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Stability analysis of short and compact cotton genotypes at varying fertility levels

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ABSTRACT : Ten short and compact (multiple cross derivatives) of cotton genoytpes were grown in randomized block design with factorial concept in 3 replications over a range of artificially created 'N' fertility levels for two years. The stability analysis of the genotypes following the Eberhart and Russels model was performed. On the basis of mean performance over all fertility levels, genotypes ADB 159, ADB 160 and ADB 164 were dwarf and high yielders with high boll weight and had less than one monopodia / plant, average sympodia/ plant and bolls/plant suggesting that their performance was stable even at high fertility level and hence can be amenable for high density planting.

Key words : Genotype, fertility, stability

Cotton is one of the most important commercial fibre crop playing a key role in the socio economic affairs of our country. Its cultivation, practiced since ages, has to be low cost, input responsive, sustainable, environment friendly and definitely a profitable production system in the present day context. Cultivation of hybrids on a very large area has been a significant achievement in Indian cotton scenario. Introduction of large number of private sector *Bt* cotton hybrids have brought in a welcome change in recent times as far as production gains are concerned. However, to meet the ever increasing demand both in the domestic and international markets an effective strategy needs to be developed. Creation of novel genetic variability for long term exploitation would certainly be one of the strategies apart from suitable agronomic interventions.

In this context 10 multiple cross derivative lines of cotton identified to possess dwarf to medium plant habit and compact nature (Pradeep and Sumalini 2005, and Pradeep and Sree Rekha, 2008) were evaluated for stability of different characters under high 'N' management.

MATERIALS AND METHODS

The materials for the present investigation comprised of 10 multiple cross derivative lines of cotton (Table 1) grown in randomized block design with factorial concept in *kharif,* 2007-2008 and 2008-2009 at Agricultural Research Station, Adilabad. All the 10 multiple cross derivatives *viz.*, ADB 155, ADB 156, ADB 157, ADB 158, ADB 159, ADB 160, ADB 161, ADB 162, ADB 163 and ADB 164 possessed short and compact plant habit (dwarf plant with 40-60 cm height) with 0-1 monopodia and short sympodial branches suitable for high density planting included in the study.

An artificial fertility gradient was created by applying different doses of nitrogen. Two levels of nitrogen N_{90} (below the RD of 120 kg/ha) and N_{150} (above RD of 120 kg/ha) were selected apart from RD of 120 kg/ha and the fertilizer gradient was generated through all possible combinations of nitrogen *viz.*, N_{90} P_{60} and K_{60}, N_{120} P_{60} K_{60} and N_{150} P_{60} K_{60} for two years. N was applied in the form of urea (46% N) in 3 doses, along with K_{20} at 25 , 45 and 75 DAS. Phosphorus was applied in the form of single super phosphate as basal dose. The plot size of each genotype comprised of 6 rows of 6m length with a spacing of 0.60x0.60 m. The normal cultural practices as recommended for the crop were followed except nitrogen application. The statistical analysis was conducted considering three 'N' fertility levels as 3 environments.

RESULTS AND DISCUSSION

Analysis of variance (Table 1) revealed highly significant mean squares due to genotypes for all the characters except for sympodia/plant indicating the existence of significant variation among the genotypes. On the contrary mean squares due to fertility levels were non significant for all the characters except for plant height, but highly significant genotype x fertility level interaction for the same character indicated that the genotypes did not show any variable response to different fertility levels with regard to yield and yield contributing triats except for plant height. The partitioning of fertility levels + (genotype x fertility levels) mean squares (Table 2) also showed that fertility levels (linear) differed significantly only in respect of boll weight and plant height and were quite similar with regard to their effect on the performance of the genotypes for yield and yield components.

