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CORRELATION AND PATH ANALYSIS FOR GREEN POD YIELD AND YIELD ATTRIBUTING TRAITS IN DOLICHOS BEAN (*LABLAB PURPUREUS* L.)

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ABSTRACT

An experiment was conducted at the Vegetable Research Farm of the Department of Horticulture, Birsa Agricultural University, Ranchi during the *kharif* 2021-22 with the objective to examine the correlation and path analysis pattern for green pod yield and its attributing characteristics of the (*Lablab purpureus* L.) dolichos bean. Altogether Forty-five genotypes of dolichos bean were taken in this investigation with four checks *viz.*, Swarna Uttakrisht, Swarna Rituvar, LC-1 and LC-2. A field trial was laid out in an augmented block design comprising of five blocks. Observations were recorded for sixteen important yield and yield attributing parameters. Analysis was carried out for all the traits which were directly or indirectly associated with the yield and yield contributing traits. The result obtained in the present investigation indicated with the characters *viz.*, number of primary branches per plant, days to 50% flowering, pod length, number of seeds per pod, ten green pod weight, number of pods per plant, green pod yield per plant, dry seed weight were yield attributing characters and may be beneficial for the further breeding programme. Maximum genetic variability in the form of GCV and PCV was observed for characters like 10 pod weight, number of pods per plant, yield per plant, yield per hectare and number of flowers per cluster. Among the various characters studied, high heritability coupled with high genetic advance over mean was noticed for number of inflorescences per plant, number of primary branches, leaf area, days to 50 % flowering, days to first flowering, pod weight and dry seed weight. The number of pods per plant had a significantly significant negative correlation with yield per plant. Additionally, it was shown that the dry seed weight and yield per plant had a highly significant positive correlation.

***Key words*:** Correlation, path analysis, Dolichos bean, *Lablab purpureus*

Introduction

Dolichos bean (*Lablab purpureus* L.) is an annual herbaceous leguminous crop with a diploid chromosome number of 2n=2x=22, 24, belongs to the Leguminosae family. It is a predominantly self-pollinated crop with some extent of cross pollination and the potential to be herbaceous perennial in upright, bushy, or climbing race types grown throughout the country. It is known by several names, including Sem, Australian pea, Egyptian Kidney bean, Bataw, Field bean, Hyacinth bean, Country bean, Indian bean, Egyptian bean, Wal, Avare and Avarai. Dolichos bean is primarily grown for green pods and rich in protein (3.8 %) on green pod basis. The crop's foliage yields hay, silage, and green manures, and the dried seeds are also utilized in a variety of vegetable dishes. (Bose *et al.*, 1993). It is photo-sensitive and both short day and long day types are available (Anonymous, 1961), but many photo-insensitive genotypes are also available. It is mainly grown for its tender pods which are cooked and consumed as vegetable.

The immature green pods of dolichos bean is a good source of protein, minerals and vitamins (Basu *et al.*,

Table 1: Estimation of range, grand mean, (PCV %), (GCV %) and (ECV %) coefficient of variation, heritability in broad sense (h^2 %), genetic advance in per cent of mean (GA %) for various parameters in Dolichos bean genotypes.

Character	Range		Grand Mean (X)	PCV (%)	GCV (%)	ECV (%)	HBS	GA	GAPM
	Highest	Lowest							
Plant Height (cm) at 30DAS	66.65	34.56	46.61	15.33	8.93	12.46	33.95	5.006	10.74
Number ofprimary branches	19.87	10.63	13.32	12.995	4.39	12.23	11.43	0.408	3.064
Leaf Area (cm^2)	219.7	101.63	13.85	14.229	12.57	6.65	78.152	31.78	22.941
Vine length (cm) at last harvest	290.47	128.01	182.63	15.84	7.81	13.77	24.328	14.50	7.95
Days to first flowering	120.5	80	94.82	11.395	9.98	5.5	76.703	17.098	18.031
Days to 50% flowering	129.4	80.4	108.33	9.216	7.86	4.80	72.819	14.999	13.845
Number of flowers per cluster	15.8	5.6	10.77	26.441	23.62	11.87	79.841	4.691	43.552
No. of inflorescences per plant	115.5	29.6	46.06	16.636	14.90	21.88	0.825	14.43	31.335
Days to 1st picking	128.6	88.5	105.89	10.143	7.69	20.67	0.574	14.48	13.683
Pod Length (cm)	13.8	4.2	10.67	17.306	13.45	10.89	60.39	2.301	21.561
Pod Width(cm)	3.07	1.15	2.31	15.408	10.98	10.81	50.79	0.37	16.145
10 pod weight(g)	186.6	42.4	117.16	32.491	31.73	6.98	95.37	74.90	63.93
No. of pods per plant	225.2	87.8	136.82	29.332	29.30	1.34	99.79	82.61	60.385
Yield per plant(g)	2507.9	736.89	1511.34	27	25.63	8.48	90.13	758.77	50.205
Yield per ha(q)	165.52	45.4	99.75	27	25.63	8.48	90.13	50.07	50.205
No. of seeds/pod	6.9	3.2	5.058	14.975	8.29	12.46	30.69	0.48	9.484

