

EFFECTS OF BIOCHAR AND VERMICOMPOST ON THE GROWTH AND YIELD OF INDIAN SPINACH (*Basella alba*)

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ABSTRACT

An experiment was conducted on at Horticulture farm, Rajendupur, Gazipur, during May-August, 2023 to investigate the effect of biochar and vermicompost. In the study, V₂B₂ showed the plant height 12 cm on day 20, 40 cm on day 40 and 90 cm on day 60. V₀B₀ showed minimum plant height. Again number of leaves also recorded after 20 days, 40 after 60 days, where the maximum numbers of leaves of this experiment were in V₂B₂. Among all the treatments V₂B₂ also produced the highest yields (43 t/ha) followed by V₂B₁ treatment (38 t/ha). The country V₀B₀ treatment produced the lowest total yield (23 t/ha) than those of other varieties. The findings of the experiment suggested that the overall best performance was obtained by the V₂B₂ treatment compared to eight other treatments for indian spinach cultivation in Bangladesh.

Key words: Biochar, vermicompost, growth, yield, indian Spinach.

Introduction

Indian Spinach is the edible perennial vine in the family Basellaceae. It is commonly known as Indian spinach. It is a quick-growing, soft-stem vine and reaching length in several meters. It is thick, semi-succulent; heart-shaped leaves have a mild fragrance. *Basella* are two species (*Basella rubra* L. and *Basella alba* L.) identified by Carl Linnaeus. Both two species *Basella rubra* L. and *Basella alba* L. are various species by their leaf characteristics and stem colors. In Bangladesh, it is generally known as Puishak found all over the country. The plant is a succulent, branched, smooth, twining and herbaceous vine reaching a length of several meters. The stems are green or purplish. The leaves are heart-shaped (cordate leaves), 8 to 12 cm in length (Ambia *et al.*, 2016). There are several varieties being cultivated in Bangladesh. BARI puishak 1 and BARI puishak 2 are developed by Bangladesh Agricultural Research Institute. Those are relatively high yielding and higher disease resistant than all other local varieties. As indian spinach production plays a vital role in the economy and nutrition are the nations as other leafy vegetable crops, more attention should be accorded to the selection of high yielding cultivars for edible leaves and other organs. Organic fertilizers, particularly vermicompost, are increasingly recognized for their role in enhancing crop productivity and improving soil health sustainably (Abou El-Nour *et al.*, 2022; Gupta and Thakur *et al.*, 2022). Vermicompost, a product of organic waste decomposition through earthworms, is rich in essential nutrients and microbial activity, making it an effective soil amendment. Previous studies have demonstrated its positive impact on plant growth and yield by improving soil structure, water retention, and nutrient availability (Jahan *et al.*, 2021; Mishra and Sahoo, 2023). By integrating organic amendments like vermicompost into farming systems, this study also addresses broader goals of improving soil fertility and reducing dependency on chemical fertilizers, aligning with the principles of sustainable agriculture (Sharma and Singh *et al.*, 2023) to cultivate spinach in Bangladesh.

Materials and Methods

The field experiment was conducted at horticulture field of Rajendrapur, Gazipur during May to August 2023. The experiment of the location site was at 24.6233° N latitude and 90.5782° E longitudes with an elevation of 16 meter above the sea level. The experiment was conducted at the subtropical monsoon climatic zone, set apart by heavy rainfall during the months from May to August (2023) and scantily of

rainfall during the rest of the year. Plenty of sunshine moderately low temperature prevails during October to March. The experimental soil belonged to the Madhupur tract under AEZ 28. Indian Spinach Sufola Seeds (HYV) used as a cultivator in this experiment.. Genetically pure seeds were used to grow healthy seeds which were used in the experiment. The land was ploughed and cross- ploughed several times followed by laddering and harrowing to obtain a good tilth. The land was leveled. The corners of the plots were trimmed with spade and large clods were broken into small pieces as far as possible. All the weeds and stubbles were removes. After final land preparation the experimental plots were laid out as per following experimental design.

Replication-1	Replication-2	Replication-3
T1=V ₀ B ₀	T4= V ₁ B ₀	T9= V ₂ B ₂
T2=V ₀ B ₁	T3=V ₀ B ₂	T8= V ₂ B ₁
T3= V ₀ B ₀	T2= V ₀ B ₁	T7= V ₂ B ₀
T4=V ₁ B ₀	T1=V ₀ B ₀	T6= V ₁ B ₂
T5=V ₁ B ₁	T9= V ₂ B ₂	T5= V ₁ B ₁
T6=V ₁ B ₂	T8= V ₂ B ₁	T4= V ₁ B ₀
T7=V ₂ B ₀	T6= V ₁ B ₂	T3= V ₀ B ₂
T8=V ₂ B ₁	T7= V ₂ B ₀	T2= V ₀ B ₁
T9=V ₂ B ₂	T5= V ₁ B ₁	T1= V ₀ B ₀

B₁=Biochar 2.5 t/ha; B₂=Biochar 5 t/ha, V₁=Vermicompost 3 t/ha, V₂= Vermicompost 5 t/ha,
B₀=Control, V₀=Control

Growing media (1) 18 kg organic fertilizer mixtures were applied to the 12 plot.

Growing media (2) 20 kg organic fertilizer mixture applied 12 plots.

After transplanting of seedlings, various intercultural operations such as irrigation, weeding etc. were accomplished for better growth and development of the Indian Spinach seedlings. Intercultural operations were carried out as and when needed. After successful cultivation of Indian spinach, recorded data for different parameters were statistically analyzed using Microsoft Office Excel.

