

# 2 – Rice Varieties and Seed Production

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Public rice varieties developed by land grant institutions such as the University of Arkansas are currently planted on nearly 100 percent of the U.S. rice acreage. This is, in part, due to the relatively small U.S. rice acreage. In contrast, private companies provide the majority of cultivars (varieties) for row crop commodities such as corn, soybeans and wheat. Recent technological advances in production of transgenic crop varieties, hybrid rice development and specialty markets have stimulated private industries interest in rice breeding and variety development. Land grant universities are cooperating with private industry to develop transgenic varieties that will assist rice farmers in controlling pests and add other valuable traits to rice that will help producers and consumers alike. University rice breeding programs remain committed to producing conventional public rice varieties.

Since 1936, 28 varieties have been developed and released by the University of Arkansas rice breeding program. The rice checkoff program has provided partial financial support for the University of Arkansas rice breeding and development program since 1980. Since 1984, between 42 and 86 percent of the Arkansas rice acreage has been seeded to varieties developed by the University of Arkansas.

## Rice Seed Production

Seed rice can be divided into four distinct categories (Table 2-1). When a new variety is released, the variety and its complete description is registered with the National Committee on Registration of Crop Varieties. Foundation seed must be maintained according to these registered standards. The general field inspection and cleaned seed standards for rice seed certification by class are provided in Tables 2-2 and 2-3. Land where seed rice is grown must not have been planted to a different rice variety or uncertified seed of the same variety for two previous years. The State Plant Board (#1 Natural Resources Dr., Little Rock, AR 72205) is the agency responsible

for regulating the seed industry in Arkansas. The State Plant Board sets and enforces seed certification standards and maintains a seed testing laboratory. Descriptions of each variety for which certified rice seed is produced in Arkansas are available. Additional information concerning certified seed production standards/regulations and laboratory services can be obtained from the Arkansas State Plant Board in Little Rock, Arkansas (501-225-1598). Use of certified seed rice is highly recommended to ensure high quality seed and to aid growers in controlling the spread of noxious weeds.

## Rice Variety Performance and Agronomic Characteristics

Many agronomic factors must be considered when choosing rice varieties for production (Tables 2-4 and 2-5). The general strengths and weaknesses of available varieties are summarized in Table 2-6. Environmental factors affecting grain and milling yield vary each year. Therefore, data from the 1997-1999 Arkansas Rice Performance Trials have been summarized to better evaluate variety performance. Several recently released varieties have data for only one or two years. For more up-to-date information, consult the most recent edition of Cooperative Extension Service's publication titled *Arkansas Rice Performance Trials* for variety performance and characteristics on different soil textures.

Variety yield performance data in Tables 2-4 and 2-5 should be used with disease ratings included in the disease management section and nitrogen recommendations in the fertilizer management section. Varieties differ in grain and milling yield potential, maturity, straw strength, disease resistance and cooking and processing characteristics. Therefore, consider all of the following factors in selecting a variety:

- Field history of disease and variety ratings: blast, sheath blight, kernel smut, stem rot and black sheath rot

- Field history of weed species and herbicide program
- Soil texture and seedling vigor
- Seeding method
- Susceptibility to lodging
- Maturity group and seeding dates
- Grain and milling yield performance
- Irrigation capacity
- Geographic location

Additional factors that must be considered before final selection are:

- Market demand for different grain types or varieties
- Availability of good quality, red rice-free seed
- Planting dates and estimated harvest schedules

Seeding a large percentage of acreage in a single variety is not recommended. Planting several varieties minimizes the risk of damage from adverse weather and disease epidemics and allows for a timely harvest which increases the chances of obtaining good quality seed with maximum milling yields. Since environmental conditions can greatly affect yield, it is also recommended to spread seeding dates so that varieties do not reach critical growth stages at the same time. Consult the DD50 computer program to plan harvest schedules based on emergence dates of varieties.

## Other Varieties

Variety characteristics and yield performance data presented in this section are for the rice varieties grown on the majority of rice acreage in Arkansas. Information on other “specialty varieties” or “older varieties not commonly produced” may be available from the Arkansas Cooperative Extension Service and Agricultural Experiment Station upon request.

