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Evaluation of Indian bean (*Dolichos lablab* L.) genotypes for growth and yield performance under east and south eastern coastal plain zones of Odisha

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Abstract
Evaluation of Twelve genotypes of Dolichos bean (Dolichos lablab L.) were done for growth and yield parameters under south eastern coastal zones of Odisha. The results revealed that there was considerable variability existing among the genotypes of Indian bean. Significant differences were also found among the genotypes analyzed for fourteen quantitative characters as well as in seven qualitative characters. The results of the experiment showed that the mean performance of growth parameters at last harvest like plant height, number of compound leaves, number of primary branches per plant, average leaf area, Days to first flowering, Days to 50% flowering were 60.21 to 73.15 cm, 16.20 to 20.07, 3.80 to 7.93, 102.81 to 267.90 cm^2, 37.20 days to 44.27 days, 42.47 to 48.93 days respectively. The yield parameters viz., Inflorescence length, Number of flowering nodes per inflorescence, Number of pods per inflorescence, Number of pods per plant, Pod length, Pod width, Pod yield per plant, Pod yield in tons per hectare were ranged from, 19.24 to 26.90 cm, 6.13 to 9.53, 5.20 to 9.60, 22.33 to 67.00, 4.20 cm to 13.00 cm, 1.30 cm to 3.10 cm, 0.04 to 0.48 kg and 5.50 t/ha to 13.00 t/ha, respectively. The genotypes 2017/DBB VAR-5 (0.48 kg), 2018/DOL B VAR-2 (0.46 kg) and 2017/DBB VAR-6 (0.43 kg) were found promising for pod yield per plant than other genotypes. These three varieties also showed better growth and yield attributing characters in comparison to other varieties. The genotype 2017/DBB VAR-5 showed variably purple color pods in contrast to rest of the genotypes and can be used in crop improvement programme for developing anthocyanin rich Dolichos bean pods. There is a need to evaluate these high yielding genotypes in larger plots and over multi locations in Odisha for their commercial utilization.

Keywords: Indian bean, growth, yield, genotypes

Introduction
Indian bean (*Dolichos lablab* L.) belongs to the family Fabaceae and it is an important leguminous vegetable crop grown throughout India. It is commonly called as Sem, Hyacinth bean, Bonavist bean, Dolichos bean, Field bean, Egyptian bean and Australian pea. In India, two botanical varieties are recognized and are sometimes considered as distinct species. They are *Dolichos lablab* var. typicus (Prain), is a twining herb treated as an annual and *Dolichos lablab* var. lignosus (L) Prain, a bushy perennial (Minde *et al.*, 2021) [14]. There are two distinct groups based on growth habit, one is pole type and the other is bush type. The vegetable crop is being grown throughout the country especially in Madhya Pradesh, Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka and North Eastern states (Verma *et al.*, 2015) [26]. It is one of the most ancient crop among the cultivated plants grown as either pure or mixed with other crops, such as finger millet, groundnut, castor, corn or sorghum (Kumar *et al.*, 2021) [11]. It is also grown in homestead. It is a multipurpose crop grown as a pulse, for green pods and tender leaves. Dolichos beans constitute an important source of nutritional (minerals and vitamins) and economic importance (Basu *et al.*, 2002; Singh and Abhilash, 2019) [4, 25]. The dried seeds contain appreciable amount of protein (21.5%) in diets cooked in different kind of forms as green pods, dry seeds and leaves as green vegetables (Miah *et al.*, 2017; Sarma *et al.*, 2010) [13, 22]. Dolichos bean is a drought tolerant crop grown in dry lands with limited rainfall, but can be grown in any kinds of soil. The crop prefers relatively cool season and sowing is done in July-August. It starts fruiting in winter and continues indeterminately in spring (Savitha, 2008) [23]. There are many local types particularly in Eastern and Southern India. Despite having many horticultural and nutritional importance, the crop has remained unexploited owing to low productivity, long duration, photosensitivity and indeterminate growth habit.

The efforts of improving the crop by utilizing indigenous and exotic germplasm have been useful in breaking the yield barriers (Shivashankar and Kulkarni, 1989) [24] resulting in compact plant type, reduced duration and photo-insensitive types. The evaluation of the existing varieties for the breeding value is very essential to use them as parents in future crop improvement programs. The observed variability is a combined measure of genetic and environmental causes. A successful breeding programmer is associated with genetic diversity of parents used in hybridization. More the diversity of parents, better the chances of improving the economic characters. Hence, this attempt has been made to know the extent of genetic parameters for yield attributing traits as well as to measure the genetic diversity among available Dolichos bean genotypes.

