Hybrid true seed production from potato mother plant as influenced by nitrogen splitting and boron

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TSR and RC, thinking about the research study. RC, doing research, data collecting, data analyzing, results interpreting, references searching and manuscripts writing. TSR and MSI, supervising the research and reviewing the manuscript.

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Dedication: The authors’ would like to dedicate their present piece of research to the farming communities of hunger world.
Abstract

Experiments were conducted to show the effect of split application of nitrogen (SN) and boron (B) on hybrid True Potato Seed (TPS) production. The TPS-67 (♂) and MF-II (♀) were used as crossing materials. The experiments comprised two factors i.e., factor-A; nitrogen splitting (4 levels): 2 split (SN₀-Conventional), 3 split (SN₁), 4 split (SN₂) and 5 split (SN₃) where 50 kg N ha⁻¹ applied as basal from total 300 kg N ha⁻¹ with each split application and the rest 250 kg N ha⁻¹ was splitted as per treatment at 10 days intervals started from 30 DAP (days after planting); and factor-B; boron (4 levels): 0 (B₀), 4 (B₁), 6 (B₂) and 8 (B₃) kg B ha⁻¹ under split-plot design with three replications. We found that SN and/or B influenced the hybrid TPS production. The maximum yield (2160.1 mg) of TPS plant⁻¹ was found from SN₁B₃ and the minimum (1001.8 mg) was in SN₀B₀. The maximum yield (172.81 kg) of TPS ha⁻¹ was found from SN₁B₃ and the minimum (80.14 kg) was in SN₀B₀. The maximum weight (86.87 mg) of 100-TPS was found from SN₃B₃; whereas, the minimum (53.36 mg) was in SN₀B₀.

1. Introduction

Potato (Solanum tuberosum) is a starchy food crop ranked 4th in the world after wheat, rice, and maize. In Bangladesh, it ranks 2nd after rice in production. Bangladesh is the 7th potato production country in the world¹ produced 10,215,957.00 metric tons with an average yield of 20.44 t ha⁻¹.¹ In Bangladesh the production of potato is increasing day by day due to the increasing trends in demand and also in consumption. But, the yield of potato (20.44 t ha⁻¹) is very low in Bangladesh compared to other potato growing countries like New Zealand (49.31 t ha⁻¹), Netherlands (45.97 t ha⁻¹), USA (48.23 t ha⁻¹), Japan (29.27 t ha⁻¹), and India (22.31 t ha⁻¹).¹ Lack of quality seeds, high cost of quality seed, unavailability and uneven distribution of certified seeds, and use of indigenous cultivars having low yield potential may be reasons
for this low yield of potato. The gap between seed demand and supply is very high in our country due to lower seed production by the government and non-government sector through conventional system. But adoption of True Potato Seed (TPS) technology may be a better alternative to produce a huge amount of seed through fertilizer management for higher potato production. Flowering and subsequent reproductive growth, including the formation of gametophytes are directly affected by nutrient content of the mother plant for the production of quality TPS. Seed physiologists reported that higher level of nitrogen (N) is required as supplementation for seed production than the production of tuber and application of higher N increases shoot biomass, enhances the bloom of potato mother plants, increase pollen germination, improves seed yield and vigor. The weight of TPS also affected by the application of nitrogen, which is used by the seed scientist to select high-yielding progenies. To “split apply” nitrogen, growers gives opportunity to plant for up taking of two or more time nutrient during the growing season rather than providing all of the crop N requirements with a single treatment before or during planting. When all of the nitrogen is supplied ahead of different growth duration of crop, more of the nitrogen is susceptible to loss through denitrification, leaching, or volatilization. The growth of pollen tube and anther development is also sensitive to boron deprivation. The primary function of boron is developing the cell wall structure of pollen tubes and in its absence pollen tube may burst. In addition to male sterility, pistil sterility is another alteration of the reproductive system due to boron deficiency, although boron requirement is minor than in the male organs. In tomato, boron fertilization has greater photosynthetic activity resulting increased production and retention of flowers and fruits, which increased number and weight of fruits. Day stated that, it may be attributed to the effect of boron in IAA metabolism which increases the number of flowers and stimulates the phosphorus uptake by roots of plants which in turn promoted the development of flower clusters and exhibited a favorable effect on retention of
flowers. It also influences the fruit formation, fruit development and seed development. Boron deficiency causes a delay in pollen germination and pollen tube development and ultimately it halts flowering and fruit setting. Stanley reported that the translocation of sugar, starches, nitrogen and phosphorus, synthesis of amino acids and proteins were affected by boron deficiencies. The use of TPS technology may reduce the cost of small and marginal farmers as a supplementation to the traditional use of seed tubers in potato production. However, the production of quality TPS under optimum agronomic management with fertilizers application on potato mother plants have not been well studied in our country with the most promising parental lines (♀ MF-II and ♂ TPS-67). Therefore, the experiments were conducted to determine the most promising combination from the split application of N and B for higher yield of hybrid TPS.

