Southwest Region

Rice Research Station News

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May 1, 2010

Hybrid Rice Research: Year Number 2

Hybrid rice research at the Rice Research Station was initiated in January 2009, when the hybrid rice introductions were first planted in the greenhouse. This hybrid rice research program was established to provide improved high yielding hybrids to the Louisiana rice industry. Development of hybrid rice requires use of unique sterility/fertility traits that do not exist in the U.S. rice gene pool. Only a collaborative effort, both domestic and international, can help us to achieve the ultimate goal of delivery of commercially viable rice hybrids to our rice growers.

Research objectives include the development and identification of male sterile lines (cytoplasmic A or environmental sensitive S) and restorer (R) lines adapted to the southern U.S. environmental conditions; identification of elite cross combinations through extensive test crossing and yield trials; exploration of the feasibility of economical hybrid seed production; and the development of a marker-assisted selection scheme involving identifying and developing molecular markers for sterility/fertility and general combining ability traits, as well as anther culture to significantly expedite the breeding process.

Because of the hard work by Prof. Weike Li, a visiting Chinese hybrid rice breeder, as well as the entire rice breeding team, significant progress was achieved in 2009, which includes the successful propagation of hybrid germplasm introductions under quarantine, the development of a total of 247 crosses or testcrosses for the breeding of adapted lines or discovery of elite cross combinations, and the identification of four candidate hybrids through a transplanted preliminary yield trial. Candidate hybrids include three-line medium-grain lines LAH10 and LAH20 and two-line long-grain lines LAH34 and LAH35. All four candidates appear to have excellent yield potential, good milling and grain quality, and agronomic characteristics and cooking quality comparable with conventional varieties. A high yielding, high quality Louisiana developed and adapted line served as the pollen parent of LAH35.

The 2010 research activities are divided into four distinctive areas: line development, test crossing, yield trials, and seed multiplication and production. For line development, selection of new and adapted R, maintainer (B), and S lines will be conducted on segregating populations derived from the crosses between introduced germplasm and elite Louisiana lines.

Several 2009 test crosses between cytoplasmic male sterile (CMS) A lines and Louisiana lines were found to be completely sterile, which suggests those local lines might be candidate B lines. This finding is being verified by further backcrossing. About 400 to 600 test crosses will be made between A or S lines and Louisiana varieties or other elite lines. Of two planned in-station hybrid yield trials, the observational yield trial was drill-seeded on March 29, which consists of 205 test crosses made in the fall of 2009.

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Special Dates of Interest:

Rice Research Station Rice Field Day
Thursday, July 1, 2010

Southwest LA Rice Field Day - Fenton/Welsh area
Wednesday, May 26

Evangeline Parish Rice Field Day - Mamou area
Tuesday, May 25 at 8:30 a.m.

Acadia Parish/RRS South Farm Field Day
Wednesday, June 16

Vermilion Parish Rice Field Day - Gueydan area
Tuesday, July 6 at 3:00 p.m.

Northeast Parish Rice Field Day - Rayville area
Wednesday, July 14 at 9:00 a.m.

Planting of hybrid rice preliminary yield trial with a cone-planter by Brent Theunissen (driver) and Steve Linscombe.

Field of small-scale seed multiplication (front) and the 1/3-acre hybrid seed production of LAH10 (back and flushed). The metal poles will support the plastic sheets during flowering, which provide isolation of different lines.

A preliminary yield test of six candidate hybrids was also drill-seeded on April 14. An effective hybrid seed production system is critical not only for rice growers but also for hybrid research. At least 2 to 3 pounds of hybrid seed must be produced of a single candidate for its inclusion in an advanced yield trial. It will be extremely expensive and time-consuming to manually produce this amount of seed. Other than genetic improvement of parental lines to maximize their outcross potential, careful selection of planting area and date, precise management of water and nutrients, and on-time application of the plant growth regulator gibberellic acid (GA) are extremely important for the production of pure and sufficient hybrid seed. A 1/3-acre of hybrid seed production of LAH10 was planted on March 29. Small scale (180-3,000 ft^2) multiplications of seven A/S lines and seed production of three candidate hybrids will be transplanted in late April.

