***Original Research Article***

**Impact of Different Growing Media and Stem Cutting on the Growth and Yield of Bindu Lau (*Lagenaria siceraria L*)**

**ABSTRACT**

The cultivated variant Bindu Lau is a hybrid variety of (*Lagenaria siceraria L*) is also known by the names white flowered gourd, calabash gourd, birdhouse gourd, and bottle gourd. To improve the output of bottle gourd, the method of stem cutting and growing media has been used in bottle gourd farming. This study evaluated the influence of growing media and stem-cutting techniques on the growth, yield, and economic viability of Bindu Lau (*Lagenaria siceraria* L.). A study was conducted at Sher-e-Bangla Agricultural University’s Horticultural Farm, Dhaka, during the rabi season. A Randomized Complete Block Design (RCBD) with three replications tested two factors: Factor A (growing media: M1 [Soil:FYM: Sand], M2 [Soil:Vermicompost: Sand], M3 [Soil: Kitchen Compost: Sand]) and Factor B (stem cuttings: P0 [control], P1 [pruning up to 90cm + top cutting], P2 [pruning up to 120cm + top cutting]). Statistical analysis of the collected data was conducted using Statistics-10 software. Mean values for all parameters were calculated, and analysis of variance (ANOVA) was performed using the ‘F’ test. Treatment means were compared using Duncan’s Multiple Range Test (DMRT) at a 5% significance level. Among nine treatment combinations, M2 (vermicompost-based media) outperformed others, yielding 48.55 female flowers, 11.74 harvested branches, 40.44 fruits/plant, and 33.07 t/ha. P2 (120cm pruning + top cutting) maximised productivity with 50.22 female flowers, 42.22 fruits/plant, and 35.36 t/ha. The synergistic M2P2 combination achieved peak performance: 52.67 female flowers, 44.33 fruits/plant, and 37.17 t/ha yield, alongside the highest net income (737,382 Tk) and benefit-cost ratio (BCR: 2.28). Conversely, M1P0 (control) recorded the lowest outputs. Findings conclusively recommend M2P2 as the optimal strategy for enhancing Bindu Lau's yield, growth, and profitability.

**Keywords**: Bindu Lau, *Lagenaria siceraria L*, Bangladesh, Bottle Gourd, Horticulture

**INTRODUCTION**

Bindu Lau is a hybrid variety of *(Lagenaria siceraria* *L*), also referred to as the bottle gourd, which is among the most important vegetables cultivated globally. It belongs to the family Cucurbitaceae, and is an important and popular vegetable in Bangladesh (Uddin et al.,2014). It is a part of the family Cucurbitaceae and is indigenous to wild species in southern Africa. The cultivated variant is also known by the names white flowered gourd, calabash gourd, birdhouse gourd, and bottle gourd. It is commonly referred to as lau in Bangladesh. It is cultivated throughout the tropics and subtropics of the world. Bottle gourd is one of the most popular and important vegetable crops cultivated in Bangladesh during the winter and summer seasons, which is also one of the most widely eaten vegetables. In 2021–2022, 284000 tons of bottle gourds were produced in Bangladesh (BBS, Statistical Year Book Bangladesh 2022).

Producing high-quality horticulture crops relies on using the right growing media. In order to ensure that seedlings have access to sufficient nutrients, the suggested media is often used as a foundational medium supplement to existing soil. Various properties are beneficial for human health, which have been attributed to *L. siceraria*, such as antioxidant, hypolipidemic, diuretic, laxative, hepatoprotective, analgesic, antihypertensive, cardioprotective, central nervous system stimulant, anthelmintic, free radical scavenging, immunosuppressive, and adaptogenic (Saeed et al.,2022). The goal is to increase the media's porosity by the addition of organic matter, such as vermicompost and farm yard manure. The huge volume of agriculture and homestead waste is produced annually in Bangladesh, and through recycling, it can become an organic source for agriculture. This waste can be effectively used to prepare growing media for horticultural plants.

Farm Yard Manure (FYM) is a significant fertiliser source that aids in the accumulation of organic matter in soil. It is a composite of agricultural byproducts, including animal and plant waste, which is created via the process of decomposition. FYM stimulate subsurface biomass of microbes and transfers chemicals and nutrients gradually (Belay *et al*, 2001; Ayuso *et al*, 1996). FYM is known to improve the soil physical environment. With regular use of FYM, soil erosion is minimized and water retention characteristics are improved (Amitayush et al.,2024). Vermicomposting is a promising method of transforming unwanted and virtually unmanageable supplies of organic wastes into usable substrates (Hammad *et al*, 2011). Vermicompost is composed of coarsely split materials that resemble peat and possess characteristics such as significant porosity, air circulation, irrigation, and retention of water. (Edwards *et al.,* 1988). Kitchen waste compost enhances various physicochemical as well as biological characteristics of the soil, including its structure, capability to retain water, along with microorganism community (Kale *et al*., 1998, Cooperband, 2000 and Stoffella *et al*., 2001; Day *et al.*, 2001). Using proper growing media could contribute to root development by providing a stable base, retaining water as well as nutrients, letting oxygen into the root system, and facilitating gas transfer with the surrounding environment (Abad and Puchades, 2002).

To improve the output of bottle gourd, the method of stem cutting has been used in bottle gourd farming. The stem cutting approach has been demonstrated to be very successful in the Cucurbitaceae family, which has a higher frequency of male flowers and sterile branches. The fruits produced from stem cuttings exhibit exceptional size and quality, resulting in a significant boost in selling price. Successful stem cuttings will help in vigorous growth and development and a more female flower ratio (Bhardwa, 2013). Pinching technique for top shooting, where the apical meristem is pruned while the plant is in its early stages. This procedure also promotes the development of secondary and tertiary branches and enhances the equilibrium between both reproductive and vegetative development in order to increase output (Patel *et al.,* 2017). This strategy is simple and cost-effective in comparison to other treatments such as plant growth regulators (PGRs) and chemical applications, which aim to maintain a balance between vegetative and reproductive development. (Naafe *et al*., 2022)

In view of the wide spectrum effectiveness of different growing media and stem cutting, the present experiment aimed to identify the effect of different growing media on the growth and yield of bindu lau and find out the impact of stem cutting on the growth and yield of bindu lau. And determine the combined effects of different growing media as well as stem cutting on the growth and yield of bindu lau.