2. Materials and methods

2.1 Study area

Sher-e-Bangla Agricultural University is situated between 23.771 and 90.375 latitude and longitude, respectively and 13.72 meters high from sea levels. Upper-level (0-10 cm) soils were clay loam in texture, olive-gray in color having fine to medium distinct dark yellowish brown mottles which belonged by Madhupur Tract (Agro-ecological Zone-28). The selected plot was situated above the flood level. Proper irrigation and drainage system was prepared during the experimental period. The soil of experimental field was characterized by 25 % sand, 20% silt, 55% clay, 0.47% organic carbon, 19.92 ppm available P and 0.13 meq/100g soil exchangeable K. Analytical result of other soil constituents were presented in Table 1.
2.2 Weather condition during the experimental period

The experimental area is situated in sub-tropical climatic zone characterized by heavy rainfall during pre-monsoon (March to May-Kharif-I), monsoon period (June to September-Kharif-II season) and scanty rainfall during the rest period of the year. The Rabi season (October to March) is characterized by comparatively low temperature and plenty of sunshine from November to February. During the period of study detailed meteorological data was collected from the Meteorological station of Sher-e-Bangla Agricultural University, Dhaka in respect of air temperature, relative humidity and total rainfall those were presented in Table 2.

2.3 Planting materials

The tubers of both parental line, TPS-67 (as a male parent, ♂) and MF-II (as a female parent, ♀) were collected from BADC farm, Domar, Dinajpur, Bangladesh. The female line MF II is tuberosum and male line TPS 67 is andigena based. No promising line had been released after MF II and TPS 67 in our country for TPS production. So, these two parental lines were used for their good combining ability for selfing to produce quality TPS.

2.4 Experimental design and treatment implementation

The experimental treatment comprised two factors i.e., Nitrogen Splitting (SN) and Boron levels (B) which are presented as follows.

i. Nitrogen Splitting (SN)

$\text{SN}_0$: 2 split (Conventional); $\text{SN}_1$: 3 split; $\text{SN}_2$: 4 split and $\text{SN}_3$: 5 split applications of N where 50 kg N ha$^{-1}$ applied as basal from total 300 kg N ha$^{-1}$ with each split and the rest 250 kg N ha$^{-1}$ was splitted as per treatment at 10 days intervals started from 30 DAP (days after planting).
ii. Boron (B)

$B_0$: 0 kg B ha$^{-1}$, $B_1$: 4 kg B ha$^{-1}$, $B_2$: 6 kg B ha$^{-1}$, $B_3$: 8 kg B ha$^{-1}$

Split-plot design was chosen for the experiments with three replications. Nitrogen splitting and boron levels were assigned to main and sub-plot, respectively $^{23}$. The size of the unit plot was 1.5 m $\times$ 1.0 m, where replication to replication and plot to plot distance was 1.0 and 1.0 m, respectively.

