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RICE RESEARCH STATION NEWS

Southwest Region

Pest of the Quarter – Red Rice

Red rice has several scientific and botanical names, but it is generally classified as the same species, *Oryza sativa*, as cultivated rice. Red rice was first reported as a weed problem in the United States in 1846 in North and South Carolina. By 1900, red rice had spread to Louisiana and by 1907 had become so problematic that rice fields had to be abandoned because of heavy red rice infestations. A survey conducted in 1929 revealed 54% of the cultivated rice samples evaluated were infested with red rice at 60 seed/lb.

Red rice possesses many undesirable characteristics such as a red seed coat, early maturing and easily shattering seeds, greater seed dormancy, stiff hairs on the leaf and seed hull, long awns attached to the hull, and taller plants with weaker straw strength making red rice susceptible to lodging. Red rice can be distinguished from cultivated rice by its light green color, tall plant stature, hairy leaves and seed hull, increased tillering, grain shattering and red seed coat. In addition, red rice can germinate during the early growing season under cool conditions and can serve as a host for diseases and insects that infest cultivated rice.

Red rice in the southern United States is composed primarily of strawhull and blackhull types. Strawhull red rice is characterized as tall-growing with reduced tillering compared with blackhull. It possesses drooping panicles that may or may not produce awned seed with a tan to brown hull. Blackhull types are tall-growing, produce densely tillered, compact plants that are slow to reach flowering. It produces awned seed with a dark brown to black hull. On average, blackhull red rice has been shown to produce 27% more tillers, to produce 18% more straw and mature later than strawhull red rice. Both types of red rice emerge earlier in the season, grow taller and produce more panicles with seed that shatters more readily than cultivated rice.

Red rice is very competitive with cultivated rice. Research has shown a red rice infestation of 32 plants/yard^2 can reduce rice yields 64%, and red rice as low as 5 plants/yard^2 can

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RICE FIELD DAY

The Rice Research Station Field Day will be held on Thursday, June 29. Field tours will begin at 7:30 a.m. with the last tour departing at 9:15. The speaker program will begin at 10:45 and lunch will be served at noon.

In this issue:

Special Dates of Interest:

Rice Research Station Field Day
Thursday, June 29, 2006

Jeff Davis Parish Field Day
Tuesday, July 11, 2006 (morning)

Vermilion Parish Field Day
Tuesday, July 11, 2006 (afternoon)

Pest of the Quarter – Red Rice Cont.

reduce yields 22%. The yield decrease can be attributed to a decrease in the number of grains per panicle produced by the cultivated rice.

In terms of nutritional value, red rice is similar to cultivated rice. But because of low grain weight and early shattering characteristics, only a portion of the total red rice seed in a field is harvested. The increased height and increased vegetation produced by red rice has a direct and negative impact on harvest efficiency.

The presence of red rice in packaged white rice is visually unattractive to consumers. To enhance the quality and visual appeal, extra milling is required. This adds expense, increased broken grains and a lower price paid to the producer because of reduced grade and milling quality.

It has been estimated that one red rice plant could produce 1,500 seed in a single season. That would result in 2.25 million seed the following season, assuming each plant produces 10 tillers, 150 seed/panicle and 100 percent seed viability. This is a worst case scenario but it provides evidence of how fast red rice can become a problem if left unchecked.

In the past, red rice management has involved a combination of cultural and chemical control measures. Cultural practices include purchasing red rice-free seed, increasing rice seeding rates, roguing and selecting more competitive rice cultivars. In Louisiana, water-seeded rice is used as a cultural management practice to minimize weed germination and emergence before permanent flood establishment. Tillage operations may be performed either before or after the establishment of the seeding flood.

Chemical control of red rice in rice is difficult because of the genetic similarities between the two. However, with the development of Clearfield rice, the management and control of red rice have changed. This technology allows producers to use the herbicides Newpath, Clearpath and Beyond for the management and control of red rice in cultivated rice. These herbicides can be used in an overall weed control/ management program. It is very important for producers to apply these herbicides in a timely manner as recommended by the manufacturer's label and the LSU AgCenter.

