March 2008

Mississippi State University Extension Service

Agronomy Notes

Inside this issue:

Cotton

by Dr. Darrin Dodds

Weed Resistance - I wrote briefly about this in last months Agronomy Notes; however, it is a subject that demands our attention. The Roundup Ready system has truly revolutionized Cotton weed control. Coincidentally, some of the benefits of this system have also led to the problems we have today with resistance. The reliance on glyphosate alone for burndown and early season weed control has placed incredible selection pressure on weed species in regards to resistance. As a result, horseweed and Italian ryegrass have been documented as being resistant to glyphosate in Mississippi. Our neighbors in Arkansas are dealing with glyphosate-resistant horseweed, Palmer amaranth, and common ragweed; Tennessee also has glyphosate-resistant horseweed and Palmer amaranth in addition to glyphosate-resistant giant ragweed. Currently, we in Mississippi do not have documented resistance to glyphosate in Palmer amaranth; however, experiments are currently underway examining populations of this weed. Early examinations of populations collected from the north Delta indicate that there may be a problem with glyphosate-resistance in this weed.

Palmer Amaranth - If you have been reading the Delta Farm Press or examining news reports from other media outlets in agriculture, you have probably heard of Palmer amaranth. Glyphosate resistance in this weed first appeared in Georgia and has spread to Tennessee and Arkansas with suspected populations in North and South Carolina as well as Louisiana. In addition to glyphosate-resistance, Palmer amaranth can be problematic due to several factors including: prolific seed production, production of a deep root system, high water use efficiency, allelopathic potential, and rapid growth. Estimates of seed production from a single Palmer amaranth plant range from 200,000 to 600,000 seeds with an average of 400,000 seeds produced per plant. If 10 plants are present in a field and they go to seed, you can expect somewhere in the neighborhood of 4,000,000 seeds to be returned to the soil seedbank. The combination of a deep root system and high water use efficiency translate into a plant that can survive during very harsh environmental conditions and still produce an enormous amount of seed. Research has shown that chemicals exudated from the roots of Palmer amaranth can damage several vegetable species, I suspect that these allelochemicals may also damage some crop plants although there is no documented research on this topic. Several researchers and extension specialists with Mississippi State University have observed the rapid growth habit of this plant. We have observed plants that double in size in a two day period. This dramatic increase in size can make this weed very difficult if not impossible to control by the time a herbicide application is made.

Herbicide Resistance Management - We have been dealing with glyphosate-resistant horseweed for several years and have been successful in developing herbicide programs for control of this species. Additionally, we have been dealing with glyphosate-resistant Italian ryegrass for several growing seasons and we are getting a better understanding of what is needed for control of this species. The looming threat of glyphosate-resistant Palmer amaranth cannot be overstated enough. The characteristics of this plant coupled with glyphosate-resistance have the potential to alter weed control practices in cotton. Additionally, Palmer amaranth in several states also has resistance to ALS chemistry which includes the herbicides Envoke and Staple in Cotton. Begin utilizing residual herbicides now before this problem explodes. If you suspect glyphosate-resistance in Palmer amaranth, or any weed, please contact myself or any MSU Weed Scientist or Extension Specialist.

Corn
by Dr. Erick Larson

Continuous corn expectations and management - The production benefits associated with crop rotation generally diminish every year after the first year in a rotation system. Additional yield, soil improvements, weed control, and reniform nematode benefits are sometimes realized by two consecutive years of corn, particularly if the field has been continuously cropped for a long time. However, yields will gradually decline and pest problems substantially arise the longer corn is grown continuously. Continuous corn cropping substantially increases the likelihood of disease infection and weed competition which will cut yield level or increase management expenses. Thus, I normally do not suggest growing corn in the same field for more than two consecutive years. If you chose to plant continuous corn, my primary suggestion is to select hybrids with resistance to foliar diseases which survive on corn residue. Northern corn leaf blight did reduce yield of susceptible corn hybrids planted in Mississippi fields following corn in 2004.

Planting Pitfalls – Early planting is a well-known component of successful corn production, since environmental stress normally increases during the summer, reducing yield potential of late-planted corn. However, rushing the process often instigates problems that overwhelm the benefits of early planting. Southern growers often hurry to get their crop planted, because rainfall restricts days suitable for fieldwork during prime planting time. This may cause several major problems which can substantially reduce corn yield potential.

