2018

Rice Varieties

& Management Tips

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Rice Varieties and Management Tips 2018

This publication handles information likely to become dated in a short time, such as changes in varieties, pest management products and other recently developed production practices. Projected cost and return information is also very important in management decisions. Additional information can be found in the Crop Enterprise Budgets publication, which can be accessed on the LSU AgCenter rice webpage.

Decisions on variety selection are some of the earliest and most critical you will make. This information will help you decide which rice varieties are best-suited to your particular growing conditions.

The varieties are grouped on the basis of grain type (long or medium/short) and use (special purpose). Clearfield (CL) varieties are resistant to Newpath and Beyond herbicides for use in the Clearfield production system. After each variety name are letters in parentheses to indicate the state of origin of the variety. A brief description of the agronomic characteristics of each of the recommended varieties is provided. In addition to recommended varieties, descriptions of other varieties are included. These are varieties that are not recommended but may be grown on limited acreage. In some cases, the lines have performed well in testing, but the number of years in testing is less than the minimum required for recommendation.

Rice Varieties and Management Tips 2018 is available through the LSU AgCenter's rice webpage at www.lsuagcenter.com/topics/crops/rice. Additional rice production information can also be found in the Louisiana Rice Production Handbook, which is also available through the LSU AgCenter's rice webpage.

Data were generated at seven research locations. These include the H. Rouse Caffey Rice Research Station in Crowley and off-station locations in Acadia, Evangeline, Jefferson Davis, St. Landry and Vermilion parishes and St. Joseph in Tensas Parish.

The following information is included:

Yield: Dry weight, lb/A

Milling:

a. Head - percent of whole kernels after milling
b. Total - percent of all kernels (whole and broken) after milling

Seedling Vigor: Vigor ratings are based on subjective estimates made during yield testing.

Days to 50 Percent Heading: Average number of days from emergence to 50 percent heading. This occurs when half of the flag leaf sheaths have panicles emerging from them. Most varieties will reach harvest maturity (20 percent grain moisture) within 30 to 40 days after heading under normal conditions. Medium grains normally require five to seven days longer after heading to reach harvest maturity than do long grains under similar environmental conditions.

Rice Varieties and Hybrids

Aura 115 (RiceTec): An early, short-stature, long-grain (non-hybrid) rice variety release by RiceTec. In limited testing, it has shown excellent yield potential and has displayed improved grain quality and reduced plant height when compared to the hybrids. It has been demonstrated to be susceptible to lodging.

Caffey (LA): An early, short-stature, medium-grain rice variety. It has excellent yield potential, comparable to Jupiter. Caffey also has excellent milling quality with low level of chalk and a very bold milled grain. The variety is comparable in maturity to Jupiter and Neptune. Caffey is similar in plant height to Jupiter but displays somewhat more resistance to lodging. Caffey is moderately susceptible to sheath blight, bacterial panicle blight and straighthead. It is resistant to blast and narrow brown leaf spot.

Cheniere (LA): An early, high-yielding, high-quality long-grain variety with very good yield potential, good lodging resistance, and moderate resistance to physiological straighthead. It is moderately susceptible to blast and susceptible to sheath blight. The variety has displayed excellent grain quality characteristics and is similar in maturity to Cypress.

CL111 (LA): A very early, short-stature, long-grain Clearfield rice variety that averages about five to seven days earlier than CL151 in number of days from emergence to harvest maturity. CL111 has shown slightly lower yield potential than CL151 but has higher head rice yields and superior grain quality. The variety is similar in height to CL151 but it is more resistant to lodging. It is moderately susceptible to blast and very susceptible to sheath blight and bacterial panicle blight. It has excellent seedling vigor and very good second crop potential.

CL151 (LA): A very early, semidwarf, long-grain Clearfield variety that displays excellent yield potential. The variety is rated very susceptible to sheath blight and blast and very susceptible to straighthead. CL151 has consistently shown high head rice yields but has displayed somewhat more kernel chalk than some other long-grain varieties. The variety has very good seedling vigor and second crop potential. CL151 is moderately susceptible to lodging. Under the severe level of blast disease pressure observed in southwest Louisiana in 2012, this variety displayed a high level of susceptibility to the disease. An appropriate fungicide program is essential, and timing of fungicide applications is critical. Please refer to the disease section in this publication for additional information on fungicide use, rates and timings.

CL153 (LA): An early, semidwarf, long-grain Clearfield rice variety that displays excellent yield potential. CL153 has shown very good head rice yields and less grain chalk than CL151. The variety is rated as moderately susceptible to blast, Cercospora, bacterial panicle blight

Table I. Agronomic Characteristics and Yields of Recommended Rice Varieties (2015-2017) in Louisiana

Variety	Grain Type	Seedling Vigor	Lodging	Days to 50% Heading	Plant Height (in.)	Milling % (Whole - Total)				Grain Yield			
						2015	2016	2017	Mean*	2015	2016	2017	Mean*
Long Grain													
XP753	L	G	S	79	41	62-76	66-74	51-73	59-74	10004	10738	10995	10505
XP760	L	G	S	82	44	60-74	55-72	51-69	56-72	10080	9987	11121	10434
LaKast	L	G	S	80	39	61-75	55-73	47-70	53-72	8208	8482	7965	8083
Diamond	L	G	MS	80	38	41-70	46-70	49-70	46-70	7147	7514	8143	7630
Catahoula	L	G	R	81	37	58-75	66-74	53-72	57-74	7201	8358	7262	7486
Cheniere	L	G	R	82	35	64-76	63-72	61-74	62-74	7458	7937	7288	7459
Roy J	L	G	MR	85	40	53-72	54-72	49-70	51-70	7362	7599	7639	7422
Mermentau	L	G	MR	80	36	72-77	60-72	59-71	64-73	7485	7913	5598	6892
Presidio	L	G	R	80	36	68-75	65-73	60-73	64-73	6574	7179	7036	6886
Medium Grain													
Jupiter	M	G	MR	85	36	63-71	66-68	58-61	62-67	7433	8308	8360	7979
Caffey	M	G	MR	85	36	49-72	66-70	60-65	58-69	7935	7889	7969	7886

*Mean is the average of 19 yield trials conducted over the three-year period. Mean is not the average of the three years (2015-2017) because there were different numbers of trials each year.
Height: Height at maturity in inches from soil line to extended panicle
Lodging: Comparative estimate of resistance to lodging. Most varieties rated as resistant will lodge, especially under excessive levels of nitrogen.
Abbreviations: R = resistant; MR = moderately resistant; MS = moderately susceptible; VG = very good; G = good

and straighthead. It is susceptible to sheath blight. CL153 has shown yield potential comparable to or slightly lower than CL151. CL153 is similar in maturity and plant height to CL151 but has improved lodging resistance. The variety has good seedling vigor and has shown good second crop yield potential.

CL163 (MS): A good yielding, long-grain, Clearfield rice variety that possesses extra high amylose that is favored by some processors. It has very good grain appearance and high head rice yields. It has shown to be very susceptible to blast disease in south Louisiana.

CL172 (AR): An early, semidwarf, long-grain Clearfield line. The variety has shown very good yield potential and excellent grain appearance quality. CL172 is moderately resistance to blast disease. CL172 is similar in maturity and height to CL151 but has shown better resistance to lodging. The variety also has good seedling vigor and second crop potential in limited testing.

CL272 (LA): A Clearfield, short-stature, medium-grain variety with excellent yield potential, having yielded comparable to Jupiter and CL271 in multiple year testing. Grain quality of CL272 appears to be superior to CL271. The variety has also shown good ratoon crop yield potential in limited testing. CL272 is moderately susceptible to blast, Cercospora, bacterial panicle blight and sheath blight. The variety is moderately susceptible to lodging.

CLXL729 (RiceTec): A very high-yielding, long-grain hybrid with resistance to Newpath herbicide for use in the Clearfield production system. CLXL729 has excellent yield characteristics and fair milling characteristics. It should be harvested at optimum grain harvest moisture (18-20 percent) to maximize milling yields. The hybrid also has excellent seedling vigor. CLXL729 has a good disease package and is moderately resistant to sheath blight and blast, as well as straighthead.

CLXL745 (RiceTec): A very high-yielding, long-grain hybrid with resistance to Newpath herbicide for use in the Clearfield production system. CLXL745 has excellent grain yield and good milling quality. Efforts, however, should be made to harvest at optimum grain moisture (18-20 percent) to minimize milling yield reductions. This hybrid has a good disease package and is moderately resistant to sheath blight and blast, as well as straighthead disorder. This hybrid also appears to have somewhat more resistance to grain shattering at maturity.

Cocodrie (LA): A very early, semidwarf, long-grain variety that has good yield potential. It is about the same height as Cypress but has displayed better resistance to lodging. Cocodrie averages two to three fewer days to 50 percent heading than Cypress. It has displayed good second crop potential, good milling quality, and fair seedling vigor. It is susceptible to sheath blight and straighthead and moderately susceptible to blast disease.

Della-2 (LA): An early maturing, short-stature, aromatic, long-grain variety with good grain and milling yields and excellent grain quality. Della-2 has comparable grain quality and aroma to Della but much higher yield potential. The variety is comparable in height and maturity to Cheniere and has shown good resistance to lodging.

Table 2. Agronomic Characteristics and Yields of Recommended Clearfield Rice Varieties (2015-2017) in Louisiana

Variety	Grain Type	Seedling Vigor	Lodging	Days to 50% Heading	Plant Height (in.)	Milling % (Whole - Total)				Grain Yield			
						2015	2016	2017	Mean*	2015	2016	2017	Mean*
CLXL745	L	VG	S	77	41	66-77	64-73	54-73	59-73	9434	10738	10251	9936
CLXL729	L	VG	S	79	40	64-76	62-73	52-72	61-74	9688	9698	10568	9799
CL272	M	G	MS	84	36	42-73	67-70	60-71	54-71	7874	8402	8047	8004
CL151	L	G	S	80	36	57-74	67-74	62-73	61-73	7593	8404	8149	7993
CL153	L	G	MR	81	37	64-75	67-73	61-73	63-73	6465	7978	7683	7696
CL172	L	G	MS	79	35	58-75	57-69	59-73	58-72	7163	8064	7594	7405
CL163	L	G	MS	82	37	56-73	59-71	60-72	58-72	6220	7079	7895	7039
CL111	L	G	MR	77	36	69-77	69-75	61-72	65-74	6744	7707	6699	6901

* Mean is the average of 19 yield trials conducted over the three-year period. Mean is not the average of the three years (2015-2017) because there were different numbers of trials each year.
Height: Height at maturity in inches from soil line to extended panicle
Lodging: Comparative estimate of resistance to lodging. Most varieties rated as resistant will lodge, especially under excessive levels of nitrogen.
Abbreviations: R = resistant, MR = moderately resistant, MS = moderately susceptible, VG = very good, G = good

Della-2 is susceptible to sheath blight, moderately resistant to blast, and moderately susceptible to bacterial panicle blight. The variety has shown good ratoon potential in limited testing.

Diamond (AR): A conventional-height, early, long-grain rice variety. It has shown excellent yield potential but has shown somewhat lower head rice yields than other currently grown long-grain rice lines. Diamond is similar in maturity to Cheniere and Mermentau and about four inches taller than these two varieties. The variety has shown good seedling vigor and second crop potential in limited testing. Diamond is susceptible to blast and sheath blight, moderately susceptible to bacterial panicle blight and straighthead and moderately resistant to Cercospora.

Gemini 214 CL (RiceTec): An early, Clearfield hybrid with excellent yield and fair milling quality. Gemini 214 CL is very similar to XL723 in appearance and performance with improved grain retention. It is resistant to blast and moderately resistant to narrow brown leaf spot and bacterial panicle blight, making it a good candidate for ratoon cropping.

Jazzman (LA): A Jasmine-type, aromatic, long-grain variety. Jazzman has good yield potential and good milling quality. Its aroma, flavor, and soft-cooking characteristics are similar to that of imported Thai Jasmine. Jazzman is similar to Wells in plant height and maturity. It is moderately susceptible to sheath blight, straighthead and lodging but moderately resistant to blast.

Jazzman-2 (LA): An early-maturing, semidwarf, Jasmine-type, aromatic, long-grain variety. It has lower yield potential compared to Jazzman but an increased aroma level. It has good lodging tolerance and very good milling quality. Jazzman-2 has typical Jasmine rice quality characteristics found in imported Thai Jasmine, which include soft-cooking, glassy appearance, sweet flavor, and very strong aroma. Jazzman-2 is similar to Cocodrie in height and maturity but about four inches shorter and four days earlier than Jazzman. Jazzman-2 is very susceptible to sheath blight, susceptible to bacterial panicle blight and straighthead but resistant to blast.

