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# Weed Science for 4-H'ers

The 4-H Weed Science Contest is to make you aware of the group of plants commonly called "weeds." You will be introduced to ways to manage these pests. The contest has two parts: the written quiz and weed identification.

You will be expected to identify 20 plants from the publication "Weeds of the Southern United States," but you will not be expected to learn scientific names. You should be able to identify a plant by its correct common name. This part of the contest is worth 100 points.

You will also be tested on the information in this publication. Questions will be short answer, true/false, matching, and multiple choice. The quiz is worth 100 points toward your total score.

## Introduction

If you look out the nearest window, chances are good you will see several hundred different plants; some look the same and some different. You know some plants are trees, others are grasses, and still others flowers. People group similar objects to make discussions about these objects easy. This is certainly true with plants. You may be familiar with specific names of some of the plants you see. You may know the grass in your lawn is bermudagrass or centipedegrass. You may recognize the azaleas and petunias in a flower bed. Perhaps you helped plant those flowers. You probably recognize the plants that produce tomatoes, peas, corn, and okra in the garden. Perhaps you helped plant the garden and pick the produce. You probably also recognize cotton, soybeans, wheat, and corn when you see those crops.

Think about the plants outside your window that you don't know. Perhaps no one has told you the names of those plants or helped you learn to identify them. Plants have differences that help identify them. The differences may or may not be obvious. The differences may be in the leaves, growth habit, roots, stems, seeds, or flowers. You can use these differences to identify plants unfamiliar to you. You will remember many of those plants once you have seen the plant and learned its name.

## Plant Names

The name you use for a certain plant may not be the same someone else in another part of the world uses. For example, the crop we call "corn" is called "maize" in Europe. To prevent confusion, many years ago a system was developed to make one scientific name for each type of plant. This scientific name can be used by anyone anywhere around the world. The scientific name of corn is *Zea mays*. This is known around the world.

The scientific name is made of two words: genus and species. The genus is the first word and is always capitalized. The species is the second word and is never capitalized. The scientific name should be written in Italic or underlined. You will not have to learn scientific names for this contest. Just be aware of the purpose of the scientific names. You do need to learn common names of weeds in the publication "Weeds of the Southern United States." Common names are written in red in that publication.

## Crop Identification

You already may be familiar with the group of plants we consider crops. Crops are plants grown for food or fiber. Crops can be further divided into agronomic, horticultural, or forestry crops.

Agronomic crops, important to the economy of this state, include corn, cotton, forages, peanuts, rice, sorghum, and soybeans. Most of us would not consider these crops favorable food sources.

Agronomic crops are produced mainly as feed for livestock. We, in turn, feed on the livestock. However, some human food products are manufactured from agronomic crops. For example, cooking oil comes from corn, soybeans, peanuts, and sunflowers. Your mother probably uses one of these types of oil for cooking. Rice, peanuts, corn, and wheat are important human food agronomic crops.

Horticultural crops include turf, vegetables, fruits, nuts, flowers, and other ornamental plants. Several vegetable crops are important in Mississippi: cabbage, cantaloupe, cucumbers, lima beans, peppers, southern peas, sweet corn, sweet potatoes, tomatoes, and watermelons. Important fruits include apples, blueberries, blackberries, grapes, peaches, and strawberries. Pecan is the important nut crop in Mississippi. We grow hundreds of different types of ornamental plants in Mississippi. Ornamental plants include shrubs, flowers, and ground covers. These plants decorate buildings, homes, offices, and have many other uses.

Forestry and timber production also are important in Mississippi. About 60 percent of the land area in Mississippi produces timber. Several types of trees are important, but the most important group of trees is the Southern yellow pines – loblolly, longleaf, shortleaf, and slash. Also important are the red and white oaks, ash, cottonwood, poplar, sweet gum, and willow.

# Noncrop Identification

In all, about 250,000 different types of advanced plants are known to exist. The one man uses to produce food, clothing, and shelter represent a small percentage. Plants man doesn't use are noncrop plants.

Many noncrop plants get in the way of man's attempt to produce crops. These plants are weeds. A weed is defined as any plant growing where it is not wanted. So, a corn plant in a soybean field is a weed. Other plants are weeds because they interfere with man's well-being. Many weeds, common ragweed (8)* and goldenrod (14), for example, produce allergens that aggravate individuals with hayfever or allergies. Poison ivy (4) produces a skin irritant that makes you itch.