Materials and Methods

The experiment was carried out at one of the Research plot of AICRP on vegetable crops under Odisha University of Agriculture and Technology, Bhubaneswar. The location of the farm is situated about 5 km away from the University campus of Bhubaneswar. Located at latitude of 20º 15' N and longitude of 85º 52' E with an altitude of 25.5 m above mean sea level (MSL). The experimental material consisted of 12 genotypes of crop which were collected from different regions of India (Table 1). The soil of the experimental plot was loamy sand with a pH of 6.5-8.0. The selected experimental site comes under the fourth agro-climatic zone of Odisha (East and South Eastern Coastal Plain) having hot and humid climate with mild winter. The average temperature varied from 15 ºC in winter, 40 ºC in summer and 30 ºC in rainy season and R. H. varied from 60% - 80% during December and January. The selected genotypes were sown in a randomized block design (RBD) with three replications during Rabi seasons. Each genotype was sown with inter row spacing of 60 cm and inter plant spacing of 45 cm. Five plants were selected from each genotype and from each replication to record the observation and biometrical traits and quality traits. Normal agronomic practice and recommended plant protection measures were followed throughout the crop period. The observations were made five plants were randomly selected from the net area of each plot, tagged and the following parameters on growth, yield and quality were recorded at different stages. The growth and flowering characters such as plant height (cm), number of compound leaves, number of primary branches per plant, average leaf area (cm^2), Days to first flowering, Days to 50% flowering were measured. The yield attributing characters like Inflorescence length, Number of flowering nodes per inflorescence, Number of pods per inflorescence, Number of pods per plant, Pod length (cm), Pod width (cm), Pod yield per plant (kg), Pod yield in tons per hectare were also recorded. The data were analysed using ANOVA for all the characters by making use of means of replication, as suggested by (Panse and Sukhatme, 1967) [7].

Results and Discussion

Growth parameters

Germplasm evaluation is a necessary and preliminary step for genetic improvement of any crop. The effectiveness of selection as well as hybridization programmer depends on the amount of variation present in the material and the extent to which it is heritable. Variability refers to the presence of differences among the individuals of plant population. Variability results due to differences either in the genetic constitution of the individual of a population or in the environment in which they are grown. Hence the presence of genetic variability in the available germplasm of a crop is of immense value to design a selection procedure and to identify the superior genotypes. An assessment of the nature and extent of variability is, therefore, one of the basic approached towards successful breeding assignment.

Analysis of variance (ANOVA) showed that genotypes (treatments) were significantly different for most of the characters which indicated that genetic variability was present among the genotypes.

Plant height

The data showed significant variation among the dwarf lablab genotypes under study (Table 2). Wide variation was observed for plant height. It is seen that plant height varied from 60.21 to 73.15 cm, with an average plant height of 67.51 cm. Among the twelve genotypes, 07 genotypes exceeded the general mean of 67.51 cm. 2017/DBB VAR-1 (73.15 cm) recorded the highest plant height followed by ESWARA (71.96 cm) and 2018/DOL B VAR-6 (70.68 cm). The lowest plant height was observed in 2017/DBB VAR-4 (60.21 cm) followed by 2017/DBB VAR-7 (63.07 cm) and 2017/DBB VAR-2 (63.87 cm). Plant height showed higher portion of genotypic variance among the selected genotypes since they were cultivated under same environment conditions (Whankate *et al.*, 2021) [27]. The results of present findings are in agreement with the results reported by Whankate *et al.* (2021) [27].

Number of compound leaves

2017/DBB VAR-8 recorded maximum number of compound leaves (20.07) followed by Arka Amogh (19.60), 2017/DBB VAR-2 (19.07), 2018/DOL B VAR-2 (18.60). The lowest number of compound leaves were observed in 2017/DBB VAR-6 (16.20) followed by 2017/DBB VAR-7 and 2018/DOL B VAR-4 (17.67). The average mean value of the character was 18.26 which ranged from 16.20 to 20.07. These finding were reported by Rathi and Dhaka (2007) [20] in pea, Idahosa *et al.* (2010) [8] in cowpea, Archana and Gadewar (2013) [3] in cowpea and Nwofia *et al.* (2013) [16] in vegetable cowpea.

