

5

CHAPTER 5. CROP PLANTS

Only a few plant species, primarily grasses and legumes, provide a large proportion of human food throughout the world. Those consumed directly as food by humans are called cereal crops and those consumed by animals producing meat and dairy products, forage crops. Fruits and vegetables supplement cereals as foods consumed directly by humans.

The annual production of 21 major crops ranked by Harlan (1976) totals 2230 metric tons, of which 44% is wheat, rice, and corn, are grasses. The fourth-ranking crop, potatoes, brings the production of the four leading crops to 57% of the total production. It is ecologically interesting that the human population should be so dependent on so few crops. The percents of each of the 21 major crops of the total annual production are illustrated in Figure 5-1.

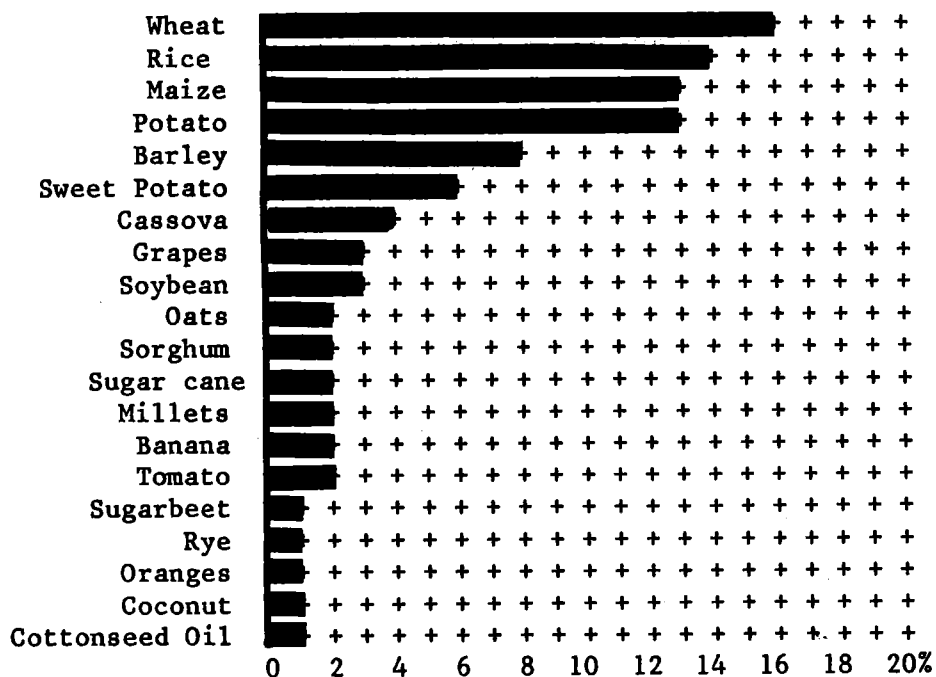


Figure 5-1. The percent of the total annual world production attributed to each of the 21 major crops (calculated from data in Harlan, 1976).

Some idea of the general distribution of crops grown may be gained from the following tabulation. The kinds of crops grown are very dependent on climate and soils, which are, of course, interrelated. Brief descriptions of the major crops grown in North America follow.

Table 5-1. Crops grown in geographic areas of the United States.

<u>Area</u>	<u>Crops Grown</u>
Northeast	Potatoes, other vegetables, forage crops
Southeast	Cotton, peanuts, tubors, vegetables, citrus fruits, forage crops
Midwest	Corn, soybeans, small grains, forage crops
Mississippi delta and southern plains	Cotton, soybeans
Great Plains	Wheat
Southwest	Cotton, vegetables, citrus fruits
Pacific northwest	Wheat, forage crops

TOPIC 1. CEREAL GRAINS

Wheat, oats, barley, rye, corn, and sorghum are the major cereal crops grown in North America. All are grasses, and yield grains that are neat packages of stored energy, conveniently harvested, easily cleaned and handled, and easily stored. Descriptions of each of these follows, summarized from Janick et al. (1969). They are divided into two groups: small grains, which are planted as dense monocultures, and row crops, planted in wide rows.

UNIT 1.1. SMALL GRAINS

Wheat. Wheat (Triticum aestivum) is grown in areas of moderate moisture with cool weather for early growth, and sunny, warm days when the grain is ripening. Some wheat, called winter wheat, is planted in the southern parts of the wheatbelt and in parts of the Northeast in the fall. It germinates quickly and grows a few inches, and then lies dormant through the winter. Growth resumes in the spring, and the crop matures in early summer. Spring wheat, planted in the the spring in northern regions too cold for winter wheat to survive over the winter, matures later in the summer. Wheat grows to a height of 3-4 feet.



