https://doi.org/10.29321/MAJ.10.A01600

Madras Agric. J., 81(12): 643-646 December, 1994



# HETEROSIS FOR YIELD AND YIELD COMPONENTS IN *Sorghum bicolor* (L) MOENCH

P.VEERABADHIRAN, S.PALANISAMY and G.A.PALANISAMY

Department of Millets, School of Genetics, Tamil Nadu Agricultural University, Coimbatore - 641 003.

**ABSTRACT**

The extent of heterosis for yield and yield components in a set of eighty one cross combinations consisting of nine male sterile lines and nine restorer lines of Sorghum were studied. The cross combinations 2077A X Co 26, 296A X IL 101, 3002A X Co 25 and TNAU Ms 1A X IL 105 were identified as the best hybrids for grain yield on the basis of *per se* performance with high heterotic expression.

The practical exploitation of hybrid vigour and quantum jump in yield in sorghum was the resultant product of the discovery of the cytoplasmic genic male sterility in sorghum. To understand the extent of the heterosis possible in the series of crosses, the present study was attempted and the experiment was conducted at the Millet Breeding Station, School of Genetics, Tamil Nadu Agricultural University, Coimbatore.

## MATERIALS AND METHODS

A total of eighty one hybrid combinations involving nine male sterile lines viz., 296A, 2077A, 2219A, A2A, TNAU Ms 1A 3002A, 3003A, 3006A and 3050A and nine restoers viz., Co 21, Co 25, Co 26, TNS 30, TNS 32, TNS 34, IL 101, IL 103 and IL 105 was studied during summer, 1989. Each of the hybrids and parents was raised in three row plot having a 3 m row length with a spacing of 45 cm x 15 cm in randomized block design replicated twice. Data on days to 50 per cent bloom, plant height, panicle length, number of leaves per plant, panicle weight, number of grains per panicle, 1000 grain weight and grain yield per plant were recorded on five randomly selected plants in each replication. The hybrid vigour was estimated over mid parental value as per standard procedures.

## RESULTS AND DISCUSSION

The mean performance of days to 50 per cent bloom ranged from 53.5 to 84.0 days for lines and 61 to 75 days for the testers. Among the lines, 3050A was the earliest and among the testers, IL 105 was the earliest. The hybrid means ranged from 53 to 79 days (Table). A similar situation was reported by shankara Gowda *et al.*, (1972).

The mean performance for plant height ranged from 84.20 (3003A) to 122.20 cm (TNAU ms 1A) for lines, 124.90 (IL 105) to 226.20 cm (IL 101) for testers. The height in the hybrids ranged from 117.30 (A2A X IL 101) to 225.15 cm (2077A X Co 26). Seventy out of eighty one hybrid combinations exhibited significant positive relative haterosis, the range being 4.29 to 64.86 per cent. The highest relative heterosis was exhibited by the comibination 3002A X Co 21 and the expression of hetersis in seventy out of eighty one hybrid combinations over mid parental value (Table 1) support the views of Lazanyi and Bajai (1986) and patel *et al.*, (1987) that there exists considerable heterosis for plant height.

The parental means of panicle length ranged from 24.15 to 37.20 cm for lines and 19.95 to 31.30 cm for testers. All but five hybrids showed significant positive relative heterosis and the cross 2077A X IL 103 recorded the highest value of 51.37 per cent (Table 1). Deasi *et al.*, (1985) and Patal *et al.*, (1987) reported high heterosis for this trait which confirms the present results.

The mean number of leaves per plant ranged from 6.90 to 13.80 for lines and 9.30 to 14.00 for the testers. 2077A among the lines and and Co 25among the testers recorded the highest number of leaves per plant. The means of hybrids ranged from 7.40 to 14.60. The hybrids 2077A X TNS 34 and 2077A X TNS 32 recorded the highest leaf number. Significant positive relative heterosis was observed in nineteen hybrids the deviation being 5.80 to 34.50 per cent, the maximum was observed in the combination A2A X TNS 32: Earlier, Saradamani (1982) observed upto 118.50 per cent relative heterosis.

