

IN MEMORY OF OUR FRIEND

REPRESENTATIVE OTTO BEAN

It is with honor and great respect that we dedicate this 45th Annual Field Day to our friend Representative Otto Bean.

His dedication to the people of Southeast Missouri as well as the whole State of Missouri will long be remembered.

“A true friend knows your weaknesses but shows you your strengths; feels your fears but fortifies your faith; sees your anxieties but frees your spirit; recognizes your disabilities but emphasizes your possibilities.”

William Arthur Ward
Educator

On behalf of the University of Missouri, we would like to express our sincere sympathy to Representative Bean's family.

45th Annual

Delta Center Field Day

2006

College of Agriculture, Food & Natural Resources
Agricultural Experiment Station
University of Missouri-Columbia
Tom Payne, Vice-Chancellor/Dean

University of Missouri Delta Research & Extension Center
Portageville, MO
Jake Fisher, Superintendent

Thursday, August 31, 2006
9 a.m. – 2 p.m.

WELCOME

TO THE 2006

DELTA CENTER FIELD DAY

Our program for the day is planned around the theme "Agriculture Technology for the 21st Century". We hope you will take advantage of the activities offered during the day in carrying out the above theme.

We encourage you to visit the "Rone Exhibit Hall" where farm and home exhibits are featured. Take the field tours to observe the research progress being made in crop production. Look over the machinery exhibits. Visit with neighbors and University staff while enjoying the noon meal.

We hope you will find our 2006 Field Day enjoyable as well as informative. This is your Center, We want you to use it. You are always welcome.

Come back soon, as we always look forward to seeing you.

*Thomas E. "Jake" Fisher
Superintendent*

ACKNOWLEDGMENT

THE DELTA CENTER STAFF WOULD LIKE TO THANK

VICE-CHANCELLOR/DEAN DR. TOM PAYNE,
ASSOCIATE DEAN DR. MARC LINIT,
AND THE ADVISORY COMMITTEE
FOR THEIR SUPPORT AND GUIDANCE.
IT IS GREATLY APPRECIATED.

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◆ ◆ ◆ MISSION STATEMENT ◆ ◆ ◆

MISSOURI AGRICULTURAL EXPERIMENT STATION

The Missouri Agricultural Experiment Station is responsible for doing problem solving research that helps the state's citizens make the most effective use possible of the state's natural resource base, including its people resources, in competing in an increasingly global economy and meeting our obligations as global citizens.

OFF-CAMPUS AGRICULTURAL RESEARCH CENTERS

Research Centers exist to support and facilitate the total research program of the Missouri Agricultural Experiment Station. As such, they are an integral part of the Missouri Agricultural Experiment Station and unique contributors to MU's comprehensive land grant responsibility.

The Delta Center exists to support and facilitate the total research program of the Missouri Agricultural Experiment Station. Recognizing that the process of a great public institution depends upon the good will of elected public officials, the Delta Center Advisory Committee shall conduct its business in a non-partisan manner.

We have a common goal of conducting high quality research that will (a) respond to the needs of Missouri citizens, (b) maintain and enhance our natural resource base, (c) support a vital food and fiber system, and (d) help keep Missouri producers competitive.

We will work with University extension, state and federal agencies and Missouri agribusiness to undergird a reliable, safe supply of quality food supplied in a sustainable, profitable manner.

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Dr. Brian Ottis, Assistant Professor.....	Rice Production
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Dr. Earl Vories, Agricultural Engineer.....	USDA/Irrigation
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2006 FIELD DAY TOURS

BLUE TOUR

COTTON PRODUCTION

Using Sensors to Predict Nitrogen Needs in Cotton
Dr. Earl Vories

Insect Update for Cotton and Corn
Glenn Studdebaker

Cotton Varieties and Selection
Dr. Mike Milam

GREEN TOUR

IRRIGATION

Twin Row Production on Corn, Soybeans and Cotton
John Engram

Ways to Decrease Irrigation Pumping Costs
Dr. Bill Casady

Determining When to Terminate Irrigation
Dr. Joe Henggeler

RED TOUR

SOYBEANS

Soybean Rust: A Curiosity, Concern or Threat
Dr. Allen Wrather

Evaluation of Soybeans for Tolerance to Soil Waterlogging
Dr. Grover Shannon

Jake and Stoddard Soybeans for Missouri
Melissa Woolard

WHITE TOUR

CROP PRODUCTION

Corn Varieties for Ethanol Production
Dr. Gene Stevens

Potential Savings from Reduced Seeding Rates
Dr. Brian Ottis

How's and Why's of Fertility Research
David Dunn

YELLOW TOUR

WEED SCIENCE

Horseweed/Mare's Tail Management
Dr. Andy Kendig

Retro Rice Weed Control
Jim Heiser

Palmer Amaranth Control
Chad Smith

Herbicide Resistance in Weeds
Dr. Anthony Ohmes

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USING SENSORS TO PREDICT NITROGEN NEEDS IN COTTON

Dr. Earl Vories, Agricultural Engineer, USDA-Agricultural Research Service

Research hypothesis: Variable-rate nitrogen application systems that incorporate within-season crop reflectance sensing will improve profitability and reduce the environmental risks associated with nitrogen application.

Applying nitrogen (N) in excess of crop needs results in unused soil nitrate and increased potential for N loss. Unused nitrate can move to groundwater, to surface waters, or denitrify from the soil into atmospheric greenhouse gases. Farmers want to be good environmental stewards; however, many ideas proposed for reducing N loss from fields create the risk of reduced productivity and profitability. To reduce N loss while maintaining productivity, several research groups have recently explored variable rate N fertilizer application. Advances in reflectance sensor technology have allowed development of sensing/applicator systems for assessing N needs and automatically adjusting N application rates based on the principle that plants under N stress are lighter in color and reflect more light than plants with sufficient N.

Researchers in Missouri and other states have been working cooperatively to develop recommendations for N fertilizer application on corn based on reflectance measurements. Research is underway at the Delta Center to apply the same approach to cotton. Research plots with N application rates ranging from 0 to 200 lb N/acre were established on a Tiptonville silt loam at the University of Missouri (MU) Lee Farm near Portageville and a Bosket fine sandy loam at the MU Rhodes Farm near Clarkton. Reflectance readings were made at approximately two-week intervals beginning shortly after the first square growth stage and are expected to continue through physiological maturity. Supporting measurements include soil N content, leaf chlorophyll content, and plant growth and maturity indicators. Similar measurements were also made in an ongoing N study on a Portageville clay at the MU Lee Farm.

The goal of this research is to develop recommendations for reflectance-based N application. In this way, optimal rates can be applied to every part of the field, rather than making field-wide blanket applications and knowing that some areas of the field will receive too much N while others don't receive enough. In this way, both the economic impact on the grower of applying more N fertilizer than needed and the environmental side-effects of excessive N application will be reduced. In addition, indirect effects on growth and maturity resulting from excessive or deficient N can be better managed.

COTTON VARIETIES AND SELECTION

Dr. Mike Milam, Area Agronomy Specialist
Dr. Bobby Phipps, Retired State Extension Cotton Specialist
Andrea Phillips, Senior Research Specialist

One of the most important decisions that cotton producers make is which variety or varieties should they plant. There are conventional and transgenic or genetically engineered varieties that are available for weed and insect control.

Producers need to research varieties and to gain as much information as possible before making a decision. University variety trails are replicated and provide unbiased information. Results from strip tests, personal observation and discussion with other producers plus seed company literature are also useful for making an informed decision.

Although yield is the most important consideration, it is better to see how a variety has performed over time. If a variety is newly released, it is important to know how the variety performed over multiple locations. Yield stability is also important because it will provide more consistency over time.

When planting a new variety for the first time, plant only a small acreage. It is better to learn how the variety will behave under your particular management style before expanding the acreage of the variety.

Other considerations include the plant height, maturity, plant hairiness, and fiber quality. Seed size and seedling vigor may be important in getting a stand. Seeding rates should be based on plant population rather than weight. While standard germination tests are useful, a cold temperature germination test is more indicative of the performance under adverse conditions.

Varieties that are resistant to herbicides such as Roundup can be part of a well-designed weed control program. However, the resistance already found in the marestail and the potential for resistance for other species should be taken into consideration. Caution is urged when planting non-Roundup or other herbicide resistant cotton to make sure that fields are labeled to prevent spraying mistakes. Drift of herbicides to non-resistant crops is increasing and precautions are necessary to prevent injury.

It is recommended that producers grow several different varieties differing in maturity to manage risk such as adverse weather and transient pest populations.

TWIN ROW PRODUCTION ON CORN, SOYBEANS AND COTTON

John Engram ^[1] and Joe Henggeler ^[2]

(^[1] Owner Lakeside Ag, LLC; ^[2] Ext. Assc. Prof., Biol. & Agric. Eng. Dept., Commercial Ag. Program, MU Delta Center;)

Recent research in the Delta has shown twin-row (TR) production can increase yields. TR production usually involves a twin pair of rows that are 7 ½ inches apart. Missouri on-farm research in corn showed TR yielded nearly 18 bu/ac more than single row with 38-inch rows (Table 1) and that population levels should probably be increased (Fig. 1)

Table 1. Hybrid, final plant population, moisture percent, test weight, and yield of twin-row versus single row plots (Henggeler, 2003).

