Growing Your Own Grains

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Most of what are called grains are members of the grass family, which has the scientific name of Gramineae or Poaceae. Grains are the most important plants in human diet, contributing most of the carbohydrates as well as a certain amount of protein, vitamins, minerals, and fiber. Generally speaking, grains are quite undemanding in terms of soil or weather.

Unfortunately most of our knowledge of raising grain in small quantities with simple tools has been lost, or at least it is hard to find. Nearly all of the present-day research is geared to modern agribusiness — hybridization, genetic engineering, and very expensive machinery and chemicals. The information gained from such research would be of no use if anything went wrong with the technical or economic infrastructure. Grains are all that stand between the human race and starvation, but the human race has made very little effort to record the fundamental information.

For the purposes of survival and small-scale gardening, never get involved with hybrids or with genetically engineered grains; this is most commonly a question with corn. Hybrid grain cannot reproduce properly, so if you wanted more of the same you would have to buy again from the supplier. Genetically engineered grains pose a number of dangers, but the biggest problem is again that of reproduction, because such grains are often given a “terminator gene” that prevents you from regrowing such seeds. The excuse for creating such a gene is that the manufacturers need to recover the cost of research and development — sounds like science fiction, but it isn’t.

TYPES OF GRAIN

Wheat, barley, rye, and oats are grown in roughly the same way. The main difference is the hardiness of the grain. Wheat requires fairly good soil, and it cannot tolerate far-northern climates, whereas barley is less demanding, and rye will grow on almost any kind of land and in a great range of climates. Corn (maize) is a much larger plant, grown widely spaced, but producing abundantly. Buckwheat (which is not a true grain, although it is used in the same way) is worth considering, especially for cold climates or poor soil, although a crop is easily destroyed by a heavy rain. Proso millet (Panicum miliaceum) or sorghum (Sorghum bicolor) would be worth growing, especially on very dry land. Only a few types of grain are described below, but actually there are dozens of cultivated species. The world’s most important grain, of course, is rice, but it’s not a very practical crop for most of North America.

SPRING AND WINTER GRAINS

Many grains have “spring” and “winter” varieties. Spring varieties are sown in the spring and harvested in the summer. Winter varieties are planted in the fall and left to grow a little, until they are partly killed by the winter. It’s good to have a lot of snow in the winter, because the snow acts as insulation, protecting that grain from the cold and the wind. When spring arrives, those winter varieties will start growing again, long before spring varieties have a chance to get going.

The planting of winter grain involves a few risks. An unusually cold but snowless winter could destroy the crop. A heavy fall rain just after sowing could also destroy the crop. For that reason, it is best to sow winter grains a little more thickly, in the hope that part of the crop will survive the vicissitudes. Nevertheless, winter grains usually have a higher yield than spring varieties. Spring wheat might produce about 35 bushels per acre, while a winter variety in the same area might produce 40.

Another problem with winter grains is “stooling” — producing stalks. After the grain is sown, you expect it to grow a few inches before winter puts an end to growth. However, if you plant too early, or if winter arrives late, you might find that the plants have grown too much and have started to produce real stalks. Grain plants at that stage of their growth are more

susceptible to winter-kill.

In any case, even if your winter grain does not do well, you will know soon enough in the spring that you can make other preparations for a crop. You could, for example, plant a spring variety of the same grain, or you could use the land for some other type of crop, perhaps beans or potatoes. But don't try planting winter varieties of grain in the spring, because you'll only end up with a lot of long grass, not with grain.

SOIL AND WATER

Grains generally don't need rich soil to grow in. Corn, however, uses up nitrogen, so it is best to plant some kind of legume in the following year and allow the nodules in the roots to draw more nitrogen out of the atmosphere and down into the soil. Wheat also does better in rich soil, but it will produce a reasonable crop even in poor soil. In fact, in the nineteenth century wheat was grown in the United States for decades on the same piece of land without adding fertilizers and without crop rotations. Rye will put up with almost any sort of land. Oats prefer cool weather and a fair amount of moisture but are otherwise undemanding.

Most grains actually do best on land that is not high in nitrogen. Too much nitrogen (perhaps from chemical fertilizer) can cause "lodging" — the stalks grow too high, and as a result the plants fall over. The problem of lodging is intensified if there is a hard rain or hail, or a strong wind, or if people or animals have been walking in the field. (Grain at the "grass" stage is safe from feet, but not grain that has started to produce stalks.) The element that grains need for developing strong stalks is not nitrogen but potassium. The problem of lodging has also been lessened by the scientific development of more-resistant varieties.

For the most part, grain-raising is done without irrigation, i.e., without water of any sort except whatever falls from the sky. Since grain on a small farm is generally sown by broadcasting (scattering the grain randomly over the soil) rather than in rows, there would be no way of getting into the field to add water even if you wanted to. Grains are adapted to a fairly waterless environment, and adding water usually does no good. On the contrary, too much water might cause a crop to rot and die.