HBS: Heritability broad sense (h^2%)**; GAPM:** Genetic advance in percent of mean (GA 5%); **GA:** Genetic advance

1999). Based on historical evidence, India is considered as origin and primary centre of diversity for dolichos bean. It has good potential in nutrition and livelihood for sustainable vegetable production. Its green pods contain 6.7 g carbohydrates, 3.8 g protein, 210 mg calcium, 1.7 mg iron, 312 IU vitamin A and 0.1 mg thiamine (Gopalan *et al.*, 2004). The leaves of dolichos bean are used for hay making, silage preparation and often used as green manure (Bose *et al.*, 1993). Its seeds contain water soluble polysaccharides comprised of rhamnose, xylose, arabinose, galactose, glucose, uronic acid, unidentified sugars proteins (Basu *et al.*, 2002). This crop has anti-diabetic property and can be used as natural cure for bladder burns and cardiac problems. Dolichos bean is used as an important source of therapeutic agent in the modern as well as traditional system of medicine among all legumes (Morris, 2009). Dolichos bean can be used as multipurpose crop since it is used for forage, soil improvement, soil protection and weed control (Shivashankar and Kulkarni, 1989; Maass, 2006). It is used as important source of dietary fibres and proteins especially in the southern part of India (Murphy, 1998). It is a drought tolerant crop grown in dry lands with limited rainfall. When sown in July or August, the crop prefers a comparatively chilly season. It starts fruiting in winter and continues in determinately in spring (Savitha, 2008). The crop's low yield, extended lifespan, photosensitivity, and erratic growth habit have kept it underutilized despite its numerous positive qualities. Due to its photosensitive nature, erratic flowering pattern, growth habit, consumer preferences based on pod size, shape, color, and aroma, and mostly low productivity, dolichos beans have been controlled. (Mishra *et al.*, 2019).

In order to comprehend the origin and diversity of a crop, research has traditionally concentrated on morphological variation; nevertheless, in the last 20 years, studies of molecular markers have taken over because, unlike morphology, they are not influenced by the environment and are typically highly variable (Rai *et al.*, 2011; Tertivanidis *et al.*, 2008). In addition, polygenes are responsible for the main plant characters and are highly influenced by the environment. Hence, the improvement of breeding approaches depends on the magnitude, nature and interrelationship of genotypic and non-genotypic variation. This creates a prerequisite to partition the total variability into heritable and non-heritable components. In a breeding programme, heritability and genetic advance for different traits were estimated which help the breeder to apply suitable breeding methodology. Heritability together with genetic advance as per cent of mean is relatively useful in predicting the accurate value of gene action responsible for effective selection. The variability found for various traits is compared with the help of genotypic co-efficient of variation (GCV) and phenotypic co- efficient of variation (PCV). Enhancing the yield is a major thrust area in crop improvement.

Material and Methods

The present investigation was carried out during *kharif* 2021-22 at Vegetable Research Farm of

Table 2: Phenotypic correlation of different parameters of Dolichos Bean

	PB	VL	LA	DFF1	DFF2	NFC	NIP	DFP	PL	PW	10PW	NPP	NSP	DSW	YPP	YPH
PH	-0.09	0	-0.3	-0.03*	-0.08	0.06	0.07	-0.2	0.09	0.22	-0.02*	-0.08	0.23	-0.43	-0.09	-0.09
PB		0.38	0.24	0.17	0.13	0.03*	0.17	0.32	-0.21	-0.09	-0.46	0.24	-0.03*	0.1	-0.35	-0.35
VL			-0.05	0.27	0.14	-0.07	0.12	0.29	-0.01**	-0.09	-0.09	0	-0.01**	0.12	-0.12	-0.12
LA				-0.02*	0.26	-0.29	-0.14	0.22	-0.1	-0.2	-0.04*	0	-0.2	0.12	-0.09	-0.09
DFF1					0.78	0.15	-0.23	0.64	-0.03*	-0.16	-0.27	-0.05*	0.02*	0	-0.35	-0.35
DFF2						0.03*	-0.35	0.68	0.11	-0.16	-0.2	-0.05*	-0.04*	-0.01*	-0.28	-0.28
NFC							0	-0.11	0.08	-0.03*	0.04	-0.01*	0.12	-0.16	0.08	0.08
NIP								-0.24	-0.22	-0.09	-0.32	0.26	0.04*	0.08	-0.16	-0.16
DFP									-0.13	-0.08	-0.39	0.21	-0.24	0.1	-0.33	-0.33
PL										0.18	0.54	-0.44	0.54	-0.15	0.44	0.44
PW											0.18	-0.25	0.03*	-0.18	0	0
10PW												-0.6	0.29	-0.01**	0.75	0.75
NPP													-0.37	0.02*	-0.01*	-0.01*
NSP														-0.14	0.2	0.2
DSW															0.02*	0.02*
YPP																1

