Lesson 1: Crop and Weed Identification

Crop fields include a variety of different plant species. The ability to identify crop and weed seeds and plants is necessary to effectively manage crop production. Weeds rob crops of sunlight, nutrients, and water that are needed for proper crop growth and development. To effectively control weeds, early detection is necessary. Unfortunately, weeds are not always easy to identify. In Unit I, plants were identified by their uses. In Unit II, plants were identified by their life cycle. In this lesson, the concept of identifying seeds and plants by their general physical characteristics is discussed.

Plant Type and Characteristics of Crop and Weed Plants

In plant type classification, plants are categorized according to their physical characteristics. Each species within a plant type has characteristics similar to other species of the same plant type. Four different plant types are found in most crop fields, grasslands, and ranges. The plant types include (1) grasses and grasslike plants, (2) legumes, (3) forbs, and (4) woody plants. Detailed discussion of these plant types can be found in the *Crop and Grassland Plant Identification Manual.*

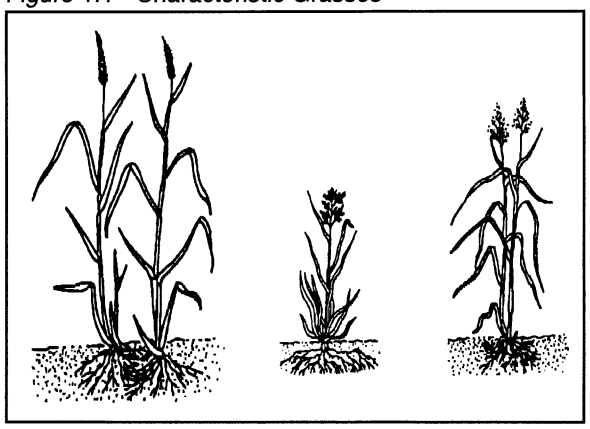
There are five main characteristics used to identify crop and weed plants. These characteristics include (1) leaf shape, (2) stem, (3) flower, (4) root, and (5) other characteristics. Differences in leaf characteristics are the most variable in number compared to any other part of the plant. Leaves can be identified by leaf parts, arrangements, types, shapes, margins, tips, venations, and base shapes.

Characteristics of Grass and Grasslike Plants

Grasses are one of the four dominant plant types found in crop fields, grasslands, and ranges. They serve many purposes such as food for humans (cereal grains), livestock (grains and forage), and erosion prevention. Common field crops that are considered grasses include corn, rice, wheat, and barley.

The grasses of the Midwest are herbaceous, or without woody stems. The stems are usually hollow and resist compaction. Leaves or blades connect directly to the stem at the sheath, which surrounds the stem. All leaf blades have distinctive parallel venation in which the veins run side by side along the length of the blade of grass. These visual characteristics make it possible to separate the grasses from the other plant species. Figure 1.1 shows characteristic grasses.

Figure 1.1 - Characteristic Grasses

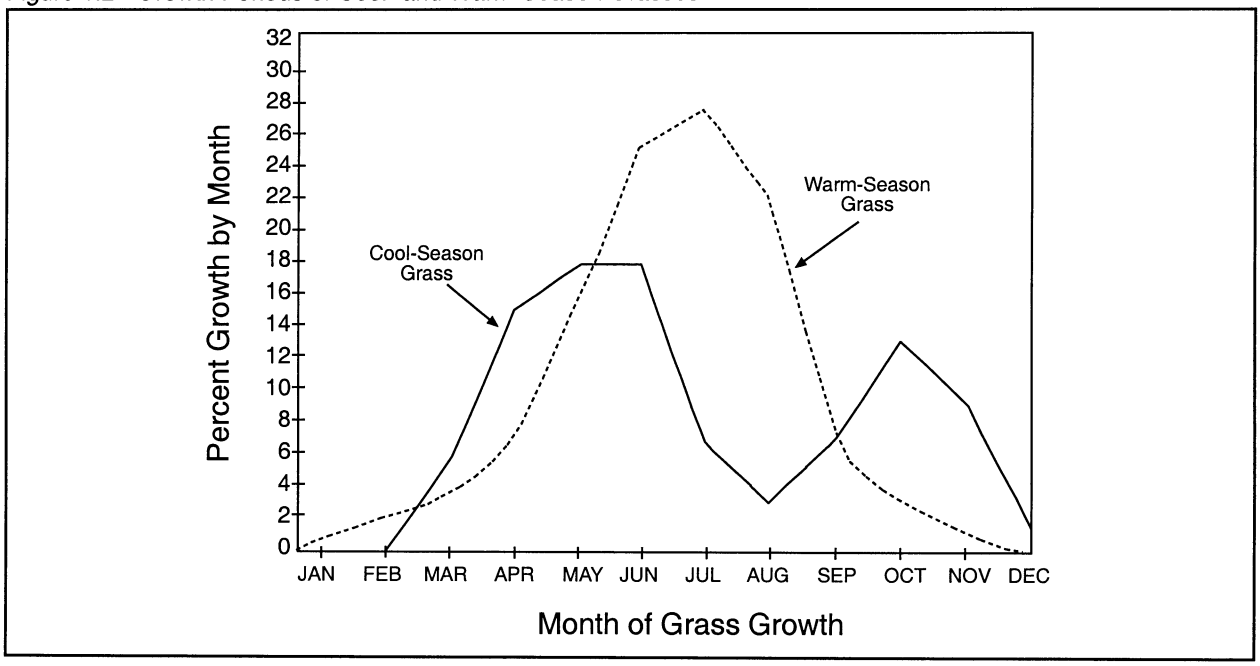


The two major groups of grasses are cool season and warm season. Cool-season grasses tend to grow best during the spring and fall. These plants begin their growing season when the soil temperature reaches 40°F, but optimum growth occurs when air temperatures increase from 59 to 77°F. They may remain green all winter, but during the summer months they tend to become brown and dormant. They may be annuals or perennials. Examples of cool-season grasses include Kentucky bluegrass, orchardgrass, and smooth bromegrass.

Warm-season grasses are just the opposite; they grow best during periods of warm temperatures. These grasses are more tolerant of heat and drought than cool season grasses. Their growing season begins when soil temperature reaches 60°F, and they grow best during the summer when temperatures range from 77 to 104°F. They are dormant in the winter and do not begin to turn green until late spring or early summer. They also may be annuals or perennials. Some examples of warm-season grasses are indiangrass, big bluestem, and switch grass.

Missouri has the right climate and amount of rainfall necessary for both cool-season and warm-season grasses. Figure 1.2 shows how the growth periods of these two grass types complement each other and extend the length of crop production in the state of Missouri.

Figure 1.2 - Growth Periods of Cool- and Warm-Season Grasses



Characteristics of Legumes

Legumes and grasses are the dominant plant types found in crop fields, grasslands, and ranges. Both are used as forage crops and are beneficial to agricultural production. Figure 1.3 shows characteristics of common Missouri legumes. Examples include soybeans, alfalfa, clovers, and birdsfoot trefoil.

Legumes have several identifying characteristics. One characteristic is the fruit or pod legumes produced. This pod has one chamber with seeds lined in a single row. The seed number and size vary for different plants. All legumes have leaves alternating in stem arrangement and connecting to the stem by a stalk called a petiole. Unlike the grasses, venation in a legume consists of a network of veins instead of veins that run parallel to each other. Legumes may be annuals, perennials, or biennials.