Jupiter (LA): A very high-yielding, semidwarf, medium-grain variety. It has been the predominant medium grain grown for several years. Jupiter is susceptible to blast, moderately susceptible to sheath blight, moderately resistant to bacterial panicle blight and straighthead and resistant to Cercospera. It has shown good seedling vigor and milling quality.

LaKast (AR): A conventional-height, very early, long-grain variety with excellent yield potential that was developed in Arkansas. The variety has shown good milling quality characteristics in limited evaluation in Louisiana. LaKast is 4 to 5 inches taller than Louisiana semidwarfs and appears to be moderately susceptible to lodging. It is moderately susceptible to Cercospora and straighthead and susceptible to blast, sheath blight and bacterial panicle blight.

Mermentau (LA): An early-maturing, long-grain rice variety with very good grain and milling yields as well as good grain quality. The variety has displayed grain yields comparable to Cocodrie and Cheniere. Mermentau is rated as susceptible to sheath blight and blast, and moderately susceptible to bacterial panicle blight and Cercospora. The variety is similar in maturity and height to Cocodrie and Cheniere and has displayed good resistance to lodging under most conditions. Mermentau has shown good seedling vigor and ratoon crop potential.

Presidio (TX): A semidwarf, long-grain variety that has good yield potential. It has displayed excellent milling and grain quality. It has good resistance to lodging and has excellent ratoon potential.

PVL01 (LA): The first variety released for the Provisia herbicide system. Developed by the LSU

Table 3. Agronomic Characteristics and Yields of Recommended Specialty Rice Varieties (2015-2017) in Louisiana

Variety	Grain Type	Seedling Vigor	Lodging	Days to 50% Heading	Plant Height (in.)	Milling % (Whole - Total)				Grain Yield			
						2015	2016	2017	Mean*	2015	2016	2017	Mean*
Specialty													
Jazzman	L	G	MS	86	38	62-74	64-72	56-69	58-71	6814	6958	6846	6866
Della-2	L	G	MR	84	38	56-73	65-72	55-70	58-71	6639	6990	6321	6683
Jazzman-2	L	G	MR	82	33	72-75	69-73	62-73	67-73	5883	6725	5443	5946

*Mean is the average of 19 yield trials conducted over the three-year period. Mean is not the average of the three years (2015-2017) because there were different numbers of trials each year.
Height: Height at maturity in inches from soil line to extended panicle
Lodging: Comparative estimate of resistance to lodging. Most varieties rated as resistant will lodge, especially under excessive levels of nitrogen.
Abbreviations: R = resistant; MR = moderately resistant; MS = moderately susceptible; VG = very good; G = good

AgCenter. A semidwarf, long-grain variety that has excellent grain appearance and has a milled grain over 7mm. It has moderate yields compared to the highest yielding Clearfield and conventional varieties. It is similar in height to Mermentau and CL111 and is about one week later maturing. It has shown moderate resistance to lodging and has moderate ratoon potential. PVL01 is moderately resistant to Cercospora, moderately susceptible to sheath blight, and is susceptible blast and bacterial panicle blight. The recommended nitrogen is between 150-180lb/A, which can increase blast pressure. PVL01 is typically a lighter green color compared to other varieties, and it displays a yellow flash in color after the Provisia herbicide application, which lasts for a few days.

Roy J (AR): A conventional-height, long-grain variety averaging 4 inches taller than CL111 in Louisiana testing. Roy J has strong stalk strength and is moderately resistant to lodging and is about one week later than CL111. Roy J is resistant to Cercospora, moderately resistant to sheath blight and moderately susceptible to bacterial panicle blight. It is susceptible to blast and straighthead disorder. It has shown excellent yield potential but only fair milling yields.

Thad (MS): A mid-maturity, long-grain variety with good yield potential. It contains extra high amylose that is favored by some processors. Thad has shown good milling potential and has been observed to be susceptible to blast.

Titan (AR): A very early, short-stature, medium-grain rice variety that has shown excellent yield potential and good milling quality. The variety has consistently shown comparable or slightly better yield potential than CL272 and Jupiter. Titan is similar in height and a week earlier than Jupiter in maturity. However, harvest maturity is similar for the three varieties.

XP753 (RiceTec): A very high-yielding, long-grain hybrid that is similar to XL723 in many aspects. It has better grain retention than XL723 but should be harvested at 18-20 percent moisture to maximize grain quality and retention. It is NOT a Clearfield hybrid and, thus, is NOT tolerant of Newpath or Beyond herbicides.

XP760 (RiceTec): A very high-yielding, long-grain hybrid that is similar to XP753. The hybrid has a good disease package and is moderately resistant to sheath blight and resistant to blast. An effort should be made to harvest at optimum grain moisture (18-20 percent) to minimize milling yield reductions. It is NOT a Clearfield hybrid and, thus, is NOT tolerant of Newpath or Beyond herbicides.

Please see Tables 1-3 for the agronomic characteristics and yields of the recommended varieties and Table 4 for the results of variety trials.

Seeding Dates

Environmental conditions vary by location and over years; therefore, the optimum seeding time is presented as a range of dates. Rice yields may be reduced by planting too early or too late outside of the recommended range. Average daily temperature at seeding (calculated by adding the daily high and low temperatures and dividing by 2) is crucial in stand establishment.

Remember: At or below 50 degrees F, rice seed germination is negligible. From 50-55 degrees, germination increases but not to any great extent until temperature is above 60 degrees. Seedling survival is not satisfactory until the average daily temperature is above 65 degrees.

Based on information from seeding date research trials, the optimum planting dates for rice are:

- Southwest Louisiana – March 10 to April 15
- North Louisiana – April 1 to May 5

Extremely early seeding can lead to a number of problems, including:

- Slow emergence and poor growth under colder conditions because of the inherent lack of seedling vigor and cold tolerance of many varieties,
- Increased damage from seedling diseases under cool conditions,
- Increased damage from birds (blackbirds, ducks, and geese), which are more numerous in early spring, and
- Interactions with herbicides.

Extremely late planting can also be detrimental to yield. Stand establishment can be equally difficult in hot weather. The yield potential of many varieties will decrease significantly with later plantings. Bacterial panicle blight is thought to be associated with higher-than-normal day and night temperatures during pollination and grain fill. Late-planted rice is more likely to encounter these conditions. Many diseases (especially blast) and insect problems are more severe, and grain quality is often decreased with later-seeded rice.

The first crop should be harvested before mid-August to ensure adequate time for a ratoon crop to develop

Table 4. Results of 2017 Louisiana Rice Variety Trials

Entry	Grain Type	Days to 50% Heading	Plant Height (in.)	Milling %* Whole Total	LDG	Locations**							Mean
						RRS	AD	EV	JD	LA	ST. J	ST.L	
Long Grain													
Gemini 214 CL	L	84	43	51-69	S	11902	11619	9692	11576	11872	11084	12900	11521
XL760	L	85	42	51-69	S	11860	11013	9465	11065	11596	11207	11639	11121
XL753	L	85	40	51-73	S	11851	10910	9498	10724	11530	11406	11045	10995
CLXL729	L	84	41	52-72	S	11358	10088	8879	10611	10046	10677	12319	10568
CLXL745	L	80	41	54-73	S	10520	11347	8749	9274	10939	10420	10508	10251
Aura 115	L	84	37	57-74	S	8452	7300	7234	7694	8175	8634	10326	8260
CL151	L	84	35	62-73	S	8903	7494	7403	8693	7795	9168	7589	8149
Diamond	L	85	37	49-70	MS	9279	7132	6028	8227	7608	9497	9230	8143
LaKast	L	86	39	47-70	MS	9054	7890	5805	8080	7245	8994	8686	7965
CL163	L	85	36	60-72	MR	8171	7611	6988	8383	7948	9097	7070	7895
CL153	L	85	35	61-73	MR	8523	7410	7271	7827	7451	8292	7006	7683
Roy J	L	90	39	49-70	MR	9034	6739	5546	8030	7087	8142	8895	7639
CL172	L	83	34	59-73	MS	8099	6810	5786	8502	7501	7808	8650	7594
Thad	L	86	36	55-71	MS	8844	5337	5885	7388	7042	7870	8748	7302
Cheniere	L	87	35	61-74	MR	8346	5984	6152	7390	6806	8935	7406	7288
Catahoula	L	85	36	53-72	MR	7994	6489	6936	8026	6434	8815	6139	7262
Presidio	L	85	36	60-73	MR	7985	5917	5850	7326	6733	7643	7803	7036
CL111	L	82	35	61-72	MR	7830	6610	5547	7233	6418	8156	5096	6699
PVL01	L	91	36	55-73	MS	7484	6584	6140	6261	6806	7401	5742	6631
Mermentau	L	88	35	59-71	MR	7255	5723	3230	6316	4454	5187	7020	5598
Cocodrie	L	90	35	50-70	MR	6350	4161	6152	6757	5501	5370	5326	5491
Specialty Grain													
Jazzman	L	92	38	56-69	MR	7454	5178	6288	7206	5570	7894	8329	6846
Della-2	L	88	37	55-70	MR	6928	6135	5983	5302	5488	7659	6751	6321
Jazzman-2	L	87	33	62-73	MR	6843	4316	4625	5996	4435	6635	5248	5443
Medium Grain													
Titan	M	85	36	61-68	MS	9885	7159	6789	8375	8214	9761	8784	8424
Jupiter	M	92	36	58-61	MS	8956	7529	7148	9126	8683	8588	8493	8360
CL272	M	89	36	60-71	MS	9162	7060	6772	8794	8396	8699	7449	8047
Caffey	M	90	36	60-65	MS	9329	7292	6089	8339	7956	8305	8469	7969

* Milling data = average of RRS, AD and LA

** RRS = Rice Research Station; AD = Acadia Parish, R&Z Farm; EV = Evangeline Parish, Beiber Farm; JD = Jefferson Davis Parish, Hoppe Farm; LA = Vermilion Parish, Lounsberry Farm; ST.J = Tensas Parish, Northeast Research Station; ST.L= St. Landry Parish, Sunland Properties

prior to the onset of cold weather. Rice planted on or before April 15 in southwest Louisiana has the most potential for meeting this harvest deadline and producing good grain yields in the ratoon crop.

Seeding Rates

Establishing a satisfactory stand is an essential first step in a successful rice production program. The amount of seed necessary to accomplish this depends primarily on the type of seeding system (dry- or water-seeded).

Rice in Louisiana is planted in three basic ways: water-seeded (dry or pre-sprouted seed dropped into a flooded field); drill-seeded (planted with a drill on 7- to 10-inch rows); and broadcast dry (broadcast on a dry seedbed by either ground equipment or airplane).

Regardless of the seeding system used, the desired plant stand is identical. The optimum stand is 10 to 15 plants per square foot; the minimum stand is six to eight plants per square foot. Rice, like most grasses, has the ability to tiller or stool. This is why a somewhat satisfactory stand can be produced from as few as six to eight seedlings per square foot if proper cultural practices are used. Stands can be too thick as well as too thin. Excessively thick stands can often lead to increased disease pressure as well as spindly plants that may be susceptible to lodging.

Experimental results and commercial experience have shown that different seeding rates are often necessary to reach these desired stands, depending on the type of seeding system used. For this reason, planting on the basis of seeds per acre to obtain the desired plant population is more accurate than planting pounds per acre. For example, 90 pounds of Caffey will contain fewer seeds than 90 pounds of CL151. For conventional varieties, an ideal plant population is approximately 10 to 15 plants per square foot. Seeding rates of hybrids are much lower than inbred varieties. Growers should consult their hybrid seed representative for guidelines and recommended seeding rates.

Under typical conditions, in a drill-seeded system, about half of the seeds survive to produce a plant. Therefore, if the target rice stand is 10-15 plants per square foot, approximately 20-30 seeds per square foot will have to be planted. Use the information in Table 5 to determine the pounds of seed per acre required to achieve the desired plant population.

When drill-seeding, about 50-80 pounds of seed per acre are required. When water-seeding or dry broadcasting, about 80-120 pounds of seed per acre are required. Refer to the plant growth regulator section for recommendations on reduced drill seeding rates when using seed treated with gibberellic acid. Use the higher rates when planting under less than optimum conditions.

Considerations:

a. Use higher seeding rates when planting early in the season when there is potential for unfavorably cool growing conditions. Cool conditions will favor seedling diseases, which can reduce stands. Varieties also differ in tolerance to cool growing conditions in the seedling stage.
b. Varieties differ considerably in average seed weight. Thus, a variety with a lower average seed weight will have more seed per pound. Table 5 shows seed weight per pound and the average number of seed per square foot at several seeding rates for most of the varieties mentioned in this publication. Producers may want to adjust seeding rates for this factor.
c. Where seed depredation by blackbirds is potentially high, use a higher seeding rate and consider using a bird repellent seed treatment.
d. Where seedbed preparation is difficult and a less than optimum seedbed is prepared, use a higher seeding rate.
e. If it is necessary to use seed of low-germination percentage, compensate with increased seeding rates. Always use high-germination, certified seed if possible.
f. When water-seeding into stale or no-till seedbeds with excessive vegetation, use higher seeding rates.
g. If any other factor exists that may cause stand establishment problems (such as slow flushing capability or saltwater problems), consider this when selecting a seeding rate.
h. Water-seeding research has shown that the best stands are obtained when planting pre-sprouted seeds. Pre-sprouted seed typically will lead to better stands than dry (non-pre-sprouted) seeds.

