Agripreneur, 11 (2) (2022) pp.82-87
Published by:IOCSCIENCE
Agripreneur: Journal of Agribusiness Agriculture
Journal homepage:www.iocscience.org/ejournal/index.php/Agripreneur

Effect of Liquid Biofertilizer Concentration and Vermi-Comvost on Growth and Yield of Pakcoy (Brassica rapa L.) Plants

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Abstract
This research aims to study the effect of the interaction of different concentrations of extragene biofertilizer and different doses of vermicompost on the growth and yield of pakcoy plants, and wants to know the optimum concentration of extragen biofertilizer and the dose of vermicompost that gives the best results on pakcoy plants. 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 experimental design used a factorial Randomized Block Design (RAK) consisting of two factors and repeated twice. The first factor is the concentration of extragenic biological fertilizer (e) which consists of four levels, namely: e0 = control (0 ml/liter); e1 = extragen (3 ml/liter); e2 = extragen (6 ml/liter) and e3 = extragen (9 ml/liter). Vermicompost fertilizer dosage (K) consists of 4 levels, namely: k0 = Control (0 g/polybag); k1 = 16 g/polybag; k2 = 32 g /polybag and k3 = 48 g/polybag). The results of this research are: 1). By administering the highest dose of extragen liquid biological fertilizer of 9 ml/liter, results showed significantly different results in the height parameters of plants aged 21 HST. 2). Giving the highest dose of vermicompost fertilizer (0 gr/polybag) showed significantly different results. 3). In the combination treatment of extragen liquid biological fertilizer and vermicompost fertilizer, no interaction occurred.

Keywords: Pakcoy Emone 26 Variety, Extragen Liquid Biological Fertilizer, Vermicompost Fertilizer

1. Introduction

The Pakcoy plant (Brassica rapa L.) is a vegetable that is popular with Indonesian people, originating from China and belonging to the Brassica family and being in the same genus as white mustard greens (petsai) and green mustard greens.(Hartatik & Asmawan, 2022). Pakchoy plants are currently one of the vegetables that are popular with people in Indonesia, because they have thick leaf bones so they are crunchy when consumed. Pak choy is a nutritious vegetable. Pakcoy plants contain vitamin A, vitamin E and vitamin K. These three vitamins are some of the vitamins that are really needed by the human body(Fatiha et al., 2022). Biological fertilizers utilize certain microorganisms in large quantities to provide nutrients and help plant growth, namely by adding large amounts of nitrogen from the air and helping the availability of phosphorus in the soil.(Yasin, 2011). One of the biological fertilizers on the market is Extragen with an inoculant made from live microorganisms which functions to add and provide nutrients, including Azotobacter sp. and Azospirillum sp. as a microbe that fixes N from the free air. Bacillus sp. and Lactobacillus sp. which can help the fermentation process of organic materials into lactic acid compounds so that they can be absorbed by plants, Aspergillus sp. as a phosphate solvent, Trichoderma sp. as a fungicide, Rhizobium sp. forms root nodules on plants(Yasin, 2011). Apart from providing extragenic biological fertilizer, vermi compost is also given to meet the nutrient needs of plants, where the application of vermi compost can improve soil structure and add nutrients to pak choy plants. Vermi compost is a fertilizer resulting from composting organic waste with the help of earthworms which is able to fertilize the soil and can improve the physical, chemical and biological properties of the soil(Ayunita, I., 2014).

2. Methods

The research method uses an experimental approach with experiments.The research method used to test the effect of providing extragen biofertilizer and vermicompost on plant growth and yieldpak choy variety EMONE 26by carrying out experiments/trials in the field.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 pH 6.21 (slightly acidic).The experiment will start from October 2022 to November 2022. The materials used in this experiment are pakchoy seeds of the EMONE 26 variety (Appendix 1), Extragen biological fertilizer and worm compost. The tools used in this experiment include polybags measuring 25 cm x 25 cm with a capacity of 2 kg, scales, plastic buckets, hoes, shovels, 2 mm sieves for filtering soil, rulers, 10 kg manual scales, electric scales. and Dial-O-Gram scales, stationery, watering tools, meters and treatment labels. The experiment consisted of 16 treatment combinations repeated 2 times so that the total treatment was 32 treatment combinations. Each treatment consisted of 10 polybags, so there were 320 polybags in total.

