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Morphological Variation and Yield Performance of Photo-insensitive Lablab bean [*Lablab purpureus* (L.) Sweet] Genotypes under Sylhet Region

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Authors' contributions

This work was carried out in collaboration between all authors. Authors TA and MSI designed the study and performed the statistical analysis. Authors DDN and JF wrote the protocol and first draft of the manuscript. Authors DDN and MR managed the literature searches and analyses of the study. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

An experiment was conducted during August 2013 to February 2014 at the experimental field of the Sylhet Agricultural University (SAU), Sylhet to study the morphological variability, yield and yield contributing characteristics among the five lablab bean genotypes viz., SB003, BP003, IPSA Sheem-2, SB008 and SB010. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The genotypes SB003, IPSA Sheem-2 and SB008 had reddish brown seed coat color while it was black in SB010 and reddish color in the genotype BP003. Among the genotypes 100 dry seed weight was ranged from 35.50 g (IPSA Sheem-2) to 41.30 g (SB003). Variation in yield and yield contributing characteristics were found among five lablab bean genotypes. The genotype SB010 produced the maximum number of pods plant^{-1} (562.3) followed by SB008 (381.3). A similar trend was also noticed in pod yield plant^{-1} among the genotypes. The highest pod yield was recorded in the genotype SB010 (20.46 ton ha^{-1}) while it was the lowest in IPSA Sheem-2 (6.26 ton ha^{-1}). For seed production potentiality, the genotype SB010

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produced the highest amount of seed plant^{-1} (451.67 g) since it produced the maximum number of dry pods plant^{-1} (228.67). Seed yield ha^{-1} varied from 1.0 ton to 3.0 tons. However, pod and seed yield ha^{-1} indicating bright scope to popularize lablab bean production in the Sylhet region.

Keywords: Lablab bean; genotypes; pod and seed yield.

1. INTRODUCTION

Lablab bean (*Lablab purpureus* L.) popularly known as 'Sheem', is an important winter vegetable in Bangladesh [1]. Its cultivation and use are so widespread that in the winter, it would be almost impossible to find a homestead in rural Bangladesh without a vine of country bean. It is believed to have originated in Indian Subcontinent [2,3] and then spread to the other parts of the world. There are about 50 species and several hundred varieties of Country bean distributed throughout the world [4]. In Bangladesh, it is commercially cultivated in Comilla, Noakhali, Sylhet, Dhaka, Kishoregonj, Tangail, Jessore, Pabna and Dinajpur [5].

It is the nutritious vegetable and its green pods provide good amount of protein in addition to vitamins and minerals. The dry seeds are also used for various vegetable preparations and foliage of the crop provides hay, silage and green manures [6]. Availability of lablab bean is restricted in winter months due to its photo-sensitive behavior. It is a short day plant and critical day length for those winter varieties is 12-13 hours. To mitigate this problem Horticulture Research Center (HRC) of BARI has developed some photo-insensitive line through genetic manipulation. But their morphological variations and yield performances are not properly assessed under Sylhet region. Islam et al. [7] found significant physico-morphological variations among different genotypes grown in Bangladesh. Yield and yield attributes are also different among the genotypes [8].

This variation is a useful material to plant breeder for crop improvement. Morphological characterization is the first step that should be done before more profound biochemical and molecular studies are carried out [9]. Most important advantages of using morphological features are that they are simple to identify and do not need specialized labor. The use of morphological features is a standard way of assessing genetic variation of researched crops. Although molecular characterization is increasingly being used, morphological characterization continues to be a useful component that enhances the power of molecular methods. Morphological characterization criteria are thus important and some main characteristics that can be used as references in Lablab bean breeding programs. Therefore, present experiment was undertaken to assess the morphological variability and yield performances among the collected genotypes.

