Original Research Article

Exploring the Interplay of Sweet Pepper Varieties and Seedling Growing Techniques on Crop Productivity

ABSTRACT

This study, conducted at the "Horticulture Farm" of Sher-e-Bangla Agricultural University in Dhaka, Bangladesh, from October 2021 to April 2022, aimed to investigate the impact of seedling growing techniques on the growth and yield of sweet pepper, considering different varieties. The experiment featured two main factors: Factor A, focusing on seedling growing techniques (T_1 = Open field, T_2 = Net house, and T_3 = Poly tunnel), and Factor B, concerning pepper varieties (V_1 = BARI Mistimorich 1, V_2 = BARI Mistimorich 2, and V_3 = California wonder). The experimental design employed was a Randomized Complete Block Design (RCBD) with three replications. Data analysis revealed significant variations in most of the studied characteristics related to sweet pepper growth and yield. The results underscored that both seedling growing techniques and pepper varieties had substantial influences on sweet pepper growth and yield. Regarding seedling growing techniques, the highest sweet pepper yield (50.83 t/ha) was observed in the Net house (T_2) treatment, while the lowest yield (21.46 t/ha) was recorded in the Open field (T_1) treatment. In terms of different varieties, the highest yield (45.00 t/ha) was obtained from BARI Mistimorich 2 (V_2) treatment, whereas the lowest yield (30.42 t/ha) was associated with the California wonder (V_3) treatment. The most promising results emerged from the combination of treatments, with the highest fruit yield (58.75 t/ha) achieved in the Net house + BARI Mistimorich 2 (T_2V_2) treatment combination. Conversely, the lowest fruit yield (15.63 t/ha) was observed in the Open field + California wonder (T_1V_3) treatment combination. Overall, this study demonstrates that the T_2V_2 treatment combination stands out as the most effective approach for achieving superior sweet pepper growth and fruit yield.

Keywords: sweet pepper, poly tunnel, net house.

I. INTRODUCTION

Sweet pepper (*Capsicum annuum* L.) is one of the most important vegetable crops grown extensively throughout the world especially in the temperate countries. It is belonging to the family solanaceae under the genus Capsicum. The Capsicum, are native to Tropical South America. Especially Brazil is thought to be the original home of peppers [1]. It is cultivated in most parts of the world especially in temperate regions of Central and South America, European countries, tropical and subtropical regions of Asian continent mainly India and China [2]. The plants are shrubby perennials, although usually grown as herbaceous annuals in tropic, sub-tropic and temperate regions [3].

One medium green bell pepper can provide up to 8% of the recommended daily allowance of Vitamin A, 180% of Vitamin C, 2% of calcium and 2% of iron [4]. Sweet pepper is famous for its pleasant aromatic flavor, pungency and high coloring substance. It is used very widely in culinary, pharmaceutical and beverage industries [5]. It is generally rich sources of antioxidants and vitamin C [6].

The optimum temperature requirement for sweet pepper growth ranged from 16-25°C. High night temperature is more detrimental to fruit set than day temperature [7]. Again, night temperature below 16°C and day temperature above 32°C also causes blossom dropping [8].

Variety is one of the important factors for the increased production of sweet pepper. Many researchers reported that different varieties of crop have different effect for reducing higher rate of flower/fruit dropping and improving fruit setting condition as well as marketable yield of sweet pepper. Different varieties respond differentially to cultivation practices and the prevailing environment condition during the growing season. Protected Cultivation practices are crop growing technique to maximize the plant yield by controlling the micro environment around the plant either partially or fully during the time period of plant growth. There is a great potential for getting higher yield from crops grown in poly tunnels compared to the open-field cultivation [9].

This research will help the farmers to produce quality fruits of capsicum which will increase production as well as will help to ensure income benefit of the farmers. The purpose of this study is to observe actual seedling growing technique on growth and yield of sweet pepper and to identify suitable variety on growth and yield of sweet pepper. It also helps to examine combined effect of seedling growing techniques and varieties on growth and yield of sweet pepper.

