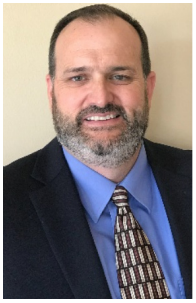
DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

CENTER NOTES

Rice Research and Extension Center | Stuttgart, Arkansas

Fall 2019

A word from the director



What a difference a year makes. Last year's drought, combined with a deep water well in need of major repairs, had me believing that in my first year I'd be the first director of the Rice Research and Extension Center to run out of irrigation water. We squeaked by last year and the droughts of the summer of 2018 gave way to the almost endless rains and a steady supply of water to our reservoirs this year. Our now-working deep water well was not needed this year, which is our goal. We have had great weather for harvest with no rain in most of late August and early September. I have to say that our harvest crews, especially those working in the breeding programs have worked very hard this year as harvest has been nonstop for them. The Foundation seed harvest was good this year, with many varieties pushing 200 bushels per acre. The State Plant Board inspector that certifies our field said it was one of the "cleanest" crops ever. My hat's off to our excellent field crew led by Mr. Ronnie Sherman on a job well done.

The past two years have seen some major renovations here at the RREC. New water lines were run at the station, worn out roofs replaced, various building renovations and the beginnings of renovations on one of our reservoirs, are just a few of the infrastructure improvements here. We have a lot more to come over the next two years as we bring the station up to par and try

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Progress in High Night Temperature Project

In 2017, the High Night Temperature, or HNT, project was initiated to address the adverse effects of extreme night temperatures on both yield and milling properties of rice. With the generous funding from the Arkansas Rice Promotion Board, a new state-of-the-art greenhouse and growth chambers were constructed that will facilitate a highly controlled environment which is suitable for screening and development of HNT tolerance. The ultimate goal of the project is to produce HNT tolerant varieties that will be available to the Arkansas rice farmers through both molecular and conventional breeding.

To date, 72 popular, recently released varieties and advanced lines from Arkansas and other rice growing states in the U.S. were in their second year of screening for HNT tolerance in the field. Four staggered planting dates (with 2-3 weeks interval) were established to ensure that a possible HNT conditions are experienced during the critical reproductive stage of the rice plant.

Plant establishment inside the greenhouse and screening protocol for HNT inside the growth chambers are continuously being refined. Currently, six varieties that include popular varieties (Diamond, Jupiter and Titan), HNT susceptible (ZHE 733) and tolerant (N22 and Kaybonnet) reported checks are being screened for HNT tolerance during the R2 stage. Preliminary results of this experiment have confirmed that N22 is

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Notes from the director

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and provide the best environment we can for our scientists to work on the innovations that shape the future of the rice industry.

Center highlights this year include:

- Working on new rice variety releases,
- Advancing high nighttime temperature tolerance research and
- Building a solid database on row rice production system recommendations, both agronomic and irrigation data.

Please read on for more on these and other projects.

This is the first issue of "Center Notes" that we have had in a while, so we are starting over with this issue as Volume one, Issue one. I plan to publish this newsletter three times a year.

Bob Scott
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Mark Cochran, head of the Division of Agriculture, discusses rice breeding with Scott Angle, director of NIFA during a June 19, 2019, visit to the Rice Research and Extension Center.

Dr. Paul Counce, left, has been named the new head of the High Nighttime Temperature Research team.

Please join us in congratulating Dr. Counce and helping him succeed in this effort.

Read more about this story here: http://bit.ly/HNT2019

Ark researchers screen varieties for HNT tolerance

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a reliable source of HNT tolerance in terms of yield as manifested by its high spikelet fertility. Crosses between N22 on both Diamond and Titan have already been made. Other traits such as yield, percentage chalk and head rice yield will also be obtained from this experiment. The same set of varieties are currently being grown inside the greenhouse and will be subjected to HNT treatment during the R5 stage. -- *By Manny Esguerra, post-doc and lead researcher on the HNT project.*

Figure 1. Filled and unfilled grains of susceptible (ZHE 733) and tolerant (N22) checks harvested from control (23 degrees C) and high night temperature conditions (28 degrees C).

Adding variety

CLM04 – A new Clearfield® medium-grain rice variety

CLM04, or 16AR1030, an early-maturing, short stature medium-grain Clearfield® cultivar with an excellent grain yield and good grain quality, is the first CL medium-grain variety out of the University of Arkansas System Division of Agriculture's rice breeding program. CLM04 has the pedigree of Neptune//Bengal/CL161/3/Jupiter, and initiated as a F4 bulk in summer 2014.

