Crop Vulnerability Statement for Rice

An up-to-date assessment of the degree of genetic uniformity of the Astanding rice crop@ in the United States.

In the Southern U.S. rice growing region six major varieties made up 90% of the rice crop during 2003 and 2004 (Table 1). These varieties are closely related to each other as evidenced by their pedigrees. Molecular genetic data also emphasize the close relatedness of US rice cultivars (Lu et al. 2005). To further assess genetic information on these varieties it is important to also know their coefficient of parentage (Bockelman et al. 2003). For example, the long grain cultivars Lebonnet and Lemont have more than 72% of their genes in common. Examination of the pedigrees of the major rice varieties in the Southern U.S. will trace back to only 24 plant introductions and those in the Western U.S., California will trace back to only 23 (Bockelman et al. 2003). There have been some specialty varieties released recently which have had some other introductions, but they are only grown on a very small percentage of the acreage.

Table 1. Harvested Rice Acreage Summary of the Southern U.S. 2003 and for AR and LA for 2004.

Variety	2003 Acreage	2003 % Acreage	2004 Acreage	2004 % Acreage	Pedigree
Bengal	197,975	8.5	171,484	8.2	Mars/M-201// Mars
CL161	127,609	5.5	316,974	15.1	Mutation of Cypress
Cocodrie	867,178	37.4	487,520	23.3	Cypress//82Cay21/Tebonnnet
Cypress	155,284	6.7	102,053	4.9	L-202/Lemont
Francis	100,481	4.3	177,643	8.5	Lebonnet/CI9902/3/Dawn/CI9596 // Starbonnet/4/LaGrue
Wells	675,841	29.1	623,803	29.8	Newbonnet/3/Lebonnet/CI9902// Labelle
Other					
Total	2,320,853	100.0	2,092,54	100.0	

Data in Table 1 is collected from the acreage information presented at the Rice Technical Working Group meeting. This data will be published in the Proceedings of the Twenty-Ninth and Thirtieth Rice Technical Working Group meetings held in New Orleans LA and Texas, respectively published by the Louisiana State University Agricultural Center Louisiana Agricultural experiment Station Rice Research Station Crowley, LA 70527. See Tables in appendix for more detailed information for this Table.

California medium grain cultivars differ in only a small fraction of the most highly variable genetic markers (Mackill et al. 1996, Lu et al. 2005). There is thus widespread recognition that the germplasm base of released cultivars should be broadened through greater incorporation of exotic cultivars as

parents. In California the majority of the rice grown is medium grain (Table 2). Again the lines are closely related and can be very susceptible to rice diseases under the right conditions.

Table 2. Harvested Rice Acreage Summary from California for 2002 and 2003.

RICE VARIETY BY GRAIN TYPE	2002				2003			
	SEED[2]		TOTAL[3]		SEED[2]		TOTAL[3]	
	ACRES	PERCENT	ACRES	PERCENT	ACRES	PERCENT	ACRES	PERCENT
SHORT GRAIN								
S-102	508	2.25	8,943	1.66	342	1.78	9,071	1.85
AKITAKOMACHI	NA	NA	5,618	1.04	NA	NA	7,497	1.53
KOSHIHIKARI	NA	NA	6,320	1.17	NA	NA	4,659	0.95
CALMOCHI-101	262	1.16	13,869	2.57	469	2.44	15,843	3.23
OTHER	NA	NA	NA	NA	21	0.11	3,065	0.63
SUBTOTAL	**770**	**3.41**	**34,750**	**6.43**	**833**	**4.33**	**40,135**	**8.19**
MEDIUM GRAIN								
M-103	68	0.30	2,045	0.38	87	0.45	7,756	1.58
M-104	2,453	10.87	41,862	7.75	2,322	12.09	62,865	12.83
M-201	0	0.00	1,475	0.27	0.00	0.00	4,000	0.82
M-202	8,162	36.18	247,200	45.77	7,180	37.37	221,883	45.28
M-204	2,146	9.51	56,629	10.48	1,520	7.91	33,261	6.79
M-205	6,175	27.38	88,497	16.39	4,218	21.96	69,635	14.21
M-206	8	0.00	8	0.00	591	3.07	591	0.12
M-401	1,838	8.15	32,210	5.96	1,449	7.54	18,607	3.80
M-402	360	1.60	6,607	1.22	164	0.86	9,466	1.93
OTHER	NA	NA	18,367	3.40	NA	NA	12,175	2.48
SUBTOTAL	**21,210**	**94.00**	**494,900**	**91.63**	**17,530**	**91.25**	**440,238**	**89.84**
LONG GRAIN								
L-204	78	0.35	1,200	0.22	139	0.72	1,929	0.39
L-205	6	0.03	2,099	0.39	28	0.15	1,893	0.39
A-201	49	0.22	1,203	0.22	43	0.22	1,455	0.30
A-301	73	0.33	1,469	0.27	92	0.48	790	0.16
CALMATI-201	33	0.15	336	0.06	21	0.11	874	0.18
OTHER	NA	NA	NA	NA	NA	NA	500	0.10
SUBTOTAL	**239**	**1.08**	**6,307**	**1.17**	**323**	**1.68**	**7,441**	**1.52**
OTHER	**338**	**1.50**	**4,143**	**0.77**	**525**	**2.73**	**2,235**	**0.46%**
TOTAL	**22,557**	**100.00**	**540,100**	**100.00**	**19,210**	**100.00**	**490,049**	**100.00**

