

APPLICATION OF RICE HUSK AND CHICKEN MANURE TO THE GROWTH AND PRODUCTION OF *Red Spinach* (*Amaranthus gangeticus* L.)

Cik Zulia¹, Syahminar Batubara²

^{1,2}) Asahan University, North Sumatra
Correspondence : Putrilubis01167@gmail.com

ABSTRACT

The research was conducted in Kisaran Naga Village, Kisaran Timur District, Asahan Regency, with a flat topography and a height of ± 15 m above sea level, ± 2 km from the Faculty of Agriculture, Asahan University, and climate classification according to Oldeman, Asahan Regency, including climate type E1 with wet months > 200 mm namely in September, October, and November. and dry months < 100 mm were only found in February. This research was conducted from March to April 2014. This research was prepared based on a factorial randomized block design (RBD) with 2 treatment factors and 3 replications. The first factor is the provision of rice husk ash with 3 levels, namely: S0 = without fertilizer, S1 = 2 kg / plot, S2 = 4 kg / plot and S3 = 6 kg / plot. The second factor is the provision of chicken coop fertilizer with 4 levels, namely A0 = 0 kg / plot, A1 = 1 kg / plot, A2 = 2 kg / plot and A3 = 3 kg / plot.

The results of the study were giving the best rice husk ash on treatment S0 (0 kg / plot) to the highest plant height at 3 weeks after planting, namely 20.25 cm, the best number of leaves in S2 treatment was 12.64 strands, the best production per plant sample in treatment S3 is 356.88 g, and the best production per plot in S2 treatment is 1.64 kg when compared to without treatment of rice husk ash fertilizer, which is 1.23 kg. Giving the best chicken manure on A3 treatment (3 kg / plot) to the highest plant height at 3 weeks after planting was 21.11 cm, the best number of leaves was 12.76 strands and the production per plot was 1.63 kg when compared to without The treatment of rice husk ash fertilizer was 1.38 kg, while the best sample production per plant was 347.50 g and the interaction of treatment of rice husk ash and chicken manure on the growth and production of red spinach showed no significant effect. against all observed parameters.

Keywords: Rice Husk Ash, Aya's Cage Fertilizer, Red Spinach (*Amaranthus gangeticus* L)

INTRODUCTION

Spinach is a vegetable plant known by the scientific name *Amaranthus gangeticus* L. The word "amaranth" in Greek means "everlasting" (eternal). Spinach comes from tropical America. Spinach was originally known as an ornamental plant. In further development. Spinach is promoted as a food source of protein, especially for developing countries. Spinach plant entered Indonesia in the XIX century when the traffic of foreign trade entered Indonesian territory. Planting Centers Spinach planting centers in Indonesia are West Java (4,273 hectares), Central Java (3,479 hectares), and East Java (3,022 hectares). The national spinach product is 72,369 tons or an average of 22.63 quintals per hectare (Anonymous 2009).

Red spinach is a variety of spinach that has a special characteristic, namely the plant is red. This vegetable plant includes herbs (shrubs) with a plant height of up to 1.5 m. The root system spreads shallowly at a depth of between 20-40 cm, and has a taproot. In general, leaves

are oval in shape with slightly tapered ends, clear leaf veins and reddish color on the edges and middle of the leaves. Stems contain lots of water (herbaceous), usually growing high above the soil surface. Meanwhile, the red color of the spinach shows that it contains pigments that can be used as natural dyes (Rukmana, 2008).

Spinach is an annual crop with a relatively short harvest cycle. This plant is very easy to cultivate organically because of its relatively short age, it can be harvested after the age of 20 days, so the risk of pest attack is relatively smaller. In terms of method, organic spinach cultivation has the same treatment as non-organic cultivation, the difference is in the type of fertilizer. Meanwhile, for pest control, farmers usually handle it by improving plant growth, such as applying fertilizers, irrigation and maintaining the cleanliness of the garden. Spinach cultivation is more effective without the first seeding stage. The thing to note is that spinach plants need full sun. The ideal temperature ranges from 160 C - 200 C, with moderate humidity. However, spinach can adapt to hot temperatures like in Jakarta as long as the humidity is high. In the rainy season, the growth of spinach is not very good, spinach leaves are easily damaged by continuous rain (Fazria, 2011).