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II. MATERIAL AND METHODS

1. Description of the site

The experiment was conducted at the Horticulture Farm, Sher-e-Bangla Agricultural University, Dhaka-1207. The location of the experimental site is situated in 23°74' N latitude and 90°35' E longitude [10]. The experimental field belongs to the Agro-ecological zone of AEZ-28 under Modhupur Tract. The experimental site was under the subtropical climate, characterized by three distinct seasons, winter season from November to February and the pre-monsoon or hot season from March to April and the monsoon period from May to October [11]. Site of study has cold winter and hot summer. The yearly average precipitation (30- years long term period) which is mostly occurred during the monsoon months is 490 mm. The mean annual average maximum and minimum temperature was 28 and 19°C respectively.

3. Statistical Analysis

The data obtained from different parameters were statistically analyzed using statistics-10 software. The mean values of all the characters were evaluated and analysis of variance was performing by the 'F' test. The significance of the difference among the treatments means was estimated by Duncan's Multiple Range Test (DMRT) at 5% level of probability.

4. Field preparation and Treatment allocation

The plot selected for the experiment was opened with a power tiller in the middle of November 2021 and left exposed to the sun for 10 days. To achieve good tilth, the land was harrowed, ploughed, and cross-ploughed several times, followed by laddering. The experiment was laid out in a Randomized Complete Block Design (RCBD) having double factor with three replications. The experiment comprised as two factors. Factor A: Seedling growing technique (viz. T_1 =Open field, T_2 =Net house and T_3 =Poly tunnel) and Factor B: Variety (Viz. V_1- BARI Mistimorich 1, V_2- BARI Mistimorich 2 and V_3- California wonder). Each block was divided into 9 plots where 9 treatments combination were distributed randomly and 27-unit plots altogether in the experiment. The size of each plot was 1.2 m × 1.2 m. The distance maintained between two blocks were 0.40 m and two plots were 0.40 m. The plots were raised up to 10 cm.

Comment [L1]: Please add the seedling breeding time and transplant time

5. Planting Materials

The seeds of variety BARI Mistimorich 2 were collected from Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur and BARI Mistimorich 1, California wonder were collected from Siddik Bazar, Gulistan, Dhaka.

6. Manuring and Fertilization

Half of the quantity of cowdung was applied during final land preparation. The remaining half of cowdung, the entire amount of TSP, gypsum and one third of urea and MoP were applied during pit preparation. Urea and MoP were applied in two equal instalments at before flowering and fruit setting.

Table 1. The following doses of organic and inorganic fertilizers were applied in the experimental plots

Manure and Fertilizer	Dose /ha
Cowdung	10 ton
Urea	250 kg
Triple super phosphate (TSP)	350 Kg
Muriate of Potash (MoP)	250 Kg
Gypsum	110 Kg
Zinc Sulphate	5 ton

Comment [L2]: 5 ton zinc sulphate is too much , it is maybe 5kg is enough if possible.

III. RESULT AND DISCUSSIONS

1. Effect of seedling growing technique

Significant differences were observed in the different parameters of plant due to different seedling growing techniques. At 120 DAT, the tallest plant was found 87.91 cm from T_2 (net house) treatment and the shortest plant was revealed 72.40 cm from T_1 (open field) treatment. The maximum number flowers per plant (29.59), fruits per plant (11.94) (Fig. 1.), individual weight of fruit per plant (101.44 g), yield per plant (0.81 kg), yield per plot (5.65 kg) and yield per hectare (50.83 t) were obtained from T_2 (Net house) treatment and maximum number of branches (6.27), fruit setting (48.44 %), and SPAD value (76.60 %) were obtained from T_3 (Poly tunnel)treatment. But, minimum days to 1st flowering

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(31.49 DAT), days to 50% flowering (61.94 DAT) and days to 1st harvest (85.73 DAT) were obtained from T_3 (Poly tunnel) treatment. The treatment T_3 (Poly tunnel) recorded the maximum number of branches per plant (6.27), and minimum days required for first flower bud initiation (61.67 days) (Table 2 and 3).