Most legumes have the unique ability to take nitrogen from the air between soil particles and change it into a form of nitrogen plants can use. This process is known as nitrogen fixation and is

Figure 1.3 - Characteristic Forage Legumes

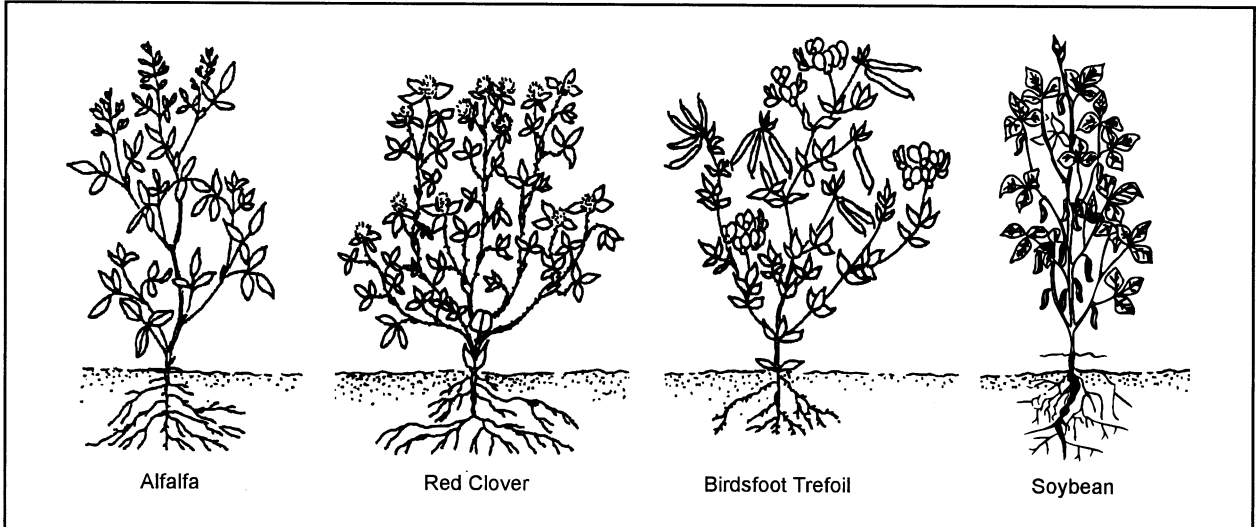
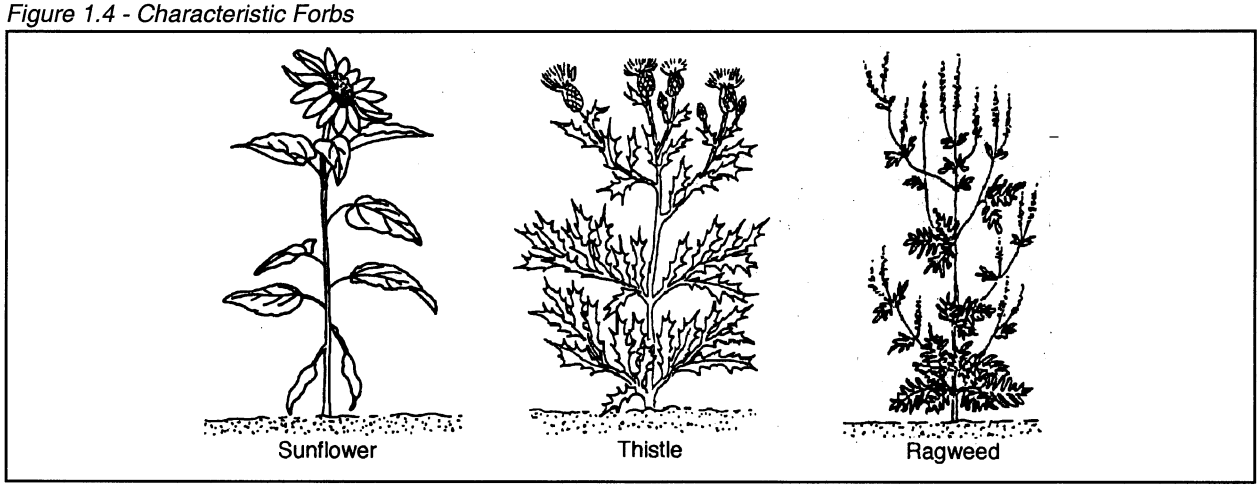


Figure 1.4 - Characteristic Forbs



conducted by symbiotic bacteria found in nodules on the roots. Nitrogen decreases fertilizer needs, reduces costs, increases yields, and enriches the soil.

Characteristics of Forbs

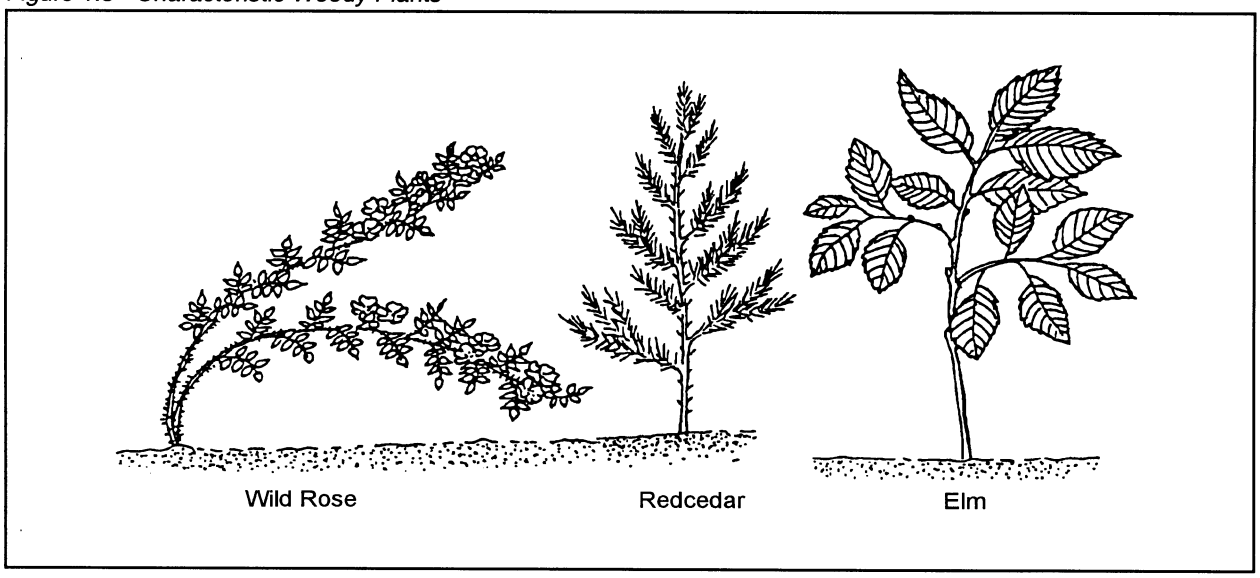
Herbaceous (not woody) plants that are neither grasses nor legumes are forbs. Most forbs are broadleafed, making it possible to distinguish them from grasses or grasslike plants. With the exception of cotton and tobacco, forbs are not usually cultivated for agricultural production, but they commonly appear in pastures, fields, and native plant habitats. Many forbs have value as wildlife food and cover or for prevention of soil erosion. Others are considered noxious weeds. Forbs may be annuals, perennials, or biennials.

Examples of forbs, sunflowers, thistle, and ragweed, are pictured in Figure 1.4.

