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Determination of off-Season Lablab Bean (*Lablab purpureus*) Production in eastern-southern part of Bangladesh

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Abstract
An experiment was conducted to evaluate lablab bean genotypes for off-season production under Sylhet condition during January to October 2018. Three photo-insensitive lablab bean genotypes viz., BP003, SB003 and SB010 were evaluated at three different sowing dates of 15 January, 15 March and 15 May 2018 under RCB design with three replications with a view to identify suitable genotypes and their sowing dates in Sylhet condition. Among the genotypes, BP003 produced the maximum number of pods per plant (283) and pod yield/plant (1.64 kg/plant) which was closely followed by the genotype SB003 (1.60 kg/plant). The highest individual pod weight (5.79 g) and pod length (10.9 cm) were recorded from SB003 which were identical to that of BP003 (5.53 g and 9.41 cm, respectively. The genotype BP003 had the highest pod breadth (2.96 cm). The genotype SB010 exhibited the lowest individual pod weight (4.72 g), pod length (8.31 cm) and pod breadth (2.66 cm) among the genotypes. Sowing dates had significant influence on pod production during off-season. The highest number of pods per plant (416.89) was recorded from the plants of 15 March sowing while it was 192.56 and 166.44 for January 15 and May 15 sowing, respectively. Similar trend was also observed for pod yield per plant. The highest pod yield per plant (2.20 kg) was recorded from March 15 sowing while it was 1.14 kg per plant for January sowing and 0.85 kg per plant for 15 May sows. Yields of pod at January and May sowing were much lower than that of March sowing. The crop sown in January experienced much colder situation caused slow initial vegetative growth and the plants grown from May sowing were largely affected by heavy rain during the month of July - August might be the reason for low yield compared to that of March sowing. Significant interactions were found between genotypes and sowing dates in case of off-season country bean production in respect to yield and yield attributes. The highest number of pods per plant (474.00) was harvested from the genotype BP003 when grown from 15 March sowing followed by SB003 grown from 15 March sowing Similar trend also found in case of pod per plant. The pod yield per plant was the maximum (2.80 kg) for the treatment combination of BP003 grown from 15 March while it was the minimum (0.68 kg) for SB010 when coupled with 15 May sowing.

Keywords: Lablab bean, Genotype, Photo-insensitive, sowing date, Yield etc.

Introduction
Lablab bean scientifically known as Lablab purpureus (L.) is a legume species which was formerly known as Dolichos lablab (L.). It is a self-pollinated crop belonging to the family Leguminosae and sub family Papilionaceae. In Bangladesh, it is most important winter vegetable and popularly known as “Country bean” or simply “Seem”. Lablab bean, Lablab purpureus (Linn.) is reported to be originated in India (Katyal and Chandha, 1985; Chowdhury et al., 1989) and then widely spread to other parts of the world. According to Rao (1977) it is native to India. Pulsegra (1968) believed that, this crop was taken to Africa and has subsequently been distributed to many tropical countries.
Beans, often known as legumes, are the human diet's second most significant food source. They are high in protein, carbs, fiber, vitamins, and minerals. Among the most popular are long beans, French beans, and four-angled beans. The protein composition of the aforementioned beans, according to Rudrappa (2019) ranges between 3 and 12 percent.

Many indigenous and underused beans, notably the lablab bean, have a substantially greater protein content. According to Al-Snafi (2017), lablab beans are known by many other names in different parts of the world, including Hyacinth bean, Field bean, Indian bean, Sem, Simii, and Bian dou. This bean grows well in tropical and subtropical climates. It is well-known in places like India, Bangladesh, Africa, and Indonesia. Good quality seeds should be made accessible locally to expand lablab bean growing to a commercial scale.

Because of its high protein content (18–25 percent), this bean is a potential candidate for use as a commercial vegetable (Subagio 2006 and Naiem et al., 2020_. To encourage and expand lablab bean farming, superior grade seeds must be produced locally. Seeds that are harvested at the proper time have a higher quality. In order to ensure maximal seed germination and optimum seedling establishment, high-quality seeds are essential. The lablab bean is a creeping plant that blooms in an uncertain manner. As a result, they can have flowers, juvenile pods, and mature pods in the same cycle. This makes seed production more difficult since pods must be picked many times at different stages of maturity. As a result, harvesting at the appropriate developmental stage must be determined using a clear, simple visual indication, such as color changes depending on physiological responses.