Hybrid	Final Plant Population (plants per acre)	Moisture (%)	Test Weight (lbs/bu)	Yield (bu/acre)
Twin-Row				
Crow 5360	---	11.5	56.0	227.23
G.H. 9471	35,307	19.2	60.0	203.48
Crow 5321	33,472	17.6	58.0	234.48
Twin Avg	34,390	16.1	58.0	221.73
Single				
Crow 5360	---	16.6	58.0	219.13
G.H. 9471	27,053	22.8	58.0	177.80
Crow 5321	29,346	18.2	52.0	215.67
Single Avg	28,200	19.2	56.0	204.20

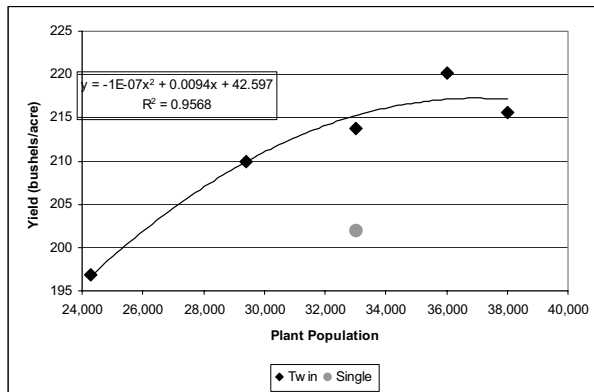


Fig. 1. Yield versus plant populations for twin-row corn, also showing the yield for the historic, optimum single row population, Vanduser, MO, 2003.

The Delta Center has started new research on cotton, soybeans and corn comparing twin, narrow and regular rows. It will be done on various soils and populations, and will include both irrigation and dryland. The test will include:

$$\left\{ \begin{array}{l} \text{Cotton} \\ \text{Beans} \\ \text{Corn} \end{array} \right\} \times \left\{ \begin{array}{l} 15\text{-in} \\ 30\text{-in} \\ 38\text{-in} \end{array} \right\} \times \left\{ \begin{array}{l} \text{Pop1} \\ \text{Pop2} \\ \text{Pop3} \\ \text{Pop4} \\ \text{Pop5} \end{array} \right\} \times \left\{ \begin{array}{l} \text{Single} \\ \text{Twin} \end{array} \right\} \times \left\{ \begin{array}{l} \text{Silt} \\ \text{Sand} \\ \text{Gumbo} \end{array} \right\} \times \left\{ \begin{array}{l} \text{Irrigated} \\ \text{Dryland} \end{array} \right\}$$

WAYS TO DECREASE IRRIGATION PUMPING COSTS

Bill Casady and Joe Henggeler

(Agricultural Engineers, University of Missouri Extension/Commercial Agriculture Program)

The high cost of diesel and propane means that irrigators have to pay more for their irrigation. Nearly 2/3 of Missouri pumps are internal combustion engines. Economic studies have been done on various parameters of energy associated with irrigation. Prime options for change that can help reduce the cost of irrigation were found to be: (a) choose cheapest energy source (plus use load management for electricity users), (b) improve pump efficiency, and (c) re-nozzling pivots to run at lower pressures.

Cheapest Energy Source. Electricity remains the cheapest form of energy, as seen in the corresponding table. Load management can add even more savings for electricity users.

Improve Pump Efficiency. Bootheel irrigation pumps are probably only about half as efficient as they could be. Making improvements to pumping plants could save pivot users \$500 to \$1000, depending on the type of fuel used.

Power Source	Cost per Energy Unit	Cost per Acre Inch ^[1]	
		Flood PWL = 30 ft Op. Pres. = 5 psi	Pivot PWL = 25 ft Op. Pres. = 42 psi
Electricity	\$ 0.10/KWH	\$ 0.82	\$ 2.41
Diesel	\$ 2.50/gal	\$ 1.38	\$ 4.04
Propane	\$ 1.50/gal	\$ 1.48	\$ 4.37

^[1] Cost is based on:

- ✓ Pump efficiency = 50% (probably typical for the area; efficiencies could be as high as 65%, which would decrease the costs 1/4).
- ✓ Motor and engine efficiencies assumed to be average⁺.

Reducing Operating Pressure. The average center pivot in Missouri runs at about 25 PSI higher than what a low-pressure pivot could run. Nearly \$4 million dollars in savings could be had in Missouri by reducing pivot pressure. The estimated savings for a 65-PSI pivot user who reduces pressure to 30 PSI is shown below.

Power Source	If at Top Efficiency ^[2] (\$)	For Typical Bootheel System ^[3] (\$)
Electricity (\$0.10/kwh)	\$1,555	\$2,146
Diesel (\$2.50/gal)	\$2,416	\$3,668
Propane (\$1.50/gal)	\$2,606	\$3,915

^[1] Based on:

- ✓ 135 acres
- ✓ 10 inches applies.

^[2] Top Efficiency is based on:

- ✓ Pump efficiency = 75%
- ✓ Motor and engine efficiencies assumed to be average⁺.

^[3] Typical System is based on:

- ✓ Pump efficiency = 50%
- ✓ Motor and engine efficiencies assumed to be average⁺.

DETERMINING WHEN TO TERMINATE IRRIGATION

Joe Henggeler, (Ext. Assc. Prof., Biol. & Agric. Eng. Dept., Commercial Ag. Program, MU Delta Center;)

Soybean. The old recommendation for terminating irrigation on soybeans is the R6 stage (seed fill). However, rooting depth in SEMO may be hampered by hard pans and frequent rains. Therefore, it may be appropriate to keep irrigating soybeans later into the season. Figure 1 shows that yields continued to increase with later irrigation termination dates. These data are from a sandy soil, but the silt soil responded in a similar manner. A yield loss of about $\frac{3}{4}$ bushel/acre per day was shown to occur when irrigation is terminated too soon on a sandy soil. Yield increase was associated with added seed weight. Therefore, irrigation should go on until the beans are not only touching, but the shoulders are beginning to bunch up in the corners. The canopy should have yellow leaves. For typical soybeans (3,000 seeds/lb), if final seed weight is less than 14 gram per hundred seed, then irrigation may have been terminated too soon.

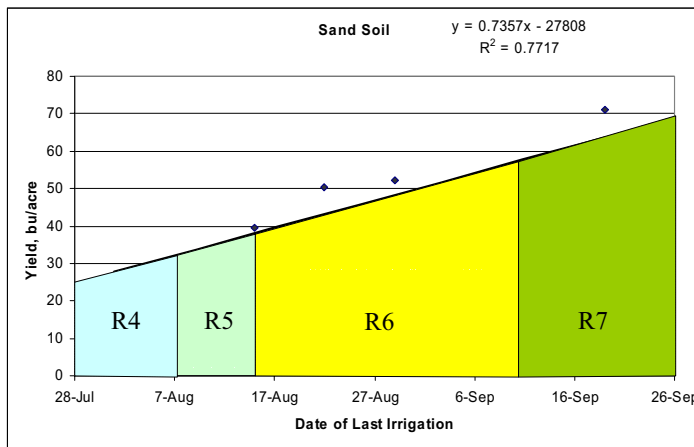


Fig. 1. Soybean yield versus the date of last irrigation for sandy soil.



Fig. 2. From L to R, a 8-, 12-, and 15-gm per 100 seed.

Corn. The *Milk Line* (ML) starts at dent and moves down the kernel towards the cob. When it reaches this point *Black Layer* (BL) occurs. It is generally reported that this takes 20 to 30 days, and $\frac{1}{2}$ ML to BL takes about 10 to 15 days. This progression has been slower the hybrids observed in our study, and therefore, cutting off irrigation at $\frac{1}{2}$ ML is too early. At the last irrigation corn should be at the $\frac{3}{4}$ ML stage and the husk beginning to loose most of its green color.

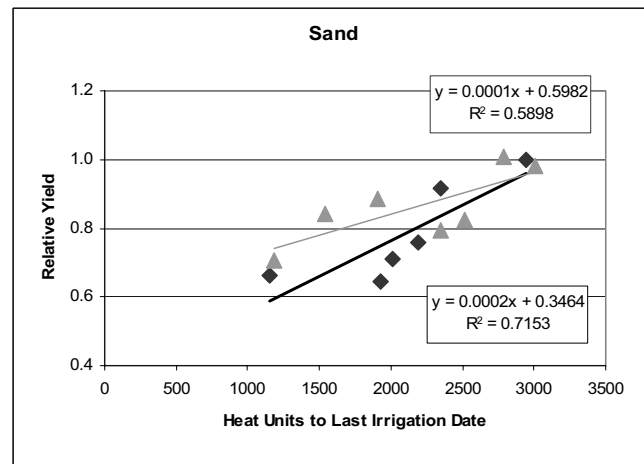


Fig. 3. Relative Yield versus Heat Units, 2003 & 2005

CORN VARIETIES FOR ETHANOL PRODUCTION

Dr. Gene Stevens, MU Crop Production Specialist

Jamey Cline, Missouri Corn Growers Association

A recently passed Energy Bill by Congress is expected to promote production of 7.5 billion gallons of ethanol in the United States by 2012. Ethanol currently utilizes about 10 percent of the U.S. corn crop. In the future, use is projected to climb to 18 to 20 percent of the total crop. That much corn used in ethanol would be close to the current annual exports and have a positive influence on the price per bushel that growers receive in the marketplace.

