General Production Information

The Louisiana soybean industry yielded over 20 million bushels of soybeans harvested on 610,000 acres in 2001. The yield averaged 33 bushels per acre. At a price averaging $5.25 per bushel, the value of production was estimated to be slightly more than $100 million making up about 1% of the national total. Louisiana ranks number 20 out of the 32 states that produce soybeans.

The top 5 soybean producing parishes in Louisiana were: St. Landry, Point Coupee, East Carroll, Avoyelles, and Concordia, each with no less than 1.3 million bushels. St. Landry and Point Coupee parishes each produced over 2.5 million bushels.

Soybeans are one of the most adaptable crops for the different soil types and varied climatic conditions found in Louisiana. Its day as a major cash crop may be over, but the soybean will remain the principle alternative crop of the state, and it continues to play a big part in the state’s agriculture economy.

Cultural Practices

Soybeans are an annual legume with pubescent stems and large pinnate leaves. Flowers are white or purple and found in axillary racemic clusters. The seedpods are pubescent, bearing 1 - 4 spherical seeds. The seeds are harvested and used for vegetable oils, shortening, margarine, bread flour, soy milk, meat substitutes, fibers, plastics, ink, and as protein supplements for livestock feed. Minor uses also include: adjuvants, pesticide carriers, and bases for pharmaceuticals.

Soybeans are adapted to a wide range of climatic and soil conditions. The recommended planting depth for no-till soybeans is 0.75-1.0". For conventional till, the recommended depth is 1.5-2.0". Under dry conditions, growers plant a little deeper, but no deeper than 2.0". On sandy soils, seeds are planted about
2.0" deep. Planting deeper than 2.0" may be necessary to get to soil moisture but delays emergence and reduces stands of some varieties. On loam and clay loam soils where resistance to no-till planting is great, and crusting more likely than on sandy soils, soybeans are planted 1.0-1.5" inches deep. Planting generally takes place mid-April through mid-June with an optimal soil temperature of 60° F.

When selecting a variety, several characteristics should be considered. Yield, herbicide tolerance, disease resistance, salt tolerance, maturity, and seed quality are just a few of the important factors to consider. Consult the LSU AgCenter’s Variety Recommendations and Production tips when choosing a variety. Row spacings vary from 7" up to 40" depending upon planting equipment used.

Growers sometimes use minimum till or no-till methods to prevent excessive soil drying, reduce soil erosion, and reduce runoff of fertilizers and pesticides. However, seeds must be covered adequately with soil or they will not germinate. Inadequately covered seed is also subject to herbicide injury. Adding weight to the planter may be necessary to obtain the proper depth. Planting into dry soil may be a gamble but so is waiting for rain and expecting conditions to be prefect after the rain. Most of the moisture for soybean germination comes from the soil beneath the seed. Soybeans in Louisiana are generally harvested in September and October.

**Insect Pests**

Soybeans can be damaged by insects any time from plant emergence until near harvest in Louisiana. Many kinds of insects feed on leaves, stems, roots, nodules, and pods, but only a few require insecticides. Soybean plants can compensate for considerable insect injury, and naturally occurring predators and parasites frequently control insect pests adequately. However, they are often overwhelmed by insect numbers in late season. To prevent severe yield reductions or a total crop loss, an insecticide must be applied.

**Bean leaf beetle**

*(Certoma trifurcata)*

Bean leaf beetles are about 0.25" long, with considerable variation in color patterns. The background color may be yellow, green, tan, or red. Most beetles have four black spots and black stripes along the edges of the wing covers. A black triangle is always present at the base of the wing covers just behind the prothorax. The larvae are white, with dark-brown areas at both ends. When mature, the larvae are about 0.375-0.5" long. Bean leaf beetles overwinter as adults under debris in protected areas. When temperatures warm in the spring, the beetles fly into alfalfa and clover fields to feed but do not lay eggs. As soon as beans begin emerging, the beetles abandon alfalfa and clover fields to colonize bean fields. Females lay eggs in the soil around the base of the plant. The lemon-shaped eggs are laid in clusters of 12-24 and are orange in color. The eggs hatch in 1-3 weeks depending on the weather. The larvae feed on the roots and nodules of the plants. When the larvae finish feeding, they form an earthen cell in which to pupate. The pupal stage lasts approximately one to two weeks. Adults feed on the soybean foliage.
The injury caused by the bean leaf beetle is two-fold. The adults feed on the leaves of the plants causing the characteristic "shot hole" appearance on the leaves. Late in the season, bean leaf beetles may chew on pods but rarely consume the seeds. Their feeding creates scars that open the way to spores of some fungal diseases. Mild infection results in seed staining while severe infection results in seed contamination.

**Control:** The tachanid fly, *Celatoria diabrotica*, is the most effective natural enemy as a biological control, but often insecticide usage is warranted. Roughly 10% of Louisiana soybean acres receive at least one insecticide application during the growing season.

**Applied more frequently:**

- Cyhalothrin (Karate Z) 0.02-0.025 lb/A
- Esfenvalerate (Asana XL) 0.03-0.05 lb/A
- Methyl Parathion 0.25 lb/A

**Applied less frequently:**

- Permethrin (Ambush/Pounce) 0.075-0.1 lb/A
- Thiodicarb (Larvin) 0.45 lb/A
- Carbaryl (Sevin) 0.5 lb/A

*When applying any pesticides to crops, consult labels for appropriate restricted entry intervals (REI) and pre-harvest intervals (PHI).

**Three-cornered alfalfa hopper**  
(*Spissistilus festivus*)

The adult three-corned alfalfa hopper is green, triangular-shaped, and less than 0.25" long. Young hoppers or nymphs are green to light brown and wingless. They can be found feeding around the stems (phloem) of young plants, girdling the stem near the soil surface. Young seedling plants may lodge from being girdled or die as a result of stem girdling near the soil surface. Girdling can also result in lower weight and number of seeds, lower nitrogen fixation and yield loss due to lodging. When bean pods are set, maturing plants may break over from early seedling damage. Both adults and nymphs will also feed on the petioles of leaves, blooms, and pods, thus reducing yields.

**Control:** A strepsipteran is the only reported parasitoid of adult three-cornered alfalfa hoppers. Mymarid and trichogrammatid egg parasitoids have been reported, but parasitism rates are difficult to assess. The fungus *Pandora delphacis* has recently been isolated from the three-cornered alfalfa hopper, but its impact on population is limited depending upon environmental conditions. Other natural enemies include ants, mites, nabids, bigeyed bugs, robber flies, spiders, toads, and birds. About 5% of Louisiana soybean acres receive at least one insecticide application during the growing season.
All of the below are frequently applied:

- Cyhalothrin (Karate Z) 0.025 lb/A
- Esfenvalerate (Asana XL) 0.03-0.05 lb/A
- Acephate (Orthene) 0.75-1.0 lb/A

**Velvetbean caterpillar**
*(Anticarsia gemmatalis)*

The velvetbean caterpillar larva varies from light to dull green, with white lines running the length of the body. The lines on the sides of this larva are usually much broader than those on the green cloverworm or looper. It has four pairs of abdominal prolegs and is about 1.5" long when full grown. When knocked to the ground, it becomes very active and wiggles about. This insect damages primarily by feeding on interveinal leaf tissue. The younger larvae feed on the bottom part of upper leaves. Middle and lower leaves are consumed following the upper leaves. Later instars defoliate the leaf leaving only veins and midribs. If the infestation is high, stems and pods may be attacked.

