
INFLUENCE OF SEED PRIMING AND CLYBIO APPLICATION ON GROWTH AND YIELD OF SPINACH

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ABSTRACT

Vegetables are important for human health but, day by day it is becoming extremely harmful and unsafe for our health due to the rapid use of high concentrations of pesticides and chemical fertilizers in vegetable production. To meet our vegetable demand by maintaining safety we need to produce vegetables organically on a commercial basis with a higher yield. Clybio is an organic biofertilizer that can improve crop yield, quality, and taste of vegetables. Seed priming is another mechanism of increase the germination rate and regulates growth. In this experiment, seed priming and Clybio were applied to increase crop growth and yield. A significant result was found from treatment 2, by the application of Clybio at 4 ml/L. Treatment 2 performed better in all aspects of growing parameters such as germination percentage, plant height, number of leaves per plant, leaf diameter, chlorophyll percentage, root length, and leaf fresh weight, while the control treatment performed lowest in all perimeters. The highest yield of spinach (14.33 t/ha) obtained from treatment 2, followed by treatment 1 (8.87 t/ha). The result suggests that the application of Clybio at 4 ml/L increases spinach growth and yield significantly.

Keywords: Clybio, organic, growth, yield, production.

1. INTRODUCTION

Vegetables are important for human health because of their vitamins, minerals, phytochemical compounds, and dietary fiber content. Taking vegetables every day is very good for our health but how good and safe is the vegetable we usually eat for our health? Almost all countries in the world are now arbitrarily using high levels of harmful chemical pesticides and chemical fertilizers in commercial vegetable production. Consumption of vegetables at different stages is becoming unsafe for our health. Excessive use of chemical fertilizer and pesticides is increasing our health and environmental risk. We are losing our soil fertility, decreasing crop taste, quality and yield. So now we have to think about how good it is to eat vegetables for health. Many people are losing interest in eating vegetables considering these risks. Those who are conscious are now looking for safe, non-toxic vegetables. In a word, most health-conscious people are now becoming more and more interested in organically grown vegetables. Almost all people in the developed world are looking for safe vegetables or organic vegetables. In Bangladesh, too, the marketing of organic vegetables has started in various super shops. Organic vegetables are relatively expensive (Iqbal,*et al.*, 2015). However, in a country with a large population like us,

food is needed first, and more vegetables to be produced. Organic vegetable cultivation gives a lower yield.

That is why organic vegetables will not help us to meet the food demand. If we can produce organic vegetables on a commercial basis with a higher yield; then, we will be able to meet our food demand by maintaining food safety. So, we have to take up the challenge of producing vegetables organically, including increasing yields. Clybio is a mixture of yeast fungus, *Bacillus natto*, and *Lactobacillus*, which can improve the yield and quality of the vegetables. Clybio is very useful for improving soil quality also. Clybio can prevent different fungal diseases so that we don't need pesticides during the vegetable production period. Seed priming is another process of increase the germination rate and regulates growth (Bose *et al.*, 2018). The critical stages during crop growth are uniform seed germination, early seedling growth, and uniform plant stand. Low crop yields are attributed to uneven seed germination and lower seedling growth. Therefore, seed quality needs to be improved through priming in addition to the field management techniques for better germination. Priming is a physiological technique of seed hydration and drying to enhance the pregerminative metabolic process for rapid germination, seedling growth, and final yield under normal as well as stressed conditions (Waquas, *et al.*, 2019).

Spinach (*Spinaciaoleracea*) is one of the perennial leafy vegetables that grow throughout the world. The average yield of spinach compare to the world is very low but we have the tremendous potentiality of spinach production. Our low yielding verity, low germination rate, old cultural practices, and limited knowledge of spinach production are the main barrier to our spinach production. Seed priming and Clybio application is the process of increase the growth and yield with organic cultivation.

