Journal of Agricultural Sciences (Belgrade) https://doi.org/10.2298/JAS2401031L
Vol. 69, No. 1, 2024 UDC: 635.264:631.863
Pages 31-44 Original scientific paper

EFFECTS OF VERMICOMPOST ON THE GROWTH AND YIELD OF SPRING ONION (*ALLIUM FISTULOSUM* L.)

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Abstract: Spring onion (*Allium fistulosum* L.) is a popular salad vegetable produced widely over the world, including in Vietnam. Thanks to its flavor and aroma, it is an indispensable ingredient used to flavor soups and other dishes. Vermicompost is a natural and environmentally friendly fertilizer used widely to increase crop production and maintain the sustainability of agrosystems. Consequently, this study was conducted to investigate the efficiency of vermicompost at different application rates in promoting the growth and yield parameters of spring onion. The results show that adding vermicompost to spring onion production had significant positive effects on plant height, number of leaves, number of tillers, individual plant weight, and plot yield. Particularly, the application of vermicompost at 40 t ha^{-1} showed the highest performance in the observed parameters, increasing the number of leaves, number of tillers, individual plant weight, and plot yields to 64.78, 21.18, 302.96 g plant^{-1}, and 4.86 kg m^{-2}, respectively. The plot yields in the treatments of the highest and lowest vermicompost application increased by 49.1% and 3.9%, respectively, in comparison to the control. Consequently, there was a strongly positive relationship between the application rate of vermicompost and the plot yield.

Key words: *Allium fistulosum*, onion, organic fertilizers, vermicompost, Welsh onion.

Introduction

Vermicomposting is an environmentally and economically friendly decomposition of organic matter by oligochaete worms. Specifically, vermicompost is produced by the action of the earthworms *Lampito mauritii*, *Eudrilus eugeniae*, *Perionyx excavatus*, and *Eisenia foetida,* utilizing their capacity to convert organic matter such as manure, coffee husks and plant residues into a

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compost by the action of their digestive systems (Pattnaik and Reddy, 2010; Dominguez and Edwards, 2011; Getachew et al., 2018). Consequently, this technology increases the bioavailability of essential nutrients by converting raw plant and animal agricultural by-products that can be used as bio-fertilizers (Pattnaik and Reddy, 2010).

Using inorganic fertilizers in crop production is essential to enhance productivity in order to ensure food security for the increasing human population (Musafiri et al., 2023). However, the intensive use of chemical fertilizers in crop cultivation causes degradation of the soils to which they are applied, leading to negative impacts on the environment, the soil microbial community, and human health (Savci, 2012). Sole inorganic or organic fertilizer applications cannot both maintain the status of soil organic matter and sustain crop productivity. A proper combination of both organic and inorganic fertilizers is therefore required to effectively maintain soil health and to enhance nutrient efficiency (Hati et al., 2006; Gentile et al., 2008).

Organic fertilizers, including vermicompost, can act as crucial sources of nutrients for plant growth. Furthermore, organic fertilizers can improve soil quality by maintaining soil structure, supplying more beneficial microorganisms, increasing soil water holding capacity, increasing microfauna density, improving soil pH, and improving the stability of earthworm communities (Zhou et al., 2022). Consequently, agricultural practices with organic fertilization can improve the growth, productivity and quality of crops (Zhou et al., 2022; Ye et al., 2022).

It is well-acknowledged that vermicomposts are reliable bio-fertilizers thanks to their slow-release properties, which allow crops to absorb the nutrients more effectively, alongside their capacity to improve soil physical, chemical, biological, and microbiological characteristics. Besides the benefits of enhancing growth and improving the production of crops (Rekha et al., 2018), vermicomposts have also shown their potential for suppressing diseases and pests in agricultural crops. Such suppression may be related to many mechanisms, such as a higher density of useful microbes or total microbiological activity, which prohibits pathogens or pests, induces systemic resistance in plants against pests/diseases, improves soil quality and provides essential nutrients for pest control, and increases the competition of useful microbes for food/space/water with harmful microbes (Che Sulaiman and Mohamad, 2020).