**Control:** Roughly 13% of Louisiana soybean acres receive at least one insecticide application during the growing season.

**Applied more frequently:**

- Cyhalothrin (Karate Z) 0.015-0.025 lb/A
- Esfenvalerate (Asana XL) 0.03-0.05 lb/A
- Methyl Parathion 0.25 lb/A

**Applied less frequently:**

- Carbaryl (Sevin) 0.25-0.5 lb/A
- Methomyl (Lannate) 0.125 lb/A
- Permethrin (Ambush/Pounce) 0.05-0.1 lb/A
- Thiodicarb (Larvin) 0.25-0.4 lb/A
- Bacillus thuringiensis (Use according to label)
- Chlorpyrifos (Lorsban) 0.5 lb/A
- Spinosad (Tracer) 0.031-0.062 lb/A

**Stink bugs**
*(Nezara sp., Acrosternum sp., Euschistus sp.)*

Adult stink bugs are about 0.5" long and may be either green or brown, depending on the species. The most common species found in soybean are the green, southern green, and brown stink bugs. In recent
years, the brown stink bug appears to be more prevalent than the other two species. These insects overwinter as adults. During spring and early summer, they feed and reproduce on weeds, corn fields, and in home gardens. Stink bugs will not seriously damage soybeans until after pods set. Nymphs and adults damage the crop by piercing the pod hulls, leaving brown or black spots, and sucking juices from the developing beans. They attack stems, foliage, blooms, and seeds. However, younger tissues and developing seeds seem to be their favorite. Feeding of this type can result in unfilled pods, severely shrunken seed, or discolored seed at the puncture site. These malformed seeds cause a lower grade (less profit) and usually have low germination and viability qualities. Sometimes, stink bug feeding results in a delay of maturity known as ‘green bean syndrome’.

Nymphs are typically orange and black, but colors vary considerably before the adults develop. Older nymphs (fourth and fifth instars) can cause as much damage as adults. Populations of brown stink bugs generally peak late in the season and are seldom high enough to require control measures. However, the brown stink bug is often more difficult to control than other stink bugs that attack soybeans.

**Control:** Almost 50% of Louisiana soybean acres receive at least one insecticide application during the growing season.

All of the below are frequently applied:

- Cyhalothrin (Karate Z) 0.025-0.03 lb/A
- Methyl Parathion 0.25-1.0 lb/A
- Acephate (Orthene) 0.75 lb/A

**Soybean looper**  
*Pseudoplusia includens*

The soybean looper sometimes occurs in large numbers and is almost an annual problem in Louisiana soybeans. The larva has a characteristic looping movement when crawling. It is light green, with thin white lines running the length of the body on the sides and top. The body tapers toward the head. The larva has two pairs of abdominal prolegs. This insect has developed resistance to some insecticides but is often controlled by disease organisms.

The larvae of the soybean looper feed in the lower part of the canopy. As they age, they tend to prefer more mature foliage. They begin feeding inside the plant (lower portion) moving towards the top as defoliation occurs. The damage looks like a "window pane" since the first and second instars of larva feed on the undersides of leaves. Other instars produce a "lacelike" damage since they feed on everything but the leaf veins. The most damaging instars range from the fourth to the sixth (95% of the total feeding). This insect is considered a defoliator, however sometimes it feeds also on soybean pods, seeds, or stems when the population is so high that that plant is almost defoliated.

**Control:** Roughly 25% of Louisiana soybean acres receive at least one insecticide application during the
The green cloverworm larva has the same looping movement as the soybean looper and is similar in appearance. It is uniformly pale green, with white stripes running along the sides. However, it has three pairs of abdominal prolegs, and its body is not tapered. The green cloverworm feeds on the leaf leaving large holes. In heavy infestations, only the main veins remain intact. When disturbed, this insect becomes very active. It is attacked by a number of predators, parasites, and diseases and rarely requires chemical control.

**Control:** Less than 1% of Louisiana soybean acres receive at least one insecticide application during the growing season.

**Applied more frequently:**

- Methyl parathion 0.25 lb/A

**Applied less frequently:**

- Carbaryl (Sevin) 0.25-0.5 lb/A
- Methomyl (Lannate) 0.125 lb/A
- Permethrin (Ambush/Pounce) 0.05-0.1 lb/A
- Thiodicarb (Larvin) 0.25-0.4 lb/A
- Spinosad (Tracer) 0.031-0.062 lb/A
- Bacillus thuringiensis (Use according to label)
The corn earworm may appear in various colors from yellow or pink to green, and sometimes almost black. Alternating light and dark stripes usually mark the body which is covered with small spines. Regardless of body color, they always have yellow-brown head capsules, except when newly hatched. A fully developed larva is 1.5-2" in length. Adult moths are grayish-brown with a wingspread of about 1.5". Most adult moths are considered to migrate north from the southern states in the spring. Individual female moths lay a single off-white colored egg. Corn earworms feed on pods and seeds.

**Control:**

About 3% of Louisiana soybean acres receive at least one insecticide application during the growing season.

**Applied more frequently:**

- Esfenvalerate (Asana XL) 0.03-0.05 lb/A
- Spinosad (Tracer) 0.047-0.062 lb/A

**Applied less frequently:**

- Methyl parathion 0.375 lb/A
- Permethrin (Ambush/Pounce) 0.1 lb/A
- Tralomethrin (Scout Xtra) 0.016-0.019 lb/A
- Carbaryl (Sevin) 0.75-0.1 lb/A
- Methomyl (Lannate) 0.25-0.45 lb/A
- Acephate (Orthene) 0.75 lb/A

**Saltmarsh caterpillars**

*(Estigmene acrea)*

Saltmarsh caterpillars (often called "woolly worms") feed in the larval stage in groups on soybean foliage. Seedling soybeans may also be attacked. They usually feed on the leaves on the upper third of the soybean canopy. Infestations seldom reach levels that require control as they are often limited to the field margins.

**Control:** Less than 1% of Louisiana soybean acres receive at least one insecticide application during the growing season.

**Applied more frequently:**

- Methomyl (Lannate) 0.45 lb/A
- Acephate (Orthene) 0.75 lb/A
**Applied less frequently:**

- Bacillus thuringiensis (Use according to label)

**Blister beetle**  
*(Epicauta sp.)*

These elongated beetles have soft wing covers that leave the tip of the abdomen exposed. They can be black, gray, or yellow with black stripes. The larva is a predator of grasshopper eggs but is harmless to soybeans. Adults feed in groups mainly on the intervein of leaves and usually occur in clusters or ‘hot spots’. Rarely do they attack other plant parts such as flowers, young pods, or stems. Soybean fields should be scouted for migrating blister beetles if alfalfa or weeds have been cut in nearby fields.

