the crop growth period, which encouraged both vegetative stage and reproductive stage. Pooled analysis of three years yield of sorghum was done and the error is found to be heterogenous, Hence from the above result it is concluded that for rainfed vertisols of Kovilpatti, moisture conservation practices like compartmental bunding, broad beds and furrows and ridges and furrows are found mostly suitable in increasing the grain yield of sorghum under rainfed condition, considering the economical factor of different moisture conservation practices (Table 3). Hence it is better to have compartmental bunding than any other system in a field with a slope of 0.5 per cent. If the slope is more than one per cent, broad beds and furrows could be formed.

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DEVELOPMENT OF NON-RESTORER PEARL MILLET LINES RESISTANT TO DOWNY MILDEW

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Twenty nine inbred parents of pearl millet and four non-restorer inbreds were involved in a programme of developing non-restorer lines carrying the genes for resistance to downy mildew. By a series of backcrosses with the non-restorers PT 732B, J 126D2B, L111B and 5141B, as recurrent parents and twenty nine resistant inbreds as donor parents 76 non-restorer lines were generated. Among these, 18 involving 732B, 17 involving 126D2B, 20 involving L111B and 21 involving 5141B exhibited high degree of uniformity combined with high degree of resistance to downy mildew. They also maintain sterility in F1 with standard male sterile lines. This programme resulted in 76 non restorer pearl milletlines with resistance to downy mildew.

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Pearl millet *(Pennisetum americanum* (L.) Leeke) is one of the most important cereals widely grown in Tamil Nadu. The crop by virtue of its protogynous nature of the floral mechanism is naturally cross fertilized and consequently permits exploitation of heterosis Advent of male sterile line made it easy to exploit heterosis commercially. Most of the hybrids, however, after a few years of their release have succumed to the downy mildew diseases (Safeulla, 1977). The original outbreak of the disease on a severe scale was, however due to the male sterile line Tift 23A (Harinarayana, 1984) which was completely susceptible to downy mildew But many lines in the germplasm were found to exhibit resistance and through the use of these resistant lines new male sterile lines and restorers with builtin, resistance were attempted to be generated. Accordingly, new malesterile lines were developed at different centres and they were being utilized by different workers in their hybrid combinations with suitable fertility restorers (Kumar *et al.* 1984).

Inheritance of the resistance mechanism to downy mildew was reported to be complex and involves many genes (Gill *et al.* 1975). It was hence thought desirable to incorporate genes for resistance to Downy mildew in the ms and maintainer non-restorer lines. Thus a multiline system could be created in the male sterile female parents possessing a common phenotype but differing in disease resistance mechanism. The development of non-restorers varying in genes for resistance to downy mildew will be the first step towards this direction. Accordingly a programme was initiated at Tamil Nadu Agricultural University and the results of the programme are discussed in this paper

MATERIALS AND METHODS

The programme was started during 1980 at KFSC, TNAU, Trichi and subsequently carried out at Coimbatore in three stages.

Stage -1 Collection and screening of already available and newly received materials for resistance to downy mildew and making initial crosses: A total number of 35 resistant lines were collected from different sources and they were screened in the sick plot which was created by standard procedure Among them the following 29 lines that showed resistance at Trichy centre were utilized in the breeding programme.

1. IP.18 2. IP.45 3. IP.56
4. IP.230 5. IP.266 6. IP.330
7. IP.394 8. IP.403 9. IP.452
10. IP.562 11. IP.830 12 IP 881
13. IP.1055 14. IP.1140 15.PT.818/10
16. PT.1518 17. PT.1577 18. PT.1824
19 P.7 20. P.10 21. MP.5 22. MP.7
23. 700251 24. 700561 26.SDN 347-1
27.SDN 503 28. Vikhram 29 PT .7525

Stage - II: Four B lines 732B, J 126 D_2 B_1 L 111B and 5141B were selected as female on the basis of their high combining ability and raised in a crossing block and each of them

Table. 1 : Morphological features, sterility maintenance with 81 A and 732 A and Downy Mildew incidence of the newly developed non-restorer lines.