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Aerial Seeding of PolyC15 Smooth Cordgrass

One important area of research at the Rice Research Station is improvement of plant species that can be used for coastal restoration efforts. Smooth cordgrass is one species that has been used extensively in these efforts, and research has been conducted on this plant type for a number of years. Smooth cordgrass typically spreads vegetatively, and while it can produce seed, seed production is limited. Researchers have been working to improve the seed production trait to facilitate the propagation of smooth cordgrass, ideally by aerial seeding. Aerial planting offers speed, ease and the versatility of getting into remote areas inaccessible by land vehicles or boats. Aerial seeding is the most economical way to conduct large-scale planting of smooth cordgrass for a variety of purposes, including ecosystem maintenance to achieve desirable habitat functions and health among Louisiana coastal marshes and quick rejuvenation of smooth cordgrass populations following a massive die-back (brown marsh) that can occur periodically.

The research has led to the development of PolyC15, which is a synthetic experimental variety of smooth cordgrass. The population is made up of 15 genetically different lines of smooth cordgrass that have all been selected for characteristics that will enhance their suitability for coastal restoration efforts. Most importantly, these lines all have the trait for high rates of seed production.

An aerial seeding study using seed of PolyC15 was conducted this spring at Bayou DuPont in a marsh-created site near Belle Chase in Plaquemines Parish, in a collaboration between the LSU AgCenter Rice Research Station and the Office of Coastal Protection and Restoration. The site is a newly created marsh built by pumping the sediment from the bottom of the Mississippi River. The seeding was conducted using a commercial aerial application plane on March 31, 2010. The seed used in the aerial study was harvested in mid-November of 2009 from PolyC15 grown at the Rice Research Station. Before being loaded onto the airplane, PolyC15 seed was mixed with clay absorbent as a spreader. A total of 60 pounds of cleaned seed were used. The average germination rate of PolyC15 seed was 70 percent. The plane was calibrated by adjusting a hopper opening at a given air speed to deliver seed in the rate of 10, 20 and 30 pounds per acre. Each seeded area was a 40-by 1,000-foot strip separated by a 56-foot unplanted area. Aerial application led to an average density of 10, 22 and 32 viable seeds per square foot, corresponding closely to seeding rates of 10, 20 and 30 pounds per acre.

The area seeded was flooded on the day of seeding. However, conditions of the study area had changed rapidly from mostly wet and inundated land fractions into dry land with less inundated land fractions. This was due to the de-watering process as the pumping project drew to a close. The speed of de-watering occurred much faster than anyone expected, while the rate of land compaction happened slower than anticipated. The breaches across the dike intended to stimulate the movement of intertidal water in and out of the created marsh did not work because of the slow rates of land compaction.

Because of these conditions, about 90 percent of the seed was not visible in most parts of the seeded area 14 days after the aerial seeding, when the site was evaluated. However, where the seed had fallen into areas where moisture remained, the germination rate was good, and large numbers of seedlings in these areas appeared to be well-established and growing well. Additional information will be collected involving monthly growth monitoring during the growing season. Data collected will be used to better understand how various micro-conditions affect the likelihood of seed to successfully establish seedlings under natural settings and how they affect the growth of the resulting plants. Quantification of these factors will help improve the rates of successful aerial seeding of PolyC15 under natural coastal marsh conditions where human control is currently limited. An important fact is that under typical coastal marsh conditions, smooth cordgrass can grow to about 9 square feet in one season.

Despite unforeseen conditions, the overall study was a success and provided valuable information on aerial seeding as well as insight into additional research needed to facilitate the success of aerial seeding efforts in the future.

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Aerial seeding of PolyC15 at Bayou DuPont newly created marsh near Belle Chase.

Distribution of seed on the ground following aerial seeding.

Growth of seedlings to two-leaf stage three weeks after aerial seeding.

Germinating seeds found on the soil crevices three weeks after aerial seeding.

Considerations for Stocking in Crawfish Aquaculture

Two examples of the rationale often preceding the question “Should I restock my crawfish ponds” are: “I caught very few crawfish this year” or “I caught most of my crawfish out.” The advice in either case would probably be that there is no need to restock. When crawfish ponds are managed for production over consecutive seasons, restocking is usually not necessary nor beneficial – especially where there was a sufficient density of crawfish to justify regular (or even periodical) harvests at some time during the preceding season. Ample broodstock would likely exist under those conditions. Trap harvesting is relatively inefficient, and enough crawfish normally avoid capture to adequately serve as broodstock. In fact, increased attrition on the population by burrowing can be a contributing factor to the drop in daily catch near the end of the season.