Estimates based on survey of rice millers and marketers and certified seed acreage conducted by Rice Experiment Station, PO Box 306, Biggs, CA 95917-0306, 530-868-5481.
[2]Planted acreage of all classes of certified rice seed provided by California Crop Improvement Association.
[3]Estimates of total rice acreage based on rice millers and marketers survey and seed acreage.
[4]Other varieties include; Short Grains S-201, Calhikari-201; and proprietary and specialty

Identification of the Highest Impact Crop Diseases for Rice

In order of importance in the Southern U.S.:
1) Sheath Blight;
2) Blast;
3) Bacterial panicle blight;
4) Seedling Diseases
5) Kernel smut;
6) Stem Rot;
others minor or local importance

Diseases already present in the rice crop in the U.S.
Rice Blast (Magnaporthe grisea (anamorph *Pyricularia grisea* (Cooke) Sacc*)*
Sheath Blight (*Rhizoctonia solani* Kühn) (AG1-1A)
Kernel Smut (*Tilletia barclayana* (Bref.) Sacc. & Syd. in Sacc.)
Leaf Smut (*Entyloma oryzae* Syd. & P. Syd.)
Brown Spot (*Cochliobolus miyabeanus* (Ito & Kuribayashi in Ito) Drechs. ex Dastur
Narrow Brown Leaf Spot (*Cercospora oryzae* Miyake)
False smut (*Ustilaginoidea virens* (Cooke) Takah)
Bakanae or "foolish seedling disease" (*Gibberella fujikuroi* Sawada Wollenworth (anormorph)
Fusarium fujikuroi Nirenberg = *Fusarium moniliforme* J Sheld) (California only)
Sheath rot (*Sarocladium oryzae*)
Bacterial panicle blight (bacterial grain rot) (*Burkholderia glumae*)
Scald (Microdochium (Gerlachia) oryzae)
Bordered Sheath Spot (Rhizoctonia oryzae)
Aggregate Sheath Spot (Rhizoctonia oryzae-sativae)
Sheath blotch (Pyrenochaeta oryzae)
Downy mildew (Sclerophthora macrospora)
Stem rot (Magnaporthe salvinii (sclerotial state = Sclerotium oryzae)
Crown sheath rot (Gaeumannomyces graminis var graminis)
White tip nematode (Aphelenchoides besseyi)
Stackburn (Alternaria padwickii)
Nigrospora sp.
Xanthomonas sp.? – erroneously reported as bacterial leaf blight from Texas and LA – true identity unknown to date.
(In order of importance in the Southern U.S. – 1) Sheath Blight; 2) Blast; 3) Bacterial panicle blight; 4) Kernel smut; 5) Stem Rot; others minor or local).

