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The Growth and Yield of Sweet Potato Treated with Different Seedlings and Chicken Manure against Cylas Formicarius Tuber Damage

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ABSTRACT

Sweet potato is a well-known food crop in Indonesia and has become an alternative substitution for rice. This research was conducted to obtain information on the effect of chicken manure doses and seed types on tuber damage by boleng pests in sweet potato plants. The research was conducted in Dayu village, Gondangrejo, Karanganyar from April to July 2022. The research was arranged using a factorial Randomized Complete Block Design (RCBD), consisting of two treatment factors, such as the type of seedlings (B1 seedlings in the shoot section 25 cm, B2 seedlings in the stem section 25 cm) and the dose of chicken manure (K0: 0, K1: 11.25, K2: 21.25, K3: 31.25, K4: 41.25 gr per plant) each treatment combination was repeated three times. Parameters observed were intensity of pest attack, the total of healthy tubers per plant, the total of boleng tubers per plant, fresh weight of tubers per plant and fresh weight of boleng tubers per plant. The results indicated that the treatment of seedling types, doses of chicken manure and their interactions did not have a significant effect on all parameters observed, the highest amount of healthy tubers per plant was 8.3 in treatment B1K2 (the use of shoot seedlings and doses of chicken manure 21.25 grams per plant) and the highest fresh weight of tubers per plant was 810 grams in treatment B1K1 (the use of shoot seedlings and doses of chicken manure 11.25 grams per plant).

Keywords: *Chicken Manure Fertilizer, Dosage, Sweet Potato*

INTRODUCTION

Considered an important food crop as a source of carbohydrates due to their high caloric content, tubers are used as a staple food in many countries, especially in Africa and Asia. In Indonesia, tubers are classified as an important commodity because besides being a food ingredient, they can also be used as an ingredient for various industrial products such as modified starch, tapioca flour, liquid sugar and other raw materials (Estiasih et al., 2017).

Sweet potatoes have been known and cultivated for a long time in Indonesia. As a carbohydrate source, sweet potato is a food crop that is often used as a substitute for rice. In addition to being used as food, sweet potatoes have the opportunity to be used as industrial materials and animal feed. Sweet potato (Ipomoea batatas L. Lam) is a very potential food crop to be developed in Indonesia. This commodity is an important source of nutrition, especially in developing countries because the storage roots of sweet potatoes are rich in vitamins and minerals, and contain a substantial of starch (Irfan et al., 2021).

Indonesia's tropical agro-climatic suitability allows sweet potatoes to grow properly. In Indonesia, this crop is favored by farmers because it is easy to manage, resistant to drought, and can grow in various types of soil. Sweet potato's specialty as one of the fourth carbohydrate-producing crops after rice, corn and cassava is its high nutritional content, especially in beta carotene content compared to other food crops. Sweet potatoes are a secondary staple food in many developing countries and may contribute to the control of vitamin A deficiency as the orange-fleshed sweet potato, rich in β-carotene, is an excellent pro-vitamin A source (Rayamajhi & Mishra, 2020).

Fresh raw sweet potato has a high nutritional content of 562 g potassium, 107 mg calcium, 2.8 protein, 53.00 calories, 5.565 SI vitamin A, 32 mg vitamin C in every 100 grams, and 26.7 g carbohydrates per 100 grams (Harti & Anugrah, 2018). Sweet potatoes have become an important product in modern countries and are used as a staple food that has many nutrients. Sweet potatoes also have prospects for a prosperous market. In addition to maintain food security for businesses and industries, the sweet potato business can provide employment opportunities for the community. It supports the government's efforts in realizing food security and is utilized as a flagship program and it is significant that sweet potatoes can replace or be developed into a substitute for staple foods, especially rice, whose productivity is decreasing from year to year (Susanto et al., 2014).

Indonesia is the second largest sweet potato producer in Asia after China around 109 million tons/year. According to BPS data in 2009, Indonesia's sweet potato production reached 2.06 million tons. However, the total sweet potato production of Indonesia is still far behind compared to China. Indonesia's sweet potato productivity is still low, this low sweet potato production is due to the reduction in land area for cultivation. In addition, sweet potatoes have low yields

when planted in the rainy season (Saitama et al., 2017). Meanwhile, the productivity increase in sweet potato crops is influenced by the use of fertilizers and good seeds. One of the efforts to fulfill the increasing demand for sweet potatoes is genetic improvement through breeding programs, especially those with high yield potential (Rahajeng et al., 2021). Sweet potatoes have high production potential because the tubers are very wasteful in absorbing nutrients. Therefore, it is necessary to provide appropriate and sufficient nutrients to obtain optimal tuber yields.