Vegetables are a commodity that consumes high soil nutrients. Organic fertilizers really need to be given to vegetable crops, especially vegetables that require nitrogen. Organic material, especially manure given to plants, must be ripe because immature organic matter undergoes a decomposition process that produces heat or toxins that are harmful to plants (Lubis, 2001).

Rice husk is a waste that has several characteristics: light weight, good drainage and aeration, does not affect pH, there is nutrient availability or salt solution but has a low water and nutrient absorption capacity and is cheap. Rice husk contains 1% of N and 2% of K. In general, this husk is burned into black husk charcoal which is widely used for commercial hydroponic media in Indonesia (Rahardi, 2001).

Chicken manure contains a lot of nutrients N = 2.6%, P = 3.1%, K = 2.4%, Ca = 12.7%, Hg = 0.9%, Na = 0.7%. So this fertilizer is very popular with vegetable farmers because of its fast reaction and matches the character of vegetables that have a short life cycle. This fertilizer has a higher nutrient content than other types of manure. Moreover, the N element in chicken manure can be absorbed by plants directly (Lingga, 2003).

Research purposes. This study aims to determine the effect of application of rice husk ash and chicken manure on the growth and production of red spinach. Hypothesis The research hypothesis are : (1). There is an effect of giving rice husk ash on the growth and production of red spinach, (2) There is an effect of giving chicken manure on the growth and production of red spinach, (3) There is an interaction between giving rice husk ash and chicken manure to the growth and production of red spinach.

Usefulness of Research are (1). As material for the preparation of a thesis which is one of the requirements to take the Bachelor of Agriculture examination at the Faculty of Agriculture, University of Asahan, (2). As input and contribution of thoughts for universities, especially the Faculty of Agriculture, University of Asahan, and (3) As information material for all parties in need, especially for farmers who cultivate Red Spinach plants.

MATERIALS AND METHODS

The research was conducted in Kisaran Naga Village, Kisaran Timur City District, Asahan Regency, with a flat topography and a height of ± 15 m above sea level, ± 2 km from the Faculty of Agriculture, Asahan University, and climate classification according to Oldeman, Asahan Regency, including climate type E1 with wet months > 200 mm namely in September, October, and November. and dry months < 100 mm were only found in February. This research was conducted from March to April 2014. The materials used in this experiment included Barata red parrot seeds, rice husk ash, chicken manure, and organic pesticides if needed. The tools used in this experiment included a tripe machete, to clean the area from grass. Hoes and rakes are used to cultivate the land. Meters, wooden stakes raffia were used for making research plots. Scales are used to weigh fertilizers, handsprayer.

The research was conducted using a factorial randomized block design (RBD) consisting of 2 levels with 4 levels of treatment for the first factor and 4 levels of treatment for the second factor, namely The first factor is the provision of rice husk ash (S) which consists of 4 (four) levels, namely

S0 = (0 kg / plot)

S1 = (2 kg / plot)

S2 = (4 kg / plot)

S3 = (6 kg / plot)

While the second factor is the provision of Chicken Coop fertilizer (A) consisting of 4 (four) levels, namely:

A0 = (0 kg / plot)

A1 = (1 kg / plot)

A2 = (2 kg / plot)

A3 = (3 kg / plot)

Plant parameters observed in the study were plant height (cm), number of leaves (strands), production per sample plant (kg) and production per plot (kg).