2. MATERIALS AND METHODS

The experimental plot was located at the Horticulture research field of the Sylhet Agricultural University, Sylhet and the experimental period was August 2013 to February 2014. Five lablab bean genotypes were used in the experiment. The seeds of these genotypes were collected from the Department of Horticulture, Sylhet Agricultural University, Sylhet. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 1.5 m × 6.0 m accommodating single row per bed. Pits were spaced 1.0 m in a bed and 2.0 m between two adjacent beds. The experimental plots were prepared by digging pits about two weeks before sowing. Manures and fertilizers @10000-20-30-75 kg ha^{-1} of cow dung, N, P and K, respectively. N, P and K were applied in the form of urea Triple Super Phosphate (TSP) and Murate of Potash (MP), respectively. A full dose of cow dung, TSP and half of the MP were applied during pit preparation two weeks before transplanting. The remaining MP and urea were applied in three equal installments as top dressing at 15, 30 and 45 days after transplanting. Hence the land was acidic in nature, lime (Dolomite) was applied in the field @ 4 kg/decimal. The soil of the pits and basal dose of fertilizers mixed well and prepared in such a way that the pit tops remained at least 10 cm above the ground level to facilitate drainage. For planting two seeds of the five genotypes were sown in polybags containing well prepared soil mixture on 25 August 2013. Then10 days old seedlings were transplanted in the pit and out of two seedlings, one was thinned out two weeks after transplanting. The young growing plant was supported by a single bamboo stake in each pit. Weeding and irrigation were done whenever

necessary. The experiment was protected from herbivorous animals (e.g. cows, sheep, goats, etc.). Fencing was made around the experimental plots for the purpose. The pods were also protected from aphids, jute hairy caterpillar and pod borer attack by applying Maladan @ 2 ml L^{-1} of water. Data were recorded from all experimental plants on different morphological parameters, yield and yield attributes. Some of the parameters were analyzed using simple statistical measures while others were analyzed using MSTAT software for interpretation of results.

3. RESULTS AND DISCUSSION

3.1 Seed and Seedlings Characteristics

Seed and seedling characteristics of the lablab bean genotypes are presented in Table 1. Before sowing it was found that 100-seed weight was ranged from 35.50 g to 41.30 g. Out of five groups of seed shape only three were found in this experiment. These were oval in SB003 and SB008, round for BP003 and flat in SB010 and IPSA Sheem-2. Black, reddish and reddish brown seed color were recorded among the five genotypes which was also reported by different researchers [7]. Two types of color i.e. green and white was observed among the five genotypes by visual observation in case of cotyledon and hypocotyl color. Among the genotypes the tallest seedling (76.03 cm) at transplanting was recorded from the genotypes SB003 while it was the shortest in IPSA Sheem-2 (30.42 cm). Similar trend also recorded in primary leaf size. Almost all the genotypes had the similar number of leaves $seedling^{-1}$ ranged from 5.77 to 7.33. Islam (2008) also observed similar result for seed color, seed shape, number of leaves $seedlings^{-1}$ etc. studied with 44 genotypes [10]. These kind of variation regarding seed color, seed shape, number of leaves $seedlings^{-1}$ etc. are useful materials for plant breeders to study the inheritance of characteristics.

3.2 Vegetative, Inflorescence and Pod Characteristics

Vegetative growth, inflorescence and pod characteristics of lablab bean genotypes were presented in the Table 2. Terminal leaflet length and breadth was ranged from 9.63 to 13.10 cm and 9.10 to 13.44 cm, respectively while both were maximum in the genotype SB010. The highest petiole length was measured from SB010 (11.72 cm) while it was the lowest in SB003 (7.47 cm). Two types of flower color were observed among the genotypes where it was purple in SB010 and white in all other genotypes. Mean inflorescence length for the five genotypes were 41.08 cm while it was the maximum in SB008 (45.17 cm) and minimum in SB010 (36.33 cm). Gupta et al. [11] observed that, the inflorescence length was negatively correlated with green pod yield $plant^{-1}$ studied with 38 genotypes. In case of pod characteristics three types of pod color (light green, deep green and whitish green) were found among the genotypes and the pod curvature was recorded straight only for SB008 and slightly curved for others while the pod beak shape was thick for BP003 and SB003 and short for all other genotypes. This results about qualitative characteristics of the pod is the agreed with the findings of Islam et al. [12].

