*Indian J. Genet.*, **61**(2): 167-168 (2001)

Short Communication

# Selection strategy for yield improvement in pearl millet [*Pennisetum glaucum* (L.) R. Br.]

**R. Madhusudhana[1] and O. P. Govila**

Division of Genetics, Indian Agricultural Research Institute, New Delhi 110 012

(Received: July 1999; Revised: February 2001; Accepted: March 2001)

One hundred and twelve hybrids developed using 14 male sterile lines and eight restorers grown in a randomized block design with three replication during *Kharif* 1995 at Indian Agricultural Research Institute, New Delhi. Each entry was planted in a single row plot of three-meter length. A spacing of 45 cm × 15 cm was maintained. Observations were recorded on five random plants for days to 50% flowering, plant height, effective tillers per plant, spike width, grain density per $cm^2$, grain yield per plant and 1000 grain weight. Mean values were used for statistical analysis. The phenotypic and genotypic correlations were worked out among different characters according to [1] and path coefficient analysis as per Dewey and Lu [2].

The grain yield per plant had highly significant positive association with effective tillers per plant, spike length, plant height and days to 50% flowering, spike width and 1000 grain weight [3, 4-7]. However, selection for increase in all these characters may not be rewarding as these characters are associated negatively with effective tillers per plant, the most important yield component [8, 9]. This is quite obvious as increase in tiller number reduces the height, spike length and spike width and even plant matures early due to distribution of total food material available per plant among tillers.

The character, grain density showed negligible association with grain yield but had positive association with effective tillers and days to 50% flowering. However, its association with spike width and 1000 grains weight is significantly negative at both genotypic and phenotypic levels. Both spike length and girth exhibited positive and significant association with 1000 grains weight, however, the association for spike width is high. This can be explained as the number of effective tillers increases, spike length, width and grain weight decreases. When grains are small, number of grains per unit area (grain density) increases.

The path coefficients analysis (Table 2) indicated that the characters, effective tillers per plant and spike length, posses high degree of direct effects on grain yield whereas that of spike width and grain density is moderate. It is interesting to note that effective tillers per plant and grain density reduced the correlation of spike length and width with yield whereas the spike length and width decreased that of effective tillers and grain density. This further substantiates the antagonistic nature of associations (Table 1).

**Table 1.** Phenotypic correlation coefficients for yield and yield attributes

| Character | Plant height | Effective tillers | Spike length | Spike width | Grain density | 1000 grain weight | Grain yield/plant |
|---|---|---|---|---|---|---|---|
| Days to 50% flowering | 0.43** | –0.11 | 0.33** | 0.25** | 0.20* | 0.15 | 0.29** |
| Plant height | | –0.06 | 0.33** | 0.39** | 0.08 | 0.29** | 0.35** |
| Effective tillers | | | –0.16* | –0.19* | 0.09 | –0.10 | 0.48** |
| Spike length | | | | 0.26** | –0.01 | 0.24** | 0.43** |
| Spike width | | | | | –0.49** | 0.75** | 0.27** |
| Grain density | | | | | | –0.64** | 0.09 |
| 1000 grain weight | | | | | | | 0.26** |

*, ** Significant at 1% and 5% level of significance

[1]Present address : National Research Centre for Sorghum, Rajendranagar, Hyderabad 500 030.