DISCUSSION

Research result

Plant height (cm)

From the observation and analysis of variance, it can be seen that giving rice husk ash shows no significant effect on the height of red spinach plants aged 1, 2 and 3 weeks after planting. The treatment of Chicken Coop fertilizer showed no significant effect at the age of 1 and 2 weeks after planting, and had a significant effect on the age of 3 weeks after planting. The interaction of giving rice husk ash and chicken manure showed no significant effect at all ages of observation. The results of the average difference test the effect of giving rice husk ash and chicken manure on the height of the red spinach plant 3 weeks after planting can be seen in table 1 below :

S/A	A ₀	A ₁	A ₂	A ₃	Rataan
S ₀	18,35 a	22,25 a	21,85 a	20,25 a	20,68 a

S ₁	20,25 a	21,00 a	19,65 a	20,75 a	20,41 a
S ₂	19,80 a	19,15 a	22,00 a	21,15 a	20,53 a
S ₃	18,50 a	20,50 a	19,70 a	22,30 a	20,25 a
Rataan	19,23 b	20,73 a	20,80 a	21,11 a	KK = 5,98 %

Table 1. Results of Mean Difference Test of the Effect of Giving Rice Husk Ash and Chicken Coop Fertilizer on the Height of Red Spinach Plants Aged 3 Weeks After Planting.

Note: The numbers followed by the same letter in the same row or column show no significant difference at the 5% level using the BNJ test.

From Table 1 it can be seen that giving Rice Husk Ash with treatment 0 kg / plot (S0) has the highest plant height, namely 20.68 cm, not significantly different from treatment 4 kg / plot (S2) 20.53 cm, 2 kg / plot (S1) 20.41 cm, and treatment 6 kg / plot (S3) 20.25 cm, while treatments S1 and S3 show no significant difference between each other. The application of chicken manure with treatment 3 kg / plot (A3) had the highest plant height, namely 21.11 cm, not significantly different from treatment 2 kg / plot (A2) 20.80 cm, and treatment 1 kg / plot (A1) 20, 73 cm but significantly different from treatment 0 kg / plot (A0) 19.23 cm. while the treatments between A1 and A0 were significantly different from each other. The interaction of giving rice husk ash and chicken manure showed no significant difference. The effect of chicken manure on the height of red spinach can be seen in the response curve in Figure 1 below

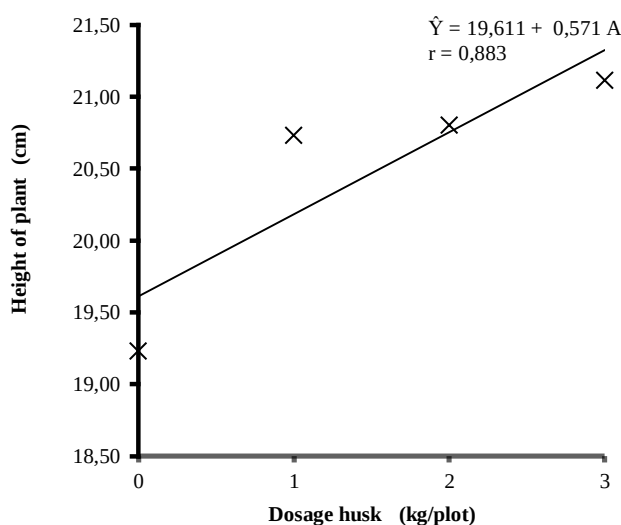


Figure 1. Response Curves of Chicken Coop Fertilizer on the Height of Red Spinach Plants at the Age of 3 Weeks after Planting

Number of leaves (strands)

From the observation and analysis of variance, it can be seen that giving rice husk ash shows no significant effect on the number of red spinach leaves 3 weeks after planting. The

treatment of chicken coop fertilizer showed a very significant effect at the age of 3 weeks after planting. The interaction of giving rice husk ash and chicken manure showed no significant effect on the observation age 3 weeks after planting. The results of the average difference test the effect of giving rice husk ash and chicken manure on the number of red spinach leaves 3 weeks after planting can be seen in Table 2 below.

S/A	A ₀	A ₁	A ₂	A ₃	Rataan
S ₀	11,25 a	12,50 a	11,95 a	12,15 a	11,96 a
S ₁	11,75 a	12,40 a	12,55 a	12,75 a	12,36 a
S ₂	11,50 a	12,40 a	13,15 a	13,50 a	12,64 a
S ₃	11,35 a	12,50 a	12,75 a	12,65 a	12,31 a
Rataan	11,46 b	12,45 a	12,60 a	12,76 a	KK = 6,15 %

Table 2. Results of the Mean Difference Test of the Effect of Giving Rice Husk Ash and Chicken Cage Fertilizer on the Number of Red Spinach Leaves aged 3 weeks after planting.