Vermicompost contains useful amounts of NPK. The typical content in vermicompost is 2–3% nitrogen, 1.85–2.25% potassium and 1.55–2.25% phosphorus, but these levels can be up to 7.37% nitrogen and 19.58% phosphorus (P_2O_5) (Sinha et al., 2010). Vermicompost has other useful components, including micronutrients, and beneficial soil microorganisms such as nitrogen-fixing bacteria, actinomycetes and mycorrhizal fungi. Vermicompost also contains plant growth-regulating hormones and enzymes such as amylase, lipase, cellulase, and chitinase, which play an important role in breaking down organic matter in the soil (Sinha et al., 2010; Rekha et al., 2018). The ability of vermicompost to effectively suppress pests and plant diseases has also been shown in several studies (Sinha et al., 2010; Che Sulaiman and Mohamad, 2020).

Consequently, there is increasing research interest in the effect of vermicompost on plant growth and yields (Yang et al., 2015; Kumar and Gupta, 2018; Khan et al., 2019; Jankauskienė et al., 2022). Yang et al. (2015) conducted a glasshouse pot experiment to assess the effects of vermicompost on tomato yield under different soil water regimes. The results showed that under an irrigation level of 60–70% field capacity, vermicompost treatment increased tomato yield by 16.30, 9.63, 51.99 and 69.30% when compared to chicken compost, horse compost, chemical fertilizer, and no fertilizer, respectively (Yang et al., 2015). In the study by Khan et al. (2019), it was found that under field conditions, the growth, yield, and quality parameters of chili (*Capsicum annum* L.) increased with increasing vermicompost levels. Particularly, the treatment with vermicompost at an application rate of 2.5 t ha^{-1} had the highest yield (8.26 t ha^{-1}) compared to the treatments with 2.0 t ha^{-1} vermicompost (yield of 6.8 t ha^{-1}) and the control without vermicompost addition (yield of 3.6 t ha^{-1}) (Khan et al., 2019). The results of Rekha et al. (2018) demonstrated that a treatment of 50% vermicompost + 50% soil increased the growth parameters of the chili plants and improved the soil quality. In addition, chili plants grown in vermicompost-amended soil showed enhanced growth rates when compared to plants treated with the two plant growth hormones gibberellic acid (GA) and indole acetic acid (IAA). Although there are studies on the effects of organic fertilizers on the growth of spring onion (Afa, 2016; Kuroda et al., 2020), the effect of vermicompost on spring onion growth is yet to be established.

Allium fistulosum L. is a type of vegetable that is widely cultivated across the globe. *A. fistulosum* belongs to the *Liliaceae* family and is popularly known as spring onion, scallion, stone leek, Chinese onion, Welsh onion, and Japanese bunching onion. The spring onion is known for its flavor and aroma and is consumed fresh or cooked (Padula et al., 2022). In Vietnam, it is an indispensable ingredient to flavor soups and other dishes. Besides having a high content of fiber and sugar, protein, vitamins K, C, A and B6, and minerals, the spring onion has also been used in traditional Chinese medicine to treat a wide range of diseases thanks to its content of bioactive phytochemicals (Padula et al., 2022; Mandey et al., 2022).

To sum up, it is well-evidenced that vermicompost has great potential as a natural fertilizer for crops and can increase production and maintain the sustainability of agrosystems. More studies on the effect of vermicompost on a variety of crops, cultivation conditions and soil types are necessary to determine its effectiveness under different propagation conditions.

Consequently, the present study investigated the growth-promoting effect of vermicompost on the growth and yield of the plant *Allium fistulosum* L. The results of this study could prove the efficiency of vermicompost in enhancing crop yields while recycling nutrients from waste products, thereby benefiting farmers through decreased input costs and increasing the environmental sustainability of farming.

Material and Methods

The present study was conducted under field conditions between April and June 2023 in Tra On hamlet, Huyen Hoi commune, Cang Long district, Tra Vinh province, Vietnam. This area is an intensive spring onion production center. The experimental soil belongs to the Arenosols group and had pH values ~ 6.0 and the sandy loam textural class.

Field preparation and fertilizer application

The field was plowed, levelled and transplanting ridges were formed. Each ridge was 20 cm higher than the field surface and 1 m wide. A 20-cm wide furrow was made between two adjacent ridges to facilitate drainage and maintenance of the experiment (Figure 2). The experiment area was divided into plots of 1 m^2.