However, the weather is full of surprises. Even with the hardiest of grains, try to grow more than a year's supply. A severe drought can destroy a crop. A bad storm just before a harvest can do at least as much damage. Always have a surplus of grain from 1 year to the next, so that if you lose a crop you will still have enough to eat and enough to plant.

CULTIVATION

In North America, most grains are grown in roughly the same manner. Corn, sorghum, and rice are exceptions. But for wheat, rye, barley, oats, millet, and buckwheat, the process begins by digging or plowing the land. Then you broadcast the seed and rake the soil to cover it.

Grain grows best on loose, well-tilled soil. However, you need the grain to be about an inch or 2 (2.5-5 cm) deep, and the easiest way to achieve this with hand tools is to leave the ground fairly rough and lumpy when you're spading it. If you were to rake and smooth the soil before sowing the grain, you'd be faced with the problem of burying it. So broadcast the grain on rough ground, and then use the rake to get the grain properly covered.

The oldest and simplest way of sowing grain is broadcasting, although it involves more losses than fancier techniques. Put the grain in a bag that hangs to your stomach or waist and has a broad strap that goes down across your chest from one shoulder. Walk in a straight line from 1 end of the field to the other. Every couple of steps, throw out a handful of grain, either to the left or to the right. What is important is to get the grain to fall onto the ground at about 1 grain per square inch. If you're not good at estimating measurements, just remember that an inch is about from the tip of your thumb to the first joint. Don't worry too much about precision. Some of the grain will go too deep, some of it will be too shallow. You can also be certain that birds and other creatures will come along later to get their percentage — just accept it as "Nature's tax." When broadcasting, you should be able to cover a strip about 6 feet (2 m) on each side of you, so to cover the whole field you'll be walking parallel strips about 12 feet (4 m) apart. When you've sown all the grain, go over it with a rake to cover it.

If you're growing on clay soil, try to get the soil broken up a little more finely, and don't let the grain get so deeply buried. With sandy soil, the opposite is true: you might want to get it down at least 2 inches (5 cm).

An ideal day on which to do your broadcasting would be just before a rain. You should still use a rake to cover the grain, but the rain will do the final smoothing for you and preserve more of the grain from depredation by animals.

WEEDS

After you've sown a grain, it's often difficult to do any weeding, so weeds can be a serious problem, especially when you're working with a piece of ground that you have only recently converted from a wild or semi-wild state. Wild land may have many species of weeds that will try to compete with your grain crop. Weeds are a nuisance for several reasons: they will reduce the yield of your grain crop, they will add their own seeds to your harvest, and they could even ruin your stored grain if their leaves start to ferment and heat up. There are basically 3 solutions to the problem of weeds: intense pre-cultivation, row planting, and planting of another species.

Pre-cultivation involves digging or otherwise tilling the land several times. In early spring, dig the land once and turn up all the weeds so that they die from exposure. About 2 weeks after you've tilled the field, it will start to look green again, as a new crop of weeds comes up. Till the soil again, so that the new weeds are killed. If you have the time and energy, do the same thing again after another 2 weeks. By then, you should have a field sufficiently free of weeds for you to grow a successful crop of grain.

If you know that your land is still going to be producing lots of weed, you could try growing the grain in rows, so that you can walk around the growing plants and use a hoe to get at the weeds. F.H. King (239-41) mentions such a method of growing wheat in China about a century ago. The wheat was planted in "hills" (groups or patches) 6 inches (15 cm) wide, of about 50 kernels, with 2 feet (60 cm) from the center of 1 hill to the center of the next. The patches were arranged in long rows, or actually pairs of rows, with 16 inches (40 cm) between the rows. (The hills formed a zigzag pattern.) Each pair of rows was in turn separated from the next pair by a space of 30 inches (75 cm), thereby leaving plenty of room for cultivation of the crop as it was growing. The yield was about 700 pounds per acre (800 kg/ha) — not a great deal of wheat, but better than harvesting weeds along with the grain.

A third method of dealing with weeds is to start with another crop and crowd out the weeds before they get a chance. You could, for example, plant clover or alfalfa and dig it back into the field before it flowered. By doing so, you'd be adding a lot of nitrogen to the soil (because these plants are legumes), increasing the organic component of the soil (as the plants decay to provide humus), and loosening the soil (as the roots dig deeper), as well as smothering the weeds. Or you could plant buckwheat, which would not add nitrogen but would certainly create organic matter and provide you with excellent grain itself, before your principal grain crop.