**Control:** Less than 1% of Louisiana soybean acres receive at least one insecticide application during the growing season.

**Applied more frequently:**

- Methyl Parathion 0.25 lb/A

**Applied less frequently:**

- Carbaryl (Sevin) 0.8 lb/A

**Grasshoppers**  
*(Melanoplus sp.)*

Several species of grasshoppers will feed on foliage usually during prolonged dry periods. Nymphs are smaller than adults and show incompletely formed wings. These insects feed on leaves, pods and seeds. Large populations can cause high yield loss. Pod feeding leaves the plant tissue vulnerable for fungus attack. Usually infestations are more severe following 2-3 years of drought.

**Control:** The use of insecticides is the most common way of grasshopper control. Applications should be based on scouting fields and estimating grasshopper density and extent of crop damage. Less than 1% of Louisiana soybean acres receive at least one insecticide application during the growing season.

**All of the below are frequently applied when this pest occurs:**

- Carbaryl (Sevin) 1.00 lb/A
- Cyhalothrin (Karate) 0.025 lb/A
- Esfenvalerate (Asana XL) 0.03 lb/A
Lesser cornstalk borer  
*(Elasmopalpus lignosellus)*

Larvae attack the stem at the soil surface. One larva can damage several seedlings by tunneling which, in turn, causes wilting. More mature plants can resist the larva attack. However, yield will be decreased. More problems occur in late planted soybeans that followed wheat or ryegrass. Drought and high temperatures are also usually associated with the problem.

**Control:** Less than 1% of Louisiana soybean acres receive at least one insecticide application during the growing season.

The below is the only insecticide applied when this pest occurs:

- Chlorpyrifos (Lorsban 15G) 8 oz/1,000 feet of row.

Beet armyworm  
*(Spodoptera exigua)*

The larvae have black spots on each side of the second body segment, four pairs of abdominal prolegs, and is about 1.25" long when full grown. The worms curl up when knocked to the ground. The larvae vary from grayish-green to near black, with pale lines running the length of their bodies.

The beet armyworm prefers to feed on foliage of soybean plants. However, they will occasionally feed on bloom buds, blooms, and small pods. The damage is seen as irregular holes in the leaves.

**Control:** Less than 1% of Louisiana soybean acres receive at least one insecticide application during the growing season.

All of the below are frequently applied when this pest occurs:

- Thiodicarb (Larvin) 0.6-0.75 lb/A
- Chlorpyrifos (Lorsban) 0.75 lb/A
- Spinosad (Tracer) 0.062 lb/A

Fall armyworm  
*(Spodoptera frugiperda)*

The larvae vary in color from light tan or green to nearly black and have a prominent inverted "Y" on the
front of the head. They can reach 1.5" long. The pupae are reddish and about 0.5" long. The adult moth is gray with a wingspan of 1.5".

Feeding occurs all through the growing season. Normally this insect feeds on the foliage, leaving large holes. Severe infestations skeletonize or completely destroy the leaves. The larvae also clip the stems of seedling soybeans decreasing plant numbers.

**Control:** Less than 1% of Louisiana soybean acres receive at least one insecticide application during the growing season.

**Applied more frequently:**

- Methyl Parathion 0.5 lb/A

**Applied less frequently:**

- Carbaryl (Sevin) 0.5 lb/A
- Methomyl (Lannate) 0.3-0.45 lb/A

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Banded cucumber beetle

*Diabrotica balteata*

Adults are about 0.25" in length, greenish yellow in color with a red head and black thorax. Usually there are three transverse bands across the front wing, green in color, but sometimes with a bluish tint, and a thin green band running down the center of the insect's back. The banding pattern is variable, and sometimes almost absent.

Banded cucumber beetles damage soybeans by eating holes in the leaves. Their damage is not severe, and large numbers are required before insecticides are necessary.

**Control:** Less than 1% of Louisiana soybean acres receive at least one insecticide application during the growing season.

**Applied more frequently:**

- Cyhalothrin (Karate) 0.025 lb/A
- Methyl Parathion 0.25 lb/A

**Applied less frequently:**

- Carbaryl (Sevin) 0.50 lb/A
**Mexican bean beetle**  
*(Epilachna varivestis)*

The Mexican bean beetle is a native of the semiarid southwestern states and has spread throughout much of the area east of the Mississippi River since 1920. Both larvae and adults feed by sucking plant juices on the lower surface of leaves. Damage caused by the adults has an open lacy appearance while the damage caused by the larva has a skeletonized appearance. Defoliation can be severe. Adults also feed on stems and pods. Injured tissue is vulnerable to the attack of pathogens like pod and stem blight.

**Control:** Less than 1% of Louisiana soybean acres receive at least one insecticide application during the growing season.

Applied more frequently:

- Cyhalothrin (Karate) 0.015 lb/A
- Methyl parathion 0.5 lb/A

Applied less frequently:

- Permethrin (Ambush/Pounce) 0.05 lb/A
- Methomyl (Lannate) 0.25 lb/A

**Nematodes**

With the exception of rice, plant-parasitic nematodes can be of economic concern in all of the major crops grown in the mid-South. Surveys conducted during the past ten years indicate that one species of the root-knot nematode (*Meloidogyne incognita*), the soybean cyst nematode (*Heterodera glycines*), and the reniform nematode (*Rotylenchulus reniformis*) are common throughout the region and may infest 50% or more of production fields in some areas. Although numerous other plant-parasitic nematode species may also be found associated with crops in the mid-South, only these three are considered to be of major economic importance in Louisiana soybeans.

**Root-Knot Nematodes**

The root-knot nematode is perhaps the easiest of the nematodes to diagnose in the field. Root-knot gets its name because infection of roots of susceptible hosts results in the formation of galls or swellings on the roots. These galls are readily visible to the naked eye from about mid-season through harvest time. Aboveground symptoms of root-knot also are relatively apparent in many fields. Symptoms include stunting and poor growth of plants in areas within infested fields. Heavily parasitized plants may exhibit
nutrient or water stress symptoms, particularly during the latter half of the growing season. This nematode species is of major economic concern in both cotton and soybean. It is common in the sandy soils along the Mississippi River.

**Cyst Nematodes**

The soybean cyst nematode continues to be the most important nematode pest of soybean throughout the region. Fortunately, soybean cyst nematodes have a narrow host range that includes soybean and a few legume weeds. The nematode can, however, survive for 7-10 years in soil in the absence of a host. Soybean cyst nematodes are also relatively easily diagnosed in the field from mid-season through harvest. The nematodes infect soybean roots and swell to form tiny (but visible with a hand lens) cysts that are attached to roots. Cysts are white in color early on, but as they age, they change to a yellow and then a brown color. Cysts can be distinguished from other structures that may be seen on soybean roots such as nodules because they are much smaller and are lemon-shaped. Aboveground symptoms of soybean cyst nematode damage range from large irregular spots of poorly developing plants to virtually no readily apparent foliar symptoms. Even without visible plant symptoms, studies in western Tennessee have documented at least 10 bu/acre yield reductions due to the nematode without visible symptoms.

