2013
GEORGIA SOYBEAN PRODUCTION GUIDE

THE UNIVERSITY OF GEORGIA
COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES

UGA SOYBEAN WEBPAGE
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CULTURAL PRACTICES

(Jared Whitaker)

Field Selection and Rotation

Fields to be considered for 2013 soybeans should have at least a 35 bushel per acre potential and should have been planted to something other than soybeans in 2012. Deep sands and eroded clays with a 15 to 20 bushel per acre soybean yield potential should be avoided.

Planting soybeans after soybeans will increase the incidence of diseases, nematodes, soil insects, and possibly herbicide residues. The result is generally decreased yields or increased production costs. Rotate soybeans with non-legume crops to help reduce these problems. When rotating with cotton in fields with southern root-knot nematode, select soybean varieties that are resistant to this nematode. Set up crop rotations so that soybeans are planted on land no more than once every two years. Also, rotate between cyst-resistant and cyst-susceptible soybean varieties. See the "Disease and Nematode Control" section for more information regarding nematode control.

Land Preparation

Land preparation for soybeans should provide for deep rooting and a moist seedbed for planting. In-row subsoiling, 12 to 14 inches deep, is desirable for getting deep-rooted soybeans on sandy textured Coastal Plain soils. Deep turning or chiseling is also acceptable if soil is not re-compacted with roto-tillers, disks and other seedbed preparation equipment. Fine textured soils and red soils of the Upper Coastal Plain, Piedmont and Limestone Valley do not usually benefit from in-row subsoiling. These soils can be prepared by deep disking and turning or chiseling.

Planting Dates

The optimum period for planting soybeans in Georgia is from May 10 to June 10. Planting can begin as early as May 1 if soils are warm (>70°F) and tall-growing MG V or VI varieties are used. Planting before May 1 usually causes premature flowering, plant stunting and reduced seed quality, especially in MG VII or later varieties. Very early-maturing soybean varieties tend to have a more narrow range of favorable planting dates than do late-maturing varieties. This occurs because at southern latitudes the photoperiod response induces early varieties to flower before obtaining adequate growth necessary for optimum yields.

Planting after June 10 reduces plant growth, auxiliary limb branching, root nodulation and nitrogen fixation, and yield. **However, the planting period can be extended as late as June 30 if adapted tall growing late maturing varieties are used.** These varieties should be used in conjunction with approved late-planting practices of higher plant populations and close rows when planting cannot be made during the optimum period. Typically, all planting should be completed before July 1. Growth and yield, even with the best of efforts, may not be economical after this time. **Expect soybean yield with good varieties and management to decline about ½ to ¾ bushel/A for every day planting is delayed after June 10.**

Planting date guidelines above can be modified slightly for the Early Soybean Production System which uses MG IV or early MG V indeterminate soybeans and the Ultra-Late Soybean Production System which consists of planting soybean following corn harvest. See the section "Early and Ultra-late Soybean Production Systems in Georgia" for more details.

Row Spacing

Top soybean yields are generally obtained with row widths of 20 to 30 inches. However, most soybean varieties will give near top yields with a wider row spacing of 30 to 36 inches if planted at the optimum time. When soybeans are planted late or under stress conditions that reduce vegetative growth, tall-growing and bushy varieties will usually perform best. When planted in May and in close rows, short growing varieties will lodge less and often give higher yields than tall-growing varieties.

Research in Georgia has demonstrated a yield benefit of 0.7% for each inch that the row is narrowed, when compared to 36" or wider rows. Assuming these benefits were realized, production which altered row spacing from 36" to 20" could increase yields by 11%. Therefore, a 35 bu/A crop produced on 36" rows could be improved 3.9 bu/A by planting 20" rows. If a 60 bu/A crop was produced on 36" rows yields, a 7.2 bu/A yield advantage may be achieved by planting 20" rows. Although row spacing alterations would require a producer to make significant investments and changes to an operation, with prices above $10/bu, these benefits may be economically attractive. However, it should be mentioned that these benefits may not be attainable; especially if planting occurs early in the season and if in-row subsoiling is not conducted under these narrower rows.

Recently there has been a considerable interest in twin-row soybean production. Twin-row planting could be a way for growers with twin-row planters for peanut to obtain more desirable row widths without considerable investments for new equipment. Research in other southern states has shown yield enhancements from twin-row soybean from 8 to 11% over single-row soybean.

Research conducted in Georgia evaluating twin-row configurations during 2009 and 2010 has shown an average yield enhancement of 3.5% over single-row configurations (36"). This yield response seems to be related to planting date and soybean variety architecture whereas more positive yield responses were observed with later planting dates and more "columnar" varieties. Of the nine variety and row configuration comparisons evaluated in this work, twin-row plantings increased yield from 0% up to 10% over single rows. From this research, there are potential advantages from twin-row configurations; however benefits are not likely to equal conventional row spacing alterations.

In general, row spacing alterations will more likely be beneficial if canopy closure does not occur prior to bloom. In addition to potential yield advantages, the issue of weed control should also be considered in row spacing decisions. With the presence of glyphosate-resistant Palmer amaranth, obtaining canopy closure as early as possible is extremely important in weed management because the time it takes for the crop to close canopy will likely play a role in success or failure of weed control systems.

Plant Population / Seeding Rates

Aim for a final stand somewhere between 85,000 and 100,000 plants per acre. Final stands as low as 60,000 plants per acre can produce reasonable yields if plants are evenly distributed. **Under normal planting conditions final stands may be as low as one soybean plant for every two planted seed**, **so calibrate planters accordingly based on soil temperature, planting date, seedbed conditions, etc.** Actual seeding rates should be based on several factors.

Consider germination and select seeds that have at least 80% germination. Consider soil temperature, and recognize that higher soil temperatures may lower overall germination. Consider seedbed condition and increase the seeding rate by 10 to 20% if planting late, or in a dry or trashy seedbed. Also consider soil moisture and crusting potential when making seeding rate decisions and alter accordingly. Since soybean are planted on varying row spacing configurations in Georgia, the following table provides information specific to numerous spacings. Recognize that seeding rate suggestions are based on obtaining a certain number of plants per acre, regardless of row spacing utilized.

Suggested Stands for Soybean (Number of Plants per Row Foot)

Row Spacing (inches)	Row Feet / Acre	Seed / Row Foot	Plants / Row Foot
36	14,520	9 - 11	5 - 6
30	17,424	8 - 10	4 - 5
20	26,146	5 - 7	3 - 4
8	29,040	4 - 6	2.5 - 3.5
7	74,674	2 - 3	1 - 1.5

Planting

Set planters to place seed 1.0 to 1.25 inches deep in moist soil. If surface soil moisture is limited, set planters to push aside dry soil and plant in a shallow seed furrow. **Postpone planting when seed cannot be placed in moist soil.** Adjust the planter packer wheels to firm soil around soybean seed; but, don't overdo it, as soil crusting and poor emergence can result. If the soil crusts, rotary hoe within one to three days to help insure getting an adequate stand.

Soybean germination will be best at soil temperatures of 70°F to 90°F and can be extremely poor at temperatures above 95°F. Postpone planting when peak daily temperature at the two-inch soil depth exceeds 100°F. Use stubble-mulch planting in hot weather to help reduce soil surface temperatures and improve stands.

If irrigation is needed for stand establishment, considerable effort should be made to maximize soil moisture prior to planting. Therefore, irrigation should be applied ahead of, not immediately after planting. For reasons not understood, planting in dry soil and irrigating soon thereafter often results in a high incidence of seed rot and poor emergence. **When applying irrigation after emergence, be sure to monitor emergence and apply irrigations until an adequate stand is established as soil crusting is likely to occur in some soils.**

CONSERVATION TILLAGE

(Jared Whitaker)

Conservation tillage offers distinct advantages but above average management is required to attain good crop stands and weed control. Management practices for conservation tillage vary depending upon the crop, soil type, and weed pressure. Listed below are some basic principles which apply to all conservation tillage systems.

Crop Rotations

Crop rotations for conservation tillage should be the same as for clean tillage. Certain pests tend to increase with continuous monoculture and reduce crop productivity. Rotating crops, especially grasses and legumes, is an important part of managing pests. Conservation tillage, in conjunction with crop rotations and appropriate varieties, can be especially valuable for maintaining good crop yields and reducing pests such as cyst nematodes.

Tennessee researchers report that the incidence of soybean stem canker is often higher with conservation tillage than clean tillage. Apparently, the mass of decaying residue on the soil surface favors the stem canker pathogen and causes a greater incidence of stem canker infection. Tolerance to stem canker varies widely among soybean varieties, **therefore, an all-out effort should be made to use stem canker tolerant soybean varieties with conservation tillage.**

Cover Crops

Winter cover crops are often used with conservation tillage to provide protection from soil erosion, moisture conservation, soil temperature modification, weed suppression, and sometimes nitrogen. Winter grass crops are best for soybeans. They are easier to establish than legumes and have fewer adverse effects on soybean stands and growth. Rye is the most commonly planted cover crop. Planting soybeans directly into growing cover crops often results in poor stands. For this reason, it is desirable to kill the winter cover crop with a contact herbicide 10 to 14 days ahead of the scheduled time of planting soybeans.

Establishment culture for winter annual grasses and legumes should be the same as those used when establishing them for forages.

Seeding Rates and Row Spacings

Good soybean stands are more difficult to obtain with conservation tillage than with clean tillage. To help reduce this problem, **soybean conservation tillage seeding rates should be increased 10 to 15 percent.** Conservation tillage seeding depths should be about the same as clean tillage. Some conservation tillage planters tend to make a furrow when planting. These should be adjusted so that the furrow depth is as shallow as possible. Deep furrows should be avoided since high intensity rains can wash excessive amounts of soil over the seed or concentrate herbicides near the seed and cause injury or stand reduction.

Soybeans do not normally accumulate quite as much vegetative growth with conservation tillage as clean tillage. Therefore, in late plant situations close rows could be especially important for conservation tillage. Row spacings of 36 inches are common for soybeans, but soybeans could

benefit from more narrow spacings of 20 to 30 inches. Narrow rows help insure full canopy development which can reduce soil moisture loss and suppress late emerging weeds.
Drill planting can be successfully used with conservation tillage but soil compaction can be a problem and getting acceptable crop stands is not easy. The soil compaction problem may be corrected by deep chiseling in the fall ahead of planting wheat or a cover crop. Winter grazing can fully reestablish soil hardpans on Coastal Plain soils. As such, drill planting is generally not a good planting behind winter grazing.

Stand problems with conservation tillage drill planting are usually associated with getting litter in the seed furrow and poor seed-soil contact. The litter problem can sometimes be reduced by using a smooth coulter instead of the normal fluted coulters on drill planters.

To get uniform seeding depth, conservation tillage drills should be equipped with double-disk furrow openers and disks that have bands for depth control. Good seed-soil contact is essential so special narrow press wheels will usually be needed. Extra weights on the planter are often needed to help get adequate soil penetration and seed coverage.

Soil moisture and temperatures should be watched carefully. Planting should be discontinued during periods when soil temperature (at the 2-inch depth) exceeds 100°F. Better stands can be obtained with conservation tillage row planters than with conservation tillage drill planters. This is apparently true because row planters place seed in moist soil and give better seed-soil contact.

Improving No-Till Soybean Stands, Growth and Yield

An ever increasing amount of the state's double crop soybean acreage is cultured by conservation tillage. Some farmers burn or remove wheat straw residue, others plant directly into this residue. This practice is discouraged for several reasons. Removing straw can facilitate use of machinery and often allows for better and/or less expensive weed control, but planting directly into wheat residue is encouraged whenever suitable no-till planting equipment is available. This reduces soil surface temperatures, conserves soil moisture and increases soybean yield. In years with hot May-June temperature this practice often allows for better soybean stands. Surface crop residues also reduce soil erosion and water runoff, benefits that are often not immediately recognized.

Getting adequate soybean stands and weed control are the biggest challenges with conservation tillage when planting into wheat residue. Wheat straw contains chemicals which reduce soybean germination and growth. Soybean planting must be done in such a way that wheat straw is kept out of the seed furrow. Wheat straw in the seed furrow also prevents good seed-soil contact and reduces germination. Modern conservation tillage planters have adjustments to pull wheat straw away from the seed furrow.

Careful straw management can also help aid chemical weed control efforts. Cut wheat as high as practically possible to allow more herbicide penetration to the soil surface - the area where it is needed most for performance. When applying postemergence directed herbicide sprays, rig equipment with press bars to push standing wheat stubble down and to the side so that it does not deflect herbicide sprays, injuring soybeans or reducing weed control effectiveness.

One-Pass Tillage/Planting

Clemson University has shown that one basic fertilization and deep tillage ahead of wheat planting in the fall can be sufficient for the wheat and subsequent summer soybeans. The tillage system consists of:

1. Deep turning or deep chiseling (11" - 14") ahead of wheat planting.
2. Planting wheat in straight rows or in same direction that subsequent soybean crop will be planted.
3. Restricting subsequent field traffic to traffic lanes to minimize re-compaction of soil.
4. Using strip-till or no-till drill to plant soybeans in wheat row middles.

No-Till Recommendations

1. Rotate grass and legume crops to reduce disease and nematode problems.

2. Plant winter cover crops for erosion control, and moisture conservation. Use herbicide to kill cover crop when planting soybeans.

3. To insure adequate soybean stands with conservation tillage (1) adjust planters to pull straw and crop litter away from seed furrow, (2) increase seeding rate 10 to 20 percent and (3) use a narrow planter packer wheel (two inches wide or less) to break soil clods and insure good seed soil contact.

4. Decrease row width for conservation tillage, especially if planting is under less than optimum conditions.

5. If drill planting, use units with cutting coulter, double disk openers, depth bands or some means of positive depth control and narrow packer wheels.

6. Manage wheat stubble so that it does not interfere with soybean stands and herbicide performance. Cut it as high as practical to reduce dragging and use a lateral bar on herbicide sprayers to press it downward and away from herbicide spray.

EQUIPMENT CONSIDERATIONS FOR NO-TILL SOYBEAN SEEDING

(Paul Sumner)

No-till planters and drills must be able to cut and handle residue, penetrate the soil to the proper seeding depth, and establish good seed-to-soil contact. Many different soil conditions can be present at the time of planting. Moist soils covered with residue, which may also be wet, can dominate during late fall and early spring and occasionally in the summer. Although this provides for an ideal seed germination environment, such conditions can make it difficult to cut through residue. In contrast, hard and dry conditions may also prevail. This is especially common when no-tilling soybean into wheat stubble during the hot, dry months of June and July. Although cutting residue is easier during dry conditions, it is more difficult to penetrate the hard, dry soils. Proper timing, equipment selection and adjustments, and management can overcome these difficult issues.

Condition of the Field and Residue

Two of the keys for success with no-till equipment are proper handling of the previous crop residue and weed control. If these issues are not considered, then the ability of the planter or drill to perform its functions is greatly limited. The residue has to be uniformly spread behind the combine if the opening devices are going to cut through the material and plant at a uniform depth. Ensure that the combine is equipped with a straw chopper and chaff spreader to distribute residue and chaff over the entire cut area.

The other key is weed control. If standing weeds exist, you are asking the planter/drill to cut and move this extra material through the system, plus the crop has lost valuable resources of nutrients and water.

Coulters and Seed Furrow Openers

Probably the primary difference between conventional planter/drill systems and those designed for conservation tillage systems is weight. Since the openers and soil engaging devices must penetrate much firmer soils and cut the residue, the conservation planter/drill systems are built heavier and have the ability to carry much more weight than conventional systems. For adequate coulter penetration, weight may have to be added to the carrier. Some planter/drills use a weight transfer linkage to transfer some of the tractor weight to the coulters to ensure penetration. Because coulters are usually mounted several feet in front of the seed opening/placement device (in the case of coulter caddies even further), many use wide-fluted coulters, a pivoting hitch or a steering mechanism to keep the seed openers tracking in the coulter slots.

Wide-fluted coulters (2-3 inches wide) perform the most tillage and open a wide slot in the residue. They allow faster soil warm-up (which may be a disadvantage in some double-cropping situations) and prepare an area for good soil-to-seed contact. However, because of the close spacing, fluted coulters require more weight for penetration, disturb more soil surface, and bury more residue. In wet soil conditions, fluted coulters may loosen too much soil, which could prohibit good seed-to-soil contact. The loose, wet soil may stick to the seed openers and press wheels resulting in non-uniform depth control and clogging.

Narrow-fluted coulters (1/2 to 1 inch wide, see Figure 1) or narrow bubble coulters, ripple coulters and turborippled coulters do not require as much weight for penetration and do not throw as much soil out of the seed furrow as the wide-fluted coulters. Turbo-ripple coulters have more cutting action over the ripped coulters of the same width. Ripple coulters with a smooth edge or smooth coulters are preferred for residue cutting. They can be sharpened to maintain the cutting surface. Operate all coulters close to seeding depth (Figure 2) to avoid excessive soil throwing at high operating speeds and to limit the formation of air pockets below the seeding depth. Use the largest diameter coulters available. When operated properly, they have the best angle for cutting residue and require less weight for penetration.

Most no-till planters/drills are equipped with independent seeding units that should allow at least 6 inches of vertical movement. This will allow smooth transit over non-uniform surface and adjust for root stubs and other obstacles. These units are sometimes staggered which helps with the unit function (more side-to-side space) as well as more space for the residue to flow through the system. These units should be equipped with heavy down-pressure springs and sufficient weight to ensure penetration of both the coulters and seed furrow openers into untilled soil. Usually these springs are adjustable and multiple springs can be added until sufficient pressure is achieved.

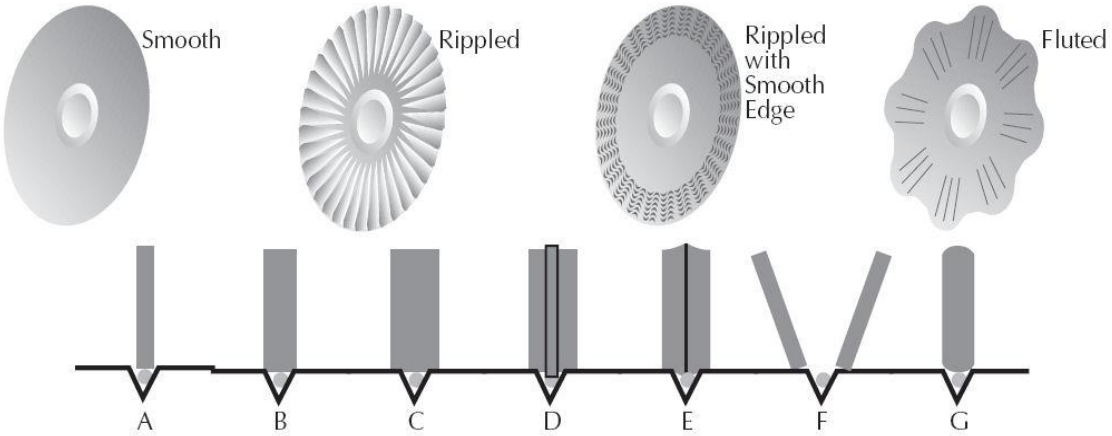


Figure 1. Top figure shows common coulter styles and the bottom figure shows various types of press wheels. Press wheels (bottom figure) are defined as: A) 1- inch wide wheel presses directly on the seed in the bottom of the seed furrow, B) 2-inch wide wheel presses on the seed and gauges planting depth by riding on the sides of the seed furrow, C) wide press wheel gauges planting depth but does not press directly on the seed, D) wide press wheel with two ribs applies pressure on the side of the seed furrow to press soil on the seed while gauging the depth, E) wide press wheel with one center rib applies pressure on the seed furrow to press while gauging the depth, F) a pair of angled press wheels gauge depth while closing the seed furrow and establishing seed-to-soil contact, G) narrow steel press wheel applies pressure directly on the seed but does not flex to "shed" soil in sticky conditions.

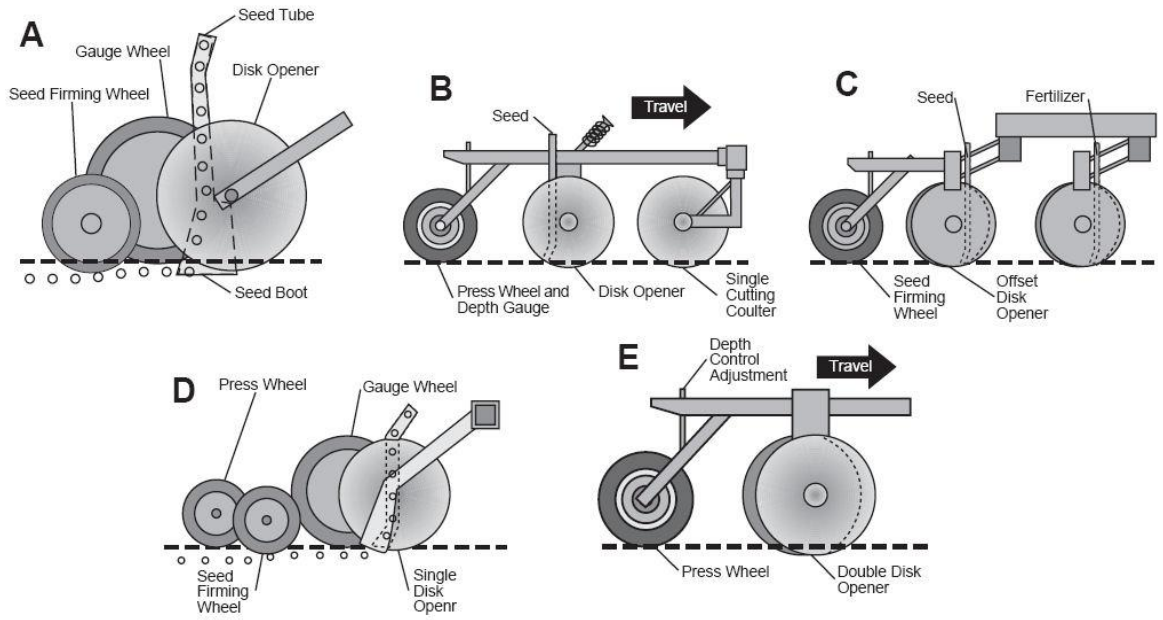


Figure 2. Diagram of typical seeding mechanisms: A) Single disk opener, B) single disk opener with add-on coulter unit, C) offset double disk openers with fertilizer opener mounted midway between seed openers, D) depth control is maintained by mounting the gauge wheel beside the seed opener disk, E) depth control is maintained by mounting the press wheel on the furrow opener frame member.

Some no-till planters/drills are not equipped with coulters (Figures 2-A and D). These planters/drills use the seed furrow openers to cut and place the seed. Several planter/drill systems have a staggered double disk seed furrow opener without a coulter (Figures 2-C and E). The leading disk (usually 1/2 to 1 inch in front) cuts the residue and the second aids in opening the seed furrow. Some manufacturers use a single, large disk set at a slight angle. These units require less weight for penetration and provide minimal soil disturbance.

Some no-till drills use offset double-disk openers (Figure 2. C & E) and the leading edge of the double disks is subject to significant wear. Single disk openers are also subject to similar wear. Essentially, the leading edge of one disk takes the abrasion and wear of cutting straw or stalks and penetration into the soil. The leading and trailing disk are typically two different parts and cannot be interchanged. As the double disk openers wear, check the gap between them. If a gap opens between the double disks they will push residue into the furrow and have less ability to cut the residue. Adjustment washers are found in the double disk opener assembly, which allow some adjustment to compensate for wear.

Summary

Successful planting/drilling with no-till equipment depends on specially designed systems that can uniformly place seed through heavy residue and into firm, moist soil. No-till equipment is available to achieve these results for good yields.

FERTILIZATION AND LIMING

(Glen Harris)

Soybeans remove a relatively large amount of nutrients from the soil. The approximate pounds of primary and secondary nutrients contained in a 40 bushel per acre soybean crop are shown in the following table.

Approximate Nutrient Utilization of 40 bu/A Soybeans[1]

	Plant Nutrients Absorbed				
Plant Part	**N[2]**	**P_2O_5**	**K_2O**	**Mg**	**S**
	lb/A				
Total Uptake	224	38	144	16	14
Seed Only	160	32	56	17	11

[1] Amounts may vary with variety, soil type, and fertilization.

[2] All N fixed from the atmosphere.

While these quantities are high, this should not be interpreted to mean that this amount of fertilizer should be added. Nutrient additions will vary according to soil type, residual nutrient status, soil pH, and past crop management. For these reasons, fertilizer needs should not be second-guessed, but based on soil test results.

Soil Testing and Recommendations

Soil tests are valuable for predicting fertilizer needs and monitoring soil nutrient status. But soil tests and the resulting fertilizer recommendations are not miracle workers. The soil test is a helpful diagnostic tool requiring common sense and experience to interpret and use in managing your fertilizer programs.

Method of Sampling

The weakest link in soil testing is the sampling procedure. Samples must accurately represent the conditions of the field or the results will be meaningless. Also, be sure to take soil samples to plow depth.

Interpreting Soil Tests

Soil pH

Low soil pH can limit soybean yields. **Liming soils for a pH near 6.0 is desirable for producing optimum soybean yields.**

Liming acid soils improves soybean yield potential by reducing toxic quantities of aluminum and manganese, favoring the growth of nodule-forming bacteria, increasing the availability of molybdenum and phosphorus, supplying calcium and/or magnesium, and improving the soil physical condition.

Limestone additions should always be based on soil test results. Adding limestone without a soil test may increase pH excessively (above pH 6.5), causing micronutrient deficiencies. The somewhat poorly drained soils of the Flatwoods in the Coastal Plain region are particularly susceptible to Mn deficiencies as soil pH increases above 6.3.

When limestone is needed, it is most effective when applied at least three months prior to planting soybeans. Since limestone is fairly insoluble and will not leach downward, it should be thoroughly incorporated throughout the plow-layer. Surface applications will have little effect on soil acidity beyond the surface two or three inches.

Fertilization

A profitable response to fertilization is more likely on a soil that tests low for a given nutrient than on one that tests high. This does not rule out the possibility of a profitable response from a fertilizer application at a high level of fertility if yield factors other than fertility are optimum. Likewise, a profitable response on soils with low fertility is not assured when other factors such as adverse climate, poor management or pest problems occur.

An example of soil test recommendations for phosphate and potash fertilizer for both full season and double-crop situations is given in the Fertilizer Recommendations for Soybeans table. Pulling a soil sample between the small grain and soybean double crop may be helpful in confirming fertility is sufficient in this system.

Fertilizer Recommendations for Soybeans

	Full Season		Small Grain - Soybean	
Plant Part	**P_2O_5**	**K_2O**	**P_2O_5**	**K_2O**
	lb/A			
Low	70	100	150	180
Medium	40	80	80	120
High	0	60	40	60
Very High	0	0	0	0

Nitrogen

The soybean plant is a legume, so nitrogen can be supplied by nitrogen-fixing bacteria contained in nodules located in the plant roots. These bacteria convert atmospheric nitrogen into forms usable by the soybean plant. Total nitrogen needs can be supplied through the symbiotic nitrogen-fixation process.

For soils where soybeans have not been successfully grown within three years, an inoculant containing nitrogen-fixing bacteria should be applied at planting. Some helpful hints concerning soybean inoculation include:

- Purchase a proven soybean inoculant from a reputable dealer.
- Check the expiration date to assure viability at planting.
- Store inoculant in a cool, dry place prior to planting.
- Do not buy inoculant that is prepackaged with fungicide treatments.
- Do not mix inoculant and fungicide treatments far in advance of planting.
- Apply inoculant at rates and in the manner according to manufacturer recommendations.

Many producers use small amounts of nitrogen fertilizer for soybeans. While there appears to be no yield advantage under most conditions to this practice, an early season growth response may be observed. In some cases, this could permit more efficient use of early season directed herbicide applications. Nitrogen in excess of 20 pounds per acre can seriously inhibit the symbiotic nitrogen-fixation process.

Phosphate and Potash
The phosphate and potash recommendations for soybeans are based on the soil test levels as shown in the Fertilizer Recommendations for Soybeans table. Fertilization without a soil test is an unsound agronomic practice.

Soybeans are known to produce best on soils with good residual fertility. On most Georgia farms, it is desirable to maintain soil P index at a "High" test level and soil K index at a "Medium" or "High" test level. **Use soil test recommendations to determine the rate of P and K to apply to each field.**

In double-cropping systems, the phosphate and potash requirements for soybeans can be applied to the crop proceeding soybeans. On deep sands (depth to clay layer greater than 18-20 inches), the potassium application should be split, with half applied in the fall, and half applied prior to planting in the spring. The quantities recommended for a small grain and soybean systems are given in the Fertilizer Recommendations for Soybeans table.

Secondary Nutrients (Calcium and Magnesium)
For most situations, adequate levels of calcium and magnesium can be maintained by using dolomitic limestone. In situations where soil pH is above 6.0 and soil Mg tests low, it is advisable to use a magnesium fertilizer rather than additional limestone.

Micronutrients
Direct application of micronutrients to soils is seldom required for soybeans in Georgia, but should be applied when soil test results indicate levels are low. When Mn levels are low and pH is above 6.0, apply 10 lbs Mn/A as manganese sulfate or manganese oxide. Liming to pH levels greater than 6.5 can induce deficiencies of manganese, zinc and copper on some soils. The most frequent occurrence of such deficiencies has been in the Ocilla, Pelham, Leefield, and similar soils in the Flatwoods area. Under these high pH conditions, foliar applications of micronutrients during the growing season are more effective than soil applications. Soil applied micronutrients are rapidly converted to unavailable forms in soils with high pH. A foliar spray of boron (1/4 to 2 lb/A) at soybean bloom often gives a slight soybean yield increase especially on sandy soils. Adding boron to insecticide sprays (wherein compatible) at R3 soybean growth stage can be a way of improving the economics of this treatment.
It is recommended to apply 2 oz/A Dimilin plus 1/4 to 2 lb/A boron at early podding (R2-R3) to (1) increase soybean yields, (2) control velvetbean caterpillar, (3) suppress soybean looper, (4) increase insecticide effectiveness if looper develops and (5) increase potential profitability of soybeans.

Poultry Litter
Poultry litter contains significant amounts of plant nutrients and is a valuable source of fertilizer for crop production. The nutrient content of poultry litter varies depending on a number of factors. These include moisture content, type of bird, feed rations, and handling / storage methods. The average value for N-P-K analysis of chicken litter reported by the University of Georgia Agricultural Services Laboratory is 3-2-2. Therefore, *on average*, a 1 ton/A application of chicken litter will supply 60 lbs of N, 40 lbs of P_2O5 and 40 lbs of K_2O.

Remember, these are average values. Having litter tested for nutrient content by a reputable laboratory before calculating application rates is highly recommended.

In addition to the primary elements, poultry litter also contains significant amounts of calcium and magnesium (around 30 lbs of Ca and 5 lbs of Mg per ton of litter). This will not only supply these secondary elements for crop uptake, but may also maintain or even increase pH of the soil. Maintaining adequate soil levels of micronutrients such as Zn Mn, B, and Cu is another potential benefit of using poultry litter, since small quantities of these nutrients are contained in litter. An additional benefit of applying poultry litter to soil is a potential increase in soil organic matter. This could result in improved soil physical properties, such as tilth and water holding capacity.

The basic strategy for using poultry litter as fertilizer is to: 1) soil test, 2) test the litter for nutrients, then 3) match the nutrient requirements of the crop with nutrients in a corresponding amount of litter.

Fertilizer recommendations are normally based on the nitrogen requirement of the crop to be grown. Nitrogen is not recommended for soybeans because soybean is a legume, and nitrogen needs are met through fixation of atmospheric nitrogen by symbiotic bacteria. However, nitrogen still needs to be considered since excessive amounts can cause pollution of surface water and groundwater with nitrates. In addition, excessive N in litter applications can cause lodging. Planting shorter stemmed soybean varieties may reduce the risk of lodging in this situation. Another consideration is that not all of the nitrogen in the applied litter will be available for uptake by the soybean. The soybean plant will have to rely on symbiotic fixation to fulfill the total nitrogen demand. Therefore, inoculating soybeans with nitrogen-fixing bacteria is still recommended if soybeans haven't been grown successfully within three years.

VARIETY SELECTION

(Jared Whitaker)

Variety Selection Process

Making proper variety selections is extremely important to the overall success of a soybean crop. Variety selection is a process, and growers need to seek out varieties which have high yield potential and high yield consistency, while not forgetting the characteristics of varieties which can and often do impact the number of bushels that make it to the bin at the end of the season. Each year there are a tremendous number of varieties that can be potentially grown in Georgia, and new varieties are released quite often.

Remembering that all soybean varieties are not created equally can help narrow choices. Knowing what makes varieties different and what characteristics are needed in a particular situation can greatly impact overall production and assist in making this daunting task more manageable.

Listed below are a few important ideas and steps which can help narrow down choices and hopefully assist in making proper variety selection. By no means is this the absolute way to go about it, but it's a start.

Planting date / Maturity Group - The large majority of soybean varieties planted in Georgia are maturity group V, VI, or VII. Based upon planting date and desired harvest timing, growers can potentially narrow their search. In both irrigated and dryland systems, it's a good idea to spread out varieties based on maturity groups. This not only spreads out harvest, but also spreads the risk of drought and heat stress effects during flowering and seed development.

Weed Control - Some growers may be able to narrow their search based on herbicide traits (or lack thereof). Most commercial varieties have the Roundup Ready® trait, which allows for glyphosate use. Some varieties have been commercialized with the Liberty Link® trait, which allows for postemergence use of Liberty®. There are also many selective herbicides which can be used on conventional, Roundup Ready, or Liberty Link varieties. Knowing the weed issues in a particular field can help growers decide on which trait they should be utilizing for maximum production.

Irrigation - When soybeans are grown in irrigated situations, a couple of things can be considered. Lodging is sometimes a problem which can reduce yield, and this is more likely to occur in irrigated situations. Therefore, selecting varieties with low lodging potential may help irrigated yields. Also, there may be an opportunity to attempt to select varieties with the highest yield potential. By examining yields from state-wide variety testing results, growers may be able to find varieties which have performed best in higher yield situations.

Nematodes - Nematodes can dramatically impact yield, and the occurrence of these pests along with species present can affect variety selection. If a grower is aware of nematode species and pressure in a field, planting a variety with resistance to those nematodes will almost certainly increase yield.

Recommended Varieties

Adapted varieties reduce hazards of soybean production and allow for maximum yields at the lowest cost per unit of input. Getting best varieties for a field is a major challenge because there are many varieties available for planting, and because variety growth and yield are widely variable with location, planting dates, soil types, row spacing, planned harvest time, glyphosate herbicide, cyst nematodes, root-knot nematodes and diseases. Getting top performance is also a problem because each variety has a 5-6 week "critical moisture period" during reproductive growth when the plant requires optimum soil moisture for normal yields. This critical period occurs from July 20 to August 20 for early maturing varieties and from August 15 to September 25 for late maturing varieties.

See the 2013 list of soybean varieties recommended for Georgia along with numerous characteristics of recommended varieties. **To get top performance select varieties from the chart: (1) that are specifically adapted to existing field situations on your farm and (2) that are of early and late maturity to spread drought risks.** Spread the risk of drought by planting soybean varieties from each of these maturity groups.

Each year the recommended list of varieties is updated, and there are two criteria a particular variety has to meet to make it on the list: (1) the variety must be tested in the UGA variety testing program for TWO years (2) the variety must have produced average yields (across all locations and years) which are above the maturity group average.

For more information on soybean variety performance refer to the UGA Soybean Webpage and click on the “Variety Testing” link to access UGA Statewide Variety Testing results which are conducted across Georgia each year.

Farmer Saved Seed Soybeans

A few words of caution when considering the use of bin run or farmer-saved seed beans:

1. The use of farmer-saved seed of any variety containing Roundup Ready technology is specifically forbidden by the technology agreement and can result is large fines or legal action.
2. With conventional varieties, remember the eye cannot detect seed viability; therefore, germination tests are **essential**. Germination should be 80 percent or above. Plump seed with high percent germination, good color, and no visible damage will generally develop into good stands.

