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The Semidwarfs-

A New Era in Rice Production

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THE SEMIDWARFS

A New Era in Rice Production

The Texas Agricultural Experiment Station, Neville P. Clarke, Director, College Station, Texas, The Texas A&M University System

Contents

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Foreword

Rice is of major economic importance in Texas. While this commodity is primarily linked to the agricultural sector in the Upper Gulf Coast, it provides a staple food, important jobs, and essential foreign trade for the future. Rice producers have encountered disproportionately greater difficulties—through higher costs and inputs, in the face of depressed world prices for their output.

Rice research is unique. A three-way partnership—the Texas Agricultural Experiment Station, the U.S. Department of Agriculture (USDA), and rice producers—forged new emphasis and targeted objectives for research. Today "Econo-Rice," a new research initiative, was made possible by this broad cooperation and support. Both the Texas Rice Improvement Association (TRIA) and the Texas Rice Research Foundation (TRRF) are to be commended, for initiating a major turnaround for rice in Texas. The technical progress and scientific advancements represented by this report are evidence of what can be done when people decide to take concerted action. Let me elaborate.

Semidwarf rice represents a new concept and greater potentials for the industry. These shorter rice varieties, with their improved management systems, provide the first major opportunity in over a decade to reduce production costs while maintaining a top quality product. "Lemont," and the earlier "Bellemont" variety, provide a new high-yielding, lodging-resistant, long-grain rice, particularly adapted to the Gulf Coast. Second crop (ratoon) opportunities are also greater. Scientists in the Experiment Station and USDA worked cooperatively in a multi-component program which included genetic improvement, cultural and management techniques, pest control (weeds, diseases, and insects), and water management.

This publication summarizes the state of the art of semidwarf rice varieties—targeted to the economic turnaround and future of the rice industry. So many people played prominent roles in this effort that it would be difficult to identify them. However, everyone is grateful for the new initiative. But more importantly, we are looking to the future for even greater advancements and progress. The longer term commitment to research is the key.

Neville P. Clarke, Director,
Texas Agricultural Experiment Station

Semidwarfs - A New Production Concept

J. W. Stansel

Texas rice producers have been experiencing economic problems because their production costs have become excessively high during a period when the world price of rice has decreased. The escalating costs of rice production during the past 10 years of erratic prices have contributed to lost markets and reduced economic opportunities for rice producers. While farmers have little direct control over world market prices, significant steps to reduce production costs can help improve their competitive situation in the world market. Growing new high-yielding, high-quality rice coupled with lower transportation costs to deep water ports can help move rice at a profit in developed markets provided the cost of rice is not excessive in comparison to world trade. Lower cost, high-quality rice can help broaden and stabilize rice markets and the economic opportunities for rice producers.

Short statured, upright leaf plants, with lodging resistance have been increasing in popularity around the world because of their superior and more stable yield potential. These characteristics are found in the varieties, referred to as semidwarfs, released from the Beaumont Research and Extension Center.

Semidwarf rice varieties have the potential to increase yields 25% and reduce the cost of good quality rice $1.05 per hundredweight. The new economic opportunities brought by the semidwarf varieties are the result of their higher yield potential under intensive management and the reduced hazard of lodging (falling down). Lodging of traditional varieties has made them susceptible to adverse weather, reduced yield, increased harvest and drying costs, reduced quality, and has limited the use of nitrogen (N) fertilizer needed to realize full economic yield potential. The semidwarfs, due to their lodging and shattering resistance characteristics, significantly reduce these hazards to economic production.

Economic production of semidwarf varieties will require some management decisions different from those used with traditional varieties. Additional N fertilizer will be required to increase economic yield but midseason timing of N fertilizer applications, while important, will not be as critical. The same level of weed, insect, or disease infestation found in fields of traditional varieties may result in greater yield losses in semidwarf fields. The different plant growth characteristics and higher yield potential of the semidwarfs increases their sensitivity to such infestations.

Semidwarf growth characteristics will require changes in water management practices to maximize economic productivity. Slower seedling emergence under drill-seeded conditions may require changes in planting techniques. Harvesting characteristics are also different from those of traditional varieties. Seed purity will become more difficult in all phases of production and processing because seed mixtures with traditional varieties will be more evident.

Increased rice production in the U.S., resulting from utilization of semidwarf varieties, can result in some suppression of rice prices. However, assuming a stabilized U.S. rice production acreage and a comparative world market, the suppression of the rice market caused by the increased production of semidwarf varieties should not be as large as the decrease in production cost. The net result should be higher profits for rice producers and a more stable market. Continued development and refinement of production technology and systems will be required to stay ahead of competing producing areas. Through this process, both producers and consumers can benefit.

The economic advantages of semidwarf rice varieties are many, but so are the management challenges. This publication presents the "state of the art" of semidwarf variety information to assist producers in making economic management decisions for their farming situation. It should be recognized that additional research may change the interpretions presented here. Contact the County Extension Agent for the latest suggestions on the economic production of semidwarf varieties in your area.

1

Lemont Characteristics and Performance

C. N. Bollich, B. D. Webb, M. A. Marchetti,
J. E. Scott, and J. W. Stansel

Lemont (*Oryza sativa L.*), PI 475833, is a semidwarf, early-maturing, long-grain rice variety developed at the Texas A&M Agricultural Research and Extension Center at Beaumont by the Agricultural Research Service, U.S. Department of Agriculture, in cooperation with the Texas Agricultural Experiment Station, the Texas Rice Improvement Association, the Texas Rice Research Foundation, and the Agricultural Experiment Stations of Louisiana and Mississippi.

Pedigree

Lemont was developed from a 1974 cross of Lebonnet and the F_1 of the cross CI 9881/PI 331581, the cross from which Bellemont was derived. CI 9881 is a selection from the cross Bluebelle//Belle Patna/Dawn, from which Lebonnet was developed. PI 331581 is a selection from the cross Bluebelle/Taichung Native 1 and then backcrossed to Bluebelle five times. The backcrosses were made at the International Rice Research Institute, Los Banos, the Philippines (IRRI Selection IR659-10-8-3). PI 33158l is essentially a semidwarf Bluebelle, possessing the semidwarf gene of Taichung Native 1. Lemont is an F_7 bulk of a single-row plot in the breeding nursery at Beaumont in 1978, Selection B741A1-85-3-6-2-1. It was entered in the Uniform Regional Rice Nurseries in 1980, with the designation RU8003043.

Plant Characteristics

Lemont possesses a semidwarf plant type and closely resembles Bellemont in appearance. Grown under the same conditions, Lemont and Bellemont plant height averaged 32 and 31 inches, respectively, in 12 tests over a 2-year period at Beaumont (Table 1-1). In the same series of tests, Leah averaged 38 and Labelle 42 inches in height. Both Lemont and Bellemont are similar in plant type to the semidwarf variety Leah, developed in Louisiana. However, the flag leaves of Leah are shorter and have a blunter appearance than those of Lemont and Bellemont. The flag leaves of Leah tend to assume a horizontal position as grain filling progresses, whereas those of Lemont and Bellemont tend to remain erect. Also, the panicles, or heads, of Leah tend to stand out above the foliage at maturity whereas the panicles of Lemont and Bellemont are down in the foliage and partially obscured from view. At heading and during grain filling, the tips of the flag leaves of Lemont extend 4 or more inches above the panicles that are turning down as they gain weight.

The outer surface of the leaf sheath of Lemont is green and the inner surface is colorless with a purple tinge near the base. The internodes are green on the outer surface and milky white or colorless on the inside. The pulvinus, or stalkjoint, is green. The leaves are smooth except for sparse hairs on the leaf margins.

The number of days from seeding to heading and to harvest for Lemont under drill-seeding is generally several days more than for Bellemont, Leah, and Lebonnet (Tables 1-2 and 1-3). The number of days to heading is strongly influenced by seeding date, the later the seeding date, the shorter the growing period (Table 1-4).

Grain Characteristics

The spikelet of Lemont is straw-colored, smooth, and awnless, or without a spiked tip. At heading, the tip of the apiculus, or tip of the spikelet in bloom, is purple, but the color fades and is hardly distinguishable at maturity. The stigma is colorless. Milled kernels of Lemont are approximately the same length as, but wider and heavier than those of Lebonnet (Table 1-5). They are distinctly larger in all dimensions than those of Labelle, Bellemont, and Starbonnet. Among Southern U.S. long-grain varieties, only Leah has a larger kernel than Lemont.

Disease Reaction

Lemont is resistant to the same races of the blast fungus (*Pyricularia oryzae*) as are Labelle and Lebonnet but is only moderately susceptible to races IB-49 and IC-17, to which Labelle and Lebonnet are susceptible (Table 1-6). Lemont differs significantly from Bellemont in reaction to various races of the blast fungus and it is in this respect that the two varieties can be most readily distinguished. Both varieties have a common resistant reaction to race IH-1 and a moderately susceptible reaction to race IB-49, but Lemont is resistant to races IB-1, IB-45, IB-54, and IG-1, whereas Bellemont is susceptible or moderately susceptible to these races.

TABLE 1-1. PLANT HEIGHT (INCHES) OF LEMONT AND CHECK VARIETIES IN YIELD TRIALS AT SIX LOCATIONS IN TEXAS, 1982-1983

Variety	Beau-mont	Eagle Lake	Katy	Bay City	Ganado	El Campo	Average
1983							
Lemont	39	34	33	31	29	33	33
Bellemont	35	32	30	31	28	32	31
Leah	46	40	37	33	39	39	39
Labelle	51	45	43	41	37	42	43
Lebonnet	53	47	41	40	38	42	44
Skybonnet	48	45	39	40	37	41	42
1982							
Lemont	32	32	—	30	30	—	31
Bellemont	30	31	—	31	28	—	30
Leah	33	37	—	31	36	—	36
Labelle	42	43	—	39	37	—	40
Lebonnet	41	41	—	37	36	—	39
Skybonnet	42	43	—	41	37	—	41

TABLE 1-2. NUMBER OF DAYS FROM SEEDING TO HEADING FOR LEMONT AND CHECK VARIETIES IN YIELD TRIALS AT SIX LOCATIONS IN TEXAS, 1982-1983

Variety	Beaumont (Seeded 4/11)	Eagle Lake (Seeded 4/19)	Katy (Seeded 4/11)	Bay City (Seeded 4/12)	Ganado (Seeded 4/12)	El Campo (Seeded 4/26)	Average
1983							
Lemont	98	101	91	100	87	88	94
Bellemont	92	98	83	101	92	91	93
Leah	97	96	91	100	92	88	94
Labelle	83	87	78	91	89	80	85
Lebonnet	91	97	87	99	89	88	92
Skybonnet	89	95	81	95	87	91	90
	(Seeded 4/7)	(Seeded 3/17)		(Seeded 4/13)	(Seeded 3/25)		
1982							
Lemont	103	105	—	93	100	—	100
Bellemont	99	101	—	92	—	—	97
Leah	99	104	—	94	102	—	100
Labelle	91	93	—	84	88	—	89
Lebonnet	98	98	—	91	92	—	95
Skybonnet	97	99	—	90	96	—	96

TABLE 1-3. NUMBER OF DAYS FROM SEEDING TO HEADING (HD) AND HARVEST (HV) FOR LEMONT AND CHECK VARIETIES IN THE REGIONAL RICE PERFORMANCE NURSERIES AT BEAUMONT, TEXAS, 1980-1983

	1983		1982		1981		1980		Average	
	Seeded 4/11		Seeded 4/7		Seeded 3/31		Seeded 4/9			
Variety	Hd	Hv	Hd	Hv	Hd	Hv	Hd	Hv	Hd	Hv
Lemont	98	133	103	134	93	125	99	131	98	131
Bellemont	92	127	99	133	90	125	97	124	95	127
Leah	97	130	99	131	95	126	95	126	97	128
Labelle	83	119	91	119	—	—	91	124	88	121
Lebonnet	91	126	98	127	93	125	98	126	95	126
Skybonnet	89	126	97	127	89	120	97	128	93	125

Lemont is resistant to panicle blight, moderately resistant to brown spot (*Bipolaris oryzae*), moderately susceptible to narrow brown leaf spot (*Cercospora oryzae*), moderately resistant to the physiological straighthead disease, and very susceptible to sheath blight (*Rhizoctonia solani*) (Table 1-7). In research plots at Beaumont that were artificially inoculated with *R. solani*, susceptible semidwarf entries were damaged more severely than susceptible non-dwarf entries with the exception of the semidwarf variety Leah, which showed less yield reduction in inoculated plots than Lemont or Bellemont.

Cooking and Processing Quality

The cooking and processing qualities of Lemont are comparable to those of present long-grain commercial varieties grown in the South, as determined by numerous evaluation tests conducted at the Regional Rice Quality Laboratory. Results of established physiochemical tests, which collectively serve as indexes of specific cooking and processing behavior of rice, were used in comparing quality of these rice varieties. Specific tests used in these evaluations included the determinations of amylose content, reaction of whole kernels in dilute alkali (indicative of gelatinization temperature type), protein content, water uptake at 77° C, and parboil-canning stability. Comparative chemical and physical (quality) characteristics of representative samples of Bellemont, Leah, Labelle, Lebonnet, Bluebelle, Starbonnet, and Bonnet 73 from Cooperative Uniform Rice Performance Nurseries in Texas, Louisiana, Arkansas, and Mississippi indicate that Lemont possesses the cooking and processing behavior required of U.S. long-grain rice. Lemont, like other high-quality long-grain varieties, is characterized as a relatively high amylose-intermediate gelatinizing type.

TABLE 1-4. NUMBER OF DAYS FROM SEEDING TO HEADING AND HARVEST FOR LEMONT AND CHECK VARIETIES IN YIELD TRIALS SEEDED ON DIFFERENT DATES. BEAUMONT, TEXAS, 1983

	UYN		Dup I		SNP I		SNP II	
	4/11/83		4/26/83		4/26/83		5/4/83	
	Hd	Hv	Hd	Hv	Hd	Hv	Hd	Hv
Lemont	98	133	92	125	90	122	88	121
Bellemont	92	127	—	—	89	122	84	118
Leah	97	130	—	—	90	122	86	118
Labelle	83	119	79	122	—	—	80	110
Lebonnet	91	126	90	122	89	122	—	—
Skybonnet	89	126	86	119	86	122	84	119

TABLE 1-5. WHOLE GRAIN MILLED KERNEL DIMENSIONS (MM) AND WEIGHT (MG) FOR LEMONT AND CHECK VARIETIES IN THE UNIFORM REGIONAL RICE NURSERIES AT BEAUMONT, TEXAS AND STUTTGART, ARKANSAS, 1981*

Variety	Length	Width	Length/Width Ratio	Weight
Lemont	7.26	2.24	3.24	21.8
Bellemont	6.89	2.10	3.28	18.9
Leah	7.47	2.20	3.40	23.6
Labelle**	6.64	1.93	3.44	15.6
Lebonnet	7.19	2.08	3.46	19.5
Starbonnet	6.78	1.97	3.44	16.4
Skybonnet	7.03	2.10	3.35	19.6
Newrex	7.25	2.02	3.59	17.2
L-201	7.68	2.00	3.84	20.6

*Measurements based on fully developed mature kernels.

**Values for Labelle based on samples from Crowley, LA and Stoneville, Mississippi.

TABLE 1-6. REACTIONS OF LEMONT AND CURRENT U.S. LONG-GRAIN RICE VARIETIES TO RACES OF THE BLAST FUNGUS (*PYRICULARIA ORYZAE*)

Variety	IB-1	IB-45	IB-49	IB-54	IC-17	IG-1	IH-1
Lemont	R	R	MS	R	MS	R	R
Bellemont	M	MS	MS	MS	S	MS	R
Leah	MS	R	S	MS	S	R	R
Labelle	R	R	S	R	S	R	R
Lebonnet	R	R	S	R	S	R	R
Skybonnet	R	R	S	R	S	R	R

R — resistant.
MR — moderately resistant.
M — intermediate.
MS — moderately susceptible.
S — susceptible.

TABLE 1-7. DISEASE REACTIONS OF LEMONT AND CURRENT U.S. LONG-GRAIN RICE VARIETIES

Variety	Sheath Blight	Straight-head	White Tip	Panicle Blight	Brown Spot	Narrow Brown Leaf Spot
Lemont	VS	M	—	R	MR	MS
Bellemont	VS	MR	R	R	MS	S
Labelle	S	R	R	R	MR	S
Lebonnet	VS	R	R	R	MR	S
Leah	M	S	—	R	R	M
Skybonnet	VS	MR	R	R	M	M

R — resistant.
MR — moderately resistant.
M — intermediate.
MS — moderately susceptible.
S — susceptible.
VS — very susceptible.

Yield Performance

Lemont has greater yielding ability than other long-grain varieties grown in the southern United States. In 1980-83, it was included in yield trials at Beaumont and the satellite locations in Texas, at various locations in Arkansas, at one or more locations in Louisiana and at Stoneville, Mississippi (Table 1-4).

In yield trials in Texas, with few exceptions, Lemont produced higher yields than any of the check varieties (Tables 1-8, 1-9, 1-10, 1-11, and 1-12). The comparative yields of Lemont tended to be greatest in tests where yields of all varieties generally were good, indicating that yield superiority of Lemont was best expressed when grown under good management practices and climatic conditions. Amount and timing of N fertilization in many of the yield trials in Texas were optimum for varieties with normal; i.e., non-dwarf plant types, but were not enough for maximum yield expression of the semidwarf types. This was particularly the case in the Regional Uniform Rice Nurseries at Beaumont, in which the great majority of experimental selections were non-dwarf types. New data indicate that semidwarf lines, such as Lemont, require higher and earlier N applications. Higher rates of N were used in yield trials at Beaumont beginning in 1983.

The yields of Lemont in Louisiana in 1982 were outstanding under both water-seeded and drill-seeded practices. In an N fertilization experiment in East Carroll Parish (north Louisiana), Lemont produced a maximum yield of 10,800 lbs/A in a fertile soil that had been in soybeans 13 previous years (Brandon et al., 1982). Louisiana data show that Lemont performs very well in relation to tall varieties at suboptimum N rates but it yields much greater than tall varieties at optimum to excessive N rates. Empirical N rate studies and leaf tissue analyses show that Lemont requires 20-30 lbs/A more for maximum yield than tall varieties like Lebonnet in Louisi-

TABLE 1-8. GRAIN YIELD (LB/A) OF LEMONT AND CHECK VARIETIES IN ADVANCED YIELD TRIALS AT FIVE LOCATIONS IN TEXAS, 1983

Variety	Eagle Lake	Katy	Bay City	Ganado	El Campo	5-Test Average
Lemont	8615	5600	5108	5328	6266	6183
Bellemont	6905	4021	4102	5127	5359	5103
Leah	6451	5355	4833	5287	4661	5317
Labelle	6180	4928	2256	3731	5377	4494
Lebonnet	6784	4514	3249	4587	5852	4997
Skybonnet	6525	4467	4215	5003	5942	5230

TABLE 1-9. GRAIN YIELD (LB/A) OF LEMONT AND CHECK VARIETIES IN PRELIMINARY YIELD TRIALS AT FIVE LOCATIONS IN TEXAS, 1983

Variety	Eagle Lake	Katy	Bay City	Ganado	El Campo	5-Test Average
Lemont	6174	6143	4436	5968	6652	5875
Bellemont	5152	4780	5690	5276	6373	5454
Leah	5975	5383	5185	6761	6491	5959
Labelle	3924	3808	2397	4888	5874	4178
Lebonnet	5288	4755	2974	5516	2772	4261
Skybonnet	5161	5578	4812	5564	4921	5207

TABLE 1-10. GRAIN YIELD (LB/A) OF LEMONT AND CHECK VARIETIES AT EAGLE LAKE, BAY CITY, AND GANADO, 1982

Variety	Eagle Lake (Adv. A)	Eagle Lake (Adv. B)	Eagle Lake (Prelim.)	Bay City	Ganado	5-Test Average
Lemont	5062	6697	7166	4529	5261	5743
Bellemont	4460	4222	6283	4384	5403	4950
Leah	4916	6299	5107	4080	5906	5262
Labelle	4051	3970	3572	4195	4119	3981
Lebonnet	5559	6527	5666	4528	3536	5163
Skybonnet	5769	5062	6296	4679	4623	5286

TABLE 1-11. GRAIN YIELD (LB/A) OF LEMONT AND CHECK VARIETIES AT FIVE LOCATIONS IN TEXAS, 1981

Variety	Eagle Lake (45 A)	Eagle Lake (45 A)	Katy	Bay City	Ganado	El Campo	Overall Average
Lemont	6121	7341	5425	6453	7124	6638	6516
Bellemont	5860	5615	4567	5896	6468	5470	5646
Labelle	5368	5708	4524	5832	6074	4506	5335
Lebonnet	6150	6252	5707	6414	6966	5159	6108
Skybonnet	5860	5615	4567	5896	6468	5470	5646

TABLE 1-12. GRAIN YIELD (LB/A) OF LEMONT AND CHECK VARIETIES AT FIVE LOCATIONS IN TEXAS, 1980

Variety	Eagle Lake	Katy	Bay City	Ganado	El Campo	5-Location Average
Lemont	6097	5418	4299	—	7322	5784
Bellemont	5593	4363	3566	5331	6547	5080
Labelle	5214	4553	3624	3806	5535	4546
Lebonnet	5479	5457	4534	4663	5916	5210
Skybonnet	5887	—	3490	—	—	—

ana. A N rate of 20-30 lbs/A should be applied at planting in both the dry-seeded and water-seeded-drained systems, followed by 50-75% of the total N within 7 days before permanently flooding in Louisiana. A distinct advantage of Lemont, Bellemont, and to a lesser extent Leah, is that they can be fertilized for maximum economic yield with little fear of lodging but excessive high N rates should be avoided. Lemont has performed well in Arkansas tests, reaching a high of 8,830 lbs/A in Clay County, Arkansas in 1981 (Table 1-13).

