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RESPONSE OF GROWTH AND YIELD OF KATOKKON CHILI PLANTS (*Capsicum chinense JACQ.*) TO THE TYPE AND DOSAGE OF ANIMAL MANURE FERTILIZER

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ABSTRACT

The aim of the research was to determine the response of growth and yield of Katokkon chilies to the type and dose of livestock manure fertilizer; and to obtain the type and dose of livestock manure that is suitable for Katokkon chili plants. The research was conducted from October 2022 to February 2023 on Jl. Mangkuraja, Tenggarong. The experiment was structured using a single factor Randomized Completely Block Design (RCBD) with thirteen treatments and six replications, namely: d0 = no fertilization as control; d1 = chicken manure 60 g polybag^{-1} or equivalent to 10 Mg ha^{-1}; d2 = chicken manure 120 g polybag^{-1} or equivalent to 20 Mg ha^{-1}; d3 = chicken manure 180 g polybag^{-1} or equivalent to 30 Mg ha^{-1}; d4 = chicken manure 240 g polybag^{-1} or equivalent to 40 Mg ha^{-1}; d5 = goat manure 60 g polybag^{-1} or equivalent to 10 Mg ha^{-1}; d6 = goat manure 120 g polybag^{-1} or equivalent to 20 Mg ha^{-1}; d7 = goat manure 180 g polybag^{-1} or equivalent to 30 Mg ha^{-1}; d8 = goat manure 240 g polybag^{-1} or equivalent to 40 Mg ha-1; d9 = cow manure fertilizer 60 g polybag^{-1} or equivalent to 10 Mg ha^{-1}; and d10 = cow manure fertilizer 120 g polybag^{-1} or equivalent to 20 Mg ha^{-1}; d11 = cow manure fertilizer 180 g polybag^{-1} or equivalent to 30 Mg ha^{-1}; and d12 = cow manure fertilizer 240 g polybag^{-1} or equivalent to 40 Mg ha^{-1}. The results showed that the effect of the type and dose of livestock manure was significantly different to very significant on plant height at 15, 30, 45, and 60 days after planting, age at flowering, age at first harvest, number of fruit per plant, and weight of fresh fruit per plant. plants, but not significantly different on the variables of number of primary branches, length, and diameter of Katokkon chili fruit. Treatment of chicken manure with a dose of 240 g polybag^{-1} produced better growth and yields compared to treatment with the type and dose of goat manure and cow manure.

KEYWORDS:

Katokkon chili (*Capsicum chinense* Jacq.), livestock manure.

INTRODUCTION

The red chili plant (*Capsicum annum* L.) is a horticultural plant that is used as a spice for flavoring and complementary seasoning in making various kinds of food, including food in Indonesia. There are many types of chili, one of which is the local Toraja variety of chili which is often called Katokkon pepper *(Capsicum chinense* Jacq.). In line with the increase in population which affects the national economy, people's need for chilies increases from year to year. This can be proven by referring to data from the Department of Industry, Trade and Cooperatives, Small and Medium Enterprisesof East Kalimantan Province that the people of East Kalimantan consume an average of 0.58 kilograms/capita/month of chili [1]. Based on calculations using a projection system, the cumulative amount of chili consumption in East Kalimantan will reach 18,069 Mg in 2021. In contrast to the increasing needs of society, chili production in East Kalimantan has decreased over the past year, in 2020 it reached 9,081 Mg ha^{-1} and in 2021 chili production will reach 8,367 Mg ha^{-1} [2]. There is a disparity between the amount of chili production which is still relatively low and the high average demand for chilies, so it is necessary to increase and improve production, one of which is through cultivation.

Increasing the production of chili plants can be done by paying attention to the cultivation stages, including fertilization. Fertilization can be done to overcome the low availability of nutrients in the soil. In Indonesia, farmers generally still apply a lot of inorganic fertilizer, excessive and continuous use of inorganic fertilizer has a negative impact, namely it can cause land productivity to decrease [3]. To reduce the use of inorganic fertilizers, you can choose the type of organic fertilizer.