Buying **certified seed** is an excellent way to ensure that seed is true to variety, of high quality and of good germination. Contact the Georgia Crop Improvement Association at 706-542-2351 for a list of certified seed suppliers in your area.

2013 GEORGIA SOYBEAN VARIETY RECOMMENDATIONS

Visit the UGA Soybean Webpage for more information including characteristics of recommended varieties.

I. Coastal Plain and Piedmont (Early Planted)

MG V	MG VI	MG VII	MG VIII
♦AGSouth AGS568RR*	Asgrow AG6931	♣AGSouth AGS828RR	Motte
♣AGSouth AGS597RR*	Dyna-Gro 36RY68	AGSouth AGS Woodruff	
♣AGSouth AGS5911LL*	Dyna-Gro V61N9RR	Asgrow AG7231	
Osage*	NC Roy	♣Dyna-Gro 34RY75	
Ozark*	♣Progeny P6710RY	Dyna-Gro 35K73	
♦Pioneer 95Y20*	♦SS RT6207N	Dyna-Gro V76N9RR	
Pioneer 95Y70*	♣SS SS6810NR2	♦NC Raleigh	
♣Pioneer 95Y71*	♦USG 620nRR	NK S78-G6	
♣Progeny P5655RY*	♣USG 76S90R2	NK S79-B9	
♣Progeny P5711RY*		Pioneer 97M50	
♦SS LL511N*		Progeny P7310RY	
SS LL595N*		Santee	
♦SS RT5160N*			
♦SS RT5760N*			
♣Terral-REV 56R63*			
Terral-REV 57R21*			

II. Coastal Plain and Piedmont (Late Planted)

MG VII	MG VIII
♣AGSouth AGS828RR	Motte
AGSouth AGS Woodruff	
Asgrow AG7231	
♣Dyna-Gro 34RY75	
Dyna-Gro 35K73	
Dyna-Gro V76N9RR	
♦NC Raleigh	
NK S78-G6	
NK S79-B9	
Pioneer 97M50	
Progeny P7310RY	
Santee	

Footnotes:

* - Recommended only for highly productive soils.

♦ - To be dropped from recommended list in 2014.

♣ - New for 2013.

III. Limestone Valley (Early Planted)

MG V

♦AGSouth AGS568RR
♣AGSouth AGS597RR
♣AGSouth AGS5911LL
Osage
Ozark
♦Pioneer 95Y20
Pioneer 95Y70
♣Pioneer 95Y71
♣Progeny P5655RY
♣Progeny P5711RY
♦SS LL511N
SS LL595N
♦SS RT5160N
♦SS RT5760N
♣Terral-REV 56R63
Terral-REV 57R21

MG VI

Asgrow AG6931
Dyna-Gro 36RY68
Dyna-Gro V61N9RR
NC Roy
♣Progeny P6710RY
♦SS RT6207N
♣SS SS6810NR2
♦USG 620nRR
♣USG 76S90R2

MG VII

♣AGSouth AGS828RR
AGSouth AGS Woodruff
Asgrow AG7231
♣Dyna-Gro 34RY75
Dyna-Gro 35K73
Dyna-Gro V76N9RR
♦NC Raleigh
NK S78-G6
NK S79-B9
Pioneer 97M50
Progeny P7310RY
Santee

IV. Limestone Valley (Late Planted)

MG VI

Asgrow AG6931
Dyna-Gro 36RY68
Dyna-Gro V61N9RR
NC Roy
♣Progeny P6710RY
♦SS RT6207N
♣SS SS6810NR2
♦USG 620nRR
♣USG 76S90R2

MG VII

♣AGSouth AGS828RR
AGSouth AGS Woodruff
Asgrow AG7231
♣Dyna-Gro 34RY75
Dyna-Gro 35K73
Dyna-Gro V76N9RR
♦NC Raleigh
NK S78-G6
NK S79-B9
Pioneer 97M50
Progeny P7310RY
Santee

Footnotes:
* - Recommended only for highly productive soils.
♦ - To be dropped from recommended list in 2014.
♣ - New for 2013.

EARLY AND ULTRA-LATE SOYBEAN PRODUCTION SYSTEMS IN GEORGIA

(Jared Whitaker)

Early Soybean Production System

Researchers have examined an Early Soybean Production System (ESPS) that allows for earlier than usual soybean planting and harvesting. ESPS involves planting a maturity group IV soybean variety and planting it between April 20 and May 31. The ESPS system has become popular in the Delta and Mid-south but is still fairly uncommon in Georgia. The ESPS system appears to have the most merit for productive soils in the Middle/Upper Coastal Plain and the Limestone Valley regions of Georgia.

MG IV or early MG V **indeterminate** varieties are used in the ESPS system because they grow better with early planting (April 20 – May 10) than determinate varieties. The critical moisture period for ESPS is July and early August. Therefore, the ESPS system can be used to escape September/October drought and/or to further spread drought risks when grown in addition to regular soybean varieties. Performance of ESPS varieties can be improved by planting in close-row widths (7 to 30 inches) and at high seeding rates (10 to 20% above normal). ESPS varieties will mature by mid-September. Harvest **must** be made by 10 to 14 days after maturity to avoid shatter and seed quality problems.

ESPS varieties are ideal for soybean trap crops. They are, for the most part, susceptible to root knot nematodes. Therefore, they should be planted only on select soils. ESPS varieties have high yield potential but have slightly higher production risks than regular varieties.

There are three major risks which must be managed when growing ESPS soybeans:

- These varieties attract stink bugs during early pod-fill (July). Therefore, stink bug scouting and control measures are essential.

- ESPS seed quality declines rapidly in the field after maturity. Harvest within two weeks of maturity to prevent possible severe seed quality problems.

- Maturity of ESPS soybeans can coincide with late August and early September rains and hurricanes, such as those encountered in 2004. Thus a large portion of one's soybean crop should not be planted in this manner. It is always best to spread risk over planting dates and maturity classes.

ESPS is not well adapted to Georgia for the above three reasons. Getting good seed quality is the biggest concern for ESPS. As such, ESPS soybean seed quality is expected to be fair in North Georgia but only fair to poor in southern Georgia counties.

Ultra-Late Soybean Production in Georgia

For several years, growers in the most southern parts of Georgia have planted soybean behind either corn cut for silage or traditional corn that is harvested early in the season. These growers have likely implemented planting soybean in this traditionally "too late" window for a couple of reasons. When corn is harvested in July or early August, the period of time before frost is long

enough that weed control may be an issue to contend with in these fields. The evolution of glyphosate-resistant Palmer amaranth, which has ample time in this situation to germinate and produce seed, further complicates this issue. Another factor in the adoption of ultra-late planted soybean is the fact that soybean prices are very attractive, and when planted behind a successful corn crop, this situation could more easily provide an economic incentive. Nevertheless, these insightful growers have used ultra-late planted soybean to help with weed control and add another crop within one growing season. The relative success of these growers, paired with high corn and soybean prices, have tremendously increased interest in planting soybean in this window across the state.

For growers interested in planting soybeans in this window, there are several things to consider which may dramatically impact the relative success or failure of this system.

1. **Planting date** – likely the most significant factor in this system.
   - Planting date research for this particular system is underway in 2013, but traditional work has indicated a loss in yield potential of 0.75 bu / day when planting soybean after the middle of June up to the end of July.
   - The actual date in which a grower should consider not planting soybean will be variable (depending latitude and fall weather). At this time, I do not feel that enough research has been conducted to predict a cut-off date for planting soybean in this manner, but my best educated guess at this time are that planting after the first week of August may prove to be too late (especially in areas not in deep south GA). Again, work is underway to more adequately predict the effect of planting date in this system.
   - It should also be considered that any practice which relates to harvesting the corn crop earlier may be beneficial to the whole system (however, a successful corn crop has to be part of the system as well).
2. **Irrigation capabilities** – irrigation is a must.
   - Irrigation water will be needed to supplement growth and ELIMINATE stress from dry soil conditions. The amount of vegetative growth that can be produced is important when producing soybean this late. Irrigation water may also help increase the overall height of the soybean crop and potentially help increase the height of pods produced on the bottom of the plant (often in this system pods are produced on the lower nodes and may be located too low to be practically harvested).
   - Irrigation will also likely be needed to ensure adequate germination (which would include irrigating prior to planting to potentially cool soils and provide better soil seed contact.
3. **Planting capabilities (row configuration / seeding rates)** – narrow rows and high seeding rates are likely needed.
   - Growers with experience in this system have adopted planting high seeding rates with narrow-row equipment (most often a grain drill).
   - Higher seeding rates help ensure optimum populations. When planting this late, each additional stalk could increase yield and help to increase overall crop height (when planted in narrow rows, soybean often compete against each other and ultimately grow taller than wide-row soybean).
   - Higher populations and narrow rows also decrease the time in which the crop needs to

close the canopy, which certainly helps with weed control and may provide benefits in yield.
    - There is also a likely benefit to plant with a no-till drill for at least three reasons. One is the time after corn harvest to planting, when utilizing a no-till drill soybean could potentially be planted the same day as corn harvest. Another potential benefit is that by leaving corn stubble, soil temperatures will likely be much cooler than bare soil (soybean emergence can be dramatically lower with higher soil temperatures). Some growers have found that the corn stubble can improve harvestability (by helping lift the soybean plant onto the harvest grain table).
4. **Soybean Variety / Maturity Group** – a lot of discussion has occurred about what variety and maturity group is best in this system. There are a couple of things to consider when making this variety selection
    - Maturity group does play a role in the soybean growth and development in Georgia during "traditional" planting windows. In general, later maturing varieties are more attractive than earlier maturing varieties because of the shorter period of time in which earlier maturity soybean has to grow vegetatively prior to shifting to reproductive growth. This phenomenon is still true for soybean planted in this system, however most varieties planted in Georgia (MG V – MG VII) will initiate flowering within a day or two of each other when planted in late-July or early-August. Therefore, maturity may not be the most important factor in the selection of a variety in this system. If fact, one MG V variety is widely planted in this system and it has been successful. However, it doesn't mean that one should choose a MG V, one should consider other characteristics of a variety.
    - Characteristics of varieties that may be important when planting this late are good early season vigor and large plant stature, especially considering limited time for vegetative growth.
5. **Fertility (additional N)** – most growers who have been successful in this system also apply addition nitrogen fertilizer prior to or close to planting. This additional nitrogen potentially increases early-season growth rate.
    - Traditionally, soybean do not need supplemental nitrogen (if properly inoculated), however the ability to produce enough nitrogen to maximize growth rate may be diminished with the decreased window for growth. Although this practice has been widely implemented by growers in this system, research has not supported the additional application of nitrogen and since behind a corn crop there may be enough residual nitrogen to sustain proper growth without additional applications
6. **Soybean prices** – this factor is likely the most important when considering whether or not to utilize this system. Since yields are compressed and can vary, the price in which the crop can be sold can greatly impact the economic profitability of this system. Prior to planting, a grower should consider the economic risk of this system.

Again, it should be emphasized that this system is much more risky than planting in traditional windows, and although relatively successful for some growers for the past couple of years, it has yet to be proven successful in other parts of the state on larger acreages. It should also be pointed out that planting soybean in this window requires extremely timely management, whereas a missed insect infestation or missed irrigation may dramatically impact yields.

SOYBEAN GROWTH STAGES

(Jared Whitaker)

Proper identification of growth stage is essential for proper soybean management throughout the year. Generally, soybean development can be divided into vegetative (V) and reproductive (R) stages. The beginning of each stage starts when at least 50% plants are at that stage. Vegetative growth stages start with soybean emergence and reproductive growth stages start with the first flower.

Vegetative Growth Stages

The vegetative stages begin with emergence (VE stage) (Table 1). Prior to germination, soybean seed absorbs water equal to approximately 50% of its weight. The elongation of hypocotyl brings the cotyledons out of the soil, which starts the soybean emergence.

After emergence, unifoliolate leaves on the first node unroll in addition to cotyledons and start the VC stage. The following vegetative stages are designed numerically from V1, V2, V3, through V(n), based on the number of nodes with trifoliolate fully developed leaf which is unrolled. A fully developed trifoliolate leaf is one that has unrolled or unfolded leaflets. For example, the V1 stage starts when one unrolled fully developed trifoliolate leaf on the second node is visible. The (n) represents the number of the last fully developed trifoliolate leaf.

Table 1. Vegetative (V) soybean growth stages.

Vegetative Stages		**Description**
VE	Emergence	Plant emergence; cotyledons have been pulled through the soil surface (Timing is dependent on temperature and soil moisture).
VC	Unrolled unifoliate leaves	A pair of unifoliate leaves has developed just above the cotyledons. Both sets of leaves are (cotelydons and unifoliates) are opposite of each other on the stem.
V1	First trifoliate	One unrolled trifoliate leaf has developed in addition to the cotyledons and unifoliate leaves.
V2	Second trifoliate	Two unrolled trifoliate leaves. At this point there are three nodes on the plant.
V(n)	(nth) trifoliate	(n) number of trifoliate leaves unrolled. (n) + 1 number of nodes. Until the plant starts to bloom growth stages are discussed in terms of main stem trifoliate leaves.

Reproductive Growth Stages

The reproductive stages in soybean start when at least one flower is present on the plant (R1) (Table 2). These stages refer to bloom development (R1 and R2), pod development (R3 and R4), seed development (R5 and R6), and maturity (R7 and R8).

Proper identification of reproductive growth stages plays an important role in timing fungicide applications to manage Asian soybean rust. Recommendations for both initiation and termination of fungicide applications are most often described by growth stage. Soybean should be safe from the effects of soybean rust when they are near or have reached full seed, or at the R6 stage. Fungicide labels also have restrictions on application based on soybean growth stages (see Nematodes and Diseases for specific recommendations).

Table 2. Reproductive (R) soybean growth stages.

Reproductive Stages		**Description**
R1	Beginning bloom	One flower present on the plant, which will generally appear towards the bottom of the plant.
R2	Full bloom	Flower present at a node immediately below the uppermost node with a fully unrolled leaf. Usually occurs 1 day after R1.
R3	Beginning pod	Pods (¼ inch in length) can be observed at any one of the four uppermost nodes. Typically occurs 10 to 12 days after R2.
R4	Full pod	Pods at any one of the four uppermost nodes are ¾ inch long. Typically occurs 8 to 10 days after R3.
R5	Beginning seed	Seeds in the pods are 1/8" long at any one of four uppermost nodes (can be felt when the pod is squeezed). Typically occurs 9 to 11 days after R4.
R6	Full seed	Pod containing full size green seeds at one of the four uppermost nodes (seed are likely touching in the pod). Typically occurs 13 to 17 days after R5.
R7	Beginning maturity	At least one pod can be found on the plant which is mature (brown or tan in color). Pods and leaves beginning to "yellow" during this stage. At this point the plant has reached physiological maturity. Typically occurs 17 to 21 days after R6.
R8	Full maturity	95% of pods mature (brown or tan in color). Typically occurs 9 to 11 days after R7. Beans are close to being harvest ready.

Acknowledgements: This section was adapted from the 2009 edition of the South Carolina Soybean Production Guide (*Soybean vegetative and generative growth stages*, Pawel Wiatrak) published by Clemson University Cooperative Extension Service, the 2004 edition of PM 1945 *Soybean Growth and Development* published by Iowa State University Extension. Original descriptions of soybean growth stages were developed by Fehr, W.R., C.E. Caviness, D.T. Burmood, and J.S. Pennington. 1971. Stage of development descriptions for soybeans, *Glycine max* (L.) Merr. Crop Science 11:929-931.

SOYBEAN DISEASE AND NEMATODE CONTROL

(Bob Kemerait)

Disease and Nematode Outlook for 2013

In 2013 growers should remain vigilant and prepared to manage Asian soybean rust. Though soybean rust was insignificant in Georgia and the rest of the United States in 2010 and in 2011, the disease was a significant problem in 2012. The importance of rust last season was likely the combined effects of a warm winter (soybean rust likely overwintered on kudzu not too far from Georgia), early tropical storms Beryl and Debbie that re-introduced the disease in Georgia by mid-June, and frequent rainfall that created near-perfect conditions for the development and spread of rust. As of February 2013, Asian soybean rust was known in Seminole, Gray and Lowndes Counties on kudzu; however the disease was no longer found at those locations in March. If we continue to have a mild winter and if we have a hurricane season that starts early, then the threat of soybean rust will continue in 2013. **The Soybean Rust Sentinel Plots** (www.sbrusa.net) will be funded again in 2013 through the Georgia Commodity Commission for Soybeans, the United Soybean Board, and the North Central Soybean Research Program. This program continues to provide an effective tool for early notice of the development and spread of ASR. By effectively managing rust, growers may achieve better control of other diseases as well, such as anthracnose, Phompsis pod and stem blight, frogeye leaf spot, and Cercospora blight. A list of fungicides currently labeled for control of Asian soybean rust and other diseases of soybeans is presented later in this section.

Southern stem blight ("white mold" in Georgia) was severe in peanuts in 2010, 2011 and 2012; the disease was also commonly observed in fields planted to soybean. The unusually high soil temperatures throughout much of the 2010 and 2011 seasons were largely to blame for the outbreak of southern blight. Though no research has been conducted at the University of Georgia on management of southern blight in soybeans using fungicides, fungicides may prove to be an effective management tool where the disease is severe. Fungicides labeled for use in management of southern blight on soybeans include Quadris, Headline, and EVITO.

Nematodes are an important threat to soybean production in Georgia. Soybean yields in the state are routinely compromised by root-knot, reniform, Columbia lance nematodes, and perhaps sting and cyst nematodes as well. From a survey of 107 soybean fields from across Georgia, root-knot nematodes were present in at least 36 fields, cysts nematodes in ten fields and reniform nematodes in five fields. The root-knot nematodes were found in fields across the state; cyst and reniform were found in much more localized areas. For example, cyst nematodes were found most commonly in Washington, Burke, and Screven Counties; reniform nematodes in Calhoun and Sumter Counties.

The first line of defense for protection from plant-parasitic nematodes is crop rotation; however crop rotation is difficult for management of nematodes that affect soybeans. This is because one or more of the important nematodes affecting soybeans will also affect most of our suitable rotation crops (e.g. cotton, corn, and peanuts). The second line of defense will be the use of soybean varieties with some level of nematode resistance. Though none of our soybean varieties are immune to nematodes, growers can plant varieties with improved resistance to the cyst and the southern root-knot nematodes. (Note: resistance to the peanut root-knot nematode and the

reniform nematode is rare in our soybean varieties.) This resistance, as a part of an over-all nematode management plan, will help to minimize losses in yield and also reduce nematode populations in a field compared to populations when a susceptible variety is planted. The third line of defense in management of nematodes on soybeans is the use of appropriate nematicides. Currently most growers who apply a nematicide to their soybean crop will use Temik 15G. Unfortunately the supply of Temik 15G will be severely limited in 2013 and the little that is available will be quite expensive. It appears that a new formulation of aldicarb (the active ingredient in Temik 15G) to be called "Meymik" will NOT be available to growers in 2013. Growers have the opportunity to use Telone II (3 gal/A) but supplies for Telone II remain limited in 2013. The seed-treatment nematicide AVICTA Complete Beans from Syngenta is also available to soybean producers. Research continues on AVICTA Complete Beans to develop use recommendations through the University of Georgia Cooperative Extension.

Tebuconazole fungicide. Tebuconazole, the active ingredient in products such as Folicur, Orius, Muscle, Tebustar, Tebuzol, etc., remains a popular fungicide used on soybeans grown in Georgia. The popularity of this product is based on its proven efficacy in management of rust, its cost per application (3-4 fl oz/A), and because delays in natural defoliation are not attributed to this fungicide. There is no doubt that tebuconazole is an attractive choice of fungicide for these reasons and will likely remain a top choice in 2012. HOWEVER, growers must recognize that tebuconazole is NOT a perfect fungicide. Growers should at least consider other fungicides when deciding what to spray on their beans as a) there are better fungicides for management of soybean rust, b) there are more effective fungicides for the management of anthracnose and other important diseases, and c) there are fungicides, typically strobilurin fungicides, that offer a longer protective window, e.g. three weeks as opposed to two weeks.

Phomopsis pod and stem blight (*Diaporthe phaseolorum* var. *sojae*) and **anthracnose** (*Colletortrichum* spp.) have been devastating in some fields in Georgia in recent years, for example in Terrell and Marion Counties. In such fields, the effects of these two diseases were much more severe than losses to Asian soybean rust. Inoculum (spores) from these fungal pathogens can survive in the field amongst the crop debris and the pathogens can also be born on infected seed as well. Although little research has been conducted in Georgia to assess management of these diseases, timely applications of effective fungicides has been reported as an important control measure for at least anthracnose. Reports of these diseases were much more common in 2009 than in 2010 or 2011. This was likely due to the abundance of wet weather experience across much of the production region in 2009. Both diseases are easily spread by wind and splashing rain that helps to move the fungal spores within a field. CRITICAL POINT: Where fields have been affected by Phomopsis and/or anthracnose in the past, growers should choose a fungicide that is proven effective both in the management of these diseases and in control of Asian soybean rust. Also, growers should ensure that the timing of the fungicide application is appropriate for all of these diseases.

Cercospora blight. Late in the season growers often begin to observe that upper leaves exposed to the sun turn a purple color that is followed by significant defoliation. The petioles (leaf stems) on many plants also develop deep purple lesions and seed from these plants are frequently stained a purple color. The fungal pathogen *Cercospora kikuchii* is the likely causal organism for all of these symptoms and can lead to a reduction in yield and quality. In field studies at the

University of Georgia, less Cercospora leaf blight is frequently observed in plots which have been treated with a fungicide to protect against soybean rust than in unsprayed plots.

Crop rotation. If the acreage planted to soybeans increases in Georgia, the time between soybean crops in a field will likely decrease (i.e. shorter rotation) and also peanuts and soybeans are more likely to be planted in shorter rotations with each other. Should shorter rotations occur, growers can expect greater problems with Cylindrocladium black rot (CBR)/Red crown rot, as this disease affects both peanuts and soybeans, and possibly the peanut root-knot nematode. Increased plantings of soybeans may also increase problems with southern root-knot nematodes, reniform nematodes, and Columbia lance nematodes on future cotton crops.

Asian Soybean Rust

Asian soybean rust remains of important concern to soybean producers across Georgia despite the low incidence of the disease in 2010. The extreme freezes late in the winter of 2009-2010, the hot and dry weather common last season and the lack of hurricanes and tropical storms basically kept this disease from becoming established in the state until late in the season. Because of this, most of the soybean acreage was not treated with a fungicide in 2010.

Growers should remember that if timely applications of fungicides to control Asian soybean rust are needed in 2013, these applications will also help to control other diseases as well, e.g. frogeye leaf spot, Cercospora blight, Phomopsis pod and stem blight, and anthracnose.

Bottom-line comments for managing Asian soybean rust in Georgia:

1. Asian soybean rust can (and does) limit yields in some soybean fields in Georgia most years.
2. Asian soybean rust has occurred in every county in the state at some time or another over the past 5 years. Soybean rust is most likely to be found on soybeans and kudzu.
3. Soybean producers are advised to protect their crop with a fungicide IF a) the crop has reached reproductive growth, b) Asian soybean rust has been detected locally or is likely to be found locally, c) environmental conditions are favorable for development and spread of rust, e.g. adequate rainfall or storms, and d) the grower's crop has the potential to make a satisfactory crop.
4. Asian soybean rust is less likely to be a problem in a field with poor growth and plants stunted by drought or other factor than in a field with good growth, heavy foliage, and a closed canopy of foliage.
5. Some growers plan to apply fungicides to their soybean crop automatically as the crop reaches the R3/pod formation growth stage. They reason that since they will already be applying Dimilin and boron during this time period and because the crop is susceptible to rust, it just makes sense to tank-mix the fungicide for good timing and to save a trip across the field later. **This is a good strategy**, especially when other diseases may occur during this time as well. However if soybean rust does not develop until much later, the R3 fungicide application may not have been needed.
6. In some studies, a single, well-timed application of an effective fungicide may be all that is needed to adequately protect a grower's crop from soybean rust. However, depending

upon the timing of arrival of the soybean rust pathogen (earlier versus later) and the impact of weather, e.g. tropical storms, it may be necessary (an profitable) to make a second fungicide application 2-4 weeks after the first application.

7. To determine where soybean rust is known to be present in Georgia, growers should consult their county agent (University of Georgia Cooperative Extension) or consult the USDA-CREES website at **www.sbrusa.net**.

Spread of Asian Soybean Rust

Soybean rust is spread from infected plants to non-infected plants by spores. Spores germinate in approximately 6-7 hours with suitable leaf wetness and temperatures between 59 and 86ºF. Pustules form in 5-10 days and new spores are formed in 10-21 days. Spores are spread by wind-blown rain and can be carried great distances in upper air currents.

Resistant Soybean Varieties

Currently, we have no varieties that are resistant to the soybean rust.

Alternative Hosts

Phakopsora pachyrhizi (the fungus that causes Asian soybean rust) infects other plants in addition to soybean. These include kudzu, snap beans, lima beans, cowpeas, and more than 90 other species of legumes (the bean family). In 2008 Asian soybean rust was confirmed on kudzu, Florida beggarweed, and iron clay pea in Georgia . **NOTE: peanut is NOT a host for the Asian soybean rust.** Alternative hosts are important because they allow the disease to survive and spread even in the absence of soybean. Thus, the disease may spread into regions where soybean does not occur and survive when soybean is not planted.

Survival of the Asian Soybean Rust

Survival of the rust pathogen is an important component in determining the threat of soybean rust in the coming season. The soybean rust pathogen does not survive for long without a living host. As most kudzu freezes back in Georgia each winter, it is very unlikely that soybean rust will survive in Georgia or in northern Florida to any appreciable amount during the winter. However, the rust pathogen will survive in central and southern Florida, provided that alternative hosts are present. The disease can then be reintroduced into Georgia as it is spread up the peninsula.

Detection of Asian Soybean Rust

Early detection of symptoms of the soybean rust is an important tool in the management of this disease. The initial symptoms begin on the under surface of the leaves and as gray lesions that change to red or tan. These early symptoms can be quite difficult to detect because they are fairly non-descript; however, it is essential to find the disease as early as possible in order to most effectively treat it. Lesions can spread from the foliage to the petioles, stems, and pods. Spores are produced in the mature lesions on the undersides of the leaves. Once these spores are visible, it is very likely that many other infections also exist which have yet to form lesions.

Lessons from the field: It is very difficult to identify the very early infections of soybean rust in a field and early detection can be likened to "finding a needle in a haystack." Based upon our efforts since 2004, effective detection of the earliest infections will require patience and use of a dissecting microscope. It is highly doubtful that growers, consultants, or county agents will find

the earliest introductions of soybean rust in a field. **Therefore, soybean rust sentinel plots (funded by the Georgia Soybean Commission and the USDA) will be carefully monitored again in 2013 to provide advanced warning to growers.**

In 2013, growers, consultants, and agents should continue to monitor the soybean crop and kudzu carefully. Suspicious samples should be submitted to the Plant Disease Diagnostic Clinic in Tifton. Any finds of soybean rust in 2013 by researchers at the University of Georgia will be immediately passed along to the County Agents and also reported on the national USDA website at www.sbrusa.net.

Management of Asian Soybean Rust with Fungicides

There are currently a number of fungicides that are labeled for the management of Asian soybean rust. Those fungicides are likely effective in the management of other diseases of soybean as well. Fungicides labeled for the management of Asian soybean rust are presented in Table 1.

Strobilurins versus Triazoles

The most important classes of chemistries that growers will use to manage soybean rust are the strobilurins (azoxystrobin, pyraclostrobin, and trifloxystrobin) and the triazoles (tebuconazole, tetraconazole, flutriafol, flusilazole, metconazole, myclobutanil, propiconazole and cyproconazole). Here are some notes on these fungicides:

1. Strobilurin fungicides, unless tank-mixed with a triazole, are for use as protectants only and must be applied before rust infection occurs.
2. Strobilurin fungicides are reported to remain active in the field longer than triazole fungicides after application (3 weeks versus 2 weeks), though we do not have clear data on this.
3. Triazole fungicides have both protectant and limited curative properties. "Curative properties" refers to their ability to eliminate or reduce some infections that have happened in the very recent past.
4. Propiconazole (i.e. Tilt, PropiMax, and Bumper) is a weaker fungicide against rust than are other triazoles such as tebuconazole (Folicur et al.), myclobutanil (Laredo), tetraconazole (Domark) cyproconazole (Alto), flutriafol (Topguard), metconazole (Caramba) and flusilazole (Punch).

Lessons from the field: Based upon fungicide trials conducted in Georgia since 2005, we have learned the following lessons:

1. Asian soybean rust can be effectively managed with the fungicides currently available to soybean growers in Georgia.
2. Producers who protect their crop with timely applications of fungicides do not need to worry about spores coming to their fields from kudzu or a neighbor's field where fungicides were not applied. In field trials, rows of soybeans that were treated with fungicides remained nearly disease-free for extended periods of time despite devastated, unsprayed, plots next to them.

3. In UGA fungicide trials, chlorothalonil products were less effective than were other fungicides for the control of rust. Although chlorothalonil is labeled for the control of soybean rust, the University of Georgia's Cooperative Extension advises growers that the optimum timing for application of this fungicide to control rust is unclear and to use the product cautiously. Chlorothalonil remains an effective tool against diseases such as frogeye leaf spot.
4. Although we have not had a single trial where we were able to evaluate each fungicide under a severe rust epidemic, we expect excellent control of rust with the use of Domark 230ME and Topguard. Tebuconazole products have also provided very good control of rust. While untested in Georgia against rust, the new products Stratego YLD (trifloxystrobin + prothioconazole), Quadris Xtra (azoxystrobin + cyproconazole) and EVITO T (fluoxastrobin + tebuconazole) should also be very good in the management of rust.
5. Used preventatively (that is before rust appears in a field), Headline, Quadris + crop oil, Quilt + crop oil, and Stratego provide good results to the grower From field studies, it seems that Quilt is not as effective as tebuconazole, Domark, or Topguard.
6. **NOTE: Headline and likely other strobilurin fungicides such as Quadris, Quadris Xtra, Quilt, EVITO, Stratego, etc. produced what we refer to as a "greening" effect. Foliage in plots sprayed with these fungicides remained greener longer than in plots sprayed with other fungicides and took considerably longer to defoliate. This did not seem to affect the % moisture of the soybeans at harvest; however the delay in defoliation did make harvest more difficult. Some growers have used harvest-aides such as paraquat to defoliate the crop and hasten harvest. It should also be noted the greening effect seems to be more pronounced where some fungicides (e.g. Headline) have been used and less pronounced (sometimes much less pronounced) where other strobilurin fungicides mentioned above have been applied.**
7. Where Folicur 3.6F and other tebuconazole products were applied in our studies, we sometimes observed striking foliar symptoms described as "interveinal chlorosis". This effect was more severe in 2005 than in later years. The foliage on these plants looked like plants that have been affected by nematodes or by sudden death syndrome. NOTE: We did not find any yield reductions associated with these symptoms; tebuconazole provides excellent control of Asian soybean rust.

Application Timing

The timing for application of fungicides to manage soybean rust is **critical**. It is unlikely that growers in Georgia can afford to spray fungicides on soybean without the imminent threat of Asian soybean rust or some other disease such as frogeye leaf spot. However, we have learned that soybean rust can be a very unforgiving disease if fungicide applications are delayed too long once it threatens. Where applications were delayed in our fungicide trials, significant reductions in yields often occurred.

Based on field studies conducted in Georgia, it appears that early reproductive growth (for example early bloom (R1-R2) through early pod (R3) stages) is an important time for rust management. To date, we have never detected rust in plots or fields prior to early bloom and typically began to find rust as the soybean crop reached early pod set and beyond. However,

based upon a variety trial in the fall of 2005, **we know that soybean rust can infect soybeans prior to bloom!**

Lessons from the field: Listed below thoughts about the timing of fungicides applications for management of soybean rust.

1. Timing fungicide applications ahead of introduction of Asian soybean rust into a field is critical in the successful management of the disease.

2. From field observations, it appears that early reproductive growth is a critical period in the management of soybean rust. From both seasons, it appears that a well-time fungicide application with an appropriate fungicide during this period is CRITICAL for maximum rust control IF the disease is threatening.

3. **If rust has not been detected in the local region (as assessed with sentinel plots and careful scouting)**, it is recommended that soybean growers delay application of a fungicide for control of soybean rust until the threat from the disease is more imminent, UNLESS the grower is protecting against some other disease, such as frogeye leaf spot, anthracnose, or Phomopsis blight. **If growers want to take a more conservative approach, they may choose to apply their first fungicide at the same time as a Dimilin application timed at the R2-R3 growth stage.**

4. **If rust has been detected in the local area, or is thought to be likely,** growers are advised to initiate fungicide applications once the crop reaches first bloom.

5. **A second fungicide application should be considered within 2-4 weeks after the first application UNLESS the crop has reached harvest maturity or weather has been unfavorable for disease spread.**

6. From field studies, it is clear that the **FIRST** fungicide application is more important than the second. In 2006, a single, well-timed application of our best fungicides was at times as effective as two fungicide applications, and sometimes better than two applications of a lesser effective fungicide. Growers should not miss the opportunity to achieve excellent control of rust by using a less effective product in the first application, if rust threatens.

"Plant Health Benefits" of Fungicides

Many soybean growers in Georgia are aware that at least one fungicide, Headline, is noted not only for its fungicidal qualities, but also for its reported "plant health" benefits. There is no question that applications of Headline on soybeans keep the leaves greener longer and delays natural defoliation. However, it is not clear that this "greening" effect actually improves yields consistently enough, in the absence of disease, to justify the expense. In Georgia we have not seen an increase in yield where Headline was used in the absence of disease. Growers who wish to apply Headline with anticipation of improved yields simply from better "plant health" should do so with caution.

Steps to manage Soybean Rust in 2013

1. Early detection is critical. Agents, consultants, and growers will be trained in the winter of 2012-2013 to recognize early symptoms of the disease. Once a grower or consultant

finds a sample that could be Asian soybean rust, they should take it to their local county Extension agent. The agent will send it immediately to Mr. Jason Brock at the Disease Diagnostic Lab at 4604 Research Way, Tifton, GA, 31793. The phone number at the Diagnostic Lab is 229-386-7495.

2. Sentinel crops. Sentinel soybean plots will be planted in April and monitored around the state to provide a means for early detection and warnings of the disease to the growers. Kudzu sentinel plots will also be monitored.
3. Fungicide programs to effectively manage rust will be developed and disseminated through the Cooperative Extension Service to the growers.
4. In using a fungicide program, growers must recognize that improper use of fungicides will increase the risk for the development of fungicide resistance by the pathogen.

The table on the following page contains information on fungicides labeled for foliar diseases of soybean. It should be noted that since this list was compiled, EVITO (fluoxastrobin, 2.0-5.7 fl oz/A) and EVITO T (fluoxastrobin + tebuconazole, 4.0-6.0 fl oz/A) have also been added to the list.

Table 1. Fungicides labeled for management of foliar diseases of soybean.

