GROWTH AND YIELD OF CAYENNE PEPPER PLANTS

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Submission date: 08-Mar-2024 08:35AM (UTC-0500)
Submission ID: 2315145545
File name: Article_1192_Soft-Copy.pdf (787.5K)
Word count: 4546
Character count: 24157

e-ISSN 2795-4362
p-ISSN 2795-4340

GPH-INTERNATIONAL JOURNAL OF AGRICULTURE & RESEARCH

GPH - JOURNAL OF AGRICULTURE & RESEARCH

10.5281/zenodo.10588208 Vol. 07 Issue 01 Jan - 2024 Manuscript ID: #01192

GROWTH AND YIELD OF CAYENNE PEPPER PLANTS (*Capsicum frutescens* l.) ON BOKASHI PLANTING MEDIA AND SOIL MIXTURE WITH BURNT HUSK

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Abstract:

Cayenne pepper (*Capsicum frutescens* L.) is an important vegetable, especially in tropical and subtropical areas. Bokashi is an organic fertilizer produced by fermenting organic materials with the help of EM4. This is a mixed culture of various types of beneficial microorganisms, namely lactic acid bacteria, photosynthetic bacteria, *Actinomycetes*, *Streptomycetes* sp., and yeast. Bokashi application is very useful for improving soil properties, both physical, chemical, and biological.This research aims to determine the effect of bokashi fertilizer doses on the growth and production of cayenne pepperand determine the right dosage for the growth and yield of cayenne pepper plants. (*Capsicum frutescens* L.). This research was carried out by Sambaliung District, from February to May 2021.The research used a Completely Randomized Design (CRD) with one factor, namely the dose of bokashi fertilizer (P) with 10 replications, namely: P0 = 0% bokashi and 100% soil mixture with burnt husks; P1 = 25% bokashi and 75% soil mixture with burnt husks; P2 = 50% bokashi and 50% mixture of soil and roasted husks; and P3 = 75% bokashi and 25% soil mixture with burnt husks. Data analysis uses a Completely Randomized Design (CRD) and if there is a significant difference then it will be continued with Duncan's Multiple Range Test at a rate of 5%. The results showed that the doses of bokashi and roasted husks were not significantly different when observing the number of leaves in the first week, number of productive branches, number of fruit per plant, production, flowering time, maturity, and fruit length. P3 treatment gave the highest results, namely 337 g plant^{-1}.

Keywords:

Cayenne Pepper, Planting Media, Bokashi, Burnt Husk.

I. INTRODUCTION

Cayenne pepper (*Capsicum frutescens* L.) is a horticultural plant from the Solanaceae family that has high economic value and complete nutritional value (Kouassi et al., 2012; Kusmanto et al., 2015; Nule et al., 2021). It is one of the important vegetables, especially in tropical areas, and is generally used as a cooking spice (spices), food ingredient, or as a raw material in the pharmaceutical industry (Shinta et al., 2014; Howard et al., 2000 in Sofiarani and Ambarwati, 2020; Alunia et al., 2021)

Organic farming can be defined as an agricultural cultivation system that does not use synthetic chemicals as fertilizers and pesticides but instead uses recycled natural materials. The aim is to cultivate plants naturally, maintain and increase long-term soil fertility, maintain environmental balance by maintaining natural cycles, avoid all forms of pollution from farming techniques, and produce healthy products (Sa'adah et al., 2015). The methods and technology used are easy to understand, easy to reach, and available at all times. Organic farming contains the principle of maintaining the environmental ecosystem, from fertilizer application, pest control, cultivation techniques, and processing of harvests which are always related to the surrounding nature (Glio, 2015).

Fertilizer is a material added to the soil to provide essential nutrient elements for plant growth (Setiawan, 2009). Organic fertilizer is fertilizer composed of living creature material which is processed through a decomposition process by decomposing bacteria, such as the decay of plant, animal, and human remains (Lumbanraja, 2012; Suriadikarta et al., 2015). Contains macro and micronutrients that play a role in the process of plant growth and production, increase soil fertility, and restore soil fertility that has been lost due to the use of chemical fertilizers, does not cause residue in the harvest so it safe for humans and the environment, and prevents erosion of the top layer of soil which causes is the layer that contains the most nutrients (Parnata, 2010; Wijaya, et al., 2017).

