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Character Association in Dolichos Bean [*Lablab purpureus* (L.) Sweet] in Agro-climatic Zone of North Bihar

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ABSTRACT

Background: The analysis of variance (ANOVA) for all characters of dolichos bean genotypes was carried out separately. The analysis of variance, test of significance of variance components were conductedin accordance to the procedure as suggested by Panse and Sukhatme (1967). Correlation and path coefficient analysis were evaluated as per the formulation of Al-Jibouri *et al.* (1958) and Dewey and Lu (1959), respectively.

Methods: Present investigation was conducted in two locations *viz.* Vegetable Research Farm, Pusa and Birauli, Dr. Rajendra Prasad Central Agricultural University, Bihar during *Rabi* season in 2019-2020 and pooled data was analyzed. The entire experiment was conducted using fourteen genotypes of dolichos bean in RBD in three replications and fourteen yield attributing and morphological traits were studied. The performance of genotypes was evaluated on the basis of all fourteen characters. Best performing genotypes were screened based on their performance. Selection has been done for all characters which are positively and directly correlated with yield.

Result: Among the fourteen genotypes it has been inferred that RAUDB-2 and RAUDB-7 had maximum pod yield. Therefore, they can replace the check variety Swarna Utkrist. The magnitude of genotypic correlation was higher than phenotypic correlation for all the traits indicating inherent associations between various characters. The traits such as pod diameter, number of pods per plant and harvest duration positively correlated with pod yield.In present investigation the path analysis revealed pod length, days to 1st flowering, days to 50% flowering and number of seeds per pod exerted positive direct effect on pod yield.

Key words: Correlation, Dolichos, Genotypes, Path analysis.

INTRODUCTION

Dolichos bean [*Lablab purpureus* (L.) Sweet] is a leguminous crop of multiple utility and multiple benefits. It is cultivated to serve the purposes as vegetable, fodder, medicine, green manure, cover crop, pulse and ornamental purpose (Ayyangar and Nambiar, 1935). In India, it is widely cultivated in eastern, southern and north-eastern regions of the country.

Dolichos beans are cultivated in July-August so as to synchronize flowering in winter months and harvesting is done in the months of February to April. Whereas, if photo-insensitive varieties are available, then it can be grownthroughout the year. This is highly valuable, rich proteinaceous legume present in modern human diet (Chattopadhyay and Dutta, 2010; Habib *et al.,* 2017; Ananth and Kumar, 2018; Ranaivoson *et al.,* 2019). Generally the green, delicious, immature pods and seeds are used as edible parts. Excellant beetroot-colored beans as well as unripe (type flageoles) and ripe black seeds can be consumed as food, which is also prescribed to be an important medicinal raw material for treatment of kidney stones (Bobos, 2016). Moreover, immature pods and seeds are enriched in dietary fiber, low carbohydrates and lipids. Due to changing lifestyle pattern and food habit all over the world, intake of low calorie and low fat vegetarian food is becoming increasingly popular. Besides, many medicinal and therapeutic properties are endowed in Dolichos. The seeds contain kievitone, which is a highly essential flavonoid for fighting breast cancer. Tyrosinase present in the seed has immense potential to reduce the problems of hypertension in human beings (Naeem *et al.,* 2009).

Correlation coefficient is a measure of the degree of association between two traits worked out at the same time. The extent of observed relationship between two characters is indicated by phenotypic correlation which includes both hereditary and environmental influences, while the real association between two characters is indicated by genotypic correlation coefficient which may be useful for selection. Path

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coefficient analysis designed by Dewey and Lu (1959), helps in subdividing the correlation coefficient into direct and indirect component which permit a critical investigation of the relative importance of every traits.