**MATERIALS AND METHODS**

**1. Experimental Site and Experimental Framework**

A study was conducted at Sher-e-Bangla Agricultural University’s Horticultural Farm, Dhaka (23°41’N, 90°22’E; 8.6 m elevation) during the rabi season. The soil, classified as Tejgaon (Modhupur Tract, AEZ-28), was sandy loam (27% sand, 43% silt, 30% clay) with pH 5.47–5.63 and 0.83% organic matter. The experiment tested two factors: Factor-A (Growing Media), M1= Soil: FYM: Sand (1:2:1), M2= Soil: Vermicompost: Sand (1:2:1), M3= Soil: Kitchen Compost: Sand (1:2:1); Factor-B (Stem Cutting), P0= Control, P1= Removal of all branches up to 90 cm + Top shoot cutting, P2= Removal of all branches up to 120 cm + Top shoot cutting. Using a Randomised Complete Block Design (RCBD) with three replications, the 360 m² area was divided into three blocks (1 m apart), each containing nine 4 m × 2 m plots (0.5 m apart). Each plot housed two plants spaced 2 m × 2 m.

**2. Planting materials**

The seeds of the Bindu Lau variety were gathered from Naomi International Seed Company in Siddique Bazar, Gulistan, Dhaka.

**3. Growing media application**

The farm yard manures, vermicompost and kitchen compost for Bindu Lau were calculated and applied as the recommended doses. As per the experiment requirement, no extra inorganic fertilisers were added to the soil during pit preparation. Amount of FYM @ 40t/ha, Vermicompost @ 25t/ha and kitchen compost @ 40t/ha was calculated coordinating the recommended NPK dose for bottle gourd production so that nutrients like nitrogen, phosphorus, potassium, etc. can be supplied by only these organic fertilisers. There were two pits prepared for each plot. In M1 treatment, FYM @ 2kg/pit, and in M2 and M3 treatment, Vermicompost @1.35kg/pit and Kitchen compost @ 2kg/pit were applied as per calculation. Maa Agro, an innovative farm based in Khulna, supplied all of the manure and compost.

**4. Application of stem cutting treatment**

Top shoot cutting and the removal of lateral branches from the main stem were performed in accordance with the treatments. The branches were eliminated when they became noticeable from the main stalk and measured two to three centimetres in length. The pruning was performed in accordance with the experimental procedures. In case of P0 treatment, no branches were removed. In P1 and P2, all branches were removed up to 90 cm and 120 cm of plant height. The top shoot of the vine was also trimmed at 25 DAT, 40 DAT and 50 DAT according to requirements for promoting apical dominance for better secondary and tertiary bud growth.

**5. Seedling producing and transplanting**

On October 17, 2022, seeds were sown in plastic bags filled with the same quantity of well-decomposed manure, sand as well and soil. Throughout the seedling growing phase, they received frequent watering. The seeds underwent full germination during a period of five to ten days. After six days of emergence, just one seedling was allowed to grow in each plastic bag. After 22 days of germination, the seedlings of Bindu Lau that were in good condition and had consistent growth were moved to the designated pits in each plot of the study field on 08th November 2022.

**6. Pest control**

The Bindu Lau is highly susceptible to pests and diseases. Pest control measures include applying 2 ml/l of Cypermethrin 10 EC (Ripcord) to combat fruit borers, flies, and beetles. Aphid infestations are managed by manually sprinkling ash powder on leaves, while powdery mildew is treated with S-dust (sulcox) @ 5 gm/l. To address fruit fly damage during reproductive stages, pheromone traps are installed at 1 per 10 meters. Regular field inspections ensure prompt removal of diseased leaves or fruits.

**7. Statistical analysis**

Statistical analysis of the collected data was conducted using Statistics-10 software. Mean values for all parameters were calculated, and analysis of variance (ANOVA) was performed using the ‘F’ test. Treatment means were compared using Duncan’s Multiple Range Test (DMRT) at a 5% significance level.

**RESULTS AND DISCUSSION**

The findings have been discussed and presented, and the following headings provide potential explanations.

**Number of leaves per plant**

The number of leaves per plant exhibited notable variations in correlation with various growing media (Table 1) at 20 DAT and 60 DAT. At 20 DAT, the highest no. of leaves per plant (9.11) was obtained from the M3 treatment (Soil: Vermicompost: Sand). the lowest no. of leaves per plant (7.74) was identified from the M1 treatment (Soil: FYM: Sand), At 60 DAT, the highest no. of leaves was obtained from the M3 treatment (38.89) and the lowest no. of leaves was identified from the M1 treatment (29.00).

The number of leaves per plant of Bindu Lau showed significant differences in relation to different stem cuttings varied significantly at 20 and 60 DAT (Table 2). At 20 DAT, the highest no. of leaves per plant (8.72) was obtained from P2 (Removal of all branches up to 120cm + Top shoot cutting) treatment and the lowest no. of leaves per plant (7.97) was noticed from P0 (control) treatment. At 60 DAT, the highest no. of leaves per plant (36.23) was performed by P1 (Removal of all branches up to 90cm + Top shoot cutting) treatment, while P0 (control) treatment gave the lowest no. of leaves per plant (31.89). Cutting off the stems allows more sunshine to reach the leaves and lessens nutrient competition. When compared to the control, stem pruning on the main stem increased the no. of leaves by 16.19%. The findings are supported by Mardhiana *et al.* (2017).

