CIHEAM
Options Méditerranéennes

Introduction and agronomic comparison of new varieties of rice in the south of Spain

Aguilar M., Grau D.

in

Chataigner J. (ed.).
Perspectives agronomiques de la culture du riz en Méditerranée : réduire la consommation de l'eau et des engrais

Montpellier : CIHEAM
Cahiers Options Méditerranéennes; n. 15(1)

1996
pages 11-21

Article available on line / Article disponible en ligne à l'adresse :

---

http://om.ciheam.org/article.php?IDPDF=CI010949

To cite this article / Pour citer cet article

Aguilar M., Grau D. **Introduction and agronomic comparison of new varieties of rice in the south of Spain.** In : Chataigner J. (ed.). *Perspectives agronomiques de la culture du riz en Méditerranée : réduire la consommation de l'eau et des engrais* . Montpellier : CIHEAM, 1996. p. 11-21 (Cahiers Options Méditerranéennes; n. 15(1))

CIHEAM
Centre International de Hautes Études Agronomiques Méditerranéennes

http://www.ciheam.org/
http://om.ciheam.org/

Introduction and agronomic comparison of new varieties of rice in the south of Spain

M. Aguilar and D. Grau
Dirección General de Investigación Agraria, CIDA Las Torres, Sevilla (Spain)

Abstract. In the south of Spain, the cultivation of the Indica type rice began by the end of the 1980s. From 1988 to 1992 trials were run on a number of varieties in order to find out their agronomic performance.

Among the long grain varieties, those best adapted and most productive were of Californian and Australian origins. Their average yields were somewhat higher than those of the Bahia variety, a Japonica type, most widely cultivated in the area at that time. The varieties from the Rice Department of Sueca (Valencia) also had good yields. However, those from the south-east of the USA (Arkansas, Texas, etc.), those from Italy, with a shorter cycle, and the Greek varieties were less productive.

Among the new short grain varieties, those from Valencia continued to prove to be better adapted to the area.

In general the Indica type varieties achieve the highest values in number of panicles per square meter than the Japonica type, but on the contrary, they have a higher percentage of filled grains per panicle and 1000 grains weight, but their percentage of blank grains is also higher. It should be underlined that Indica type varieties require more attention to achieve good germination and their milling yield tends to slightly lower.

I – Introduction

The acreage of rice growing land in Andalusia is about 35,000 hectares, this being quite stable, except in years of water shortage.

Seville is practically the only province in Andalusia where rice is grown. Some years very small surfaces are sown in Cadiz and Malaga. The rice growing area of Seville is comprised of a circular area covering both banks of the Guadalquivir river in the Marisma "marshlands". The land is flat and the soil clayey and saline, of sedimentary origin.

Over the last few years, because of the drought and water shortage, there have been severe problems for the irrigation of these fields in the Marisma area, especially in 1993, when the greater part of the acreage could not be sown. Previously, in 1989, only 30% of the crop was sown; and in 1994 only 10% of the aforementioned acreage was sown. The situation in the rice growing area along this final stretch of the Guadalquivir river and its edaphological characteristics mean that this crop is most prejudiced when water is scarce.

In this final stretch of the river, between Seville and the river mouth, there is very slightly uneven part; here the tidal water meets the fresh water of the river and increases its salinity. This water is used for irrigation and its saline content usually oscillates around 0.5 g/l and just above 1 g/l. The salty sea water tends to flow upstream while the water from the river flows in the opposite direction. This forms an area of transition of variable salinity, the concentration being greater the closer one gets to the river mouth. This “saline plug” may move south when the water from the Dam at Alcalá del Río is let out thus reducing the salinity of the water in the river since a concentration exceeding 0.8 g/l can lead to a reduction in rice yield. The caudal fresh water below 25 m^3/s will permit penetration of salt water to distances between 9 and 15 km up river, depending on the tidal flow.

Except in very small areas, only rice farming is the most usual practice, as a result of the salinity of the soil and of the water. It would be convenient to study alternative crops in less salty areas. Likewise, in areas of very high salinity, it might also be interesting to run trials on new varieties resistant to these extreme conditions which make it impossible to grow rice.

With regard to the structure of the farms, the most common are the medium-size farms (25–30 hectares), larger than the average acreage in other areas of Spain and similar to those in Italy. The proximity of the different plots and their rectangular shape, the high degree of mechanization and the independent irrigation systems place Andalusian farms in a privileged position when it comes to reducing the unitary costs of production, lower than other regions of Spain and even Italy.