Stand uniformity – Root systems and uniform stands are the foundation of “plant health” and high corn yields. Both healthy root systems and plants are directly affected by planter performance. Variable plant spacing and plant emergence are common stand problems that can affect corn yield potential as much, or more than actual plant population. Corn plants are extremely sensitive to variable plant spacing because they do not tiller or produce branches to adjust their plant size, and only produce one fruit-bearing organ per plant, unlike most other crops. Crowded plants produce small, often poorly filled ears and spindly stalks due to intense competition for light, water and nutrients with adjacent plants. Late-emerging corn plants experience a permanent developmental disparity which reduces yield potential of the whole field, because these runts steal resources from their healthy neighbors. Planter meter system tune-up and proper calibration can certainly improve planter performance, but performance also depends a lot upon operator input in the field. I believe the most prevalent cause of seed distribution problems is excessive planter speed. Francis Childs, multiple-time NCGA corn yield contest winner and world record holder (442 bu./a.) plants his corn at 2-4 mph. The standard maximum planter speed for corn is 5.0 mph or less. Speeds exceeding these values will usually cause much poorer seed spacing, increased double-drops, and less seed depth uniformity because seeds may roll and/or bounce in the seed furrow. These factors reduce yield potential by increasing plant competition for available resources or by causing permanent physiological disparity.

Avoid Planting Wet Soils – Rainy springs not only encourage growers to plant quickly, but also tempt them to plant marginally wet fields, particularly when planting intentions are high. This often causes severe corn root development problems. Seed furrow openers will compact soil around the seed trench when planting into excessively moist soil. The soil shrinks when it dries, particularly in clay soils, causing the seed furrow to open and expose the nodal roots - just like shallow planting. These hard, compacted seed furrow walls also prohibit nodal root penetration, causing rootless corn syndrome, poor nutrient and water uptake and exacerbate root lodging at maturity. I believe that dry conditions last spring, promoted much better root growth than normal and was one of the primary factors contributing to the outstanding corn grain yields produced in 2007.

Figure 1. Corn yields are influenced more by planting performance than any other Mississippi row crop.

Planting depth - Many “new” corn producers may plant corn the same depth as soybeans or even cotton. This can produce substantial seasonal root development problems. Corn seed should normally be planted 1 ½ - 2 inches deep. Planting depth should be set in the field during planting. This is important because soil type, seedbed condition and soil moisture will influence optimal seeding depth. Corn seed’s inherent energy and germination process ensure emergence from a 3-inch depth or more. However, the initiation point of the nodal root system (near the crown of the stem) is moved upward when corn seed is not planted deep enough. Corn seed placed less than 1-inch deep will develop nodal roots near or even above the soil surface. This potentially exposes these roots to factors such as hot, dry soil, herbicide injury, and insect predation which can significant impede root development. This often leads to standability problems, nutrient deficiencies and even drought stress throughout the year. Birds may also cause stand loss by extracting shallow planted corn seeds or entire, small plants.

Corn and Wheat continued...

by Dr. Erick Larson

Starter fertilizer – Many corn growers use starter fertilizer to supplement their corn fertility. Starter fertilizer promotes earlier maturity, enhances plant vigor, and often improves grain yield, especially in minimum or no-tillage systems. Starter fertilizer works by providing a concentrated phosphorus supply directly in the root zone of young plants. Phosphorus placement is very important to young plants with small root systems because phosphorus doesn't move in the soil. Even though nitrogen is an important part of starter fertilizer, it can move in the soil. That's why nitrogen placement is not as important to corn uptake, especially since corn has a fibrous root system with lots of lateral growth. Thus, nitrogen fertilizers alone are not very valuable as starter fertilizers. The most commonly used source of starter fertilizer is ammonium polyphosphate (10-34-0 or 11-37-0). Many brands of orthophosphate fertilizers are readily available. But they are much more expensive, have lower nutrient analyses, and routinely show no yield difference compared to polyphosphate fertilizers in field trials. When you apply starter fertilizer in the seed furrow, use no more than 4 gallons of ammonium polyphosphate per acre in 38 to 40-inch rows or 5 gallons per acre in 30-inch rows. Otherwise, you may cause salting injury to seedlings. Corn Belt growers often use coulter rigs that band starter fertilizer to the side and below the seed. These systems are efficient, safe for the plant, and effective.

Figure 2. Starter fertilizer often enhances early corn vigor.