The yield advantage of Lemont is graphically illustrated in Figures 1-1, 1-2, 1-3, 1-4, and 1-5, based on data from yield trials in Texas, Louisiana, Arkansas, and Mississippi in the period 1980-83 and in Figures 1-6, 1-7, 1-8, 1-9, and 1-10, constructed from data from fertilizer experiments in Louisiana in 1982 (1). (See pages 8 to 10 for Figs. 1-1 through 1-10.) Each figure shows the yields of Lemont relative to those of Bellemont, Leah, Labelle, Lebonnet, or Skybonnet. Each dot in a figure shows the yield of Lemont relative to the yield of the particular check variety in the same test. The broken diagonal line in each graph represents the point at which Lemont and the respective check variety produced the same yield. All dots above the diagonal indicate comparisons in which Lemont yielded more than the respective check, and dots below the diagonal show when Lemont yielded less than the check.

The figures cited clearly show the superior yield potential of Lemont relative to all other varieties. A significant point is that Lemont tended to express its superior yield potential at the very high yield levels. This is a further indication that to realize the maximum advantages of Lemont, producers must follow good management practices.

Data for ratoon (second crop) potential of Lemont are too limited to draw reliable conclusions. However, observations of regrowth in the breeder and foundation fields at Beaumont suggest that it may have excellent ratoon potential when planted reasonably early; i.e., about April 1-15. Also, the fact that Bellemont has produced excellent ratoon yields in commercial fields west of Houston, Texas further indicates that Lemont may have the ability to produce good ratoon yields. In spite of earlier than normal cool temperatures in September and October, ratoon yields averaging 1,368 lbs/A (12% moisture) were reported in five commercial fields totaling 312 acres of Lemont in 1983.

Milling Quality

Characteristically, whole-grain milling yields vary considerably among years and locations because they are strongly influenced by environmental factors during grain maturation, by grain moisture content at harvest, and by drying procedures after harvest. All available data indicate that Lemont has good to excellent milling quality. Data from the Regional Uniform Rice Nurseries in Texas, Arkansas, and Louisiana in 1980-82 indicate that the milling quality of Lemont is distinctly better than that of Leah, better than that of Lebonnet, and equal to or superior to that of other current U.S. long-grain varieties (Table 1-15). The percent whole-grain milling yields in Table 1-15 are generally higher than what might be expected from combine-harvested commercial fields of rice because samples were thoroughly cleaned before milling in order to compare the inherent milling quality of varieties and selections after eliminating any influence of varying levels of dockage or light seed that might have been present. The primary interest in Table 1-15 is relative milling yield. The bushel weight of Lemont is similar to that of other U.S. long-grain varieties (Table 1-16).

Tests were conducted in 1981 and 1982 at Beaumont to determine the effect of grain moisture content at harvest on whole-grain milling yields. The milling response to harvest moisture varied considerably in the 2 years. In 1981, the highest milling yield (56.7% whole grain) for Lemont was at a harvest moisture level of 20.5%, whereas, in 1982 the highest milling was at 17.6%. In both years of this study Lemont milled markedly better than Leah. In 1981 the milling yield of Lemont was slightly below that of Bellemont, and in 1982 it averaged about the same as that of Labelle. The whole-grain milling yields for foundation seed of Lemont grown at Beaumont and Eagle Lake were 65 and 62%, respectively. The foundation seed was dried in on-farm storage bins.

Seed Purity

The principal variants, or off types, observed in Foundation and Registered seed fields of Lemont were tall; i.e., non-dwarf, plants numbering about 1 per 50,000 plants. The tall variants were not uniform among themselves. Most headed earlier than Lemont, but a few were extremely late and headed long after Lemont plants matured. The tall variants generally were glabrous (smooth) long-grain types with a faint purple apiculus like Lemont, but some were pubescent medium-

TABLE 1-13. GRAIN YIELD (LB/A) OF LEMONT AND CHECK VARIETIES AT FOUR LOCATIONS IN ARKANSAS, 1981*

Variety	Clay	NREC	CBS	PTS	Average
Lemont	8830	7600	6300	5090	6955
Bellemont	6760	4820	5280	3660	5130
Leah	7620	6980	5560	4510	6167
Labelle	6820	6360	6130	5790	6275
Lebonnet	7690	7020	7280	5980	7060
Skybonnet	6390	6820	7460	5500	6643

*Excerpted from Summary of 1981 Arkansas Rice Performance Test, K. S. McKenzie, F. N. Lee, and B. R. Wells, Arkansas Farm Research. January-February, 1982.

TABLE 1-14. GRAIN YIELD (LB/A) OF LEMONT AND CHECK VARIETIES IN THE REGIONAL UNIFORM RICE PERFORMANCE NURSERIES IN TEXAS, LOUISIANA, ARKANSAS, AND MISSISSIPPI, 1980-83

	Lemont	Bellemont	Leah	Labelle	Lebonnet	Skybonnet
Texas						
1983	6650	6163	5335	5266	3197	4518
1982	5155	4737	4706	5135	4838	4693
1981	5460	5708	3654	—	3237	4040
1980	5435	4676	5299	4493	4828	4650
Average	5674	5321	5299	4493	4828	4650
Arkansas						
1983	5176	3893	6562	6042	5931	6215
1982	6912	5433	6502	5300	5986	6049
1981	5435	4862	6213	—	6134	6093
1980	6157	4838	6305	3841	5148	3355
Average	5920	4757	6396	5061	5800	5428
Mississippi						
1983	3565	2954	5754	4924	5750	5182
1982	6609	5426	5974	5040	5320	6108
1981	6270	6219	6699	6413	5828	6346
1980	6062	5111	5817	4262	4978	5686
Average	5627	4928	6061	5160	5469	5831
Louisiana						
1983	6611	5204	5838	5934	5850	6658
1982	7664	7009	7405	6576	6697	7379
Average	7163	6107	6622	6255	6274	7019

grain types with long awns, either purple or colorless. The tall variants are highly visible during the tillering stage in a Lemont field and can be rogued out with ease. Only 19 tall variants were noted and rogued from the 9-acre Breeder seed field of Lemont in 1983; therefore, such variants should be essentially absent from future Foundation Seed. Variants other than the tall types were extremely rare or essentially absent in Lemont fields.

ACKNOWLEDGMENTS

Information on the performance of Lemont in other states was furnished through the courtesy of D.M. Brandon and K.S. McKenzie, Rice Research Station, LAES, LSUAC, Crowley, LA; M.C. Rush, Plant Pathology and Crop Physiology Department, LAES, LSUAC, Baton Rouge, LA; T.H. Johnston, (USDA-ARS), K. Kuenzel, R.H. Dilday (USDA-ARS), and F. N. Lee, Rice Research and Extension Center, Stuttgart, AR; and M. R. Milam, Delta Branch Experiment Station, Stoneville, MS.

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TABLE 1-15. MILLING YIELD (% WHOLE GRAIN) FOR LEMONT AND CHECK VARIETIES IN THE UNIFORM REGIONAL RICE PERFORMANCE NURSERIES IN TEXAS, ARKANSAS, AND LOUISIANA, 1980-83

Variety and State	Lemont	Bellemont	Leah	Labelle	Lebonnet	Starbonnet
Texas						
1983	68	67	62	63	61	62
1982	54	60	43	60	53	53
1981	54	62	31	—	34	49
1980	67	69	58	62	65	69
	61	65	49	62	53	58
Arkansas						
1982	61	54	45	59	58	64
1981	66	64	56	61	62	67
1980	65	64	61	58	66	62
	64	61	54	59	62	64
Louisiana						
1982	66	64	50	61	61	61
Overall Average	63	63	51	61	58	61

TABLE 1-16. BUSHEL WEIGHT OF LEMONT AND CHECK VARIETIES IN THE UNIFORM REGIONAL RICE PERFORMANCE NURSERIES AT BEAUMONT, TEXAS, 1982-1983

Year	LMNT	BLMT	LEAH	LBLE	LBNT	SKBT
1982	44.5	44.7	43.8	45.3	44.3	41.3
1983	43.9	43.9	42.9	43.6	40.9	43.7

(Figures 1-1 through 1-10 are on the following pages.)

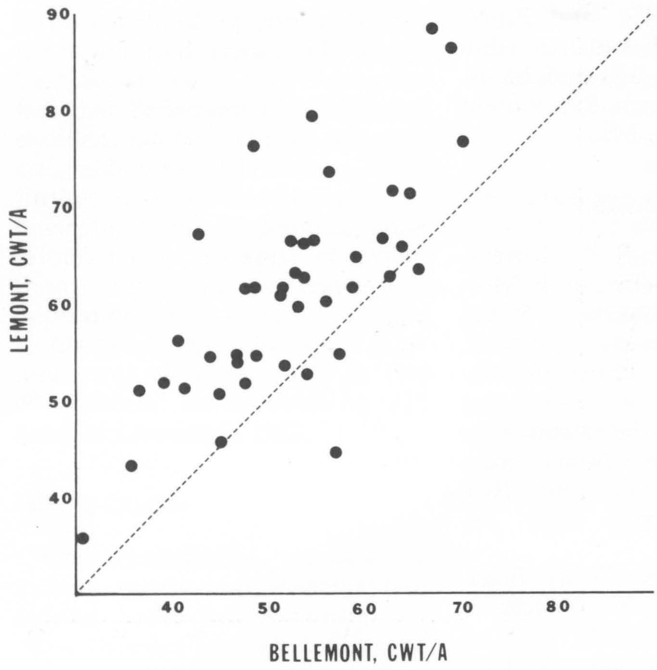

Figure 1-1. Comparative Yields of Lemont and Bellemont in Yield Trials in Texas, Louisiana, Arkansas, and Mississippi. 1980-83.

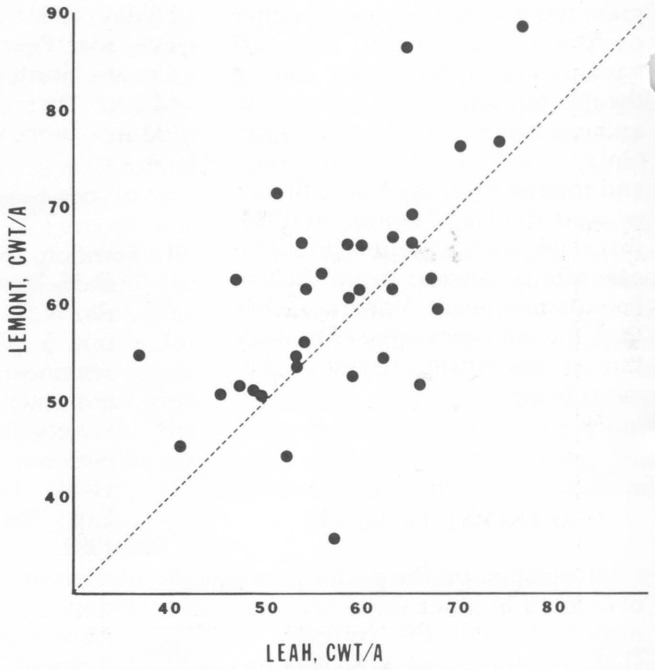

Figure 1-2. Comparative Yields of Lemont and Leah in Yield Trials in Texas, Louisiana, Arkansas, and Mississippi. 1980-83.

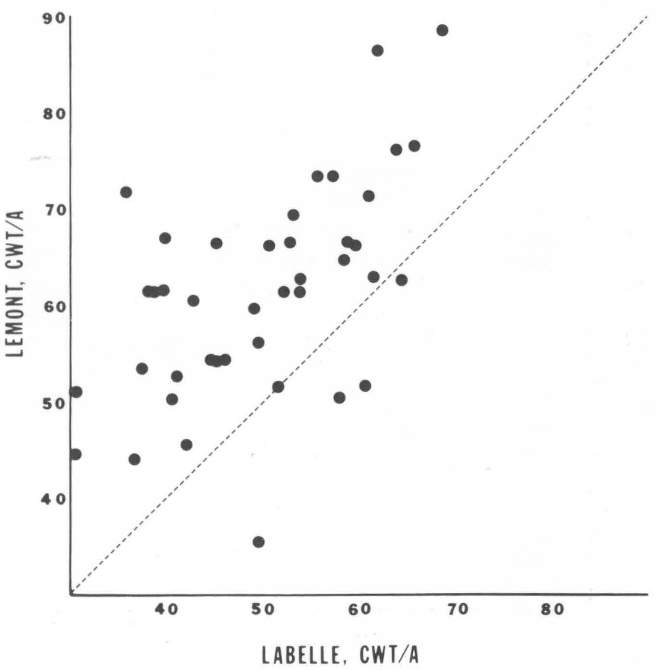

Figure 1-3. Comparative Yields of Lemont and Labelle in Yield Trials in Texas, Louisiana, Arkansas, and Mississippi. 1980-83.

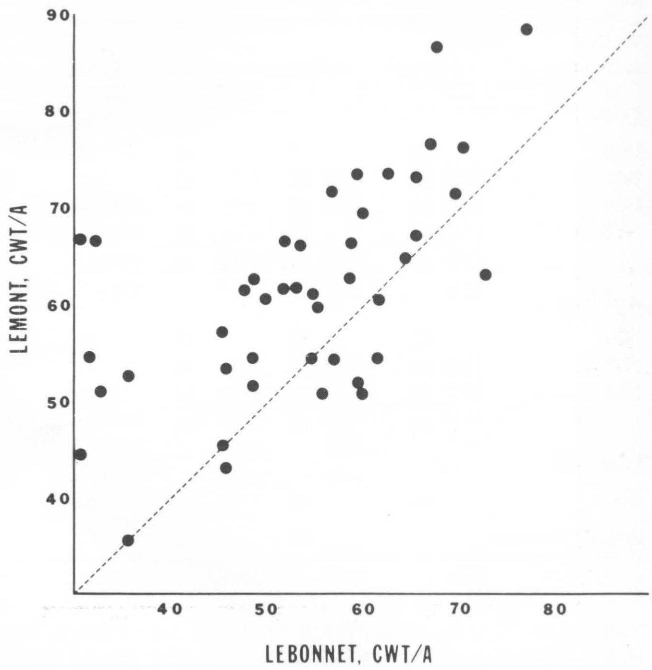

Figure 1-4. Comparative Yields of Lemont and Lebonnet in Yield Trials in Texas, Louisiana, Arkansas, and Mississippi. 1980-83.

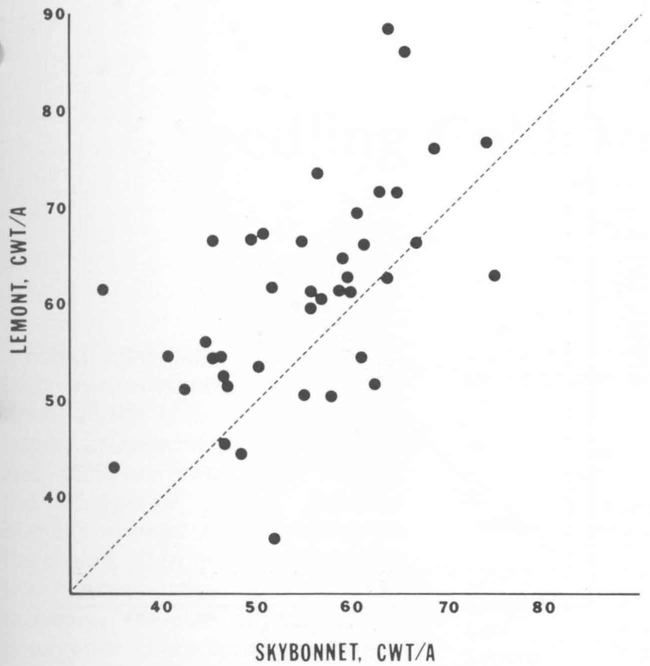

Figure 1-5. Comparative Yields of Lemont and Skybonnet in Yield Trials in Texas, Louisiana, Arkansas, and Mississippi. 1980-83.

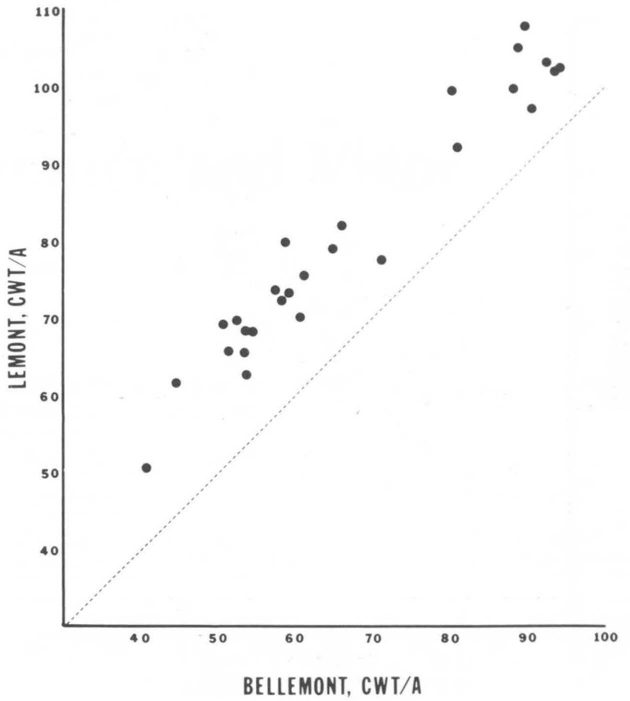

Figure 1-6. Comparative Yields of Lemont and Bellemont under Different Nitrogen Treatments in Fertilizer Trials in Louisiana. 1982.

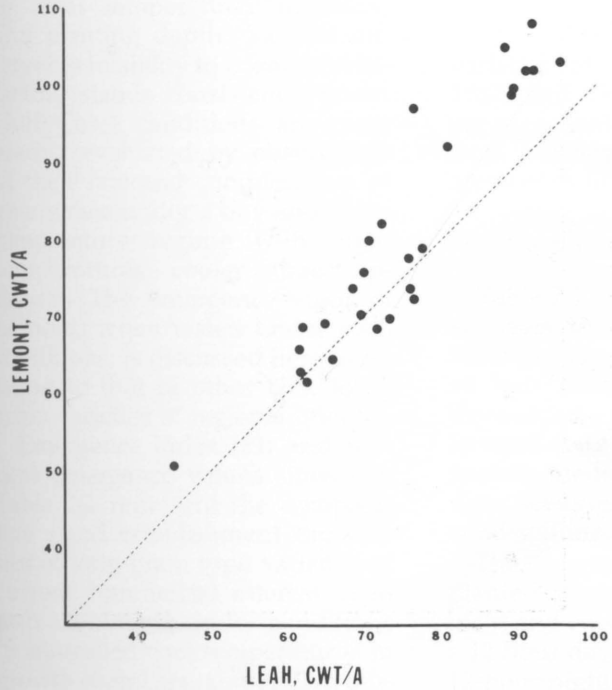

Figure 1-7. Comparative Yields of Lemont and Leah under Different Nitrogen Treatments in Fertilizer Trials in Louisiana. 1982.