Fertilizer improvement is one of the possible treatments to increase sweet potato production. Organic fertilizers can be used in order to increase the productivity of sweet potato crops. The best and most natural way to improve soil is using organic fertilizers rather than artificial or synthetic fertilizers. Organic fertilizers contain low levels of macro-nutrients N, P, K, but contain ample micro-nutrients needed for plant growth. Furthermore, the term "organic fertilizer" refers to fertilizers made from plant, human, or animal remains such as compost or manure. Natural ingredients are used to make organic fertilizers, which are usually associated with biodegradable wet clothes, and compost is often made through the decomposition of biodegradable waste (Assefa & Tadesse, 2019).

Sweet potato production can be increased by applying the right fertilizer, both in composition and application. Nowadays, the application of organic fertilizers has become a concern of environmentalists and agricultural experts who want to reduce the negative impacts caused by chemical fertilizers that can cause land degradation. Therefore, the government through the Ministry of Agriculture has launched a campaign known as “Go Organic 2010” as an initiative to implement organic farming.

The application of organic fertilizers into the soil can improve the soil structure to make it more friable, which allows the root system to grow better and the process of nutrient absorption can proceed optimally. Unfortunately, sweet potato productivity is still relatively low at around 10.78 t/ha. One of the factors causing the low productivity of sweet potatoes is the attack of the boleng pest, cylasformicarius, which has not been optimally controlled by farmers. To overcome boleng pest attacks, integrated control through two or more control components is required.

Integrated boleng pest control is conducted by combining several control components, such as land sanitation, farming methods including the use of seeds or selection of cuttings, hilling, irrigation, crop rotation, the usage of boleng-tolerant varieties/clones such as Cangkuang and Genjahrante, and the usage of appropriate fertilizers. This research aims to examine the dose of chicken manure and the seed type on the damage of boleng (Cylas Formicarius) tubers in sweet potato plants. It is suspected that the dose of chicken manure and the type of stem seedlings affect the damage of boleng tubers.

RESEARCH METHODOLOGY

The research was conducted in Dayu village, Gondangrejo, Karanganyar from April to July 2022. The materials used in this research include sweet potato seeds, chicken manure, soil, urea, TSP and KCL fertilizers, while the tools used in this research include hoes, sharp knives/scissors, rulers, stationery and oven scales. This research used a Randomized Complete Group Design (RCBD) arranged factorially. RCBD is a commonly used design for biostatistical experiments, in which blocks or replicates of similar experimental units are used. It is applied to experiments to manage variation (Alkutubi, 2021). One of the advantages of a completely randomized design is that the experimental units available for use should be as homogeneous as possible in each block (Santosa & Priyono, 2023).

This research consists of two treatment factors, such as B1 seedlings on the shoot at 25 cm, B2 seedlings on the stem at 25 cm and the dose of chicken manure K0: 0, K1: 11.25, K2: 21.25, K3: 31.25, K4: 41.25 gr per plant, each treatment combination was repeated three times. The data obtained were analyzed using analysis of variance (ANOVA), if there is an effect between treatments, it will be continued with the BNT test at the 5% level.

RESULT AND DISCUSSION

Table 1. The Average of Observation Results

Treatment	Type of Observation				
	Pest Attack Intensity (%)	Number of Healthy Tubers per Plant	Number of Boleng Tubers per Plant	Fresh Weight of Tubers per Plant (g)	Fresh Weight of Boleng Tubers per Plant (g)
B1K0	20.6	7,5	0,92	680,00	57,3
B1K1	28.1	7,4	1,22	810,00	130,0
B1K2	52.5	8,3	2,18	690,00	160,0
B1K3	26.3	7,7	1,35	700,00	96,0
B1K4	52.5	6,9	2,06	405,00	230,0
B2K0	13.1	6	0,72	645,00	80,7
B2K1	43.1	7,5	1,73	625,00	153,3
B2K2	37.5	7	1,34	730,00	119,7
B2K3	30.0	5,7	1,23	770,00	136,7
B2K4	18.7	6,3	1,03	670,00	80,7