Plant Growth Regulators

Seed treatment with gibberellic acid promotes rapid, uniform emergence in dry-seeded systems. It is especially effective on semidwarf varieties. With gibberellic acid, seeding depth can be increased to ensure seed placement into soil moisture adequate for germination and emergence to minimize flushing, but the depth should not be more than 1.5 inches. In drill-seeded rice varieties, the seeding rate can be decreased by 10 percent when planting under warm conditions (daily average temperature higher than 70 degrees). Under cool conditions (daily average temperature of 60-70 degrees), the higher rates are recommended.

Rice Fertilization

Fertilizer nutrients are most efficiently used by rice when applied immediately before planting until before the rice reaches the 4-leaf stage of development. There are situations when fall application of some nutrients may be a suitable alternative. Neither nitrogen (N) nor zinc (Zn), however, should be applied in the fall. For more details, consult the Louisiana Rice Production Handbook (Pub. No. 2321).

Phosphorus (P) and potassium (K) should be applied according to soil test recommendations. On soils where P and K are needed, apply fertilizer preplant or before rice reaches the 4-leaf stage of development. Currently, soil test-based fertilizer recommendations (Tables A to D) only address main rice crop needs and do not address ratoon rice needs. Recent research has shown that rice grown on soils that test very low, low, or medium in soil test P and/or K will need an additional 30 pounds of P (as P_2O_5) and/or K (as K_2O) to maximize ratoon yields. The additional P and K fertilizer can be applied with P and K in the first crop or can be applied after first crop harvest.

Generally, lime is not recommended for rice production unless the pH of the soil is 5.4 or lower. Crops grown in rotation with rice, such as cotton, soybeans and other pH-sensitive crops, may benefit from liming. The pH of the soil should not be increased to more than 6.2 for rice production. Over liming can induce Zn deficiency in rice. Lime should be applied in the fall after rice harvest.

In a water-seeded pinpoint flood system, a third of the crop's N fertilizer needs should be applied during

Table 5. Seed per Pound and Average Number of Seed per Square Foot for Important Rice Varieties and Hybrids

Variety	Seed/lb*	Seeding Rate (lb/A)											
		20	25	30	40	50	60	70	80	90	100	110	120
		----------seed/ft^2----------											
Aura 115	19,079				18	22	26	31	35	39	44	48	53
Caffey	15,724				14	18	22	25	29	32	36	40	43
Cheniere	19,646				18	23	27	32	36	41	45	50	54
CL111	18,225				17	21	25	29	33	38	42	46	50
CL151	19,412				18	22	27	31	36	40	45	49	53
CL153	18,392				17	21	25	30	34	38	42	46	51
CL163	18,429				17	21	25	30	34	38	42	47	51
CL172	18,486				17	21	25	30	34	38	42	47	51
CL272	17,221				16	20	24	28	32	36	40	43	47
CLXL729	20,590	9	12	14									
CLXL745	19,743	9	11	14									
Cocodrie	19,014				17	22	26	31	35	39	44	48	52
Della-2	17,525				16	20	24	28	32	36	40	44	48
Diamond	19,435				18	22	27	31	36	40	45	49	54
Gemini 214 CL	20,331	9	12	14									
Jazzman	18,007				17	21	25	29	33	37	41	45	50
Jazzman-2	20,351				19	23	28	33	37	42	47	51	56
Jupiter	17,322				16	20	24	28	32	36	40	44	48
LaKast	18,015				17	21	25	29	33	37	41	45	50
Mermentau	19,772				18	23	27	32	36	41	45	50	54
Presidio	18,839				17	22	26	30	35	39	43	48	52
PVL01	19,324				18	22	27	31	35	40	44	49	53
Roy J	19,113				18	22	26	31	35	39	44	48	53
Thad	19,624				18	23	27	32	36	41	45	50	54
Titan	16,587				15	19	23	27	30	34	38	42	46
Titan	16,330				15	19	22	26	30	34	37	41	45
XL753	20,604	9	12	14									
XL760	20,475	9	12	14									

*Average seed weights are determined from multiple seed sources and years.

the brief drain period between planting and re-flooding. If urea is the fertilizer source, it should be treated with a urease inhibitor product containing the active ingredient N-(n-butyl) thiophosphoric triamide (NBPT). The second third of the N fertilizer should be applied one to two weeks later and the final third by internode elongation (green ring). In a drill-seeded, dry broadcast or water-seeded delayed flood system, two thirds of the N should be applied immediately before permanent flood. In order to maximize N efficiency, the application should be made on dry ground and flooded as soon as possible after the application. The balance of the N should be applied at internode elongation (green ring) or earlier if deficiency symptoms occur.

Nitrogen fertilizer applied as urea is prone to loss through ammonia volatilization. A urease inhibitor which contains the active ingredient NBPT or NPPT can be applied to the surface of urea fertilizer to slow down its breakdown and reduce ammonia volatilization. Use of a urease inhibitor is recommended to reduce volatilization losses when applied urea is expected to remain on the soil surface for longer than three days prior to flood establishment or if the soil is moist (without standing water) prior to application. It is not recommended if urea is applied into standing water.

The recommended seasonal N rates as determined by rice variety grown are presented in Table 6. Rice varieties may differ in their N requirements by location. Native soil fertility, soil type, and other factors effect N efficiency. Rice growers should determine the N rate that provides optimum grain yield on their soil. The higher N rates within the recommended range for each variety are generally required on clay soils in central and northeast Louisiana. Avoid N deficiency and excessive N fertilization.

Zinc (Zn) deficiency can be a serious problem in rice resulting in greatly reduced yields if not corrected. Currently, if a soil has less than 1 ppm of extractable Zn using the Mehlich-3 soil test, it is considered deficient in Zn. Soil pH is important in determining the potential for Zn deficiency in rice because, as soil pH increases above 6, the solubility of Zn begins to decrease. This relationship can cause Zn to become unavailable for plant uptake even when soil test levels exceed 1 ppm. Therefore, both soil pH and the Mehlich-3 soil test are used to determine Zn fertilizer needs in rice. See Table D for Zn fertilizer recommendations. Zinc fertilizer recommendations are based on using a granular zinc sulfate. Other Zn sources can be used; however, inorganic Zn sources should be greater than 50 percent water soluble. Liquid inorganic or chelated Zn fertilizers can be soil applied at lower rates as compared with granular sources, generally between 2.5-5 pounds, since they can be applied more uniformly. When Zn deficiency symptoms begin to occur (bronzing), it is recommended to immediately drain the field. When the rice begins to show signs of recovery (new growth), a foliar Zn application can be applied to rice at rates between 1 and 2 pounds of Zn per acre. Granular Zn applications at this time have also shown to be equally effective. Application of N fertilizer should also be applied prior to reflooding to account for the N losses associated with draining. Ammonium sulfate is generally the preferred N source in this situation.

Sulfur (S) may be needed at a rate of 20-25 pounds per acre where large amounts of soil have been moved in land leveling. Sulfur deficiencies resemble N deficiencies, producing pale yellow plants that grow slowly. Sulfur deficiency symptoms in rice generally appear beginning with the newest leaf becoming yellow first, while N deficiency symptoms appear first in the lowest (oldest) leaves. If these symptoms appear, applying 100 pounds of ammonium sulfate per acre will provide 21 pounds of N and 24 pounds of S per acre.

Table 6. Nitrogen Recommendations

Varieties	N rate (lb/A)
CL151, Jupiter	90-130
Aura 115, Caffey, Cheniere, CL111, CL153, CL163, CL172, CL272, CLXL729, CLXL745, Cocodrie, Della-2, Diamond, Gemini 214 CL, Jazzman, Jazzman-2, LaKast, Mermentau, Presidio, Roy J, Thad, Titan, XL753, XL760	120-160
PVL01	150-180

Ratoon Management

Ratoon, or second-crop rice, should be fertilized with 75-90 pounds of N per acre when the first crop is harvested before August 15. When conditions appear favorable for good second crop production (minimal field rutting, little or no red rice, healthy stubble), apply the higher rate of N. Apply N and establish a shallow flood within five days after harvest. Research has consistently shown that N fertilizer should be applied and the field flooded as soon as possible after the first crop harvest to maximize second crop yield. When the main crop is not harvested before August 15, the potential for profitable second crop production is reduced because of the probable delay in maturity, especially at higher N rates and the increased likelihood of unfavorable weather. Days to ratoon maturity increase with increasing N fertilization rates. Therefore, when the first crop is not harvested before August 15, lower N rates are recommended. A good rule of thumb is to reduce N by 5 to 6 pounds per day after August 15. Fertilizer N is not recommended after Sept. 1.

As stated in the fertility section, currently LSU AgCenter soil test-based P and K recommendations do not consider the ratoon rice crop. Recent research has shown that rice grown on soils that test very low, low, or medium in soil test P or K will need an additional 30 pounds of P (as P_2O_5) or K (as K_2O) to maximize ratoon yields. The additional P and K fertilizer can be applied with P and K in the first crop or can be applied after first crop harvest.

Stubble management practices, such as post-harvest mowing of the stubble to approximately 8 inches or

LSU AgCenter Soil Testing Tables

Soil testing is a useful tool in assessing the soil fertility status and determining fertilizer application rates. Currently, the LSU AgCenter Soil Testing and Plant Analysis Laboratory uses the Mehlich-3 soil test extraction for phosphorus (P), potassium (K), sulfur (S) and zinc (Zn), the most commonly deficient nutrients in commercial rice production in Louisiana. Mehlich-3 soil test based recommendation tables for P, K, S and Zn are included below as a reference. Generally, if your soil test results fall into the very low, low or medium categories, fertilizer applications would be recommended to increase rice yields. Recommendation tables do not include ratoon rice needs. Recent research has shown that rice grown on soils that test very low, low or medium in soil test P or K may need an additional 30 pounds of P_2O_5 and K_2O fertilizer to maximize ratoon yields. The additional P and K can be applied with first crop fertilization or after the main crop harvest.

Table A. Potassium Fertilizer Recommendations and Soil Test Ratings Based on the Mehlich-3 Soil Test Extraction

Soil Type	Texture	Very Low	Low	Medium	High	Very High
		---------- ppm ----------				
Alluvial						
	clay, silty clay	<114	114 - 182	183 - 227	228 - 273	>273
	clay loam, silty clay loam	<91	91 - 136	137 - 182	183 - 205	>205
	loam and silt loam	<57	57 - 91	92 - 136	137 - 159	>159
	sandy loam	<45	45 - 80	81 - 114	115 - 136	>136
Upland						
	clay, silty clay	<114	114 - 182	183 - 227	228 - 250	>250
	clay loam, silty clay loam	<57	57 - 102	103 - 148	149 - 170	>170
	loam and silt loam	<57	57 - 91	92 - 136	137 - 159	>159
	sandy loam	<45	45 - 80	81 - 114	115 - 136	>136
Fertilizer Recommendation		---------- lb K_2O / A ----------				
		60	40	20	0	0

Table B. Phosphorus Fertilizer Recommendations and Soil Test Ratings Based on the Mehlich-3 Soil Test Extraction

Soil Test Ratings	Very Low	Low	Medium	High
	---------- ppm ----------			
	<10	11 - 20	21 - 35	≥36
Fertilizer Recommendation	---------- lb P_2O_5 / A ----------			
	60	40	20	0

Table C. Sulfur Fertilizer Recommendations and Soil Test Ratings Based on the Mehlich-3 Soil Test Extraction

Soil Test Ratings	Low	Medium	High
	---------- ppm ----------		
	<12	12 - 16	≥16
Fertilizer Recommendation	---------- lb / A ----------		
	40	20	0

Application of 100 pounds of ammonium sulfate will provide 21 pounds of N and 24 pounds of S.

Table D. Zinc Fertilizer Recommendations and Soil Test Ratings Based on the Mehlich-3 Soil Test Extraction and Current Research on the Effects of pH on Zinc Availability[1]

Soil Test	≤ 1 ppm		1 - 1.5 ppm			1.6 - 2 ppm	
pH	≥ 7	< 7	≥ 7	6.9 - 6.0	< 6	≥ 7	< 7
Granular Fertilizer Recommendation[2]	15 lb/A	10 lb/A	10 lb/A	5 lb/A[2]	none	5 lb/A	none

[1] The granular zinc fertilizer source must be at least 50 percent water soluable or higher rates of zinc may be needed.
[2] Even distribution of most granular zinc fertilizer sources at rates of less than 10 pounds per acre is difficult to achieve. It can be achieved, however, when the zinc is premixed with a starter N application using 50-100 pounds of ammonium sulfate.

post-harvest rolling of the stubble, have shown to increase ratoon yields significantly. Additional benefits of post-harvest stubble management of the rice straw include even maturity of the grain, reduced incidence of Cercospora and increased grain quality. However, it should be noted that post-harvest stubble management practices do delay maturity by approximately two weeks and should be avoided if the main crop is harvested after Sept. 1.