2. MATERIALS AND METHODS

The experiment was conducted at Sher-e-Bangla Agricultural University (Dhaka-1207) research field from October to December 2020 to increase the yield and quality of spinach vegetables by organic cultivation. The experimental field is situated at 23.750 N latitude and 90.340 E longitudes with an elevation of 8.45 meters from the sea level. The soil was Sandy loam with field capacity and bulk density, 29.3%, and 1.48 g cc⁻¹, respectively. The soil was slightly acidic in reaction with a pH value of 5.8-6.5. The experiment was designed with four treatments and three replications, where T₀ was controlled, T₁; 2ml/L, T₂; 4ml/L, and T₃; 6 ml/L Clybio applied. The size of each experimental plot was 3 meters in length and 1-meter width. The plots spaced at an equal distance (0.5 m). The experiment was set up in a Completely Randomized Design (CRD). BARI Spinach-1 variety was used in the experiment. The seed priming was done by following the Hydro priming method. Total 55 gm seed was wetted overnight (12 hours) with the mixture of water and Clybio according to the experimental design. After priming, the seeds were dried, properly. The primed seeds were sown, in a well-prepared seedbed by maintaining 30x30 cm line distance and 10x10 cm plant distance. The Clybio was applied at 10, 15, 20, 25, and 35 DAS, respectively. Clybio was mixed with water carefully and applied to the specific treatment according to the experimental design (2 ml/L, 4 ml/L, and 6 ml/L) by using a hand sprayer. Weed management, irrigation, and other intercultural operation were done as per the requirement of the crop. Crops were harvested at 50 DAS by hand. The yield achieved from each

plot was calculated and converted on yield per hectare. Data were collected as per the CRD method from sowing to harvesting in different parameters, and the collected data was analyzed statistically using computer software Statistics 10. The treatment mean values were compared with the least significant difference (LSD) at the 5% level of significance.

3. RESULTS AND DISCUSSION

The experiment was conducted at Sher-e-Bangla Agricultural University, Dhaka, Bangladesh, to examine the growth and yield of spinach through seed priming and Clybio application. The results of the experiment are presented and explained in different parameters. The seed germination and seedling growth phase of crops are the most critical stage for determining the crop stand density and establishment under different stress conditions. In this study, treatment 2 was the most significant treatment where the maximum germination percentage (86) recorded. However, the minimum germination percentage found in the control treatment (74). Seed priming with 4 ml / L Clybio significantly enhances seed metabolism resulting in the highest germination rate, which is more vigorous than others and resistant to abiotic stress.

Seed priming with a growth regulator accelerates the metabolic process involve during seed germination, seedlings growth and also improves growth and yield (VijendraKumar,*et al.*, 2014).Chlorophyll is essential in photosynthesis, allowing plants to absorb energy from light. Treatment 2 increased the chlorophyll content of leaves remarkably (Table 1). The maximum chlorophyll percentage was 55.9 obtained from treatment 2, while the minimum was in control 30.56, which is very low compare to other treatments. The result suggests that 4 ml/L Clybio application significantly increases the chlorophyll content of spinach, which makes the plants healthier and more spirited.

Table 1: Germination and chlorophyll percentages, plant height, root length of spinach.

Treatment	Germination percentages (%)	Chlorophyll percentages (%)	Plant height (cm)	Root length (cm)
T0	74 c	30.56 d	21.33 c	8.3 d
T1	82 b	49.57 b	30 b	15.6 b
T2	86 a	55.9 a	35.33 a	18.5 a
T3	79 b	41.86 c	27.33 b	13.6 c
CV	2.07	7.46	5.55	4.48
LSD	3.12	6.24	2.97	1.18

The results presented in Table 1 show that the tallest plants (35.33 cm) were noticed in treatment 2, followed by treatment 1 (30 cm). On the other hand, the shortest plants (21.33 cm) were found in the control treatment. Similarly, results of root length revealed the maximum root length (18.5

cm) recorded in treatment 2, followed by treatment 1 (15.6 cm). The minimum root length (8.3 cm) was observed in the control treatment.