Note: The numbers followed by the same letter in the same row or column show no significant difference at the 5% level, with the BNJ Test.

From Table 2 it can be seen that giving Rice Husk Ash with treatment 4 kg / plot (S2) has the highest number of leaves, namely 12.64 strands, not significantly different from treatment 2 kg / plot (S1) 12.36 strands, 6 kg / plot (S3) 12.31 strands, and 0 kg / plot treatment (S0) 11.96 strands, while S3 and S0 treatments showed no significant difference between each other. The application of chicken manure with treatment 3 kg / plot (A3) had the highest number of leaves, namely 12.76 pieces, not significantly different from the treatment of 2 kg / plot (A2) 12.60 pieces, and treatment 1 kg / plot (A1) 12 , 45 strands but significantly different from treatment 0 kg / plot (A0) 11.46 strands. while the treatments between A1 and A0 were significantly different from each other. The interaction of giving rice husk ash and chicken manure showed no significant difference. The effect of giving chicken manure on the number of red spinach leaves can be seen in the response curve in Figure 2 below

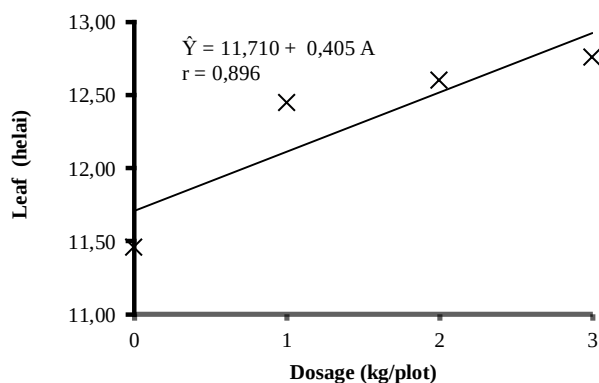


Figure 2. Response Curves of Chicken Coop Fertilizer Against Number of Red Spinach Leaves 3 weeks after planting.

Production per sample plant (g).

From the observation and analysis of variance, it can be seen that giving rice husk ash shows a very significant effect on the production per plant sample of red spinach. The treatment of Chicken Coop fertilizer showed a significant effect on the observed parameters. The interaction of giving rice husk ash and chicken manure showed no significant effect on the observed parameters. The results of the average difference test for the effect of giving rice husk ash and chicken manure per plant sample of red spinach can be seen in Table 3 below.

S/A	A ₀	A ₁	A ₂	A ₃	Rataan
S ₀	272,50 a	305,00 a	330,00 a	297,50 a	301,25 c
S ₁	337,50 a	327,50 a	320,00 a	362,50 a	336,88 b
S ₂	330,00 a	330,00 a	342,50 a	337,50 a	335,00 b
S ₃	327,50 a	327,50 a	397,50 a	375,00 a	356,88 a
Rataan	316,88 c	322,50 b	347,50 a	343,13 ab	KK = 7,39 %

Table 3. Results of Average Difference of Effect of Rice Husk Ash and Chicken Coop Fertilizer on Production per Red Spinach Sample Plant

Note: The numbers followed by the same letter in the same row or column show no significant difference at the 5% level using the BNJ Test

From Table 3 it can be seen that giving Rice Husk Ash with treatment of 6 kg / plot (S₃) has the heaviest production per plant sample of 356.88 g, significantly different from treatment 4 kg / plot (S₂) 335.00 g, 2 kg / plot (S₁) 336.88 g, and treatment 0 kg / plot (S₀) 301.25 g, while treatments S₁ and S₂ show no significant difference between each other, but treatments between S₁ and S₀ show significant differences between each other. The application of chicken manure with treatment 2 kg / plot (A₂) had the heaviest production per plant sample of 347.50 g, not significantly different from treatment 3 kg / plot (A₃) 343.13 g, but significantly different from treatment 1 kg / plot (A₁) 322.50 g and treatment 0 kg / plot (A₀) 316.88 g. while the treatments between A₁ and A₀ were significantly different from each other. The interaction of giving rice husk ash and chicken manure showed no significant difference.