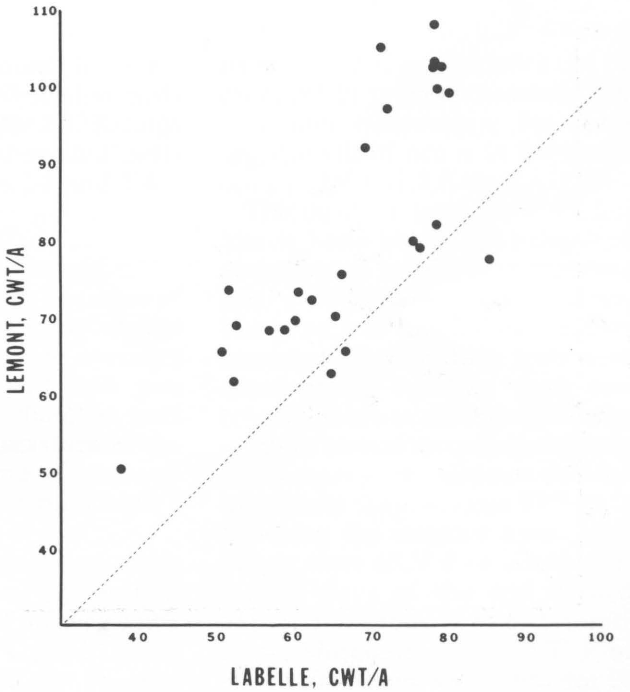

Figure 1-8. Comparative Yields of Lemont and Labelle under Different Nitrogen Treatments in Fertilizer Trials in Louisiana. 1982.

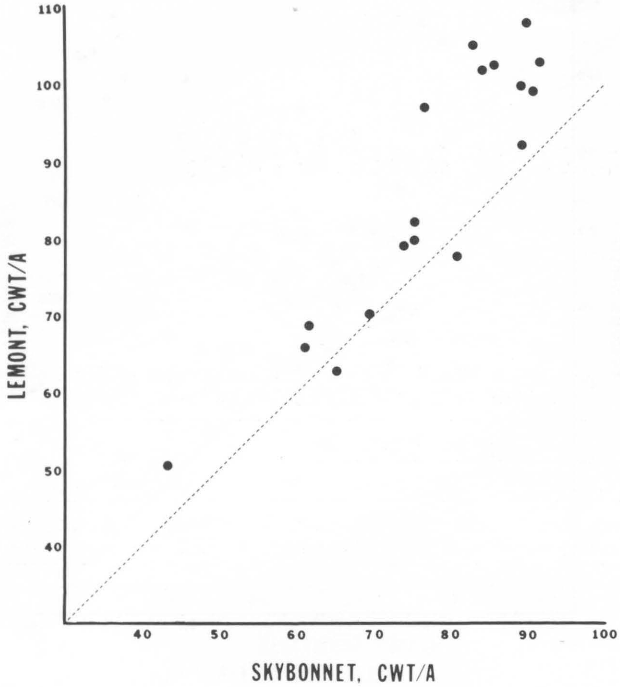

Figure 1-9. Comparative Yields of Lemont and Skybonnet under Different Nitrogen Treatments in Fertilizer Trials in Louisiana. 1982.

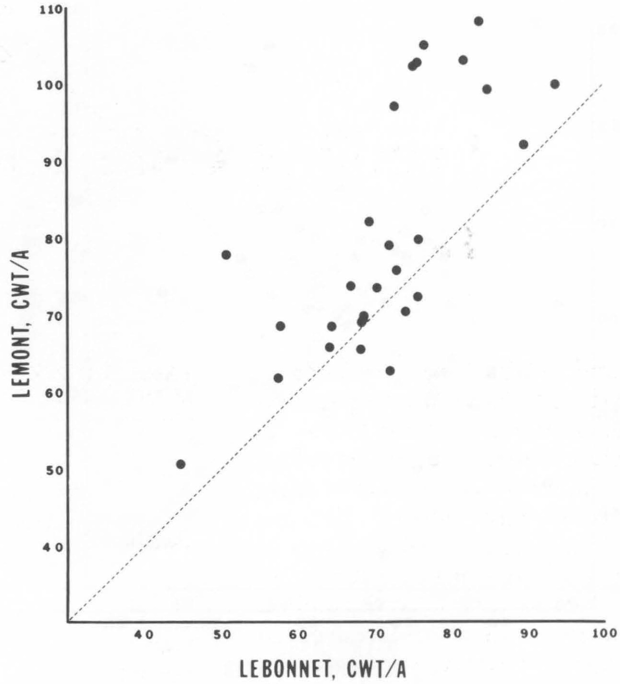

Figure 1-10. Comparative Yields of Lemont and Lebonnet under Different Nitrogen Treatments in Fertilizer Trials in Louisiana. 1982.

2

Seedling Cold Tolerance and Vigor

W. O. McIlrath

TABLE 2-1. RELATIVE EMERGENCE VIGOR AND PERCENT EMERGENCE OF LEMONT VERSUS OTHER SEMIDWARF AND TALL LONG-GRAIN VARIETIES

	Growth Chamber Tests					
	Pregerminated Tests[1]		Dry-Seeded Tests[2]		Outdoor Tests[3]	
Variety	Average E.I	Average % Emergence	Average E.I.	Average % Emergence	Average E.I.	Average % Emergence
Labelle	7.84	88	4.88	70	10.87	91
Lebonnet	7.75	94	4.90	62	9.89	87
Leah	6.40	82	4.18	58	9.41	94
Lemont	5.27	82	4.27	63	5.84	95
Skybonnet	3.72	57	2.55	46	8.10	90
Bellemont	3.85	78	1.93	44	4.73	87
Newrex	—	—	—	—	4.85	64

[1]Averages of tests 82-3, 82-4; 20 seeds/rep sprouted in growth chamber on 12/12-hr., 15-20°C diurnal cycle; highest possible E.I. = 20.

[2]Averages of tests 82-6, 83-1; 20 seeds/rep dry-seeded in sand at 2.5 cm depth with growth chamber on 12/12-hr., 15-20°C diurnal cycle; highest possible E.I. = 20.

[3]Averages of tests seeded March 3 and March 8, 1983; 30 seeds/rep dry-seeded in sand-soil medium at 1-inch depth; highest possible E.I. = 30.

Stand establishment of rice, in both dry-seeded and water-seeded fields of the U.S. Gulf Coast, is largely influenced by temperature and moisture conditions during the emergence period. Because March and early April seedings in the region often may be subject to low temperatures and limited moisture, varietal differences in emergence characteristics are important to consider along with seeding date, depth, and rate. Stand establishment is of particular concern when currently available semidwarf varieties are drill- or dry- broadcast seeded.

Seedling vigor differences among rice varieties are minimized when seedings are subject to ideal temperature, moisture, and planting depth. Varietal differences in ability to produce satisfactory stands consistently under Gulf Coast conditions are more readily evaluated by observation of their rate and completeness of emergence under a day and night temperature regime with night temperatures cooler than optimum. The emergence vigor of Lemont, when tested under such conditions, is discussed here in relation to that of other U.S. long-grain varieties of regional interest.

Emergence index (EI) and percent emergence values shown in Table 2-1 represent the comparative stand establishment capabilities of long-grain type varieties of current commercial interest 1) in tests conducted under conditions of controlled cool temperatures in growth chambers, and/or 2) in outdoor seedling cold tolerance trials seeded earlier than recommended for the Gulf Coast region. Stand density and stand ratings observed for Lemont and other varieties at Beaumont in 1981, 1982, and 1983 drill-seeded tests are presented in Table 2-2. Ratings from various water-seeded tests are shown in Tables 2-3 and 2-4.

Test Conditions

Table 2-1 results are averages of six tests for each variety except Newrex. The results are averages of two pregerminated and two dry-seeded growth chamber tests in sand at 12-15% moisture as the growth medium, and of two outdoor seedings in test beds with a sand-soil mixture.

The growth chamber tests were planted at a depth of 2.5 cm (1.0 inch) and conducted on cycle with a 12-hour day at 20° C (68° F) and a 12-hour night at 15° C (59° F); sand temperatures for these tests therefore approached a 63.5° F mean each day, or well below the 68° F minimum soil temperature at which germination and growth of recommended rice varieties can be expected to proceed normally (6). Optimum temperature for seedling growth of rice is in the range of 77 to 88° F (1,2,5,6).

The outdoor tests were seeded March 3 and March 8 at a depth of about 1-inch in excellent moisture and were observed for 29 days. Temperatures and other weather conditions during these tests were excellent for seedling vigor and cold tolerance evaluations. Nearby weather station recordings of daily soil temperature extremes showed midpoints ranging from 53.5-69.0° F during the outdoor tests. Midpoints were 63.5° F or above during 12 days of the test seeded March 3 and below 63.5° F for 17 days. Midpoints were 63.5° F or above for 9 days and below for 20 days during the test seeded March 8. Consequently, temperatures during the outdoor tests were less constant than those of the growth chamber tests. Effects of constant

TABLE 2-2. REGIONAL UNIFORM NURSERY PLANT SURVIVAL AND STAND RATINGS OF LEMONT VERSUS OTHER SEMIDWARF AND TALL LONG-GRAIN RICE VARIETIES, BEAUMONT, TEXAS

	No. Plants/ft²			Stand Rating[4]					
				1981[1]		1982[2]		1983[3]	
Variety	1982[2]	1983[3]	2-year Average	I	F	I	F	I	F
Labelle	37.4	39.8	38.6	—	—	7	0	3	0
Lebonnet	29.1	31.3	30.2	3	2	8	0	4	0
Lemont	24.8	34.7	29.8	4	1	8	2	5	0
Skybonnet	23.3	30.4	26.9	4	3	8	1	3	0
Leah	16.4	28.1	22.3	4	2	9	2	4	1
Bellemont	16.4	31.4	23.9	4	2	9	4	5	0
Newrex	14.1	30.9	22.5	4	2	9	4	3	0

[1]Seeded April 2, 1981; initial (I) and final (F) ratings taken 13 and 28 days after seeding (3 and 18 days after general emergence date for all test groups).

[2]Seeded April 7, 1982; stand counts taken 33 days after seeding and 11 days after emergence; initial (I) and final (F) ratings taken 21 and 43 days after seeding (1 day before and 21 days after general emergence date for all test groups).

[3]Seeded April 11, 1983; stand counts taken 28 days after seeding and 9 days after emergence; initial (I) and final (F) ratings taken 21 and 30 days after seeding (2 and 11 days after general emergence date for all test groups).

[4]Stands rated 0-9 scale; 0 = perfect stand; 9 = no stand.

TABLE 2-3. SEEDLING VIGOR RATINGS OF LEMONT VERSUS OTHER SEMIDWARF AND TALL LONG-GRAIN VARIETIES. BIGGS, CALIFORNIA*

	Seedling Vigor Rating[1]				
Variety	1979	1980	1981	1982	Average
Labelle	3.1	3.5	2.5	3.0	3.0
Lebonnet	5.0	5.0	3.0	3.8	4.2
Leah	3.9	4.0	2.8	2.5	3.3
Lemont	—	3.0	3.5	2.0	2.8
Skybonnet	5.0	4.0	3.2	2.5	3.7
Bellemont	2.8	2.0	2.5	2.0	2.3
Calif. Check	5.0	5.0	4.5	4.4	4.7

[1]Water-seeded; ratings 1-5 scale; 1 = very poor; 5 = excellent.

*Ratings courtesy H. L. Carnahan, California Co-operative Rice Research Foundation, Inc., Biggs, California

TABLE 2-4. SEEDLING VIGOR RATINGS OF LEMONT VERSUS OTHER SEMIDWARF AND TALL LONG-GRAIN VARIETIES, CROWLEY, LOUISIANA

	Seedling Vigor Rating[1]					
	N-Rate and Timing Tests[2]			Regional Uniform Nursery		
Variety	1981	1982	Average	1982	1983	Average
Labelle	6.0	4.4	5.2	4.0	6.0	5.0
Lebonnet	2.0	5.0	3.5	4.0	6.0	5.0
Leah	1.0	6.0	3.5	4.0	5.0	4.5
Lemont	—	2.0	2.0	6.0	5.0	5.5
Skybonnet	—	7.0	7.0	6.0	6.0	6.0
Bellemont	4.0	8.0	6.0	7.0	6.0	6.5
Newrex	4.0	—	4.0	5.0	7.0	6.0
L201 (CA Check)	1.0	2.1	1.6	5.0	4.0	4.5

[1]Water-seeded; ratings 1-9 scale; 1 = excellent; 9 = poor.

[2]Ratings averaged over N treatments.

*N-rate and timing test ratings from D. M. Brandon et al. *In:* 73rd, 74th Ann. Prog. Rpt., Louisiana State Univ. Rice Exp. Sta., pp. 31-133. 1981; pp. 52-158. 1982

Regional Uniform Nursery ratings from K. S. McKenzie et al. *In:* 74th, 75th Ann. Prog. Rpt., Louisiana State Univ. Rice Exp. Sta., pp. 6-27. 1982; 1983, unpubl.

versus alternating temperature cycles and initial cycle temperature on rice seed germination have been investigated (3).

Emergence indices used in these tests represent weighted values of numbers of emerged plants at succeeding stand counts. Higher values result from both early emergence and a high percentage of emergence (5).

Varietal Comparisons

Seedling emergence vigor data for Lemont in relation to Labelle, Lebonnet, Leah, Skybonnet, Bellemont, and Newrex are presented in Table 2-1. The varieties are listed in their order of relative emergence capability under cool temperature conditions. The order of listing in Table 2-2 reflects varietal survival rate in the Regional Uniform Nursery at Beaumont in 1982. The 1982 Uniform Nursery was subject to cold, wet weather during most of the month of April, which provided good conditions for cold tolerance evaluation.

Indices from the growth chamber tests and the outdoor trials indicate that Lemont is intermediate in emergence vigor in relation to the other listed varieties (Table 2-1). Labelle and Lebonnet are generally superior to all of the other varieties. Labelle exceeded Lebonnet in terms of emergence vigor, with higher EI values in four of the six tests contributing to the averages in Table 2-1, but showed higher emergence percentages in only three of the tests. Lemont is a semidwarf variety and generally showed lower emergence vigor than Lebonnet in these tests, but it should be noted that Lemont emergence percentages in one dry-seeded growth chamber test and both outdoor tests exceeded those of Lebonnet. Tolerance of the conditions prevalent during these tests, as shown by such high plant survival rates, indicate that good to excellent stands of Lemont may be established even under cool soil conditions. However, the time required for a high proportion of Lemont seedlings to emerge will exceed that of Lebonnet or Labelle when temperatures are low. Some similarity in emergence characteristics of Lemont and Lebonnet might be expected since Lebonnet is in the Lemont pedigree. (See Chapter 1, Lemont Characteristics and Performance.)

Final stand ratings of semidwarfs Lemont, Leah, and especially Bellemont, as well as the taller variety Newrex, were adversely affected by the cold conditions noted during April in the 1982 drill-seeded Regional Uniform Nursery at Beaumont. Lemont plots did eventually emerge to good stands in this test (Table 2-2). Seeding depths each year in this nursery are necessarily shallow, about one-half of an inch, because of the high capacity of the Beaumont Clay soil to retain moisture which, in excess, delays seedling emergence of both semidwarf and tall types. With minor exceptions, comparison of the initial and final stand ratings and the 1982 and 2-year average Uniform Nursery stand counts, suggests about the same order of emergence capabilities for these varieties as determined from the results in Table 2-1. Stands of Leah, Bellemont, and Newrex were the least satisfactory in 1982 but all were better in 1983. Among tall varieties, those which developed slowest at a constant 60° F in water-seeded growth chamber tests have also been found to have the lowest survival (4).

Lemont EI values were lower than those for Leah in two of the four growth chamber tests for which averages are shown in Table 2-1, but slightly greater than values noted for Leah in the two remaining growth chamber tests. Leah appeared to exhibit considerably greater emergence vigor than Lemont in the March 1983 outdoor tests. However, final emergence values for Lemont were 7-15% higher than those of Leah in three of the tests, as compared to 5-9% lower emergence values in two tests, from which the averages in Table 2-1 were derived. These results and the lower stand counts observed for Leah relative to Lemont in the 1982 and 1983 uniform nursery at Beaumont (Table 2-2) suggest that somewhat better stands may be obtained with Lemont than with Leah under less than ideal soil temperature conditions, particularly if relatively low temperatures are rather constant during the emergence period.

Skybonnet exhibited generally less emergence vigor and lower emergence percentages than Lemont in both pregerminated and dry-seeded growth chamber tests (Table 2-1). However, with the less constant temperatures observed in the March 1983 outdoor tests, emergence indices for Skybonnet, like those for Leah, were considerably higher than those of Lemont. Apparently the daily mean soil temperatures were high enough at times during the outdoor tests that taller varieties such as Skybonnet could respond faster than some semidwarfs. Since EI and plant survival values in Tables 2-1 and 2-2 for Newrex were also considerably lower than those for Lemont, it is evident that cold sensitive taller varieties have no advantage over more cold tolerant semidwarf types when low temperatures prevail during seedling emergence. In general, Lemont appears to show an advantage over both Skybonnet and Newrex in stand establishment characteristics at temperatures suboptimal for germination and growth, but Lemont may emerge to a full stand more slowly than Skybonnet when temperatures are higher during the emergence phase.

Even at temperatures favorable to seedling germination and growth, commercially available semidwarfs do not emerge as readily as taller varieties from drilled depths of 1 inch or more primarily because of poor mesocotyl elongation. Planting at a depth no greater than about three-fourths of an inch is therefore recommended for drilled seedings of Lemont and Bellemont in particular.

Water-Seeding

Seedling vigor ratings from water-seeded tests in California, where low water temperatures at seeding time are normally unfavorable to germination and seedling development of rice varieties recommended for the Gulf Coast region, placed Lemont below all of the taller varieties as well as the semidwarf Leah (Table 2-3). However, variation in the ratings suggests that varieties with intermediate seedling vigor are likely to be evaluated less accurately than those with very low or high vigor. It should be noted that the ratings shown in Table 2-3 represent stand establishment observations for the listed varieties when seeded in water and submerged during the entire emergence period.

The difficulty encountered in evaluating seedling vigor by subjective scale when test conditions vary too widely for true varietal response differences to be expressed consistently, is further illustrated by differences among varietal ratings over years and between tests in Louisiana water-seeded field trials, which were drained for several days immediately after seeding (Table 2-4).

Both Bellemont and Lemont have emerged to satisfactory stands in water-seeded fields along the Gulf Coast when seedings have been made using the latter method and with soil temperatures near 80° F or above. Early to mid-April planting dates should therefore be adhered to in order to gain full advantage of the inherently high yield potential of such semidwarfs by avoiding possible low temperature effects on stands which can make necessary the extra expense of reseeding.

Good seedbed preparation and maintenance of a shallow water depth initially when fields are permanently flooded are also important considerations to maximizing yields of Lemont, Bellemont, and other semidwarf varieties for either drill or water seedings. Delay of permanent flood by about 1 week longer for semidwarfs than for standard height varieties as related to tillering is discussed in Chapter 3, Semidwarf Field Performance.

SUMMARY

Stand establishment characteristics of the semidwarf rice variety Lemont and other long-grain varieties were evaluated in growth chamber and outdoor test environments. Temperatures during growth chamber tests and outdoor tests were well below optimum for seedling growth of rice. Percent emergence, stand count, and visual rating results show that good stands of Lemont may be obtained even under cool soil conditions. Lemont was intermediate in seedling vigor among long-grain varieties of current commercial interest for the region, emerging slowly relative to Labelle and Lebonnet, but considerably more rapidly than Bellemont and Newrex. Emergence rates for Lemont in tests with wide variation in daily soil temperatures were slower than those of Leah and Skybonnet; however, relatively high plant survival rates suggest that stands of Lemont will generally exceed those of either Leah or Skybonnet, particularly if low temperatures are constant during the emergence period. Points to consider when planting Lemont and other semidwarf varieties include: 1) good seedbed preparation (not too cloddy); 2) favorable soil temperature at seeding time (preferably early to mid-April); 3) planting depth no greater than about three-fourths of an inch for drilled seedings; 4) delay of permanent flood about 1 week longer than for taller varieties; and 5) maintenance of minimal permanent flood depth (3 inches or less).

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3

Semidwarf Field Performance

J. W. Stansel and A. D. Klosterboer

Producer trials of the semidwarf varieties provided important clues to economic production over a wide range of soil, weather, and cultural conditions. The weather patterns of 1983 were among the worst recorded for Texas rice production, yet, the semidwarfs performed very well. The cold dry conditions in April, the severe rain and hail storms of May, the high incidence of rain and dew in June, hot conditions in July, followed by hurricane Alicia in August and cold conditions in mid-September provided extreme tests for the semidwarf varieties. The performance of the semidwarfs (under producer conditions) illustrated stability, good yields, and high quality under widely varying growing and weather conditions.

Field Size

Rice producers receiving seed of the semidwarf varieties were requested to provide culture, yield, and quality data for both the semidwarfs and traditional varieties grown under similar conditions of soil, culture, and planting dates. Suggestions for growing the semidwarfs were provided to each grower. The producer field survey characteristics are summarized as follows:

Survey Field Size and Number

	Number of Fields	Field Size (Ac) Low	High	Mean	Total Acreage
Lemont	41	5	137	47	1,946
Bellemont	16	19	148	81	1,296
Labelle/Lebonnet	28	26	200	159	4,452

While not scientifically designed, the survey was large and diverse enough to be representative of the soil, culture, and weather conditions of the Texas Rice Belt.

