



The Effect Mnure And Concentration Of Em-4 Dose On Plant Growth And Yield Of Red Spinach (*Alternanthera Amoena Voss*)

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Abstract: The purpose of the study to determine the effect of various doses of manure on the growth and yield of red spinach. Randomized Factorial Experiment is used with three replications. The first factor is the dose Manure P1 = 5 tons/hectare; P2 = 10 ton/ hectare; P3 =Dose manure 15 t / ha. The second factor is the concentration of EM-4, among others K1 = dose of 5 ml/liter of water/polybag; K2 = dose of 10 ml/liter of water/polybag; K3 = dose of 15 ml/liter of water/polybag. Of the two factors 9 combination treatments are obtained which was then repeated 3 times. There was no significant interaction at F5% test level on all variables studied i.e plant height, leaf number and gross weight per plant at all age of observation. There were significant effects of manure dose factor studied, mainly on plant height variables, number of leaves and gross weight per plant; and statistically, a better value in all of these variables is achieved by treatment P3 manure dose of 15 ton/ha. EM-4 concentration factor has significant influence on plant height variables, number of leaves and gross weight per plant; statistically, a better value in all of these variables are also achieved by treatment of the K3 of 15 ml/liter of water/polybag.

Keywords: Spinach , Manure, EM-4, RAK.

1. INTRODUCTION

Red spinach is one of the vegetable plants with high nutrition. This plant originated in tropical America yet is now spread all over the world. In some developing countries, spinach I promoted as a source of vegetable protein, for it doubles for fulfillment of nutritional needs and public health services. This plant contains many proteins, fats, carbohydrates, potassium, amarantin, routine, purines and vitamins (A, B and C), while the richest content in spinach is iron (Damanhuri, 2005). This is the body's necessary substances to stimulate the formation of red blood cells.

Consuming spinach is protecting you from the symptoms of blood deficiency disease that makes the body become weak. Red spinach leaves are good for kidney and digestive organs because of its high fiber content that it can overcome constipation and launch a bowel movement. The content of nutrients in red spinach can lower cholesterol, blood sugar, blood circulation and reduce excessive blood pressure. Red spinach can also wipe out the remains of dirty blood (Magdalena, 2006).



Manure is a source of some nutrients such as nitrogen, phosphorus, potassium, and others. Nitrogen is one of the nutrients for most major crops that can be obtained from manure. Lack of potassium in some specific locations cannot be corrected with a common dose of manure. Use manure is a cycle of nutrients useful in optimizing the use of renewable natural resources, on the other hand it can reduce toxic nutrients to plants.

To improve quality of nutrition, it is necessary to add Effective microorganisms (EM - 4). EM-4 is a brownish liquid and sweet sour (fresh) acid which contains a mixture of several living microorganisms beneficial to the process of absorption or nutrient supply in the soil. It is expected to provide higher production in the form of broad leaves, high number of leaves, healthy and large plant canopy and healthy roots. Vegetable plant products with healthy and large canopy have a higher selling value.

2. METHODOLOGY

This research is a Factorial Experimental research prepared by using Randomized Block Design (RAK) with three replications. The First Factor (P) is Manure with three levels of treatment and the second Factors (K) is concentration of EM-4 with three levels of treatment and materials used including ground planting (*Alluvial*), manure, seeds red spinach, and EM -4. Tools used include hoe, shovel, knife, scoop, polybag size 5 kg (35x35 cm), camera for documentation, measuring instruments, stationery, and equipment in the laboratory.

3. RESULTS AND DISCUSSION

3.1. Plant height

The results of statistical analysis indicate no significant interaction between dose factor of manure and EM-4 concentration to variable of height. Separately, dosage of manure provides a real effect on plant height at observation of 10 1 7 2 4 and 31 days after planting; whereas the treatment of EM-4 concentration also gives very real effect to the plant height variable on observation age 1 7 2 4 and 31 days after planting. The average plant height observations at various ages observations is presented at table 1.



Table 1. Average height of Red Spinach Plants on Various Observations on treatment dose and concentration of manure and EM-4.

Treatment	Average Plant Height (cm)			
	10	17	24	31
P ₁	3.57 a	6.20 a	15.60 a	19.34 a
P ₂	4.39 b	8.37 b	18.73 b	22.42 b
P ₃	4.96 c	10.29 c	21.86 c	28.77 c
BNT 5%	0.40	0.66	1.00	1.45
K ₁	4.14	7.59 a	17.78 a	22.02 a
K ₂	4.29	8.43 b	18.59 a	23.32 a
K ₃	4.48	8.83 b	19.82 b	25.19 b
BNT 5%	tn	0.66	1.00	1.45

Description: The numbers followed by the same letter in the same column are not significantly different at 5% BNT test.