## Kernel Classification and Cooking Qualities

Rice varieties are classified as either long, medium or short grain by their rough, brown and milled kernel dimension ratios (Table 2-7). Since

kernel type, dimension and cooking quality are of primary importance to millers and processors, these characteristics are considered in variety development.

The cooking qualities of rice depend on the chemical composition of the rice grain. Most long grain varieties grown in the southern U.S. have cooking qualities described as typical. Varieties with “typical southern U.S. cooking quality” produce rice that is dry and fluffy (non-sticky) when cooked. These varieties are parboiled, quick cooked or used in processed rice products. Aromatic long grain varieties tend to have similar textures when cooked but also have a distinct taste and aroma when cooking. Medium grain varieties produced in the southern U.S. produce a moist sticky rice when cooked. Medium grains are used for dry breakfast cereals, soups, baby food and brewing purposes.

The rice kernel is made of starch. Starch consists mainly of highly branched chains called amylopectin and some linear chains with fewer branches called amylose. The temperature at which the rice starch forms a gel when cooking is the gelatinization temperature. The amylose content and gelatinization temperature influence the cooking quality of the rice grain.

Traditional southern U.S. long grain rices, such as Cypress, Drew and Wells, have intermediate amylose contents of 20 to 25 percent and intermediate gelatinization temperatures 70° to 75°C compared to the extra high amylose rices, Rexmont and Dixiebelle, which have an amylose content > 25 percent and intermediate gelatinization temperatures. The medium and short grain rices, such as Bengal, Nortia and Koshihikari, have low amylose (10 to 20 percent) and low gelatinization temperatures < 70°C.

Traditional southern U.S. long, medium and short grain varieties are translucent or clear in appearance. Waxy or glutinous rices have an amylose content of only 1 to 2 percent, a low gelatinization temperature and an opaque appearance. They are often used in sweets, frozen products and as thickening agents. In general, if the amylose content is intermediate to high, the rice cooks drier and less sticky. Low amylose rice tends to cook stickier and waxy rices are very sticky. The starch-iodine-blue test is used to estimate amylose content during early stages of variety development.

**Table 2-1. Description of Four Seed Rice Classes**

<b>Seed Class</b>	<b>Tag Color</b>	<b>Description</b>
Breeder	White	Breeder seed is not available to the public and is reserved for licensed plant breeders for the production of foundation, registered or certified seed.
Foundation	White	Progeny of breeder seed. Is also reserved for licensed plant breeders. Must be produced under the direct supervision of licensed plant breeder to maintain genetic purity/identity of the variety.
Registered	Purple	Progeny of foundation seed.
Certified	Blue	Progeny of either registered or foundation seed.

**Table 2-2. Arkansas State Plant Board Field Inspection Standards for Seed Rice Certification<sup>1</sup>**

<b>Factor</b>	<b>Seed Class</b>		
	<b>Foundation</b>	<b>Registered</b>	<b>Certified</b>
Other Varieties	None	1 per 5 sq rods	1 per sq rod
Noxious Weeds	None	None	None
Red Rice	None	None	1 plant per acre

<sup>1</sup>Standards as of 1999. Standards taken from the certified seed directory.

**Table 2-3. Arkansas State Plant Board Cleaned Seed Inspection Standards for Seed Rice Certification<sup>1</sup>**

<b>Factor</b>	<b>Seed Class</b>		
	<b>Foundation</b>	<b>Registered</b>	<b>Certified</b>
Pure Seed (minimum)	98.0%	98.0%	98.0%
Other Varieties <sup>2</sup>	None	None	2 per lb
Other Crop Seed (maximum)	None	None	2 per lb
All Noxious Weeds	None	None	None <sup>3</sup>
Total Weed Seed (maximum)	0.03%	0.03%	0.08%
Inert (maximum)	2.0%	2.0%	2.0%
Germination (minimum)	80.0%	80.0%	80.0%
Moisture (maximum)	14.0	14.0	14.0%

<sup>1</sup>Standards as of 1999. Standards taken from the certified seed directory.

<sup>2</sup>Other varieties shall not include variations which are characteristics of the variety.