Yield and Milling

The first crop yield and milling results from producer fields are summarized as follows:

Variety	Grain Yield (12% Moisture) (lbs/A) High	Low	Mean
Lemont	7,161	3,225	5,531
Bellemont	6,075	4,323	5,079
Labelle/Lebonnet	5,025	2,939	4,433

Variety	Milling Yields (in Percent) (Head/Total) High	Low	Mean
Lemont	68/73	50/71	60/70
Bellemont	66/73	60/70	64/72*
Labelle/Lebonnet	62/70	45/68	55/69

*May not be representative because of the small sample of milling results received for Bellemont.

All but five of the semidwarf fields were harvested after hurricane Alicia while most of the Labelle/Lebonnet fields were harvested before the hurricane. Lodging did occur under conditions when N rates were above 200 units of N and when winds were above 100 miles per hour (mi/h). Some lodging was observed in portions of fields where very high soil fertility conditions and heavy seeding rates occurred. Much of this lodging occurred where sheath blight was a problem. In lodged areas, the rice generally was not completely flat, but was leaning at about a 45-degree angle. Less than 7% shattering was observed in standing rice under wind conditions above 75 mi/h.

Seeding Rates

Seeding rates for the semidwarf varieties were generally low because of the limited supply of seed. The average seeding rate for Lemont was 70 lbs/A. In one 20-acre field, a 120 lbs/A seeding rate of Lemont was compared to Labelle planted under similar conditions (Figure 3-1). Lemont produced a dry weight of 6,500 lbs/A compared to 4,593 lbs/A for Labelle. This indicated Lemont would do well under normal seeding rates.

The ability to produce good yields under low seeding rates was very evident. The semidwarfs started tillering (stooling) at an earlier stage of development (4th leaf) than Labelle (5th leaf). Tillering was more prolific for the semidwarfs which compensated for the lower seeding rate. In the Katy area, several fields were planted at seeding rates of 50-55 lbs/A with 14 inches between drill rows. While yields were above 5,000 lbs/A, yield loss may have occurred. Some fields had problems

Characteristic	Compared to Labelle
Seeding rate	20-30 lbs/A less
Seedling emergence (drilled)	2-5 days slower
Seedling emergence (water seeded)	Same
Seedling survival	Better (except under soil crusting conditions)
Stooling (tillering)	Earlier and more vigorous
Water management	1 week delay to flood, more sensitive to flood over 3 inches deep during tillering
Herbicide	Need persistent herbicide
Fertility requirements	
Nitrogen	30 to 50 lbs N/A more
Other nutrients	Same
Lodging	Extremely resistant (except under disease conditions)
Shattering	Much less
Height	6-10 inches shorter
Maturity	10-18 days later
Harvesting	Slower
Milling yield	Comparable to slightly better
Ratoon crop	Comparable to slightly better

Figure 3-1. Characteristics of Semidwarfs.

with weed control as Lemont did not produce a full canopy until late under the wide spacing. However, one 80-acre field was planted at 46 lbs/A in 12-inch rows and produced 6,059 lbs/A. Only 4 of 41 fields reported poor stands. A 31-acre field having a poor stand was drill-planted over 2 inches deep on March 10. The soil crusted under very cold conditions before seeds could emerge but the field produced 4,842 lbs/A with an average stand count below five plants per square foot. Some fields exhibited leafing under the soil but still emerged satisfactorily. Uniformity of stand will be the major problem in stand establishment as final stands were generally satisfactory, but emerged over a long period under cool conditions. Final seed emergence was very good in most fields.

Planting Conditions

Field observations indicate that the semidwarfs produced good stands when planted less than three-fourths of an inch deep. Bellemont did particularily well under water planted conditions when the seed was covered less than one-half of an inch deep. It appeared that seeding rates could be reduced 20-30 lbs/A below traditional varieties when planted under similar conditions. By planting when soils are warmer, seeding rates as low as 60-70 lbs/A are possible under most planting conditions. However, when drill seeding, plantings should be less than three-fourths of an inch deep but planted into good soil moisture. Deeper planting increases the hazard of soil crusting before seedling emergence. Therefore, priority should be given to planting the semidwarfs when soil moisture conditions are good.

Planting Date

The average planting dates for the producer fields were April 8 for Labelle and April 11 for the semidwarfs. The cool, dry conditions of April delayed planting more than normal. Observations suggest that growers should plant the semidwarf varieties when soil conditions are warm (above daily minimum temperature of 65°F). The combination of low seeding rates with cool planting conditions could cause severe reductions in stands and poor weed control. The yields of semidwarfs do not drop off as severely under later planting dates as do traditional varieties. Therefore, there is less hazard and lower production costs associated with early to mid-April plantings. Plantings should be made before April 15 for highest probability of producing a satisfactory ratoon (second) crop.

Water Management

Water management for the semidwarfs should be altered from that used for traditional varieties. Semidwarf varieties can require 5-9 days longer than non-semidwarf varieties to reach a plant height that can tolerate a consistent flood. Reduced tillering occurred in several fields where water depth was 4 or more inches during tillering. Since tillering was a major contributor to yield under low seeding rates or low stands, shallow water (less than 3 inches) can increase yields, provided weeds are controlled.

Weed Control

The delayed and shallow flood requirements make weed control very important in maximizing economic yields of semidwarfs. Semidwarf fields averaged 2.2 herbicide applications while Labelle fields received 1.7 applications. However, with careful management of persistent herbicides, the semidwarf varieties should require the same number of herbicide applications as traditional varieties.

Disease Sensitivity

The semidwarf disease sensitivity may be greater due to higher N rates and the shorter plant height. The Lemont fields averaged 0.4 more applications of fungicide than the traditional varieties. However, one 100-acre field receiving no fungicide and which had severe sheath blight yielded 4,171 lbs/A. This indicated that losses under severe sheath blight can reduce semidwarf yields up to 30%. Producers should follow an intense fungicide program in fields where sheath blight may occur.

Harvest Characteristics

The harvest characteristics differed from the traditional varieties in several respects. Due to the nonshattering characteristic, the grain may be more difficult to thresh under high moisture conditions. The grain was harder to thresh in the mornings and afternoons when the moisture was higher in the straw. However, most producers did not feel threshing was a serious problem.

The separation of grain and straw in combining was more difficult. Even though the semidwarfs were shorter, the flag leaf extended above the heads. A dense leaf canopy located close to the heads was also characteristic of the semidwarfs. The leaves and stems had remained green at harvest which resulted in a higher moisture content. The combination of more and heavier leaf and stem made the separation of grain and straw more difficult.

The higher yields combined with the threshing and separation characteristics resulted in slower harvest speeds. With traditional varieties, harvest speed in nonlodged rice approached 3 mi/h. Under comparable conditions in semidwarf fields, producers reported combine speeds down to 1.5 mi/h. The average difference in combine speed was probably 1 mi/h. The nonlodging and nonshattering characteristics of the semidwarfs made them less vulnerable to severe weather than the traditional varieties. Thus, the harvest time was not as critical. The semidwarfs appeared to maintain good milling yields when field grain moisture was as low as 17%. However, milling yields may be reduced when grain moisture is rapidly reabsorbed under conditions such as midafternoon thundershowers.

Milling and Drying

The grain size of the semidwarfs was larger than Labelle and Lebonnet. This characteristic may require slightly longer time to dry than Labelle under comparable moisture and drying conditions. The drying characteristics have not been adequately evaluated as most grain was saved for seed and was not subjected to commercial drying and milling.

Milling yields of the semidwarfs was very good when compared to Labelle. Lemont averaged 3% higher head rice than did Labelle. One field of Lemont milled 68/73 (percent head/total), indicating a high potential for good milling quality. There was some variation in grain size, partly because of lower seeding rates. Grain size in this trial was probably due to lower seeding rates, but Lemont grain size may not be as uniform as Labelle. Milling yields of Bellemont were also very good, but the milling yields reported may not be representative because the number of fields sampled may have been too small and the fields were concentrated in one growing area.

Ratoon Crop

The cool spring of 1983 delayed the main crop, making ratoon, or second crop evaluation of the semidwarfs difficult. However, producers felt the regrowth characteristics of the semidwarfs were good and they indicated ratoon crop performance should be comparable to Labelle. Several semidwarf ratoon fields produced about 300 lbs/A more than Labelle under comparable conditions. However, this may not have been a true comparison because ratoon crop yields of Labelle were also much lower due to the late season.

Five Lemont fields totaling 312 acres averaged 1,368 lbs/A (12% moisture) for ratoon crop yields. One 80-acre field reported 1,771 lbs/A (12% moisture). These reports, while limited, indicate that Lemont has good potential for economical ratoon crop production. For consistent second crop potential, semidwarfs should be planted before April 15, and harvested before August 10.

SUMMARY

The field performance of the semidwarf varieties across the Texas Rice Belt was very good. Lemont yields averaged 1,000 lbs/A more than Labelle and Lebonnet under comparable producer growing and management conditions. Head rice yields of the semidwarfs averaged 3% higher than Labelle. The semidwarf production practices and harvest characteristics are different from traditional varieties and do require additional management inputs. Stands at seeding rates lower than traditional varieties did not appear to be a problem in most fields. With some precautions, stands should not be a problem with Lemont. Economic production of semidwarfs will require some modifications in cultural practices to reach full economic potential. The semidwarf varieties, especially Lemont, appear to have a wide range of adaptability under good management conditions. A summary of semidwarf characteristics compared to those of Labelle are shown in Figure 3-1.

4

Fertilizer Management for Semidwarfs

F. T. Turner

Advantage of Lodging Resistance

The lodging resistance of semidwarf plant types like Lemont and Bellemont allows the application of higher nitrogen (N) rates and thereby maximizes the yield potential of these varieties. Semidwarf varieties will not reach their potential yield if they become N deficient during the growing season.

Table 4-1 shows that 1,000 lbs/A yield losses can occur when N deficiencies are not corrected. Fertilizer Treatment A (105 lbs N/A) allowed Lemont to become N deficient. Correcting the N deficiency by topdressing with an additional 45 lbs N/A at panicle differentiation (PD) growth stage (Treatment B) increased Lemont yield about 1,000 lbs/A (6.1 bbls.). Panicle differentiation is defined as the growth stage when 30% of the main culms have panicles at least one-sixteenth of an inch (2 mm) in length. Delaying topdressing until heading (Treatment C), or 2 weeks after heading (Treatment D) failed to overcome the adverse effects of N deficiency at the PD stage.

Nitrogen rates of 140 lbs/A (Treatment E) rather than 105 lbs/A (Treatment A) minimized the N deficiency occurring at PD. Under the conditions of Treatment E, topdressing with 60 lbs N/A at PD (Treatment F), had little effect on increasing yield and demonstrated that good yields of Lemont can be obtained with only 140 lbs N/A under some conditions.

Nitrogen Rates and Times of Application

Based on all available fertilizer response data and field experience, the optimum N rate for maximum Lemont and Bellemont yield in Texas appears to be 150-170 lbs N/A. Since N requirements vary with weather conditions and planting date, one way to express the N requirement of Lemont and Bellemont is that they require from 30-50 lbs more N than would be applied to Labelle under similar growing conditions. For example, assuming Labelle generally requires 120 lbs N/A, the semidwarfs would need 150-170 lbs N/A for good first crop yields. Figures 4-1 and 4-2 show that 150 lbs of N generally produced yields similar to those achieved with 200 lbs N/A. These data should discourage use of 200 lbs N/A and encourage use of 150 lbs N/A; which would decrease cost and reduce the potential for disease problems associated with 200 lbs N/A.

Figures 4-1 and 4-2 indicate that time or frequency of applying 150 or 200 lbs N/A had little effect on yield of Lemont, possibly because all experiments were planted relatively late after April 15. Even though Figures 4-1 and 4-2 do not show it, remember that high rates (45 or more lbs N/A) of preplant N will usually be wasteful under cool conditions when rice plants grow slowly and require little N. High rates of preplant N can be efficient for later planting and warm weather.

When using these data to help develop a fertilizer program for

TABLE 4-1. YIELD RESPONSE OF LEMONT PLANTED APRIL 12, 1983 AT BEAUMONT WHEN 45 OR 60 LBS N/A WERE TOPDRESSED AT PANICLE DIFFERENTIATION (PD), AT HEADING (HD), AND 2 WEEKS AFTER HEADING (HD + 25 WKS) ONTO 105 OR 140 LBS OF PREVIOUSLY APPLIED N, RESPECTIVELY. TOPDRESSING INCREASED YIELD MOST WHEN N DEFICIENCY (TREATMENT A) WAS CORRECTED BEFORE HEADING (TREATMENT B)

Fertilizer Treatment	Total N	N rate at various growth stages (lbs/A)					Yield (1,000 lbs/A)
		PP	PF	PD	Hd	Hd + 2 wks	
A	105	45	60	0	0	0	6.1
B	150	45	60	45	0	0	7.1
C	150	45	60	0	45	0	6.2
D	150	45	60	0	0	45	6.2
E	140	60	80	0	0	0	7.1
F	200	60	80	60	0	0	7.2
G	200	60	80	0	60	0	6.8
H	200	60	80	0	0	60	6.8

(On following pages.)
Figures 4-1 and 4-2.
Yield response of Labelle, Skybonnet, and Lemont to 0, 100, 150, and 200 lbs N/A. Percent of N applied at a given growth stage is shown at bottom of graph. These results were obtained in 1983 at the four locations and planting dates shown.

Figure 4-3.
Yield response of Labelle, Bellemont, and Lemont to 0, 120, and 150 lbs N/A applied at rates and growth stages shown at bottom of graph. These results were obtained in 1982 at the three locations and planting dates given.

(Centerfold)
Lemont Genealogy Chart

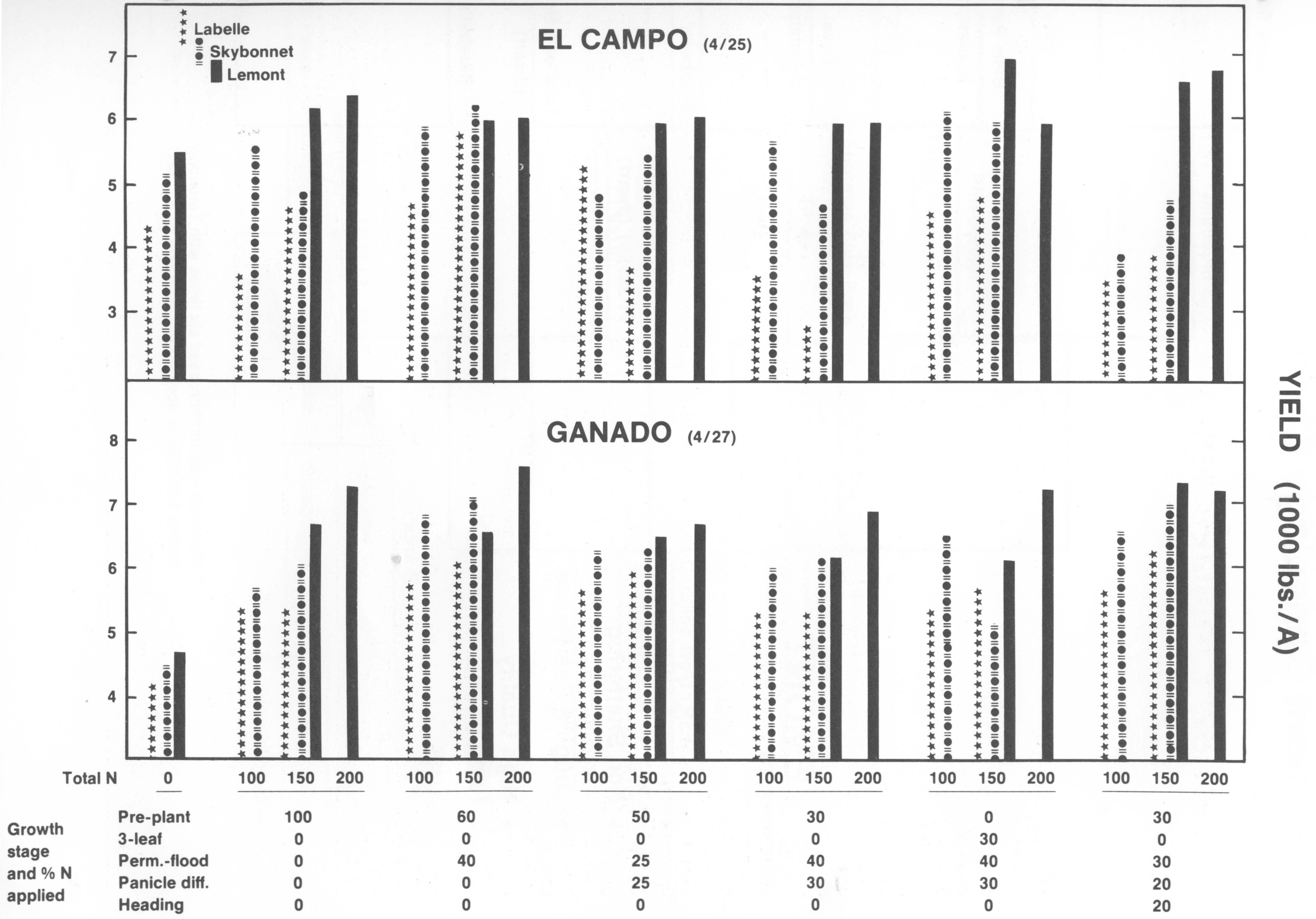
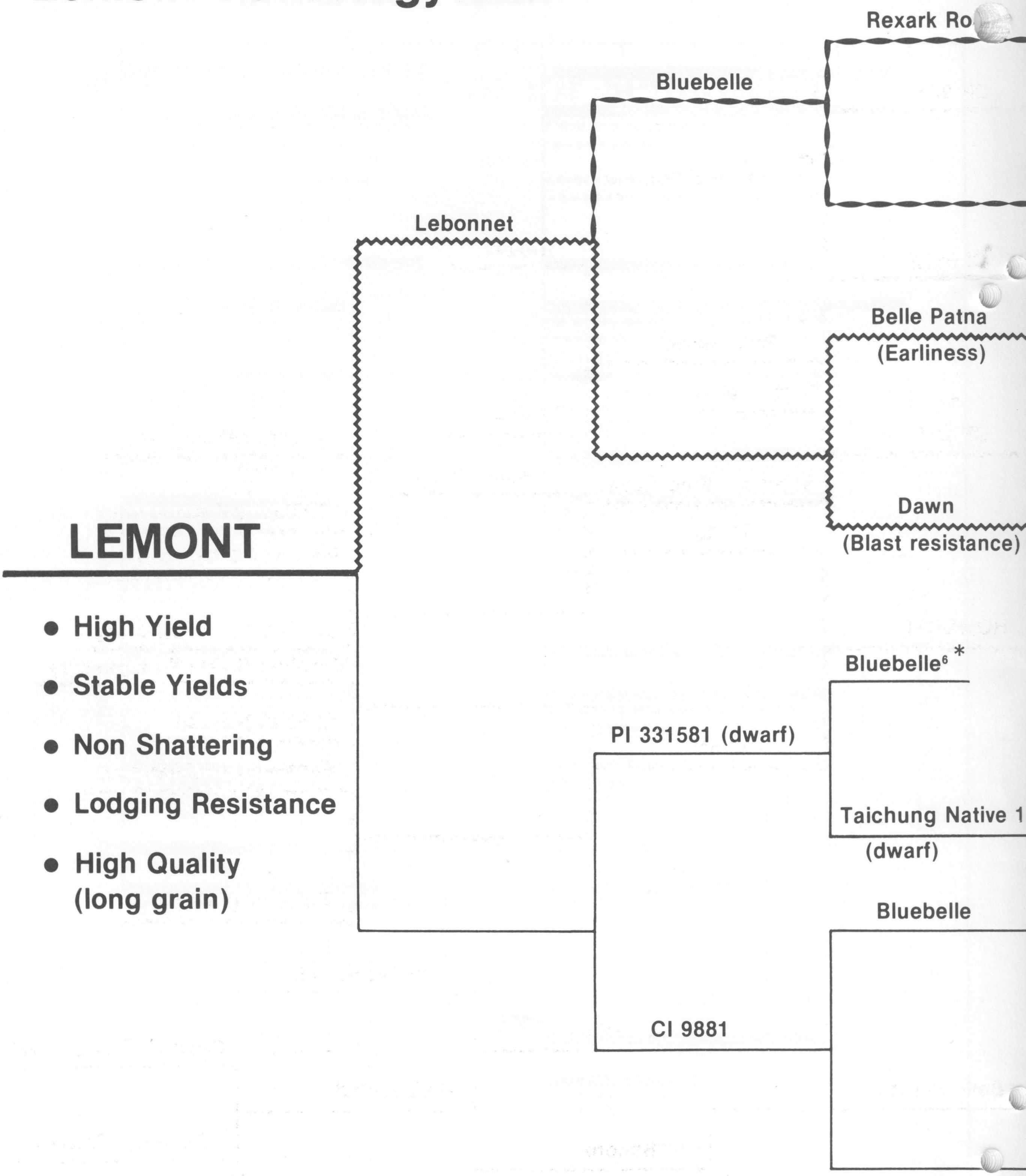
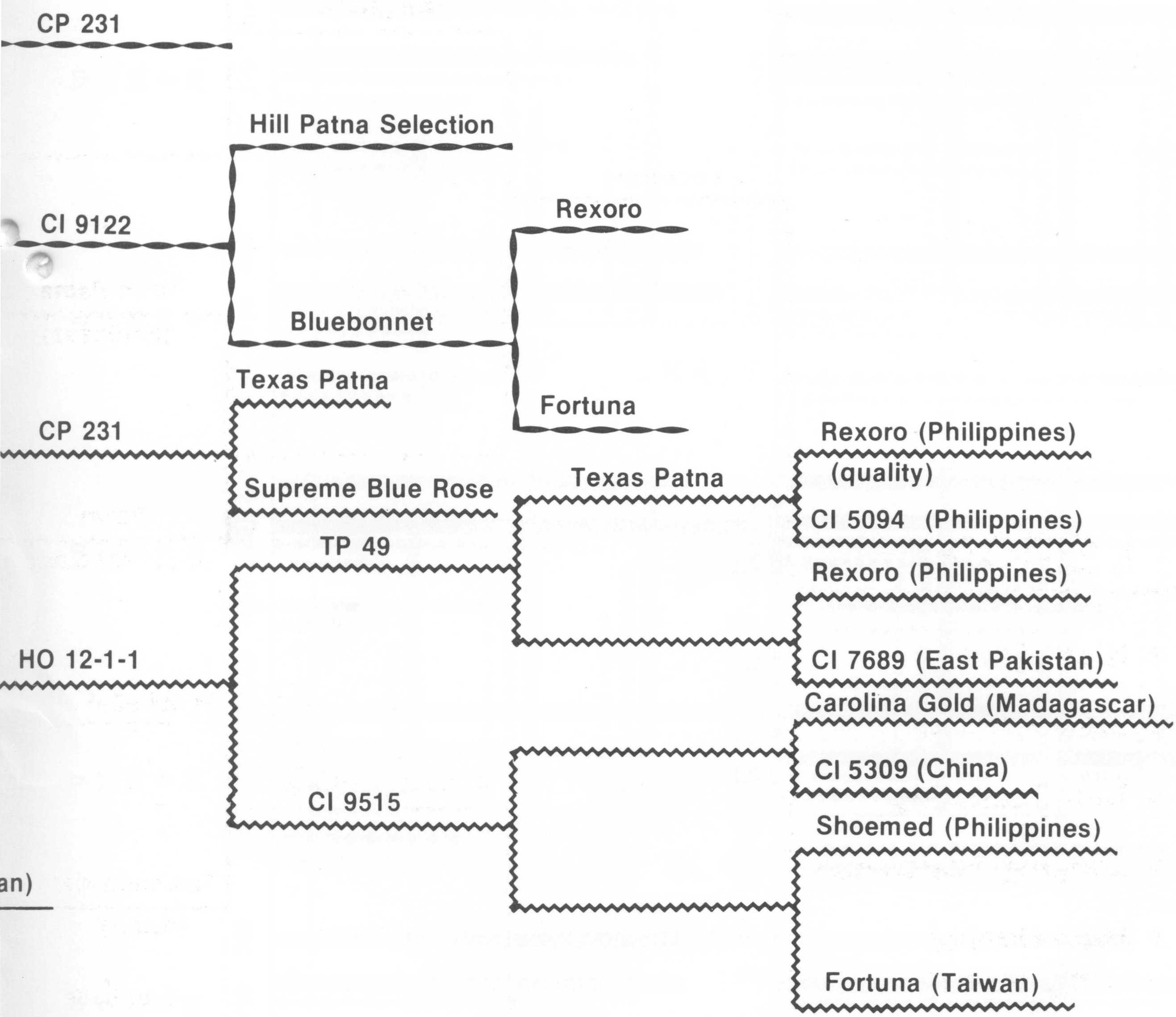