Bokashi is an organic fertilizer produced from fermentation, which is useful for improving soil properties, both physical, chemical, and biological (Indriani, 2011; Kresnatita, 2012; Roidah, 2013). So it can increase soil fertility and increase the growth and production of plants (Kusuma, 2013). Contains macronutrients N, P, K, Mg, S, and Ca and micronutrients Zn, B, Fe, Cu, Mn, Mo, and Cl. The advantage of bokashi fertilizer is that it has a higher nutrient content and is already decomposed so it is ready to be absorbed by plant roots. Contains effective microorganisms that are useful for suppressing the growth of pathogens in the soil Rinaldi, et al (2021). The results of the analysis of the chemical properties of bokashi contain N 1.48%, P, 0.59%, K 0.87%, and C/N 11 (Soil Laboratory, Faculty of Agriculture, 2021)

Roasted husks and raw husks have the same level of porosity. As a planting medium, it plays an important role in improving soil structure so that the aeration and drainage system in the planting medium becomes better, contains high carbon (C) so that it makes the planting medium loose, easily binds water, does not rot easily (Prihmantoro, 2003), is a source of potassium. (K) which plants need and does not easily clot or compact so that plant roots can grow perfectly (Gustia, 2013). Contains N 0.32%, PO 15%, KO 31, Ca 0.95%, Fe 180 ppm, Mn 80 ppm, Zn 14.1 ppm and PH 6.8. High air circulation, and high water holding capacity, so it can absorb sunlight effectively (Hakim, 2013 in Nule et al., 2021). does not clot easily, the price is relatively cheap, the material is easy to obtain, light, sterile, and has good porosity (Oktaviani, 2017). Husk charcoal retains or absorbs water and nutrients in the soil. This is proven by research by Septiani (2012), showing that husk charcoal can affect the growth and yield of cayenne pepper plants.

The research aimed to determine: (1) the effect of bokashi fertilizer on the growth and yield of cayenne pepper plants and (2) the correct dose for the growth and yield of cayenne pepper plants (Capsicum frutescens L.).

RESEARCH METHODS

A. Time and Place

This research was conducted from February 2021 to May 2021 in Sambaliung District, Berau Regency, East Kalimantan Province, Indonesia.

B. Materials and Tools

The materials and tools used are cayenne pepper seeds, slaughterhouse waste, husk charcoal, soil, bran, MA11, brown sugar and stakes, cameras, hoes, machetes, stakes, buckets, scales, polybags measuring 40 cm x 30 cm, and rope. raffia and meter.

C. Experimental Design

The research used a Completely Randomized Design (CRD) with one factor, namely the dose of bokashi fertilizer (P) with 10 replications, namely:

P0 = 0% bokashi and 100% soil mixture with burnt husks.
P1 = 25% bokashi and 75% soil mixture with burnt husks.
P2 = 50% bokashi and 50% mixture of soil and roasted husks.
P3 = 75% bokashi and 25% soil mixture with burnt husks.

D. Research Procedures

1. Sowing seeds: seeds are first soaked in water for 15 minutes, then transferred to a seeding container with a mixture of soil, roasted husks, and sand.
2. Planting: chili seeds that are 30 days old after sowing are transplanted into polybags with a distance between polybags of 100 cm x 75 cm.
3. Replanting is carried out on plants that experience poor growth by replacing plants of the same age and having the same treatment
4. Installation of supports is carried out after the plants are 30 days after planting, at a distance of approximately 10 cm from the plant stem.
5. Bokashi fertilizer is applied when processing the planting media according to the treatment, namely 7 days after transplanting the seeds.
6. Plant maintenance, including watering, weeding, pest and disease control.
7. Fruit harvesting is carried out according to the criteria of orange-red fruit color and smooth, shiny fruit skin surface.

E. Data Observation

Data collected included plant height (cm), number of productive branches (branches), flowering time (days), number of fruit per plant (fruit), fruit diameter (cm), fruit length (cm) and fruit weight per plant (g)

F. Data Analysis Method

Data analysis was carried out using variance. If there is a significant difference, then continue using Duncan's Multiple Range Test at the 5% level.

RESEARCH RESULTS AND DISCUSSION

A. Plant Height

The results of variance analysis showed that the treatments of bokashi planting media and soil mixture with burnt husks were significantly different in terms of the average height of plants aged 12, 36, and 60 days after transplanting. The research results are presented in Table 1.