Dr. Eric Webster
ewebster@agcenter.lsu.edu

Rice Station Scientists Win Research Award

A team of Rice Research Station scientists who released 17 major rice varieties in 14 years received the Distinguished Rice Research and Education Team Award at the Rice Technical Working Group meeting, Feb. 26-March 1, in Houston.

The annual RTWG is a gathering of rice experts from around the world to give presentations on their research.

The team that received the award included Dr. Steve Linscombe, senior breeder and regional director; Dr. Xueyan Sha, breeder; Dr. Pat Bollich, agronomist; Dr. Richard Dunand, physiologist; Dr. Don Groth, pathologist; and Larry White, director of the Foundation Seed Program.

The rice variety development team has released the long-grain varieties Cypress, Jodon, Cocodrie, CL121, CL141, CL161, Cheniere, CL131 and Trenasse; the medium grains Bengal, Lafitte, Earl and Jupiter; the short-grain Pirogue; the aromatics Dellrose and Dellmati; and the first crawfish forage variety, Ecrevisse.

Varieties released by this team have been grown on average on more than 60 percent of the rice acreage in the southern United States for the past five years. In Louisiana, more than 90 percent of the rice acreage has been planted with varieties developed by the LSU AgCenter during that time.

The varieties helped raise Louisiana's rice yield 22 percent in the past seven years from 5,080 pounds per acre in 1999 to an estimated record 6,200 pounds per acre in 2005, an increase of 4.9 million hundredweight of rice each year worth a conservative $35 million per year just to Louisiana rice farmers.

In addition to yield improvements, varieties released by this group have led to substantial improvements in milling quality and stability. Cypress has redefined the standard for grain quality. This variety consistently displays high whole-grain milling yields, low chalk content, and excellent retention of whole-grain milling yields at sub-optimum harvest moisture. The newer long-grain releases from this team have also demonstrated consistent high whole-grain yields as well as milling stability at low grain harvest moisture. The team also has produced more than 35 journal articles, 115 abstracts and proceedings, and 50 popular press articles that have contributed to the knowledge of rice production.

The rice varietal development team has been supported by the Louisiana rice growers through check-off funds, state funds, the Rice Foundation (a national rice research board), private industry and other granting agencies. Grants have totaled more than $5.8 million for the past five years. The varietal development team keeps a close working relationship with the Louisiana Rice Research Board, which administers the research funds from the 5-cent per hundredweight of rice paid by farmers. The program is also supported from seed sales through the foundation seed program and maintains a close relationship with the Louisiana Seed Rice Grower's Association.

SEED-BASED *SPARTINA ALTERNIFLORA* (SMOOTH CORDGRASS) PROPAGATION TECHNOLOGY FOR COASTAL WETLANDS RESTORATION

If coastal erosion persists at the present rate, Louisiana will lose more than 1 million acres in the next 40 years. This tremendous loss will have devastating consequences because of the potential loss of life, infrastructure, industry, ecosystems and culture. It will also affect the nation's security, navigation, food supply and energy consumption. It is important, therefore, to establish a comprehensive construction program for the entire Louisiana coast combined with a large-scale revegetation technology. For decades, plant improvement has been a fundamental part of a successful agricultural system. Improving wetland plant species and developing seed-based propagation technology for coastal wetland restoration, however, is a relatively new concept.