Harvesting seeds at the right time, according to Vidigal et al., (2011) can reduce seed losses and the ratio of immature seeds owing to early harvest, while also increasing seed germination, vigor, and viability. Harington (1972) defines physiological maturity (PM) as the point at which seed quality reaches its peak (Tekrony 1997). After this moment, the seeds' physiological quality begins to deteriorate. However, there is ample evidence that seed quality can improve with PM. To reduce seed loss, lablab's development habits are ambiguous, thus determining the best time to harvest is crucial. To address this problem some photo and/or thermo-insensitive lablab bean lines through genetic manipulation have been developed which are suitable for summer season (Anonymous, 2011). This experiment had conducted to estimate the pod yield potentiality of different photo-insensitive lablab bean genotypes and the influence of sowing dates on morphological and pod characteristics of lablab bean during off season.

Materials and Methods

The experiment was conducted from January 2018 to October 2018 at the experimental field of Horticulture Department, Faculty of Agriculture, Sylhet Agricultural University, Sylhet-3100 which is under the Agro-ecological Zone-20: Eastern Surma-Kusiyara Flood Plain (UNDP and FAO, 1988).

The site was characterized by heavy rainfall during the months of August to September and scanty rainfall during rest of the year. The soil of experimental field was sandy loams in texture and belongs to the 'Non-calcareous Grey' under Eastern Surma-Kusiyara Floodplain with moderate organic matter content. The treatments of the experiment included three lablab bean genotypes viz. BP003, SB003 and SB010; and three sowing times starting from January to May with 2 months interval viz. T1 (15 January, 2018), T2 (15 March, 2018) and T3 (15 May, 2018). The seeds were collected from the Department of Horticulture, Sylhet Agricultural University.

The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 1.5 m x 6.0 m accommodating single row per bed and six pits per bed. Plants were spaced at 1.0 m in a bed and 1.5 m between two adjacent beds. Distances of 50 cm in the form of drain between the block and between the beds within a block were maintained. The experimental land was first opened by using a power tiller and subsequently spading and followed by laddering to obtain the desirable tilth. Hence, the land was acidic in nature, lime (Dolomite) was applied in the field @ 4kg per decimal. Each plot was fertilized with basal dose of manures during the final land preparation.

Manuring and fertilization

The dose of manure and fertilizers were applied in the experimental field as recommended by Rashid (1999). The full dose recommended by Rashid (1999) of cow-dung (10 ton/ha), TSP (150kg/ha) and half dose of MP were applied basally during pit preparation one week before transplanting. The remaining MP (150kg/ha) and urea @ 50kg/ha were applied in the three equal installments as top dressing at 15, 30 and 45 days after transplanting.

Transplanting and gap filling of seedlings

Ten-day old seedlings were transplanted from the poly bags in the experimental field. The damaged seedlings were replaced immediately by new ones to keep the entire plant stand uniform.

Intercultural operation

Staking, Weeding, mulching, Irrigation were done properly when it was being required. To control aphids, jute hairy caterpillar and pod borer spray of Malathion @ 2 ml/L.

Collection of data

Observations of different characters were recorded from each genotype of country bean. Data of internode length, petiole length, inflorescence length, leaf length, leaf breadth, days to flower, days to harvest, pod length, pod breadth, number of seeds per pod, number of pods per plant, individual pod weight, pod yield/plant, pod yield (t/ha) in three country bean genotypes were recorded.

Statistical analysis

The collected data were analyzed by Analysis of variance (ANOVA) technique and the mean differences were adjusted by Duncan's Multiple Range Test (DMRT) using computer package program MSTAT C.

Results and Discussion

Effect of genotypes

Influence of genotypes on morphological characteristics:

Internode length (cm)

The influence of genotype on internode length was not statistically significant (Table 1). The genotype SB003 showed the highest internode length (13.22 cm) which was identical with the genotypes SB010 (12.61 cm) and BP003 (12.24 cm).

Petiole length (cm)

No significant difference was found for petiole length

among the genotypes (Table 1). However, highest petiole length was measured from SB003 (6.58 cm) and the lowest from BP003 (6.41cm).

Inflorescence length (cm)
Statistically significant difference was found among the genotypes in inflorescence length (Table 1). The highest inflorescence length was measured from the genotype of SB003 (35.41 cm) and the result was as per with Roy (2014) and which was followed by the genotype BP003 (34.50 cm). The lowest inflorescence length was recorded from the genotype SB010 (29.32 cm).