CHEMICAL AND FORMULATION	RATE PER ACRE	REMARKS AND PRECAUTIONS
Quadris 2.08F	6.2-15.4 fl oz/A (to include frog eye leaf spot and soybean rust)	**Note 1**: Prior to the discovery of Aisan soybean rust in Georgia, foliar fungicides were not generally recommended on soybeans in the state. Result s of Georgia research on foliar fungicides have been extremely erratic. Before deciding to apply a fungicide, a grower should consider the current yield potential in the field and the potential for further disease spread. **Note 2:** The presence of the Asian soybean rust in Georgia has greatly affected disease control recommendations. **Note 3:** Asian soybean rust can develop vary rapidly in a field when enough spores are present and environmental conditions are favorable. Once a soybean crop reaches reproductive growth stages, growers should be prepared to treat with fungicides very quickly as soon as the disease is likely to be present in the area. **Note 4:** The key to successful management of Asian soybean rust is use of an effective fungicide in a timely manner before the disease becomes established in a field. **Note 5:** Higher rates of a product provide greater residual activity and may reduce the need for later sprays to manage rust. **Note 6:** Although, "Headline SBR" is no longer available commercially, growers can tank-mix3.1 fl oz tebuconazole with 4.7 fl oz Headline to create a similar product.
Quadris Xtra	4.0-6.8 fl oz for management of soybean rust; 5.0-6.8 fl oz for other foliar diseases.	
Quilt	14-20 fl oz (for management of foliar diseases to include Asian soybean rust.)	
Alto	2.75-5.5 fl oz. For control of Soybean rust use 2.75-4.0 fl oz/A. For other foliar diseases use 4.0- 5.5 fl oz/A.	
Domark 230 ME	4.0-5.0 fl oz (for management of foliar disease to include soybean rust.)	
Tebuconazole	3.0-4.0 fl oz (for management of foliar disease to include soybean rust.)	
Headline	6.0-12.0 fl oz (for management of foliar disease to include soybean rust.)	
Propiconazole (Tilt And Bumper)	4.0-6.0 fl oz (for management of soybean rust and other foliar diseases.)	
Stratego	10.0 fl oz/A (for management of soybean rust and other foliar diseases.)	
Stratego YLD	4.0-4.65 fl oz (for management of soybean rust and other foliar diseases.)	
EVITO (fluoxastrobin)	2.0-5.7 fl oz/A	
EVITO T (fluoxastrobin tebuconazole)	4.0-6.0 fl oz/A	
Topguard	7.0-14.0 (for management of soybean rust and other foliar diseases).	
Topsin-M 70WP	Rate: ½ -1 lb/A (controls frog eye leaf spot and other foliar diseases but NOT soybean rust)	
Topsin-M 4.5 FL	10-20 fl oz/A (controls frog eye leaf spot and other foliar diseases but NOT soybean rust)	
Bravo Weather Stik	1-2 ¼ pts/A (for management of foliar disease including suppression of rust)	
Echo 720	Rate: 1-2 ¼ pts/A (for management of foliar disease including rust)	
Equus 720	1-2 ¼ pts/A (for management of foliar diseases including rust).	
Bravo Ultrex	0.9-2.2 lb/A (for management of foliar diseases including rust)	
Equus DF	0.9-2.2 lb/A (for management of foliar diseases including rust)	
Echo 90DF	0.875-2.0 lb/A ((for management of foliar diseases including rust)	

Seedling Diseases and Seed Treatments

Over the years, seedling diseases have reduced soybean yields 0.5 to 1%. *Rhizoctonia* or *Pythium* are usually the pathogens responsible, but *Rhizoctonia* damage is far more common than *Pythium* damage in soybean fields. Non-uniform stands and/or death of plants soon after emergence are the problems caused by these diseases. Typical symptoms are reddish to dark brown lesions at the base of the stem or on the roots.

Seedling diseases are usually associated with poor quality seed and cool, wet soils. Seed rots and seedling diseases are rarely a problem if high quality seed are planted in well drained, warm soils. However, the increased incidence of seed-borne diseases such as anthracnose shows a need for general fungicide treatment of soybean seed. Commercial treatment of seed is the most effective, but on-farm treatment is acceptable. Rotation should be used in combination with seed treatment for control of these diseases.

A good stand is essential to ensure maximum production. See the "Cultural Practices" section of this guide for information about proper soybean stands.

Soybean Seed Treatments

Common Names (Compounds)	Remarks and Precautions
Dynasty (azoxystrobin, Syngenta) Trilex (trifloxystrobin, Bayer CropScience) Captan Thiram Thiabendazole Molybdenum Carboxin PCNB Metalaxyl *Bacillus subtilis*	Use according to label recommendations.

Fusarium Wilt

Symptoms: Fusarium wilt occurs in midseason during hot weather. The disease is rarely found in seedlings and is more common in sandy soils. Initial aboveground symptoms include a general wilting. The disease may progress rapidly with leaves becoming chlorotic (yellow) then withering. Unlike many soybean diseases, Fusarium wilt can kill plants. Fusarium wilt can be identified in the field by cutting into the stem just above the soil line to observe the condition of the vascular tissue: Fusarium wilt causes tan or brown discoloration in the vascular tissue whereas healthy tissue is white. Fusarium wilt is often exacerbated by root-knot nematode or soybean cyst nematode damage though the presence of the nematodes is not necessary for Fusarium wilt to occur. Drought can enhance disease development.

Control: In fields with a history of Fusarium wilt, crop rotation may help reduce disease pressure. If soybean cyst or root-knot nematodes are present, varieties resistant to those

nematodes should be grown. Genetic resistance to Fusarium wilt has been documented, but varieties are not routinely screened and Fusarium wilt resistance information is rarely reported. If a variety is reported to have Fusarium wilt resistance, it should be grown in fields with a history of Fusarium wilt.

Stem Canker

Symptoms: Symptoms of stem canker are first evident when the soybean plant is in the early reproductive stage. Symptoms appear as small, reddish brown lesions at the base of a petiole on the lower stem. If conditions favor disease development, these lesions elongate laterally along the stem and may, or may not, girdle the stem. Generally, there is a distinct border between the lesion and healthy stem tissue. Foliar symptoms (similar to red crown rot and/or sudden death syndrome) can appear as the season progresses and are expressed as an interveinal chlorosis (yellowing) which becomes necrotic (brown with dead tissue). This disease can cause premature death of plants which significantly reduces yields.

Control: Use crop rotation, resistant varieties, and destruction (plowing under) of infected crop residue to reduce stem canker incidence and severity. Even in fields where stem canker has never occurred, resistant varieties should be grown. All Georgia recommended varieties have fair to good resistance to stem canker. Do not plant susceptible varieties (refer to the variety table in previous section). Some weeds can serve as hosts for the stem canker fungus, so when incorporating fallow into a rotation, it should be as "weed free" as possible.

Pod and Stem Blight

Symptoms: The fungal pathogen of pod and stem blight remains latent in the plant throughout most of the growing season, and symptoms are usually not evident until near harvest. There may be evidence of small black dots along the stems and pods as plants reach maturity. The dots are pycnidia (a fungal reproductive structure) of *Diaporthe phaseolorum* var. *sojae*, the causal agent of pod and stem blight. These pycnidia are more abundant during periods of wet weather.

Control: Rotate with corn and plow down residues. Plant high quality, treated seed. Plant late or during a time that allows maturation during a dry period. Plant resistant varieties may be available. Do not delay harvesting. Maintain adequate potash to minimize moldy seed.

Anthracnose

Symptoms: The plant is susceptible to the fungus at all growth stages, but initial symptoms usually appear during the early reproductive stages. Symptoms are predominantly on the stems and pods in the form of brown to black blotches. As the disease progresses the lesions (blotches) contain black fruiting structures of the fungus. These structures (acervuli) produce minute spines that are easily seen with a hand lens and are very good diagnostic characteristics of this disease. Foliar symptoms are rare, but occur after prolonged periods of high humidity. They include necrosis (browning) of the laminar veins, leaf rolling, petiole cankering, and premature defoliation.

Control: Use disease-free seed and a fungicidal seed treatment. Plow under infected crop residue and rotate the field to something other than soybean.

Red Crown Rot

Symptoms: Symptoms of red crown rot usually appear during the early reproductive stage. The symptoms are expressed as an interveinal chlorosis in the foliage. Prior to harvest, a close examination of the base of the stem may reveal the presence of brick red perithecia, which are fungal fruiting structures that look like clusters of small, red balls. These structures allow the fungus to survive and spread.

Control: Red crown rot is caused by the same fungal pathogen responsible for Cylindrocladium black rot (CBR) in peanut. Therefore, DO NOT rotate soybean with peanut in fields that have problems with red crown rot. This disease is favored by moderate soil temperatures (70 to 85°F) and wet (field capacity) soil. Disease severity is often greater in heavy soils. Management practices reducing red crown rot are as follows: 1) rotate (3-5 years) with any crop except peanut (peanut is highly susceptible), and 2) delay planting. After working in fields infested with this fungus, remove soil from equipment before moving to another field.

Foliar Diseases other than Asian Soybean Rust

Grower complaints for Frogeye leaf spot and downy mildew are common in some years. Many growers who felt they had a good soybean crop were concerned about losses that could be associated with the foliar diseases and called the Extension Service for recommendations on fungicides for the control of this disease. Our recommendations are as follows:

1. In most situations, control of Frogeye leaf spot with a fungicide will not be economically justified. Growers should focus on using a resistant variety.
2. Currently, it is not economically justified to control downy mildew with fungicides.
3. Growers who want to use a fungicide for managing the disease should use the fungicide on irrigated land and only when they expect exceptional yields, typically 45 bu/A or greater.
4. Fungicide spays should begin when the symptoms first start to appear or in the range of the R3 (1/4 inch pod) to the R5 (1/8 inch seed) growth stages.
5. If a growers waits too long to begin spraying (i.e. the diseases is rampant in the field), the fungicides will not help him.
6. In addition to many of the fungicides that are labeled (Section 3) for the control of Asian soybean rust, Topsin-M (thiophanate methyl) is labeled for control of foliar diseases such as frogeye leaf spot.

Nematodes

Take soil samples prior to harvest (typically August or September) to determine if economically damaging nematodes are present. Nematode populations decline following harvest, so do not delay sampling or you may fail to identify nematode problems. Do not sample overly dry soil and protect samples to keep them from getting too hot or dry. Several species of nematode can damage soybean, but root-knot nematodes and soybean cyst nematode are the most common problems in Georgia. In some parts of Georgia, reniform and Columbia lance nematodes are common and cause significant damage to soybean. Sting nematodes are not common and are limited to very sandy sites, but they can be extremely damaging where they occur.

For some nematode species, damage can be determined by examining soybean roots prior to harvest. Root-knot nematode damage can be identified by the presence of root galls. Root galls differ from nitrogen nodules by the fact that galls are caused by swelling of the root tissue and cannot be removed from the root, but nodules are located on the side of the root and can easily be broken off. If roots are gently washed free of soil, soybean cyst nematodes can be seen as small white specks on the roots (they are much smaller than nodules). As cysts age, they get darker and may appear golden, tan, or brown.

Root-knot nematode is the most commonly occurring nematode problem in soybean in Georgia, and three different species (Southern, Peanut and Javanese root-knot) cause damage here. Many fields in the Coastal Plain region of Georgia are infested with one or more species of these nematodes, and heavy infestations can cause severe damage and, in extreme cases, even plant death. The most common and widespread is the Southern root-knot nematode, which is found in all counties where soybean is grown. For predictive purposes, assume that root-knot nematodes detected in cotton or corn fields are southern root-knot. Peanut root-knot is common in areas with significant peanut production. Javanese root-knot is found less commonly in some areas of south Georgia. Many soybean varieties have genetic resistance to one or more of these root-knot species. The level of resistance to these three species is given in variety recommendations. It is critical to select varieties with resistance to the root-knot species present in your field. Anyone using the early soybean production system should be aware that few varieties in early maturity groups have root-knot nematode resistance. An example of a soybean variety with resistance to the southern root-knot nematode is 'Prichard RR'.

Soybean cyst nematode is present in almost all counties where soybean is grown in Georgia. In the midwestern US, soybean cyst can cause significant yield losses with no above-ground symptoms. It seems unlikely here, but Georgia soils typically have much lower fertility and organic matter; however, it may be possible. Sixteen different races of soybean cyst nematode are theoretically possible, but there are only three races of significance currently widespread in Georgia. Race 3 is the most widespread race of soybean cyst nematode in Georgia. Much less commonly, race 9 or 14 is identified. In Georgia, populations often shift readily between races 9 and 14. University of Georgia variety recommendations include a rating of the level of resistance to the species of root-knot and the races of soybean cyst nematode common in Georgia. Even if you do not have a soybean cyst nematode infestation, rotation with crops other than soybean is extremely helpful in reducing losses from other diseases.

Columbia lance, reniform, and sting nematodes cause economic damage in some counties. Nematicides can provide good control, but they are expensive. Rotation with peanut is an excellent control for these nematodes, but peanuts are susceptible to many of the same soilborne fungal disease problems.

The reniform nematode is a growing problem in Georgia and can cause significant yield loss in soybean and cotton. Corn and peanut are non-hosts for the reniform nematode. Most soybean varieties are very susceptible to the reniform nematode, but some soybean varieties have extremely effective reniform nematode resistance and others have moderate resistance. If reniform nematodes are present, a highly resistant variety should be chosen to minimize soybean

losses and to reduce reniform levels in the field. A highly resistant soybean variety can reduce reniform populations as effectively as a non-host crop such as corn. An example of soybean varieties with reported resistance to reniform nematodes include 'Santee', 'Motte', 'DP 5806 RR', 'DP 5644 RR', and 'Delsoy 5710'. Reniform nematodes are not believed to have races, but a population may be able to overcome reniform resistance in soybean if resistant soybeans are grown for several consecutive years. Crop rotation can be used to minimize this possibility.

Both fumigant and non-fumigant nematicides are registered for use on soybeans and either type can provide effective nematode control. Resistant varieties are available for root-knot, soybean cyst, and reniform nematodes, and those varieties should be grown if these nematodes are present. Nematicides may be necessary if sting or Columbia lance nematodes are present, though it is probably better economically to avoid such fields. Root-knot resistant soybean still suffers some yield loss in heavily infested fields, and research shows that yields of root-knot resistant varieties may be increased by nematicides.

Historically, nematicides have not been economically feasible in most situations, but they may be an option in high profit potential situations such as production of foundation or certified seed. Given better prices for soybeans in the recent past, more growers may consider use of nematicides to manage nematodes and to increase yields. Nematicides are not recommended as a general soybean production practice unless production potential is excellent and the price for soybeans makes this added expense worthwhile.

SOYBEAN NEMATODE CONTROL

Chemical and Formulation	Rate/Acre (36" Row Basis) Amount of Formulation	Pounds Active Ingredient	Ounces/1000 Feet of Row Any Row Spacing	Remarks and Precautions
Preplant Injected				
Telone II	3 to 5 gals		30 to 50 fl ozs	Inject 8 inches deep beneath future row. Wait seven days between application and planting when using Telone II.
Preplant or At Planting				
Temik 15G	5 to 7 lbs			Apply to the open furrow at time of planting. Do not make more than one application per season and harvest within 90 days of treatment. See label for required distance from well heads.
AVICTA Complete Bean	Seed treatment			AVICTA Complete Bean is a combination of abamectin and thiomethoxam + additional fungicides. Research continues to develop more specific recommendations for this product on soybeans grown in Georgia.

SOYBEAN WEED CONTROL

(Eric Prostko)

One of the most important aspects of soybean production is weed management. Uncontrolled weeds not only reduce soybean yields through their competition for light, nutrients, and moisture, but they can also severely reduce harvest efficiency. Before implementing a weed management plan for soybeans, several factors need to be considered including weed species, rotational crops, and cost/A.

Soybean Weed Management Strategies

The most effective weed management programs in soybeans use a combination of cultural, mechanical, and chemical control strategies. Cultural practices include such factors as planting date, planting rate, and row spacing. Cultural practices improve weed control by enhancing the competitive ability of the soybeans. Mechanical practices, such as cultivation, are a non-chemical method for controlling weeds between rows. A multitude of herbicides are labeled for use in soybeans and can be applied preplant incorporated, preemergence, postemergence, and post-directed. A complete update on the herbicides recommended for use in Georgia can be found at the end of this section. Because there are an extensive number of herbicides labeled for use in soybeans, just about any weed problem that arises can be controlled. It is just a matter of how much money can be economically justified for weed control in soybeans.

Georgia's Soybean Weed Problems

The following is a list of Georgia's most common and troublesome weeds of soybean:

Rank	Common	Troublesome
1	Palmer amaranth	Glyphosate + ALS-resistant Palmer amaranth
2	Texas millet (panicum)	Glyphosate-resistant Palmer amaranth
3	Smallflower morningglory	Benghal dayflower (tropical spiderwort)
4	*Ipomoea* morningglory species	Palmer amaranth
5	Florida pusley	*Ipomoea* morningglory species
6	Crabgrass species	Florida pusley
7	Florida beggarweed	Nutsedge species
8	Nutsedge species	Spreading/Asiatic dayflower
9	Sicklepod	Smallflower morningglory
10	Bristly starbur	Texas millet

Weed Competition in Soybeans

If a weed management program in soybeans is going to be successful and economical, a thorough understanding of the competitive effects of weeds is important. In regards to this area, two things must be considered: 1) When do the weeds need to be controlled in order to prevent significant yield losses? and 2) How much yield loss are they actually causing? Research has shown that weeds that emerge just prior to or at the same time as the soybeans cause greater yield losses than later emerging weeds. Consequently, effective weed control during the initial 2 to 4 weeks after soybean emergence usually prevents yield losses due to weed competition. However, later emerging weeds can have a negative influence on seed quality and harvest

efficiency. Other research has shown that soybean plants can tolerate a certain level of weed pressure and that control strategies should only be implemented when the potential yield losses caused by the weeds exceeds the cost of control (i.e. economic threshold concept). The following table illustrates the influence of various weed species on soybean yield:

Table 1. Number of weeds/100 feet of row that cause yield reductions in soybeans.

Weed	Soybean Yield Loss (%)					
	1	**2**	**4**	**6**	**8**	**10**
Cocklebur or giant ragweed	1	2	4	6	8	10
Pigweed or lambsquarters	2	4	6	10	15	20
Morningglory or velvetleaf	8	16	24	32	40	50
Smartweed or jimsonweed	2	4	6	10	15	20

Source: Pike, D. R. 1999. Economic Thresholds for Weeds. University of Illinois, Cooperative Extension. Available on-line at http://web.aces.uiuc.edu/vista/pdf_pubs/ECTHR.PDF.

Roundup Ready (RR) Soybeans

It has been estimated that 93% of the soybeans planted in the U.S. during 2012 were herbicide-resistant varieties. Since 1996, producers rapidly adopted the Roundup Ready (glyphosate) soybean system because of its ease of use. In the early days of this system, it was very common for growers to apply 1 or 2 applications of glyphosate and to not use any other herbicides or weed control strategies. Consequently, glyphosate-resistant weeds have become a serious problem. It is now recommended that **every** acre of Roundup Ready soybeans in Georgia should receive at least 1 application of a residual herbicide. **In most cases, 2 residual herbicides may be required for optimum weed control**. Additional information about the control of herbicide-resistant weeds in soybeans is discussed later in the chapter.

Tank-Mixes with Glyphosate for Improved Morningglory Control in RR Soybeans??

One of more common weeds that glyphosate has not provided consistent control of is morningglory. Single applications have rarely been adequate to control this weed complex. Split applications of glyphosate will provide better morningglory control than single applications but many producers are reluctant to pay the additional application and herbicide costs. Tank-mixes with other broadleaf herbicides can help to improve the control of morningglory at a reduced cost compared to split applications. However in most cases, the addition of these herbicides has only resulted in a 5 to 10% increase in morningglory control. Morningglory

control with glyphosate can also be greatly improved by making a timely application **before** the weed exceeds 2" in height.

Table 2. Potential tank-mixes with glyphosate to improve morningglory control.

Herbicide	Rate/A
Classic 25DF	0.25 - 0.33 ozs
FirstRate 84WDG	0.15 - 0.20 ozs
Resource 0.86EC	4 ozs

Glyphosate/Boron/Dimilin Tank-Mixes

A common soybean production practice in Georgia is to apply a combination of Dimilin + Boron at the R2 to R3 stage of growth. Numerous inquiries have been made about the potential for adding glyphosate to this treatment. Research conducted in Georgia and South Carolina indicated that the 3-way combination of glyphosate + Dimilin + Born can be used in soybeans without concern for compatibility problems or excessive soybean injury.

However, it has been demonstrated in numerous studies that the best time to apply glyphosate is between the V2 and V3 stages for soybeans grown in 30" rows and between the VC and V4 stages for soybeans grown in 7.5" rows. Thus, single applications of glyphosate made at the R2 to R3 stage of growth are ***too late*** to provide the best level of weed control and optimal yields. The 3-way combination of glyphosate + Dimilin + boron would be much more effective when used following an earlier application of glyphosate applied at the appropriate time. If the 3-way combination is used, the rate of boron should not exceed 0.25 lb ai/A.

Glyphosate/Manganese Tank-Mixes

Growers with soybeans that are exhibiting foliar manganese (Mn) deficiency symptoms should be cautious when considering tank-mixing Mn fertilizers with glyphosate. Research has shown that certain formulations of Mn, particularly Mn-EAA, Mn-LS, and $MnSO_4$, applied in combination with glyphosate, can significantly reduce weed control. Consequently, split-applications would be preferred if these formulations of Mn are used. Mn-EDTA (chelated) formulations of Mn have not reduced weed control when applied in combination with glyphosate.

$MnSO_4$ has not reduced the weed control performance of other herbicides such as Basagran, Ultra Blazer, Classic, or Pursuit.

Nutsedge Management in RR Soybeans
Potential nutsedge control strategies in the RR soybean production system include the following:

1. Two postemergence applications of glyphosate (14 days apart). This treatment will be more effective on purple nutsedge than yellow nutsedge.
2. Classic tank-mixed with glyphosate. This treatment will control yellow and suppress purple.
3. Pursuit tank-mixed with glyphosate. This combination will be more effective on purple than yellow. A pre-mixed combination of Pursuit + glyphosate is sold under the trade names of Extreme or Tackle.

Soil-applied herbicides that have fair to good activity on yellow nutsedge include the following: Canopy/Cloak, Dual Magnum, Envive, Intrro, Prefix, Pursuit, Reflex, and Scepter.

Liberty-Link (LL) Soybean System
Liberty-Link soybean varieties were introduced into the market in 2009. These varieties are resistant to postemergence applications of Liberty (glufosinate). Generally, Liberty is very effective on numerous broadleaf weeds, particularly morningglory species. With proper management, the Liberty-Link system can also be used to help control glyphosate- and ALS-resistant Palmer amaranth. Before using the Liberty-Link soybean system, consider the following:

1. Liberty (glufosinate) is not necessarily a direct replacement for Roundup (glyphosate). There are many differences in weed susceptibility to these herbicides. Please refer to the Weed Response Chart at the end of this chapter for more information.

2. It is strongly recommended that a **residual** herbicide be used with the Liberty-Link system! The use of residual herbicides in the Liberty-Link system will improve the control of herbicide-resistant weeds and help delay the development of resistance to Ignite.

3. Liberty must be applied in a minimum of **15 GPA.**

4. Liberty should be applied using nozzles and pressures that generate **medium** spray droplets (250-350 microns). Refer to spray nozzle tip manufacturer guidelines for more information about droplet size. UGA weed scientists have used **flat fan** nozzles tips in their Liberty-Link soybean weed control research with good success.

5. Liberty is most effective when applied between the hours of 9:00 am and 6:00 pm.

6. Liberty tank-mixes with grass herbicides (Assure, Fusilade, Poast, and Select) may result in reduced grass weed control.

7. Liberty will not consistently and effectively control Palmer amaranth that exceeds **3"** in height.

8. Liberty-Link soybean varieties that are adapted to Georgia were limited in 2011. Please refer to the latest UGA Variety Tests for more information about the agronomic performance of Liberty-Link soybeans. These results can be accessed from the following web-site: *www.swvt.uga.edu/ssfTests.html*

9. Some Liberty-Link soybean varieties have exhibited poor tolerance to metribuzin herbicides in UGA field tests. These include AGS LL5911, SS LL511N and SS LL595N. Do not use metribuzin herbicides on these varieties. Herbicides that contain metribuzin include the following: Authority MTZ, Boundary, Canopy, Intimidator, and Tricor.

Sicklepod Control

Historically, sicklepod has been one of the most troublesome weed problems in Georgia soybeans. Although it is considered to be less competitive than many other weeds, sicklepod populations can quickly reach levels that can cause significant yield loss. Fortunately, several control strategies for this weed are available.

In conventional soybeans, the best method to control sicklepod is to use a systems approach that includes a preplant incorporated or preemergence application of Tricor (metribuzin), Canopy/Cloak (metribuzin + chlorimuron), or Boundary (metribuzin + *S*-metolachlor) followed by a postemergence application of Classic. Caution is advised when using metribuzin products because several restrictions on soil type, organic matter, pH, and variety exist. Refer to the specific herbicide label for these restrictions. Python (flumetsulam) can be substituted for metribuzin products in those situations where metribuzin use would be prohibited or not preferred.

Sicklepod is susceptible to glyphosate and glufosinate (Liberty/Ignite) thus can be managed using either the RR or LL production systems. However, 2 applications of glyphosate or glufosinate may be required to provide season-long control.

Tropical Spiderwort (Benghal Dayflower) Control in Soybean

Tropical spiderwort, also known as hairy wandering jew or Bengal dayflower, has become an increasing problem in many soybean production fields. Planting in narrower rows and increasing soybean plant populations will help improve the control of tropical spiderwort through competition and shading.

The most effective herbicide control strategies for tropical spiderwort include using a combination of both preemergence and postemergence herbicides. One of the best soil applied herbicides for the control of tropical spiderwort is Dual Magnum *(S*-metolachlor). Generic formulations of metolachlor are available (Me-Too-Lachlor, Stalwart, and Parallel PCS) but these formulations have not provided the same length of residual control of tropical spiderwort as Dual Magnum in UGA trials. Postemergence herbicides that have fair to good activity on tropical spiderwort include Basagran, Classic, FirstRate, and Pursuit.

Gramoxone Inteon/Firestorm/Parazone or Aim can be used post-directed or in a hooded sprayer. When using Gramoxone Inteon/Firestorm/Parazone post-directed, the soybeans must be at least 8" in height and the herbicide should not be sprayed higher than 3" on the soybean plant.

In RR soybean systems, glyphosate can provide fair to good control of tropical spiderwort if it is applied to plants that are 3" tall or less and under ideal growing conditions. However, more effective control can be obtained by applying either Sequence or Extreme/Tackle. Sequence is a pre-mix of glyphosate + Dual Magnum. Extreme/Tackle is a pre-mix of glyphosate + Pursuit.

Other herbicides which can be tank-mixed with glyphosate to improve control of tropical spiderwort include Classic or FirstRate.

Rotational Crop Concerns

Advances in herbicide chemistry have led to the development of some exceptional families including the sulfonlyureas (Classic, Pinnacle), imidazolinones (Pursuit, Scepter), sulfonanilides (Python, Firstrate), and others. Many herbicides in these families are used in soybeans. However, some of these herbicides have the potential to injure rotational crops if the appropriate replanting interval is not observed. Because of the diversity of crops that are grown in Georgia, producers must consider the potential effects that herbicides could have on a rotational crop the next year. This information is readily available on nearly all herbicide labels.

Herbicide-Resistant Weeds

Herbicide resistant weed species can become a serious problem in fields when a single herbicide or herbicides with similar modes of action are used repeatedly. This phenomenon has been documented in Georgia with Palmer amaranth (pigweed) and other weed species (Table 4). Populations of Palmer amaranth have been found in the state that are resistant to glyphosate or ALS-inhibiting herbicides. Check with your county extension agent for updated information about the distribution of herbicide resistant weeds in your area.

Table 4. Herbicide Resistant Weeds in Georgia.

Weed	Year	Herbicide(s)	Site of Action
goosegrass	1992	Treflan	Tubulin protein
Prickly sida	1993	Scepter	ALS enzyme
Italian ryegrass	1995	Hoelon	ACCase enzyme
Palmer amaranth	2000	Cadre, Pursuit	ALS enzyme
Palmer amaranth	2005	glyphosate	EPSP synthase
crabgrass	2007	Poast	ACCase enzyme
Palmer amaranth	2007	atrazine	PS II
Italian ryegrass	2008	Osprey	ALS enzyme
Italian ryegrass	2010	Poast, Hoelon	ACCase enzyme
Palmer amaranth	2010	Prowl	Tubulin protein

Herbicide resistant weeds can be managed by using a combination of strategies including crop rotation, row patterns, mechanical cultivation, and utilizing herbicides with different modes of action. Specific herbicide recommendations for the control of glyphosate–resistant Palmer amaranth and ALS-resistance management in soybeans are presented in later in this chapter.

SOYBEAN WEED CONTROL

Eric P. Prostko, Extension Agronomist – Weed Science

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE: AMOUNT OF FORMULATION	BROADCAST RATE/ACRE: POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
MINIMUM TILL, STRIP-TILL, OR NO-TILL BURNDOWN OPTIONS	glyphosate (various trade names) 3.00 lb ae/gal 3.73 lb ae/gal 4.00 lb ae/gal 4.17 lb ae/gal 4.50 lb ae/gal 5.00 lb ae/gal	16 - 128 oz 13 - 103 oz 12 - 96 oz 11.7 - 92 oz 11 - 85 oz 10 - 77 oz	0.38 - 3.0 ae	Controls most emerged annual grass and broadleaf weeds. Glyphosate rates vary according to weed species, weed size and spray volume. Refer to the individual product labels for additional information. Use of tank-mixes with glyphosate for bermudagrass or johnsongrass control in minimum tillage systems is not recommended. The higher rates are suggested for johnsongrass and bermudagrass control. The use of ammonium sulfate (AMS) is only recommended where hard water (Ca, Na, Mg, K) is a concern. Additional spray adjuvants are not required in loaded formulations. MOA = 9.
	paraquat (Gramoxone SL) 2.0 lb/gal (Firestorm/ Parazone) 3.0 lb/gal	30 – 60 oz 20 – 40 oz	0.47 - 0.94	Apply during or after planting, but before crop emerges to kill emerged annual grasses and weeds. Add a nonionic surfactant at 0.25% (1 qt. per 100 gal. spray) on a volume basis. Apply in a minimum of 15 GPA. Refer to label for specific cautions and restrictions. Numerous tank-mixes are allowed. Rain-free period = 30 minutes. MOA = 22.
	glufosinate (Liberty 280 SL) 2.34 lb/gal	29 – 36 oz	0.53 – 0.66	Apply during or after planting, but before crop emerges to kill emerged annual grasses and weeds. Liberty will not provide adequate burndown control of small grains. **Very effective for burndown control of volunteer peanuts.** Can be tank-mixed with glyphosate or 2,4-D. Rain-free period = 4 hours. MOA = 10.
	carfentrazone (Aim) 2EC	0.5 - 1.0 oz	0.008 - 0.016	Tank-mix with glyphosate or glufosinate for the improved control of large morningglories. Can be applied up to 24 hours after soybean planting. Rain-free period = 6-8 hours. MOA = 14.
	pyraflufen (ET) 0.208EC	0.5 - 2.0 oz	0.0008 - 0.003	Tank-mix with glyphosate or glufosinate for the improved control of large morningglories. Soybeans can be planted immediately. Rain-free period = 1 hour. MOA = 14.
	thifensulfuron + tribenuron (FirstShot SG) 50SG	0.5 – 0.8 oz	0.008 – 0.013+ 0.008 – 0.013	Can be tank-mixed with glyphosate, paraquat, glufosinate, and 2,4-D ester. **Soybean can be planted in 7-14 days after treatment depending upon soil type.** Use a NIS (0.25% v/v) or COC (1% v/v). MOA = 2 + 2.
	2,4-D (various trade names) 3.8 lb/gal	16 oz	0.475	Very effective for cutleaf eveningprimrose control. Can be tank-mixed with glyphosate, glufosinate, or paraquat to provide broad-spectrum burndown control. **Soybeans can be planted in 7 (ester) or 15 days (amine) after application depending upon the formulation used.** MOA = 4.
	dicamba (Clarity, Sterling, Vision, others) 4 lb/gal	4 – 16 oz	0.125 – 0.50	Can be tank-mixed with glyphosate, paraquat, or glufosinate to improve the control of broadleaf weeds such as horseweed. Soybeans can be planted in **14 days** (≤ 8 oz/A) or **28 days** (> 8 oz/A) if 1" of rainfall or irrigation has occurred since application Rain-free period = 4 hours. MOA = 4.

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE: AMOUNT OF FORMULATION	BROADCAST RATE/ACRE: POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
PREPLANT INCORPORATED	pendimethalin (Prowl/Pendimax) 3.3 lb/gal	1.2 – 2.4 pt	0.5 – 1.0	For annual grasses and small seeded broadleaf weed control Soil incorporate 2" deep within 7 days of application. Mechanical incorporation is not required if rain of 0.5" or more occurs within 7 days of application. MOA = 3
	Prowl H_20 3.8ASC	1.5 – 2.1 pt	0.71 – 1.0	
	trifluralin (Treflan, others) 4 lb/gal 60DF	1-2 pt 0.88 – 1.67 lb	0.5 – 1.0	For annual grasses and small-seeded broadleaf weed control. Soil incorporate 2-3 inches deep within 24 hours of application. Treflan should be applied within 4 weeks of planting. Rates should be adjusted for soil type. Refer to specific herbicide label for use information. MOA = 3.
	metribuzin (Metri, Metribuzin, Tricor) 75DF	5.3 – 8.0 oz	0.25 – 0.38	Incorporation should be shallow (1-2") to prevent placement of herbicide in soybean seed zone. **Do not use on sands! Do not use on loamy sands or sandy loams if OM is <1%.** Use the low rate on coarse soils. Do not apply to sensitive soybean varieties. Refer to soybean seed label for information on sensitivity to metribuzin. Do not apply with soil applied organic phosphate pesticides such as Dasanit, Di-Syston, Thimet, Mocap, Lorsban, or Nemacur, as soybean injury may occur regardlesss of soybean variety. Can be tank-mixed with Treflan or Prowl for broader spectrum weed control. A split treatment of 1/2-2/3 the normal rate of Metribuzin incorporated followed by the remaining 1/2-1/3 rate after planting may be used. This split treatment may lessen the injury potential compared to a full rate incorporated and may increase consistency of control over that of a preemergence treatment. Do not use increased rates when splitting the application. **Refer to the end of this section for an up-to-date list of soybean varieties that have exhibited acceptable tolerance to metribuzin in UGA tests.** MOA = 5.
	metribuzin + chlorimuron (Canopy, Cloak) 75DG	6 – 10 oz	0.24 - 0.40 + 0.04 - 0.07	Canopy may be soil incorporated or applied preemergence for control of several broadleaf weeds. **The rate of application varies with soil type.** Not recommended for use on sands and any other coarse soil types with <1% OM.. Incorporation should be 1 to 2 inches deep. Canopy may be tank-mixed with a dinitroaniline herbicide for broader spectrum weed control. Follow label directions for the use rates. Refer to Remarks and Precautions discussion of metribuzin for sensitive soybean varieties and potential herbicide-insecticide interactions. Soybean injury expressed as stunting has been observed. **Refer to the end of this section for an up-to-date list of soybean varieties that have exhibited acceptable tolerance to metribuzin in UGA tests.** Canopy use rates for soils with 0.5-3% organic matter are as follows: loamy sand, sandy loam = 6 oz/A; loam, silt loam, silt, sandy clay loam = 8 oz/A; silty clay loam, clay loam, clay = 10 oz/A. Rotation restrictions: soybeans = 0 months; barley, wheat, rye = 4 months; field corn 9-10 months; cotton, tobacco, sorghum = 10 months; peanuts = 8 months; canola, onions = 18 months. MOA = 5 + 2.