Ethanol is a clean-burning, renewable, domestic fuel produced through a fermentation and distillation process that converts the sugars in corn into alcohol. Ethanol greatly reduces tailpipe emissions, helps bolster the agricultural economy and directly displaces imported oil. All automobiles manufactured since the 1970s can burn up to 10 percent ethanol. The most common blend of ethanol in the Midwest is E10, a blend of 10 percent ethanol with 90 percent unleaded gasoline. Several metropolitan areas use reformulated gasoline, which might contain up to 10 percent ethanol. Another ethanol-blend called E85 is a blend of 85 percent ethanol and 15 percent unleaded gasoline. Numerous vehicles are able to burn E85. These automobiles, called Flexible Fuel Vehicles (FFV), can run on any combination of ethanol and gasoline. Approximately 5 million E85-capable FFVs are on the highways today.

In 2005, Missouri's three farmer-owned ethanol plants will produce over 115 million gallons of ethanol utilizing approximately 11 percent of the annual Missouri corn crop. That is an increase of 50 million gallons from 2004. Northeast Missouri Grain Processors, Macon, MO, processes over 16 million bushel of corn annually to produce over 45 million gallons of ethanol. NEMO started production in May 2000. Golden Triangle Energy Cooperative, Craig, MO, processes 9 million bushel of corn annually to produce over 25 million gallons of ethanol. GTEC started production in February 2001. Mid-Missouri Energy, Malta Bend, MO, will process over 16 million bushels of corn annually to produce over 48 million gallons of ethanol. MME started in February 2005.

According to a study by Dr. Donald VanDyne, MU professor emeritus, the direct and indirect benefits of five ethanol plants in Missouri would mean 8,890 jobs, \$845 million in economic output and \$87 million in tax revenues from over 17 million bushels of corn.

New scientific discoveries continue to influence what and how corn products are used by consumers. In 2006, we began four field corn experiments at the Delta Center comparing 58 varieties for Food grade, High Extractable Starch, Protein, and Nutri-Dense uses. The study is funded by the Missouri Corn Growers Association. At press time for this report, plots had not been harvested. But we plan to present yield results at the tour stop.

POTENTIAL SAVINGS FROM REDUCED SEEDING RATES

Dr. Brian Ottis, Rice Agronomist

Currently, University Extension Services recommend a seeding rate of 30 to 40 seeds/ft² for conventional varieties in order to achieve an optimum final plant population ranging between 10 and 20 plants/ft². These are recent changes, as the former seeding rate recommendation was 40 seeds/ft² with a final plant density of 15 to 20 plants/ft². The recommendations assume that 50% or more of the planted seed will not emerge. With today's drill-seeding technology and fungicide seed treatments, we hypothesize that on average, emergence is better than 50%, and that seeding rates can be lowered even further while not sacrificing yield or milling quality.

Rice has the innate ability to compensate for voids in the canopy by producing more reproductive tillers. Since the introduction of hybrid rice, producers who have grown it have become accustomed to sparse stands after emergence, and then watched as the canopy was filled and excellent yields were obtained. In a recent 3-year study on a silt loam soil it was determined that seeding rates ranging from 5 to 40 seed per square foot did not affect yield of Wells, CL161, or XL8, indicating that seeding rates for these varieties can be reduced while not sacrificing yield. Based on these results, we are not suggesting that growers set their drills to plant 5 seed per square foot; however, we are suggesting that growers evaluate their current seeding rates and consider lower rates, especially on well-prepared silt loam soils. When planting early in cool conditions or on heavy clay soils, seeding rates may need to be increased to compensate for reduced germination and poor seed to soil contact.

Studies were initiated in 2005 evaluating the interaction of seeding rate, variety, and nitrogen rate and their effects on yield and milling quality. The varieties being evaluated include Cheniere, a new semidwarf long-grain, Wells, a popular conventional variety, and CL131, the latest CLEARFIELD* semidwarf variety. Seeding rates ranging from 7.5 to 60 seeds/ft² are being evaluated with total nitrogen rates ranging from 60 to 180 lbs N/Acre. We have also initiated an experiment evaluating an early-season application of ammonium sulfate at low seeding rates to determine if such an application can be used to recover yield at low plant densities. This is a regional project being conducted in Arkansas, Louisiana, Mississippi, and Texas.

In 2006, two studies were initiated at the Lee Farm and at the Rice Farm near Glennonville to evaluate the effects of seeding rate, nitrogen rate, and variety on the incidence and severity of sheath blight disease. When scouting for sheath blight, the first lesions usually appear where rice was double-planted on the edges or where fertilizer overlap occurred. Sheath blight forms in these areas first because of the lush canopy as a result of dense plant stands and over-fertilization. Although some rice varieties are more susceptible to sheath blight than others, we hypothesize that by reducing the seeding rate to allow more air flow through the canopy, we can reduce the incidence and severity of sheath blight, possibly eliminating a costly fungicide application.

HOW'S AND WHY'S OF FERTILITY RESEARCH

David Dunn, Supervisor Soils Laboratory

The goal of research is two fold. In basic science research we investigate topics that may not have applications in farming operations. These topics may seem esoteric to farmers. However, the knowledge gained may lead to practical application in the future. An example of basic science research at the Delta Center is Dr. Stevens's project to understand the mechanism by which soybean plants tolerate flooded soil conditions. The lessons learned here may be applied many years down the road. In applied research the goal is to evaluate products or practices that producers may be asked to use in the near future. This type of research helps producers to compare options. An example of applied research is Dr Shannon's screening of soybean varieties for flood tolerance. The results of this study allow producers to select soybean varieties suitable for condition on their farm. Ideally both types of research work together, basic science adds to our knowledge base, this knowledge is then applied in a practical way.

Most of my research at the Delta Center has been applied research, where different fertilizer programs are directly compared. The goal is to determine which program produces the highest yields. There are many variable factors in crop production. In research one factor at a time is investigated. The other variables are held constant. In a fertility experiment the other production practices (tillage, pest control & irrigation) would be the same for the entire trial.

An example of applied research would be my Phosphorus (P) trials for rice production. For this trial a location that tested low for soil P was selected. The goal was to determine the rate of P fertilizer that would maximize rice yields. Four rates of P were chosen 0, 25, 50 and 100 lbs P/a all as Triple Super Phosphate. The rates were chosen to give a range of P, the highest rate being above what a soil test would recommend. Each rate was assigned a number and referred to as a treatment: Treatment # 1 = untreated check, Treatment # 2 = 25 lb/a, Treatment #3 = 50lb/a..... To ensure valid statistical comparisons of the results, four replications of each treatment were used. Next a plot map was produced; with each treatment # randomly assigned to a plot #. Wooden plot stakes were prepared with the plot# and treatment # to aid in relocating the plots during the growing season. The area of each plot was 10 X 25". The amount of fertilizer for each plot was calculated and weighed into bags. The field was measured into plots and the designated with the wooden stakes. Each of these were then applied by hand to the designated plots and incorporated with tillage. Rice was then planted and uniformly grown using the standard practices for SE Missouri. At the end of the season each plot was harvested. A plot combine was used to harvest the middle portion of each plot. The resulting grain was weighed and yields were calculated on a per acre basis. The yield of each plot was then statistically compared. One comparison used is average yield. Some times a single plot that yields lower or higher, for what ever reason, than the others may bias the results. For a more reliable picture a method called Least Statistical Difference (lsd) is used. In this method a confidence interval is selected and the (lsd) is calculated. A confidence interval of 95 means that if the average yield difference between two treatments is greater than the lsd we can expect the same results 95% of the time. In my research I found that 95% of the time P will increase yields but that 95% of the time 50 lb was as good as 100 lb for increasing rice yields.

SOYBEAN RUST- A CURIOSITY, CONCERN OR THREAT

Dr. Allen Wrather, Professor, University of Missouri

We have heard a lot during the last 24 months about soybean rust. Prior to November 2004, most of us were curious about soybean rust because it was a disease in other parts of the world. After November 2004, when it was discovered in several states including Missouri, it became a concern. It is now considered a threat to the US soybean crop because it developed in a few states in the Southeast US during 2005 and 2006. Many scientists consider soybean rust a threat because it has reduced yield in parts of Paraguay, Argentina, and Brazil since it was discovered there 3-5 years ago, and it may do the same here. Some scientists are not as concerned about it as others because the weather in most areas of the US is not as suitable for rust as in those countries where it is causing yield loss. Until scientists are more confident about how this disease spreads in the US and the impact it will have on our soybean crop, producers must remain watchful and follow the development of this disease each year. Will it spread to our area, the upper mid-south, and cause yield loss? No one knows for sure. But a lot of people, including me, want the public to know that we are frequently scouting soybean fields for this disease and will notify the public as soon as rust is in or near our area. If this happens, producers can treat their soybean fields with fungicides to protect the crop from attack.