Leaf length (cm)
There was no significant difference observed in leaf length among three genotypes (Table 1). The highest leaf length was recorded from the genotype SB003 (9.55 cm) and the lowest leaf length (9.30 cm) from the genotype SB010 (9.30 cm). The result was similar with the result of Roy (2014).

Leaf breadth (cm)
No significant difference was found for leaf breadth of the genotypes (Table 1). The highest leaf breadth was measured from the genotype SB003 (8.59 cm) and the lowest leaf breadth was measured from the genotype BP003 (8.30 cm). Similar result was found from Roy (2014).

Table 1: Influence of genotypes on morphological characteristics of lablab bean.

Genotypes	Internode length (cm)	Petiole length (cm)	Inflorescence length (cm)	Leaf length (cm)	Leaf breadth (cm)
BP003	12.24	6.41	34.50a	9.31	8.30
SB003	13.22	6.58	35.41a	9.55	8.59
SB010	12.61	6.56	29.32b	9.30	8.34
F-test	NS	NS	**	NS	NS
CV	4.36	8.52	6.16	2.63	3.50

Influence of genotypes on pod characteristics:
Days to flowering
Significant variation among the genotypes was found in respect to days of first flower (Table 2). The genotype SB010 took the maximum days (61.55 days) to flowering. On the other hand, the genotype BP003 (59.00 days) took the minimum days to flowering which was followed by the genotype SB003 (59.44 days).

Days to harvest
In case of days to harvest, there was no significant variation among the genotypes (Table 2). However, the genotype SB010 took the maximum days to harvest, while BP003 and SB003 took minimum days to harvest.

Fruit length (cm)
Statistically significant variation on fruit length was observed among the genotypes (Table 2). The genotype SB003 produced the longest (10.94 cm) fruit and similar result was obtained by Roy (2014). The shortest fruit length was recorded 8.31 cm from the genotype SB010 and similar result was at par with Kishor (2014). Pengelly and Maass (2001) reported that fruit length varied range between 2.5 to 14.0 cm among 249 genotypes studied in Australia. Similar variation in respect of fruit length was also reported by Mollah *et al.,* (1995) and Sultana (2001).

Fruit breadth (cm)
Statistically significant variation on fruit breadth was observed among the genotypes (Table 2). The genotype BP003 produced the maximum (10.94 cm) fruit breadth. The shortest fruit breadth was recorded 2.66 cm from the genotype SB010 and which was statistically similar with SB003 (2.68 cm).

Number of seeds per pod
There was no significant difference on number of seeds per pod among the genotypes (Table 2). However, the SB003 produced highest number of seeds per pod (4.67) and lowest number of seeds per pod was produced by the genotype BP003 (4.56) and SB002 (4.56). Similar results were obtained from Roy (2014).

Table 2: Influence of genotypes on pod characteristics of lablab bean:

Genotype	Days to flower	Days to harvest	Fruit length (cm)	Fruit breadth (cm)	Number of seeds/pods
BP003	59.00b	85.67	9.41b	2.96a	4.56
SB003	59.44b	85.67	10.94a	2.68b	4.67
SB010	61.55a	86.67	8.31c	2.66b	4.56
F-test	**	NS	**	**	NS
CV	2.42	1.44	3.89	4.14	11.67

Influence of genotypes on pod yield and yield attributes:
Number of pods per plant
The trait for number of pods per plant varied significantly among the genotypes (Table 3). The highest number of pods/plant (283.00) was recorded in the genotype BP003, which was identical with genotype SB003 (281.78). On the other hand, lowest number of pods per plant (211.11) was recorded in the genotype SB010. Although each raceme produced huge number of flower buds but ultimate retention of pod was very low. Khan (2003) recorded 83-88% flower drop among three genotypes, who also obtained 320.7 pods per plant from the genotype HB001. The variation in number of pods per plant might be due to differences in number of inflorescences per plant, pods per raceme and flower dropping tendency of the genotypes (Mollah *et al*., 1995; Khan, 2003).

Individual pod weight (g)
The genotypes differed significantly for individual pod weight (Table 3). The maximum number of individual pod weight was observed in the genotype SB003 (5.79 gm), which were statistically similar with the genotype BP003

(5.53 g). The minimum number of individual pod weight was recorded in the genotype SB010 (4.72 g).