The spring onion production procedure of local farmers was applied in this experiment. Particularly, in all treatments, including the control, 500 kg ha^{-1} of cow manure was applied to the soil in the preparation period. Lime was also applied to adjust the soil pH to a range of 6.5–7.0. Before seedling transplantation, the plots were covered by a thin layer of dry paddy straw in order to retain soil moisture and control weeds. A basal dose of inorganic fertilizers (58.5 kg ha^{-1} N, 114.5 kg ha^{-1} P_2O_5 and 37.5 kg ha^{-1} K_2O) was applied at the same rate to all treatments. In addition to this basic fertilization, vermicompost was applied at rates between 10 and 40 t ha^{-1}.

Preparation of the transplants

The onion transplants used in this study were uniform, healthy, vigorously growing, and free of diseases. Roots and dry leaves covering the onion tillers (stems) were removed to ensure that new baby roots and sprouts were able to grow well after planting. Each onion seedling included two tillers (Figure 1).

Figure 1. The spring onion transplants used in this experiment.

Experimental design

The one-factor experiment was designed in a Completely Randomized Design (CRD) to evaluate the effect of vermicompost on the growth and yield of spring onions (Figure 2). The present experiment included five treatments, including the control, as follows:

T1: Control (no vermicompost application);

T2: Vermicompost application 10 t ha^{-1} (1 kg m^{-2});

T3: Vermicompost application 20 t ha^{-1} (2 kg m^{-2});

T4: Vermicompost application 30 t ha^{-1} (3 kg m^{-2});

T5: Vermicompost application 40 t ha^{-1} (4 kg m^{-2}).

The treatments were replicated three times. Each replication was a plot of 1 m^2 and each plot was planted with 20 seedlings (with a spacing between plants of 30 cm x 20 cm).

Vermicompost application

Vermicompost produced from vermicomposting of cow manure using *Perionyx excavatus* was bought from a local worm farm in Tra Vinh province. On each plot where vermicompost was applied, the application was divided into three times to slowly add nutrients during the plant growth time. The applications were made as follows: 50% of each application was applied before planting (by spreading it evenly over the plot before covering it with paddy straw), another 25% of the treatment was applied 15 days after planting, and the remaining 25% was applied 30 days after planting as a top dressing around the plant base.

Cow manure and inorganic fertilizers were applied equally in all treatments, including the control treatment (as described in the section on fertilizer application).

All growth parameters were measured every 10 days after planting. The yield parameters were determined on the harvest day (50 days after planting). Nine of the 20 plants in each plot were selected randomly to collect data. The growth parameters of plant height (cm), the number of leaves and the number of tillers (stems) were recorded at 10, 20, 30, 40 and 50 days after planting. In terms of yield parameters, the fresh weight of the individual plants and the total yield of each plot (plot yield calculated by the total weight of all 20 plants) were also evaluated on the harvest day (50 days after planting). Before investigating the yield parameters, all yellow leaves and soil/sand clinging to the plant roots were removed. The diameter of a single tiller was measured on the harvest day to determine if the production of multiple tillers affected tiller size.

Figure 2. The experimental area during spring onion growth showing the ridge and furrow system of cultivation.

Data analysis

Statistical analysis was conducted with SPSS *vs.* 22 (IBM Inc.). The data were statistically analyzed to determine the significance of the differences between the treatments in the growth and yield parameters of spring onion.

The data sets were analyzed for homogeneity of variance with the Levene's test to ensure that all comparison groups had the same variance prior to comparing means by a one-way ANOVA. The significance of the effects of vermicompost on the growth and yield of spring onion plants among treatments was determined by the Tukey's HSD *post-hoc* test at $p < 0.05$.

Results and Discussion

Effects of vermicompost on the growth parameters of spring onion

There were differences in the plant height, the number of leaves and the number of tillers per spring onion plant among the treatments during the experiment period (Tables 1, 2, 3).

The plant heights in the treatments with vermicompost were not significantly different from the control in any of the samplings during the growing period (Table 1). At the period of 10 days after planting, the plant height was higher than after 20 and 30 days. This was due to the fact that the plants were in adaptation phase 10 days after planting and old leaves were still present, but then new tillers and leaves developed, and the old leaves died. Spring onion plants of treatments T4 and T5 reached their greatest height 40 and 50 days after planting (Table 1).