Number of primary branches per plant

2017/DBB VAR-8 recorded maximum number of Primary branches per plant (7.93) followed by 2018/DOL B VAR-6 (7.40), 2018/DOL B VAR-2 (7.07), 2017/DBB VAR-1 and 2017/DBB VAR-4 (6.93). The lowest number of Primary branches was observed in 2017/DBB VAR-6 (3.80) followed by 2017/DBB VAR-5 and 2017/DBB VAR-7 (5.27). The average mean value of the character was 6.24 which ranges from 3.80 to 7.93. Genotypic variance was moderate for number of primary branches per plant indicating meager influence of the environment. The results of the present findings are in close conformity with findings reported by Pandey *et al.* (2011) [17] and Whankate *et al.* (2021) [27].

Average leaf area

Significant differences for this trait were observed among the genotypes in the Rabi season crop of Indian bean. 2017/DBB VAR-2 recorded significantly maximum average leaf area (267.90 cm^2) followed by 2018/DOL B VAR-4 (210.69 cm^2) and ESWARA (200.31 cm^2) whereas, the lowest average leaf

area was observed in 2017/DBB VAR-4 (102.81 cm^2) followed by 2017/DBB VAR-8 (107.93 cm^2) and 2017/DBB VAR-6 (111.05 cm^2). Leaf area varied from 102.81 to 267.90 cm^2 with a mean value of 152.94 cm^2. These finding were reported by Rathi and Dhaka (2007) [20] in pea, Nwofia *et al.* (2013) [16] in vegetable cowpea, Archana and Gadewar (2013) [3] in cowpea and Idahosa *et al.* (2010) [8] in cowpea.

Days to first flowering

Variation was observed among the genotypes for this trait (Table 2). The days to first flowering ranged from 37.20 days to 44.27 days with a mean value of 40.95. 2017/DBB VAR-2 (37.20) followed by 2018/DOL B VAR-2 (38.80), ESWARA (39.40), 2017/DBB VAR-5 and 2018/DOL B VAR-4 (39.93) were earlier in flowering than the rest of the genotypes. The genotype Arka Amogh (44.27) was found to be late in flowering followed by 2017/DBB VAR-7 (43.83) and 2017/DBB VAR-8 (42.13).Similar result was reported by Nath *et al.* (2019) [15] and Ravinaik *et al.* (2015) [21] was reported in Dolichos bean.

Days to 50% flowering

Significant differences were recorded (Table 2) among the genotypes for this trait. The results on days to 50% flowering revealed significant variation existing among the genotypes. Days to flowering varied from 42.47 to 48.93 days with an average of 45.68. The genotype 2017/DBB VAR-2 (42.47) is found to be earliest in days to 50% flowering followed by 2018/DOL B VAR-4 (43.00) and 2017/DBB VAR-1 (43.93). The genotype Arka Amogh (48.93) was found to be late in having 50% flowering followed by 2017/DBB VAR-7 (48.53), 2017/DBB VAR-8 (47.87), 2017/DBB VAR-4 (46.80) and 2018/DOL B VAR-6 (46.67). The results of present findings are in close conformity with the results reported by Pandey *et al.* (2011) [17] who also reported the variation in 50% flowering from 37 days (Makwapur) to 47 days (Mandir) and Whankate *et al.* (2021) [27] reported that similar results in French bean.

Inflorescence length

The data showed statistically significant differences for this trait (Table 2). 2017/DBB VAR-1 showed maximum inflorescence length of 26.90 cm among all the other genotypes followed by 2017/DBB VAR-2 (25.59 cm) and 2017/DBB VAR-5 (25.56 cm). The genotype 2017/DBB VAR-7 recorded lowest inflorescence length of 19.24 cm followed by 2017/DBB VAR-8 (19.83 cm) and 2018/DOL B VAR-4 (20.75 cm). A range of 19.24 to 26.90 cm was observed among the genotypes with an average of 22.91 cm. This observation is in accordance with the findings of Ali *et al.* (2005) [1].

