



Research Article

GROWTH AND YIELD RESPONSE OF LEEK PLANTS DUE TO GOAT MANURE DOSE AND SETTING PLANT SPACING IN ORGANIC FARMING

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Abstract

Leeks (*Allium Fistulosum L.*) is a horticulture commodity which belongs to allium family that can be cultivated organically. Organic Leeks production can be increased in any other way, including adjusting the dose of goat manure and setting plant spacing. This research is to know the effect of goat manure dosage and plant spacing on the growth and yield of leek plants. The research was conducted in Trawas, Mojokerto, East Java, Indonesia in January – March 2024. This research was conducted using the Split Plot method with two treatment factors. The treatment used was the dose of goat manure as the main plot and the plant spacing as the sub plot. The dose of goat manure (D) consists of three levels, namely: D1= 10 tons/ha, D2= 20 tons/ha, and D3= 30 tons/ha. The second factor is setting the planting distance (J), including: J1= 20 x 20 cm, J2= 15 x 20 cm, and J3= 10 x 10 cm. The research results showed that the combination of a fertilizer dose of 30 tons/ha with a planting distance of 10 x 20 cm had an effect on increasing the fresh weight of leekss per hill. The research results showed that the combination of a goat manure dose of 30 tons/ha with a planting distance of 10 x 20 cm had an effect on increasing the fresh weight of leeks per bunch. The interaction of the two treatments produced 232.11 g of leeks as the highest yield.

Keywords: Leeks, Organic farming, Goat manure dose, Plant spacing.

INTRODUCTION

Leeks (*Allium fistulosum L.*) are a type of leaf vegetable that is widely cultivated in Indonesia inorganically and organically. Cultivating leeks organically does not require large costs because it uses natural ingredients in its application. Cultivating leeks organically does not require large costs because it uses natural ingredients in its application.[1] Organic vegetable production requires careful advance planning to provide adequate soil fertility, nutrient availability, and acceptable crop protection. The need for leeks is increasing so efforts are needed to increase leek production. Increasing organic leek production can be done by various ways of adjusting the dosage of goat manure and planting distance. Goat manure is included in fertilizers that can be used in organic farming. Goat manure can increase soil fertility and the nutrients contained in the soil. This will affect the growth and yield of leeks. [2] Goat manure contains the elements N (2.43%), P (0.73%), and K (1.35%). These nutrients play an important role in the growth of leek plants because [3] leeks require N (2.55%), P (0.42%), and K (1.66%). Therefore, it is necessary to provide goat manure at the right dose. [4] Plant spacing is a technique for regulating the layout and population of plants in one area which aims to minimize competition. Setting plant spacing with the right population size will reduce competition between plants in obtaining light, water and nutrients. And each type of plant has different spacing settings according to the shape of the plant canopy. Setting plant spacing can affect the growth and yield of leek plants. [5] Plant spacing that is too close will inhibit plant growth and yield due to high competition between plants. [6] Wide planting distances affect population numbers resulting in a decrease in the fresh weight of consumption per plot and per hectare.

Based on the description above, it is necessary to carry out research on leek plants through managing the dosage of goat manure and setting appropriate plant spacing on the growth and yield of leek plants organically.

MATERIALS AND METHODS

Time and place of research

The research was conducted in January – March 2024 at Brenjonk Organic Farming, Trawas, Mojokerto, East Java, Indonesia. That location meets the growing requirements for leeks and support organic farming research.

Materials and tools

The materials used in this study were 2-month-old red onion seeds, goat manure, and decomposer. The tools used included: hoes, scales, measuring cups, meters, and cameras. The materials used in this study.

Research Methods

The research was conducted using the Split Plot method with two treatment factors, namely the dose of goat manure and the arrangement of planting distances. The treatment of goat manure dosage becomes the main plot and the arrangement of planting distance becomes the sub-plot. The goat manure dosage treatment consists of 3 levels, namely: D1= 10 tons/ha, D2= 20 tons/ha, and D3= 30 tons/ha. The second factor is the arrangement of planting distance (J), including: J1 = 20 x 20 cm, J2 = 15 x 20 cm, and J3 = 10 x 10 cm. Based on these two factors, 9 treatment combinations were obtained which were repeated 3 times, resulting in 27 experimental units.