3.3 Pod Yield and Yield Attributes

Significant variations were observed on pod yield and yield attributes of five lablab bean genotypes are presented in Table 3. Days to first flowering among the different genotypes were varied from 47.33 (SB008) to 68.33 (IPSA Sheem-2). Purseglove [2] reported that some of the hyacinth bean varieties can produce flower at about 6 weeks after sowing. Sultana [13] also reported similar results. Similar trend also recorded for days to first harvest which was the minimum in SB003 and SB008 (78.33) and maximum in IPSA Sheem-2 (89.00). Moniruzzaman et al. [14] reported that time required for first harvesting ranged from 62-134 days after planting. The genotype SB003 produced the longest (12.83 cm) pod while it was the shortest in IPSA Sheem-2 (7.26 cm). Pod breadth of the genotypes ranged from 2.02 to 3.09 cm while it was the maximum for BP003 and minimum for IPSA Sheem-2. Pengelly and Maass (2001) reported pod length ranged from 2.5 to 14.0 cm and breadth 1.6 to 3.2 cm among 249 genotypes studied in Australia [15]. Similar variation in respect of pod length was also reported by Sultana [13]. The highest pod yield $plant^{-1}$ was recorded in the genotype SB010 (3.07 kg) since the number of pods $plant^{-1}$ (562.3) was almost double in compared to other genotypes. Pods $plant^{-1}$ ranged from 180-320 among nine country bean genotypes as recorded by Halim and Ahmed [16]. The pod yield was the lowest (0.94 kg $plant^{-1}$) for IPSA Sheem-2 due to lowest number of pods $plant^{-1}$ (208.0) and lowest individual pod weight (4.52 g). Similar pattern of variability in germplasm evaluation of

Table 1. Seed and seedling characteristics of lablab bean genotypes

Genotype	100 dry seed weight (g)	Shape	Seed color	Cotyledon color	Hypocotyl color	Seedling height (cm)	Primary leaf length (cm)	Primary leaf breadth (cm)	No of leaves seedling^{-1}
SB003	41.30	Oval	Reddish brown	Light green	Light green	76.03	7.40	7.93	6.67
BP003	36.50	Round	Reddish	Light green	Light green	47.87	5.18	6.05	6.67
IPSA Sheem-2	35.50	Flat	Reddish brown	Light green	Light green	30.42	3.19	4.14	6.00
SB008	38.67	Oval	Reddish brown	Creamy white	Creamy white	70.40	6.83	6.80	6.33
SB010	39.83	Round	Black	Light green	Creamy white	59.23	7.33	7.70	7.33
Mean	38.36	-	-	-	-	56.79	5.98	6.52	6.6
Range	35.50-41.30	-	-	-	-	30.42-76.03	3.19-7.40	4.14-7.93	6.00-7.33
St dev	2.37	-	-	-	-	18.27	1.80	1.52	0.49

Table 2. Vegetative, inflorescence and pod characteristics of lablab bean genotype

Genotype	Terminal leaflet length (cm)	Terminal leaflet breadth (cm)	Petiole length (cm)	Flower color	Inflorescence length (cm)	Pod color	Pod curvature	Pod beak shape
SB003	10.33	9.10	7.47	White	44.83	Deep green	Slightly curved	Short beak
BP003	9.63	9.50	7.87	White	41.50	Deep green	Slightly curved	Thick beak
IPSA Sheem-2	11.85	10.70	9.55	White	37.57	Whitish green	Slightly curved	Short beak
SB008	12.50	10.93	9.75	White	45.17	Light green	Straight	Short beak
SB010	13.10	13.44	11.72	Purple	36.33	Light green	Slightly curved	Thick beak
Mean	11.48	10.73	9.27	-	41.08	-	-	-
Range	9.63-13.10	9.10-13.44	7.47-11.72	-	37.57-44.83	-	-	-
St dev	1.46	1.69	1.69	-	4.06	-	-	-

