Annals of Arid Zone 36(4): 383-385, 1997

Short Communication

Performance of Pearl Millet Hybrids based on Male-sterile Lines With and Without Genetic Contribution from Landraces under Arid Environments

O.P. Yadav[1] and V.K. Manga
Central Arid Zone Research Institute, Jodhpur 342 003, India

The cultivation of pearl millet (*Pennisetum glaucum* (L.) R. Br.) hybrids played a key role in increasing the crop productivity in the areas having either assured irrigation facilities or receiving good and evenly distributed rainfall. However, their superiority is doubted in arid areas of north-western India (Bidinger and Parthasarthy Rao, 1990) primarily due to their poor adaptation in such areas. In contrast, local landraces are highly adapted to harsh growing areas and usually perform better than the high yielding modern varieties (Weltzien and Witcombe, 1989). Thus there arises the need to combine the adaptation of the landraces in the hybrids for the arid areas. Mahalakshmi *et al.* (1992) and Bidinger *et al.* (1994) have earlier reported good adaptation of landrace-based top cross hybrids in arid environments.

At Central Arid Zone Research Institute (CAZRI), male sterility was transferred to an inbred line (44B) derived from a pearl millet landrace from western Rajasthan. This medium tall male-sterile line (CZMS 44A) having an erect growth habit and profuse tillering is being utilized as seed parent in hybrid breeding programmes. The objective of this study was to compare the relative performance of hybrids, under arid environment, made on a male-sterilized landrace and three other male-steriles that do not have any genetic material in their parentage from Rajasthan landraces.

Thirty two hybrids produced by crossing each of four male-sterile lines, CZMS 44A, 81A, 843A and 841A with eight genetically diverse inbred lines (P 13-65G, CZI 846, CZI 726, CZI 848, CZI 850, CZI 790, CZI 767 and CZI 852) were grown at Jodhpur in 1992 in a randomized block design with three replications. The net plot size was 4.8 sq. m. Data were recorded for days to flowering, grain yield, and plant height and were subjected to line x tester analysis of variance following Kempthorne (1957). The mean performance of hybrids grouped by their seed parent was compared with LSD.

The total rainfall during the crop season was 383 mm, whole of which occurred well before the average head emergence date of trial and thus the crop experienced water stress during and after grain-filling period.

There was significant variation in hybrids for all three characters suggesting that further genetic analysis could be carried out. Therefore, the total variation in hybrids

[1] Agricultural Research Station, Mandor, Jodhpur 342 004, India.

Table 1. Mean performance of pearl millet hybrids produced on four male-sterile lines

Male-sterile line	Days to flowering (No.)	Plant height (cm)	Grain yield (q ha^{-1})
CZMS 44A	46.0	170.0	15.73
81A	47.0	168.0	13.71
843A	40.0	142.0	12.19
841A	44.0	162.0	12.71
LSD	0.9	2.9	0.61

was partitioned into variation due to lines, pollinators and their interaction. The variation due to lines was highly significant for all traits indicating that male-sterile lines contributed significantly in determining the performance of hybrids.

Mean performance of hybrids on various male-sterile lines differed significantly for days to flowering, plant height and grain yield (Table 1). Hybrids on CZMS 44A attained the maximum height and took 2-6 days more to flower than those on 843A and 841A. However, they flowered one day earlier than 81A hybrids. Hybrids on 843A grew significantly shorter and were earliest to flower. The average grain yield advantage of hybrids made on CZMS 44A was of the order of 15-29% over hybrids produced on other male-sterile lines. CZMS 44A-based hybrids out yielded all but four hybrids produced on three other male-sterile lines and the superiority in several individual cases was as high as 80-90%. If even half of this yield advantage of better cross combinations is maintained at farmers' field, the gain in productivity would be substantial.

The higher grain yield of CZMS 44A-based hybrids led to establish CZMS 44A as the best general combiner for grain yield in arid environments (Table 2). This suggested that the male-sterile CZMS 44A passed on its good adaptation to stress-prone environments to its hybrids. On the other hand, lines 843A and 841A that contained no genetic material from landraces proved to be poor general combiner for grain yield. However, the former was the best general combiner for both earliness and dwarfness.

The results of this study indicated that the use of landraces as seed parents provides an opportunity to combine the adaptation

Table 2. General combining ability estimates of four male-sterile lines of pearl millet

Male-sterile line	Days to flowering (No.)	Plant height (cm)	Grain yield (q ha^{-1})
CZMS 44A	1.81**	9.79**	2.15**
81A	2.94**	7.21**	0.12
843A	-4.56**	-18.46**	-1.39**
841A	-0.19	1.46	-0.88**
SE(gi)	0.33	1.04	0.22
LSD	0.93	2.94	0.62

** significant at P = 0.01.

of landraces in the hybrids. However, there have not been serious attempts, hitherto, to exploit them in hybrid breeding programmes either as seed parent or as pollinator. Efforts are underway at CAZRI to transfer male sterility to more landraces so as to use them in hybrid development.

References

Bidinger, F.R. and Parthasarthy Rao, P. 1990. Genetic and cultural improvement in the production of pearl millet. In *Proceedings of the International Congress of Plant Physiology,* New Delhi, India (Eds. S.K. Sinha, P.V. Sane, S.C. Bhargava and P.K. Agarwal), pp. 194-206. Society for Plant Physiology and Biochemistry, New Delhi, 15-20 February 1988.

Bidinger, F.R., Weltzien, R.E., Mahalakshmi, V., Singh, S.D. and Rao, K.P. 1994. Evaluation of landrace top cross hybrids of pearl millet for arid zone environments. *Euphytica* 76: 215-226.

Kempthorne, O. 1957. *An Introduction to Genetic Statistics*. John Wiley & Sons Inc., New York, U.S.A.

Mahalakshmi, V., Bidinger, F.R., Rao, K.P. and Raju, D.S. 1992. Performance and stability of pearl millet top cross hybrids and their variety pollinators. *Crop Science* 32: 928-932.

Weltzien, R.E. and Witcombe, J.R. 1989. Pearl millet improvement for the Thar desert, Rajasthan, India. *Vortraege fur Pflanzenzuchtung* 15: 23-24.