Zinc application – Corn is a sensitive crop to zinc availability, particularly at high production levels. Like phosphorus, zinc is relatively immobile in soils. Therefore, if you desire to apply zinc in a band, it is best to apply it near the row in a starter fertilizer. Conversely, zinc will not be utilized very well when sidedressed with nitrogen fertilizer. Broadcast zinc should be incorporated into the soil with tillage prior to planting.

Early nitrogen application – Because Mississippi springs are often very wet, we suggest you apply nitrogen fertilizer at different times according to crop need. This split application method reduces the likelihood of considerable nitrogen loss due to wet weather before crop use. Corn uses less than 10 percent of its nitrogen before rapid vegetative growth begins. This growth spurt usually happens in late April through mid-May, depending on planting date and seasonal temperatures. You can use nitrogen more efficiently if you apply only a small portion of nitrogen just after plants emerge. Add the bulk of your nitrogen fertilizer just before the growth spurt, when the plants need it most. Our standard nitrogen recommendation is to apply no more than one-third of the total nitrogen near planting/crop emergence. Apply the remaining nitrogen about 30 days later. Corn should be higher than 12 inches or at V6 growth stage by the second application. Early fertilization can waste a lot of nitrogen, especially if there's a long period of wet weather before rapid corn growth begins. Nitrogen loss because of saturated soil happens mostly through denitrification, particularly in heavy, clay soils. Denitrification happens when microorganisms turn nitrate nitrogen into nitrogen gas. These gases then escape into the air. Warm soil temperatures speed up this process. Research indicates denitrification rates range from 2 to 3 percent per day at soil temperatures from 55 to 65 ˚F. Denitrification rates increase to about 5 percent per day when soil temperatures are warmer.

Wheat Topdressing – Wheat nitrogen topdressing should be completed soon. Proper nitrogen topdress timing should generally be based upon wheat growth stage and plant health, rather than the calendar. Wet soils and frequent rains have made for less than ideal application conditions this spring, but this is precisely why we strongly prefer split applications of nitrogen fertilizer for wheat production in Mississippi. Split application minimizes exposure of substantial amount nitrogen to unfavorable conditions. Delaying all nitrogen application indefinitely due to inclimate weather will greatly reduce yield potential by depriving plants of adequate nutrition. In other words, wheat's biological clock does not stop running because fertilizer application is late. The second nitrogen application of a split application method should usually occur just prior to rapid vegetative growth and deliver the majority of the crop's nutritional needs. This timing should generally be just prior to stem elongation (Feekes growth stages 5-6) when rapid upright growth and nitrogen uptake begins. If aerial application is possible and you choose to make a third split application, it should be applied during rapid stem elongation stages, well prior to heading. Nitrogen application at heading is generally too late to enhance grain yield. As temperatures warm and evaporation rates increase as the spring progresses, the general need for urease inhibitors, such as Agrotain, on urea fertilizers increases.

Corn continued...
by Dr. Erick Larson

Seeding Rate Suggestions – Corn growers should strive for a goal of 24,000 to 32,000 plants per acre. Seeding rates should exceed the desired plant population about 5 to 10% depending upon planting conditions, seedbed preparation, and seed germination. The desired plant population may vary depending upon a field's yield potential, planter row width and planting date. If a corn yield goal of 200 bushels or more per acre (50 bu./a. soybeans or 2 bale cotton) is realistic, particularly under irrigation, then strive for 28,000-32,000 plants/acre. If this goal is unrealistic, then lower the seeding rate accordingly - do not generally exceed 28,000 plants/acre in dryland culture. Also, different row widths alter optimum plant population because it ultimately affects plant spacing. Close plant spacing increases competition for light, water and nutrients, which weakens stalk quality without increasing yield potential, particularly under stress. Thus, optimum plant population in wide rows is generally around 2,000 - 4,000 plants/acre less than narrow rows. Twin wide rows should be planted at rates similar to 30-inch rows. Ultra-early planted corn (soil temperature 50-55 degrees F) should be seeded about 10% thicker than normal because cool spring conditions usually promote higher seedling mortality and smaller plants with less leaf area at tassel, meaning more plants are needed to intercept available light. Conversely, growers should reduce seeding rate at later planting dates since warm temperatures enhance seedling establishment and produce taller, leafier plants, but are more likely to expose the crop to late-season drought stress, decreasing grain yield potential. Please refer to the following tables for specific seeding rate suggestions.