Different varieties of wheat mature in different numbers of days; a 90-day variety is a short-season variety. Average yields are about 50 bushels (3000 pounds) per acre, with variations from less than 25 in drier states to more than 100 bushels in eastern Washington.

Rust fungi, which spread by airborne spores, are particularly bad on wheat, infecting the stems and reducing yields. Rust-resistant varieties of wheat are developed regularly because rusts adapt by mutation and natural selection.

Most of the "hard wheat" is used for human consumption, and contains 13-16% protein. Much of the "soft wheat" is used for livestock consumption, and contains 8-11% protein.

Oats. Oats (Avena sativa) is a common feed grain that grows from 2-4 feet tall, yields well--the average yield is about 60 bushels per acre--has 11 to 12% protein, and makes a good feed for livestock. Some oats is used in cereal production for human consumption as breakfast cereals and oatmeal. The heads are a loose panicle, with the grains separated.



Barley. Barley (Hordeum vulgare) is grown widely in a variety of climates and soils. As with wheat, there are winter and spring varieties, planted in the fall and spring, respectively. Winter barley is grown further south, spring barley further north. The average yield in the United States is just over 32 bushels per acre. The grain is used mostly for cattle feed and for making malt.

Rye. Rye (Secale cereale) is grown for human consumption, for hay and livestock feed, and as a cover crop. The grain contains about 13% protein. It is often planted in the fall as winter rye, or in the spring. Yields may reach 1.8 tons (over 100 bushels) per acre. Some rye is made into flour, especially in Europe.

Sorghum. Sorghum (Sorghum vulgare) is a hybrid plant that has been produced through male sterility. It is used primarily for grazing and chopping in the United States. The grains may be harvested and used as livestock and poultry feed also. Sorghum may yield an average of 1.3 tons per acre of forage. It is sometimes planted as a row crop.

UNIT 1.2. ROW CROPS

Corn. Corn (Zea mays) also called maize, is now a highly-developed hybrid crop plant with the staminate flowers on a terminal tassel at the top of the plant and the pistillate flowers on one or more lower cobs. The developed grain, called seeds or kernels, are firmly attached to the cob, and are enclosed by husks. The cobs develop upright next to the stalk, but bend over and hang down when fully developed and dry. Corn may grow to heights of 10-12 feet.



Hybrid corn is produced by cross-pollination, which is easily controlled because of the monoecious flower structure. Tassles are clipped off to prevent self-pollination and adjacent rows of the appropriate genetic line fertilize the pistils. Yields are high, reaching over 200 bushels per acre and averaging nearly 100 bushels per acre. Most of the corn produced is used as animal feed, including not only the seed but also the stalks, which are chopped and fed as silage. The corn grain is about 10% protein. Corn oil is extracted from the embryo, and used as human food and for industrial purposes. A recent use of corn is in the production of gasohol, a mixture of corn-derived alcohol and gasoline.

TOPIC 2. FORAGES

Forage crops are grass and legume plants grown primarily for their stems and leaves to be used as feed for ruminant animals (Hartmann et al. 1981). They may be growing naturally, as on western rangeland and hilly, rocky, untillable land in many parts of the United States, as planted and managed pastureland, and as field crops that are planted and harvested mechanically to be fed to domestic animals.

It is often suggested, especially recently, that crops should be consumed directly by humans rather than fed to animals which produce meat for human consumption. Forages, however, are plants with high cellulose contents, not digested efficiently by humans. Further, many millions of acres of rangeland are unsuited for anything but native grasses, and such ecological constraints should be recognized and respected lest we begin to think that the world can produce more food and support more humans than it actually could.

Brief descriptions of major forage species follow. Wild ruminants also feed on these, and on a variety of native plants not palatable to domestic livestock.

UNIT 2.1. LEGUMES

Legumes are nitrogen-fixing plants that are especially good sources of protein. They are used extensively as forages, especially hay, for livestock, and they are very good crops for rotation since they fix nitrogen, thereby improving the soil.

Alfalfa. Alfalfa (Medicago sativa), called lucerne in Europe, is an excellent, high-protein legume forage. It is also a high producer; 3-6 tons of hay per acre, with a dry nutrient content of 4 to 5 tons with 1.5 tons of that being protein. The different varieties of alfalfa available are adapted to a wide variety of growing conditions, except acid soils. It has a taproot that penetrates many feet into the soil, making it quite drought-resistant. Alfalfa stands may last for several years, improving the soil when it is rotated with other crops. It has perfect flowers, and is pollinated by bees. Alfalfa used for hay is sometimes planted in mixtures with grasses. Two to four or more cuttings of hay are made each summer, the number depending on the length of the growing season. Deer graze very readily in alfalfa fields.