The rice growing sector in Andalusia is endowed with an excellent industrial structure, it even has facilities for vaporisation. These in turn favour the future of this crop in the area. One large company, Arrocerías Herba S.A., has a great influence on rice cultivation and the industrial aspects. It should be pointed out that this company was a pioneer in the introduction of Indica type varieties in Andalusia.

Regarding the varietal structure, it is also worth mentioning the rapid implantation of the Indica type varieties. Over the last four or five years, the acreage sown with these varieties has gradually been on the increase, and today they cover almost 90% of the rice growing area. The L-202 variety, also known as Thaibonnet, is almost the only Indica type cultivated in the marisma area. Thanks to the exceptional weather conditions, more than half the long grain Indica type rices produced in the European Union are of Andalusian origin.

II – Material and methods

The experiments were carried out in Villafranco (Seville). The soil is alluvial clay textured, representative of this rice growing area. The crop was sown in mid-May and the harvesting was done with an essay harvester, at the end of September. 150 kg/ha of seed was sown and 160 kg/ha of nitrogen was applied before sowing, like urea 46%. No other fertilizers were applied. The remaining farming practices were as normal in the zone.

Explanation of the methodologies of the different types of essays carried out:

1. Trials on varieties from Europe, America and Australia

The statistical design used was as follows: random blocks with three repetitions. The size of the elemental plots was 2 x 12 m (24m^2). A 0.5 metre wide corridor was left between plots.

The parameters taken into account from each of the plots were:
❐ Cycle to heading: number of days from date of sowing to heading, 50% of the plants with the panicle completely out. This was determined by means of a sample from the whole length of the plot.
❐ Cycle to maturity: number of days from the date of planting to maturity. The date of maturity was calculated visually at five-days intervals.
❐ Plant height: average of 10 plants taken at random from the plot. The length between the ground and the tip of the panicle in flowering.
❐ Lodging: an estimation of the percentage of the lodging area in the doughy and ripen grain stages.
❐ Number of panicles per square meter: mean of four samples of panicles per plot, each sample being taken from an area of 0.25 m^2.
❐ Number of grains per panicle: mean of 40 samples from elemental plot in maturity phase considering the sum of blank and filled grains.
❐ Percentage of blank grains in relation to the total number of grains from the previous sample.
❐ The weight of 1000 grains (filled and blank)
❐ Grain yield: the whole plot was harvested with an essay harvester.
❐ Milling yield: percentage of total and head rice

2. Essays in collaboration with IRRI

From 1990 to 1992 a total of six varietal trials were carried out included in the International Rice Testing Program (IRTP). This program is co-ordinated by the International Rice Research Institute (IRRI) whose headquarters are in the Philippines.

A. Trials for Production control

A total of three trials were run, depending on the length of the cycle in 1990: (i) the International Rice Yield Nursery very early (IRYN-VE), (ii) early (IRYN -E), and (iii) medium (IRYN-M).

24 varieties were tested in each of the three assays plus a control. The majority of these varieties originate from the IRRI itself, as well as other Asian countries (e.g., India, Taiwan, Indonesia). The control was on the Thaibonnet variety in all three assays as it was the most widely cultivated one in the area.

In accordance with the IRRI instructions, random block statistic with three repetitions were used and, given the small amount of seed received, the transplant technique was used.

The following parameters were considered: Number of days from date of sowing to 50% heading, number of panicles per square meter, plant height and production with a moisture content of 14%.

B. Observation trials

A total of three International Irrigated Rice Observational Nursery (IIRON) trials were run in 1990, 1991 and 1992. In 1990, 204 lines were assayed (15 very early cycle and 84 early cycle and 105 medium cycle). In 1991, 167 were assayed (22 very early, 145 early cycle) and, in 1992, 191 lines were assayed (46 very early cycle and 145 early cycle). In the last two years, the medium cycle lines have not been essayed because, given the length of their cycle, the majority did not even produce panicles.

Each line is planted in a single 5 meter long furrow using the direct sowing method.

The parameters considered were: number of days from planting to 50 % heading, plant height and seedling vigour as well as the phenotype acceptability.