S No	Isogenic line No.	Pedigree	Plant height (cm)	No. of tillers	Length of earhead (cm)	Girth of earhead (cm)	Days to 50 % bloom	% plant showing sterility on		Downy Mildew incidence %
								81A	732A	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1.	TN 101 732 B	X IP 45	83.0	4-5	28.0	2.2	55	95	98	0
2.	,, 102 ,,	X IP 450	133.7	3-4	21.5	1.9	59	75	95	0
3.	,, 103 ,,	X IP 56	101.7	4-5	21.5	2.0	59	98	100	0
4.	,, 104 ,,	X MP5	131.0	3-4	20.0	1.9	55	65	100	0
5.	,, 105 ,,	X IP 266	88.0	2-3	20.3	1.8	56	65	86	0
6.	,, 106 ,,	X IP 330	90.3	3-4	21.3	2.3	59	100	100	0
7.	,, 107 ,,	X IP 403	85.3	5-6	22.0	1.5	59	100	100	0.5
8.	,, 108 ,,	X IP 562	85.0	4-5	22 0	1.4	56	100	100	0
9.	,, 109 ,,	X PT 818/10	111.3	3-4	21.7	1.9	55	92	100	0
10.	,, 110 ,,	X ID 830	83.3	2-3	22.0	1.6	56	100	100	0 4
11.	,, 111 ,,	X IP 1055	79.0	3-4	18.7	1.7	52	98	100	0
12.	,, 112 ,,	X IP 1140	83.0	3-4	23.3	1.7	55	98	100	0
13.	,, 113 ,,	X PT 1518	163.0	3 4	24.7	2.0	68	100	—	0
14.	,, 114 ,,	X PT 1577	88.3	4-5	21.0	1.6	59	100	—	0
15.	,, 115 ,,	X SDN 347-1	85.3	3-4	22.5	2.1	59	100	—	0
16.	,, 116 ,,	X 700251	93.3	4-5	26.3	1.7	52	100	100	0
17.	,, 117 ,,	X 700651	87.0	4-5	17.5	2.0	68	100	100	0.1
18.	,, 118 ,,	X PT 7225	103.0	4-5	29.7	2.2	55	100	—	0
19.	,, 201 ,,	X IP 18	108.7	4-5	21.7	1.7	52	100	—	0 4
20.	,, 202 ,,	X IP 45	117.0	3-4	18.7	2.0	49	100	—	0
21.	,, 203 ,,	X IP 230	151.0	2-3	23.7	1.9	56	25	100	0
22.	,, 204 ,,	X IP 394	92.3	2-3	20.5	1.9	55	25	100	0
23.	,, 205 ,,	X IP 403	116.3	3-4	22.3	2.2	56	98	25	0
24.	,, 206 ,,	X IP 452	149.0	3-4	27.0	1.7	50	100	—	0 4
25.	,, 207 ,,	X IP 830	122.3	3-5	21.3	2.3	60	45	—	0
26.	,, 208 ,,	X IP 881	110.0	3-4	18.7	2.1	55	25	20	0 5
27.	,, 209 ,,	X IP 1140	156.7	3-4	21.0	1.8	60	100	—	0
28.	,, 210 ,,	X PT 1518	110.3	3-4	22.3	1.9	59	—	96	0
29.	,, 211 ,,	X PT 1824	103.0	3-4	22.3	1.9	59	100	100	0 9
30.	,, 212 ,,	X PP. 5	149.3	2-3	25.7	1.8	58	100	—	0
31.	,, 213 ,,	X MP. 7	149.7	2-3	22.0	1.6	57	95	20	0
32.	,, 214 ,,	X SDN 503	130.0	3-4	23.0	1.6	60	100	100	0
33.	,, 215 ,,	X 347-1	104.3	4-5	24.7	2.2	57	100	—	0
34.	,, 216 ,,	X 700651	99.3	3-4	23.0	2.1	55	95	—	0.8
35.	,, 217 ,,	X PT 7525	106.7	3-4	23.3	1.7	68	98	—	0
36.	301 L 111 B	X IP 56	123.0	3-4	26.7	2.3	55	100	—	1.2