**Reniform Nematodes**

The reniform nematode is a relative newcomer to the mid-South. This nematode has historically been of concern primarily in tropical and sub-tropical areas of the world, and in 1960 reniform was thought to occur in the U.S. only in extreme southern Texas, Louisiana, and Florida. Incidence of the reniform nematode, unfortunately, has changed during the past 40 years—moving steadily northward. In 1999, the reniform nematode was named the most important nematode pest of cotton in the states of Mississippi and Louisiana. This nematode has now been identified in every cotton producing county or parish in these two states. In addition, since 1990, the reniform nematode has been identified in 10 major cotton producing counties in Arkansas, from the Louisiana line to the Missouri boot heel. The nematode has also been reported in western Tennessee, and appears to be on the increase there as well.

**Nematode Control**

The most important single factor in managing a nematode problem in any crop is accurate diagnosis of the presence and identity of the species involved. Although visual inspection may indicate the presence of root-knot or soybean cyst nematodes, the reniform nematode is almost impossible to identify based on field symptoms or root inspection. Soil sampling for assay by a nematology laboratory is the most accurate and dependable means of determining whether or not a nematode problem exists. Public (university) or private nematology laboratories that provide assays on a fee basis are available in virtually all parts of the U.S. These laboratories can also provide advice on timing and methods for sampling fields and the procedures for handling and shipment of the samples. Nematodes are living organisms. They must remain alive until the assays are conducted. Consequently, handling samples properly is as important as the sampling process itself. Results of nematode assays are always only as
In the mid-South, nematode management is primarily accomplished through one or a combination of methods. Options include the use of resistant cultivars, crop rotation with resistant or poor hosts to lower nematode population densities, or the use of chemical nematicides. Selection of the method or methods for managing nematodes in any individual field must be determined based on the nematode species that is present, the crops that may be grown, and the economics of the management program. For most of the major crops, threshold levels have been established to aid in determining the magnitude of a nematode problem. These levels vary considerably from state to state, and should be used as general guides only. Experience with crop performance in individual fields should always be included in considerations when formulating nematode control strategies.

**Resistant Cultivars:** The least expensive and many times most effective means of managing nematode damage to crops is through the use of nematode resistant cultivars. Both root-knot and reniform nematode resistant soybean cultivars are available, although few are highly resistant. Recent studies in Arkansas indicate that severe root-knot may suppress soybean yield by as much as 50%. These studies also indicated that selection of a moderately resistant cultivar resulted in yield improvement of 15-25 bu/acre depending on the infestation level. Numerous reniform nematode resistant soybean cultivars are also available, although none are highly resistant and some population increase can be expected during the season on these cultivars.

There are numerous soybean cultivars with resistance to the soybean cyst nematode. A complicating factor, however, in managing this nematode with resistant cultivars is the existence of races or biotypes of the nematode. There are currently 16 possible races of the soybean cyst nematode, each of which is characterized by their ability to reproduce on different resistant soybean types. Historically, soybean cyst nematode race 3 was predominant in much of the area, but within the past few years, races 4, 5, 6, 9, and 14 have increased in frequency. Continued production of any given resistant cultivar (or cultivar representing a particular type of resistance) may exert sufficient selection pressure on the local soybean cyst nematode population to force a change in race, resulting in the ineffectiveness of the resistant cultivar. Consequently, resistant cultivars must be used judiciously in combination with crop rotation to avoid undue selection pressure and loss of effectiveness of the resistant cultivar.

**Crop Rotation:** Crop rotation may be an effective means of lowering nematode population densities and the accompanying crop loss. Selection of rotation crops and cropping sequences must be determined based on the nematode species in question and on the economic feasibility of using the rotation program. Rice is perhaps the most effective rotation crop across all of the economic nematode species. Rice is susceptible to at least 2 races of the common root-knot species (2 and 4). However, the flooded culture of rice keeps them from ever becoming a problem, presumably by lowering the oxygen concentration in the soil for long periods of time during the summer months. In the mid-South, a common rotation is a soybean-rice system. This rotation may be very effective in controlling root-knot and reniform nematodes, and is also somewhat effective in lowering soybean cyst nematode densities. Research has shown, however, that a significant number of soybean cyst nematodes may survive a year of rice. Combinations of rice-soybean rotation and use of resistant and susceptible soybean cultivars appear to
be the most effective long-term solution to soybean cyst nematode problems.

As indicated earlier, grain sorghum may also be a rotational crop with either cotton or soybeans for lowering reniform, soybean cyst, and root-knot nematodes. However, there have been mixed reports about grain sorghum and its reaction to root-knot nematode. The length of the rotation (number of years needed) may vary according to the nematode population density that is present in a field. A single year of rotation may be very effective at lowering populations that were initially moderate to high. Two years may be necessary, however, in some fields with extremely high initial population densities.

Corn can provide a very effective and possibly more economically attractive rotation crop for growers who need to manage either soybean cyst or reniform nematodes in soybeans. As in the Midwest, corn-soybean rotations are becoming more popular in the mid-South. Before this rotation regime is adopted, an accurate identification of the nematode problem is necessary. Although corn will lower soybean cyst or reniform nematodes, it may increase the severity of a root-knot problem. Where root-knot is a problem in soybeans, use of resistant soybean cultivars may allow this rotation to be continued. Many soybean cultivars are not highly resistant to the nematode and may still show yield suppression if root-knot populations increase to high levels on the corn.

**Nematicides:** Chemical nematicides are available to help control nematodes in soybeans. However, at present time, they are usually not recommended because they are generally not considered cost effective. Less than 1% of Louisiana soybean acres use nematicides.

**Diseases**

As soybean acreage expanded in Louisiana, soybean diseases also increased in number and severity. Disease losses in the state for the past 10 years have averaged around 20%. Diseases continually affect the soybean crop and have partially been responsible for a reduction in acreage during the late 1980’s and early 90’s. Seed treatments in soybean production have been used very little in the past for disease control but are on the rise due to an increase in early varieties. The diseases described below are commonly found in Louisiana, and most have caused significant economic losses at one time or another. Included are symptoms and control methods.

**Seedling Disease**  
*(Rhizoctonia solani, Phytophthora, Pythium, etc.)*

**Symptoms:** Seed decay and postemergence "damping off." Roots and basal portion of stem may be killed.

**Source of Inoculum:** Most of these organisms are soil borne and persist in crop residue.
**Charcoal Rot**

*(Macrophomina sp.)*

**Symptoms:** Initial infections from charcoal rot fungus occur early in the growing season. Young plants 3-4 weeks old may die. Most of the damage occurs late in the season as plants senesce several weeks earlier than normal. This results in the formation of small, light-weight seed and yield loss of 20-40% in some cases. In any given season, as much as 25% of plants may show damage. This is a hidden and very subtle problem. Young plants may die if hot, dry conditions exist or survive in wet weather with disease symptoms reappearing during hot dry spells. In older plants, a light-brown discoloration of internal tissue occurs. Plants turn yellow and "mature" very early. Below the epidermis, at the soil line, small black bodies called sclerotia appear, giving the tissue a grayish-black "charcoal" appearance.

**Control:** Avoid excessive seeding rates. Rotate with non-host crops. Maintaining good fertility will reduce the incidence of this disease. Avoid plant stress as much as possible by using good management practices.