Rice Insects

The major insect pests of rice in Louisiana are the rice water weevil, the rice stink bug and a complex of stem-boring moths. Armyworms, billbugs, chinch bugs, colaspis, rice leafminer, rice seed midges, the South American rice miner, and sugarcane beetles can cause crop injury in some years. Under high infestation levels, yield can be reduced by all of these pests. Identification and management information for these pests is presented. More detailed descriptions can be found in the LSU AgCenter Louisiana Rice Production Handbook, publication 2321. Information about these pests is also available on the Rice Scout Smartphone app. If you suspect insect injury in your field(s), contact your parish agent for verification and help with damage assessment and insect management.

Rice Water Weevil

The rice water weevil is the most economically important pest of rice in the U.S. Adults are grayish-brown (1/8-inch long) beetles that fly into rice fields to feed on the leaves of rice plants. Leaf feeding by adults causes narrow scars that run lengthwise on the leaf, but this feeding rarely causes yield reduction. Females lay eggs in the leaf sheath at or below the water line, beginning soon after permanent flood is applied. The larvae are white, legless grubs (less than 1/4 inch in size) with brown heads that feed on the roots, reducing plant growth and rice yields.

Adult rice water weevil

Although application of insecticides remains the primary means of controlling or preventing rice water weevil infestations, other practices can significantly reduce the impact of rice water weevils on rice yields.

One key to developing an effective management program for this insect is to remember that damaging infestations only occur once rice is flooded, and that water seeded and early flooded rice are the most susceptible to yield losses. Delaying application of permanent flood to rice can reduce yield losses from weevils but may not be compatible with other agronomic practices, particularly weed management. Another key to managing this insect is early planting. Weevil infestations tend to be less severe in rice planted in mid- to late March than in later-planted rice because emergence of adults from overwintering sites does not begin until early April and is not complete until May. Additionally, yield losses from weevil feeding tend to be lower in early-planted rice than in late-planted rice because more mature plants are less susceptible to impacts of root feeding. Seeding conventional rice at low rates (e.g., 20-50 pounds per acre in drill-seeded rice) can make rice more susceptible to infestation and yield losses from the rice water weevil.

All currently grown rice varieties and hybrids are susceptible to the rice water weevil. Recent research, however, indicates some differences in susceptibility. For example, medium-grain varieties appear to be more susceptible to infestation than long grain.

Management of the rice water weevil with seed treatments: Dermacor X-100, Cruiser, and NipsIt are insecticidal seed treatments that are applied by the seed dealer. Rates, costs and the spectrum of pests controlled vary between treatments (Table 7). NipsIt and Cruiser are also available in combination with fungicide treatments. Seed treated with Dermacor X-100 may be used in either dry- or water-seeding practices. Cruiser and NipsIt can only be used in rice that is drilled into a dry seedbed. Generally, populations of rice water weevil in southwest Louisiana are high enough that seed treatments are warranted in most fields. Under typical conditions, the cost of seed treatments is off-set by the protection of yields from losses to weevil damage.

Weevil management is greatest with Dermacor X-100 which typically exceeds 80 percent control, but satisfactory control is also achieved with Cruiser and NipsIt. The spectrum of pest controlled should be a major factor in selecting seed treatments. In southwest Louisiana, where economically damaging infestations of stem borers are prevalent, Dermacor X-100 is recommended. If preventative seed treatments are used, there is little need to scout for rice water weevil adults.

Seeding at low rates (30 to 50 lb seed per acre) may compromise the effectiveness of seed treatments, particularly Cruiser and NipsIt. If Cruiser or NipsIt are used in fields seeded at low rates, additional management practices should be considered, such as early planting or foliar insecticide applications, if heavy infestations of rice water weevil adults are found.

Management of the rice water weevil with foliar applications of pyrethroid or neonicotinoid insecticides: Multiple pyrethroid insecticides are labeled for use in rice under variable trade names and formulations. Active ingredients available include: lambda-cyhalothrin, zeta-cypermethrin, gamma-cyhalothrin, and alpha-cypermethrin. Trebon (etofenprox) is a granular insecticide; the chemistry of which is similar to the pyrethroids. Belay (clothianidin) is an insecticide that belongs to the neonicotinoid class of insecticides. The pyrethroids are extremely toxic to crawfish, and drift

Table 7. Summary of Insecticidal Seed Treatment Characteristics

Seed treatment	Active ingredient	Rate	Estimated cost ($/A)*	Pests controlled							
				Rice water weevil	Stem borers	Fall armyworm	Colaspis	Chinch bugs	Thrips	Aphids	Fungal pathogens
Dermacor X100	Chlorantraniliprole	1.5 fl. oz./acre	$18	√	√	√	×	×	×	×	×
Cruiser 5FS	Thiamethoxam	30 lbs. seed 100 lbs. seed	$5.40 $18	√	×	×	√	√	√	√	×
CruiserMaxx	Thiamethoxam + 3 fungicides	30 lbs. seed 100 lbs. seed	$9 $30	√	×	×	√	√	√	√	√
NipsIt Inside	Clothianidin	30 lbs. seed 100 lbs. seed	$6 $19	√	×	×	√	√	√	√	×
NipsIt Suite	Clothianidin + 2 fungicides	Variable		√	×	×	√	√	√	√	√

*Cost estimates subject to variation among pesticide distributors.

into crawfish ponds must be avoided. Belay is also toxic to crawfish; however, the acute toxicity of Belay is much lower than that of pyrethroids.

All of these foliar insecticides only kill adult weevils, not eggs or larvae, so timing of applications is crucial for management. Egg laying (oviposition) must be prevented. Once eggs are laid in rice stems or larvae are in the roots, these insecticides will not be effective. Scouting for adult weevils is important and may begin at any time after emergence of rice, but efficacy of these insecticides is maximized when adults are controlled just before oviposition. Oviposition is possible anytime water is present in the field, but it is most likely to occur after the establishment of permanent flood. Check at least five to 10 locations per field for the presence of adults or their feeding scars. Treat when adult weevils or their feeding scars are observed and conditions for egg laying are favorable as described above. Applications made up to 24 hours before initiation of permanent flood can be effective when adults are present; pre-flood applications appear to be more effective than post-flood applications for Belay. Trebon should not be applied pre-flood because of the movement of the granules when flood water is applied. More than one application of pyrethroids may be required, especially in late planted rice. Once fields have been treated, begin sampling again after seven days.

Rice Stink Bug

Rice stink bugs are the greatest threat to headed rice and can reduce yields as well as grain quality. These tan and golden bugs (about 1/2-inch long) feed on rice when it begins to head. Females lay light green, cylinder-shaped eggs in two-row clusters on leaves, stems and panicles. Eggs turn red-black just before hatching. Nymphs (immatures) are black with red marks on the abdomen. Older nymphs resemble adults.

Adult stink bug

Rice stink bug nymph

Nymphs and adults feed on the rice florets and suck the sap from developing rice grains. Feeding on florets and on grains in the early milk stage can reduce rough rice yields; however, most economic losses arise from reduction in grain quality that results from stink bugs feeding on developing kernels. Pathogens enter the grain at the feeding spot, and the infection and stink bug feeding together cause discolored and pecky rice kernels. Discolored or pecky rice kernels have lower grade and poor milling quality.

To scout for rice stink bugs in the field, use a 15-inch diameter sweep net and take 10 sweeps at 10 different areas within each field. Count the number of mature and immature stink bugs collected after every 10 sweeps. In the first two weeks of heading, treat fields when there are 30 or more bugs per 100 sweeps. Insecticides that can be used include a variety of pyrethroids. The neonicotinoid, Tenchu (dinotefuran), can also be used, but this insecticide cannot be applied when rice is flowering because of potential effects on bees. More mature grain is less susceptible to stink bug damage. From the dough stage until two weeks before harvest, treat fields when there are 100 bugs per 100 sweeps. When approaching two weeks before harvest, you can treat with any of the chemicals listed above with the exception of lamda-cyhalothrin and gamma-cyhalothrin, which have 21-day preharvest intervals.

Rice Stem Borers

The sugarcane borer, rice stalk borer and Mexican rice borer are important pests of rice in some regions in Louisiana. All three species attack rice in southwest Louisiana, but only the sugarcane borer is considered a pest in northeastern Louisiana rice areas. The invasive Mexican rice borer is becoming increasingly damaging in southwestern rice areas.

All borer species overwinter as mature larvae in the stalks of rice and other host plants. These larvae then pupate and adult moths emerge in the spring. Detailed descriptions of the identification, biology, and behavior of these stem borers can be found in the Louisiana Rice Production Handbook, publication 2321. Although larvae of each species resemble each other, distinguishing characteristics are present. Larvae of the sugarcane borer are cream-colored with a series of brown spots on the back, black bristles and a dark-colored head capsule. Mexican rice borer larvae are white to honey-colored with two pairs of dark brown to purple-colored discontinuous stripes running the length of the body. Rice stalk borer larvae have four solid lines down the body and a dark head capsule.

Larvae can attack all stages of rice, but damaging infestations generally occur when rice is in its reproductive stages. Larvae emerge within four to five days of egg-laying.

Early infestations by borers are noticed when the youngest partially unfurled leaf of the rice plant begins to wither and die, resulting in a condition called deadheart. Stem feeding that occurs during panicle development causes partial or complete sterility and results in a whitehead. Severe infestations cause stalk breakage and plant lodging above the water surface.

The insecticidal seed treatment Dermacor X-100 has been shown to provide a decent level of control of stem borers, with reductions in whitehead densities of greater than 70 percent compared to untreated fields. Use of this product is recommended where rice water weevils are a problem, and problems with stem borers are anticipated.

Stem borer larvae

Scouting for borers should start at green ring and must be intensified as plants reach early boot stages. Scouts should look for feeding lesions on the inside surface of the leaf sheath. These lesions are caused by the larva that feeds underneath the leaf sheath during the brief period before it bores into the stem. These feeding lesions are easily observed from the outside. Care must be taken, however, to avoid confusing these lesions with those caused by sheath blight. Peel back the leaf sheath to expose the feeding larva or to detect the presence of powdery frass to ensure it is a stem borer and not sheath blight. Applications of foliar insecticides later in the season must coincide with larval emergence so small larvae are killed before they enter the rice stalks or during the time they feed on the inside surface of the leaf sheath. Once larvae enter the stalks, insecticides are not effective. Several pyrethroids are labeled for stem borer control in rice. No economic thresholds, however, have been developed for these insects in rice.

Early planting allows the rice crop to avoid severe infestations of stem borers, especially where populations of the sugarcane borer increase in host plants, such as corn, sugarcane and grain sorghum, and move to rice plants later in the season. Destruction of rice stubble and weedy grasses after harvest will also help in borer management by eliminating overwintering populations.

Rice Seed Midge

Adult midges resemble small mosquitoes and swarm over rice fields, levees, roadside ditches and other bodies of water. Elongated eggs are laid on the surface of open water in strings. Larvae live on the bottom of flooded rice fields in spaghetti-like tubes. Larvae injure water-seeded rice by feeding on the embryo of germinating seeds or on the developing roots and seeds of very young seedlings. The potential for midge injury increases when fields are flooded far in advance of water-seeding rice.

Water-seeded fields should be scouted for midge injury, checking for hollowed out seed within five to seven

days after seeding. Monitor fields until rice seedlings are several inches tall. Depending on the severity of injury, whole fields may need to be replanted, while in some cases, only a portion of the field may require reseeding.

Control rice seed midge by applying a pyrethroid insecticide if a large number of hollowed out seeds are observed in the first week after planting or stands are being reduced significantly during the first two weeks after planting (less than 15 plants per square foot).

Rice Leafminer

Adult flies are metallic, blue-green, and less than 1/4-inch long. They lay eggs on rice leaves as they lie on the water. The larvae are transparent to cream-colored after hatching but become yellow to light-green within a few days. Larvae injure the plant by tunneling between the layers of the leaf and attacking and killing leaves closest to the water before moving up the plant, killing additional leaves. Under heavy infestations, the entire plant may die. Rice is attacked in the early spring, and infestations usually occur in continuously flooded rice on the upper side of leaves where water is deepest. Scout for rice leafminer larvae by pulling a rice leaf gently between the thumb and forefinger feeling for the presence of a bump in the leaf. If a bump is detected, the larvae or pupae can be found by separating the layers of the leaf. If plant populations are being reduced to less than 15 plants per square foot, chemical control may be necessary. Insecticide efficacy is not well documented, but pyrethroids will likely provide sufficient control.