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE: AMOUNT OF FORMULATION	BROADCAST RATE/ACRE: POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
PREPLANT INCORPORATED (cont.)	metribuzin + S-metolachlor (Boundary) 6.5 lb/gal	1.2 - 2.1 pt	0.19 - 0.33 + 0.94 - 1.64	Incorporate uniformly within top 2" of soil . Not recommended for use on sands or any other coarse soil types with < 1.0% OM. Follow rate restrictions for soil type, pH, varieties, etc. listed under remarks and precautions for metribuzin. Can be tank-mixed with Python, Scepter, Canopy, Canopy XL, Command, and Prowl. **Refer to the end of this section for an up-to-date list of soybean varieties that have exhibited acceptable tolerance to metribuzin in UGA tests.** Rotation restrictions: soybeans = 0 months; barley, wheat = 4 months; corn, cotton = 8 months; canola, peanut, sorghum, tobacco, tomato = 12 months; onions = 18 months. MOA = 5 + 15.
	imazethapyr (Pursuit) 2 lb/gal 70DG	0.25 pt 1.44 oz	0.063	Controls several annual broadleaf weeds and suppresses nutsedge. May be tank-mixed with Prowl or trifluralin for improved annual grass control. Incorporate to a depth of 1 to 2 inches. Pursuit should only be applied one time per year to soybeans. Do not apply Classic, Canopy, Scepter, Scepter O.T., or use Pursuit either preemergence or postemergence on fields previously treated with Pursuit. Refer to the label for rotation restrictions. MOA = 2.
	imazethapyr + pendimethalin (Pursuit Plus) 2.9 lb/gal	2.5 pt	0.063 + 0.8	Incorporate 1 to 2 inches deep within 7 days of application. Do not plant cotton within 18 months of application. Refer to label for other rotation restrictions. Do not apply Classic, Canopy, Scepter, Scepter O. T., or Pursuit to fields previously treated with Pursuit Plus. Do not graze or feed treated soybean forage or hay to livestock. MOA = 2 + 3.
	flumetsulam (Python) 80WDG	0.9 - 1.0 oz	0.045 - 0.05	Controls a wide range of broadleaf weeds. Incorporate 2 to 3 inches deep. Tank-mix with herbicides such as Treflan or Prowl for the control of annual grasses. Crop rotational restrictions are: corn - 0 months; small grains - 4 months; tobacco - 9 months; cotton - 18 months; onions, canola - 26 months. MOA = 2.
	S-metolachlor + fomesafen (Prefix) 5.29EC	2 pt	1.09 + 0.24	Useful for the control of both glyphosate and ALS-resistant Palmer amaranth. Can also be applied PRE. Incorporate uniformly into top 2" of soil within 7 days of application. Can also be tank-mixed with burndown herbicides such as 2,4-D, paraquat, or glyphosate for use in reduced tillage systems. **Crop rotation restrictions are as follows: soybean, dry bean, snap bean = 0 months; cotton = 1 month; barley, wheat, oat, rye = 4.5 months; field corn, peanut, pea, rice, sorghum = 10 months; alfalfa, sunflower, other crops = 18 months.** MOA = 15 + 14.

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE: AMOUNT OF FORMULATION	BROADCAST RATE/ACRE: POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
PREPLANT INCORPORATED (cont.)	sulfentrazone + metribuzin (Authority MTZ 45DG)	12-14 oz	0.135 - 0.156 + 0.20 – 0.24	General broadleaf weed control with minimal control of annual grasses. Follow same precautions as for other metribuzin herbicides discussed above. Do not use on sands or any other coarse soils with less than 1% OM. Do not use on soils with a soil pH > 7.5. Do not incorporate deeper than 2". **Refer to the end of this section for an up-to-date list of soybean varieties that have exhibited acceptable tolerance to metribuzin in UGA tests.** Rotational crop restrictions: barley, wheat = 4 months; cotton = 12 months ***Some UGA research suggests that the cotton rotation restriction should be 18 months**. peanut = 12 months; field corn = 4 months; sorghum, tobacco = 12 months. MOA = 14 + 5. Sulfentrazone is also available in other premixes: **Authority Assist** (sulfentrazone + imazethapyr); **Authority XL** (sulfentrazone + chlorimuron); **Spartan Advance** (sulfentrazone + glyphosate); and **Spartan Charge** (sulfentrazone + carfentrazone).
	sulfentrazone + chlorimuron (Authority XL) 70DG	3-6 oz	0.117-0.233 + 0.015-0.029	**Do not use on soils classified as sands.** Provides residual control of several broadleaf weed species including pigweed, morningglory, and prickly sida. **Do not incorporate deeper than 2".** Can be tank-mixed with Prowl or Treflan to improve the control of annual grasses. Crop rotation restrictions (soil pH <6.8): canola = 36 months; cotton = 12 months*; soybeans = anytime; small grains = 4 months; sorghum = 10 months; tobacco = 10 months; field corn = 10 months; peanuts = anytime. ***Some UGA research suggests that the cotton rotation restriction should be 18 months.*** MOA = 14 + 2.
	ethalfluralin (Sonalan HFP) 3EC	1.5 - 2.0 pt	0.56 - 0.75	Uniformly incorporate into top 2-3" of soil within 48 hours of application. Do not plant soybeans deeper than 2". Can also be applied PRE after planting and incorporated with 0.5-1" of rainfall or irrigation within 48 hours after application. MOA = 3.
PREEMERGENCE	linuron (Lorox) 50DF (Linex) 4L	1.0 - 2.0 lb 1.0 - 2.0 pt	0.50 - 1.0	Provides good control of Florida beggarweed, common ragweed, and pigweed. Do not use on sands or loamy sands and/or soils with less than 1% OM. Sicklepod will not be controlled effectively with Lorox or Linex. Linuron may be tank-mixed with Lasso, Dual, or Prowl. Plant soybeans at least 1.5 inches deep to reduce injury. MOA = 7.
	alachlor (Intrro/Micro-Tech) 4 lb/gal	2.0 - 2.75 qt	2.0 - 2.75	Apply these herbicides to the soil surface prior to soybean emergence. Prowl application just prior to soybean emergence may result in slight soybean growth suppression, stand reduction, or breaking of the plants. Do not apply Prowl after the soybeans crack the soil surface since severe injury may occur. Tank-mixes of Dual, Intrro/Micro-Tech, or Prowl with metribuzin or linuron may improve control of certain annual weeds. Refer to manufacturer's label for specific rates.
	pendimethalin (Prowl/Pendimax) 3.3EC	1.2 - 2.4 pt	0.50 - 1.0	
	Prowl H_20 3.8ACS	1.5 - 2.0 pt	0.71 - .95	
	metolachlor (Stalwart, Parallel PCS, Me-Too-Lachlor	1.0 - 1.33 pt	1.0 - 1.33	*The generic formulations of metolachlor **(Parallel PCS, Stalwart, Me-Too-Lachlor)** have not provided the same length of residual control of certain weeds as similar rates of Dual Magnum formulations in some UGA field trials.
	S-metolachlor (Dual Magnum 7.62E)	1.0-1.33 pt	0.95 - 1.27	

		BROADCAST RATE/ACRE		
STAGE OF APPLICATION	HERBICIDE FORMULATION	AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
PREEMERGENCE (cont.)	clomazone (Command) 3ME 3.0 lb/gal	2.67 - 3.33 pt	1.0 - 1.25	Controls annual grasses and certain annual broadleaf weeds. Particularly effective for velvetleaf control. The spectrum of weed control is increased when Metribuzin is tank-mixed. Care should be taken to minimize spray drift when applying Command. See label for specific directions. Do not rotate to small grains or alfalfa within 12 months of application. Do not apply by air or within 1,200 feet of towns and housing developments, commercial fruit, nut or vegetable production areas, or commercial greenhouse or nurseries. Especially weak on carpetweed and pigweed. MOA = 13.
	imazethapyr (Pursuit) 2.0 lb/gal 70DG	0.25 pt 1.44 oz	0.063	Controls several annual broadleaf weeds and suppresses nutsedge. May be tank-mixed with Prowl, Lasso or Dual. Pursuit should be applied only one time per year to soybeans. Do not apply Classic, Canopy, Scepter, Scepter O. T., or use Pursuit either preplant incorporated or postemergence, on fields previously treated with Pursuit. Refer to label for rotation restrictions. MOA = 2.
	flumioxazin (Valor) 51WG	2 – 3 oz	0.064 - 0.096	Provides good to excellent control of many annual broadleaf weeds. Valor will **not** control grass weeds, nutsedges, cocklebur, and sicklepod. Apply as a preemergence treatment only. **Do not apply to emerging soybeans.** Should be tank-mixed with Command or Prowl/Pendimax. **Do not use Valor in the same field with Axiom, Domain, Intrro/ Micro-Tech, Dual, or Frontier/Outlook or severe injury can occur.** Valor can also be tank-mixed with glyphosate for use as a preplant burndown in reduced tillage production systems. Refer to label for specific rotation restrictions. MOA = 14.
	flumioxazin + chlorimuron (Valor XLT) 40.3WDG	3 - 4 oz	0.056 - 0.075 + 0.019 - 0.026	Will provided better cocklebur, yellow nutsedge, and sicklepod control than Valor. Plant soybeans at least 1.5" deep and make sure soybean seed is completely covered by soil. Do not apply later than 3 days after planting. Do not tank-mix with Axiom, Dual, Outlook, or Intrro. Can be tank-mixed with Command, Metribuzin, Lorox, or Prowl. Crop rotations: wheat, barley, ryegrass = 4 months; field corn = 10 months; cotton = 10 months; peanuts = 18 months; soybeans = 0 months, tobacco (transplant) = 10 months; sorghum = 10 months. MOA = 14 + 2.

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE: AMOUNT OF FORMULATION	BROADCAST RATE/ACRE: POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
PREEMERGENCE (cont.)	dimethenamid (Outlook/Propel) 6.0 lb/gal	10 - 18 oz	0.46 - 0.84	Use rates vary according the cation exchange capacity (CEC) of the soil. If CEC is not known, select the use rate based on soil texture and organic matter. Controls many annual grasses, pigweeds, and spotted spurge. Outlook may be tank-mixed with Canopy, Metribuzin, Lorox, Pursuit or Scepter. Fall-seeded small grains may be planted 4 months after an application of Outlook. Can also be applied PPI. MOA = 15.
	imazethapyr + pendimethalin (Pursuit Plus) 2.9 lb/gal	2.5 pt	0.063 + 0.8	Apply to soil surface prior to soybean emergence. Refer to label for rotation restrictions. Do not apply Classic, Canopy, Scepter, Scepter O. T. or Pursuit to fields previously treated with Pursuit Plus. Do not graze or feed treated soybean forage to livestock. MOA = 2 + 3.
	flumetsulam (Python) 80WDG	0.9 - 1.0 oz	0.045 - 0.05	Controls a wide range of broadleaf weeds. Tank-mix with preemergence herbicides such as Lasso, Dual, Prowl, etc. for the control of annual grasses. DO NOT apply to emerged soybeans (cracking stage or later). Crop rotational restrictions are: small grains - 4 months; tobacco - 9 months; cotton - 18 months; canola - 26 months. MOA = 2.
	metribuzin (Metri, Metribuzin, Tricor) 75DF	5.3 - 8.0 oz	0.25 - 0.38	If rainfall or irrigation occurs within 3 to 5 days after application, control will be as good as obtained with PPI treatments. **Do not use on sands or any other soil coarse types with <1% OM.** Use the low rate on coarse soils. Do not apply to sensitive soybean varieties. Refer to soybean seed label for information on variety sensitivity to metribuzin. Do not apply metribuzin with soil-applied organic phosphate pesticides such as Dasanit, Di-Syston, Mocap, Nemacur, or Thimet as soybean injury may occur irrespective of soybean variety. A split treatment of 1/2 - 2/3 the normal use rate of Sencor incorporated followed by the remaining 1/2 - 1/3 rate after planting may be used. This split treatment may lessen the injury potential compared to a full rate incorporated and may increase consistency of control over that of a preemergence treatment. Do not use increased rates when splitting the application. **Refer to the end of this section for an up-to-date list of soybean varieties that have exhibited acceptable tolerance to metribuzin in UGA tests.** MOA = 5.

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE: AMOUNT OF FORMULATION	BROADCAST RATE/ACRE: POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
PREEMERGENCE (cont.)	metribuzin + chlorimuron (Canopy, Cloak) 75DG	6 - 10 oz	0.24 - 0.40 + 0.04 - 0.07	Canopy may be applied preemergence for control of broadleaf weeds. **The rate of application varies with soil type.** Do not use on sands or any other coarse soil type with <1% OM. Do not exceed 6 ozs/A of 75 WDG on sand or loamy sand Coastal Plain soils. Canopy should not be applied preemergence if previously applied preplant incorporated. Canopy should not be used if Scepter has been applied preplant incorporated or preemergence. If 1 inch of rainfall is not received after application, a rotary hoeing or shallow cultivation should be made after emergence of the crop while weeds are small enough to be controlled by mechanical means. Canopy may be applied preemergence as a tank-mix with either Intrro, Dual or Prowl or following the use of a preplant incorporated grass material such as Treflan. Refer to Remarks and Precautions for Prowl when applying Prowl preemergence and refer to Remarks and Precautions for metribuzin for sensitive soybean varieties and potential herbicide-insecticide interactions. Soybean injury expressed as stunting has been observed. There are specific rotational crop restrictions based on soil pH that may be found on the Canopy label. Do not apply Canopy to soils having a pH greater than 7.5. Refer to DuPont's specific recommendations on sprayer cleanout following use of Canopy. **Refer to the end of this section for an up-to-date list of soybean varieties that have exhibited acceptable tolerance to metribuzin in UGA tests.** MOA = 5 + 2.
	metribuzin + S-metolachlor (Boundary) 6.5 lb/gal	1.2 - 2.1 pts	0.19 - 0.33 + 0.94 - 1.64	Not recommended for use on sands and any other coarse soil types with < 1.0% OM. Follow rate restrictions for soil type, pH, varieties, etc. listed under remarks and precautions for metribuzin. Can be tank-mixed with Python, Scepter, Canopy, Canopy XL, Command, and Prowl. **Refer to the end of this section for an up-to-date list of soybean varieties that have exhibited acceptable tolerance to metribuzin in UGA tests.** MOA = 5 + 15.
	fomesafen (Reflex) 2L	1 pt	0.25	For the residual control of yellow nutsedge, bristly starbur, and various pigweed species. Can also be used in minimum-till situations and tank-mixed with a burndown herbicide. **When tank-mixing with paraquat, use the following mixing order: 1) Reflex; 2) NIS or COC; and 3) paraquat.** MOA = 14.
	S-metolachlor + fomesafen (Prefix) 5.29EC	2 pt	1.09 + 0.24	Refer to comments in PPI section. MOA = 15 + 14.
	flumioxazin + chlorimuron + thifensulfuron (Envive 41.3DG)	2.5 - 4 oz	0.046-0.073 + 0.014 -0.023+ 0.0045-0.007	A three-way mixture of Valor + Classic + Harmony GT. Do not use in combination with Axiom, Micro-Tech. Intrro, Dual, Outlook. Can be tank-mixed with Prowl or Command to improve grass control. Do not use on soil types with less than 0.5% organic matter. Use low rate on coarse soils. Do not irrigate when soybeans are cracking. Crop injury may occur on poorly drained soils under cool, wet conditions. Excessive rainfall following soybean emergence may also result in temporary crop injury. Cool, cloudy, wet weather may also cause soybean stunting. Rotation restrictions: soybeans = anytime; small grains = 4 months; peanut = 6 months; field corn = 10 months; cotton = 10 months; sorghum = 10 months. MOA = 14 + 2 + 2.

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE: AMOUNT OF FORMULATION	BROADCAST RATE/ACRE: POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
PREEMERGENCE (cont.)	sulfentrazone + metribuzin (Authority MTZ 45DG)	12 - 14 oz	0.135 - 0.156 + 0.20 – 0.24	Refer to comments in PPI section. MOA = 14 + 5. Sulfentrazone is also available in other formulations such as **Authority Assist** (sulfentrazone + imazethapyr), **Authority XL** (sulfentrazone + chlorimuron), **Spartan Advance** (sulfentrazone + glyphosate) or **Spartan Charge** (sulfentrazone + carfentrazone).
	sulfentrazone + chlorimuron (Authority XL) 70DG	3-6 oz	0.117-0.233 + 0.015-0.029	**Do not use on soils classified as sands.** Can be applied at planting or within 3 days after planting but before soybean emergence. **Do not apply if soil is cracking or soybeans have emerged.** Provides residual control of several broadleaf weed species including pigweed, morningglory, and prickly sida. Can be tank-mixed with Prowl to improve the control of annual grasses. Can be tank-mixed with glyphosate, paraquat, or Ignite for use in reduced tillage systems. Crop rotation restrictions (soil pH <6.8): canola = 36 months; cotton = 12 months*; soybeans = anytime; small grains = 4 months; sorghum = 10 months; tobacco = 10 months; field corn = 10 months; peanuts = anytime. ***Some UGA research suggests that the cotton rotation restriction should be 18 months.*** MOA = 14 + 2.
	acetochlor (Warrant) 3ME	1.5 qt/A	1.125	Will provide control of certain annual grasses and small-seeded broadleaf weeds including Palmer amaranth. May be applied preplant, at-planting, or preemergence. Mechanical incorporation is not recommended. If PRE and POST applications of Warrant are made, do not exceed 4 qt/A/season of Warrant. Warrant is also labeled for center-pivot applications. For the following soil types, do not apply Warrant within 50 feet of any well where the depth to groundwater is 30 feet or less: sands <3% OM; loamy sands < 2% OM; sandy loams <1% OM. These restrictions do not apply for areas more than 50 feet from a well or if groundwater is more than 30 feet below land surface. MOA = 15.
	s-metolachlor+ metribuzin + fomesafen (Intimidator) 4.81EC	1.9 - 2.4 pt	0.81 - 1.02 + 0.18 - 0.23 + 0.16 - 0.20	Apply PRE for the control of certain annual broadleaf and grass weeds, including Palmer amaranth. Can also be applied PPI. Plant soybeans at least 1.5" deep. **Only for use on metribuzin-tolerant soybean varieties. Refer to the end of this section for an up-to-date list of soybean varieties that have exhibited acceptable tolerance to metribuzin in UGA field tests. Do not use on sand, sandy loam, or loamy sand soils with < 1.1% OM.** Crop rotation restrictions: cotton = 12 months; field corn = 10 months; sorghum = 12 month; soybeans = anytime; peanut = 18 months; wheat = 4.5 months. MOA = 15 + 5 + 14
POSTEMERGENCE	Application of postemergence herbicide treatments to moisture stressed weeds will usually result in poor control.			
	bentazon (Basagran, Depend, Leader) 4 lb/gal	1.5 - 2 pt	0.75 - 1.0	Apply to soybeans at the second or third trifoliate (V2 or V3) leaf stage, but before weeds exceed 2-4 inches in height (14 to 21 days after planting). A non-phytotoxic oil concentrate (1 qt/A) should be added depending on the weed species as specified on the label. Basagran can be tank-mixed with Blazer. **Rain-free period is 4 hours.** Soybeans are tolerant of Basagran at all stages of growth. MOA = 6.
	acifluorfen (Ultra Blazer) 2 lb/gal	1.5 pt	0.38	Blazer requires a nonionic surfactant (1 qt/100 gals.) to be added to the spray tank when used alone and when tank-mixed with Basagran. Apply to soybeans at the second or third trifoliate (V2 or V3) leaf-stage, but before weeds have more than 4 to 6 true leaves (14-21 days after planting). Control of larger weeds may be poor. Ultra Blazer can be tank-mixed with Classic, Scepter, or Basagran. **Rain-free period is 4 hours.** Apply at least 50 days before harvest. MOA = 14.

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE: AMOUNT OF FORMULATION	BROADCAST RATE/ACRE: POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
POSTEMERGENCE (cont.)	lactofen (Cobra) 2 lb/gal	12.5 fl. oz	0.20	Apply to soybeans in the first or second trifoliate leaf stage if weeds are in the 2 to 6 leaf stage. Add a crop oil concentrate @ 0.25% to 1.0% v/v depending upon humidity (refer to label). With aerial applications, the use of 1.0 qt/A of crop oil concentrate is required. Do not apply Cobra when crop or weeds are under stress of drought. Crop injury expressed as leaf burn and/or suppression may occur. This injury is usually temporary but may cause lasting effects to late planted (after July 1) soybeans especially if the application is followed by a period of drought stress. Cobra can be tank-mixed with Basagran and Classic. **Rain-free period is 30 minutes.** Do not apply Cobra later than 45 days before harvest or after growth stage R6 (full seed). MOA = 14.
	fomesafen (Reflex/Dawn /TopGun) 2 lb/gal	1.5 pt	0.38	Apply Reflex when weeds are small and not stressed from dry weather. Application should be made when weeds have 1 to 4 true leaves (14 to 21 days after planting). Add a nonionic surfactant (0.25 % v/v) or crop oil concentrate (1.0% v/v) to the spray mixture. Can be tank-mixed with glufosinate or certain formulations of glyphosate. However, avoid tank-mixing Reflex with potassium salt formulations of glyphosate (Credit Extreme, Roundup Original MAX, Roundup WeatherMAX, Roundup PowerMAX, Touchdown HiTech, Touchdown Total, Touchdown CT2, Traxion). **Rain-free period is 1 hour.** Do not apply within 45 days of harvest. Rotational crop restrictions: cotton, soybean = 0 months; small grains = 4 months; field corn, peanuts = 10 months; tobacco, sorghum = 10 months. MOA = 14.
	imazethapyr (Pursuit) 2 lb/gal 70 DG	4 oz 1.44 oz	0.063	Pursuit may be applied anytime after soybean emergence but before weeds exceed 3 inches. Add 0.25% of a nonionic surfactant (2 pts/100 gals. of spray mixture). After application wait at least 10 days before cultivation. Do not apply Pursuit if Canopy, Scepter or Pursuit was used as a preplant incorporated or preemergence treatment. Refer to the label for rotational restrictions. **Rain-free period is 1hour.** MOA = 2.
	bentazon + acifluorfen (Storm) 4 lb/gal	1.5 pt	0.5 + 0.25	Apply to soybeans at the first or second trifoliate leaf but before weeds exceed the 4 true-leaf stage. A crop oil concentrate or surfactant should be used at the rate of 1-2 pts/A. Any crop injury should be temporary. **Rain-free period is 4 hours.** Do not apply Storm within 50 days of harvest. MOA = 6 + 14.
	cloransulam (FirstRate, Amplify) 84WDG	0.3 oz	0.016	Controls a wide range of annual broadleaf weeds (except prickly and arrowleaf sida, common lamsbsquarters, black nightshade, and pigweeds). May be applied from soybean emergence up to 50% flowering. Add either 0.25% v/v nonionic surfactant or 1.2% v/v crop oil concentrate to the spray mix. May be tank-mixed with Blazer, Basagran, Cobra, Reflex, Pursuit, glyphosate, or postemergence grass herbicides. Two applications of 0.3 oz/A can be made. Rotational crop restrictions: soybean = 0 months; wheat = 3 months; field corn, cotton, peanut, sorghum, oats = 9 months. **Rain-free period is 2 hours.** MOA = 2.

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE AMOUNT OF FORMULATION	BROADCAST RATE/ACRE POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
POSTEMERGENCE (cont.)	cloransulam (84%) + flumetsulam (80%) (FrontRow)	0.3 oz + 0.12 oz	0.016 + 0.006	FrontRow is a co-packed product of FirstRate and Python. Controls a wide range of broadleaf weeds, but not annual grasses. Add either a nonionic surfactant at 0.25% v/v or crop oil concentrate at 1.2% v/v to the spray mix. Front Row may be tank-mixed with Basagran, Blazer, Cobra, Reflex, Pursuit, Roundup Ultra/UltraMax or various postemergence grass herbicides. Rotational crop restrictions are: small grains - 3 months; cotton, peanuts, corn - 9 months; tobacco and canola - 30 months. **Rain-free period is 2 hours.** FrontRow can be applied from 1st trifoliate stage up until 50% flowering. MOA = 2 + 2
	chlorimuron (Classic) 25DF	0.5 - 0.66 oz	0.008 - 0.01	Apply over-the-top after soybeans have their first trifoliate leaf. The addition of a nonionic surfactant at 0.25% by volume is required. Crop oil concentrate may be substituted for nonionic surfactant, but may increase soybean injury. Control of sicklepod is consistently better if chlorimuron is used following a preplant incorporated or preemergence treatment of Metribuzin. Do not apply when soybeans or weeds are under temperature or drought stress. Refer to rotational crop restrictions shown on the label. Refer to label for information on sprayer cleanout procedures following use. Classic can be tank-mixed with glyphosate for improved control of morninglories and other broadleaf weeds in **Roundup Ready soybeans only.** When tank-mixed with glyphosate, apply Classic at 0.25-0.33 oz/A. **Rain-free period is 1 hour.** Do not apply Classic within 60 days of harvest. MOA = 2.
	thifensulfuron (Harmony GT XP) 75DF (Harmony SG) 50SG	1/12 oz 1/8 oz	0.004	**Salvage** treatment for the control of Palmer amaranth (pigweed) that is **NOT** ALS-resistant. Can be applied any time after the first trifoliate leaf has expanded but no later than 60 days before harvest. Use in combination with NIS (0.25% v/v) or COC (1% v/v) and nitrogen (32-0-0/28-0-0 @ 1 qt/A or AMS @ 3 lb/A) Can be tank-mixed with glyphosate for use in RR soybeans. Rotational crop restrictions: wheat, barley, oats, triticale, soybeans, field corn = anytime; all other crops = 45 days. **Rain-free period =3 hours.** . Do not tank-mix with Classic. **Harmony GT will cause soybean injury in the form of leaf and terminal burn. DO NOT USE HARMONY EXTRA ON SOYBEANS!** MOA = 2 *Higher rates of Harmony GT XP (0.33 oz/A) or Harmony SG (0.50 oz/A) can be used on **STS®** soybean varieties. A list of STS soybean varieties is provided at the end of this section.
	flumiclorac (Resource) 0.86 EC	4 oz	0.027	**Tank-mix with glyphosate for improved control of tall, ivyleaf, and entireleaf morningglory in Roundup Ready soybeans only.** Must be applied with a NIS (0.25% v/v) or COC (1 pt/A) and spray grade ammonium sulfate (2.5 lbs/A). **Rain-free period is 2 hours.** Do not apply Resource within 60 days of harvest. MOA = 14.

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE: AMOUNT OF FORMULATION	BROADCAST RATE/ACRE: POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
POSTEMERGENCE (cont.)	glyphosate (various trade names) 3.00 lb ae/gal 3.73 lb ae/gal 4.00 lb ae/gal 4.17 lb ae/gal 4.50 lb ae/gal 5.00 lb ae/gal	 24 - 64 oz 19 - 52 oz 18 - 48 oz 17 - 46 oz 16 - 43 oz 14 - 38 oz	0.56 - 1.50 ae	**Apply glyphosate over-the-top of improved soybean varieties that are designated as soybeans with the Roundup Ready™ gene.** Severe injury or death of soybeans will result if any soybean varieties not designated as having the Roundup Ready™ gene are sprayed with glyphosate. Controls a wide range of grass and broadleaf weeds. May be applied from the cracking stage through the full-flowering stage of soybeans. Use the low rate on weeds up to 3 inches tall. Higher rates are needed as weeds increase in size. For morninglories, applications should be made when morninglories are less than 3 inches tall. Sequential treatments may be applied provided that the maximum postemergence (from cracking thru flowering) total use rate does not exceed 2.25 lb ae/A. (ex. 2.25 lb ae/A = 2 qt/A of Roundup PowerMax or 3 qt/A of Glyfos). There are no crop rotational restrictions for glyphosate. Not all formulations are labeled for use on RR soybeans. Refer to specific product label. The use of ammonium sulfate (AMS) is only recommended where hard water (Ca, Na, Mg, K) is a concern. Additional spray adjuvants are not required in loaded formulations. MOA = 9.
	imazethapyr + glyphosate (Extreme) 2.17 lb/gal	 3 pt	0.063 + 0.75	**Appy Extreme only to Roundup Ready soybeans.** Add a nonionic surfactant at a rate of 1 pt/100 gallons and spray grade ammonium sulfate (2.5 lb/A) or liquid N (1-2 qts/A). Apply before weeds exceed 8". Applications should be made before bloom. Only 1 application/year is permitted. **Cotton rotation is 18 months.** Refer to label for additional rotation intervals. Also sold as **Tackle 4.128SL** (Tackle use rate = 2 pt/A = 0.032 lb ai/A imazethapyr + 1.0 lb ai/A of glyphosate). Very effective for the control of tropical spiderwort if applied early. **Rain-free period** = 1 hour. MOA = 2 + 9.
	S-metolachlor + glyphosate (Sequence) 5.25 lb/gal	 3.0 - 3.5 pt	1.13 -1.31 + 0.84 - 0.98	**Apply Sequence only to Roundup Ready soybeans.** Most effective when applied from cracking up through the 3rd trifoliate leaf stage. Applications can be applied no later than 90 days before harvest. Very effective for the control of tropical spiderwort if applied early. MOA = 15 + 9.
	quizalofop (Assure II, Targa) 0.88 lb/gal	 7.0 - 8.0 oz	0.05 - 0.06	Apply to annual grasses at recommended stage of growth. A crop oil concentrate (1% v/v) or nonionic surfactant (0.25% v/v) should be used. Many tank-mixes will reduce the activity of Assure. **Rain-free period is 1 hour.** MOA = 1
	quizalofop (Assure II, Targa) 0.88 lb/gal	 5.0 ozs	0.03	Apply with crop oil concentrate or nonionic surfactant for control of rhizome johnsongrass when 10 to 24 inches tall. Apply an additional 5 ozs/A when johnsongrass re-growth is 6-10 inches tall. **Do not apply in a tank-mix with a broadleaf herbicide when using this reduced rate program.** Do not apply more than 18 ozs/A/year. MOA = 1.

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
POSTEMERGENCE (cont.)	sethoxydim (Poast) 1.5 lb/gal	1.0 -1.5 pt	0.19 - 0.28	Apply with a crop oil concentrate (1 qt/A) over the top of annual grasses and crop. Refer to label for suggested stage of application. Many tank-mixes will reduce the activity of Poast. Apply with a crop oil concentrate for control of rhizome johnsongrass when 15-20 inches tall. If regrowth occurs or new plants emerge, a second application of 1.5 pts/A. may be used at the 6-10 inch stage. Do not apply more than 7.5 pts/A/year. **Rain-free period is 1hour.** MOA = 1.
	(Poast Plus) 1.0 lb/gal	1.5 - 2.25 pt		
	fluazifop - P (Fusilade DX) 2.0 lb/gal	12 oz	0.19	Apply with a crop oil concentrate (0.5-1.0% v/v) or nonionic surfactant (0.25-0.5% on a volume basis) over the top of annual grasses and crop prior to soybean bloom stage. Refer to label for suggested stage of application and specific rates. Many tank-mixes will reduce the activity of Fusilade. Apply to johnsongrass before the boot stage of growth at 8-18 inches in height. If regrowth occurs or new plants emerge, apply a second application of 8 fl. ozs. when the johnsongrass is 6-12 inches tall. Do not apply more than 32 ozs/A/year. **Rain-free period is 1 hour.** MOA = 1
	clethodim (Select, Arrow, others) 2EC	6 - 8 oz	0.09 -0.125	Apply to annual grasses at recommended stage of growth. A crop oil concentrate at 1.0% v/v should be added to the spray mix (Select/Arrow). A NIS (0.25% v/v) can be used with Select Max to reduce crop injury. Do not graze or feed treated soybean forage or hay to livestock. Higher rates and split applications may be needed for optimum perennial grass control (rhizome johnsongrass and bermudagrass). Do not exceed 32 oz/A/year for Select or 64 oz/acre/year for Select Max. / TapOut. **Rain-free period is 1 hour.** MOA = 1.
	(Select Max / TapOut, others) 0.97EC	12 -16 oz		
	S-metolachlor + fomesafen (Prefix) 5.29EC	2 - 2.33 pts	1.095 - 1.26 + 0.24 - 0.28	Can be applied from cracking through the third trifoliate leaf stage of soybean. Can be tank-mixed with glyphosate for use on RR soybeans. Use a NIS @ 0.25% v/v (1 qt/100 gallons) when applying alone or in combination with glyphosate products that do not contain a built-in adjuvant. Do not exceed 3.0 pt/A of Prefix per acre per season. Do not use Prefix postemergence if a soil-applied application of S-metolachlor containing products was used. **Rain-free period is 1 hour.** MOA = 15 + 14.
	pyraflufen (ET) 0.208EC	0.5 - 0.75 oz	0.0008-0.0016	Can be applied over-the-top of soybeans up to V6 stage of growth. Can be tank-mixed with glyphosate for use in RR soybeans to improve the control of annual morningglories and certain other broadleaf weeds **less than 4" tall.** Additions of ET to glyphosate will increase soybean leaf burn but this symptom is usually temporary. **Rain-free period = 1 hour. Do not use a COC adjuvant.** MOA = 14.
	fluthiacet-methyl (Cadet) 0.91L	0.4-0.6 oz	0.0028-0.0042	Tank-mix with glyphosate (RR soybeans) or glufosinate (LL soybeans) to improve the control of annual morningglory and pigweed. Additions of Cadet to glyphosate or glufosinate will increase soybean leaf injury. Soybean leaf injury will also be increased if applied to wet crop foliage (dew, rain, irrigation). Cadet can be applied from soybean emergence until full flowering. PHI = 60 days. **Rain-Free period = 4 hours**. MOA = 14.
	fomesafen+ glyphosate (Flexstar GT 3.5) 2.82SL	3.5 - 5.3	0.25 – 0.37 + 0.99 - 1.50	**Only for use on RR soybean varieties.** Do not apply within 45 days of soybean harvest. Use in combination with a NIS (0.25% v/v) or COC (1% v/v). Rotational crop restrictions: cotton, soybean = 0 months; small grains = 4 months; field corn, peanuts = 10 months; tobacco, sorghum = 10 months. MOA = 14 + 9.

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE: AMOUNT OF FORMULATION	BROADCAST RATE/ACRE: POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
POSTEMERGENCE (cont.)	Glufosinate (Liberty 280) 2.34SL	22 – 36 oz	0.19 - 0.28	**Only for use on Liberty-Link® soybean varieties.** The use of Liberty on other varieties will result in severe injury or crop death. Liberty can be applied from soybean emergence (VE) up to but not including the bloom stage of growth (R1). Up to 2 applications of Liberty can be applied per season. Do not apply more than 36 oz/A in a single application. Do not apply more than 65 oz/A/year on soybeans. If Liberty is used in a burndown prior to planting, only 1 in-crop application @ 22-29 oz/A can be used. Optimum time of application for Liberty is between 9:00 am – 6:00 pm. Avoid tank-mixes with grass herbicides such as Assure, Fusilade, Poast, and Select. If desired, a residual herbicide such as Dual Magnum or Reflex can be tank-mixed with Liberty. However, tank-mixes with residual herbicides will increase crop injury. **Liberty should be applied in a minimum of 15 GPA using flat fan nozzle tips or other nozzles tips that produce medium size spray droplets (300-400 microns). Rain-free period is 4 hours.** MOA = 10. ** Do not rely exclusively on Liberty. The use of a soil residual herbicide at planting and/or postemergence is mandatory for optimum weed control in the Liberty-Link soybean system and to help delay the development of herbicide resistance.*
	acetochlor (Warrant) 3ME	1.5 qt	1.125	Tank-mix with glyphosate for use in RR soybean systems. Apply over-the-top from emergence until the R2 stage of growth. Warrant will help provide residual control of tropical spiderwort, crabgrass, and Palmer amaranth. Warrant does not control emerged weeds. If a PRE application of Warrant was made, do not exceed 4 qt/A/season of Warrant. For the following soil types, do not apply Warrant within 50 feet of any well where the depth to groundwater is 30 feet or less: sands <3% OM; loamy sands < 2% OM; sandy loams <1% OM. These restrictions do not apply for areas more than 50 feet from a well or if groundwater is more than 30 feet below land surface. MOA = 15.
POSTEMERGENCE DIRECTED	metribuzin (Metribuzin, Tricor) 75DF	5.3 - 10.7 oz.	0.25 - 0.50	Do not apply until soybeans have reached the following minimum heights: Herbicide — Minimum Soybean Height Prior to Directed Spraying metribuzin — 8-12” metribuzin + 2,4-DB — 8-12” paraquat — 8” 2,4-DB — 8”
	paraquat (Gramoxone SL) 2.0 lb/gal	16 - 32 oz.	0.25 - 0.50	
	(Firestorm/ Parazone) 3.0 lb/gal	5.3 fl. oz.	0.124	Rates should be adjusted to band width. At the early growth stages, do not spray unless the soybean stand is uniform in height as slow emerging soybeans will be killed. Crop oil concentrate or nonionic surfactant should also be added to spray. If weeds exceed 4 inches in height, the tank-mix of 2,4-DB with metribuzin will improve weed control. When using paraquat adjust equipment to spray no higher than 3” of the soybean plant. Paraquat can also be applied in a hooded or shielded sprayer.
	2,4-DB (Butyrac 200) 2L (Butyrac 175) 1.75L (Butoxone) 1.75L	0.7 - 0.9 pt 0.8 - 1.0 pt 1.0 pt	0.18 - 0.22 0.18 - 0.22 0.22	
	carfentrazone (Aim 2EC)	0.5 - 1.5 oz	0.008 - 0.025	For the control of tropical spiderwort, annual morningglory, and pigweed. Apply as post-directed treatment with spray directed toward base of plant and avoid contact with soybean foliage. Use a NIS at 0.25% v/v (1 qt/100 gal). Do not feed treated soybean forage or hay to livestock.