The only way to protect soybean against rust is to apply fungicides to the foliage because there are no soybean varieties resistant to rust. Several fungicides are labeled for soybean rust control and are effective, but they must be applied just before the disease develops or soon after. A list of these products, the current location of rust in the USA, and other information about the symptoms of this disease, how it spreads, and the conditions necessary for rust to develop are at the University of Missouri Rust Management Team's web site, <http://agebb.missouri.edu/mgt/soyrust/>. In Missouri, the soybean rust scouting program and several research projects on soybean rust are supported by the Soybean Producer Checkoff.

Information about the current location of rust in the USA, about rust monitoring work in Missouri, and about research on the Early Soybean Production System effect on rust and research to develop rust resistant soybean varieties will be presented during the University of Missouri Delta Center Field Day on August 31.

EVALUATION OF SOYBEANS FOR TOLERANCE TO SOIL WATERLOGGING

J.G. Shannon, R.L. McGraw, J.D. Lee, D.A. Sleper, and H.T. Nguyen, Division of Plant Sciences – University of Missouri

Excess rain and over-irrigation on poorly drained fields or low-lying areas can result in flooding and soil waterlogging. Soil waterlogging for as little as two days can reduce yields by 25%. Soybean may never fully recover from flooding injury. Genetic variability for flooding tolerance exists among soybean varieties.

In a field screening of soybean cultivars for tolerance to severe soil water-logging, most tolerant cultivars had yield reductions of 40% versus an 80% reduction for most susceptible cultivars. Still the 40 % yield loss to severe flooding for tolerant cultivars would severely impact a farmer's profits. Thus, varieties that limit yield losses by 10% or less are needed to protect soybean yields under severe field flooding.

Soybean plant introductions (PIs) from the USDA collection could offer higher levels of soil water logging tolerance than in current soybean cultivars. In 2005, 262 maturity group III PIs collected from both wet and dry areas of the world were planted in three replicate hills near New Franklin, MO in specially constructed channels where the duration and amount of flooding can be precisely controlled by pumping water on and off of plots as necessary. Plots were flooded about 5cm deep at flowering until plants began to yellow, wilt and die (about 14 d). Plots were then drained, soil allowed to dry and PIs were rated for injury on a 1 (no injury) to 5 (all plants dead) scale after a two week recovery period. Twenty (20) soybean PIs had flood tolerance scores of 1.0 to 2.0 and showed little injury to severe flooding. Seventy-eight (78) PI lines had scores of 2.3 to 3.0 and were moderately tolerant – moderately sensitive to excess water; and 164 PIs were severely injured from severe soil water-logging with scores of 3.3 – 5.0. Data combined from New Franklin in 2005 and in 2006 from New Franklin and Portageville, MO will identify PIs that show the best flooding tolerance over years and locations. The range in levels of tolerance of the 300 PIs is shown in Figure 1.

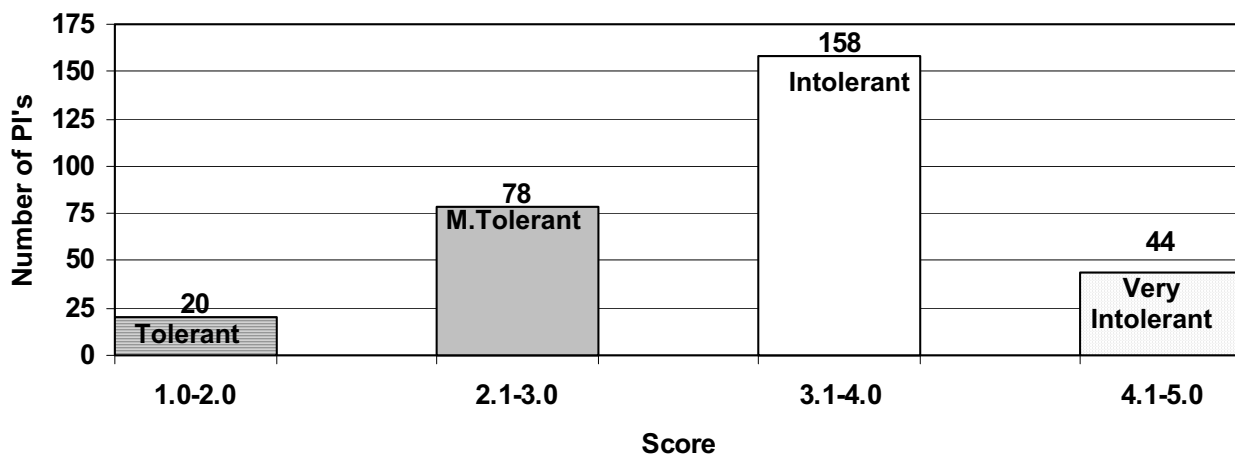


Figure 1 – Number of Flood Tolerant, Moderately Tolerant, Intolerant and very Intolerant Based on Scores of 1=No injury to 5 all plants dead for 300 Group III and IV Soybean Plant Introductions (PIs), New Franklin, MO, 2005.

Phytophthora root rot (PRR) and flooding in soybeans are often a problem on heavy clays or poorly drained soils. The question then arises do phytophthora root rot (PRR) resistance genes protect soybeans from flooding? There are genes for PRR resistance at eight or more loci. Yields of Williams rps (susceptible) and 13 Williams isolines with different PRR genes for resistance were grown on a gumbo soil at Portageville under severe flooding and normal irrigation. Yield of Williams rps, Rps 1a, rps1b, rps1k and AG 3906 is shown in Figure 2. Yield of Williams without a PRR resistance gene was reduced 10 Bu/A. Yields were also reduced for Rps1a, rps2, Rps3a, Rps4, Rps5, and Rps 6. On the other hand Williams with Rps1k, and Rps3b yielded the same or more under flooding compared to non-flood treatments showing that PRR resistance genes can protect soybeans from yield losses under excess moisture. Combinations of PRR resistance genes at different loci could be of even greater benefit for increased protection under wet soils where damage from this disease is likely. More than 50 races of *Phytophthora sojae* cause PRR and different resistance genes protect against specific races. Thus, the effectiveness of PRR resistance genes under conditions of excess water will depend on races of the pathogen present in the field. However, because other factors are obviously involved, PRR resistance will not entirely eliminate losses due to flooding.

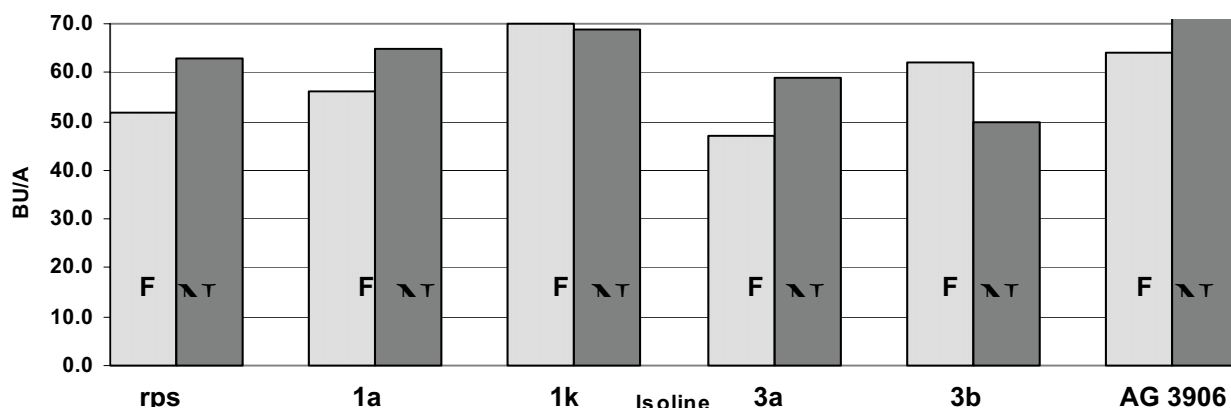


Figure 2 – Yield Bu/A comparison of Williams isolines with different phytophthora root rot resistance genes rps (susceptible), Rps1a, Rps1k, Rps3a, Rps3b and variety AG 3906 under flood (F) and non-flood (NF) conditions, Portageville, MO, 2005.

JAKE AND STODDARD- TWO NEW SOYBEANS VARIETIES FOR MISSOURI

Melissa Woolard, Senior Research Specialist

Two new high yielding conventional soybean varieties ‘Jake’ and “Stoddard were developed and released by the Missouri Agricultural Experiment Station in January 2006. The name Jake is in honor of Jake Fisher, 45 year University of Missouri employee and current superintendent of the University of Missouri-Delta Center at Portageville, MO. Stoddard was named after Stoddard County. Both varieties have broad resistance to soybean cyst nematode (SCN) and resistance to root knot nematode. Jake also carries resistance to reniform nematodes. They have shown moderate resistance to stem canker, SDS and have good resistance to some races of frogeye leaf spot. They have shown moderate resistance to SCN HG type 2.5.7 (Race 1), HG type 1.2- (Race 2), HG type 0- (Race 3) and HG type 2– (Race 5) and HG type 1.3-(Race 14) in greenhouse tests. Broad resistance to SCN is derived from Hartwig via Anand one of the parents of each variety.