**Phytophthora Root Rot**

*(Phytophthora sp.)*

**Symptoms:** Attacks roots and stems of infected plants at any stage, resulting in rapid death. Older plants turn yellow and leaves wilt. A brown discoloration develops in the stem. Source of Inoculum: Soil borne. Damage is most severe on heavy clay soils or on poorly drained soils.

**Control:** Avoid planting susceptible varieties on poorly drained soils. Use crop rotation.

**Red Crown Rot (Black Root Rot)**

*(Calonectria sp.)*

**Symptoms:** First symptoms appear as an interveinal, blotchy yellowing of the tops of individual plants, generally when plants are in the early pod stage. Later, interveinal tissue of leaves turns brown followed by defoliation. On the stems, reddish fruiting structures appear at the soil surface and up to 3 inches above. Stem tissue appears reddish.

**Control:** Research and field observations indicate there are differences in varieties but ratings are difficult to achieve because of the sporadic nature of the problem. Delay planting until later part of recommended planting time.

**Southern Blight**

*(Sclerotium sp.)*
**Symptoms:** Scattered plants wilt suddenly and die. White mold appears at the base of the plant and girdles the stem. Tan to brown sclerotia (resting bodies) about the size of mustard seed appear in the mold. Source of Inoculum: The fungus is soil borne and occurs widely in many soils. It is capable of persisting on almost any type of organic matter. Losses to this disease are usually very minimal and do not warrant control measures.

**Aerial Blight**  
*(Rhizoctonia sp.)*

**Symptoms:** Typically the infected area involves the lower third of one or more of the three leaflets. The necrotic areas may vary in shape from circular to irregular with reddish-brown margins. Leaf blight, leaf spots, and defoliation are symptoms of the disease. Lesions may vary from reddish-brown to brown or tan. Petioles, stems and young pods also are attacked.

**Source of Inoculum:** Weed hosts, field trash and soil.

**Control:** Fall cultivation of stubble. Use good seedbed preparation and weed control. Research and field observations indicate there are differences in varieties. Azoxystrobin (Quadris) fungicide is applied at first appearance of disease development. Economic loss each year ranges from 2 to 6%. As much as 20% of crop acreage can be sprayed during the growing season.

**Brown Leaf Spot**  
*(Septoria sp.)*

**Symptoms:** Angular brown to reddish-brown spots appear first on lower leaves causing yellowing, and later defoliation. Sizes of spots vary from pinpoint to 0.25” in diameter.

**Source of Inoculum:** The fungus overwinters in crop residue and in infected seed. Control: Plant disease-free seed. Rotate crops. Bury crop residue deep as soon as possible. Development of the disease is limited by warm weather and not a problem for the most part.

**Downy Mildew**  
*(Peronospora sp.)*

**Symptoms:** Indefinite yellowish-green areas on upper leaf surface. Grayish tufts of mold growth on lower leaf surface beneath chlorotic spots.

**Source of Inoculum:** Overwinters in soil, on seed, and in soybean residue.

**Control:** Crop rotation. Use disease-free seed. Does not cause economic loss.
**Frogeye Spot**  
* (Cercospora sp.)*

**Symptoms:** An eyespot type of lesion with a gray or light tan center and a narrow reddish-brown border forms on the leaves. May cause premature defoliation.

**Source of Inoculum:** Seed and airborne.

**Control:** Use resistant varieties. Foliar fungicides are sometimes needed for control.

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**Cercospora Leaf Blight**  
* (Cercospora sp.)*

**Symptoms:** Pink or light purple to dark purple discoloration of seed. Cracks may occur in discolored areas. Reddish-brown angular lesions, approximately 1/16" in diameter, may occur on leaves, stems or pods late in the growing season. Causes purple streaks in foliage and petioles. Leaves may fall prematurely, leaving petioles sticking up, and causing plants to stay green.

**Source of Inoculum:** Overwinters on crop residue and in infected seed. This disease has become a major problem within the last 4 or 5 years causing heavy losses with 25-30% of fields showing damage.

**Control:** Plant disease-free seed. Treat seed with fungicides. Foliar fungicides are sometimes needed for control.

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**Anthracnose**  
* (Colletotrichum sp.)*

**Symptoms:** Symptoms appear as irregular brown areas most frequently on stems and pods. In advanced stages, affected tissues are covered with black fruiting bodies. The disease may cause serious losses, especially during rainy periods. Seed may fail to form or be wrinkled and moldy.

**Control:** Plant disease-free seed. Some benefit may be derived from seed treatment. Plow under crop residue. Foliar fungicides are sometimes needed for control.

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**Pod and Stem Blight**  
* (Diaporthe phaseolorum var. sojae)*

**Symptoms:** Numerous, small black fruiting bodies appear on the pods and stems of mature plants, blight usually in linear rows on the stem. Under favorable environmental conditions for the disease, it can be observed as a white mycelial growth on seed.
**Source of Inoculum:** Fungus is seed borne and overwinters on diseased plant tissue in the field.

**Control:** Plant disease-free seed. Some benefit may be derived from seed treatment. Rotate crops. Foliar fungicides are sometimes needed for control

**Stem Canker**

*(Diaporthe phaseolorum var. caulivora)*

**Symptoms:** Attacks cotyledons or leaves early in the growing season and spreads into the lower stems. Infection usually starts as a small lesion at the leaf scar after the petiole has fallen. Lesions enlarge rapidly to form a slightly sunken reddish-brown canker. Plants are brittle and break at the canker. Leaves in the upper canopy show interveinal chlorosis. Late in the season, the stems become completely girdled and plants die.

**Control:** Use resistant varieties. Delay planting until later part of recommended planting time. Avoid stress. Maintain good fertility.

**Fungicides used in LA**

**Seed treatment:** Metalaxyl (Apron 50W) at 0.16-0.64 fl. oz/ 100 lb. of seed is applied to control Pythium sp. and early Phytophthora sp. Metalaxyl is used on approximately 2% of Louisiana soybean acres.

**Foliar treatments:** Azoxystrobin (Quadris) at 0.1 -0.25 lb/A is applied to control Rhizoctonia sp., Anthracnose sp. and Diaporthe sp. Azoxystrobin is used on approximately 10% of Louisiana soybean acres.

Thiophanate-methyl (Topsin M 70WP) at 0.5-1.0 lb/A is applied to control Anthracnose sp., Cercospora sp., and Diaporthe sp. At 1.0 lb/A, it will suppress Rhizoctonia sp. Thiophanate-methyl is used on approximately 5% of Louisiana soybean acres.

**Soybean Mosaic Virus**

**Symptoms:** Symptoms of soybean mosaic virus (SMV) vary depending on the soybean cultivar, the age of the soybeans, the virus strain, and the temperature. Symptoms are most noticeable under cool temperatures of 18 to 24° C. When temperatures rise above 30° C, leaf symptoms may be masked. The youngest and most rapidly growing leaves show the most severe symptoms. Leaves of infected plants are distorted and narrower than normal and develop dark green swellings along the veins. Infected leaflets are puckered and curl down at the margin. Plants infected early in the season are stunted with shortened petioles and internodes. Diseased seed pods are often smaller, flattened, less pubescent, and curved more acutely than pods of healthy plants. Infected seed are mottled brown or black, usually smaller than seeds from healthy plants, and germination may be reduced. Soybean Mosaic Virus is
spread by aphids.