III – Results and discussion

In *table 1* the agronomic performance can be observed for those varieties from the Rice Department of Sueca (Valencia), others commercialised by the seed company HERBA, located in Seville (including L-202 or Thaibonnet of Californian origin) and other American varieties from Arkansas or Texas as well as the Italian variety Niva. The high production achieved by Thaibonnet is worthy of note and to a lesser extent that of Newbonnet, amongst the Indica types. It is also interesting to see the performance of the Leda and Thainato varieties as well as that of the traditional Japonica type variety Bahía. The non-Californian American varieties obtained low grain yields. Also of note was the low percentage of lodging in the Indica type varieties compared to the Japonica type. In general, the industrial yield tends to be slightly higher for the Japonica types.

Table 2 shows the results of essay 1 which confirms that Thaibonnet is the most productive Indica type variety and is most suited to the Andalusian conditions. The Japonica types of Californian origin M-201 and S-101 also achieved high yields. In essay 2, Thaibonnet performs far better than Newbonnet out of the Indica type varieties and Thainato, Leda and Guadiamar stand out among the Japonica type ones. Of the two Italian varieties, only Selenio achieved good results. Comparing Thaibonnet with Bahía and in general comparing the Indica varieties with the Japonica type varieties, it was clear that the Indica types achieved a higher number of panicles per square meter, fewer filled grains per panicle, lower weight per 1000 grains and higher percentage of blank grains than the Japonica types. The greater height of the Indica type varieties and greater percentage of lodging ares also notable.

Table 3 shows the first essay, Thaibonnet and Puntal are the varieties with the best performance. It is also interesting to note that IRION-90-164 has a good production but a high percentage of lodging and a cycle too long. In essay 2 the most notable are: Guadiamar, Thaibonnet and Thainato for their grain yield.

Figure 1 shows the evolution of the percentage of lodging throughout the different phenological stages of the eight rice varieties. It is also clear from this figure that the Indica type varieties have a low percentage of lodging if compared to the Japonica type varieties.

In *Table 4* it is possible to see the poor behaviour of the Italian and Greek varieties. Thaibonnet, Puntal and the advanced Indica lines obtained from the Rice Department of Sueca (Valencia) showed the best performance.

The results obtained from the ten most productive varieties running the IRYN-VE and IYRN-E trials are shown in *Table 5*. There is a poor agronomic result shown for the varieties sent by the IRRI because all the varieties give lower production levels than the local control, for Thaibonnet.

Table 6 shows the results of the three observation essays, but only those lines which seemed to us to be of interest are shown due to their short cycle to heading, low height, dense panicle, lack of and symptom of disease, etc.

The varieties assayed at present form a germoplasm bank and will be used in the future to obtain new varieties through a breeding program.

References

• **Aguilar M.** (1992). Situación, análisis y perspectivas futuras de los cultivos de arroz y maíz en Andalucía. Perspectivas de la agricultura del Valle del Guadalquivir (secanos y regadios). Consejería de Agricultura y Pesca. Junta de Andalucia. Congresos y Jornadas 26/92. 99-111.

• **Aguilar M., Grau D.** (1994). Influencia de la dosis de abonado nitrogenado de fondo sobre los componentes del rendimiento y el comportamiento agronómico del arroz. *Investigación Agraria*, Serie Producción y Protección Vegetales. Vol. 9 (1).

• **De Datta S. K.** (1986). *Producción de Arroz*. Ed. Mundi Prensa, 690 p.

• **Hill J.E., Roberts S.R., Scardaci S.C.** (1989). Description and performance summary of the 1986 and multiyear statewide rice variety test in California. *Agronomy Progress Report*. University of California, Davis (211) 2-32.

• **IRRI** (International Rice Research Institute) (1989a). Final report of the fifteenth international irrigated rice yield nursery. 15th IRON, IRRI.

• **—** (1989b). Final report of the sixteenth international irrigated rice yield nursery early. 16th IRYN-E, IRRI.

• **—** (1989c). Final report of the ninth international irrigated rice yield nursery very early. 9th IRYN-VE, IRRI.

• **—** (1989d). Final report of the seventeenth international irrigated rice observational nursery, 17th IIRON, IRRI.

• **Steel R.G.D., Torrie J. H.** (1985). *Bioestadística. Principios y procedimientos.* Ed Mc Graw Hill, 622 p.

• **Tinarelli A.** (1988). *El arroz.* Ed Mundi-Prensa, 577 p.