2.5 Crop husbandry

The experimental area was opened by power tiller at the last week of October 2013 and 2014. Fertilizer such as Urea, TSP, MoP, Gypsum, Borax, and ZnSO$_4$ was used as a source of N, P, K, S, B, and Zn, respectively. Fifty (50) kg of N and full amount of other fertilizers along with cow dung were applied as basal irrespective of treatments. The remaining quantity of N was applied at 10-day intervals as per treatment $^{24}$, started from just before blooming (30 days after planting). On 1 November 2013 and 2014, well-sprouted and uniform sized (60-70 g) seed tuber of the female parent was planted with a spacing of 0.5 m $\times$ 0.25 m in a plot of 1.5 m $\times$ 1.0 m size. The plants emerged from tuber were not ridged as followed in standard potato production. Male plants were planted in separate plot at least 7 days (on 25 October, 2013 and 2014) earlier than female plant to harmonize their flowering for pollination purposes. Two earthing up were done at 30 and 50 DAP, respectively. True Potato Seed (TPS) production needs more water than normal tuber production for supplying proper moisture for vigorous growth. Water was applied by using watering can as per requirement. To manage the female plant easily two stems hill$^{-1}$ were kept. To extend the photoperiod (9 to 14 hours) a 200 watt white florescent bulb was provided (Plate 1) from 25 DAP and continued till completion of harvesting of berries to give the light intensity in the range of 30,000 to 50,000 lux on the plant surface to induce profuse flowering and berry sets $^{25}$. To get the best quality TPS, flowers of primary and secondary inflorescence were considered. The female parent
was hand-pollinated (named as artificial pollination for TPS production) at morning (9.00 am-11.00 am) by using the collected pollen grains from male parent (Plate 2) for proper assurance of fertilization. Well ripened soft berries were used to collect the seed. The method of seed extraction was as same as the method described by Roy 24. Thereafter, the seeds were weighed.

2.6 Parameters studied

2.6.1 Number of TPS berry\(^{-1}\)

Collected berries were packed separately for each plot with subjective treatment and then extraction of true seeds was done properly and then seeds were counted against each berry of different sizes.

2.6.2 Yield of TPS kg\(^{-1}\) of berry (g)

One kg berry was packed separately for each plot and extraction of seed was done properly to weigh the total yield of TPS kg\(^{-1}\) berry in gram unit.

2.6.3 Total yield of TPS plant\(^{-1}\) (mg)

Five plants were randomly selected against each plot and the collected berries were packed separately for each plant. The extraction was done properly to weigh the TPS plant\(^{-1}\) and finally the means were taken in terms of milligram unit.

2.6.4 Total yield of TPS (kg ha\(^{-1}\))

The yield of true seed plant\(^{-1}\) was converted to plot\(^{-1}\) then finally converted to ha\(^{-1}\).

2.6.5 Weight of 100-TPS (mg)

Hundred numbers of TPS were taken against each treatment to weigh in terms of milligram unit by using electric balance.

2.6.4 Pearson correlation coefficient (r) was calculated among different yield traits of hybrid TPS by using MS Excel spreadsheet.
2.7 Statistical package used

Following the analysis of variance technique (ANOVA), the data obtained for different characters were statistically analyzed by using the F-test through Statistix 10 (2013) computer program and the treatment means were separated by Least Significant Difference (LSD) test at $p \leq 0.05$.23

