From the Director

Foundation seed in the bin and will be ready for spring

Comments in the last newsletter about an unusually wet season deserve repeating. The rains continued well into November, making harvest very difficult. Fortunately, our rice and soybean seed are finally in the bin and in good condition, largely through the wise choices and hard work of Ronnie Sherman, the manager of foundation seed.

We have been hearing reports of a lot of rotted, sprouted seed throughout the state, turning what could have been a bumper crop into a disaster in many locations. There is no indication that we should have any trouble meeting our seed orders. We’ll be ready for spring. But first, it’s hunting season.

High yielding rice line considered for release in 2010.

The Rice Outlook Conference is in December at New Orleans. Chuck Wilson, our extension agronomist and soil fertility specialist will be presenting a research report in what is a new format for state reports. Each state will have a single topic presented in depth, and the panel and audience will have an opportunity to ask questions. We anticipate this will generate much more interest in the session and will be a good vehicle to demonstrate some of our rice research accomplishments.

Christopher W. Deren

NEARLY READY — Construction of the new facilities has gotten a little behind schedule but neared completion in mid-November. Weather was partly responsible for delays. The main entry, with a tongue and groove portico ceiling (left) continuing into the foyer, is between the office wing and conference center. The complex also includes a “clean lab,” which will house the physiology, molecular genetics and biomass energy labs; and a field lab, which will house the breeding, pathology, agronomy and entomology labs.
**Controlled heat can improve rice and wheat straw bioenergy characteristics**

Two agriculture production byproducts, rice and wheat straw, may prove viable as alternative sources of clean energy that do not compete with food production. Since there is an abundance of straw left in the field following rice and wheat harvest, the challenges of removing, storing and refining the residue must be addressed.

With each crop production cycle, rice straw, as a residue, averages about 2 to 3.5 tons per acre, or 10 million tons nationwide, while wheat straw yields approximately 1.2 tons per acre or 75 million tons nationwide. If these byproducts can be turned efficiently into bioenergy, they might contribute millions of clean BTUs every year.

Both straws, however, contain low bulk and low energy per unit, the content of both have irregular particle sizes and shapes, and both offer critical challenges in their handling during and after harvest.

Rather than seeking to answer the challenge of gathering the straw, which we anticipate could lead to expensive equipment; we have focused our attention on transforming wheat and rice straw into a state where the straw’s energy output per unit of mass is highly efficient. A potentially promising solution can be found in a process called torrefaction. Torrefaction is very similar to the process that wood undergoes to become charcoal.

When torrefaction is initiated, ideally in an oxygen-free environment and at temperatures between 400 to 570 degrees Fahrenheit, moisture is released and the biomass undergoes physical changes, resulting in a product which becomes light, flaky in texture and relatively easy to grind.

In addition, torrefied straw loses its tendency to absorb water, making it stable in storage. This is the key to preserve the torrefied straw against any biological degradation. Torrefied straw can then be used as a solid fuel for industrial applications. It can also be co-fired with coal in pulverized coal boilers.

Researchers in Europe who have studied the torrefaction of hardwood sawdust report that torrefaction temperature has a profound effect upon the biomass weight loss. One of the most important findings is that torrefaction of wood reduces the power consumption required for biomass size reduction by about 50 percent.

Research on torrefaction of rice straw and wheat straw by Samy Sadaka and team members Sunita Negi and Mahmoud Sharara at the University of Arkansas Division of Agriculture found there is a need to explore torrefaction of agricultural residue for energy production and to develop a batch-type torrefaction system for laboratory scale work. The main objective of their study was to investigate the effects of torrefaction temperature and time on the physical and thermochemical characteristics of rice straw and wheat straw as measured by changes in moisture content, weight loss and energy content.

Sadaka reported an increase in energy density by about 16 percent against raw straw. He also found that the torrefied straw from rice and wheat became hydrophobic, with final moisture content of about 4 percent to 6 percent under torrefaction temperatures of 500 degrees Fahrenheit.

The research team found the higher the torrefaction temperature (right to left in the photos), the darker the biomass. Also, the longer the torrefaction residence time (top to bottom) the darker the biomass. The dark-colored straw represents a more coal-like material. Sadaka’s team also evaluated the size reduction of wheat straw and found that the higher the torrefaction temperature and the longer the residence time, the smaller the size of torrefied straw, which means that torrefied straw becomes shorter in length after grinding.

This project is a part of a larger project led by Mark Cochran, director of the Arkansas Agricultural Experiment Station, who is coordinating the Mid-South/Southeast BioEnergy Consortium, which includes projects in Arkansas and Georgia and supported in part by the U.S. Department of Energy.

The bioenergy team is convinced torrefaction has improved the physical and thermochemical properties of biomass in numerous ways, including the reduction of moisture content and weight and an increase in the energy content per pound. This process can help solve some of our farmers’ challenges with agricultural wastes while producing renewable energy.