• **Yoshida S.** (1978). Tropical climate and its influence on rice. Int. Res. Inst. Res. Ser. 20.

TABLE 1
PERFORMANCE SUMMARY OF THE RICE VARIETIES.
SEVILLA, 1988.

CULTIVAR	Origin	Plant type	Days to flowering	Lodging percentage in maturity	Grain yield (kg/ha at 14 % moisture)	Milling yield (%)	
						Head	Total
Bahia	Sevilla	Jap.	91	85	6961	57	70
Niva	Italy	Jap.	86	90	5586	49	69
Alba	Valencia	Jap.	91	70	5619	58	70
Clot	Valencia	Jap.	87	55	6076	55	69
Leda	Valencia	Jap.	91	55	7164	60	72
Mareny	Valencia	Jap.	87	70	6808	57	72
Thaibonnet	Sevilla	Ind.	94	0	7851	57	67
Thainato	Sevilla	Jap.	86	30	7825	58	69
Gulfmont	U.S.A.	Ind.	105	0	5557	58	66
Lemont	U.S.A.	Ind.	105	0	5545	51	69
Lebonnet	U.S.A.	Ind.	105	0	5416	58	69
Skybonnet	U.S.A.	Ind.	94	0	6090	60	69
Bond	U.S.A.	Ind.	91	35	5991	52	66
Newbonet	U.S.A.	Ind.	100	0	7268	59	69
Mean					6411		
C.V. %					10.4		
L.S.D. 0.05					1119		

TABLE 2
PERFORMANCE OF THE RICE EXPERIMENTAL LINES AND VARIETIES, TWO TRIALS SUMMARY. SEVILLA, 1990.

LINE or CULTIVAR	Origin	Plant type	Days to Flowering	Days to Maturity	Plant height (cm)	Lodging % Doughy grain	Lodging % Ripen grain	Yield components Panicles/m2	Yield components Grains /panicle	Yield components Blank grain %	Yield components 1000 grain weight	Grain yield (kg/ha at 14 % moisture)	Milling yield % Head	Milling yield % Total
1st TRIAL														
V-7917	U.S.A.	Ind.	100	145-150	75.3	0	0	448	73	-	21.3	6796	67	70
V-7876	U.S.A.	Ind.	86	135-140	90.0	0	0	553	70	-	21.0	7718	67	71
S-201	U.S.A.	Jap.	83	135-140	88.7	0	100	444	75	-	28.3	7324	69	72
Thaibonnet	Sevilla	Ind.	76	130-135	80.3	0	0	561	60	-	25.0	8021	63	68
M-201	U.S.A.	Jap.	78	130-135	90.0	0	0	434	79	-	27.3	8800	69	70
V-7835	U.S.A.	Ind.	80	130-135	92.3	0	57	540	77	-	21.3	6503	64	71
LLC-303	U.S.A.	Ind.	86	135-140	78.7	0	0	431	65	-	24.0	6534	69	71
LLC-101	U.S.A.	Ind.	88	135-140	76.3	0	0	419	64	-	24.3	6333	67	71
S-101	U.S.A.	Jap.	73	125-130	88.7	0	63	537	73	-	25.7	7899	66	70
LLC-404	U.S.A.	Ind.	76	130-135	92.7	0	100	499	79	-	24.3	6338	66	71
CB-801	U.S.A.	Jap	100	145-150	69.3	0	0	472	54	-	23.7	7312	69	71
MEAN					83.8	0	29	485	70	-	24.2	7234	67	70
C.V. %					2.6			9.3	12.5	-	3.3	4.0	1.4	1.1
L.S.D. 0.05					3.7			77	15	-	1.4	494	1.6	1.3
Miara	Italy	Jap.	70	120	86	15	50	517	73	-	23.7	4311	61	66
Veneria	Italy	Jap.	74	120	105	5	45	354	93	-	31.0	5304	63	69
Selenio	Italy	Jap.	74	120	93	10	15	529	88	-	25.3	7494	64	71
Thainato	Sevilla	Jap.	77	127	98	5	5	474	86	-	28.3	7586	68	69
Leda	Valencia	Jap.	80	135	99	0	5	368	87	-	29.7	7593	63	70
Onda	Italy	Jap.	75	120	114	95	95	466	72	-	29.3	5358	64	70
Veta	Sevilla	Jap.	77	127	90	0	0	463	88	-	25.3	6803	65	70
Ringo	Italy	Jap.	74	120	119	95	100	403	88	-	31.0	4913	53	68
Guadiamar	Sevilla	Jap.	77	122	100	0	5	451	76	-	27.3	7903	59	69
Thaibonnet	Sevilla	Ind.	77	127	83	0	0	514	59	-	25.3	7452	58	65
Vialone Nano	Italy	Jap.	71	120	133	95	100	531	70	-	33.3	3457	50	61
Thaiperla	Sevilla	Jap.	81	135	93	0	5	526	74	-	28.7	7241	65	72
Arborio	Italy	Jap.	77	127	133	100	100	375	68	-	38.7	3069	32	61
Newbonet	U.S.A.	Ind.	92	140	84	0	5	392	80	-	23.0	5641	63	69
Bahía	Sevilla	Jap.	83	135	107	0	20	407	89	-	34.0	7859	59	69
MEAN					102			445	79	-	28.9	6132	59	68
C.V. %					3.2			10.9	14.7	-	3.7	10.4	4.7	1.4
L.S.D. 0.05					5.5			81	19	-	1.8	1063	5	1.6