Significant variation was noticed due to the combined effect of different growing media and stem cutting on the number of leaves per plant of Bindu Lau at 20 DAT and 60 DAT (Table 3). At 20 DAT, the highest no. of leaves per plant (9.68) was recorded from the M2P2 treatment combination and the lowest no. of leaves per plant was noticed in the M1P0 (7.23) treatment combination, which is equivalent to the M1P1 treatment combination. At 60 DAT, the highest no. of leaves per plant (41.67) was noticed from the treatment combination M2P2 and the lowest no. of leaves per plant (26.00) was noticed from the M1P0 treatment combination. The current study's results suggest that a combination of varied growing media and stem cuttings may have improved growing conditions, which in turn may have increased the no. of leaves produced by each plant. Vermicompost promoted the greater number of leaves, which contributes to Bindu Lau's increased leaf count.

**Leaf length (cm)**

Variation on leaf length at 20,40, and 60 DAT varied significantly due to different growing media (Table 1). Results revealed that at 20 DAT maximum leaf length (14.39 cm) was noticed from M2 (Soil: Vermicompost: Sand) treatment which was statistically identical to M3 (Soil: Kitchen Compost: Sand) treatment and minimum leaf length (13.23 cm) was noticed from M1 (Soil: FYM: Sand) treatment. At 40 DAT, the highest leaf length (17.31 cm) was recorded from the M2 (Soil: Vermicompost: Sand) treatment and the lowest leaf length (15.51 cm) was noticed from the M1 (Soil: FYM: Sand) treatment. At 60 DAT, the highest leaf length (19.23 cm) was recorded from M2 (Soil: Vermicompost: Sand) treatment and the lowest (17.94 cm) was noticed from M1 (Soil: FYM: Sand) treatment.

Significant influence was noticed in terms of leaf length of Bindu Lau influenced by different stem cutting techniques at 20,40, and 60 DAT (Table 2). Findings revealed that at 20 DAT, maximum leaf length (14.85 cm) was noticed from P2 (Removal of all branches up to 120cm + Top shoot cutting) treatment and minimum leaf length (13.06 cm) was noticed from P0 (control) treatment. At 40 DAT, the highest leaf length (17.68 cm) was recorded from treatment P2 (Removal of all branches up to 120cm + Top shoot cutting) and the lowest leaf length (14.25 cm) was noticed from P0 (control) treatment. And finally, at 60 DAT, the highest leaf length (20.79 cm) was recorded from treatment P2 (Removal of all branches up to 120cm + Top shoot cutting) and the lowest (16.66 cm) was noticed from P0 (control) treatment.

Significant variation was noticed due to the combined effect of different growing media and stem cutting on leaf length of Bindu Lau at, 20,40 and 60 DAT (Table 3). At 20 DAT, the highest leaf length (15.62 cm) was recorded from the M2P2 treatment combination which is followed by to M3P2 treatment combinations and the lowest leaf length was noticed in the M1P0 (12.05 cm) treatment combination. At 40 DAT, the highest leaf length (18.92 cm) was noticed from the treatment combination M2P2 and the lowest leaf length (13.17 cm) was noticed from the M1P0 treatment combination. And finally, at 60 DAT, the highest leaf length (21.48 cm) was recorded from treatment M2P2 and the lowest (15.86 cm) was noticed from M1P0 treatment. The recent noticed results suggest that a combination of varied growing media and stem cuttings may have improved growing conditions, which in turn may have increased the attributes of leaves produced by each plant. Vermicompost increased the leaf length, which contributes to Bindu Lau's increased leaf count.

**Table 1. Effect of different growing media on the number of leaves and leaf length per plant at different days after transplanting of Bindu Lau**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatments** | **No. of leaves per plant** | | **Leaf length (cm)** | | |
| **20 DAT** | **20 DAT** | **20 DAT** | **40 DAT** | **60 DAT** |
| M1 | 7.74 c | 29.00 c | 13.23 b | 15.51 c | 17.94 c |
| M2 | 8.17 b | 34.11 b | 14.39 a | 17.31 a | 19.23 a |
| M3 | 9.11 a | 38.89 a | 14.21 a | 16.09 b | 18.58 b |
| LSD (0.05) | 0.2546 | 1.3379 | 0.7473 | 0.5145 | 0.4767 |
| CV% | 7.28 | 9.29 | 4.70 | 7.45 | 3.84 |

In a column, means with similar letter (s) are not significantly different, and those having dissimilar letter (s) are significantly different by LSD at the 5% level of significance. Where, M1: Soil: FYM: Sand; M2: Soil: Vermicompost: Sand; M3: Soil: Kitchen Compost: Sand.

**Table 2.** **Effect of different stem cuttings on the number of leaves per plant and leaf length at different days after transplanting of Bindu Lau**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatments** | **No. of leaves per plant** | | **Leaf length (cm)** | | |
| **20 DAT** | **60 DAT** | **20 DAT** | **40 DAT** | **60 DAT** |
| P0 | 7.97 c | 31.89 c | 13.06 c | 14.25 c | 16.66 c |
| P1 | 8.72 a | 36.23 a | 13.92 b | 16.98 b | 18.31 b |
| P2 | 8.33 b | 33.89 b | 14.85 a | 17.68 a | 20.79 a |
| LSD (0.05) | 0.2546 | 1.3379 | 0.7473 | 0.5145 | 0.4767 |
| CV% | 7.28 | 9.29 | 4.70 | 7.45 | 3.84 |

In a column, means with similar letter (s) are not significantly different, and those having dissimilar letter (s) are significantly different by LSD at 5% level of significance. where P0: Control; P1: Removal of all branches up to 90cm + Top shoot cutting P2: Removal of all branches up to 120cm + Top shoot cutting.

