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Effect of Chicken Manure Rate and Biofertilizer Concentration on the Growth and Yield of Land Kale Plants (Ipomea reptans Poir.)

Sulistyowati Puji Rahayu[1], Lia Amalia[2], R Wahyono Widodo[2]
[1,3] Mahasiswa Program Studi Magister Agroteknologi Fakultas Pertanian-Universitas Winaya Mukti, Jl. Raya Bandung-Sumedang Km.29 Tanjungsari 45362, Kab. Sumedang, Jawa Barat, Indonesia.
[2] Dosen Program Studi Magister Agroteknologi Fakultas Pertanian-Universitas Winaya Mukti, Jl. Raya Bandung-Sumedang Km.29 Tanjungsari 45362, Kab. Sumedang, Jawa Barat, Indonesia
Email: Sulistyowati_pujirahayu@yahoo.co.id

Abstract
This study aims to study the interaction between the dose of chicken manure and the concentration of biofertilizers on growth and the concentration of biological fertilizers on the growth and yield of kale and wants to know the optimum dose of chicken manure and the concentration of biological fertilizers that have the best effect on water spinach plants. The experiment was conducted in Cisondari Village, Pasirjambu District, Bandung Regency, West Java Province. with an altitude of 1200 meters above sea level, Latosol soil type with a pH of 6.21 (slightly acidic). The experimental design used a factorial randomized block design (RBD) consisting of two factors and was repeated twice. The first factor is the dose of chicken manure which consists of four levels, namely: a0 = Control (0 g/polybag); a1=15g/poly bag; a2 = 30 g/polybag and a3 = 45 g/polybag). The concentration of Extragen Biological Fertilizers (E) consists of 4 levels, namely: e0 = Control (0 ml/liter); e1 = extragen (3 ml/liter); e2 = extragent (6 ml/liter) and e3 = extragent (9 ml/liter). The results of this study are: 1). There was no interaction between the application of chicken manure and the concentration of extragen biofertilizers on the growth and yield of ground kale. 2). The results of independent analysis of chicken manure application had a significant effect on plant height at 30 HST. number of leaves aged 15 HST, plant dry weight and root loss ratio. Meanwhile, the concentration of extragen biological fertilizers had a significant effect on plant height at 30 HST and plant fresh weight. 3). The optimum dose of chicken manure was found in treatment a3, namely 45 tons/ha, and the optimum concentration of extragen biofertilizer, namely 3 ml/liter for fresh weight, and 9 ml/liter of water for plant height of ground kale.

Keywords: Ground Water Spinach, Chicken Manure, Extragen biological Fertilizer

1. Introduction

Land kale is a plant belonging to the Convolvulaceae family which grows widely in tropical and subtropical areas. Water spinach plants have excellent economic value and can be developed for agribusiness. Land kale plants are short-lived vegetable plants(Yulianingsih, 2018). Increasing consumer demand for kale plants has made this vegetable widely available in local and modern markets, the price is relatively cheap compared to other types of vegetables. Water spinach production at the farmer level is still relatively low, so kale cultivation requires fertilizer to optimize growth and harvest yields.(Febriyono et al., 2017). The use of manure has long been identified with the success of fertilizer programs in sustainable agriculture. This is because manure can increase the availability of nutrients for plants. Apart from that, manure also has a positive influence on the physical and chemical properties of soil, and can encourage the development of microorganisms. Biofertilizer is a liquid organic fertilizer with an inoculant made from live microorganisms whose function is to add and provide nutrients. Extragen biological fertilizer is a biofertilizer made from fresh raw materials without a mixture of chemicals which is processed using an extract process to produce enzymes, inoculant fertilizer made from live microorganisms which function to add and provide nutrients in the soil(Munawaroh, 2019) The nutrient content of extragen liquid biological fertilizer is macro and micro nutrients, microorganisms (Bacillus sp, Azotobacter sp, Azospirilium sp, Actinomycetes sp, Lactobacillus sp)(Puji Cahyani et al., 2021)

2. Methods

The research method uses an experimental approach with experiments. The experiment was carried out in Cisondari Village, Pasirjambu District, Bandung Regency, West Java Province. with an altitude of 1200 meters above sea level, Latosol soil type with a pH of 6.21 (slightly acidic). The experiment will start from October 2022 to November 2022. The materials used in this experiment are: land spinach seeds of the Bangkok LP-1 variety, chicken manure and Extragen biological fertilizer. The tools used in this experiment include polybags measuring 25 cm x 25 cm (diameter 16 cm) with a capacity of 2 kg, scales, plastic buckets, hoes, shovels, sieves measuring 2 mm for filtering soil, rulers, manual scales 10 kg, electric scales and Dial-O-Gram scales, stationery, watering tools, meters and treatment labels. The experimental design used was a factorial Randomized Block Design (RAK) consisting of two factors. The first factor is the dose of chicken manure (A) consisting of 4 levels, namely: a0 = 0 tons/ha (control) (0 gr/polybag); a1 = 15 tonnes/ha (15 gr/polybag) a2 = 30 tonnes/ha (30 gr/polybag) and a3 = 45 tonnes/ha (45 gr/polybag). The second factor is the concentration of Extragen biological fertilizer (e) consisting of 4 treatment levels, namely: e0 = control (0 ml / liter of water); e1 = extragen (3 ml / liter of water; e2 = extragen (6 ml / liter of water) and e3 = extragen (9 ml / liter of water). The experiment consisted of 16 treatment combinations repeated 2 times so that the total treatment was 32 treatment combinations.