Source: Processed Data

The Intensity of Pest Attack

The observation of pest attack intensity started from 8 weeks after planting until harvest (16 weeks after planting) with an observation interval of 2 weeks. The highest intensity of boleng pest attack was observed in the B1 treatment, which is seedlings with a seedling tip length of 25 cm with a dose of chicken manure K2 21.25 grams at 52.5% which described in Table 1. The effect of seedling type and fertilizer dose on the intensity of boleng pest attack can be depicted in the form of a graph as illustrated in Figure 1 below.

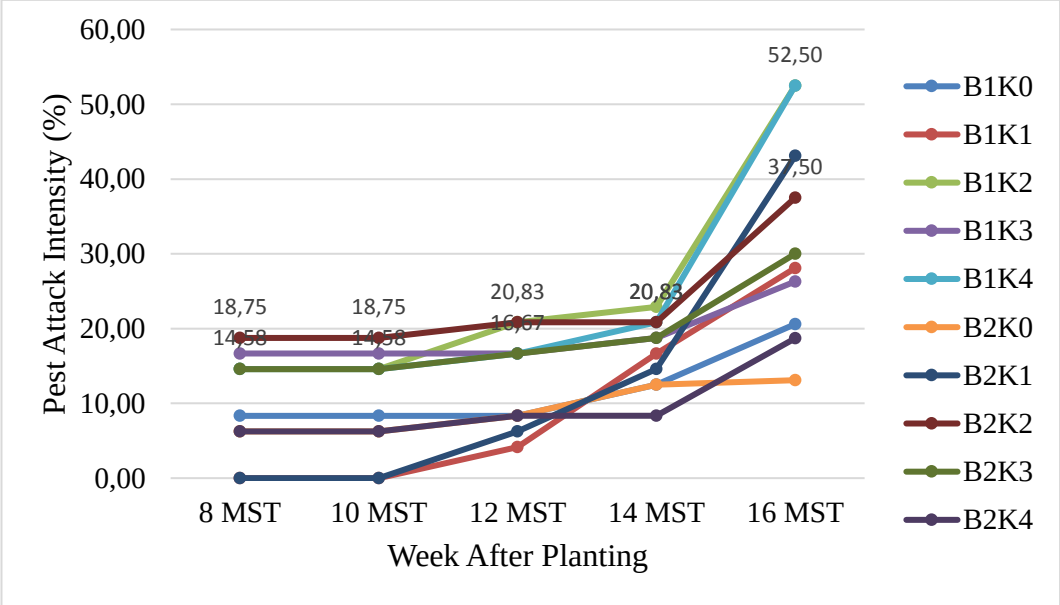

Figure 1. The Graph of Average Intensity of Boleng Pest Attack in Each Week of Observation

The figure illustrates that the treatment of B2 sweet potato seedlings in pruning and the combination of K2 with a dose of 21.25 grams of chicken manure had the highest attack intensity, with an average attack intensity of 18.75%. Generally, Cylas formicarius beetles lay their eggs on seedlings, stem cuttings or tubers. Furthermore, at the age of 16 weeks after planting, the highest attack intensity was found in two treatments, which were B1 treatment on shoots and a combination of chicken manure K2 dose of 21.25 grams and sweet potato seedling treatment B1 on shoots and a combination of chicken manure K4 dose of 41.25 grams.

Total of Healthy Tubers per Plant

The observation of the total of healthy tubers per plant was counted at harvest time. Based on Table 1 above, it is known that the highest average total of healthy tubers per plant was found in the B1 treatment of 25 cm long shoot cuttings seedlings with a dose of 21.25 grams of K2 chicken manure, which was 8.3 pieces. The reason for this is that seedlings from shoot cuttings (B1) are generally more

sterile from boleng eggs and larvae, while seedlings from older stems may already be attacked.