Number of flowering nodes per inflorescence

The Number of flowering nodes per inflorescence showed statistically significant differences (Table 2) and it ranged from 6.13 to 9.53. 2018/DOL B VAR-2 (9.53) recorded maximum number of flowering nodes per inflorescence followed by 2017/DBB VAR-2, 2017/DBB VAR-4 and ESWARA (8.67). The lowest number of flowering nodes per inflorescence was observed in 2017/DBB VAR-6 (6.13) followed by Arka Amogh (7.20), 2017/DBB VAR-7 (7.47) and 2017/DBB VAR-5 (7.73). The average mean value of the character was 8.09. Similar findings were reported by Karnwal and Singh (2009) [10] in soya bean.

Yield attributing parameters

Number of pods per inflorescence

The number of pods per inflorescence directly influences the yield of green pods (Table 2). Pods per inflorescence ranged from 5.20 to 9.60 with an average of 6.71. Highest number of pods per inflorescence was recorded in 2017/DBB VAR-2 (9.60) followed by 2018/DOL B VAR-2 (7.93) and 2018/DOL B VAR-4 (7.67). The lowest number of pods per inflorescence were recorded in 2017/DBB VAR-7 (5.20) genotype followed by 2017/DBB VAR-8 (5.33). Difference in growth characters might be due to genetic variability within genotype itself or due to the environmental effects. The significant differences among the genotypes with respect to number of pods per inflorescence were also reported by Whankate *et al.* (2021) [27] in genotypes of French bean.

Number of pods per plant

Results on number of pods per plant recorded significant variation among the genotypes which range from 22.33 to 67.00, with a mean value of 42.84. Highest number of pods per plant was observed in 2017/DBB VAR-6 (67.00) followed by 2017/DBB VAR-5 (59.60) and 2017/DBB VAR-7 (55.00). The lowest number of pods per plant was observed in 2017/DBB VAR-8 (22.33) followed by the genotype 2018/DOL B VAR-6 (22.67). The significant differences among the genotypes with respect to number of pods per plant were also reported by Whankate *et al.* (2021) [27] in genotypes of French bean.

Pod length

Pod length showed significant variations among the genotypes (Table 2). Pod length varied from 4.20 cm to 13.00 cm with an average value of 9.06. The highest pod length was recorded in 2017/DBB VAR-6 (13.00 cm) followed by 2018/DOL B VAR-4 (11.47 cm) and ESWARA (10.27 cm). The lowest pod length was observed in 2017/DBB VAR-8 (4.20 cm) followed by 2017/DBB VAR-4 (4.80 cm). Such observations were also noted by earlier workers and they reported that the significantly higher length (7.15-15.05 cm) of green pod in Dolichos bean (Chattopadhyay and Dutta, 2010) [5], 5.18-10.48 cm in Dolichos bean (Parmar *et al.*, 2013) [18] and 9.21-14.29 cm in French bean (Whankate *et al.*, 2021) [27].

Pod width

The data on pod width of bean was presented in Table 2 and it showed significant difference among the genotypes for this character under study. Pod width ranged from 1.30 cm to 3.10 cm. The highest pod width was observed in genotype 2018/DOL B VAR-4 (3.10 cm) followed by 2017/DBB VAR-7 (2.13 cm). The lowest pod width was recorded in 2017/DBB VAR-8 (1.30 cm). The average pod width was 1.93 cm. This above finding was supported by Chattopadhyay and Dutta (2010) [5] who reported the breadth of pod of 1.44-3.11 cm in Dolichos bean and 0.90 -1.51cm in French bean (Whankate *et al.*, 2021) [27].

Pod yield per plant

The mean performance of the genotype for pod yield per plant is furnished in Table 2. The results revealed that significant difference was found in between the genotypes for pod yield per plant which varied from 0.04 to 0.48 kg with mean value of 0.25 kg. Five number of genotypes recorded more than the average value of 0.25 kg. Among the genotypes, 2017/DBB

VAR-5 (0.48 kg) produced maximum pod yield per plant followed by 2018/DOL B VAR-2 (0.46 kg) and 2017/DBB VAR-6 (0.43 kg). The lowest pod yield per plant was observed in genotype 2017/DBB VAR-8 (0.04 kg) followed by 2017/DBB VAR-4 (0.06 kg). It is evident in the present study which agreed with observations of Whankate *et al.* (2021) [27] in French bean (7.60), 4.14- 4.25 in Dolichos bean (Pramoda *et al.*, 2020) [19], 3.00 -5.00 in Dolichos bean (Ravinaik *et al.*, 2015) [21]. 4.00-6.00 in Dolichos bean (Das *et al.*, 2015) and 3.93-4.67 in lablab bean (Nath *et al.*, 2019) [15].