Table 1. The Average Height of Cayenne Pepper Plants Aged 12, 36, and 60 Days After Transplanting (cm)

Age (Days After Transplanting)	Treatment			
	P0	P1	P2	P3
12	5,12 a	5,08 a	5,32 a	5,87 b
36	22,14 a	23,33 a	24,39 a	30,81 b
60	77,40 a	76,84 a	83,14 b	84,09 b

Note: Numbers followed by the same letter in the same row indicate that they are not significantly different in the 5% level DMRT test

Based on the results of variance analysis, it showed that the bokashi treatment was significantly different for the height of plants aged 12, 36, and 60 DAP. Increasing the dose of bokashi will increase plant height, this is due to the N content in bokashi which plays a role in increasing growth. According to Iskandar (2013) in Ramayana et al. (2021), N is needed for the vegetative growth of plants such as roots, stems, and leaves, formation of carbohydrates, proteins, fats, and other organic compounds. Nurdin (2010) in Ramayana et al. (2022); and Ramayana et al., (2023) added that the vegetative growth of plants such as stems, branches, and leaves requires the nutrient N.

Bokashi is an organic fertilizer produced from fermentation and functions to improve the physical, chemical, and biological properties of soil. According to Kusuma (2013), giving bokashi can increase soil fertility so that plant growth and yields increase. Wididana et al (1996) in Rinaldi (2021) added that bokashi contains the macronutrients N, P, K, Mg, S, and Ca and the micronutrients Zn, B, Fe, Cu, Mn, Mo, and Cl. Furthermore, Tufaila and Alam (2014); and Wijaya et al (2017) stated that the advantage of bokashi fertilizer is that it contains higher nutrient elements and is already decomposed so that it is ready to be absorbed by plant roots. Contains effective microorganisms that are useful for suppressing the growth of pathogens in the soil.

B. Diameter of Stem

The results of variance analysis showed that the treatments of bokashi planting media and soil mixture with burnt husks were not significantly different in terms of the average stem diameter at ages 12, 36, and 60 after transplant. The research results are presented in Table 2.

Table 2. Average Stem Diameter of Cayenne Pepper Plants Aged 12, 36, and 60 Days After Transplanting

Age (Days After Transplanting)	Treatment			
	P0	P1	P2	P3
12	0,09	0,14	0,14	0,14
36	0,42	0,44	0,45	0,48
60	0,53	0,57	0,57	0,60

Based on the results of variance analysis, it showed that the bokashi treatment had no significant differences in the stem diameter of plants aged 12, 36, and 60 DAP. Bokashi application tends to provide a larger plant stem diameter when compared to without bokashi application. It is suspected that the application of bokashi will increase the availability of N nutrients in the soil which

will increase the diameter of plant stems. According to Ashgar (2010); and Arinong (2013), in the vegetative growth phase, plants need the nutrient N, so its availability can support further plant growth.

According to Mamoto (2015), increasing the circumference of the stem diameter, increasing plant height and root growth are influenced by the availability of the nutrient N. Meanwhile, according to Ademiluyi and Fabiyi (2015), the availability of the K nutrient helps plants to form larger stem diameters. Fadwiwati and Tahir (2013) in Ramayana et al (2022) added that sufficient N nutrient availability can promote better plant growth because of the role of N as a constituent of amino acids, proteins, and the building blocks of cell nuclei.

C. Flowering time, number of productive branches per plant, number of fruit per plant, fruit length per plant, diameter, fruit weight per plant, fruit weight per plant

The results of variance analysis showed that the treatments of bokashi planting media and soil mixture with burnt husks were significantly different in terms of the average fruit diameter and fruit weight, but not significantly different in terms of the average flowering time, number of productive branches per plant, number of fruits per plant, and fruit length. The research results are presented in Table 3.

Table 3. Average Flowering Time, Number of Productive Branches, Number of Fruit & Fruit Weight per Plant.