Table 2. The Average Total of Healthy Tubers per Plant as a Result of Dosage Treatment of Chicken Manure and Seedling Type

Type of Seedlings	Chicken Manure Dosage (K)				
	K_0	**K_1**	**K_2**	**K_3**	**K_4**
B_1	7.5 a	7.4 a	8.3 a	7.7 a	6.9 a
B_2	6.0 a	7.5 a	7.0 a	5.7 a	6.3 a

Source: Processed Data

Description: Mean of total yam per plant followed by the same letter means not significantly different at the 5% BNJ level.

Although Table 2 indicates that there was no significant difference in the total of healthy tubers per plant between the treatments of chicken manure dose and seed type, the next Figure 2 below provides further details:

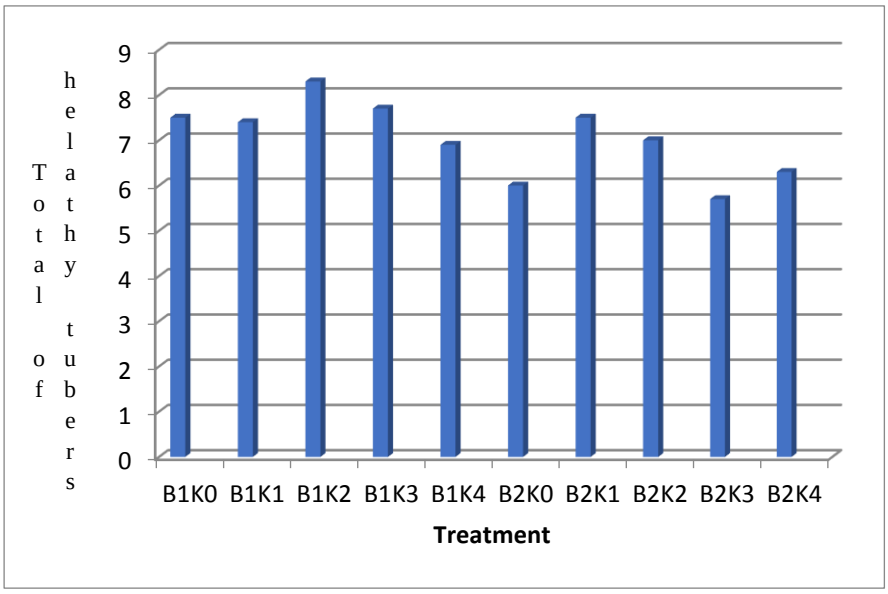

Figure 2. The Effect of Chicken Manure Dose and Seed Variety on The Total of Healthy Tubers

Based on Figure 2, it can be observed that the treatment combination B1K2 (the use of shoot seedlings and a dose of chicken manure of 21.5 grams per plant) provided the highest total of healthy tubers per plant, which was 8.3 pieces. Chicken manure has a high organic nitrogen content to fertilize the soil and also has an important role to improve the physical, biological and chemical properties of agricultural soil naturally. In addition, the benefits obtained from using chicken manure as a plant fertilizer are providing several macro and micro nutrients such as

Zn, Cu, Mo, Co, Ca, Mg and Si. Moreover, chicken manure improves soil physical properties, provides a crumbly structure and enhances soil aeration by increasing soil porosity or pore space, which has an impact on root development (Dani et al., 2021).

Total of Boleng Tubers per Plant

The observation of the total boleng tubers per plant was calculated at harvest time. Based on Table 1 above, it is known that the highest average of boleng tubers per plant was found in the B1 treatment of 25 cm long shoot seedlings with a dose of 21.25 grams of K2 chicken manure, which was 2.18%.

Table 3. The Average of Total Bulbs per Plant as a result of Seedling Type and Chicken Manure Treatments

Seedling Type	Chicken Manure Dosage (K)				
	K_0	**K_1**	**K_2**	**K_3**	**K_4**
B_1	0.92 a	1.22 a	2.18 a	1.35 a	2.06 a
B_2	0.72 a	1.73 a	1.34 a	1.23 a	1.03 a

Source: Processed Data

Description: The average of total bulbs per plant followed by the same letter means not significantly different at the 5% BNJ level.

The table 3 indicates that the highest average total boleng tubers per plant was found in the treatment of B1 stem seedlings, with a seedling length of 25 cm and K2 chicken manure, which is the application of chicken manure at a dose of 21.25 grams. The lowest number of boleng tubers was found in the treatment of B2 stem part seedlings, with a length of 25 cm and K_0 chicken manure, which is the application of chicken manure at a dose of 0 grams per plant.