Rice Pathogens of quarantine significance (see Appendix B from Review of the Current U.S. Quarantine Procedures and Regulations for Imported rice germplasm. T. W. Mew)

Pyricularia grisea (rice blast)
Bipolaris oryzae (brown spot)

Fusarium moniliforme (bakanae)
Sarocladium oryzae (sheath rot)
Xanthomonas oryzae pv *oryzae* and pv *oryzicola* (bacteria)
Alternaria padwickii
Ephelis oryzae (Balansia spp.).
Microdochium oryzae
Tilletia barclayana

List of seed borne pests/pathogens in current APHIS Regulations (see Appendix C from Review of the Current U.S. Quarantine Procedures and Regulations for Imported rice germplasm. T. W. Mew)

Fungi:
1. *Ascochyta oryzae* Catt. Collar rot
2. *Balansia oryzae* (Syd.) Narasimham &Thirumalachar (*B. oryzae-sativae* Hashioaka)
3. *Oospora cryzetorum* Sacc. (blight)
4. *Sarocladium oryzae* (Sawada) Gams & Hawskworth (same as *A. oryzae*)
5. *Trematosphaerella oryzae* (Miyake) Tadw.
6. *Pyricularia oryzae Cavara*
7. *Melanomma glumarum* (glume blight)
8. *Trematosphaerella oryzae* (Miyake) Padwick
9. *Sclerophthora macrospora* (Sacc.) Thirum., Sjaw and Naras. (downy mildew)
10. *Entyloma oryzae* H.& P. Sydow (leaf smut)

Bacteria:

1. *Erwinia sp.* (Brown stripe pathogen; TWM notes: Erwinia sp. Not known to cause brown stripe, perhaps it means *Acidovora avenae* formerly known as *Pseudomonas avenae*).
2. *Xanthomonas campestris* pv *oryzae = X. oryzae* pv *oryza*e (not listed in the original pest and pathogen list)
3. *Xanthomonas campestris* pv *oryzicola = X. oryzae* pv *oryzicola* (not listed in the original pest and pathogen list)

Crop Genetic Diversity

Genetic variability is the basis of plant breeding, and the extent of variability has been associated with rate of progress in yield gains (Tanksley and McCouch 1997). Lack of sufficient genetic variability is not only a concern to continued progress in breeding. A narrow genetic base of commercial cultivars may lead to vulnerability to new pests. Incorporation of exotic cultivars into breeding programs is necessary to avoid over reliance on a single cultivar or a few closely related cultivars.

The current rice germplasm collection is part of the USDA-ARS National Small Grains Collection which contains over 17,000 accessions from 110 countries and regions, representing nine *Oryza* spp, but most are *Oryza sativa* and many are commercial cultivars and breeding lines (Bockelman et al. 2003). These lines in the collection are available too as genetic resources and would be important in the event of a disease-associated emergency. The more complete collection at the International Rice Research

Institute (IRRI) in the Philippines contains over 90,000 accessions. While it is unrealistic to attempt to assemble the entire collection in the US, there are several reasons for accelerating the import exotic accessions. These include (a) the need to broaden the genetic base of US cultivars, (b) the need to search for genes which may be present in only a limited number of cultivars, (c) the need to obtain newly developed germplasm that may contain valuable mutations or novel trait combinations, (d) and the need to conduct collaborative breeding experiments with cooperators which involve exchange of rice germplasm. The urgency of the situation is highlighted by the increasing restrictions on the flow of germplasm due to intellectual property issues. There is a need to import accessions from the gene banks at the International Centers such as IRRI while they are still available.

References

Bockelman, HE, Dilday, RH, Yan, W, and Wesenberg, DM. (2003) Germplasm collection, preservation,and utilization. In CW Smith and RH Dilday eds. Rice origin, history, technology and production. John Wiley & Sons, Inc. Hoboken NJ. P 597-625.

Lu H, Redus MA, Coburn JR, Rutger JN, McCouch SR, and Tai TH. (2005) Population structure and breeding patterns of 145 U.S. rice cultivars based on SSR marker analysis. Crop Sci: 45: Jan-Feb.

Mackill DJ, Zhang Z, Redona ED, Colowit PM (1996) Level of polymorphism and genetic mapping of AFLP markers in rice. Genome 39:969-977.