MATERIALS AND METHODS

Present investigation was conducted in two locations *viz.* Vegetable Research Farm, Pusa and Birauli, Dr. Rajendra Prasad Central Agricultural University, Bihar during *rabi* season in 2019-2020 and pooled data was analyzed. The entire experiment was conducted using fourteen genotypes of dolichos bean in RBD in three replications. The collection of materials was done from different districts of Bihar. The evaluation of genotypes were done basedon fourteen quantitative characters *viz.,* days to first flowering, days to 50% flowering, days to 1st pod harvest, days to last pod harvest, harvesting duration (days), number of pods per plant, number of seeds per pod, pod length (cm), pod diameter (cm), individual pod weight (g), weight of seeds per pod (g), 100 fresh green seed weight (g), pod yield (q/ha), percent incidence of yellow mosaic virus. ANOVA was estimated based on the methodologies proposed by Panse and Sukhatme (1978). Correlation and path coefficient analysis were evaluated as per the formulation of Al-jibouri *et al.* (1958) and Dewey and Lu (1959), respectively.

RESULTS AND DISCUSSION

Analysis of Variance clearly depicted that significant genetic variation was observed for eight characters under study (Table 1). Table 2 depicted that for most of the characters, RAUDB-2 and RAUDB-7 recorded highest among all genotypes. For earliness and resistance to YVMV, RAUDB-7 recorded early as well as resistance to the virus. Therefore, RAUDB-7 AND RAUDB-2 are the best genotypes under study. The correlation coefficient of fourteen characters estimated from the data recorded from fourteen genotypes of dolichos bean is presented in Table 3 and 4. The magnitude of genotypic correlation was higher than phenotypic correlation for all the traits indicating inherent associations between various characters. The findings were in agreement to Rai and Asati, 2006. Days to first flowering was significantly positively correlated to days to 50% flowering (0.963), days to 1st pod harvest (0.731), weight of seeds per pod (0.656), 100 fresh green seed weight (0.647) and percent incidence of yellow mosaic virus (0.567). Days to 50% flowering was significantly positively correlated to days to 1st pod harvest and 100 fresh green seed weight (g). The character days to 1st pod harvest was significantly positively correlated with weight of seeds per pod (0.537) and 100 fresh green seed weight (0.732). Days to last pod harvest had positive significant correlation with harvesting duration (0.929) and pod diameter (0.533). Harvest duration had positive significant correlation with number of pods per plant (0.606), pod diameter (0.760) and pod yield (0.632), Number of pods per plant had significant positive correlation with pod diameter (0.649) and pod yield (0.726). Pod length had positive significant correlation with individual pod weight (0.638). Pod diameter had positive significant correlation with individual pod weight (0.685) and pod yield (0.811), Weight of seeds per pod (g) had positive significant correlation with100 fresh green seed weight (0.785) and percent incidence of yellow mosaic virus (0.723). 100 fresh green seed weight was negatively correlated with pod yield (-0.851). Incidence of yellow mosaic virus had significant negative correlation with pod yield (-0.618).Pod diameter, number of pods per plant and harvest duration positively correlated with pod yield , So these characters should be given paramount importance while making selection. These findings are in accordance with Lal *et al.* (2005), Singh *et al.* (2015) and Parmar *et al.* (2013).

Selection of superior genotypes based on yield as such may not be effective for the enhancement of yield and hence selection should be made for component traits. Path coefficient analysis helps in understanding magnitude of direct and indirect contribution of each character on the dependant character. In present investigation the path analysis revealed pod length, days to 1st flowering, days to 50% flowering and number of seeds per pod exerted positive direct effect on pod yield. This indicated that these characters played direct role in increasing pod yield. Therefore, the direct selection of these characters might bring an overall improvement in pod yield. Hence selection of genotype

Table 1: Analysis of Variance for fourteen characters in dolichos bean.

Traits	Source of variation	Mean squares		
		Replication	Treatments	Error
	df	2	14	28
DFF		588.39	300.54	226.19
D50%F		729.04	303.19	260.27
DFPH		1088.26	288.78	284.6
DLPH		2184.7	864.61	871.98
HD (Days)		214.46	498.08**	162.37
NPPP		537.43	2342.83**	329.61
NSPP		0.99	0.83	0.54
PL (cm)		3.76	7.42**	1.86
PD (cm)		0.21	0.51**	0.14
IPW (g)		1.78	27.96**	1.54
WSPP (g)		0.74	1.61**	0.05
100 FGSW (g)		196.01	696.86**	64.46
IYMV		407.01	1134	595.79
PY (q/ha)		14.08	94.79**	7.57

** Significant at 1% level.

DFF: Days to first flowering; D50%F: Days to 50% flowering, DFPH: Days to 1st pod harvest, DLPH: Days to last pod harvest, HD: Harvest duration (days), NPPP: Number of pods per plant, NSPP: number of seeds per pod, PL: Pod length (cm), PD: Pod diameter (cm), IPW: Individual pod weight (g), WSPP: Weight of seeds per pod (g), 100 FGSW: 100 fresh green seed weight (g), IYMV: Per cent incidence of yellow mosaic virus, PY: Pod yield (q/ha).