Further, the higher magnitude of mean squares due to fertility levels (linear), as compared to genotypes x fertility level (linear) suggested that linear response of fertility levels accounted for the major part of total variation for the characters under study. This implies that the mean differences between effects of fertility levels and influence of fertility variations on yield and its components were quite real in nature. Similar observations were reported by Tuteja (2006) in cotton. Non significant mean square due to genotype x fertility gradients (linear) component against pooled deviation for all the characters emphasizes the fact that the genotypes were similar in their regression response to change in the fertility gradient. Similarly, non significant pooled deviation observed for all the traits further confirms the stability of the genotypes for the plant characters irrespective of the amount of 'N' fertilizer applied. Thus, in the present case both linear and non linear components did not play any role and the performance of the cotton genotypes bred with the objective of developing dwarf, medium compact plant habit were expected to behave on predicted lines.

According to Eberhart and Russell model a genotype is considered to be stable if it exhibits high mean performance with unit regression coefficient (bi=1) and non significant deviation from the regression line (s^2di). In the present investigation the data indicated that the fertility status appears to have affected the plant height of the genotypes significantly. All the genotypes except ADB 155, ADB 156 and ADB 157 had more or less similar plant height with negligible bi values and non significant deviation from regression and therefore their performance would remain stable irrespective of the quantity of nitrogen applied.

The genotypes ADB 158, ADB 159, ADB 161, ADB 162 and ADB 164 had negligible bi values for monopodia/plant, with non significant s^2di indicating that these short and compact genotypes were non responsive to 'N' fertilizer and hence did not produce higher monpodia/ plant except the genotypes ADB 155, ADB 156 and ADB 157 which produced more than one monopodia/plant.

For sympodia/plant all the ten genotypes had almost similar mean values with non significant regression coefficient (bi) and deviation from regression (s^2di). However, the genotypes ADB 156, ADB 157 and ADB 159 had higher mean and unit regression coefficient and hence could be stable only in high fertility regime.

Mean performance of genotypes for bolls/ plant varied significantly and the genotypes ADB 155, ADB 156 and ADB 157 produced higher bolls/ plant. As far as stable performance is concerned genotype ADB 157 with average mean performance and bi nearing to unity and non significant deviation is likely to perform consistently irrespective of the fertility levels.

For seed cotton yield, 4 genotypes *i.e.*, ADB 155, ADB 159, ADB 160 and ADB 164 had high mean yield with negative values for regression coefficient and deviation from regression which indicated that these four genotypes were found to be stable. Tuteja (2006), also observed similar trend for stability of cotton yield. On the contrary, ADB 158, ADB 161 and ADB 162 with higher bi

Table 1. Stability parameters for plant characters in cotton

Genotypes	Plant height (cm)			Monopodia/plant			Sympodia/plant			Bolls/plant			Boll weight (g)			Yield (kg/ha)		
	Mean	b_i	S^2di	**Mean**	b_i	S^2di	**Mean**	b_i	S^2di	**Mean**	b_i	S^2di	**Mean**	b_i	S^2di	**Mean**	b_i	S^2di
ADB 155	**246.00**	10.04	3696.46	**1.55**	3.56	-0.05	**14.26**	-10.53	-0.86	**31.76**	3.18	11.01	**3.68**	3.15	-0.13	**1873.11**	-1.26	-54062
ADB 156	**155.52**	0.00	-3697.44	**1.48**	-3.09	-0.05	**15.33**	12.20	-0.29	**26.21**	-0.73	-7.05	**3.93**	-1.99	-0.16	**1415.44**	0.95	-68230
ADB 157	**140.44**	0.00	-3712.44	**1.21**	3.48	-0.05	**14.91**	5.95	0.50	**25.93**	0.90	-6.58	**3.95**	0.09	-0.13	**1714.33**	-1.13	-68316
ADB 158	**112.44**	-0.11	-3725.65	**0.59**	-1.49	-0.03	**13.26**	-3.81	-0.58	**20.40**	2.98	-5.41	**5.12**	4.80	-0.14	**2016.77**	5.49	-51787
ADB 159	**112.12**	0.04	3729.84	**0.40**	-0.80	-0.05	**13.44**	4.28	-0.97	**20.44**	-2.29	-2.74	**5.39**	-1.78	-0.16	**1912.77**	-3.43	-69196
ADB 160	**110.88**	-0.14	3719.38	**0.62**	5.02	-0.04	**14.13**	0.69	-0.96	**25.11**	1.40	-5.55	**5.16**	1.73	-0.15	**1990.33**	-0.46	-65850
ADB 161	**101.81**	0.16	-3729.18	**0.30**	-0.09	0.00	**13.73**	2.84	-0.97	**17.66**	0.88	-1.42	**5.06**	-0.34	-0.16	**1985.66**	8.55	-2342
ADB 162	**104.14**	0.21	-3727.95	**0.70**	0.51	-0.05	**14.26**	-3.81	-0.58	**20.43**	0.85	-7.33	**4.78**	2.25	-0.16	**1747.44**	7.83	-69014
ADB 163	**92.48**	-0.24	3728.02	**0.65**	3.40	-0.05	**12.83**	2.77	-0.39	**17.87**	0.86	-8.18	**5.33**	1.37	-0.15	**1467.33**	-3.23	-2892
ADB 164	**110.26**	0.04	3729.36	**0.48**	-0.49	-0.03	**14.28**	-0.59	-0.66	**19.77**	1.97	-3.36	**5.29**	0.72	-0.03	**2162.77**	-3.31	-46343