**Table 3. Combined effect of different growing media and stem cutting techniques on leaf length per plant at different days after transplanting of Bindu Lau**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatment combinations** | **No. of leaves per plant** | | **leaf length (cm)** | | |
| **20 DAT** | **20 DAT** | **20 DAT** | **40 DAT** | **60 DAT** |
| M1P0 | 7.23 f | 7.23 f | 12.05 d | 13.17 g | 15.86 e |
| M1P1 | 7.67 ef | 7.67 ef | 13.64 bc | 16.73 cd | 17.48 d |
| M1P2 | 9 b | 9 b | 14.00 bc | 16.63 cd | 20.48 b |
| M2P0 | 8 de | 8 de | 13.58 c | 15.28 e | 17.36 d |
| M2P1 | 8.5 c | 8.5 c | 13.98 bc | 17.71 b | 18.85 c |
| M2P2 | 9.68 a | 9.68 a | 15.62 a | 18.92 a | 21.48 a |
| M3P0 | 8 de | 8 de | 13.55 c | 14.29 f | 16.74 d |
| M3P1 | 8.33 cd | 8.33 cd | 14.15 bc | 16.49 d | 18.59 c |
| M3P2 | 8.67 bc | 8.67 bc | 14.93 ab | 17.50 bc | 20.41 b |
| LSD (0.05) | 0.4409 | 0.4409 | 1.2944 | 0.8912 | 0.8257 |
| CV% | 7.28 | 7.28 | 4.70 | 7.45 | 3.84 |

In a column, means with similar letter (s) are not significantly different, and those having dissimilar letter (s) are significantly different by LSD at 5% level of significance. Where, M1: Soil: FYM: Sand; M2: Soil: Vermicompost: Sand; M3: Soil: Kitchen Compost: Sand, where P0: Control; P1: Removal of all branches up to 90cm + Top shoot cutting P2: Removal of all branches up to 120cm + Top shoot cutting.

**Number of branches per plant at harvest**

The use of different growing media resulted in a considerable difference in the no. of branches per plant (Fig. 1). At harvest (110 DAT), the highest (11.74) no. of branches was estimated from M2 (Soil: Vermicompost: Sand) treatment and the lowest (9.46) no. of branches was estimated from M1 (Soil: FYM: Sand) treatment. The results indicated that the application of vermicompost containing growing media maximises the number of branches. compared to other growing media.

Significant differences in the no. of primary and secondary branches per plant were seen when alternative stem cutting procedures were applied (Fig. 2). At the time of harvest (110 DAT), the highest no. of branches (12.62) was obtained from P2 treatment (removal of all branches up to 120 cm + top shoot cutting) and the lowest no. of branches (7.08) was identified from P0 (control) treatment. The outcome also showed that a large increase in branch count can be achieved by early stem trimming. Pruning of all the side branches at certain lengths was discovered to improve the no. of branches/plant of the Cucurbitaceae family in the current investigations. This result is supported by the findings of Khan *et al.* (2023). The combined effect of different growing media and stem cutting resulted in a wide range of variability in the no. of primary branches per plant at harvest (Table 6). At harvest, the highest no. of branches per plant (14.50) was discovered in the M2P1 treatment combination, whereas the lowest no. of branches per plant (6.34) was identified in the M2P0 treatment combination. Suitable growing media with proper pruning techniques are important in a variety of ways. Photosynthesis, respiration, energy storage, transport, and cell division are all physiological processes that will considerably improve plant auxiliary stalk or branching. Increased branch number was caused by factors such as glucose translocation hindrance, greater auxin levels, and starch hydrolysis.

**Fig. 1.** **Effect of different growing media on** **the number of branches per plant at harvest of Bindu Lau.** Here, M1: Soil: FYM: Sand; M2: Soil: Vermicompost: Sand; M3: Soil: Kitchen Compost: Sand); where FYM @ 40t/ha, Vermicompost @ 25t/ha, Kitchen compost @ 40t/ha.

**Fig. 2.** **Effect of different stem cutting on** **the number of branches per plant at harvest of Bindu Lau;** where P0: Control; P1: Removal of all branches up to 90cm + Top shoot cutting P2: Removal of all branches up to 120cm + Top shoot cutting.

**Days required for the first male flowering**

There is a substantial influence of different growing media on the no. of days necessary for the appearance of the first male flower of Bindu Lau (Table 4). Maximum days to first male flowering (19.06) were noticed in M2 (Soil: Vermicompost: Sand) treatment, whilst minimum days to first male flower appearance (17.02) were noticed in M1 (Soil: FYM: Sand) treatment. The data on days necessary for the first male flowering was shown to be relevant in terms of different stem cutting techniques on Bindu Lau (Table 5). The results revealed that the P2 (Removal of all branches up to 120cm + Top shoot cutting) treatment required the maximum days (19.29) to first male flowering, but the P0 (control) treatment required the lowest days (16.02) to first male flowering. Significant variation in days to first male flowering was seen on Bindu Lau when varied growing media and stem cutting were used (Table 6). The M2P2 treatment combination required the maximum days (20.70) to first male flowering, while the M1P0 treatment combination required the lowest days (15.02) to first male flowering.