Table 1. Irrigated corn seeding rate recommendations.

	Planter Row Width			Final Stand	
	30-inch	38-inch	40-inch		
Seeding	**Seed Spacing (inches)**			@10%	@5%
24000	8.7	6.9	6.5	21600	22800
26000	8.0	6.3	6.0	23400	24700
28000	7.5	5.9	5.6	25200	26600
30000	7.0	5.5	5.2	27000	28500
32000	6.5	5.2	4.9	28800	30400
34000	6.1	4.9	4.6	30600	32300
36000	5.8	4.6	4.4	32400	34200

Suggestions dependent upon relative planting date:

Ultra-early planting dates

Optimum planting dates

Late planting dates

Table 2. Dryland corn seeding rate recommendations.

	Planter Row Width			Final Stand	
	30-inch	38-inch	40-inch		
Seeding Rate	**Seed Spacing (inches)**			@10% loss	@5% loss
24000	8.7	6.9	6.5	21600	22800
26000	8.0	6.3	6.0	23400	24700
28000	7.5	5.9	5.6	25200	26600
30000	7.0	5.5	5.2	27000	28500
32000	6.5	5.2	4.9	28800	30400
34000	6.1	4.9	4.6	30600	32300
36000	5.8	4.6	4.4	32400	34200

Suggestions dependent upon relative planting date:

Ultra-early planting dates

Optimum planting dates

Late planting dates

Forages
by Dr. Rocky Lemus

Increasing fertilizer prices and the need for strategies that will maintain productivity is a major issue among livestock producers throughout the state. Fertilizing pastures is different from fertilizing hay because most of the nutrients can be recycled into the system. Pasture fertilization should be carefully controlled by considering the individual goals of the producer. I Necessity dictates the following questions in the determination of a fertility program: 1) How much production is needed for the animals; 2) What time of the year is the forage needed most?; 3) What species are present?; and 4) What are my management strategies?. These questions will allow a producer to increase fertilizer efficiency and reduce cost.

Soil Testing

Fertilizer is one of the major annual maintenance costs associated with the productivity of an established pasture. Soil testing is one of the most valuable tools for understanding pasture fertilization and recommendations are tailored to the type of forage being grown. However, less than 10% of the pastures in Mississippi are soil tested. Nitrogen, phosphorous, potassium, and lime constitute a real cash cost for forage producers. Therefore, many producers do not test soil and fertilize their soils regularly to avoid this expense. Soil testing should be considered an investment instead of an expense with today's fertilizer prices. Pasture land should be soil tested every 2 – 3 years. Before any nutrient application, it is necessary to know what soil pH is desirable for the species that are present. At the same time, soil pH has a large effect in nutrient availability and nutrient uptake (**Table 1**).

Alternative Fertilizer Options

Poultry Litter – Producers have expressed great interest in using poultry litter. Not all of the nutrients in poultry litter are immediately available for plants to use. Most of the nitrogen in poultry litter is in an organic form (about 89%), but poultry litter also contains ammonium (about 9%) and a small amount of nitrate (about 2%). The inorganic nitrogen (ammonium and nitrate) can be immediately used by plants. Organic nitrogen is not available to plants until it is converted to ammonium or nitrate by microorganisms in the soil. Because this is a biological process, the rate of conversion depends on soil moisture and temperature. The conversion takes place over time with the largest release of nitrogen shortly after application if the soil conditions are favorable [moist and warm conditions (>50 ^{o}F)]. One advantage of poultry litter for pastures is that the slow conversion of organic to inorganic nitrogen distributes available nitrogen more evenly over the growing season.

Legumes – Increased incorporation of forage legumes becomes increasingly attractive as the expense of nitrogen fertilizer increases. While soil pH, phosphorus, and potassium requirements are higher for legumes; the combined cost of the increased requirement for these soil amendments is lower than the cost of nitrogen fertilizer. Another incentive for using clovers and other legumes is that they reduce the need for nitrogen fertilizers, improve seasonal distribution of forage dry matter by boosting summer production from the legumes, and improve forage quality by increasing protein levels and overall digestibility of the forage. The primary pathways for nitrogen transfer from the legumes to the soil are through grazing livestock and decomposition of dead legume plant material. If pastures contain at least 30 to 40% legumes, the addition of commercial nitrogen fertilizer can usually be avoided since most legumes could provide enough N to sustain productivity (**Table 2**). The amount of N legumes fix varies among species due to soil conditions, amount of water available, and other seasonal factors during growth (assume a 30 – 40% legume composition) (**Table 3**). It can range from as little as 20 lbs N/acre/year to more than 250 lbs N/acre/year. With N at 0.651 cents/lb, this would be equivalent to from $13 to $163/acre.

