cylinders so that the spinning chain links just miss the pipe basin.

The motor mounting plate will have to be adapted to your particular motor but you can use this illustration as a guide.

You may select pulley (sheave) sizes to fit your purpose. To make ours adaptable, we used a four-inch step sheave on the motor, a six-inch step sheave on one cylinder end and an eight-inch sheave on the other cylinder end. On the side opposite the motor, install two identical pulleys of any size; we used four-inch ones. Run a V-belt around them so that the shafts turn in unison.

Attach the motor to the mounting plate with four bolts. Hoist the motor into a good central position so that any change you may want to make is only a vertical one. Now bolt the mounting plate to the side of the thresher and adjust the height according to the V-belt fitting.

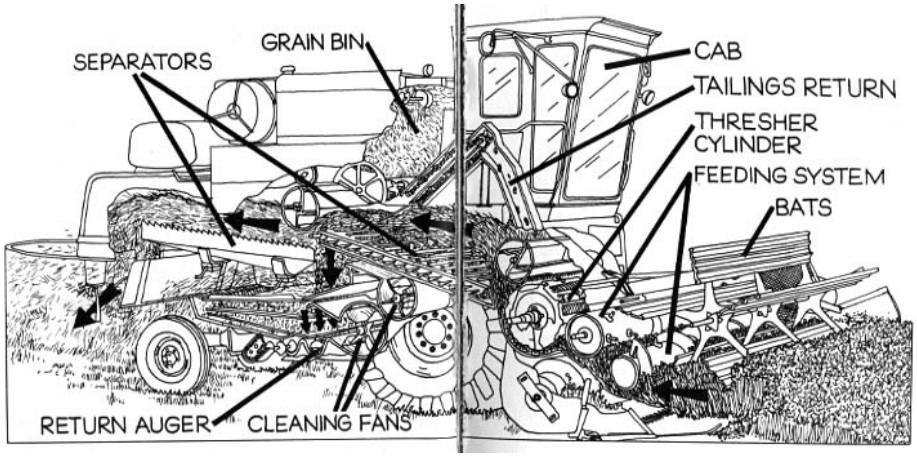
Operation: You'll need a screen of appropriate size for each different grain you want to thresh. Make a frame one foot wide and anywhere from three feet to five feet long to fit in right below the second concave. Beaten grain and straw will fly from the cylinders onto the screen. The smaller, heavier grain will fall, while the straw is blown on through. You may find it a help to brush the straw against the screen to help separate the seed. Two people are better than one for this job.

We found that the thresher worked better at a slow speed for larger items, like soybeans, and at fast speeds for the small items. You can be your own judge here.

Caution! Be sure to keep your hands away from the grinding chamber. If you are allergic to dust, you may want to enclose the threshing chamber better.

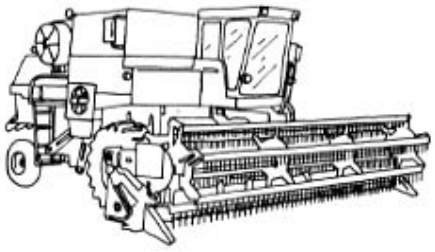
Grain Combines

This machine combines the work of both the binder and the thresher, hence the name, "combine." Minimum size now made for commercial farms cuts a swath 10 feet wide. Older, smaller combines varied from four- to seven-foot cutting widths, and would be very practical today for homesteaders if you can find one in good shape. It is not difficult at all to put $400 of necessary new parts into an old combine you get at a "bargain" for $100.