**Days required for first female flowering**

The days required for the first female flowering showed a significant difference for different growing media (Table 4). Due to application of growing media, the maximum days required to first female flowering (21.56) was recorded in M1 (Soil: FYM: Sand) treatment which is equivalent to M3 treatment while the minimum day to first female flower appearance (20.21) was recorded in M2 (Soil: Vermicompost: Sand) treatment which is statistically equivalent to M3 (Soil: Kitchen Compost: Sand) treatment. Application of different stem cuttings on Bindu Lau showed a significant effect on days to first female flowering (Table 5). The maximum days required to first female flowering (22.51) was noticed in P0 (control) treatment, while the minimum days to first female flowering (19.43) was recorded in P2 (Removal of all branches up to 120cm + Top shoot cutting) treatment. The early emergence of female flowers in pinched plants could be related to alterations in auxin and cytokinin concentrations in the plant. According to Patel *et al.* (2017), pinching causes more cytokinins to concentrate in lower areas of the body. plants, which stimulates lateral growth branches. Furthermore, pinching has been prohibited, carbon nitrogen balance documented ratio in plants, which stimulates flowering in plants. The combination of different growing media and stem cutting considerably altered the days to first female flower appearance (Table 6). It was determined that the highest number of days required to flower the first female (23.50) occurred from the M1P0 treatment combination, whilst the lowest number of days required to flower the first female (18.3) was obtained from the M2P2 treatment combination.

**Number of male flowers per plant**

The data on the no. of male flowers per plant was noticed to be significant for varied growing media applied to Bindu Lau (Table 4). The M1 (Soil: FYM: Sand) treatment produced the maximum male flowers per plant (69.33), whereas the M2 (Soil: Vermicompost: Sand) treatment produced the lowest (66.78). This could be because nutrient levels present in different growing media aided in the correct development of Bindu Lau's reproductive system. The quantity of male flowers per plant was significantly affected by the stem cutting techniques applied to Bindu Lau (Table 5). The treatment P0 (control) produced the maximum male flowers (72.89), which is statistically significant when compared to the other treatments, whereas the P2 (Removal of all branches up to 120cm + Top shoot cutting) treatment produced the lowest (65.00) male flowers per plant. In terms of the quantity of male flowers per plant, the combined effect of different growing media and stem cutting indicated a statistically significant variance (Table 6). The highest no. of male flowers per plant (74.00) was obtained from the M1P0 treatment combination, whereas the lowest no. of male flowers per plant (63.67) was obtained from the M2P2 treatment combination, which is statistically equivalent to the M2P1 treatment combination.

**Table 4. Effect of different growing media on the number of days required to first male flower, days required to first female flower and no. of male flowers per plant of Bindu Lau**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatments** | **Days required to**  **First male flower** | **Days required to**  **First female flower** | **No. of male flowers per plant** |
| M1 | 17.02 c | 21.56 a | 69.33 a |
| M2 | 19.06 a | 20.21 b | 66.78 c |
| M3 | 17.78 b | 20.84 ab | 67.56 b |
| LSD (0.05) | 0.4139 | 0.8091 | 0.4262 |
| CV% | 5.74 | 6.29 | 4.26 |

In a column, means with similar letter (s) are not significantly different and those having dissimilar letter (s) are significantly different by LSD at 5% level of significance. Where, M1: Soil: FYM: Sand; M2: Soil: Vermicompost: Sand; M3: Soil: Kitchen Compost: Sand.

**Table 5. Effect of** **different stem cutting on the number of days required to the firstmale flower of, days required to the first female flower, no. of male flowers per plant of Bindu Lau**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatments** | **Days required to**  **first male flower** | **Days required to**  **first female flower** | **No. of male flowers per plant** |
| P0 | 16.02 c | 22.51 a | 72.89 a |
| P1 | 18.55 b | 20.67 b | 65.78 b |
| P2 | 19.29 a | 19.43 c | 65.00 c |
| LSD (0.05) | 0.4139 | 0.8091 | 0.4262 |
| CV% | 5.74 | 6.29 | 4.26 |

In a column, means with similar letter (s) are not significantly different, and those having dissimilar letter (s) are significantly different by LSD at the 5% level of significance. where P0: Control; P1: Removal of all branches up to 90cm + Top shoot cutting P2: Removal of all branches up to 120cm + Top shoot cutting.

**Number of female flowers per plant**

The data on the no. of female flowers per plant was noticed to be significant for varied growing media applied to Bindu Lau (Fig. 3). The M2 (Soil: Vermicompost: Sand) treatment produced the maximum female flowers per plant (48.55), whereas the M1 (Soil: FYM: Sand) treatment produced the lowest (44.45). The quantity of female flowers per plant was significantly affected by the stem cutting techniques applied to Bindu Lau (Fig. 4). The P2 (Removal of all branches up to 120cm + Top shoot cutting) treatment produced the highest female flowers (50.22), which is statistically significant when in contrast to the other treatments, whereas the P0 (control) treatment produced the lowest (41.44) female flower per plant. This could be a result of training improving the reproductive growth of the cucumber plant. Furthermore, Kumar *et al.* (2017) noticed that training cucumbers produces more female flowers. In terms of the number of female flowers per plant, the combined effect of different growing media and stem cutting indicated a statistically significant variance (Table 6). The highest no. of female flowers per plant (52.67) was obtained from the M2P2 treatment combination, whereas the lowest no. of female flowers per plant (40.00) was obtained from the M1P0 treatment combination. Anand *et al.* (2014) showed that lateral branches were more efficient at producing female flowers, and vines with a higher number of female flowers would yield a greater quantity of fruits.

**Fig. 3. Effect of different growing media on** **number of female flowers per plant of Bindu Lau;** (M1: Soil: FYM: Sand; M2: Soil: Vermicompost: Sand; M3: Soil: Kitchen Compost: Sand); where FYM @ 40t/ha, Vermicompost @ 25t/ha, Kitchen compost @ 40t/ha.

**Fig. 4.** **Effect of different stem cutting on the number of female flowers per plant of Bindu Lau;** (P0: Control; P1: Removal of all branches up to 90cm + Top shoot cutting P2: Removal of all branches up to 120cm + Top shoot cutting).