Table 3. Pod yield and yield attributes of lablab bean genotypes

Genotype	Days to first flower	Days to first harvest	Pod length (cm)	Pod breadth (cm)	No. of seedspod^{-1}	No. of pods plant^{-1}	Individual pod weight (g)	Pod yield plant^{-1} (kg)	Pod yield (ton ha^{-1})
SB003	49.67bc	78.33c	12.83a	2.57b	4.67	333.0c	6.48a	2.16bc	14.4
BP003	54.33b	82.00b	9.89b	3.09a	4.53	216.3d	6.43a	1.39cd	9.26
IPSA Sheem-2	68.33a	89.00a	7.26c	2.02d	4.57	208.0d	4.52c	0.94d	6.26
SB008	47.33c	78.33c	10.95ab	2.33c	4.80	381.3b	6.33a	2.41ab	16.06
SB010	48.33c	80.00bc	8.43bc	2.67b	4.93	562.3a	5.47b	3.07a	20.46
F-test	**	**	**	**	NS	**	**	**	**
CV%	3.62	1.40	9.65	2.16	3.42	2.39	2.24	4.72	4.72

In a column same letter (s) do not differ significantly at P<0.05 by DMRT, ^{NS}-Not-significant, **- significant at 1% level of probability

Table 4. Seed yield and yield attributes of lablab bean genotypes

Genotype	No. of dry pod plant^{-1}	No. of seed pod^{-1}	No. of seed plant^{-1}	Dry seed yield (gm plant^{-1})	Seed yield (ton ha^{-1})	100 dry seed weight (gm)
SB003	133.87b	4.56ab	619.05b	256.98b	1.66b	41.50
BP003	102.33d	4.20b	418.40e	157.61e	1.00e	37.50
IPSA Sheem-2	105.67d	4.50b	476.67d	170.44d	1.06d	35.50
SB008	120.33c	4.47b	532.47c	208.21c	1.33c	39.00
SB010	228.67a	4.97a	1142.67a	451.76a	3.00a	39.50
F-test	**	**	**	**	**	NS
CV%	1.34	3.27	2.67	3.52	2.16	12.5

In a column same letter (s) do not differ significantly at P<0.05 by DMRT, ^{NS}-Not-significant, **- significant at 1% level of probability

different sizes for various horticultural traits in Dolichos bean have earlier been reported by Borah and Shadeque and Baswana et al. [17]. Abdullah [18] also found that yield depends mainly on the number of pods per plant. Similar trend also found in case of pod yield ha^{-1} as well as of the pod yield $plant^{-1}$ which was the highest in SB010 (20.46 ton ha^{-1}) and lowest in IPSA Sheem-2 (6.26 ton ha^{-1}). Mollah et al. [8] observed yield variation of 9.4-21.4 ton ha^{-1} in nine lablab bean genotypes grown under Chittagong condition during winter season. Moniruzzaman et al. [14] found that pod yield varied from 7.01-32.24 ton ha^{-1}. Bangladesh have a negligible production trend (4.8 t ha^{-1}, compared to in global context of 10 t ha^{-1}). However, the country has a huge variability of lablab been for it's various yield contributing characters [19].

3.4 Seed Yield and Yield Attributes

Effect of five lablab bean genotypes on seed yield and yield attributes is presented in Table 4. Significant variations were observed among the genotypes in respect to seed yield and yield attributes except 100 dry seed weight. The maximum number of seeds $plant^{-1}$ was found in the genotype SB010 (1142.67) due to highest number of pods $plant^{-1}$ (228.67) and number of seeds pod^{-1} (4.97) while it was minimum in BP003 (418.40) since number pods $plant^{-1}$ and number of seeds pod^{-1} was lowest in this genotype. Barua et al. [20] was recorded the number of green seeds pod^{-1} ranged from 4.33-5.33. The highest seed yield was obtained from SB010 (3.00 ton ha^{-1}) was significantly differed from the other genotypes. The lowest seed yield (1.0 ton ha^{-1}) was obtained from BP003. Similar variation in case of seed yield and yield attributes were recorded by Salim et al. [21] studied with 66 genotypes.