3. Results and discussion

3.1 Number of TPS berry$^{-1}$ at different berry sizes

3.1.1 Effect of nitrogen splitting

A significant ($p \leq 0.01$) variation was noted among the different split application of N in case of number of TPS berry$^{-1}$ at different berry sizes (Figure 1-A). In case of TPS in small-sized berry, the maximum number was found from SN$_1$ (71.49) and thereafter decreased the seed number berry$^{-1}$ with the increasing rates of nitrogen splitting and the minimum number was found from SN$_3$ (52.74). In case of TPS in medium-sized berry, a gradual increasing trend was found in case of number of seed berry$^{-1}$ with the increasing of split application of N up to SN$_2$ treatment. The maximum number of TPS berry$^{-1}$ was found from SN$_2$ (226.25) followed by SN$_3$ (218.00) and the minimum from SN$_0$ (160.75). In case of TPS in large-sized berry, a gradual increasing trend was found in case of number of seed berry$^{-1}$ with the increasing of split application of N up to SN$_2$ treatment. The maximum number of TPS berry$^{-1}$ was found from SN$_2$ (280.25) followed by SN$_3$ (267.50) and the minimum from SN$_0$ (229.25). Different rates of food partitioning in different sized berry and higher portioning in larger sized berry may be reason of such differences found in TPS number berry$^{-1}$ of different sizes.
3.1.2 Effect of boron

In respect of number of TPS in small-sized berry, a non-significant effect was found due to different B levels (Figure 2-B). A significant (p≤0.05) variation was noted in case of TPS in medium-sized berry and an increasing trend was found on the number of seed berry$^{-1}$ with the increasing of boron (Figure 2-B). The maximum number (220.50) of TPS berry$^{-1}$ was found from B$_3$ which was statistically similar (207.50) to B$_2$ and the minimum (194.50) was in B$_0$. In case of TPS in large-sized berry, there was a significant (p≤0.01) variation was noted and a gradually increasing trend was found on the number of seed berry$^{-1}$ with the increasing of boron (Figure 2-B). The maximum number (279.50) of TPS berry$^{-1}$ was found from B$_3$ followed by B$_2$ (261.50) and the minimum (245.50) was in B$_0$.

3.1.3 Combined effect of nitrogen splitting and boron

Significant (p≤0.01 and p≤0.05) variation was found among different combinations of split application of N and B in respects of number of TPS berry$^{-1}$ at different berry sizes (Table 3). In case of number of TPS in small-sized berry, the maximum number (77.99) of TPS berry$^{-1}$ was found from SN$_1$B$_2$ which was statistically similar to SN$_1$B$_3$ (76.99), SN$_2$B$_0$ (72.99) and SN$_1$B$_1$ (68.99). The minimum number (50.00) was found from SN$_3$B$_2$. In case of TPS in medium-sized berry, the maximum number (249.00) of TPS berry$^{-1}$ was found from SN$_3$B$_3$ which was statistically similar to SN$_1$B$_2$ (243.00), SN$_2$B$_3$ (240.00), SN$_3$B$_3$ (238.00), SN$_3$B$_4$ (221.00) and SN$_3$B$_0$ (220.00). The minimum number of TPS (143.00) in medium sized berry was found SN$_0$B$_0$. In the case of TPS in large-sized berry, the maximum number (316.00) of TPS berry$^{-1}$ was found from SN$_3$B$_3$ which was statistically similar to SN$_2$B$_3$ (297.00) and SN$_2$B$_2$ (295.00). The minimum number of TPS (213.00) in large sized berry was found SN$_0$B$_0$. 
3.2 Yield of TPS kg\(^{-1}\) berry (g)

A profound (p≤0.01) variation was found in case of yield of TPS kg\(^{-1}\) berry (g) due to nitrogen splitting (Figure 2-A). The yield was increased with increasing of the splitting of N up to SN\(_2\) treatment and thereafter slightly decreased with the increasing of split application. The maximum TPS yield (23.49 g) was found from SN\(_2\) followed by SN\(_3\) (22.53 g) and the minimum (17.15 g) was in SN\(_0\). Significant (p≤0.01) variation was noted among boron doses in case of yield of TPS kg\(^{-1}\) berry (g) (Figure 2-B). The yield was increased with the increasing of B. The maximum TPS yield (24.07 g) was found from B\(_3\) followed by B\(_2\) (20.49 g), B\(_1\) (19.64 g) and the minimum (18.87 g) was in B\(_0\). Significant (p≤0.01) variation was found among different combinations of split application of N and B in respect of the yield of TPS kg\(^{-1}\) berry (g) (Table 3). The maximum yield (29.09 g) of TPS was found from SN\(_3\)B\(_3\) combination which was statistically similar to SN\(_2\)B\(_3\) (27.86) combination and the minimum (14.81) was in SN\(_0\)B\(_0\).