Characteristics of Woody Plants

Woody plants are probably the easiest plants to identify in grassland because of their tough, woody (nonherbaceous) stems. They are either shrubs, vines, or trees. Woody trees found in grasslands are usually immature due to the nature and use of the grassland. They are kept small by animals grazing on terminal branches, fires that stunt growth, mechanical cutting, or chemical treatments used to maintain the grassland. Woody plants are all perennials. Woody plants found in grasslands include wild rose, red cedar, and elm, as shown in Figure 1.5.

Figure 1.5 - Characteristic Woody Plants



Characteristics of Common Weed Plants

Weeds cause loss of and damage to crops and cost American producers millions of dollars each year. These losses increase production costs and reduce profit. Weeds also serve as hosts to insects and diseases. The presence of weeds in a field can weaken crop plants, making them more susceptible to diseases. Certain weeds can also be harmful to animals and people, causing severe illness and even death when eaten. Steps have been taken to properly identify and classify weeds posing health problems. Three classifications of weeds are common, noxious, and prohibited. Numerous common weed plants with new species variances are identified constantly.

Common weeds are all weeds not classified as noxious or prohibited. These weeds are relatively easy to control, but they interfere with agricultural production by reducing crop yields and increasing production costs. Common weeds include both perennials and annuals, as well as forbs and grasses. Additional information on a plant's life cycle, height, and where the plant is most commonly found is also helpful in plant identification. Examples of common weeds include cocklebur, morning glory, ragweed, milkweed, and velvet leaf. Refer to the *Crop and Grassland Plant Identification Manual* for detailed characteristics of common weed plants. They can also be found in IML's *Crop Science* reference.

Characteristics of Noxious Weed Plants

A noxious weed crowds out desirable crops, robs them of plant nutrients and moisture, and causes extra labor in cultivation. In an effort to control the spread of noxious weed plants, these seeds in agricultural crop seed are restricted in Missouri. Noxious weeds can include perennials, biennials, and annuals, as well as forbs and grasses. The characteristics of noxious weeds in Missouri are summarized in Table 1.1

Certain "growing" plants in Missouri are listed by the Missouri Department of Agriculture as being on the state noxious list of weeds. Those weeds listed as noxious include musk, Scotch, and Canada thistles, multiflora rose, bindweed, purple loosestrife, marijuana (*cannabis sativa*), and Johnsongrass. It is, however, left to the county weed board to determine which weeds will be listed as noxious in its county. Therefore, there are several variances across the state. Complete information may be obtained by reading the state statutes beginning with 263.190.

Characteristics of Crop and Weed Seeds

Seed identification is important for seed selection and weed control. The Bureau of Feed and Seed administers laws and regulations to ensure that seeds are labeled consistently and accurately. Weed seeds include the seeds of all plants generally recognized as weeds within the state and include noxious and prohibited seeds.

Some seeds vary greatly, whereas others are very much alike. The five characteristics used in seed identification are size, shape, color, surface markings, and other botanical characteristics. Review IML's *Crop Science* Student Reference to identify the characteristics of common crop and weed seeds.

Restricted Noxious Weed Seeds

When identifying "seeds," refer to the Missouri Seed Law and Regulations for current information concerning weed seeds listed as noxious. As determined by law, restricted noxious weed seeds are defined as highly objectional in fields, lawns, or gardens of Missouri and are difficult to control by good cultural practices. Noxious weeds must be listed on the seed label sold by seed companies as none or zero, or must be expressed in numbers per pound by the maximum allowed tolerance as outlined in the *Missouri Seed Law and Regulations* manual. Noxious weed seeds in Missouri include red sorrel, curly dock, dodder, buckhorn, black nightshade, giant foxtail, hedge bindweed, leafy spurge, hoary cress, purple moon flower, quackgrass, Russian thistle, slender oats, wild garlic, wild onion, wild oats, and yellow star thistle.

Restricted Prohibited Weed Seeds

Restricted prohibited weed seeds are defined by law as the seeds of weeds that when established are highly destructive and difficult to control in this state by good cultural practices.

According to current *Missouri Seed Law and Regulations*, the following weed "seeds" are listed as prohibited in Missouri. They are balloon vine, Canada thistle, field bindweed, Johnsongrass, musk thistle, serrated tussock, and sorghum almum. Each state determines its own prohibited

Table 1.1 - Characteristics of Noxious Weed Plants

Weed Plant	Life Cycle	Plant Height	Leaves	Stem	Flower	Root
Canadian Thistle	perennial	2 - 5 ft.	crinkled edges and spiny margins	grooved, slightly hairy	male and female on different plants, usually numerous and compact, 1.9 cm or less diameter	extend several feet down and horizontally
Musk Thistle	biennial	3 - 6 ft.	alternate, coarsely toothed	erect spiny wings lower portion branched	heads as much as 2" across, drooping, purple to lavender	large thick root stock
Scotch Thistle	biennial	6.5 ft.	inversely lance shaped, lobed margins	winged at the bases of leaves, 2 " broad	globe shaped, 1-2" diameter, reddish purple	
Multiflora Rose	perennial	4 - 6 ft.	compound, pinnate with three to nine leaflets	green or brown with many prickles	large bulbous flower bud, small green leaf buds	
Field Bindweed	perennial	2 - 7 ft.	ovate with spreading basal lobes	smooth, slender, twining or spreading over ground	white or pink, funnel-shaped 2.5 cm across, single in the axis of the leaves	extensive down 20 - 30 feet
Johnsongrass	perennial	1.5 - 6 ft.	alternate, simple, smooth, 6-20" long 1/2-1 1/2" wide	erect, stout	panicles-large, purplish, hairy	freely branching, fibrous, rhizomes, stout, creeping
Purple Loosestrife	annual	1 - 4 ft.	narrow, 1/2 " wide, 1-4 " long	four-angled, branch extensively	four petals, bright rose or whitish	
Marijuana	annual	2 - 10 ft.	palmately divided, 5-9 hairy leaflets w/notched edges	coarse, somewhat grooved, rough, and hairy	male and female on separate plants	branched taproot

seed list (seeds that are not to be included in seed sold in its state). This indicates it does not want these plants in its state. It is interesting that one eastern state (Maryland) has fescue and certain varieties of bluegrass on its prohibited list. Seed companies must design seeds to certain state specifications.

Summary

By understanding plant types and their life cycles, producers can manage their pastures and fields for many purposes. Crops may be annuals, biennials, or perennials; they may also be grasses legumes, forbs, or woody plants. To effectively manage crop production levels, the producer must have the ability to identify noxious and prohibited plants and weed seeds.

Credits

Growers Weed Identification Handbook (Publication 4030). Cooperative Extension. University of California, Division of Agriculture and Natural Resources, 1991.

Humphrey, John Kevin. *Crop Science* (Student Reference). Columbia, MO: University of Missouri-Columbia: Instructional Materials Laboratory, 1992, Lesson 3.

Missouri Seed Law and Regulations. Missouri Department of Agriculture, Bureau of Feed and Seed Plant Industries Division, Jefferson City, MO, January 1998.

Suits, Susie. *Introduction to Grassland Management* (Student Reference). Columbia, MO: University of Missouri-Columbia: Instructional Materials Laboratory, 1997, Lesson 2.

Lesson 2: Crop Selection

When producers are choosing what crops to produce, there are many factors that need to be considered. This lesson will discuss growing regions, maturity groups, economic factors, and management practices that are determining factors in crop selection.