Stocking is usually required only in new ponds, ponds that have been fallow for a year or longer, and when there has been a catastrophic loss of the population, such as from a chemical kill or major pond renovation. Introducing additional broodstock when adequate residual crawfish remain is a waste of money and effort. Research has shown that crawfish yields have little to do with the amount of broodstock introduced over and above a minimal amount if survival and reproduction are adequate. There appears to be some level of self-regulation of populations when broodstock numbers vary. More broodstock do not necessarily correspond to greater populations of crawfish.

When stocking is needed, the question of optimum stocking rate is always raised. The go-to recommendation that has served many well in the crawfish business over the years has been one to two sacks of crawfish (35-70 pounds) per surface acre of ponds. Though generally sufficient, this catch-all recommendation may not be the most cost-efficient for every situation. Actual recommendations will depend on such things as the quantity of native stock present, the survival rate of both native and introduced crawfish stock, the success rate of reproduction, and the survival rate of the young-of-the-year hatchlings. The degree to which these factors will have an impact will be largely unknown at the time of stocking and, to a large extent, governed by weather patterns. However, there are certain levels of management that producers have control over that will aid in the most effective and efficient results from stocking. Consideration should be given to each of the following practices to maximize effectiveness and improve cost efficiency:

- Because markets in the South highly favor the red swamp crawfish (*Procambarus clarkii*) over the white river crawfish (*P. zonangulus*), care should be taken to stock reds only.
- Research has shown that the source of the broodstock (rice-field pond, marsh pond, Atchafalaya Basin) doesn’t matter as long as the crawfish are healthy and in good condition at time of stocking.
- Stocker crawfish should be lively and contain adequate body reserves (as indicated by full, yellow/orange hepatopancreas or “fat”). Survival and completion of reproduction in the burrow depend on adequate body condition.
- At least half the stockers should be females, with a majority of those in the mature state at stocking.
- Size of broodstock matters little. Large stockers will not necessarily mean their offspring will reach a large size. Although smaller broodstock have fewer offspring, this is offset by more females per pound (or sack) stocked.
- Stocker crawfish should not be stored in a thoroughly chilled state (less than 40 degrees F), although it is often beneficial to keep broodstock cool (55-75 degrees F) and moist during transport.
- Care should be taken to avoid stocking of overly stressed crawfish. Stress can occur in the trap because of crowding and low oxygen conditions or following the harvest by poor handling conditions.
- Crawfish should be stocked as soon as possible after harvest – preferably during the cooler part of the day. Handling and stocking on cloudy or rainy days or during early morning hours may improve survival.
- Stock all major sections of a pond and place crawfish in the water, not on dry ground.
- Preferred months of stocking are April, May and June. Water temperature on the day of stocking is critical and should be less than 90 degrees F, or crawfish may die or simply exit the pond.
- Ponds should be maintained for several weeks after stocking (if possible) to allow crawfish to complete maturity and mating (if necessary) and to facilitate maximum burrowing opportunity.
- Water levels should generally be held steady until the decision to drain because burrowing is best accomplished at the water/levee interface and may take several days to complete.
- Adequate cover should be maintained at the water’s edge to protect crawfish as they burrow. This can be natural cover (weeds, tall grass, etc.) or artificial substrate (roofing tin, cardboard, etc.) placed periodically along levees at the water’s edge, if levees are newly constructed or devoid of natural cover.
- Insufficient evidence exists for precise recommendations on water management during the summer dry period, but the complete flooding of burrows may force crawfish out of the burrow prematurely, with some possibly leaving the pond area entirely.

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Considerations for Stocking in Crawfish Aquaculture

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If large acreages are to be stocked, aside from the above considerations, it may also be best to consider obtaining broodstock from several sources, stocking over several weeks, and choosing a good mixture of mature and immature sub-adults. The reasoning behind these additional considerations can be akin to the old adage, “Don’t keep all your eggs in one basket.” Large scale recruitment failures are less likely when steps are taken to mitigate unforeseen circumstances, such as undue stress in one batch of crawfish or highly synchronized egg development in another.