Jake is mid group V (relative maturity 5.4) with purple flowers, tawny pubescence and tan pods. Seed are shiny yellow with black hila averaging about 3100 seed per lb. Yield performance of Jake in five years of Delta Center tests averaged across 25 environments and in Regional uniform tests is shown in Table 1 below. Jake has averaged similar in yield on loam soils, but 8 Bu/A more on clay and sands compared to Anand which it is intended to replace. It has averaged four inches taller and one day earlier than Anand.

Stoddard soybean is early group V maturity (relative maturity 5.1) with white flowers tawny pubescence and tan pods. Seeds are shiny yellow with black hila averaging about 3200 seed per lb. Stoddard averages three inches shorter, similar maturity and slightly better lodging resistance than Manokin. Plants most closely resemble Anand in height, lodging and seed characteristics. Performance of Stoddard compared to Manokin in 25 southeast Missouri tests and in the regional uniform tests is shown in Table 2.

Table 1: Agronomic performance and disease reaction of Jake, Anand, and USG 5601T in Southeast Missouri on Various Soil Types (2001-2005) and in the Southern Regional Uniform Tests 2003-2004.
Yield, BU/A

Line	Southeast Missouri Tests 2001-2005				Mean	US Regional Tests- 2003-04
	Loam	Clay	Sand			
Jake	62.4	58.5	51.4		58.6	56.1
Anand	61.7	50.6	43.7		53.7	-
USG 5601T	60.2	48.5	48.4		53.2	55.3
#Tests						

Table 2: Agronomic performance and disease reaction of Stoddard and Manokin in southeast Missouri on various soil types (2001-2004) and in the Southern Regional Uniform tests 2003-2004.

Line	Loam	Clay	Sand	Mean	US Regional Tests-2003-04
Stoddard	62.7	63.8	50.7	57.2	50.7
Manokin	59.5	57.2	47.1	51.9	47.4
# Tests	10	10	5	25	23

WEED SCIENTISTS KNOW NOTHING ABOUT MARESTAIL

Dr. Andy Kendig, State Extension Weed Specialist
MU Delta Center

Glyphosate-resistant horseweed or marestalk has made liars out of many weed scientists. The first recommendations were early applications of growth regulator herbicides. Later recommendations included Ignite at planting time. November applications have been recommended. This year, residual tank mix herbicides in March have been recommended. None of these recommendations have offered reliable control.

With funding from the Cotton Incorporated State Support Program we have an extensive horseweed research program underway, including seven separate studies.

Currently, our research is supporting the following recommendations:

Fall applications of traditional preemergence herbicides provide relatively little horseweed control; however, fall-applied Envoke appears to have potential to control horseweed through cotton planting.

2, 4-D and dicamba (Clarity) both have provided adequate horseweed control in our research; however, some states recommend dicamba instead of 2,4-D. Mixtures of dicamba and 2, 4-D may allow slightly reduced rates of each herbicide to be used.

Target burndown applications as late as reasonable possible. In our data, late March applications of 2, 4-D and dicamba have had minimal problems with new germination.

In-crop Envoke applications provide good suppression of smaller horseweed.

Do not tank mix “burner” herbicides with “systemic” herbicides. Some of our data hint that “burn-type preemergence herbicides like Caparol, Direx and Cotoran, may reduce the activity of dicamba. Additional research is needed; however, there were some failures this year from this type of treatment. Although there are exceptions, A general rule of thumb is that you should not mix herbicides which cause burning symptoms with herbicides that are systemic.

RETRO RICE WEED CONTROL

Jim Heiser Graduate Assistant
Delta Center Weed Science Project

Over the last several years, problems with duckweed and roundleaf mudplantain have increased. Additionally, in the past year, a number of calls have been received regarding a strange nutsedge that was not controlled with Permit. This nutsedge is actually smallflower umbrella sedge and is common in California. This was also the first rice weed to develop resistance to the ALS herbicide Londax.

It appears that this is the same situation, and this nutsedge also appears to be resistant to the other ALS chemistries including Permit and Grasp. In Missouri, this nutsedge also seems to be associated with zero-grade, water-seeded fields- which is similar to California production practices.

To date, our research has indicated that propanil provides good control of smallflower umbrellasedge, and to date, all of our control complaints have come from fields where no propanil was used. Basagran appears to be providing good control of the large escapes; however, we are recommending traditional, early-post propanil applications and according to our counterparts in California, this propanil is “the recommendation”.

In a small study we did in 2005, it appeared that Storm and propanil provided good control of roundleaf mudplantain.

In my thesis project, we are finding some carryover of the herbicide Newpath when we rotate back to conventional rice. However, we are not finding damage where Beyond was used. We want to stress that a Clearfield-to-conventional rotation should not be used- unless the producer is certain that there is no red rice present in a field. These types of rotations can result in the Clearfield trait crossing into red rice and would render the system useless.

We are conducting some renewed research on the herbicide Bolero, but find that it still requires critical water management. With current economics and more forgiving herbicides, Bolero still has a limited fit.

PALMER AMARANTH CONTROL

Chad Smith, Research Specialist
Delta Center Weed Science Project

Palmer amaranth continues to be a troublesome weed in corn, soybeans, cotton and even sometimes rice. Fortunately corn and soybeans appear to have a fair amount of competitive ability to “shade out” Palmer amaranth and in rice, Palmer does not tolerate a flood. However, Palmer amaranth is especially difficult in cotton- especially the first-generation Roundup Ready cotton as the pigweed can grow 12” a week and can quickly ruin a height differential.

Flex cotton has offered our best Palmer amaranth control in recent years. While herbicide resistance is a concern- in our programs, only one or two additional glyphosate applications were needed. When compared to hooded applications of glyphosate this can sometimes mean no net change in the number of glyphosate applications.

Reflex received a full federal label for post directed and preemergence use. For post-directed use, Reflex has been much like Valor, providing good contact and residual pigweed control. Careful application is critical as both Reflex and Valor are damaging if they contact cotton leaves. Preemergence Reflex has provided outstanding pigweed control; however, there is some risk of severe crop injury if a heavy rainfall occurs shortly after cotton emergence. The Reflex label limits this application to coarse textured soils only. While preemergence Reflex may be something we want to avoid- it could become more of a necessity if glyphosate resistance develops.

The Dual-type mixes with glyphosate (Sequence, Dual and Stalwart) have improved Palmer amaranth control- as long as an activating rain occurs. Syngenta has been stating that Stalwart is less active than Dual Magnum, and it is correct that pint for pint- Dual magnum is more active. However reduced Dual rates have provided additional pigweed control- so the Full Stalwart rate (equal to approximately 2/3 of the Dual activity) can provide additional pigweed activity.)

We have extensively tested post-directed herbicides and more often than not, they all provide good residual control. Sometimes Valor appears to be slightly better than Direx. Also we have found that using Dual or Prowl in a post-directed mix with glyphosate may improve Palmer amaranth control

RESISTANCE IS FUTILE

Dr. Anthony Ohmes, Mississippi County Regional Agronomist
MU Extension

Herbicide resistant weeds are not a new subject. Southeast Missouri became familiar with resistance in the 1990's with ALS resistant cocklebur and Palmer amaranth. More recently, glyphosate resistance has been appearing in the United States. Glyphosate-resistant horseweed is now widespread, glyphosate-resistant common ragweed has been found in two states, glyphosate-resistant Palmer amaranth has been discovered in Georgia and North Carolina and glyphosate resistant waterhemp has been discovered in Northern Missouri.

With Roundup Ready soybeans and cotton being grown on more than 95% of our acres and Roundup Ready corn acres expanding steadily, much of our weed control depends on glyphosate. Repeated use of the same herbicide is a resistance prone use pattern; although, glyphosate itself has a lower resistance potential.

The standard recommendations for resistance are to rotate herbicide modes of action, and to include other cultural practices including tillage. However, this recommendation is easier to make than it is to follow. Preemergence herbicides are commonly recommended as alternatives; however, if a good activating rainfall does not occur, preemergence herbicides will fail. Additionally, some preemergence herbicides can cause crop injury.

Postemergence tank mixes can help- especially residual tank-mix partners. However, many tank mix herbicides use the ALS mode of action. In the case of pigweed, many pigweed species are already ALS resistant, so these tank mixes will not help with pigweed. Residual tank mix partners will not work if activating rain does not occur. In cotton, the use of traditional layby chemistry is important. With Flex cotton being available, there is a temptation to make all applications over-the-top glyphosate or a glyphosate tank mix. However, we urge growers to still make a layby with any of the residual herbicides. Flex cotton makes layby herbicide applications extremely easy.

In soybeans, the old preemergence herbicides generally work well. The use of tank mix partners appears to happen somewhat regularly also, and this can help.

Resistance prevention for Roundup Ready corn is very straightforward, as Atrazine exists as an herbicide that is every bit as effective as glyphosate and every bit as cheap. Roundup ready corn should receive an atrazine treatment, either PRE in a post tank mix.