EL CAMPO (4/25)
GANADO (4/27)
Labelle
Skybonnet
Lemont
YIELD (1000 lbs./A)
3
4
5
6
7
8
Total N
0
100 150 200
100 150 200
100 150 200
100 150 200
100 150 200
100 150 200
Growth stage and % N applied
Pre-plant 100 60 50 30 0 30
3-leaf 0 0 0 0 30 0
Perm.-flood 0 40 25 40 40 30
Panicle diff. 0 0 25 30 30 20
Heading 0 0 0 0 0 20

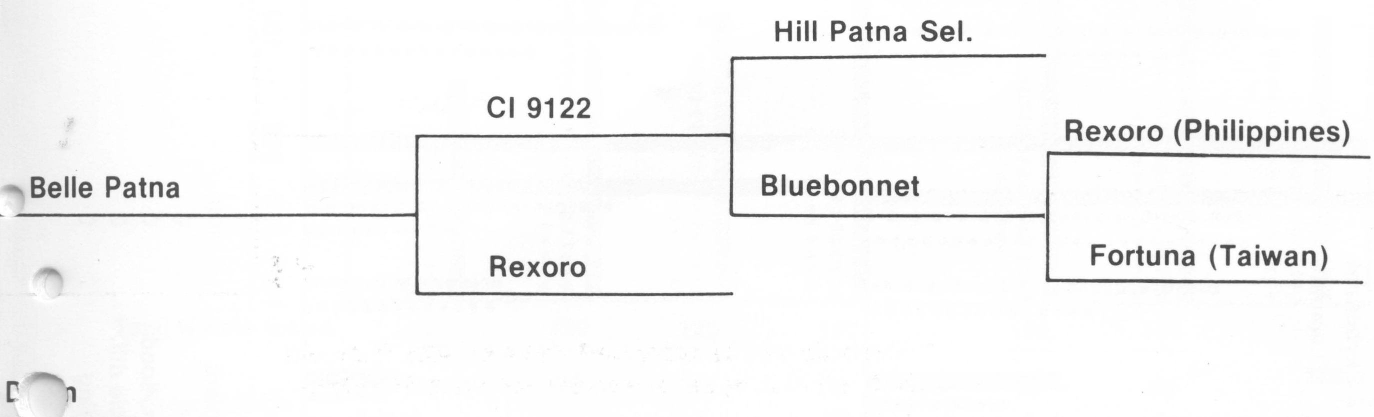
Figure 4-1

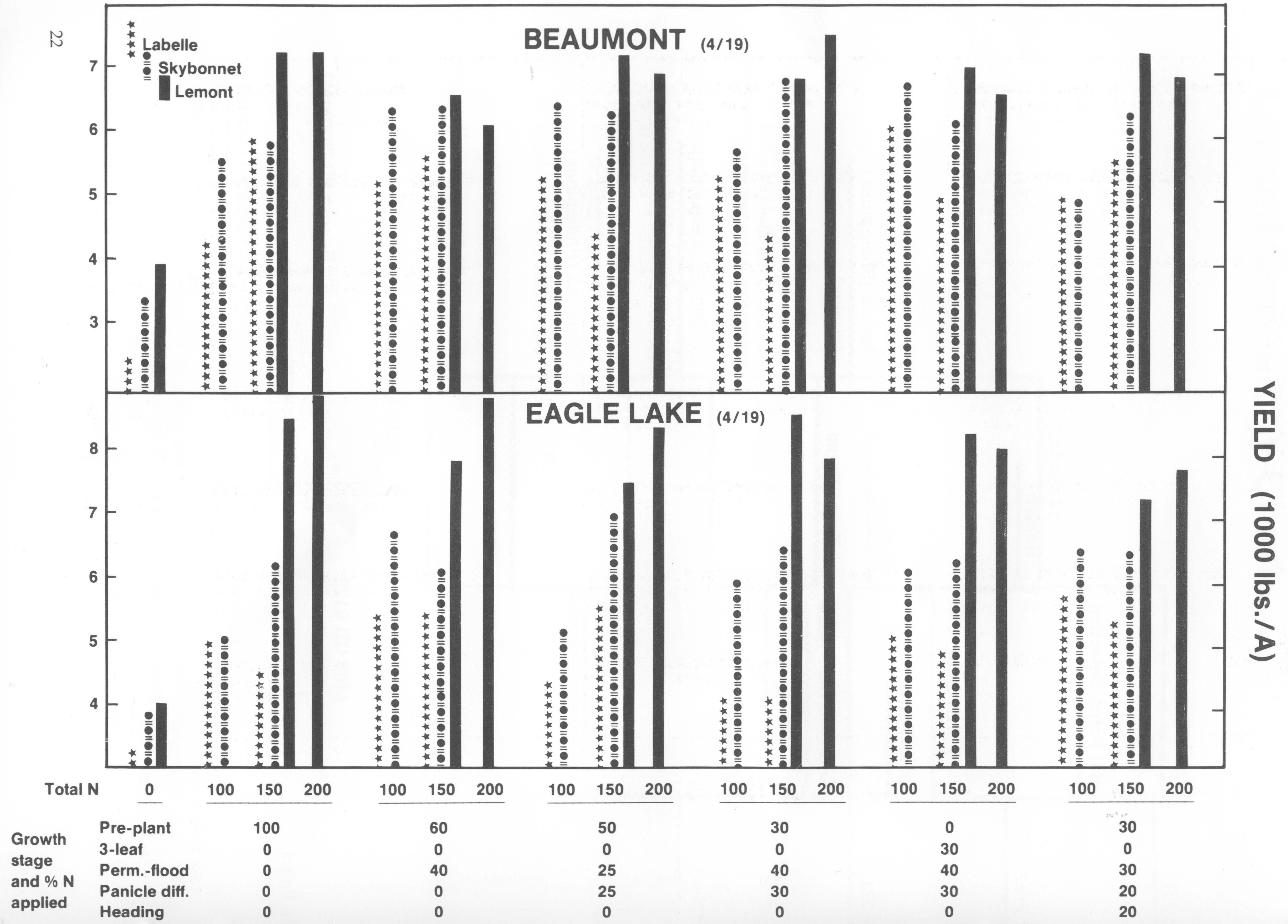
Lemont Genealogy Chart



* Bluebelle was backcrossed six times with Taichung Native 1 at IRRI to develop the selection PI 331581.


CP 231
Hill Patna Selection
CI 9122
Rexoro
Bluebonnet
Texas Patna
Fortuna
CP 231
Rexoro (Philippines)
(quality)
Supreme Blue Rose
Texas Patna
CI 5094 (Philippines)
TP 49
Rexoro (Philippines)
HO 12-1-1
CI 7689 (East Pakistan)
Carolina Gold (Madagascar)
CI 5309 (China)
CI 9515
Shoemed (Philippines)
an)
Fortuna (Taiwan)

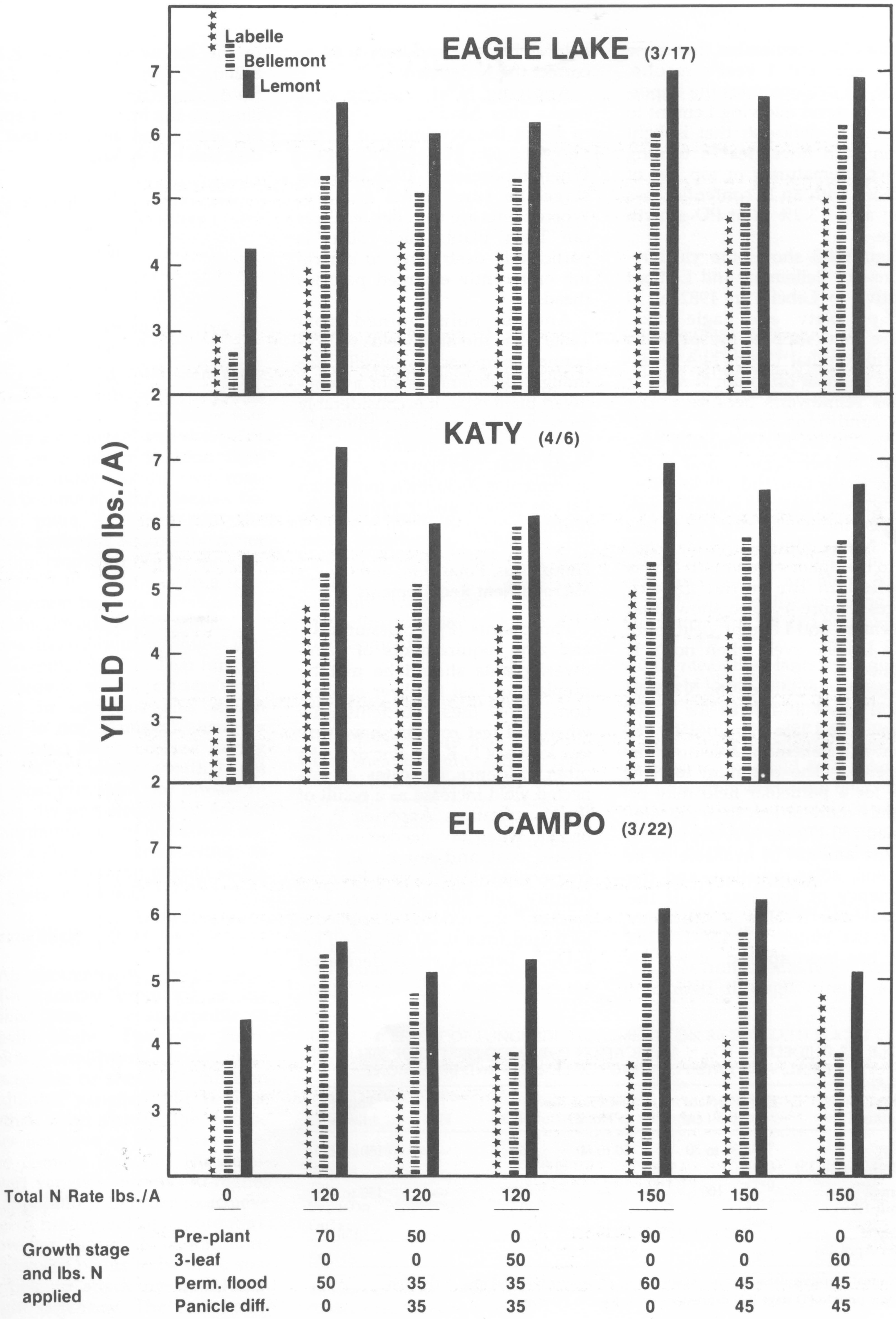

Hill Patna Sel.
CI 9122
Rexoro (Philippines)
Belle Patna
Bluebonnet
Rexoro
Fortuna (Taiwan)



Labelle
Skybonnet
Lemont
BEAUMONT (4/19)
EAGLE LAKE (4/19)
3
4
5
6
7
8
YIELD (1000 lbs./A)
Total N
0
100 150 200
100 150 200
100 150 200
100 150 200
100 150 200
100 150 200
Growth stage and % N applied
Pre-plant 100 60 50 30 0 30
3-leaf 0 0 0 0 30 0
Perm.-flood 0 40 25 40 40 30
Panicle diff. 0 0 25 30 30 20
Heading 0 0 0 0 0 20

Figure 4-2

Figure 4-3



Labelle
Bellemont
Lemont
EAGLE LAKE (3/17)
KATY (4/6)
EL CAMPO (3/22)
YIELD (1000 lbs./A)
7
6
5
4
3
2
Total N Rate lbs./A
0
120
120
120
150
150
150
Growth stage and lbs. N applied
Pre-plant 70 50 0 90 60 0
3-leaf 0 0 50 0 0 60
Perm. flood 50 35 35 60 45 45
Panicle diff. 0 35 35 0 45 45

Lemont, also remember that these data represent 1 year's results. Table 4-1 demonstrates the importance of never allowing Lemont to become N deficient; that is light green with lower leaves turning brown prematurely or top leaf of Lemont with an N content of less than about 3.2% N at PD growth stage.

Figure 4-3 shows the yield response of Bellemont and Lemont relative to Labelle in 1982 at El Campo, Katy, and Eagle Lake. These data support the previous conclusion that 150 lbs N/A represents the near optimum N rate for Texas semidwarfs because under the conditions of these experiments 150 lbs N/A generally produced higher Lemont and Bellemont yields than did 120 lbs N/A. The growth stage at which N was applied influenced rice yields less than N rate, although yields tended to be higher when more N was applied in the initial growth stages. Figure 4-3 also shows that Bellemont and Lemont yield more than Labelle even when no N is applied.

General guidelines for N application times and rates for early, normal, and late plantings of Lemont and Bellemont are shown in Table 4-2. The optimum total N rate for a particular field may be slightly more or less than the suggested 150-170 lbs N/A depending on the amount of available N in the soil, solar radiation, and the efficiency of fertilizer N. If the semidwarfs develop N deficiency after the suggested 150-170 lbs N/A has been applied, it will be helpful to apply additional N to correct the N deficiency.

Applying N at heading or 2 weeks after heading, was shown to speed the development of the ratoon crop by 10 days to 2 weeks. When topdressing after heading stage, be sure plants are dry. When plants are wet, dry fertilizer can "burn" plants. Such "burn" is particularly destructive to emerging or recently emerged panicles (heads).

Another point gained from Table 4-2 is the high yields of Skybonnet compared to Labelle. Although Skybonnet is not a semidwarf plant type, it is considerably more lodging resistant than Labelle. Current information suggests that Skybonnet's N requirement is 20-30 lbs/A more than Labelle grown under similar conditions.

Phosphorus, Potassium, and Micronutrient Requirements

Phosphorus (P), Potassium (K), and zinc requirements of semidwarf plants should be met by preplant or first fertilizer application. Apply these nutrients only when soil test reports show very low levels of P, K, or zinc or when other evidence indicates an expected yield increase as a result of their application. Applying P, K, or zinc when not needed will increase cost and sometimes decrease yield. Data from a Brazoria County soil having a very low level of P showed that as applied P increased from 0, 20, 40, 54-65 lbs P_2O_5/A, Lemont yields decreased in the following fashion: 8,200; 8,200; 7,300; 7,100; and 7,000 lbs/A, respectively. These results illustrate the importance of applying only those nutrients that are deficient in a specific soil.

TABLE 4-2. GUIDELINES FOR N APPLICATION FOR GOOD FIRST CROP YIELDS OF EARLY, NORMAL, AND LATE PLANTINGS OF LEMONT AND BELLEMONT

Planting Time	Preplant to 3-Leaf	Just Prior to Flood	PD	Hd	Total N lbs/A
Early (before March 15)	30 to 50	50 to 80	50	—	150 to 170
Normal (April 1)*	100	—	50**	—	150 to 170
Delayed (after April 15)	100 to 150	0 to 50	—	—	150

* "Normal" planting dates may be slightly earlier on sandier soils and west of Houston.

**Apply prior to PD stage if N deficiencies occur prior to PD stage.

5

Disease Control

N. G. Whitney and R. K. Jones

HISTORICAL PERSPECTIVE

Rice diseases did not seem to be as much of a problem in the 1950's and 1960's. The rice producer was usually a cattleman and rice fields were on a longer rotation than they are today. As the crop rotations became shorter, diseases became more prevalent. In the 1970's, soybeans became the major rotation crop with rice on the Gulf Coast. Soybeans fit well in a rotation system because it was an agronomically adapted crop with only one disease-causing fungus that was common to rice. That fungus, *Rhizoctonia solani,* causes aerial blight in soybeans and sheath blight in rice. Damage caused by the fungus has increased during the 1980's, making sheath blight the most prevalent rice disease in Texas. Its persistence and spread is attributed to its soil-borne nature and its overwintering as sclerotia, which can remain viable for years in the soil.

Sheath Blight

All commercially grown long-grain varieties produced in the United States are susceptible to sheath blight. The new high-yielding semidwarfs are not more susceptible to sheath blight than traditional varieties, but because of their short stature, the disease does not have as far to travel before damage is done. The semidwarf varieties respond to higher N applications in order to achieve their high-yielding potential. However, heavy N applications predispose plants to be more susceptible to attack by the sheath blight organism. The new semidwarf varieties need protection from this disease.