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE AMOUNT OF FORMULATION	POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
ROPE WICK	glyphosate (various trade names)	1 gal/2 gal of water		Use in wiper applicators at a ratio of 1 gallon of glyphosate to 2 gallons of water (33% solution). For best results: 1. Mount equipment on front of tractor. 2. Maintain wick saturation. 3. Operate equipment at 2-3 mph, slower on dense weed clumps. 4. Avoid wiping weeds when wet or drought stressed. 5. Make a second application in the opposite direction. Not all formulations of glyphosate may be labeled for this use. Refer to specific product label. MOA = 9.
POSTEMERGENCE SHIELDED OR HOODED SPRAYERS	glyphosate (various trade names) 3.00 lb ae/gal 3.73 lb ae/gal 4.00 lb ae/gal 4.17 lb ae/gal 4.50 lb ae/gal 5.00 lb ae/gal	 16 - 48 oz 13 - 39 oz 12 - 36 oz 11.7 - 35 oz 11 - 32 oz 10 - 29 oz	0.38 - 1.13 ae	Do not apply until soybeans have reached the Effective "chemical cultivation" treatment for emerged weeds in row middles. Hood or shield height must be adjusted so that glyphosate does not contact soybean green stems or foliage. Apply in a spray volume of 3 to 10 GPA. Not all formulations of glyphosate are labeled for this use. Refer to specific product label. MOA = 9.
	paraquat (Gramoxone SL) 2.0 lb/gal	16 - 32 oz.	0.25 - 0.50	Do not apply until soybeans have reached the following minimum height of 8". Rates should be adjusted to band width. At the early growth stages, do not spray unless the soybean stand is uniform in height as slow emerging soybeans will be killed. Crop oil concentrate or nonionic surfactant should also be added to spray. If weeds exceed 4 inches in height, the tank-mix of 2,4-DB with metribuzin will improve weed control. When using paraquat adjust equipment to spray no higher than 3" of the soybean plant.
HARVEST AID	glyphosate (various trade names) 3.00 lb ae/gal 3.73 lb ae/gal 4.00 lb ae/gal 4.17 lb ae/gal 4.50 lb ae/gal 5.00 lb ae/gal	 32 - 64 oz 26 - 52 oz 24 - 48 oz 23 - 46 oz 21 - 42 oz 19 - 38 oz	0.75 - 1.5 ae	Apply after soybean pods have lost all green color. Application is usually timed 14 to 21 days before harvest. May be aerially applied. This treatment is not recommended for conventional soybeans grown for seed purposes. Not all formulations of glyphosate are labeled for this use. Refer to specific product label. MOA = 9.
	sodium chlorate 3 lb/gal 5 lb/gal 6 lb/gal 7.5lb/gal	 2 gal 1.2 gal 1 gal 0.8 gal	6.0	Apply 7 to 10 days prior to normal anticipated harvest of soybeans to desiccate soybeans and weeds. Apply in a minimum spray volume of 20 GPA for ground applications and 5 GPA for aerial applications. Do not feed treated foliage or graze treated fields. Apply on warm, sunny day with high temperatures and humidity. Do not apply if rainfall is expected within 24 hours. More effective on grass weeds than broadleaf weeds. Dessication of morningglory and other vines may be erratic. MOA = NC.

STAGE OF APPLICATION	HERBICIDE FORMULATION	BROADCAST RATE/ACRE: AMOUNT OF FORMULATION	BROADCAST RATE/ACRE: POUNDS ACTIVE INGREDIENT	REMARKS AND PRECAUTIONS
HARVEST AID (cont.)	paraquat (Gramoxone Inteon / Gramoxone SL) 2.0 lb/gal	16.0 oz	0.25	**Indeterminate Varieties:** Apply when at least 65% of the seed pods have reached a mature brown color or when seed moisture is 30% or less. **Determinant Varieties:** Apply when soybeans are fully mature (full pod development, 50% leaf drop, and the remaining leaves are yellow). Mature cocklebur and drought stressed weeds are not adequately controlled by this treatment. Do not apply to immature soybeans. Add a nonionic surfactant at 0.25% v/v. May be ground or aerially applied. PHI = 15 days. MOA = 22.
	(Firestorm/ Parazone) 3.0 lb/gal	10.7 oz		
	carfentrazone (Aim 2EC)	1.5 oz	0.023	For the pre-harvest dessication of pigweeds and annual morningglories (*Ipomoea* species). Apply at least 3 days before harvest. Can be applied by ground or air. Use with a crop oil concentrate @ 1% v/v . Can be tank-mixed with glyphosate to improve the spectrum of control. MOA = 14.
CENTER PIVOT IRRIGATION APPLICATION	alachlor (Micro-Tech/ Intrro) 4 lb/gal	3 qts.	3.0	Herbicides should be applied only through center pivot systems that water uniformly. Apply in 1/4-1/2 inch of irrigation water/A. Equipment must have appropriate check valves or other suitable devices in the system to insure that the herbicide solution cannot siphon back into water supply.
	metolachlor (Stalwart, Parallel PCS, Me-Too-Lachlor)	1.0 pts	1.0	
	S-metolachlor (Dual Magnum 7.62EC)	1.0 pts	0.97	

SOYBEAN WEED RESPONSE TO HERBICIDES

Eric P. Prostko, Extension Agronomist – Weed Science

	Prowl Pendimax	Scepter	Treflan	Squadron	Sonalan	Metribuzin	Pursuit	Canopy	Authority MTZ	Authority XL
	PREPLANT INCORPORATED									
PERENNIAL WEEDS										
bermudagrass	P	P	P	P	P	P	P	P	P	P
johnsongrass (rhizome)	P	P	P	P	P	P	P	P	P	P
yellow nutsedge	P	F-G	P	F-G	P	P	F-G	F	F-G	G
purple nutsedge	P	P-F	P	P-F	P	P	G	P	F-G	G
ANNUAL GRASSES										
broadleaf signalgrass	G	P-F	G	G	G	P-F	P		P	P
crabgrass	E	F	E	E	E	G	P	G	P	F
crowfootgrass	E		E	G		G	P	G		
fall panicum	E	P	E	G	E	P	P		P	F
goosegrass	E	F	E	G	E	G	P	G	P	
johnsongrass (seedling)	E	F	E	E	E	P	P	P	P	F
sandbur	E		E	G		P	P			
Texas panicum	G-E	F	G-E	G-E	G-E	P	P			F
BROADLEAF WEEDS										
bristly starbur	P	F	P	F	P	G	F	G		G
burcucumber	P	F-G	P	F-G	P	P	P	F		
citronmelon	P	P	P	P	P	F	P-F			
cocklebur	P	G	P	G	P	F	F-G	G-E	P-F	G
coffee senna	P	F	P	F	P	G	F-G	G		E
common ragweed	P	G	P	G	P	G	P	G	F	P-F
copperleaf	P	P	P	P	P	G-E		G-E		
cowpea	P	P	P	P	P	F	P	F		
crotalaria	P		P		P	G		F		
Florida beggarweed	P	P-F	P	P	P	E	P	E		E
Florida pusley	E	E	E	E	E	E	E	E		E
hemp sesbania	P	P	P	P	P	G-E	P	G-E	P	F-G
Horseweed						G		G	G	
ALS-resistant						G		F	G	
Glyphosate-resistant						G		G	G	
jimsonweed	P	G	P	G	P	G	G	G	F	F-G
lambsquarters	G-E	G	G-E	G-E	E	G-E	F	G-E	G-E	G-E
morningglories										
cypressvine	P	F	P	F	P	F-G	G	F-G		E
entireleaf	P	F	P	G	P	P-F	G	G	G-E	E
ivyleaf	P	F	P	G	P	P-F	G	G	G-E	E
pitted	P	G	P	G	P	F-G	G	G	G-E	F-G
red	P	F	P	G	P	F	G			
smallflower	P	G	P	G	P	G	E	G		E
tall	P	F	P	G	P	P-F	G	F-G		E
Pennsylvania smartweed	P	G	P	G	P	G		G	G-E	E
pigweeds	G	E	G	E	G-E	G-E	E	E	G-E	E
ALS-resistant	G	P	G	G	G	G-E	P	G-E	G-E	E
Glyphosate-resistant	G	E	G	E	G	G-E	E	E	G-E	E
prickly sida	P	F	P	F-G	P	G-E	G-E	G-E	G	F-G
purslane	E		E	E	E	G-E		E		G-E
redweed	P	P-F	P	F	P					F
sicklepod	P	F-G	P	F	P	F-G	P	G		P
tropic croton	P		P	P	P	G	P	G		E
tropical spiderwort	P					G	F-G	G	F	G
velvetleaf	P	P-F	P	P-F	P	G-E	G	G	P	
wild poinsettia	P	G	P	G	P	G	E	G	F	P-F

Key to response symbols: E=Excellent; G=Good; F=Fair; P=Poor. If no symbol is given, weed response is unknown.

SOYBEAN WEED RESPONSE TO HERBICIDES (continued)

	Python	Prowl Pendimax	Squadron	Dual Magnum[1]	Command	Intrro	Pursuit	Linex Lorox	Metribuzin
	PPI/PRE	PREEMERGENCE							
PERENNIAL WEEDS									
bermudagrass	P	P	P	P	P	P	P	P	P
johnsongrass (rhizome)	P	P	P	P	P	P	P	P	P
yellow nutsedge	P	P	F-G	F-G	P	F	F-G	P	P
purple nutsedge	P	P	P-F	P	P	P	G	P	P
ANNUAL GRASSES									
broadleaf signalgrass		G	G	F-G	E	F-G	P		P
crabgrass	P	G-E	G-E	E	E	E	P	G	G
crowfootgrass	P	G-E	G-E	G	G	E	P	G	G
fall panicum	P	G	G	G	G	G	P	G	P
goosegrass	P	G	G	E	G	E	P	G	G
johnsongrass (seedling)	P	G	G		F		P		P
sandbur	P	G	G	G	F	G	P	G	
Texas panicum	P	G	G	P	F-G	P	P		P
BROADLEAF WEEDS									
bristly starbur	E	P	F	P		F	F	F	G
burcucumber	P	P	P-F	P	P	P	P	P	P
citronmelon		P	P	P	P	P			F
cocklebur	E	P	G	P	P	P	F-G	P	F
coffee senna	F	P	F	P	F	P-F	P		G
common ragweed	G	P	G	P	F-G	P	P	G	G
copperleaf	F	P	P	P		P	P	P	G-E
cowpea	P	P	P	P	P	P	P	P	F
crotalaria		P							F
Florida beggarweed	F-G	P	P	P-F	F-G	F	P	G	E
Florida pusley	G	G	E	G	F-G	G	E	G	G
hemp sesbania		P	P	P		P	P		G-E
horseweed	G								G
ALS-resistant	P								G
Glyphosate-resistant	G								G
jimsonweed	P	P	G	P	F-G	P	G		G
lambsquarters	E	G	E	F	G-E	F	P-F	G-E	G
morningglories									
cypressvine	F-G	P	F				G		F-G
entireleaf	F-G	P	G	P	P	P	G	G	P-F
ivyleaf	F-G	P	G	P	P	P	G	G	P-F
pitted	F-G	P	E	P	P	P	G	G	F-G
purple	P	P	P-F	P	P	P	P		P
red	F-G	P	G	P	P		G		F
smallflower	G-E	P	G	P-F	G	P-F	E	G	G
tall	F-G	P	G	P	P	P	G	G	P-F
Pennsylvania smartweed		P	G	P	G	P			G
pigweeds	E	G	E	G-E	P-F	G-E	E	G	G-E
ALS-resistant	P	G	G	G--E	P-F	G-E	P	G	G-E
Glyphosate-resistant	E	G	E	G-E	P-F	G-E	E	G	G-E
prickly sida	E	P	G	F	G	G	G-E		G
purslane		E	E	G	G	G		G	G-E
redweed	G	P	F						
sicklepod	F-G	P	F	P	P	P-F	P	P	F-G
tropic croton		P	P	P	G	P	P		G
tropical spiderwort		P		G	F		F-G		F-G
velvetleaf	E	P	P-F	P	E	P	G		G
wild poinsettia	G	P	G	P	P	P	G-E		G

Key to response symbols: E=Excellent; G=Good; F=Fair; P=Poor. If no symbol is shown, weed response is unknown.

[1]The generic formulations of metolachlor **(Parallel PCS, Stalwart, Me-Too-Lachlor)** have not provided the same length of residual control of certain weeds as similar rates of Dual Magnum formulations in some UGA field trials.

SOYBEAN WEED RESPONSE TO HERBICIDES (continued)

	Scepter	Valor	Valor XLT Envive	Reflex	Prefix	Warrant	Assure II	Poast	Fusilade DX	Ultra Blazer	Basagran
	PREEMERGENCE						POSTEMERGENCE				
PERENNIAL WEEDS											
bermudagrass	P	P	P			P	G-E	F	G-E	P	P
johnsongrass (rhizome)	P	P	P			P	E	G	E	P	P
yellow nutsedge	F-G	P	F-G	G-E	G-E	P	P	P	P	P	G*
purple nutsedge	P-F	P	P-F			P	P	P	P	P	P
ANNUAL GRASSES											
broadleaf signalgrass	P-F	P	P	F-G	F-G	F-G	G	E	E	P	P
crabgrass	F	P	P	F-G	E	E	F-G	G	F	P	P
crowfootgrass		P	P		G	E	G	F-G	F	P	P
fall panicum	P-F	P	P		G	G	G	G	G	P	P
goosegrass	P-F	P	P		E	E	F-G	F-G	F-G	P	P
johnsongrass (seedling)	P	P	P			P	E	G-E	G-E	P	P
sandbur		P	P		G	F-G		G	G	P	P
Texas panicum	F	P	P	F	F	P-F	F-G	E	G-E	P	P
BROADLEAF WEEDS											
bristly starbur	F	F	F-G	G		P	P	P	F-G	F	E
burcucumber	P-F	P	P-F				P	P	P	F	P
citronmelon		G	G			P	P	P	P	G-E	P
cocklebur	E	P	F-G	G	G	P	P	P	P	G	E
coffee senna	F	P-F	F-G	P	P		P	P	P	P-F	G
common ragweed	G	G-E	G-E	G	G		P	P	P	E	G
copperleaf	P	G-E	G-E				P	P	P	G-E	P
cowpea	P	P	P			P	P	P	P	F	P
crotalaria		G	G			P	P	P	P	E	P
Florida beggarweed	P	G-E	G-E	P	P-F	F	P	P	P	P-F	P
Florida pusley	G-E	G-E	G-E	P	G	G-E	P	P	P	E	P
hemp sesbania		G	G-E	P	P		P	P	P	E	P
horseweed		G	G				P	P	P		
ALS-resistant		G	G				P	P	P		
Glyphosate-resistant		G	G			P	P	P	P		
jimsonweed	E	G	G				P	P	P	E	E
lambsquarters	G-E	G-E	G-E			F-G	P	P	P	F	F
morninglories											
cypressvine	F-G	G	G	F	F	P	P	P	P	G-E	G-E
entireleaf	P	F-G	F-G	F	F		P	P	P	G	P
ivyleaf	P	F-G	F-G	F	F		P	P	P	G	P
pitted	G	F	F-G	F	F		P	P	P	G-E	F
purple	P			F	F		P	P	P	G-E	P
red	F	G	G	F	F		P	P	P	G-E	F-G
smallflower	G	G-E	G-E	G-E	G-E		P	P	P	G-E	G-E
tall	F	F-G	F-G	F	F		P	P	P	G	F
Pennsylvania smartweed		P-F	F				P	P	P	G	G-E
pigweeds	E	G-E	G-E	G-E	G-E	G-E	P	P	P	G-E	P-F
ALS-resistant	P	G-E	G-E	G-E	G-E	G-E	P	P	P	G-E	P-F
Glyphosate-resistant	E	G-E	G-E	G-E	G-E	G-E	P	P	P	G-E	P-F
prickly sida	G-E	G-E	G-E				P	P	P	P	G
purslane		G-E	G-E	G	G		P	P	P	E	G
redweed		G-E	G-E				P	P	P		G-E
sicklepod	F	P	F				P	P	P	P-F	P
tropic croton	P	G	G	F-G	F-G		P	P	P	E	P
tropical spiderwort		P-F	F	P	G-E	G-E	P	P	P	P	G
velevetleaf	P-F	G-E	G-E				P	P	P	F	G-E
wild poinsettia	G	F-G	F-G	G-E	G-E		P	P	P	G	P

Key to response symbols: E=Excellent (>90%); G=Good (80-89%); F=Fair (70-79%); P=Poor (<70%). If no symbol is given, weed response is unknown.
*Assumes 2 applications.

SOYBEAN WEED RESPONSE TO HERBICIDES (continued)

	Storm	2,4-DB	Scepter	Classic	Reflex	Cobra	Select Arrow	Liberty	Glyphosate
	POSTEMERGENCE								
PERENNIAL WEEDS bermudagrass	P	P	P	P	P	P	G-E	P	P-F
johnsongrass (rhizome)	P	P	P	P	P	P	E	P-F	G-E
yellow nutsedge	P	P	P-F	G	F	P-F	P	P	F
purple nutsedge	P	P	P	P-F	P	P	P	P	F-G
ANNUAL GRASSES broadleaf signalgrass	P	P	P	P	P	P-F	E	G	E
crabgrass	P	P	P	P	P	P-F	G	F-G	E
crowfootgrass	P	P	P	P	P	P	G	G	E
fall panicum	P	P	P	P	P	P	G	G	E
goosegrass	P	P	P	P	P	P	F-G	P	E
johnsongrass (seedling)	P	P	F	P	P	P	E	G	E
sandbur	P	P	P	P	P	P-F	G		E
Texas panicum	P	P	P	P	P	P	G-E	G	E
BROADLEAF WEEDS bristly starbur	G			G		G	P	G-E	G
burcucumber	P-F	P	P	G	F	F	P		E
citronmelon	G	P				G	P	G	G
cocklebur	G-E	G-E	E	E	F-G	G-E	P	E	E
coffee senna	G	F	F	P	P	P-F	P		G
common ragweed	G-E	P	F-G	G	G-E	E	P	G	G
copperleaf	G	P	P	P	G-E	G-E	P		P-F
cowpea	P-F	P-F	P	G	F	P-F	P		F-G
crotalaria	E				G-E	E	P		G
Florida beggarweed	P	P	P	E	P	P-F	P	G-E	G
Florida pusley	E		F	F	G	F-G	P	P-F	P-F
hemp sesbania	E	P	P	E	G	E	P	G-E	F
horseweed ALS-resistant Glyphosate-resistant				F-G P F-G				G G G	F-G F-G P
jimsonweed	E	G	P	G-E	G	E	P	G	G
lambsquarters	G		F	P	P-F	P-F	P	E	G
morninglories cypressvine	G-E	F	F	P	G-E	G-E	P	G-E	F
entireleaf	F-G	G	P	F-G	F	F-G	P	G-E	F
ivyleaf	F-G	G	P	F-G	F	F-G	P	G-E	F
pitted	G	G	F	G	G	G	P	G-E	P-F
purple	G	G	P	P	G-E	F-G	P	G	P-F
red	G	G-E	F-G	G-E	G-E	G-E	P	G-E	F
smallflower	G-E	G	F	G-E	G	G-E	P	G-E	F
tall	G	G-E	P-F	P-F	G	G	P	G-E	F
Pennsylvania smartweed	G-E	P	F	G	G	G-E	P	G-E	G
pigweeds ALS-resistant Glyphosate-resistant	G-E G-E G-E	F F F	E P E	F P F	G-E G-E G-E	G-E G-E G-E	P P P	F-G F-G F-G	G-E G-E P
prickly sida	G	P	P	P	P	G	P	P-F	P-F
purslane	G	G				E	P	G	G
redweed	G-E			F		F	P		G
sicklepod	P	F	F	F-G	P	P-F	P	G	E
tropic croton	G-E	P		P		E	P	G	G
tropical spiderwort	F						P	P-F	F
velevetleaf	F-G	P	P	G-E	F	F	P	E	G
wild poinsettia	F-G	P	F	F	F-G	G-E	P		G

Key to response symbols: E=Excellent (>90%); G=Good (80-89%); F=Fair (70-79%); P=Poor (<70%). If no symbol is given, weed response is unknown.

SOYBEAN WEED RESPONSE TO HERBICIDES (continued)

	FirstRate Amplify	Front Row	Pursuit	Harmony GT XP or SG	2,4-DB	Paraquat	Metribuzin	Metribuzin + 2,4-DB
	POSTEMERGENCE				POST-DIRECTED			
PERENNIAL WEEDS								
bermudagrass	P	P	P	P	P	P	P	P
johnsongrass (rhizome)	P	P	P	P	P	P	P	P
yellow nutsedge	P-F	P	F-G	P	P	P-F		P-F
purple nutsedge	P-F	P	G	P	P	P-F		
ANNUAL GRASSES								
broadleaf signalgrass	P	P	G	P	P	G		G
crabgrass	P	P	F	P	P	F	E	G-E
crowfootgrass	P	P	F	P	P	G	E	G-E
fall panicum	P	P	F	P	P	G	G	G
goosegrass	P	P	F	P	P	G	E	G-E
johnsongrass (seedling)	P	P	F-G	P	P	G	G	G
sandbur	P	P		P	P	G	E	G
Texas panicum	P	P	P	P	P	G	F	F-G
BROADLEAF WEEDS								
bristly starbur	E	E	F		G	G	G	E
burcucumber	F		P	P-F	P	G		
citronmelon			P		F	F	G	G-E
cocklebur	E	E	G-E	F	E	G	E	E
coffee senna			F		F-G			G-E
common ragweed	E	E	P		G	G	G	E
copperleaf	P		P		P			G-E
cowpea	P	P	P		P-F	G		G
crotalaria			P			G	E	E
Florida beggarweed	F-G	F-G	P		P	G	E	E
Florida pusley	F	F	P			F-G	G	G
hemp sesbania	P	P-F	P		P	P		G
horseweed	G							
ALS-resistant	P							
Glyphosate-resistant	G							
jimsonweed	P	P	F	F	G	G	E	G
lambsquarters	P	F	P	G-E	G	F-G	E	E
morningglories								
cypressvine	G	G	G		F	F	E	E
entireleaf	G	G	G		G	F-G	F	E
ivyleaf	G	G	G		G	F-G	F	E
pitted	G	G	G		G	F-G	G-E	G-E
purple	P-F		P		G			G-E
red	G	G	G		G-E	F-G	G-E	E
smallflower	G	G	G		G	F-G	G-E	E
tall	G	G	G		G-E	F-G	F	G
Pennsylvania smartweed			F-G	G-E	P	P-F		F-G
pigweeds	P	F	E	G-E	F	F-G	G-E	G-E
ALS-resistant	P	P	P	P	F	F-G	G-E	G-E
Glyphosate-resistant	P	F	E	G-E	F	F-G	G-E	G-E
prickly sida	P	E	P		P	P-F	E	G-E
purslane					G	G	G	G
redweed			F		P			
sicklepod	F	F-G	P		G	G	E	G-E
tropic croton			P		P	G	G	G
tropical spiderwort						G-E		
velvetleaf	G		G		P			F
wild poinsettia	G	G	P-F		P	F-G	P-F	F

Key to response symbols: E=Excellent (>90%); G=Good (80-89%); F=Fair (70-79%); P=Poor (<70%). If no symbol is given, weed response is unknown.

WEED AND COVER CROP RESPONSE TO BURNDOWN HERBICIDES USED IN CONSERVATION TILLAGE SOYBEAN PRODUCTIONS SYSTEMS IN GEORGIA

Weed	Glyphosate	Glyphosate + 2,4-D	Glyphosate + Clarity	Glyphosate + Aim or ET	Glyphosate + FirstShot	Paraquat	Paraquat + 2,4-D	Paraquat + Metribuzin	Liberty
Carolina geranium	P	F-G	G	F-G	G-E	G-E	G-E	G-E	G-E
chickweed	E	E	E	E	E	E	E	G-E	G-E
corn spurry	G-E	G-E	G-E			F-G			
crimson clover	P-F	F	F-G	F		G	G-E	G	
cutleaf evening primrose	P-F	E	G	F	F	F	E	G	G-E (mature plant)
henbit	G	E	E	E	G-E	G	E	G	G-E
Horseweed	F-G	G-E	E	G	G-E	F	G	G	G-E
Glyphosate-resistant	P	F-G	E	P	P			G	
red sorrel	E	E	E			E	E	E	P-F
ryegrass**	G	G	G	G	G	P-F	P-F	P-F	P
small grains	E	E	E	E	E	F-G	F-G	F-G	P-F
swinecress	F-G	G	F-G	F-G	G	P-F	F-G		G-E
volunteer peanut	F	F	G	F	F	P	P-F	F	G-E
wild radish	F-G	G-E	G-E	G	G-E	F	G-E	F	G-E (mature plant)
Soybean plant-back restriction	**0 days**	**7-15 days**	**14-28 days 1" rainfall or irrigation**	**0 days**	**7-14 days**	**0 days**	**7-15 days**	**0 days**	**0 days**

PREPACKAGED TANK-MIXES FOR SOYBEANS

[See manufacturer's label for specific rates and application uses.]

Product Name	Active Ingredients (lbs ai/gal or % ai)	Product Name	Active Ingredients (lbs ai/gal or % ai)
Authority Assist	sulfentrazone (3.33) + imazethapyr (0.67)		
Authority MTZ	Sulfentrazone (18%) + metribuzin (27%)	Backdraft	imazaquin (0.25) + glyphosate (1.25)
Authority XL	sulfentrazone (62%) + chlorimuron (8%)		
Axiom	flufenacet (54.4%) + metribuzin (13.6%)	Authority First	sulfentrazone (62.1%) + chloransulam (7.9%)
Boundary	metribuzin (1.25) + S-metolachlor (5.25)	Broadstrike + Treflan	flumetsulam (0.25) + trifluralin (3.4)
Canopy	chlorimuron (10.7 %) + metribuzin (64.3 %)	Canopy EX	chlorimuron (22.7%) + tribenuron (6.8%)
Canopy XL	sulfentrazone (46.9%) + chlorimuron (9.4%)		
Commence	clomazone (2.25) + trifluralin (3.0)	Concert	chlorimuron (12.5%) + thifensulfuron (12.5%)
Detail	imazaquin (0.5) + dimethenamid (3.6)	Domain	flufenacet (24%) + metribuzin (36%)
Enlite	chlorimuron (2.85%) + flumioxazin (36.21%) + thifensulfuron (8.8%)	Envive	chlorimuron (9.2%) + flumioxazin (29.2%) + thifensulfuron (2.9%)
Extreme	imazethapyr (0.17) + glyphosate (2.0)	Flexstar GT 3.5	fomesafen (0.56) + glyphosate (2.26)
Freedom	alachlor (2.67) + trifluralin (0.33)		
Fusion	fluazifop (2.0) + fenoxaprop (0.56)	Galaxy	bentazon (3.0) + acifluorfen (0.67)
Gangster	flumioxazin (51%) + cloransulam (84%)	Gauntlet	sulfentrazone (75%) + cloransulam-methyl (84%)
Prefix	fomesafen (0.95) + S-metolachlor (4.34)	Passport	trifluralin (2.4) + imazethapyr (0.2)
Pursuit Plus	imazethapyr (0.2) + pendimethalin (2.7)	Reliance STS	thifensulfuron (9%) + chlorimuron (16%)
Sequence	glyphosate (2.25) + S-metolachlor (3.0)	Sonic	sulfentrazone (62.1%) + chloransulam (7.9%)
Spartan Advance	sulfentrazone (0.56) + glyphosate (4.04)	Spartan Charge	sulfentrazone (3.15) + carfentrazone (0.35)
Squadron	imazaquin (0.33) + pendimethalin (2.0)	Steel	pendimethalin (2.25) + imazethapyr (0.17) + imazaquin (0.17)
Stellar	lactofen (2.4) + flumiclorac (0.7)	Storm	bentazon (2.67) + acifluorfen (1.33)
Synchrony XP	chlorimuron (21.5%) + thifensulfuron (6.9%)	Tackle	imazethapyr (0.128) + glyphosate (4.0)
Typhoon	fluazifop (0.47) + fomesafen (0.94)	Valor XLT	flumioxazin (30%) + chlorimuron (10.3%)

SOYBEAN PRE-MIXTURES AND EQUIVALENT RATES

Pre-Mixture	Rate/A	Equivalent Rates/A
Authority MTZ 45DG	14 oz/A	Spartan 4L @ 5.04 oz Metribuzin 75DG @ 5.04 oz
Boundary 6.5EC	1.5 pt	Dual Magnum 7.62EC @ 16.5 oz Metribuzin75DF @ 4.9 oz
Canopy 75DG	6 oz	Metribuzin 75DG @ 5.1 oz Classic 25DG @ 2.6 oz
Envive 41.3DG	2.5 oz	Valor 51WG @ 1.44 oz Classic 25DG @ 0.90 oz Harmony 75DG @ 0.14 oz
Flexstar GT 3.5 2.82 SL	3.5 pt	Touchdown Total 4.17SL @ 30.4 oz Reflex 2SL @ 15.7 oz
Prefix 5.29SL	2.33 pt	Dual Magnum 7.62EC @ 21.2 oz Reflex 2SL @ 17.7 oz
Sequence 5.25SL	3 pt	Dual Magnum 7.62EC @ 18.9 oz Touchdown Total 4.17SL @ 25.9 oz
Valor XLT 40.3DG	4 oz	Valor 51WG @ 2.35 oz Classic 25DG @ 1.65 oz

RR CORN CONTROL IN RR SOYBEANS

Herbicide*	Corn Size (in)	Rate/A (ozs)
Arrow/Select	4-12 12-24	4-6 6-8
Assure II/Targa	1-12 12-18 18-30	1-12 12-18 18-30
Fusilade	12-24	6-8
Poast	1-12 12-20	12 16
Poast Plus	1-12 12-20	18 24
SelectMax / TapOut	4-12 12-18 18-24	8-12 10-14 12-16

*In RR soybean production systems, these grass herbicides can be tank-mixed with glyphosate.

HERBICIDE PROGRAMS FOR MANAGING VOLUNTEER RR COTTON IN RR SOYBEANS[1]

Preemergence	Postemergence[2]
Canopy / Cloak 75DG (6-8 oz/A[3]) or Metribuzin, 75DF (5.3-8 oz/A[3])	glyphosate + Resource (4 oz/A), or 2,4-DB (2 oz/A), or Reflex (12 oz/A), or Classic (0.33 oz/A)

[1]A combination of preemergence and postemergence herbicides is needed to provide optimum control.
[2]Postemergence applications should be made when cotton is 6" or less.
[3]Rate depends upon soil type. Refer to label.

SUGGESTIONS FOR HORSEWEED (MARESTAIL) CONTROL IN SOYBEANS

Time of Application	Treatment	Comments
Preplant Burndown	Liberty 280 2.34SL @ 29-36 oz/A	Use at least 15 GPA and flat fan nozzle tips or other nozzle tips that produce medium size spray droplets (300-400 microns). Apply between 9:00 am and 6:00 pm. Temperatures less than 75^{0}F will reduce control. Labeled for 6-12" horseweed plants.
	Roundup PowerMax 5.5 SL@ 22-43 oz/A + Clarity 4SL @ 8 oz/A	Soybeans can be planted in 14 days if 1" of rainfall or irrigation has occurred since application.
	Roundup PowerMax 5.5SL@ 22-43 oz/A + 2,4-D amine 3.8SL @ 1.5-2.0 pt/A	Soybeans can be planted 30 days after application.
	Gramoxone Inteon / Gramoxone SL 2SL @ 48 oz/A + Metribuzin/Tricor 75DF @ 4 oz/A + NIS @ 0.25% v/v	Apply to 6" or smaller horseweed plants. Use at least 15 GPA and flat fan nozzle tips. Plant a metribuzin-tolerant soybean variety.
Residual Control	Valor SX 51WG @ 2-2.5 oz/A	Excellent residual control but no postemergence activity
	Python 80WG @ 1 oz/A	Will not control ALS-resistant populations.
Postemergence (in-crop)	Firstrate 84DG @ 0.3 oz/A + NIS @ 0.25% v/v	Apply to horseweed plants that are 6" tall or less. Can also be tank-mixed with glyphosate in RR soybeans. Will not control ALS-resistant populations.
	Liberty 2.34 SL @ 22-29 oz/A	**For use in LL soybeans only.** Apply in at least 15 GPA with flat fan nozzle tips or other nozzle tips that produce medium size spray droplets (300-400 microns). Apply between 9:00 am and 6:00 pm for optimum activity. Labeled for use on 6-12" tall horseweed plants.

HERBICIDE PROGRAMS FOR MANAGING GLYPHOSATE/ALS-RESISTANT PALMER AMARANTH AND DELAYING PPO/VLCFA RESISTANCE IN SOYBEANS. [1]

Soybean Variety	Program	Preemergence[2]	Postemergence[3,4]
Roundup Ready	1	TriCor/Metribuzin; or Canopy/Cloak[5] ;or Authority MTZ[7,13]; or Authority XL [7,14]	glyphosate + Reflex[7]; or glyphosate + Prefix[7,8] ; or glyphosate + Warrant[15]; or glyphosate + Dual Magnum[15]; or Sequence[9]; or Flexstar GT[7,10]
	2	Boundary[6]	glyphosate + Reflex[7]; or Flexstar GT[7,10]
	3	Prowl; or Dual Magnum[15]; or Intrro[15]; or Warrant[1]	glyphosate + Reflex[7]; or Flexstar GT[7],
	4	Reflex; or Valor; or Envive[7,11]; or Valor XLT[7,12]	glyphosate + Warrant[15]; or glyphosate + Dual Magnum[15]; or Sequence[9]
Liberty-Link	1	Prowl; or Dual Magnum[15] ; or Intrro15; or Warrant[15]	Liberty + Reflex[7]
	2	Reflex; or Valor ; or Envive[7,11]; or Valor XLT[7,12]	Liberty + Dual Magnum[15] or Warrant[15]
Conventional	1	TriCor/Metribuzin; or Canopy/Cloak[5]; or Authority MTZ[7,13]; or Authority XL[14] + Prowl	Reflex[7]; or Ultra Blazer[7]+ Dual Magnum[15] or Warrant[15]; or Cobra[7] + Dual Magnum[15] or Warrant[15]; or Prefix[7,8]
	2	Boundary[6]	Reflex[7]
	3	Prowl; or Dual Magnum[15]; or Intrro[15]; or Warrant[15]	Reflex[7]

[1]Glyphosate- and ALS-resistant Palmer amaranth are very serious concerns. An aggressive management program is necessary to slow spread of resistant biotypes and to reduce selection pressure in areas currently not infested with resistant biotypes.