Clovers. Clovers (Trifolium spp.) are important forage species as they are high in protein--20 to 30% on a dry weight basis--and very palatable to livestock. They, especially white clover (T.repens), are often planted with grasses in mixed

pastures. Crimson clover (T. incarnatum) is used in winter pasture with ryegrass in southeastern states. Red clover (T. pratense) is more important as a hay crop in northeastern United States. Alsike clover (T. hybridum) is grown in northern Europe, but not in North America to any large extent.

Bird's-food trefoil. Birds-food trefoil (Lotus corniculatus), a trailing perennial that is high in protein, is planted east of the Mississippi as a pasture and cover plant. It produces most heavily in mid to late summer, and is used as pasture forage.

Vetches. Several species of vetches (Vicia spp.) are used as winter-annual cover crops, especially in southeastern states and on the Pacific coast.

Sweet clovers. Yellow and white sweet clover (Melilotus officinalis and M. alba) are tall (3-5 feet) biennial plants that are especially good as drought-resistant forage plants and for soil improvement.

Lespedeza. Several species, both annual and perennial, in the genus Lespedeza are used as cover crops and for hay and pasture, primarily in the south.

UNIT 2.2. GRASSES

Grasses, many of them native to North America, are grazed by both wild and domestic ruminants. Some of the widely-cultivated ones are described here, and those of importance to the western ranges are listed also.

Most native grasses can serve as forage for ruminants, but preferences by the animals and the introduction of cultivated ones reduce the number of important forage species to just a few. Grasses are often planted with legumes in "mixed pastures;" the legumes supply more protein than the grasses, but the grasses yield well and are able to tolerate repeated cutting or grazing.

The more important grasses planted as forages are briefly described below.

Sorghum-sudan. Sorghum-sudan crosses are bred for their rapid growth and high yields. The forage may grow up to 15 feet tall, and produce up to 18 tons of dry matter per acre. It is planted primarily as pasture (40-65%), some of it is chopped (15-30%), and less than 10% is harvested as hay. Kansas leads in production of sorghum-sudan grass.

Kentucky bluegrass. Kentucky bluegrass (Poa pratensis) is one of the richest and most palatable grass forages. It spreads by rhizomes, forming a very stable sod which protects the soil. It is widely used as a lawn grass. It was introduced from Europe into the early colonies, and quickly became a prime pasture and forage grass. It became "Kentucky bluegrass" as a result of its success in that State.

Bromegrass. Smooth bromegrass (Bromus inermis) was introduced into the United States from Europe in the late 1800s. It is a widely-used grass in the northern plains where it is often mixed with alfalfa.

Timothy. Timothy (Phleum pratense) is a major forage grass, especially in the eastern states. It was grown for horse hay when horses supplied farm power, and is now often mixed with red clover to make a mixed hay. It was introduced into New England about the middle of the 18th century, and is still a popular choice for mixed hay.

The most important native grasses that serve as forage for livestock are briefly described below. They grow in plant communities known as "prairie," with the tall-grass prairie lying in the midwestern states just east of the eastern deciduous forest. This native tall-grass prairie is now actively farmed. Following a gradient of reduced precipitation westward, the mixed prairie, the most extensive grazing area in North America (Weaver and Albertson 1956), lies in the Forest Plains. Further westward lies the desert grass and bunch grass regions (Stoddart and Smith 1955) characterized by low annual precipitation. At higher elevations, shrub communities appear which are of some value as rangeland also.

Weaver (1954) places grasses into different ecological groups, depending on their time of growth, (cool-season and warm-season grasses), habits of growth, (sod-forming and bunch-forming grasses), height classes, resistance to drought, relation to grazing (those most preferred to least preferred), and dominance (species which influence the habitat and effect other species). Brief descriptions of native grasses follow.

Big and little bluestem. Big bluestem (Andropogon gerardi) and little bluestem (A. scoparius) are the two most important dominants in tall-grass prairie. The former is abundant on lowlands where there is more available moisture, and reaches heights of 5 to 6 feet. The latter is more abundant on the uplands, and grows 2 to 4 feet tall.

Blue grama. Blue grama (Bouteloua gracilis) is a short grass (16 inches) of importance in mixed prairie (Weaver 1954). It is a drought-resistant bunch grass, but forms a continuous sod when the bunches are close together.

Needlegrass. Needlegrass (Stipa spartea) is a cool-season bunchgrass. It grows rapidly in early summer, and is mature at heights of 15 to 36 inches, depending on moisture. It produces 4 to 6-inch awns which must drop before it can be harvested as hay for domestic animals in order to prevent problems caused by the very sharp needle-like awns in the digestive tract.