**Table 6.** **Combined effect of different growing media and stem cutting techniques on the number of branches at harvest, number of days required to first male flower, days required to first female flower, no. of male flowers,** **no. of female flowers of Bindu Lau.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatment combinations** | **No. of branches at harvest** | **Days required to first male flower** | **Days required to firstfemale flower** | **No. of male flowers** | **No. of female flowers** |
| M1P0 | 6.34 f | 15.02 g | 23.5 a | 74 a | 40 f |
| M1P1 | 12.2 bc | 17.05 e | 20.83 bcd | 68.33 c | 44.67 d |
| M1P2 | 9.85 d | 19 c | 20.33 d | 65.67 d | 48.67 c |
| M2P0 | 7.57 e | 16.70 ef | 21.83 bc | 72.67 b | 42.67 e |
| M2P1 | 14.5 a | 19.77 b | 20.5 cd | 64 e | 50.33 b |
| M2P2 | 13.17 b | 20.7 a | 18.3 e | 63.67 e | 52.67 a |
| M3P0 | 7.33 ef | 16.33 f | 22.2 ab | 72 b | 41.67 e |
| M3P1 | 11.17 c | 18.83 cd | 20.67 cd | 65 d | 45.67 d |
| M3P2 | 12 c | 18.167 d | 19.67 de | 65.67 d | 49.33 bc |
| LSD (0.05) | 1.151 | 0.7169 | 1.4014 | 0.7382 | 1.5832 |
| CV% | 3.94 | 5.74 | 6.29 | 4.26 | 11.07 |

In a column, means with similar letter (s) are not significantly different and those having dissimilar letter (s) are significantly different by LSD at 5% level of significance. Where, M1: Soil: FYM: Sand; M2: Soil: Vermicompost: Sand; M3: Soil: Kitchen Compost: Sand, where P0: Control; P1: Removal of all branches up to 90cm + Top shoot cutting P2: Removal of all branches up to 120cm + Top shoot cutting.

## Days to first fruit harvest

The days required for the first fruit harvest showed a significant difference for different growing media (Table 7). Due to the application of growing media, the maximum days required to first fruit harvest (61.78) was recorded in M1 (Soil: FYM: Sand) treatment, while the minimum days to first fruit harvest (59.12) was recorded in M2 (Soil: Vermicompost: Sand) treatment. Equivalent findings were also reported by Shah *et al.* (2020), who noted that applying organic manure can enhance the development and growth of plants, transferring all necessary macro- and micronutrients to the plant to facilitate earlier harvesting and fruiting. Application of different stem cutting on Bindu Lau showed a significant effect on days to first fruit harvest (Table 8). The maximum days required to first fruit harvest (67.35) was noticed in P0 (control) treatment, while the minimum days to first fruit harvest (55.56) was recorded in P2 (Removal of all branches up to 120cm + Top shoot cutting) treatment. The findings showed that the maximum no. of days needed to first fruit harvest  using particular pruning procedures was less than that of the control, ensuring a higher yield of Bindu Lau. Early fruit development was aided by certain pruning techniques as well as additional variables, and it boosted branch and flower development. Khan *et al.* (2023) emphasised the supported outcome. The combination of different growing media and stem cutting considerably altered the days to first fruit harvest (Table 9). It was determined that the highest number of days required to first fruit harvest (69.33) occurred from the M1P0 treatment combination, whilst the lowest number of days required to first fruit harvest (52.67) was obtained from the M2P2 treatment combination. The results on the no. of days required for the first fruit harvest obtained from the current investigation demonstrated that higher doses of vermicompost combined with pruning of side branches up to 120 cm, ensure the earlier fruit harvest.

**Fruit length**

Bindu Lau's fruit length changed statistically significantly according to different growing media (Table 7). The M2 (Soil: Vermicompost: Sand) treatment produced the largest fruit length (17.49 cm), which is statistically equal (17.24 cm) to the M3 treatment (Soil: Kitchen Compost)., while the M1 (Soil: FYM: Sand) produced the smallest fruit length (16.41 cm). According to Rahman and Akter (2020) when inorganic sources of nutrients are used along with kitchen waste compost and vermicompost, it promotes plant growth by increasing glucose synthesis. The substantial flow of assimilates to the sink in this condition may have contributed to the increased fruit length. Fruit length variability was noticed to be statistically significant for different stem cutting techniques (Table 8). Where P2 treatment (Removal of all branches up to 120cm + Top shoot cutting) produced the largest fruit length (18.09 cm), and P0 (control) treatment produced the smallest fruit length (15.82 cm). Bindu Lau fruit length was shown to be considerably different when different growing media and stem cutting were combined (Table 8). The M2P2 treatment combination produced the largest fruit length (18.73 cm), which was statistically equivalent to the (18.16 cm) M3P2 treatment combination, and the M1P0 treatment combination produced the smallest fruit length (15.21 cm). Experimental results indicated that a higher rate of vermicompost containing growing media integration with different levels of pruning application produces increased fruit length compared to FYM or Kitchen compost containing growing media and no pruning association. Bindu Lau fruit was shown to be considerably different when different growing media and stem cutting were combined (Table 9). The M2P2 treatment combination produced the largest fruit breadth (11.53 cm), which was statistically equivalent to the (11.23 cm) M3P2 treatment combination, and the M1P0 treatment combination produced the smallest fruit breadth (9.88 cm). Experimental results indicated that a higher rate of vermicompost containing growing media integration with different levels of pruning techniques application produces increased fruit breadth compared to FYM or Kitchen compost containing growing media and no pruning association.