Table 2: Mean performance of genotypes for each characters.

Characters / Variety	Days to first flowering	Days to 50% flowering	Days to 1st pod harvest	Days to last pod harvest	Harvesting duration (days)	No. of pods per plants	No. of seeds per pod	Pod length (cm)	Pod diameter (cm)	Individual pod weight (g)	Weight of seeds per pod (g)	100 fresh green seed weight (g)	Pod yield (q/ha)	Per cent incidence of yellow mosaic virus
Swarna Utkrist	92.67	98.33	107.67	170.33	62.66	122.67	4.10	9.26	2.30	8.31	1.84	60.60	137.47	13.32
ArkaVistar	85.67	90.67	109.33	188.67	79.34	119.33	4.13	11.01	2.37	11.83	2.30	62.93	133.17	22.72
Pusa Sem- 3	94.67	102.67	110.00	187.67	77.67	98.67	4.57	7.96	2.51	7.31	1.58	47.63	161.55	10.22
ArkaPrasidhi	103.33	108.33	113.33	173.67	60.34	91.67	4.87	11.42	1.87	9.76	3.46	79.05	125.23	24.77
ArkaAdrash	98.00	104.67	111.00	184.67	73.33	84.33	4.70	9.59	2.08	7.95	3.11	72.30	120.27	13.32
RAUDB-1	95.67	101.33	108.67	190.67	82.01	136.67	4.53	9.95	1.96	6.48	3.00	54.97	138.60	20.23
RAUDB-2	85.33	90.67	98.67	196.67	98.00	158.33	5.13	10.40	3.03	14.85	2.01	38.33	168.42	16.68
RAUDB-3	91.39	99.61	107.31	171.1	63.79	132.12	4.0	9.20	2.30	8.15	2.0	60.98	142.40	11.23
RAUDB-4	84.07	89.32	109.64	192.23	82.59	112.45	4.1	10.99	2.52	11.95	2.5	63.76	131.21	13.25
RAUDB-5	95.05	103.33	110.02	186.37	76.35	109.29	4.5	8.13	2.26	7.35	1.6	47.53	153.91	16.45
RAUDB-6	94.63	101.64	110.67	188.4	77.73	125.76	4.5	9.52	1.94	6.50	2.45	44.51	129.53	21.01
RAUDB-7	82.61	88.35	96.64	190.53	93.89	144.77	5.1	10.44	2.98	15.00	1.85	37.87	161.73	10.33
RAUDB-8	100.32	106.67	113.39	170.6	57.21	88.34	4.9	11.81	1.85	11.75	3.4	78.5	123.00	23.78
RAUDB-9	101.34	105.36	112.08	184.97	72.89	72.45	4.4	9.45	2.02	8.55	3.1	72.5	119.21	24.09
C.D.	9.701	12.36	13.49	19.58	11.010	12.91	0.43	1.48	0.29	1.35	0.38	10.00	13.86	2.90
SE(m)	3.114	3.97	4.33	6.29	3.612	4.14	0.14	0.48	0.09	0.43	0.12	3.21	4.45	0.93
C.V.	5.85	7.01	7.01	5.84	11.987	6.44	5.16	8.28	6.99	7.62	8.75	9.36	5.60	9.49

** Significant at 1% level.

DFF: Days to first flowering; D50%F: Days to 50% flowering, DFPH: Days to 1st pod harvest,DLPH: Days to last pod harvest, HD: Harvest duration (days), NPPP: Nnumber of pods per plant, NSPP: Number of seeds per pod, PL: Pod length (cm), PD: Pod diameter (cm), IPW: Individual pod weight (g), WSPP: weight of seeds per pod (g),100 FGSW: 100 fresh green seed weight (g), IYMV: Per cent incidence of yellow mosaic virus, PY: Pod yield (q/ha).