**Table 1. Relative heterosis for yield and yield components**

| Hybrids | Plant height | Days 50% bloom | Panicle length | Number of leaves per plant | Panicle weight | Number of grain per panicle | 1000 grain weight | Grain yield |
|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 296A x Co 21 | 45.77** | 20.00** | 25.34** | -6.05 | 26.86** | -8.11 | 5.79 | 0.14 |
| 296A x Co 25 | 39.25** | 6.23** | 17.29** | -0.76 | 41.32** | 3.62 | 22.74** | 24.26** |
| 296A x Co 26 | 32.13** | 7.81** | 21.22** | -16.04** | 24.94** | 8.69 | 0.22 | 4.37 |
| 296A x TNS 30 | 16.69** | 1.20 | 41.40** | -7.08 | 65.05** | 56.22** | -14.93** | 32.45** |
| 296A x TNS 32 | 16.42** | 8.00** | 31.74** | 3.57 | 80.72** | 41.21** | 18.09** | 68.58** |
| 296A x TNS 34 | 32.31** | 7.17** | 31.85** | -2.31 | 69.62** | 32.23** | 12.82** | 46.10** |
| 296A x IL 101 | -18.70** | -4.18** | 33.69** | -20.32** | 78.13** | 111.34** | -26.43** | 54.24** |
| 296A x IL 103 | 12.33** | 9.16** | 44.71** | -3.23 | 90.00** | 63.08** | -10.50** | 62.16** |
| 296A x IL 105 | 43.68** | 3.67** | 8.70** | 19.44** | 73.39** | 33.76** | 14.12** | 48.66* |
| 2077A x Co 21 | 50.86** | -13.22** | 33.93** | 4.76 | 67.18** | 12.75 | 26.41** | 39.24** |
| 2077A x Co 25 | 24.72** | -1.88* | 15.91** | 0.00 | 35.58** | -0.13 | 7.85** | 9.55 |
| 2077A x Co 26 | 50.88** | -1.66* | 26.23** | -0.39 | 44.52** | 36.46** | 16.47** | 51.56** |
| 2077A x TNS 30 | 13.41** | -22.97 | 12.83** | -14.88** | -27.15** | -44.70** | 2.96 | -44.43** |
| 2077A x TNS 32 | 26.76** | -15.93 | 23.81** | 20.83** | 24.76** | 6.91 | 29.68** | 35.66** |
| 2077A x TNS 34 | 25.64** | -3.23 | 17.18** | 5.80 | 14.56** | 32.53** | -8.89* | 23.07** |
| 2077A x IL 101 | -5.05** | 2.60 | 32.08** | -1.87 | 14.61** | 25.55** | -17.41** | 12.38* |
| 2077A x IL 103 | 43.14** | -3.58 | 51.77** | 0.00 | 38.71** | 42.16** | -2.85 | 57.12** |
| 2077A x IL 105 | 5.06** | +3.45 | 20.20** | 20.69** | 61.82** | 14.72* | 38.31** | 66.71** |
| 2219A x Co 21 | 40.08** | -4.56** | 20.64** | 7.51 | 95.51** | 53.91** | 34.71** | 95.97** |
| 2219A x Co 25 | 23.96** | -9.09** | 1.88 | -5.45 | 5.25 | -0.73 | 9.95* | 3.56 |
| 2219A x Co 26 | 24.03** | -5.26** | 16.07** | -5.47 | 9.28 | 16.72 | 2.11 | 3.40 |
| 2219A x TNS 30 | 17.59** | -10.75** | 30.58** | -6.52 | 55.13** | 31.72** | 23.86** | 63.92 |