Table 1. Treatment Combination of Chicken Manure Dosage (a) and Fertilizer Concentration Biological Extragen (e)

Chicken manure (a)	Extragen biofertilizer (e)			
	e0	e1	e2	e3
a0	a0e0	a0e1	a0e2	a0e3
a1	a1e0	a1e1	a1e2	a1e3
a2	a2e0	a2e1	a2e2	a2e3
a3	a3e0	a3e1	e3e2	a3e3

Table 2. Operationalization of Independent Variables and Dependent Variables

Variable Type	Sub Variable	Variable Indicator
Independent Variable (Treatment)	Dosage of Chicken Manure (a)	• a0 = control (0 g/polybag) • a1 = chicken manure 15 tons/ha (15 g/polybag) • a2 = chicken manure 30 tonnes/ha (30 g/polybag) • a3 = chicken manure 45 tonnes/ha (45 g/polybag) •
	Biofertilizer dosage (e)	• e0 = control 0 ml / liter of water • e1 = biological fertilizer 3 ml / liter of water • e2 = biological fertilizer 6 ml / liter of water • e3 = biological fertilizer 9 ml / liter of water
Dependent variable (Response)	Plant Growth Characteristics	• Plant height • Number of leaves
	Crop Results	• Total fresh weight of the plant • Total dry weight of the plant • Root loss ratio

Table 3. Testing Various Randomized Block Designs with Factorial Patterns.

Variety Source	DB	JK	KT	Fh	F 0.05
Deuteronomy (r)	1	ΣXi..2/ t – X...2/rt	JKr/DBr	KTr/KTg	4.54
Treatment (t)	15	ΣX..jh2/ r – X...2/rt	JKt/DBt	KTt/KTg	2.41
Extragen (E)	3	ΣX.j.2/ rk – X...2/rt	JKM/DBE	KTE/KTg	3.29
Chicken Manure (A)	3	ΣX..h2/ rm – X...2/rt	JKK/DBA	KTA/KTg	3.29
Interaction (E x A)	9	JKt – JKM – JKK	JKI/DBEK	KTI/ATg	2.59
Error (g)	15	JKTotal – JKr – JKt	JKg/DBg	-	-
Total	31	ΣXijk2 – X...2/rt	-	-	-

Source: Toto Warsa and Cucu SA (1992)

Information : DB = Degrees of Freedom JK = Sum of Squares Fh = Fcount
KT = Middle Square F0.05 = F Table level 5%

3. Results and Discussion

3.1 Observation of Plant Height

The results of the analysis of variance showed that the treatment of chicken manure and extragen biological fertilizer had no significant effect on plant height at the ages of 10, 15, 20, 25 HST, but at the age of 30 DAP it showed a significant effect.

Table 4. The effect of chicken manure and extragen biological fertilizer on the height of land kale plants at the ages of 10, 15, 20, 25 and 30 HST.

Treatment	Average Plant Height									
	10 HST		15 HST		20 HST		25 HST		30 HST	
Chicken Fertilizer:										
a0= 0 tons/ha	3.03	a	8.08	a	11.53	a	13.66	a	16.56	a
a1= 15 tonnes/ha	2.92	a	7.81	a	10.89	a	17.64	a	21.51	b
a2=30 tonnes/ha	3.09	a	7.69	a	10.67	a	15.30	a	19.80	b
a3=45 tons/ha	3.15	a	8.09	a	11.28	a	14.31	a	19.00	b
Extragen:										
e0= 0 ml/liter of water	3.02	a	7.53	a	9.84	a	14.69	a	20.62	a
e1= 3 ml/liter of water	3.12	a	8.00	a	12.66	a	14,11	a	19.53	b
e2= 6 ml/liter of water	2.93	a	8.19	a	10.89	a	15.79	a	17.12	b
e3= 9 ml/liter of water	3.12	a	7.95	a	10.97	a	16.33	a	19.61	b

Information : Average numbers marked with the same letter in the same column are not significantly different according to Duncan's Multiple Range Test at the 5% significance level.

3.2 Observation of Number of Leaves

The results of the analysis of variance showed that chicken manure treatment at the age of 15 DAT had a significant effect on the number of leaves, whereas the extragene biological fertilizer treatment had no significant effect at all ages observed.