TILLERING

A stalk of wheat is known as a tiller, but the term is more often applied to extra stalks that grow from the same grain. All grains produce tillers, although the tillers on corn are called suckers. Generally speaking, each tiller will produce 1 head of grain, with several dozen kernels per head. Tillering is always good, because more tillers per plant means a greater total yield of grain. Tillering tends to create a balance between how much you sow and how much you reap, because grain that is sown at low density will probably produce more tillers. By taking advantage of tillering, therefore, you can keep to a minimum the amount of grain you have to sow in order to get a good crop in return. Figuring out that balance requires a good deal of experimentation, but it will depend on such matters as soil and climate, as well as on the type of grain you're growing.

HARVESTING

A few months after it starts growing, your grain is ready to harvest. Hand-harvesting tends to shake up the plants more than harvesting by machine, so some of the grain might fall to the ground and be lost. To avoid the problem, the grain should be collected when it is still somewhat chewy, not completely hard. Pick out a few grains from time to time and test them to see what stage they're at. When they're at the correct stage, you'll notice that the entire plant has become a different color: about half green, half yellow. Another indicator may be the suddenly greater interest taken by the birds.

The yield on home-grown grain can vary anywhere from 600 to 6,000 pounds per acre (700-7,000 kg/ha), depending on the type of grain, the weather, and many other factors. At the low end would be rye, buckwheat, and millet, although these should produce roughly 1,800 pounds per acre (2,000 kg/ha). Wheat should produce about 2,400 pounds per acre (2,700 kg/ha), oats and barley perhaps 3,600 pounds per acre (4,000 kg/ha), although the hull-less types produce less. Field corn, however, might result in as much as 6,000 pounds per acre (7,000 kg/ha). The maximum figures here, of course, are rather idealistic.

When the grain is ready to cut, you'll need a good stretch of dry weather. Since it's summertime, you're pretty likely to get good weather, but you can never be certain. Do whatever you can to get the grain harvested on dry days.

Hand-harvesting generally means using a sickle. What you have to do is to bend down, grab a handful of grain, and then cut it off by reaching around it with the sickle and cutting it off. There's a lot of bodily movement involved, so go slowly and take lots of breaks, at least until you get used to it.

A sickle is a one-handed tool, whereas a scythe is for two hands and allows you to stand up. You can go much faster with a scythe than with a sickle, since you don't have to move around so much. There are 2 general types of scythe, one with a curved handle and one with a straight one. The type with the curved handle (actually double-reflexed, like an archery bow) is sometimes called "American style," although it appears in several other countries, and the straight-handled type is called "Austrian style," although it's not just Austrian. The Austrian style is not well known in North America, but it's far superior to the American style, since you don't have to bend your back constantly to use it. A lot of modern Austrian-type scythes have aluminum handles, which work quite well.

At this point, however, I should dispel a popular myth. Throughout world history, the scythe alone was almost never used to harvest grain. It was commonly used for cutting hay, but not grain. The problem with a scythe is that, by itself, it cannot lay the stalks straight enough for them to be gathered and bound. The solution, invented mainly in the nineteenth century, was to attach to the scythe a set of long, finger-like projections known as a cradle. It's possible to harvest grain with a scythe that has no cradle, but it certainly does a messy and wasteful job.

But the scythe with a grain cradle is not necessarily superior to the sickle, and the latter is still used in many countries. Scythes with cradles are heavy, they are dangerous (people sometimes cut their legs while flipping the stalks off the cradle and onto the ground), and they still do a less neat job than sickles, so grain tends to be wasted. A final advantage of a sickle is that you can leave a longer stubble if you wish to do so, leaving most of the stalk in the field; that longer stubble can later be dug in to replace the organic matter in the soil.

Cutting the grain is just one part of the harvesting process. After that comes gathering and banding. The sheaf (bundle) can be any size, although some people like to have it as big as can be held in 2 arms. In the old days, the sheaf was held between the legs and tied with a few stalks of the same grain; the stalks were wrapped around the sheaf to act as a band, the 2 ends of the band were put together and twisted 3 or 4 times, and then the twisted part was tucked back under the main part of the band to keep everything together. Nowadays baling twine or something similar does the job more easily but less cheaply; to keep the stalks parallel in the sheaf, cut the twine long enough so that it can go around the sheaf several times before being knotted.

Set the sheaves upright in groups of about ½ dozen, called shocks or stooks. Leave them outside for at least a month to finish ripening. Then put them together in a rick (stack): lay about 30 sheaves together on the ground with their heads inward, so that you're forming a tight circle with no space in the middle; lay more sheaves around this to form a wider circle; and then start another layer on top of the first circle. Continue until you've got about a dozen layers, forming a sort of cylindrical tower. Cover it with a tarpaulin. The rest of the work can be done whenever there's time available. Unthreshed grain will remain in good condition almost indefinitely, as long as it stays dry.