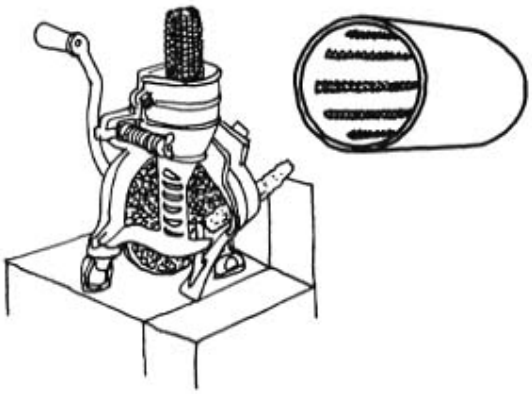
Very small combines are made for research plot work; universities and other institutions of sophisticated research are about the only customers for the expensive little things. One manufacturer is Kincaid Equipment Manufacturing Co., Haven, Kansas 67543. The combine sells for over $5,000, 1975 quotation.

Of the smaller, now more or less obsolete farm combines, I am partial to the Allis-Chalmers All-Crop because I lived with one so long I got to know its every quirk and foible, which were considerable. But unless you are quite mechanically minded and can get one for next to nothing, I think you would be better off to hire a custom combiner to harvest your crop.



Corn Shellers

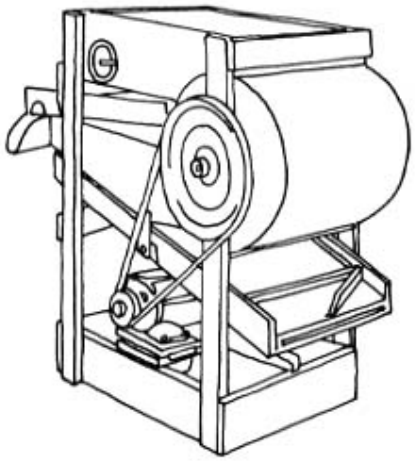
Most homesteaders will harvest their corn as ear corn and so might need to shell it for feeding to animals or themselves. Ground feed for chickens and hogs requires shelled corn, not to mention meal for human use. (For cows, the whole ear, cob and all, can be ground into the feed.) For shelling, every size implement has been made at one time or another, from a very small handheld sheller handy for shelling out your popcorn, to very large tractor-powered shellers that can shell out a whole crib full of corn in an afternoon. In between are hand-cranked shellers and small motor-driven models. Hand-cranked shellers are still available (Nasco and other country catalogs) but are not as effective as the old heavier ones you can still buy at farm sales that have their own wooden frame. These stand about three feet tall, and the crank has a flywheel that makes turning much easier on your arm.



Seed Cleaners

These machines were standard equipment on farms when farmers saved their own seed for planting. They had to get the weed seeds out, especially out of clover. Most farmers buy their seed each year now, a practice homesteaders might find reason to avoid at some real savings of money. Modern combines clean out the weed seed and chaff fairly well, older ones not so well and in either case, not well enough either for seed or for grinding for table use.

At almost every farm sale I attend, an old seed cleaner usually sells around $50. New ones cost from about $150 on up, available through the seed equipment industry sources already mentioned. Nasco has one; Sears sells one too. The cleaner "shakes" the grain across a series of screens where anything larger or smaller, lighter or heavier, is sifted or winnowed out. Some are hand cranked or converted to a motor. Quite fascinating to operate, I think. Pour dirty chaffy clover seed in one end and it comes out the other as so many million clean and lovely little yellow-reddish-grey pearls, while dirt, chaff, and weed seeds dribble out of separate spouts.

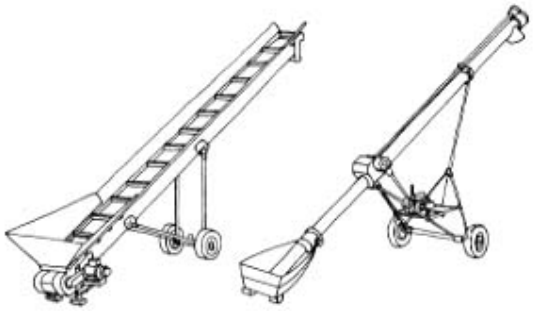


Bushel Basket

No farm worthy of the name ought to be without a metal bushel basket. Next to the pitchfork, no tool was more common in days gone by. You will find one most useful.