This outcome aligns with research by [19], who found that controlled environments, such as net houses and poly tunnels, provide better growth conditions and can lead to taller plants due to protection from adverse weather and pests.Different seedling growing techniques showed different plant height. [12] revealed that the tallest plant of sweet pepper was observed when grown under tunnel cover with polythene and nylon net while it was the lowest under open field condition. [13] reported that number of leaves/plants were recorded higher under shade net house as compared to open field condition because of improved photosynthesis and respiration rate due to the favourable climatic conditions in the shade net house. [14], [15] also found the same result.

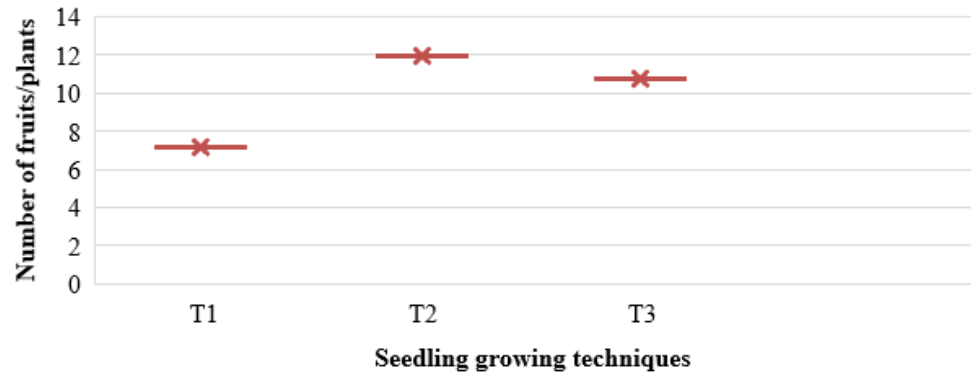

Fig. 1.Effect of seedling growing techniques on number of fruits/plants. Here, T_1 = Open field, T_2= Net house and T_3 = Poly tunnel

2. Effect of variety

Different varieties significantly influence the growth, yield contributing characters and yield of sweet pepper. Data revealed that in case of varieties, at 120 DAT, the tallest plant (85.11 cm), maximum fruit setting (43.08 %) were observed from V_1 (BARI Mistimorich 1), maximum number of branches (5.75), flowers per plant (26.72), fruits per plant (11.26) (Fig. 2.), SPAD value (73.20 %),individual weight of fruit per plant (100.21 g), yield per plant (0.72 kg), yield per plot (5.00 kg) and yield per hectare (45.00 t) were obtained from V_2 (BARI Mistimorich 2). But, minimum days to 1st flowering (32.54 DAT) was obtained from V_1 (BARI Mistimorich 1) and days to 50% flowering (63.04 DAT) and days to 1st harvest (85.70 DAT) were obtained from V_2 (BARI Mistimorich 2). (Table 2 and 3).Different varieties produced different plant height on the basis of their varietal characters and crop variety is one of the most important factors. [16], [17] opined that plant height is a desirable character which contributes to the increment of plant canopy and biomass. [16] opined that the variations in leaf number among varieties may be due to the genetic makeup of the varieties. [18], [19], [20] also found the same result.This is in line with numerous studies highlighting the positive impact of controlled environments on pepper yields [22].

