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Stability of yield and its components in urdbean

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ABSTRACT

Twelve genotypes of urdbean (*Vigna mungo* L. Hepper) were studied under four environments for seven different characters to assess their stability using Eberhart and Russell model. The GE (linear) and pooled deviation were significant for days to maturity. The magnitude of GE (linear) was greater than the pooled deviation revealing preponderance of linear over non-linear component for all the characters studied. Genotypes LBG 719 and LBG 729 were stable over all environments for seed yield. These genotypes could be used in breeding programmes to obtain high yielding stable segregants. The association of seed yield was found to be positively significant with days to maturity and number of pods per plant at Ragolu.

Key words: Stability, GE interaction, Urdbean, *Vigna mungo*

Genotype x Environment (GE) interaction underlines the very success of breeding prgorammes. As a result, the post-breeding adaptive evaluation of improved strains is essential before they are released as varieties for their commercial cultivation. Hence, an attempt was made to study the stability of promising genotypes of urdbean (*Vigna mungo* L. Hepper) over four locations.

MATERIALS AND METHODS

Twelve urdbean genotypes were grown in a randomized block design with three replications under four locations (E1 = Lam, E2 = Munipalle {Rice fallows}, E3 = Jagityal, E4 = Ragolu) during *Rabi* 2002-03. Each genotype was sown in a plot of 6 rows of 4 m length. The inter- and intra-row spacings were kept at 30 and 10 cm. Recommended package of practices was adopted throughout the crop season. Observations were recorded in each plot for days to 50% flowering, days to maturity, plan height, number of pods per plant, number of seeds per pod, 100-seed weight and seed yield (kg/ha). Stability analysis was carried out following Eberhart and Russell (2) model. Character association between seed yield and different yield components was worked out according to Dewey and Lu (1).

RESULTS AND DISCUSSION

The pooled variance due to genotypes was highly significant fulfilling the requisite of stability analysis (Table 1). Insignificant environment variance, E (linear), for all the traits except number of seeds per pod and 100-seed weight indicated that variation among environments was not linear. However, variance due to GE (linear) was highly significant for all the traits indicating differential performance of genotypes under diverse environments. Significant pooled deviation for days to maturity indicated performance of different varieties fluctuated from their linear path of response to environments for days to maturity. The magnitude of GE (linear) interaction was greater than pooled deviation revealing preponderance of linear over non-linear component for all the characters studied. Similar results in mungbean were also reported by Manivannan *et al.* (3).

Table 1. Analysis of variance for stability in urdbean

Source	df	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of pods/plant	Number of seeds/pod	100-seed weight (g)	Seed yield (kg/ha)
Genotypes (G)	11	9.577**++	17.731**++	164.990**++	313.941**++	1.455**++	15.146**++	1759.703**++
E+(GE)	36	18.828**++	41.532**++	42.522**	64.555**	0.511**	1.369**++	560.736**++
Environment (linear)	1	1	1	1	1	1*	1**++	1
G E(linear)	11	166.652**++	366.870**++	132.461**++	299.283**++	1.400**++	11.341**++	4888.380**++
Pooled deviation	24	0.426	1.112++	7.836	16.910	0.191	0.122	26.374
Pooled error	88	0.290	0.410	22.047	45.616	0.316	0.118	21.240

+, ++ significant at 5 and 1% levels when tested against pooled error; *,** Significant at 5 and 1% levels when tested against pooled deviation

Table 2. Environmental index values for yield and yield components of urdbean in different environments

Character	Lam (E_1)	Munipalle (E_2)	Jagityal (E_3)	Ragolu (E_4)
Days to 50% flowering	-4.139	-2.556	4.888	1.806
Days to maturity	-6.458	-3.292	6.597	3.153
Plant height	3.409	0.548	1.298	-5.256
Number of pods per plant	0.464	-0.053	-0.381	-0.030
Number of seeds per pod	0.097	6.736	-1.208	-5.625
100-seed weight	-1.629	0.216	0.494	0.919
Seed yield	-0.426	-0.184	1.083	-0.472

Table 3. Estimates of stability parameters for yield and yield component characters in urdbean