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Observation parameters and data analysis models

The study was conducted by observing plant length, number of leaves, number of tillers, fresh weight of plants per clump and fresh weight of plants per hectare with observations made every 7, 28, 49, and 70 DAP (Days After Planting). The data obtained were then analyzed using the F test, if there was diversity continued using the Tukey Test at the 5% level.

Research Implementation

The first stage of the study was carried out by cultivating the land using a hoe and providing goat manure according to the dosage used in this study, then spraying decomposer on the land to be used. The second stage was planting leek seeds according to the planting distance used in the study. The third stage of plant maintenance included watering and weeding. The last stage was harvesting leeks that were 70 DAP old.

RESULTS AND DISCUSSION

Plant Length

The treatment of goat manure dosage and planting distance arrangement did not significantly affect the length of the leek plants at 7 DAP. The treatment of goat manure dosage of 30 tons/ha had a significant effect and increased the length of the plant as indicated by the highest value of 35.76 cm at 28 DAP, 50.17 cm at 49 DAP, and 58.03 cm at 70 DAP. The treatment of goat manure dosage of 30 tons/ha was also significantly different from other doses. The treatment of 20 x 20 cm planting distance arrangement produced the highest plant length of 35.04 cm at 28 DAP, while at 49 DAP and 70 DAP the highest plant length was found in the treatment of 10 x 20 cm planting distance arrangement of 50.17 cm and 58.03 cm

Table 1. Average plant length of leeks due to goat manure dose treatment and setting plant spacing at 7 to 70 DAP

Treatment	Plant Length (cm)			
	7 DAP	28 DAP	49 DAP	70 DAP
Goat Manure Dosage				
D1 (10 ton/ha)	21.38	33.63 a	46.94 a	54.50 a
D2 (20 ton/ha)	21.18	34.71 b	48.78 b	56.61 b
D3 (30 ton/ha)	21.08	35.76 c	50.17 c	58.03 c
Tukey 5%	ns	0,68	1.17	0.92
Setting Plant Spacing				
J1 (20 x 20 cm)	21.21	35.04 b	48.40 a	56.05 a
J2 (15 x 20 cm)	21.16	34.74 b	48.59 a	56.22 a
J3 (10 x 20 cm)	21.27	34.33 a	48.90 b	56.88 b
Tukey 5%	ns	0.33	0.26	0.49

*Numbers followed by the same letter in the same column and treatment show no significant difference in the 5% Tukey test; ns = not significant.

Numbers of leaves per clump

The treatment of goat manure dosage and planting distance arrangement did not significantly affect the number of leaves per clump at 7 DAP. The treatment of goat manure dosage of 30 tons/ha significantly affected and increased the number of leaves by 12.70 at 28 DAP, 23.96 at 49 DAP, and 30.93 at 70 DAP. The treatment of 20 x 20 cm planting distance arrangement produced the highest number of leaves of 12.48 at 28 DAP. The 20 x 20 cm planting distance arrangement also increased the number of leaves and was significantly different at 49 DAP and 70 DAP by 23.56 and 30.48.

Table 2. Average number of leaves per clump due to goat manure dose treatment and setting plant spacing at 7 to 70 DAP

Treatment	Number of leaves per clump			
	7 DAP	28 DAP	49 DAP	70 DAP
Goat Manure Dosage				
D1 (10 ton/ha)	1.37	11.67 a	22.37 a	29.33 a
D2 (20 ton/ha)	1.44	12.33 b	23.07 a	30.07 b
D3 (30 ton/ha)	1.70	12.70 b	23.96 b	30.93 c
Tukey5%	ns	0.39	0.66	0.26
Setting Plant Spacing				
J1 (20 x 20 cm)	1.56	12.48 b	23.56 c	30.48 c
J2 (15 x 20 cm)	1.67	12.22 ab	23.15 b	30.15 b
J3 (10 x 20 cm)	1.30	12.00 a	22.70 a	29.70 a
Tukey5%	ns	0.26	0.28	0.15

*Numbers followed by the same letter in the same column and treatment show no significant difference in the 5% Tukey test; ns = not significant.