Age (Days After Transplanting	**Observation Variables**					
	Flowering Time (days)	Number of Productive Branches (branches)	Number of Fruits (fruits)	Fruit Length (cm)	Fruit Diameter (cm)	Fruit Weight Per Plant (g)
P0	78,10	3,90	115,80	3,14	0,62 b	294 a
P1	78,10	4,50	120,00	3,23	0,67 b	299 a
P2	78,30	4,00	121,90	3,27	0,75 ab	328 b
P3	77,60	3,90	129,00	3,29	0,88 a	337 b

Note: Numbers followed by the same letter in the same column indicate that they are not significantly different in the 5% level DMRT test

Application of bokashi tends to provide faster flowering times, fewer productive branches, greater fruit sets, and longer fruit sets. This shows that the application of bokashi will provide better availability of N, P, and K nutrients in the soil to support plant growth and yield. The bokashi application also provides a larger fruit diameter and heavier fruit when compared to those without the bokashi application.

Microorganisms in bokashi play a role in providing nutrients through a recycling process and forming a soil structure suitable for plant growth and yield (Soplanit and Soplanit, 2012 in Rinaldi et al., 2020). Chemically increasing the availability of N, P, and K nutrients through the decomposition process (Nguyen and Shindo, 2011 in Rinaldi et al., 2020). Mayunar (2011); and Arinong (2013) stated that the N, P, and K contained in bokashi play a role in the vegetative and generative growth of plants, this can be seen from the faster flowering time compared to controls. Soemeinaboedhy (2007); Artiana et al., (2016); and Hafizah Dan Mukarramah (2017), also stated that flowering and fruiting of plants require the nutrients P and K.

The number of productive branches is smaller but produces a greater number of fruit, longer fruit with a wider diameter. According to Kusuma (2013), giving bokashi can increase soil fertility so that plant growth and yields increase. Anonymous (2012) in Nule et al., (2021) added that planting media is said to be fertile if it can provide sufficient and balanced amounts of nutrients for plant

growth and yield. Efendi et al. (2017) added that bokashi plays a role in providing macro and micronutrients, improving the structure and loosening the soil, making it easier for plant roots to absorb nutrients. Furthermore, Tola et al. (2007) Rinaldi et al., 2020; Zainuddin (2016); Sofiarani and Ambarwati (2020) stated that the organic material in bokashi becomes food for microorganisms to reproduce, as well as increasing the availability of nutrients for plants.

A good growing medium must be able to provide adequate nutrients, water, and air to ensure perfect root development and better plant growth and yields. According to Naimmule (2016); and Sitepu (2013) in Thonak and Tulle (2021), increased plant growth and yields are influenced by the support of better environmental conditions in plant-growing media, thus allowing optimal root development. Prihmantoro (2003) in Nule et al., (2021), husk charcoal can improve the physical, chemical, and biological structure of soil. Increasing soil porosity thereby increases the soil's ability to absorb water, and the soil becomes loose.

The application of bokashi which contains macro and micronutrients supports metabolic processes in plants, as stated by Lumowa and Ermawati (2014); and Lakitan in Thonak and Tulle (2021), the availability of nutrients is needed by plants for their metabolic processes. According to Tola, et al., (2007); Silvia, et al., (2012) in Iswahyudi et al., 2020, bokashi can restore the physical, chemical, and biological fertility of the soil because it acts as a binder for soil particles through the soil aggregation process. Increases the ability to absorb and retain water so that it affects the accumulation of food substances and metabolic products stored in fruit and seeds. (Kusuma, 2013; Marpaung et al., 2017; Azwir, 2018) Adding bokashi with its nutrient content can stimulate the growth of productive branches, increase the formation of flowers and fruit, and reduce the fall of leaves, flowers, and fruit.

The results of research by Arinong (2013), cow dung bokashi had a significantly different effect and gave the highest yields (plant height, number of pods and dry weight, faster flowering and harvest time). The results of research by Santosa and Suryanto (2015) showed that the application of N, P, and K fertilizer combined with organic fertilizer for cow pens resulted in a higher number of calves and panicles per hill. The application of organic fertilizer from slaughterhouse waste combined with N, P, and K fertilizer tends to produce a higher number of rice tillers per pot compared to only inorganic fertilizer.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that:

1. Bokashi treatment had a significantly different effect on plant height, fruit diameter, and weight, but not significantly different on stem diameter, flowering time, number of productive branches, number and length of cayenne pepper fruit.
2. Treatment doses of 75% bokashi and 25% soil mixture with roasted husks provide the best growth and results for cayenne pepper plants.

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