Grain Conveyor

You may on occasion hear this term and wonder. It refers to the long, metal troughs with conveyor belts or augers in them, the whole mounted on two wheels used to move grain from one bin (or wagon) to another. Grain is funnelled or shoveled into the hopper at one end, and is carried upward in the trough or pipe to the opening or window in the crib or bin being filled. Obviously one is necessary at least where crib or bin is too high to shovel into directly.



Corn Drag

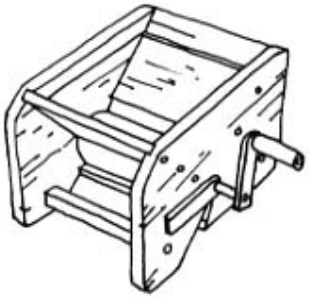
A fork with tines bent at right angles to the handle is a corn drag. It is for pulling corn piled in a crib down to the exit or door. Ear corn is notorious for sticking to its pile and rarely will roll down by gravity to the floor where you can scoop it into a shovel.

Scoop Shovel

Every homestead needs a scoop shovel if grain is to be handled by hand. Aluminum scoops are much lighter and therefore more desirable than steel ones.

Clover Huller

While most commercial hullers are quite expensive, at least one small hand-operated one is available (from Burrows, address already given). It will hull (which in this case means thresh out) any small seeds from the head like clover or grass seeds.



Rice Hullers and Shellers

Machines for processing rough rice to a condition where it can be used by man all seem to be of the large commercial size in this country. Smaller equipment is made in profusion in Japan and elsewhere, but so far I have not been able to find outlets in this country for the CeCoCo tools I mention in this chapter. The catalog address is CeCoCo, Chuo Boeki Goshi Kaisha, P.O. Box 8, Ibaraki City, Osaka, Japan. A most interesting catalog for the homesteader, if and when their products become available in this country.

Barley Pearler (Huller)

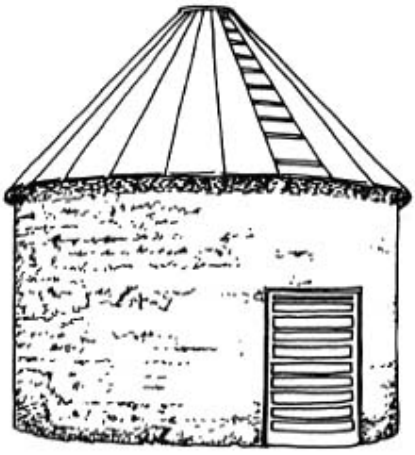
Both hand-powered and motor-driven barley hullers are available from the seed equipment industry (like Burrows already mentioned). A machine that dehulls barley ought to work on oats and buckwheat too. Worth at least a try, since I know of no other huller of this size or low a price available for grains like oats and barley.

Sorghum (or Cane Sugar) Press

You can, if you are very lucky, locate an old sorghum press rusting away in a southern barn. Otherwise, you have to find someone who operates a press and mill. I have stated flatly in previous years, that very few if any sorghum mills still operate in northern Ohio, only to find that I was very wrong. I now know two within easy driving distance of my farm, so I imagine this is true of most of the Midwest. And of course sorghum mills are common in the South. The Japanese company mentioned above (CeCoCo) makes a hand-cranked press or squeezer that I would love to own.

Crib

The term usually used for the building(s) ear corn is stored in is a crib. See examples in chapter on corn and below.



Diatomaceous Earth

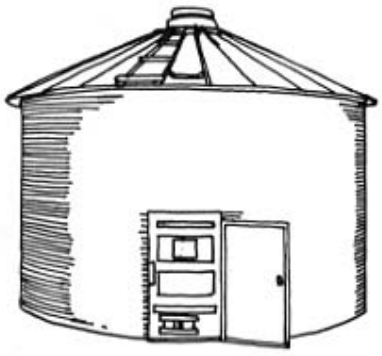
Diatomaceous earth is an organic insecticide that has been found to be effective in controlling insect infestation in stored grain, especially weevils in wheat. The material is a finely ground talc-like powder made from the fossilized shells of tiny one-celled plants called diatoms. See the chapter on wheat.