Crop Selection

When selecting a crop to produce, several factors must be considered before making a decision. The greatest influencing factor is climate. Climate includes annual rainfall and temperature. Crops requiring an abundance of rainfall would not be considered in arid areas unless irrigation was an option. For example, rice would not be planted in the southwest region of the United States because of the lack of rainfall. In addition, many crops are tolerant to very warm temperatures but some are not. For example, winter wheat is generally not planted in the southeast region of the United States. The weather and climate of the Midwest are generally the most appealing to the production of row crops including corn, wheat, and soybeans. Rice and cotton are more suited to the climate of the southeastern portion of the United States.

Soil conditions are another consideration. Soil conditions include the soil type and fertility of the soil. Soil test recommendations are made based on crops that are conducive to existing nutrient supplies and fertilizer recommendations.

Field history is important in selecting a crop for production. Past rotations and current cropping options are important. A field currently sown to grass would require extensive herbicide and tillage if one chose to plant a row crop, or vice versa. Current cultural and biological conditions concerning insects, diseases, and weeds must be evaluated as well.

Equipment resources often help the producer select a crop. If a crop required specific equipment to plant and harvest and the producer did not own or have access to the equipment, the crop would probably not be considered.

Economic demands of producing a crop are often the deciding factors for the producer. Input costs such as fuel, seed, herbicides, pesticides, and fertilizers can become very expensive depending on the type of crop considered. Producers must continually monitor different crop values to determine if the market value of the crop is greater than the input costs. Crops with little value or demand are generally not considered if the possible income from the crop does not cover the cost of production. Furthermore, if a crop was produced for livestock feed, it should be a good nutrition source for the animal.

Market access is important for producers to consider in selecting a crop to produce. The cost of transporting the crop to the nearest market generally is of greatest importance in regard to market access. It is unlikely a producer would opt to raise cotton if a gin was not found locally.

Growing Regions

Growing regions across the United States for specific crops are generally determined by temperature, rainfall, and soil composition. Each of the major crops needs optimum conditions in these three areas for proper growth. States considered to be in the "wheat" or "corn" belt have conditions of temperature, rainfall, and soil types that make it ideal for their growth.

Common agricultural crops are divided into cool-season and warm-season plants. Cool-season plants survive mild spring frosts and may be planted early in the spring or late in the fall. Examples of cool-season crops include wheat, oats, barley, rye, and fescue. Warm-season crops include corn, soybeans, cotton, grain sorghum, as well as truck garden crops of watermelon, tomatoes, and peppers. Examples of planting dates to avoid frost damage for warm season crops are illustrated by Figures 2.1 and 2.2.

Growing regions with specific amounts of annual rainfall also determine the type of crop selected for a specific region. Table 2.1 below gives examples of the amount of annual water usage of crops.

Table 2.1 - Annual Water Usage

Crop	Inches/year
Corn	23 - 28
Soybeans	20 - 25
Grain sorghum	18 - 23
Winter wheat	16 - 18
Alfalfa	31 - 36

Figure 2.1 - Average Spring Frost Dates

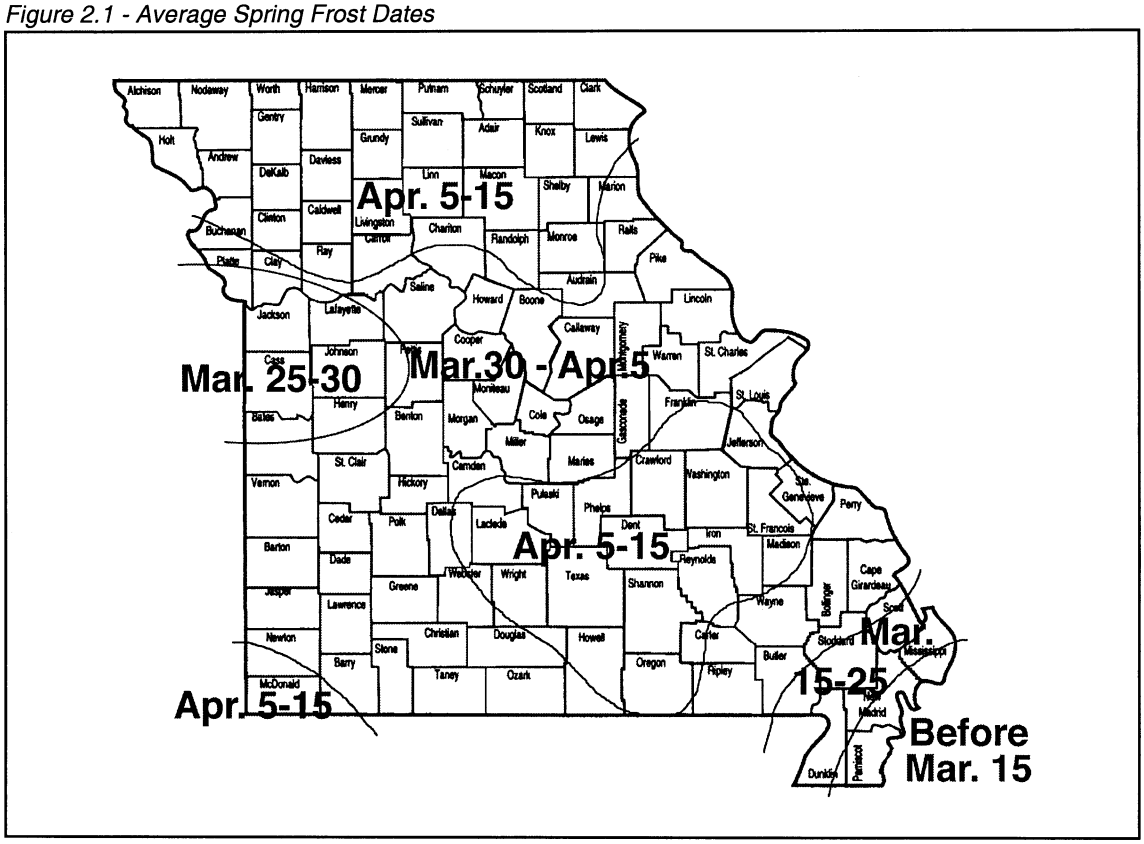
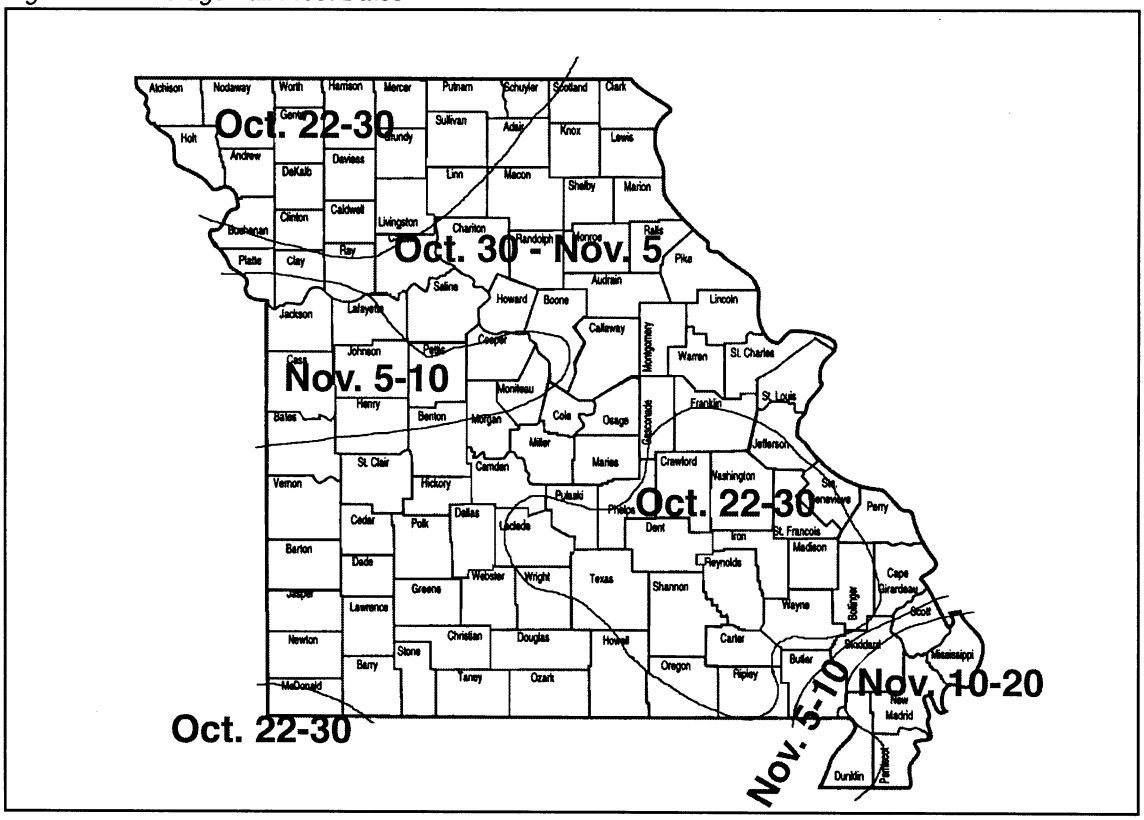