Tanksley SD, McCouch SR (1997) Seed banks and molecular maps: unlocking genetic potential from the wild. Science 277:1063-1066.

Appendix A Acreage Summaries

2004 Arkansas Harvested Rice Acreage Summary

COUNTY/ PARISH	2003	2004	MEDIUM		LONG GRAIN							
	ACREAGE	ACREAGE	BENGAL	OTHERS[2]	CL161	CLXL8	COCODRIE	CYPRESS	FRANCIS	XL 8	WELLS	OTHERS[2]
ARKANSAS	111,514	117,675	5,450	176	9,490	798	16,926	89	21,461	697	54,567	8,020
ASHLEY	15,513	14,846	0	0	2,917	0	5,818	1,020	3,604	0	1,330	156
CHICOT	32,946	32,615	100	0	6,632	203	13,452	368	155	203	8,085	3,417
CLAY	77,709	84,034	2,594	85	8,361	2,613	6,933	0	17,350	2,136	26,670	17,292
CRAIGHEAD	78,110	83,923	12,444	149	10,594	2,554	15,251	0	8,257	320	31,599	2,755
CRITTENDEN	36,818	41,839	356	0	5,302	80	6,045	0	1,111	0	28,458	487
CROSS	105,919	106,254	6,794	185	16,646	2,894	4,516	1,440	9,611	1,283	56,389	6,486
DESHA	42,992	45,784	48	0	9,495	1,668	13,742	230	1,225	234	17,868	970
DREW	15,906	17,030	422	0	9,209	0	3,188	0	1,000	423	2,290	498
FAULKNER	3,190	2,844	0	0	307	0	374	0	1,568	0	596	0
GREENE	61,662	69,044	5,649	0	7,293	7,911	8,674	829	15,170	3,473	19,253	792
INDEPENDENCE	8,634	10,896	92	0	0	0	0	0	0	0	10,804	0
JACKSON	82,292	101,762	17,402	253	4,766	6,229	5,132	5	8,442	1,829	56,381	1,323
JEFFERSON	58,872	62,416	564	0	15,251	0	6,730	1,305	2,944	0	31,853	3,769
LAFAYETTE	3,169	3,959	0	0	705	0	1,228	0	327	0	1,320	379
LAWRENCE	94,864	99,480	13,622	135	14,825	3,091	22,820	1,759	10,551	628	27,346	4,703
LEE	23,415	30,988	863	0	1,614	301	2,466	0	3,213	0	22,531	0
LINCOLN	32,355	36,518	641	0	11,975	1,306	11,210	0	7,469	779	3,138	0
LONOKE	77,046	81,890	7,996	85	15,323	152	12,368	703	5,748	785	37,243	1,042
MILLER	5,819	7,018	0	0	3,235	0	1,095	0	0	0	1,927	761
MISSISSIPPI	39,287	42,230	0	1	5,406	1,632	1,738	10,631	8,699	0	10,039	4,086
MONROE	51,398	54,869	2,647	0	3,003	117	17,761	0	7,558	345	21,190	2,248
PHILLIPS	25,574	25,720	0	0	770	0	9,639	0	7,617	0	6,080	1,613
POINSETT	126,683	134,944	43,830	796	15,258	2,442	4,117	0	7,539	1,217	56,597	3,129
PRAIRIE	57,031	68,122	10,009	9	7,564	120	14,493	0	7,015	2,494	21,336	5,082
PULASKI	4,792	6,505	1,671	0	3,352	0	154	0	0	0	1,328	0
RANDOLPH	28,848	33,257	6,455	59	6,992	3,402	4,955	0	2,315	2,152	6,541	386
ST. FRANCIS	47,353	48,483	6,238	57	1,169	3	7,317	0	5,455	465	27,737	43
WHITE	16,060	15,843	890	0	1,093	0	6,999	0	1,328	0	5,412	121
WOODRUFF	62,323	65,792	7,612	0	6,582	1,719	12,467	1,087	9,078	855	23,562	2,830
OTHERS[3]	6,861	6,861	0	0	169	0	1,332	0	881	1,268	728	2,592
Unaccounted[4]	20,048	6,449	--	--	--	--	--	--	--	--	--	--
2004 TOTAL		1,560,000	154,389	1,990	205,300	39,235	238,942	19,466	176,691	21,586	620,198	74,980
2004 PERCENT		100.00%	9.90%	0.13%	13.16%	2.52%	15.32%	1.25%	11.33%	1.38%	39.76%	4.81%
2003 TOTAL	1,455,000		162,163	1,721	68,636	--	317,251	22,695	91,561	15,325	658,150	151,955
2003 PERCENT	100.00%		11.15%	0.12%	4.72%	--	21.80%	1.58%	6.29%	1.05%	45.23%	10.44%