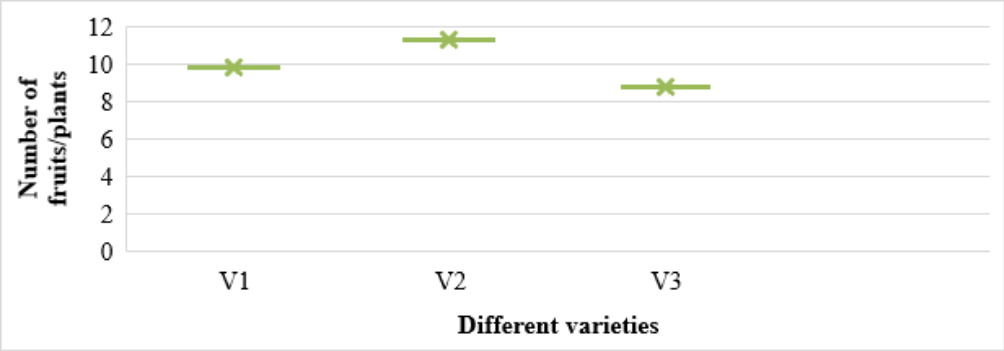

Fig. 2.Effect of different varieties on number of fruits/plants of sweet pepper. Here, V_1 = BARI Mistimorich 1, V_2 = BARI Mistimorich 2 and V_3 = California wonder

3. Combined effects of seedling growing techniques and varieties of sweet pepper

Combined effect of different seedling growing techniques and different varieties significantly influenced by the growth, yield contributing characters and yield of sweet pepper. Data revealed that, at 120 DAT, the tallest plant (93.13 cm) was observed from the treatment combination of T_2V_1 (Net house + BARI Mistimorich 1), maximum number of branches (7.69) and SPAD value (80.40 %) were observed from the treatment combination of T_3V_2 (Poly tunnel + BARI Mistimorich 2), maximum number of flowers per plant (30.67), fruits per plant (13.50), individual weight of fruit per plant (104.80 g), yield per plant (0.94 kg), yield per plot (6.53 kg) and yield per hectare (58.75 t) were obtained from the treatment combination T_2V_2 (Net house + BARI Mistimorich 2) and maximum fruit setting (54.00 %) and fruit diameter (8.70) was obtained from the treatment combination T_3V_1 (Poly tunnel + BARI Mistimorich 1). But minimum days to 1st flowering (30.07 DAT) was obtained from the treatment combination of T_3V_1 (Poly tunnel + BARI Mistimorich 1) and days to 50% flowering (59.73 DAT) and days to 1st harvest (83.20 DAT) were obtained from the treatment combination of T_3V_2 (Poly tunnel + BARI Mistimorich 2) (Table 2 and 3). [12] reported that number of fruits per plant was 5.57 observed in BARI Mistimorich 1 grown in open field condition and 15.67 for california wonder grown in course net protection system.

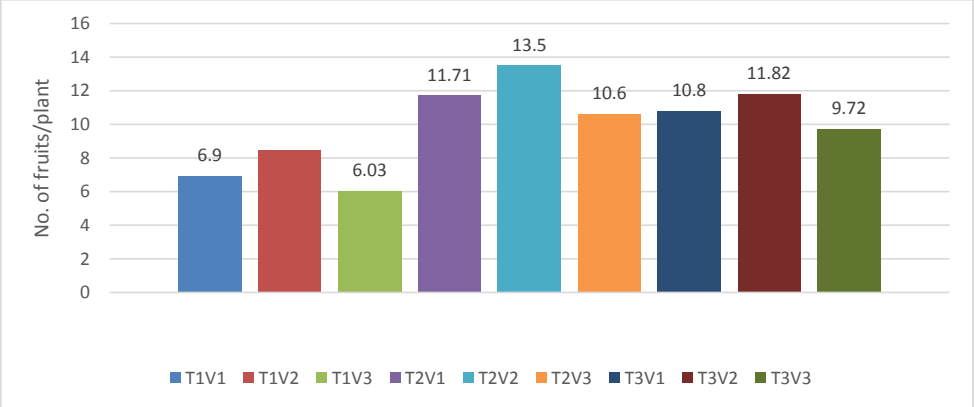

Fig. 23. Effect of different varieties and seedling growing techniques on number of fruits/plants of sweet pepper. Here, T_1 = Open field, T_2 = Net house and T_3 = Poly tunnel, V_1 = BARI Mistimorich 1, V_2 = BARI Mistimorich 2 and V_3 = California wonder