Grazing Management and Nutrient Cycling

Rotational grazing usually benefits nutrient cycling and distribution in pastures by high sticking rate in smaller areas. With continuous grazing at low stocking rates, much of the animal excreta are concentrated around the water source and under shade trees. When livestock consumes the available forage, 80 to 90% of the nitrogen in that forage passes through the animal and is excreted in the urine and feces. Unfortunately about 50% of the nitrogen in the urine is lost through volatilization. A rotational grazing management practice that leaves more of the soil covered with green plant residual (stop grazing at 3 -4 inches height) or dead litter keeps the soil cooler and enhances the urine infiltration rate while reducing ammonia loss. Producers can reduce recommended nitrogen rates 20% for the same yield goal on intensively managed pastures than in a continuously grazed pasture. Some studies have suggested that in a rotational grazing system as much as 50% of the pasture surface area may be affected by urine in a single year. In a continuous grazing system, approximately 2 to 5% of the pasture may be affected by cattle urine in a single grazing season. The effective N application rate from cattle urine is also affected by the type of grazing system. In a continuous grazing system, the effective N application is less than 1 lb N/acre/year, in a rotational system, it is about 30 – 50 lbs N/acre/year, and a twice-weekly rotation could contribute approximately 20 lb/acre/week of readily available urinary N to the pasture.

Fertilizing with nitrogen is a short-term management tool since its effect is usually immediate and does not last more than one grazing cycle. On the other hand, legume establishments are a long-term investments that improve soil and water quality as well as productivity. Additions of N fertilizer may cause a shift to more grass content in the year of application, and under poor management, fertilization is a driving force for increased weed competition. It is important that producers fertilize wisely and only the pastures most likely to be grazed at the start of the season. With the high cost of N, use it as a specific management tool, not a blanket treatment.

Table 1. Effect of soil pH on relative efficiency of nutrient uptake.

Soil pH	Nitrogen	Phosphorous	Potassium
4.5	21	8	21
5.0	38	10	30
5.5	52	15	45
6.0	63	15	60
7.0	70	30	60

Source: Tony Provin, Soil Chemist, Texas A&M University.

Table 2. Estimated potential of N input by legumes.

Legumes	Seasonality	N (lb/ac)
White Clover	Perennial	200
Red Clover	Perennial	110
Crimson Clover	Annual	100
Arrowleaf Clover	Annual	100
Vetch	Annual	60

Source: Williams and Watson, MSU

Table 3. Economic value of interseeding legumes over N fertilization

N rate (lb/ac)	Difference in Cost per acre for Interseeding Legumes ($)
50	-8.95
100	-41.50
150	-74.05

Nutrient and Soil Management
by Dr. Larry Oldham

New Land in Production - Increased crop prices apparently are bringing land into production from some government programs, particularly in loess areas and northeast Mississippi. If you are considering this, be sure to know and understand the potential issues arising from support programs and payments. In addition, other land not traditionally used for row crops may come into production. With either case, it is critical to begin with soil testing, and to know crop specific issues such as inoculating soybean seed with rhizobia bacteria (see http://msucares.com/newsletters/pests/cis/2008/mcs208.pdf for more details by Dr. Trey Koger), managing nitrogen in corn, and managing potassium in cotton.

Soil Testing - Soil testing is the key for managing nutrients other than nitrogen in warm, humid Mississippi. As always, the most important results are the pH and lime requirement of the soil. Soil pH controls the availability of the nutrients already present in your soil, and lime requirement is a separate measurement of your soil's ability to react with added lime. Managing soil fertility in forage and pasture production with higher fertilizer prices is more challenging without higher end product prices. Check the forages section of this newsletter for more information on that subject.

Can't Afford Fertilizer? Back to the row crops, I'm hearing a lot of people saying they cannot afford fertilizer this year. However, is the question you cannot afford fertilizer? Or is the question can you not afford to fertilize? Presented below is one way to examine this issue.