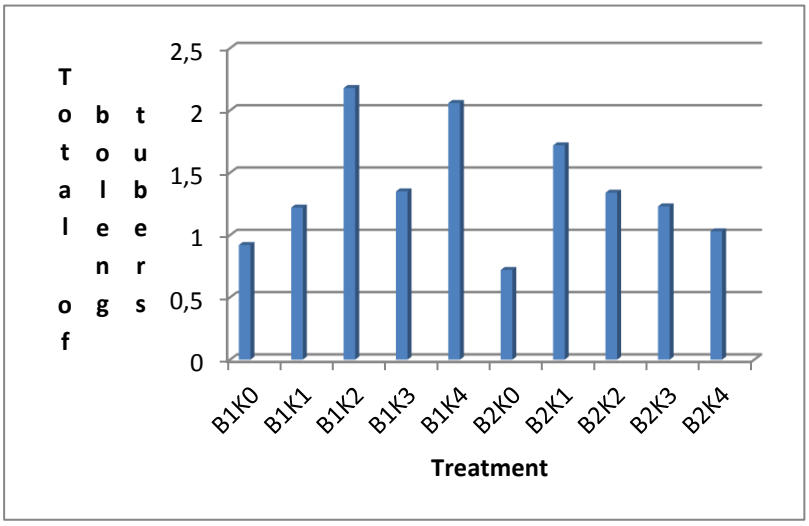

Figure 3. The Effect of Chicken Manure Dose and Seed Variety on The Total of Boleng Tubers

Broiler manure has a relatively higher P nutrient level compared to other manures, this nutrient level is strongly influenced by the type of concentrate supplied. In addition, chicken manure mixed with chicken food scraps and chaff as a bedding can provide additional nutrients in fertilizers for vegetables. According to some researchers, the first growing season always has the best crop response when applying chicken manure. This results from the fact that chicken manure decomposes relatively faster and has sufficient nutrient content when compared to the same number of units of other manures. Considering the high nitrogen concentration and low moisture level in chicken manure, composting with chicken manure can encourage microorganisms to decompose various organic solid wastes into quality compost (Hwang et al., 2020).

Fresh Weight of Healthy Bulbs

The observation of fresh weight of healthy tubers per plant was calculated at harvest time. Based on Table 1 above, it is known that the highest average total boleng sweet potato per plant was found in the treatment of B1 seedlings with a shoot length of 25 cm and a dose of K1 chicken manure of 11.25 grams, which was 810 pieces.

Table 4. The Average Fresh Weight of Healthy Tubers per Plant (gr) due to Treatment of Seedling Type and Chicken Manure

Seedling Type	**Chicken Manure Dosage (K)**				
	K_0	**K_1**	**K_2**	**K_3**	**K_4**
B_1	680 a	810 a	690 a	700 a	405 a
B_2	645 a	625 a	730 a	770 a	670 a

Source: Processed Data

Description: Mean fresh weight of healthy tubers per plant followed by the same letter means not significantly different at the 5% BNJ level.

Based on Table 4, it can be observed that the highest average weight of healthy tubers per plant is found in the treatment of B1 seedlings with a length of 25 cm and K1 chicken manure, which is the application of chicken manure at a dose of 11.25 grams. The lowest per plant was found in the treatment of B1 seedlings with a stem length of 25 cm and K4 chicken manure, which is the application of chicken manure at a dose of 41.25 grams per plant, which is 405 grams.