Successful widespread coastal erosion control requires large-scale efforts, including development of a source of seed for large-scale planting. A large source of seeds can be produced with cultural management similar to an agricultural crop production system. Under this system, optimum seed production can be maintained every year. Currently, *Spartina alterniflora* seeds are obtained by harvesting the seeds from the wild. The amount of seeds that can be harvested varies from one year to another depending on the climatic conditions affecting seed production. Because all the harvesting is done by hand, the yields are extremely limited. A large operation to obtain a significant amount of seeds for restoration purposes is challenging and can potentially cause adverse effects to the sites. Since the seeds are gathered from genetically unknown materials, it is difficult to predict germination and performance of these materials. In addition to being less efficient, harvesting seeds from the wild may pose significant ecological consequences in the long run. Seed production under a cultural environment will provide a steady supply of *S. alterniflora* seed, and the size of the operation can easily be adjusted to meet the demand. A seed-based *S. alterniflora* propagation method can expedite the establishment of vegetation over a large area quickly and economically. Hundreds of acres can be planted by air in a day at a fraction of the cost of current planting practices.

Through funding from several agencies, including the USDA's Cooperative State Research, Education, and Extension Service (CSREES), Coastal Restoration and Enhancement Through Science and Technology (CREST), and the Sea Grant Office, seed-based propagation technology for *S. alterniflora* is being developed through collaborative efforts among scientists from the Rice Research Station and Department of Agronomy and Environmental Management at LSU. Separate plots of 13 fertile and agronomically superior smooth cordgrass lines have been established at the Rice Station. The genetic materials with high capability to produce viable seed have gone through extensive testing. The plots will be used to provide a pure stock of parental planting materials. Purity tests were confirmed visually and through DNA fingerprinting. A crossing block was developed to produce synthetic or blend seed from these elite lines. A limited amount of mixed seed was harvested from the crossing block and cold-treated to break the dormancy. This seed will be used for further studies.

S. alterniflora is an aquatic plant species. It is a facultative halophyte with the ability to tolerate a wide range of salinities, but does not require salt for its growth. Populations of *S. alterniflora* have been cultivated and maintained under freshwater conditions at the Rice Station for several years and have performed consistently well. Since cultivation of *S. alterniflora* can be accomplished in a broad range of salinity environments, from sea strength to freshwater, large-scale commercial seed production is highly probable. It is conceivable that *S. alterniflora* and *S. californicus* could be an adjunct crop to rice production with a little modification to existing equipment and land. Rice producers have decades of experience in cultivating aquatic plant species. In addition, because of increasing contamination of inland groundwater with salt, many areas historically used for rice production have been abandoned and may provide opportunity for *S. alterniflora* production as an alternative crop.

Dr. Herry Utomo
hutomo@agcenter.lsu.edu

Important Rice Growth Stages

Several growth stages help identify critical periods during the life cycle of the rice crop. They are generally separated into the vegetative and reproductive phases or stages of growth. The vegetative phase occurs first and is associated with the 6- to 8-week period following planting. The reproductive phase follows and is generally associated with the formation of the panicle and grain.

Germination and emergence are the first stages in the vegetative phase of growth and are important growth events because they provide the basis on which stand or plant population is determined. Germination begins with the appearance of the young shoot and root through the seed coat at one end of the seed. As the shoot elongates and reaches the soil surface, emergence occurs.

When rice is planted on the soil surface, germination and emergence occur almost simultaneously. In drill planting where seeds are planted below the soil surface, germination and emergence are separated by the time it takes for the shoot to grow the distance between the seed and the soil surface. Seedling growth follows emergence and is usually denoted by number of leaves (1-leaf, 2-leaf, etc., stages).

Seedling stages are determined by the number of leaf blades that are fully developed. This can be confusing since growth is a continuous process. When a leaf has fully exerted, another is usually emerging, and it is tempting to consider the emerging leaf in the count. The emerging leaf should not be counted. Seedling stages occur during the first two to five weeks after planting.