The vegetative and reproductive growth potential of plants is responsible for superior plant height and root length. Furthermore, the probable reason could be that the optimum amount of Clybio application resulted in increased physiological growth of spinach and more established root growth, which enhanced the plant competency for light, water, and nutrients resulting in more established plants. Similar findings reported by S. Fahad,*et al.*, (2006), they showed that exogenously applied growth regulators enhance the plants morpho-physiological growth.

Leaves plant⁻¹ in leafy vegetables like spinach is a character that contributes vitally to the overall crop production. The results related to the number of leaves plant⁻¹ of spinach as influenced by different amounts of Clybio application and without Clybio application are given in Table 2. The application of 4 ml/L Clybio produced the highest number of leaves plant⁻¹, while the lowest number of leaves plant⁻¹ observed in the control treatment. It was found that the application of 4 ml/L Clybio (Treatment 2) improved this trait. However, treatment 1, and treatment 3, resulted in an almost equal number of leaves plant⁻¹. Leaf diameter is an important character for calculating spinach yield performance. The maximum leaf diameter was found from treatment 2 (13.33 cm), followed by treatment 1 (10.33 cm).

The minimum leaf diameter (7.67 cm), observed from the control treatment. The increased number of leaves and leaf diameters may increase due to the application of Clybio. Clybio can promote the plant biological process and able to provide excellent nutrient support, which improves vigorous plant growth. Gao Canhong,*et al.*, (2020), agreed with these findings, who reported that biofertilizers can improve plant growth, metabolism, and nutrient uptake significantly.

Table 2. Spinach leaves number, leaf diameter, fresh weight and yield performance.

Treatment	Leaves plant ⁻¹	Leaf Diameter (cm)	Fresh Weight (plant/gm)	Yield (t/ha)
T0	7 a	7.67 c	13 c	4.33 c
T1	8 a	10.33 b	26.67 b	8.87 b
T2	9 a	13.33 a	43 a	14.33 a
T3	8 a	9.67bc	21bc	7 bc
CV	13.98	11.27	16.86	16.86
LSD	2.1	2.17	8.22	8.22

Fresh weight (plant⁻¹) of spinach has a direct effect on the final crop yields of spinach. The maximum fresh weight recorded from treatment 2, of 43 gm/plant followed by treatment 1, of 26.67 g/plant. The application of 4 ml/l Clybio has produced the maximum fresh weight. However, the minimum fresh weight observed from the control treatment, 13 gm/plant. The yield of spinach has been calculated based on the yield plot⁻¹, and the results are presented in Table-2. The highest yield 14.33 t/ha obtained from treatment 2, followed by treatment 1, of 8.87 t/ha. However, the lowest yield, 4.33 t/ha observed in the control treatment.

Yield is the ultimate and final output of any crop depending on its various factors. The increased yield of spinach in the experiment may be due to the seed priming and Clybio application. Seed priming and application of Clybio on spinach has increased germination, early seedling growth, physiological improvement, and improved nutrient support. The result is supported by the findings of GaoCanhong, *et al.*, (2020), who reported that biofertilizers increase plant microbial activity, physiological growth, and crop yield.

4. CONCLUSION

The experiment was conducted in the horticulture farm of Sher-e-Bangla Agricultural University from October to December 2020. The objective of the study was to increase the yield and improve vegetable quality by organic cultivation. The experiment was set up in a Completely Randomized Design (CRD) with 4 Replications. Three Clybio applications and one control treatment were used, in the experiment. Treatment 2 performed better in all aspects of growing parameters like germination percentage, plant height, number of leaves, leaf diameter, chlorophyll percentage, root length, and leaf fresh weight, while control treatment performs lowest in all perimeters. The highest yield of spinach, 14.33 t/ha⁻¹ was obtained from treatment 2, where 4 ml/L Clybio was applied. It can be concluded that the application of 4 ml / L Clybio significantly increases the growth and yield of spinach.

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