Table 3: Genotypic correlation coefficient between different characters combination in dolichos bean.

	DFF	D50%F	DFPH	DLPH	HD (Days)	NPPP	NSPP	PL (cm)	PD (cm)	IPW (g)	WSPP (g)	100 FGSW (g)	IYMV	PY (q/ha)
DFF	1	0.99	0.760**	-0.990	-0.895**	-0.890**	-0.12	-0.245	-0.98	-0.770**	0.770**	0.729**	0.695**	-0.772**
D50%F		1	0.98	-0.920**	-0.855**	-0.856**	0.136	-0.287	-0.919**	-0.799**	0.589**	0.636*	0.48	-0.653*
DFPH			1	-0.986	-0.987	-0.913	-0.680**	-0.073	-0.939	-0.988	0.774**	0.986	0.762**	-0.999
DLPH				1	0.953	0.473	0.225	-0.059	0.751**	0.298	-0.35	-0.909**	-0.248	0.486
HD (Days)					1	0.623*	0.387	-0.115	0.774**	0.498	-0.443	-0.796**	-0.325	0.723**
NPPP						1	0.239	0.091	0.690**	0.396	-0.600*	-0.790**	-0.444	0.761**
NSPP							1	0.35	0.259	0.527	0.128	-0.334	0.04	0.461
PL (cm)								1	-0.078	0.680**	0.541	0.4	0.45	-0.248
PD (cm)									1	0.721**	-0.727**	-0.728**	-0.660*	0.931**
IPW (g)										1	-0.107	-0.212	-0.103	0.352
WSPP (g)											1	0.797**	0.730**	-0.862**
100 FGSW (g)												1	0.52	-0.916**
IYMV													1	-0.664**

** Significant at 1% level.

DFF: Days to first flowering; D50%F: Days to 50% flowering, DFPH: Days to 1st pod harvest,DLPH: Days to last pod harvest, HD: harvest duration (days), NPPP: number of pods per plant, NSPP: Number of seeds per pod, PL: pod length (cm),PD: pod diameter (cm),IPW: Individual pod weight (g), WSPP: weight of seeds per pod (g),100 FGSW: 100 fresh green seed weight (g),IYMV: percent incidence of yellow mosaic virus, PY: pod yield (q/ha).

Table 4: Phenotypic correlation coefficient between different characters combination in dolichos bean.

	DFF	D50%F	DFPH	DLPH	HD (Days)	NPPP	NSPP	PL (cm)	PD (cm)	IPW (g)	WSPP (g)	100 FGSW (g)	IYMV	PY (q/ha)
DFF	1	0.963**	0.731**	-0.538*	-0.708**	-0.767**	0.017	-0.148	-0.847**	-0.619*	0.656*	0.647*	0.567*	-0.625*
D50%F		1	0.746**	-0.554*	-0.723**	-0.682**	0.043	-0.227	-0.824**	-0.684**	0.517	0.554*	0.428	-0.5
DFPH			1	-0.446	-0.745**	-0.747**	-0.381	-0.007	-0.873**	-0.639*	0.537*	0.732**	0.503	-0.723**
DLPH				1	0.929**	0.389	0.257	-0.069	0.533*	0.274	-0.275	-0.626*	-0.158	0.439
HD (Days)					1	0.606*	0.351	-0.045	0.760**	0.471	-0.432	-0.772**	-0.327	0.632*
NPPP						1	0.186	0.096	0.649*	0.388	-0.594*	-0.765**	-0.428	0.726**
NSPP							1	0.314	0.263	0.475	0.115	-0.261	0.046	0.368
PL (cm)								1	-0.042	0.638*	0.518	0.371	0.412	-0.27
PD (cm)									1	0.685*	-0.706**	-0.707**	-0.645*	0.811**
IPW (g)										1	-0.106	-0.194	-0.096	0.355
WSPP (g)											1	0.785**	0.723**	-0.822**
100 FGSW (g)												1	0.52	-0.851**
IYMV													1	-0.618*