Figure 2.2 - Average Fall Frost Dates



Within a given temperature zone, the availability of water is the most important factor in determining which plants will grow and how productive they will be. If the temperature is adequate but annual rainfall is lacking, some type of irrigation method should be considered for the selection of a specific crop. Figure 2.3 indicates the average annual rainfall for Missouri.

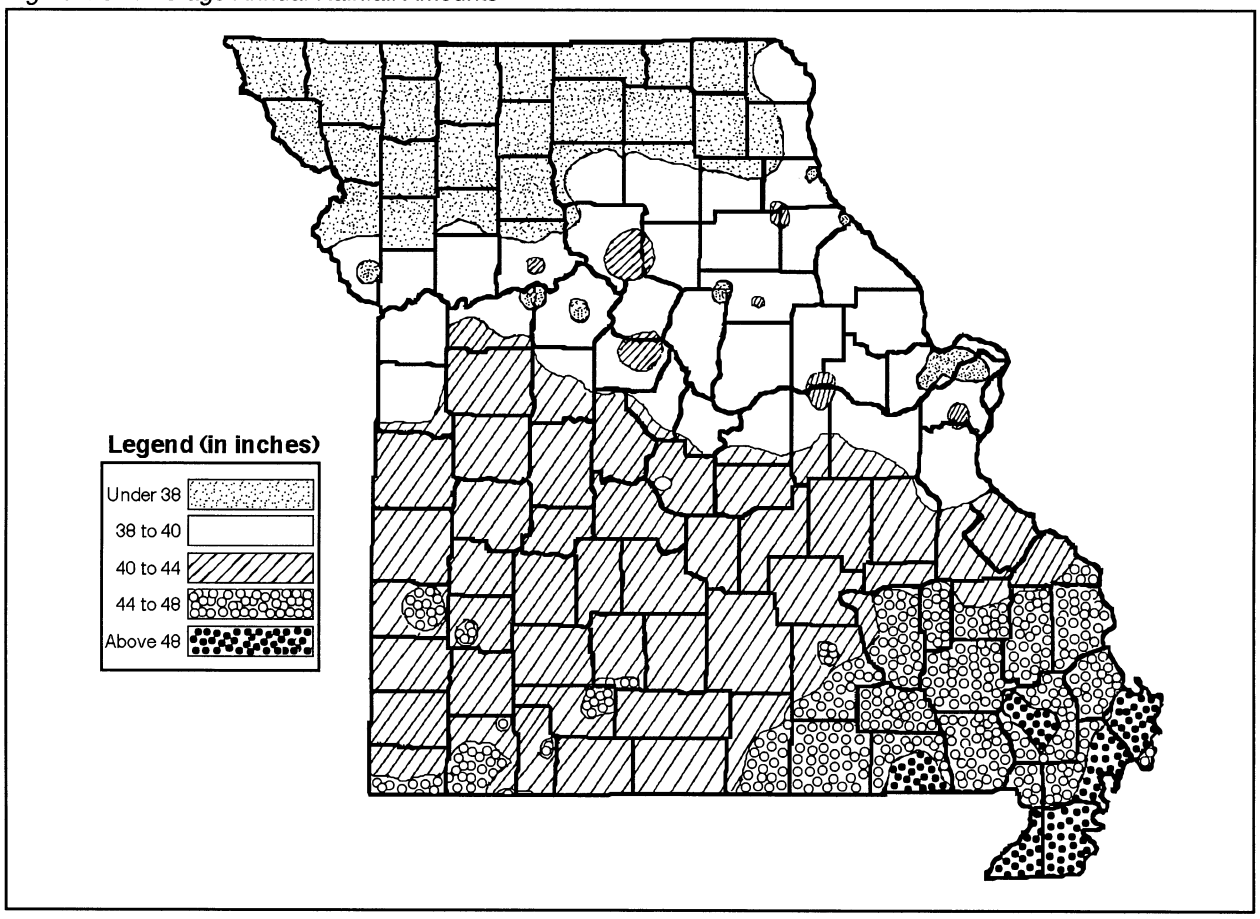
The third major factor that determines crop selection in a given region is soil types and conditions. The selected crop must be adaptable to the soil types in the region. A more in-depth discussion of soils was presented in the previous unit.

Maturity Groups

Corn - Corn varieties are divided into three basic maturity groups: full season, mid-season, and late season. Research shows that most corn is planted from mid-April to mid-May, depending on the growing region. Soil temperature is important. An early morning soil temperature of 50°F at the 1/2- to 2-inch depth usually indicates that the soil is warm enough to plant. The latest practical date to plant corn ranges from about June 15 to July 1. Planting a full-season hybrid first and then planting a mid-season hybrid allows the grower to take advantage of maturity ranges and gives the late-season hybrids the benefit of maximum heat unit accumulation. Planting hybrids of different maturities reduces damage from diseases and environmental stress at different growth stages and spreads out harvest time and workload. Even with high-capacity modern equipment, most growers cannot plant their full acreage in just a few days. A planned scheduling of planting different maturity groups is often referred to as "calendarizing" the corn crop.