Table 1. Effects of vermicompost on the height of spring onion plants (cm).

Treatments	Plant height (cm) in different growth periods				
	10 days	20 days	30 days	40 days	50 days
T1 (control)	41.55 ± 0.50	37.78 ± 0.84	35.17 ± 0.89	42.67 ± 2.24	48.48 ± 2.36
T2	43.08 ± 0.69	35.71 ± 1.28	34.21 ± 1.48	41.11 ± 1.70	48.00 ± 1.53
T3	43.02 ± 1.41	38.06 ± 0.78	34.70 ± 2.26	41.76 ± 1.64	48.96 ± 2.97
T4	41.61 ± 1.28	37.33 ± 0.29	36.24 ± 1.14	46.48 ± 1.69	52.40 ± 1.48
T5	42.52 ± 1.61	36.15 ± 1.30	35.81 ± 0.60	45.49 ± 0.60	51.41 ± 1.00
$F_{(4,10)}$	*0.398*	*1.123*	*0.344*	*2.014*	*0.944*
Sig.	*ns*	*ns*	*ns*	*ns*	*ns*

Values are mean ± S.E. of three replications; ns: non-significant; T1: no vermicompost application; T2: vermicompost application of 10 t ha^{-1}; T3: vermicompost application of 20 t ha^{-1}; T4: vermicompost application of 30 t ha^{-1}; T5: vermicompost application of 40 t ha^{-1}.

A positive effect of vermicompost on the number of leaves produced by the spring onion plants was shown in the present study (Table 2). The total number of leaves per plant increased with increasing application rates of vermicompost. The best performance for the number of leaves was recorded in the T5 treatment with vermicompost, an application of 40 t ha^{-1}. At harvest (50 days after planting), the mean number of leaves on the plant in the T5 treatment reached 64.78, an increase of 28.5% compared to the control (Table 2).

The results of a one-way ANOVA analysis showed that there were no significant differences in the number of leaves among treatments for 10, 20 and 30 days after planting, but significant differences were found after 40 and 50 days. Specifically, at harvest, plants in the T5 treatment had a significantly higher number of leaves compared to the control and all other treatments, but the number of leaves in the treatments with lower vermicompost application rates (10, 20 and 30 t ha^{-1}) did not differ significantly from each other or from the control (Table 2).

Table 2. Effects of vermicompost on the number of leaves of spring onion plants.

Treatments	The number of leaves per plant in different growth periods				
	10 days	20 days	30 days	40 days	50 days
T1 (control)	9.78 ± 0.70	18.74 ± 1.32	33.85 ± 2.29	44.89 ± 1.33^{b}	50.41 ± 1.22^{b}
T2	9.30 ± 0.45	18.11 ± 0.80	30.89 ± 0.71	44.78 ± 2.71^{b}	51.00 ± 2.10^{b}
T3	9.89 ± 0.22	19.00 ± 1.79	34.44 ± 2.89	47.11 ± 3.45^{b}	53.34 ± 1.79^{b}
T4	8.81 ± 0.35	20.30 ± 1.99	34.85 ± 3.54	47.97 ± 0.70^{ab}	54.22 ± 0.11^{b}
T5	9.52 ± 0.51	19.33 ± 1.50	38.18 ± 2.26	57.44 ± 0.99^{a}	64.78 ± 1.22^{a}
$F_{(4,10)}$	*0.813*	*0.275*	*1.078*	*6.057*	*16.00*
Sig.	*ns*	*ns*	*ns*	$p < 0.05$	$p < 0.05$

Values are mean ± S.E. of three replications; ns: non-significant; Means with different letters are significantly different at the $p < 0.05$ level according to the Tukey's significant difference test; T1: no vermicompost application; T2: vermicompost application of 10 t ha^{-1}; T3: vermicompost application of 20 t ha^{-1}; T4: vermicompost application of 30 t ha^{-1}; T5: vermicompost application of 40 t ha^{-1}.