Leaf pulled back to expose rice leafminer maggot

South American Rice Miner

The South American rice miner (SARM) is a sporadic invasive insect pest of rice in the United States. It is a close relative of the rice leafminer, which is widely distributed across U.S. rice production regions. Small, gray flies (about 1/10-inch long) deposit individual eggs on the upper surface of rice leaves, near the leaf margins.

Larvae are small, white or yellowish, legless maggots about 1/4-inch long. The brown puparium is elongated and tapered at both ends. Economic injury to rice plants tends to occur in young rice from emergence until the tillering stages. In most years, this insect is more of a problem in late-planted rice, although heavy infestations have been observed in rice planted in March and April in southwest Louisiana. Injury from the larvae (maggot) causes large, elongated lesions along the margins of emerging leaves. As the leaf expands, yellow damaged areas are more visible. Affected young leaves usually break off, display a ragged appearance or have a withered tip. The maggot continues to feed on the whorl tissue and enters the stem of developing plants. Affected seedlings are either killed or plant growth is severely retarded. Pupation occurs inside the affected stem near the collar of the leaf. Field damage is distributed in large patches. If the infestation is not too severe and occurs in the tillering stage, rice appears to be able to tolerate some injury without loss in yield.

South American rice miner pupa (top plant) and larva (bottom plant)

No chemicals are currently registered to control SARM. Dermacor X-100 appears to provide some level of protection, but injury to seedlings may still occur. The only recommendation available at this time is to avoid late planting. If you suspect a SARM infestation, contact your parish agent for damage assessment and to obtain the latest developments on this insect pest.

Colaspis

There are two species of colaspis in Louisiana rice: *Colaspis brunnae* and *Colaspis louisianae*. This pest can be found damaging fields of dry-seeded rice in a soybean-rice or a pasture-rice crop rotation. It is common to find a clumped distribution of larvae in the soil and patches of stand loss. The damage is often concentrated in high spots in the field. Colaspis will complete a single generation in soybeans and lespedeza. Colaspis larvae overwinter in the soil. When rice, or another crop, is planted into a field that is infested with colaspis larvae, the larvae will begin to feed on the roots. The larvae pupate in the soil and emerge as adult beetles. Oval-shaped, golden-colored adults have tan stripes running the length of the body and are about 1/4 inch in length with long antennae.

To scout for this pest, locate plants that are stunted, withering, dying, and surrounded by declining plants. Dig around the base of the plants, carefully peeling back the soil and looking for white grubs with brown heads that are a little larger than rice water weevil larvae. Cruiser and NipsIt seed treatments have shown some ability to control Colaspis in drilled rice. When rice is planted following soybeans or pasture, treating seed with Cruiser or NipsIt may be justified. No foliar insecticides are labeled to control Colaspis in Louisiana rice. Applying permanent flood as soon as possible will help control Colaspis but

may exacerbate weevil damage. Early flooding is only recommended if weevils are controlled. Colaspis larvae are not aquatic, and application of water will decrease feeding injury and eventually cause death of the larvae.

Fall Armyworm

Larvae feed on the leaves of young rice plants, destroying large amounts of tissue. When large numbers of armyworms are present, seedlings can be pruned to the ground, resulting in severe stand loss. Fall armyworm infestations generally occur along field borders, levees and in high areas of fields where larvae escape drowning. The most injurious infestations occur in fields of seedling rice that are too young to flood. To scout for fall armyworms in young rice, begin scouting after germination of seedlings, and continue to scout fields weekly for the presence of larvae on plants. Sample plants every 10 feet along a line across the field and repeat this process in a second and third area of the field. Treat with a pyrethroid when there is an average of one armyworm per two plants. Since adults lay eggs on grasses in and around rice fields, larval infestations can be reduced by effective management of weedy grasses. Cultural control consists of flooding infested fields for a few hours to kill fall armyworm larvae. This requires that levees be in place and that rice plants be large enough to withstand a flood. Parasitic wasps and pathogenic microorganisms frequently reduce armyworm numbers below economical levels. Formulations of *Bacillus thruingiensis* are available, but must be used when caterpillars are small.

Fall armyworm larvae

Rice Diseases

Since the list of labeled fungicides may change, check with your cooperative extension agent for current recommendations. For more information, consult publication 1802, "Louisiana Plant Disease Guide" at www.lsuagcenter.com/laplantdiseasemanagementguide or see our webpage, www.lsuagcenter.com/ricediseases.

Fungicide timing is critical for disease control (Table 9). Sheath blight should be treated between early boot (2- to 4-inch panicle) and heading growth stage but not beyond 50-70 percent of heads emerging (any part of the head exposed). Blast must be treated at the 50-70 percent heading growth stage. Kernel smut must be treated at mid-boot growth stage (4- to 6-inch panicle in the boot) for best activity. Yield and grain quality increase with disease control but quickly decrease if fungicides are applied after 70 percent heading. Remember, growth stages are very hard to detect and anticipate, so it is important to scout for the rice growth stage at the same time you scout for disease. Rice disease control using a single fungicide application is becoming more difficult due to fungal resistance to fungicides, multiple diseases requiring different timings for effective control, and higher multiple applications being warranted. Rice producers are encouraged to use full labeled rates, rotate modes of actions and use multiple fungicide applications when justified to effectively and economically manage rice diseases.

Blast: Blast is caused by the fungus, *Pyricularia grisea*. The leaf blast phase occurs between the seedling and late tillering stages. Leaf spots start as small white, gray or blue tinged and then enlarge quickly under moist conditions to either oval diamond-shaped spots or linear lesions with pointed ends with gray or white centers and narrow brown borders.

Leaves and whole plants are often killed under severe conditions. Rotten neck symptoms appear at the base of the panicle, starting at the node soon after heading. The tissue turns brown to chocolate-brown and shrivels, causing the stem to snap and lodge. Panicle branches and stems of florets also have gray-brown lesions.

Scouting for blast should begin early in the season during the vegetative phase and continue through to heading. Leaf blast will usually appear in high areas of the field where the flood has been lost or is shallow. As part of management, the flood must be maintained. Areas of heavy nitrogen fertilization and edges of the fields are also potential sites. If leaf blast is in the field or has been reported in the same general area, and if the variety is susceptible, fungicidal applications are advisable to reduce rotten neck blast. The absence of leaf blast does not mean rotten neck blast will not occur. Fungicide timing is critical (Table 9). If a single fungicide application is used to

Leaf blast

Node blast

Collar blast

Rotten-neck blast

control blast, it should be applied when 50-70 percent of the heads have begun to emerge. Application before or after this growth stage will not provide good control of this disease! This growth stage is very difficult to detect, so it is important to scout for the crop growth stage at the same time as scouting for disease. Allow time to obtain a fungicide, schedule the application, and allow for poor weather conditions. Under heavy blast pressure, two applications, one at boot and one at 50-70 percent heading, may be needed to effectively suppress blast.

Sheath Blight: Sheath blight is one of the most important diseases in rice in Louisiana. It is characterized by large oval spots on the leaf sheaths and irregular spots on leaf blades. Infections usually begin during the late tillering/joint-elongation stages of growth. The fungus, *Thanatephorus cucumeris* (*Rhizoctonia solani*), survives between crops as structures called sclerotia or as hyphae in plant debris. Sclerotia, or plant debris, floating on the surface of irrigation water serve as sources of inoculum that attack and infect lower sheaths of rice plants at the waterline. Fungal mycelium grows up the leaf sheath, forms infection structures, infects and causes new lesions. The infection can spread to leaf blades. After the panicle emerges from the boot, the disease progresses rapidly to the flag leaf on susceptible varieties. With very susceptible varieties, the fungus will spread into the culm from early sheath infections. Infected culms are weakened and the tillers may lodge or collapse.

As lesions coalesce on the sheath, the blades turn yellow-orange and eventually die. Damage is usually most common where wind-blown, floating debris accumulates in the corners of cuts when seedbeds are prepared in the water. Disease severity can be reduced by integrating several management practices. Dense stands and excessive use of fertilizer both tend to increase the damage caused by this disease. Rotation with soybeans or continuous rice increases the amount of inoculum in field soils. Fungicides are available for reducing sheath blight.

Avoid late application beyond 50-70 percent heading (Table 9). However, in some areas of south Louisiana, the fungus has developed resistance to the strobilurin fungicides and other modes of action must be used to control sheath blight.

Sheath blight

Bacterial Panicle Blight: Bacterial panicle blight, caused by the bacteria *Burkholderia glumae* and *gladioli*, is one of the most important rice diseases in the South. The disease is associated with hot weather.

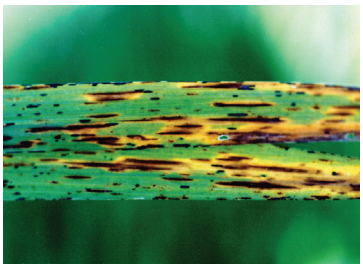
Bacterial panicle blight

Losses include reduced yields and poor milling. The bacteria are seed-borne and survive in the soil. The bacteria appear to survive as an epiphytic population on the leaves and leaf sheaths and follow the canopy up.

This population infects the grain at flowering and causes grain abortion and rotting during grain filling. The disease is first detected as a light- to medium-brown discoloration of the lower third to half of hulls shortly after emergence.

The stem below the infected grain remains green. Pollination occurs, but the grain aborts sometime after grain filling begins. The disease tends to develop in circular patterns with the most severely affected panicles in the center remaining upright because of grains not filling. No chemical control measures are recommended. Some varieties have more resistance than others. Rice planted later in the season and fertilized with high nitrogen rates tends to have more disease.

Cercospora: The fungus *Cercospora janseana* causes narrow brown leaf spot and other symptoms. Leaf lesions are linear and reddish-brown. On susceptible cultivars, the lesions are wider, more numerous, and lighter brown with gray necrotic centers. Spots usually appear near heading. Both young and old leaves are susceptible. Sheaths and glumes can be infected causing significant discoloration and necrosis. On sheaths, the disease is referred to as "sheath net blotch" because of the brown cell walls and the tan-to-yellow intracellular areas that form a netlike pattern. Branches of the seed heads can become infected, causing premature ripening and unfilled grains. Symptoms can be confused with rotten neck and panicle blast lesions. Narrow brown disease lesion symptoms usually are darker brown and develop in the internodal area of the neck. Grain infection appears as a diffused brown discoloration. The disease is often severe on the second crop. Resistance to narrow brown leaf spot is available, but new races of the pathogen develop rapidly. Low and high nitrogen rates appear to favor disease development. Fungicides containing propiconazole are most effective. The best timing against all stages of this



Cercospora

disease is between panicle differentiation and boot growth stages (Table 9). The later the rice is planted, the earlier the fungicide must be applied.

Kernel Smut: Kernel smut symptoms appear just before maturity. A black mass of smut spores replaces all or some of the endosperm of the seed. Often, the spores ooze out of the grain leaving a black mass along the seam of the hulls. The fungus, *Tilletia barclayana*, overwinters as spores in soil of affected fields and in seed. Significant quality and yield reductions are possible. Disease development is favored by high nitrogen rates. Research results from other states indicate that boot applications of propiconazole containing fungicides reduce damage significantly.

Kernel smut

False Smut: The false smut fungus, *Ustilaginoidea virens*, infects rice at flowering. The disease is characterized by large orange to olive-green spore balls that replace one or more grains on a head. In the middle of the spore masses are sclerotia that act as the survival structure. These sclerotia can be spread with the seed and infect the next crop. Removal of the sclerotia in seed cleaning reduces spread. Seed treatment with a fungicide also reduces inoculum potential. False smut spores cause discoloration of milled rice, but no significant yield loss is associated with the disease. Presence of the smut sclerotia in grain for export has caused problems. Some foliar fungicides applied at boot can reduce disease incidence.

False smut

Sheath Rot: Sheath rot is caused by the fungus *Sarocladium oryzae*. Symptoms are most severe on the uppermost leaf sheaths that enclose the young panicle during the boot stage. Lesions are oblong or irregular oval spots with gray or light brown centers and a dark reddish-brown diffuse margin. Early or severe infections may affect the panicle so that it only partially emerges. The unemerged portion of the panicle rots with florets turning red-brown to dark brown. A powdery white growth consisting of spores and hyphae of the pathogen is usually observed on the inside of affected leaves. Insect or mite damage to the boot or leaf sheaths increases the damage from this disease. Emerged panicles may be damaged with

Sheath rot

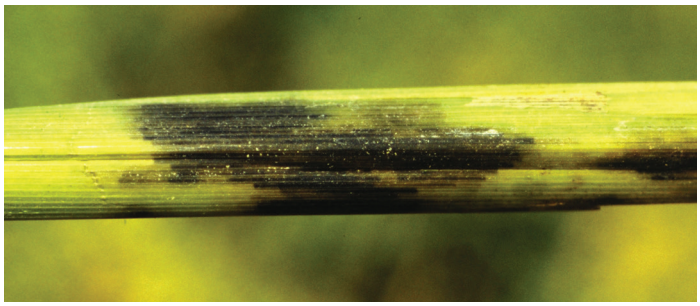
florets discolored reddish-brown to dark brown and grain not filling. Some varietal resistance is available. The disease is usually minor, affecting scattered tillers in a field and plants along the levee. Occasionally, large areas of a field may have significant damage. No control measures are currently recommended.