Table1. Combination Treatment of Extragen Biological Fertilizer Concentration (E) and Vermicompost Fertilizer Dosage (K)

Extragen Biological Fertilizer (E)	Vermicompost Fertilizer (K)			
	k0	k1	k2	k3
e0	e0k0	e0k1	e0k2	e0k3
e1	e1k0	e1k1	e1k2	e1k3
e2	e2k0	e2k1	e2k2	e2k3
e3	e3k0	e3k1	e3k2	e3k3

Table2. Operationalization of Independent Variables and Dependent Variables

Variable Type	Sub Variable	Variable Indicator
Independent Variable (Treatment)	Concentration of extragen biologica fertilizer (E)	• e0 = control (0 ml/liter of water) • e1 = extragen (3 ml/liter of water) • e2 = extragen (6 ml/liter of water) • e3 = extragen (9 ml/liter of water)
	Worm Compost Dosage (K)	• k0 = control (0 g/polybag) • k1 = 16 (g/polybag) • k2 = 32 (g/polybag) • k3 = 48 (g/polybag)
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 (NPA)

Table3. List of Factorial Pattern Randomized Group Design Analysis

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	2.40
Extragen (E)	3	ΣX.j.2/ rk – X...2/rt	JKM/DBM	KTM/KTg	3.29
Vermicompost Fertilizer (K)	3	ΣX..h2/ rm – X...2/rt	JKK/DBK	KTK/KTg	3.29
Interaction (E x K)	9	JKt – JKM – JKK	JKI/DBMK	KTI/KTg	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 extragen biological fertilizer treatment had a significant effect on plant height at 21 DAT, but the vermicompost treatment had no significant effect at all ages of observation.

Table4. Effect of Extragen Biological Fertilizer Concentration and Vermicompost Fertilizer on the Height of Pakcoy Plants at 14, 21 and 28 HST.

Treatment	Average Plant Height (cm)		
	14 HST	21 HST	28 HST
Extragent Biological Fertilizer:			
e0 = control (0 ml/liter of water)	13.58 a	16.73 a	16.90 a
e1 = extragen (3 ml/liter of water)	14.60 a	17.60 ab	17.75 a
e2 = extragen (6 ml/liter of water)	14.56 a	18,17 BC	18.73 a
e3 = extragen (9 ml/liter of water)	15.33 a	19.27 c	19,10 a
vermicompost fertilizer			
k0 = Control (0 g/polybag)	13.71 a	17.81 a	18.21 a
k1 = 16 (g/polybag)	14.45 a	18.40 a	18.13 a
k2 = 32 (g/polybag)	14.69 a	17.54 a	18.04 a
k3 = 48 (g/ polybag)	15.23 a	18.02 a	18.10 a

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 the concentration treatment of extragen biological fertilizer and vermicompost had no significant effect on the number of leaves at all ages of observation. However, administering extragen concentration showed better results compared to not administering extragen.

Table5. Effect of Biological Fertilizer and Vermicompost Concentrations on the Number of Leaves of Pakcoy Plants at the Age of 14 DAP, 21 HST and 28 HST.

Treatment	AverageNumber of Leaves (Strands)		
	14 HST	21 HST	28 HST
Extragent Biological Fertilizer:			
e0 = Control (0 ml/liter of water)	9.58 a	5.88 a	7.54 a
e1 = Extragen (3 ml/liter of water)	10.17 a	6.29 a	8.04 a
e2 = Extragen (6 ml/liter of water)	9.67 a	6.50 a	7.96 a
e3 = Extragen (9 ml/liter of water)	10.33 a	6.46 a	8.38 a
Vermicompost Fertilizer			
k0 = Control (0 g/polybag)	9.92 a	6.25 a	8.17 a
k1 = 16 (g/polybag)	10.17 a	6.42 a	8.13 a
k2 = 32 (g/polybag)	9.67 a	5.83 a	7.58 a
k3 = 48 (g/ polybag)	10.33 a	6.63 a	8.04 a

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.