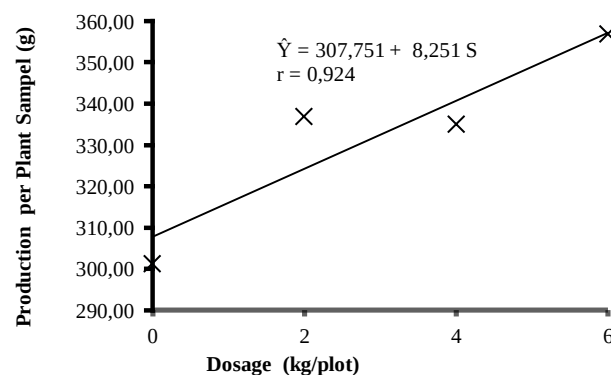


Figure 3. Response Curve of Rice Husk Ash on Production per Red Spinach Sample Plant.

The effect of giving rice husk ash on the production per plant sample of red spinach can be seen in the response curve in Figure 3 above. And then the effect of giving chicken manure on the production per plant sample of red spinach can be seen in the response curve in Figure 4 below.

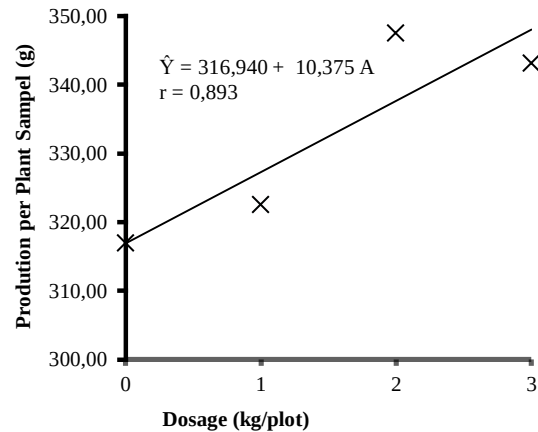


Figure 4. Response Curve of Chicken Coop Fertilizer on Production per Red Spinach Sample Plant

Production per plot (kg)

From the observation and analysis of variance, it can be seen that giving rice husk ash shows a very significant effect on the production per plot of red spinach. The treatment of Chicken Coop fertilizer showed a significant effect on the observed parameters. The interaction of giving rice husk ash and chicken manure showed no significant effect on the observed parameters. The results of the average difference test the effect of giving rice husk ash and chicken manure on the production per plot of red spinach can be seen in Table 4 below.

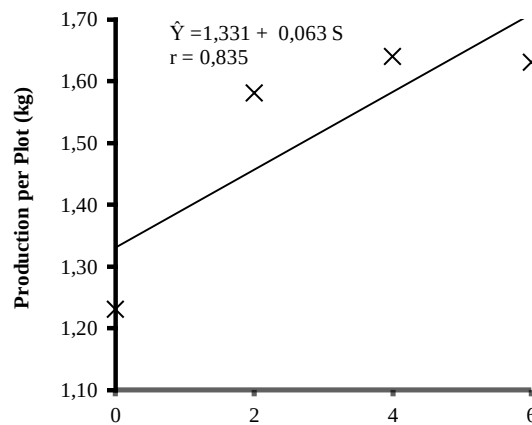
S/A	A ₀	A ₁	A ₂	A ₃	Rataan
S ₀	0,95 a	1,13 a	1,50 a	1,35 a	1,23 c
S ₁	1,38 a	1,58 a	1,65 a	1,73 a	1,58 b
S ₂	1,68 a	1,70 a	1,48 a	1,73 a	1,64 ab
S ₃	1,50 a	1,53 a	1,78 a	1,73 a	1,63a
Rataan	1,38 c	1,48 b	1,60 ab	1,63 a	KK = 10,86 %