Samy Sadaka, Ph.D., P.E., P.Eng.
Assistant Professor, Extension Engineer-Biosystems
Draining rice fields for harvest is a critical timing question for rice growers. Draining too early risks reduction of rice yield and milling quality. Draining too late leads to wasting water, harvest in muddy soil conditions with equipment problems and increased tillage and land forming costs. Research on this project has the potential to improve timing and provide a scientific basis for draining rice fields. We have developed a program that takes into account water available to the crop after draining the field, timing between reproductive growth stages and water use during reproductive growth stages. From this information, a recommendation for a safe stage of rice for draining is reached.

Our previous research results indicated farmers could drain long-grain rice cultivars on many soils two weeks after 50% heading (50% of the panicles in a field were judged to have emerged). That is 11 days or earlier than the standard practice and extension service recommendation at the time of 25 days after 50% heading for long-grain cultivars, 35 days after 50% heading for medium-grain cultivars and 45 days after 50% heading for short grain cultivars. This practice allowed water savings of $23/acre. In addition, soybean yields could be increased when the water not used for rice can be shifted to soybean irrigation if pumping capacity is limiting.

Farmers have often been reluctant to practice earlier draining for fear of injuring rice. Farmers often do not know when rice is at 50% heading and prefer a more visible marker. The rice growth staging system was developed to provide an objective, uniform and adaptive system for determining the stage of rice development and facilitates communication about rice production practices and research findings.

The system is objective in that discrete plants characteristics form the basis for determining the stage of development. The system is uniform in that two or more people employing the criteria for stages of development for the same plant will arrive at the same conclusion. The system is adaptive in that the enumeration and determinations are based on visible plant criteria.

We set about to determine when rice could be safely drained and found, as other scientists have found, that rice can be injured by water deficits anytime until the rice grain has completed filling. However, our findings indicate that the soil can hold sufficient moisture to prevent water deficits for up to four weeks after draining. The soil profile provides a substantial water reservoir for the rice crop during late reproductive development. Also, as the crop proceeds towards maturity, the rice crop uses less water. Consequently, the soil provides substantial water reserve and the crop uses less water as the crop matures. In addition, the reproductive development of the rice crop, just as vegetative development, follows thermal time — the DD50. So, the rice crop’s reproductive development can be predicted using projections based on reproductive development and DD50 accumulation.

The program works as follows:

First determine the amount of water held in the soil profile after draining surface water, then determine in a backward direction from maturity the amount of water used from:
- R9 (grain maturity) to
- R8 (brown grains on one grain on main stem panicle) to
- R7 (one yellow grain on main stem panicle) to
- R6 (grain elongated to end of hull) to
- R5 (grain elongating to end of hull on one grain on main stem panicle to
- R4 (anthesis on one grain on main stem panicle) and R3 (exertion of main stem panicle).
Making a no-till rice rotation work in Arkansas

No-till rice and soybean production is not a common practice in Arkansas. With rising fuel costs and an interest in carbon sequestration there is a possibility that no-till will become more popular in the future. This will no-doubt happen if there is a market for sequestered carbon and farmers receive reasonable payments for no-till practices.

One of the most common reasons farmers give for not practicing no-till crop production is that they fear grain yields and profitability will decline. More often, farmers realize that no-till will result in reduced fuel and equipment costs but worry that these will not be sufficient to offset expected yield losses. Switching to no-till management is confounded with rice production in that there are a number of field operations that are needed to provide adequate water management and that those operations oftentimes are different for soybeans than for rice. In general, there is little information available to farmers on how they might manage a rice-soybean no-till production system.

In 2000, we initiated a study at the Rice Research and Extension Center that compares grain yields in a no-till, rice-soybean rotation to a similar conventional-till rotation. Both tillage systems use the same varieties, fertilizer levels, and pest and disease control measures. They are planted and harvested at the same time with the same equipment. Two varieties are used each year with Wells having been used in every year of the study. Each plot is divided into two fertility levels; one representing a lower application rate and the other a higher application rate.

When comparing tillage treatments, no treatment was better in all years. However, there was a trend of increasing grain yields in the no-till plots as the study got older. Initially, rice grain yields were lower in the no-till plots when compared to the conventional-till plots. This same trend has been documented for a number of crops and was expected here. Much of the decreased grain yields at the start of the study can be attributed to our lack of understanding of how to properly manage the no-till plots.

Further analysis of these data has shown that, over all years, there was less variation in the no-till rice grain yields as compared to the conventional-till yields. It was also noted that individual year highs and lows generally occurred in the conventional-till plots. Stability in the no-till rice grain yields makes this management system attractive to farmers who are adverse to high risk.

Soybean grain yields have steadily increased over the eight years of this study. This is attributed to the availability of higher yielding soybean varieties.
When the cumulative water use from these stages through R9 is determined they can be matched to the water available in the soil at draining. The cumulative stage, which is equal to or less than the water available in the soil, is the stage at which the rice is predicted to be safe to drain. This computer program can become a useful tool for planning and managing the rice crop.