Neem Seed-Kernel Powder

This is a substance used to prevent weevils from infesting stored grain. It is used commonly in India. The leaves of the neem plant are also used for the same purpose. Scientific tests of this traditional practice have indicated that neem seed powder is effective against insects that feed externally on stored grain, but is not so effective on borer-type insects.

Bin

Any storage room for small grains, beans, or shelled corn is a bin. The difference between a crib and a bin is that the former has openings in the walls for air circulation to complete the drying of the corn. Bins for grains other than ear corn are of tight construction so that no kernel can leak out and no rain whatsoever can get in. Grain must be dried (13 percent moisture or lower) for bin storage unless special bin-dryers are present to blow hot air through the grain and dry it. See the chapter on wheat and the illustration below.



Dry Ice for Insect Control in Stored Grain

I won't vouch for either the safety or effectiveness of this method as I have no personal experience with it. People who use this method say it should be done this way: line a metal can (a clean trash can works fine) with two plastic bags, one inside the other. Pour about an inch of grain in the bag, put a piece of dry ice approximately the size of a walnut on the grain, then pour the bag nearly full of grain. Tie the top of the bags loosely so air can escape

as the carbon dioxide gas from the ice rises. Leave overnight, in which time the piece of dry ice will dissipate. Then tie the bags airtight closed and put a lid on the can. Store in cool dry place.

Carbon Disulfide

This was the old traditional control for bean weevils, though it is not one most organicists would approve.

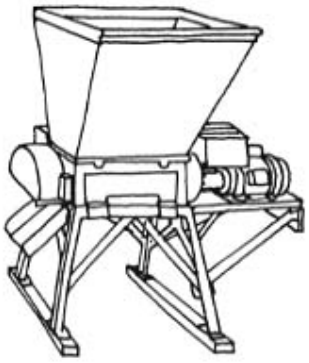
Cold Storage

Cold storage of grain is the easiest and safest way to keep them from becoming infested with insects. It doesn't take much space to store a goodly supply of wheat in a freezer or refrigerator. Some folks keep secondhand refrigerators in the basement for drinks. Why not for grains? Also a note of cheer. On corn, oats, barley, sorghum, buckwheat, and soybeans which for many years I have kept around my house and barn, I have never had problems with weevils or bugs. Only on wheat and dried beans and then only rarely. I believe the secret is to keep grain in bug-tight, or at least rodent-tight containers and use it up within six to nine months after harvesting, and never keep it more than a year.

Feed Grinders

Any of various machines to reduce grains to meal for easier digesting by animals or humans. There are three basic kinds: 1) burr mill with either stone or steel burrs, 2) roller mill, and 3) hammer mill.

Burr mill: the old-time gristmill of the ages, driven by water power, wind power, or mule power, is the best example. On farms, some steel-burr tractor-powered mills are still in use and in fact can be bought new. On all these mills, the principle, crushing grain between two heavy wheels, one stationary and the other revolving, is the same. New burr mills are available from or through farm implement dealers, who will probably try to talk you into buying a hammer mill or roller mill instead. If, however, you want to grind your own meal and flour for table use in addition to your animal feeds, the burr mill may be the one you want. None of the whole grain is lost in a burr mill, and generally speaking, it grinds finer (though you may have to run your meal through it twice to get the finest flour). Old burr mills are often available too, though you can probably count on having to replace the steel burrs.



Harrell Noble, who was homesteading years and years before the idea became fashionable, told me of his adventure in restoring an old burr mill to use:

"I had an idea that the mill could solve at least two problems connected with home-produced flour," he told me. "It could grind a larger volume of grain than the smaller mills on the market, and could grind (I hoped) finer than the old stone gristmill burrs."

"The mill I had in the barn my grandfather had used for grinding livestock feed. It is a burr-type grinder, one that operates just like the stone gristmills but which uses steel plates rather than stone burrs for the grinding process.