Table 1 is from soil test summaries from the Mississippi State Extension Service Laboratory for two years in the fairly recent past for samples from the Delta and northeast Mississippi. Approximately 10 to 20 percent of the samples have pH's lower than 5.4. Below pH 5.4, some nutrients are less plant available and other non-essential elements become more problematic for growing plants. Interestingly, in this comparison, the Delta cotton samples indicate fewer potential soil pH issues eight years later, and correspondingly, about fifteen percent better soil test phosphate results. However, do these soil test phosphate levels indicate the conventional wisdom about cotton and phosphorus nutrition in the Delta needs questioning? Particularly after over 100 years of production in some fields? Maybe, or maybe not, these results are from only one laboratory.

Table 2 contains the Mississippi soil test based phosphate and potash recommendation set for soybeans from the MSU ES soybean fertility publication. No phosphate or potash fertilizer is recommended in the high and very high categories. In the medium category, the recommended fertilizer rates can be considered maintenance. Soil fertility Extension specialists at North Carolina State recently compiled and updated nutrient removal rates for many agronomic and horticultural crops. At a fifty bushel yield level, the updated data is 40 pounds of phosphate and 74 pounds of potash removed in the beans, and 16 pounds phosphate and another 74 pounds of potash are in the recycled leaves, stems, and pods.

Where we need to pay very close attention with DAP prices in the mid-$700's and potash in the $500's is the low and very low categories. While it is possible the percentage yield decrease may be minimal (8%) if fertilizer is not used with soil tests in the low range, it is also possible the yield will be 25% lower. At a 50 bushel per acre potential yield, taking 12.5 bushels out of the picture, at $12 per bushel for soybeans, the cost of not applying is $150. Management needs to assess whether this is acceptable given their production system and variables in addition to fertilizer costs: soil-specific yield potential, irrigation, pest management, weather, variety yield potential, etc. Soils testing in the very low range require even detailed decision processes.

Table 1. Row crop soil test results for pH, phosphate, and potash as percentages of samples for soybeans, cotton, and feed grains during two fiscal years by the Mississippi State University Extension Service Soil Testing Laboratory from the Upper Coastal Plain (northeast Mississippi) and Delta regions. (Note: MSU ES calibration for phosphate and potash is based on the Mississippi Soil Test method.)

Variable	Upper Coastal Plain		Delta	
	1996-1997	2004-2005	1996-1997	2004-2005
***Soybeans** as Indicated Crop*				
pH < 5.4	22	21	18	21
Low or Medium P_2O_5	54	49	31	29
Low or Medium K_2O	46	40	14	15
***Cotton** as Indicated Crop*				
pH < 5.4	19	29	14	10
Low or Medium P_2O_5	40	43	27	28
Low or Medium K_2O	49	43	35	18
***Corn** (feed grains) as Indicated Crop*				
pH < 5.4	23	23	19	8
Low or Medium P_2O_5	52	58	28	28
Low or Medium K_2O	59	55	23	20

Nutrient and Soil Management continued... by Dr. Larry Oldham

Table 2. Mississippi soil test phosphate indices, corresponding expected yields, and fertilizer recommendations for soybeans, based on using Mississippi Soil Test extractant.

	Expected Yield Without Fertilizer		MSU-ES Fertilizer Recommendation	
	P_2O_5	K_2O	P_2O_5	K_2O
Soil Test	------ % ------		------ lb/acre ------	
Very Low	35-80	50-80	120	120
Low	75-96	75-96	60	60
Medium	92-100	92-100	30	60
High	100	100	0	0
Very High	100	100	0	0

I have stressed the importance of a good relationship with your fertilizer supplier in the past, and it continues to be critical as planting begins the next few weeks. Fertilizer prices are higher at each level of movement, from manufacturing or mining, and the price of energy seems to increase daily. The local coop or business must manage their assets efficiently to continue to operate, so cooperation can be beneficial to both ends of the deal.

Soybean by Dr. Trey Koger

Seed Shortage - By now, most if not all of us who are planting soybean this spring are aware of the seed shortage issue. The shortage is not restricted to group four varieties, which we plant on the majority of our acreage statewide. The shortage is for all maturity groups we plant in the state (group three, four, and five varieties) and not is restricted to just Mississippi. This issue is affecting the entire midsouth and southeastern US regions. All of the seed companies have experienced seed shortages to some degree that in the end has affected all of us, and is leaving some uncertainty to how many acres we are able to plant this spring.