Table 2. Pooled analysis of variance (Eberhart and Russell, 1966) for 10 multiple cross derivatives of cotton

Source	Df	Monopodia/ plant	Sympodia/ plant	Bolls/ plant	Boll weight (g)	Plant height (cm)	Yield (kg/ha)
Genotypes	9	0.61***	1.70*	61.08***	1.29***	6149.97***	175944.90**
Environment+(Genotypes x Env.)	20	0.02	0.71	3.61	0.04	3363.35***	22952.15
Environments (Fertility levels)	2	0.03	0.14	3.78	0.05	3324.34***	6504.53
Genotype x Environment	18	0.03	0.77	3.59	0.03	3367.68***	24779.66
Environments (Linear)	1	0.05	0.28	7.57	0.12*	6648.68***	13009.07
GenotypesxEnvironment (Linear)	9	0.04*	1.09	1.98	0.05	6723.51***	27701.13
Pooled Deviation	10	0.01	0.39	4.68	0.02	10.67	19672.37
Pooled Error	54	0.06	0.95	9.08	0.12	3765.19	73400.14
Total	**29**	**0.21**	**1.01**	**21.45**	**0.43**	**4228.16**	**70432.65**

values can perform better under high nitrogen fertilization and their performance can be predicted. Rest of the genotypes exhibited poor performance indicating their suitability to poor environments.

From this study it is concluded that the multiple crossing programme that was initiated to create novel genetic variability in cotton has really helped in identifying the new genotypes with short and compact nature as is evidenced by their stability of performance irrespective of the fertility gradient. Thus the genotypes ADB 158, ADB 159, ADB 160, ADB 161, ADB 162, ADB 163 and ADB 164 identified in present study have either average or high mean yield with high boll weight, average sympodia, least monopodia and dwarf plant type and therefore would best suited for high density planting. Besides they can also be exploited as parents for hybridization programme or as diverse genotypes for introduction of *Bt* gene.

REFERENCES

Pradeep, T. and Sumalini, K. 2005. Studies on performance and pattern of genetic variability for plant type and productive traits in multiple crosses of cotton (G. *hirsutum* L.). *J. Indian Soc. Cotton Improv.*, **30** : 59-66.

Pradeep, T. and Sree Rekha, M. 2008. Multiple crossing a tool for developing ideal plant type in cotton, Paper presented during National Seminar on *"Second Green Revolution – A Necessity or Compulsion"* held at ARS, Adilabad from 19-21st October, 2008.

Tuteja, O.P. 2006. Comparative studies on stability parameters and sustainability index for selecting stable genotypes in upland cotton (*Gossypium hirsutum* L.). *Indian J. Genet,* **66** : 221-24.

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