3.3 Total yield of TPS plant\(^{-1}\) (mg)

In aspect of total yield of TPS plant\(^{-1}\) (mg) a remarkable (p≤0.01) variation was noted among the different split application of N (Figure 3-A). A gradual decreasing trend was exhibited with the increasing of split doses of N from SN\(_1\) towards ahead of splitting number. The maximum TPS yield (1838.6 mg) was found from SN\(_1\) followed by SN\(_2\) (1594.9 mg) and the minimum (1340.0 mg) was in SN\(_0\). Profound (p≤0.05) variation was noted among different levels of boron application in respect of the total yield of TPS plant\(^{-1}\) (mg) (Figure 3-B). A gradual increasing trend was found with the increasing of boron doses. The maximum TPS yield (1648.3 mg) was found from B\(_3\) which was statistically similar to B\(_2\) (1549.4 mg), B\(_1\) (1524.6 mg) and the minimum (1456.6 mg) was in B\(_0\). Profound (p≤0.01) variation was noted among different combinations of split application of N and B in respect of the total yield of
TPS plant\(^{-1}\) (mg) (Table 3). The maximum yield (2160.1 mg) of TPS was found from SN\(_1\)B\(_3\) and the minimum yield (1001.8 mg) was in SN\(_0\)B\(_0\).

### 3.4 Total yield of TPS (kg ha\(^{-1}\))

Split application of N showed a significant (p≤0.01) difference on the total yield of TPS (kg ha\(^{-1}\)) (Figure 4-A). A gradual decreasing trend was found with the increasing split doses of N. The maximum TPS yield (147.09 kg ha\(^{-1}\)) was found from SN\(_1\) followed by SN\(_2\) (127.59 kg) and the minimum (107.20 kg ha\(^{-1}\)) was in SN\(_0\). Raj\(^{26}\) reported that the application of nitrogen (150 kg ha\(^{-1}\)) at 3-time or 4-time as splitting produced the highest grain yield of canola. The present result was in agreement with this report. A remarkable (p≤0.05) variation was noted among boron levels in respect of the total yield of TPS (kg ha\(^{-1}\)) (Figure 4-B). A gradual increasing trend was found with the increasing boron levels. The maximum TPS yield (131.87 kg) was found from B\(_3\) which was statistically similar to B\(_2\) (123.95 kg), B\(_1\) (121.97 kg) and the minimum (116.53 kg) was in B\(_0\). Dordas\(^{27}\) reported that boron is highly required for seed production than forage production in alfalfa which supported the result of present study. Significant (p≤0.01) variation was found among different combinations of split application of N and boron in respects of the total yield of TPS (kg ha\(^{-1}\)) (Table 3). The maximum yield (172.81 kg) of TPS was found from SN\(_1\)B\(_3\) and the minimum (80.14 kg) was in SN\(_0\)B\(_0\).