* Numbers in parentheses after weeds listed in this publication indicate the page where that weed is found in "Weeds of the Southern United States."

# Weed Characteristics

Weeds have characteristics that distinguish them from crop plants. Weeds produce many seeds. Weed seeds can live in the soil for a long time. Weeds invade and become established quickly in disturbed sites. Many weeds have several ways to reproduce. Weed seeds are adapted for spread to other areas by wind, rain, and animals. Some weed seeds are in a resting state (dormant) when released from the plant. Some weed seeds are released before maturity and must go through a ripening or additional maturity period before they can germinate.

# Weed Interference

Perhaps you wonder how weeds get in the way of crop production. One way is by competition. Plants must have four essential resources to grow: light, water, carbon dioxide, and nutrients. Weeds growing beside a cotton plant take the resources the cotton plant needs to produce its best yield. Most weeds emerge ahead of, or at the same time as, the crop and grow faster than the crop. Their root systems develop more rapidly and take up a greater area than crop plants do. Hence, they can take nutrients and water the crop would get later. Also, because of the faster growth rate, they develop more vegetation above ground and can shade crop plants. Without sunlight, crop plants cannot grow.

Another way weeds interfere with crops is allelopathy, which occurs when one plant produces an organic chemical that hinders the growth and development of another plant. Usually, closely related plants are not affected by the compound. Crop plants, however, can be severely stunted if the chemical is in the soil in which they grow.

Weeds also reduce the quality of harvested products. The price for cotton lint contaminated with grass vegetation (large crabgrass (24), for example), is reduced. The value of wheat is reduced if the sample has wild garlic (31) seeds. Cattle grazing bitter sneezeweed (13) produce milk with a bitter flavor. Likewise, wild garlic (31) gives an off-flavor to milk. A price reduction occurs if off-flavors are detected in milk. Some plants produce seeds toxic to animals. Showy crotalaria (30) seeds are highly toxic to poultry. The price of soybeans contaminated with showy crotalaria (30) is severely reduced.

Weeds also interfere with the harvest of crop plants. Large weeds may clog machinery and slow harvesting. Produce that is hand-harvested may be hidden by weed vegetation and may get left in the field.

Insects and diseases live on some weeds. These pests can move from the weeds to crop plants and reduce yield if the pest infestation in crops is severe.

# Plant Identification

Seed-producing plants are classified as monocot or dicot plants. Monocot plants have one seed leaf, and dicot plants have two seed leaves. Large crabgrass (24), corn, wild garlic (31), and yellow (20) and purple (21) nutsedge are monocot plants. Monocot plants also have fibrous roots and parallel veins in the leaves. Dicot plants have two seed leaves. Dicot plants also have fibrous roots or a taproot and net-shaped veins in the leaves.

Examples of dicot plants include common cocklebur (15), cotton, soybeans, tomatoes, pokeberry (34), and tall morningglory (17).

# Weed Groups

## Annuals

Weeds are placed in three groups based on on their life cycle: annual, biennial, and perennial.

Annual weeds emerge and produce seed within one year. Annual weeds can be further separated into summer and winter annuals. Summer annual weeds emerge in the spring and produce seeds in the fall or early winter.

Examples of summer annual weeds include common cocklebur (15), large crabgrass (24), goosegrass (25), and Pennsylvania smartweed (35).

Winter annuals emerge in the fall and produce seeds in late spring or early summer. Henbit (28), chickweed (7), Carolina geranium (23), and annual bluegrass (27) are winter annual weeds.

## Biennial

Biennial weeds require two years to produce seeds. These weeds emerge and grow the first year. Biennials survive the winter in a resting state. They start growing again the second year and produce seeds in the fall. These plants require a period of cold temperatures to start the seed production mechanism. Biennial plants include wild carrot (41), common mullein (39), and cudweed (12).

## Perennial

Perennial plants emerge, grow, and produce seeds the first year. In addition, part of the plant survives the winter, continues growing, and produces seeds the next year. This cycle is repeated for many, many years. Perennial weeds are "simple" or "creeping."

Simple perennials reproduce mainly by seed. Bigroot morningglory (17), curly dock (36), and dandelion (15) are simple perennials.

Creeping perennials reproduce by seed or plant parts. Examples of creeping perennial weeds include bermudagrass (24), johnsongrass (28), redvine (36), and trumpetcreeper (5).