Number of tillers per clump

The combination of goat manure dose treatment and planting distance arrangement showed interaction on the number of tillers per clump of leeks at 70 DAP. The combination of D3J1 dose treatment became the highest value of 6.33 tillers which was not significantly different from D2J2 of 6, D2J1 of 5.89, and D3J2 of 5.67.

Table 3. Average number of tillers per clump due to the interaction of goat manure dose treatment and setting plant spacing at 70 DAP

Goat Manure Dosage	Number of Tillers per clump 70 DAP			
	Setting Plant Spacing	J1 (20 x 20 cm)	J2 (15 x 20 cm)	J3 (10 x 20 cm)
D1 (10 ton/ha)	5.56 a	5.44 a	5.33 a	5.33 a
D2 (20 ton/ha)	5.89 ab	6.00 ab	5.44 a	5.44 a
D3 (30 ton/ha)	6.33 b	5.67 ab	5.33 a	5.33 a
Tukey 5%	0.68			

*Numbers followed by the same letter in the treatment combination show no significant difference in the 5% Tukey test.

The treatment of goat manure dose did not show any significant effect on the number of tillers per clump at 7 DAP, 28 DAP, and 49 DAP. The treatment of planting distance arrangement also did not show any effect at 7 DAP and 28 DAP. The arrangement of planting distance showed an effect at 49 DAP with the number of tillers 4 at a planting distance of 20 x 20 cm.

Table 4. Average plant length of leeks due to goat manure dose treatment and setting plant spacing at 7 to 49 DAP

Treatment	Number of Tillers per clump		
	7 DAP	28 DAP	49 DAP
Goat Manure Dosage			
D1 (10 ton/ha)	0.22	1.78	3.63
D2 (20 ton/ha)	0.22	1.89	3.89
D3 (30 ton/ha)	0.22	1.96	3.82
Tukey 5%	ns	ns	ns
Setting Plant Spacing			
J1 (20 x 20 cm)	0.29	1.78	4.00 b
J2 (15 x 20 cm)	0.26	1.89	3.78 ab
J3 (10 x 20 cm)	0.11	1.96	3.55 a
Tukey 5%	ns	ns	0.30

*Numbers followed by the same letter in the same column and treatment show no significant difference in the 5% Tukey test; ns = not significant.

Fresh weight of plants per clump

The combination of goat manure dose treatment and planting distance arrangement showed interaction on the amount of fresh weight of leeks per clump. The combination of fertilizer dose of 30 tons/ha with a planting distance of 20 x 20 cm

produced the highest weight of 232.11 g. This treatment combination produced a significantly different plant weight from other treatment combinations.

Table 5. Average fresh weight of leeks per clump due to the interaction of goat manure dose treatment and setting plant spacing

Goat Manure Dosage	Fresh Weight of Plants per Clump		
	Setting Plant Spacing J1 (20 x 20 cm)	J2 (15 x 20 cm)	J3 (10 x 20 cm)
D1 (10 ton/ha)	168.44 b	164.55 ab	159.78 a
D2 (20 ton/ha)	189.78 d	178.22 c	164.56 ab
D3 (30 ton/ha)	232.11 f	219.78 e	182.00 c
Tukey 5%	6.84		

*Numbers followed by the same letter in the treatment combination show no significant difference in the 5% Tukey test.

Fresh weight of plants per hectare

The treatment of goat manure dosage produced a significant effect with a dosage of 30 tons/ha as the highest result. A dosage of 30 tons/ha increased the weight of leeks per hectare by 24.19 tons which was significantly different from other doses. The arrangement of planting distance also produced a significant effect with a planting distance of 10 x 20 cm as the highest result of 29.19 tons. These results were significantly different from other planting distance arrangements.