The susceptibility of Lemont to sheath blight is the result of several factors. With optimum seeding rates and suggested N fertility, an upright but compact canopy of foliage results. This compact canopy is also influenced by the increased tillering capacity of the new semidwarfs. While a full canopy develops later than with traditional varieties, it does hold moisture which can produce a microclimate suitable for fungus development.

Yield Losses to Sheath Blight

The potential for losses in yield from sheath blight can be partitioned into lodging losses and direct yield losses from damage to leaves and culms that reduce grain filling. Lemont is resistant to lodging but can lodge when infected with sheath blight. The dense canopy of the new semidwarfs traps humidity and creates longer dew periods which favor growth and parasitism of the hyphae of the fungus and also favor the plant-to-plant spread of the fungus. As a result, foliar damage and lodging patterns caused by sheath blight may become the most recognized symptom of this disease.

Although sheath blight eventually kills the rice plant, the slow process allows the plant time to produce some grain in the panicle.

However, such grain may be poorly filled and have reduced milling quality. Yield losses in severe cases usually are about 30%. In Table 5-1, the disease rating for the control was 7.4 and had a yield loss of 23% . A disease rating of 9 would mean the plants were dead, and yield losses would be approximately 30% at the time of rating. Fortunately for the producer, sheath blight occurs in spots or patches in the field and usually not uniformly across the field. The data in Table 5-1 shows what yield losses a producer might sustain in sheath blighted areas of his field.

DISEASE MANAGEMENT

Cultural Practices

Losses from sheath blight can be minimized through careful inte-

TABLE 5-1. EFFECT OF FUNGICIDE TREATMENTS ON RICE SHEATH BLIGHT CONTROL AND YIELD IN INOCULATED PLOTS.

Treatment	Rate/A Formulated	Sheath blight[a] Control	Yield lbs/A	Yield Diff. from Control lbs/A
Control (untreated)	-	7.4	3807	-
Benlate	1.0 lb	4.8	4430	623
Tilt	8.0 oz.	1.1	4710	903
SuperTin	10.0 oz.	2.5	4319	512
DuTer	1.0 qt.	1.5	4431	624
LSD.05		1.0	380	

All values are the mean of four replications over 2 years.
[a]Disease rating 0-9; 9 most severe.

gration of an overall disease management program. Field selection will play an important role in minimizing losses. Fields for semidwarf production should be selected carefully. Fields with a history of the disease should be avoided. When possible, avoid planting semidwarf rice varieties in fields that have been rotated with drill row soybeans. Control grass weeds in production fields. Broadleaf signalgrass *(Brachiaria platyphylla)* and barnyardgrass *(Echinochloa crus-galli)* are both hosts of *Rhizoctonia solani* and will further serve to spread and maintain the disease. Excessive seeding rates and high N applications should be avoided in fields with a history of sheath blight. Long-term rotations are effective in reducing the incidence of sheath blight, but both soybeans and sorghum are susceptible to the fungus. Rotations with wheat or pasture grasses can reduce sheath blight if practiced for 2 years. Deep plowing (moldboard) of fields with a history of sheath blight may also be effective in reducing losses.

DISEASE MANAGEMENT

Fungicides

Foliar fungicides have proven effective in reducing losses from sheath blight. Triphenyltin hydroxide (TPTH) has been effective in reducing both the incidence and severity of sheath blight. Texas producers have utilized TPTH fungicides to reduce losses from sheath and stem diseases for the past 3 years through temporary registrations. While the future registration of these materials is uncertain, a single application at panicle differentiation is recommended if labeling is available.

Promising systemic fungicides are now becoming available. Some of these not only protect the plants through systemic circulation of the active chemical but are therapeutic. Triphenyltin hydroxide is a contact fungicide rather than a systemic, and is considered a protectant. It has been effective on stem diseases in part because of the continual leaching of the product down the stems after a rain or heavy dew. However, it has no therapeutic properties. Benomyl (Benlate) is systemic and has been a standard for rice disease control since its release in 1976. Benomyl does provide suppression of sheath blight when applied at the proper time. A new systemic rice fungicide, propiconazol (Tilt), will likely be available to producers in the near future. This fungicide not only controls sheath blight effectively, but most of the other leaf diseases as well. Future fungicides will be systemic types because of the advantages they offer in plant disease control.

Examples of how well these fungicides perform are found in Table 5-1. These data are from inoculated plots. Plots are inoculated so that there is a uniform disease pressure for each fungicide evaluated. A 2-year average shows that each of the fungicides exhibited yield differences significantly higher than the untreated control. Tilt had the highest yield increase and the lowest average rating. Disease ratings under 3.0 are very good, whereas, ratings of 5.0 or higher usually produce little yield increases. It is interesting to note that Benlate does not produce good disease ratings, but applications result in significant yield increases.

Other Diseases

Benlate continues to do an excellent job in controlling blast. However, *Cercospora* has become resistant to the fungicide in much of the rice area west of Houston. Tilt controls the two *Cercospora* diseases, narrow brown leaf spot and brown blotch, and also brown leaf spot caused by *Helminthosporium oryzae*.

There is no chemical control for kernel smut (*Neovossia horrida*) at the present time. Each grain showing disease symptoms is a separate infection from an airborne spore. The semidwarf varieties are shorter in height than traditional varieties, hence bringing the panicle closer to the flood where the airborne spores originate. This could make the semidwarfs more vulnerable to the disease, but at present no data are available on the effect of this disease on semidwarfs.

Further discussions concerning the disease resistance and susceptibility characteristics of the semidwarfs are found in Chapter 1, Lemont Characteristics and Performance. Contact the local County Extension Agent or Extension Plant Pathologist for the latest information concerning fungicides that are cleared for use and their proper application.

6

Water Management

G. N. McCauley

The growth characteristics of the semidwarf varieties require special water management consideration at specific stages of plant development and growth.

There are at least three characteristics of the semidwarf varieties that require special consideration in their water management. (l) Semidwarf varieties may require from 2-5 additional days to emerge than traditional varieties when the seed is covered more than three-fourths of an inch deep. Little difference in emergence time is noted when seed is covered less than one-half of an inch deep. (2) The semidwarf growth characteristics result in a longer growth period to reach sufficient height for permanent flood irrigation than traditional varieties. (3) The improved tillering (stooling) characteristics of the semidwarfs can be reduced when water depths greater than 3 inches are held during active tillering. This chapter discusses these and other characteristics in more detail.

Planting

During stand establishment, water management for conventional varieties will also be acceptable for the semidwarfs. Water seeding procedures for semidwarfs should be similar to those of other varieties. With good seedbed preparation, few problems have been observed in the water seeding of semidwarfs.

Planting early under cool soil conditions should be avoided with the semidwarfs due to the slower seedling emergence and slower growth. Conditions of cloddy seedbed or "mudding in" operations could be detrimental to the semidwarfs because of seed being placed too deep. Consideration should be given to planting other varieties under these conditions. Semidwarfs should be planted under good conditions to maximize their economic potential.

Drill seeding semidwarfs requires special attention. Semidwarfs, if drilled, should be planted to a shallow depth, generally less than three-fourths of an inch, especially in crust prone soils. This means very shallow soil moisture is required if seed is to germinate without flushing or rainfall. The combined effect of these characteristics requires that the semidwarfs be given seeding priority in the management system; i.e., semidwarfs should be planted when the soil conditions are optimum.

Management at planting for drill seeding should be designed to avoid the necessity of flushing. Flushing on a soil that crusts could be severely detrimental to stand establishment. If planting conditions develop where flushing will be necessary for germination, seed should be only slightly covered. Flushing must be continued to keep the soil moist so that the crust strength is minimized. Flushing should be done rapidly so that the rice seed is under water the least possible length of time.

Flood Management

Flood establishment for semidwarfs is normally delayed 7-10 days later than traditional varieties. Observations and preliminary research indicate the duration of permanent flood irrigation for semidwarf varieties may be reduced. Table 6-1 shows the results of a producer field where water management was observed for Labelle and Bellemont. The growth period of the semidwarf was 10 days longer but days of permanent flood were reduced 12 days due to the later establishment of flood irrigation. Further research is needed to determine if this relationship will hold true over a range of conditions. The delay of flood establishment may require an additional flush irrigation. Flood establishment for thin stands should be delayed an additional 3-5 days to encourage tillering. Soil should be kept moist during this period. The degree of weed control and plant height will influence when the permanent flood should be established. The permanent flood should be delayed only when weed control is adequate.

Consideration should be given to leveling or smoothening fields and reducing field size for better water management of semidwarfs. Fields should be small enough to flush in 2-3 days and flood in 4-5 days. Flood depths should be kept at a minimum to maximize economic return and reduce water usage. Research has demonstrated that the shallowest flood (about 1 inch) produced the highest yield

TABLE 6-1. GROWTH, CROP DEVELOPMENT, AND FLOOD IRRIGATION PERIOD (IN DAYS)

	Avg.	Labelle	Semidwarf
Seeding to Maturity	119	116	126
Days of Flooding	66	70	58

TABLE 6-2. THE EFFECT OF DRAIN DATE ON RICE AGRONOMIC FACTORS

Date of Drain*	Mean Emergence Date	Mean Heading Date	Mean Plant Height (cm)	Mean Harvest Moisture (%)	Mean Dry Moisture (%)	Mean Yield (lbs/A)	Mean Lodged (%)	Mean Head Rice (%)
1	5-01-83	8-01-83	113.0	19.5	9.0	4989.6	27.7	45.1
2	5-01-83	7-31-83	113.3	18.4	8.8	4349.2	30.7	48.8
3	5-01-83	7-31-83	113.8	19.7	9.1	5407.8	36.2	52.4
4	5-01-83	7-31-83	113.7	17.9	8.7	5276.2	32.4	52.7

*1 = 7 days after heading (8-10-83) using Lebonnet for determining cultivar.
2 = 14 days after heading (8-17-83).
3 = 21 days after heading (8-24-83).
4 = 28 days after heading (8-31-83).

with all varieties (provided weeds were controlled).

Several factors should be considered in determining when to drain fields for first crop harvest. Research has shown that fields can be drained as early as 15-20 days after heading with no loss in yield or quality. Tables 6-2 and 6-3 illustrate the effect of drain date on various agronomic factors. Yields indicate the semidwarfs responded similarly to traditional varieties and the optimum drain was about 21 days after heading. On the average, head rice was not reduced by drain times as early as 21 days after heading. However, bad weather conditions late in the growing season, did have a greater influence on milling yields of some large grain varieties. Table 6-3 illustrates the semidwarfs outyielded and produced milling yields as good as other traditional Texas varieties under a range of early drain tests.

Ratoon crop (second crop) production can be significantly reduced by early draining of the first crop. Table 6-4 demonstrates the effect of early drain on ratoon tillering. Regrowth or tiller number is the most important characteristic for ratoon crop production. When planning to produce a ratoon crop, the flood should be maintained as long as possible to encourage ratoon crop regrowth but drained early enough to allow the soil to firm for harvesting.

Harvesting on firm ground is even more critical with the semidwarfs. Due to the very short height of the ratoon crop, rutting of the first crop can make ratoon crop harvest much more difficult than with traditional varieties.

TABLE 6-3. CULTIVARS RESPONSE TO AVERAGE ACROSS DRAIN DATES

Cultivar	Heading Date	Plant Height (cm)	Harvest Moisture (%)	Dry Moisture (%)	Head Rice (%)	Yield (lbs/A)
Lemont	8-06-83	104.7	17.8	8.3	57.6	5986
M-302	7-18-83	108.6	17.6	8.6	55.2	5541
Bellemont	8-03-83	93.2	16.8	8.6	58.7	5518
RAX-2414	8-08-83	114.3	19.0	9.2	42.5	5460
Pecos	7-25-83	112.7	—	9.2	55.6	5250
CB-785	8-03-83	107.1	17.4	8.7	53.2	5217
L-201	7-26-83	131.2	17.9	9.4	54.2	5130
CB-801	8-08-83	90.6	20.0	8.6	52.4	4961
Leah	7-27-83	112.3	19.9	8.9	46.7	4924
RAX-2408	8-08-83	116.1	19.9	8.3	46.1	4729
Skybonnet	7-28-83	121.3	18.3	8.6	54.8	4719
Labelle	7-25-83	130.9	21.0	9.5	57.0	4516
Lebonnet	8-03-83	134.8	21.1	9.4	49.6	4220
CB-744	8-04-83	110.6	18.5	9.3	48.0	3888

TABLE 6-4. EFFECTIVE RATOON TILLERS AS AFFECTED BY EARLY FIRST CROP DRAIN (TILLER PER FT^2)

		Drained (Days After Heading)			
Variety	Moisture	7	14	21	28
Labelle	20	4.00	7.50	6.50	12.50
Labelle	25	5.75	9.00	8.25	13.25
Lebonnet	20	4.75	7.00	6.25	9.00
Lebonnet	25	4.25	6.25	7.50	8.25

SUMMARY

Water management will play an important role in achieving the economic potential of the semidwarf varieties. At planting time, producers need to plant semidwarfs under as near optimum conditions as possible, which may require management priority over other varieties. The slower growth characteristics of the semidwarf varieties require that more attention be given to their water management. Seed should not be covered by more than three-fourths of an inch of soil. The permanent flood should be delayed 7-10 days and maintained at a shallow depth if weeds have been controlled. Fields should be drained early enough to permit harvesting on firm ground. The ratoon crop should be flooded as soon as possible, preferably the same day harvesting is completed and maintained at the minimum depth to control weed reinfestation and germinating rice seed.

Future planning and consideration should be directed toward making land as suitable as possible for economic semidwarf production. This might include precision

leveling, re-engineering water delivery systems, and reducing field sizes so flushing can be done in 2-3 days and flooding in 4-5 days. Precision leveling can not only benefit semidwarf production but can reduce water use and increase the amount of rainwater entraped and utilized in crop production. Multiple irrigation inlets can increase the speed in which fields can be flushed or flooded. If engineered properly, multiple inlets can provide more protection from levees bursting and help entrap more rainwater. Water conservation and utilization will be key factors in the economic production of semidwarf varieties.

7

Weed Control in Semidwarf Rice

E. F. Eastin and A. D. Klosterboer

The new semidwarf rice varieties such as Lemont and Bellemont will necessitate changing some cultural practices. However, research (3) has shown that weed control practices for Lemont are very similar to those for the standard varieties such as Labelle. The key to Lemont weed control is to determine what weeds are present in the field and the optimum time for herbicide application. Bellemont, because of its lower seedling vigor, will require even better management.

Weed control is one of the most important management aspects of rice production. Rice weed control consists of an integration, or combination of several aspects of production including cultural control, preventive measures, and chemical control, all designed to reduce the recurrence and competitive effect of weeds. It has been estimated that without herbicides weeds would account for a 70% reduction in yield of rice (1). With our present weed control practices, including herbicides, weeds still account for an average 17% yield reduction (2).

The rice crop is affected by weeds in several ways. They compete with the rice plant for the essentials of growth; i.e., light, nutrients, space, and water, thereby reducing the growth and production of the crop. Weed competition with rice has been shown to dramatically reduce yields (4, 5, 6, 7). If not controlled, weeds will interfere with harvesting operations and cause lodging of rice. Seed of several weed species cause low quality and financial loss to the producer. Some weed seed such as dayflower, morningglory, and red rice are very difficult to remove from the rice grain and therefore reduce quality and price. In addition to the direct effects of weeds on rice, many weeds also harbor disease organisms and insects which can attack the rice plant.

Weed histories of individual fields help in developing the best weed control practices for particular weed problems. A weed control program should be geared or designed to control the weeds which are present or expected to be present. The most cost efficient process in weed control is the time spent scouting the field and planning the possible control measures to be used.

WEED CONTROL PRACTICES

As stated previously, weed control in rice is a combination of several operations, many of which are necessary in the production of the crop. Proper timing and execution of many cultural practices needed in crop production will aid in controlling weeds. Changes in cultural practices for growing Lemont or other semidwarf rice varieties may necessitate a slight change in weed control strategies. These changes will be discussed as they occur.

Crop Rotation

One weed control practice that is often overlooked or downplayed is the practice of crop rotation for weed control. An intensified rice rotation tends to increase infestation of those weed species that are difficult to control in rice, such as red rice. In addition to weeds, a continuous rice rotation can also increase disease problems; therefore, a producer is inviting both weed and disease problems if he grows rice continuously in the same field. Research has shown that a rotation of 1 year rice and 2 years out of rice with crops such as soybeans or grain sorghum can greatly decrease the population of red rice in a field if proper weed control practices are followed in the rotation crop. By the same principle weeds that may be a problem in soybeans or grain sorghum, such as johnsongrass, can be adequately controlled with the flood management of rice production during a rotation.

Cultural Practices

Land Leveling.—Since Lemont and Bellemont are semidwarf rices with less seedling vigor than our conventional cultivars, level fields are needed to facilitate proper water management, as deep floods early in the season may adversely affect Lemont and Bellemont. Level fields also enhance weed control in that the fields have fewer levees, thus more of the area is in production and under flood. Land leveling also provides for more uniform distribution of water within the field, thus avoiding excessively dry or wet areas. This results in more even germination of weeds, as well as rice seed, thereby facilitating better chemical weed control. Weeds in different growth stages are more difficult to control.

Seedbed Preparation.—The type of seedbed prepared influences weed growth and weed control practices; however, the type of seedbed preparation depends on the anticipated seeding method.

For dry seeding the seedbed can be worked with a disk to remove existing vegetation. If this is done at 2- to 3-week intervals several times before planting, weeds will germinate and be destroyed by the next tillage operation, thus reducing the weed seed population in the soil. The final disking should be shallow so no additional weed seed are brought to the surface. The field is smoothed with a spiketoothed harrow or similar implement and the rice seed either drilled with a grain drill or broadcast. It is important from a weed control standpoint to have a well prepared seedbed with no large clods so that a herbicide can be evenly distributed over the area.

For water seeded rice the seedbed should be prepared so seed will not be covered more than three-fourths of an inch. If a vegetated field is flooded it can be worked in the water to destroy unwanted vegetation. The rice is then seeded into the water and the water removed from the field after germination of the rice.

The rough seedbed is usually not as weed free as a smooth seedbed, therefore, there are more existing weeds. As the larger clods are dissolved by the water, weed seed are released. The water saturated condition at planting retards germination of many weed seed, offsetting the rough seedbed; but the nature of the rough seedbed may result in an uneven growth or germination of weeds, thereby making them more difficult to control with herbicides later. After removal of the water from the field, water-seeded rice is cultured similarly to dry-seeded rice in that the flood is not applied until the rice is well established.

Seeding

From the weed control standpoint the primary concern in seeding is the use of good quality, weed seed-free, rice seed. Seeding rates that result in rice stands of 15-20 plants per square foot are optimum for both yield and competition against weeds.

The seeding method, whether drilled, broadcast on dry soil, or water seeded, has less influence on weeds and their control than other factors such as seedbed preparation, seeding rate, seed quality, water management, and other practices. One exception is an integrated red rice control program where red rice infestation is reduced in the rotation crop with proper weed control practices. Ordram* is applied preplant and incorporated into the soil. The field is flooded and presprouted rice seed is then water seeded. This prevents direct contact of the rice seed with concentrations of Ordram high enough to cause damage. By keeping the soil saturated during the growing season, germination of red rice and many other weeds is inhibited.

Planting date can have a profound effect on weeds and their control. Planting rice too early can result in rice that does not grow well due to cold weather, thus is unable to adequately compete with early germinating weeds such as barnyardgrass. Early planting of rice many times results in need for a herbicide application during cool (below 70° F) weather, thereby resulting in reduced activity of the herbicide. Late planting can also cause weed problems due to weeds such as dayflower germinating and growing faster than the rice. Rice planted at the optimum time germinates and emerges rapidly and is able to better compete with weeds.

Fertilizer.—Fertilizer rate and timing can have a significant effect on weeds and their control. For example, preplant or very early phosphorus application can stimulate weed germination and growth. Phosphorus application into the flood on water-seeded rice stimulates growth of algae and other aquatic weeds. One way to reduce this weed stimulation from phosphorus is to apply it the previous year in a rotation crop rather than in rice. Use only the amount of phosphorus needed; excess phosphorus can actually reduce rice yield.

Nitrogen timing also influences weed growth. The general practice is to split N into two or three applications. This is not only best for the rice plant but eliminates an excess of N available to stimulate weed growth early in the growing season. Nitrogen application can also be timed so that normal flooding or herbicide applications will help control the weeds stimulated by the N.

Water Management.—Changes in water management practices may increase weed pressure in Lemont and other semidwarf varieties. Semidwarf varieties may require a few days in flooding, thereby allowing another flush of weeds to germinate. The main weed control difference caused by the change in water management is the need to check semidwarf fields again before flooding. If a herbicide is needed, it should be applied at this time. The use of a residual herbicide such as Bolero, Machete, or Modown should be considered because of the additional soil exposure time from seeding to permanent flood.