Pod yield per plant (kg/plant)

The influence of genotype on pod yield per plant was statistically significant (Table 3). The highest pod yield per plant (1.64 kg/plant) was recorded in the genotype BP003, which was identical with genotype SB003 (1.60 kg/plant). The result was at par with Roy (2014). The higher yield per plant was attributed due to both, the higher number of pods per plant and the higher individual pod weight. On the other hand, lowest pod yield per plant (0.97 kg/plant) was recorded in the genotype SB010, due to its lowest number of pods per plant and lowest individual pod weight. Similar result was obtained by Abdullah (1974), who report that yield depends mainly on the number of pods per plant in case of field bean.

Pod yield (t/ha)

The highest pod yield (10.66 t/ha) was recorded in the genotype BP003 and the genotype SB003 produced 10.40 t/ha. The lowest pod yield was recorded in the genotype SB010 (6.30 t/ha). (Fig. 1)

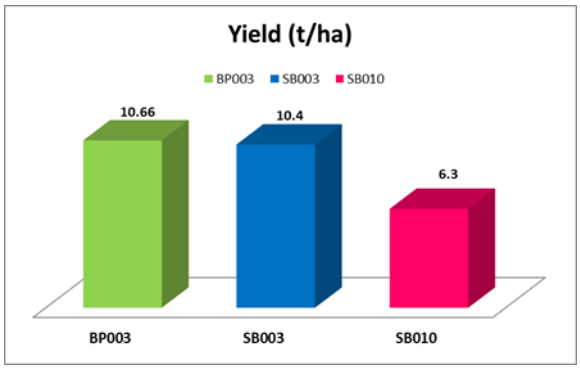

Fig. 1: Pod yield (t/ha) of three genotypes

Table 3: Influence of genotypes on pod yield and yield attributes of lablab bean:

Genotypes	Number of pods/plants	Individual Pod Weight (gm)	Pod yield/plant (kg/plant)
BP003	283.00a	5.53a	1.64a
SB003	281.78a	5.79a	1.60a
SB010	211.11b	4.72b	0.97b
F-test	**	**	**
CV	17.08	7.99	18.93

Effect of sowing dates

Influence of sowing dates on morphological characteristics:

Internode length (cm)

Statistically significant differences were not (according to table) found among the sowing dates in internode length (Table 4). The longest internode length was measured from the plants grown from 15 May sowing (13.22 cm) which was followed by the plants of 15 January sowing (12.97 cm). The shortest internode length was recorded from the plants of 15 March sowing (11.88 cm).

Petiole length (cm)

No significant difference was found for petiole length among the sowing dates (Table 4). However, highest petiole length was measured from the plant of January 15 sowing (6.62 cm) and the lowest from sowing date of 15 March (6.36 cm).

Inflorescence length (cm)

The influence of sowing dates on inflorescence length was statistically significant (Table 4). The sowing date of 15 May showed the longest inflorescence length (34.39 cm) which was identical with sowing date of 15 January (33.07 cm). The shortest inflorescence length (31.77 cm) recorded from sowing date 15 March.

Leaf length (cm)

There were significant differences observed in leaf length among sowing dates (Table 4). The highest leaf length was recorded from sowing date 15 January (9.68 cm). The lowest leaf length (9.19 cm) recorded from sowing date 15 May (9.30 cm) and it was statistically similar with sowing date 15 March (9.30 cm).

Leaf breadth (cm)

Statistically significant variation on leaf breadth was observed among the sowing dates (Table 4). The highest leaf breadth was measured from the plant grown from 15 January (8.64 cm) and it was identical with sowing date 15 March (8.48 cm). The lowest leaf breadth was measured from sowing date of 15 May (8.11 cm).

Table 4: Influence of sowing dates on morphological characteristics of lablab bean:

Sowing date	Internode length (cm)	Petiole length (cm)	Inflorescence length (cm)	Leaf length (cm)	Leaf breadth (cm)
15 January	12.97	6.62	33.07ab	9.68a	8.64a
15 March	11.88	6.36	31.77b	9.30b	8.48ab
15 May	13.22	6.57	34.39a	9.19b	8.11b
F-test	**	NS	*	**	**
CV	4.36	8.52	6.16	2.63	3.50

Influence of sowing dates on pod characteristics:

Days of flowering

Variation among the sowing dates in respect of days to flowering was insignificant (Table 5). However, the plants grown in 15 January took the maximum days (60.11 days) to flowering. On the other hand, sowing date of 15 March took the minimum days (59.88 days) to flowering which was identical with sowing date of 15 May (60.00 days).