One may also want to compensate for individual circumstances by stocking at a slightly higher or lower rate. For example, if post-stocking survival is expected to be low (such as from handling stress, predators, short flood duration, etc.), stocking rate can be increased. In contrast, if there is evidence of a healthy native population, stocking rate may be adjusted downward. Like other judgment calls in crawfish aquaculture, though, it is often beneficial to review all considerations before implementing a management practice where outcomes can be influenced by so many factors.

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Stocking crawfish ponds at the Rice Research Station.

Pest of the Quarter Ducksalad

Ducksalad (*Heteranthera limosa*) is native to the Americas. It is an aquatic freshwater annual and under certain growing conditions acts as a perennial. It can spread by seed or rhizomes in wet cultivated areas, ditches and shallow ponds.

Ducksalad stems and rhizomes can reach a length of 6 inches and leaf blades, including the petiole, can be 4 inches. The leaves can be narrow, 0.15 inches to 1.3 inches, with a fully expanded leaf, often referred to as a spoon leaf. The flowers are found as a single flower per flower stalk, referred to as a raceme in the taxonomy literature, with white or blue petals. A close relative of ducksalad is round-leaf mudplantain, which produces multiple flowers per raceme. The seed pods are round in shape, and each plant is capable of producing several viable seed.

Ducksalad is found in every rice field and parish in Louisiana. The late Dr. Roy Smith, a former U.S. Department of Agriculture weed scientist, published a paper on the competitiveness of ducksalad with rice. Dr. Smith found that rice yield loss because of competition from ducksalad varies from year to year. In one year, rice yields were reduced 77 percent when ducksalad was allowed to compete for eight weeks. Over a five-year period, yields were reduced 6 percent to 77 percent when allowed to compete for eight weeks. The interesting thing is yields were not reduced as much when allowed to compete for the entire season. He did not explain why this happened, but he did mention ducksalad matures within eight weeks of emergence. The short growing season indicates the plant is competitive over a short duration, and after the plant reaches maturity, some of the nutrients obtained during vegetative growth may be returned to the soil and become available to rice.

Unfortunately, the best way to control ducksalad is to keep the production dry, which is not conducive for rice production. The best control of ducksalad is obtained without the use of herbicides. A uniform stand of rice can be the best tool for managing this weed. The key is to get rice planted in a timely manner and germinated, with stand establishment occurring early. This can often be accomplished by drill seeding and only surface irrigating when needed. By delaying the permanent flood, the rice can stay under an upland situation before ducksalad can germinate and become established.

If ducksalad is present at planting, which is often the case in a water-seeded system, herbicides may be the only option. The problem with this situation is the cost of these herbicides. Command and NewPath provide excellent control of ducksalad from a preemergence standpoint, but activity is reduced on emerged weeds. The postemergence options are limited, and the expense increases drastically. The best products for postemergence control are Grasp and Londax. Londax works better in the water and before ducksalad produces the waxy spoon leaves. The herbicide 2,4-D is economical, but by the time this product can be applied, rice yield has already been affected by competition from ducksalad. Suppression of the weed can be obtained with Permit and Strada, but activity usually is short-lived.

In conclusion, the best way to manage this weed is to establish a uniform stand of rice before ducksalad emergence, use products like Command or NewPath as preemergence herbicides, and use Grasp and Londax as postemergence herbicides. On large spoon leaf ducksalad, Grasp is the better choice.

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Can Reflectance Technology Provide Real-time Midseason N Rate Recommendations in Rice?

Over the years, several methods of estimating midseason nitrogen fertilizer needs in rice have been proposed. These include chlorophyll and SPAD meters, tissue testing, the Rice Gauge and, most recently, the Leaf Color Chart. While each of these has been somewhat successful, the most common way of determining the midseason need of a rice crop is by knowing the nitrogen need of a particular variety or hybrid and applying the midseason nitrogen application rate based what was already applied and adjusting for the visual color of the crop.