[1] - Harvested acreage. Source: Arkansas Argicultural Statistics and FSA

[2] - Other varieties: AB647, Adair, Alan, Banks, Bond, Cheniere, Clearfield 121, Clearfield 141, Delmatti, Dellrose, Drew, Earl, Gulfmont, Jackson, Jefferson, Koshikari, Lacassine, LaGrue, Lemont, Maybelle, Nortai, Pirogue, Rice Tec XL7, Rice Tec XP 710, Rice Tec 7015, Saber, Skybonnet, and Texmont.

[3] - Other counties: Clark, Conway, Crawford, Hot Spring, Little River, Perry, Pope, and Yell.

[4] - Unaccounted for acres is the total difference between USDA-NASS harvested acreage estimate and preliminary estimates obtained from each county FSA.

2004 LOUISIANA RICE ACREAGE SUMMARY

Parish	2003	2004	MEDIUM GRAIN			LONG GRAIN						
	Acreage	Acreage	Bengal	Pirogue*	Other1	Cheniere	Cocodrie	Cypress	CL161	Jefferson	Wells	Other2
Acadia	76,217	90,378	3,422	30	312	11,927	41,229	18,223	12,058	2,029	150	998
Allen	17,190	19,900	400	0	0	1,000	6,580	1,000	10,370	0	0	550
Avoyelles	11,384	12,725	0	0	0	1,405	4,215	6,259	766	0	0	80
Beauregard	1,901	2,177	30	0	0	100	598	274	976	0	0	199
Bossier	0	168	0	0	0	0	168	0	0	0	0	0
Caddo	0	46	0	0	0	0	46	0	0	0	0	0
Calcasieu	12,970	17,415	0	0	0	3,483	5,225	2,612	6,095	0	0	0
Caldwell	1,178	1,352	0	0	0	0	1,352	0	0	0	0	0
Cameron	12,069	14,156	0	0	0	2,993	4,297	1,996	4,870	0	0	0
Catahoula	2,500	4,682	500	223	0	35	2,348	661	388	0	200	327
Concordia	10,234	11,501	0	0	0	0	9,201	0	1,725	0	0	575
East Carroll	15,910	14,915	0	0	0	1,148	11,589	895	1,283	0	0	0
Evangeline	43,689	52,911	4,497	0	0	485	31,334	5,810	9,685	0	575	525
Franklin	921	496	0	0	0	0	496	0	0	0	0	0
Iberia	715	1,147	0	0	0	265	340	262	175	0	0	105
Iberville	214	186	0	0	0	0	186	0	0	0	0	0
Jeff Davis	75,455	85,950	1,150	250	0	8,730	41,830	13,470	16,000	530	1,800	2,190
Lafayette	5,319	6,366	241	0	0	833	2,901	1,179	770	140	0	302
Madison	4,711	7,412	0	0	0	0	7,412	0	0	0	0	0
Morehouse	28,795	43,734	2,800	0	43	1,000	21,657	2,000	15,234	1,000	0	0
Natchitoches	4,295	3,677	0	0	0	60	3,367	0	250	0	0	0
Ouachita	8,754	8,836	1,700	0	0	3,000	4,036	0	0	0	0	100
Pointe Coupee	2,200	2,325	75	50	0	600	1,050	300	50	0	0	200
Rapides	6,325	6,297	0	0	0	260	5,087	200	750	0	0	0
Red River	350	0	0	0	0	0	0	0	0	0	0	0
Richland	6,330	5,263	0	0	0	774	3,613	200	516	0	0	160
St. Landry	18,370	23,321	0	0	0	1,010	4,925	4,340	12,582	464	0	0
St. Martin	2,000	5,405	0	0	0	335	2,753	2,042	275	0	0	0
Tensas	2,646	954	0	0	0	0	829	0	0	0	0	125
Vermilion	67,073	83,105	2,280	800	397	15,555	25,885	20,864	15,236	0	880	1,208
West Carroll	5,785	5,749	0	0	0	0	4,029	0	1,620	0	0	100
2004 Total		532,549	17,095	1,353	752	54,998	248,578	82,587	111,674	4,163	3,605	7,744
2004 Percent		100.00	3.21	0.25	0.14	10.33	46.68	15.51	20.97	0.78	0.68	1.45
2003 Total	445,500		17,770	0	715	0	257,906	111,999	30,224	4,868	10,328	11,690
2003 Percent	100.00		3.99	0.00	0.16	0.00	57.89	25.14	6.78	1.09	2.32	2.62