Since 2015, CLM04 has showed an outstanding yield potential as compared with CL272, Jupiter, and Titan in statewide and regional yield trials which include Arkansas Rice Performance Trial, Uniform Regional Rice Nursery, and the Medium-Grain Producer Rice Evaluation Program. The average yield of CLM04 is 198 bushels per acre, which is 11 bushels higher than CL272's 187 bushels per acre, and similar to Jupiter's 195 bushels and Titan's 200 bushels.

CLM04 also has a good milling and grain quality. In the same trials, CLM04 has an averaged head rice yield of 60.1%, which is slightly lower than Jupiter, 60.6 percent, but higher than CL272, 57.4 percent, and Titan, 58.4 percent. CLM04 is moderately susceptible to lodging, and measures 42 inches in height, which is taller than CL272 at 40 inches, Jupiter at 38 inches, and Titan at 39 inches. CLM04 has the similar maturity as CL272 and Jupiter. The average number of days from emergence to 50 percent, heading is 86 as compared with 85, 87, and 81 of CL272, Jupiter, and Titan, respectively.

CLM04 has the typical medium-grain shape with a minimum chalkiness, and its kernels appear larger than that of CL272 and Jupiter but slightly smaller than that of Titan. Average amylose content of CLM04 is 16.6% compared with 13.9%, 16.1%, and 15.9% of CL272, Jupiter, and Titan, respectively. CLM04 has a low gelatinization temperature of 62.6 degrees C similar to the 62.6 degrees C of Jupiter. These results indicate that CLM04 has typical U.S. medium-grain rice cooking characteristics.

CLM04 appears moderately susceptible to leaf blast just like CL272, Jupiter, and Titan in inoculated tests. However, molecular marker data indicated that CLM04 possesses both blast resistant genes *Pi-z* and *Pi-ks* in contrast to Jupiter's *Pi-ks* gene. CLM04 appeared susceptible to sheath blight, bacterial panicle blight, kernel smut, and false smut.

Breeder headrow seed of CLM04 will be maintained by the University of Arkansas System Division of Agriculture Rice Research and Extension Center, 2900 Hwy 130 E., Stuttgart, AR 72160 and BASF. Plans are being made to apply for PVP and a utility patent for the CLM04 cultivar.

Visit us online at http://bit.ly/RREC-Ark

Re-evaluating defoliation thresholds in rice

Over the past several years we have seen an increase in defoliation in rice. Most of this defoliation can be attributed to true armyworms and fall armyworms. Our current threshold for defoliation in rice was adopted from wheat in the mid-1990s. The current threshold is based on a number of caterpillars per square foot. We are re-evaluating this threshold, and moving towards a percent

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Re-evaluating defoliation thresholds in rice

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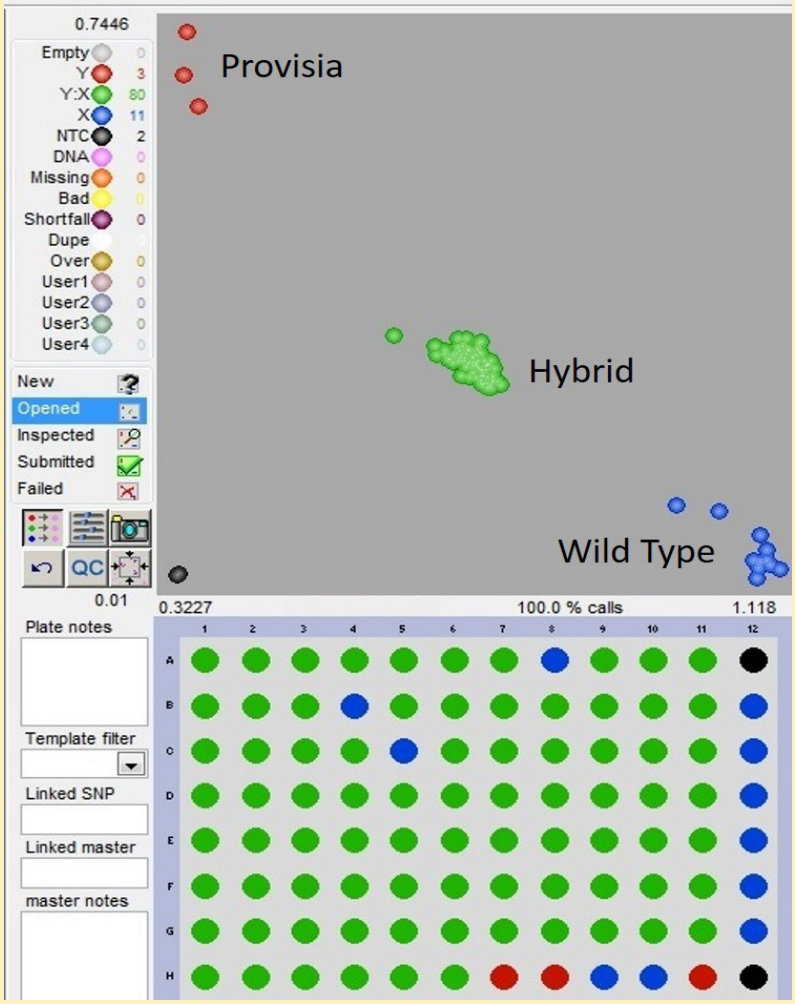
defoliation threshold that more resembles what we use in soybean.