In the past year we have discovered an ALS resistant nutsedge in rice. Fortunately, the herbicide propanil appears to provide good control.

DELTA CENTER

RESEARCH

PROJECTS

PLANT PATHOLOGY

Allen Wrather, Professor Plant Science Division; **Cory Cross**, Research Specialist; and **Joyce Elrod**, Senior Research Laboratory Technician

Vision:

The vision of the MU-Delta Center Plant Pathology Team is to serve the citizens of Missouri through problem solving research and extension education. Our goals are to discover through research new and better ways to protect soybean, cotton, and rice from diseases, and then to deliver this information to members of the agriculture community. We plan to accomplish these through high quality, focused research and extension instruction.

Current Research:

- Compile estimates of soybean yield suppression due to diseases in the USA from 1996 to 2006 (Cooperating with S. Koenning, Professor at North Carolina State University, funded by United Soybean Board).
- Determine the impact of diseases on world soybean supply during 2006 (Cooperating with scientists in these ten countries, funding from USDA).
- Determine the correlation between drought tolerance of soybean and tolerance to charcoal root rot (Cooperating with Grover Shannon and John Rupe, Professor at University of Arkansas, funded by Missouri Soybean Merchandising Council).
- Search for soybean lines resistant to charcoal root rot and frogeye leaf spot (Cooperating with Grover Shannon and Jason Bond, Associate Professor at Southern Illinois University and scientists at four other universities, funded by the North Central Soybean Research Program).
- Determine soybean planting date effects on soybean rust (Cooperating with Bill Wiebold, Professor, and Laura Sweets, Associate Professor, University of Missouri, funded by Missouri Soybean Merchandising Council).
- Site-specific detection and management of root knot nematodes in cotton (Cooperating with Gene Stevens, Earl Vories, and Terry Kirkpatrick, Professor at University of Arkansas, funded by Cotton Incorporated).
- Site-specific detection of rice stress due to diseases using remote sensing (Cooperating with Gene Stevens, Brian Ottis, and Dave Dunn, funded by Missouri Rice Merchandising Council).
- Evaluate foliar fungicides for control of soybean rust (funded by industry).
- Determine effect of seed applied and in furrow applied fungicides for control of cotton seedling diseases (funded by industry and National Cotton Foundation).

Current Extension Projects:

- Missouri Certified Crop Advisor Training (Dr. Andy Kendig-Leader).
- Missouri Cotton Integrated Pest Management (Dr. Andy Kendig and Dr. Allen Wrather-Leaders).
- USA Cotton Nematode Management (Dr. Don Blasingame, Professor Mississippi State University-Leader).

- Missouri Commercial Pesticide Applicator Training (Dr. Wayne Bailey-Leader).
- Soybean Rust Management (Dr. Laura Sweets, Dr. Bill Wiebold, and Dr. Allen Wrather-Leaders).
- Missouri Rice Production Systems (Dr. Gene Stevens-Leader).

Recent Accomplishments:

- We determined that soybean cyst nematode (SCN) caused more damage to soybeans in the USA than any other disease during 1996 to 2002.
- We learned that SCN was present in 63% of Missouri soybean acres, that SCN races 1, 2, and 3 accounted for 86% of those in Missouri, and that the value of SCN damage to Missouri soybean in 1999 was \$58 million.
- We determined that Phomopsis seed decay of soybean can be best controlled with resistant soybean lines SS 93-6012 and 93-6181, and that foliar fungicides are not very effective for control of this disease.
- We published the book titled "The Biology and Management of Soybean Cyst Nematode, Second Edition." This is the only text on SCN in the world.
- We determined that planting rice in no-till or stale seedbed fields yielded similar to rice planted in conventional till fields.
- We determined the nematodes causing cotton yield loss in the US and their distribution within states.
- We learned that seedling diseases can reduce cotton plant population, but cotton yields will not be reduced until the plant population falls below 13,000 plants per acre.
- We determined that root-knot nematode distribution in cotton fields can be mapped by post harvest grid sampling fields for cotton root galls due to this nematode.
- We learned that midseason remote images of cotton fields will not be very useful for predicting distribution of root-knot nematode in these fields.
- We determined that midseason remote images of rice fields will not very well predict rice yield.
- We identified 38 maturity group 3-4 soybean varieties from 300 tested during 2003-2005 that have high resistance to frogeye leaf spot, and these could be included in soybean breeding programs.

RICE PRODUCTION SYSTEMS FOR SOUTHEAST MISSOURI

Dr. Brian Ottis, Rice Agronomist and Ralph Tanner, Technician

Due to good soils and abundant water in the region, southeast Missouri offers excellent opportunities for profitable, sustainable rice production. The vast majority of rice in Missouri is grown on soils that have been precision-graded to aid in water management. This investment in land preparation has reduced labor and irrigation costs to growers, allowing for easier management and increased profit potential. With the increasing rice acres in Missouri, the goal of the Rice Project is to research and develop rice production systems that will benefit the rice growers of southeast Missouri.

Seeding Rate Studies. The recent introduction of herbicide-tolerant and hybrid rice, seeding rates have become a point of discussion because of the increased costs associated with these seeds. Currently, hybrid rice is planted at roughly 1/3 the rate of conventional varieties. However, recent data suggest that conventional varieties can also be seeded at lower rates while maintaining adequate yield levels. We are evaluating the interaction of nitrogen fertility and seeding rates of three rice varieties to determine if seeding costs can be reduced while not sacrificing yield.

Variety Performance and Nitrogen Validation Trials. Several small-plot experiments have been initiated evaluating various components of rice production, including variety and hybrid performance and nitrogen validation trials. The rice project is constantly evaluating the latest varieties and hybrids. This year we are testing two potential CLEARFIELD* varieties, 'CL171' and 'CL151.' We are also testing various nitrogen rates and timings for the new varieties 'Cybonnet,' 'Jupiter,' 'Spring,' and 'Trenasse,' as well as the hybrids 'CLXP729,' 'CLXP730,' and 'XL723.'

Irrigation Research. We are evaluating three types of rice production practices common throughout the Bootheel to determine which provides the best profit margin as it relates to irrigation inputs. We are comparing delay-flooded drill-seeded rice, pinpoint flooded water-seeded rice, and delay-flooded water-seeded rice on precision-leveled and zero-grade fields. At the Marsh Farm located behind the Delta Center, we are also evaluating a low-pressure drip irrigation system for rice, which has shown potential water savings compared to traditional flood-irrigation techniques.

Crop Rotation and Management Research. A rice/soybean rotation is the most common practice in Mid-south rice production. Recent data suggest that soybean yields following rice may be reduced due to the previous year's rice crop. Three studies evaluating soybean varieties, tillage, and irrigation practices have been initiated in 2006 to determine how the soybean crop can be manipulated in order to produce optimum yield following rice.

The Rice Project is supported by grant dollars from the USDA-CSREES, check-off dollars from the Missouri Rice Research and Merchandising Board, and RiceTec, Inc. Special thanks are extended to all those who have provided financial support.

CROP PRODUCTION PROJECT

Dr. Gene Stevens, Crop Specialist, **Matt Rhine**, Research Specialist, **Joseph Trevathan**, Senior Research Lab Tech, and **Daniel Walker**, Lab Tech

The objective of this project is to develop profitable crop production systems for Southeast Missouri farmers. Primary emphasis is finding methods to increase crop yields and decrease the input costs.

Research Projects

Reducing Urea Fertilizer Losses in Cotton In 2005, we initiated three field cotton experiments at the University of Missouri-Delta Center in Portageville to study methods of reducing urea volatilization. Treatments included surface broadcast urea (80 lb N/acre) with and without an additive (Agrotain™, N-(n-butyl) thiophosphoric triamide, 4 quarts/ton urea) to reduce volatilization. Urea treatments were applied at cotyledon or 7th node cotton growth stages. May and June were unusually dry in 2005 for the region (1.0 inch rainfall in May and 2.3 inches in June). Early bloom cotton petiole nitrate in cultivated plots averaged across all N fertilizer treatments (including ammonium nitrate) was 26000 ppm compared to 16667 ppm in non-cultivated plots. Although weed control was maintained in all plots with herbicide and hand chopping, cotton yields were 832 lb lint/acre in cultivated and 921 lb lint/acre in non-cultivated plots. In experiment 3, a fire hose sprayer was used to create five levels of soil moisture by applying 0, 0.125, 0.25, 0.375, and 0.50 inches of water before or after urea and urea+Agrotain were broadcast. When water was added before urea was applied, early bloom petiole nitrate levels declined as pre-urea application soil moisture increased. This indicates that moist soil surface conditions promoted urea volatilization. In cotton plots without Agrotain, cotton yield declined linearly 3.5 lb lint per 1 percent increase in 0 to 2-inch volumetric water content. Cotton yields in plots with Agrotain were not affected by increased soil moisture before urea was applied.