*** & **=Significant at 0.05 and 0.01 respectively**

(PH- Plant height (cm) at 30 DAS, **PB-** Number of primary branches, **VL-** Vine length (cm) at last harvest, **VA-**Vine area (cm^2), **DFF1-** Days to first flowering, **DFF2-** Days to 50% flowering, **NFC-** Number of flowers per cluster (inflorescence), **NIP-** Number of inflorescence per plant, **DFP-** Days to first picking, **PL-** Pod length, **PW-** Pod width (mm), **10PW-** 10 Pod weight (g), **NPP-** Number of pods per plant, **NSP-** Number of seeds per pod, **DSW-** Dry seed weight (g), **YPP-** Yield per plant (kg), **YPH-** Yield per ha (q)

Department of Horticulture, Birsa Agricultural University, Kanke, Ranchi, Jharkhand to estimate genetic diversity in Dolichos bean. The experiment material comprised of 45 genotypes including four check entries *viz.*, Swarna Uttakrisht (C-1), Swarna Rituvar (C-2), LC-1 (C-3) and LC-2(C-4) in an augmented block design using five blocks. Altogether total number of entries were 49 including checks. Number of plots per block was thirteen. Row length was five meter and number of entries per row was one. The quantity of plants in each row was 10. The seeds were sown at a spacing of 300 cm x 50 cm during first fortnight of July 2021. The optimal plant stand was maintained by allowing the recommended agronomic practices and plant protection measures were applied. The observations were recorded on five randomly selected competitive plants from genotype for the traits *viz.*, Plant height (PH), Number of primary branches per plant (NBP), Leaf Area, Vine length (cm) at last harvest, Days to first flowering (DFF1), Days to 50 % flowering (DFF2), Number of flowers per cluster, Number of inflorescences per cluster (NFC), Days to 1st picking (DFP), Pod Length (PL), Pod Width, 10 pod weight, No. of pods per plant, Yield per plant, Yield per ha, No. of seeds/pod and Dry seed weight(g/100seeds). averaged data were subjected to statistically analyse for the analysis of variance as per the method suggested by Panse and Sukhatme (1995). The genotypic and phenotypic correlation coefficients were calculated from the genotypic and phenotypic variances as described by Burton (1952). The estimates of direct and indirect effect were calculated by the path coefficient analysis as suggested by Dewey and Lu (1959).

Results and Discussion

The genetic material exhibited a substantial amount of genetic variability, as evidenced by the significant differences between the genotypes for all the observed characters in the analysis of variance. Genetic variability is a basic need for breeders to improve the crops by adopting suitable selection criteria based on the type of variability existing in the genotypes. The genotypes in the present study exhibited considerable amount of variability for the 17 characters studied. The wide range of variation indicates the scope for selection of suitable basic material in breeding programme for further improvement. The range in the mean value reflects the extent of phenotypic variability present in the material. High GCV and PCV where observed for number of pods per plant, yield per plant, number of primary branches, yield per hectare, 10 pod weight. Minimal values of PCV and GCV were observed for plant height, number of flowers per cluster, number of pods per cluster, number of seeds per pod, pod length and days to 50 per cent flowering and low GCV and PCV were observed for plant height, number of flowers per clusters, number of pods per cluster, number of seed, pod length and days to 50 per cent flowering. Results in accordance with results of Kabir and Sen (1987), Nayar (1984), Das *et al.*,

Table 3: Direct and indirect effect of yield attributing character on yield per plant of 45 genotypes of Dolichos Bean.