Table 4. Results of Mean Difference Test Effect of Giving Rice Husk Ash and Chicken Coop Fertilizer on Production per Plot of Red Spinach

Note: The numbers followed by the same letter in the same row or column show no significant difference at the 5% level using the LSD test

From Table 4 it can be seen that giving Rice Husk Ash with treatment of 6 kg / plot (S3) has the heaviest production per plot of 1.63 kg, not significantly different from treatment of 4 kg / plot (S2) 1.64 kg, but significantly different with treatment 2 kg / plot (S1) 1.58 kg, and treatment 0 kg / plot (S0) 1.23 kg, while treatments S1 and S2 showed significant differences

between each other. The application of chicken manure with treatment 3 kg / plot (A3) had the heaviest production per plot, namely 1.63 kg, not significantly different from treatment 2 kg / plot (A2) 1.60 kg, but significantly different from treatment 1 kg / plot (A1) 1.48 kg and treatment 0 kg / plot (A0) 1.38 kg. while the treatments between A1 and A0 were significantly different from each other. The interaction of giving rice husk ash and chicken manure showed no significant difference. The effect of giving rice husk ash on the production per plot of red spinach can be seen in the response curve in Figure 5 below



Picture. 7. Response Curve of Rice Husk Ash on Production per Red Spinach Plot.

The effect of giving chicken manure on the production per plant of red spinach plots can be seen in the response curve in Figure 6 below :

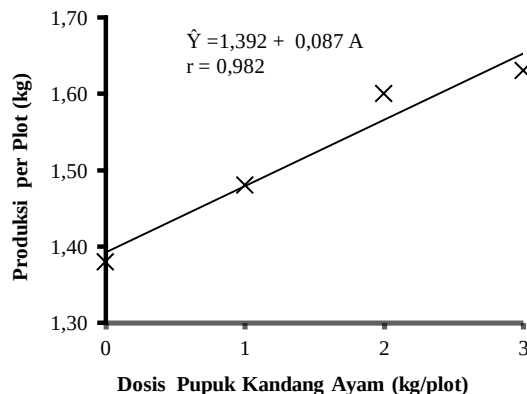


Figure 6. Response Curve of Chicken Coop Fertilizer on Production per Red Spinach Plot

There was no significant effect on the height parameters of plants aged 1, 2 and 3 weeks after planting and had no significant effect on the number of leaves of the red spinach plant aged 3 weeks after planting, it was suspected because rice husk ash had not broken down completely so it could not add nutrients and changes in soil pH on vegetative growth of red spinach plants. There is a significant effect on the production per sample plant and production per plot of red spinach. This is thought to be due mainly to the nutrients from husk ash that can be utilized and

available optimally as a stimulator by plants. Harold and Robert (1962) in Sumadiharta and Ardi (2001) say that ash is a solid leftover from combustion of organic matter that does not evaporate, can increase pH and increase a number of important nutrients such as potassium, magnesium, calcium and phosphorus in the soil.

Martanto (2001) stated that giving husk ash to tomato plants has a significant effect on the growth rate and reduces the attack of pests and diseases. Furthermore, by Nurhajati et al (2006) and Sarwono (2002), that the nutrients N, P, K, Ca, Mg and S are part of the essential macro nutrients that are indispensable for plants and their functions cannot be replaced by other elements, so if the amount is not sufficiently deep. soil will cause plants not to grow normally. Sulfur helps green leaf grains so that the leaves are greener and increase the protein and vitamin content.

Nitrogen functions to increase vegetative growth such as forming shoots, development of plant stems and leaves, greener plant color and protein formation. While the role of K includes increasing sugar translocation in the formation of starch and protein (Novizan, 2002).