[2]Generic brands of Prowl (pendimethalin) are available and perform similarly. When using Authority MTZ, Boundary, TriCor/Metribuzin or Canopy, follow label for appropriate rates, soil pH restrictions, and soybean variety tolerance. Dryland growers should consider mechanically incorporating Authority MTZ, Metribuzin, Canopy, Boundary, and Prowl. If mechanically incorporating herbicides, Treflan can be used instead of Prowl if preferred.

[3]***Postemergence applications MUST be made before the largest Palmer amaranth plant in the field exceeds 2-3" in height. If a preemergence herbicide is used but not moisture activated, this could occur as early as 10-14 days after planting depending upon the time of year. Palmer amaranth plants can grow from 1-3" per day.*** When applied in combination with glyphosate, use either 16-24 oz/A of Reflex, 24 oz/A of Ultra Blazer, or 12.5 oz/A of Cobra.

[4]If residual herbicides are activated by a timely rainfall or irrigation event, a second postemergence application may not be needed. The total amounts of these herbicides that can be applied per acre per year are as follows: Cobra - 25 oz/A; Reflex – 24 oz/A; and Ultra Blazer – 32 oz/A. Reflex may be preferred because of residual control of Palmer amaranth. On Roundup Ready soybean, glyphosate can be included in the second application if needed for the control of other weeds.

[5]Canopy/Cloak is a pre-mixture of metribuzin + chlorimuron (Classic).

[6]Boundary is a pre-mixture of metribuzin and S-metolachlor (Dual Magnum).

[7]Authority MTZ, Authority XL, Cobra, Envive, Flexstar GT, Prefix, Reflex, Ultra Blazer, Valor, Valor XLT have the same mode of action (PPO inhibitor). More than 1 application of these herbicides in a single season should be avoided if at all possible to prevent/delay the development of PPO resistance.

[8]Prefix is a pre-mixture or fomesafen (Reflex) and S-metolachlor (Dual Magnum).

[9]Sequence is a pre-mixture of glyphosate and S-metolachlor (Dual Magnum). **Sequence will not control emerged glyphosate resistant pigweed.**

[10]Flexstar GT is a pre-mixture of fomesafen (Reflex) and glyphosate (Touchdown).

[11]Envive is a pre-mixture of chlorimuron (Classic), flumioxazin (Valor) and thifensulfuron (Harmony).

[12]Valor XLT is a pre-mixture of flumioxazin (Valor) and chlorimuron (Classic).

[13]Authority MTZ is a pre-mixture of sulfentrazone (Spartan) and metribuzin.

[14]Authority XL is a pre-mixture of sulfentrazone (Spartan) and chlorimuron (Classic).

[15]Dual Magnum, Intrro, and Warrant are members of the same herbicide family (chloroacetamide) and have the same mode of action (inhibit very long chain fatty acids). Multiple applications of these herbicides in a single year should be avoided to prevent or delay the evolution of resistance. These herbicides have no postemergence activity.

SOYBEAN VARIETY TOLERANCE TO METRIBUZIN HERBICIDES

Soybean varieties that have exhibited acceptable tolerance to metribuzin herbicides (Boundary, Canopy, TriCor) in UGA tests conducted in 2008-2012 include the following:

Group IV: Asgrow 4903 RR/STS, Southern States RT4808

Group V: Asgrow 5905RR, AGS 568RR, Delta Pineland DP5634, Pioneer 95Y20, Pioneer 95Y40, Pioneer 95Y50, Pioneer 95Y70, Southern States RT5951NRR, Southern States RT5960NRR, Pioneer 95Y61, Pioneer 95Y71, Pioneer 95Y80

Group VI: Asgrow 6301RR, Delta Pineland DP6568, Pioneer 96M60, Southern States RT 6451NRR, Vigoro V61N9

Group VII: AGS 758RR, Asgrow 7501RR, Asgrow H7242, Benning, Northrup King NKS 76L9, Northrup King NKS 78G6, Pioneer 97M50, Southern States RT7270NRR, USG 7732nRR, Vigoro V74N9, Woodruff

Group VIII: Northrup King NKS 80P2, Prichard RR

**** Soybean varieties not included in this list have not been adequately evaluated.***

*****Rates tested in these studies include the following: Boundary 6.5EC @ 24 oz/A; Canopy 75DG @ 6 oz/A; Metribuzin 75DG @ 5.3 oz/A.***

***** Metribuzin herbicides are NOT recommended for use on sands or other coarse soils with less than 1% OM.***

******METRIBUZIN HERBICIDE SHOULD NOT BE USED ON THE FOLLOWING SOYBEAN VARIETIES: Southern States LL511N and LL595N; AG6730; AG6130***

2013 STS SOYBEAN VARIETIES

SOUTHERN STATES
1) RT 4470N-STS
2) SS 4700 RS-STS
3) RT 4808N-STS
4) RT 4996N-STS
5) RT 5160N-STS
6) SS 5200-STS (CONVENTIONAL)
7) RT 5471N-STS

PIONEER
1) 95Y70 RR/STS
2) 95M50 RR/STS

ASGROW
1) AG 4031 GENRR2T/STS
2) AG 4232 GENRR2Y/STS
3) AG 4404 RR/STS
4) AG 4531 GENRR2Y/STS
5) AG 4605 RR/STS
6) AG 4730 GENRR2Y/STS
7) AG 4831 GENRR2Y/STS
8) AG 5405 RR/STS
9) AG 5605 RR/STS
10) AG 5632 GENRR2Y/STS

DELTAPINE
1) DP 4888 RR/STS
2) DP 5335 RR/STS

NORTHRUP KING
1) NK S44-D5 RR/STS
2) NK S41-M5 RR/STS
3) NK S54-T5 RR/STS
4) NK S54-V4 RR/STS

DEKALB
1) DK 4866 RR/STS

POSTEMERGENCE HERBICIDE FOR SOYBEANS LABELED TIMES OF APPLICATION AND PRE-HARVEST INTERVALS (PHI)

Herbicide	Soybean Stage of Growth		PHI (DAYS)
	Earliest	Latest	
Assure II	NL[1]	R3	80
Basagran	ANYTIME	ANYTIME	NL
Cadet	VE	R2	60
Classic	V1	NL	60
Cobra	VC-UF	R6	45
Dual Magnum	VE	V3	90
ET	VE	V6	70
FirstRate	V1	R2 (50%)	65
Flexstar GT 3.5	NL	NL	45
Fusilade DX	NL	NL	60
Glyphosate	VE	R2	14
Liberty	VE	R1 (before)	70
Poast	NL	NL	75
Prefix	VE	V3	90
Pursuit	VE	R1 (before)	85
Reflex	NL	NL	45
Resource	NL	NL	60
Select Max	NL	NL	60
Storm	NL	NL	50
Ultra Blazer	NL	NL	50
Warrant	VE	R2	NL

[1]NL = none specifically listed on the label. However, UGA weed scientists would suggest that the earliest applications be made at the V1 stage.

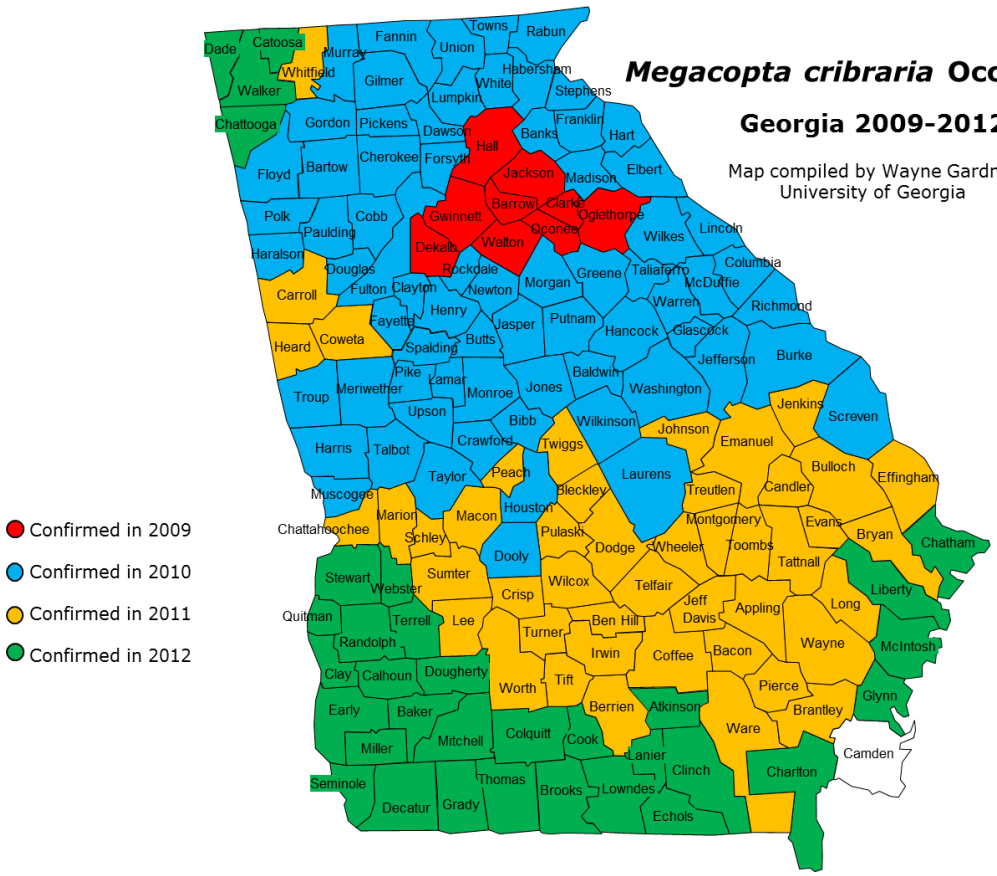
INSECT MANAGEMENT

(Phillip Roberts, Mike Toews, and David Buntin)

A number of insect pests are capable of severely damaging soybeans. However, it is important to realize that soybeans can withstand considerable insect damage at certain times without economic yield losses. In Georgia, it is possible to produce a crop of soybeans without having to use any insecticides. In some years, however, several insecticide applications may be necessary to protect the crop. Because of this situation, soybeans are ideally suited to an insect pest management program. This program consists of two phases: (1) planning to prevent damage from insects and (2) periodic monitoring or scouting of the insect pest situation in each field so that control decisions can be made based on the kinds and numbers of insects found.

Kudzu Bug, *Megacopta cribraria*, A New Invasive Pest of Soybeans in Georgia:

The "Kudzu Bug", *Megacopta cribraria*, is an exotic pest that was first detected in the US during the fall of 2009 in nine northeast Georgia counties. Kudzu bugs have now been detected all Georgia counties with the exception of Camden. Observations during previous years suggest that economic damage to soybeans in a county is possible the season following initial detection. Thus all soybean production areas in Georgia are at risk to economic damage from kudzu bugs if not managed appropriately. Kudzu bugs have also been detected in South and North Carolina, Virginia, Tennessee, Alabama, Florida, and Mississippi. From 2010 to 2012 we have collected yield data from 24 field trials and **the average yield loss in unprotected plots was 20 percent** with a range of 0 to 60 percent yield loss.



Kudzu bug adults are oval shaped, small, about ¼ inch in diameter, and greenish brown in color. Eggs are creamy white and are laid in double-rowed batches of about 20 eggs. Nymphs are also oval shaped and are light green to brown in color and have numerous setae or hairs. Both adults and nymphs are most often observed on plant stems and have sucking mouthparts which they use to feed on plant sap. Excessive feeding weakens and stresses the plant which can result in fewer pods per plant, fewer seeds per pod, and smaller seed size.

Kudzu bugs survive the winter under tree bark and in debris on the ground in well drained areas. During early spring adults are active on warm days and are in search of a reproductive host. Although kudzu bug adults may be observed on many plant hosts (i.e. fig trees and others), the primary reproductive hosts in Georgia are kudzu and soybean; reproduction has also been observed on wisteria. Kudzu appears to be a very important spring host. Kudzu bugs begin laying eggs on kudzu shoots when kudzu breaks dormancy; this generally occurs in late March in south Georgia and mid-April in north Georgia. Adults will lay eggs on kudzu for several weeks. The time required to reach the adult stage is about 6-8 weeks. These new adults then disperse to soybeans and other reproductive hosts. Soybeans become attractive to kudzu bug adults when plants are in the V3 (three trifoliates) stage. Adults will begin laying eggs on the underside of soybean leaves and a generation requiring about 6 weeks will be completed on soybeans. Initial field invasions tend to be more concentrated on field margins but will eventually spread throughout the field. In many situations we will begin to see immature kudzu bugs in soybeans at about the R2-R3 stage. Kudzu bugs complete two generations per year.

Planting date has a significant impact on the risk of kudzu bug infestations. Field trials conducted during 2012 confirmed field observations in 2011 that early planted soybeans are more likely to experience high kudzu bug infestations compared with late plantings. For example, kudzu bug egg mass counts per 5 plants at the R2 growth (flowering) stage were 49, 23, 8, and 2 for soybeans planted in April, May, June, and July. Yield data tended to follow the same trend with the greatest yield loss in unprotected plots occurring in April followed by May, June, and July. These data should not be the deciding factor concerning planting date; soybeans should be planted when maximum yield potential occurs. But rather the grower should understand the risk of infestations does vary by planting date. Insecticide application(s) may be needed for kudzu bugs regardless of planting date so thorough monitoring for kudzu bugs and other pests is needed.

Kudzu bugs can be scouted using a 15-inch diameter sweep net. Kudzu bug populations can be extremely high. Current recommendations include interrupting the development of each generation of kudzu bug by applying an insecticide to target the immature stage of the insect. Treatment thresholds and sampling plans for kudzu bugs are being developed and refined. However, tentative recommendations include applying an insecticide whenever sweep–net sampling catches one immature insect per sweep. Samples should be taken from all areas of the field, including edges and the middle, taking care not to bias sampling along border rows where population build initially. As an alternative to sweep-net sampling, visual inspections of insect density lower in the canopy will suffice. If immature kudzu bugs are easily and repeatedly found on leaf petioles and/or main stems, treatment is likely warranted.

In some situations, a single properly timed insecticide application for kudzu bug based on the 1 nymph per sweep threshold has preserved soybean yield. If insecticides are applied when adults are still actively migrating from kudzu to soybeans; additional applications may be needed. Multiple classes of insecticides have shown activity on kudzu bugs. Growers actively treating kudzu bugs with broad spectrum insecticides should consider using a preventive application of Dimilin at the R2/R3 growth stage for control of velvetbean caterpillar and green clover worm (*see Preventative Insect Control and Damage section).*

Prevent Early-Season Insect Problems

Each year, try to anticipate seedling-insect problems and apply preplant, at-planting, or early post-emergence insecticides to prevent stand losses. The following generalizations should be considered:

Before Planting

Check for soil insects such as wireworms, white grubs, and whitefringed beetle larvae in each field. Inspect soil closely when preparing land for planting (especially when turning land) for the presence of these insects. Since these insects will go back into the soil within seconds, inspections should be made immediately after turning. Inspect the soil and the root systems (and around the roots) of any weeds present for these insects and their feeding damage. Remember that these insects tend to build up in individual fields.

After cultivation, let fields remain fallow for as long as possible before planting. This practice reduces the risk of cutworms and lesser cornstalk borer which may have been established on weeds or the previous crop from infesting seedlings.

At-Planting

Probably the best way to apply an at-planting insecticide (where the label allows) is to apply it in a narrow band over the row in front of the press wheel and incorporate into the top ½ to 1 inch of soil using suitable equipment. This method of application incorporates some of the material in a band near the surface of the soil, and insects which feed at or near the soil surface (lesser cornstalk borer, cutworms, sugarcane beetle) will be more likely to come in contact with it.

Anticipate seedling-insect problems in the following situations and plan at-planting and/or an early postemergence insecticide application accordingly:

1. When late-planting for any reason, lesser cornstalk borer populations may increase as the season progresses.

2. When planting on light soils following periods of drought, lesser cornstalk borer damage is more likely under these conditions.

3. When planting behind burned wheat stubble, lesser cornstalk borer infestations are more likely to develop.

4. When planting in double-crop or minimum-till situations where previous-crop residue remains on the soil surface, cutworms or other soil insects may have built up in the preceding crop.

Check Crop Regularly to Prevent Insect Damage

Soybeans should be checked at least once a week, twice a week under certain conditions, from the time plants begin emerging until the leaves begin to turn yellow and fall from the plants. Look for:

Seedling Pests

Check seedlings very closely until the plants are about 12 inches tall. The stems become woody and severe damage from seedling pests becomes less likely at this time. Look for insects on the plant (threecornered alfalfa hopper) or in the soil around the base of the plants (lesser cornstalk borer, cutworms, sugarcane beetle). Evaluate stand loss (percentage of dead or dying plants) and try to determine if future stand loss is probable (insects easily found and actively damaging plants).

Foliage Feeders

Throughout the season, determine what insects are feeding on the foliage and how much defoliation they are causing. On small beans, it is possible to brush the insects off the plants into the row middle where they can be counted. On larger beans, it is better to use a shake cloth or sweep net. Place the shake cloth on the ground in the row middle ahead of you under undisturbed plants, because some insects fly or fall off plants quickly when disturbed. Quickly shake or beat the plants on the 3 feet of row so that foliage feeders (and pod feeders after pods are set) are dislodged onto the cloth where they can be counted and identified. With a sweep net, take a 25 sweep sample across a single row to capture insects into the net. After passing the net through the foliage take a step forward, then pass the net back across the foliage. Then identify and count the insects present in the net. At each sample point, estimate the percent of the foliage loss so that an average defoliation value can be calculated for the field.

Pod Feeders

After full bloom (when pods are being set), look closely for any pod feeding caterpillars (corn earworm and fall armyworm) and stink bugs that are dislodged on the shake cloth or in the 25-sweep sample.

When to Treat

Important: Reserve materials which are highly disruptive to beneficial insects for late season use. Conservation of beneficial insects and spiders, especially during early and mid-season, suppress some pest species.

Soil Insects (wireworms, white grubs, whitefringed beetle larvae):

Treat fields with a history of infestation or if insects are found during land preparation at an average of one per square yard.

Seedling Pests

Use preventive methods if damage is expected due to planting situation and/or treat if stand is being threatened. From seedling emergence until plants are 12 inches tall treat for:

Lesser cornstalk borer: treat when 10% of seedlings are infested with larvae

Cutworms: treat when 10% of stand is lost and larvae are still present

Sugarcane beetle: treat when 10% of plants (regardless of plant size) are damaged or dead and beetles are still present

Threecornered alfalfa hopper: treat when 10% of plants are infested with nymphs and/or adults.

It is uncommon for the above pests (with the exception of sugarcane beetle) to damage soybeans larger than 12 inches.

Foliage Feeders **(beet armyworm, loopers, corn earworm, velvetbean caterpillar, green cloverworm, Mexican bean beetle, bean leaf beetle, blister beetles, Japanese beetle):**

<u>Foliage feeders should be controlled based on defoliation and plant growth stage.</u>

Prior to full bloom: foliage feeders should be controlled when the defoliation level reaches 30%.

After full bloom (2 to 3 weeks after first blooms are noted) and up to full-pod-fill: treat when the defoliation level reaches 15%.

After full-pod-fill: treat when the defoliation level reaches 25%. It usually requires an average of 8 or more beet armyworms, loopers or velvetbean caterpillars (½ inch long or longer) per foot of row to cause this much defoliation. It usually requires 4 corn earworms (½ inch long or longer) per foot of row to cause this much defoliation.

Fields should be scouted twice per week when insect pest populations and percent defoliation are within 50 percent of the treatment threshold, and the decision to treat is being delayed in order to derive maximum benefits from natural control factors.

The green cloverworm rarely requires control measures on soybeans in Georgia. It is very common on soybeans throughout the season but generally does not occur in sufficient numbers to cause economic defoliation losses. Green cloverworms infest soybeans early at low levels and serve as a host for numerous insect parasites and predators, spiders, and diseases. These beneficial insects in turn are of great value in suppressing subsequent infestations of insect pests.

Pod Feeders: **(stink bugs, corn earworm and fall armyworm):**
Pod feeders should be controlled based on number of pod feeding insects present and plant growth stage:

Stink Bugs:	**Bloom to mid pod fill:**	0.33 stink bugs per row foot or 3 per 25 sweeps
	Mid pod fill to maturity:	1 stink bug per row foot or 6 per 25 sweeps

** beans being grown for seed production, 1 stink bug per 6 row feet will justify control.*

Pod Feeding Caterpillars: Pod feeding caterpillars such as the corn earworm or fall armyworm should be controlled at any time after bloom when an average of 2 per row foot (1/2 inch or longer) are found.

Trap Cropping

Trap cropping has been proven to be a cost effective means of managing insects in soybeans. Soybean producers have found that managing stink bugs using trap crops can often reduce insecticide applications and preserve yields. Soybean field borders (trap) are planted using a soybean variety at least 2 maturity groups earlier than the rest of the field. Early maturity group soybeans planted around late MG VII or MG VIII soybeans have been proven to be most effective in trapping stink bugs from the whole field. Treating only the trap area for stink bug controls the pest without disrupting beneficial insect populations in the rest of the field. Although a trap crop is used, be sure to scout the remainder of the field and treat on an as needed basis. Field evaluations indicate that trap cropping can be extremely effective in controlling stink bugs without flaring soybean looper or velvetbean caterpillar populations. Two or more insecticide treatments of the trap may be necessary.

Preventive Insect Control and Damage

Historical insect data indicate that the probability for treating late season foliage feeding caterpillars in soybeans is extremely high in the Coastal Plain Region of Georgia. Growers often budget 1-2 insecticide spray applications for late season insect control. Heavy populations of velvetbean caterpillar and soybean looper migrate into Georgia during August and September. For this reason, growers have been applying protective treatments using Dimilin in combination with boron at the R2-R3 stage.

Research with Dimilin and boron applied at the R2-R3 stage has consistently shown yield increases. A two ounce application of Dimilin at the R2-R3 stage controls velvetbean caterpillar and green cloverworm season long without disrupting beneficial insect populations. In most cases, fields treated with Dimilin at the R2 stage (full bloom) do not require an additional insecticide treatment for foliage feeders for the remainder of the growing season. However, soybean looper will sometimes require treatment and should be scouted closely. Fields that are not treated with Dimilin require an average of 1.5 treatments for late season insect control.

Sweep Net and Drop Sheet Sampling for Soybean Insect Pests

Research indicates that the sweep net is just as efficient as using the drop sheet for detecting most soybean insect pest problems. It has been found to be especially effective in capturing the

more mobile insect pests. It has also been found to be very effective in narrow row or lodged soybeans.

When using a drop sheet the scout typically makes 10 random 3-feet examinations for each 20 acres of soybeans being surveyed. If using a sweep net, the scout should also make 10 random checks of 25 sweeps for each 20 acres. Results of the drop sheet are reflected in the average number of larvae or insects per foot of row. The results of the sweep net should be averaged to reflect the number of insect pests per 25 sweeps.

Early Soybean Production System

Planting an early maturing soybean variety (Maturity Group IV or V) in mid-April can be an effective production practice for avoiding high populations of defoliating caterpillars. By using this early production system, soybeans mature in late August to early September, before the peak populations of these major soybean insect pests occur. However, growers should expect higher populations of kudzu bugs. For information on the Early Soybean Production System (ESPS), refer to the section entitled, "Early Soybean Production System" in the Georgia Soybean Production Guide. This is a very useful system for reducing the risks associated with insect pests.

Sweep Net and Drop Sheet Thresholds for Soybean Insects

INSECT PEST	SWEEP NET Avg. no. per 25 Sweeps		DROP SHEET Avg. no. per 1 foot of row
Kudzu bug	25 immatures		
Stink bug (both adult and nymph)	3	bloom to mid pod fill	0.33
	6	mid-pod fill to maturity	1
	** beans being grown for seed production, 1 stink bug per 6 row feet will justify control.*		
Velvetbean caterpillar	40		8
Green cloverworm	60		10
Corn earworm	5		2
Soybean looper	20	small worms	8
	15	large worms	6
Threecornered alfalfa hopper	25		3

Mites: Treat for mites if infestations become general over the field and leaf discoloration is becoming evident.

SOYBEAN

SOYBEAN INSECT CONTROL

Phillip Roberts, Extension Entomologist, Mike Toews, Research Entomologist, and David Buntin, Research Entomologist

PEST	INSECTICIDE	FORMULATION PER ACRE	LBS. ACTIVE PER ACRE	REMARKS AND PRECAUTIONS
Bean Leaf Beetle	bifenthrin (Brigade) 2EC (Discipline) 2EC	 2.1-6.4 ozs. 2.1-6.4 ozs.	 0.033-0.1 0.033-0.1	WHEN TO TREAT FOR SOYBEAN INSECTS SOIL INSECTS (Wireworms, white grubs, whitefringed beetle larvae): Treat fields with a history of OR if these insects are found during land preparation at an average of 1 per square yard. SEEDLING PESTS: Treat preventively if damage is expected due to planting situation or treat if stand is being threatened. From seedling emergence until plants are 12 inches tall, treat for: 1. lesser cornstalk borer when 10% of seedlings are infested with larvae: 2. cutworms when 10% of stand is lost and larvae are still present: 3. sugarcane beetle (regardless of plant size) when 10% of plants are damaged or dead and beetles are still present; 4. three-cornered alfalfa hopper when 10% of plants are infested with nymphs and/or adults. It is very unusual for the above pests (except sugarcane beetle) to damage soybeans larger than 12 inches. KUDZU BUG (Megacopta cribraria): Current recommendations include interrupting the development of each generation of kudzu bug by applying an insecticide to target the immature stage of the insect. Treatment thresholds and sampling plans for kudzu bugs are being developed and refined. However, tentative recommendations include applying an insecticide whenever sweep–net sampling catches one immature insect per sweep. Samples should be taken from all areas of the field, including edges and the middle, taking care not to bias sampling along border rows where population build initially. As an alternative to sweep-net sampling, visual inspections of insect density lower in the canopy will suffice. If immature kudzu bugs are easily and repeatedly found on leaf petioles and/or main stems, treatment is likely warranted. FOLIAGE FEEDERS (beet armyworms, grasshoppers, blister beetles, loopers, corn earworm, velvetbean caterpillar, green cloverworm, Mexican bean beetle, bean leaf beetle, Japanese beetle, whitefringed beetle adults): Prior to full bloom, foliage feeders should be controlled when the defoliation level reaches 30%. From full bloom up to mid - pod-fill, treat when the defoliation level reaches 15%. After full-pod-fill, treat when the defoliation level reaches 25%. It usually requires an average of 8 or more green cloverworms, loopers or velvetbean caterpillars (1/2 inch long or longer) per foot of row to cause this much defoliation. It usually requires 4 corn earworms (1/2 in. long or longer) per foot of row to cause this much defoliation. NOTE: The green cloverworm seldom requires control measures in Georgia. It is very common on soybeans throughout the season but does not occur in sufficient numbers to cause economic defoliation losses. It usually requires 15 green cloverworm larvae per foot of row to cause threshold level defoliation. This species infests soybeans early at low levels and serves as a good host for numerous insect parasites and predators, spiders and diseases. These beneficials, in turn, are of great value in suppressing infestations of economically important insect pests later in the season. NOTE: Beet armyworm infestations sometimes occur on seedling beans. When this occurs, controls should not be applied until the defoliation level exceeds 50% because soybeans can compensate for this early-season damage. (cont. next pg.)
	carbaryl (Sevin) 80S (Sevin) 4F	 0.625-1.25 lbs. 1-2 pts.	 0.5-1.0 0.5-1.0	
	beta-cyfluthrin (Baythroid XL) 1	 1.6-2.8 ozs.	 0.0125-0.022	
	gamma-cyhalothrin (Prolex) 1.25 (Declare) 1.25	 0.77-1.28 ozs. 0.77-1.28 ozs.	 0.0075-0.0125 0.0075-0.0125	
	lambda-cyhalothrin (Karate Zeon) 2.08 (Silencer) 1	 0.96-1.6 ozs. 1.92-3.2 ozs.	 0.015-0.025 0.015-0.025	
	methyl parathion (Penncap-M) 2	 2-3 pts.	 0.5-0.75	
	zeta-cypermethrin (Mustang Max) .8EC	 2.8-4 ozs.	 0.0175-0.025	
Beet Armyworm	flubendiamide (Belt) 4SC	 2.0-3.0 ozs	 0.063-0.094	
	indoxacarb (Steward) 1.25 EC	 5.6-11.3 ozs.	 0.055-0.1	
	methoxyfenozide (Intrepid) 2F	 4-8 ozs.	 0.06-0.12	
	spinosad (Tracer) 4SC	 1.5-2 ozs.	 0.047-0.062	
Blister Beetles	carbaryl (Sevin) 80S (Sevin) 4F	 0.625-1.25 lbs. 1-2 pts.	 0.5-1.0 0.5-1.0	
	beta-cyfluthrin (Baythroid XL) 1	 1.6-2.8 ozs.	 0.0125-0.022	
	gamma-cyhalothrin (Prolex) 1.25 (Declare) 1.25	 1.28-1.54 1.28-1.54	 0.0125-0.015 0.0125-0.015	
	lambda-cyhalothrin (Karate Zeon) 2.08 (Silencer) 1	 1.6-1.92 ozs. 3.2-3.84 ozs.	 0.025-0.03 0.025-0.03	
	zeta-cypermethrin (Mustang Max) .8EC	 2.8-4 ozs.	 0.0175-0.025	

PEST	INSECTICIDE	FORMULATION PER ACRE	LBS. ACTIVE PER ACRE	REMARKS AND PRECAUTIONS
Blister Beetles (cont.)				POD FEEDERS: Pod feeding caterpillars, such as the corn earworm and fall armyworm should be controlled at any time after bloom when an average of 2 per foot of row (1/2 inch long or longer) are found. After full bloom and up to the mid-pod-fill stage, stink bugs should be controlled when an average of 1 per 3 feet of row is found. After mid-pod-fill, through maturity, they should be controlled when an average of 1 per foot of row is found. If beans are being grown for seed, 1 stink bug per 6 feet of row will justify control measures.
Corn Earworm	bifenthrin (Brigade) 2EC (Discipline) 2EC carbaryl (Sevin) 80S (Sevin) 4F beta-cyfluthrin (Baythroid XL) 1 flubendiamide (Belt) 4SC gamma-cyhalothrin (Prolex) 1.25 (Declare) 1,25 lambda-cyhalothrin (Karate Zeon) 2.08 (Silencer) 1 esfenvalerate (Asana XL) .66EC indoxacarb (Steward) 1.25 EC methomyl (Lannate) 2.4LV spinosad (Tracer) 4SC zeta-cypermethrin (Mustang Max) .8EC	 2.1-6.4 ozs. 2.1-6.4 ozs. 0.625-1.875 lbs. 1-3 pts. 1.6-2.8 ozs. 2.0-3.0 ozs 0.77-1.28 0.77-1.28 0.96-1.6 ozs. 1.92-3.2 ozs. 5.8-9.6 ozs. 5.6-11.3 ozs. 0.75-1.5 pts. 1.5-2 ozs. 2.8-4 ozs.	 0.033-0.1 0.033-0.1 0.5-1.5 0.5-1.5 0.0125-0.022 0.063-0.094 0.0075-0.0125 0.0075-0.0125 0.015-0.025 0.015-0.025 0.03-0.05 0.055-0.1 0.225-0.45 0.047-0.062 0.0175-0.025	IMPORTANT: Reserve materials containing methyl parathion for late season use. This material is very toxic to beneficial insects and spiders which help keep down insect pest infestations. Late season conservation of beneficials is not as critical as it is in the early season since it is unlikely a new pest infestation will have time to develop if a late treatment has to be made for velvetbean caterpillar or stink bugs. MITES: Treat if infestations become general over the field and leaf discoloration is becoming evident. If using a 15-inch diameter sweep net, and taking several 25-sweep samples in each field, the following treatment threshold levels can be used: SWEEP NET Pests — Average # Per 25 Sweeps Kudzu Bugs (immatures) 25 Corn Earworms 5 Green Cloverworms 60 Soybean Loopers 20 sm. or 15 lg. Stink Bugs (bloom to mid-pod) 3 (Mid-pod to maturity) 6 Three-cornered Alfalfa Hopper 25 Velvetbean Caterpillar 40 If using a ground cloth, make 10 random 3-feet examinations for each 20 acres being surveyed. GROUND CLOTH Pests — Average # Per 1 Foot of Row Corn Earworms 2 Green Cloverworms 10 Soybean Loopers 8 sm. or 6 lg. Stink Bugs (bloom to mid-pod) 0.33 (Mid-pod to maturity) 1 Three-cornered Alfalfa Hopper 3 Velvetbean Caterpillar 8
Cutworms	bifenthrin (Brigade) 2EC (Discipline) 2EC chlorpyrifos (Lorsban) 4E beta-cyfluthrin (Baythroid XL) 1 gamma-cyhalothrin (Prolex) 1.25 (Declare) 1,25 lambda-cyhalothrin (Karate Zeon) 2.08 (Silencer) 1 zeta-cypermethrin (Mustang Max) .8EC	 2.1-6.4 ozs. 2.1-6.4 ozs. 2 pts. 0.8-1.6 ozs. 0.77-1.28 ozs. 0.77-1.28 ozs. 0.96-1.6 ozs. 1.92-3.2 ozs. 1.28-4 ozs.	 0.033-0.1 0.033-0.1 1.0 0.0065-0.0125 0.0075-0.0125 0.0075-0.0125 0.015-0.025 0.015-0.025 0.008-0.025	

SOYBEAN INSECT CONTROL (continued)