1 - Other Medium Grains include: XP712 and XP716

2 - Other Long Grains include: CL121, CLXL8,XL8,XP710, Maybelle, Francis, Della, Jasmine, Saber, and Toro-2

* - Pirogue is a short grain variety

MISSISSIPPI ACREAGE SUMMARY 2003

County	Clearfield	Cocodrie	Cypress	Dixiebelle	Drew	Hybrid	Jackson	Jefferson	Lemont	Priscilla	Francis	Wells	Total Acreage
Bolivar	13,410	52,150		300		450		350		4,470	1,500	1,850	74,480
Coahoma	249	11,201				373				622			12,445
DeSoto			2,700								500		3,200
Grenada		300							200	500			1,000
Humphreys	525	2,800								300	150		3,775
Issaquena	1,875	1,160											3,035
Leflore	3,400	9,800								2,550	600	650	17,000
Panola	500	2,600								200			3,300
Quitman	2,600	7,000								100		300	10,000
Sharkey		3,273								278	50	520	4,121
Sunflower	2,800	20,143				400			2,000	7,000	500	400	33,243
Tallahatchie	858	15,449								858			17,165
Tunica	1,600	18,500				400		800		700	300	1,200	23,500
Washington	932	20,074								13,550		1,505	36,061
Total Acreage	28,749	164,450	2,700	300	0	1,623	0	1,150	2,200	31,128	3,600	6,425	242,325

Data collected by County Directors/Area Extension Agents and compiled by Dr. Joe Street, Rice Specialist.

TEXAS RICE ACREAGE BY VARIETY AND COUNTY 2003

County	2002 Acreage	2003 Acreage	Long Grain											Med. Grain	
			Cocodrie	Cypress	CL161	Jefferson	Francis	XL8	Wells	Saber	Dixiebelle	XL7	Risotto	Bengal	Other*
East Zone:															
Brazoria	14,969	10,646	8,264	259	518	518	259								828
Chambers	12,692	10,937	7,734		2,620		426	157							
Galveston	1,166	781	781												
Hardin	633	738	480		258										
Jefferson	18,389	15,187	7,593		6,834	152				152				304	152
Liberty	9,073	7,788	5,093		1,970		79	158						99	389
Orange	414	0													
East Total	**57,336**	**46,077**	**29,945**	**259**	**12,200**	**670**	**764**	**315**		**152**				**403**	**1,369**
Northwest Zone:															
Austin	1,694	1,684	711	356		617									
Colorado	30,726	28,572	23,210	3,101	1,899		144	218							
Harris	2,083	1,664	1,016					42		606					
Lavaca	1,690	1,582	140	1,256		186									
Waller	6,917	7,300	6,280		196	206		382				44			192
Wharton	49,139	46,454	34,632	5,862	2,448	2,191	251	192	109	109	78	204			378
Northwest Total	**92,249**	**87,256**	**65,989**	**10,575**	**4,543**	**3,200**	**395**	**834**	**109**	**715**	**78**	**248**			**570**
Southwest Zone:															
Calhoun	1,498	1,897	1,634	263											
Fort Bend	8,615	6,525	5,617			131									777
Jackson	13,214	13,510	6,327	6,057	733	309	46			38					
Matagorda	27,750	18,884	15,631	331		2,276	61				458		102		25
Victoria	1,748	1,247	1,247												
Southwest Total	**52,825**	**42,063**	**30,456**	**6,651**	**733**	**2,716**	**107**			**38**	**458**		**102**		**802**
Northeast Zone:															
Bowie	1,287	1,332	81	405			36		629	18				163	
Hopkins	1,034	713	713												
Red River	1,017	587	387						200						
Northeast Total	**3,338**	**2,632**	**1,181**	**405**			**36**		**829**	**18**				**163**	
2003 Total Acreage		178,028	127,571	17,890	17,476	6,586	1,302	1,149	938	923	536	248	102	566	2,741
2003 Percentage		100.0%	71.7%	10.0%	9.8%	3.7%	0.7%	0.6%	0.5%	0.5%	0.3%	0.1%	0.1%	0.3%	1.5%
2002 Total Acreage	205,748		164,257	4,851		13,424		121	1,475	9,164	1,096	856		686	9,818
2002 Percentage	100.0%		79.8%	2.4%		6.5%		0.1%	0.7%	4.5%	0.5%	0.4%		0.3%	4.8%