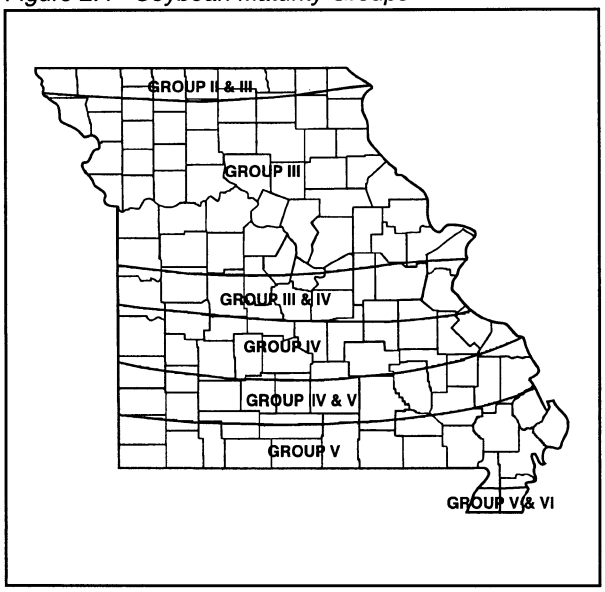
Soybeans - Classification of soybeans into maturity groups has helped producers choose the correct varieties for their regions. Planting a maturity group of soybeans not suited for the production area will affect the plant's flowering and

Figure 2.3 - Average Annual Rainfall Amounts



reproductive stage, thereby affecting or reducing the production potential of the plant. If a variety of a northern maturity group is planted farther south, it will encounter longer nights earlier during its vegetative stage. As a result, the plant will flower and set pods before it has reached its full vegetative growth, leading to a reduced yield. Figure 2.4 shows what maturity groups are recommended for Missouri.

Figure 2.4 - Soybean Maturity Groups



Varieties of soybeans that mature earlier may be used in Missouri when following small grains. Many growers will plant soybeans after wheat harvest as a method of "double cropping."

Wheat - This grain crop differs from most grains. Instead of maturity groups, wheat is divided into wheat types. The type of wheat grown in an area is determined by its growing season and climate. The three basic wheat types are hard red spring wheat, soft red winter wheat, and hard red winter wheat. Most hard red spring wheat is grown in the Northern Plains: Montana, North Dakota, and South Dakota. Most soft red winter wheat is grown in areas of Ohio, Indiana, lower Illinois, and some on the east coast states from North Carolina through parts of Georgia. Missouri is adapted for hard red winter wheat production as is the major hard wheat production areas of north Texas, Oklahoma, and Kansas.

Grain Sorghum - Grain sorghum closely follows the planting recommendations of corn. There are four basic maturity groups of grain sorghum. The recommended planting date is about 1 week later than that of corn. Some early maturing varieties (75 to 80 days to maturity) are available for emergency planting situations.

Cotton - Although scientists have identified 39 species or kinds of cotton, only 4 of the 39 are cultivated. These four kinds are divided into two groups: New World cotton and Old World cotton. The New World cotton includes upland and pima cotton. Upland is cultivated in many parts of the world, including the United States. Pima is one type of species grown on the coasts of Peru and Ecuador. Old World cotton includes tree cotton and Levant. These are grown in northern Africa and parts of Asia.

Rice - There are three basic maturity groups of rice. Very early maturing rice only requires 90 days from germination to harvest; early maturing varieties require 90 to 97 days to harvest; and intermediate or late maturing varieties require 98 to 105 days from germination to harvest. Rice thrives under the hot and humid conditions that characterize the southern United States during the summer months. In addition to Arkansas, Louisiana, Texas, and Mississippi, some southern regions of the Bootheel of Missouri are adapted to rice production.

Forages - Forage grasses and legumes are divided into cool-season or warm-season classifications instead of maturity groups. Cool-season grasses include fescue, orchard grass, ryegrass, and timothy. Examples of cool-season legumes include birdsfoot trefoil, alsike clover, and ladino clover. These grasses and legumes thrive when moisture is adequate and temperatures are between 65 and 75°F. They exhibit vigorous growth habits in the spring and fall months. Warm-season grasses and legumes have the potential for producing good hay and pasture growth during the warm and dry midsummer months. These grasses and legumes initiate growth during late April or early May and produce 65 to 75% of their growth from mid-June to mid-August. Warm-season grasses produce well on soils with low moisture-holding capacity, low pH, and low phosphorus levels. Examples of warm-season grasses include big bluestem, Indiangrass, and switchgrass. Warm-season legumes include alfalfa, crownvetch, and lespedeza.

Economic Factors

When crop producers are beginning to determine what crop they may select for their operation, the first step is to develop a marketing plan for their selection. Farm management specialists refer to this as "taking an inventory of resources." These resources are divided into four main groups: land, labor, capital, and management.

Land is the resource provided by nature. Producers will need to sketch or map the farm showing ditches, ponds, fences, streams, and any other physical features that would affect their crop selection plans. Soil tests should be made on all fields to show basic soil fertility needs for specific crops and levels of expected production. A land use capability map should also be prepared.

Labor refers to the number of people available for performing the physical work necessary to produce and harvest specific crops. The labor available would include not only the producer but family members and possible hired labor.

Capital refers to the amount of money required for the input costs of producing that crop. Items such as buildings, machinery and equipment, fertilizer, fuel, and seed must be included. Some producers like to include money or financial credit as a capital item whereas others include this as a part of management.

Management consists of the knowledge, experience, and effort of the person making the decisions concerning the planning and everyday operations of the cropping system. Some producers own and manage their own farms, whereas some landowners employ professional farm managers to provide this service for them. The likes and dislikes (personal preferences) of the producer and his or her family with regard to specific crops should be considered.

Summary

There are several factors that play a part in crop selection for the grower. These include climate, soil conditions, field history, equipment resources, economic demands, and available markets. The regions of the United States that are considered optimal growing regions for specific crops are determined largely by temperature, rainfall, and soil conditions. Growers are also faced with the decision of what maturity group or type of crop to plant. This is largely decided by planting times. The length of available growing times will make this determination. Land, labor, capital, and management are four economic factors that influence crop selection.

Credits

Aldrich, Scott, and Hoeft. *Modern Corn Production*, 3rd ed. Champaign, IL: A & L Publishers, 1986

Parker, Rick. *Introduction of Plant Science*, 1st ed., Albany, NY: Delmar Publishers, 1998.

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Lesson 3: Crop Seed Selection

Agricultural researchers have devoted considerable time and effort to providing dependable, quality seed to producers. It is important for the producer to understand the different seed options that are available to ensure the best quality crop.

Characteristics of Quality Seeds

Careful consideration should be given to selecting crop seed. Quality crops possess specific characteristics as do quality seed. Quality crop seeds should exhibit uniformity. Seed should be examined for shape, color, size, and standard surface markings. Using quality seed improves crop yields an estimated 10 to 20% over crops produced from poor seed.

When purchasing seed, producers should select seed from a good variety. A good variety would be one that has a reputation of producing a quality crop. Good germination is another desirable characteristic. Seeds that fail to germinate are worthless. Other characteristics of quality seed are proper size and development; uniformity in size and shape; absence of seedborne diseases and insects; absence of prohibited, noxious, and other weed seeds; absence of mixtures with other crop seeds and other varieties; and absence of inert materials. Information on the performance of a specific variety and the germination percent should be readily available from reputable seed dealers.

Two of the major factors that aid in the viability (ability to germinate) of the seed are the age of the seed and the conditions under which it is stored. Most seeds remain viable longest if stored under cool, dry conditions.