TABLE 3
PERFORMANCE OF THE RICE EXPERIMENTAL LINES AND VARIETIES, TWO TRIALS SUMMARY.
SEVILLA, 1991.

LINE or CULTIVAR	Origin	Plant type	Days to Flowe-ring	Days to Matu-rity	Plant Height (cm)	Lodging % Doughy grain	Lodging % Ripen grain	Yield components Paní-cles/ m2	Yield components Grains /pani-cle	Yield components Blank grain %	Yield components 1000 grain weight	Grain yield (kg/ha at 14 % moisture)	Milling yield % Head	Milling yield % Total
1st TRIAL														
ML-11	Valencia	Jap.	89	135-140	72.3	0	0	473	91	19.3	32.8	7284	-	-
YL-122	Valencia	Ind.	96	140-145	63.3	0	6	732	60	9.0	24.0	5409	-	-
YL-33	Valencia	Ind.	96	140-145	75.0	0	6	473	78	8.7	28.1	6319	-	-
YN-11A	Valencia	Ind.	96	140-145	103.7	0	65	677	64	16.3	28.9	5595	-	-
M-5	Valencia	Jap.	87	135-140	90.3	0	10	527	93	8.3	32.0	7551	-	-
M5-10A	Valencia	Jap.	87	135-140	69.3	0	0	611	81	17.0	31.7	7650	-	-
IRION-90-164	I.R.R.I.	Jap.	94	140-145	115.7	0	100	523	109	7.3	24.0	7930	-	-
M-201	U.S.A.	Jap.	87	135-140	91.0	0	3	572	125	6.7	28.0	8366	-	-
Puntal	Australia	Ind.	92	135-140	93.7	0	3	508	145	4.3	23.5	9916	-	-
Thaibonnet	U.S.A.	Ind.	90	135-140	86.3	0	0	715	73	7.3	26.8	8729	-	-
MEAN					86.1	0	19	581	92	10.4	28.0	7475	-	-
C.V. %					4.8	-	-	7.8	14.9	35.9	4.9	6.4	-	-
L.S.D. 0.05					7.1	-	-	78	23	6.4	2.4	824	-	-
2nd TRIAL														
Veneria	Italy	Jap.	83	130-135	107.7	50	100	489	122	8.0	27.5	8265	65	72
Selenio	Italy	Jap.	83	130-135	94.4	80	100	647	93	7.3	23.8	8119	64	75
Lemont	U.S.A.	Ind.	100	150-155	77.3	0	0	579	93	7.7	23.9	6582	66	69
Guadiamar	Sevilla	Jap.	85	130-135	99.8	3	45	560	115	7.7	26.3	9087	60	64
Thaibonnet	Sevilla	Ind.	89	135-140	86.3	0	5	808	80	7.7	25.0	8764	63	67
Newbonnet	U.S.A.	Ind.	100	150-155	101.9	0	0	555	146	11.7	20.0	7115	67	70
Thainato	Sevilla	Jap.	85	130-135	99.9	0	95	674	87	4.0	28.0	8885	67	71
PS-2	Sevilla	Ind.	87	135-140	119.9	40	100	680	100	9.0	25.3	7908	58	65
PV-7	Valencia	Ind.	104	150-155	83.3	5	12	618	106	8.0	21.3	6499	62	67
PV-8	Valencia	Ind.	100	150-155	81.1	2	3	614	82	4.3	24.7	6904	62	67
MEAN					95.2			622	102	7.5	24.6	7813	63	69
C.V. %					2.1			7.8	7.9	23.0	4.8	6.6	5.3	3.8
L.S.D. 0.05					3.5			84	14	3.0	2.0	884	6.0	5.0