4. CONCLUSION

Among the genotypes, the genotypes SB010, SB008 and SB003 showed better performance especially in respect of green pod and seed yield production. Therefore, these genotypes can be taken under consideration for commercial cultivation in Sylhet region.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. NRC (National Research Council). Lablab. In: Lost crops of Africa, vol. II: vegetables. NRC, Washington DC, USA. 2006;190–205.
2. Purseglove JW. Tropical crops. In: Dicotyledons. Longman, London. 1977; 273-276.
3. Chowdhury AR, Ali M, Quadir MA. Aspects of Pollination and floral biology of lablab bean (*Lablab purpureus* L. Sweet). J. of the Japanese Society for Horticultural Sci. 1989;58(3):665-71. Pl. Br. Abstr. 60(12): 1567.
4. Osama OA. Abdullahi H, Abdel Wahab H, Abd Elmoneim O. Proximate composition, minerals, tannins, *in vitro* protein digestibility and effect of cooking on protein fractions of hyacinth bean (*Dolichos lablab*). J. Food Sci. 2002;39:111-115.
5. BBS. Yearbook of Agricultural Statistics of Bangladesh. Bangladesh Bureau of Statistics, Ministry of planning. Govt. of the People's Republic of Bangladesh, 1998.
6. Bose TK, Som MG, Kabir J. Vegetable Crops, Naya Prakash Kolkata. 1993;612.
7. Islam T, Haque MM, Rahman MM. Catalogue on hyacinth bean germplasm. PGRC, BARI, Gazipur. 2002;55.
8. Mollah MS, Saha SR, Islam MS. Effect of method of support on the yield performances of some advanced lines of hyacinth bean. Bangladesh J. Crop Sci. 1995;6(1-2):37-40.
9. Hedrick PW. Genetics of population, 3rd Ed.; Jones and Bartlett Pub. Co: Sulbury, MA, USA; 2005.
10. Islam MS. Genetic diversity, combining ability and heterosis in hyacinth bean (*Lablab purpureas* (L.) sweet), A Ph.D. Thesis, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh; 2008.
11. Gupta M, Rao KP, Rajwade VB. Correlation study of floral traits, yield and nutritional parameters in dolichos bean (*Lablab purpureus* L.) genotypes under Allahabad agro climatic zone. Journal of Pharmacognosy and Phytochemistry. 2017;6(6):1585-1591.

12. Islam MS, Rahman MM, Hossain T. Physico-morphological variation in hyacinth bean [*Lablab purpureus* (L.) Sweet]. Bangladesh J Agril. Res. 2010; 35(3):431-438.
13. Sultana N. Genetic variation of morphology and molecular markers and its application to breeding in Lablab bean. A Ph.D. Thesis, Kyushu University, Fukuoka, Japan. 2001;143.
14. Moniruzzaman, M, Hasan J, Ahmed NU, Firoz ZA, Quamruzzaman AKM. Effect of date of planting and spacing on the yield attributes and yield of different varieties of country bean [*Lablab purpuria* L. (Sweet)]. Bangladesh Journal of Agricultural Research. 2010;35(4):573-584.
15. Pengelly BC, Maass BL. *Lablab purpureas* (L.) Sweet-diversity, potential use and determination of a core collection of this multi-purpose tropical legume. Genetic Resources and Crop Evolution. 2001;48: 261-272.
16. Halim GMA, Ahmed S. Study of the morphogenetic divergence in country bean. Bangladesh Horticulture. 1992; 20(2):103-107.
17. Borah P, Shadeque A. Studies on genetic variability of common Dolichos bean. Indian J. Hort. 1992;49:270-273.
18. Abdullah MMF. Potentialities of breeding field beans. *Vicia faba* L. Egyptian J. Genet and Cytology. 1974;3(2):298-302.
19. Sultana N, Ozaki Y, Okubo H. Morphological and physiological variation in Lablab bean (*Lablab purpureus* (L.). J. Faculty of Agric. Kyushu University. 2009; 45(2):465-472.
20. Barua H, Rahman MH, Alam Patwary MM, Zahirul Alam M, Nahar S. Variation in growth and yield of indigenous hyacinth bean (*Lablab purpureus* L.) genotypes. The Agriculturist, 2014;12(2):01-05.
21. Salim M, Hossain S, Alam S, Rashid JA, Islam S. Estimation of genetic divergence in Lablab bean (*Lablab purpureus* L.) genotypes. Bangladesh J. Agril. Res. 2013;38(1):105-114.

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