Results and Discussion

Effect of biochar and vermicompost on plant height

The effects of biochar and vermicompost plant heights of indian Spinach are reported in Table 1. In case of control (V₀B₀) sufola seed showed that plant height is 7 cm on day of 20, 22cm after 40, 60 at 60 days respectively . In case of treatments (V₂B₁) showed that plant height was 11cm on day of 20, 38cm on day of 40 and 85cm on the day of 60. In case of different growing media (V₂B₂) showed that plant height is 12cm on day of 20, 40cm on day of 40 and 90cm on the day of 60.

Table 1. Performance of biochar and vermicompost on plant height of Indian spinach at different days after sowing

Treatments	Average plant height		
	Day 20	Day 40	Day 60
V ₀ B ₀	7	22	60
V ₀ B ₁	8	24	62
V ₀ B ₂	8	25	65
V ₁ B ₀	9	25	68
V ₁ B ₁	9	30	75
V ₁ B ₂	10	35	83
V ₂ B ₀	9	33	80
V ₂ B ₁	11	38	85
V ₂ B ₂	12	40	90

Effect of biochar and vermicompost on number of leaves

In case of control (V_0B_0) Sufola (HYV) showed 4 numbers of leaves in day 20, 20 numbers of leaves on the day of 40 and 42 numbers of leaves on the day of 60 (Table 2). In case of treatment (V_1B_1) Sufola (HYV) showed 5 number of leaves in day 20, and 30, 60 number of after 40 and 60 days of observation respectively. In case of treatment (V_2B_1) Sufola seed showed that 6 number of leaves in day 20, number 40, and 80 after 40 and 60 days observations. In case of treatment (V_2B_2) Sufola seed showed 7 numbers of leaves in day 20, 45 numbers of leaves on day 40 and, 85 number of leaves on day of 60 (Table 2). Sufola seed shows that in case of number of leaves from the different treatment 1 (V_2B_1), (V_2B_2) is effective than other treatments of control (V_0B_0).

Table 2. Performance of biochar and vermicompost on leaves number of Indian spinach at different days after sowing

Treatments	Average number of leaves		
	Day 20	Day 40	Day 60
V_0B_0	4	20	42
V_0B_1	4	22	45
V_0B_2	4	25	50
V_1B_0	5	25	55
V_1B_1	5	30	60
V_1B_2	6	38	65
V_2B_0	5	35	65
V_2B_1	6	40	80
V_2B_2	7	45	85

Effect of biochar and vermicompost on leaf area

The effect of biochar and vermicompost on leaf area after 20, 40 and 60 days of observation are reported in Table 3. With control (V_0B_0) Sufola (HYV) showed leaves area 8, 32 and 72 cm^2 after 20, 40 and 60 days of observation. In case of treatment (V_1B_1) Sufola (HYV) showed leaves, area are 24, 45 and 94 cm^2 after 20, 40 and 60 days of observation, respectively. In case of treatment (V_2B_1) Sufola seed showed that leaves area are 32 cm^2 in day 20, leaves area area 84 cm^2 on day 40 and leaves area 150 cm^2 on day of 60. In case of growing media (V_2B_2) Sufola seed showed leaves area 40 cm^2 in day 20, 98 cm^2 leaves area on day 40 and and 160 cm^2 on day of 60. Sufola showed that in case of leaves area, growth media 1(V_1B_1), (V_2B_1) and (V_2B_2) was more effective than other treatments including (V_0B_0)

Table 3. Performance of biochar and vermicompost on leaves area of Indian spinach at different days after sowing

Treatments	Average leaf area (cm^2)		
	Day 20	Day 40	Day 60
V_0B_0	8	32	72
V_0B_1	12	32	72
V_0B_2	12	32	84
V_1B_0	18	40	84
V_1B_1	24	45	94
V_1B_2	28	60	140
V_2B_0	28	72	130
V_2B_1	32	84	150
V_2B_2	40	98	160

Effect of biochar and vermicompost on yield

After harvest control (V_0B_0) showed average yield of 2.3(kg/plot) and 23 (t/h). In case of treatment (V_1B_1) average yield recorded to 3.1 (kg/plot) and 31(t/h). For applying treatment (V_2B_1) the yield 3.8 kg/plot and

38 (t/h) and treatment (V₂B₂) 4.3 (kg/plot) and 43 (t/h) were also noted from the study. According to this result of the present study, V₂B₂ was more effective than other treatment (Table 4).

Table 4. Performance of biochar and vermicompost on yield of Indian spinach at different days after sowing

Treatments	Yield (kg/plot)	Yield (t/ha)
V ₀ B ₀	2.3	23
V ₀ B ₁	2.4	24
V ₀ B ₂	2.5	25
V ₁ B ₀	2.8	28
V ₁ B ₁	3.1	31
V ₁ B ₂	3.6	36
V ₂ B ₀	3.3	33
V ₂ B ₁	3.8	38
V ₂ B ₂	4.3	43

Conclusion

According to this result, treatment (V₂B₂) is effective than other media and control. According to the result partially from the different treatment for yield performance (V₂B₂) are more effective from the other treatment. Farmers maybe advised to use treatment (V₂B₂) because in Indian Spinach yield is important. Red soils are known as problem soils, where sound soil management practices are impotents for better crop yield including indian spinach too (Sattar 2002,2022).

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