Days to harvest

In case of days to harvest, there was significant variation among the sowing dates (Table 5). However, the sowing date 15 March took the maximum days (88.22 days) to harvest. On the other hand, the plants grown in 15 May took minimum days (84.44 days) to harvest and it was identical with sowing date 15 January (85.33 days).

Pod length (cm)

Statistically significant variation on fruit length was observed among the sowing dates (Table 5). The sowing date 15 January produced the longest (10.10 cm) pod and it was identical with 15 March sowing (9.67 cm). The shortest fruit length was recorded 8.90 cm from the plants grown in 15 May.

Pod breadth (cm)

Statistically significant variation on fruit breadth was observed among the sowing dates (Table 5). The plants grown from the 15 January sowing produced the maximum (2.87 cm) pod breadth and which was statistically similar with sowing date 15 May (2.80 cm). The shortest pod breadth was recorded 2.59 cm from sowing date of 15 March.

Number of seeds per pod

There was no significant difference among the sowing dates (Table 5). However, plants from the 15 January and 15 May sowing produced highest number of seeds per pod (4.67) and lowest number of seeds per pod was produced by the plants grown in 15 March (4.44).

Table 5: Influence of sowing dates on pod characteristics of lablab bean:

Sowing date	Days to flowering	Days to harvest	Fruit length (cm)	Fruit breadth (cm)	Number of seeds/pods
15 January	60.11	85.33b	10.10a	2.87a	4.67
15 March	59.88	88.22a	9.67a	2.59b	4.44
15 May	60.00	84.44b	8.90b	2.80a	4.67
F-test	NS	**	**	**	NS
CV	2.42	1.44	3.89	4.14	11.67

Influence of sowing dates on pod yield and yield attributes:

Number of pods per plant

The trait for number of pods per plant varied significantly among the genotypes (Table 6). The highest number of pods per plant (416.89) was recorded from the plants grown from 15 March. On the other hand, lowest number of pods per plant (166.44) was recorded in 15 May sowing which was statistically similar with 15 January sowing (192.56). The variation in number of pods per plant might be due to differences in number of pods per plant, pods per raceme, flower dropping tendency of the genotypes (Mollah *et al*., 1995; Khan, 2003).

Individual pod weight (g)

The genotypes differed significantly for individual pod weight (Table 6). The maximum number of individual pod weight (5.80 g) was observed in plants grown from 15 January. The minimum number of individual pod weight (5.12 g) was recorded from the plants grown from 15 March, which was statistically similar with sowing date 15 May (5.13 g).

Pod yield per plant (kg/plant)

The influence of sowing date on pod yield per plant differed significantly (Table 6). The highest pod yield per plant (2.33 kg/plant) was recorded from the plants sown on 15 March. On the other hand, lowest pod yield per plant (0.85 kg/plant) was recorded in 15 May sowing, which was identical with sowing date 15 January (1.14 kg/plant). The higher yield per plant was attributed due to both, the higher number of pods per plant and the higher individual pod weight.

Pod yield (t/ha)

The highest pod yield (15.14 t/ha) was recorded in the sowing date 15 March and the sowing date 15 January produced 7.41 t/ha. The lowest seed yield was recorded in the sowing date 15 May (5.53 t/ha) (Fig.2).

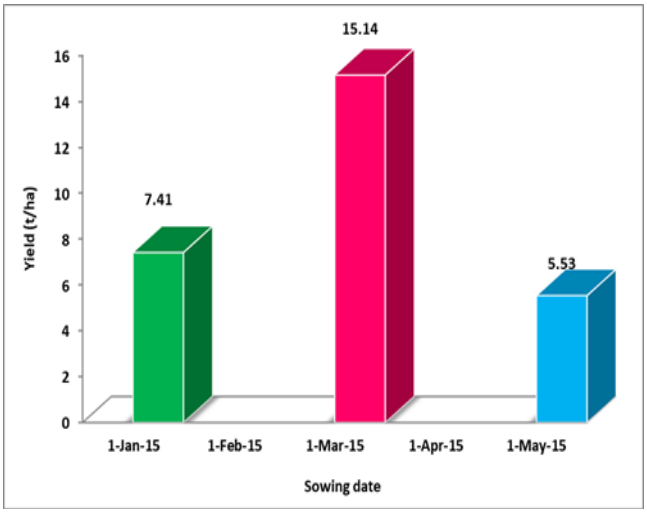

Fig. 2: Pod yield (t/ha) of three sowing dates

Table 6: Influence of sowing dates on pod yield and yield attributes of lablab bean:

Sowing dates	Number of pods/plants	Individual pod weight (gm)	Pod yield/plant (kg/plant)	
15 January	192.56b	5.80a	1.14b	
15 March	416.89a	5.12b	2.20a	
15 May	166.44b	5.13b	0.85b	
F-test	**	**	**	
CV	17.08	7.99	18.93	

Interaction effects

Influence of interactions on morphological characters

Internode length (cm)

There was no significant effect observed between interaction of genotype and sowing dates but the highest internode length of the vine was measured from the genotype SB003 grown from 15 May sowing (14.13 cm) and shortest internode length recorded from the plants of SB010 raised from 15 March sowing (11.35 cm).

Petiole length (cm)

No significant difference was found for petiole length of the interactions between genotype and sowing date (Table 7). However, highest petiole length was measured from the genotype SB003 grown from 15 January (6.75 cm) while it was the lowest for genotype SB010 grown from 15 March (6.30 cm) and genotype SB003 grown from 15 March (6.30 cm).

Inflorescence length (cm)

The influence of interactions on inflorescence length was statistically significant (Table 7). The interaction between SB003 genotype with sowing date 15 May showed the longest inflorescence length (37.67 cm) which was identical with interaction between genotype BP003 grown from 15 January sowing (37.42 cm) and genotype BP003 grown from 15 May sowing (36.00 cm). The shortest inflorescence length (27.33 cm) recorded from genotype SB010 grown from 15 January and it was statistically similar with genotype SB010 grown from 15 May (29.50 cm).

Leaf length (cm)

There were significant differences observed in leaf length among the interactions between genotype and sowing date (Table 7). The longest leaf length was recorded from interaction between genotype SB010 grown from 15 January sowing (10.37 cm). The intermediate type of leaf length was found from interactions between genotype BP003 grown from 15 March sowing (9.72 cm), genotype SB003 grown from 15 January sowing (9.60 cm) and genotype SB003 grown from 15 March sowing (9.55 cm). The shortest leaf length (8.61 cm) recorded from interaction between genotype SB010 grown from 15 March sowing and it is statistically similar with interaction between genotype SB010 grown from 15 May sowing (8.93 cm).

Leaf breadth (cm)

Statistically significant variation on leaf breadth was observed among the interactions between genotype and sowing date (Table 7). The highest leaf breadth was measured from interaction between genotype SB010 grown from 15 January sowing (9.29 cm) and it was identical with interactions between genotype SB003 grown from 15 March sowing (8.78 cm) and interactions between genotype BP003 grown from 15 March sowing (8.75 cm). The lowest leaf breadth was measured from interaction between genotype SB010 grown from 15 May sowing (7.80 cm) and it was statistically similar with interactions between genotype SB010 grown from 15 March sowing (7.93 cm) and genotype BP003 grown from 15 January sowing (8.07 cm).

Table 7: Influence of interactions on morphological characteristics of lablab bean:

Genotype× Sowing date	Internode length (cm)	Petiole length (cm)	Inflorescence length (cm)	Leaf length (cm)	Leaf breadth (cm)
V_1S_1	12.01	6.37	37.42a	9.07c-e	8.10b-e
V_1S_2	12.17	6.54	30.07b-d	9.72b	8.75a-c
$V_1 S_3$	12.53	6.33	36.00a	9.13c-e	8.07c-e
V_2S_1	13.41	6.75	34.44ab	9.60bc	8.52b-d
$V_2 S_2$	12.12	6.30	34.11a-c	9.55bc	8.78ab
V_2S_3	14.13	6.70	37.67a	9.50b-d	8.47b-e
$V_3 S_1$	13.49	6.73	27.33d	10.37a	9.29a
$V_3 S_2$	11.35	6.30	31.12b-d	8.61e	7.93de
$V_3 S_3$	13.00	6.68	29.50cd	8.93de	7.80e
F-test	NS	NS	**	**	**
CV	4.36	8.52	6.16	2.63	3.50

Note: V_1 =BP003; V_2 = SB003; V3 = SB010; S_1= 15 January, 2018; S_2= 15 March, 2018; S_3 = 15 May, 2018