Genotype	Days to 50% flowering			Days to maturity			Plant height (cm)			Number of pods/plant			Number of seeds/pod			100-seed weight (g)			Seed yield/plant (g)		
	Mean	b_1	S^2d_i	Mean	b_1	S^2d_i	Mean	b_1	S^2d_i	Mean	b_1	S^2d_i	Mean	b_1	S^2d_i	Mean	b_1	S^2d_i	Mean	b_1	S^2d_i
LBG 709	47.67	0.943	0.121	83.58	1.087	0.967*	30.17	0.591	-16.528	30.00	0.367	-45.471	7.07	0.384	-0.074	4.77	1.018	-0.077	1036.33	0.881	-16.896
LBG 693	48.50	0.765	-0.122	89.90	1.075	0.286	39.50	1.089	-17.643	28.30	2.344	-28.962	7.18	1.774	-0.019	4.80	1.061	0.098	1065.83	1.139	-7.772
LBG 712	49.50	1.730	0.176	85.50	0.407	0.493	31.25	1.694	-14.080	28.42	0.887	-15.263	7.02	0.391	-0.070	4.69	0.714	-0.045	833.17	1.057	27.947
LBG 714	46.50	0.280	0.211	89.08	1.178	-0.009	37.08	1.483	-12.588	29.83	1.330	-31.969	7.63	2.639	-0.167	4.56	1.198	-0.116	933.42	0.999	-16.216
LBG 716	49.25	1.462	0.362	90.17	1.242	-0.254	34.67	0.804	-20.442	23.58	0.263	-33.429	7.19	0.221	-0.271	4.79	1.067	0.107	931.58	0.899	-15.384
LBG 719	50.33	1.059	0.486	88.17	1.838	2.123**	35.25	0.771	1.605	24.33	2.160	-29.779	7.30	2.438	-0.039	4.46	0.793	0.188	1069.33	1.052	32.754
LBG 728	48.83	0.831	0.658	87.00	0.719	0.128	32.67	0.874	-14.878	31.83	0.140	-40.883	7.44	0.305	-0.263	4.69	1.320	-0.369	1067.25	1.077	-11.696
LBG 731	45.17	0.484	-0.101	83.83	1.056	1.745**	31.92	0.793	-20.326	24.83	2.247	-42.355	7.15	1.229	-0.199	4.79	1.131	-0.052	932.83	0.990	30.125
LBG 734	48.17	1.895	0.070	87.67	1.627	1.377*	28.75	1.150	-5.852	23.92	0.353	-21.220	6.91	1.515	-0.245	4.58	0.870	-0.117	873.83	0.903	18.464
LBG 402	50.25	1.181	-0.199	88.17	0.192	0.694	35.25	0.829	-12.003	27.50	1.851	-1.020	7.18	1.230	-0.075	4.83	1.099	0.149	1050.50	0.834	-0.980
LBG 17	42.17	0.972	0.033	87.83	1.709	-0.270	32.42	1.189	-19.653	27.17	0.956	-23.440	7.10	0.596	-0.164	5.02	0.757	0.176	981.42	1.502	-17.481
LBG 685	49.33	1.258	-0.069	88.83	0.948	1.130*	29.17	1.301	-18.152	28.75	1.356	-30.655	6.87	1.449	-0.199	5.26	1.483	0.170	958.67	0.769	-11.254
Grand mean	47.97	1.07	-	87.43	1.08	-	33.18	1.05	-	27.37	1.18	-	7.17	1.18	-	4.77	1.04	-	977.85	1.01	-

X = Mean, b_1 = Regression coefficient, S^2d_i = Deviation from regression, * Significant at 5% and 1% levels

The environmental index value were positive and high for days to 50% flowering, days to maturity and seed yield in Jagityal indicating favourable environment for these traits (Table 2). Lam was favorable for plant height, Munipalle for number of pods per plant and Ragolu for 100-seed weight. According to Eberhart and Russell (2), a stable genotype is one with g_i > mean, $b_i = 1$ and $S^2d_i = 0$. Among the genotypes studied, all recorded non-significant S^2d_i for all characters except for days to maturity (Table 3).

Grouping of these genotypes into different environments was done based on stability parameters. For seed yield, the genotypes LBG 719 and LBG 728 performed well in all the environments, while LBG 693 and LBG 17 performed well under favourable environments (Table 4). The genotype LBG 693 was found stable over all the environments for days to maturity, plant height and 100-seed weight. The genotypes LBG 714 and LBG 402 were stable in favourable environments for days to maturity, number of pods and seeds per plant. The genotype LBG 728 was stable in poor environments for traits like days to 50% flowering and maturity, and number of pods and seeds per plant.

Seed yield was positively and significantly associated with days to maturity (0.802**) and number of pods per plant (0.512*) at Ragolu location. Manivannan *et al.* (4) also reported significant positive correlation of seed yield with number of pods per plant in mungbean. For days to maturity, the association with seed yield was negative and non-significant at Munipalle. At Lam location, 100-seed weight recorded significant positive correlation with days to 50% flowering (0.404*) and number of seeds per pod (0.425*). Number of pods per plant was found to be negatively correlated with plant height in all the environments. Hence, genotypes LBG 719 and LBG 728 were found superior to other genotypes with respect to responsiveness to environments and stability over environments. These genotypes could be used as parents in breeding programmes to obtain superior stable genotypes.

Table 4. Grouping of urdbean genotypes suitable for different environments

Character	Genotypes stable over all environments (g_i >mean b_i= 1, S^2d_i = 0)	Genotypes stable for favourable environments (g_i >mean b_i> 1, S^2d_i =0)	Genotypes stable for poor environment (g_i >mean b_i<1, S^2d_i =0)
Days to 50% flowering	LBG 719, LBG 709	LBG 402, LBG 712, LBG 685, LBG 716, LBG 734	LBG 728, LBG 693
Days to maturity	LBG 693	LBG 716, LBG 714, LBG 17, LBG 402	LBG 728
Plant height	LBG 693	LBG 714	LBG 719, LBG 402, LBG 716
Number of pods/plant	LBG 17, LBG 712	LBG 714, LBG 685, LBG 693, LBG 402	LBG 728, LBG 709
Number of seeds/pod	Nil	LBG 714, LBG 719, LBG 402, LBG 693, LBG 731	LBG 728, LBG 716
100-seed weight	LBG 709, LBG 693, LBG 716, LBG 402	LBG 685, LBG 731	LBG 17
Seed yield	LBG 719, LBG 728	LBG 693, LBG 17	LBG 709, LBG 402

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