The Soil Research Institute (2000) states that giving agricultural waste in the form of ash (residual burning) into the soil can provide several advantages, compared to fresh forms. Because the nutrients contained are relatively easily available to plants and are able to improve soil physical properties such as aeration and drainage. From the results of research, Sigit (2004) also explains that giving husk ash can provide a slight increase in the availability of potassium and phosphorus in the soil. Furthermore, it is said that husk ash can increase silicate, potassium, and phosphorus in grain, straw and roots.

In the generative phase (plant production), P is also a component of phytic acid as P reserves in seeds, namely $C_6H_6(H_2PO_4)_6$. Elemental K has a direct effect on plant metabolism, because it is an activator of enzymes. Magnesium is the most important component in the formation of chlorophyll compounds, even each chlorophyll molecule contains 1 Mg atom, so the presence of Mg greatly affects the effectiveness of metabolism, especially in the photosynthesis process. S elements are absorbed by plants in the form of SO_4^{2-} which has a very important role in the photosynthesis process as part of the peroxidase molecule (energy carrier), and also as part of the components of the amino acids cysteine and methionine (Dartius, 2003).

This is in accordance with Soepardi's (2001) statement that K plays an important role in photosynthesis because it directly increases growth and also increases CO_2 assimilation and increases the translocation of photosynthetic results out of leaves. Hardjadi (2001) continued, emphasizing that if photosynthesis runs well, the photosynthate formed becomes a lot which is then transferred to all parts of the plant to support plant growth.

Dwijoseputro (2006) explains that a plant will thrive, if all the nutrients needed by the plant are sufficiently available, and after all these nutrients are in a form suitable for plant absorption.

The production parameters per sample plant showed S3 production of 356.88 g was significantly different from S0 301.25 g where the difference between S3 and S0 treatments ranged from 55.63 g (15.58%), while the production parameters per plot showed S3 1 production, 63 kg was significantly different from S0 1.23 kg where the difference between S3 and S0 treatments ranged from 0.40 kg (24.53%)

There was a significantly different effect on plant height, number of leaves, crop production of samples and production per plot which were observed, it is assumed that the

nutrients needed by red spinach plants can be fulfilled in the A3 treatment, while the provision of chicken manure in the A2 and A1 treatments gives an average large number of leaves but inefficient in applying fertilizer. In addition, giving chicken manure to treatment A2 gave good results on production per sample plant and production per plot when compared to treatment A0. Therefore, giving chicken manure is better than without giving chicken manure, because the treatment without giving chicken manure, nutrients are only supplied from the soil. In addition, the provision of chicken manure can make the water binding capacity of the soil better, so that the process of nutrient absorption and photosynthesis goes well.

Giving chicken manure into the soil is better, because it can provide enough nutrients in the soil, so that the nutrient needs for plants can be met in the vegetative growth phase of the red spinach. According to Sutedjo and Kartasapoetra (2002), a high rate of photosynthesis causes more carbohydrates produced by plants, where the increase in photosynthate will affect the accumulation of organic matter in the plant body itself. Giving chicken manure can provide nutrients needed by plants in the process of forming the vegetative part of the plant, so that photosynthetic products can be buried in plant organs and add dry matter from the plant itself. Therefore, giving chicken manure is better than without giving chicken manure.

The application of chicken manure to treatments A3, A2, and A1 gave better results compared to other treatments. This is because chicken manure in this treatment can meet the needs of plants in producing fruit. Chicken manure can also contribute decomposer microorganisms to the soil, so that the process of decomposition of organic matter in the soil is better and can provide nutrients needed by plants for fruit formation.

The production parameters per plant sample A3 343.13 g shows the heaviest production per plant sample is significantly different from A0 316.88 g, the difference between A3 and A0 ranges from 26.25 g (7.65%), while in the production parameters per plot A3 1.63 kg shows the heaviest production per plot is significantly different with A0 1.38 kg the difference between A3 and A0 ranges from 0.25 kg (15.33%).

There is no significant effect on all observed parameters, this indicates that the interaction between the treatment of rice husk ash and chicken manure has not been able to influence the pattern of plant physiological activity at intervals, although among the treatments tested have been able to support plant growth physiologically. Another possibility that causes no significant effect on all observed parameters is thought that the interaction between the two treatments is less supportive of each other, so the effect is that plant roots do not respond and this is in accordance with the opinion of Munawar, (2011), which states that good plant growth can be achieved when the factors affecting growth are balanced and profitable.