Influence of interactions on pod characteristics:

Days of flowering

Variation among the interactions in respect of days to flowering was significant (Table 8). However, the interaction between genotype SB010 grown from 15 January took the maximum days (64.00 days) to flowering and which was identical with the interaction between genotype SB003 grown from 15 March (61.00 days) and genotype SB010 grown from 15 May (61.00 days). On the other hand, interaction between genotype SB003, sowing date 15 January took the minimum days (57.33 days) to flowering which was identical with genotype SB010 grown from 15 January (59.00 days), genotype BP003 grown from 15 May (59.00 days), genotype BP003 grown from 15 March (59.00 days).

Days to harvest

In case of days to harvest, there was no significant variation observed among the interactions (Table 8). However, the interaction between genotype BP003 grown from 15 March took the maximum days (89.00 days) to harvest. On the other hand, interaction between genotype BP003 grown from 15 January and 15 May and genotype SB003 grown from 15 May took minimum days (84.00 days) to harvest.

Fruit length (cm)

Statistically significant variation on fruit length was observed among the interactions (Table 8). The interaction between genotype SB003 grown from 15 January produced the longest (12.09 cm) fruit. The intermediate type of fruit length was recorded from genotype SB003 grown from 15 March (11.16 cm). The shortest fruit length was recorded

8.05 cm from between genotype SB010 grown from 15 May.

Fruit breadth (cm)
Variation among the interactions in respect of fruit breadth was insignificant (Table 8). The interaction between genotype BP003 grown from 15 May produced the maximum (3.07 cm) fruit breadth. The shortest fruit breadth was recorded 2.53 cm from interaction between genotype SB010 grown from 15 March.

Number of seeds per pod
There was no significant difference among the sowing dates (Table 8). However, interaction between genotype SB010 grown from 15 January produced highest number of seeds per pod (5.00) and lowest number of seeds per pod was produced by the interaction between genotype SB010 grown from 15 March (4.00).

Table 8: Interaction effect on pod characteristics of lablab bean:

Genotype× Sowing date	Days to flowering	Days to harvest	Fruit length (cm)	Fruit breadth (cm)	Number of seeds/pods
$V_1 S_1$	59.00bc	84.00	9.50cd	2.98	4.33
$V_1 S_2$	59.00bc	89.00	9.67c	2.70	4.66
$V_1 S_3$	59.00bc	84.00	9.07cd	3.07	4.66
$V_2 S_1$	57.33c	85.00	12.09a	2.78	4.66
$V_2 S_2$	61.00ab	88.00	11.16b	2.54	4.66
$V_2 S_3$	60.00bc	84.00	9.57cd	2.73	4.66
$V_3 S_1$	64.00a	87.00	8.71de	2.84	5.00
$V_3 S_2$	59.66bc	87.67	8.18e	2.53	4.00
$V_3 S_3$	61.00ab	85.33	8.05e	2.60	4.66
F-test	**	NS	**	NS	NS
CV	2.42	1.44	3.89	4.14	11.67

Note: V_1 =BP003; V_2 = SB003; V3 = SB010; 2015 S_1= 15 January, S_2= 15 March, 2015; S_3 = 15 May, 2015

Influence of interactions on pod yield and yield attributes:

Number of pods per plant
The trait for number of pods per plant varied significantly among the interactions (Table 9). The highest number of pods/plant (474.00) was recorded from the genotype BP003 grown from 15 March and it was statistically similar with genotype SB003 grown from 15 March (470.00). On the other hand, lowest number of pods/plant (144.33) was recorded in the interaction between genotype SB003 grown from 15 May which was statistically similar with genotype SB010 grown from 15 January (162.67) and genotype SB010 grown from 15 May (166.00). The variation in number of pods per plant might be due to differences in number of pods per plant, pods per raceme, flower dropping tendency of the genotypes (Mollah *et al*., 1995; Khan, 2003).

Individual pod weight
The interactions differed significantly for individual pod weight (Table 9). The maximum number of individual pod weight (6.40 g) was observed in interaction between genotype SB003 grown from 15 January. The minimum number of individual pod weight (4.20 g) was recorded in interaction between genotype SB010 grown from 15 May, which was statistically similar with genotype SB010 grown from 15 March (4.45 g).