<sup>3</sup>Four pounds of cleaned rice seed is hulled from each lot to determine the noxious weed content, including red rice.

**Table 2-4. Agronomic Characteristics of Rice Varieties by Year<sup>1</sup> (1997-1999)**

Maturity Group & Variety	Grain Type <sup>2</sup>	Straw Strn <sup>3</sup>	Days to 50% Heading	Plant Ht	Milling Yield				Grain Yield, bu/A			
					1997	1998	1999	Avg.	1997	1998	1999	Avg.
				inches	% Head Rice - % Total Rice				bushels/A			
Bengal	M	2	84	36.5	70-76	66-71	58-74	66-74	171	161	184	172
Cocodrie	L	2	82	37.5	67-65	65-70	66-73	66-73	159	147	161	156
Cypress	L	2	87	37.5	68-74	65-69	66-73	67-73	148	147	144	146
Drew	L	4	88	45.0	66-74	64-69	58-67	63-71	159	157	160	159
Jefferson	L	2	80	36.0	63-74	60-69	53-69	60-71	150	137	146	145
Kaybonnet	L	5	84	43.5	64-73	63-69	57-72	62-72	146	139	157	147
LaGrue	L	3	86	44.0	65-73	61-69	60-72	63-72	167	159	180	168
Madison	L	1	87	33.0	NA	64-68	49-66	56-67	NA	142	149	145
Priscilla	L	1	84	38.5	NA	62-69	58-71	60-70	NA	151	145	148
Wells	L	3	86	40.5	62-75	61-70	55-74	60-74	171	151	169	164

<sup>1</sup>Arkansas Rice Performance Trials, 1997-1999.

<sup>2</sup>Grain Type: L = long grain, M = medium grain, LA = long grain, aromatic.

<sup>3</sup>Straw strength rating: 0 = very strong straw, 9 = very weak straw.

NA – Not Available. The rice variety was not an entry in the Arkansas Rice Performance Trials during that year.

**Table 2-5. Agronomic Characteristics of Rice Varieties by Location<sup>1</sup> (1997-1999)**

Variety	Milled Kernel Weight	Milling Yield <sup>2</sup>			Grain Yield <sup>2</sup>			
		PTBS	RREC	SEREC	NEREC	PTBS	RREC	SEREC
	milligrams	% Head Rice - % Total Rice			bushels/A			
Bengal	19.4	72 - 76	68 - 74	60 - 74	164	169	171	177
Cocodrie	17.5	67 - 76	66 - 73	67 - 73	127	156	170	159
Cypress	17.0	68 - 73	68 - 72	65 - 72	130	140	159	142
Drew	15.9	68 - 73	67 - 69	57 - 72	150	148	163	165
Jefferson	19.4	63 - 75	63 - 71	54 - 70	147	133	140	151
Kaybonnet	15.0	68 - 73	66 - 71	55 - 71	122	145	156	153
LaGrue	18.0	63 - 72	64 - 72	60 - 72	151	150	178	182
Madison <sup>3</sup>	16.0	NA	64 - 65	49 - 70	131	128	165	158
Priscilla <sup>3</sup>	18.5	NA	62 - 70	58 - 70	133	149	166	144
Wells	18.6	61 - 75	67 - 74	51 - 73	135	164	173	169

<sup>1</sup>Arkansas Rice Performance Trials, 1997-1999.

<sup>2</sup>Yield data is the 3-year average of studies conducted at each location unless otherwise noted.

<sup>3</sup>Grain and milling yield data Madison and Priscilla are 2-year averages from 1998 and 1999.

NA – Data not available for this location.