Table 5. The effect of chicken manure and extragen biological fertilizer on the number of leaves

Treatment	Average Number of Leaves (Strands)									
	10 HST		15 HST		20 HST		25 HST		30 HST	
Chicken Fertilizer:										
a0= 0 tons/ha	8.00	a	16.00	a	19.95	a	27.00	a	31.00	a
a1= 15 tonnes/ha	8.00	a	16.25	b	22.38	a	25.50	a	32.75	a
a2=30 tonnes/ha	8.00	a	16.25	b	19.85	a	26.50	a	30.50	a
a3=45 tons/ha	8.75	b	16.25	b	20.63	a	26.25	a	31.50	a
Extragen:										
e0= 0 ml/liter of water	8.00	a	16.00	a	19.73	a	24.50	a	30.00	a
e1= 3 ml/liter of water	8.25	a	16.25	a	21.78	a	27.50	a	32.25	a

e2= 6 ml/liter of water	8.25	a	16.25	a	19.40	a	27.25	a	32.50	a
e3= 9 ml/liter of water	8.25	a	16.25	a	21.90	a	26.00	a	31.00	a

Note: Average numbers marked with the same letter in the same column are not significantly different according to Duncan's Multiple Range Test at the 5% significance level.

3.3 Observation of Plant Fresh Weight

The results of the analysis of variance showed that the chicken manure treatment had no significant effect on the fresh weight of the plants, whereas the extragene biological fertilizer treatment had a significant effect.

Table 6. Effect of Chicken Manure and Extragen Biological Fertilizer Treatment on Fresh Weight of Land Water Spinach Plants

Treatment	Average Fresh Weight(g)	
Chicken Manure:		
a0 = control (0 g/polybag)	18.81	a
a1 = 15 tonnes/ha (15 g/polybag)	19,19	a
a2 = 30 tons/ha (30 g/polybag)	15.69	a
a3 = 45 tonnes/ha (45 g/polybag)	17.98	a
Extragent Biological Fertilizer:		
e0 = control 0 ml / liter of water	13.34	a
e1 = 3 ml / liter of water	22.38	c
e2 = 6 ml / liter of water	18.92	BC
e3 = 9 ml / liter of water	17.04	ab

Information : Average numbers marked with the same letter in the same column are not significantly different according to Duncan's Multiple Range Test at the 5% significance level.

3.4 Observation of Plant Dry Weight

The results of analysis of variance showed that chicken manure treatment had a significant effect on plant fresh weight, in treatments a2 and a3 significantly different from treatment a0.

Table 7. The Effect of Chicken Manure and Extragen Biological Fertilizer Treatment on Dry Weight of Ground Water Spinach Plants

Treatment	Average Dry Weight (g)	
Chicken Manure:		
a0 = control (0 g/polybag)	1.89	a
a1 = 15 tonnes/ha (15 g/polybag)	3.93	ab
a2 = 30 tons/ha (30 g/polybag)	5.85	b
a3 = 45 tonnes/ha (45 g/polybag)	7.81	b
Extragent Biological Fertilizer:		
e0 = control 0 ml / liter of water	4.10	a
e1 = 3 ml / liter of water	4.73	a
e2 = 6 ml / liter of water	5.09	a
e3 = 9 ml / liter of water	5.56	a

Note: Average numbers marked with the same letter in the same column are not significantly different according to Duncan's Multiple Range Test at the 5% significance level.

3.5 Observation of Root Extinction Ratio

The results of the analysis of variance showed that chicken manure treatment had a significant effect on the plant root loss ratio, in treatment a3 it was significantly different from treatments a0, a1 and a2.

Table 8. The effect of chicken manure and extragen biological fertilizer on the root loss ratio of land kale plants

Treatment	AveragePlant Root Loss Ratio(g)	
Chicken Manure:		
a0 = control (0 g/polybag)	3.38	a
a1 = 15 tonnes/ha (15 g/polybag)	2.70	a
a2 = 30 tons/ha (30 g/polybag)	2.02	a
a3 = 45 tonnes/ha (45 g/polybag)	2.78	b
Extragent Biological Fertilizer:		
e0 = control 0 ml / liter of water	3.14	a
e1 = 3 ml / liter of water	2.52	a
e2 = 6 ml / liter of water	2.23	a
e3 = 9 ml / liter of water	2.99	a

Note: Average numbers marked with the same letter in the same column are not significantly different according to Duncan's Multiple Range Test at the 5% significance level.

4. Conclusion

There was no interaction between the application of chicken manure and the concentration of extragenic biological fertilizer on the growth and yield of land kale plants. The results of independent analysis of giving chicken manure had a significant effect on plant height at 30 HST. number of leaves aged 15 HST, plant dry weight and root loss ratio. Meanwhile, the concentration of extragene biological fertilizer had a significant effect on plant height at 30 DAT and fresh plant weight. The optimum dose of chicken manure is found in the A3 treatment, namely 45 tons/ha, and the optimum concentration of extragen biological fertilizer is 3 ml/liter for fresh weight, and 9 ml/liter of water for plant height. To increase yields in land kale cultivation, it is recommended to use chicken manure (45 tons/ha) and extragenic biological fertilizer at a concentration of 3 ml/liter of water and 9 ml/liter of water given together.

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