| 2219A x TNS 32 | 26.10** | -7.88** | 29.28** | 4.40 | 23.25** | 3.49 | 12.77** | 18.39 |
| 2219A x TNS 34 | 18.98** | -3.13** | 19.67** | -1.83 | 9.85 | 50.89** | -23.38** | -0.57 |
| 2219A x IL 101 | -6.94** | -6.30** | 26.47** | -2.39 | 30.85** | 23.43** | 0.12 | 5.76 |
| 2219A x IL 103 | 41.84** | -12.25** | 44.04** | -5.83 | 88.89** | 90.05** | 6.27 | 99.35** |
| 2219A x IL 105 | 30.16** | -8.47** | 17.15** | 1.15 | 45.53** | 1.38 | 30.26** | 34.05* |
| A 2A x Co 21 | 49.50** | -4.17** | 27.91** | 3.70 | 122.78** | 61.50** | 38.21** | 90.59** |
| A 2A x Co 25 | -14.92** | -11.03** | 5.55* | -17.70** | 13.78 | -16.34* | 32.21** | 2.53 |
| A 2A x Co 26 | 15.50** | -3.25** | 7.66** | 26.32** | -11.00 | -30.31** | 15.19* | -25.72** |
| A 2A x TNS 30 | 7.13** | 2.90** | 20.65** | -1.73 | 17.51 | -7.73 | 42.43** | 8.37 |
| A 2A x TNS 32 | 41.57** | 3.30** | 7.87** | 34.50** | -32.56** | -44.97** | 6.68 | -25.28 |
| A 2A x TNS 34 | 29.24** | 8.24** | 7.68** | 22.71** | -14.73 | -5.72 | -25.07** | -14.03 |
| A 2A x IL 101 | -30.53** | -1.19 | 16.12** | -25.25** | -27.21** | -3.11 | -8.23 | -37.78** |
| A 2A x IL 103 | -4.57** | -1.59 | 17.59** | -18.97 | 64.23** | 32.12** | 53.38** | 25.80** |
| A 2A x IL 105 | 0.59 | 4.68** | 6.19** | -4.91 | 80.55** | 27.10* | 35.77** | 89.63** |
| TNAUMS1A x Co 21 | 24.22** | -1.19 | 20.60** | 9.18* | 34.99** | -4.95 | 17.13** | 25.82** |
| TNAUMS1A x Co 25 | 8.70** | -8.70** | -3.88 | -6.17* | -25.46** | -36.10** | -23.43** | -28.72** |
| TNAUMS1A x Co 26 | 10.02** | -3.47** | 9.13** | -8.93** | -22.27** | -11.18 | 19.68** | -30.02** |
| TNAUMS1A x TNS 30 | 23.44** | 4.72** | 3.10 | 10.14** | 16.83* | 15.87* | 7.88 | 31.02** |
| TNAUMS1A x TNS 32 | 38.02** | 9.09** | 9.33** | 25.85** | 53.88** | 57.02** | 27.78** | 67.63** |
| TNAUMS1A x TNS 34 | 18.35** | -4.48** | -7.37* | -6.22* | 21.31** | -2.44 | -16.28** | 16.77** |
| TNAUMS1A x IL 101 | 20.58** | -6.02** | 24.84** | -2.59 | 15.94** | 37.10** | -16.28** | 19.98** |
| TNAUMS1A x IL 103 | 24.41** | -4.15** | 31.97** | 0.44 | 14.00 | 8.35 | 1.40 | 13.32 |
| TNAUMS1A x IL 105 | 45.00** | 0.00 | 21.27** | 11.68** | 114.61** | 71.51** | 34.01** | 121.58** |
| 3002A x Co 21 | 64.86** | 3.28** | 6.27* | 12.50** | 48.37** | -8.14 | 40.58** | +25.23** |