Compiled by Dr. James Stansel and Robin Clements, Texas A&M Univ. System at Beaumont.
Survey data from dryers, sales offices, agribusiness, USDA/CFSA and County Extension Agents as appropriate.
*Other varieties include: Delmatti, XP710, Millgro, CL121, Sierra, Texmati Type, Cheniere, XP110, CLXL8

MISSOURI RICE ACREAGE PLANTED BY COUNTY
2001-2003

County	2001	2002	2003	% change ('02 to'03)
Bollinger	1,305.2	459.6	894.0	+94.5 %
Butler	69887.4	63,297.0	63,155.1	-0.2 %
Cape Girardeau	0	0	191.9	+191.9 a.
Dunklin	13,092.1	15,028.0	13,732.0	-8.6 %
Mississippi	425.0	100.0	320.0	+320 %
New Madrid	29,466.3	26,400	19,578.3	-25.2 %
Pemiscot	16,009.4	19,149.8	17,970.8	-6.2 %
Ripley	5,847.9	4,976.3	4,896.2	-1.6 %
Scott	1,433.0	1,101.0	1,409.0	+28.0 %
Stoddard	69,316.0	61,590.7	51,633.0	-6.4 %
Wayne	35.8	0	0	0
Total	**206,818.1**	**192,102.4**	**155,809.5**	**-18.9 %**

Source:

USDA-FSA offices in the respective counties.

Compiled by:

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APPENDIX B

RICE PATHOGENS OF QUARANTINE SIGNFICANCE

There are several rice pathogens that invade the seeds. These pathogens cause seedling diseases and are internally seed-borne. The fungal pathogens such as *P. grisea, Bipolaris oryzae, Sarocladium oryzae, Fusarium moniliforme, Alternaria padwickii* and *Ephelis oryzae* can be detected after removing the hulls of the seed (Kato, et al. 1988).

At IRRI, we have observed, on limited samples of dehulled seeds during blotter tests, the following fungi on heavily infected seed: *Alternaria padwickii, Curvularia* spp., *Bipolaris oryzae, Fusarium moniliforme, F. solani, Microdochium oryzae, Phoma* spp. *Tilletia barclayana, Pyricularia oryzae, Sarocladium oryza,* and *Nigrospora oryzae*.
Among these fungi, the following are of quarantine significance.

Primary:
1. *Pyricularia grisea* B the rice blast fungus invades the spikelets, penetrating the epidermis of the hulls. Primary infection occurs in empty glumes, pedicels and the distal ends of the hulls. In samples collected from diseased panicles, the fungus is detected from the lemma, palea and the empty glumes. The fungus may be detected in the endosperm but not in the embryos (Chung and Lee, 1983). In a submerged nursery, blast in not a problem. Under upland conditions, especially seedling boxes for mechanical transplanting, seeds should be treated.
2. *Bipolaris oryzae* B the brown spot fungus invades the hulls through the inner epidermis of the hulls at flowering. It is detected more frequently in empty glumes and pedicels than in the lemma and palea. Conditions for disease development from infected seeds are the same as the blast fungus.