### 3.5 Weight of 100-TPS (mg)

Weight of 100-TPS (mg) was significantly (p≤0.01) influenced by different N splitting doses (Figure 5-A). A gradual increasing trend was found with the increasing split doses of N up to SN\(_3\). The maximum TPS weight (80.38 mg) was found from SN\(_3\) followed by SN\(_2\) (79.26 mg) and the minimum (68.45 mg) was in SN\(_0\). Singh\(^{28}\) mentioned that seeds those are weightier than 75 mg of 100-TPS showed good quality for raising seedling tuber from TPS. The present
study advocated that the weight of 100-TPS was increased with the increase of nitrogen splitting levels. Such result happened probably due to the fact that delay in senescence caused by split nitrogen of application which allowed enough time for berries to receive photosynthates until the last stage of development 3. So, nitrogen should be applied at SN2 and SN3 which partially supported the present findings. Significant (p≤0.01) variation was noted among boron doses in respect of the weight of 100-TPS (mg) (Figure 5-B). The weight was increased with the increasing of boron level. The maximum TPS weight (80.72 mg) was found from B3 which was statistically similar to B2 (77.16 mg) and the minimum (70.98 mg) was in B0. Active partitioning of photosynthates and greater accumulation of food reserves in seed resulted higher 1000-seed weight from boron application 29. Foliar application of B could increase the seed weight (100-grain weight) than those without B on treatment given water in soybean 30. Profound (p≤0.05) variation was noted among different combinations of split application of N and boron in respects of the weight of 100-TPS (mg) from potato mother plant (Table 3). The maximum weight of 100-TPS (86.87 mg) was found from SN3B3 which was statistically similar to SN2B3 (84.24 mg), SN2B2 (82.04 mg), SN3B1 (79.94 mg) and SN3B0 (78.16 mg); whereas, the minimum (53.36 mg) was in SN0B0.

3.6 Pearson correlation coefficient (r)
Correlation analysis showed a significant positive relationship among 100-TPS weight, number of TPS berry⁻¹ of larger size and total yield of TPS (kg ha⁻¹). A positive relation (r=0.83 and R²= 0.69) was found between 100-TPS weight (mg) and the number of TPS berry⁻¹ of larger size (Figure 6-A). That may be due to higher partitioning of nitrogen in berry through the split application. A strong linear relation (r=0.88 and R²= 0.68) was found between the total yield of TPS (kg ha⁻¹) and the number of TPS berry⁻¹ of larger size (Figure 6-B).
4. Concluding remarks

It may be concluded that nitrogen splitting and boron exhibited the significant performances on most the traits studied under present experiments. The maximum yield of TPS plant\(^{-1}\) was found from SN\(_1\)B\(_3\) (2160.1 mg) and the minimum yield was found from SN\(_0\)B\(_0\) (1001.8 mg). The maximum yield of TPS ha\(^{-1}\) was found from SN\(_1\)B\(_3\) (172.81 kg) and the minimum yield was found from SN\(_0\)B\(_0\) (80.14 kg). But, the weight of 100-TPS was found maximum from SN\(_3\)B\(_3\) (86.87 mg); whereas, the SN\(_0\)B\(_0\) showed the minimum weight. In conclusion, the combination of SN\(_1\)B\(_3\) (3 split applications of N and 8 kg B ha\(^{-1}\)) is best for producing high amount of hybrid TPS from the potato mother plant.

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Table 1. Analytical data of soil before planting of mother tuber and after harvest of final berry (Mean data from two-year experiments)