"I have a four-inch belt to run from the pulley on the tractor PTO to the mill pulley. (The mill was designed to run off a six to 12 h.p. motor). The tractor pulley had to be lined up perfectly with the mill pulley or the belt would run right off the pulley. This lining up requires a bit of jockeying the tractor around. Since the belt exerts considerable pull on the mill pulley, I had to stake the mill solidly with steel fenceposts so it wouldn't budge during the grinding operation," he continued. "Rather than try to grind the grain real fine in just one pass through the burrs and risk breaking something, I ground the grain three times, each time setting the grinding plates closer together. There's a crank on the mill to adjust the space between the plates.

"I poured shelled corn in the hopper, opened the gate valve that let the grain flow into the burrs, and we were in business. After the first pass, the cornmeal was rather coarse, but after the third grinding it was very fine and made absolutely delicious corn bread.

"Next we tried some wheat. Again I had to run the flour through the mill three times to get it as fine as I wanted. My daughter immediately made biscuits and did not need to add one bit of white flour for lightness. The biscuits were out of this world. Next day, my wife made yeast rolls, and that's when I knew for sure all the work had been worth it," he said.

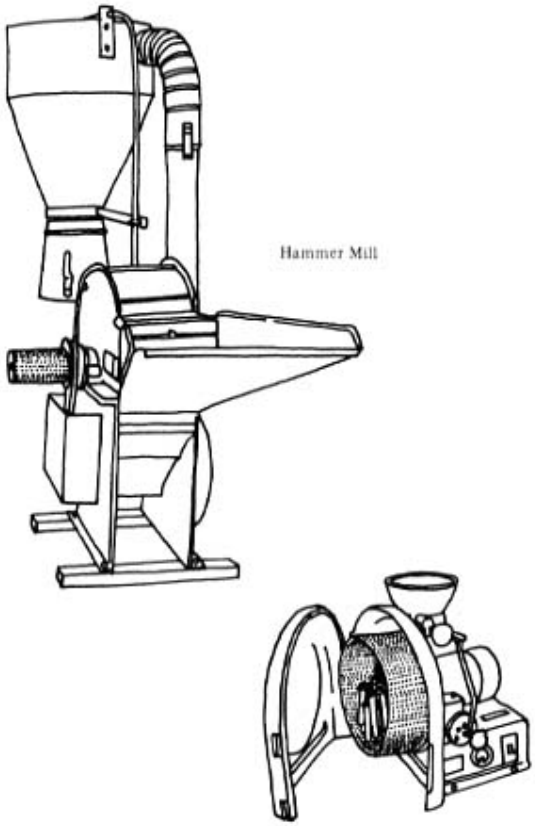
Noble's burr mill is a model made between 1909 and 1948. Burr-type mills are still made however. The first farm implement dealer I called had two used ones (about $300) for sale for which new parts were available. And I was assured new ones can still be purchased. Newer models are portable, that is, on wheels so they can be moved handily to where you need them. Many, if not all, newer portable mills are powered directly off the PTO shaft rather than by pulley and belt, and are therefore easier to set up for grinding. Whether any of the newer mills will grind fine flour for table use no one I've talked to seems to know, but most figure that if you proceed like Noble has done, you should get similar results.

For animal feed, the burr mills do a good job on shelled corn and small grains, but will not grind hay or other roughages. The burrs should not be run empty. They wear out fast as it is.

The Hammer Mill is most often used today to grind livestock and poultry feed. It grinds faster, but takes more power and is more expensive. Instead of having burrs for the grinding process, the hammer mill employs rows of free swinging, steel flails whirling at high speeds with more or less the same action as a leaf shredder. The screen under the hammers controls the fineness of the ground feed; the finer the mesh, the finer the feed. Hammer mills will grind all manner of feed, even mixed grains, ear corn, and hay.

Noble has a hammer mill also. Will it grind grain for table use?