As rice enters the 3- to 4-leaf stage, tiller formation can begin, initiating the **tillering stages**. Tillers appear as secondary shoots to the main shoot. Tillers are initiated at the base of the plant, emerging from the inside of the seedling leaves on the main shoot. The number of tillers is primarily determined by plant population, and tiller formation occurs over a two- to three-week period. Generally, a stand of 10 plants/sq ft will average 2 to 4 tillers per plant. When one tiller appears, the growth stage is the first tiller stage. Tillering stages are numbered according to the number of tillers present, and, generally, with a stand of 10 plants/sq ft, plants in the fourth tiller stage are common.

Panicle initiation is the first stage in the reproductive phase of growth and denotes the beginning of panicle formation. The developing panicle is microscopic in size inside the stem, and panicle initiation can usually be associated with the beginning of stem internode formation.

As the **internode elongation stage** begins, a build-up of chlorophyll occurs between the nodes that are to separate in the process of forming the first stem internode between them. This accumulation of chlorophyll imparts a green color that encircles the developing internode producing a green ring or band. Thus, the internode elongation stage is sometimes referred to as the **green ring stage**.

This stage is also referred to as **first green ring** because additional internodes that form on top of the first internode can also have the green ring effect as they begin to form. A total of five internodes can be produced in the formation of a stem of rice.

As internode and panicle formation continue, the **panicle differentiation** stage occurs. Panicle differentiation is the first stage in the reproductive phase when the newly forming panicle first becomes visible. At this stage, the panicle inside the stem has grown to approximately 1/8 inch in length. In the metric system, the length is approximately 2 mm, and the stage is sometimes referred to as the 2 mm panicle stage.

The panicle continues to grow and develop inside the stem. As it does, the growth stage is referred to as booting and identified by the length of the panicle. When the panicle is up to 2 inches in length, the growth stage is **early boot**. **Middle boot** and **late boot** occur when the length of the panicle is 2 to 5 inches and 5 inches or greater, respectively. Up to this point, identification of the growth stages in the reproductive phase requires the stem to be dissected (split in half). During late boot, the panicle develops completely, and the growth stages that follow occur after the panicle has exerted and is visible outside the stem.

The **heading stage** is noted when a portion of a panicle is observed growing out of the end of a rice stem. From this time forward, growth stages are based on the state of the panicle outside of the rice stem. Heading stages are identified by percentages, and the 50% heading stage occurs when 50% of rice stems are heading or headed (panicle completely emerged from the stem).

The **flowering and grain filling stages** begin within one to five days after heading, and grain filling is complete within three weeks. The grain filling stages are separated in the milk, dough and physiological maturity stages.

The **milk stage** is observed when a milky white substance begins to accumulate, usually seven to 10 days after heading, and the **dough stage** occurs about a week later as the milky substance begins to change and become the texture of bread dough.

When rice grains first become firm, they are at **the physiological maturity stage**. Grain moisture at physiological maturity is around 30%. Depending on the weather, an additional two weeks are required for moisture content to drop to around 20% and the grain to ripen.

Knowing, understanding and identifying the growth stages of rice are critical in managing the rice crop. Most cultural management practices after planting are based on crop growth stages. Water management and agricultural chemical inputs must be properly timed to obtain optimum stands, tillering, and panicle and grain formation. The DD50 program for predicting rice growth involves identifying growth stages. Also, the effects of adverse weather conditions on the crop can be better understood and the resultant damage anticipated when there is an understanding of growth stages.

Note: For photographs of rice growth stages and a more detailed explanation of rice growth and development, contact your local county agent and request the latest version of the Louisiana Rice Production Handbook or view the handbook online.

Dr. Richard Dunand
rdunand@agcenter.lsu.edu

Some Assessments of Crawfish Burrows

Industrywide, crawfish yields for the 2005-2006 production season to date have been abnormally low. This is especially true for those using the production strategy where crawfish are cultured behind rice in a field rotation approach. This strategy, involving most of the acreage devoted to crawfish production in Louisiana, is most susceptible to crawfish population adversities because population densities are typically lower than in ponds permanently dedicated to crawfish production. When crawfish are not cultured in the same field (pond) during consecutive production seasons, there is little opportunity for development of a wide range of reproduction cycles within the population, which tends to mitigate adverse effects on populations. Therefore, adverse weather patterns or other environmental conditions that affect crawfish broodstock survival and reproduction generally have a greater impact on crawfish production systems using a field rotation approach. By all perspectives, Louisiana was experiencing drought-like conditions during the summer and fall of 2005, with the exception of some significant rains associated with one or both hurricanes.