Seed Quality - Another key issue that is taking a back seat to seed availability, but is every bit as important is seed quality. Once you know you are going to have sufficient quantity of seed to plant your planned acreage, the quality of the seed should be a top priority. If it comes down to picking between two really good varieties you are familiar with that are different with respect to quality, pick the one with the best quality. This year, however, it doesn't appear we're going to have that luxury.

Tests for Evaluating Seed Quality - Percent seed germination is the most common test conducted to provide some information as to the overall quality of soybean seed. Percent germination is a measure of the percentage of the seed that germinates at a standard temperature of 77º F. The standard level for germination is 80%. Seed that has as low as 60% germination can be sold in Mississippi. Seed sold in Mississippi must be tagged with the percent germination according to the state seed law. Percent germination for soybean seed sold in Mississippi is bracketed into three categories. Seed that has 80% or better germination is tagged as 80% germination. Seed that has 70 to 79% germination must be tagged as 70% germination. Seed that has 60 to 69% germination is tagged as 60% germination. Soybean seed that has less than 60% germination is not permitted to be sold according to state law.

Soybean continued... by Dr. Trey Koger

The accelerated aging test is a good measure of soybean seed quality and vigor. This test exposes seed for short periods to high temperatures (105º F) and relative humidity (100%) for 3 to 4 days. The seeds are then removed from the stress conditions and then exposed to optimal germination conditions. Exposing seed to extreme temperature and humidity causes rapid seed deterioration and provides excellent information on overall vigor of the seed. Seed lots with high vigor will withstand these extreme conditions and still germinate at high levels. Seed lots with low vigor will deteriorate quicker when exposed to these extreme conditions and will not maintain good germination levels. Soybean seed sold in Mississippi are not required to be subjected to an accelerated aging test. However, most companies subject seed lots to this test before shipping the seed to the distributor. Ask your seed dealer or distributor about whether or not your seed has been tested for accelerated aging.

Germination vs. Accelerated Aging Results - The percent germination and accelerated aging tests are both excellent for providing information on overall seed quality. It is important to note, however, that the results of the two tests are not always mirror images of one another. Just because the results of one is high doesn't necessarily mean the results of the other is going to be high. It is not uncommon to see percent germination low, but results of accelerated aging high. In some cases the percent germination can be high and the accelerated aging test low. Remember that the percent germination test is a good measure of just that, the percent of the seed that germinates and is not a good measure of the overall seed vigor. The accelerated aging test is a good measure of overall seed vigor.

Seed Testing Lab - The Seed Testing and Inspection lab (Bureau of Plant Industry) on the MSU campus is testing seed lots at a record pace right now. Just last week, Dr. Lester Spell (Commissioner of the Mississippi Department of Agriculture and Commerce) requested that all soybean seed lots to be sold in the state were to be tested for percent germination. This request was made because 40% of all seed tested in the Seed Testing and Inspection lab were running low germination (below 80%). This level of low germination is extremely high compared to levels we have seen in previous years. Significant levels of low germinating soybean seed lots are attributed to extreme weather conditions last summer and early fall in areas of the country where the majority of our soybean seed is increased. Most of the soybean seed we plant in Mississippi comes from seed increase production fields in northeast Arkansas, the bootheel of Missouri, and southern Illinois and Indiana. These areas had extremely hot conditions during the seed fill period and had extremely low moisture levels during harvest. A tremendous amount of mechanical damage to harvested seed was the result. Nearly 90% of the seed running low germination in the Seed Testing and Inspection lab is due to mechanical damage. See the photo in **Figure 1** for an example of soybean seed having low germination due to mechanical damage. Pay special attention to the red arrow showing a seed that germinated but was cracked due to mechanical damage. The seed germinated normally but the lower portion of the cotyledons are brown and dying due to the seed being cracked due to mechanical damage. This seedling will eventually die. The second picture (**Figure 2**) is a close up of the dying seedling.

Compensating for Mechanical Damage - If seed has low germination due to mechanical damage, the only thing we can do is plant more seed . The seeding rate should be adjusted accordingly to account for seed having low germination. On a good note, the overall vigor of soybean seed tested in the Seed Testing and Inspection lab is good, with 70% germination for seed exposed to the accelerated aging test. Seed having good germination that are then exposed to the accelerated aging test shows that the soybean seed we are going to plant, overall, have good vigor.