PEST	INSECTICIDE	FORMULATION PER ACRE	LBS. ACTIVE PER ACRE	REMARKS AND PRECAUTIONS
Fall Armyworm	flubendiamide (Belt) 4SC	2.0-3.0 ozs	0.063-0.094	**OBSERVE THE FOLLOWING PESTICIDE USE PRECAUTIONS:** Apply any of the materials listed in this table with aerial or ground equipment (unless otherwise noted for each material) as label directs. Where a range of rates is given in the table, and if label does not direct otherwise, use the low rate on small plants or small larvae and the high rate on larger plants (especially, if lapped in the middle) or large larvae. acephate (Orthene): Do not apply within 14 days of harvest. Do not graze or cut vines for hay or forage. Do not apply more than 1.5 lbs. active ingredient per acre per season. bifenthrin (Brigade): Do not apply more than 0.3 lbs. per acre per season, minimum application interval is 30 days. Do not apply within 18 days of harvest. beta-cyfluthrin (Baythroid XL): Pre-harvest interval or feeding of dry vines is 45 days. Do not make more than 4 applications per season. carbaryl (Sevin): Highly toxic to bees. chlorpyrifos (Lorsban 4E): Do not apply more than 6 pints of Lorsban 4E per acre per season. Do not apply last treatment within 28 days of harvest nor apply last two treatments closer than 14 days apart. Do not allow livestock to graze in treated areas nor otherwise feed treated soybean forage to meat or dairy animals within 14 days after application. Do not feed straw from treated soybeans to meat or dairy animals within 28 days after application. chlorpyrifos (Lorsban 15G): Do not make more than one application per season. clothianidin (Belay 2.13): Do not apply foliar treatments less than 7 days apart. Do not apply within 21 days of harvest. Do not make foliar applications of Belay insecticide in fields treated with a neonicotinoid insecticide seed treatment(s) within 45 days of planting. Regardless of formulation or type of application (foliar or seed treatment), do not apply more than 0.2 lb ai of clothianidin per acre per season. Do not graze or feed soybean forage and hay to livestock. gamma-cyhalothrin (Prolex 1.25): Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 30 days of harvest. Do not apply more than 0.03 pounds active ingredient per acre per season. lambda-cyhalothrin (Karate 2.08Z, Silencer): Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Do not apply within 30 days of harvest. Do not apply more than 0.06 lb. ai/acre per season. dimethoate (Cygon): Apply as needed but do not apply within 21 days of harvest for beans. Do not apply within 5 days of grazing or harvesting for hay. diflubenzuron (Dimilin): Do not make more than 2 applications per season. Do not apply within 21 days of harvest. Do not cut for hay nor allow milk or meat animals to graze. esfenvalerate (Asana XL): Do not feed or graze livestock on treated plants. Do not exceed 0.2 lb. a.i. per acre per season. Do not apply within 21 days of harvest.
	indoxacarb (Steward) 1.25 EC	5.6-11.3 ozs.	0.055-0.1	
	methomyl (Lannate) 2.4 LV	1.5 pts.	0.45	
	spinosad (Tracer) 4SC	1.5-2 ozs.	0.047-0.062	
Grasshoppers	bifenthrin (Brigade) 2EC (Discipline) 2EC	 2.1-6.4 ozs. 2.1-6.4 ozs.	 0.033-0.1 0.033-0.1	
	acephate (Orthene 90S) (Orthene 97)	 0.56 lb. 0.5 lb.	 0.5 0.48	
	beta-cyfluthrin (Baythroid XL) 1	2.0-2.8 ozs.	0.0155-0.022	
	gamma-cyhalothrin (Prolex) 1.25 (Declare) 1.25	 1.28-1.54 ozs. 1.28-1.54 ozs.	 0.0125-0.015 0.0125-0.015	
	lambda-cyhalothrin (Karate Zeon) 2.08 (Silencer) 1	 1.6-1.92 ozs. 3.2-3.84 ozs.	 0.025-0.03 0.025-0.03	
	methyl parathion (Penncap-M) 2	2-3 pts.	0.5-0.75	
	zeta-cypermethrin (Mustang Max) .8EC	3.2-4 ozs.	.02-.025	
Green Cloverworm	carbaryl (Sevin) 80S (Sevin) 4P	 0.625-1.25 lbs. 1-2 pts.	 0.5-1.0 0.5-1.0	
	beta-cyfluthrin (Baythroid XL) 1	0.8-1.6 ozs.	0.0065-0.0125	
	flubendiamide (Belt) 4SC	2.0-3.0 ozs	0.063-0.094	
	gamma-cyhalothrin (Prolex) 1.25 (Declare) 1.25	 0.77-1.28 ozs. 0.77-1.28 ozs.	 0.0075-0.0125 0.0075-0.0125	
	lambda-cyhalothrin (Karate Zeon) 2.08 (Silencer) 1	 0.96-1.6 ozs. 1.92-3.2 ozs.	 0.015-0.025 0.015-0.025	
	diflubenzuron (Dimilin) 2L	2-4 ozs.	.03-.063	
	esfenvalerate (Asana XL) .66EC	2.9-5.8 ozs.	0.015-0.03	
	indoxacarb (Steward) 1.25 EC	5.6-11.3 ozs.	0.055-0.1	

SOYBEAN INSECT CONTROL (continued)

PEST	INSECTICIDE	FORMULATION PER ACRE	LBS. ACTIVE PER ACRE	REMARKS AND PRECAUTIONS
Green Cloverworm (cont.)	methomyl (Lannate) 2.4LV	0.4-0.75 pt.	0.12-0.225	flubendiamide (Belt): Pre-harvest interval; Dry seed 14 days; Forage and hay--3 days. Do not apply more than 3 fl oz per acre per 5-day interval. Do not apply more than 6 fl ozs per acre per crop season. indoxacarb (Steward): Will not provide acceptable control of velvetbean caterpillar. Do not feed or graze livestock on treated fields. methomyl (Lannate): Apply Lannate as needed. Do not apply within 10 days of grazing, 12 days of harvest for hay, or 14 days of harvest for beans. methoxyfenozide (Intrepid 2F): Do not apply more than 64 fl. ozs. or make more than 4 applications per season. Do not apply within 7 days of harvest of hay and forage or within 14 days of harvest of seed. methyl parathion: Do not apply within 20 days of grazing or hay or bean harvest. methyl parathion (Penncap M): Do not apply more than twice per season. Do not apply within 20 days of grazing or hay or bean harvest. spinosad (Tracer): Do not apply within 28 days of harvest. Do not feed or graze livestock on treated foliage. Do not apply more than 6 ounces per acre per year. zeta-cypermethrin (Mustang Max): Do not graze or harvest treated soybean forage, straw or hay for livestock feed. Do not exceed 0.15 lb a.i. per acre per season.
	methoxyfenozide (Intrepid) 2F	4-8 ozs.	0.06-0.12	
	methyl parathion (4EC) (Penncap-M) 2	1-2 pts. 2-3 pts.	0.5-1.0 0.5-0.75	
	spinosad (Tracer) 4SC	1-2 ozs.	0.031-0.062	
	zeta-cypermethrin (Mustang Max) .8EC	2.8-4 ozs.	0.0175-0.025	
Japanese Beetle	carbaryl (Sevin) 80S (Sevin) 4F	0.625-1.25 lbs. 1-2 pts.	0.5-1.0 0.5-1.0	
	beta-cyfluthrin (Baythroid XL) 1	1.6-2.8 ozs.	0.0125-0.022	
	gamma-cyhalothrin (Prolex) 1.25 (Declare) 1.25	1.28-1.54 ozs. 1.28-1.54 ozs.	0.0125-0.015 0.0125-0.015	
	lambda-cyhalothrin (Karate Zeon) 2.08 (Silencer) 1	1.6-1.92 ozs. 3.2-3.84 ozs.	0.025-0.03 0.025-0.03	
	zeta-cypermetrin (Mustang Max) .8EC	2.8-4 ozs.	0.0175-0.025	
Kudzu Bug	acephate (Orthene 97)	0.75-1.0 lb.	0.5-0.97	
	bifenthrin (Brigade) 2EC (Discipline) 2EC	5.12-6.4 ozs. 6.4 ozs.	0.08-0.1 0.1	
	clothianidine (Belay) 2.13	3-4 ozs.	0.05-0.067	
	gamma-cyhalothrin (Declare) 1.25	1.28-1.54 ozs.	0.0125-0.015	
	lambda-cyhalothrin (Karate Zeon) 2.08	1.92 ozs	0.03	
	zeta-cypermethrin (Mustang Max) .8 EC	4 ozs.	0.025	
Lesser Cornstalk Borer	(Lorsban) 15G	8 ozs. per 1000 feet of row	1.0	
	(Lorsban) 4E	2 pts.	1.0	
Loopers, Soybean	flubendiamide (Belt) 4SC	2.0-3.0 ozs	0.063-0.094	
	indoxacarb (Steward) 1.25 EC	5.6-11.3 ozs	0.055-0.1	

SOYBEAN INSECT CONTROL (continued)

PEST	INSECTICIDE	FORMULATION PER ACRE	LBS. ACTIVE PER ACRE	REMARKS AND PRECAUTIONS
Loopers, Soybean (cont.)	methoxyfenozide (Intrepid) 2F spinosad (Tracer) 4SC	4-8 ozs. 1-2 ozs.	0.06-0.12 0.031-0.062	
	Note: Soybean loopers are highly resistant to pyrethroid insecticides and should not be used for control.			
Mites	bifenthrin (Brigade) 2EC (Discipline) 2EC dimethoate (4EC)	 5.12-6.4 ozs. 5.12-6.4 ozs. 1 pt.	 0.08-0.1 0.08-0.1 0.5	
Stink Bugs	acephate (Orthene 90S) (Orthene 97) beta-cyfluthrin (Baythroid XL) 1 bifenthrin (Brigade) 2EC (Discipline) 2EC clothianidin (Belay) 2.13 gamma-cyhalothrin (Prolex) 1.25 (Declare) 1.25 lambda-cyhalothrin (Karate Zeon) 2.08 (Silencer) 1 methyl parathion (4EC) (Penncap M) 2 zeta-cypermethrin (Mustang Max) .8EC	 0.56-1.1 lb. 0.5-1 lb. 1.6-2.8 ozs. 2.1-6.4 ozs. 2.1-6.4 ozs. 3-6 ozs. 1.28-1.54 ozs. 1.28-1.54 ozs. 1.6-1.92 ozs. 3.2-3.84 ozs. 1 pt. 1-3 pts. 3.2-4 ozs.	 0.5-1.0 0.5-0.97 0.0125-0.022 0.033-0.1 0.033-0.1 0.05-0.1 0.0125-0.015 0.0125-0.015 0.025-0.03 0.025-0.03 0.5 0.25-0.75 0.02-0.025	
Sugarcane Beetles	The treatments for lesser cornstalk borer give helpful control.			
Three-cornered Alfalfa Hopper	acephate (Orthene 90S) (Orthene 97) carbaryl (Sevin) 80S (Sevin) 4F beta-cyfluthrin (Baythroid XL) 1 gamma-cyhalothrin (Prolex) 1.25 (Declare) 1.25 lambda-cyhalothrin (Karate Zeon) 2.08 (Silencer) 1	 0.83-1.1 lb. 0.75-1 lb. 1.25 lbs. 2 pts. 1.6-2.8 ozs. 0.77-1.28 ozs. 0.77-1.28 ozs. 0.96-1.6 ozs. 1.92-3.2 ozs.	 0.75-1.0 0.73-0.97 1.0 1.0 0.0125-0.022 0.0075-0.0125 0.0075-0.0125 0.015-0.025 0.015-0.025	

SOYBEAN INSECT CONTROL (continued)

PEST	INSECTICIDE	FORMULATION PER ACRE	LBS. ACTIVE PER ACRE	REMARKS AND PRECAUTIONS
Three-cornered Alfalfa Hopper (cont.)	methyl parathion (Penncap-M) 2FM	2-3 pts.	0.5-0.75	
	zeta-cypermethrin (Mustang Max) .8E	2.8-4 ozs.	0.0175-0.025	
Velvetbean Caterpillar	carbaryl (Sevin) 80S (Sevin) 4F	0.625-1.25 lbs. 1-2 pts.	0.5-1.0 0.5-1.0	
	beta-cyfluthrin (Baythroid XL) 1	1.6-2.8 ozs.	0.0125-0.022	
	flubendiamide (Belt) 4SC	2.0-3.0 ozs	0.063-0.094	
	gamma-cyhalothrin (Prolex) 1.25 (Declare) 1.25	0.77-1.28 ozs. 0.77-1.28 ozs	0.0075-0.0125 0.0075-0.0125	
	lambda-cyhalothrin (Karate Zeon) 2.08 (Silencer) 1	0.96-1.6 ozs. 1.92-3.2 ozs.	0.015-0.025 0.015-0.025	
	diflubenzuron (Dimilin) 2L	2-4 ozs.	.03-.063	
	esfenvalerate (Asana XL) .66EC	2.9-5.8 ozs.	0.015-0.03	
	methomyl (Lannate) 2.4LV	0.4-0.75 pt.	0.12-0.225	
	methoxyfenozide (Intrepid) 2F	4-8 ozs.	0.06-0.12	
	methyl parathion (4EC) (Penncap M) 2	1-2 pts. 2-3 pts	0.5-1.0 0.5-0.75	
	spinosad (Tracer) 4SC	1-2 oz.	0.031-0.062	
	zeta-cypermethrin (Mustang Max) .8EC	2.8-4 ozs.	0.0175-0.025	

Premixed or Co-Packaged Insecticide Products:

Products listed below are available as premixes or co-packages of two insecticidal active ingredients. When using premixed or co-packaged products, be sure the use of all active ingredients is necessary. Unnecessary applications or use of reduced rates of an active ingredient may lead to or intensify insecticide resistance.

bifenthrin, imidacloprid (Brigadier)

zeta-cypermethrin, chlorpyrifo (Stallion)

imidacloprid, cyfluthrin (Leverage)

lambda-cyhalothrin, thiomethoxam (Endigo)

Spinosad, gamma-cyhalothrin (Consero)

zeta-cypermethrin, bifenthrin (Hero)

chlorpyrifos, lambda-cyhalothrin (Cobalt Advanced)

IRRIGATION

(Jared Whitaker)

Dryland soybean yields in Georgia range from about 5 to 50 bushels per acre. Extended drought during the "critical fruiting period" is the major reason for this yield variation. Timely irrigations can stabilize soybean yields at 45 to 50 bushels per acre **OR MORE** and improve average yields by at least 20 bushels per acre.

Irrigation is expensive and requires proper management to be economically feasible. This can usually be accomplished when soybean market prices are good and irrigation for soybeans can be targeted for soybean "critical periods" in July, August and September.

When soybean market prices were below 7 dollars per bushel, irrigating soybean is a difficult task when considering profitability. Recently, soybean market prices have remained extremely high and there is no doubt that irrigation, if applied properly, is of economic benefit.

Irrigation recommendations for soybean in the past have been based on properly utilizing irrigation to produce a 45 to 50 bushel soybean crop while maintaining profitability at much lower market prices. To meet those criteria, the following recommendations were created and have been used for many years.

The following water balance method is suggested for 45 to 50 bushel soybean yields:

Growth Stage	Trigger	Amount
Stand Establishment	Irrigate prior to planting	1 - 1.5”
Prior to 1st Bloom (VE – R1)	Wilting by late afternoon	1 – 1.5”
1st Bloom – Beginning Pod Elongation (R1 – R4)	Wilting by mid-day	1.0 – 1.5”
Beginning Seed – Full Seed (R5 – R6)	Keep from wilting	1.0 – 1.5”
Full Seed – Maturity (R6 – R7)	Wilting by late afternoon	1.0”

This scheduling method can consistently increase yield. However, current soybean market prices and higher yield potential of modern varieties create a situation where producers may be able to more adequately manage irrigation to further increase yield. Current work in Georgia is being conducted to further develop irrigation methods for maximizing soybean yield. Until new recommendations are developed, there may be ways to modify this system to potentially reach higher yield goals.

One issue with our traditional recommendations is that scheduling has been based on wilting of the soybean crop. It’s very likely that when soybean wilts, yield potential can be lost and the

degree of loss is related to soybean development during which that stress occurs. Specifically, when wilting occurs during reproductive growth the chance for lost yield potential can be much greater than if it were to occur during vegetative growth. Therefore, one way to potentially modify this system would be to irrigate to prevent wilting from 1st Bloom (R1) until full seed (R6) instead of just between R5 and R6.

Temperatures during early reproductive growth also likely play a large role in Georgia soybean yield potential. High temperatures during early reproductive growth (R1 through R3) can significantly reduce flower and pod retention, often negatively impacting yield. There are two ways in which proper irrigation could help alleviate these effects. First, proper irrigation prior to bloom can help to ensure canopy closure, and that shading may potentially create a cooler microclimate during reproductive growth. Secondly, by ensuring adequate soil moisture during initiation of reproductive growth with proper irrigation, the crop may be able to withstand more heat and maintain adequate retention of pods and blooms.

Below is a table showing a weekly water demand from soybean based on general growth development. Utilizing a checkbook method based on this information may be another guide to irrigate soybean. This checkbook was adapted from University of Arkansas soybean irrigation recommendations, although recommendations in Georgia may be different this chart is an alternative to traditional methods.

Growth Stage	Water Requirement	
	Per day	Per week
	---------- inches ----------	
Germination/Seedling	0.05 to 0.10	0.35 to 0.70
Vegetative Growth	0.10 to 0.20	0.70 to 1.40
Flower to Full Seed	0.25 to 0.35	1.75 to 2.45
Maturity to Harvest	0.05 to 0.20	0.30 to 1.40

Irrigation Scheduling Methods

To schedule irrigation for most efficient use of water and maximum production, it is essential to frequently determine the soil water conditions throughout the root zone of the crop being grown. A number of methods for doing this have been developed and used with varying degrees of success. In comparison to investment in irrigation equipment, these instruments are relatively inexpensive. Talk to your local UGA County Extension Agent for more information about particular sensors technology and potential costs.

Keeping a Chart

Regardless of what method is used to irrigate, you can obtain the full benefit of using soil moisture sensors by recording readings and plotting them on a chart. Maintaining good records allows a producer to more properly predict irrigations since chart lines show what has happened in the past. By projecting them ahead, there is an advance indication of what you can expect in a few days. This information is helpful in scheduling the next irrigation and in measuring the effectiveness of a previous irrigation (by following trends after irrigation and during soil drying). Most manufacturers include charts with their instruments. If not included, they can easily be made. Record rainfall data along with the instrument reading to aid in evaluating soil water changes. When keeping records of irrigations and/or soil moisture it is extremely important to document growth stage of the soybean crop to adequately understand water use and properly schedule future irrigations this year and the years to come.

Water Balance Methods

The most common method used that does not require frequent field activity is the water balance method. The principle of the water balance method is to obtain a balance of incoming and outgoing soil water so that adequate soil water is maintained for the plant. Inputs include incoming water in any form, whether rainfall or irrigation. Outputs include evapotranspiration, runoff, and deep percolation. Water removal is more commonly referred to as evapotranspiration (ET). Evapotranspiration is usually expressed in inches per day. It consists of water removal by the plant and water loss directly by the soil. Two variations of the water balance method are used. One uses crop use curves, the other uses pan evaporation data. To use either variation you must know your soil type and the available water holding capacity of the soil. This information can be obtained from your local Natural Resource Conservation Service. Next you determine the zone you are trying to manage. This zone will vary according to the effective rooting depth of the soybeans. Usually 24 inches (2 feet) is the most that can be managed with irrigation. Determine the total water you have available to manage in this zone. It is desirable to try to maintain water content above 50% of the available water holding capacity. As water is removed daily (by either crop use or evaporation) these amounts are subtracted from the water available. When the moisture available approaches a zero balance, it is time to irrigate. The amount to add depends on the soil type, but will usually be the same as the 50 percent value calculated earlier plus an added amount to account for application efficiencies less than 100%. (Typical application efficiencies for sprinkler irrigation equipment vary from 75 percent to 90 percent.)

SPRAYER APPLICATION AND CALIBRATION

(Paul Sumner)

Nozzle section is one of the most important decisions to be made related to pesticide applications for soybeans. The type of nozzle determines not only the amount of spray applied, but also the uniformity of the applied spray, the coverage obtained on the sprayed surfaces, and the amount of drift that can occur. Each nozzle type has specific characteristics and capabilities and is designed for use under certain application conditions. The types which are commonly used for ground application of agricultural chemicals for soybeans are the fan and cone nozzles.

Herbicide Application

The type of nozzle used for soil incorporation and applying herbicides is one that develops a large droplet and has no drift. The nozzles used for broadcast applications include the regular flat fan, extended range flat fan, drift reduction flat fan, turbo flat fan, twin flat fan, air-assist flat fan, flood and wide angle cone nozzles. Operating pressures should be 20 to 30 psi for the flat fan, turbo flat fan and twin flat fan. The flood and wide angle cone nozzles should operated at 18 to 20 psi. Pressure more than 40 psi create significant drift. Air assist or air induction nozzles should be operated above 40 psi. All of the flat fan type nozzles will achieve uniform application of the chemical if they are placed properly along the boom. For the flat fan nozzles overlap should be 50 to 60 percent. Wide angle cone and flood nozzles should have 100 percent overlap. The following table presents suggested boom heights for flat fan nozzles with different angles. Also the orientation of each along the boom should place such they are angled 5 degrees from the center line of the boom.

Various Nozzle Heights for a 20-Inch Spacing.

Spray Angle (degrees)	Nozzle height (inches)
65	**22-24**
80	**17-19**
110	**15-18**

Even flat-fan nozzles are used for banding herbicides over the row to apply uniform coverage across the entire width of the spray pattern. The width of the band produced is determined by nozzle height (table below).

Nozzle Height for 80 and 95 Degree Even Flat Fan Nozzles in Inches.

Band Width (inches)	80 degree	95 degree
8	**5**	**4**
10	**6**	**5**
12	**7**	**6**
14	**8**	**7**

Insecticide Applications

Hollow cone nozzles are used primarily when plant foliage penetration is essential for effective insect or disease control, and **when drift is not a major concern**. At pressures of 60 to 120 psi, these nozzles produce small droplets that readily penetrate plant canopies and cover the underside of the leaves more effectively than any other nozzle type. The hollow-cone nozzles produce a cone-shaped pattern with the spray concentrated in a ring around the outer edge of the pattern. Even fan and hollow cone nozzles can be used for banding insecticide and fungicides over the row.

Fungicide Applications

Coverage of the plant at bloom stage is critical for prevention and control of Asian Rust on soybeans. Rust is first established on the lower plant surfaces so good fungicide coverage is needed on the lower leaves and stems. Therefore, fungicide must get on the lower plant to protect it. The fungicides that are available for treatment of Asian Rust need surface coverage to be effective and this is achieved best by smaller droplets. The two types of the chemistries currently available for Asian Rust are contact and locally systemic. The contact fungicides remain on the surface and will only protect the area that is covered. The locally systemic material is absorbed into the plant tissue. However, this is not the same type of systemic movement normally seen in systemic-based herbicides. The fungicide will not move throughout the plant, only within a small absorption zone (within a single leaf, for example).

Droplet Size, Spray Volume and Boom Height

In order to get the maximum plant surface coverage one should use a nozzle that develops medium to fine droplets (225 – 325 microns). Some fine droplets are acceptable but fine droplets drift easily and may blow over a dense canopy, while coarse sprays drift less but make fewer droplets available for coverage. The extended range and low drift fan nozzles can achieve good coverage when operated at pressures above 50 psi. At this pressure spray is forced down into the canopy. Care should be taken not to operate sprayer above 75 psi with these nozzles, a large amount of fine droplets will be generated. Consult nozzle manufactures catalogues for droplet classification at the various pressure settings and nozzle sizes.

- Total spray volume applied should be 15-20 GPA for ground application. This will give sufficient droplets to cover the target area. Ground speed of 5–7 mph is desirable.
- The boom height should provide 50 percent overlap. Keep as low as possible giving you better penetration, coverage and lessening drift potential.

Aerial Application

Growers may elect to use aerial application. Aerial applicators should also use a nozzle that will produce a medium droplet size (285 – 235 microns). Spray volume applied should be 3 – 5 GPA.

REOURCES

The two excellent publications on sprayer setup have been developed specifically for Asian Rust.

- Spraying Recommendations for Soybean Rust, Ohio State University Extension – http://www.tifton.uga.edu/spray/ohio0526.pdf

- Aerial Application: Tips for Rust Control, University of Arkansas - http://www.tifton.uga.edu/spray/Rust%20Arkansas.pdf

Nozzle Material

Various types of nozzle bodies and caps, including color coded versions, and multiple nozzle bodies are available with threads as well as quick-attaching adapters. Nozzle tips are interchangeable in the nozzle cap and are available in a wide variety of materials, including hardened stainless steel, stainless steel, brass, ceramic, and various types of plastic. Hardened stainless steel and ceramic are the most wear-resistant materials but are also the most expensive. Stainless steel tips, with corrosive or abrasive materials, have excellent wear resistance. Plastic tips are resistant to corrosion and abrasion and are proving to be very economical for applying pesticides. Brass tips have been common but wear rapidly when used to apply abrasive materials such as wettable powders and are corroded by some liquid fertilizers. Brass tips are economical for limited use, but other types should be considered for more extensive use.

The following chart can be used as a guide for selecting the proper nozzle type for most soybean spraying applications.

Suggested Application for Various Spray Nozzles Used in Soybeans.
1 - Excellent, 2 - Very Good, and 3 - Good.

	Pre-Emerge Herbicide			Post-Emerge Herbicide				Insecticides - Fungicides		
Type	**Soil Incorp**	**Band**	**Broad-cast**	**Contact Band**	**Contact Broadcast**	**Systemic Band**	**Systemic Broadcast**	**Soil Incorp**	**Band**	**Broad-cast**
Regular Flat Fan (8003)*	**2**		**2**		**2**		**2**	**2**		**2**
Ext Range Flat Fan (XR8004 and 80-4R)	**1**		**2**		**1**			**2**		
Drift Control Flat Fan (DG8002 and RF2)	**1**		**1**		**2**		**1**	**1**		
Turbo Flat Fan (TT11002)	**1**		**1**		**2**		**1**	**1**		
Air-Assist Fan (TDXL-11003, AI11003, Raindrop Ultra 3)	**1**		**1**		**1**		**1**	**1**		
Flood (TK-2 and D 2)	**2**	**3**	**2**				**2**	**2**		
Turbo Flood (TF-VS4)	**1**		**1**				**1**	**1**		
Wide Angle Full Cone (FL-8 and RA-8)	**3**		**2**				**2**	**3**		
Even Fan (8004E)		**1**		**2**		**1**			**2**	
Twin Flat Fan (TJ60-8003)		**1**		**1**					**1**	
Hollow Cone (TX-6 and HC 6)									**1**	**1**
Hollow Disc-Core (D 4-23 and DC 4-23)									**1**	**1**

* Example of nomenclature for nozzle

Selecting the Proper Size Nozzle Tip

The correct nozzle tip size will depend upon application rate in gallons per acre (GPA), ground speed (MPH), effective spray width of each nozzle (W). The best method for choosing the correct nozzle tip size is to determine the gallons per minute (GPM) of nozzle output required and then select a nozzle tip size that, when operated within the recommended pressure range, will provide this flow rate. Avoid relying on the "gallons per acre" rating which some manufacturers give their nozzles as means of selecting nozzle tip size. This rating is correct only for standard conditions (usually 30 psi, 4 MPH, and 20-inch nozzle spacings). The gallons-per-acre rating is useless if any conditions vary from the standard. By following the steps described below, the proper nozzle tip size can be selected well ahead of the spraying season.

1. *Determine "GPA "* - First select the application rate in gallons per acre (GPA) used. The application rate consists of the gallons of carrier (water, fertilizer, etc.) plus chemical applied per treated acre. The best guides for this decision are the recommended ranges listed on the label, the recommendation of a chemical dealer or county agricultural agent, and experience with that particular chemical.
2. *Determine "MPH"* - Select an appropriate ground speed in miles per hour (MPH) for the field to be sprayed. Experience is the best guide here. Generally, speeds between 3 to 7 MPH are considered appropriate for low pressure ground sprayers depending upon field conditions. Do not rely solely on speedometers as an accurate measure of ground speed, especially on older tractors. Slippage and variation in tire sizes can result in speedometer errors of 30 percent or more. Ground speed can be determined by the following equation:
3. *Determine "W"* - Determine the effective sprayed width per nozzle (W) in inches. For broadcast spraying, W = nozzle spacing, For band spraying, W = band width, For row-

$$MPH = \frac{Distance(ft)\ x\ 60}{Time(\sec)\ x\ 88}$$

   crop application, W = row spacing (or band width).
4. *Determine Tip Size* - Once the application rate, ground speed, and spray width per nozzle have been determined, the flow rate required for each nozzle in gallons per minute (GPM) can be determined by using a nozzle catalog, tables or the following equation:

$$GPM = \frac{GPA\ x\ MPH\ x\ W}{5{,}940}$$

The constant, 5,940, is used to convert gallons per minute, miles per hour, and inches to gallons per acre. The use of 6,000 instead of 5,940 will make the calculation easier and result in an error of only 1 percent.

Example: A herbicide is to be broadcast at 20 GPA at a speed of 5 MPH, using flat fan nozzles spaced 20 inches apart on the boom. What size nozzle tip should be selected?

The required flow rate for each nozzle is as follows:

$$GPM = \frac{GPA \, x \, MPH \, x \, W}{5{,}940}$$

$$GPM = \frac{20 \, x \, 5 \, x \, 20}{5{,}940} = \frac{2{,}000}{5{,}940} = 0.34$$

The nozzle selected must have a flow rate of 0.34 GPM when operated within the recommended pressure range of a flat-fan nozzle (20 to 30 psi). By checking nozzle catalogs, you will find a number of different brands of flooding flat fan nozzles which will provide this flow rate. For example, the Spraying Systems XR8004 and Delavan LFR80-4R nozzles have a rated output of 0.35 GPM at 30 psi. Either of these nozzles will be sufficient for this application.

***Example*:** A foliar fungicide is to be applied at 15 GPA at a speed of 7 MPH, using hollow cone nozzles. The row spacing is 36 inches with three nozzles directed toward each row. What size tip should be selected?

$$GPM = \frac{GPA \, x \, MPH \, x \, W}{5{,}940}$$

The required flow rate for each row is as follows:

$$GPM_{row} = \frac{15 \, x \, 7 \, x \, 36}{5{,}940} = \frac{3{,}780}{5{,}940} = 0.64$$

The flow rate for each nozzle is the row (GPM) divided by the number of tips per row.

$$GPM_{nozzle} = \frac{0.64}{3 \, nozzles/row} = 0.21$$

The nozzle selected must have a flow rate of 0.21 GPM operating between 40 to 80 psi. Checking nozzle catalogs, the Spray Systems TX-10 and Delavan HC-10 cone spray nozzles have a rated output of 0.20 GPM at 60 psi. Or the Spray System D 4-23 and Delavan DC 4-23 disc-core nozzles have a rated output of 0.21 GPM at 80 psi. Either one of the nozzles chosen would deliver the proper amount per acre.

Water Rates (GPA)
The grower who plans to use spray materials at the low water rates should follow all recommendations carefully. Use product label recommendations on water rates to achieve optimal performance. Plant size and condition influence the water rate applied per acre. Examination of the crop behind the sprayer before the spray dries will give a good indication of coverage.

Agitation
Most materials applied by a sprayer are in a mixture or suspension. Uniform application requires a homogeneous solution provided by proper agitation (mixing). Agitation may be produced by jet agitators, volume boosters (sometimes referred to as hydraulic agitators), and mechanical agitators. These can be purchased separately and installed on sprayers. Continuous agitation is needed when applying pesticides that tend to settle out, even when moving from field to field or when stopping for a few minutes.

Calibration

The procedure below is based on spraying $^{1}/_{128}$ of an acre per nozzle or row spacing and collecting the spray that would be released during the time it takes to spray the area. Because there are 128 ounces of liquid in 1 gallon, this convenient relationship results in ounces of liquid collected being directly equal to the application rate in gallons per acre.

Calibrate with clean water when applying toxic pesticides mixed with large volumes of water. Check uniformity of nozzle output across the boom. Collect from each for a known time period. Each nozzle should be within 10 percent of the average output. Replace with new nozzles if necessary. When applying materials that are appreciably different from water in weight or flow characteristics, such as fertilizer solutions, etc., calibrate with the material to be applied. Exercise extreme care and use protective equipment when active ingredient is involved.

1. Use the table below to determine the distance to drive in the field (two or more runs suggested). For broadcast spraying, measure the distance between nozzles. For band spraying, use band width. For over the row or directed, use row spacing.
2. Measure the time (seconds) to drive the required distance, with all equipment attached and operating. Maintain this throttle setting!
3. With sprayer sitting still and operating at same throttle setting or engine RPM as used in Step 2, adjust pressure to the desired setting. Machine must be operated at same pressure used for calibration.
4. For broadcast application, collect spray from one nozzle or outlet for the number of seconds required to travel the calibration distance.
    - For band application, collect spray from all nozzles or outlets used on one band width for the number of seconds required to travel the calibration distance.
    - For row application, collect spray from all outlets (nozzles, etc.) used for one row for the number of seconds required to travel the calibration distance.

5. Measure the amount of liquid collected in fluid ounces. The number of ounces collected is the gallons per acre rate on the coverage basis indicated. For example, if you collect 18 ounces, the sprayer will apply 18 gallons per acre. Adjust applicator speed, pressure, nozzle size, etc. to obtain recommended rate. If speed is adjusted, start at Step 2 and recalibrate. If pressure or nozzles are changed, start at Step 3 and recalibrate.

Distance to Measure to Spray $^{1}/_{128}$ Acre.
One Ounce Discharged Equals One Gallon per Acre.

Nozzle Spacing (inches)	Distance (feet)	Nozzle Spacing (inches)	Distance (feet)
6	**681**	**20**	**204**
8	**10**	**22**	**186**
10	**408**	**24**	**170**
12	**340**	**30**	**136**
14	**292**	**36**	**113**
16	**255**	**38**	**107**
18	**227**	**40**	**102**

To determine a calibration distance for an unlisted spacing, divide the spacing expressed in feet into 340. Example: Calibration distance for a 13" band = 343*13/12=313 feet.

HARVESTING, DRYING AND STORAGE

(Paul Sumner)

Producing a high-quality soybean crop is one thing. Harvesting those soybeans with minimum losses and then drying and storing them in a way that maintains quality until the soybeans are marketed is another. A reduction in harvest losses of three bushels per acre when harvesting three acres per hour can result in a savings of $54 per harvesting hour based on $6 per bushel. Proper drying and storage will maintain quality soybeans and assure minimum losses.

Harvesting

Harvesting Losses

The grain-combine harvester has been used for soybeans since the mid-twenties but little progress was made in reducing harvesting losses until about 1970. Until then, the average combine using a rigid grain platform header resulted in as much as 10 percent losses during the harvesting operation. The introduction of attachments such as the floating cutter bar and pick-up reel reduced harvesting losses to 7 or 8 percent. Combine headers that have a built-in, flexible cutterbar have been designed and developed specifically for use in soybeans can reduce harvest losses to about 4 percent of yield.

The types of harvesting losses should be identified and measured so that proper combine adjustments can be made to increase soybean harvesting efficiency.

Preharvest losses are those that occur from natural causes before harvest. These losses result from soybeans that have fallen to the ground by the time harvest begins. If soybeans that are ready for harvest are subjected to several alternating periods of wet and dry weather, preharvest losses could be as high as 25 percent.

Gathering or **header losses** are soybeans that are not gathered into the combine. These losses are caused by the action of the cutter bar, reel and auger and account for more than 85 percent of the total soybean losses at harvest. There are four kinds of gathering losses. **Shatter losses** are shelled soybeans and detached soybean pods that are shattered from stalks by the header. **Stubble losses** are soybeans in pods remaining on the stubble because of operating the cutterbar too high, etc. **Stalk losses** are soybeans remaining in pods attached to stalks that were cut but not delivered into the combine. **Lodged losses** are soybeans remaining in pods attached to stalks that were not cut or that were cut at heights greater than that of the stubble.

Soybeans are easy to thresh, separate and clean. Soybeans can be rubbed out of the pod readily and their size and shape are ideal for cleaning. Even so, small errors in the adjustment of the combine can result in disastrous losses during the threshing, separating, and cleaning operations. **Threshing** or **cylinder losses** occur when shelled soybeans are carried out the back of the machine with the stalks. Separating losses are usually insignificant unless the combine is overloaded. **Cleaning** or **shoe losses** occur when shelled soybeans are carried over the chaffer or top sieve and out the back of the combine.

Measuring Losses

Harvesting losses can be measured by enclosing a ten square foot area with a rectangular frame

and counting the soybeans remaining in that area after harvest. A count of 40 beans within the frame represents approximately one bushel per acre. Make the frame from heavy cord or cloth line so it can be coiled and carried on the combine. The length of the frame should be equal to the cutting width of the combine header (see table on page 58). Make four pins 3 to 4 inches long from No. 9 wire and tie them to the frame to mark the corners. The pins should be pushed into the ground to hold the frame tight.

Frame Width Based on Combine Header Width.

Header width (feet)	Frame width (inches)
16	7 1/2
18	6 3/4
20	6
22	5 1/2
24	5

The procedure for determining field losses can be done by operating the combine in the normal way, move into the crop until well away from the edge of the field. Then, the combine should be stopped, the platform drive disengaged, the platform raised and the combine backed up 15 to 20 feet. In measuring total losses the frame should be placed across the harvested rows behind the combine and the loose soybeans, soybeans in pods on or off the stalks, and soybeans on the stubble inside the frame should be counted. This figure divided by 40 represents an estimate of the losses in bushels per acre, and it includes both preharvest and harvest losses. If the loss is near 3 percent of the yield, continue harvesting.

To measure preharvest losses, the frame should be placed across the rows of standing soybeans in front of the combine and loose soybeans and soybeans in pods on the ground should be counted and divided by 40. To determine the total harvesting losses, the preharvest losses should be subtracted from the total losses found behind the combine.

The shaded areas indicate frame placement for measuring total soybean loss, preharvested loss, and gathering loss.