3.3 Observation of Plant Fresh Weight

The results of the analysis of variance showed that the concentration treatment of extragen biological fertilizer and worm compost had no significant effect on the fresh weight of pak choy plants.

Table6. Effect of Biological Fertilizer and Vermicompost Concentration on Fresh Weight of Pakcoy Plants.

Treatment	AverageFresh Weight(g)	
Extragent Biological Fertilizer:		
e_0= Control (0 ml/liter of water)	90.58	a
e_1= Extragen (3 ml/liter of water)	98.34	a
e_2= Extragen (6 ml/liter of water)	108.56	a
e_3= Extragen (9 ml/liter of water)	108.63	a
Worm Compost:		
k0 = Control (0 g/polybag)	111.49	a
k1 = 16 (g/polybag)	106.50	a
k2 = 32 (g/polybag)	94.22	a
k3 = 48 (g/ polybag)	93.91	a

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 the analysis of variance showed that the concentration treatment of extragen biofertilizer and vermicompost had no significant effect on the dry weight of pak choy plants.

Table7. Effect of Biological Fertilizer and Vermicompost Concentration on Weight dry Pakchoy Plants.

Treatment	AverageDry Weight(g)	
Extragent Biological Fertilizer:		
e_0= Control (0 ml/liter of water)	5.13	a
e_1= Extragen (3 ml/liter of water)	5.22	a
e_2= Extragen (6 ml/liter of water)	5.65	a
e_3= Extragen (9 ml/liter of water)	5.99	a
Vermicompost Fertilizer		
k0 = Control (0 g/polybag)	6.12	a
k1 = 16 (g/polybag)	5.67	a
k2 = 32 (g/polybag)	5.17	a
k3 = 48 (g/ polybag)	5.03	a

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.

3.5 Observation of Root Loss Ratio

The results of the analysis of variance showed that the concentration treatment of extragen biofertilizer and vermicompost had no significant effect on the weight ratio of pakcoy root rot.

Table8. Effect of Biological Fertilizer and Vermicompost Concentrations on the Root Loss Ratio of Pakcoy Plants.

Treatment	AverageRoot Loss Ratio(g)	
Extragent Biological Fertilizer:		
e_0= Control (0 ml/liter of water)	3.48	a
e_1= Extragen (3 ml/liter of water)	4.41	a
e_2= Extragen (6 ml/liter of water)	3.89	a
e_3= Extragen (9 ml/liter of water)	3.67	a
Worm Compost:		
k0 = Control (0 g/polybag)	3.67	a
k1 = 16 (g/polybag)	3.77	a
k2 = 32 (g/polybag)	4.06	a
k3 = 48 (g/ polybag)	3.94	a

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.

4. Conclusion

There was no interaction between the administration of extragen biofertilizer concentration and vermicompost fertilizer on the growth and yield of Pakcoy plants of the EMONE 26 variety Pakcoy seeds. Independently, the administration of extragen biofertilizer concentration had a significant effect on the height of plants aged 21 HST, whereas the vermicompost treatment had no significant effect on all ages of treatment.

The optimum concentration of extragen biological fertilizer is 9 ml/liter and the dose of vermicompost fertilizer is 0 g/polybag or without vermicompost fertilizer. To increase yields in pakcoy plant cultivation, it is recommended to use extragen biofertilizer at a concentration of 9 ml/liter given together with vermicompost fertilizer. Further research needs to be carried out by increasing the concentration of extragen biofertilizer and vermicompost fertilizer dosage to obtain more complete information on the treatment. similar.

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