Creeping perennial weeds produce new plants from existing plant parts and seeds. Several structures exist from which new plants arise on creeping perennials. Bermudagrass produces stolons (stems above the ground) that produce roots and new plants. Bermudagrass also produces rhizomes (underground stems) that can produce new plants. Yellow and purple nutsedge and Florida betony (29) produce tubers from which new plants develop. Wild garlic (31) produces bulbs that can produce new plants. Red vine and horsenettle (40) produce creeping roots that develop new plants.

# Weed Control

Because of the harmful results weeds have on crop yield, it is helpful to keep populations low. Weed control is essential for an acceptable crop yield and economic income. Often, a combination of methods is needed to provide acceptable, season-long control.

## Preventative

Weed control methods are divided into preventative, mechanical, cultural, biological, and chemical.

Preventative weed control involves methods that prevent weed movement into an area. For example, using clean, weed-free crop seed for planting; irrigating from weed-free water sources; feeding weed-free feed to livestock; and removing weed vegetation from tillage implements before moving into other fields.

## Mechanical

Mechanical is one of the oldest methods of weed control and means physical removal of weeds from an area. This involves hand-pulling, hoeing, tilling (cultivation), and mowing.

## Cultural

Cultural control involves production practices that favor crop growth and slow weed growth. Flooding rice fields is one such cultural practice. Controlled burning of pine woodlands and mulching vegetables or fruits are other examples of cultural control. Mulching involves placing on the soil surface a barrier that blocks light. Seedling plants cannot survive without light.

Another method of cultural control is crop rotation. Some weeds are more easily controlled in some crops than others. Sicklepod (29), for example, is more easily controlled in corn than in soybean; this is partly because of the competitive advantage of corn, different production practices, and herbicide options for corn. Farmers with soybean fields heavily infested with sicklepod could rotate to corn and reduce population of the weed.

Cultural control also involves managing the crop to use its competitive abilities to help control weeds. Farmers should use production practices that favor crop growth over weed growth. Plant early, add recommended rates of fertilizer, maintain favorable soil pH, and use high vigor seed to promote crop growth. Also, planting in narrow rows helps crops shade the area between rows earlier in the season and thus restrict weed development.

## Biological

Recently, biological control methods have gained attention. This practice uses one organism to manage populations of another organism and is not a new concept. In the 1940's and 1950's, geese were used to eat grass in Mississippi cotton fields. Current interests are for use of diseases, insects, and fish to control weeds. For example, grass carp fish control weeds growing in ponds and lakes. High populations of thistle weevils control blessed thistle (10) in pastures and other areas. Several plant diseases have been and are being tested for potential to control certain weeds.

Researchers must be cautious before these organisms are released, however. A biological control agent, released in the environment at populations sufficient to control weeds, can become a new pest. These organisms must be tested to determine their potential to become pests before commercial use is allowed. For example, bass feed on small fish. Pond weeds provide a habitat for small fish to feed, hide, and reproduce. If grass carp eat the plants that protect the small fish, their population will decline, and the bass population also would suffer from starvation.

## Chemical

Using chemical compounds to control unwanted plants began in the 1940's. The first commercially available herbicide was 2,4-D, a chemical that kills plants and offers rapid, economical control of unwanted plants.

Before a herbicide is offered for sale, its potential to harm animals, crops, and the environment is evaluated. Millions of dollars are spent to determine if the compound is toxic to animals or fish or if it causes cancer, birth defects, tumors, or genetic mutations. Products produced as the herbicide decomposes (breaks down) also must be tested. Scientists must determine what happens to the compound after it is sprayed in the environment. Behavior of the herbicide in soil and water is also determined. When used correctly, herbicides pose small risk to humans and the environment.

# Herbicides

## Classification

Herbicides are classified as selective or nonselective. Used at recommended rates, selective herbicides control some plants but not others. For example, Basagran effectively controls common cocklebur (15) but does not affect soybeans or peanuts. Treflan controls annual grasses such as barnyardgrass (25) and goosegrass (25) but does not injure cotton or soybeans. PoastPlus and Fusilade control annual (Texas Panicum (26) and foxtail [27]) and perennial (bermudagrass (24) and johnsongrass [28]) grasses but do not damage broadleaf crops such as cotton and soybeans. Note that at recommended rates these herbicides are selective. Any chemical compound used incorrectly can damage crop plants.