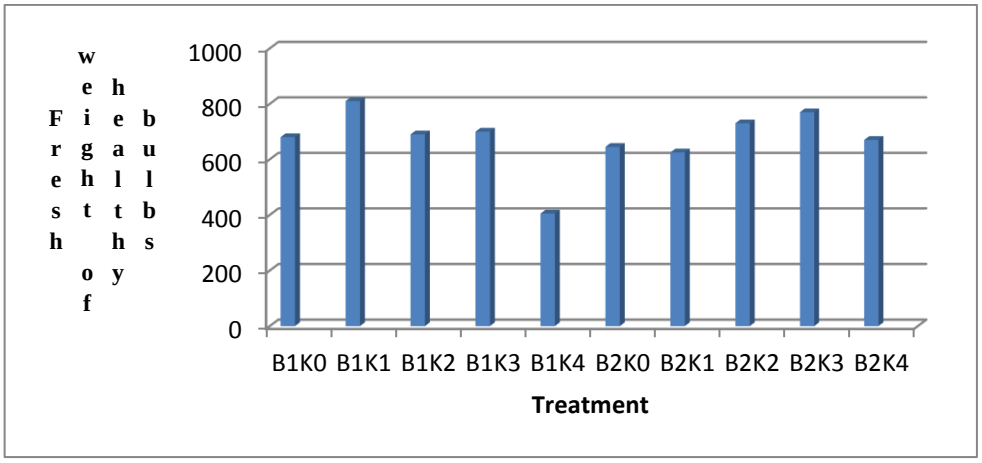

Figure 4. The Effect of Chicken Manure Dose and Seed Variety on The Weight of Healthy Tubers per Plant

Based on Figure 3, it is observed that the treatment of using seedlings from the top of the stem (B1) produced the highest fresh weight of healthy tubers. Sweet potatoes planted on high and not thick mounds will produce more than low and thick mounds. The best size for sweet potato plants is 60 cm wide by 40 cm high and 30 cm spacing in rows, while the length of cuttings for seedlings is 25 - 30 cm or 3 - 4 internodes taken from the tip of the stem.

Fresh Weight of Boleng Tubers per Plant

The observation of fresh weight of boleng tubers per plant was calculated at harvest time. Based on Table 1 above, it is known that the highest average total of boleng tubers per plant was found in the B1 treatment, which is seedlings with a shoot length of 25 cm with a dose of 21.25 grams of K2 chicken manure, which is 160 tubers.

Table 5. The Average Fresh Weight of Boleng Tubers per Plant as A Result of Seedling Variety and Chicken Manure Treatment

Seedling Variety	Chicken Manure Dosage (K)				
	K_0	K_1	K_2	K_3	K_4
B_1	57.3 a	130 a	160 a	96 a	230 a
B_2	80.7 a	153.3 a	119.7 a	136.7 a	80.7 a

Source: Processed Data

Description: The average total of tubers per plant followed by the same letter is not significantly different at the 5% BNJ level.

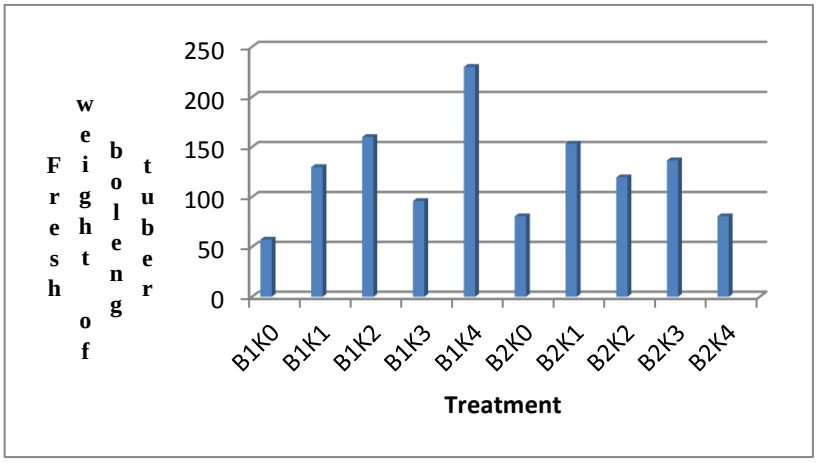

Figure 5. The Effect of Chicken Manure Dose and Seed Variety on Fresh Weight of Boleng Tubers per Plant

CONCLUSION

Indonesia's tropical climate is agroclimatically suitable for sweet potato growth. Since it is easy to cultivate, resistant to drought, and can adapt to various types of soil, it is widely cultivated by farmers in Indonesia. One of the factors causing the low productivity of sweet potato is the boleng pest, cylasformicarius, which has not been optimally controlled by farmers. Integrated boleng pest control is conducted by combining several control components, such as land sanitation, farming methods including the use of seedlings or selection of cuttings, hilling, irrigation, and crop rotation, the use of varieties/clones that are tolerant to boleng pests such as Cangkuang and Genjahrante varieties, and the appropriate use of fertilizers. Based on the research results, various doses of chicken manure and the type of seedlings tested did not significantly affect all parameters studied, which were the intensity of boleng pest attack, the total of healthy tubers per plant, the total of tubers per plant, the fresh weight of healthy tubers per plant, and the fresh weight of tubers per plant. The highest total of healthy tubers per plant was 8.3 in the B1K2 treatment and the highest fresh weight of tubers per plant was 810 grams in the B1K1 treatment.