	PH	PB	VL	LA	DFF1	DFF2	NFC	NIP	DFP	PL	PW	10PW	NPP	NSP	DSW
PH	**-0.024**	-0.002	0.000	0.008	-0.001	0.005	0.001	0.001	-0.003	0.014	-0.011	-0.022	-0.057	0.015	-0.015
PB	0.002	**0.024**	-0.015	-0.006	0.004	-0.008	0.001	0.002	0.005	-0.033	0.004	-0.500	0.170	-0.002	0.004
VL	0.000	0.009	**-0.040**	0.001	0.006	-0.009	-0.001	0.002	0.004	-0.002	0.004	-0.098	0.000	-0.001	0.004
LA	0.007	0.006	0.002	**-0.025**	0.000	-0.017	-0.005	-0.002	0.003	-0.016	0.010	-0.043	0.000	-0.013	0.004
DFF1	0.001	0.004	-0.011	0.001	**0.022**	-0.051	0.003	-0.003	0.009	-0.005	0.008	-0.293	-0.035	0.001	0.000
DFF2	0.002	0.003	-0.006	-0.007	0.017	**-0.065**	0.001	-0.005	0.010	0.017	0.008	-0.217	-0.035	-0.003	0.000
NFC	-0.001	0.001	0.003	0.007	0.003	-0.002	**0.018**	0.000	-0.002	0.013	0.001	0.043	-0.007	0.008	-0.006
NIP	-0.002	0.004	-0.005	0.004	-0.005	0.023	0.000	**0.014**	-0.003	-0.035	0.004	-0.348	0.184	0.003	0.003
DFP	0.005	0.008	-0.012	-0.006	0.014	-0.044	-0.002	-0.003	**0.014**	-0.021	0.004	-0.424	0.149	-0.016	0.004
PL	-0.002	-0.005	0.000	0.003	-0.001	-0.007	0.001	-0.003	-0.002	**0.158**	-0.009	0.587	-0.311	0.036	-0.005
PW	-0.005	-0.002	0.004	0.005	-0.004	0.010	-0.001	-0.001	-0.001	0.028	**-0.048**	0.196	-0.177	0.002	-0.006
10PW	0.000	-0.011	0.004	0.001	-0.006	0.013	0.001	-0.004	-0.006	0.085	-0.009	1.087	-0.424	0.019	0.000
NPP	0.002	0.006	0.000	0.000	-0.001	0.003	0.000	0.004	0.003	-0.070	0.012	-0.652	**0.707**	-0.024	0.001
NSP	-0.006	-0.001	0.000	0.005	0.000	0.003	0.002	0.001	-0.003	0.085	-0.001	0.315	-0.262	**0.066**	-0.005
DSW	0.010	0.002	-0.005	-0.003	0.000	0.001	-0.003	0.001	0.001	-0.024	0.009	-0.011	0.014	-0.009	**0.036**
Residual Value: 0.6702129															

(1987)) and Upadhyay *et al.*, (2010). The phenotypic co- efficient of variation was higher than the genotypic co-efficient of variation for all the characters indicating greater role played by environment in the manifestation of these characters. Moderate GCV indicating the heritable portion of the total variance existed in the population.

High heritability coupled with high genetic advance over the mean was recorded for number of pods per plant, yield per plant, yield per hectare and 10 pod weight. High heritability coupled with high genetic advance over mean for the above traits indicates the predominance of an additive gene effects and these provides ample scope for further improvement of these characters through selection. These findings are concern with those of Dhaliwal *et al.*, (2004), Basavarajappa and Gowda (2004) in dolichos bean, Raffi *et al.*, (2004) in french bean, Ali *et al.*, (2005), Aghora (2006) for pod length, pod width Rai *et al.*, (2008) number of pods per plant Upadhyay *et al.*, (2010) in dolichos bean for days to 50 per cent flowering, plant height, number of flowers per cluster, number of seeds per pod. Moderate heritability and

Genetic advance percentage of mean for number of branches per plant, number of pods per plant, yield per plant, yield per hectare and 10 pod weight. Moderate heritability value coupled with moderate genetic advance suggests the role of both additive and non-additive gene action in the experimental traits. Correlation studies indicate the degree of inter- relationship of plant characters for improvement of yield as well as important quality parameters in any breeding programme. Hence understanding of the inter-relationship between pod yield and yield influencing characters is vital importance because this would facilitate effective selection for simultaneous improvement in one or more yield characters. The intense and direction of association among the characters was measured by simple correlation. In the present investigation phenotypic correlations worked out for pod yield and its contributing character. In general, genotypic correlation was higher than phenotypic correlations for most of the characters studied. This suggests that the influence of the environment reduces the phenotypic expression of correlation.

Conclusion

The result obtained in the present investigation indicated with the characters *viz*., number of primary branches per plant, days to 50% flowering, pod length, number of seeds per pod, ten green pod weight, number of pods per plant, green pod yield per plant, dry seed weight were yield attributing characters and may be beneficial for the further breeding programme. Maximum genetic variability in the form of GCV and PCV for characters like 10 pod weight, number of pods per plant, yield per plant, yield per hectare and number of flowers per cluster. Among the various characters studied, high heritability coupled with high genetic advance over mean was noticed for number of inflorescences per plant, number of primary branches, leaf area, days to 50% flowering, days to first flowering, pod weight and dry seed weight. Yield per plant showed was negatively correlated and highly significant with number of pods per plant. Additionally, it was shown that the dry seed weight and yield per plant had a highly significant positive correlation. Among the different genotypes AMAD-16, AMAD- 17, AMAD-21, AMAD-23 and AMAD-24 has

recorded superior yield per plant and per hectare.

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