Herbicides

While the above procedures will help with weed control, herbicides must be considered the backbone of a rice weed control program. Rice herbicides must be used properly to avoid rice injury, reduce or eliminate weed growth, and prevent harm to the environment. Herbicide registrations and labels constantly change. Current labels and information made available by commercial companies, the Texas Agricultural Experiment Station, and the Texas Agricultural Extension Service should be consulted for the most current information concerning rice herbicides.

Weed control programs which are effective for conventional varieties should be effective (with minor modifications) for semidwarf varieties. Table 7-1 compares several rice herbicide treatments for Lemont and Labelle. Herbicide applications effective for one variety are usually effective for the other also. In semidwarf production, consideration should be given to the use of a residual herbicide, either preemergence or in combination with propanil.

While many weeds infest Texas rice fields, the major weeds are barnyardgrass, dayflower, sprangletop, and red rice. Table 7-2 summarizes many of the herbicides available or under development for weed control in rice.

Barnyardgrass.—Barnyardgrass is the predominate weed in rice fields. Because of its wide distribution, it must be considered in any weed control program.

Ordram at 3 lbs/A preplant incorporated combined with water seeding gives good control of barnyardgrass and suppression of red rice.

Bolero at 4 lbs/A and Modown at 2-3 lbs/A preemergence gives fair to good barnyardgrass and dayflower control, while Modown gives good broadleaf signalgrass and mexicanweed control. In most situations, Bolero is a little safer on the rice than Modown, which under certain water management conditions can result in rice injury.

Propanil is the standard postemergence herbicide for control of grasses and many broadleaf weeds in rice. Barnyardgrass in the 1- to 3-leaf stage is usually controlled with 3 lbs/A; however, since propanil has no soil residual activity, barnyardgrass can quickly reinfest by germination of additional seeds. Therefore, fields must be watched closely for reinfestation as a second application may be required, particularly after a rain or flush has resulted in germination of new weeds. The addition of 2-3 lbs/A of Bolero, 2 lbs/A of Modown, 2-3 lbs/A of Machete, or 2-3 lbs/A of Ordram, to propanil increases the control of dayflower and sprangletop. Propanil plus Ordram has no preemergence activity, thus, a second application may be required. Addition of Bolero, Modown, or Machete will help control weeds germinating after application in addition to the increased postemergence activity.

Granular Ordram can be applied at 2-3 lbs/A active ingredient (a.i.) (20-30 lbs/A of 10 G) into the flood for the control of barnyardgrass less than 5 inches tall and at least two-thirds submerged until effective weed control is obtained, usually about 1 week. Granular Ordram can also be used post-flood for suppression of barnyardgrass 5-15 inches tall.

Dayflower.—Dayflower usually germinates in warm soil, quickly establishing heavy infestations. Dayflower usually does not germinate under saturated soil conditions, thus, infestation occurs before the flood; however, once germinated, dayflower will grow through a flood. Dayflower is a greater problem in late planted rice due to its warm temperature requirement for germination. Dayflower frequently germinates after the first propanil application and grows unnoticed until it becomes too large for effective treatment.

Bolero at 4 lbs/A or Modown at 2-3 lbs/A preemergence will give fair to good control of dayflower.

Postemergence treatments that effectively control small dayflower, when properly applied, include Basagran at 0.75 lbs/A, Ordram plus propanil at 2-3 plus 3 lbs/A, Bolero plus propanil at 3 plus 3 lbs/A, Machete plus propanil at 2-3 plus 3 lbs/A, and Modown plus propanil at 2 plus 3 lbs/A. Propanil is usually needed in these treatments to give increased barnyardgrass control. Also, Basagran will control large dayflower provided adequate coverage is achieved. Post flood

TABLE 7-1. EFFECT OF SELECTED HERBICIDES ON WEED CONTROL, INJURY, AND YIELD OF LABELLE AND LEMONT RICE AT BEAUMONT, TEXAS, 1983.

	Rate		Lemont			Labelle			Yield (lbs/A)	
Chemical	(lbs/A)	TOA	Rice	JR	BLSG	Rice	JR	BLSG	Lemont	Labelle
Check	0	None	0	0	0	0	0	0	3872	3050
Bolero	4	LPre	0	68	24	4	97	50	4565	3871
Modown	3	LPre	0	64	45	0	89	96	4169	3714
Propanil	3	EP	0	80	94	0	98	98	4735	3470
Ordram + Propanil	3 + 3	EP	0	95	95	0	98	98	4702	3777
Bolero	3	EP	0	56	20	0	72	72	3352	3294
Bolero + Propanil	3 + 3	EP	0	94	95	0	98	98	5324	3021
Modown	3	EP	0	73	88	0	74	74	3941	3050
Modown + Propanil	3 + 3	EP	0	69	93	0	98	98	4284	4017
Machete + Propanil	3 + 3	EP	0	89	95	10	98	97	4304	2452
Prowl + Propanil	1 + 3	EP	0	93	93	0	98	98	4236	3614
CV			312.9	35.9	37.3	66.7	27.0	34.3	18.6	9.2
LSD.05			NS	37	35	9	32	37	975	426
LSD.01			NS	49	47	12	42	50	1296	569

1) TOA = time of application; LPre = late preemergence; EP = early postemergence; rice = rice injury; JR = junglerice; BLSG = broadleaf signalgrass. Yield = Lbs/A of rough rice at 12% moisture; NS = not significant.

2) Values are means of four replications. Evaluations made 12 and 10 weeks after late emergence and early postemergence applications, respectively, and range from 0 = no effect to 100 = complete kill.

ontrol of dayflower can be obained using granular Ordram at .5-3 lbs a.i./A applied when daylower is completely submerged. 'or control of late season dayflowr that is extending above the lood, the phenoxy herbicides uch as 2,4-D or MCPA can be ısed from late tillering to panicle lifferentiation. However, phenxy herbicides are regulated in nany areas and the local regulaions should be checked before aplication. These herbicides are ısed at rates of 0.75-1.25 lbs/A. Basagran can also be used at this ime for dayflower control.

Sprangletop.—If a field has a iistory of sprangletop, a control rogram for this weed should be mplemented. Bolero at 4 lbs/A or Modown at 2-3 lbs/A applied preemergence to dryseeded rice will esult in fair to good sprangletop control. After the weeds have emerged, Ordram plus propanil at 3 plus 3 lbs/A, Bolero at 3 lbs/A very early; Bolero plus propanil at 3 plus 3 lbs/A; Modown plus propanil at 2 plus 3 lbs/A; or Machete plus propanil at 2-3 plus 3 lbs/A can be applied for control of small sprangletop. If the sprangletop is allowed to get more than approximately one-half of an inch tall, effective control may not be obtained with these treatments.

Red Rice.—Red rice is the most troublesome weed in Texas rice fields and is getting worse in many areas. Currently there are no effective herbicides for satisfactory control of red rice in rice; therefore, the use of crop rotations with proper weed control programs are recommended if the infestation is bad. If rice must be grown on a red rice infested field, Ordram at 3 lbs/A can be applied preplant incorporated, the field flooded, and presprouted rice seed broadcast into the flood. By keeping the ground moist or flooded throughout the growing season, 80-90% control of red rice can be obtained by this method. However, lower stands of cultivated rice result from constant flooding. A higher seeding rate is required to offset this effect.

If semidwarf rice is produced on a red rice infested field, normal red rice will be taller than the semidwarf which may facilitate hand roguing, spot application of a herbicide, or use of a herbicide such as Roundup with a rope wick applicator. Such a technique could be another tool in a red rice control program.

TABLE 7-2. SELECTED HERBICIDES FOR USE IN RICE

Time of Application	Herbicide and rate (lbs/A)	Weed Controlled
Preplant incorporated (water seeded rice)	Ordram (3)	Barnyardgrass, suppression of red rice
Preemergence	Bolero (4)	Sprangletop, dayflower, some aquatics; Fair to good control of barnyardgrass and hemp sesbania
	Modown (2-3)	Similar to Bolero; Weaker on sprangletop and barnyardgrass; Controls broadleaf signalgrass and mexicanweed
Early postemergence	Propanil (3-6)	Barnyardgrass, broadleaf signalgrass, hemp sesbania, jointvetch, mexicanweed; Contact only, no residual
	Propanil + Basagran (3+0.75)	Same as propanil plus dayflower
	Propanil + Bolero (3+3)	Same as propanil plus sprangletop and dayflower; Residual except on broadleaf signalgrass
	Propanil + Machete (3+2-3)	Same as propanil plus sprangletop and dayflower; Residual
	Propanil + Modown (3+2)	Same as propanil plus sprangletop and dayflower; Residual
	Propanil + Ordram (3+2-3)	Same as propanil plus sprangletop and dayflower; Contact only
Post flood	Ordram (Granules) (3)	Barnyardgrass, dayflower, suppression of large barnyardgrass and sprangletop
	Basagran (0.75-1)	Dayflower, sedges
	Blazer (0.25)	Hemp sesbania
Late tillering to panicle initiation	2,4-D (0.5-1.25) MCPA (0.5-1.25)	Many broadleaf weeds such as hemp sesbania, jointvetch, morningglory, and dayflower

Herbicides listed are either labeled or under final development at this time. Rates are in pounds per acre (lbs/A) of active ingredient (a.i.). Refer to current label for most recent revisions.

SUMMARY

In addition to the use of herbicides, a total weed control program must include sound management practices and attention to detail. A weed control program that omits one or more of these aspects usually results in less than optimum control.

As with any weed control program, weed control in the semidwarf varieties requires attention to detail and proper timing of cultural practices and herbicides for optimum results. When applying any pesticide, including herbicides, always read and follow the label instructions for obtaining maximum effectiveness and minimum injury to the rice and/or environment.

Some of the herbicides mentioned above do not have labels at the time of writing but are under development; therefore, refer to current labels or recommendations for those available. Contact the County Extension Agent or the Extension Agronomist for the latest information concerning herbicides available and their proper usage.

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*Mention of a pesticide does not constitute a guarantee, recommendation, or warranty by the Texas Agricultural Experiment Station, nor does it imply registration under the Federal Insecticide, Fungicide, and Rodenticide Act as amended, nor does it imply approval of the product to the exclusion of other products that also may be suitable.

8

Insect Management for Lemont

M. O. WAY

Lemont and several other semidwarf varieties grown in Texas were evaluated in 1983 for resistance to the rice water weevil. Replicated paired plots seeded with a single variety were heavily infested or maintained relatively weevil-free with insecticides. The smaller the difference in yield between plots of a pair, the more resistant the variety to rice water weevil. Table 8-1 shows that Lemont and Labelle possess a similar level of moderate susceptibility. Bellemont and Pecos are the most susceptible.

A study was initiated to refine economic thresholds for the rice water weevil. Labelle and the newest semidwarf, Lemont were seeded at a high (100 lbs seed/A) and a low (50 lbs seed/A) rate, and half of the research plots were treated with insecticide to control the weevil.

Lemont gave a 13.3% yield increase over Labelle averaged over seeding rate and weevil control. The low seeding rate resulted in a 9.7% increase in yield over the high seeding rate averaged over variety and weevil control. This was probably due to a higher incidence of sheath blight in plots seeded at the higher rate. Treated plots averaged a 10.0% increase in yield over untreated plots averaged over variety and seeding rate. Untreated plots averaged 4.8 immature rice water weevils per plant.

There were no significant interactions between variety and seeding rate, variety and weevil control, and seeding rate and weevil control. In addition, no interaction was apparent among the three treatments (variety x seeding rate x weevil control). Thus, Lemont and Labelle had similar yield responses to rice water weevil populations encountered in 1983.

Due to increased yields from Lemont coupled with stable rice prices, the economic threshold for the rice water weevil is expected to decrease. (The same applies to the rice stink bug). The extent of this decrease is not fully defined since data are preliminary.

Contact the local County Extension Agent or the Extension Entomologist for the latest information on controlling insect pests.

TABLE 8-1. VARIETAL RESISTANCE TO THE RICE WATER WEEVIL. BEAUMONT, TEXAS 1983

	x̄ Yield (g)/plot		
Variety	Weevil free	Weevil infested	% Reduction[1]
Bellemont	435.8	202.8	53.5
Brazos	740.0	515.5	30.3
Labelle	553.5	388.3	29.8
Lebonnet	463.3	333.5	28.0
Lemont	448.8	305.0	32.0
Mars	700.0	539.0	23.0
Nato	644.5	396.3	38.5
Pecos	584.0	297.3	49.1
Skybonnet	506.8	280.8	44.6

[1]Underlined values are significant at 5% level-t test for paired observations.

9

Crop Development - DD50 Projections

J. W. Stansel

Daily mean temperatures have been used in Arkansas and Texas for several years to predict when important stages of rice development will occur. Plant development rate slows under cool conditions and increases with warmer weather. This relationship of plant development to temperature occurs only within specific temperature ranges. When temperatures fall below 50° F (10° C) rice plant development slows dramatically or stops. Therefore, temperature units are accumulated only above a base of 50° F, thus, the degree day (DD50) concept. At warmer temperatures, plant development rate will increase only to a maximum rate and no faster. To characterize this maximum development rate, high temperature limiters are used. The Arkansas technique (1) uses an upper temperature limit of 94° F (35° C). The Texas method (2) uses a limit of 25 DD units per day. Both procedures work well. The symbol DD50/25 is used to describe the 50° F base and the maximum daily accumulation of 25 degree day units.

Crop Development

The accumulative heat unit technique (DD50/25) can be used effectively to warn producers when to expect important stages of crop development to occur for cultural inputs such as fertilizer, fungicide, insecticide, etc. These projections are to be used as alerts for producers to check their fields for stage of development. Field verification of the projections is essential. Experience has shown that the crop rarely develops faster than the DD50/25 projections. However, when crop development was later than the projections, some type of crop stress had generally occurred. The most common stresses, causing delays in crop development, have been moisture and herbicide stress. When projections were not accurate, producers were asked to determine if the crop had been stressed. This technique can help producers pinpoint conditions resulting in stress and minimize such occurrences in the future. The DD50/25 program does not make adjustments for non-temperature induced stresses.

The DD50/25 technique was used to project up to 12 development stages as shown in Figure 9-1. Field surveys on 15 producer fields indicated Lemont panicle differentiation (PD) and first heading (HD) could be predicted within 2 days of reported occurrence. However, maturity (20% grain moisture) was not accurately predicted by this method because atmospheric and soil moisture conditions in addition to temperature influenced how rapidly the grain dried and matured.

Seedling Emergence

Daily accumulation of DD50/25 units begins with the date of seedling emergence and not planting date. It becomes essential to accurately record when seedling emergence occurs so the projections will be more accurate. Generally, seedling emergence occurs over a period of time as fields seldom emerge evenly. The 10-10 criterion has been used to determine the range of seedling emergence. The first emergence date occurs when 10% or more of the field has emerged as described below. The second emergence date occurs when 10% or less of the field has not emerged. Using two seedling emergence dates in the projections provides a range of dates for each development stage to more accurately depict what is occuring in the field.

Seedling emergence becomes a judgement decision by the producer. The following can be used as a guide in determining dates of seedling emergence:

1. First seedling emergence date occurs when viewing the field in the morning with dew on the ground and the sun to one's back, distinct green rows or a light green cast becomes evident over at least 10% of the field. Sometimes weeds will emerge before the rice, making it necessary to verify the kind of vegetation observed.
2. The second seedling emergence date occurs when viewing the field under the same conditions, 10% or less of the field has not emerged.

Calculation of DD50/25

The procedure for determining heat units uses daily maximum and daily minimum air temperatures. These daily values are averaged for the day and 50 is subtracted from the average value. If the result is less than 25 units, the calculated value is used. If the result is over 25 units then 25 is used as the daily value instead of the calculated value. Daily values are accumulated beginning with the day of seedling emergence.

The formula for determining daily DD50/25 units follows:

$$\frac{\left(\begin{array}{l}\text{Daily Air Temp.}\\ \text{Max.} + \text{Min.}\end{array}\right)}{2} - 50 = \begin{array}{r}\text{Daily}\\ \text{DD50}\end{array}$$

If the daily DD50 is above 25 units, the daily value is reduced to 25 units.

Example:

If the temperatures on June 20 were 95° F for the maximum and 75° F for the minimum, the daily units are: $\frac{95 + 75}{2} - 50 = 35$. In this case, 25 units are used for June 20 because the calculated value (35) exceeded 25.

DD50/25 Units

Figure 9-1 is an illustration of how the program can be used in a culture management system. The column of DD50/25 units are the accumulative units required for the development stages listed for Lemont and Bellemont. Please note that the harvest date is listed as an estimate because of the difficulty in accurately predicting harvest. A specific culture calendar can be developed for each field in cooperation with the County Extension Agent or the Extension Agronomist.

The National Weather Service, Agricultural Advisory Service of NOAA, broadcasts the DD50/25 information three times a week during May to August. This information is available over numerous radio stations in the area.

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RICE CULTURE CALENDAR
(Lemont and Bellemont)
(Example)

Plant Development	Culture (example)	DD50/25 Units	First Projected Date	Second Projected Date
First Crop Germination	Preplant Fert-Plant Irrig. or Rain (to seal soil) Preemergence Herbicide (on sealed soil)	−140	______	______
Seedling Emerg.		0	______	______
1 leaf	Irrigate As Needed	60	______	______
2 leaf		120	______	______
3 leaf		180	______	______
1st Tiller	Postemergence Herbicide	240	______	______
	1st N Topdress	510	______	______
2nd Tiller	Permanent Flood	555	______	______
	Water Weevil Control	705	______	______
Pan. Diff.	2nd N Topdress	1293	______	______
	1st Foliar Fung. (Stem. Rot)*	1362	______	______
	1st Foliar Fung. (Blast)	1463	______	______
First Head	(no aerial app. at pollination)	1960	______	______
	2nd Foliar Fung.	2037	______	______
Milk Stage	1st Stinkbug (if needed)	2123	______	______
Soft Dough	2nd Stinkbug (if needed)	2408	______	______
Med. Dough	3rd Stinkbug (if needed)	2652	______	______
	Drain	2721	______	______
Maturity (20%)	Harvest	2896 (Est.)	______	______

*Only if there is a past history of stem rot on that field will adjustments on foliar fungicide applications for blast at 450 unit intervals be needed.

Figure 9-1. An illustration showing development stage, suggested cultural inputs, and the accumulative DD50/25 units for each development stage for Lemont and Bellemont.

10

Economic Impact of Lemont

M. E. Rister and W. R. Grant

The rice production and marketing environment of the early 1980's presents serious challenges to Texas Rice Belt producers. Net income has trended downward since the mid-1970's, with many rice producers now struggling to cover their variable production costs. Target price, loan rate, and deficiency payment concepts associated with the current domestic government rice program provide limited income security and price stability to rice producers. The 1983 Payment-in-Kind (PIK) program resulted in temporary economic relief to the rice industry. New production technologies, such as Lemont, Bellemont, and other new high-yielding semi-dwarf rice varieties, provide producers a longer term opportunity to reduce per unit production costs. Should these increased yields lead to increases in total production, a negative impact on prices will result, assuming other factors remain unchanged. This chapter evaluates the impact of shifting to a new production technology (i.e., Lemont) on production costs, industry prices, and expected returns for the Texas rice producer.

Trends in Net Income for Rice Producers

The world rice situation from 1972 to 1974, characterized by reduced exportable supplies and increased demand, triggered a sharp rise in prices followed by a change in farm policy in 1976. Recent Texas cash rice prices have been volatile with current prices below per unit cost of production (Figure 10-1). The low prices currently being received by Texas rice producers are a result of excess U.S. production, higher relative value of the dollar, worldwide recession, and subsidization practices of foreign competition. Approximately 40% of U.S. rice production is marketed through domestic channels. The rice export market situation has deteriorated as a result of weak global demand coupled with a loss of world market share by the U.S. The latter is a result of competing country export subsidies, remaining effects of the 1980 embargo, and domestic structural problems (4).

Texas rice producers historically have received a premium above the prices received by rice producers in the other Southern states (Table 10-1). This premium is attributable to producers' proximity to a deep water export facility, mill location, and the type of rice produced. Recent long-grain acreage increases in northeast Arkansas, the Grand Prairie of Arkansas, and the Mississippi River Delta (7) as well as a slight decline in Texas acreage have resulted in milling capacity relocating from Texas to locations on the Mississippi River. As a result, Texas rice producers will likely realize a smaller price premium in the future.