Cost savings are not trivial. The cost of one less 3-inch irrigation is $4 to $19 per acre for pumping depths of 50 to 300 ft. Further savings can be realized by the reduction of tillage costs associated with rutting rice fields. Additional benefits from early rice draining are the availability of water for soybeans at yield-critical stages of soybean development.

This system has not been tested on other soils in the state, and this research is needed to extend the program beyond Grand Prairie soils.

The program has been field tested on Grand Prairie locations during four years (2005-08). Another test was conducted in 2009 and the results will soon be evaluated. Our results have so far shown no decrease in rice grain yield or quality from draining by the program compared to conventional, later draining.


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This project was partially funded by a grant from the Arkansas Rice Research and Promotion Board through rice producer checkoff funds. Cooperators on the project are farmers Jody Holzhauer, Danny Bulluck and Walter Hillman, and Division of Agriculture scientists Brad Watkins, Kris Brye and Terry Siebenmorgen.

For more information, contact Paul Counce, Rice Research and Extension Center, 2900 Highway 130 East, Stuttgart, AR 72160; phone: 870- 673-2661; pcounce@uark.edu.

Paul Counce, Plant Physiologist
Professor of Crop, Soil, and Environmental Sciences

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### Rice Outlook Conference in New Orleans, Dec. 9-11

The 2009 USA Rice Outlook Conference will be Dec. 9-11 at the Marriott hotel in New Orleans. The conference is the an educational forum for rice producers and all segments of the U.S. rice industry.

Educational program topics will include:
- Situation and Outlook for U.S. Rice Domestically and Internationally
- Economic Outlook and Implications for U.S. Agriculture
- Domestic and International Market Issues
- Reports on the Regulatory Front
- State-by-State Rice Production Outlooks
- State and National Rice Research, and more

A trade show will feature rice-related farm equipment, technology, products and services.

Keynote speaker will be Jim Wiesemeyer, vice president, Informa Economics, Washington Bureau, with insight on issues in Washington, D.C., and implications for the U.S. rice industry.

For information, e-mail jdavis@usarice.com, or call 800-888-7423 or 703-236-1447.

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### Making a no-till rice rotation...

As was the case with rice, initial grain yields in the no-till plots were lower than in conventional-till plots. This problem is attributed to our having difficulties in managing the plots and an increase in *Phytophthora* in the no-till plots. Once we changed to varieties resistant to *Phytophthora* there was a steady increase in the no-till soybean grain yields.

We have documented improvements in soil quality and reduced water and plant nutrient runoff from the no-till compared to conventional-till. When we put these data with the grain yield data (page 3), it is evident that a no-till approach to rice-soybean production has a good future. In order to better facilitate farmers’ knowledge of this work, we are preparing extension publications that will cover: 1) how to manage a no-till rice-soybean rotation, 2) economic benefits of a no-till rice-soybean rotation, and 3) natural resource benefits from a rice-soybean rotation. These will be available in late 2009.

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*Merle Anders, Rice Systems Agronomist*

Research Assistant Professor of Crop, Soil, and Environmental Sciences
High yielding rice line considered for release in 2010

The experimental line RU0801076 is being considered for release to qualified seed growers for the summer of 2010. It is a high-yielding long-grain rice variety derived from crosses between the following parents: LaGrue, Katy, Starbonnet, Newbonnet, a mutation line from Bonnet 73, Lemont, Lebanon, CI 9902, Dawn and CI 9695 (number 20001692) made at the Rice Research and Extension Center, Stuttgart, in 2000.

RU0801076 has excellent rough rice yields with good milling yields. The preliminary (one location still remained in the field when this was written) three-year mean for 2007-09 from the Arkansas Rice Performance Trials for RU0801076 is 191 bu/A compared to Wells, Francis, Taggart and RTXL 723 at 176, 178, 179 and 186 bu/a, respectively. The two-year mean (2007-08) for milling yield (head rice:total rice) is 57:70 for RU0801076 compared to Wells, Francis, Taggart and RTXL 723 at 51:71, 57:71, 54:71 and 57:71, respectively.

RU0801076 has excellent straw strength even though it is two inches taller than Wells. Lodging over the years has been minimal. Even when tropical storm force winds caused most of the varieties to lodge in northern Arkansas in 2008, RU0801076 was still standing in all but one plot, which was pushed over by the neighboring plot.

Karen Moldenhauer
Rice Industry Chair for Variety Development and Professor of Crop, Soil, and Environmental Sciences

HEAD ROWS — Breeder head rows of experimental long-grain rice line RU0801076 pictured in 2008 at the Rice Research and Extension Center.

HIGH YIELD — Experimental line RU0801076 posted excellent rough rice yields with good milling yields in the Arkansas Rice Performance Tests, 2007-09.

STRONG STRAW — Experimental line RU0801076 has excellent straw strength even though it is two inches taller than Wells.