https://doi.org/10.29321/MAJ.10.A02674

Madras Agric J. 70. (11) 705–708 November 1983

GENOTYPE X ENVIRONMENT INTERACTIONS OF INDUCED MUTANTS IN MOTHBEAN

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Genotype-environment interaction was investigated over 3 years (1977, 1978 and 1980) for grain yield in respect of 25 moth mutants evolved by treating 'Jadia' a locally adapted variety of the region, with chemical mutagen (EMS). There was a significant variation for genotypes and genotypes X environment interaction for grain yield. The mutant genotypes, JMM-259, JMM-60 and JMM-211 appeared to be best suited for favourable growing seasons, whereas mutant genotypes JMM-242, JMM-251, JMM-227, JMM-202, JMM-273 and JMM-265 gave stable performance under fluctuating environmental conditions. In general, the mutants were able to exploit the favourable growing seasons better than check varieties.

Genotype x enviroment interactions are of great importance in plant breeding since genotypes are known to exhibit differential reaction to varying environmental conditions. There fore, newly evolved materials like pure breeding lines, mutants and collections of self pollinated crop like mothbean need to be evaluated in multienvironmental tests so as to identify most stable and widely adapted genotype. Inspite of the difficulity of identifying high yielding mutants, there is no doubt about their existence and a number of high yielding evolved by mutantion breeding have been released (Block, 1965; Sigubjornsson and Micke, 1974). Genotype-envinronment interactions pose a serious problem for evolving a stable genotype in case of leguminous crops (Paroda, 1980). Particularly, no information on these aspects is available in case of mothbean *Vigna aconifolia* (Jacq.) Marechal), an important grain legume grown on drylands of Western Rajasthan.

In the present paper some mutant genotype of mothbean have been evaluated for genotype-euvironment interactions for identifying stable genotypes for breeding programmes.

MATERIAL AND METHODS

Mutation breeding programme was started during 1975 by treating a local adapted variety 'Jadia' with 0.3% concentration of Ethyl Methane Sulphonate, EMS. The selection of desirable mutants was done in M_2 and M_3 generations in the kharif season of 1976 and summer of 1977, respectively. The material from M_1 to M_3 generation was handled by M. V. R. Prasad.

In the kharif of 1977, 1978 and 1980 promising 25 Jadia moth mutants (JMM) in M_4, M_5 and M_6 generations were evaluated along with parent

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'Jadia' and two promising strains 'T 2' and 'T 18' as a check in Randomized Block Design having three replications for assessing their yield performance. Plot size was 6 m^2, 7 5 m^2 and 9 m^2 in 1977, 1978 and 1980, respectively. The row to row distance was kept at 30 cm The crop was given a basal dressing of 20 kg N + 40 kg P_2O_5/ha in all the season. The analysis of variance and parameters were computed following Eberhart and Russell (1966).

RESULTS AND DISCUSSION

Mean grain yield (q/ha), regression coefficients (b) and deviations from regression (s^2 d) for the 28 genotypes are given in Table 1.

Analysis of variance for grain yield revealed significant differences among the genotypes and the environments. In general, genotypes performed well in 1977 and 1978 because of good rainfall distribution seasons but yield levels were low in 1980, due to acute drought conditions. The significant genotype environment interactions revealed that the genotypes showed differential reaction in different year. A major portion of these interaction was accounted for by the presence of linear component although the non-linear component (deviation) was also significant (Table 2). The significance of the latter appeared to be due to presence of genetic variability among the material tested (Perkins and Jinks, 1968; Paroda and Hayes, 1971; Paroda *et al.*, 1973). An ideally adaptable variety (Eberhart and Russel, 1966) would be the one having high mean value,unit regression coefficient (b= 1.0 and deviation from regression as small as possible ($s_1 = 0$).

The perusal of data in Table 1 revealed that genotypes JMM - 253 JMM-227, JMM 202 JMM-273 and, JMM - 265 were the most stable with almost unit responses to changes in environmental condition. However, these genotypes were not the highest yielder although the mean yield over all environment was in the range of 5.4 to 6.9 q/ha as against the yield of parent variety 'Jadia' (3 2 q/ha) and check varieties 'T 18' (3 6 q/ha) and 'T 2' (5.2 q/ha) The genotypes 'JMM JMM60', JMM 211' and 'JMM 242' had high mean yield and were more responsive to favourable environments as reflected by high 'b' values. These genotypes were also found staple as these had low s_2d values as compared to parent 'Jadia' and checks. Genotypes 'JMM 140', '7MM 262', 'JMM 209' and 'JMM 212' were specially suited for unfavourable years as reflected by low 'b' values (b<1) and low deviation s^2d values, with mean yield ranging from 5. 6-6.1 q/ha. The checks 'Jadia' and 'T 18, were the lowest yielder and also showed an unstable performance over environments, as there exists high, s^2d, values. However, the check 'T 2' has mean yield of the order of 5.2 q/ha but showed unstable performance as it has high s^2d value.

In the present study, computation of stability parameters indicated that, in gendral, the mutant tried were able to take advantage of the favourable environmental conditions ($bi > 1$), whereas check varieties could not take the advantage of such situation ($bi < 1$). Prediction of phenotypic mean performance across genotypes as well as across environments based on genotype-environment interactions had established the practical utility of studies on parameters of stability (Samnel *et al.*, 1970; Paroda *et al.*, 1973; Karwasra *et al*, 1975). The studies of this kind help a breeder in selecting the most stable genotype along with the desired response which would largely depend on the environmental conditions with which he is confronted. In the present material genotypes, 'JMM 259', 'JMM 60', 'JMM 211', appeared to be best for favourable environmental conditions, while genotypes 'JMM 253', JMM 227 JMM 202', 'JMM 273' and 'JMM 265' were the most stable genotypes under fluctuating enviromental conditions.