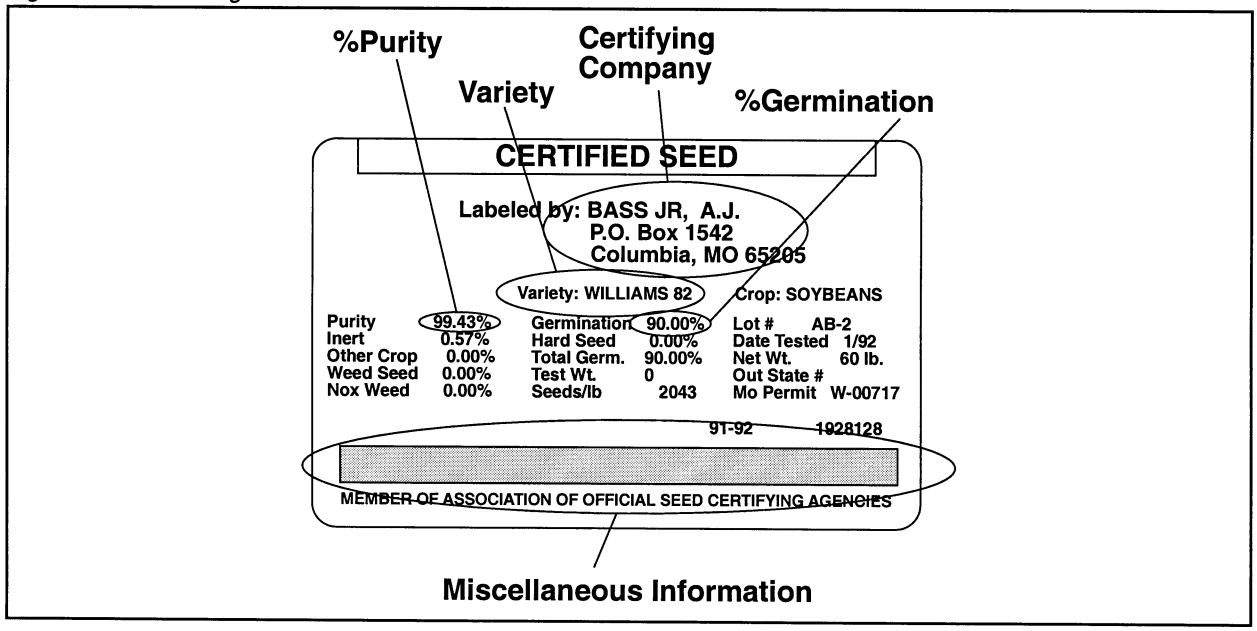
Information Included on a Seed Tag

Bags of seed are labeled with a seed tag. Each seed tag contains important seed quality information. The information is critical for producers to determine seeding rates and overall seed quality of the seed that will be planted. A seed tag includes these basic components:

- Percent pure seed
- Percent inert matter
- Percent other crop
- Percent weed seed
- Percent germination
- Percent hard seed
- Percent total germination
- Net weight
- Lot number
- State of origin
- Test date
- Kind and number of noxious weeds

The seed count is often included on many labels. It is also important to note that the law requires labeling for any seed treated with fungicide,

Figure 3.1 - Seed Tag



insecticides, or any chemical substance to enhance the performance of the seed. Figure 3.1 is an example of a seed tag containing the seed quality information.

Optimum Seeding Rates

Many factors relate to a productive stand. Using good management practices, crop producers can increase their potential yield. Plant population refers to the number of growing plants in a given area. The density of growing plants directly influences the yield potential. Desired plant population depends upon several factors, one of which is the seeding rate.

Seeding rate refers to the amount of seed planted in a given area (per foot, per acre, etc.). Accurate seeding rates are important. Overseeding wastes seed and underseeding reduces yields. By underseeding, the utilization of available light, moisture, and nutrients is inefficient. Overseeding creates excess competition among the plants, thus reducing yield. Optimum seeding rates should be based on the type of crop, use of crop, pure live-seed ratio, seed quality, soil moisture, soil productivity, time of seeding, method of seeding, row width, and expected average rainfall.

The type of crop planted influences the desired seeding rate. Corn can be planted at populations of 18,000 to 32,000 seeds per acre, whereas soybeans are typically planted at 130,000 to 170,000 seeds per acre. The intended use of the crop is also a factor. Corn silage is generally planted at a higher plant population than corn harvested for grain.

The pure live-seed ratio refers to the ratio of weight of the viable seed of the cultivar (variety within a plant species) being seeded to the total weight of the seed stock, which may include nonviable seeds, weed seeds, and inert matter. If 80% of the seed is viable (able to germinate) and it is 95% pure, the pure live-seed ratio is 76% .

0.80 viable seed x 0.95 pure = 0.76 pure live seed ratio

If an individual has 100 pounds of seed, there would be 76 pounds of pure live-seed of the desired cultivar to plant. To calculate the correct seeding rate from pure live-seed ratios, refer to the cultivar's recommended seeding rate. An example is presented as follows.

A recommended seeding rate based on 100% pure live-seed is 6 pounds per acre. This rate is common for small-seeded range grasses. The appropriate seeding rate would be slightly less than 8 pounds per acre based on the following calculations:

$$\frac{\text{Rate based on 100\% pure live-seed}}{\text{[pure live seed (ratio)]}} = \text{Seeding rate}$$

$$\frac{6}{0.76} = 7.9 \text{ pounds per acre}$$

Seeding rate can also be affected by seed quality. Seed quality is based on germination rate and other factors. If seed quality is low, it is advisable to increase the rate of seeding to ensure a good stand. Seeding time refers to seeding the stand at the appropriate time of the season (e.g., fall or spring). Climatic conditions can reduce stand establishment if planted after the optimum time. Increased seeding rates are suggested when planting before or after optimum planting dates.

Soil productivity and soil moisture also affect the optimum seeding rate. Productive soils may sustain the recommended seeding rates, whereas poor soils may sustain production only at lower seeding rates due to the less fertile soil condition. Excessive soil moisture can retard germination. Most seeds cannot tolerate excessive moisture and may rot. If there is excessive moisture, seeds should be planted at a shallower depth and at a higher seeding rate. This will promote faster germination and compensate for loss due to wet conditions.

The method of seeding and row width also affects the seeding rate. Row planting usually involves relatively lower seeding rates than the drill method. Broadcast seeding is used when high seeding rates are desired. Generally, as row width narrows, the number of seeds planted can be increased to some degree. Conversely, planting seeds in wide rows should be completed at lower seeding rates.

Seeding Rate and Equipment Calibration

After the desired plant population is determined, the next step is to properly calibrate the planting equipment. This varies with the type and brand of equipment. The first and probably most important instruction to the producer is to read the owner's manual. The manual explains how to adjust the

planting equipment to achieve the desired seeding rate. It is also an excellent guide in determining the planter's maximum speed for a given planting rate. Do not exceed the recommended planting speed or the metering mechanism will turn too fast for accurate control of the planting rate.

Planting equipment should also be checked for worn parts. Worn parts will interfere with achieving desired seeding rates. Planting depth should also be adjusted at this time to match seed recommendation and moisture conditions.

The next step would be to do a calibration check in a barn lot or dirt roadway before going to the planting field. This "practice" planting involves uncovering planted areas to count seed populations (number of seeds in a given distance), checking to see if the seeds are being accurately delivered into the soil.

The final step would be to conduct the calibration in the actual planting field. This should also be done one to two times each planting day to ensure no change has occurred that will affect the equipment's performance.