Table 2. Effects of seedling growing techniques on plant height, number of branches/plants, days to 1st flowering (DAT), days to 50% flowering (DAT), number of flower/plantsof Sweet pepper

Treatments	Plant height (cm)				Number of Branches	Days to 1st flowering (DAT)	Days to 50% Flowering (DAT)	No. of Flower/Plant
	30 DAT	60 DAT	90 DAT	120 DAT				
Technique								
S_1	12.69 c	27.87 c	46.53 c	72.40 c	3.66 c	35.67 a	66.80 a	22.566 b
S_2	13.99 a	33.51 a	55.30 a	87.91 a	5.02 b	34.96 b	64.17 b	29.59a
S_3	13.58 b	31.06 b	51.68 b	83.69 b	6.27 a	31.49 c	61.94 c	22.046 c
LSD (0.05)	0.3456	1.0392	0.5174	2.1521	0.2975	0.5386	0.8341	0.4236
CV%	4.05	6.25	5.83	3.69	4.65	6.25	4.25	5.28
Variety								
V_1	14.94 a	33.02 a	53.17 a	85.11 a	4.38 c	32.54 c	64.47 b	24.302 b
V_2	13.77 b	30.72 b	50.51 b	80.76 b	5.75 a	33.62 b	63.04 c	26.724a
V_3	11.55 c	28.69 c	49.83 c	78.13 c	4.82 b	35.97 a	65.40 a	23.176 c
LSD (0.05)	0.3456	1.0392	0.5174	2.1521	0.2975	0.5386	0.8341	0.4236
CV%	4.05	6.25	5.83	3.69	4.65	6.25	4.25	5.28
Combinations								
S_1V_1	14.50 bc	30.70 de	49.70 f	75.70 e	3.33 g	33.52 de	66.10 ab	22.1 d
S_1V_2	12.50 d	27.30 fg	45.23 g	71.70 f	3.96 f	35.30 c	66.80 a	24.77 c
S_1V_3	11.07 f	25.60 g	44.67 g	69.80 f	3.70 fg	38.20 a	67.50 a	20.828 e
S_2V_1	16.33 a	35.67 a	57.47 a	93.13 a	4.62 e	34.02 de	64.80 bc	29.4 b
S_2V_2	14.00 c	33.47 b	55.10 b	89.50 ab	5.59 bc	34.25 d	62.60 d	30.67a
S_2V_3	11.63 ef	31.40 cd	53.33 c	81.10 d	4.86 de	36.60 b	65.10 b	28.7 b
S_3V_1	14.00 c	32.70 bc	52.33 d	86.50 bc	5.21 cd	30.07 g	62.50 d	21.406 de
S_3V_2	14.80 b	31.40 cd	51.20 e	81.07 d	7.69 a	31.30 f	59.73 e	24.733 c
S_3V_3	11.93 de	29.07 ef	51.50 de	83.50 cd	5.91 b	33.10 e	63.60 cd	20 f
LSD (0.05)	0.5987	1.8000	0.8962	3.7275	0.5153	0.9329	1.4447	0.7337
CV%	4.05	6.25	5.83	3.69	4.65	6.25	4.25	5.28

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability.
Here, T_1 = Open field, T_2 = Net house and T_3 = Poly tunnel, V_1 = BARI Mistimorich 1, V_2 = BARI Mistimorich 2 and V_3 = California wonder

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Table 3. Effects of seedling growing techniques fruit setting (%), days to first harvest (DAT), chlorophyll content, individual fruit weight (gm), yield/plant (kg), yield/plot (kg) and yield/hectare (ton) of Sweet pepper