When you're ready to thresh, put the bundles on a clean floor (but not bare cement, since you'll never get rid of the grit) and beat them with a flail, which is a tool somewhat like a broomstick to which a shorter stick is attached with a leather thong. Or you just can pick up the sheaves and beat them over a horizontal pole, or even over the back of a chair. Actually almost anything can be used to beat the grain, and human or animal feet might do as good a job. All that matters is to get the grain free from the stalks.

The next stage is winnowing, to separate the grain from the chaff — the thin husks or scales that enclose each grain. One way is to wait for a windy day and then pour the grain from 1 container into a second which is placed several feet lower. As the grain falls, the chaff is caught by the wind and whisked away. A somewhat more laborious method is to use a fan as a substitute for the wind.

With oats and barley, the process is more complicated, because those husks enclose the grain completely to form a hull. You must first remove the hulls, and there is no really practical way to do this on a small scale. Hull-less (naked) varieties of oats and barley are available, and they may be suitable crops for certain regions.

Store the grain in any rodent-proof container, but be sure that your crop is quite dry before you do so. If you have any doubts about the dryness, keep it in a shallow pile and stir it frequently to keep the temperature to a minimum.

The grain is then ready to be ground into flour. If you wanted to be really old-fashioned, you would use one stone-shaped somewhat like a pastry-rolling pin, and another much larger, flatter, and perhaps concave stone. Nowadays it might be more practical to use a good hand-turned grain mill, which you could buy for about $100 or $200.

Part of your harvest must be put aside for the next year's planting. Grain that's saved for seed must be kept alive. That means that it should be really dry before it's stored. It's best to keep it outdoors, in the rick, for at least a month before you bring it in, thresh it, and store it. If you thresh and store the grain too early, it will heat up, which means that it will not

germinate later when you need it to.

COOKING

Bread can be made from yeast, sugar, salt, oil, water, and the flour of any grain, although the gluten in wheat produces a lighter loaf. Yeast-raised bread, however, has 3 disadvantages. In the first place, making such bread is a time-consuming process. Secondly, yeast-raised bread requires an oven; electric ovens are expensive to operate, while wood-burning ovens can be both hot and unpredictable.

Flat bread (tortillas, chapatis, etc.) is a lot easier to prepare, and it is always fresh because it is made just before a meal. My own recipe is very simple: take 3 cups (750 ml) of flour, 1 cup (250 ml) of cold water; stir and knead only until the flour and water form a thick dough; break off pieces the size of a golf ball; use a roller or your hands to make them flat and very thin; and drop each one onto a greased — or even ungreased — cast-iron skillet at medium temperature until cooked.

Bannock bread takes very little time to prepare. Mix 2 cups (500 ml) of flour, 1 tablespoon (15 ml) of baking powder, 1 teaspoon (5 ml) of salt, and 2 tablespoons (30 ml) of oil. (Dried fruit or nuts may be added.) Then add 1 cup (250 ml) of water and mix just long enough to get a uniform dough; if you play with it too long, the baking powder will stop working. Put the bannock into a heated oiled frying pan and pat the dough down to flatten it. Cook for 4 minutes on each side.

Perhaps the easiest way to eat grain is by boiling it. For each person, add ½ cup (75 ml) of cracked (roughly ground) grain and perhaps a pinch of salt to 1 cup of water. (This 1:2 ratio works for any grain, contrary to what you may have heard or read elsewhere.) Bring to a boil, stirring occasionally. Then put the lid on the pot and set it at low heat for about ½ hour; if you have a wood stove, the pot can be set on a rack on a cooler part of the stove. Serve it with sugar and milk as a breakfast food, or eat it like rice.

The kernels of grain can also be left whole and then roasted or boiled, or they can be sprouted slightly before cooking. Sprouted grains, when roasted, crushed, added to water, and left to ferment, form the basis for various alcoholic beverages.

WHEAT (Triticum aestivum and T. turgidum)

Wheat is easy to grow, since it doesn't need rich soil or much water. It's easy to process, because the grain falls away from the chaff. It's popular as a food because it's high in gluten, which is what makes bread both chewy and light. Overall, wheat is the most nutritious of grains, since it has a fair amount of protein and vitamins.

For wheat to grow well, the soil should not be acidic, wet, or sandy. Wheat requires a long growing period, generally about 150 days, with not too much heat but a good deal of sunlight. The annual rainfall should be between 15 and 35 inches (40-90 cm), and there should be a nice dry period during the harvest.

Wheat is subject to a disease called rust; agribusiness solves the problem by constantly creating new cultivars. As a small-scale grower, you are probably hoping to produce your own seed grain perpetually, so rust can be serious, especially in humid southern regions.