TABLE 4
PERFORMANCE OF THE RICE EXPERIMENTAL LINES AND VARIETIES, TWO TRIALS SUMMARY. SEVILLA, 1992.

LINE or CULTIVAR	Origin	Plant type	Days to Flowering	Days to Maturity	Plant height (cm)	Lodging % Doughy grain	Lodging % Ripen grain	Yield components Panicles/m2	Yield components Grains/panicle	Yield components Blank grains %	Yield components 1000 grains weight (g)	Grain yield (kg/ha at 14 % moisture)	Milling yield % Head	Milling yield % Total
1st TRIAL														
L-509	Valencia	Ind.	91	130-135	66.7	0	0	521	48	12	27.8	5997	-	-
L-511	Valencia	Ind.	91	130-135	68.0	0	0	604	63	18	25.7	7201	-	-
L-531	Valencia	Ind.	91	130-135	67.0	0	0	533	74	18	25.2	5935	-	-
NL-2	Valencia	Ind.	95	135-140	63.7	0	0	624	60	22	24.6	6649	-	-
NL-11	Valencia	Ind.	95	135-140	61.7	0	0	667	56	18	26.0	7718	-	-
Ispaniki "A"	Greece	Jap.	89	135-140	81.0	0	0	449	102	16	25.9	6109	-	-
Rea	Greece	Ind.	91	135-140	76.7	0	0	461	66	14	22.8	3351	-	-
Coral	Italy	Ind.	91	135-140	80.3	0	0	495	57	17	28.6	4057	-	-
Loto	Italy	Jap.	89	130-135	70.0	0	0	388	56	26	32.0	3778	-	-
Panda	Italy	Ind.	85	130-135	90.3	0	0	440	75	14	23.9	4151	-	-
Thaibonnet	Sevilla	Ind.	89	135-140	68.7	0	0	668	56	20	26.3	7545	-	-
C-2	Sevilla	Ind.	91	135-140	93.7	0	0	333	70	22	30.9	3023	-	-
C-3	Sevilla	Ind.	91	135-140	68.7	0	0	656	74	14	25.9	5670	-	-
Puntal	Australia	Ind.	98	140-145	80.0	0	0	437	132	15	22.0	7349	-	-
MEAN					74.0	0	0	520	71	18	26.3	5610	-	-
C.V. %					3.8	-	-	10.9	9.8	31.3	7.6	10	-	-
L.S.D. 0.05					4.7	-	-	95	12	N.S.	3.4	983	-	-
2nd TRIAL														
Thaibonnet	Sevilla	Ind.	89	135-140	77.1	0	2	700	69	12.7	26.0	9111	56	64
Blue Belle E	Greece	Ind.	99	140-145	94.6	0	1	500	91	17.5	22.0	6296	63	68
C-1	Sevilla	Jap.	89	130-135	96.9	0	1	396	113	9.3	29.3	5163	61	69
M11-A	Valencia	Jap.	89	140-145	71.9	0	0	548	82	15.6	30.7	8667	53	58
Pegaso	Italy	Ind.	77	110-115	92.4	0	0	576	73	6.3	24.7	5922	48	67
Dedalo	Italy	Ind.	94	125-130	93.3	0	3	520	103	10.9	24.0	6320	60	65
Idra	Italy	Ind.	89	125-130	92.2	0	10	792	61	17.2	24.7	6413	61	65
Mida	Italy	Ind.	89	125-130	92.6	0	8	528	94	3.9	25.0	5575	62	69
M-5	Valencia	Jap.	91	140-145	83.2	0	0	572	88	7.6	30.0	6622	62	66
Icaro	Italy	Ind.	94	125-130	87.2	0	3	564	100	9.2	20.7	6412	64	70
MEAN					88.1			568	88	11.0	25.7	6650	59	66
C.V. %					3.5			9.0	11	20.4	3.1	10.0	5.9	5.7
L.S.D. 0.05					5.2			22	17	5.7	1.4	1138	6	N.S.

