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A COLD TOLERANT RICE VARIETY MDU. 2 FOR 'CUMBUM VALLEY' OF MADURAI DISTRICT

G. SOUNDRAPANDIAN[1], V. D. GURUSWAMY RAJA[2], M. KADAMBAVANASUNDARAM[3] and P. RANGASWAMY[4].

In Keelagudalur area of Madurai District of Tamil Nadu, rice is cultivated at an elevation of 500 m. During the second crop season, the flowering coincides with low temperature in January and results in high spiklet sterility. Several genotypes obtained from different national and international sources were screened for the cold tolerance and a strain ACM. 5 was found to be the best with low spiklet sterility and high yield. It was found to absorb more K and P compared to the local check variety I. R. 20. This has been released as MDU. 2. a cold tolerant rice variety. Its performance in different trials has been presented.

Rice production is heavily influenced by disturbed agricultural factors such as drought, flood, injurious salts present in the soil, heavy incidence of pests and diseases and extreme climatic conditions like cold temperature and very hot temperature. Yield reduction in rice due to low temperature was recorded in hilly zones of North India (Hamdani, 1979). Generally, cold injury is not a problem in plains. However in certain pockets such as "Cumbum valley" of Madurai district with 500 m altitude and surrounded by hills on three sides, the climate is cool with minimum temperature reaching 14-16°C during the flowering phase of the crop falling between January and February. Due to cool weather, significant yield reduction of 20 to 40 per cent was noticed on account of high spikelet sterility during the second crop season in "Cumbum valley". In order to evolve a cold tolerant rice variety for this tract extending over 6000 hectares, intensive breeding was launched by the Department of Agrl. Botany, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai during the year 1980-81.

The intensive research work carried out by concerted effort at the hot spot area of "Cumbum valley" lead to the identification of a high yielding, medium duration, semi dwarf, cold tolerant fine grain rice culture, ACM. 5 which is endowed with field tolerance to major pests and diseases. Culture ACM. 5 was released as MDU. 2 during January, 1984 by the approval of State Varietal Release

1 and 4. Department of Agricultural Botany, Agricultural College and Research Institute, Madurai.

2 and 3. Dean, P. G. Studies and Professor, School of Genetics, Tamil Nadu Agricultural University, Coimbatore.

Committee for general cultivation in "Cumbum valley" of Madurai district in Tamil Nadu. MDU. 2 can be introduced into lower elevation upto 500 m above MSL where cooler climate prevails during the flowering phase of the rice crop.

MATERIALS AND METHODS :

One hundred and sixty six rice germplasm lines and breeding lines from various sources at national and international levels were collected and evaluated at the hot spot area of cooler climatic region of Cumbum valley, the sub-centre for cold tolerant rice research, situated at an elevation of 500 m above MSL and having low temperature of 14-16°C during January-February months. The crop was sown in middle of October every year so that the flowering phase synchronised with cool temperature months of January and February. The biometrical observations on plant height, number of tillers, panicle length, number of filled grains, number of unfilled chaffy grains and single plant grain yield were recorded. Based on low spikelet sterility (unfilled grains) and higher grain yield, the selection pressure was exercised and lines were forwarded for further breeding tests. During 1981-82, forty seven promising rice selections were studied. Out of these, four lines viz., ACM. 4, ACM. 5, ACM 6 and ACM. 7 were found to be consistant in their superior performance as compared to the check IR. 20. These cultures were simultaneously tested under farmers holdings under multi-location trials in Cumbum valley and in the Rice Coordinated Yield trials in different Agricultural Research Stations during 1982-83 to collect data on the performance of these cultures in different locations. Based on superior performance in different locations, culture ACM 5 was selected and tested for its reaction to pests and diseases besides subjecting it to quality tests in comparison with IR 20 and the data are presented in tables 1 to 7.

RESULTS AND DISCUSSION :

1. *Research Stations Trial :* The results of the yield trials conducted during the three years 1980-81 to 1982-83 at Keela Gudalur State Seed Farm and at other Research Stations of the Tamil Nadu Agrl. University are furnished in tables 1 and 2 respectively.

The improved rice culture ACM. 5 recorded consistantly higher grain yield over the standard IR. 20 with an average increased yield of 25.2 per cent (Table 1)

The yield potential of ACM. 5 varied from 2.3 to 6.3 t/ha in the trials coducted at the Research Stations (Table 2). Its performance at Pondicherry, Bhavanisagar, Madurai was above 5 t ha and the overall mean averaged over all the stations was 4.4 t/ha showing an increase

Table 1. Performance of ACM. 5 rice culture at Keela Gudalur of Cumbum valley.

Year	IR. 20	ACM. 5	Percentage over IR. 20
	Grain yield (kg / ha)		
1980	3215	4213	125.6
1981	3093	3833	129.2
1982	2334	2925	121.0
Mean	2881	3657	125.2

Table 2. Performance of ACM. 5 rice culture at Research Stations.