During 2018 and 2019 we used electric weed trimmers to defoliate conventional rice at the 2-3 leaf, early tiller, later tiller and green ring growth stages.

We defoliate plots at either zero, 33, 66, or 100 percent at the given growth stages. Based on our work it appears that early vegetative stages are less sensitive to defoliation than late tiller or green ring. We observed a decrease in yield up to 60 percent when plots were defoliated 100 percent at green ring. We will be repeating these studies in hybrid rice over the next two years to determine if thresholds should be adjusted for hybrid versus conventional rice.

-- By Nick Bateman, extension entomologist.

Left, armyworms defoliating rice. Right, rice defoliation with an electric weed trimmer.



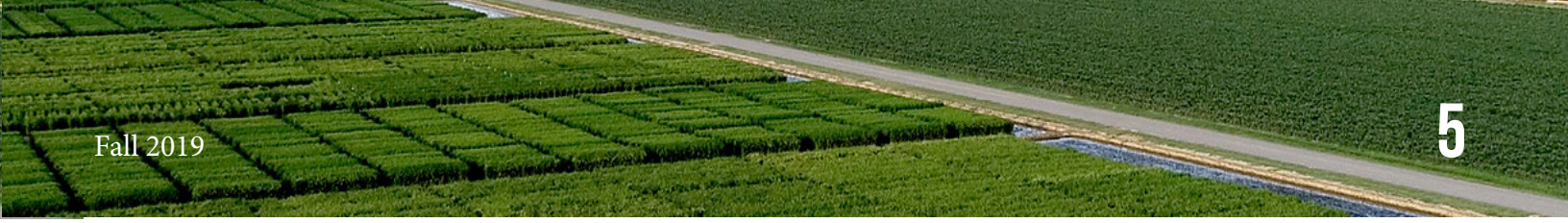
Breeding with Provisia traits

Earlier this spring the Division of Agriculture entered into an agreement with BASF Corporation to develop Provisia rice varieties. Our breeders have wasted no time in making their initial backcrosses and creating the first generation of Arkansas breed Provisia rice lines.

Xueyan Sha, Division of Agriculture rice breeder said "the process of creating a successful Provisia line could take as little as three to four years". The Division has been involved with breeding Clearfield® varieties with BASF since the early 2000s.

In addition to spraying the plants with Provisia herbicide our molecular genetics lab has the markers for detecting the Provisia trait.

"Leaf samples are collected from the plants in the field or greenhouse and processed in the lab to extract the DNA. The DNA is then analyzed through a fluorescent detection method to determine if they have the Provisia trait," said Virginia Boyett, lab manager.



Examining flood tolerance in soybean

The soybean breeding group, with grants from the U.S. Department of Agriculture and Mid-South Soybean Board/Arkansas Soybean Board, conducted flood screening research of more than 3,400 plots at the Rice Research and Extension Center in 2019.

