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# Genotype x Environment Interaction and Stability Analysis in Indian Bean (*Dolichos lablab* (L.)*

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## ABSTRACT

**An experiment was conducted at Pulses Research Station, Navsari, Agril. Research Station, Achhalia, Regional Rice Research Station, Vyara during season of 1995-96 to study the G x E interaction and stability performance in Indian bean. The G x E interactions were significant for all the traits except 100-seed weight. Among parents, NVS-141 was found to be stable for seed yield per plant. While NVS-61 and NVS-62 were found stable under unfavourable environments. The highest yielding hybrid, Red Paria x AKW-9304 was found stable for seed yield in unfavourable environment. While the high yielding hybrids NVS-61 x NVS-102, 125- 36 x NVS-121 and Red Paria x NVS-102 were identified as stable for seed yield per plant, specifically under good farming condition.**

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## INTRODUCTION

The occurance of genotype x environment interactions has long provided a major challenge in obtaining a fuller understanding of the genetic control of variability. G x E interaction, which is the difference in response of genotypes to a given change or changes in the additive environments, poses serious difficulties in making proper assessment of genotypes when these are compared over a range of additive environmental variability. Detection and estimation of the magnitude of G x E interaction is, therefore important for obtaining unbiased estimate of genetic variance. The ultimate goal of most of the breeding programmes is to breed and develop high yielding and stable varieties of crop plants. Because different genotypes react differently in various environmental condition (Singh and Chaudhary, 1985). Therefore, this study was undertaken to determine the stability performance of different genotypes at various locations.

## MATERIALS AND METHODS

The experimental material consisted of 4 females, 15 males and their 60 hybrids produced in L x T matings by hand emasculation and pollination were evaluated in randomized block design with three replications in single row plots of 3 m length

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at three research stations viz., Navsari, Vyara and Achhalia of Gujarat Agril. University during *rabi*, 1995-96.

Five randomly selected competitive plants were chosen at all the three locations from each row to record the data seed yield per plant, number of branches per plant, number of pods per plant, number of seeds per pod, 100-seed weight, pod length, protein content, plant height, days to 50 per cent flowering and days to maturity. The magnitude of G x E interaction and stability parameters for the above different characters were estimated as per the procedure outlined by Eherhart and Russel (1966).

*TABLE 1*

**Analysis of variance for phenotypic stability with regard to different traits in Indian bean.**

| *Source of variation* | *d.f.* | *Days to 50% flowering* | *Plant height (cm.)* | *Number of branches per plant* | *Number of pods per plant* | *Number of seeds per pod* |
|---|---|---|---|---|---|---|
| Genotype (G) | 78 | 55.453*+ | 621.209*+ | 3.079*+ | 164.624*+ | 0.010 |
| Environment (E) | 2 | 13.106*+ | 1681.833*+ | 11.918*+ | 338.235*+ | 0.045*+ |
| G x E | 156 | 2.138* | 68.921*+ | 0.563* | 19.891* | 0.010* |
| Environment (Linear) | 1 | 26.464*+ | 3364.025*+ | 23.837*+ | 676.484*+ | 0.903*+ |
| G x E (Linear) | 78 | 2.504*+ | 131.743*+ | 0.407* | 17.766* | 0.014+ |
| Pooled deviation | 79 | 1.746 | 45.510* | 0.710* | 21.737* | 0.005 |
| Pooled error | 468 | 1.429 | 25.563 | 0.088 | 5.836 | 0.011 |

*Table 1 (contd.)*

| *Source of variation* | *d.f.* | *Pod length (m)* | *100-seed weight (g)* | *Seed yield per plant (g)* | *Protein content (%)* | *Days to maturity* |
|---|---|---|---|---|---|---|
| Genotype (G) | 78 | 0.561*+ | 18.164*+ | 136.636*+ | 20.484*+ | 116.916*+ |
| Environment (E) | 2 | 0.121* | 15.569*+ | 389.91*+ | 1.139*+ | 68.409*+ |
| G x E | 156 | 0.091 | 0.306 | 17.078* | 0.124*+ | 3.611* |
| Environment (Linear) | 1 | 0.240*+ | 31.000*+ | 779.833* | 2.445*+ | 136.677*+ |
| G x E (Linear) | 78 | 0.068 | 0.368+ | 15.334* | 0.179*+ | 3.819 |
| Pooled deviation | 79 | 0.113* | 0.244 | 18.583* | 0.066* | 3.362* |
| Pooled error | 468 | 0.005 | 0.433 | 3.210 | 0.032 | 0.326 |

* Significant at 5 per cent probability level against pooled error.

\+ Significant at 5 per cent probability level against pooled deviation.