Sl. No.	Regional Research Stations	Grain Yield (kg / ha)	
		IR. 20	ACM. 5
1.	Coimbatore	3503	3430
2.	Pondicherry	3863	5307
3.	Bhavanisagar	6367	6353
4	Paiyur	3345	3681
5.	Ambasamudram	3272	3434
6.	Madurai	5357	5877
7.	Tirurkuppam	2485	2328
8.	Aduthurai	3232	3043
	Mean	3228	4428
	% on control	100.0	112

of 12.9 per cent over IR.20. In the multilocation trials conducted at the farmers' holdings of the hot spot area of the cooler climatic regions of Cumbum valley, the improved rice culture ACM. 5 registered consistantly higher grain yield in most of the locations and the yield ranged from 3.77 to 10.38 t/ha with an average of of 6.1 t/ha (Table 3).

An overall yield estimate of the different yield trials, showed that the culture ACM. 5 recorded on an average 4.7 t/ha with 17.1 per cent increased yield over the check variety IR 20. The spikelet sterility recorded by the culture ACM. 5 was as low as 23.4 per cent as compared to 44.6 per cent recorded by IR.20 (Table 5), the ruling variety. Varietal difference in the incidence of chaff percentage under low temperature conditions was reported by Kondo *et al* (1948). The

Table 3. Performance of ACM. 5 at farmers' holdings in the Cumbum valley.

Sl. No.	Farmers holdings	Grain yield (kg/ha)	
		IR. 20	ACM. 5
1.	Keelagudalur I	3825	4000
2.	Keelagudalur II	4000	4500
3.	Keelagudalur III	3835	4000
4.	Keelagudalur IV	3875	4125
5.	Keelagudalur V	6250	6375
6.	Cumbum	4500	4625
7.	Kamaya goundenpatti	4125	4250
8.	Pudupatti	3750	4000
9.	Uthamapuram	5125	5500
10.	Uthamapalayam I	4900	5750
11.	Uthamapalayam II	5025	5850
12.	Gohilapuram I	5500	6000
13.	Gohilapuram II	6250	6525
14.	Anamalayanpatti	6500	7500
15	Rayappanpatti I	7000	8000
16.	Rayappanpatti II	6918	8326
17.	Rapappanpatti III	6823	7830
18.	Markayankottan	10000	10383
19.	Doraichamypuram	7000	7300
20.	Poolanandapuram I	8000	8400
21.	Poolanandapuram II	8033	8633
22.	Maripatti	3845	4875
23.	Bodinayakanur	3625	3775
	Mean	5500	6110
	Percetage on IR. 50	100 0	111.

Table 4. Mean Performance of the culture ACM. 5 in the Research Station, Multi location and Rice Coordinated Yield Trials.

Sl. No.	Experiments	Grain yield (kg/ha)	
		IR. 20	ACM. 5
1.	Research Stations Trials	2881	3657
2.	Multi location trials	5500	6110
3.	Rice Coordinated Yield Trials	3728	4428
	Mean	4033	4732
	Percentage on IR. 20	100.0	117.1

Table 5. P and K uptake under stress condition of cold in field.

Variety	Cold condition	K absorption %	P absorption %	Spikelet sterility
ACM. 5	R	2.00	0.43	23.4 %
IR. 20	S	1.20	0.35	44.6 %

Table 6. Pest/disease reactions under field condition.

Variety	T. V.	L. B.	G. M.	Leaf roller	Stem borer	BPH	WPH
ACM. 5	R	MR	MR	MR	MR	MR	MR
IR. 20	R	S	S	MR	MR	S	S

R — Resistant
MR — Moderately resistant
S — Susceptible

Table 7. Cooking quality of culture ACM. 5

Quality characteristics	IR. 20	ACM. 5
Length of the grain (mm)	8.02	7.72
Breadth of the grain (mm)	2.84	2.60
Thickness (mm)	1.544	1.555
1000 kernal weight (g)	19.289	19.524
Husk content %	20.3	20.0
Milled rice yield %	74.7	74.7
Gelatinisation temperature (C°)	73.0	71.9
Elongation index of cooked ric	1.14	1.28
Volume expansion	3.28	3.00
Time taken for cooking (mt)	33.0	25.0
Percentage of water uptake	85.6	98.0
Mean panel score of cooked rice		
a) Tenderness	2.3	3.7
b) Cohesiveness	4.3	3.7
c) Colour	5.0	5.0

high pollen sterility caused by the prevalence of cold weather during the flowering period resulted in high chaff percentage as reported by Hayase *et al* (1969).

Culture ACM. 5 was more efficient than IR. 20 in the uptake of P and K, though the level of absorption was low due to the effect of low temperature (Table 5). Reddy and Madhusudhan Rao (1976) and Selvakumar (1982) reported that the high uptake of P and K was highly associated with low temperature tolerance of rice varieties.

Culture ACM. 5 was found moderately resistant to gall midge, leaf roller and stem borer as well as leaf blight and blast under field conditions (Table 6). Culture ACM. 5 possesses good grain quality as well as cooking quality attributes (Table 7). Culture ACM. 5 is cooked in 25 minutes as against 33 minutes in the case of IR. 20.

Culture ACM. 5, besides being endowed with high yielding potential coupled with cold tolerance, possessed desirable quality as well as pest and disease resistance attributes. Based on superior performance and cold tolerance characteristic, culture ACM. 5 was approved by the State Varietal Release Committee and released in January, 1984 as the improved variety, MDU. 2 for general cultivation by farmers in the cooler climatic region of Cumbum valley in Madurai district and similar other regions of Tamil Nadu.

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