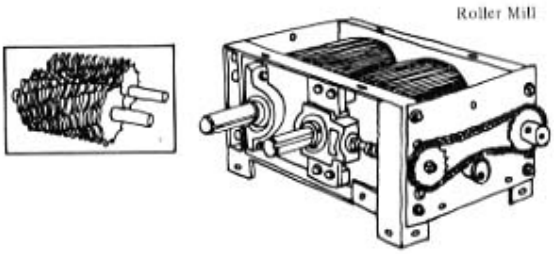
"I tried several years ago to grind cornmeal in my hammer mill. In two passes, with an 1/8-inch mesh screen, I got fairly good meal, though a little coarse. With a finer screen I feel sure a hammer mill would make good cornmeal. However, one of the drawbacks of the hammer mill is that it does not produce a feed of uniform texture. Some rather coarser material is always combined with some duty material. So you could make usable flours from all grains, but I doubt you'd ever get a truly high-quality, fine whole wheat flour for bread that you can get from a burr mill.

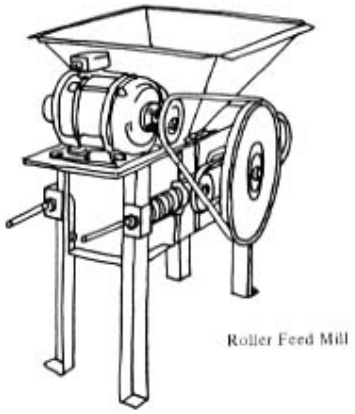


"For the animals though, a hammer mill is just the ticket. I use a ¼-inch mesh screen for grinding hog feed, usually shelled corn, oats, and alfalfa hay. I mix the grains beforehand, because I don't have a power mixer to mix the feed after grinding. For cattle I grind corn on the cob with oats, using the ½-inch mesh screen."

Roller Mills combine many attractive features for homesteaders. First of all, they are less expensive to buy, and require less power to run. Grain is mashed between two rollers running with the same kind of action as the old clothes-wringer. The roller surface is serrated, however, or cogged, so that the "teeth" on one roller fit the space between the teeth on the other. Grain can be merely hulled, or cracked, or ground quite fine. Some say not fine enough for table use, but plenty fine for animals. Better makes (and don't ask me to give brand names because I would only be going on some other opinion, having not tried to grind grain for table use in a roller mill), champions of the roller mill say, will produce a fine enough flour. Be that as it may, roller mills typically lose a little of the germ I am told. In fact, that is one reason why roller-type mills are used in commercial flour-making, they can be set to throw out all the germ or part of it. But by the same token, you, with your own little mill, can save that germ and feed it on back through. Well worth the extra effort if you need a dehuller, cracker, crusher, and grinder all in one machine. Also, with special crusher rollers, good

commercial roller mills will chop green corn, barley, or whatever into silage, and will handle any kind of grain, wet or dry.





Household Gristmills

Hand- or electric-powered mills with either steel or stone burrs, capable of turning out five to 50 or more pounds of flour per hour, depending on size, are available for household use. Hand-cranked models are best for producing a cup or two of freshly ground grain as needed. Stone grinders are generally recognized as grinding a finer flour than steel ones.

Be sure you know what you are buying and are buying what you want. A stone mill won't work long for grinding peanuts, or soybeans, or any high-oil kernel. Also some mills are designed only to grind wheat and similar-sized grain and will not accept a kernel as large as corn or as small as sorghum. Nor will grain with excess moisture (over 13 percent) grind well on a stone. On the other hand, good stone grinders do not generate heat that can ruin nutritional value.

An ordinary kitchen blender will substitute fairly well for a grinder. We grind our grains for table use with our blender, but it is a slow process.