Some varieties of wheat are “spring” wheat, planted in spring and harvested in the same summer. Other varieties are “winter” wheat, planted in the fall, left to die down in winter, then harvested in the summer. Winter wheats usually produce higher yields but can sometimes be killed by severe winters.

Both spring and winter wheats can be divided into “soft” wheats and “hard” wheats, and also into “red” and “white” varieties. All kinds of wheat are interchangeable in cooking, but some kinds are preferred for certain purposes. Hard red winter wheat, used for making bread, is resistant to cold winters. It is commonly grown in the central United States. Hard red spring wheat, used for both bread and pasta, is grown in areas that are too cold even for hard red winter wheat: the north-central United States and the Canadian prairies. Soft red winter wheat, used for pastry, requires more moisture and cannot tolerate great cold. It is grown in the southeastern United States and in the Pacific Northwest. White wheat is not quite so common, but it is found in the Pacific Northwest, in the northeastern United States, and in parts of Canada.

Durum wheat, used for pasta, is a separate species, T. turgidum. Because it is the most drought-resistant of all wheats, it is grown in the north-central United States and parts of the Canadian prairies.

The best time to plant winter wheat is at the time of the first frost. The planting time is critical, because wheat that has begun stooling (producing stalks) is less resistant to cold weather. In addition, winter wheat should be planted after the danger from an insect pest called Hessian fly. Learn the “fly date” for your area, the date after which the insect is not active; this date will be roughly September 15. Spring wheat should be planted fairly early, perhaps 3 or 4 weeks before the average date of the last spring frost.

If you are broadcasting wheat, use about 3 pounds for every 1,000 square feet (1.5 kg/100 m2) of land, or about 100 pounds per acre (110 kg/ha).

RYE (Secale cereale)

Rye seems originally to have been a weed growing among wheat and barley, but around 3,000 B.C. it was being grown as a crop. Rye looks a lot like wheat, but the head is more slender, it tends to “nod” (bend), and it always has bristles, whereas some kinds of wheat have no bristles. Rye grains are longer than those of wheat. There is both “winter” and “spring” rye. Rye also appears as light, medium, or dark.

As a “survival” food, rye is an excellent choice. It does very well in cold areas, and it is highly tolerant of poor soil, doing well even on very sandy soil. It is also less bothered by birds than other grains.

Ergot sometimes infects rye. This fungus is easy to identify because it makes the grain black and swollen. Keeping your stored grain dry can help prevent this problem. Sowing seed that’s more than a year old may help, since the fungus doesn’t stay viable after that length of time. If you get ergot anyway, dump your grain into a mixture of 1 cup (250 ml) of salt to 4 cups (1 L) of water, stir until the infected grain floats to the top, and then dry out the good grain.

Rye should be planted in the same manner as wheat, but it will be ready to harvest about a week earlier. The yield will be slightly less than with wheat, barley, or oats, but the fact that it is so hardy means that you are less likely to lose your crop.

BARLEY (Hordeum vulgare)

The domestication of barley has a long history: farmers in the Near East were growing it 10,000 years ago. Barley looks like wheat or rye, except that barley always has 3 flowers in a cluster, whereas the flowers of wheat and rye are attached singly. Modern barley has either 6 rows of kernels on each head, or 2 rows, although an older form had 4 rows. Like wheat, barley comes in both “winter” and “spring” varieties, but winter types are grown only in the southern United States. If you have trouble with deer, you can get a bearded, rough-awned barley that the deer won’t touch. Alkaline soil is fine for barley, but not acidic soil, and it does better in clay soil than in sandy soil.

Barley may not be the most practical crop for small-scale gardening, because most modern forms have husks that adhere to the grain, and removing such husks really requires a pearling machine or a roller mill. It’s possible to put the entire grain through an ordinary hand-mill, but only if you like a highly fibrous product. There are hull-less (naked) forms of barley, however, and although their yield is not as great they might be suitable for the small farm.

The growing of barley has a number of advantages, however. The yield of barley is often better than that of wheat. Barley can stand much colder climates than wheat, and it has a great ability to withstand drought. Barley bread will not rise like wheat bread, but sprouted barley is the main source of malt, used in beer-making.

Winter barley should be planted at about the same rate as wheat, 3 pounds for 1,000 square feet (1.5 kg/100 m2), 100 pounds for an acre (110 kg/ha). Barley ripens a little earlier than wheat.

OATS (Avena sativa and A. nuda)

Like rye, oats probably used to be a weed growing among other crops. They were the last major grain to be domesticated, not appearing until about 1000 B.C. Oats have wide-spreading branches and flowers that hang down, very much unlike wheat, rye, or barley. There are both “winter” oats and “spring” oats, but winter oats can be grown only in very mild climates. Most modern forms of oats have hulls. Hull-less varieties (A. nuda) are available, but they yield less, are more subject to deprivations from birds, and do not resist cold weather as well.