TABLE 5
INTERNATIONAL RICE YIELDS NURSERY VERY EARLY (IRYN-VE) and EARLY (IRYN-E). TEN MORE PRODUCTIVE VARIETIES RESULTS. SEVILLA 1990.

LINE or CULTIVAR	ORIGIN	Grain yield (t/ha at 14 % moisture)	Days to Flowering	Plant height (cm)	Panicles/m2
IRYN-VE					
Thaibonnet (testing)	Local	6.3	123	95	303
IR39357-133-3-2-2-2	IRRI	5.8	117	110	303
BAU148-27	India	5.7	107	97	314
IR42015-83-3-2-2	IRRI	5.7	118	91	309
IR22107-14-2-1	IRRI	5.6	109	89	291
RP1669-1529-4254	India	5.5	117	105	266
AT77-1	Sri Lanka	5.4	130	113	296
IR13539-100-2-2-2-3	IRRI	5.4	131	90	283
IR31787-85-3-3-3-2	IRRI	5.4	116	96	281
RP1442--2-2-3-5-1	India	5.4	116	95	293
GENERAL MEAN		5.3	119	99	294
C.V. %		11.3	1.5	2.1	3.2
L.S.D. 0.05		NS	3	3	15
IRYN-E					
Thaibonnet (testing)	Local	6.3	123	98	302
IR31805-20-1-3-3	IRRI	5.9	144	93	271
IR41985-98-3-1-3-2	IRRI	5.6	117	93	292
RP1699-183-133-1	India	5.6	135	109	285
RP2240-147-143	India	5.6	149	96	283
IR42028-50-2-1-3-2-2	IRRI	5.5	128	87	293
LUKE3	China	5.5	132	98	287
IR35293-125-3-2-3	IRRI	5.4	123	98	300
IR35366-40-3-3-2-2	IRRI	5.4	131	92	292
SI-PI 681032	Taiwan	5.4	143	100	292
GENERAL MEAN		5.3	130	97	292
C.V. %		8.7	2.9	3.0	4.3
L.S.D. 0.05		NS	6	5	NS

TABLE 6
INTERNATIONAL IRRIGATED RICE OBSERVATIONAL NURSERY (IIRON).
SEVILLA 1990, 1991 and 1992.

LINE or CULTIVAR	ORIGIN	Plant height (cm)	Days to Flowering	Seedling vigor (1)	Phenotypic acceptability (1)
1990					
Thaibonnet (testing)	Local	97	95	5	2
HURI 289	Hungary	103	68	5	2
SZARVASI 27	Hungary	113	65	5	2
IR44657-49-2-2-2-2	IRRI	95	88	5	2
IR44688-76-1-1-1-2	IRRI	82	88	5	2
IR39385-20-1-2-1-1	IRRI	86	86	5	5
RP1442-4-6-1-1	India	164	80	1	5
IR58	IRRI	90	82	5	5
DJM509	Senegal	100	82	5	5
PUSA578-1-177	India	105	96	5	2
IR37344-AC800	IRRI	85	88	5	5
1991					
Thaibonnet (testing)	Local	81	101	5	2
HURI 302	Hungary	82	70	5	3
HURI 366	Hungary	82	70	5	3
IR51673-50-2-2-3	IRRI	83	106	5	5
PELDE (ACC65721)	Australia	105	101	5	5
RP2263-2561-1	India	81	106	5	5
1992					
Thaibonnet (testing)	Local	95	83	5	2
IR19743-46	IRRI	98	74	5	2
ORO	Chile	124	68	7	5
OR165-86-12	India	105	80	5	5
QUELLA-INIA	Chile	120	67	7	5
80055-TR198-5-1-1	Turkey	93	67	5	3
IR45907-160-3-2-2	IRRI	85	74	5	5
IR52287-153-1-1-2	IRRI	95	89	5	5
IR53970-115-2-2-2	IRRI	90	85	5	5
IR53970-9-2-2-1	IRRI	85	83	5	5
RICO 1	USA	105	85	5	5

(1) Standard Evaluation System (SES): 1-3 = good; 4-6 = fair; 7-9 = poor

Fig. 1.- Lodging evolution of the rice experimental lines and varieties. Villafranco del Guadalquivir (Seville). 1991.