Stem Rot: The fungus *Sclerotium oryzae* causes stem rot. Losses are not usually detected until late in the season when control practices are ineffective. Damage appears as severe lodging, which makes harvesting difficult. Seed sterility also has been reported. No high level of resistance to stem rot is available. High nitrogen and low potassium levels favor the disease. Stem rot is more serious in fields that have been in continuous rice for several years. The pathogen overwinters as sclerotia in the top 2-4 inches of soil and in plant debris. During early floods, sclerotia float to the surface, come in contact with the plant, germinate, and infect the tissues near the water surface.

The first symptom is a black angular lesion on leaf sheaths near the waterline at tillering or later growth stages. As lesions develop, the outer sheath may die, and the fungus penetrates into the inner sheaths and then finally the culm. These become discolored and have black or dark brown lesions.

At maturity, the softened culm breaks, plants lodge, and numerous small, round, black sclerotia develop in the dead tissues. The fungus can continue to develop in the stubble after harvest, and numerous sclerotia are produced.

Control measures include burning or cultivating stubble after harvest to destroy sclerotia, using crop rotation when possible, applying potassium fertilizer and avoiding excessive nitrogen rates. Fungicidal sprays used in a general disease control program against other fungal diseases may reduce damage due to stem rot.



Stem rot

Table 8. Reaction of Rice Varieties to Major Diseases and Disorders

"VS" indicates a very susceptible reaction, "S" indicates a susceptible reaction, "MS" indicates a moderately susceptible reaction, "MR" indicates a moderately resistant reaction, "R" indicates a resistant reaction and "—" indicates that the reaction is not known. Varieties labeled "S" or "VS" for a given disease may be severely damaged under conditions favoring disease development.

Variety	Disease					
	Sheath Blight	Cercospora	Bacterial Panicle Blight	Straight Head	Blast	Blast Resistance Spectrum
Caffey	MS	R	MS	MS	R	Limited
Catahoula	S	R	MS	S	MR	Broad
Cheniere	S	S	MS	MR	MS	Limited
CL111	VS	S	VS	S	MS	Intermediate
CL151	S	S	VS	VS	VS	Limited
CL153	S	MS	MS	MS	MS	Broad
CL163	S	R	MS	MS	VS	Limited
CL172	S	S	MS	MS	MS	Broad
CL272	S	S	MS	MS	MS	Intermediate
CLXL729	MS	R	R	MS	R	n/a*
CLXL745	MR	R	MR	MR	R	n/a*
Cocodrie	VS	S	S	S	MS	Limited
Della-2	S	MS	MS	MR	R	Unknown
Diamond	S	MR	MS	MS	S	Minimal
Jazzman	MS	S	S	MS	R	Unknown
Jazzman 2	S	S	VS	VS	MS	Minimal
Jupiter	MS	R	MR	MR	S	Limited
LaKast	MS	MS	MS	MS	S	Minimal
Mermentau	S	MS	MS	S	S	Limited
PVL01	MS	MR	S	—	S	Limited
Roy J	MR	R	MS	S	S	Minimal
Titan	S	MR	MS	MR	MS	Intermediate
XL753	MR	R	MR	MR	R	n/a*
XL760	MR	R	MR	—	R	n/a*

Blast Resistance Spectrum Characterization
— Broad: Contains blast resistance genes known to give resistance across most common blast races
— Intermediate: Contains blast resistance genes known to give resistance to some common blast races
— Limited: Contains blast resistance gene that gives resistance to few of the common blast races
— Unknown: Shows resistant phenotype, but does not contain any of the common blast genes
— n/a*: Marker data not available for RiceTec products

Grain and Head Disorders: Many fungi and bacteria infect developing grain and cause spots and discoloration on the hulls or kernels. Damage by the rice stink bug, *Oebalus pugnax F.*, also causes discoloration of the kernel. Kernels discolored by fungal infections or insect damage are commonly called pecky rice. This is a complex disorder in rice that involves many fungi, the white-tip nematode and insect damage. High winds at the early heading stage may cause similar symptoms. Proper insect control and disease management will reduce this problem.

Straighthead: This physiological disorder is associated with sandy soils, fields with arsenic residues or fields having anaerobic decomposition of large amounts of organic matter incorporated into the soil before flooding. Panicles are upright at maturity because the grain does not fill or panicles do not emerge from the flag leaf sheath. Hulls may be distorted and discolored, with portions missing or reduced in size. Distorted florets

with a hook on the end are called "parrot beak" and are typical of straighthead. Plants are darker green or blue-green and often produce new shoots and adventitious roots from the lower nodes. These symptoms can be mimicked by herbicide damage. Management is by using resistant varieties and draining the field approximately 10 days before internode elongation (green ring) as well as allowing the soil to dry until it cracks. This growth stage can be determined by slicing the crown of the plant lengthwise and counting the nodes. When three nodes are distinctly visible, internode elongation is approximately 10 days away. It is important that the flood be established again by internode elongation.

Rice Disease Management

Yield potential of any rice variety can be severely reduced under high disease levels. An integrated disease management program including the following practices should be implemented:

- Plant resistant varieties.
- Avoid late planting.
- Maintain proper fertility levels.
- Maintain adequate flood (avoid loss of flood).
- Use fungicides at the correct growth stage if necessary.

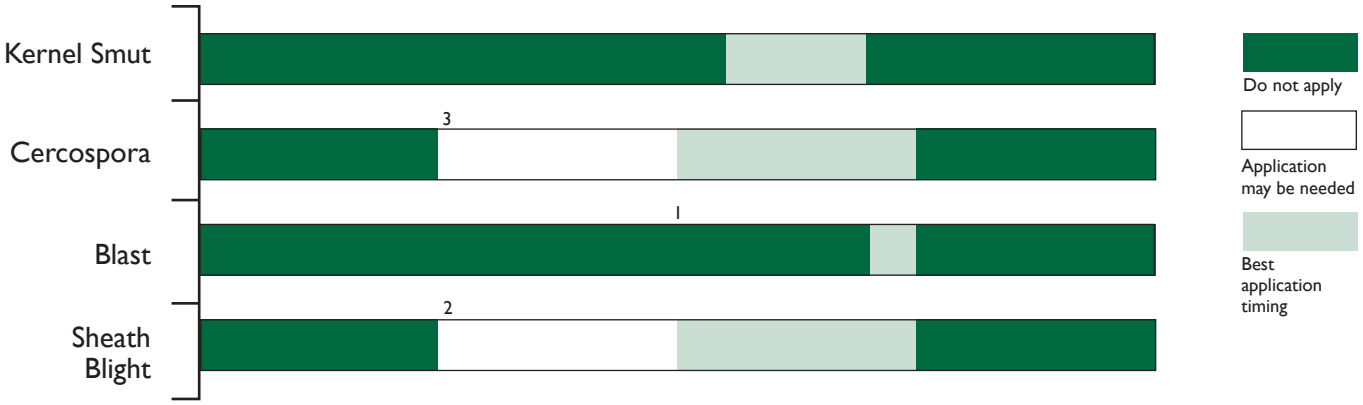
Fungicide timing is critical for disease control (Table 9). Sheath blight should be treated between early boot and heading but not beyond 50-70 percent heading. Blast must be treated at the 50-70 percent heading growth stage. Yield and grain quality increases as a result of disease control and quickly decreases if fungicide is applied after 70 percent heading. Remember, this growth stage is very difficult to detect, so it is important to scout for the rice growth stage at the same time as you scout for disease. Also, you will need to allow time to obtain a fungicide, schedule the application, and allow for poor weather conditions to apply the fungicide at the correct time. The use of foliar fungicides is justified in many cases. Some factors to consider in making this decision are whether or not:

a. The field has a history of disease.
b. The variety is susceptible.
c. The yield potential is good.
d. The rice is being grown for seed.
e. The rice was planted late (late-planted rice is more likely to encounter foliar disease problems than early-planted rice).
f. A second crop is planned. (Disease not suppressed in the first crop may cause significant damage in the second crop).

Scouting for diseases should begin early in the season. For sheath blight, very susceptible to susceptible cultivars will experience an economic loss if 5-10 percent of the tillers are infected during vegetative stages. For moderately susceptible cultivars, the level is 15 percent. At these levels, consider using a fungicide. For blast control, apply a foliar fungicide at early heading (50-70 percent heads emerging) when leaf blast symptoms are present. Leaf blast does not always precede rotten neck blast, and preventive applications of a fungicide may be warranted if a blast-susceptible variety is grown. The incidence and severity of blast increases when plants are stressed (loss of flood, fertility imbalance, etc.). Draining for straighthead and/or water weevil control may increase the incidence and severity of blast. Also, blast is normally worse on later planted rice. Cercospora disease control and yield increases appear best when fungicides are applied between panicle differentiation and boot growth stages. Propiconazole containing fungicides have the best activity against Cercospora. They may not be applied to the second or ratoon crop. For reaction of rice varieties to major diseases, see Table 8.

Additional information on rice disease control can be obtained at www.lsuagcenter.com/ricediseases.

Table 9. Fungicide Application Timing



[1]A boot application followed by the heading spray may be necessary if disease pressure is high and the variety is susceptible.
[2]An early application may be necessary if sheath blight appears early and is severe followed by the boot to heading application.
[3] Late-planted rice requires earlier application of fungicides for Cercospora control.

Weed Management in Rice

Management of weeds is critical for optimum rice production in both dry- and water-seeded systems. Although herbicide options and management strategies differ under these systems, managing both herbicides and water in a timely manner is critical.

In dry-seeded production, four to six weeks may elapse between planting and permanent flood establishment, and controlling weeds during this period is critical for maximizing yields. During this time, weeds, such as barnyardgrass, broadleaf signalgrass, morningglory and hemp sesbania, can become established. Although these weeds can survive a permanent flood, establishment and maintenance of a sufficient flood over these weeds can enhance control.

The effectiveness of selected rice herbicides on common rice weeds is presented in Table 10. The effectiveness of selected burndown herbicides on common winter vegetation is presented in Table 11. The activity of selective herbicide programs for perennial grass control is presented in Table 12. Information about rice herbicide use in crawfish production can be found in Table 13.

Herbicide Options for Weed Control

2,4-D – (Burn-down; Post-emergence). Herbicide controls most broadleaf weeds in rice. Apply herbicide after tillering but before panicle initiation. A shallow flood should be present at the time of application. Refer to specific 2,4-D product labels for use on ratoon crop rice.

Aim – (Post-emergence). Contact broadleaf herbicide that controls morningglory, hemp sesbania, jointvetch and Texasweed. Aim is more effective when tank-mixed with Grandstand or propanil. Aim has no soil activity.

Command – (Pre-emergence, Post-emergence and Pegging). Command provides economical residual control of annual barnyardgrass, broadleaf signalgrass, sprangletop and fall panicum when applied before weed emergence. Command may be applied as a surface broadcast application before rice emergence or as an early post-emergence treatment to rice at the 1- to 2-leaf growth stage. Early post-emergence applications with Command usually include a herbicide, such as propanil, to control emerged grass and broadleaf weeds. Command rates are soil texture dependent. Apply by ground equipment to minimize drift. Refer to label for aerial application restrictions in Louisiana. In water-seed rice, Command may be applied by air when impregnated on a granular fertilizer; rice should be in the 1- to 2-leaf stage. Use a minimum of 150 pounds of dry fertilizer per acre. Field must be drained prior to application. Applications are restricted to selected parishes. Consult label for specific parishes in Louisiana. Delay reflooding for at least 48 hours.

Basagran – (Post-emergence). Controls annual and yellow nutsedge, redstem, ducksalad and dayflower. Basagran is a contact herbicide that must be applied to small, actively growing weeds. Lowering the flood may be required to expose weeds. Basagran may be applied to ratoon rice.

Beyond – (Post-emergence). Apply only to Clearfield rice varieties and Clearfield hybrids in a dry-, drill- or water-seeded production. Beyond selectively controls red rice, annual grasses and broadleaf weeds. The application must be made after an application of Newpath or Clearpath. Beyond can be applied from 4-leaf to panicle initiation (green ring) plus 14 days for Clearfield varieties and 4-leaf to panicle initiation (green ring) for Clearfield hybrids. Beyond can be applied from 4 to 6 ounces per application with no more than two applications per season and should not exceed a total of 10 ounces per acre.