*TABLE 2*

**Stability parameters of parents and their hybrids for different characters in Indian bean.**

| *Sr No.* | *Characters* | *Ideal genotypes with general adaptability* | | *Specific adaptability to favourable environments* | | *Specific adaptability to unfavourable environments* | |
|---|---|---|---|---|---|---|---|
| | | *Parents* | *Hybrids* | *Parents* | *Hybrids* | *Parents* | *Hybrids* |
| 1. | Days to 50% flowering | AKW-9304 | Red Paria x Kokan Bhusan | AKW-9312 | Red Paria x AKW-9304 | Kokan Bhusan | NVS-62 x NVS-31 |
| | | | Red Paria x NVS-141 | AKW-9311 | Red Paria x NVS-31 | | Red Paria x NVS-106 |
| | | | Red Paria x NVS-121 | | | | |
| | | | 125-36 x AKW-9305 | | | | |
| 2. | Plant height (cm) | — | Red Paria x Kokan Bhusan | AKW-9312 | Red Paria x NVS-31 | Kokan Bhusan | 125-36 x AKW-9301 |
| | | | NVS-61 x AKW-9306 | AKW-9303 | | AKW-9304 | NVS-61 x AKW-9303 |
| 3. | Number of branches per plant | Red Paria | NVS-61 x NVS-102 | — | 125-36 x NVS-121 | NVS-61 | NVS-61 x Kokan Bhusan |
| | | | NVS-61 x NVS-31 | | NVS-62 x NVS-50 | NVS-62 | NVS-62 x NVS-42 |
| | | | NVS-61 x NVS-41 | | | | |
| | | | Red Paria x AKW-9304 | | | | |
| 4. | Number of pods per plant | NVS-141 | NVS-62 x Kokan Bhusan | NVS-121 | 125-36 x NVS-42 | — | NVS-62 x AKW-9306 |
| | | NVS-62 | NVS-62 x AKW-9311 | | NVS-62 x AKW-9312 | | NVS-62 x NVS-106 |
| | | | 125-36 x AKW-9306 | | | | 125-36 x Kokan Bhusan |
| 5. | Pod length (cm) | NVS-61 | — | AKW-9304 | NVS-61 x Kokan Bhusan | AKW-9303 | NVS-61 x AKW-9304 |
| | | | | NVS-31 | NVS-61 x AKW-9301 | | NVS-62 x AKW-9306 |

| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|
| 6. | 100 seed weight (g) | AKW-9303 | NVS-61 x AKW-9311<br>NVS-61 x NVS-50<br>125-36 x AKW-9305<br>NVS-62 x NVS-31 | NVS-61 | NVS-61 x NVS-50<br>NVS-62 x AKW-9304<br>NVS-62 x NVS-141 | NVS-31 | NVS-61 x AKW-9311<br>NVS-61 x NVS-102 |
| 7. | Seed yield per plant (g) | NVS-141 | NVS-62 x Kokan Bhusan<br>125-36 x Kokan Bhusan<br>125-36 x NVS-106 | | NVS-62 x AKW-9311<br>NVS-62 x NVS-106<br>Red Paria x AKW-9312 | NVS-61<br>NVS-62 | NVS-61 x AKW-9306<br>Red Paria x AKW-9304 |
| 8. | Protein content (%) | NVS-106 | NVS-61 x NVS-106<br>125-36 x Kokan Bhusan | NVS-31 | NVS-61 x NVS-102<br>NVS-61 x NVS-50<br>125-36 x AKW-9305<br>125-36 x NVS-141 | Kokan Bhusan | NVS-61 x AKW-9301<br>125-36 x AKW-9303 |
| 9. | Days of maturity | AKW-9306 | Red Paria Kokan Bhusan<br>NVS-61 x NVS-31 | AKW-9311 | NVS-61 x AKW-9312<br>Red Paria x AKW-9312 | Kokan Bhusan | Red Paria x NVS-141<br>Red Paria x NVS-106 |

## RESULTS AND DISCUSSION

The pooled analysis of variance for stability showed different among the genotypes were significant for all the characters except number of seeds per pod when tested against pooled deviation and pooled error (Table 1). Similarly, the environments differed from each other for all the characters except for pod length when tested against pooled deviation. Thus, the genotypes as well as environments were different from each other. The G x E interaction was significant for all the characters when tested against pooled error except number of seeds per pod and 100-seed weight indicating that genotypes reacted differently in different environments.

The prediction of performance based on regression analysis might not be reliable as

observed from the significant pooled deviation for all the characters except days to 50 per cent flowering, number of seeds per pod and 100-seed weight when tested against pooled error indicating their fluctuation in performance over locations. The results were generally in agreement with those of Perkins and Jinks (1968) and Desai *et al.* (1991).

The investigation further revealed that none of the genotype was found stable for all the traits (Table 2). Among parent, NVS-141 was found stable for seed yield per plant and number of pods per plant, and among hybrids NVS-62 x Kokan Bhusan, 125-36 x Kokan Bhusan and 125-36 x NVS-106 exhibited stability for seed yield per plant. It was observed that the crosses which depicted high performance above or below average stability for seed yield per plant and its related components viz., number of branches per plant, number of pods per plant and pod length involved either NVS-61 or NVS-62 as common female. The hybrids NVS-62 x AKW-9311 and NVS-62 x NVS-106 were found average stable suggesting their suitability in favourable environments. Whereas the crosses NVS-61 x AKW-9306 and Red Paria x AKW-9304 exhibited below average stability for seed yield which indicated that these were suitable for unfavourable conditions. The yield performance of other hybrids could not be predicted owing to their very high or very low bi-value and higher value of $S^2di$.

It was evident from the results that stability of these genotypes might be due to stability for various yield components, like number of branches per plant, number of pods per plant and pod length as observed by Shoran *et al.* (1981) in pigeonpea and Muduli and Hati (1994) in *Phaseolus radiatus*. Further, the results indicated that genotypes having stability over environments for seed yield had also stability for yield components, like number of branches per plant and number of pods per plant. This indicated that stability of various component traits might be responsible for the observed stability of various genotypes for seed yield. Based on the results it is suggested that selection in segregating generations of crosses NVS-62 x Kokan Bhusan, 125-36 x Kokan Bhusan and 125-36 x NVS-106 would be fruitful in isolating high yielding stable varieties as the yield performance of these crosses was quite high with appreciable stable perforamance across the locations.

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