Soil Fertility Buildup

Soil nutrient buildup from fertilizer was studied in three cropping systems at Portageville, Qulin, and West Plains, Missouri. Cropping systems included continuous corn, continuous soybean, corn/soybean/wheat rotation, rice/soybean rotation, and fescue hay and pasture. We found that crop yield response, fertilizer cost, and crop value determined which build-up program was most profitable. In the fescue test, hay yield doubled with the 1-year buildup P treatment. But, P fertilizer was expensive and hay price was cheap (\$30/ton), so 8-year build up the most profitable. In the rice/soybean test, soil tests showed more K was needed than P. Since K was less expensive than P and rice and soybean prices were higher than hay, a short-buildup of 3 years was the most profitable fertility program in this cropping system.

Mid-Season Rice N Monitoring

Highest yields from Cheniere and Francis rice were from one pre-flood N application of 140 lb N per acre. However, year-to-year environment conditions can cause N losses in rice fields. To help farmers be sure that no additional mid-season is needed, we developed a fast field test for consultants and farmers. Experiments at Qulin and Portageville showed that the method did an excellent job of predicting yield response to mid-season N. In 3 ½

minutes, plant height can be measured and leaf canopy estimated by counting the inch numerals visible on a yardstick floating between rice row drills. No calculations are needed.

Pharmaceutical Tobacco

A safe, cost-efficient alternative to mammalian cell culture drug manufacturing is pharmaceutical tobacco production. Currently, Southeast Missouri is in a prime position to be the leader in the industry. At the Delta Center, we have been cooperating with Chlorogen, Inc. and the Donald Danforth Center in St. Louis to develop pharmaceutical tobacco plants for shrinking cancer tumors.

Soybean Water Tolerance-Growth Stage/Duration Four factors affecting a soybeans flood tolerance are root survival in the first hours after flooding, ability to change to a “spongy” root structure, resistance to phytophthora root rot, and continued nitrogen fixation by root nodules. Research at the Delta Center showed that genetic diversity among current soybean varieties is probably too narrow to find complete flood tolerance. Yield losses under severe flooding were 40% for the most tolerant varieties and 80% for the most sensitive varieties. In 2006, we began testing plant introductions (PI) which were identified as beginning very flood tolerant by scientists at Columbia. In the future, these PI will be used in breeding programs to develop new soybean varieties.

Acceleration of Rice Straw Decomposition. Soybeans were planted in the spring following fall residue treatments such as burning, baling, and soil incorporation. Obvious visual differences in spring rice straw were found between treatments, which were verified with sample weights, and digital image analysis. However, soybean yields did not show significant benefits from straw treatments. We learned that rice root balls and lower stem sections (2 to 3 inches above soil) are the most resistant plant parts for microbes to decompose. Unfortunately, burning or baling usually fails to destroy or remove these parts. Even with conventional till soybeans, the rice root balls can be found in the soil in August of the next year. Of all the treatments we have evaluated, a spray treatment after rice harvest using a low rate of N and septic tank bacteria shows the most promise.

Pelletized Lime Pelletized lime is finely ground limestone, which is made into small pellets for broadcasting with conventional fertilizer equipment. Because pelletized lime is relatively expensive per ton, it is applied at lower rates (<300 lbs/acre) as compared to recommended rates of agricultural lime. In 2005, we began a soybean study on acid soil comparing palletized and ag lime. At 75 and 100% of MU recommended lime rates, yields last year were generally higher with agricultural lime than with pelletized lime. Applying low rates of pelletized lime over or directly in the soybean seed furrow did not increase soybean yields.

COTTON PRODUCTION

Andrea Phillips, Sr. Research Specialist

Bobby Tanner, Farm Worker II

Our major objective is to develop and evaluate cotton production techniques that will enable Missouri cotton farmers to maximize profits. The effective transfer of scientific technical information about cotton production is essential for the Missouri cotton producer to remain competitive in a global market

The commercial variety trials are conducted at Senath, Clarkton, Sikeston and Portageville. At Portageville the test is on both silt loam and clay soils. The Clarkton location is on sandy soil. Senath and Sikeston are on silt loam soils. The trial has fifty-two entries. The USDA Delta Regional Variety test and the Regional High Quality trials are conducted in cooperation with other states. The new strains trial evaluates very elite breeding lines in the Missouri environment. Varieties are in the marketplace a much shorter period that they have been in the past and little is known about the yield and lint quality stability. Predicting yield stability is being studied in cooperation with Tennessee and Arkansas. This project is attempting to identify varieties that consistently produce high yields. It is funded by Cotton Incorporated.

For the second year we are developing a nitrogen management package for cotton on gumbo soils. This project is funded by Cotton Incorporated.

The fifth year evaluation of planting date and stand density is being conducted to determine replanting needs. Cotton Incorporated is funding this trial.

In cooperation with Arkansas, we are conducting a study measuring and predicting internal temperatures for comparison with ambient temperatures for calculation of heat units to determine defoliation time. Cotton Incorporated core program is funding this project.

Trials using several seed treatments and in-furrow insecticide treatments are being compared. EN-ZONE, a bacterial inoculate is being evaluated. ACT, a soil conditioner, and Helena foliar products are also being evaluated. Growth regulators are being studied.

Comparison of timing of irrigation on clay soil was conducted. In the last four years the "thumbs up", hand feel method, using a soil probe is showing to be superior to the Woodruff method, Arkansas scheduler and use of the tensiometer. USDA funds this project.

Many thanks for funding of these projects by Cotton Incorporated, Missouri Lime and Fertilizer Board, USDA, agricultural chemical and seed companies and entry fees.

USDA-Agricultural Research Service Irrigation Research

Earl Vories, Agricultural Engineer, Lead Scientist; **Ray Benson**, Agricultural Science Research Technician; **John Sadler**, Soil Scientist; **Ken Sudduth**, Agricultural Engineer; other **Delta Center** faculty; and other **MU** and **USDA-ARS** faculty as appropriate

Objectives:

1. Develop methods and techniques for design, operation, and management of irrigation systems in southeastern Missouri.
2. Develop and evaluate the benefits and limitations of site-specific management (precision irrigation) technologies for irrigated agriculture.
3. Evaluate the impact of soil compaction on irrigation and possible changes in management to reduce the effects of compaction.

The irrigation research program at the Delta Center is part of the USDA-ARS Cropping Systems and Water Quality Research Unit located at Columbia, Missouri. It began in 2000 with cooperative research between ARS scientists at Columbia and Delta Center faculty. By 2003 the program had expanded enough to support additional faculty at Portageville. Earl Vories was hired as Lead Scientist in 2004 and Ray Benson as Agricultural Science Research Technician in 2005.

Current studies in southeast Missouri address soil compaction effects on irrigation management, using sensors for nitrogen management of irrigated corn and cotton, and determination of optimal seeding rates for rainfed and irrigated cotton. In addition to conducting studies at the Delta Center and with cooperators on nearby farms, the program includes cooperative studies with researchers at other locations addressing problems pertinent to southeast Missouri agriculture. For example, cooperative research with scientists from the University of Arkansas, Mississippi State University, and USDA-ARS deals with rice irrigation and impacts on water quality. With rice becoming increasingly important in southeast Missouri, this information will be quite valuable to producers in the region.

The project's objectives and research plans are currently being updated in conjunction with related programs around the country. In 2005, scientists and stakeholders met in Denver, Colorado to initiate the process. In addition to the input from stakeholders who attended the Denver meeting, information was gathered from southeastern Missouri producers and agricultural leaders to ensure that the major irrigation-related problems in the region are recognized and that appropriate strategies are developed to address them. A new five-year research plan has been developed and is currently being reviewed by other scientists as part of ARS's Congressional Mandate for peer review with the Office of Scientific Quality Review.

MISSOURI FOUNDATION SEED

Rick Hofen, Manager, **Bobby Ward**, Supervisor, Delta Center, **Joe Amelon**, Seed Plant/Warehouse, **Mary Ann Quade**, Secretary-Bookkeeper

The purpose of the Foundation Seed Program is to increase and make available planting seed of improved varieties, to distribute seed of new varieties in an equitable manner and to maintain each crop variety in a manner that will safeguard the genetic identity and purity. Foundation Seed is a self-funded project of the Missouri Agriculture Experiment Station.

All certified seed production originates from foundation seed stock. The purity of foundation seed is critical to assure high quality seed is available to the growers of Missouri.

This year Missouri Foundation Seed at the Delta Center is producing five varieties of soybeans, two varieties of rice, and one variety of bermuda grass.

Of the five soybean lines being grown, three are public varieties, two are experimental Roundup Ready lines, and one is a conventional experimental line being tested for possible release.

The rice varieties in production this year are Cheniere and Wells.

Ozark is a variety of hybrid forage bermuda grass being grown again this year.

New varieties of these commodities are giving producers some exciting new choices for their production. We encourage you to contact us or the certified seed dealer in your area for more information on these varieties.

VARIETY TESTING

Dr. William J. Wiebold, Associate Professor,
Scotty Smothers, Research Specialist,

Objective:

The objective of the University of Missouri Crop Performance Testing Program at the Delta Research Center is to provide producers with an up-to-date, reliable and unbiased source of information that will permit growers in southeast Missouri to make valid comparisons of available varieties of soybeans, corn, and grain sorghum.