** Significant at 1% level.

DFF: Days to first flowering; D50%F: Days to 50% flowering, DFPH: Days to 1st pod harvest,DLPH: Days to last pod harvest, HD: harvest duration (days), NPPP: Number of pods per plant, NSPP: Number of seeds per pod, PL: pod length (cm), PD: Pod diameter (cm), IPW: Individual pod weight (g), WSPP: Weight of seeds per pod (g), 100 FGSW: 100 fresh green seed weight (g), IYMV: Per cent incidence of yellow mosaic virus, PY: Pod yield (q/ha).

Table 5: Genotypic direct (Diagonal) and indirect effect of fourteen characters in dolichos bean.

	DFF	D50%F	DFPH	DLPH	HD (Days)	NPPP	NSPP	PL (cm)	PD (cm)	IPW (g)	WSPP (g)	100 FGSW (g)	IYMV	PY (q/ha)
DFF	-1.944	-2.643	-1.477	1.945	1.739	1.729	0.232	0.476	2.028	1.497	-1.496	-1.417	-1.351	-0.772**
D50%F	0.383	0.282	0.321	-0.259	-0.241	-0.241	0.038	-0.081	-0.259	-0.225	0.166	0.179	0.135	-0.653*
DFPH	1.030	1.544	1.355	-1.803	-1.540	-1.508	-0.922	-0.099	-1.679	-1.366	1.049	1.367	1.032	-1.199
DLPH	1.550	1.425	2.061	-1.549	-1.941	-0.732	-0.349	0.091	-1.164	-0.462	0.541	1.408	0.384	0.486
HD (Days)	-3.541	-3.383	-4.499	4.960	3.958	2.467	1.532	-0.454	3.062	1.971	-1.754	-3.149	-1.285	0.723**
NPPP	-2.092	-2.012	-2.618	1.112	1.466	2.352	0.561	0.213	1.622	0.931	-1.412	-1.857	-1.043	0.761**
NSPP	-0.275	0.313	-1.565	0.519	0.891	0.549	2.301	0.806	0.596	1.213	0.295	-0.769	0.093	0.461
PL (cm)	0.648	0.758	0.194	0.155	0.303	-0.240	-0.926	-2.645	0.207	-1.798	-1.432	-1.057	-1.191	-0.248
PD (cm)	0.934	0.822	1.108	-0.672	-0.692	-0.617	-0.232	0.070	-0.895	-0.645	0.651	0.651	0.591	0.931**
IPW (g)	-0.115	-0.119	-0.150	0.044	0.074	0.059	0.078	0.101	0.107	0.149	-0.016	-0.032	-0.015	0.352
WSPP (g)	-1.550	-1.186	-1.558	0.704	0.892	1.209	-0.258	-1.090	1.464	0.216	-2.013	-1.604	-1.469	-0.862**
100 FGSW (g)	3.564	3.108	4.932	-4.442	-3.889	-3.859	-1.633	1.953	-3.556	-1.035	3.893	4.887	2.542	-0.916**
IYMV	0.636	0.439	0.696	-0.227	-0.297	-0.406	0.037	0.412	-0.604	-0.094	0.667	0.476	0.914	-0.664**

** Significant at 1% level.

DFF: Days to first flowering; D50%F: Days to 50% flowering, DFPH: Days to 1st pod harvest,DLPH: Days to last pod harvest, HD: harvest duration (days), NPPP: number of pods per plant,NSPP: number of seeds per pod, PL: pod length (cm),PD: pod diameter (cm),IPW: Individual pod weight (g), WSPP: weight of seeds per pod (g),100 FGSW: 100 fresh green seed weight (g),IYMV: percent incidence of yellow mosaic virus, PY: pod yield (q/ha).

Table 6: Phenotypic direct (Diagonal) and indirect effect of fourteen characters in dolichos bean.