**Table 1.** Genetic components of generation means in three maize crosses for yield and its components

| Cross | Genetic components (m) | (d) | (h) | (i) | (j) | (l) | Type of interaction |
|---|---|---|---|---|---|---|---|
| **Grain yield** | | | | | | | |
| CML56 × CML49 | 96.9 ± 2.4$^{**}$ | 3.5 ± 3.2 | 135.2 ± 12.5$^{**}$ | 70.2 ± 11.9$^{**}$ | 3.1 ± 3.6 | −112.9 ± 18.1$^{**}$ | D |
| CML85 × CML42 | 61.1 ± 1.5$^{**}$ | 11.7 ± 2.9$^{**}$ | 98.3 ± 8.8$^{**}$ | 32.2 ± 8.4$^{**}$ | 13.3 ± 3.3$^{**}$ | 63.2 ± 14.2$^{**}$ | C |
| CML39 × CML14 | 69.0 ± 1.7$^{**}$ | −0.9 ± 4.8 | 179.4 ± 12.2$^{**}$ | 122.2 ± 11.9$^{**}$ | 5.4 ± 5.1 | −160.3 ± 21.2$^{**}$ | D |
| **Plant height** | | | | | | | |
| CML56 × CML49 | 121.2 ± 1.7$^{**}$ | −10.8 ± 2.8$^{**}$ | 60.0 ± 8.9$^{**}$ | 39.8 ± 8.7$^{**}$ | −9.0 ± 2.9$^{**}$ | −58.7 ± 13.3$^{**}$ | D |
| CML85 × CML42 | 118.3 ± 1.4$^{**}$ | −12.0 ± 2.8$^{**}$ | 79.9 ± 8.2$^{**}$ | 60.8 ± 7.9$^{**}$ | −1.9 ± 3.2 | −61.4 ± 13.1$^{**}$ | D |
| CML39 × CML14 | 113.9 ± 1.7$^{**}$ | −13.4 ± 2.2$^{**}$ | 64.3 ± 8.4$^{**}$ | 42.2 ± 8.2$^{**}$ | 3.4 ± 2.6$^{**}$ | −37.3 ± 11.8$^{**}$ | D |
| **Days to tasseling** | | | | | | | |
| CML56 × CML49 | 64.4 ± 0.5$^{**}$ | 0.2 ± 0.7 | −14.7 ± 2.5$^{**}$ | −10.5 ± 2.4$^{**}$ | −0.3 ± 0.8 | 12.9 ± 3.6$^{**}$ | D |
| CML85 × CML42 | 64.0 ± 0.5$^{**}$ | −3.2 ± 0.6$^{**}$ | −12.4 ± 2.4$^{**}$ | −8.1 ± 2.4$^{**}$ | −0.1 ± 0.6 | 1.2 ± 3.2 | - |
| CML39 × CML14 | 63.5 ± 0.5$^{**}$ | −0.1 ± 0.5$^{**}$ | −18.0 ± 2.1$^{**}$ | −12.7 ± 2.1$^{**}$ | −1.5 ± 0.6$^{**}$ | 12.9 ± 2.9$^{**}$ | D |
| **Days to maturity** | | | | | | | |
| CML 56 × CML 49 | 108.3 ± 0.5$^{**}$ | 2.0 ± 0.6$^{**}$ | −11.7 ± 2.3$^{**}$ | −7.9 ± 2.2$^{**}$ | 0.0 ± 0.0 | 8.3 ± 3.1$^{**}$ | D |
| CML85 × CML42 | 106.4 ± 0.6$^{**}$ | 10.8 ± 2.8$^{**}$ | −1.7 ± 2.8 | −3.4 ± 0.7$^{**}$ | −11.3 ± 3.7$^{**}$ | | C |
| CML39 × CML14 | 106.7 ± 0.6$^{**}$ | 1.6 ± 0.5$^{**}$ | −14.8 ± 2.5$^{**}$ | −7.9 ± 2.5$^{**}$ | −0.8 ± 0.6 | 6.3 ± 3.3 | D |
| **Ear length** | | | | | | | |
| CML56 × CML49 | 13.5 ± 0.3$^{**}$ | −0.7 ± 0.4 | 6.5 ± 1.4$^{**}$ | 4.5 ± 1.4$^{**}$ | −1.3 ± 0.5$^{**}$ | −7.6 ± 2.1$^{**}$ | D |
| CML85 × CML42 | 13.0 ± 0.3$^{**}$ | 0.9 ± 0.4$^{*}$ | 5.9 ± 1.3$^{**}$ | 3.2 ± 1.3$^{*}$ | 0.8 ± 0.4 | −1.6 ± 1.9 | - |
| CML39 × CML14 | 13.2 ± 0.2$^{**}$ | −0.2 ± 0.4 | 8.2 ± 1.3$^{**}$ | 4.3 ± 1.2$^{**}$ | 0.4 ± 0.5 | −4.2 ± 2.1$^{*}$ | D |
| **Ear girth** | | | | | | | |
| CML56 × CML49 | 4.2 ± 0.1$^{**}$ | −0.2 ± 0.1$^{*}$ | 1.8 ± 0.3$^{**}$ | 1.2 ± 0.3$^{**}$ | −0.1 ± 0.1 | −1.9 ± 0.4 | D |
| CML85 × CML42 | 3.7 ± 0.1$^{**}$ | 0.2 ± 0.1$^{**}$ | 1.4 ± 0.3$^{**}$ | 0.9 ± 0.3$^{**}$ | 0.1 ± 0.1 | −0.1 ± 0.4 | - |
| CML39 × CML14 | 3.8 ± 0.1$^{**}$ | 0.1 ± 0.1 | 2.7 ± 0.2$^{**}$ | 1.9 ± 0.2$^{**}$ | 0.3 ± 0.1$^{**}$ | −2.5 ± 0.4$^{**}$ | D |
| **Kernel rows/ear** | | | | | | | |
| CML56 × CML49 | 13.3 ± 0.2$^{**}$ | −0.6 ± 0.3 | 4.62 ± 1.1$^{**}$ | 2.7 ± 1.0$^{**}$ | −0.7 ± 0.4$^{*}$ | −3.1 ± 1.7 | D |
| CML85 × CML42 | 12.3 ± 0.2$^{**}$ | −0.5 ± 0.4 | 5.2 ± 1.0$^{**}$ | 2.4 ± 1.0$^{*}$ | −0.2 ± 0.4 | −0.1 ± 1.7 | - |
| CML39 × CML14 | 12.3 ± 0.2$^{**}$ | 0.3 ± 0.4 | 7.5 ± 1.1$^{**}$ | 5.4 ± 1.1$^{**}$ | 0.6 ± 0.4 | −7.5 ± 1.8$^{**}$ | D |
| **Kernels/row** | | | | | | | |
| CML56 × CML49 | 26.8 ± 0.5$^{**}$ | 1.3 ± 1.0 | 22.6 ± 2.9$^{**}$ | 15.1 ± 2.8$^{**}$ | 0.4 ± 1.1 | −26.4 ± 4.8$^{**}$ | D |
| CML85 × CML42 | 23.7 ± 0.4$^{**}$ | −1.2 ± 1.1 | 25.9 ± 2.8$^{**}$ | 19.1 ± 2.7$^{**}$ | −0.0 ± 1.1 | −19.9 ± 4.8$^{**}$ | D |
| CML39 × CML14 | 24.8 ± 0.4$^{**}$ | −0.1 ± 1.0 | 20.0 ± 7.4$^{**}$ | 12.5 ± 2.6$^{**}$ | 0.4 ± 1.1 | −16.4 ± 4.6$^{**}$ | D |
| **Kernels/ear** | | | | | | | |
| CML56 × CML49 | 362.2 ± 8.9$^{**}$ | 2.1 ± 13.7 | 384.8 ± 46.3$^{**}$ | 242.3 ± 45.0$^{**}$ | −11.9 ± 15.0 | −406.6 ± 70.0$^{**}$ | D |
| CML85 × CML42 | 291.0 ± 5.4$^{**}$ | −36.6 ± 16.8$^{*}$ | 471.7 ± 42.1$^{**}$ | 298.7 ± 39.9$^{**}$ | −14.2 ± 17.9 | −213.6 ± 75.4$^{**}$ | D |
| CML39 × CML14 | 305.1 ± 7.1$^{**}$ | 4.1 ± 16.4 | 444.6 ± 45.3$^{**}$ | 291.1 ± 43.3$^{**}$ | 15.0 ± 18.1 | −373.9 ± 76.4$^{**}$ | D |
| **100-grain weight** | | | | | | | |
| CML56 × CML49 | 27.2 ± 0.4$^{**}$ | 0.5 ± 0.7 | 7.7 ± 2.2$^{**}$ | 0.4 ± 2.1 | 1.5 ± 0.7$^{*}$ | −2.4 ± 3.3 | - |
| CML85 ± CML42 | 21.9 ± 0.4$^{**}$ | 4.6 ± 0.8$^{**}$ | −0.9 ± 2.3 | −7.1 ± 2.2$^{**}$ | 3.6 ± 0.8$^{**}$ | 23.9 ± 3.7$^{**}$ | D |
| CML39 × CML14 | 23.0 ± 0.4$^{**}$ | −0.4 ± 0.8 | 20.6 ± 2.3$^{**}$ | 14.9 ± 2.2$^{**}$ | 0.9 ± 0.8 | −20.2 ± 3.6$^{**}$ | D |