Prolonged summer drought when crawfish are confined to burrows (where they reproduce) can hamper reproduction if residual water within the burrows is lacking. If the drought is severe enough and burrows completely dry out, massive mortalities of broodstock can result. Drought during the fall, at a time when crawfish are emerging from burrows with young, can also hamper emergence for those burrowed in levees above the water line because crawfish remain trapped in burrows until the hardened dirt plug can be sufficiently softened by rainfall or pond flooding.

Soil type, burrow depth, burrow location, and amount of water inside the burrow initially may play a role in how well burrowed crawfish respond to prolonged drought conditions. Because little research exists regarding the burrow ecology of crawfish, especially as it relates to crawfish aquaculture, research at the Rice Research Station is being focused in this area. One such project examined crawfish burrows in 2005 approximately one month after pond draining. Two hundred sixty burrows were excavated and crawfish were retrieved, water volume and burrow depth recorded, and location of burrow entrance was noted.

Average burrow depths and water volume, by crawfish survival and number of burrow occupants, are presented in Table 1. Burrows containing female crawfish only are further organized according to burrow location and depth category in Table 2. It was surprising to observe that 45% of the burrows contained no living crawfish after such a short time following pond draining. Dead crawfish were generally associated with burrows containing no measurable water, and there was a strong positive relationship between the amount of water present and burrow depth. There was also a marked difference in average water volume, percentage of burrows with no measurable water, and crawfish survival between burrows initiated at or above the pond's water line (likely pre-drain burrows) and those made on the pond bottom (post-drain burrows). Though the average burrow depths were similar, burrows found on the pond bottom (often near the base of the levee) generally contained much greater volumes of water, had fewer burrows without free water, and contained more living crawfish than burrows found at or above the water line on levees.

Though the implication of the findings with regard to burrow location is unclear, in the Crowley silt loam soil, burrow depth and water volume appear to be highly correlated; and the volume of water found in burrows soon after burrowing may play a significant role in the ultimate survival of reproductive female crawfish within the burrow. It was surprising to observe high mortalities in burrows within the first month of summer drawdown. These findings strongly implicate summer/fall drought as significant factor in negatively impacting crawfish reproduction and subsequent yield, at least on silt-loam soils, and may help to explain the reduced yields reported, following the unusually dry conditions during 2005 in Louisiana.

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Burrow excavations are difficult and time consuming but necessary to obtain data critical to the understanding of burrow ecology of crawfish in aquaculture.

Some Assessments of Crawfish Burrows

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Table 1. Aspects of burrow ecology relating to crawfish extracted from burrows following pond draining in experimental crawfish production ponds. Information is organized by crawfish burrow occupancy number and survival status.

Burrows	**No.**	**Average Depth of Burrows** (and Range)	**Range of Water Volume (ml)**	**% of Burrows without Water**
With Remnants of Dead	113	20.8 (4-48)	0 – 1,500	90.3
Single Occupancy[1] - Live	87	24.2 (9-45)	0 – 2,820	42.5
Single Occupancy[2] - Dead	1	34	0	-
Double Occupancy[3] – Both Alive	55	28.8 (8-55)	0 – 2,000	30.9
Double Occupancy[3] – Both Dead	2	39.5 (29-50)	0	100
Double Occupancy[3] – One Alive	2	34.5 (27-42)	0 - 600	50

[1] 11 of the 87 burrows contained male crawfish.

[2] Consisted of a male crawfish.

