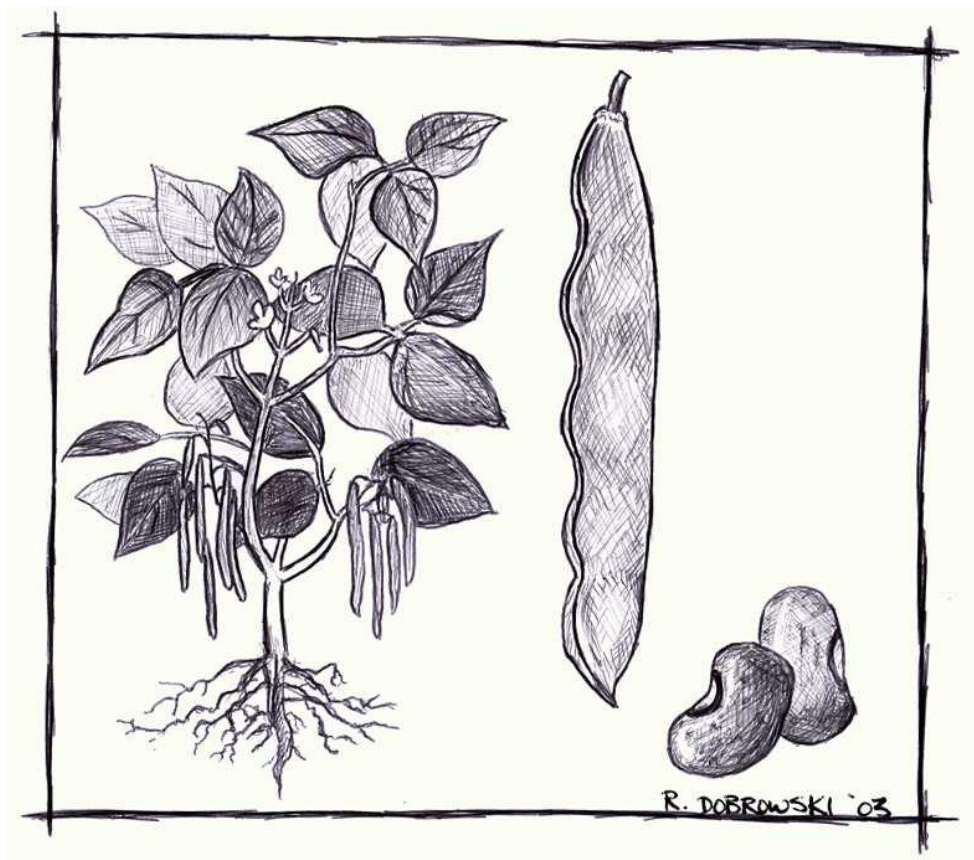


**Plants and Macronutrients** (Macronutrients include carbohydrates, proteins, fats and water.)

Many parts of plants are important sources of food for us. Examples include:

1. **Stems:** celery, asparagus, bamboo shoots, rhubarb
2. **Leaves:** lettuce, spinach, cabbage, basil
3. **Flowers:** broccoli, cauliflower, asparagus
4. **Pods:** pea pods, snow peas, green beans
5. **Fruits:** apples, peaches, berries, tomatoes, cucumbers, winter squash, almonds
6. **Bulbs:** garlic, onions
7. **Roots:** carrots, radishes, beets, taro root (poi is made from this), cassava (also called manioc and its starchy part is sold as tapioca)
8. **Tubers:** potatoes
9. **Seeds:** all of these are seeds:
  - Grains: wheat berries (used to make flour), rice, barley, oats (oatmeal is a rolled oat seed), etc.
  - Dried Legumes (seeds that were in a pod): kidney beans, peanuts, soybeans, split peas, lentils, etc.
  - Seeds: sesame seeds and sunflower seeds