**Bean Pod Mottle Virus**

**Symptoms:** Diseased plants with bean pod mottle virus (BPMV) show a mild yellow mottling on young actively growing leaves. As these leaves approach maturity the mottling becomes masked. Plants infected with both soybean mosaic and pod mottle are stunted, have distorted foliage, misshapen fruit, and necrotic tissue. Seed from plants infected with pod mottle are smaller than normal. This virus is transmitted mainly by the feeding of certain insects, particularly the bean leaf beetle. However, the virus is not seed transmitted.

**Tobacco ringspot virus**

**Symptoms:** Infected plants with tobacco ringspot virus (TRV) are stunted and the pith of stems and branches show a brown discoloration, first near the nodes, then throughout the stem. Leaves on infected plants are smaller, wrinkled, and have a bronze discoloration. Buds become brown, necrotic, and brittle; hence the name bud blight. The most striking symptom is the curving of the terminal bud to form a crook. Diseased pods are often aborted or contain no seed. In the field, plants that are infected remain green after healthy plants have matured. Yields may be reduced 25-100% depending on the time of infection. The virus is spread by planting infected seed, but the amount of infected seed produced is usually extremely low.

**Weeds**

Soybeans, like most other crops, are sensitive to competition from weeds. Weeds can reduce yields by competing for space, water, nutrients and sunlight. They also complicate harvesting procedures. Weed surveys reveal several things. Weeds such as morningglories, cocklebur and hemp sesbania, occur throughout the state; whereas sicklepod and wild poinsettia tend to be regional problems.

Below is a list of the 10 most common weeds found in Louisiana soybeans and the 10 most difficult to control weeds as determined by the Southern Weed Science Society (SWSS).

**Most Common:**

- crabgrass
- broadleaf signalgrass
- pigweeds
- cocklebur
- morningglories
- johnsongrass
- hemp sesbania
- sicklepod
- prickly sida
- wild poinsettia

**Most Troublesome:**

- johnsongrass
- redvine
- morningglories
- sicklepod
- jointvetches
- wild poinsettia
- Texasweed
- hemp sesbania
- itchgrass
- Florida beggarweed

A recent trend toward reducing pesticide use when possible has re-introduced the concept of depending on mechanical weed control. Growers will certainly have to choose which system works best for them, but the obvious solution combines the best of both practices. The use of herbicides will remain in the forefront of soybean weed control in Louisiana. However, every effort should be made to use no more herbicide than necessary to obtain acceptable weed control.

**Herbicide tolerant soybean varieties**

**Roundup Ready Soybeans**

Currently 80% of Louisiana soybeans are Roundup Ready. The initial application of Roundup Ultra is applied at 1.0 qt/acre when weeds are less than 4 inches tall. If the first application is made to weeds 5-12 inches tall, then the rate increases to 1.5 qt/acre. Often in Louisiana another formulation of glyphosate is used if the labels states it is approved for Roundup Ready soybeans.

In Louisiana, controlling some morningglories, hemp sesbania, yellow and purple nutsedge and dayflower is weak with one application and sometimes two applications are required. Sequential treatments may be needed, depending upon weed pressure, growing conditions and other factors. Sequential treatments are also timed to weed size: 2-3 inch weeds need 12 to 16 oz/A, 3-6 inch weeds need 24 oz/A, and 6-12 inch weeds need 32 oz/A.

**Sulfonylurea Tolerant Soybeans (STS)**

Soybean varieties known as STS are tolerant to herbicides such as Classic. These varieties allow
utilization of the sulfonylurea herbicides in high pH soils. Less than 1% of Louisiana acres use STS varieties.

**PREPLANT**

**Glyphosate (0.5-3.0 lb/A):** Approximately 50% of Louisiana crop acres receive at least one application of glyphosate. Several trade names are used. It is often used in conservation or reduced tillage soybeans.

**Paraquat (0.66-095 lb/A):** Gramoxone Extra, Boa, or Gramoxone Max are applied to approximately 30% of Louisiana crop acres at least once during the growing season.

**2,4-D (0.5-1.0 lb/A):** Various formulations and trade names are used. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Sulfentrazone (0.11-0.13 lb/A) + chlorimuron (0.02-0.03 lb/A):** Canopy XL or Authority Broadleaf is applied for no-till burndown. The label must be consulted on soil pH, OM and recrop restrictions. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Flumioxazin (1.02 -1.53 oz/A) + glyphosate or paraquat:** Valor at 2 to 3 oz/A + glyphosate or paraquat will enhance control of some weed species that are difficult for glyphosate or paraquat alone. This combination can provide some residual weed control. The label must be consulted for approved tank-mix partners. Approximately 20% of Louisiana crop acres receive at least one application during the growing season.

**PREEMERGENCE - surface applied**

**Alachlor (2.0-3.0 lb/A):** Lasso is applied at 2.0 qt/A-lt soil, 2.5 qt/A-med soil, and 3.0 qt/A-hvy soil for annual grass control with fair control of some broadleaf weeds. Shallow incorporation (1-2") with a spike tooth harrow or rolling cultivator is required to control red rice under low rainfall conditions. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Metolachlor (1.5-2.5 lb/A):** Dual, Dual II, and Dual 8E are applied at 1.5-2.0 pt/A-lt soil and 2.0-2.5 pt/A-med soil to control annual grasses and red rice with fair control of some broadleaf weeds. Shallow incorporation (1-2") with a spike tooth harrow or rolling cultivator is required to control red rice under low rainfall conditions. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Metribuzin (0.25-0.75 lb/A):** Sencor 4F is applied at 0.50-1.0 pt/A-med soil and 1.0-1.5 pt/A-hvy soil. Sencor DF is applied 0.30-0.67 lb/A-med soil and 0.67-1.0 lb/A-hvy soil. This herbicide controls annual grasses and most broadleaf weeds such as cocklebur, prickly sida, hemp sesbania, & wild poinsettia. On light soils, O.M. content should be 2% or greater. Metribuzin cannot be applied to sensitive varieties. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.
**Sulfentrazone (0.15-0.23 lb/A) + chlorimuron (0.03-0.05 lb/A):** Same as above. This combination cannot be applied to land rotated with cotton the following year. Soil pH > 7.0 greatly reduces rotational flexibility. Do not use on soils with pH > 7.5. Crop stunting may occur if excessive rainfall occurs after application but before soybean emergence. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Imazaquin (0.125 lb/A):** Scepter 70 DG is applied at the surface, preplant incorporate, or at planting for annual grasses and most broadleaf weeds. A sequential postemergence application may be required for hard to kill weeds such as sicklepod. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Imazaquin (0.12 lb/A) + pendimethalin (0.75 lb/A):** Squadron 3.0 pt/A is applied to approximately 10% of Louisiana crop acres at least once during the growing season. Same as above with the addition of preemergence weed control.