Oats are predominantly a grain of cool moist regions such as Scotland. Oats do very well in cool weather, and should be planted as soon as the ground can be worked. The longer you wait, the less the yield will be. The crop will grow on most types of soil but does best on clay loam. The planting rate for broadcasting oats is about 120 pounds per acre (130 kg/ha), higher than for most other grains.

PROSO MILLET (Panicum miliaceum)

The word “millet” is applied to quite a number of grains, most of which have nothing in common other than being members of the grass family. One “millet” that is worthy of attention is usually called proso millet or broomcorn millet — the latter a misleading term, since brooms are made from sorghum, not millet. The plant is about 3 feet (1 m) tall, with somewhat thick and hairy stems and leaves. The head of grain is a large, many-branched cluster, drooping considerably when ripe. The grains are red or yellow, quite small and shiny.

In North America, this grain is used almost entirely as bird food, but it is actually an excellent food for humans. Millet is

quite easy to grow, broadcast in the same manner as wheat, but the yield may be less. It is ready for harvesting three months after planting, much more quickly than wheat. During a long drought, millet just stops growing and waits until the rain returns. The grain is quite undemanding in terms of soil, moisture, or weather. The shiny hulls are hard to detach from the grain, but there is little need to do so, because the entire grain can be ground to produce a mild-tasting flour.

SORGHUM (Sorghum bicolor)

Sorghum can withstand considerable drought, although it can't handle cold weather, and it is easy to harvest and process. It will grow in most temperate regions, including here in Ontario.

Sorghum grains are light to dark brown, round like peppercorns but about half the size of wheat grains. For planting, you need to wait until about 10 days after the last spring frost date. Sorghum will grow in the same kind of land that will support corn. Plant the grains about 4 inches (10 cm) apart, in rows about 30 inches (75 cm) apart, although in dry regions you'll need to use wider spacing. Then you'll need 100 frost-free days after that for the grain to ripen properly, so it isn't a particularly early crop.

A small amount of seed grain goes a long way: you need only about 8 pounds of sorghum to plant an entire acre (9 kg/ha) , as opposed to about 100 pounds of wheat per acre (100 kg/ha). The yield is also impressive: about 6,000 pounds per acre (6,700 kg/ha), as opposed to 3,600 pounds per acre (4,000 kg/ha) for wheat.

The mature stalk might be any length, depending on the variety, but again it will look slightly like corn, except that the grains are in a tight cluster at the very top. When the plants turn yellow-brown, cut off the seed heads and about a foot of the stem, and bring them inside, away from birds. You can tie them in bunches and hang them up, or you can spread the heads on a clean floor, but don't pile them deeply. Down south, the harvested grain might be dry enough for immediate threshing; in a northern area you might need to harvest the crop before it is fully ripe, so you'll have to leave it to dry for a few weeks. When the grain has been sufficiently dried, rub the heads to loosen the grain, and winnow to get rid of the bits of hull and stalk. The grain is then ready to grind.

Besides grain sorghum, there is also sweet sorghum, used to produce syrup, but sweet sorghum cannot be grown very far north. A type of sorghum that does do well in a northern climate is broomcorn, used for broom-making. Sweet sorghum and broomcorn are both planted a little more widely than grain sorghum: the grain should be about 6 inches (15 cm) apart, the rows about 40 inches (100 cm) apart.

CORN (Zea mays)

The word "corn" is somewhat confusing, because in England "corn" refers to any type of grain, while "maize" is the name for the plant that Americans and Canadians call "corn." In any case, the scientific name of the latter is Zea mays.

Most of the native people of North America grew their own food, and by far the most important crop was corn, which was first developed around 7000 B.C. Corn needs warm weather, but the natives nevertheless grew corn quite far north. Even the Huron Indians of southern Ontario had large corn fields, and there were large corn fields around what is now Montreal. All of the modern kinds of corn, which give us popcorn, cornmeal, "corn on the cob," and so on, are descended from Indian varieties of corn, although in those days there were far more varieties than we have today.

Nowadays there are 2 main types of corn, sweet corn and field corn, although these are not botanical distinctions. The former is the type that we usually eat as “corn on the cob,” while the latter is the type that is either ground into cornmeal or fed to animals. In general, the sweet varieties of corn are less suitable for drying, and they have more problems with diseases and insects. Field corn, on the other hand, is definitely worth growing. It has a higher yield per acre than any other temperate-climate grain, and (unlike some other grains) there is no complicated threshing or winnowing involved. In Canada, the United States, and Europe today, by far the most common type of corn is a field corn called “yellow dent.” Less common is “flint” corn, a harder type (hence the name) that lacks the “dent” at the top of the dried kernel. Popcorn, the most ancient of all the surviving types of corn, is actually a sort of flint corn.