Secondary:
1. *Fusarium moniliforme* B the bakanae fungus infects the flowers of the rice plants. Infected seeds are the main source of inoculum. In infected seeds, the fungus is found in the empty glume and pedicel.
2. *Sarocladium oryzae* B the sheath rot fungus that survives in infected rice straw and on seed. The fungus invades the rice plant through stomatal wounds. The disease occurs more in the rainy season. Infection is often enhanced by insect injury. With early and severe infection, the panicle may fail to emerge completely.
3. *Xanthomonas oryzae* pv *oryza*e and pv *oryzicola* - Both bacteria survive for short periods in infected seeds, and the rate of seed transmission is poor. For pv oryzae, the bacterial pathogen is known to survive well in infected straw and grass weed host in the rice field. The safeguard is to avoid obtaining seeds from infected mother plants, and hot water seed treatment is adequate to eliminate the inoculum if they are there.
4. There are other fungi also found internally but most of them are not considered important rice pathogens. These are *A. padwickii*, and *Ephelis oryzae*. There are other fungi found on rice seeds primarily due to contamination rather than seed infections (Kato, et al. 1988). These fungi are *Tilletia barclayana* and *Ustilaginoidea virens.* Rice seed also carries a large number of saprophytes. They are *Nigrospora* spp., *Phyllosticta* spp., *Trematosphaerella* spp. *Oospora oryzae*, etc. They grow on glumes.

Control Measures:

Preventing contamination through rigorous quality control in seed production is the first defense against spread of weeds as well as pests and pathogens. The proven system of quality control in seed production is seed health testing for seed as well as for phytosanitory certification. Decontaminating seeds by seed cleaning machines or manual labor is the second line of defense. In both defenses, the key safeguards are inspection and testing for which well established methodologies are available for use in quarantine procedures based on sound biology and ecology of the target pests, pathogens or weeds.

References:

Chung, H. S., Lee. C. U. 1983. Detection and transmission of *Pyricularia oryzae* in germinating rice seed. Seed Sci. Technol. 11:625-637

Kato, H., Ohata, K., Kauraw, L. P., and Y. H. Lee. 1988. Fungal diseases of rice seed. pp. 151-162. In Rice Seed Health. International Rice Research Institute. Los Baños, Philippines. 257 p.

APPENDIX C

LIST OF SEED-BORNE PESTS/PATHOGENS IN CURRENT APHIS REGULATIONS

Fungi:

3. Ascochyta oryzae Catt.
4. Balansia oryzae (Syd.) Narasimham & Thirumalachar (B. oryzae-sativae Hashioaka)
5. Oospora cryzetorum Sacc.
6. Sarocladium oryzae (Sawada) Gams & Hawskworth (same as A. oryzae)
7. Trematosphaerella oryzae (Miyake) Tadw.
8. Pyricularia oryzae Cavara

Bacteria:

9. Erwinia sp. (Brown stripe pathogen; TWM notes: Erwinia sp. Not known to cause brown stripe, perhaps it means *Acidovora avenae* formerly known as *Pseudomonas avenae*).
10. Xanthomonas campestris pv *oryzae = X. oryzae* pv *oryza*e (not listed in the original pest and pathogen list)
11. Xanthomonas campestris pv *oryzicola = X. oryzae* pv *oryzicola* (not listed in the original pest and pathogen list)

Nematodes:

12. Ditylenchus angustus (Butler) Filipjev (TWM notes: *D. angustus* a stem nematode causes a disease known as ufra in deep-water rice. It is not known to be seed-borne but associated with rice straw).

Noxious weedy rice species (both APHIS and Agricultural Research Service, ARS quarantine staff inspects imported rice germplasm for the presence of the following Oryza spp.):

13. *Oryza longistaminata*
14. *Oryza punctata*
15. *Oryza rufipogon*