Calculating Seeding Rates - Here are a few scenarios for adjusting seeding rate when percent germination for the seed you are going to plant is low (below 80%). Keep in mind that we like to target 120,000 plants per acre for group fours and 100,000 plants per acre for group fives. These recommended rates are based on extensive seeding rate research we have conducted over the past three years for our early soybean production system. Let us use recommended rates of 120,000 and 100,000 plant per acre. Keep in mind, these rates are plants per acre—not seeds per acre. There are several assumptions made when coming up with seeding rates for these planting rates. Let us initially assume 80% of the seed germinates and 90% of those seed that germinate actually come up. The 90% emergence number is an arbitrary number that you come up and is strictly based on how many of the seed capable of germinating will actually come up. Percent emergence can be affected by planting depth, roughness of the ground, potential for soil crusting, and type of planter or drill. The percent germination information will be posted on the seed bag. The percent emergence number is not posted on the bag, but is again is an arbitrary number you come up with.

Scenario 1: To obtain 120,000 plants per acre at 80% germination and 90% emergence you need to plant about 167,000 seeds per acre.

(120,000 / 80% germination) / 90% emergence ~ 167,000 seeds/acre.

Scenario 2: To obtain 120,000 plants per acre at 70% germination and 90% emergence, you need to plant about 190,000 seed per acre.

(120,000 / 70% germination) / 90% emergence ~ 190,000 seeds/acre.

Soybean continued...

by Dr. Trey Koger

Figure 1. Low germination due to mechanical damage.

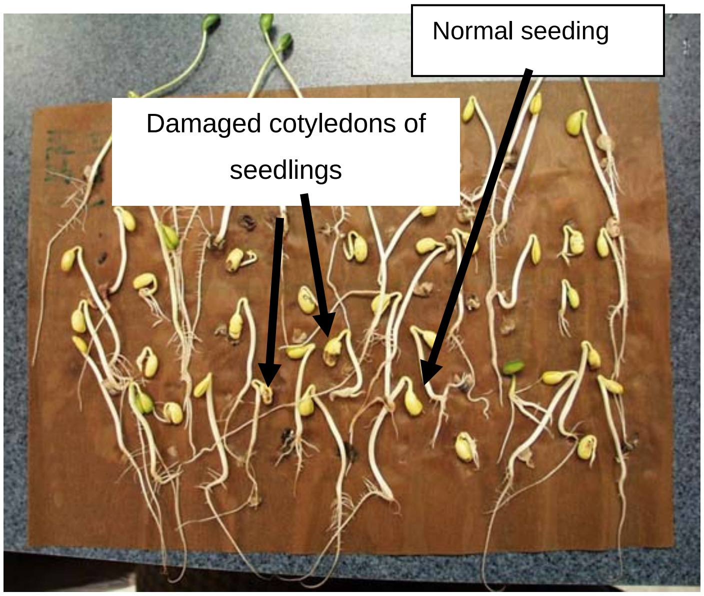
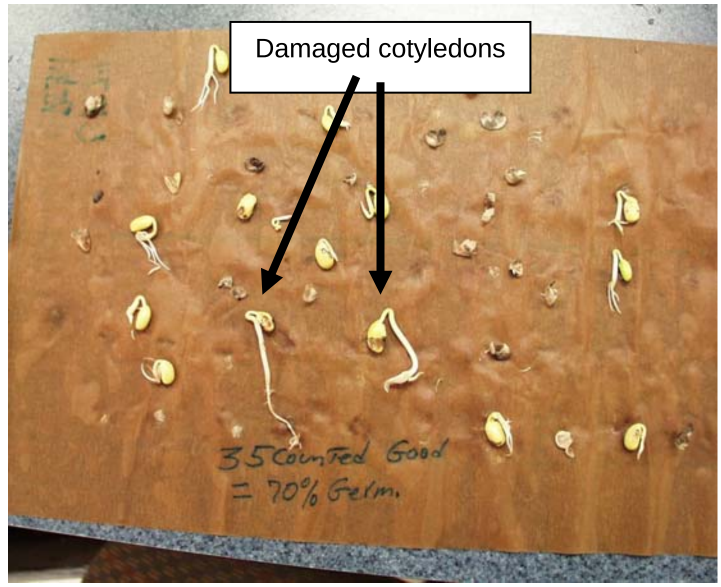


Figure 2. Unsuccessful seedlings from the same test.



To receive Agronomy Notes via email, please contact Tammy Scott at (662) 325-2701.

Mississippi State University Extension Service

Department of Plant & Soil Sciences, Mississippi State University

Michael Collins