Pod yield in tons per hectare

The genotypes showed significant differences for this trait (Table 2). The Pod yield per hectare ranged from 5.50 t/ha to 13.00 t/ha with an average of 10.00 t/ha. Among the genotypes, 2017/DBB VAR-2 (13.00 t/ha) produced maximum Pod yield per hectare followed by 2018/DOL B VAR-2 (12.98 t/ha) and 2018/DOL B VAR-4 (12.80 t/ha). The lowest pod yield per hectare was observed in genotype 2018/DOL B VAR-4 (5.50 t/ha) followed by 2017/DBB VAR-8 (7.00 t/ha).Similar results were also reported by Zeliang *et al.* (2018) [28] in French bean genotypes at different locations. Nath *et al.* (2019) [15] reported that the pod yield of lablab bean was in the range of 2.87 to 7.73 t/ha. Ananth and Kumar (2018) [2] reported that the yield of Dolichos bean was 11.71 t/ha.

Leaf characteristics

The genotypes showed observable variation in leaf colour and petiole colour but no difference in leaf shape (Table 3). The leaf shape was ovate in all the genotypes. The leaf colour varied from light green to deep green. 84% of the genotypes had green colour leaf and rest 16% genotypes showed light green leaf colour. Variation was observed with respect to petiole colors. Green colour petiole (67%), Purple colour petiole (8%) and Light green colour petiole (25%). It is evident in the present study which agreed with observations of Jan *et al.* (2021) [9], Loko *et al.* (2018) [12] in common bean.

Pod characteristics

The genotypes showed observable difference in Pod shape and size, pod colour and pod cross-section (Table 3). Pod characteristics are the main deciding factor with respect to consumer preference and thereby market demand. Pod shape in relation to suture was found to be straight, curved and intermediate of both. Pods having straight shape in relation to suture were most common i.e., in 58.33% genotypes, pods with curved shape were found in 33.33 genotypes and 8.33% genotypes were intermediate in shape between curved and straight. The genotypes with small sized pods were common 33.33% while genotypes with long pod size were 50% and that of medium sized pod are 16.66%. 2017/DBB VAR-5 genotype had purple colour pods which is rich in anthocyanin and accounted for 8.33%. Similarly, 25% of the genotypes had creamish pod colour while 50% of genotypes had light green colour and rest 16.66% had green colour pods. The pod cross section of genotypes varied from round to flat in shape. The genotypes with round pod cross section are 66.66% and rest all had flat cross section. The findings are in conformity with the study of Loko *et al.* (2018) [12], Jan *et al.* (2021) [9] in common bean.

Table 1: Sources of Dolichos bean genotypes [*Lablab purpureus* (L.) sweet var. typicus]

Genotypes	Name	Sources
V1	2017/DBB VAR-1	AVT-2, AICRP on Vegetable crops, OUAT
V2	2017/DBB VAR-2	AVT-2, AICRP on Vegetable crops, OUAT
V3	2017/DBB VAR-4	AVT-2, AICRP on Vegetable crops, OUAT
V4	2017/DBB VAR-5	AVT-2, AICRP on Vegetable crops, OUAT
V5	2017/DBB VAR-6	AVT-2, AICRP on Vegetable crops, OUAT
V6	2017/DBB VAR-7	AVT-2, AICRP on Vegetable crops, OUAT
V7	2017/DBB VAR-8	AVT-2, AICRP on Vegetable crops, OUAT
V8	2018/DOLBVAR-2	AVT-1, AICRP on Vegetable crops, OUAT
V9	2018/DOLBVAR-4	AVT-1, AICRP on Vegetable crops, OUAT
V10	2018/DOLBVAR-6	AVT-1, AICRP on Vegetable crops, OUAT
V11	ARKA AMOGH	IIHR, Bangalore
V12	ESWARA	B Bio Seeds