**Chlorimuron (4.5-9.0 oz/A) plus metribuzin:** is applied as Canopy SP 6.0-7.7 oz/A-lt soil, 7.7-10.0 oz/A-med soil and 10.0-12.9 oz/A-hvy soil. This combination is applied preplant incorporated or surface applied at planting to control annual grasses and most broadleaf weeds. Canopy cannot be used postemergence. This combination cannot be applied to soils with a pH greater than 7.5. The exact rate is dependent on % soil organic matter. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Flumioxazin (0.063-0.09 lb/A):** Valor is applied 2-3 oz/A for broadleaf weeds with some suppression of annual grasses. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Dimethenamid (0.76-1.3 lb/A):** Frontier is applied 13.0-16.0 oz/A-lt soil, 16.0-20.0 oz/A-med soil, 18.0-22.0 oz/A-hvy soil for most annual grasses, red rice, johnsongrass from seed, and fair control of some broadleaf weeds. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**OVERTOP - early season**

**Acifluorfen (0.25-0.5 lb/A):** Blazer 2L is applied 1.0-2.0 pt/A when seedling weeds are in the 2-4 leaf stage and actively growing. It controls Hemp sesbania, most morningglories, smellmelon, pigweed and other broadleaf weeds. Approximately 30% of Louisiana crop acres receive at least one application during the growing season.

**Bentazon (0.75-1.5 lb/A):** Basagran is applied at 1.5-3.0 pt/A after soybean plants have first trifoliate leaves. It controls cocklebur and prickly sida but is only fair on other broadleaf weeds. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.
**Acifluorfen + bentazon:** Blazer 2L 1.0-2.0 pt/A plus Basagran 1.5-3.0 pt/A, OR Storm 1.5 pt/A, OR Conclude Xtra 1.5 pt/A is applied to control the weeds listed above. Approximately 25% of Louisiana crop acres receive at least one application during the growing season.

**Acifluorfen (0.25 lb/A) + bentazon (0.50 lb/A) + clethodim (0.12 lb/A):** Conclude Xact B 24 oz/A + Conclude Xact G 24 oz/A plus 1 pt COC/A OR Conclude Ultra B 24 oz/A + Conclude Ultra G 14 oz/A plus 1 pt COC/A is applied to small grassy and broadleaf weeds less 2-6". A tank mix of Conclude Xtra G plus Conclude Xtra B is called Conclude Xtra. When mixing Conclude Xtra B with Conclude Xtra G, ENSURE that Conclude Xtra B is added to agitating water in the spray tank first, followed by the COC, followed by Conclude Xtra G. DO NOT pour Conclude Xtra B + G into the tank simultaneously. It can be a very effective treatment if timed correctly. Approximately 15% of Louisiana crop acres receive at least one application during the growing season.

**Chlorimuron (0.008-0.012 lb/A):** Classic 25% DG at 0.5-0.75 oz/A or Skirmish 25% DG is applied after soybeans have first trifoliate leaves and when weeds have 2-6 leaves. It controls morningglories, pigweed, sicklepod, and hemp sesbania. It cannot be applied to soils with a pH greater than 7.5. It can be tank- mixed with glyphosate in Roundup Ready soybeans. Approximately 35% of Louisiana crop acres receive at least one application during the growing season.

**Cloransulam-methyl (0.25 oz/A):** Firstrate plus an approved adjuvant 0.30 oz/A is applied before weeds exceed height limitations (generally 2-4" tall) and prior to soybeans reaching 50% flowering stage. It controls cocklebur and morningglories. Application prior to full emergence of first soybean trifoliate may cause temporary chlorosis. Grassy weed control may be reduced when tank- mixed with some grass herbicides. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Imazaquin (0.125 lb/A):** Scepter 70 DG is applied at 2.0 oz/A after soybeans have emerged but before cocklebur and pigweed are 12" tall (6" for wild poinsettia). Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Imazaquin (0.06 lb/A) + acifluorfen (0.25 lb/A):** Scepter OT 1.0 pt/A + NIS or COC is applied before weeds exceed height limitations. Same as above. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Lactofen (0.15-0.19 lb/A):** Cobra 2 lb/gal 10.0-12.5 fl. oz/A plus 0.25% nonionic surfactant is applied to control some morningglories, cocklebur, pigweeds, prickly sida, smellmelon, puncturevine, and copperleaf. Application may cause moderate burn of soybeans. Soybeans normally recover in 10 days without loss of yield. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Fomesafen (0.25-0.38 lb/A):** Reflex 2 lb/gal 1.0 pt-1.5 pt/A OR Flexstar (1 lb/gal), 2.0 - 3.0 pts/A plus
0.25% nonionic surfactant or 1% COC is applied to control morningglories, cocklebur, pigweed, hemp sesbania and suppression of grassy weeds. Soybeans are very tolerant to Reflex. Rotation intervals: 4 mo. for small grains; 10 mo. for beans, corn, cotton, and rice. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Sethoxydim (0.19 - 0.47 lb/A):** Poast Plus at 1.5 pt/A is applied for annual grasses up to 4 in. tall. It is applied 2.25 pt/A for bermudagrass runners 4 to 6 inches long. Application to larger grasses or grasses growing under drought stress will result in reduced control. Activity may be reduced if tank-mixed with other herbicides. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Fluazifop (0.125-0.50 lb/A):** Fusilade DX plus 1.0% COC or 0.25% nonionic surfactant is applied 0.37-0.75 pt/A for annual grasses up to 4” tall and johnsongrass 1-2 feet tall. It is applied at 0.75 pt/A for bermudagrass runners 4-6” long. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Fenoxyprop-ethyl (0.06-0.22 lb/A) + fluazifop:** Fusion is applied at 4.0-14.0 oz/A. with either 1-2 pts COC or 1/2-1.0 pt nonionic surfactant/25 gal spray solution. Same as above. Aerial applications require adjuvant adjustment. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Quizalofop (0.10-0.20 lb/A):** Assure II is applied 5-10 oz/A + 0.25% nonionic surfactant or 1% COC for annual and perennial grass control. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

**Clethodim (0.09-0.25 lb/A):** Select is applied at 6-16 oz/A plus 1 qt/A or 1% COC for annual and perennial grass control. Addition of a spray grade nitrogen fertilizer or ammonium sulfate may further improve weed control. Approximately 5% of Louisiana crop acres receive at least one application during the growing season.

### POSTEMERGENCE

A Rotary hoe can be used as soon as soybeans are up to a stand or before full emergence if soil crusts enough to prevent stand. Preemergence herbicides may remain more effective following rotary hoeing. Small seedling grassy and broadleaf weeds can be controlled in this manner. However, it is not effective if soil is damp or wet. Rotary hoeing may be used repeatedly until 3rd set of true leaves are expanded. Soybean seedlings may be injured if hoed when fully turgid. Approximately 10% of Louisiana soybean acres use a rotary hoe or other row cultivator as a means of postemergence weed control.