**Individual fruit weight (gm)**

Bindu Lau's fruit weight changed statistically significantly according to different growing media (Table 7). The M2 (Soil: Vermicompost: Sand) treatment produced the largest fruit weight (666.67 g) while the M1 (Soil: FYM: Sand) produced the smallest fruit weight (623.33 g). As stated by Kharga *et al.* (2019), the cause for increased fruit weight could be due to the simple availability of nutrients to plants via inorganic fertilisers, improved soil solubilization of organic manures, ultimately leading to the production and distribution of an adequate quantity of photosynthates from the leaves to the reproductive organs. Fruit weight variability was noticed to be statistically significant for different stem cutting techniques (Table 8). Where P2 treatment (Removal of all branches up to 120cm + Top shoot cutting) produced the largest fruit weight (677.44 g). The P0 (control) treatment produced the smallest fruit weight (598.67 g). The findings are consistent with the results of Mardhiana *et al.* (2017), who showed that pruning eliminated unproductive parts, resulting in a wide allocation of resources for assimilation of the photosynthetic process to improve cell enlargement. Bindu Lau's fruit weight was shown to be considerably different when different growing media and stem cutting were combined (Table 9). The M2P2 treatment combination produced the largest fruit weight (700.67 g), which was statistically equivalent to the (686.33 g) M2P1 treatment combination, and the M1P0 treatment combination produced the smallest fruit weight (587.33 g). Experimental results indicated that a higher rate of vermicompost containing growing media integration with different levels of pruning techniques application produces increased fruit weight compared to FYM or Kitchen compost containing growing media and no pruning association.

**Yield (t/ha)**

The effect of different growing media was shown to have a significant impact on the amount of Bindu Lau produced per plant (Table 7). The highest fruit yield per plant (13.23 kg) came from the M2 treatment (Soil: Vermicompost: Sand), while the lowest fruit yield per plant (11.59 kg) came from the M1 treatment (Soil: FYM: Sand). More fruits per plant are inevitably related to a larger fruit production per plant. Variations in stem cutting intensity were noticed to have a significant effect on the yield of Bindu Lau fruits per plant (Table 8). In contrast, the P0 treatment (control) resulted in the lowest fruit yield per plant (9.79 kg), while the P2 treatment (Removal of all branches up to 120cm + Top shoot cutting) provided the highest fruit yield per plant (14.14 kg). Bindu Lau's yield per plant was shown to be considerably different when different growing media and stem cutting were combined (Table 9). The M2P2 treatment combination produced the highest yield per plant (14.87 kg), which was statistically equivalent to the 14.58 kg M2P1 treatment combination and the M1P0 treatment combination produced the lowest yield per plant (9.21 kg). Different growing media showed a notable variation in Bindu Lau fruit yield per hectare (Table 7). The M2 treatment (Soil: Vermicompost: Sand) generated the maximum yield per hectare (33.04 tons), while the M1 (Soil: FYM: Sand) generated the least fruit yield per hectare (28.89 tons). The study revealed that growing media consisting of vermicompost gives maximum productivity per hectare. Different levels of stem cutting resulted in considerable differences in total Bindu Lau yield per hectare (Table 8). The P2 treatment (Removal of all branches up to 120cm + Top shoot cutting) produced the highest yield per hectare (35.36 tons). In comparison to other treatments, P0 (control) had the lowest yield per hectare (24.47 tons). The combined effect of different growing media and stem cutting resulted in a statistically considerable variation in total Bindu Lau yield per hectare (Table 9). The M2P2 treatment combination produced the highest yield per hectare (37.17 tons), which was statistically equivalent to the M2P1 treatment (36.44 ton) combination. On the other hand, the M1P0 treatment combination yielded the lowest yield per hectare (23.03 tons). Shah *et al*. (2020) reported equivalent results; according to him, plant development was enhanced when inorganic sources of nutrients were combined with organic sources, such as vermicompost, chicken manure, or farmyard manure, increased production of carbohydrates, which resulted in maximum crop fruit production

**Table 7.** **Effect of different growing media on the number of days required to first fruit harvest, no. of fruits harvested per plot, fruit length, individual fruit weight and yield per (t/ha) of Bindu Lau**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Treatments | Number of days required for the first fruit harvest | No. of fruits harvested per plot | Fruit length (cm) | Individual fruit weight (gm) | Yield per (t/ha) |
| M1 | 61.78 a | 36.89 c | 16.41 b | 623.33 c | 28.99 c |
| M2 | 59.12 c | 40.44 a | 17.49 a | 666.67 a | 33.07 a |
| M3 | 60.67 b | 37.56 b | 17.24 a | 646.78 b | 30.67 b |
| LSD (0.05) | 0.8943 | 0.6603 | 0.5345 | 12.803 | 0.961 |
| CV% | 7.90 | 8.44 | 7.79 | 5.25 | 6.02 |

In a column, means with similar letter (s) are not significantly different, and those having dissimilar letter (s) are significantly different by LSD at the 5% level of significance. Were, M1: Soil: FYM: Sand; M2: Soil: Vermicompost: Sand; M3: Soil: Kitchen Compost: Sand.

**Table 8. Effect of different stem cutting on the number of days required to first fruit harvest, no. of fruits harvested per plot, fruit length, fruit breadth and individual fruit weight of Bindu Lau**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Treatments | Number of day required to first fruit harvest | No. of fruits harvested per plot | Fruit length (cm) | Individual fruit weight (gm) | Yield per  (t/ha) |
| P0 | 67.35 a | 33.33 c | 15.82 c | 598.67 c | 24.47 c |
| P1 | 58.67 b | 39.33 b | 17.23 b | 660.67 b | 32.91 b |
| P2 | 55.56 c | 42.22 a | 18.09 a | 677.44 a | 35.36 a |
| LSD (0.05) | 0.8943 | 0.6603 | 0.5345 | 12.803 | 0.961 |
| CV% | 7.90 | 8.44 | 7.79 | 5.25 | 6.02 |

In a column, means with similar letter (s) are not significantly different and those having dissimilar letter (s) are significantly different by LSD at 5% level of significance. Were (P0: Control; P1: Removal of all branches up to 90cm + Top shoot cutting P2: Removal of all branches up to 120cm + Top shoot cutting).