Pod yield per plant
The influence of interactions on pod yield per plant was statistically significant (Table 9). The highest pod yield per plant (2.80 kg/plant) was recorded in interaction between genotype BP003 grown from 15 March and it was identical with the genotype SB003 grown from 15 March (2.52 kg/plant). On the other hand, lowest pod yield per plant (0.68 kg/plant) was recorded in interaction between genotype SB010 grown from 15 May, which was identical with genotype SB003 grown from 15 May (0.84 kg/plant), genotype SB010 grown from 15 January (0.89 kg/plant). The higher yield per plant was attributed due to both, the higher number of pods per plant and the higher individual pod weight.

Pod yield (t/ha)
The highest pod yield (18.20 t/ha) was recorded in the interaction between genotype BP003 with sowing date 15 March and the intermediate type of pod yield (16.38 t/ha) was recorded in the interaction between genotype SB003 with 15 March sowing date. The lowest pod yield was recorded in the interaction between genotype SB010 with 15 May sowing date (4.42 t/ha). (Figure 3)

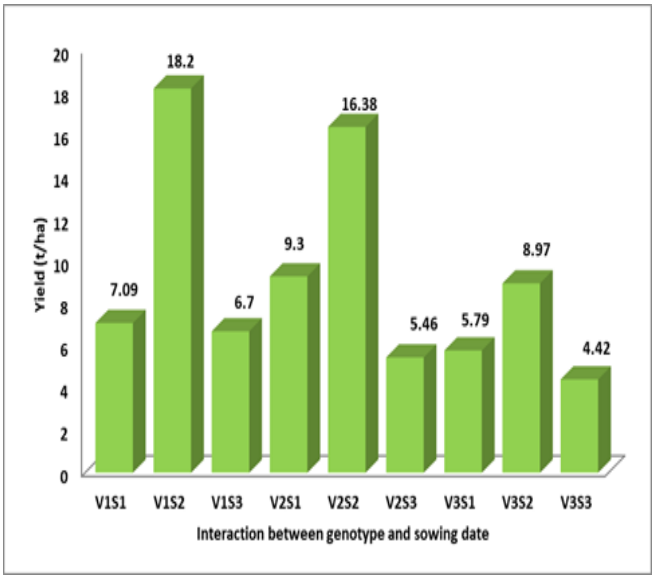

Fig. 3: Pod yield (t/ha) of Interaction between genotypes and sowing dates

Table 9: Influence of interactions on pod yield and yield attributes:

Genotype× Sowing date	Number of pods/plants	Individual pod weight (gm)	Pod yield/plant (kg/plant)
V_1S_1	184.00cd	5.38b	1.09bc
V_1S_2	474.00a	5.61b	2.80a
V_1S_3	191.00cd	5.61b	1.03bc
V_2 S_1	231.00bc	6.40a	1.43b
V_2 S_2	470.00a	5.30b	2.52a
V_2 S_3	144.33d	5.58b	0.84c
V_3 S_1	162.67cd	5.52b	0.89c
V_3 S_2	306.67b	4.45c	1.38b
V_3 S_3	166.00cd	4.20c	0.68c
F-test	*	*	**
CV	17.08	7.99	18.93

Note: V_1 =BP003; V_2 = SB003; V3 = SB010; S_2= 15 March, 2015 S_1= 15 January, 2015; S_3 = 15 May, 2015

Summary

From the above discussion it was found that the pod yield of the genotypes BP003 (10.66 t/ha) and SB003 (10.44 t/ha) was appreciably high at 15 March sowing. However, the pod yield of these two genotypes was comparatively lower at 15 January and 15 May sowing and this low yield will be compensated by the higher price of the produce. Therefore, these two genotypes can be grown during off-season in Sylhet region.

Conclusion and Recommendations

The three-photo insensitive lablab bean genotypes were differed for some physic-morphological characteristics like maximum pod yield per plant, number of pods per plant, individual pod weight, internode length, inflorescence length and fruit length etc. All the genotypes were able to produce flower and pod during off-season at Sylhet region. Among the genotypes, BP003 showed the highest pod yield potentiality followed by SB003. Among the sowing dates, 15 March sowing showed the highest pod yield. Yield of pod at 15 January and 15 May comparatively lower than that of 15 March sowing. Therefore, the two genotypes SB003 and BP003 are most promising for 15 March sowing. However, these two genotypes can also be recommended for January and May sowing to ensure the availability of lablab bean in the market of Sylhet region during off-season.

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