C = Complementary, D = Duplicate

## References


1. **Mather K.** 1949. Biometrical Genetics. Dover Publication Inc. New York, USA.

2. **Cavalli L. L.** 1952. Analysis of linkage in quantitative inheritance. In: Quantitative inheritance (eds. E.C.R. Rieve and C.H. Waddington) HMSO, London: pp 135-144.

3. **Hayman B. I.** 1958. The separation of epistasis from additive and dominance variation in generation mean. Heredity, **12**: 371-391.

4. **Gamble E. E.** 1962. Gene effects in corn (*Zea mays* L.) II Relative importance of gene effects for plant height and certain component attributes of yield. Canad. J. Plant Sci., **42**: 349-358.

5. **Mukherjee B. K., Agrawal S. B., Singh M. P., Gupta N. P. and Singh N. N.** 1974. Studies on diverse germplasm complexes of maize. 1. Gene effects and nature of heterosis in diverse germplasm and their crosses. Genetika, **6**: 33-41.

6. **Melchinger A. F., Geiger H. H. and Schnell F. W.** 1986. Epistasis in maize. Genetic effect in crosses among early flint and dent inbred lines determined by three methods. TAG., **72**: 231-239.

7. **Hallauer A. R. and Russel W. A.** 1962. Estimates of maturity and its inheritance in maize. Crop Sci., **2**: 289-294.

8. **Comstock R. E., Robinson H. F. and Harvey H. H.** 1949. A breeding procedure designed to make maximum use of both general and specific combining ability. Agron. J., **41**: 360-367.