| Nitrogen splitting × Boron | Before planting | After harvest |
|---------------------------|-----------------|--------------|
|                           | Total Nitrogen (%) | Total Boron (µg/g soil) | pH Level | Total Nitrogen (%) | Total Boron (µg/g soil) | pH Level |
|                           | (Critical Level: 0.05-0.2) | (Critical Level: 0.5-1.0 µg/g) |          |                     |                     |          |
| SN₀B₀                    | 0.052            | 0.193         | 5.57     | 0.035              | 0.177             | 5.55     |
| SN₀B₁                    | 0.051            | 0.188         | 5.56     | 0.036              | 0.195             | 5.54     |
| SN₀B₂                    | 0.050            | 0.185         | 5.57     | 0.035              | 0.189             | 5.53     |
| SN₀B₃                    | 0.051            | 0.184         | 5.55     | 0.034              | 0.186             | 5.51     |
| SN₁B₀                    | 0.053            | 0.190         | 5.56     | 0.049              | 0.183             | 5.52     |
| SN₁B₁                    | 0.054            | 0.185         | 5.55     | 0.051              | 0.188             | 5.51     |
| SN₁B₂                    | 0.052            | 0.191         | 5.58     | 0.053              | 0.209             | 5.54     |
| SN₁B₃                    | 0.051            | 0.194         | 5.57     | 0.056              | 0.245             | 5.52     |
| SN₂B₀                    | 0.052            | 0.183         | 5.60     | 0.059              | 0.176             | 5.55     |
| SN₂B₁  | 0.055 | 0.189 | 5.69 | 0.058 | 0.285 | 5.61 |
|-------|-------|-------|------|-------|-------|------|
| SN₂B₂  | 0.052 | 0.187 | 5.70 | 0.063 | 0.341 | 5.64 |
| SN₂B₃  | 0.054 | 0.195 | 5.75 | 0.062 | 0.343 | 5.70 |
| SN₃B₀  | 0.054 | 0.186 | 5.75 | 0.061 | 0.289 | 5.71 |
| SN₃B₁  | 0.053 | 0.187 | 5.72 | 0.060 | 0.331 | 5.66 |
| SN₃B₂  | 0.054 | 0.183 | 5.75 | 0.061 | 0.339 | 5.71 |
| SN₃B₃  | 0.055 | 0.191 | 5.73 | 0.064 | 0.345 | 5.70 |

Source: Soil Resource Development Institute, Dhaka-1207
### Table 2. Weather data on temperature, relative humidity and total rainfall

| Year         | Month   | Temperature (°C) | Relative Humidity (%) | Total Rainfall (mm) |
|--------------|---------|------------------|-----------------------|---------------------|
|              |         | Maximum          | Minimum               |                     |
| 2013-2014    | October | 30.18            | 14.85                 | 67.82               | 1.40                |
|              | November| 28.13            | 6.88                  | 58.18               | 0.52                |
|              | December| 25.36            | 5.21                  | 54.30               | 0.21                |
|              | January | 28.10            | 11.05                 | 69.48               | 8.00                |
|              | February| 28.00            | 12.09                 | 79.13               | 32.00               |
|              | March   | 34.12            | 17.05                 | 70.07               | 61.00               |
|              | April   | 36.37            | 18.03                 | 73.31               | 65.11               |
| 2014-2015    | October | 32.11            | 13.31                 | 65.21               | 1.29                |
|              | November| 28.56            | 12.28                 | 62.09               | 3.51                |
|              | December| 25.02            | 9.82                  | 55.84               | 5.09                |
|              | January | 23.81            | 11.02                 | 50.03               | 1.10                |
|              | February| 26.08            | 14.55                 | 44.59               | 14.98               |
|              | March   | 29.58            | 17.29                 | 46.19               | 44.96               |
|              | April   | 36.71            | 28.21                 | 59.89               | 105.32              |

Source: Meteorological Station of Sher-e-Bangla Agricultural University, Dhaka-1207
Table 3. Combined effect of nitrogen splitting and boron on number of TPS berry\(^{-1}\) at different berry sizes, yield and yield contributing traits in potato mother plant (Mean data from two-year experiments)