Some manufacturers of household mills:

Lee Household Mill
Lee Engineering Co.
2021 West Wisconsin,
Milwaukee, Wisconsin 53201

Victor Manufacturing Company
8141 Seventh Southwest
Seattle, Washington 98106

Corona
R&R Mill Company
45 West First North
Smithfield, Utah 84335

Quaker City Grain Mills
The Other Way
P.O. Box 20
Grand Isle, Vermont 05458

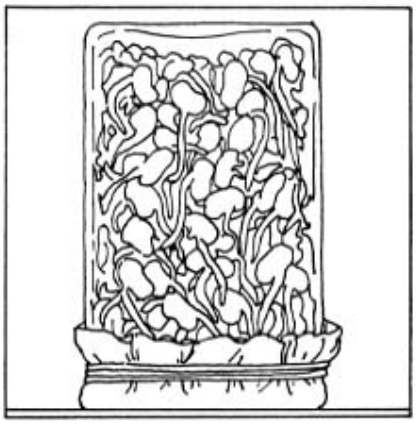
Retsel Inc.
McCammon, Idaho 83250

Burrows, Sears, and many other companies sell small mills.

Sprouting

Germinating grain and bean seeds quickly makes them more nutritious eating. Wheat, alfalfa, triticale, soybeans, rye, barley, oats, mung beans, lentils, garbanzos, and other seeds and beans may be sprouted, the sprouts eaten as a salad, cooked into casseroles, or used in many other ways.

Devotees of sprouted grain like to refer to what they call an explosion of vitamins that occurs when grain sprouts. Vitamin C content of soybeans, for instance, is known to increase as much as 500 percent during sprouting. Vitamin B2 content in oats increases over 1,000 percent in five days. Increases in vitamins A, E, and K also occur. In wheat, lysine content can double. When farmers used to feed sprouted grain to their chickens, no fowl ever had it so good. Unfortunately it rarely occurred to American farmers to try the sprouts themselves.

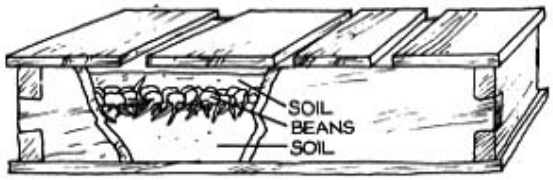


Sprouters

Any receptacle or set of equipment used to sprout grains for human consumption can be called a sprouter. Basically, all that such equipment must do is hold the grain in a moist condition, but not so moist as to cause mold to form. The simplest sprouter is a wide-mouth jar (or an earthenware bowl). After making sure your seeds are not contaminated with chemical treatments for field planting, allow them to soak overnight (12 hours) in the jar or bowl with a piece of cheesecloth, galvanized wire screen, or stainless steel screen over the top. Then pour off the water in the morning and add new. Keep the jar in a dark place at room temperature, and rinse the seeds several times a day. Stand the jar upside down, so the water can keep draining off the seeds between rinsings. The rinsings keep mold from forming. In about four days for beans, two or three for wheat, or about six for alfalfa, you should have succulent, tender sprouts to eat.

Earth Box Sprouter

The Chinese earth box method of sprouting avoids the need to keep rinsing the seeds. Presoaked seeds are placed in a wooden box partly buried in the earth. The bottom of the box is first covered with a layer of fine soil, two or three inches is enough. Then the beans are spread on the soil, but no more than two beans deep. Next another layer of soil covers the seeds. A cover on the box can be adjusted for more or less ventilation, to provide just enough circulation to prevent molds from forming. No rinsing, but of course when you harvest the sprouts, they will need washing.



Automatic Commercial Sprouters

A pretty fair number of sprouting devices are available commercially. Some reduce the number of rinsings necessary and some dispense with rinsing altogether. The latter kind use capillary action to draw water up to seeds. Seeds lay on strips of special cardboard, and are kept moist as if laying on a blotter.

The fault of all these sprouters, if they have a fault at all, is that only comparatively small amounts of sprouts can be produced at one time. In an effort to perfect an automatic sprouter that would produce sprouts more or less constantly in family-sized quantities, the research and development arm of Rodale Press has built a family-sized sprouter that is completely automatic. It uses hot water and more or less constant rinsing to inhibit mold development. Plans are available from the Research and Development Groups, Rodale Press, 33 East Minor St., Emmaus, Pennsylvania 18049.