Table 1. (Contd.,)

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|
| 3002A Co 25 | -7.99** | 4.87** | 9.32** | 9.42** | 68.58** | 56.06** | 20.58** | 77.74** |
| 3002A x Co 26 | 25.28** | -8.0** | 6.04* | -2.94 | -7.79 | -2.55 | -7.90* | 16.73* |
| 3002A x TNS 30 | -5.31** | 24.16** | 20.22** | -2.67 | 10.26 | -10.21 | 8.33 | -0.05 |
| 3002A x TNS 32 | -6.56** | 25.57** | 26.50** | -2.70 | 64.27** | 32.08** | 17.49** | 48.72** |
| 3002A x TNS 34 | -1.93* | 21.88** | 14.34** | 1.36 | 9.05 | 58.60** | -28.31** | 5.93 |
| 3002A x IL 101 | -1.95* | 4.29** | 15.96** | -9.43** | 35.84** | 15.99 | 10.64** | 29.48** |
| 3002A x IL 103 | 3.13** | 42.32** | 46.05** | 19.62** | 5.40 | -26.97* | 21.86** | -6.75 |
| 3002A x IL 105 | 11.30** | 14.40** | 28.13** | -6.21 | 72.71** | 28.29* | 34.89** | 78.69** |
| 3003A x Co 21 | -1.65 | 43.14** | 13.77** | 10.11* | 72.11** | 24.73* | 30.87** | 57.86** |
| 3003A x Co 25 | -11.70** | 18.02** | 4.61 | -13.78** | -15.95 | -37.97** | -8.20* | -44.12** |
| 3003A x Co 26 | -7.26** | 23.54** | 17.19** | -6.80 | -3.89 | 11.68 | -23.11** | -20.44** |
| 3003A x TNS 30 | -8.64** | 21.39** | 16.90** | -3.70 | 52.07** | -5.48 | 2.41 | -10.80 |
| 3003A x TNS 32 | -7.44** | 18.10** | 14.23** | -2.67 | 24.97** | 18.75* | 4.77 | 15.09 |
| 3003A x TNS 34 | -4.28** | 12.73** | 9.75** | -3.14 | -4.28 | 26.14** | -39.26** | -26.50** |
| 3003A x IL 101 | -1.96* | -9.41** | 18.76** | -4.67 | 48.18** | 34.52** | -5.98 | 16.27* |
| 3003A x IL 103 | 11.02** | 37.74** | 28.04** | -0.47 | 111.47** | 33.78* | -10.98** | 93.89** |
| 3003A x IL 105 | -5.49** | 32.19** | 13.67** | 0.56 | 37.20** | 2.74 | 11.39** | 18.40 |
| 3006A x Co 21 | 4.96** | 48.20** | 18.88** | 16.28** | 36.36** | -5.46 | 33.30** | 29.62** |
| 3006A x Co 25 | -7.17** | 22.95** | 8.85** | -9.59** | -13.56* | -20.39 | 6.80 | -18.68** |
| 3006A x Co 26 | -7.26** | 32.96** | 12.08** | -2.00 | -0.28 | -7.25 | 8.56* | -3.93 |
| 3006A x TNS 30 | -0.41 | 19.88** | 7.33* | 16.94** | +80.54** | 53.38** | 22.67** | 87.95** |
| 3006A x TNS 32 | -0.09** | 28.30** | 21.87** | 1.66 | 22.48** | 10.60 | 1.08 | 16.93 |
| 3006A x TNS 34 | 2.72* | 25.01** | 19.00** | -2.30 | 31.76** | 39.57** | -4.49 | 26.74** |
| 3006A x IL 101 | -3.53** | 1.15 | 20.60** | -3.55 | 13.59** | 1.84 | 4.84 | 7.96 |
| 3006A x IL 103 | -6.30** | 40.53** | 19.91** | 4.39 | 37.21** | 28.12** | 41.47** | 12.22 |
| 3006A x IL 105 | -5.49** | 31.36** | 19.43** | 8.67* | 38.16** | -5.38 | 24.55** | 20.36 |
| 3050A x Co 21 | -1.71 | 50.95** | 11.18** | 18.29** | 60.57** | 49.79** | 18.72** | 74.02** |
| 3050A x Co 25 | -8.95** | 22.77** | 15.20** | -7.11* | 0.22 | 8.02 | -9.61* | -4.69 |
| 3050A x Co 26 | -5.00** | 34.05** | 20.39** | 0.00 | 10.38 | 6.66 | -5.33 | -11.19 |
| 3050A x TNS 30 | -9.79** | 32.85** | 30.34** | 2.86 | 49.24** | 34.57** | 11.27* | 55.28** |
| 3050A x TNS 32 | -5.98** | 32.63** | 31.85** | 1.73 | 42.74** | 10.56 | 6.55 | 21.99 |
| 3050A x TNS 34 | -6.83** | 23.34** | 33.20** | -5.26 | 39.83** | 78.29** | -19.66** | 38.44** |
| 3050A x IL 101 | -4.45** | -14.41** | 29.51** | -16.00** | 17.01* | 39.53** | -11.12** | 15.18 |
| 3050A x IL 103 | 0.00 | 39.56** | 42.09** | -3.55 | 83.01** | 52.97** | 39.10** | 115.04** |
| 3050A x IL 105 | -4.80** | 28.83** | 15.77** | -3.03 | 50.23** | 18.43 | 19.03** | 50.51** |

** Significant at 5 per cent level

* Significant at 1 per cent level

Considerable amount of haterosis was also observed for panicle weight. The parental means ranged from 22.85 to 99.61 g (2077A) for the lines and 48.52 to 136.40 g (Co 25) for the testers. The pancile weight of the hybrids ranged from 47.65 to 173.28g, (296A X IL 101). The highest relative heterosis was exhibited by A2A X Co 21 (Table 1). A high percentage of heterosis upto 78.60 was reported by Palanisamy (1977) for this trait.

The parental means for number of grains per panicle ranged from 1161.30 to 3339.50 for lines and 1361.70 to 3810.90 for the testers. Line 2077 A and the tester Co 25 had more number of grains per panicle. The grain number in the hybrids ranged from 1012.00 to 5005.40. The cross 296A X IL 101 ranked first. The cross 296A X IL 101 showed the highest relative heterosis. Singhania (1980) recorded 38.01 per cent average heterosis for this