| Nitrogen Splitting × Boron | Number of TPS berry\(^{-1}\) at different berry sizes | Yield of TPS kg\(^{-1}\) berry (g) | Total yield of TPS plant\(^{-1}\) (mg) | Total yield of TPS (kg ha\(^{-1}\)) | Wt. of 100-TPS (mg) |
|---------------------------|-----------------------------------------------------|-----------------------------------|--------------------------------------|--------------------------------------|---------------------|
|                           | Small (<5 g)                                         | Medium (5-10 g)                   | Large (>10 g)                        |                                      |                     |
| SN\(_0\)B\(_0\)           | 40.00 h                                              | 143.00 i                          | 213.00 g                            | 14.81 f                              | 1001.80 g           | 80.14 g             | 53.36 e             |
| SN\(_0\)B\(_1\)           | 53.99 d-g                                            | 155.00 hi                         | 229.00 fg                           | 17.08 ef                             | 1324.30 f            | 105.94 f            | 71.66 d             |
| SN\(_0\)B\(_2\)           | 58.99 d-f                                            | 167.00 g-i                        | 235.00 e-g                          | 18.16 d-f                            | 1473.70 d-f          | 117.90 d-f          | 74.04 cd            |
| SN\(_0\)B\(_3\)           | 62.99 cd                                             | 178.00 f-i                        | 240.00 d-g                          | 18.56 c-e                            | 1560.20 c-f          | 124.82 c-f          | 74.75 cd            |
| SN\(_1\)B\(_0\)           | 61.99 c-e                                            | 193.00 d-g                        | 245.00 c-f                          | 19.03 c-e                            | 1630.20 b-e          | 130.42 b-e          | 75.18 cd            |
| SN\(_1\)B\(_1\)           | 68.97 a-c                                            | 201.00 d-f                        | 251.00 c-f                          | 19.77 c-e                            | 1680.20 b-d          | 134.42 b-d          | 76.07 b-d           |
| SN\(_1\)B\(_2\)           | 77.99 a                                              | 243.00 ab                         | 268.00 c                            | 20.01 cd                             | 1883.80 b            | 150.70 b            | 75.98 b-d           |
| SN\(_1\)B\(_3\)           | 76.99 a                                              | 215.00 b-e                        | 265.00 cd                           | 20.77 cd                             | 2160.10 a            | 172.81 a            | 77.01 b-d           |
| SN\(_2\)B\(_0\)           | 72.99 ab                                             | 222.00 a-d                        | 270.00 bc                           | 21.08 bc                             | 1733.50 bc           | 138.68 bc           | 77.22 b-d           |
|          | SN₂B₁  | SN₂B₂  | SN₂B₃  | SN₃B₀  | SN₃B₁  | SN₃B₂  | SN₃B₃  | CV (%) | LSD (0.05) | F test |
|----------|--------|--------|--------|--------|--------|--------|--------|--------|------------|--------|
|          |        | 67.99 bc | 55.00 d-g | 55.99 d-g | 53.99 e-g | 55.00 e-g | 50.00 g | 51.99 fg | 9.13       | **     |
|          | 205.00 c-f | 238.00 a-c | 240.00 a-c | 220.00 a-e | 221.00 a-d | 182.00 e-h | 249.00 a | 249.00 a | 11.09       | *      |
|          | 259.00 c-e | 295.00 ab | 297.00 ab | 254.00 c-f | 252.00 c-f | 248.00 c-f | 316.00 a | 316.00 a | 6.78        | *      |
|          | 20.88 b-d | 24.14 b  | 27.86 a  | 20.56 cd  | 20.84 cd  | 19.65 c-e | 29.08 a  | 29.08 a  | 9.61        | **     |
|          | 1660.90 b-d | 1501.50 c-f | 1483.80 c-f | 1460.80 d-f | 1433.20 ef | 1338.50 f | 1389.10 f | 1389.10 f | 9.93        | **     |
|          | 132.87 b-d | 120.12 c-f | 118.70 c-f | 116.87 d-f | 114.66 ef | 107.08 f  | 111.13 f | 111.13 f | 9.93        | **     |
|          | 73.54 cd | 82.04 a-c | 84.24 ab | 78.16 a-d | 79.94 a-d | 76.56 b-d | 86.87 a | 86.87 a | 7.82        | *      |

Means followed by different letters in the same column differ significantly according to LSD test

*, ** indicate F test significant at P≤0.05 and P≤0.01, respectively

Note: SN₀ = 2 split dose (conventional), SN₁ = 3 split dose, SN₂ = 4 split dose, SN₃ = 5 split dose

B₀ = 0 kg B ha⁻¹, B₁ = 4 kg B ha⁻¹, B₂ = 6 kg B ha⁻¹, B₃ = 8 kg B ha⁻¹