The authors are grateful to the Directer, Central Arid Zone Research Institute, Jodhpur, for providing necessary facilities.

REFERENCES

BROCK, R D. 965 'Induced mutation affecting quantitative characters". The use of induced mutations in plant breeding (Rep. FAO/IAEA Tech Meeting, Rome, 1964). Pergamon Press, Oxford, pp, 443-50.

EBERHART, S A. and W A. RUSSEL, 1966. Stability parameters for comparing varieties. *Crop Sci*, 6 : 36-40

KARWASRA, R. R, H. R. YADAV and R. S PARODA, 1975. Prediction of phenotypic mean performence through genotype-environment interaction studies in yellow sweet clover (Melilotus Parviflora Desf) *Enphtica*, 24 : 261-67.

PARODA, R. S and J. D. HAYES, 1971. An investigation of genotype-environment interactions for rate of ear emergence in spring barley. *Heredity* 26 : 157-75.

PAROD, R S M. L SAINI, and J. V. SINGH, 1980 Variety x Environment interactions in clusterbean *Porage Res*, : 71-74.

PARODA, R. S. K. R SOLANKI and B. S. CHAUDHARY, 1973. Phenotypic stability in Oats. *Indian J. Genet.*, 33 : 82-95.

PERKINS, J M. and J, L. JINKS, 1968. Environmental and genotype environmement components of variability III. Multiple lines and crosses. *Heredity*. 23 339-56

SAMUVEL, C. J A., J. HIL, E. L BREESE and A. DAVIES, 1970. Assessing and predicting environmental response in Lolium perenne. *J. agric. sci.*, Camb; 75 : 1-9.

SIGURBAJORNSSON, B, and A MICKE, 1974. 'Philosophy and accomplishments of mutation breeding'. Polyploidy and indnuced mutations in plant breeding (Proc Meeting Bari, 1972), IAEA, Vienna, pp. 303-43.

Table 1. Mean yield (q/ha) and two parameters of stability of the 25 mutant genotypes, parent 'Jadia' and check varieties 'T 2' and 'T 18'.

Genotypes	1977 (297.0mm)	1978 (297.7 mm	1980 (239.0mm)	Mean	b	s^2d
JMM 211	7.8	10.0	2.8	6.9	1.30*	0.725
JMM 242	8.2	9.7	3.4	7.1	1.16*	-0.009
JMM 60	11.4	9.4	4.0	8.2	1.29*	2.861*
JMM 240	7.5	9.4	2.0	6.3	1.37*	0.324
JMM 267	8.8	9.2	3.5	5.4	1.15*	-0.479
JMM 253	6.7	8.9	3.0	6.2	1.03*	0.909
JMM 259	12.4	8.9	3.6	8.3	1.41*	0.280
JMM 255	8.9	8.8	2.5	6.7	1.30*	-0.268
JMM 179	7.6	8.7	2.9	6.4	1.11*	-0.319
JMM 251	6.2	8.2	1.4	5.3	1.22*	0.514
JMM 227	9.1	8.1	3.6	6.9	1.02*	0.506
JMM 202	8.5	8.0	3.5	6.7	0.98*	-0.029
JMM 140	6.4	7.9	3.6	6.0	0.74*	0.188
JMM 262	6.1	7.8	2.8	5.6	0.89	0.337
JMM 206	9.5	7.8	2.2	6.5	1.31*	2.140*
JMM 247	10.3	7.6	2.9	6.9	1.22*	4.963**
JMM 254	9.1	7.5	3.4	6.7	0.99*	1.647
JMM 14	6.0	7.4	2.4	5.2	0.92*	0.003
JMM 273	8.3	7.1	2.8	6.1	0.98*	0.862
JMM 238	8.0	7.0	1.7	5.6	1.18*	0.751
JMM 265	7.2	6.9	2.0	5.4	1.05*	-0.186
JMM 209	7.2	6.3	3.4	5.7	0.67	0.272
JMM 257	6.7	6.6	2.2	5.2	0.91	-0.374
JMM 212	8.3	6.0	4.0	6.1	0.61	2.945*
JMM 246	3.4	5.3	2.7	3.8	0.37	0.955
Parent variety						
Jadia	1.3	6.6	1.5	3.2	0.61	13.320**
Checks						
T 2	3.3	8.8	3.5	5.2	0.60	4.548**
T 18	2.8	6.2	1.9	3.6	0.59	11.995**
Mean	7.4	7.9	2.8	6.0	1.00	
SEm±	1.0	0.6	0.2	1.1	0.41	
CD 5%	2.8	1.8	0.4			

* Significant at 5% level

** Significant at 1% level

Note : Figure in parnthesis indicate amount of rainfall received during cropping seasons.

Table 2. Analysis of variance for genotype x exvironment for grain yield of mothbean.

Source of variation	dF	M. S
Genotypes	27	4.348**
Environment + (genotype x Env.)	56	9.597** ++
Environment (lincar)	1	433.568** ++
Genotype x Environment (liner	27	1.208**
Pooled deviation	28	2.544**
Pooled error	168	0.491

** Significant against pooled error at 1% level

++ Significant against pooled deviation at 1% level