Table 6. Average fresh weight of leeks per hectars due to goat manure dose treatment and setting plant spacing

Treatment	Fresh Weight of Plants per Hectare (Tons)
Goat Manure Dosage	
D1 (10 ton/ha)	20.18 a
D2 (20 ton/ha)	21.15 a
D3 (30 ton/ha)	24.19 b
Tukey 5%	1.43
Setting Plant Spacing	
J1 (20 x 20 cm)	16.11 a
J2 (15 x 20 cm)	20.22 b
J3 (10 x 20 cm)	29.19 c
Tukey 5%	1.54

*Numbers followed by the same letter in the same column and treatment show no significant difference in the 5% Tukey test

DISCUSSION

Effect of combination of goat manure dose treatment and setting plant spacing on the growth and yield of leeks

The combination of goat manure dose treatment and setting plant spacing affected the number of leek tillers at 70 DAP and fresh weight per plant. The combination of D3J1 treatment produced an average number of tillers per clump of 6.33 tillers. This is because the administration of a high dose of goat manure and wider setting plant spacing with a low population allows leek plants to grow optimally. [7] Wide planting distance increases the number of leek tillers, while close planting distance causes leek plants to have few tillers. The high number of tillers indirectly affects the fresh weight of plants per clump. The more leek tillers, the higher the weight of the leek plants. According to the research conducted, the D3J1 treatment produced the highest fresh weight of leek plants at 232.11g.

Effect of goat manure dose treatment on the growth and yield of leeks

The treatment of goat manure dose significantly affected the length of the plant, number of leaves, number of tillers, and

fresh weight of the plant per hectare. The treatment of goat manure dose of 30 tons/ha affected all parameters compared to the treatment of goat manure dose of 10 tons/ha and 20 tons/ha. [8] The higher the dose given, the higher the soil nutrient content including the N element which plays an important role in the vegetative growth of the plant. The vegetative growth is in the form of an increase in tillers which affects the increase in the number of tillers in leeks. The provision of goat manure with a high dose of 30 tons/ha supports the growth of leeks due to the nutrients contained in goat manure. These nutrients meet the needs of leeks, which are indicated by the increase in plant length, number of leaves and number of leek tillers. The increase in these parameters affects the production of the resulting plants. [9] Nutrients play a role in metabolic activities in the leaf and stem areas, thus affecting the fresh weight of the plant. Therefore, increasing the dose of goat manure also affects the fresh weight of the plant per hectare.

Effect of setting plant spacing treatment on the growth and yield of leeks

The treatment of setting plant spacing significantly affected the parameters of plant length, number of leaves, number of tillers and fresh weight of plants per hectare. Planting distance arrangement of 10 x 20 cm resulted in the highest average plant length at 49 DAP and 70 DAP. This was due to competition between plants in obtaining sunlight which caused the plant height to increase. [10] The closer the planting distance, the higher the plant height and the lower the number of leaves. In accordance with the research that has been conducted, the planting distance arrangement of 10 x 20 cm resulted in the lowest number of leaves at 7 DAP, 28 DAP, 49 DAP, and 70 DAP. The planting distance arrangement of 10 x 20 cm also increased the fresh weight of plants per hectare with a high population. The close planting distance causes the population in a unit of land to increase and affects the production of leeks per hectare. In accordance with the research that has been conducted, the fresh weight of plants per hectare is found in the planting distance arrangement of 10 x 20 cm. The planting distance arrangement of 20 x 20 cm resulted in the highest number of tillers and leaves due to the minimal competition that occurs. [9] Wider planting distances minimize competition so that plants can grow and produce optimally. In addition, wide planting distances provide space for the leek plants to produce shoots.

Conclusion

Increasing the dose of goat manure can increase the fresh weight production of leeks clump at all planting distances tested. The highest results from the treatments tested were in the goat manure dose treatment of 30 tons/ha and a planting distance of 20 x 20 cm. The setting plant spacing affects the population per unit area. Increasing the population can increase the production of leeks per hectare. The highest production was obtained with a planting distance of 10 x 20 cm with a population of 366.670 leeks per hectare.

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