In other cases, external factors from the plant itself may not support the activity of the two treatments, because the combination of the two particular treatments will not always have a good effect on the plant. There are times when the combination will encourage growth, inhibit growth or completely fail to respond to plant growth and development.

CONCLUSIONS

The conclusions of this study are: (1) Giving the best rice husk ash on treatment S0 (0 kg / plot) to the highest plant height 3 weeks after planting, namely 20.25 cm, the best number of leaves in S2 treatment was 12.64 strands, the best production per plant sample in treatment S3 is

356.88 g, and the best production per plot in S2 treatment is 1.64 kg when compared to without treatment giving rice husk ash fertilizer which is 1.23 kg, (2). Giving the best chicken manure on A3 treatment (3 kg / plot) to the highest plant height 3 weeks after planting, namely 21.11 cm, the best number of leaves is 12.76 pieces and the production per plot is 1.63 kg when compared with no treatment, the application of rice husk ash fertilizer was 1.38 kg, while the best sample production per plant was in A2 treatment, namely 347.50 g, (3) The interaction of treatment with rice husk ash and chicken manure on the growth and production of red spinach showed no significant effect on all observed parameters.

Suggestion of this study is described as follow. In the treatment of giving rice husk ash and chicken manure to red spinach plants, it is suggested that the recommended treatment includes giving chicken manure, because in the second treatment the best response is in chicken manure which affects plant height, leaf number, production per sample plant and production per plot, whereas the treatment of rice husk ash only affected the production parameters per sample plant and per plot, while the plant height and number of leaves had no significant effect.

REFERENCES

- Anonymous.2009..Bayam.(http://agrolink.moa.my/doa/bcd/vegetable/sp_agro_bm.html).Diakses tanggal 25 Juli 2009.
- Dwijoseputro, D. 2006. Pengantar Fisiologi Tumbuhan. Penerbit PT. Gramedia Jakarta.
- Fazria, M. A. 2011. Pengukuran Zat besi dalam bayam merah dan suplemen penambah darah serta penanganan terhadap peningkatan hemoglobin dan zat besi dalam darah. [Skripsi] Universitas Indonesia, Depok.
- Lingga, Pinus. 2003. Pupuk dan Cara Memupuk. Kanisius, Jakarta.
- Martanto.2001. Pengaruh Abu Sekam Terhadap Pertumbuhan Tanaman Dan Intensitas Penyakit Layu Fusarium Pada Tomat.
- Nurhayati, H. Y. Nyakpa, A.,M. Lubis. S.G. Nugroho, M.R. Saul, M.A Dika 1986. Dasar dasar ilmu tanah. Lampung. Universitas Lampung.
- Novizan, 2002. Petunjuk Pemupukan yang Efektif. Tangerang. Agromedia Pustaka.
- Rahardi, F. 2001. Hidroponik semakin canggih.Trubus : XXII (264) : 196198.
- Rukmana, S. K. 2008. Budidaya Tanaman Bayam. Penerbit Kanisius. Yogyakarta.
- Sarwono, H. 2002. Ilmu Tanah. Jakarta. Akademika Pressindo.
- Sumadiharta, D.A. dan A. Ardi. 2001.Penggunaan Pupuk dalam Rangka Peningkatan Produktivitas Lahan Sawah.Jurnal Penelitian dan Pengembangan Pertanian.
- Sigit, Gunardi. 2000. Pengaruh pemberian kotoran ayam dan abu sekam terhadap perubahan sifat kimia tanah, pertumbuhan dan produksi padi gogo varietas tondano pada tanah podzolik merah kuning jasinga. IPB. Bogor. 90 hal.
- Sutedjo, M.M dan A.G. Kartasapoetra. 2002.Pengantar Ilmu Tanah, Terbentuknya Tanah dan Tanah Pertanian. Bina Aksara. Jakarta