REFERENCES

Alkutubi, H. (2021). On Randomized Complete Block Design. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, *53*(2), 230–243.

Assefa, S., & Tadesse, S. (2019). The Principal Role of Organic Fertilizer on Soil Properties and Agricultural Productivity -A Review. *ARTOAJ: Agricultural Research and Technology Open Access Journal*, *22*(2).

Dani, U., Budiarti, A. N. S., & Wijaya, A. A. (2021). Application of Chicken manure Dosage and Plant Growth Promoting Rhizobacetria on the Growth and Yield of Shallot Plants (Allium ascalonicum L.). *IOP Conference Series: Earth and Environmental Science*. https://doi.org/10.1088/1755-1315/748/1/012044

Estiasih, T., Putri, W. D. R., & Waziiroh, E. (2017). *Umbi-umbian & Pengelohannya* (Cetakan Pe). UB Press.

Harti, A. O. R., & Anugrah, Z. H. (2018). Pengaruh Jarak Tanam dan Pemberian Pupuk Kandang Ayam terhadap Pertumbuhan dan Hasil Tanam Ubi Jalar (Ipomoea batatas L.). *AGRIVET: Journal of Agricultural Sciences and Veteriner*, *6*(2). https://jurnal.unma.ac.id/index.php/AG/article/view/1167

Hwang, H. Y., Kim, S. H., Kim, M. S., Park, S. J., & Lee, C. H. (2020). Co-composting of chicken manure with organic wastes: characterization of gases emissions and compost quality. *Applied Biological Chemistry-*, *63*(3).

Irfan, Z., Sumilah, & Srimaryati. (2021). Local Cultivars of Sweet Potato in West Sumatra, Indonesia: Its Characteristics, Yield Potentials, and Organoleptic Values. *Proceedings of the International Seminar on Promoting Local Resources for Sustainable Agriculture and Development (ISPLRSAD 2020)*. https://doi.org/https://doi.org/10.2991/absr.k.210609.056

Rahajeng, W., Restuono, J., Indriani, F. C., & Purwono. (2021). Evaluation of Promising Sweet potato Clones for Higher Root Yield and Dry Matter Content. *PlantaTropika: Jurnal Agrosains*, *9*(1), 42–47.

Rayamajhi, U., & Mishra, A. (2020). Impact of Processing on Retention of Beta Carotene of Sweet Potatoes. *Journal of Food Science and Technology Nepal*, *12*(12), 20–24. https://doi.org/https://doi.org/10.3126/jfstn.v12i12.33400

Saitama, A., Nugroho, A., & Widaryanto, E. (2017). Yield response of ten varieties of sweet potato (Ipomoea batatas L.) cultivated on dryland in rainy season. *Journal of Degraded and Mining Lands Management*, *4*(4), 919–926. https://doi.org/https://doi.org/10.15243/jdmlm.2017.044.919

Santosa, S. J., & Priyono. (2023). The Scientific Study of Urea Fertilizer and Cow Manure Composition on The Growth and Yield of Kailan Plants. *ACITYA WISESA (Journal of Multidisciplinary Research)*, *2*(1), 20–31. https://journal.jfpublisher.com/index.php/jmr/article/view/233

Susanto, E., Herlina, N., & Suminarti, N. E. (2014). Respon Pertumbuhan Dan Hasil Tanaman Ubi Jalar (Ipomoea Batatas L.) Pada Beberapa Macam Dan Waktu Aplikasi Bahan Organik. *Jurnal Produksi Tanaman*, *2*(5), 412–418. https://doi.org/https://dx.doi.org/10.21176/protan.v2i5.125