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
37.	TN 302 ,,	X IP 56	157.3	4-5	24.7	1.8	68	100	100	0
38.	,, 303 ,,	X IP 330	88.5	3-4	22.3	2.2	55	25	95	0 6
39.	,, 304 ,,	X IP 394	113.6	5-6	39.2	2.2	57	95	10	0
40	,, 305 ,,	X IP 452	157.0	3-5	23.5	2.2	60	100	100	0.4
41.	,, 306 ,,	X IP 562	159.5	3-4	27.0	2.3	60	95	15	0 4
42.	,, 307 ,,	X PT 818/10	107.0	3-4	26.3	2.2	68	100	—	2 3
43.	,, 308 ,,	X IP 830	154.5	3 5	26.0	1.9	62	100	95	0 3
44.	,, 309 ,,	X IP 881	153.7	6-7	25.3	2.0	55	100	—	0
45.	,, 310 ,,	X IP 1055	137.0	3-5	25.3	1.9	55	95	—	0
46.	,, 311 ,,	X PT 1518	133.7	3-5	23.3	2.0	59	100	—	0
47.	,, 312 ,,	X PT 1577	120.0	3-5	25.5	2.3	56	100	20	0
48.	,, 313 ,,	X MP 5	164.0	2-3	26.3	2.3	73	100	—	0
49.	,, 314 ,,	X MP 7	117.0	3-5	24.3	1 5	62	95	20	0
50.	,, 315 ,,	X SDN 347-1	151.2	3-5	26.7	2.3	61	100	15	0
51.	,, 316 ,,	X 700251	138.0	2 3	27.6	2.0	55	25	100	0 3
52.	,, 317 ,,	X 700516	118.3	2-3	26.0	1.7	61	100	—	0
53.	,, 318 ,,	X 700651	137.7	2-3	27.2	2.2	61	100	95	0
54.	,, 319 ,,	X Vikhram	131.0	4-5	27.0	2.0	61	15	85	0.5
55.	,, 320 ,,	X PT 7225	108.3	3-4	23.0	1.9	62	100	90	0 4
56.	,, 401 5141 B	X IP 18	123.0	3-4	19.3	1.7	58	100	94	1.3
57.	,, 402 ,,	X IP 45	121.3	3-5	21.5	2.1	55	100	—	1.1
58.	,, 403 ,,	X IP 230	117.8	5-6	17.5	2.1	55	95	—	4.5
59.	,, 404 ,,	X IP 266	101.5	3-5	17.0	2.1	52	—	100	2.9
60.	,, 405 ,,	X IP 394	99.0	3-5	17.7	2.0	58	100	—	2.3
61.	,, 406 ,,	X IP 400	92.5	4-5	15.8	1.6	61	95	90	0.4
62.	,, 407 ,,	X IP 452	118.3	3-5	16.3	1.6	55	100	100	2.6
63.	,, 408 ,,	X IP 562	107.2	3-4	15.5	1.8	59	95	—	2.0
64.	,, 409 ,,	X IP 830	93.3	3-4	15.6	1.6	55	100	10	2.0
65.	,, 410 ,,	X IP 1055	98.4	2-4	18.3	1.9	54	10	—	1.4
66.	,, 411 ,,	X IP 1140	136.3	3-5	24.0	1.7	54	100	—	0
67.	,, 412 ,,	X PT 1518	117.2	3-5	20 5	1.6	61	100	95	0
68.	,, 413 ,,	X PT 1757	101.3	4-5	19.8	1 6	55	90	15	2.6
69.	,, 414 ,,	X PT 1824	118.6	4-6	15.9	2.4	54	100	—	2.5
70.	,, 415 ,,	X MP 7	102.0	3-4	17.8	2.1	55	100	10	0
71.	,, 416 ,,	X P.7	113.5	3-5	18.0	2.6	61	100	5	0
72.	,, 417 ,,	X P.10	109.7	4-5	16.5	1.9	61	95	—	4.9
73.	,, 418 ,,	X SDN 503	109.3	4-5	17.3	1.7	58	15	100	0
74.	,, 419 ,,	X 700251	123.4	3-5	18.2	2.1	55	100	100	0.0
75.	,, 420 ,,	X 700516	137.5	3-4	21.5	2.4	58	95	100	0.0
76.	,, 421 ,,	X PT 7525	98.8	5-6	16.3	2.3	55	90	15	0.6

was crossed with the 29 resistant lines. The resultant 116 hybrids were raised in the sick plot and their reaction to downy mildew was studied. The selected F1s were backcrossed with their respective non - restorer parents (B-lines). The process of raising the progenies in the sick plot

and backcrossing was continued for six generations. At the end of the sixth back cross the materials were transferred to Coimbatore.

Stage - III: Testing of the newly developed non-restorers for their sterility maintenance. Non-restorers were crossed with standard male steriles and F1s were studied for their sterility maintenance. The lines which show sterility upon selfing are considered as steriles.

RESULTS AND DISCUSSIONS

The morphological characters of the non-restorer lines developed in stage II are paesented in table 1. They heve attained stability for most of the characters. They were then crossed with two standard male sterile lines (732A and 81A) and the progenies were scored for sterility. Though a total number of 105 lines were obtained, all the lines did not maintain sterility in F1 generation. Among the lines only 76 were agronomically promising.

The ability of the 76 lines to maintain sterility with 81A and 732A differed. This may be due to differential cytoplasm of A line. In the downy mildew disease reaction, it was observed that the lines developed out of 5141B show higher incidence of downy mildew disease than the others. This is due to the fact that the downy mildew susceptibility or resistance is due to the interaction of genome and cytoplasm as suggested by Gill *et. al* 1975.

As the B lines were used as recurrent parent, the non-restorer genes would have been incorporated into the backcross lines. The disease resistance potential has been scored in each BC generation. The gene for resistance have also been brought in to the background from the donor parent. The lines that maintain complete sterility in F1 could serve as new source of 'B' lines to develop male sterile lines by complete genome substitution of the existing male sterile lines. After complete genome substitution, the developed male sterile lines are to be tested in different locations for race specificity and stability for male sterility expression. Lines resistant to different races of the pathogen may be pooled and used in a multiline heterosis breeding programme after testing their combining ability.

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