The research included commercial varieties from the Official Variety Trials, as well as genetics from our soybean breeding program. Plots were screened at either early vegetative stage, simulating heavy spring rainfall events, or at early reproductive stages, simulating furrow/flood irrigation practices. Most of the varieties screened were susceptible to flooding, showing severe yellowing and/or plant death. However, 25 percent of the plots assessed showed responses of five-or-better on a one to nine scale, indicating that some lines could perform/survive better when exposed to waterlogging. The soybean breeding group is utilizing results from this research to advance towards pre-commercial stages the breeding lines that have enhanced tolerance to flooding. -- *By Leandro Mozzoni, soybean breeder.*

Hybrid Rice

Team uses barriers to overcome obstacles in two-, three-parent hybrid development

To provide Arkansas rice growers the option of competitive hybrids, the rice breeding team here is committed to developing hybrids with improved yield potential, milling and processing quality, and disease package over RiceTec's commercial varieties. Several experimental hybrids of both two- and three-lines look promising in the early preliminary trials. Because rice is a self-pollinated crop, producing hybrid seeds that involves two or three parental lines is one of the challenges in hybrid rice breeding. Physical isolation/barrier and synchronization of flowering through staged planting are common practices for hybrid seed production. (Continued Pg. 6)

A 6-foot tall isolation barrier made of burlap cloth is erected between different seed production/multiplication paddy/bay by the medium-grain rice breeding crew. From left to right are Blake Sanders, Paul Braithwaite, Jill Bulloch, and Tony Beaty. Richie Weaver and Emily Carr are behind the barrier.

Hybrid breeding efforts moving ahead

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The hybrid rice breeding program includes two separate activities, development of the hybrid line parental lines for both the two- and three-line hybrid rice systems and development the hybrid rice varieties themselves. The pipelines for developing the male sterile line for the two-line system, maintainer and restorer line for three-line hybrid rice production were successfully con-structed, and soon a new male sterile line will be introduced.

Our activities for development of our two-line hybrid rice varieties in the summer of 2019 included production of hybrid (F1) seeds resulting from 500 different combinations made by crossing the Division of Agriculture's new male sterile lines and its rice advanced breeding lines. Fifty experimental hybrid lines (F1) were evaluated in three locations and testing of three experimental hybrid lines, which showed good potential yield previously in preliminary studies, in the 2019 Arkansas Rice Performance Trials.

Dr. Xueyan Sha and Dr. Ehsan Shakiba both have hybrid breeding programs headquartered at the Rice Research and Extension Center.

Two line hybrid rice seed production bays with Corn used as a "pollen" trap on levees separating bays. This design was established by Dustin North and Taylor Sherman.

Rice DD50: Management Program Still Relevant

The Degree Day 50 Rice Management Program -- better known as Rice DD50 -- has been focused at the RREC for more than 30 years. Current commercial and lead experimental cultivars are planted across a range of planting dates to evaluate their development based on daily temperature, or degree day, accumulation. This information is critical for establishing when cultivars reach key growth stages such as internode elongation and heading.

Currently, cultivars are planted at six planted dates from late March through early June. In addition to plant development measurements, grain yield and milling yield data are also collected. To enroll a field visit https://dd50.uaex.edu/ -- *By Jarrod Hardke, extension rice agronomist*

AT LEFT - Program Associate Donna Frizzell planting this year's DD50 trial at the Rice Research and Extension Center.

Building a great foundation

Foundation seed program shines with Diamond, ARoma17

The 2019 rice harvest is nearing completion and soybean crop is about ready for harvest at the Rice Research and Extension Center.

Our weather patterns have blessed us with excellent rice yields and quality, with most of our foundation seed fields pushing over the 200 bushels per acre yield mark. Timely rains aided in pest control, especially weeds, and our Arkansas State Plant Board inspectors declared that this was one of the best inspection reports they've ever filed for us.

Our commercial rice varieties grown in 2019 included long grain varieties of Diamond, Lakast, CLL15, 17AR1087 - which will receive a name this fall - Spring and the aromatic jasmine variety ARoma17.

Titan, Jupiter, CLM04 and 17AR1121 were our medium grain varieties. We have also produced the short grain variety 1099 for some marketing companies desiring a sushi-type rice.

Foundation seed also produced some potential new rice variety releases at the RREC this summer, including 17AR1084, 17AR1081, CLXAR19 and 18AR1109. Several hybrid rice varieties will be entered in the commercial-style yield trial next year.

Keep checking Dr. Jarrod Hardke's rice updates at http://bit.ly/JHRice to follow the yield and quality reports on all these superb varieties from your University of Arkansas System Division of Agriculture rice breeding team.

-- Glenn Bathke, Ph.D.
Director of foundation seed.