Availability Options for Seed

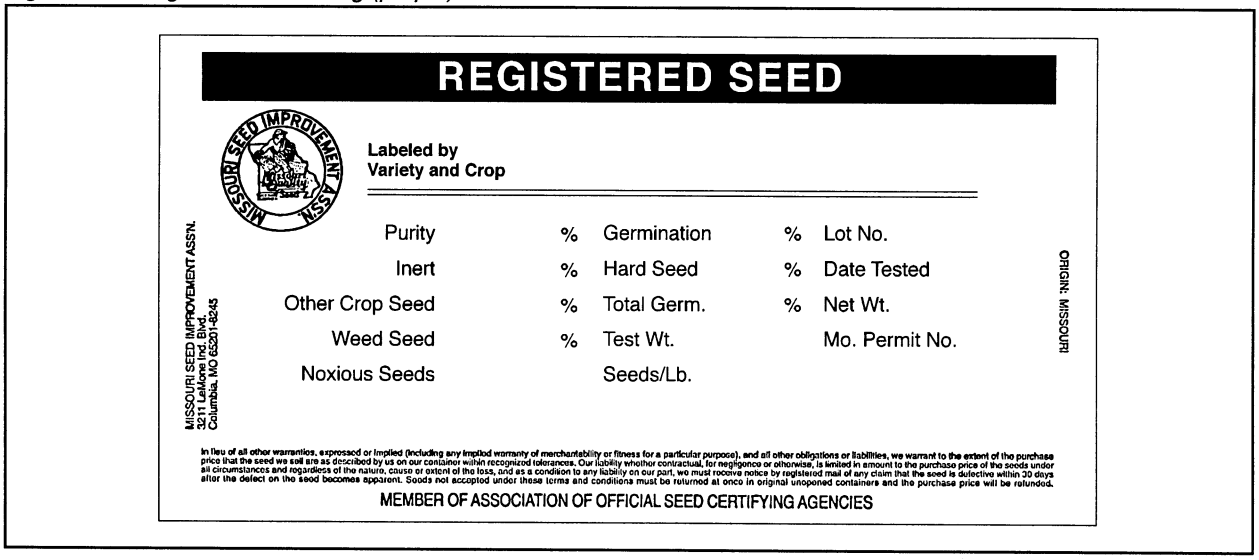
Certified seed is sold to producers with strict production guidelines to ensure genetic purity. Certification programs have four classes of seed: breeder seed, foundation seed, registered seed, and certified seed. For seed to be certified, specific criteria must be met. Criteria for certified seed are (1) the seed must be grown from registered or certified seed stock; (2) the crops produced must pass an inspection for mixtures, weeds, and diseases in the field; and (3) the harvested crop must attain the standard of perfection set by the seed association. Seed that fails to meet any of these three requirements cannot be sold as certified seed in the state.

Each seed class must meet specific requirements for certification. Breeder seed is controlled by the originating plant breeder it used in producing foundation seed and does not require identification tags or labels. Only small quantities of breeder seed are produced by commercial seed companies. Foundation, registered, and certified seeds require tags or identification labels.

Foundation seed is owned and supervised by the original plant breeder (usually an agricultural experiment station). It is the parent line for registered and/or certified classes of seed. Foundation seed requires a white identification tag or label. All foundation seed is grown and traded between the company and breeder.

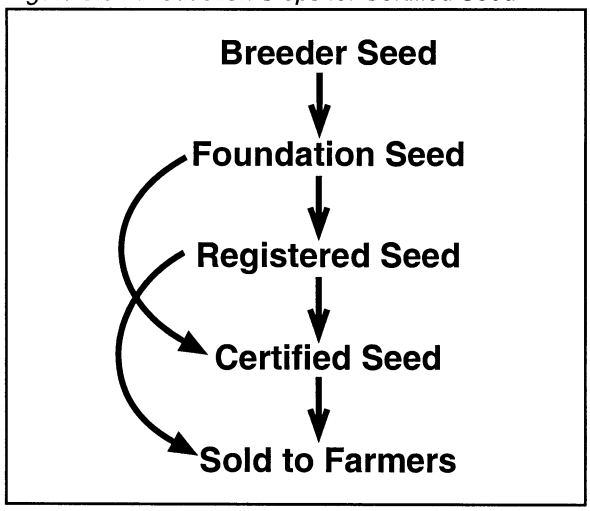
Registered seed is produced from foundation seed that meets genetic purity and identity guidelines. It may be used to produce certified seed or sold directly to farmers. Contracts are generally established with producers to grow the type of seed for the company. Registered seed is tagged with a purple identification tag or label as shown in Figure 3.2. Certified seed is produced from foundation or registered seed that meets genetic

Figure 3.2 - Registered Seed Tag (purple)



identity and purity guidelines. Certified seed is tagged with blue identification tags or labels. Seed trade of certified seed always occurs between a company seed dealer and a producer. The steps in the production of certified seed are diagramed in Figure 3.3. The arrows indicate where the seed is used. For example, registered seed can be sold for producing certified seed or for producing field crops by farmers.

Figure 3.3 - Production Steps for Certified Seed



Many states produce seed for export to other countries. The Organization for Economic Cooperation and Development (OECD) has set forth specific minimum requirements that must be met by the seed producers to receive an OECD tag. The Missouri Seed Improvement Association, working with the Missouri Agricultural Experiment Station and the USDA Agriculture Research Service, provides the needed information to Missouri seed producers regarding this certification.

Farmers are also able to purchase seed from local producers. The practice of selling saved seed allows a producer to earn premiums above market price for the quality seed. However, this practice has been limited in recent years due to plant patents. It is important to check plant variety protection laws before purchasing seed from local producers. Producers may also sell brown bag seed. Brown bagged seed is considered generic or no variety stated (NVS) because no quality or performance data is labeled on the bag. Individuals purchasing seed should check with the local producer on the quality of the seed before making any purchases.

Plant Patents Effect on Seed Selection

Before discussing how plant patents affect seed selection, it is important to understand what a patent is. A patent is an exclusive property right to an invention as issued by the Commissioner of Patents and Trademarks, U.S. Department of Commerce. The rights granted are limited to the claims of the patent. Plant patents are granted for 17 years for plants when they are asexually reproduced with the exception of tuber-propagated plants or plants found in an uncultivated state. Patentable plants must have been reproduced by means other than seeds, such as by the rooting of cuttings or by grafting. A patent has the potential of providing tremendous wealth to its owner. The owner can prevent all others from using, making, or selling the patented item throughout the United States for 17 years.

Plant patents have limited some options for producers for seed selection. Producers are not allowed to save back seed from genetically superior seed that is patented. The purchase of seed must be made yearly, and many companies may require special contract agreements requiring the producer to produce and market the crop in a specific marketing program.

Using Certified Seed

Producers have found that using certified seed provides specific benefits. Certified seed is guaranteed to be the variety advertised with no unexpected varieties. The minimum germination rate is also guaranteed and listed on the tag. Therefore, the buyer is ensured of the viability of the seed purchased. Using certified seed guarantees a high-quality seed free of weed seeds, disease organisms, and insects. Many argue that the cost of certified seed is a disadvantage; however, considering the improved performance, it is really an advantage.

Summary

Quality seed will exhibit specific characteristics. Seed tags provide information that is critical for producers in choosing the seed that will give a productive stand. Optimum seeding rates must be determined to avoid over- or underseeding. Factors that should be considered for optimum seeding rate are the type and use of the crop, pure live-seed ratio, seed quality, soil and moisture productivity, timing and method of seeding, row

width, and average rainfall. An important step before actually planting the seed is to properly calibrate the planting equipment according to the owner's manual. Certified seed is available in four classes: breeder seed, foundation seed, registered seed, and certified seed. The producer needs to be aware of the advantages and disadvantages of using certified seed.

Credits

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