To Producers:

Selection of a productive crop variety is an important and low cost management decision. However, the large number of varieties available and the various combinations of plant characteristics can make the decision difficult and time consuming. In an effort to make the process of choosing a variety that performs well in a given environment easier, the Missouri Crop Performance Testing Program evaluates hundreds of varieties at multiple test locations across the bootheel region.

Our goal is to treat each variety the same, eliminating all variables possible within the test plots, both natural and man made, and allowing each variety to express its own unique genetic potential. Tests are conducted under as uniform conditions as possible using small plots to reduce the chance of soil and climatic variations occurring between one variety and another.

While there is a tendency to consider the test results nearest ones own farm, studies suggest basing variety selection on multiple locations across time can make the greatest gains in productivity. Therefore, to obtain an improved estimate of a particular varieties' potential, the performance results of that variety should be checked at several different locations and for several different years. This method of variety selection should allow a grower to chose a variety with high yield potential, regardless of the environmental conditions in which it is grown, given that routine and accepted farming practices are used during the production of the variety.

Every effort has been made in the Missouri Crop Performance Testing Report to facilitate comparisons of varieties across years and locations and should aid the individual grower in evaluating the merits of most commercial varieties available in Missouri today. It is also suggested that growers using a new variety for the first time consider the information contained in this report and then grow a small acreage to determine if the variety in question is one which will work well in their particular farming program.

Major Accomplishments

Over the years, the Missouri Crop Performance Testing Program has made many innovations in variety testing procedures and in the distribution of data. Field equipment has been upgraded to include state-of-the-art planters and plot combines. Harvesting equipment has been fitted with electronic weighing systems, moisture monitors, and data recorders to improve accuracy and to speed the acquisition, processing and publication of information gathered.

Information is now distributed in the form of published reports and electronic media. Results of variety evaluations are published every year in three separate Missouri Crop Performance Special Report books. There are approximately 14,000 copies of these books distributed across Missouri for the three major crops of corn, soybeans, and grain sorghum. There are some 20,000 copies of a condensed soybean publication sent by mail directly to growers around the state, which are printed and distributed in cooperation with the Missouri Soybean Merchandising Council and farmer check-off dollars. In addition to these printed versions variety evaluations can be found on the World Wide Web at <http://agebb.Missouri.edu/cropperf>. The data on the web site is exactly the same as the data found in the printed versions of the Missouri Crop Performance books.

SOIL TESTING LABORATORY

David Dunn, Supervisor, **Anne Johnson**, Office Support Staff III

Hope Bynum, Research Laboratory Assistant

The past year was a good year for the Delta Regional Soils Testing Lab. Soil and plant sample numbers as well as revenue were up from 2004. In 2005 we processed 16,043 soil and 2,750 plant samples. This represents an almost 50% increase in soil sample numbers over 2004. Our revenue for the year was up \$29,000 to \$161,000. Our expenses increased by \$6,000 to \$160,000 leaving us with a gain of \$1,000 for 2005. As of December 31, 2005 our bank account totaled \$57,343. In 2005 we continued to update our computer capabilities. Using residual funds from our USDA Rural development grant several new computers were purchased. These computers have allowed us to generate/retrieve results faster for our customers. In 2004 we added the ability to generate comma delineated data files that include crop recommendations. In 2005 this feature was used by our precision ag customers to develop prescription application maps for variable rate fertilizer and lime applications. In 2005 this feature was used on over 2,700 samples. This represents 17% of our soil sample numbers and is an increase of over 1,000 samples from 2004. Also a new window based recommendations system for agricultural samples has been installed. The new system also allows customers to access soil sample results from past years. This was a big help to our customers as when they were getting their records together for enrolment in USDA CSP program. Our new program makes it possible for our customers to easily access soil test results and recommendations via the Internet. This system allows customers to change crop and yield goals for their sample results. Now our customers can compare fertilizer requirements for different crops on-line. Previously these changes have required assistance from Soil Lab personnel. This same type of on-line system is currently being developed for horticultural soil samples. We continue to generate computer recommendations in MS Word or Word Perfect format. These recommendations can easily be sent via E-mail to our customers. This has reduced our turn around time and is much appreciated by the producers that we work with. Additionally to reduce turn around time for our customers who submit soil samples via US Mail we are picking up our mail on Saturday. This allows us to process samples on Monday that previously would not have been received by the lab until Monday. This timesaving is much appreciated by our more distant customers.

During 2005 we continued to work with Dr. Gene Stevens to develop a plant analysis system. Previous work had indicated that adding phosphorus (P) and potassium (K) at midseason could increase rice yields in P or K deficient fields. For the last three summers we have worked on a rice project where plant K levels were determined for individual plant parts at various growth stages. Our goal is to determine which plant part and growth stage best predicted yield. As a result of this study we determined that K levels of whole plant sample collected at pre-flood was a good predictor of yield. Also, later in the season, lower rice leaves are a better indicator of K deficiency than flag leaves. In 2004 & 2005 a study of the phosphorus (P) needs of rice was conducted. In this study rice plots were treated with P at different times during the growing season. From this we learned that adding P as late as inter-node elongation could increase rice yields. However the maximum benefits of P fertilization could be obtained when P was added at the pre-flood stage. This timing allows rice producers to use ground rigs to apply P in the same trip as their pre-flood N, thus saving the expense of a separate application. This work has also caused us to take a second look at our recommendations for P fertilization of rice.

SOUTHERN TELECOMMUNICATION COMMUNITY RESOURCE CENTER (TCRC)

Ann Matthews, Interim Coordinator, **Eddie Lowery**, IT Specialist
James Burton, Education Extension Assistant

Programs

1. Credit programs: Offer classes toward college degrees. Classes are being offered from Three Rivers Community College, University of Missouri Columbia and St. Louis, and Arkansas State University.
2. State Agency: State personnel that travel frequently to Jefferson City for training could reduce travel time, mileage, hotel fees and time away from work by meeting through interactive television in all Telecenter sites.
3. Client Consultation: Physicians, Lawyers, Financial advisors and other professional consultants can easily use TeleCenters to consult with clients at a distance.
4. Extension programs: Extension is an integral partner with the TeleCenter network. These programs will involve continuing education opportunities, meetings, training and workshops.
5. Technology training: there is need and potential for teaching people to use technology in our TeleCenters.
6. Conference Rooms: In 2006 we had 4246 people attend various meetings, classes and conferences held at the Telecenter.
7. Public Access: We have several computers open for use by the public. In 2006 we logged 657 hours of computer usage by the public.
8. Disaster Preparedness: A major function of this Telecenter is to provide training for first responders in case of Terrorist attack earthquake and/or flood. We are therefore engaged in training volunteer fire department members, law enforcement officers, emergency medical persons, emergency management personnel and citizens in how to be ready for disaster. Homeland Security has come forward importance. First responder training is a major part of our mission. We are currently negotiating with federal agencies concerning major training exercises in disaster preparedness that will involve Federal, State and Local first responders, Army Corp of Engineers and Coast Guard. The Missouri National Guard has recently become involved in training discussions. The Missouri Seismic commission has become involved. SEMA and the Center for Earthquake Studies at University of Missouri, Rolla have held pilot training programs from the TeleCenter. The University of Missouri Fire and Rescue Training Institute has also conducted several training opportunities for local volunteer fire departments. The Local Emergency Planning Committee has become active in the Southern Telecenter.

Facility

1. ITV 110 Classroom seats 22 students

2. ITV 111 Classroom seats 40 students
3. ITV 112 Classroom—Computer Lab—24 computer workstations available.
4. The Video Conference Room 109--seats 14 people.
5. Auditorium can accommodate 200

Operating Overview and Input

Management Committee, Executive Committee and Program Advisory Council.

Business Hours, 2004:

Monday - Friday	8:00 A.M. - 9:00 P.M.
Saturday	As Needed

The Center will be open on an as-needed basis, upon written request from a programming source.

I. Personnel

University Extension staff @ the Southern TeleCenter:

Extension Associate –

Information Technology Specialist Eddie Lowrey

TeleCenter Interim Coordinator Ann Matthews

Education Extension Assistant James Burton



**DELTA CENTER FIELD DAY AND
FARM SAFETY FIELD DAY
FOR FFA STUDENTS
University Outreach and Extension**

On our nations farms and ranches, it is estimated that there are from 100 to 300 deaths and 100,000 to 250,000 injuries each year. Farming, behind mining, is the second most hazardous occupation in the United States.

From one-third to one-half of non-fatal childhood agricultural injuries occur to children who do not live on farms. The highest injury rate of all farm accidents is among boys 14 to 17 years of age. There is no doubt that our young agriculture people in Southeast Missouri are at risk for farm and rural injuries.

To address this concern, Local FFA Chapters and University of Missouri will sponsor Farm Safety Day during the Delta Center Field Day program in Portageville, Missouri.

More than 500 Vocational Agriculture students will be participating. There will be seven or more separate demonstrations and presentations for the students to attend, and a field tour of research plots.

The Farm Safety Field Day area is located east of the shop in the machinery building. Presentations will be continuous from 10:00 a.m. to noon. Every one is invited to attend.