Bolero – (Pre-emergence and Post-emergence). Controls barnyardgrass, sprangletop and annual sedges and suppresses some aquatic weeds. The herbicide should be applied pre-emergence to dry-seeded rice after soil has been sealed by irrigation or rainfall. Apply post-emergence to dry-seeded rice to wet soil after rice has emerged or to dry soil when rice is in the 2- to 3-leaf stage. For water-seeded rice, apply after rice is in the 2-leaf stage. Treatment usually is tank-mixed with a post-emergence herbicide and surface irrigated or flooded within three days. Do not submerge rice when applying permanent flood. Residual control usually will not exceed three weeks.

Broadhead – (Post-emergence). A prepackaged mixture of quinclorac plus carfentrazone (Aim) for control of broadleaf weeds and grasses. Quinclorac provides both residual and post-emergence activity, and carfentrazone provides only post-emergence activity. The product is labeled as preplant, pre-emergence and post-emergence to rice, but it has a better fit as a post-emergence herbicide. Rice should have at least two leaves before Broadhead is applied post-emergence.

Clearpath – (Pre-emergence and Post-emergence). Apply only to Clearfield rice varieties and Clearfield hybrids in dry- or water-seeded production. Clearpath is a package mixture of Newpath and Facet. Clearpath controls red rice, annual sedges, barnyardgrass, broadleaf signalgrass, hemp sesbania, jointvetch and morningglory. This herbicide can be applied seven days prior to rice planting pre-emergence and post-emergence up to 5-leaf rice in dry-seeded rice and 2- to 5-leaf rice in water-seeded rice. Apply at a rate of half a pound per acre, which is the equivalent of 4 ounces per acre of Newpath and 0.4 of a pound per acre of Facet.

Clincher – (Post-emergence). This contact grass herbicide controls barnyardgrass, broadleaf signalgrass, fall panicum, knotgrass and sprangletop. Clincher has no activity on broadleaf weeds. Apply to small actively growing grasses in the 2- to 4-leaf stages. Clincher has activity as a post-flood treatment on 4-leaf to 2-tiller grasses. Clincher works best under saturated soil conditions. Refer to label for approved tank mixes.

Facet – (Pre-emergence and Post-emergence). Provides pre-emergence and post-emergence control of barnyardgrass, hemp sesbania, broadleaf signalgrass and morningglory. The herbicide does not control sprangletop or nutsedge. Pre-emergence applications are restricted to drill-seeded rice only. Rainfall or surface irrigation

is necessary for herbicide activation. Post-emergence applications should be applied after rice is in the 2-leaf stage. A half of a pound per acre rate of Facet DF is equivalent to 32 ounces per acre of the Facet L. Follow the label concerning the addition of crop oil or surfactants. Tomatoes and cotton are sensitive to Facet drift.

Facet + Pendimethalin – (Delayed pre-emergence and post-emergence). The combination controls annual grasses including sprangletop and several broadleaf weeds in drill-seeded rice. Rice seed must have imbibed germination water prior to herbicide application or five to nine days after planting. Do not apply to water-seeded rice as a delayed pre-emergence application.

Gambit – (Post-emergence). Gambit is a pre-package mixture of halosulfuron plus prosulfuron. Gambit should be applied at a rate of 1 to 2 oz/A under dry or flooded conditions. Do not apply more than 2 oz/A per year. Refer to label for approved adjuvants. Gambit controls broadleaf weeds and sedges. Apply to actively growing weeds in the 1- to 3-leaf stage and 3- to 6-leaf stage for sedges. If applied under flooded conditions, weeds should be exposed above the flood 70 to 80 percent. Do not flush or flood within 24 hours after application. Hold flood water for 14 days after application and do not apply within 48 days of harvest.

Grandstand – (Post-emergence). Controls alligatorweed, hemp sesbania, Texasweed, jointvetch and other broadleaf weeds. It does not control ducksalad. Do not overlap swaths or dress ends during application. Grandstand may be applied to ratoon rice. Grandstand works better in a herbicide mixture with propanil or another post-emergence herbicide.

Grasp – (Pre-emergence and Post-emergence). Controls barnyardgrass, annual sedges and broadleaf weeds. The residual activity is limited to approximately 10 days. Temporary crop injury, in the form of stunting and root mass reduction, may occur. This injury is transient; however, the plant normally recovers within two to three weeks. Refer to label for approved surfactants and tank mixes.

Grasp Xtra – (Post-emergence). This is a prepackaged mixture of penoxulam plus triclopyr. The two products together improve control of difficult-to-control weeds compared to when applied alone. In drill-seeded production, apply to rice in the 2- to 3-leaf to half-inch internode growth stages. In water-seeded production, apply to rice in the 3- to 4-leaf to half-inch internode growth stages. Do not apply more than 22 ounces per acre per year.

League – (Pre-emergence and Post-emergence). Controls grasses, sedges, hemp sesbania, jointvetch and Texasweed. League can be applied from 3 to 6 ounces per acre. League should be applied at 5 to 6 ounces per acre when applied pre-emergence. Post-emergence applications should be applied at 3 to 4 ounces per acre. The 4 ounces per acre rate can provide some residual activity. Significant injury can occur on long-, medium- and short-grain rice when applied pre-emergence. Refer to the label for tank mixes and recommended adjuvants.

Londax – (Post-emergence). Controls hemp sesbania, ducksalad, pickerelweed and other aquatic broadleaf weeds and sedges. The herbicide is most effective when applied to submerged weeds one to seven days after the permanent flood is established. When applied before permanent flood, tank-mix with propanil to broaden weed control spectrum. Londax may be used for aquatic broadleaf weed control in areas where 2,4-D is prohibited.

Loyant – (Post-emergence). Loyant can be applied to both drill- and water-seeded rice in the 2-leaf stage at a rate of 1 pt/A. A methylated seed oil (MSO) at 0.5 pt/A is required. Wait at least 14 days between Loyant applications, and do not apply more than 2 pt/A per year. Loyant controls most broadleaf and sedge weeds found in rice, including many aquatic broadleaf weeds. Loyant has no activity on Texasweed. Loyant has activity on small barnyardgrass, broadleaf signalgrass, junglerice and Amazon sprangletop no larger than 3- to 5-leaf. Apply to small, actively growing weeds. If the flood is not present at application, establish permanent flood within 3 days. If the permanent flood is present at application, make sure weeds are exposed 70 percent above flood level and wait three hours before adding additional water. Loyant has no residual activity on weeds that have yet to emerge. Avoid the use of Loyant on freshly cut or leveled ground, except water-leveled fields. Loyant has auxin activity similar to 2,4-D or Grandstand; therefore, caution should be taken to avoid drift to neighboring soybean and other broadleaf crops.

Newpath – (Pre-emergence and Post-emergence). Apply only to Clearfield rice varieties and Clearfield hybrids. Newpath controls red rice, sedges and annual grasses. The first application to Clearfield rice should be Newpath or Clearpath for red rice control. The herbicide is weak on hemp sesbania and jointvetch. A total post-emergence program is more effective. Adequate soil moisture is required for optimum herbicide residual activity. Newpath must be applied prior to flooding when rice is in the 3- to 5-leaf growth stages. Permanent flood should be established as soon as possible after second application.

Obey – (Pre-emergence and Post-emergence). Obey is a prepackage mixture of Command plus quinclorac. The mixture provides both broadleaf and grass control. Obey controls barnyardgrass, broadleaf signalgrass, sprangletop, jointvetch and hemp sesbania. Apply post-emergence to 2- to 5-leaf rice. Follow the label concerning the addition of crop oil concentrate. Refer to rates for specific soil types. Obey can be applied from 26 to 52 ounces per acre.

Permit/Halomax – (Pre-emergence and Post-emergence). Controls annual and perennial sedges, hemp sesbania and jointvetch. Permit/Halomax may be mixed with other post-emergence herbicides to broaden weed control spectrum. Applications may be made pre- or post-flood. Can also be used as a salvage treatment 48 days prior to harvest.

Permit Plus – (Pre-emergence and Post-emergence). A prepackaged mix of halosulfuron and thifensulfuron.

The addition of thifensulfuron to Permit broadens the weed spectrum. The herbicide has excellent activity on all weeds controlled by Permit with increased activity on alligatorweed and ducksalad. The herbicide should be applied at 0.75 of an ounce per acre, and the rate should not be reduced as is often done with Permit. The 0.75 of an ounces per acre rate provides half an ounce per acre of Permit and 0.06 of an ounce per acre of thifensulfuron. A reduction in rate will reduce the benefit of the thifensulfuron in the mix. It also can be used as a salvage treatment 48 days prior to harvest, but crop maturity may be delayed and result in a yield reduction.

Propanil – (Post-emergence). Sold under several trade names. Controls annual grasses, annual sedges and broadleaf weeds in the seedling stage. Best control is achieved when applied 10 to 14 days after seeding. Propanil is often tank-mixed with a residual herbicide, such as Command, Prowl or Bolero.

Provisia – (Post-emergence). Apply only to Provisia rice varieties. Provisia controls red rice, weedy rice, and annual and perennial grass weeds commonly found in rice fields. The first application to Provisia rice should be applied at 13 to 18 oz/A. Adequate soil moisture is required for optimum herbicide activity. A second application of Provisia must be applied prior to panicle initiation. Do not apply more than 31 oz/A per year. Applications of Provisia to Provisia rice can cause injury, and it is usually in the form of yellow foliage often referred to as a "Yellow Flash." Caution should be taken to avoid spray overlap. When Provisia is mixed with other herbicides, antagonism can occur. Refer to Provisia label for approved mixtures.

RebelEX – (Post-emergence). A prepackaged mixture of Clincher plus Grasp. This product should be applied to small actively growing weeds. Grasses should not exceed the 3-leaf stage to avoid antagonism. The field should be wet for maximum Clincher activity, but weed vegetation should be 75 percent exposed for Grasp activity.

Regiment – (Post-emergence). A contact herbicide with activity on barnyardgrass and broadleaf weeds. The herbicide has little to no soil activity. Do not apply to rice prior to the 3-leaf stage. Temporary crop injury, in the form of stunting, may occur. Refer to label for approved Indian toothcup adjuvants and herbicide mixes.

RiceBeaux – (Post-emergence). A prepackaged mixture of Bolero (thiobencarb) plus propanil for control of broadleaf and grass weeds. Provides control of barnyardgrass, sprangletop and broadleaf aquatic weeds.

Ricestar HT – (Post-emergence). Controls barnyardgrass, broadleaf signalgrass and sprangletop. Ricestar has no activity on broadleaf weeds. Apply to small actively growing grasses in the 2- to 3-leaf stages. Ricestar HT works best under saturated soil conditions. The best option for Nealley's sprangle top control is 24 ounces per acre. Refer to label for approved tank mixes.

RiceOne – (Delayed Pre-emergence or Early Post-emergence). RiceOne is a prepackage mixture of clomazone and pendimethalin. Due to the presence of pendimethalin in the mixture, this herbicide cannot be applied as a pre-emergence treatment immediately after planting. The mixture controls annual barnyardgrass, broadleaf signalgrass, sprangletop and fall panicum and small-seeded broadleaf weeds when applied prior to weed emergence. RiceOne may be applied as a surface broadcast application as a delayed pre-emergence application or as an early post-emergence treatment to rice. Early post-emergence applications will need another herbicide to control emerged weeds. RiceOne rates are soil texture dependent; therefore, refer to the RiceOne label for proper rates. Do not apply to water-seeded rice.

Sharpen – (Pre-emergence and Post-emergence). When used as a pre-emergence apply 2 ounces per acre. Do not apply more than 1 ounce per acre when applying post-emergence. Controls many broadleaf weeds and grasses less than 2- to 3-leaf. Suppression is observed on aquatic weeds. Excessive injury can occur under saturated conditions. Refer to label for appropriate surfactants.

Strada – (Post-emergence). Controls annual sedges, hemp sesbania and jointvetch. Strada may be mixed with other post-emergence herbicides to broaden the spectrum. A Strada plus propanil mixture is often recommended.

Strada PRO – (Post-emergence). A prepackaged mixture of Strada plus halosulfuron that broadens the weed control spectrum compared with Strada alone, especially on sedge species. It is formulated as a 54 percent wettable granule. Apply 2.08 to 2.5 ounces per acre prior to rice emergence through permanent flood. Do not apply after the half-inch internode stage.

Strada XT – (Post-emergence). A prepackaged mixture of Strada plus quinclorac. The mixture provides both broadleaf and grass control. It is formulated as a 70 percent wettable granule. Apply 6 to10 ounces per acre prior to or after rain or flushing. Rice seed exposed to spray may be severely injured.