The number of tillers and the tiller diameter are important parameters that are closely related to the yield of spring onion (Tendaj and Mysiak, 2011). In the present study, the tiller number for each onion plant differed among treatments. Between 10 and 20 days after planting, there were slight differences in the number of tillers among treatments as the transplants were in an adaptation phase and starting to grow. After 30 days, new tillers started to be produced by the onion plants; thus, the differences in the number of tillers among treatments were more apparent. At 50 days after planting, the number of tillers in treatments T4 and T5 was the highest in comparison to the control and the other treatments, with 18.92 and 21.18 tillers plant $^{-1}$, respectively, an increase of 29.9% and 45.5% compared to the control (Table 3).

Subsequent statistical analysis confirmed that there were no significant differences in the number of tillers among the treatments at 10 to 30 days after planting, but significant differences occurred 40 and 50 days after planting. Particularly, the number of tillers in treatments T4 and T5 was significantly higher than that in the control and in the treatment with the lowest vermicompost application (10 t ha^{-1}; Table 3).

Previous work has shown that the more tillers that were made by an onion plant, the smaller the weight of each tiller was (Tendaj and Mysiak, 2011). Although the diameter of individual tillers was not investigated during the plant growth periods, this parameter was recorded at harvest (50 days after planting) in order to investigate if the diameter of the individual tillers of a plant that had more tillers was smaller than that of a plant that had fewer tillers. The result showed that the average diameter of a single tiller in the control, treatments T1, T2, T3, T4, and T5 was 9.33, 9.89, 10.67, 10.22, and 10.44 mm, respectively. Consequently, the highest diameter was found in the treatment T5 (10.44 mm) and the lowest diameter was observed in the control (9.33 mm), indicating that the positive effect of the vermicompost treatment T5 on the tiller number did not result in a reduction but in an increase of the tiller size.

Table 3. Effects of vermicompost on the number of tillers per spring onion plants.

Treatments	The number of tillers in different growth periods				
	10 days	20 days	30 days	40 days	50 days
T1 (control)	3.14 ± 0.07	4.55 ± 0.11	8.56 ± 0.45	11.26 ± 0.39[b]	14.56 ± 0.65[b]
T2	3.18 ± 0.04	5.00 ± 0.19	8.18 ± 0.16	11.11 ± 0.6[b]	14.92 ± 0.52[b]
T3	3.15 ± 0.04	4.52 ± 0.35	8.48 ± 0.60	12.41 ± 0.93[ab]	17.81 ± 1.16[ab]
T4	3.04 ± 0.04	4.70 ± 0.35	9.07 ± 0.58	13.00 ± 0.00[ab]	18.92 ± 0.59[a]
T5	3.11 ± 0.06	4.52 ± 0.10	9.22 ± 0.27	14.26 ± 0.52[a]	21.18 ± 0.61[a]
$F_{(4,10)}$	1.150	0.685	0.936	4.90	14.00
Sig.	*ns*	*ns*	*ns*	$p < 0.05$	$p < 0.05$

Values are mean ± S.E. of three replications; ns: non-significant; Means with different letters are significantly different at the $p < 0.05$ level according to the Tukey's significant difference test; T1: no vermicompost application; T2: vermicompost application of 10 t ha^{-1}; T3: vermicompost application of 20 t ha^{-1}; T4: vermicompost application of 30 t ha^{-1}; T5: vermicompost application of 40 t ha^{-1}.

Previous studies demonstrated that vermicompost had positive influences on the crops, soil parameters, and the environment (Rekha et al., 2018; Kumar and Gupta, 2018; Khan et al., 2019; Che Sulaiman and Mohamad, 2020; Jankauskienė et al., 2022). It is well-established that vermicompost has positive effects on promoting plant growth (Rekha et al., 2018; Kumar and Gupta, 2018; Khan et al., 2019). For example, Rekha et al. (2018) found that the treatment of 50% vermicompost + 50% soil increased the length of shoots, average intermodal length and the number of leaves and branches of *Capsicum annum* (Linn.) Hepper. Similarly, Jankauskienė et al. (2022) showed that mixing vermicompost with peat increased the plant height and the number of leaves of cucumber plants. In the present study, the growth of plants was also found to be significantly increased with increasing vermicompost application rates.