Some people believe their eyes are “the best calibrated midseason nitrogen rate tool there is.” But, this still involves a lot of guesswork. Reflectance technology has the potential to give instantaneous midseason nitrogen fertilizer recommendations just by waving the handheld sensor over an area of interest. While we are not there yet in terms of predicting midseason nitrogen rates in rice, the technology is being used in the Midsouth for variable rate nitrogen fertilizer recommendations in wheat, corn and cotton production.

Unlike upland crops, one of the hurdles we face in getting this technology to work in rice is the flood water. The general operation of the meter requires the use of two small reference plots/areas: a very high rate nitrogen plot and a check plot where no nitrogen was applied preflood. This is how we can tell the difference between the look and responsiveness of nitrogen fertilization between varieties and years.

In general, the sensor measures the amount of light reflected by the rice canopy at two different wavelengths from a light source on the sensor. When the canopy (biomass) is full and has a dark green color, more light of one wavelength is absorbed, and less light is reflected. However, in the check plot, the rice is thin, and a lot of water is showing between the drill rows. This water tends to adversely alter the readings. While this has made the technology challenging in rice production, we do feel this can be overcome by altering the angle of the sensor.

We have been working with reflectance technology in rice for the past three years in Louisiana, Mississippi and Arkansas. To make the technology work, we must calibrate the sensor by making a working algorithm capable of predicting the midseason nitrogen needs of mid-southern grown rice varieties. The working algorithm includes two primary components, a yield potential predictive equation and in-season estimate of responsiveness of rice to nitrogen fertilization. We can get this data by coupling the sensor research with our variety by nitrogen trials that we conduct every year. To date, we have approximately 13 variety-site years worth of data, and we have plans to add seven more this year. The more data we have to generate the algorithm, the more sound the nitrogen rate predictions should be.

With our current data we have found a very good association ($r^2 = 0.59$) between actual grain yield and the sensor-yield estimate. By this time next year, we should be able to answer the question of whether or not reflectance technology has the potential to accurately predict midseason nitrogen fertilizer needs in rice. So far, the research results look promising.

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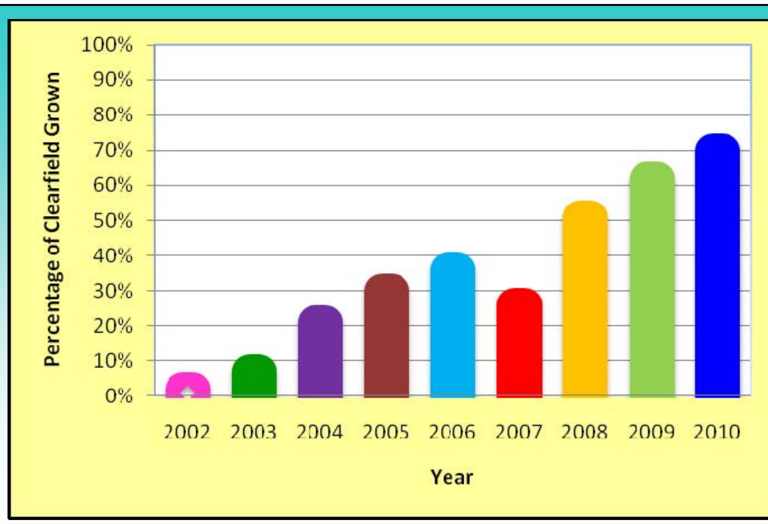
Are We Planting Too Much Clearfield Rice?



We have been growing Clearfield rice in Louisiana for almost 10 years now. In 2002, we planted approximately 12,000 acres in the state, primarily CL121. In most years since that time, we have seen an increase in the percentage of Louisiana rice acres planted to Clearfield varieties or hybrids. In 2009, we estimate that we had about 62 percent of our acreage in Clearfield lines. In 2010, based on conversations with producers, county agents and seed dealers, it appears that we will have well over 70 percent of the state's rice acres seeded to a Clearfield line.

With this substantial increase in Clearfield acres in recent years, I continuously get the question, "Are we planting too much Clearfield rice?" Some may ask another question, "Why does it matter how many acres we plant to Clearfield rice?" This second question may be the easier of the two to answer. The Clearfield system is based on two related herbicides to control red rice as well as other grasses and some broadleaf weeds. As with any herbicide system in any crop, over time there is potential to develop populations of weeds resistant to the herbicide activity through selection for those weeds with higher levels of genetic resistance to activity of the herbicide.