Harvest Aids

Aim – May be applied to rice to desiccate troublesome broadleaf weeds that may be present at harvest at 1.6 to 3.2 ounces per acre. Aim may be used alone or as a tank mixture with other harvest aids. Applications shall be made when the crop is mature and the grain has begun to dry down. May be applied three days prior to harvest; more time is usually needed for satisfactory results. Activity is directly related to temperature and sunlight. Refer to the Aim label for appropriate timings, adjuvants and application volume (GPA).

Sodium Chlorate – Several formulations of sodium chlorate are labeled for use in rice. Refer to each label for appropriate rates, timings, adjuvants and application volume (GPA). Sodium chlorate works best with high water volume (GPA) to aid in coverage. Activity is directly related to temperature and low humidity. Use sodium chlorate to facilitate harvest and reduce moisture in fully mature seed heads and to desiccate some weeds in mature rice. Apply 7-10 days before anticipated harvest. Thorough coverage of the crop is essential to achieve good results.

Table 10. Effectiveness of Selected Pre-plant and Pre-emergence Rice Herbicides on Certain Weeds

	Palmleaf morningglory	Eclipta	Barnyardgrass	Red rice	Sprangletop	Signalgrass	Fall panicum	Sedge	Alligatorweed	Ducksalad	Redstem	Hemp sesbania	Waterhyssop	Jointvetch	Smartweed	Dayflower	Texasweed
Pre-plant Incorporated, Pre-plant, Pre-emergence or Delayed Pre-emergence	----- Weed Control Ratings -----																
Bolero PPS	4	0	8	8	8	7	6	5	4	7	3	0	6	4	5	7	5
Bolero PRE/DPRE	5	8	8	0	8	5	7	5	4	8	8	6	8	5	5	8	6
Clearpath	8	8	9	8	8	9	5	9	6	8	8	7	6	7	6	7	8
Command	0	0	9	0	8	8	9	0	0	7	0	0	0	0	2	7	0
Facet L	8	8	9	0	0	9	5	2	4	3	4	7	6	7	0	5	4
Newpath (PPI/PRE)	8	6	8	8	8	9	5	9	6	8	8	4	6	4	6	7	8
Obey (PRE)	8	8	9	0	8	9	8	2	4	7	4	7	6	7	2	7	4
Pendimethalin + Facet (DPRE)	8	8	9	0	9	8	5	4	6	3	2	8	4	7	0	3	6
RiceOne	0	0	9	0	8	9	9	0	0	7	0	0	0	5	2	7	0
Sharpen	8	7	4	4	4	4	6[6]	6	4	4	6	7	6	7	6	7	7
Effectiveness of Selected Post-emergence Rice Herbicides on Certain Weeds																	
2,4-D	9	9	0	0	0	0	0	2[3]	8	9	9	9	9	7	6	8	9
Aim[4]	8	6	0	0	0	0	0	5	5	4	6	9	7	6	8	5	6
Aim + Grandstand	9	8	0	0	0	0	0	5	8	6	9	9	8	9	8	6	7
Basagran	8	8	0	0	0	0	0	8[4]	4	8	9	4	8	3	7[2]	9	2
Beyond	8	6	8	9	7	9	7	8	3	2	8	3	6	3	5	6	7
Blazer	5	4	0	0	0	0	0	0	4	3	9	9	0	0	0	0	5
Bolero + Propanil (RiceBeaux)	5	9	9	0	9	9	8[2]	7	5	7[2]	7[2]	9	9	8[2]	6[2]	8[2]	8
Broadhead	8	9	9	0	0	9	5[2]	5	6	4	6	9	7	7	8	5	6
Clearpath	8	9	9	8	6	9	6	8	6	3	3	8	6	8	6	6	7
Clincher	0	0	9	0	9	9	8	0	0	0	0	0	0	0	0	0	0
Facet L	8	9	9	0	0	9	5[2]	4	6	3	3	8	3	8	0	3	6
Facet L + Propanil	8	9	9	0	7[2]	9	8[2]	5[3]	6	7[2]	7[2]	9	8	9[2]	6[2]	7[2]	8
Gambit	9	9	0	0	0	0	0	9	8	9[4]	9	9	7	9	9	8	8[3]
Grandstand	9	8	0	0	0	0	0	5	7	3	9	7	8	8	7	6	9
Grasp	3	7	9	0	3	3	3	8	7	8	8	9	7	7	8	7	6
Grasp Xtra	9	8	9	0	3	3	3	8	7	8	9	9	8	8	8	7	9
League	8	8	0	0	0	0	0	8	6	7	8	9	—	8	—	8	8
Londax	5	8	0	0	0	0	0	8	7	9	9	6	9	6	6	8	8
Loyant	9	9	9[4]	0	7[4]	7[4]	7[4]	8	9	9	8	9	8	9	9	8	0
Newpath	8	6	8	8	6	9	4	8	3	2	8	3	6	3	4	6	7[4]
Obey	8	9	9	0	7[2]	9	7[2]	4	6	3	3	8	3	8	0	3	6
Permit/Halomax	7[4]	8	0	0	0	0	0	9	4	5	8	9	4	9	4	8	7[4]
Permit/Halomax + Londax	7[4]	8	0	0	0	0	0	9	7	9	9	9	9	9	6	8	8
Permit Plus	7[4]	9	0	0	0	0	0	9	6	7	9	9	6	9	8	8	7[4]
Propanil	5	8	9	0	7[2]	9	8[2]	4[3]	5	6[2]	7[2]	7	8	8[2]	6[2]	6[2]	6
Propanil + Aim	9	8	9	0	7	9	8[2]	6	5	6	7	9	8	9	8[2]	6	6
Propanil + Londax	9	9	9	0	7[2]	9	8[2]	9	7	7	9	9	8	9[2]	8	8[2]	9
Propanil + Permit/Halomax	9	9	9	0	7[2]	9	8[2]	9	5	5	8	9	9	9	5	8	8[4]
Pendimethalin + Facet	8	8	9	0	8	9	5[2]	4	6	3	2	8	4	7	0	3	6
Pendimethalin + Propanil	5	9	9	0	9	9	8[2]	5	5	7	9	9	8[2]	8[2]	6[2]	7	6
Provisia	0	0	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0
RebelEX	3	7	9[2]	0	9[2]	9[2]	8[2]	8	7	8	8	9	7	7	8	7	6
Regiment	8	6	9	0	3	3	0	7[3]	7	8[2]	8	8	7	8	7	7	8
Ricestar HT	0	0	9	0	8	9	7[2]	0	0	0	0	0	0	0	0	0	0
Sharpen	8	8	0	6	6[2]	5[2]	6[2]	6[3]	7	8	9	8	-	9	7	7	8[5]
Strada	7	8	0	0	0	0	0	8	5	7	9	9	8	9	6	9	6
Strada PRO	7	8	0	0	0	0	0	9	5	7	9	9	8	9	6	9	6
Strada XL	8	9	9	0	0	9	5[2]	8	6	7	8	9	8	9	6	9	4

[1] Annual sedge suppression. [2] With proper water management. [3] Weeds must be <4 inches tall. [4] Controlled only when small (< 2 leaf).

Table 11. Effectiveness of Selected Burndown Herbicides

Pre-plant Burndown	Rice Plant Back (Days)	Annual ryegrass	Annual bluegrass	Carolina foxtail	Little barley	Henbit	Cutleaf evening primrose	Chickweed	Geranium spp.	Curly dock	Buttercup spp.	Mare's tail	Smartweed	Swinecress	Shephard's purse	Bittercress
		Weed-Control Ratings														
2,4-D	30; 1-inch rain	0	0	0	0	5	9	3	6	7	9	6	6	6	9	7
FirstShot + glyphosate	0	7	9	9	9	9	7	9	8	9	9	9	9	9	9	9
Gramoxone XL	0	4	9	8	9	8	4	9	9	4	9	5	4	2	9	9
Grandstand + glyphosate	21 dry-seed/14 water-seed	7	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Glyphosate	0	7	9	9	9	6	5	9	5	6	9	9	7	7	9	9
Leadoff	pH<6.5; 60 days pH>6.5; 90 days	8	9	–	–	9	9	9	–	–	9	9	9	–	–	–
Sharpen + glyphosate	15	7	9	9	9	9	8	9	7	9	9	9	9	9	9	9
Valor + glyphosate	30 days	7	9	9	9	9	8	9	6	8	9	9	9	8	9	9

Table 12. Activity of Selective Herbicide Programs for Perennial Grass Control[1]

Herbicide Program	Brook paspalum	Knotgrass	Creeping Rivergrass[3]	Water paspalum	Nealley's Sprangletop
Clincher fb Clincher[1]	7	9	8	9	6
Command PRE[2]	4	5	4	5	5
Command PRE fb Clincher[1]	5	9	8	8	6
Command + Facet PRE[2]	4	5	4	5	6
Command + Facet PRE[2] fb Clincher[1]	5	9	8	9	6
Command PRE fb Grasp[1]	5	5	7	5	6
Facet + pendimethalin DPRE[2]	4	6	5	7	6
Facet + pendimethalin DPRE fb Clincher[1]	6	9	7	9	6
Grasp[1]	4	2	6	2	6
Loyant	5	5	5	3	7
Newpath fb Beyond[1]	7	9	8	8	6
Newpath fb Newpath[1]	7	9	8	8	6
Propanil[1]	2	3	3	2	5
Provisia fb Provisia	7	9	8	9	9
Regiment fb Regiment[1]	3	2	7	2	4
Ricestar HT fb Ricestar HT[1]	3	4	6	5	8

[1] Control rating is based on herbicides applied to small actively growing plant segments.
[2] Weed-control rating taken two weeks after application.
[3] Also referred to as perennial barnyardgrass.

Table 13. Crawfish Production and Rice Herbicides

Aim	Commercial crawfish not specifically mentioned; however, herbicide is moderately toxic to fish.
Basagran	Do not use Basagran on rice fields where the commercial cultivation of crawfish is practiced.
Beyond	Crawfish production not specifically mentioned.
Blazer	Do not harvest crawfish from treated rice areas for food.
Bolero	Crawfish production not specifically mentioned. Toxic to shrimp.
Broadhead	Do not use treated rice fields for the aquaculture of edible fish and crustaceans.
Clearpath	Do not use treated rice fields for the aquaculture of edible fish and crustaceans.
Clincher	Do not fish or commercially grow fish, shellfish or crustaceans on treated acres during the year of treatment.
Command	Do not apply on rice fields in which concurrent crawfish farming is included in the cultural practices.
Duet	Do not apply to fields where commercial crawfish farming is practiced.
Facet	Do not use treated fields for aquaculture of edible fish or crawfish.
Gambit	Do not commercially grow fish, shellfish or crustaceans on treated acres during the year of treatment.
Grandstand	Do not commercially grow shellfish or crustaceans on treated acres during the year of treatment.
Grasp	Except for crawfish, do not fish or commercially grow fish, shellfish or crustaceans on treated acres during the year of treatment.
GraspXtra	Do not apply later than three months prior to crawfish production.
League	Do not apply to rice fields if fields are used for the aquaculture of edible fish and/or crustaceans.
Londax	Do not harvest crawfish prior to harvesting rice.
Loyant	Except for crawfish, do not fish or commercially grow fish, shellfish or crustaceans on treated acres during the year of Loyant treatment.
Newpath	Crawfish production not specifically mentioned.
Obey	Do not apply on rice fields in which concurrent crawfish or catfish farming are included in the cultural practices.
Permit/Halomax	Crawfish production not specifically mentioned in restrictions.
Pendimethalin	Crawfish not specifically mentioned. Product may be hazardous to aquatic animals.
Permit Plus	Crawfish not specifically mentioned.
Propanil	Crawfish not specifically mentioned in restrictions. Commercial catfish production prohibited.
Provisia	Crawfish not specifically mentioned; however, do not allow Provisia rice go to seed in a non-rice year. This includes any fallow or crawfish production fields.
RebelEX	Do not fish or commercially grow fish, shellfish or crustaceans on treated acres during the year of treatment.
Regiment	Crawfish not specifically mentioned.
RiceBeaux	Applications to fields where catfish/crawfish farming is practiced and draining water from treated fields into areas where catfish farming is practiced is prohibited during 12 months following treatment. Do not use adjacent to catfish/crawfish ponds.
RiceOne	Do not apply on rice fields in which concurrent crawfish farming is included in the cultural practices.
Ricestar HT	Ricestar must not be applied to fields where crawfish are cultured commercially.
Roundup Ultra Max	Crawfish production not mentioned in restrictions. Herbicide cannot be applied to areas where surface water is present.
Sharpen	Sharpen may be applied to rice fields used for crustacean (including crawfish) production and commercial fish production.
Storm	Do not use Storm on rice fields where commercial crawfish production is practiced.
Strada	Crawfish production not specifically mentioned.
Strada PRO	Crawfish production not specifically mentioned.
Strada XT	Crawfish production not specifically mentioned.
2,4-D	May be toxic to aquatic invertebrates.

NOTES

NOTES

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