Prairie dropseed. Prairie dropseed (Sporobolus heterolepis) is a warm-season, perennial bunch-grass. It reaches heights of 1 to 3 feet, with roots that penetrate to depths of 4 to 5 feet. It is palatable to all kinds of livestock and furnishes considerable forage when it is not allowed to mature (Weaver 1954).

TOPIC 3. VEGETABLES AND FRUITS

Vegetables and fruits make up a relatively small part of total agricultural production. They are, however, important components of our diets as they are sources of vitamins and minerals, and they add variety and even color to our meals.

UNIT 3.1. VEGETABLES

Vegetables as a category includes a variety of food plants used primarily for human consumption as a main part of a meal. Different parts of different plants are eaten, such as underground roots, tubers, corms, and bulbs and above-ground stems and leaves. Potatoes are the number one "root crop;" it is the tubers that are actually eaten. Onion bulbs are used for seasoning. Stems and leaves of lettuce, asparagus, celery, cabbage, and spinach are eaten. Vegetables are usually quite perishable so they are grown in local truck farms and shipped by refrigerated trucks to markets. Because vegetables are planted as high-density crops, the total acreages in vegetable fields is much less than in cereal grains such as wheat and corn.

UNIT 3.2. FRUITS

Fruit crops include apples, oranges, grapefruit, plums, grapes, etc. Some of these occupy large acreages in local parts of the United States. Apple orchards are quite widespread geographically because apple trees are adapted to northern climates. Orange and grapefruit groves are limited to the very warm climates, such as in Florida and California. Plums are more widespread, especially wild ones (Genus Prunus), but the cultivars are limited to warmer climates. Grapes are limited to areas with fairly long growing seasons, adequate moisture, and winters with moderate temperatures. Vineyards are localized along the Finger Lakes in New York State, for example, because of the

ameliorating effects of these long narrow lakes on the local climate.

Fruit trees grown commercially are descendants of native trees, of course, with selection and management which promotes desirable production and consumption characteristics. A recent development of interest to orchardists and wildlife biologists is the tendency toward semi-dwarf and dwarf trees. These trees are smaller than those grown in years past, and they are planted closer together. This results in a very much larger percentage of the productive branches within reach of both the fruit-grower and wildlife such as deer. As a result, the potential for damage by browsers is much greater. The effects of different management practices in orchards are discussed further in CHAPTER 12.

TOPIC 4. TEXTILE CROPS

Textile crops produce fibers that are used in cloth and specialized uses. They are now in competition with synthetic fibers such as nylon, acrylics, and polyesters. Wool is another fiber, but that is produced by sheep and not by plants. Two textile crops--cotton and flax--are discussed here.

Cotton. Cotton (Gossypium spp.) plants supply the world's single most important natural fiber. They are grown in the southern and southwestern states. The fiber itself is a single cell of nearly pure cellulose up to 6000 times as long as it is wide.

Flax. Flax (Linum usitatissimum) is a textile crop that is made into linen. It is always planted in the spring, and is a late-maturing crop that does best in cool weather with good moisture. It is harvested from late August to October. Flax seed is also used as a cash crop for processing into linseed oil, and the stems of oil flax are used in the making of cigarette papers.

TOPIC 5. SUMMARY

This CHAPTER has included brief descriptions of the major crop plants grown on farms in the United States and southern Canada. The emphasis has been on those grown in larger acreages since they affect larger areas of wildlife habitat. CHAPTER 8 is devoted to CROP MANAGEMENT. Concerns over the effects of wildlife on such enterprises as vegetable farms and orchards are discussed again in CHAPTER 12: WILDLIFE DAMAGE AND DEPREDAATION.

LITERATURE CITED

- Janick, J., R. W. Schery, F. W. Woods, and V. W. Rutton. 1969. Plant Science. W. H. Freeman and Company, San Francisco. 629 pgs.
- Harlan, J. 1976. The plants and animals that nourish man. Sci. Amer. 235(3):89-97.
- Hartmann, H.T., W.J. Flocker, and A.M. Kofranek. 1981. Plant Science. Prentice-Hall, Inc., Englewood Cliffs, N.J. 676 pgs.
- Stoddart, L.A. and A.D. Smith. 1955. Range Management. McGraw-Hill Book Company, Inc., N.Y. 433 pgs.
- Weaver J.E. 1954. North American Prairie. Johnson Publishing Company, Lincoln, Neb. 348 pgs.
- Weaver, J.E. and F.W. Albertson. 1956. Grasslands of the Great Prairie. Johnson Publishing Company, Lincoln, Neb. 395 pgs.