With the Clearfield system, however, we have two things working against us in our continuing battle to prevent development of resistance. One is that the herbicides themselves, imidazolinones, have a natural propensity for resistance to develop – more so than other herbicides. We've seen this in other crops in which the imidazolinone chemistry is used to control weeds. The other problem is that the main weed we're targeting with the imidazolinones – red rice – is a cousin of rice. Thus, pollen more easily flows between these two plants. This means that outcrosses between the weed and the Clearfield rice can lead to the development of populations of weedy rice types that contain the Clearfield gene and, thus, cannot be controlled by the imidazolinone herbicides used with the system.

Common sense tells us that the more acres upon which a herbicide system is used, the greater the potential for either of these types of resistance to develop. Barnyardgrass resistant to NewPath (one of the imidazolinone herbicides used in Clearfield rice) has been documented in Arkansas by Dr. Jason Norsworthy, a University of Arkansas weed scientist. Weedy rice types resistant to these herbicides (as the result of outcrossing) have been documented in all the southern states where this technology is used.

One sure way to prevent resistance from developing is to use the technology on zero acres, which, of course, is not an option. However, one thing that is absolutely certain is regardless of how many acres we plant to Clearfield rice, one of the worst things that we can possibly do is plant Clearfield rice on the same fields in subsequent years – especially several years in a row. When this is done, if resistant populations develop (through either of the mechanisms discussed earlier), these populations will flourish because in each generation that these populations are not controlled, they will produce increasing amounts of seed to return to the soil seed bank.

The absolute best thing we can do in this situation is plant to a different crop where the resistant populations can be controlled by a different herbicide mode of action or even plant no crop and fallow plow to destroy the resistant plants that germinate. So, is 70 percent of the 2010 Louisiana rice acreage too much Clearfield rice? In the grand scheme of things, the answer is probably yes. This just magnifies the importance of following as closely as possible the Clearfield stewardship guidelines on each of these Clearfield acres. Again, the most important of these guidelines is to avoid planting Clearfield rice on the same field in subsequent years.

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Schedule of Area Field Days

- ⇒ **Rice Research Station Rice Field Day, Crowley: Thursday, July 1, 2010**
- ⇒ **Evangeline Parish Rice Field Day, Mamou area: Tuesday, May 25**
- ⇒ **Southwest LA Rice Field Day, Fenton/Welsh area: Wednesday, May 26**
- ⇒ **Acadia Parish/RRS South Farm Field Day: Wednesday, June 16**
- ⇒ **Vermilion Parish Rice Field Day, Gueydan area: Tuesday, July 6**
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RICE RESEARCH STATION 1909-2009

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Focus

Man Behind the Scenes: Tim Miller

When you attend the LSU AgCenter Rice Research Station Field Day on July 1, you will notice the manicured grounds of the facility. One of the men behind the scenes who makes that pristine look happen is Tim Miller.

He oversees the summer labor crew of high school and college students, and they do much of the grass-cutting, litter cleanup, setting up tables and odd jobs to make the station presentable for its open house.

"By Field Day, I've worn them out," Miller said.

Miller has worked at the station since July 1984. After graduating from Iota High School in 1979, he worked as a derrickman in the oilfield for three years. Work had started to slow down in the oil patch, and Miller saw the job opening at the station as an opportunity. "I always wanted to farm, but I couldn't."

He worked in the foundation seed program for 10 years and then took a job on the farm crew, where he has worked since 1994. In 1997, he was promoted to the position of research farm supervisor. "I've done everything on this farm that can be done."

After Field Day, Miller said his focus will shift to harvest by preparing and cleaning combines. After the harvest of each different rice variety, the combines have to be disassembled and cleaned to make sure variety purity is maintained.

Miller said he enjoys working with his fellow employees, and they often visit each other away from the job.

Miller said he couldn't have found a better place to work with better people, but he said the personnel shortage caused by budget restrictions has become obvious with a much higher workload.

"There are two people on this farm I want to thank, Wayne Faulk and Bill Leonards." (Leonards is his boss, and Faulk preceded Leonards.)

Miller and his wife, Roxanne, have three grown children and three grandchildren. His wife will graduate this year with an education degree after attending college for 10 years.

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