Atrazine herbicide is selective at low rates but nonselective at high rates. Sencor is safe to use on soybeans if the correct rate is applied. If, however, the rate is too high, soybeans will be killed. Most of the herbicides used in crop production are selective, since injury to the crop is not acceptable. Plants not killed or injured by the selective herbicide are tolerant. Plants killed by the herbicide are susceptible.

Several herbicides are selective because of the application procedure. This is particularly true for many of the herbicides used in cotton. Herbicides such as Karmex, Goal, and Caparol are safe to use in cotton but will kill cotton plants if the leaves are sprayed. Hence, the method of application can determine herbicide safety in a particular crop.

The other broad group of herbicides is nonselective. Nonselective herbicides injure most of the plants that come in contact with the spray. Roundup or Gramoxone control most of the plants sprayed with these herbicides. Some nonselective herbicides are applied to the soil and control weeds before emergence.

Some nonselective herbicides can be selective if the method or time of application prevents contact of the spray solution with live crop foliage. Roundup controls emerged winter weeds in dormant bermudagrass turf; however, the bermudagrass must be completely dormant to prevent injury. Likewise, Gramoxone, applied with a shielded sprayer in soybeans, controls emerged weeds in the row middle without crop injury.

# Application

Another method of herbicide categorization is by time of application in relation to weed and crop development. Herbicide applications for crop production are preplant incorporated, preemergence, or postemergence. Herbicide applied to the soil surface and incorporated into the top one to two inches of soil before planting is called “preplant incorporated.” Soil incorporation prevents herbicide loss and, hence, unacceptable weed control. Some herbicides turn into gas at field temperatures and evaporate, and ultraviolet sunlight destroys some herbicides. Herbicide incorporation into the soil prevents these losses and ensures acceptable weed control. Treflan and Eptam are examples of preplant incorporated herbicides.

Several implements provide acceptable incorporation: disk, field cultivator, rolling or Lilliston cultivator, drag, power-driven rotary hoe, or do-all. Two passes of the implement provide the best incorporation. Areas of high or low herbicide concentration can result from poor incorporation.

Crop injury or poor weed control results from poor incorporation. One disadvantage of preplant incorporated application is the cost. Two passes of any of these implements can be expensive. Soil moisture must be just right for good incorporation. Farmers are often rushed to get crops planted and don't want to wait for the soil to dry enough for herbicide incorporation.

Herbicides applied after planting but before weeds emerge are preemergence herbicides. Examples include Lasso, Dual, Atrazine, and Cotoran. One advantage of using preemergence herbicides is the ease of application. A spray boom attached to the planter lets the farmer plant and apply the herbicide in one operation.

Preemergence herbicides must move into the top 1/4 to 1/2 inch of soil to control weeds. This usually occurs if 1/4 to 1/2 inch of rain occurs or the field is irrigated after herbicide application. Farmers not equipped to irrigate fields must rely on rain to move the herbicides into the soil. This can be a disadvantage to using preemergence herbicides. If preemergence herbicides do not move into the soil within several days after application, weed control is poor.

The length of time preemergence herbicides can wait for rainfall and still provide good weed control varies. This information is on the herbicide label. In general, the sooner after application the herbicide moves into the soil, the better the weed control activity.

Many preemergence herbicides are flexible as to application, meaning the application can be preemergence or preplant incorporated. The incorporation should, however, be as shallow as possible, usually in the top 1/4 inch of soil. Incorporation ensures the farmer of acceptable weed control regardless of rainfall occurrence after application. However, as previously stated, incorporation increases the farmer's expense.

The other group of herbicides is the postemergence herbicides. These herbicides are applied to weeds after they emerge from the soil. The farmer must know which weeds are in the field before he can select a herbicide to control those weeds. Postemergence herbicides usually control many types of weeds but often do not control all of them in a particular field. In those fields, a combination of herbicides is required. However, some weeds in a field may not be controlled by any herbicide or combination of herbicides.

Apply postemergence herbicides to small, actively growing weeds. The best control occurs if the weeds have two to four leaves at the time of application. Weeds become more difficult to control (with postemergence herbicides) as they get larger and more mature.

Most postemergence herbicides control weeds up to a certain size. Usually, the rate required to control large weeds is greater than that required to control small weeds. Weeds germinate and emerge over an extended period, and you must try to time the postemergence herbicide application to control as many weeds as possible. The application must be before the weeds that emerged early in the season get too large to control. Postemergence herbicides must stay on the plant for several hours to control weeds. Rainfall soon after application can wash the herbicide from the plant; therefore, do not apply if rainfall is predicted within 24 hours.