Reducing Losses

Preharvest losses can be minimized by planting shatter-resistant varieties and early harvest. Soybeans should be harvested shortly after their moisture content first reaches 14-16 percent.

Header designs play an important role in reducing harvesting losses. The row-crop header has proven to be more efficient than platform type headers. Of the platform type headers, the flexible floating cutterbar header is the most efficient but slightly less efficient than the row-crop header.

The flexible floating cutterbar header has several features that enable it to reduce soybean losses: its long dividing points help prevent problems that occur in lodged soybeans; its extended platform and low profile reduce shatter and stalk losses; and its large-diameter auger rapidly moves plant material to the center and helps reduce stalk losses.

To take full advantage of the time available for harvesting, make all necessary repairs and major adjustments well before the harvest season. The combine should be thoroughly repaired, lubricated and adjusted as instructed in the operator's manual. Reduction in gathering losses can be accomplished only if the header is adjusted to cut close to the ground to avoid leaving soybeans on the stubble and shattering them from the stalks. To further reduce shatter losses, set the header to handle the soybeans as gently as possible. Rough handling by the header's cross auger and by the slat conveyors in the feeder housing can thresh a substantial percentage of the soybeans before they reach the combine cylinder. These soybeans can be lost if the slope of the header's deck is improperly adjusted, the deck is not tight, or if the plant material is not fed uniformly into the combine cylinder.

Almost all gathering losses are caused by the action of the knife and reel. The knife must be kept sharp, and broken or badly worn sections replaced. Plates should be adjusted to minimize knife vibration. The guards should be aligned and the knife clips adjusted so the knife can move freely and cut efficiently.

Proper reel adjustments are particularly necessary to keep losses low. If the reel turns too fast, it will shatter soybeans excessively. If the reel turns too slowly, it may drop stalks or allow them to be recut. A pick-up reel can help reduce harvesting losses. The speed of the pick-up reel should be 50 percent greater than ground speed. A 42-inch reel should rotate at about 12 revolutions per minute (rpm) for each 1 mph of forward speed.

The reel axle should be eight to 12 inches ahead of the sickle on most headers. With a pick-up reel and floating cutter bar, the reel axle should be about eight inches ahead of the sickle. Several manufacturers are now providing headers with a built-in, flexible cutter bar. When harvesting short plant material, the reel axle should be moved nearer the cutter bar.

To prevent excessive threshing and separating losses and to still keep the soybeans clean, the threshing and separating mechanisms must be kept properly adjusted. The single most important item to check is the separator speed. In each combine a particular shaft serves as a starting point for checking the operation speed. In some machines this starting point is the cylinder beater cross-shaft; in others it is the primary counter shaft. Most combines are designed to operate at the proper speed when the speed control lever of the engine is in the maximum position. Adjustment is needed if the separator is not running at the proper speed with the control level in this position.

To determine the procedure for adjusting engine speed, the operator's manual should be used or adjustments should be made by a local dealer. A small deviation from the correct engine speed can affect the operation of the cleaning and separating units making it impossible to get soybeans clean and keep losses to a minimum.

Before taking the combine to the field, the cylinder speed, the cylinder-concave clearance, the sieve settings, and the speed and opening of the cleaning fan should be adjusted. If the operator's manual is followed closely in making these adjustments, only minor adjustments should have to be made in the field.

The cylinder and fan speed must be adjusted to fit threshing conditions. When the moisture content of the soybeans is above 13 percent, they are usually tough; so the cylinder speed may have to be increased to 600 rpm. As soybeans dry, lower the cylinder speed to reduce breakage; 450 to 550 rpm should be high enough for soybeans that are below 13 percent in moisture content.

Drying and Storing Soybeans

Drying soybeans has two principal advantages. Drying permits harvesting the grain as soon as it is ripe and mature to avoid field losses and it places the grain in a condition for safe storage reducing storage losses from heat damage and molds. Drying is the universal method of conditioning wet grain to preserve its quality and nutritive value for feed and food and its germination for seed.

Soybeans should be harvested promptly when they are mature to reduce field losses and lessen chances of damage from bad weather. However, at this stage soybeans contain too much moisture for safe storage. With adequate **drying methods**, soybeans can be harvested at a moisture content as high as 20 percent.

However, when drying from 20 percent to a safe moisture content, a large amount of water must be removed increasing the cost of the drying operation. High moisture grain loses this moisture rapidly in the field; thus, for maximum returns soybeans should be harvested when they have reached approximately 14 to 16 percent moisture content. The percent weight reduction when drying grain and soybeans can be easily estimated (see following).

Percent Reductions in Weight of Soybeans from Drying.

Original Moisture Content (%)	Final Moisture Content (%)					
	10	11	12	13	14	15
	---------- Weight Reduction (%) ----------					
16	6.7	5.6	4.5	3.4	2.3	1.2
17	7.8	6.7	5.7	4.6	3.5	2.3
18	8.9	7.9	6.9	5.8	4.7	3.6
19	10.1	9.0	8.0	6.9	5.8	4.7
20	11.0	10.1	9.0	8.1	7.0	5.8

For example, soybeans with an original moisture content of 16 percent dried to a final moisture content of 11 percent lose approximately 5.6 percent from the original weight. On 1,000 pounds of soybeans (original weight), the loss would be 56 pounds and the final dried weight, 944 pounds.

The recommended maximum moisture content for one year of safe storage of soybeans in Georgia is 11 percent in north Georgia and 10 percent below the fall line. Note that this is the maximum moisture content to be found anywhere in the storage bin and is not the average for all the beans in the bin.

The two principal factors involved in the safe storage of soybeans are moisture content and temperature. The amount of moisture in soybeans determines whether or not mold damage will occur. The higher the moisture and temperature, the faster mold growth and more rapid the spoilage of soybeans will occur. Insect damage is also less in dry, stored soybeans.

Low temperatures offset the effects of high moisture, particularly as it affects the development of molds and insects. Cooling is one of the greatest benefits gained from moving and turning soybeans in elevators. This can be accomplished more effectively by aeration which cools soybeans so that damp soybeans can be held in storage for weeks or even months.

In all practical soybean drying systems, air is used as a medium for removing moisture as it is evaporated. Evaporation of the moisture requires heat energy that is normally supplied by the air forced through the soybeans. When dry air is forced up through a deep layer of wet soybeans, drying starts at the bottom where the air first enters. As the flow of air continues, more of the soybeans begin to dry, so that a layer known as the "drying zone" is formed. The drying zone continues to move upward through the wet soybeans until it is passed through the surface layer.

Relative humidity of the drying air determines the moisture to which grain will dry. At a given temperature and relative humidity, there is a corresponding moisture content below which the grain will dry no more. This property of grains is referred to as the "equilibrium moisture content" (see table below).

Equilibrium Moisture Content

Air Temp. (˚F)	Relative Humidity (%)					
	20	**35**	**55**	**70**	**80**	**90**
	---------- Moisture Content (%) ----------					
40	6.3	8.5	11.0	13.5	15.5	19.5
60	5.8	8.0	10.0	12.0	14.0	17.5
80	4.5	7.0	9.0	11.0	13.0	15.8
100	4.0	6.0	8.2	10.3	12.2	14.5

The safe maximum temperature of the heated air for drying any grain is determined by the final use of the grain. For soybeans to be milled for oil and those to be used for food, the temperatures in heated-air batch driers should be limited to 130°F. Soybeans to be used for seed should not be exposed to air over 110°F.

For in-storage drying, temperatures of the drying air over 100°F are seldom encountered. However, the initial moisture content and the time of exposure of the wet grain to this higher temperature above the drying zone become important factors. The greater the moisture content of the soybeans, the greater the air flow required per bushel to dry it to a safe moisture content before mold attach can set in.

Stored soybeans should be **aerated** to keep them at a cool, uniform temperature. If stored in bins equipped for drying, all the soybeans can be cooled to a uniform temperature in about 10 to

15 hours. The soybeans should be cooled immediately after drying is completed and the cooling repeated every two months during the winter and once in the spring on a cool, dry day. After each cooling, all openings to the plenum under the floor should be closed and a tight cover put over the fan inlet to prevent any outside air circulating through the grain. The air can be forced up through the grain as in drying, provided condensation does not occur on the bin roof. It is not always necessary to pull the air through the grain as in aerating grain with smaller fans, in which case pulling is essential. The purpose of aeration is to keep the grain at a uniform cool temperature which prevents "top sweating" in the top layer of grain in the center of the bin.

Mechanical injury to soybean seed should be avoided as it is an important cause of decline in germination and vigor. Injury to soybean seed results primarily from impacts of the seed with hard surfaces or other seed. The extent and severity of mechanical damage are related to the moisture content of the seed, the velocity of the seed at the moment of impact, and the degree of hardness of the impacted surface. A single 10-foot drop of seed with less than 12 percent moisture against a metal surface can reduce germination by as much as 10 to 15 percent. Seeds with 14 percent or more moisture are relatively unaffected by impacts resulting from drops as high as 20 feet.

Soybeans for use other than seed are also affected by dropping into a bin if moisture content is too low. A certain amount of splitting will occur each time they are dropped. Soybeans should be handled as little and as gently as possible.

Safety

Good safety habits are a must for anyone who operates a modern combine or who is involved in soybean storage and hauling.

Always keep the combine clean because field trash around the exhaust system can cause fires. Before a combine is lubricated or adjusted or cleaned, all drives should be disengaged and the engine stopped.

Grain drying and handling can be dangerous. Transport augers can hit power lines, unguarded augers can catch hands or feet, and fans and shafts can catch unsuspecting victims. A deadly hazard exists for anyone in a grain bin as deaths occur every year from suffocation and injuries caused by unloading augers. Power to the unloading auger should be disconnected before entering bins. A knotted safety rope hanging near the center of the bin offers greater protection, and a second person who can offer assistance should be standing by. Air pockets sometimes form when grain bridges over unloading augers due to spoiled grain and moisture. This crusted surface should not be walked over because the pocket can collapse. Wear an effective dust mask when exposed to grain dust.

STEPS TO GROWING HIGH YIELD, HIGH QUALITY SOYBEANS IN GEORGIA

1) Rotate land so that soybeans and other legumes are planted (on the same site) no more often than once every two years. **If field has nematodes, plant an appropriate nematode resistant soybean variety.** Avoid deep sands or eroded clay soils.

2) Soil test. Lime and fertilize for soybeans according to test results. **Apply an inoculant specific for soybeans** if soybeans have not been grown on this land in the last three years. Make sure soybean inoculant is fresh. Check expiration date.

3) For Coastal Plain soils, use deep tillage (12"- 14") to get deep soybean rooting. For conservation tillage, use strip tillage and/or traffic control to reduce soil compaction.

4) Use good cultural practices.
    a. Plant between **May 10 and June 10.**
    b. Plant tall growing and/or late maturing varieties if planting after June 10.
    c. Plant in rows 10" to 36" wide.
    d. **Plant about 145,000 seed per acre (~10 seed per foot for 36" row spacing)**
    e. Plant seed 1.0" to 1.25" deep in moist soil.
    f. Plant when soil temperature 2" deep is between 70° and 90° F.
    g. If irrigating, apply water
        i. During vegetative growth, if leaf wilt occurs by mid-day.
        ii. During reproductive growth (R2-R5) to eliminate soil moisture stress and prevent wilting.

5) **Plant recommended varieties for your location and planting situation**. Plant varieties of different maturities to spread drought risks. Contact your local county extension agent or refer to the UGA Soybean Webpage for the most current list of recommended varieties

6) Control weeds.
    a. In reduced tillage production systems, do everything possible to obtain a weed-free seedbed at planting.
    b. Use preeemergence herbicides at planting.
    c. Apply postemergence herbicides when weeds are 2"– 4" tall.
    d. Be on the lookout for glyphosate and ALS-resistant Palmer amaranth.
    e. Refer to the Weed Control Section of this guide for more specific weed control information.

7) Control insects.
    a. Scout fields weekly to monitor insect populations.
    b. If in the Georgia Coastal Plain, apply preventative velvetbean caterpillar control treatment (Dimilin + boron) **at or after full flower (R2)**.
    c. Treat for stinkbugs, and other pod/foliage feeding insects as needed.
    d. Refer to the Insect Control Section of this guide for more specific insect control information.
8) Control Asian soybean rust and other foliage diseases.
    a. Scout fields bi-weekly prior to first-bloom and weekly at first-bloom and beyond to

monitor for leaf diseases (Asian soybean rust, frogeye leaf spot, etc.).

b. Pre-bloom, apply foliar fungicide if Asian soybean rust is detected in your fields or very close by. (View UGA soybean website for current rust status. Stay alert for local news.)
c. Post-bloom (R1-R6), apply foliar fungicide if Asian soybean rust is detected in your region or local area (e.g. in UGA/USDA sentinel plots). Specific choice of a fungicide will be determined in part by confirmed proximity of disease to a specific field. (See 2012 GA Soybean Production Guide for fungicide rec.)
d. Refer to the Disease Control Section of this guide for more specific disease control information.

9) Harvest soon after maturity to reduce seed shatter and maintain good seed quality.
    a. Adjust combine to match crop and field situation.
    b. Begin harvest soon after soybean seed have dried to 13% moisture or less.

Non-Irrigated Soybeans
South Georgia, 2013

Estimated Costs and Returns

Expected Yield: **30** bushel Your Yield _____

Variable Costs	Unit	Amount	$/Unit	Cost/Acre	$/bushel	Your Farm
Seed	bag	1	$ 50.00	$ 50.00	$ 1.67	
Inoculant	acre	1	$ 3.50	$ 3.50	$ 0.12	
Lime	ton	0.33	$ 42.00	$ 13.86	$ 0.46	
Fertilizer						
Phosphate	pounds	40	$ 0.55	$ 22.00	$ 0.73	
Potash	pounds	80	$ 0.50	$ 40.00	$ 1.33	
Boron	pounds	0.5	$ 5.25	$ 2.63	$ 0.09	
Weed Control *	acre	1	$ 30.10	$ 30.10	$ 1.00	
Insect Control	acre	1	$ 4.35	$ 4.35	$ 0.15	
Disease Control **	acre	1	$ -	$ -	$ -	
Preharvest Machinery						
Fuel	gallon	3.6	$ 3.75	$ 13.60	$ 0.45	
Repairs and Maintenance	acre	1	$ 7.45	$ 7.45	$ 0.25	
Harvest Machinery						
Fuel	gallon	2.4	$ 3.75	$ 8.93	$ 0.30	
Repairs and Maintenance	acre	1	$ 6.08	$ 6.08	$ 0.20	
Labor	hours	0.8	$ 12.00	$ 10.00	$ 0.33	
Crop Insurance	acre	1	$ 20.00	$ 20.00	$ 0.67	
Land Rent	acre	1	$ -	$ -	$ -	
Interest on Operating Capital	percent	$ 116.24	6.5%	$ 7.56	$ 0.25	
Total Variable Costs:				**$ 240.04**	**$ 8.00**	
Fixed Costs						
Machinery Depreciation, Taxes, Insurance and Housing						
Preharvest Machinery	acre	1	$ 21.14	$ 21.14	$ 0.70	
Harvest Machinery	acre	1	$ 29.28	$ 29.28	$ 0.98	
General Overhead	% of VC	$ 240.04	5%	$ 12.00	$ 0.40	
Management	% of VC	$ 240.04	5%	$ 12.00	$ 0.40	
Owned Land Cost, Taxes, Cash Payment, etc.	acre	1	$ -	$ -	$ -	
Other _____	acre	1	$ -	$ -	$ -	
Total Fixed Costs				**$ 74.43**	**$ 2.48**	
Total Costs Excluding Land				**$ 314.47**	**$ 10.48**	
Your Profit Goal			**$**	_____	**/bushel**	
Price Needed for Profit			**$**		**/bushel**	

* In the case of Liberty Link Soybeans, add $4/ac for additional herbicide cost.
** In the case of Asian Soybean Rust or other disease, add $15-$30 for additional fungicide sprays.

Developed by Nathan Smith and Amanda Smith. Data may be modified by the user to more closely reflect their operation. UGA estimates are available online at http://www.ces.uga.edu/Agriculture/agecon/agecon.html.

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Sensitivity Analysis of Non-Irrigated Soybeans

Net Returns Above Variable Costs Per Acre

Varying Prices and Yields (bushel)

Price \ bushel/Acre	-25% 23	-10% 27	Expected 30	+10% 33	+25% 38
$9.00	**-$37.54**	**$2.96**	**$29.96**	**$56.96**	**$97.46**
$10.00	**-$15.04**	**$29.96**	**$59.96**	**$89.96**	**$134.96**
$11.00	**$7.46**	**$56.96**	**$89.96**	**$122.96**	**$172.46**
$12.00	**$29.96**	**$83.96**	**$119.96**	**$155.96**	**$209.96**
$13.00	**$52.46**	**$110.96**	**$149.96**	**$188.96**	**$247.46**

Estimated Labor and Machinery Costs per Acre

Preharvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use*** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
Heavy Disk 27' with Tractor (180-199 hp) MFWD 190	13.2	1	0.09	0.74	$ 1.67	$ 4.86
Disk Harrow 32' with Tractor (180-199 hp) MFWD 190	16.3	1	0.08	0.60	$ 1.48	$ 4.29
Bed-Disk (Hipper) 6R-36 with Tractor (180-199 hp) MFWD 190	9.6	1	0.13	1.02	$ 1.46	$ 4.51
Plant - Rigid 6R-36 with Tractor (120-139 hp) 2WD 130	9.5	1	0.13	0.70	$ 1.75	$ 4.90
Spray (Broadcast) 60' with Tractor (120-139 hp) 2WD 130	35.5	3	0.11	0.57	$ 1.08	$ 2.58
Total Preharvest Values			0.54	3.63	$ 7.45	$ 21.14

Harvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use*** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
Header -Soybean 18' Flex with Combine (200-249 hp) 240 hp	7.0	1	0.18	1.75	$ 4.80	$ 25.82
Grain Cart Corn 500 bu with Tractor (120-139 hp) 2WD 130	10.6	1	0.12	0.63	$ 1.28	$ 3.46
Total Harvest Values			0.29	2.38	$ 6.08	$ 29.28

*** Includes unallocated labor factor of 0.25. Unallocated labor factor is percentage allowance for additional labor required to move equipment and hook/unhook implements, etc.

Developed by Nathan Smith and Amanda Smith. Data may be modified by the user to more closely reflect their operation. UGA estimates are available online at http://www.ces.uga.edu/Agriculture/agecon/agecon.html.

Non-Irrigated Soybeans, Strip Tillage
South Georgia, 2013

Estimated Costs and Returns

Expected Yield: **30** bushel Your Yield _____

Variable Costs	Unit	Amount	$/Unit	Cost/Acre	$/bushel	Your Farm
Cover Crop Seed	bushel	1.5	$ 15.00	$ 22.50	$ 0.75	
Seed	bag	1	$ 50.00	$ 50.00	$ 1.67	
Inoculant	acre	1	$ 3.50	$ 3.50	$ 0.12	
Lime	ton	0.33	$ 42.00	$ 13.86	$ 0.46	
Fertilizer						
Phosphate	pounds	40	$ 0.55	$ 22.00	$ 0.73	
Potash	pounds	80	$ 0.50	$ 40.00	$ 1.33	
Boron	pounds	0.5	$ 5.25	$ 2.63	$ 0.09	
Weed Control *	acre	1	$ 44.41	$ 44.41	$ 1.48	
Insect Control	acre	1	$ 4.35	$ 4.35	$ 0.15	
Disease Control **	acre	1	$ -	$ -	$ -	
Preharvest Machinery ***						
Fuel	gallon	3.1	$ 3.75	$ 11.47	$ 0.38	
Repairs and Maintenance	acre	1	$ 6.54	$ 6.54	$ 0.22	
Harvest Machinery						
Fuel	gallon	2.4	$ 3.75	$ 8.93	$ 0.30	
Repairs and Maintenance	acre	1	$ 6.08	$ 6.08	$ 0.20	
Labor	hours	0.7	$ 12.00	$ 8.97	$ 0.30	
Crop Insurance	acre	1	$ 20.00	$ 20.00	$ 0.67	
Land Rent	acre	1	$ -	$ -	$ -	
Interest on Operating Capital	percent	$ 121.37	6.5%	$ 7.89	$ 0.26	
Total Variable Costs:				**$ 273.13**	**$ 9.10**	
Fixed Costs						
Machinery Depreciation, Taxes, Insurance and Housing						
Preharvest Machinery ***	acre	1	$ 18.47	$ 18.47	$ 0.62	
Harvest Machinery	acre	1	$ 29.28	$ 29.28	$ 0.98	
General Overhead	% of VC	$ 273.13	5%	$ 13.66	$ 0.46	
Management	% of VC	$ 273.13	5%	$ 13.66	$ 0.46	
Owned Land Cost, Taxes, Cash Payment, etc.	acre	1	$ -	$ -	$ -	
Other _____	acre	1	$ -	$ -	$ -	
Total Fixed Costs				**$ 75.06**	**$ 2.50**	
Total Costs Excluding Land				**$ 348.19**	**$ 11.61**	
Your Profit Goal			**$** _____		**/bushel**	
Price Needed for Profit			**$**		**/bushel**	

* In the case of Liberty Link Soybeans, add $4/ac for additional herbicide cost.
** In the case of Asian Soybean Rust or other disease, add $15-$30 for additional fungicide sprays.

*** Rip, strip and plant in one pass. Performing rip, strip and plant as separate operations increases preharvest fuel use by 0.6 gal ($2.13/ac), labor costs by $0.77/ac, and repairs by $0.80/ac. Fixed costs would increase by $2.30/ac.

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Sensitivity Analysis of Non-Irrigated Soybeans, Strip Tillage

Net Returns Above Variable Costs Per Acre

Varying Prices and Yields (bushel)

Price \ bushel/Acre	-25% 23	-10% 27	Expected 30	+10% 33	+25% 38
$9.00	**-$70.63**	**-$30.13**	**-$3.13**	**$23.87**	**$64.37**
$10.00	**-$48.13**	**-$3.13**	**$26.87**	**$56.87**	**$101.87**
$11.00	**-$25.63**	**$23.87**	**$56.87**	**$89.87**	**$139.37**
$12.00	**-$3.13**	**$50.87**	**$86.87**	**$122.87**	**$176.87**
$13.00	**$19.37**	**$77.87**	**$116.87**	**$155.87**	**$214.37**

Estimated Labor and Machinery Costs per Acre

Preharvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use**** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
Spin Spreader 5 ton with Tractor (120-139 hp) 2WD 130	23.8	1	0.05	0.28	$ 0.59	$ 1.67
Disk Harrow 32' with Tractor (180-199 hp) MFWD 190	16.3	1	0.08	0.60	$ 1.48	$ 4.29
Spray (Broadcast) 60' with Tractor (120-139 hp) 2WD 130	35.5	1	0.04	0.19	$ 0.36	$ 0.86
ST Plant Rigid 6R-36 with Tractor (180-199 hp) MFWD 190	6.9	1	0.18	1.42	$ 3.03	$ 9.07
Spray (Broadcast) 60' with Tractor (120-139 hp) 2WD 130	35.5	3	0.11	0.57	$ 1.08	$ 2.58
Total Preharvest Values			0.45	3.06	$ 6.54	$ 18.47

Harvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use**** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
Header -Soybean 18' Flex with Combine (200-249 hp) 240 hp	7.0	1	0.18	1.75	$ 4.80	$ 25.82
Grain Cart Corn 500 bu with Tractor (120-139 hp) 2WD 130	10.6	1	0.12	0.63	$ 1.28	$ 3.46
Total Harvest Values			0.29	2.38	$ 6.08	$ 29.28

**** Includes unallocated labor factor of 0.25. Unallocated labor factor is percentage allowance for additional labor required to move equipment and hook/unhook implements, etc.

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Irrigated Soybeans
South Georgia, 2013

Estimated Costs and Returns

Expected Yield: **60** bushel Your Yield _____

Variable Costs	Unit	Amount	$/Unit	Cost/Acre	$/bushel	Your Farm
Seed	bag	1	$ 50.00	$ 50.00	$ 0.83	
Inoculant	acre	1	$ 3.50	$ 3.50	$ 0.06	
Lime	ton	0.33	$ 42.00	$ 13.86	$ 0.23	
Fertilizer						
Phosphate	pounds	40	$ 0.55	$ 22.00	$ 0.37	
Potash	pounds	80	$ 0.50	$ 40.00	$ 0.67	
Boron	pounds	0.5	$ 5.25	$ 2.63	$ 0.04	
Weed Control *	acre	1	$ 44.41	$ 44.41	$ 0.74	
Insect Control	acre	1	$ 4.35	$ 4.35	$ 0.07	
Disease Control **	acre	1	$ 28.80	$ 28.80	$ 0.48	
Preharvest Machinery						
Fuel	gallon	3.6	$ 3.75	$ 13.60	$ 0.23	
Repairs and Maintenance	acre	1	$ 7.45	$ 7.45	$ 0.12	
Harvest Machinery						
Fuel	gallon	2.4	$ 3.75	$ 8.93	$ 0.15	
Repairs and Maintenance	acre	1	$ 6.08	$ 6.08	$ 0.10	
Labor	hours	0.8	$ 12.00	$ 10.00	$ 0.17	
Irrigation***	applications	5	$ 12.13	$ 60.63	$ 1.01	
Crop Insurance	acre	1	$ 15.00	$ 15.00	$ 0.25	
Land Rent	acre	1	$ -	$ -	$ -	
Interest on Operating Capital	percent	$ 165.61	6.5%	$ 10.76	$ 0.18	
Total Variable Costs:				**$ 341.99**	**$ 5.70**	
Fixed Costs						
Machinery Depreciation, Taxes, Insurance and Housing						
Preharvest Machinery	acre	1	$ 21.14	$ 21.14	$ 0.35	
Harvest Machinery	acre	1	$ 29.28	$ 29.28	$ 0.49	
Irrigation	acre	1	$ 125.00	$ 125.00	$ 2.08	
General Overhead	% of VC	$ 341.99	5%	$ 17.10	$ 0.28	
Management	% of VC	$ 341.99	5%	$ 17.10	$ 0.28	
Owned Land Cost, Taxes, Cash Payment, etc.	acre	1	$ -	$ -	$ -	
Other _____	acre	1	$ -	$ -	$ -	
Total Fixed Costs				**$ 209.62**	**$ 3.49**	
Total Costs Excluding Land				**$ 551.61**	**$ 9.19**	
Your Profit Goal				**$ _____**	**/bushel**	
Price Needed for Profit				**$**	**/bushel**	

* In the case of Liberty Link Soybeans, add $4/ac for additional herbicide cost.
** In the case of Asian Soybean Rust or other disease, add $15-$30 for additional fungicide sprays.

*** Average of diesel and electric irrigation application costs. Electric is estimated at $7/appl and diesel is estimated at $17.25/appl when diesel costs $3.75/gal.

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Sensitivity Analysis of Irrigated Soybeans

Net Returns Above Variable Costs Per Acre

Varying Prices and Yields (bushel)

Price \ bushel/Acre	-25% 45	-10% 54	Expected 60	+10% 66	+25% 75
$9.00	**$63.01**	**$144.01**	**$198.01**	**$252.01**	**$333.01**
$10.00	**$108.01**	**$198.01**	**$258.01**	**$318.01**	**$408.01**
$11.00	**$153.01**	**$252.01**	**$318.01**	**$384.01**	**$483.01**
$12.00	**$198.01**	**$306.01**	**$378.01**	**$450.01**	**$558.01**
$13.00	**$243.01**	**$360.01**	**$438.01**	**$516.01**	**$633.01**

Estimated Labor and Machinery Costs per Acre

Preharvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use**** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
Heavy Disk 27' with Tractor (180-199 hp) MFWD 190	13.2	1	0.09	0.74	$ 1.67	$ 4.86
Disk Harrow 32' with Tractor (180-199 hp) MFWD 190	16.3	1	0.08	0.60	$ 1.48	$ 4.29
Bed-Disk (Hipper) 6R-36 with Tractor (180-199 hp) MFWD 190	9.6	1	0.13	1.02	$ 1.46	$ 4.51
Plant - Rigid 6R-36 with Tractor (120-139 hp) 2WD 130	9.5	1	0.13	0.70	$ 1.75	$ 4.90
Spray (Broadcast) 60' with Tractor (120-139 hp) 2WD 130	35.5	3	0.11	0.57	$ 1.08	$ 2.58
Total Preharvest Values			0.54	3.63	$ 7.45	$ 21.14

Harvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use**** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
Header -Soybean 18' Flex with Combine (200-249 hp) 240 hp	7.0	1	0.18	1.75	$ 4.80	$ 25.82
Grain Cart Corn 500 bu with Tractor (120-139 hp) 2WD 130	10.6	1	0.12	0.63	$ 1.28	$ 3.46
Total Harvest Values			0.29	2.38	$ 6.08	$ 29.28

**** Includes unallocated labor factor of 0.25. Unallocated labor factor is percentage allowance for additional labor required to move equipment and hook/unhook implements, etc.

Developed by Nathan Smith and Amanda Smith. Data may be modified by the user to more closely reflect their operation. UGA estimates are available online at http://www.ces.uga.edu/Agriculture/agecon/agecon.html.

Irrigated Soybeans, Strip Tillage
South Georgia, 2013

Estimated Costs and Returns

Expected Yield: **60** bushel Your Yield _____

Variable Costs	Unit	Amount	$/Unit	Cost/Acre	$/bushel	Your Farm
Cover Crop Seed	bushel	1.5	$ 15.00	$ 22.50	$ 0.38	
Seed	bag	1	$ 50.00	$ 50.00	$ 0.83	
Inoculant	acre	1	$ 3.50	$ 3.50	$ 0.06	
Lime	ton	0.33	$ 42.00	$ 13.86	$ 0.23	
Fertilizer						
Phosphate	pounds	40	$ 0.55	$ 22.00	$ 0.37	
Potash	pounds	80	$ 0.50	$ 40.00	$ 0.67	
Boron	pounds	0.5	$ 5.25	$ 2.63	$ 0.04	
Weed Control *	acre	1	$ 44.41	$ 44.41	$ 0.74	
Insect Control	acre	1	$ 4.35	$ 4.35	$ 0.07	
Disease Control **	acre	1	$ 28.80	$ 28.80	$ 0.48	
Preharvest Machinery ***						
Fuel	gallon	3.1	$ 3.75	$ 11.47	$ 0.19	
Repairs and Maintenance	acre	1	$ 6.54	$ 6.54	$ 0.11	
Harvest Machinery						
Fuel	gallon	2.4	$ 3.75	$ 8.93	$ 0.15	
Repairs and Maintenance	acre	1	$ 6.08	$ 6.08	$ 0.10	
Labor	hours	0.7	$ 12.00	$ 8.97	$ 0.15	
Irrigation****	applications	4	$ 12.13	$ 48.50	$ 0.81	
Crop Insurance	acre	1	$ 15.00	$ 15.00	$ 0.25	
Land Rent	acre	1	$ -	$ -	$ -	
Interest on Operating Capital	percent	$ 157.52	6.5%	$ 10.24	$ 0.17	
Total Variable Costs:				**$ 347.78**	**$ 5.80**	

Fixed Costs						
Machinery Depreciation, Taxes, Insurance and Housing						
Preharvest Machinery ***	acre	1	$ 18.47	$ 18.47	$ 0.31	
Harvest Machinery	acre	1	$ 29.28	$ 29.28	$ 0.49	
Irrigation	acre	1	$ 125.00	$ 125.00	$ 2.08	
General Overhead	% of VC	$ 347.78	5%	$ 17.39	$ 0.29	
Management	% of VC	$ 347.78	5%	$ 17.39	$ 0.29	
Owned Land Cost, Taxes, Cash Payment, etc.	acre	1	$ -	$ -	$ -	
Other _____	acre	1	$ -	$ -	$ -	
Total Fixed Costs				**$ 207.53**	**$ 3.46**	

Total Costs Excluding Land		**$ 555.30**	**$ 9.26**
Your Profit Goal	**$** _____		**/bushel**
Price Needed for Profit	**$**		**/bushel**

* In the case of Liberty Link Soybeans, add $4/ac for additional herbicide cost.

** In the case of Asian Soybean Rust or other disease, add $15-$30 for additional fungicide sprays.

*** Rip, strip and plant in one pass. Performing rip, strip and plant as separate operations increases preharvest fuel use by 0.6 gal ($2.13/ac), labor costs by $0.77/ac, and repairs by $0.80/ac. Fixed costs would increase by $2.30/ac.

**** Average of diesel and electric irrigation application costs. Electric is estimated at $7/appl and diesel is estimated at $17.25/appl when diesel costs $3.75/gal.

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THE UNIVERSITY OF GEORGIA
COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES

Sensitivity Analysis of Irrigated Soybeans, Strip Tillage

Net Returns Above Variable Costs Per Acre

Varying Prices and Yields (bushel)

Price \ bushel/Acre	-25% 45	-10% 54	Expected 60	+10% 66	+25% 75
$9.00	**$57.22**	**$138.22**	**$192.22**	**$246.22**	**$327.22**
$10.00	**$102.22**	**$192.22**	**$252.22**	**$312.22**	**$402.22**
$11.00	**$147.22**	**$246.22**	**$312.22**	**$378.22**	**$477.22**
$12.00	**$192.22**	**$300.22**	**$372.22**	**$444.22**	**$552.22**
$13.00	**$237.22**	**$354.22**	**$432.22**	**$510.22**	**$627.22**

Estimated Labor and Machinery Costs per Acre

Preharvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use***** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
Spin Spreader 5 ton with Tractor (120-139 hp) 2WD 130	23.8	1	0.05	0.28	$ 0.59	$ 1.67
Disk Harrow 32' with Tractor (180-199 hp) MFWD 190	16.3	1	0.08	0.60	$ 1.48	$ 4.29
Spray (Broadcast) 60' with Tractor (120-139 hp) 2WD 130	35.5	1	0.04	0.19	$ 0.36	$ 0.86
ST Plant Rigid 6R-36 with Tractor (180-199 hp) MFWD 190	6.9	1	0.18	1.42	$ 3.03	$ 9.07
Spray (Broadcast) 60' with Tractor (120-139 hp) 2WD 130	35.5	3	0.11	0.57	$ 1.08	$ 2.58
Total Preharvest Values			0.45	3.06	$ 6.54	$ 18.47

Harvest Operations

Operation	Acres/Hour	Number of Times Over	Labor Use***** (hrs/ac)	Fuel Use (gal/ac)	Repairs ($/ac)	Fixed Costs ($/ac)
Header -Soybean 18' Flex with Combine (200-249 hp) 240 hp	7.0	1	0.18	1.75	$ 4.80	$ 25.82
Grain Cart Corn 500 bu with Tractor (120-139 hp) 2WD 130	10.6	1	0.12	0.63	$ 1.28	$ 3.46
Total Harvest Values			0.29	2.38	$ 6.08	$ 29.28

***** Includes unallocated labor factor of 0.25. Unallocated labor factor is percentage allowance for additional labor required to move equipment and hook/unhook implements, etc.

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ATTENTION!
PESTICIDE PRECAUTIONS

1. Observe all directions, restrictions and precautions on pesticide labels. It is dangerous, wasteful and illegal to do otherwise.

2. Store all pesticides in original containers with labels intact and behind locked doors. "**KEEP PESTICIDES OUT OF THE REACH OF CHILDREN**."

3. Use pesticides at correct label dosage and intervals to avoid illegal residues or injury to plants and animals.

4. Apply pesticides carefully to avoid drift or contamination of non-target areas.

5. Surplus pesticides and containers should be disposed of in accordance with label instructions so that contamination of water and other hazards will not result.

6. Follow directions on the pesticide label regarding restrictions as required by State or Federal Laws and Regulations.

7. Avoid any action that may threaten an Endangered Species or its habitat. Your county Extension agent can inform you of Endangered Species in your area, help you identify them, and through the Fish and Wildlife Service Field Office identify actions that may threaten Endangered Species or their habitat.

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J. Scott Angle, Dean and Director
The University of Georgia College of Agricultural and Environmental Sciences