Effects of vermicompost on the yield parameters of spring onion

There were large differences in the individual mean plant weight at harvest and in the total yield of spring onions in the 1m^2 plots among treatments (Table 4, Figure 3). The results of the present study demonstrated that individual weight and plot yields increased when doses of vermicompost application were raised. The highest average weight of a single plant was found in treatment T5 with a mean of 302.93 g, which corresponds to an increase of 48.5% and 38.2% compared to the control (T1) and the lowest vermicompost treatment (T2), respectively. In terms of the total yield of the plots, the highest yield of 4.86 kg m^{-2} was again found in the treatment with the highest vermicompost application (T5), and the lowest yield of

3.26 kg m^{-2} was recorded in the control (no vermicompost application). The increases in plot yields compared to the control ranged from 3.9% in T2 to 49.1% in T5, clearly indicating the effectiveness of vermicompost application in increasing yields (Table 4). As a result, a strongly positive relationship between the vermicompost rate and the plot yield was observed in this study (Figure 4).

Table 4. Effects of vermicompost on the individual weight and plot yield of spring onion plants.

Treatments	The individual weight and plot yield of spring onion (fresh weight)	
	Individual weight (g plant^{-1})	Plot yield (kg m^{-2})
T1 (control)	204.07 ± 0.74^{e}	3.26 ± 0.08^{c}
T2	219.26 ± 0.24^{d}	3.39 ± 0.08^{c}
T3	247.04 ± 0.93^{c}	3.66 ± 0.20^{bc}
T4	265.93 ± 1.96^{b}	4.16 ± 0.11^{b}
T5	302.96 ± 1.96^{a}	4.86 ± 0.14^{a}
$F_{(4,10)}$	831.77	25.77
Sig.	$P < 0.05$	$P < 0.05$

Values are mean ± S.E. of three replications; Means with different letters are significantly different at the $p < 0.05$ level according to the Tukey's significant difference test; T1: no vermicompost application; T2: vermicompost application of 10 t ha^{-1}; T3: vermicompost application of 20 t ha^{-1}; T4: vermicompost application of 30 t ha^{-1}; T5: vermicompost application of 40 t ha^{-1}.

Figure 3. Sizes of spring onion plants in different treatments. T1 (control): no vermicompost application (A); T2: vermicompost application of 10 t ha^{-1} (B); T3: vermicompost application of 20 t ha^{-1} (C); T4: vermicompost application of 30 t ha^{-1} (D); T5: vermicompost application of 40 t ha^{-1} (E).

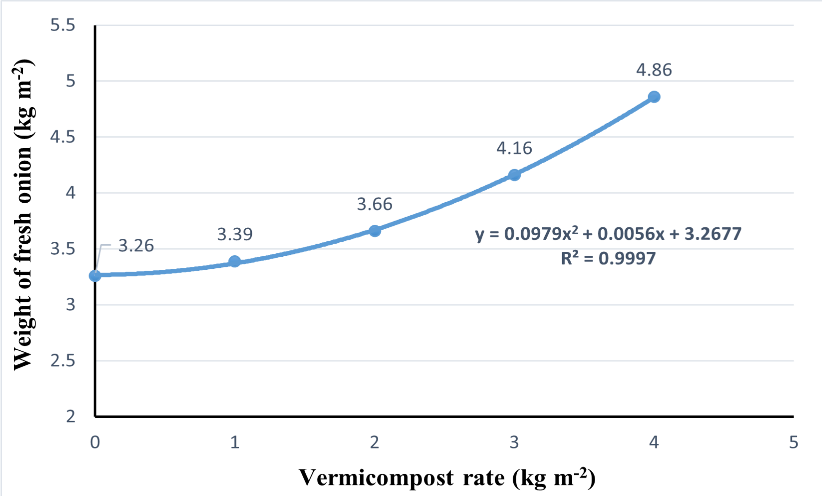

Figure 4. The relationship between the application rate of vermicompost and the yield of spring onion.

Consequent statistical analysis confirmed that there were significant differences in the mean weight of single plant among treatments, with the individual weights of spring onions significantly higher in all vermicompost treatments than in the control (Table 4, Figure 3). A similar tendency was found in the plot yields. The plot yields of treatments T4 and T5 increased significantly compared to the control (Table 4).