Table 2: Mean Performance for 14 characters in 12 Dolichos bean genotypes

Genotypes	Plant height (cm)	Number of Compound Leaves	Number of Primary Branches	Average leaf area (cm^2)	Days to 1st flowering	Days to 50% flowering	Inflorescence length (cm)
2017/DBB VAR-1	73.15	18.07	6.93	154.07	40.67	43.93	26.90
2017/DBB VAR-2	63.87	19.07	6.47	267.90	37.20	42.47	25.59
2017/DBB VAR-4	60.21	17.80	6.93	102.81	41.93	46.80	22.37
2017/DBB VAR-5	70.24	17.87	5.27	112.05	39.93	44.47	25.56
2017/DBB VAR-6	68.14	16.20	3.80	111.05	41.73	45.00	20.99
2017/DBB VAR-7	63.07	17.67	5.27	166.55	43.83	48.53	19.24
2017/DBB VAR-8	64.45	20.07	7.93	107.93	42.13	47.87	19.83
2018/DOL B VAR-2	70.17	18.60	7.07	132.37	38.80	44.33	25.46
2018/DOL B VAR-4	68.13	17.67	6.20	210.69	39.93	43.00	20.75
2018/DOL B VAR-6	70.68	18.53	7.40	148.63	41.53	46.67	23.24
ARKA AMOGH	65.99	19.60	6.07	120.89	44.27	48.93	22.23
ESWARA	71.96	17.93	5.60	200.31	39.40	46.20	22.80
Total mean	67.51	18.26	6.24	152.94	40.95	45.68	22.91
SE(m)	1.14	0.51	0.40	12.18	1.02	1.17	0.76
CD (0.05)	3.35	1.50	1.16	35.71	2.99	3.44	2.23
CV (%)	2.93	4.85	10.99	13.79	4.31	4.45	5.76

Genotypes	Number of flowering nodes per inflorescence	Number of pods per inflorescence	Number of pods per plant	Pod Length (cm)	Pod Width (cm)	Pod Yield Per Plant (kg)	Yield in t/ha
2017/DBB VAR-1	8.00	6.13	42.67	9.87	1.53	0.27	9.50
2017/DBB VAR-2	8.67	9.60	41.80	9.46	2.00	0.39	13.00
2017/DBB VAR-4	8.67	6.00	34.00	4.80	1.42	0.06	7.60
2017/DBB VAR-5	7.73	6.87	59.60	9.76	1.93	0.48	12.06
2017/DBB VAR-6	6.13	6.00	67.00	13.00	1.90	0.43	7.50
2017/DBB VAR-7	7.47	5.20	55.00	7.30	2.13	0.22	5.50
2017/DBB VAR-8	8.33	5.33	22.33	4.20	1.30	0.04	7.00
2018/DOL B VAR-2	9.53	7.93	50.70	9.51	2.00	0.46	12.98
2018/DOL B VAR-4	8.33	7.67	41.67	11.47	3.10	0.21	12.80
2018/DOL B VAR-6	8.33	6.07	22.67	9.67	1.94	0.11	8.90
ARKA AMOGH	7.20	6.40	43.90	9.44	2.02	0.22	11.06
ESWARA	8.67	7.27	32.70	10.27	1.93	0.17	12.14
Total mean	8.09	6.71	42.84	9.06	1.93	0.25	10.00
SE(m)	0.50	0.31	1.58	0.65	0.17	0.01	0.77
CD (0.05)	1.46	0.90	4.63	1.91	0.51	0.03	2.25
CV (%)	10.67	7.90	6.38	12.47	15.63	7.85	13.31

Table 3: Leaf and pod characteristics

Genotypes	Leaf Characteristics			Pod Characteristics		
	Leaf shape	Leaf colour	Petiole colour	Pod shape and size	Pod colour	Pod cross-section
2017/DBB VAR-1	Ovate	Green	Green	Straight, Medium	Light Green	Round
2017/DBB VAR-2	Ovate	Green	Green	Straight, Short	Light Green	Flat
2017/DBB VAR-4	Ovate	Light green	Green	Curved, Short	Creamish	Flat
2017/DBB VAR-5	Ovate	Green	Purple	Intermediate, Long	Purple	Round
2017/DBB VAR-6	Ovate	Green	Green	Straight, Long	Light Green	Round
2017/DBB VAR-7	Ovate	Green	Green	Straight, Short	Light Green	Round
2017/DBB VAR-8	Ovate	Green	Light green	Curved, Short	Light Green	Flat
2018/DOL B VAR-2	Ovate	Green	Light green	Straight, Medium	Creamish	Flat
2018/DOL B VAR-4	Ovate	Green	Green	Straight, Long	Green	Round
2018/DOL B VAR-6	Ovate	Light green	Green	Straight, Long	Creamish	Round
ARKA AMOGH	Ovate	Green	Green	Curved, Long	Light Green	Round
ESWARA	Ovate	Green	Light green	Curved, Long	Green	Round