Table 1 shows that on several observation, manure treatment dose P₃ provides the highest value by 28.77 cm compared to the other treatments of P₂ and P₁ by 22.42 cm and 19.34 respectively at the age of 31 days after planting. Concentration of EM-4 treatment reached the be the highest value at treatment of K₃ by 25.19 cm compared to two treatments of K₁ and K₂ respectively by 22.02 cm and 23.32 cm, both without significant effect on observation at the age 31 days after planting.

Extension of the plant occurs due to the formation and enlargement of new cells, a process which requires the delivery of nutrients and adequate water for the plants, and the formation process of carbohydrates results of plant photosynthesis and endogenous hormone certain forms during the growth period will allow the cell wall stretches for more increasing the metabolic processes of plants (Harjadi, S,1991).

3.2. Leaf Amount

The result of statistical analysis indicates that there is no significant interaction between dosage factor of manure and EM-4 concentration on the variable of red spinach plant



variety. However, manure gives a significant influence on the number of observations of plant leaves at age 10, 17, 24 and 31 days after planting; treatment of EM-4 concentration also gives a very real effect to the variable of plant leaf on the observation age of 17, 24 and 31 days after planting. The average number of observations at various ages of observations is presented at table 2.

Table 2. Average Number of Red Spinach Leaves at Various Observations on manure and EM-4 concentration

Treatment	Average Leaf Amount			
	10	17	24	31
P ₁	2.00 a	4.48 a	8.57 a	11.02 a
P ₂	2.09 a	5.79 b	10.48 b	13.48 b
P ₃	2.76 b	7.54 c	14.50 c	16.30 c
BNT 5%	0.16	0.47	0.92	0.87
K ₁	2.20	5.59 a	10.58 a	12.91 a
K ₂	2.28	5.90 ab	10.88 a	13.74 ab
K ₃	2.37	6.32 b	12.09 b	14.14 b
BNT 5%	tn	0.47	0.92	0.87

Description: The numbers followed by the same letter in the same column are not significantly different at 5% BTN test.

Table 2 shows that in some observations the dosage factor of manure P₃ still provided the highest result by 16.30 than other treatments of P₂ and P₁ by 13.48 and 11.02 respectively at the age of 31 days after planting; whereas the concentration of EM-4 treatment K₃ made 14.14 compared to the other treatments, yet not significant with K₂ treatment by 13.74 on observations of plant life of 31 days after planting.

EM-4 can play a role to ferment organic matter in the soil into organic elements quickly, and can improve soil fertility and crop productivity because it contains bacterial fermentation of the genus *Lactobacillus*, fungal fermentation, photosynthetic bacteria *actinomyces*, bacteria and yeast phosphate solvent (Wahyudi, 2011).

3.3. Gross Weight per Plant

The results of statistical analysis reveal that there was no significant interaction between dose factor of manure and concentration of EM-4 on the variable of gross weight per red



spinach plant. Separately, dosage of manure provided real effect on gross weight per plant at the age of 31 days of observation after planting; while EM-4 concentration also provided real effect to variable of gross weight per plant on observation age of 31 days after planting. Observation on average gross weight per plant at the end of the observation is presented in table 3.

Table 3. Average per plant gross weight at the end of observation (31 Days After Planting) on the manure dose and concentration of EM-4 treatments.

Treatment	Average Gross Weight per Plant (gram)
P ₁	65,38 a
P ₂	74.36 b
P ₃	88.20 c
BNT 5%	3.62
K ₁	72.44 a
K ₂	75.23 a
K ₃	80.26 b
BNT 5%	3.62

Description: The numbers followed by the same letter in the same column are not significantly different in 5% BNT test.

Table 3 shows that on several factors observation manure treatment dose of P₃ sereed the highest weight by 88.20 gram compared to other treatments by 74.36 grams for P₂ and 65.38 grams for P₁ at the age of 31 days after planting; whereas the concentration of EM-4 treatment provided the highest value by the treatment of K₃ by 80.26 gram than other treatments on observations of plant at 31 days after planting. Plant growth is an irreversible measure of where the indicator can be known from the increasing size and number of vegetative and generative plants growth parameters (Harjadi, S. 1991).

Subianto added it (2011) that implementation of EM-4 actively capable of fermenting organic matter (remnants of plants, green manure, manure etc). The results of the fermentation can be absorbed directly by the roots of plants, such as sugars, alcohols, amino acids, proteins, carbohydrates and other organic compounds. In addition, EM-4 stimulates the development of



beneficial microorganisms of plants; protect crops from disease which in turn can enrich the soil and improve plant productivity.

4. CONCLUSION

There was no significant interaction at F5% test level on all variables studied including plant height, leaf number and gross weight per plant at all ages of observation. There were significant effects of manure dose factor studied, mainly on plant height, number of leaves and gross weight per plant; and statistically, a better value in all of these variables is achieved by treatment of P3 manure by 15 ton/ha. Similarly, EM-4 concentration factor had significant influence on plant height, number of leaves and gross weight per plant variables; statistically, the best value in all of these variables was also achieved by treatment of K3 with 15 ml/liter of water/polybag.

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