In modern times, however, you’re unlikely to find varieties of corn that qualify as both “field corn” and “open-pollinated,” with the exception of those that are generally known as “Indian” or “ornamental” corn. As long as you don’t choose a variety that has too long a growing season for your area, you should do fine. Indian corn can be ground for cornmeal, or at an earlier stage it can be cooked in the same manner as sweet corn, although the colors don’t look so pretty if the ears are boiled. The types of Indian corn listed as “flour” corn are easier to grind and therefore more practical than the harder types.

Corn is technically the simplest of grains to grow. It has multiple uses as food, since the kernels can be turned into everything from soup to bread. The silk can be steeped to make a pleasant tea. But other parts of the plant are useful. The cobs, after the kernels are removed, can provide fuel for a campfire or stove. The husks can be made into rope, baskets, or dolls, and they make a good stuffing for a mattress.

There are, however, several drawbacks to growing corn. A common fungal problem is smut, which appears as large grayish lumps on the ears; be sure to burn these right away, since the spores can last for years — or eat them when they’re young, since they taste like ordinary mushrooms.

Insects are often the biggest worry. Corn earworms can devastate a crop. The most troublesome insect is the European corn borer; the larva is pale gray, brown, or pink, with a dark brown or black head.

There are no “organic” methods that will totally prevent insects from attacking your corn. There are, however, a few tricks that will reduce insect problems considerably: grow field corn rather than sweet corn; grow open-pollinated types; plant late; bury or burn all crop residues (the plants after the ears have been harvested); grow corn with longer and tighter husks (older varieties are best for this reason); keep your soil in good condition; and don’t peel back the tips of the husks to see if the ears are ripe (since that invites insects).

Corn is also a favorite food of many birds and mammals. One defense is to plant several kernels to a hole, in the hope that the animals will leave 1 to grow. Plant the kernels deeply, and step on them to keep them hidden. Another tactic is to post a guard over the field: dogs, children, and elderly people can be conscripted, and scarecrows might work. Or you could put up a high fence.

As food, corn has the defect that it is low in isoleucine and lysine, 2 of the essential amino acids that make up protein. To take care of this deficiency, you should eat corn with beans, which have roughly the opposite amino-acid composition. Corn is also low in one of the B vitamins, niacin (nicotinic acid), and again the problem can be remedied by eating beans.

Corn will grow on almost any kind of soil, although it does better on rich soil, high in nitrogen; it’s best to plant a legume such as beans, alfalfa, or clover, in the year before you plant corn. In the north, sandy soil is better, since it heats up more quickly in the spring. It also needs a lot of light, so don’t plant it where trees or houses are going to cast a shadow.

Plant your corn around the time of the last spring frost, but if you want to play it safe you might want to wait a few more days because corn is sensitive to cold weather. Just make sure you give the plants plenty of room: the kernels should be planted about 1 or 2 inches (2.5-5 cm) deep and about 2 feet (60 cm) apart, in rows that are 3 feet (1 m) apart. In an arid area, you might want to increase these distance. Many of the native tribes planted the kernels in clusters separated by perhaps 3 feet (1 m) in every direction; this method may have conserved water or ensured that a few plants would survive depredation by animals.

If you're growing field corn, you probably don't need to add water, but in an arid climate you may have to give each plant an occasional cup of water during the first weeks of growth.

About a week after you've planted the kernels, they'll appear above ground, and after that they'll grow at an amazing rate. If you lose any plants, just replace them. You can also try replanting, if you have some that need thinning out, although replanted corn doesn't always grow.

Each corn plant has a male part and a female part. The male part, at the top of the plant, produces pollen, which is so light that the wind should be able to blow it onto the female part of another plant. If this happens, the pollen mysteriously travels along the silk, and the result is germination. If the entire process is successful, the mature ear of corn will have all its kernels nicely filled out. If the pollination has not been entirely successful, you will notice gaps in the rows of kernels on an ear. In order to maximize the chances of successful pollination, it is important that each corn plant be surrounded by other corn plants. That is why corn should be planted in blocks rather than single rows.

Corn plants often have "suckers" (tillers), small stalks that rise up beside the main stalk. There is no reason to remove suckers from a plant, in spite of advice to the contrary. Actually, suckers provide more leaf area for the plant, which means that it can react further with sunlight to provide more food energy for its growth.

You could try growing corn, beans, and squash together, as the native people used to do, although the crowding of plants might create a problem with the consumption of rainwater. On the south side of the corn patch, about 2 weeks after the corn is sown, plant 1 pole bean beside each corn sprout. The beans grow up the corn stalk, utilizing the land more fully, and the beans replace some of the nitrogen that the corn takes out of the soil. You can also plant squash among some of the corn plants: put about 3 squash seeds in a hole, about 1 inch deep, a few inches away from the base of each of the corn sprouts.