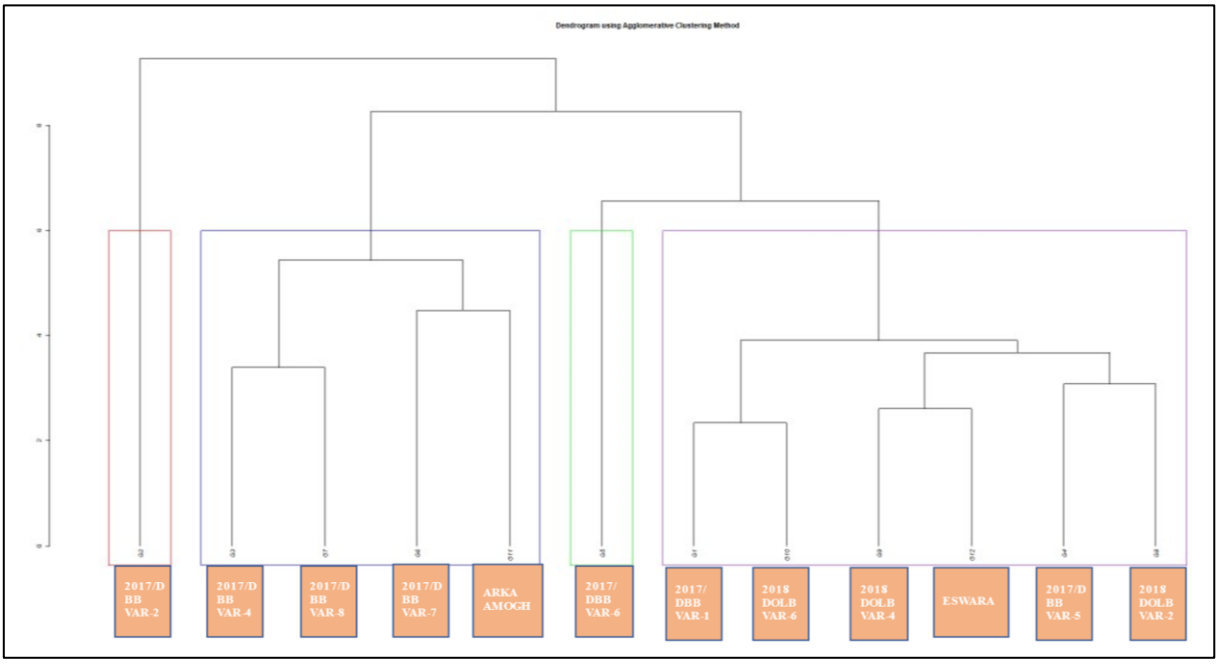

Fig 1: Dendrogram of 12 genotypes

The clustering depicts that among the genotypes taken in study have genetic variation in comparison to the check varieties. Total four clusters are formed in which, CLUSTER I contains ggenotypes 2017/DBB VAR-1, 2017/DBB VAR-5, 2018/DOL B VAR-2, 2018/DOL B VAR-4, 2018/DOL B VAR-6 and ESWARA sharing a single cluster, CLUSTER II including genotypes 2017/DBB VAR-4, 2017/DBB VAR-7, 2017/DBB VAR-8 and ARKA AMOGH (Fig 1). Variety 2017/DBB VAR-6 and 2017/DBB VAR-2 formed an individual clusters each.

Conclusion

Among the genotypes used in this study are of diverse nature and could be used for breeding programmer for the

development of new verities. The genotypes 2017/DBB VAR-5 (0.48 kg), 2018/DOL B VAR-2 (0.46 kg) and 2017/DBB VAR-6 (0.43 kg) were found promising for pod yield per plant than other genotypes. Therefore, these genotypes can be taken under consideration for commercial cultivation during rabbi seasons at east and south eastern coastal plain zones of Odisha. The performance of these genotypes can be studied during Kharif season also. The study also revealed that yield of Indian bean could be improved through direct selection for highest number of pods per inflorescence, highest number of pods per plant, maximum pod yield per plant and maximum pod yield per hectare.

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