[3] All burrows containing 2 crawfish consisted of 1 male and 1 female

Table 2. Observations obtained from burrows with female crawfish only, segregated by location of burrow and burrow depth.

Depth Group (inches)	**(N)**	**(N) as % of Total**	**Avg. Depth (inches)**	**% Live Crawfish**	**Avg. Water Volume (ml)**	**% of Burrows with No Water**
Burrows Constructed at Water Line or Above						
4 – 10	4	2.2	6.3	0	0	100
11 – 20	65	35.3	16.5	18.5	2.1	93.8
21 – 30	67	36.4	25.4	45.5	44.5	83.6
31 – 40	34	18.5	35.4	64.7	184.6	55.9
41 – 55	14	7.6	46.2	75.0	351.1	28.6
Average[1] (or Total)	**184**		**25.3**	**40.8**	**77.7**	**78.3**
Burrows Constructed on Pond Bottom						
4 – 10	9	14.1	8.3	44.4	22.2	55.6
11 – 20	24	37.5	16.2	95.8	238.3	20.8
21 – 30	24	37.5	25.0	100	579.3	4.2
31 – 40	6	9.4	35.5	100	1236.7	0
41 – 55	1	1.6	42.0	100	1200.0	0
Average[1] (or Total)	**64**		**20.6**	**90.6**	**448.1**	**17.2**

[1] Averages are weighted averages and not simply grand means from each depth category.

Dr. Ray McClain
rmcclain@agcenter.lsu.edu

Rice Research Station
1373 Caffey Road
Rayne, LA 70578

Phone: 337-788-7531
Fax: 337-788-7553
E-mail: **slinscombe@agcenter.lsu.edu**

www.lsuagcenter.com/en/our_offices/research_stations/Rice/

This newsletter is produced by:
Karen Bearb
Bruce Schultz
Don Groth
Darlene Regan
Steve Linscombe
Linda Benedict
Frankie Gould

Focus on Research Associates

Dilly Contributes to Station’s Value

Raymond Russell Dilly Jr. has worked as a research associate at the LSU AgCenter Rice Research Station for 27 years.

Dilly, 49, started his career at the Rice Station in August 1979, right after he graduated from the University of Louisiana at Lafayette with a degree in agricultural education. He has worked his entire career with Dr. Richard Dunand on physiology projects.

Dunand said Dilly has been an important part of research at the station.

“Russell is a very dedicated research associate,” Dunand said. “Anytime he is needed, he is available. And the quality of his work is excellent.”

Dunand said Dilly has the ability to work independently.

“He reviews data he collects and is knowledgeable enough to realize when errors have occurred in recording data,” Dunand said. “I trust him implicitly with all aspects of project lab, greenhouse and field work.”

But Dilly’s work is not limited to Dunand’s research projects.

“I do a lot of things in support of the station," he said.

He coordinates greenhouse space for rice research projects. He also is the station's safety coordinator and conducts an annual safety audit of the station and a quarterly inspection of the station's 60 buildings.

Dilly said one reason he has stayed at the station is because of the satisfaction he gets from his work.

"We have the opportunity to really help the farmer. I enjoy the work," Dilly said. "You see the focus of the station helping the farmers survive."

Dilly remembers planting research plots by hand.

"The thing that's always been nice here is the family atmosphere," he said. "I like being part of it."

Dilly said even though agriculture is having a difficult time now, "I just think this is a cyclical thing. Things will pick back up."

His father, the late Raymond Russell Dilly Sr., was a county agent in St. Landry and Acadia parishes.

Dilly lives in Maurice with his wife, Geraldine. He is the father of a son, Nick, and daughter, Laura.

In his spare time, he is an avid turkey, deer and goose hunter. He loves sports, and coached youth league baseball teams for several years.

"I've enjoyed working for LSU, but I bleed purple and gold, so that's just a given," he said.

Research partially funded by the Louisiana Rice Research Board