**Table 2-6a. Brief Description of Standard Varieties**

<b>Variety</b>	<b>Release Year</b>	<b>State</b>	<b>Comments</b>
Alan	1990	AR	Very-short season long grain with good yield potential and average milling quality. Is moderately sensitive to Ordram.
Adair	1993	AR	Very-short season long grain with high yield potential and poor milling quality that is susceptible to Ordram and lodging.
Bengal	1992	LSU	High yielding, semi-dwarf medium grain with a large kernel size that is preferred by the cereal industry.
Cocodrie	1997	LSU	Semi-dwarf long grain with very high yield potential and excellent milling yield. Is very susceptible to straighthead.
Cypress	1992	LSU	Semi-dwarf long grain with high yield potential and excellent milling yield.
Drew	1996	AR	High yielding long grain with good milling yields that has excellent resistance to blast.
Jackson	1990	MS	Short statured long grain with high yield potential and average milling quality.
Jefferson	1996	TX	Very-short season, semi-dwarf long grain with large seed size, average yield potential and poor milling quality. Has excellent resistance to straighthead.
Katy	1989	AR	Long grain variety with average yield potential and excellent resistance to blast and sheath blight.
Kaybonnet	1994	AR	High yielding long grain with good milling yields that has excellent resistance to blast and yields well when planted late. Susceptible to lodging.
LaGrue	1993	AR	Long grain variety with very high yield potential, average milling yields, and is susceptible to blast and kernel smut.
Lacassine	1991	LSU	Semi-dwarf long grain with high yield potential and is susceptible to sheath blight and blast.
Lemont	1983	TX	Semi-dwarf long grain with high yield potential and is susceptible to sheath blight.
Madison	1997	TX	Semi-dwarf long grain with average yield potential, poor milling quality and excellent resistance to blast.
Mars	1978	AR	Tall medium grain with high yield potential, low cost of production and excellent sheath blight resistance. Is susceptible to lodging.
Maybelle	1990	TX	Very-short season long grain with good yield potential and average milling quality. Earliest maturing variety available. Susceptible to both sheath blight and blast.
Millie	1990	AR	Very-short season long grain with average yield potential, excellent milling quality, and is susceptible to lodging and Ordram.
Newbonnet	1983	AR	Long grain variety with high yield potential and is very susceptible to blast.
Priscilla	1997	MS	Semi-dwarf long grain with high yield potential and poor milling quality. Is moderately sensitive to Ordram.
Wells	1999	AR	Stiff strawed, short statured long grain with very high yield potential, average milling yield and good resistance to kernel smut.

State abbreviations: AR, Arkansas; LSU, Louisiana State University; MS, Mississippi State University; TX, Texas A&M University

**Table 2-6b. Brief Description of Specialty Varieties**

Variety	Year Released	State	Comments
AB647	1996	AB	Selection from Congui, a Chinese indica rice, that is a long season, medium grain with high yield potential and atypical cooking qualities. Used for brewing.
Akitakomachi	—	Japan	Premium quality very short season, short grain that is less susceptible to lodging and matures earlier than Koshihikari.
Baldo	—	Italy	Very short season, large kenneled, medium grain variety used for risotto.
Della	1971	LSU	Aromatic, mid-season, long grain with low yield potential and average milling quality that is susceptible to lodging.
Dellmont	1992	TX	Semi-dwarf, aromatic long grain with good yield potential and milling quality.
Dellrose	1995	LSU	Semi-dwarf, aromatic long grain with good yield potential and milling quality.
Dixiebelle	1996	TX	Short season long grain with 'Newrex' quality. Specialty rice used for canning and steam tables.
Jasmine-85	1990	TX	Aromatic, high yielding long grain with good yield potential and poor milling quality.
Koshihikari	—	Japan	Premium quality, very short season, short grain variety with low yield potential and good milling quality. The standard for Japanese quality.
Toro 2	1984	LSU	Special-purpose, low amylose and low gelatinization temperature, long grain rice variety. Toro 2 cooks moist and sticky like a medium grain rice variety.

State abbreviations: AB, Busch Agri. Research; LSU, Louisiana State University; TX, Texas A&M

**Table 2-7. Grain Type Classification Based on Kernel Dimensions**

Grain Type	Grain Form	Kernel Length/Width Ratio
Long	Rough	3.4 to 1 and greater
Long	Brown	3.1 to 1 and greater
Long	Milled	3.0 to 1 and greater
Medium	Rough	2.3 to 1 and greater
Medium	Brown	2.1 to 1 and greater
Medium	Milled	2.0 to 1 and greater
Short	Rough	2.2 to 1 and greater
Short	Brown	2.0 to 1 and greater
Short	Milled	1.9 to 1 and greater