Crop oil concentrates and nonionic surfactants enhance weed control activity with postemergence herbicides. These additives help get the herbicide into the plant tissue.

Weeds will not be controlled if the herbicide molecules remain outside the plant. The product label will indicate whether or not adding one of these additives is suggested or required.

Some herbicides burn weed foliage that the spray solution contacts. These herbicides are called contact herbicides. These are effective to control annual plants but provide only temporary control of perennial weeds. Since these herbicides kill only the foliage covered with the herbicide spray solution, complete plant coverage is essential for good weed control. Basagran and Blazer are examples of postemergence, selective, contact herbicides. Gramoxone is an example of a postemergence, nonselective, contact herbicide.

Systemic herbicides are a better choice to control perennial weeds than are contact herbicides. These herbicides move into the leaves, then within the plant to the areas of active food accumulation. Perennial weeds must send food to the top of the plant (apex) and to the vegetative reproductive structure near the soil (see creeping perennials in life cycle section). Systemic herbicides accumulate in both areas; hence, plant parts above, at, or beneath the ground are killed.

Preemergence and postemergence herbicides are applied broadcast or banded. Broadcast applications cover the row and areas between rows. In comparison, banded applications are applied to a portion of the row or row middle. For example, a broadcast, preemergence application of Dual will prevent grass emergence within and between rows. Dual applied preemergence banded over the row will prevent grass emergence within the row but not between rows. Some other method of weed control must be used to control those weeds emerging between rows after banded herbicide application. Banded applications reduce the amount of herbicide used and costs of crop production.

# Label Information

The label has use directions and must be attached to every container of each herbicide sold — this is required by law.

The label provides instructions for buyers and applicators on the correct uses for that herbicide. No herbicide or other pesticide can be sold without a label. The label indicates the product name, the common chemical name, amount of active ingredient(s), and inert ingredients. The active ingredient is the part of the herbicide that actually kills the weeds. Inert ingredients are additives that help mix the active ingredient with water and keep it mixed, may help move the active ingredient into the plant, improve shelf life, and keep the active ingredient suspended in the product mixture.

The label lists the name and address of the herbicide manufacturer, EPA product registration number, net contents of the container, and the type formulation. Herbicides designed to be mixed with water before application are formulated as emulsifiable concentrates (designated E or EC), water soluble liquids (designated S or LC), flowables, (F or L), wettable powders (WP, W, SP), or dry flowables (DF). Others are manufactured as dry granules (G) that are applied directly to the soil.

Information on the label indicates which crops the herbicide can be applied to legally and safely and product use rates and weeds controlled at those rates. It is against of Federal law if the herbicide is not applied according to the label. The rate is important for weed control, crop safety, and residue tolerance.

Also on the label are suggestions to help ensure best herbicide activity and information, such as suggestions for nozzle type and size, the number of gallons of water per acre to apply, time of application (preplant incorporated, preemergence, or postemergence), weed size for postemergence herbicides, and whether or not a surfactant or crop oil concentrate is needed. If surfactant or crop oil concentrate is needed, that rate also will be on the label.

Safety information is provided on the label. This includes information on animal and environmental toxicity, physical and chemical hazards, length of time after application an individual can go into the treated area (reentry interval), and what to do and whom to contact if the herbicide is swallowed, spilled on skin or soil, or catches fire.

Also on the label is a signal word. This signal word indicates the toxicity of the herbicide to humans. "Danger" indicates the material is highly toxic to man. "Warning" indicates the herbicide is moderately toxic to humans. "Caution" indicates low toxicity to man.

As we said earlier, the rate is important to ensure acceptable weed control, but it is also important to avoid unacceptable pesticide residues in the harvested crop. During testing for registration, the Food and Drug Administration determines, based on toxicity data, how much of the herbicide residues mammals can eat without danger of sickness or injury. The residue allowed is many thousands times less than that amount that could cause illness. This information must be considered to determine how much and when to apply the herbicide. The label will indicate the number of days that must pass after application and before crop harvest (preharvest interval). Failure to follow this preharvest interval or use of excessive rates can result in illegal residues in the crop. If illegal residues are detected, the producer will be fined by state and Federal authorities. In addition, the crop is condemned and cannot be sold.

Rerised by **Dr.Al Rankins**, Assistant Professor, Plant & Soil Sciences



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