Regarding the potential use of vermicompost in the promotion of crop yields, several studies have demonstrated that the addition of vermicompost increased the yield of tomato (Yang et al., 2015), radish (Kumar and Gupta, 2018), chili (Khan et al., 2019), cucumber (Jankauskienė et al., 2022), and lettuce (Papathanasiou et al., 2012). The results of this study were in agreement with the results of these previous studies and confirmed the positive effects of vermicompost on alliums; adding vermicompost promoted the individual plant weight and the yield of spring onion (Table 4, Figures 3 and 4). Furthermore, the higher plant growth and yield depended on the amount of vermicompost added to the soil. The research by Khan et al. (2019) also demonstrated that the addition of vermicompost at an application rate of 2.5 t ha^{-1} (fruit yield of 8.27 t ha^{-1}) gave a higher yield compared to the application of 2.0 t ha^{-1} (fruit yield of 6.88 t ha^{-1}) and 1.5 t ha^{-1} (fruit yield of 5.50 t ha^{-1}) and to the control (fruit yield of 3.61 t ha^{-1}). Similarly, Jankauskienė et al. (2022) found that the treatment with peat + 30% vermicompost produced a higher cucumber yield than the treatments with peat + 10% and 20% vermicompost. In the present study, the growth and yield parameters of spring onion improved by adding vermicompost, with an application of 40 t ha^{-1} yielding the best performance on all parameters. Noticeably, a strongly positive relationship between vermicompost doses and the growth and yield parameters of spring onion was observed in the present study (Figure 4).

There is no doubt that vermicompost benefits crop yield in a range of different crops. This reflects the fact that vermicompost contains macronutrients (N, P, K), micronutrients, beneficial soil microbes, plant growth-regulating hormones, and enzymes such as amylase, lipase, cellulase, and chitinase (Sinha et al., 2010). As a result, the application of vermicompost in agricultural cultivation promoted plant growth and increased the yield of crops.

Conclusion

Vermicompost had significant positive effects on the growth and yield of spring onion. These positive effects increased with the level of the vermicompost application. At the highest vermicompost application rate (40 t ha^{-1}), onion plants had the highest performance in terms of plant height, number of leaves, number of tillers, individual weight, and plot yield. Noticeably, an increase in plot yield of 49.1% was found in the treatment of the highest vermicompost application compared to the control. Consequently, the findings of this study demonstrate that vermicompost has great potential for use as a bio-fertilizer in agricultural cultivation in general and in spring onion cultivation in particular.

Acknowledgements

The authors gratefully acknowledge the financial support from Tra Vinh University.

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Received: September 19, 2023
Accepted: December 3, 2023

UTICAJI GLISTENJAKA NA RAST I PRINOS ALJME (*ALLIUM FISTULOSUM* L.)

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R e z i m e

Aljma (*Allium fistulosum* L.) je popularno povrće za salatu koje se proizvodi širom sveta, uključujući i Vijetnam. Zahvaljujući svom ukusu i aromi, nezamenjiv je sastojak koji se koristi za aromatizovanje supa i drugih jela. Glistenjak je prirodno i ekološki prihvatljivo đubrivo koje se široko koristi za povećanje prinosa useva i očuvanje održivosti agrosistema. Shodno tome, ova studija je sprovedena da bi se ispitala efikasnost glistenjaka pri različitim količinama primene u unapređivanju parametara rasta i prinosa aljme. Rezultati pokazuju da je dodavanje glistenjaka prilikom proizvodnje aljme imalo značajne pozitivne uticaje na visinu biljke, broj listova, broj izdanaka, masu cele biljke i prinos po parcelici. Konkretno, primena glistenjaka u količini od 40 t ha^{-1} pokazala je najviši učinak kod posmatranih parametara, povećavajući broj listova, broj izdanaka, masu cele biljke odnosno prinose po parcelici na 64,78, 21,18, 302,96 g po biljci, odnosno 4,86 kg m^{-2}. Prinosi po parcelici u tretmanima sa najvišom i najnižom primenom glistenjaka povećani su za 49,1% odnosno 3,9% u poređenju sa kontrolom. S tim u vezi, postojala je jaka pozitivna veza između količine primenjenog glistenjaka i prinosa po parcelici.

Ključne reči: *Allium fistulosum*, crni luk, organska đubriva, glistenjak, aljma.

Primljeno: 19. septembra 2023.
Odobreno: 3. decembra 2023.

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