**Herbicide resistance:** Several biotypes of johnsongrass resistant to the graminicide herbicide family have been identified in Louisiana. Generally, if it is resistant to Fusilade DX, Assure II, Poast Plus, or Poast, it may be susceptible to Select. However, several biotypes have been confirmed in Franklin parish
that are resistant to all of these herbicides. Therefore, an aggressive resistance management program should be implemented if you suspect resistance on your farm.

Simply rotating graminicicides within a single crop will not be sufficient to delay resistance for a substantial period of time. Rotating crops, and changing modes of action is the best method for delaying resistance. Rotating to corn, for instance, allows the use of Accent to control johnsongrass. Rotating to a Roundup Ready crop allows the use of Roundup (or another glyphosate) as an additional tool for delaying resistance.

**WORKER ACTIVITIES**

**Land Preparation/Planting Methods/Cultivation:** In conventional tillage, using a moldboard followed by disking and harrowing are good prime tillage operations. Double disking or disking and rowing are done in small enough acreage to avoid soil moisture loss. Soybeans are usually drilled on flat ground, but raised beds will enhance root zone drainage. Row feet on raised beds are usually 1000 feet or less to facilitate good drainage.

Conservation tillage systems for soybeans have evolved in the last 15-20 years in Louisiana and the southeastern U.S. for a variety of reasons. This system is defined as that which leaves at least 30% of the soil covered with residue from the previous crop. Usually the residue is maintained with herbicides and not the steel of a plow. Planters are equipped with a variety of coulters and press wheels to allow planting in existing vegetation. Reduced erosion, cost savings in land preparation and labor, and ease of planting are just a few good reasons to implement this system. Approximately 35-40% of Louisiana soybean acres now use some type of conservation tillage. This number is increasing.

The stale seedbed system has developed in the last 10 years for soils of high clay content such as those in the river bottoms of Arkansas, Louisiana, Mississippi, and Missouri. In this system, farmers will till the land in the fall after harvest and form rows allowing the rows to sit "stale" over the winter. Herbicides are applied to control the winter vegetation before planting the following spring.

**Fertilization:** Soybeans are not side-dressed with fertilizer during the growing season in Louisiana. For fields that have been grown to soybean before (i.e. are infested with the bacteria for fixing nitrogen), no nitrogen is required. The most frequent fertilizer requirements are for phosphorus and potassium which would be applied before planting. Deficiencies of micronutrients are rare. In certain cases, molybdenum is required to help in nitrogen fixation. There have been reports of Boron required, but these have largely been restricted to sandy soils in the Southeastern states along the Atlantic coast.

**Irrigation** There are several methods of soybean irrigation used. Currently, irrigation of soybeans in Louisiana is limited relative to other Mid-South states. Methods include furrow irrigation in which the soybeans are planted on raised beds, allowing a furrow between each row. Water is then directed down the furrows when irrigation is needed. This is usually done using a material called "poly pipe". Poly pipe is a plastic material that is rolled out across the top of a soybean field and connected to an irrigation
riser. Workers simply punch holes in places along the poly pipe to allow water to go into the furrow. Another method is flood irrigation in which the farmer has soybeans planted on flat land and simply runs poly pipe along the top of the field and allows water to flow across the field. The problem with this method is getting the water to spread evenly over the field. If the field is not sloped and graded properly and/or has depressions in certain areas, the water will flow to some areas of the field and leave others with none. The farmer ends up with a field that is only partly irrigated. Difficulties with flood irrigation led to the development of the "border irrigation" method in which soybeans are planted on flat land, small levees are made (not big enough to interfere with planting the rows) at certain intervals across the land. The interval depends upon the capacity of the farmer's pump to put out water. The greater the capacity of the pump, the greater the levee intervals can be. Land again needs to be sloped so that water will run down from the top of the field. Development of these bordered areas for flood irrigation allows greater control for irrigation across the field relative to flood irrigation. A fourth irrigation method is pivot sprinkler irrigation in which sprinklers mounted on rollers are moved across a field to irrigate. Although you see some of this used in other states, this method is not used much in Louisiana.

The rule-of-thumb is that irrigation for soybean is necessary whenever the available soil water falls to 50%. Factors that influence available soil water level are: soil type, initial amount of water in the soil at the start of the growing season, rain during the growing season, crop canopy cover, relative humidity, temperature, wind, tillage methods and genotypic factors.

The number of man hours required for irrigation depends upon the irrigation method. Simple flood irrigation requires the least effort, but also has the highest risk of failure (i.e. leaving certain areas of the field un-irrigated). All the other methods require more work because of greater land preparation and more irrigation management required. It some cases it is impossible to get a 100% accurate estimate of man-hours needed for irrigation, because of all the possible things that may go wrong during irrigation. For example, if a farmer is furrow irrigating, he may have some furrows that simply do not allow water to get to the end of the field, while all the others do. Therefore, he will have to be constantly opening and closing different pores in the poly pipe to get an even irrigation across the field. Then, there is an additional problem of getting water off the field to avoid water-logging stress. All these factors make prediction of man-hours a wild card.

Scouting: Most soybean farmers do not use consultants for scouting because of the expense. Soybeans in Louisiana are a low-profit crop (largely because yields are low) and farmers just don't think the expense for scouting is justified. The fields are either left un-scouted or the farmer checks them himself. The recommendation is that soybean fields should be scouted at weekly intervals beginning with R1 (first flower) through to the end of seed filling (R7). However, this is almost never done because of the enormous amount of time it would take. Generally, for defoliating insects, farmers usually start checking (if they check at all) for these in late August or early September, because this is usually when the loopers, velvet bean caterpillars, and green cloverworms come into the state. Stink bugs become a problem around R5 stage (seed initiation), and this date can vary anywhere from mid-July through late August depending on variety and planting date.

Pesticide applications: Approximately 98% or more of the 100 HP and larger tractors used on modern
Louisiana farms have cabs and air conditioning. You will be hard-pressed to find any combine or self-propelled sprayer manufactured during the past five years that does not have a cab and AC. A few smaller farms may have older tractors that do not have cabs and AC. This situation exists on a very small percentage of the total acreage.

After-market activated charcoal filters can be purchased for the air conditioner on most tractors, combines and sprayers. This type filter is very helpful on sprayers if it is changed at recommended intervals. Keeping windows and door gaskets and latches in good condition will reduce operator exposure to dust and pesticides. Use of spray nozzle that minimize misting or creation of small drops is also helpful.

Approximately 75 to 85% of the burndown herbicide applications in conservation and stale seedbed preparation are applied aerially and almost exclusively by commercial means. Approximately 75% of herbicide applications within the crop are applied by the farmer using ground equipment. Others will contract aerial or custom applications. Approximately 70% of all insecticide applications are applied by air.

**Harvesting:** Basically, it only takes a combine and a truck to harvest soybeans. This can be done with as few as 2 people, one to drive the combine and the other to drive the truck. How many acres could be harvested in a day depends on the skill of the combine operator, how soon in the morning the pods can be threshed, equipment breakdowns, etc.

**Worker Injuries:** Possible injuries can occur from a variety of sources: tractor overturning in a ditch, harm caused by spray drift or a mistake in preparing agricultural chemicals for application, or physical injury from using hand tools (cuts, bruises, abrasions) in repairing equipment.

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