While rice prices have trended downward in recent years, per unit production costs have steadily increased (Table 10-2). Texas rice producers, relative to producers in other U.S. rice-producing areas, are at a competitive disadvantage (10). Texas ranked last in comparative advantage across all major U.S. rice areas during 1972/82 (7). California's lower costs relative to Texas' costs are primarily a result of higher per acre yields and less expensive supplies of irrigation water. The lower costs per unit in the other Southern states are due to cheaper supplies of irrigation water, lower land rents, lower machinery costs, and/or lower levels of variable inputs (e.g., fertilizer, herbicides, insecticides, labor) (10).

Alternatives for Increasing Net Income

Information in Tables 10-1 and 10-2 relate the cost-price environment within which U.S. rice producers are operating. Relief from unprofitable circumstances can come from (a) increased demand and/or reduced supply resulting in higher market prices, (b) lower per unit costs of production, and/or (c) government programs. The second alternative is more within the control of individual rice producers who, by using less inputs and/or attaining higher per acre yields, may be able to realize lower production costs per hundredweight harvested. In evaluating and implementing production decisions directed towards such a goal, producers should recognize the profit-maximizing economic rule of producing another unit of output only if its value exceeds the additional costs of production (i.e., marginal revenue is greater than marginal cost). The increase in per acre yield associated with Lemont appears to satisfy this criterion.

Profitable Texas Rice Production

Previous discussion recognized the competitive disadvantage of Texas rice producers relative to

TABLE 10-1. SEASON AVERAGE PRICE RECEIVED BY FARMERS BY STATE[a]

CROP YEAR	Farm Price[b]				
	AR	LA	MS	TX	U.S.
			($/CWT)		
1977/78	—	—	—	—	9.49
1978/79	8.47	7.50	7.98	9.27	8.16
1979/80	10.60	10.60	10.30	11.60	10.50
1980/81	12.30	12.00	12.70	12.80	12.45
1981/82	9.37	9.36	9.14	10.40	9.05
1982/83	—	—	—	—	8.18

[a]Eligible producers also received deficiency payments of $0.78/cwt in 1978/79, $0.28/cwt in 1981/82, and $2.71/cwt in 1982/83.

[b]Average Price Received by Farmers. United States prices include California.

Source: USDA, *Agricultural Prices*.

TABLE 10-2. TOTAL COST PER HUNDREDWEIGHT TO GROW RICE IN THE UNITED STATES

Location	1978	1979	1980	1981
		($/cwt)		
Northeast Arkansas	7.91	9.41	11.48	11.88
Grand Prairie, Arkansas	8.07	9.87	12.01	12.13
Delta, Mississippi	8.22	10.10	12.37	12.46
Southwest Louisiana	7.86	9.38	11.60	11.42
Upper Counties, Texas	9.00	11.91	14.32	13.67
Lower Counties, Texas	9.62	12.50	13.61	13.88
California	7.73	8.15	9.37	9.46

Source: USDA, *FEDS Budgets*.

producers in other U.S. rice-producing states. A more in-depth analysis of Texas rice sales receipts and associated production costs is required to identify the economic merits of growing Lemont rather than the Texas varieties currently being grown (i.e., Labelle and Lebonnet).

Stansel and Klosterboer (14) report per acre yields of 5,531 and 4,433 lbs (first crop only), respectively, for Lemont and Labelle/Lebonnet on the basis of 1983 field demonstrations. These demonstrations were on farms with high management levels. The first two enterprise budgets in Table 10-3 indicate Lemont as having a net return advantage of $45.39/A over Labelle and Lebonnet after all additional production costs are accounted for.

On the receipts side, Lemont benefits from a $.30/cwt. price premium due to a higher whole kernel yield (58 versus 55) and total milling yield (70 versus 69). Brorsen, Grant, and Rister (3), in analyzing rice prices from several Texas bid/acceptance markets for the 1978-79, 1981-82, and 1982-83 marketing seasons, identified average significant price premiums of $0.0836/lb of whole kernel yield and $0.0462/lb of total milling yield. Government deficiency payments are assumed to be identical in both cases.[1] Lemont's total revenue was $131.88/A greater than that of Labelle/Lebonnet.

Additional costs associated with producing Lemont's 1,098 lbs/A yield advantage over Labelle/Lebonnet in the 1983 Texas field demonstrations must be recognized. The cost of additional fertilizer, herbicides, fungicides, and associated application costs must be taken into account. Additional labor and management related to water control and chemical usage must also be acknowledged as well as substantially greater operating costs associated with the slower harvest speeds. In addition, Lemont's higher yield and greater sales receipts imply added drying, hauling, and sales commission expenses. Lastly, inasmuch as these budgets assume land is rented on an one-tenth share tenure arrangement, the higher yield and sales price associated with Lemont result in a higher rental payment.[2] Considering all costs, Lemont is estimated to have per acre total costs which are $86.49 higher than those of Labelle/Lebonnet.

An economic analysis of the data from 1983 Texas field demonstrations indicates Lemont is relatively more profitable ($45.39/A) than Labelle and Lebonnet. Although this analysis is based on data for only 1 year, experimental results indicate similar yield advantages for Lemont across several years (2). The first two columns in Table 10-3 identify differences in costs associated with the reported 1983 field demonstrations' input levels (e.g., 197 lbs of N fertilizer for Lemont as opposed to 128 lbs of N fertilizer on Labelle/Lebonnet). These may not be the most profitable levels of such inputs. Differences in nonreported inputs may also occur under more widespread production of Lemont.

The enterprise budget in the third column of Table 10-3 is an estimation of the per acre receipts and costs associated with growing

[1]After a period of time, the higher yields associated with Lemont would enable producers to raise their ASCS proven farm yields and thereby increase the per acre benefits associated with government program participation.

[2]Other tenure arrangements may require landowners to share in the added costs associated with producing Lemont, thereby reducing the rental payment. Full owners would fully realize the benefits of Lemont themselves, netting an additional $12.22/A above the net returns reported for Lemont in Table 10-3.

Lemont according to Texas Agricultural Experiment Station and Texas Agricultural Extension Service suggestions. In relation to the 1983 results for Lemont, similar yields are assumed while less N, less herbicides, and more fungicides are suggested (13). A net return of $90.55/A is projected for Lemont under these conditions. This is $15.56 more per acre than estimated for Lemont in the 1983 field demonstrations. Producers are encouraged to review the materials presented in previous sections of this report and consult with Texas Agricultural Extension Service specialists and Texas Agricultural Experiment Station scientists in deciding on their cultural practices.

CONCLUSIONS

The results of this firm level budgeting analysis should be prefaced with several cautions. Producers should observe economic criteria in deciding on their variable input levels. They should apply an additional unit of fertilizer (or herbicide, fungicide, etc.) only if the additional revenues are high enough to cover the costs of such additional inputs.

Improved technologies, such as Lemont and Bellemont, are transferable to other southern rice-producing areas. Stansel (13) projects approximately 300,000 acres will be planted to Lemont in Texas by 1987. An additional 1,045,200 acres of Lemont in Arkansas, Louisiana, Mississippi, and Missouri are also projected by 1987. Assuming an average increase in per acre yields of 1,000 lbs for these 1.35 million acres, such projections imply additional U.S. production of 13.452 million hundredweight of long-grain rice annually by 1987.[3]

[3]These statistics assume U. S. rice acreage will return to the pre-PIK levels of 1982. They also assume producers will not reallocate acreage and/or other production inputs to other crops as rice production increases. Should future government programs require acreage reductions and/or lower program benefits, estimated total production will probably be less and market prices higher.

TABLE 10-3. RICE ENTERPRISE BUDGETS—LEMONT VS. LABELLE/LEBONNET (1983 FIELD DEMONSTRATION RESULTS) AND LEMONT GROWN PER TAES/TAEX SUGGESTIONS[a]

Item	1983 Results: Lemont	1983 Results: Labelle/ Lebonnet	Lemont Grown per TAES/TAEX Guidelines
		($/acre)	
Gross Receipts			
First crop rice sales[b]	597.35	465.47	597.35
Deficiency payments[c]	87.08	87.08	87.08
Total Income	684.43	552.55	684.43
Variable Costs			
Preharvest			
Seed[d]	18.80	23.40	18.80
Fertilizer[e]	67.62	48.99	62.49
Insecticides[f]	14.63	14.63	14.63
Herbicides[g]	42.35	32.73	32.73
Fungicides[h]	19.35	15.05	21.50
Custom aerial[i]	38.67	32.34	36.40
Irrigation[j]	59.13	49.13	59.13
Tractor[k]	16.98	16.98	16.98
Equipment[k]	6.92	6.92	6.92
Labor[l]	44.40	41.87	44.40
Operating capital interest[m]	15.29	13.11	14.60
Subtotal, Preharvest	344.14	295.15	328.58
Harvest			
Tractor[n]	6.71	4.03	6.71
Equipment[n]	10.55	6.33	10.55
Labor[n]	13.41	8.05	13.41
Drying[o]	44.04	35.30	44.04
Hauling[o]	16.94	13.58	16.94
Sales commission[p]	4.18	3.26	4.18
Subtotal, Harvest	95.83	70.55	95.83
Total Variable Costs	439.97	365.70	424.41
Fixed Costs			
Tractor[q]	30.54	30.54	30.54
Equipment[q]	53.31	53.31	53.31
Irrigation[q]	22.00	22.00	22.00
Share rent[r]	63.62	51.40	63.62
Total Fixed Costs	169.47	157.25	169.47
Total Costs	609.44	522.95	593.88
Net Returns Above Specified Costs	74.99	29.60	90.55
Per Unit Production Costs ($/cwt)	11.02	11.80	10.74

[a]These budgets are intended to represent average Texas Rice Belt production conditions. Budgets previously prepared for 1983 (5, 15), field demonstration data compiled by Stansel and Klosterboer (14), and information from Stansel (13) are used to differentiate the economic returns and costs associated with the respective varieties. These enterprise budgets are prepared on a per planted acre basis.

[b]Rice sales assume a base market price in Texas for No. 2 long-grain rice of $10.50/cwt. on the basis of fall 1983 bid/acceptance market sales data (1, 8, 12, 19). A price premium of $.30/cwt. is assumed for the Lemont sales as a result of its higher head yield/total mill turnout (3). Lemont and Labelle/Lebonnet sales are based on per acre yields of 5,531 and 4,433 lbs, respectively (13).

[c]Assumes 1983 target price of $11.40/cwt., a weighted season average U.S. cash price of $9.25/cwt. (18), a national allocation factor of 0.90 for rice, and an ASCS proven farm yield of 4,500 lbs/A.

[d]Labelle/Lebonnet is assumed to be seeded at 117 lbs/A with seed priced at $20.00/cwt. Lemont is assumed to be seeded at a rate of 94 lbs/A with seed price at $20/cwt. (13).

[e]Nitrogen rates of 197, 128, and 179 lbs/A, respectively, are assumed; similar phosphate and potash rates are assumed for the respective budgets.

[f]Includes Furadan costs.

[g]Assumes 2.2, 1.7, and 1.7 herbicide applications, respectively.

[h]Assumes 1.8, 1.4, and 2.0 fungicide treatments, respectively.

[i]Aerial rates account for differences in N fertilizer rates, seeding levels, and number of herbicide applications and fungicide treatments; similar insecticide applications are assumed.

[j]Lemont requires an additional flush ($10/A) (9).

[k]Fuel, lubrication, and repairs.

TABLE 10-3. (FOOTNOTES CONTINUED)

[l]One-half additional hour of labor per acre is assumed for Lemont to account for more intensive water management requirements.

[m]Operating capital is assumed to be invested .31 of a year (11); a 15% annual rate of interest is assumed.

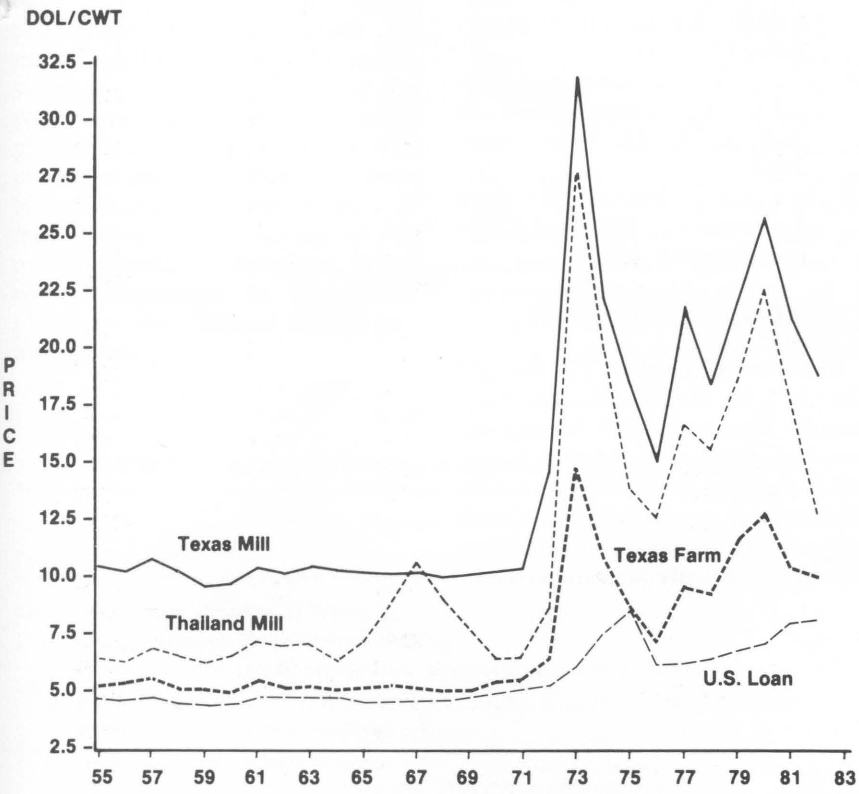
[n]Harvesting operations for Labelle/Lebonnet are assumed to proceed faster than those for Lemont (i.e., 2.5 mi/hr versus 1.5 mi/hr).

[o]Shrink losses of 10.22% are assumed during drying. Therefore, 6,160 and 4,937 lbs of Lemont and Labelle/Lebonnet, respectively, are assumed to be harvested at 22.22% moisture. Drying and hauling charges are based on wet weight.

[p]0.7% of rice sales.

[q]Depreciation, interest, property taxes, and insurance.

[r]Share rent is based on one-tenth of total receipts less one-tenth of drying and sales commission.



Data Source: USDA-ERS, *Rice Outlook and Situation*

Figure 10-1. Season Average Rice Prices, 1955-1982.

The current world demand/supply situation is such that, with an especially strong U.S. dollar relative to other currencies, U.S. inventories are increasing. Without PIK in 1983, U.S. rice carryover at the end of the 1983/84 market year would most probably have been above 65 million hundredweight, similar to the 1982/83 carryover. Given an elasticity of demand for U.S. rice of −0.82 (6), a 1.219% decrease in rice prices is required to market a 1% increase in rice supply, assuming other factors remain unchanged. Thus, assuming a $10.50/cwt. Texas price for long-grain rice in the absence of the new variety Lemont and a projected U.S. usage of 165.4 million hundredweight rice in 1987/88,[4] marketing an additional 13.452 million hundredweight of long-grain rice would result in a $1.04/cwt. decrease in Texas rice prices. Such a price reduction would result in Texas long-grain rough rice selling for $9.46 in 1987 as opposed to $10.50 (1983 prices).

As long as the current government commodity program remains in effect, and assuming government payment limitations are not a constraint, such results imply Texas rice producers would still realize the benefits of Lemont provided they adopt the technology. The benefits would accrue both through increased sales and through increased deficiency payments.

New high-yielding semidwarf rice varieties such as Lemont can provide Texas rice producers an opportunity to lower their per unit costs of production. Results from 1983 Texas field demonstrations indicate a per hundredweight cost of production of $11.02 for Lemont relative to $11.80 for Labelle/Lebonnet. Projected cost of production associated with growing Lemont, according to the Texas Agricultural Experiment Station/Texas Agricultural Extension Service suggestions, is $10.74/cwt. This lower per unit cost should improve Texas producers' position relative to other U.S. and world rice-producing areas.

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[4]U.S. rice usage in 1981/82, 1982/83 and projections for 1983/84 (including exports) averaged 142.89 million hundredweight. A heuristic assumption of the analysis is usage will increase at an annual rate of 5% between now and the 1987/88 marketing year.

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11

Tips to Economic Production

Staff

Producers are faced with many management decisions on a daily basis during a crop year. Often production tradeoffs must be made and it is important to understand the potential economic impact of such decisions so the most profitable choice can be made. The producer may be faced with over 50 production decisions but 10 may impact the majority of his profit potential. Therefore, it becomes important to place emphasis on the cultural inputs that impact profits most.

Table 11-1 outlines many of the economic opportunities the producer has, and it can be used as a guide in identifying possible cultural inputs and their relative impact. Some factors will primarily influence yields, others more directly influence costs. Table 11-1 uses the basic assumption of average Texas yields and the average seasonal price received. Each production practice listed must be evaluated independently of all other practices because the results are nonadditive. Most producers follow only about 50% of these tips.

The agronomic and economic impact of each tip will be different as production levels change and are therefore nonadditive. These tips are intended only as general reminders of economic opportunities that may not be fully utilized by producers.

TABLE 11-1. ECONO-RICE: TIPS TO ECONOMIC RICE PRODUCTION (1984 CROP)

Production Practice	Yield (lbs/A)	Variable Cost/A	Cost/ Cwt	Cost Change 1 Cwt
Base Assumptions (Price at $11/cwt)	4400	$513	$11.67	$ -0-
1. Expand the acreage of semidwarf varieties				
A. Increase total N rate approximately 40 lbs/A (compared to Labelle)		+$ 12		
B. Put increased nitrogen (N) at 1st or 2nd application (25 lbs) depending on temperatures at or near seeding				
C. *Never allow plant to be in N stress* Can stimulate growth when wanted with minimum fear of lodging				
D. Apply N at heading for stimulation of 2nd crop				
E. Delay permanent flood where practical				
F. Do not let soil dry after emergence except to apply preflood N		+$ 10		
G. Use full label dosage of preemerge herbicide		+$ 5		
H. Use no more than two herbicide applications (see notes in herbicide management)		−$ 10		
I. Use foliar fungicides		+$ 15		
Potential Benefits	5600	$553	$ 9.83	−$1.79
2. Herbicide Program				
A. Identify specific weeds in field				
B. Pattern herbicide program to specific weed problem		−$ 10		
C. Apply herbicide only when grass is not stressed	+250	−$ 10		
D. Do not shave rates—apply label rates		+$ 10		
E. Reduce number of applications by using persistant herbicides		−$ 15		
F. Keep soil sealed for persistant herbicides				
Potential Benefits	4650	$485	$10.44	−$1.23

TABLE 11-1. ECONO-RICE: TIPS TO ECONOMIC RICE PRODUCTION (1984 CROP) (Continued)

Production Practice	Yield (lbs/A)	Variable Cost/A	Cost/ Cwt	Cost Change 1 Cwt
3. Water Management				
A. Delay permanent flood 1 week		−$ 5		
B. Shallow flood	+250	−$ 10		
C. Entrap rainwater		−$ 5		
D. Use tailwater				
E. Reduce field size so can:				
1) Flush in 2-3 days				
2) Flood in 4-5 days				
F. Multiple water entry				
G. Precision grade (long-term)				
Potential Benefits	4650	$495	$10.64	−$1.03
4. Fertility Program				
A. Only use urea as N fertilizer		−$12		
B. Reduce P and K				
1) Apply P only when soil test is very low <5 ppm		−$12		
2) Apply K only when soil test is very low <60 ppm		−$ 4		
C. Keep soils moist except when applying post flood N. Apply N on dry soil and flood within 4 days	+660			
Potential Benefits	5060	$490	$ 9.68	−$1.99
5. Disease Control				
A. Use field history as guide for disease potential		−$ 20		
1) Recognize early warning systems and record				
2) Rotation with soybeans increases sheath diseases				
B. Weather conditions for blast				
Potential Benefits	4400	$493	$11.21	−$0.46
6. Insect Management				
A. Scout fields for insects		−$ 10		
B. Delay using insecticide as long as possible		−$ 5		
C. Use residual insecticides		−$ 5		
D. Use label rates		+$ 16		
Potential Benefits	4650	$511	$10.99	−$0.68
7. Maximize Second Crop Potential				
A. Apply N at heading to stimulate 2nd growth				
B. Apply 50-70 units N on dry soil immediately after harvest	+500	+$ 15		
C. Apply flood immediately following harvest	+500	+$ 15		
D. Good weed control in first crop				
Potential Benefits	5400	$550	$10.19	−$1.48

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The Texas Agricultural Experiment Station, Neville P. Clarke, Director, College Station, The Texas A&M University Station

All programs and information of the Texas Agricultural Experiment Station are available to everyone without regard to race, color, religion, sex, age, national origin, or handicap.

4M—3-84