Treatments	Fruit Setting (%)	Days to 1st Harvest (DAT)	Chlorophyll Content	Individual Fruit Weight (gm)	Yield/Plant (Kg)	Yield/Plot (Kg)	Yield/ha (ton)
Technique							
S_1	31.86 c	91.50 a	62.07 c	89.77 c	0.34 c	2.38 c	21.46 c
S_2	40.26 b	88.57 b	68.10 b	101.44 a	0.81 a	5.65 a	50.83 a
S_3	48.44 a	85.73 c	76.60 a	97.11 b	0.62 b	4.31 b	38.75 b
LSD (0.05)	0.5105	1.327	1.5132	0.6274	0.0185	0.1288	1.1592
CV%	4.02	6.24	7.84	4.85	5.24	5.24	5.24
Variety							
V_1	43.08 a	89.13 b	68.67 b	96.40 b	0.57 b	3.95 b	35.63 b
V_2	40.18 b	85.70 c	73.20 a	100.21 a	0.72 a	5.00 a	45.00 a
V_3	37.29 c	90.97 a	64.90 c	91.70 c	0.49 c	3.38 c	30.42 c
LSD (0.05)	0.5105	1.327	1.5132	0.6274	0.0185	0.1288	1.1592
CV%	4.02	6.24	7.84	4.85	5.24	5.24	5.24
Combinations							
S_1V_1	31.22 g	91.50 b	61.40 ef	91.80 f	0.32 f	2.22 f	20.00 f
S_1V_2	34.19 f	87.30 de	65.90 d	96.90 d	0.46 e	3.19 e	28.75 e
S_1V_3	30.17 h	95.70 a	58.90 f	80.60 g	0.25 g	1.74 g	15.63 g
S_2V_1	44.02 c	89.20 cd	67.80 d	100.71 b	0.78 b	5.42 b	48.75 b
S_2V_2	39.83 d	86.60 e	73.30 c	104.80 a	0.94 a	6.53 a	58.75 a
S_2V_3	36.93 e	89.90 bc	63.20 e	98.80 c	0.72 c	5.00 c	45.00 c
S_3V_1	54.00 a	86.70 e	76.80 b	96.70 de	0.61 d	4.24 d	38.13 d
S_3V_2	46.53 b	83.20 f	80.40 a	98.93 c	0.76 b	5.28 b	47.50 b
S_3V_3	44.79 c	87.30 de	72.60 c	95.70 e	0.49 e	3.40 e	30.63 e
LSD (0.05)	0.8843	2.2993	2.6209	1.0867	0.0321	0.2231	2.0078
CV%	4.02	6.24	7.84	4.85	5.24	5.24	5.24

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability.
Here, T_1 = Open field, T_2 = Net house and T_3 = Poly tunnel, V_1 = BARI Mistimorich 1, V_2 = BARI Mistimorich 2 and V_3 = California wonder

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IV. CONCLUSION

- In summary, the results indicate that both seedling growing techniques and the choice of sweet pepper varieties significantly influence growth and yield parameters. Controlled environments such as poly tunnels and net houses tend to enhance various aspects of pepper growth and yield. Additionally, the selection of appropriate pepper varieties plays a crucial role in determining fruit setting, yield, and fruit quality. On the basis of present study, it is concluded that the combination of seedling growing technique T_2 (Net house) along with variety V_2 (BARI Mistimorich 2) were given the better performance of all the yield contributing parameters, yield (58.75 t/ha) and quality of sweet pepper than the other treatment combinations.
- In the consideration productivity, the treatment combination T_2V_2 (Net house + BARI Mistimorich 2) was more than the other treatment combinations. So, it can be concluded that farmers will be benefitted by using Net house along with BARI Mistimorich 2 variety in sweet pepper production. But it can be repeated in different agro-ecological zones of Bangladesh for better yield**.**

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