**Table 9. Combined effect of** **different growing media and stem cutting techniques on the number of days required to first fruit harvest, no. of fruits harvested per plot, fruit length, fruit breadth and individual fruit weight yield of Bindu Lau**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Treatment combinations | The day required for the first fruit harvest | No. of fruits harvested | Fruit length (cm) | Individual fruit weight(g) | Yield per hectare (t) |
| M1P0 | 69.33 a | 32.33 f | 15.21 e | 587.33 f | 23.03 g |
| M1P1 | 59.33 c | 37 d | 16.67 cd | 628 d | 30.15 e |
| M1P2 | 56.67 e | 41.33 c | 17.37 bc | 654.67 c | 33.78 cd |
| M2P0 | 66.04 b | 34 e | 16.23 d | 613 de | 25.61 f |
| M2P1 | 58.67 cd | 43 b | 17.5 bc | 686.33 ab | 36.44 ab |
| M2P2 | 52.67 f | 44.33 a | 18.73 a | 700.67 a | 37.17 a |
| M3P0 | 66.67 b | 33.67 e | 16.03 de | 595.67 ef | 24.76 f |
| M3P1 | 58 cde | 38 d | 17.53 bc | 667.67 bc | 32.13 d |
| M3P2 | 57.33 de | 41 c | 18.16 ab | 677 b | 35.12 bc |
| LSD (0.05) | 1.5489 | 1.1436 | 0.9258 | 22.175 | 1.664 |
| CV% | 7.90 | 8.44 | 7.79 | 5.25 | 6.02 |

In a column, means with similar letter (s) are not significantly different, and those having dissimilar letter (s) are significantly different by LSD at 5% level of significance. Where, M1: Soil: FYM: Sand; M2: Soil: Vermicompost: Sand; M3: Soil: Kitchen Compost: Sand, where P0: Control; P1: Removal of all branches up to 90cm + Top shoot cutting P2: Removal of all branches up to 120cm + Top shoot cutting.

**Gross return**

The combined effect of different growing media and stem cutting techniques resulted in a variation in gross return (Table 10). The M2P2 treatment combination resulted in the highest gross return (1314075 BDT./ha), while the M3P2 treatment combination resulted in the second highest (1238925 BDT. /ha). The M1P0 treatment combination resulted in the lowest gross return (801375 BDT. /ha).

**Net return**

In terms of net return, different treatment combinations produced a wide variety of net returns. The combination of M2P2 produced the highest net return (73738 BDT. /ha), while the combination of M3P2 produced the second highest net return (633967 BDT /ha). Table 10 shows that the M1P0 treatment combination had the lowest net return (227457 BDT /ha).+

**Benefit-Cost Ratio**

The combination of different plant growing media and stem cutting techniques for benefit-cost ratio was different in all treatment combinations (Table 10). The M2P2 treatment combination had the highest benefit-cost ratio (2.28), and the M3P2 treatment combination had the second highest benefit-cost ratio (2.05). The M1P0 treatment combination had the lowest benefit-cost ratio (1.40). From a financial perspective, the ongoing results showed that the M2P2 treatment combination was more financially profitable than the other treatment combinations.

## Table 10. Cost and return of Bindu Lau cultivation as influenced by different growing media and stem cutting techniques.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Treatment combinations | Cost of production (BDT/h) | Yield (branch number) | Return (branch) (BDT) | Yield (t/ha) | Return (Fruit) (BDT) | Gross return (BDT/ha) | Net return (BDT/ha) | BCR |
| M1P0 | 573918 | 7365 | 110475 | 23.03 | 690900 | 801375 | 227457 | 1.4 |
| M1P1 | 596118 | 8586 | 128790 | 30.15 | 904500 | 1033290 | 437172 | 1.73 |
| M1P2 | 596118 | 8865 | 132975 | 33.78 | 1013400 | 1146375 | 550257 | 1.92 |
| M2P0 | 554493 | 9955 | 149325 | 25.61 | 768300 | 917625 | 363132 | 1.65 |
| M2P1 | 576693 | 11660 | 174900 | 36.44 | 1093200 | 1104860 | 528167 | 1.91 |
| M2P2 | 576693 | 13265 | 198975 | 37.17 | 1115100 | 1314075 | 737382 | 2.28 |
| M3P0 | 582798 | 9579 | 143685 | 24.76 | 742800 | 886485 | 303687 | 1.52 |
| M3P1 | 604958 | 10569 | 158535 | 32.13 | 963900 | 1122435 | 517477 | 1.89 |
| M3P2 | 604958 | 12355 | 185325 | 35.12 | 1053600 | 1238925 | 633967 | 2.05 |

**Note:** M1: Soil: FYM: Sand; M2: Soil: Vermicompost: Sand; M3: Soil: Kitchen Compost: Sand, where P0: Control; P1: Removal of all branches up to 90cm + Top shoot cutting P2: Removal of all branches up to 120cm + Top shoot cutting.

Price of branches = 15 BDT/four (4) branches,

Price of bindu lau = 30 BDT/kilograms

**Conclusion**

The following conclusion may be drawn based on the findings of this study: Treatment M2 (Soil: Vermicompost: Sand), was superior to others; vermicompost @ 25t/ha with a half amount mixture of sand and soil may be used to get a desirable yield of Bindu Lau. Stem cutting or pruning had a significant effect on Bindu Lau growth and production P2 (Removal of all branches up to 120cm + Top shoot cutting) was indicated to produce the highest yield of Bindu Lau among the several stem cutting techniques. The treatment combination M2P2 (Soil: Vermicompost: Sand + Removal of all branches up to 120cm + Top shoot cutting) could be used to increase the yield of fruits per plant and total yield of Bindu Lau. It may provide the maximum significant advantage to farmers. As a result, it may be recommended to farmers for Bindu Lau growing during the rabi season.

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