## Selected Food Crops: Growing and Processing

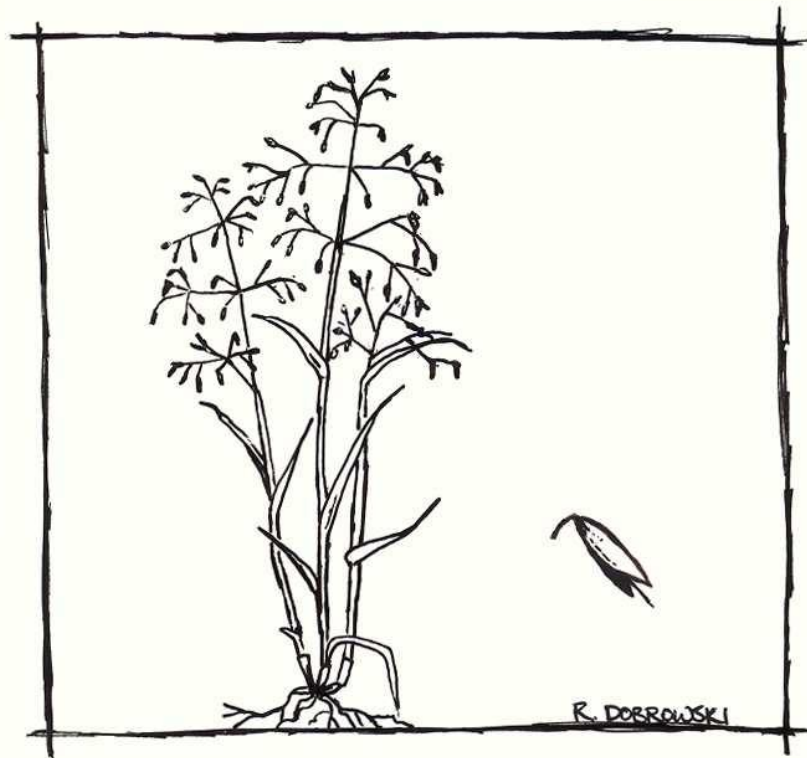


### DRY EDIBLE BEANS

Dry edible beans are legumes (seeds or "peas" in a pod) and they enrich soil with nitrogen. They are excellent sources of **protein** (which the bean plant uses to provide amino acids to build the sprout), **starch** (which the bean plant uses to provide glucose to release energy for sprouting) and **fiber** (BOTH soluble fiber which the bean plant uses to help hold onto water and insoluble fiber which the bean plant uses for structure). They are LOW in fat (except for soybeans which have a fair amount of polyunsaturated fatty acids). They are also excellent sources of many B-vitamins and many minerals and also a variety of phytochemicals.

**Growing:** Dry edible beans have viny plants which either grow upright like a bush or spread evenly across the ground. The beans are planted in late May to mid-June, typically grow 24 inches tall and take about 3 months to mature. They are drought-resistant partly because the bean plants make **soluble** fiber. The bean seed grows in a pod and it's this seed that we eat. Harvest begins in early September [*beans eaten as the fresh "pods, which we know as green beans, begin being harvested in July*], when the plants are dry and the leaves start to fall off the plants.

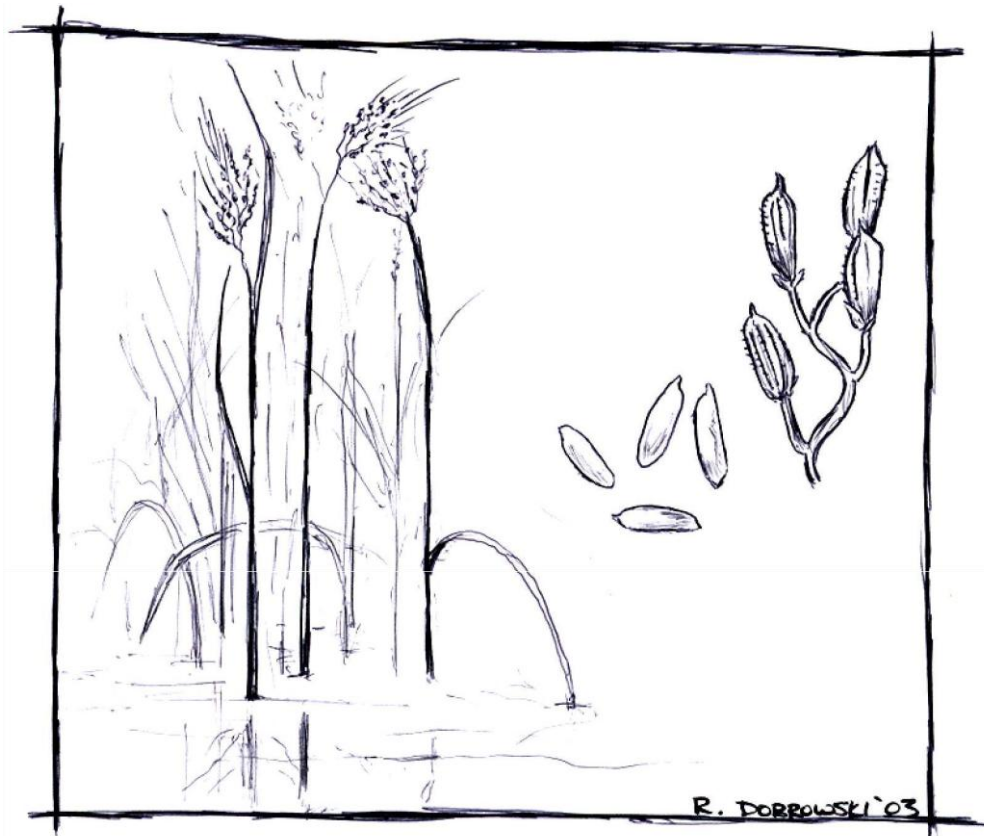
**Processing:** Beans are brought to a processing station where they are cleaned and sorted for size, but they are not processed any further so they're considered a whole food.



## OATS

**Growing:** Oats were discovered thousands of years ago in Egypt. They were once considered a weed and were sometimes used in medicines. The crop became popular with farmers because it is easy to grow, harvest and feed to animals. In the mid-1800s, oatmeal began to gain importance as a breakfast food.