	DFF	D50%F	DFPH	DLPH	HD (Days)	NPPP	NSPP	PL (cm)	PD (cm)	IPW (g)	WSPP (g)	100 FGSW (g)	IYMV	PY (q/ha)
DFF	2.056	1.981	1.503	-1.107	-1.455	-1.578	0.036	-0.304	-1.741	-1.272	1.348	1.331	1.166	-0.625*
D50%F	1.869	1.940	1.447	-1.075	-1.402	-1.323	0.083	-0.441	-1.598	-1.326	1.002	1.075	0.831	-0.5
DFPH	-6.308	-6.438	-8.629	3.847	6.432	6.448	3.291	0.060	7.535	5.511	-4.633	-6.314	-4.340	-0.723**
DLPH	-7.915	-8.154	-6.558	14.710	13.663	5.727	3.774	-1.022	7.842	4.035	-4.047	-9.209	-2.317	0.439
HD (Days)	12.558	12.834	13.230	-16.487	-17.750	-10.762	-6.225	0.797	-13.496	-8.355	7.675	13.710	5.806	0.632*
NPPP	-0.169	-0.150	-0.165	0.086	0.134	0.220	0.041	0.021	0.143	0.086	-0.131	-0.169	-0.094	0.726**
NSPP	-0.022	-0.055	0.491	-0.330	-0.451	-0.239	-1.287	-0.404	-0.339	-0.611	-0.148	0.336	-0.059	0.368
PL (cm)	-0.341	-0.524	-0.016	-0.160	-0.104	0.222	0.724	2.305	-0.096	1.472	1.194	0.856	0.950	-0.27
PD (cm)	0.093	0.090	0.096	-0.058	-0.083	-0.071	-0.029	0.005	-0.110	-0.075	0.077	0.078	0.071	0.811**
IPW (g)	-0.332	-0.367	-0.343	0.147	0.252	0.208	0.255	0.342	0.367	0.536	-0.057	-0.104	-0.052	0.355
WSPP (g)	-1.643	-1.295	-1.346	0.690	1.084	1.489	-0.289	-1.298	1.770	0.266	-2.506	-1.968	-1.813	-0.822**
100 FGSW (g)	-0.067	-0.057	-0.076	0.065	0.080	0.079	0.027	-0.039	0.073	0.020	-0.081	-0.104	-0.054	-0.851**
IYMV	-0.404	-0.305	-0.358	0.112	0.233	0.305	-0.032	-0.293	0.459	0.069	-0.515	-0.370	-0.712	-0.618*

** Significant at 1% level.

DFF: Days to first flowering; D50%F: Days to 50% flowering, DFPH: Days to 1st pod harvest,DLPH: Days to last pod harvest, HD: harvest duration (days), NPPP: number of pods per plant,NSPP: number of seeds per pod, PL: pod length (cm),PD: pod diameter (cm),IPW: Individual pod weight (g), WSPP: weight of seeds per pod (g),100 FGSW: 100 fresh green seed weight (g),IYMV: percent incidence of yellow mosaic virus, PY: pod yield (q/ha).

based on above character as selection criteria would be helpful in pod yield potentials of genotypes. It can be inferred that direct selection on the basis of above mentioned traits would be beneficial for yield improvement in dolichos bean. Similar results had been reported by Bangar *et al.* (2008), Konda *et al.* (2008), Mishra *et al.* (2008), Rai *et al.* (2009) and Chattopadhyay and Dutta (2010). The traits like harvest duration, days to 1st pod harvest, weight of seeds per pod, percent incidence of YMV and 100 fresh green seed weight had negative direct effect on yield per plant. The residual effect of path coefficient analysis of present study was 0.1641 which clearly indicated that the thirteen characters taken for study were sufficient for genetic analysis in dolichos bean. Only 16.41% of the variability was controlled by other traits besides these thirteen characters. The Genotypic and phenotypic direct (Diagonal) and indirect effect of fourteen characters in dolichos bean are illustrated in Table 5 and 6.

CONCLUSION

Based on the above result, traits such as pod diameter, number of pods per plant and harvest duration positively correlated with pod yield. Whereas yield could be improved by selecting characters like pod length, days to 1st flower, days to 50% flowering, number of pods per plant which have direct effect on pod yield.

Conflicts of interest: None.

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