Weeding is simple, since you can walk around the plants freely. Give the land a weeding before you plant the corn, of course. You can give the plants another good weeding as soon as they come up. Once the corn gets to be about knee-high, however, don't put the hoe more than an inch into the ground, or you'll damage the roots, which are quite close to the surface and reach out horizontally for a foot or so.

Unlike most other grains, those of sweet corn will not last long as viable seed — perhaps 4 years, perhaps only 1. You need to keep replanting it on a regular basis. But field corn will stay viable for many years.

When a crop has grown, look for the healthiest plants and the best ears, and save these for your next year's crop. You might want to be even more selective: from each ear, choose the best kernels from those ears, those in the middle rather than the ends of the ear.

Corn has a problem with genetic deterioration, so it should not be grown indefinitely from its own “progeny.” You can save some of the dried kernels and replant them to form the next year’s crop, but eventually you may find your corn plants becoming degenerate. To avoid such a problem, always mix the kernels from at least 100 plants if you want to use the kernels for the next year’s crop; 200 plants would be better. Even if you have that many plants to choose from, it would be best to refresh the gene pool of your corn field by occasionally introducing new seed from elsewhere. (For the same reason, if you want to grow “Indian” corn, you should buy a package of seeds, instead of relying on 1 or 2 ears from a Thanksgiving decoration.)

In late summer, when the corn begins to ripen, you can pick some of it and eat it as “corn on the cob,” just as with sweet corn. To remove an ear, grasp it firmly, then twist it while you bend it downwards. You can leave the husk on and place the ears in the ashes of a fire. Most of the ears, however, should be left until the plants have gone brown and dried. The ears can then be brought inside. Pull the husks back and hang the corn up to dry.

Actually there are several ways of harvesting corn. Some people prefer to cut the plants close the ground, stack them together, and then tie them, somewhat in the manner of harvesting wheat, instead of removing the ears immediately. The plants can be left that way to dry for a few more weeks.

At some point you have to get the roots out of the ground. You might find that you can just pull up the entire plant, although that can be tiring. Or you can dig them out with a spade or shovel.

The native people crushed the kernels into flour in a huge wooden mortar and pestle, or the crushing was done with 2 stones, the bottom one wide and flat, the top one smaller and rounder. The finished cornmeal was used to make soups, pudding, or bread. Nowadays a good steel hand-mill does a quicker job.

BUCKWHEAT (Fagopyrum esculentum)

Buckwheat is quite unrelated to any of the other grains. It’s not a member of the grass family at all, but of the Polygonaceae, which also includes dock, sorrel, and knotweed. Buckwheat plants are delicate, succulent plants that grow about 3 feet (1 m) high and have heart-shaped leaves. The plant produces a cluster of white flowers that eventually become pyramidal black seeds.

Buckwheat can handle the poorest of soils, and is often used as a green manure, dug into the soil to improve it. Because it grows in such luxuriance, it is often used to smother weeds before planting other crops. The only problem that might occur is that the stems are somewhat fragile, so a heavy rain can do a lot of damage. Buckwheat will grow well in hot weather, but it needs cool weather later in order to produce seed. On the other hand, frost can quickly kill buckwheat.

Buckwheat should be planted an inch or 2 (2.5-5 cm) deep, at a rate of about 35 pounds per acre (40 kg/ha), or perhaps double that amount on poor soil. For 1,000 square feet (100 m2), you’d need about a pound (0.45 kg) of seed. If you want to use it as a cover crop or a green manure, you’d need to apply about 3 or 4 times that amount.

You can plant buckwheat for grain up to 12 weeks before a severe frost. But if you’re growing it for that purpose, you should plant it so that the seed will form in cool weather. Spring planting can be risky if you want grain, because warm weather might arrive too quickly; midsummer is a better time. If you’re growing it merely as a cover crop, you can do so at any time between spring and midsummer.

Under ideal conditions, you might get a yield of between 1,000 and 3,000 pounds per acre (1,700-3,400 kg/ha). One problem with buckwheat is that the grain doesn't all ripen at once. Most of it will ripen in about 90 days after planting, but some will ripen in 70 days, some in 110. Try to estimate the point of maximum yield, so that you're not losing too much. The plants can be cut, bound, shocked, and dried like other grains.

The black hulls don't detach easily from the soft white inner portion of the grain. It's possible to toast the grain, grind it, and use a flour sifter to remove the bits of hull. But there's no real need to remove the hulls, since they're fairly soft; you can just grind up the entire grain.

Buckwheat supplies several kinds of food. In North America, the most familiar is buckwheat pancakes. The whole grain, however, can be cooked like rice. The leaves can also be eaten, either raw or cooked.

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