**Processing:** Like other grains, oats must go through a milling process before they can be used for human food products. When oats arrive at the mill, they are cleaned to remove other seeds, weeds and sticks. Next, they are dried and the hulls are removed. Then they are cut (oat groats), flaked (oatmeal) or ground into flour. Because the flour is not coarse, it doesn't need to be further separated the way wheat and rice often are. So the oat flour used to make Cheerios is a whole-grain flour.



## RICE

**Growing:** Rice can be grown in rice paddies where it stays immersed in water and it also can be grown on irrigated or rain-fed land. Much of the rice grown in the United States is grown in California. The growth duration of the rice plant is 3-6 months, depending on the variety and the environment under which it is grown. Rice is the seed of the plant so it is rich in starch that provides the energy to produce the sprout.

**Processing:** Many people around the world prefer white rice from which the outer husk and bran (which includes the germ) have been removed by milling, which causes nutrient losses. By slightly boiling or steaming unmilled rice for a short time (a process called parboiling), a small amount of the vitamins and minerals in the bran are transferred to the rice grain. Brown rice has not been milled.

brown rice 1 cup ckd	3.5 mg fiber	0.9 mg iron	84 mg Mg
parboiled white rice enr 1 cup ckd	0.7 g fiber	2.0 mg iron	21 mg Mg
white rice enr 1 cup ckd	0.6 g fiber	1.9 mg iron	19 mg Mg

### **Varieties:**

**Jasmine:** Grown in Thailand, jasmine rice is an aromatic rice that's similar in flavor and aroma to the more expensive basmati rice from India and California. Jasmine rice is sold in both brown and white varieties. White rice sets off food flavors more distinctly, while brown rice has a higher fiber content and takes longer to cook.

**Basmati:** This fragrant rice has been grown in the foothills of the Himalayas for thousands of years (the name literally means "queen of fragrance"), and it is now grown in the United States. Aging the harvested rice decreases its moisture content and enhances the distinctive nutlike flavor and aroma. It is available in white and brown (unprocessed) forms.



## CORN

**Growing:** Corn is an annual plant that grows seven to ten feet tall. Strong roots called prop roots help support the cornstalk. Ears of corn grow where the leaves join the stalk. A plant normally has one or two ears. Each corn kernel has what looks like a silk thread that runs from the kernel up the row, and sticks out of the husk at the end of the ear. This thread is called the corn silk. Each silk needs to be pollinated to produce **ONE** kernel of corn.

The different types of corn include dent corn, sweet corn, flint corn, popcorn, and flour corn. Dent corn and flint corn are commonly called "field corn" because they are fed to animals. Sweet corn, popcorn and flour corn are used for human food.

### **Processing**

After harvest, the dry corn kernels will go to a processing plant to be made into cereal, cornmeal, oil, syrup, cornstarch and more than 1,000 other products like packaging materials and ethanol which is used to fuel.

A kernel of corn has an outer husk surrounding a white or yellow starchy substance. At the core of the starchy substance and toward the pointy end of the kernel is the germ. The germ contains a small amount of oil. If you cut a popcorn kernel in half, you can see the husk, starch and germ. If you cut out the tiny piece of germ and squeeze the germ on a piece of paper, you will see the oil!

**Cornstarch** comes from the starchy part of the corn. To make **corn syrup**, enzymes are added to cornstarch, and it is turned into a syrupy mixture of fructose and glucose.



## Sugar Beets (for table sugar)

**Growing:** The beet plant is an over-wintering biennial that produces a rosette of leaves and enlarged root one year and a stalk that produces seeds the following season. (Most seeds for sugarbeet plants are produced in our own Willamette Valley.) Except for seed production, however, sugarbeets are grown as an annual seeded in spring and harvested in the fall. The leaves during that year rise from the crown of the enlarged root with the largest leaves reaching 18 inches or more in over-all length. When fully grown, a sugarbeet weighs two to five pounds and produces about three teaspoons of sugar

Note from Beth: *The sugarbeet plant produces glucose in its leaves by photosynthesis and uses some of this glucose for its own growth. I'm guessing that some of this glucose is changed to fructose, then combined with glucose to make sucrose and then stored inside the underground beet as it grows and develops. This sugar in the root probably provides energy for the growth of new leaves during the plant's 2-year growth. I'll try to confirm this guess.*

**Processing:** First, the beets are cleaned in a beet washer. Then, a machine cuts the beets into long strips. The beet "noodles" are mixed with hot water to dissolve and remove the sugar from the beet noodles. The water and sugar juice are saved, and this solution is called "raw juice". The beet noodles, now free of most of their sugar, are dried into beet pulp for livestock feed. The raw juice is treated with lime and carbon dioxide gas to clean the mixture again. It is sent through a big, round filter to clean it and remove other non-sugars. The raw juice goes a series of evaporations, filtrations and spins to separate the sugar crystals, which are then dried and cooled.