Providing organic fertilizer that can be the right alternative is livestock manure. Each type of livestock manure contains different nutrients, namely chicken manure contains 1.0% Nitrogen; 0.8 % Phosphorus; and 0.4% Potassium; Goat manure contains 0.6% Nitrogen; 0.3%, Phosphorus, and 0.17% Potassium; and cow manure contains 0.4% Nitrogen; 0.2% Phosphorus, and 0.1% Potassium; The difference in nutrient content is caused by several factors, namely the type of animal, the type of food given and the age of the livestock itself [4].

Apart from the type of fertilizer, another thing that is no less important is the dose measurement process that must be paid attention to. The research results reported by [5] that giving chicken manure is much better than not giving fertilizer, the result is that the plants grow well. Application of 20 Mg ha^{-1} chicken manure gave good and efficient results, especially for plant height, plant dry weight, root volume, number of fruit, and weight of chili fruit. Dosing has a high influence on results. If the dose given during the fertilization process is too little, the result will be that the plant will lack nutrients, conversely, if the dose given during the fertilization process is excessive it can suppress growth and make the plant weak, as a result, vulnerable to pests and disease.

The research aimed to determine the response of the growth and yield of Katokkon chilies to the type and dose of livestock manure fertilizer; and to obtain the type and dose of livestock manure that is suitable for Katokkon chili plants.

RESEARCH METHODOLOGY

A. Time and place

The research was conducted from October 2022 to February 2023, the research site was on Jalan Mangkuraja, Tenggarong District, Kutai Kartanegara Regency, East Kalimantan, Indonesia.

B. Materials and Tools

The materials used are local Toraja variety chili seeds (Katokkon), planting medium in the form of topsoil, chicken manure fertilizer, cow manure fertilizer, goat manure fertilizer, water, and organic pesticides. The tools used are portrayed for seedbeds, polybags measuring 35 cm x 35 cm, hoes, buckets, scoops, digital scales, measuring rulers, calipers, label paper, scissors, stationery, and documentation tools.

C. Experimental Design

The research was a single-factor experiment, namely the type of fertilizer and dosage of livestock manure using a Randomized Completely Block Design (RCBD), consisting of thirteen treatments and six groups as replications. Treatment consists of: d0 = no fertilization (control); d1 = chicken manure 60 gpolybag^{-1} or equivalent to 10 Mg ha^{-1} d2 = chicken manure 120 g polybag^{-1} or equivalent to 20 Mg ha^{-1}; d3 = chicken manure 180 g polybag^{-1} or equivalent to 30 Mg ha^{-1}; d4 = chicken manure 240 g polybag^{-1}or equivalent to 40 Mg ha^{-1}; d5 = Goat manure 60 g polybag^{-1}or equivalent to 10 Mg ha^{-1};d6 = Goat manure120g polybag^{-1}or equivalentto 20 Mg ha^{-1}; d7 = Goat manure180g polybag^{-1}or equivalent to 30 Mg ha^{-1}; d8 = Goat manure240g polybag^{-1}or equivalentto 40 Mg ha^{-1}; d9 = Cow manure fertilizer 60 g polybag^{-1}or equivalent to 10 Mg ha^{-1}; 10 = Cow manure fertilizer 120 g polybag^{-1}or equivalent to 20 Mg ha^{-1}; d11 = Cow manure fertilizer 180 g polybag^{-1}or equivalent to 30 Mg ha^{-1} and d12 = Cow manure fertilizer 240 g polybag^{-1}or equivalent to 40 Mg ha^{-1}.

D. Research Procedures

The stages of research activities are as follows:

1. Preparatory stage

At this stage, the following are carried out: (1) preparation of materials and tools that will be used in the research process, apart from tools and materials, (2) preparation of the research site, namely the land used measuring 10 m x 5.5 m is cleared of bushes and the area around the site is leveled. study; (3) preparation of planting media in the form of 0"25 cm topsoil taken from around the location, the soil is air"dried while being loosened and then put into polybags measuring 35 cm x 35 cm weighing 12 kg, and each polybag is labeled with treatment and arranged neatly at a distance 70 cm x 50 cm according to random results using simple random sampling.

2. Providing livestock manure fertilizer

The application of livestock manure fertilizer to each polybag is adjusted to the type and dose of treatment. Animal manure fertilizer is given 14 days before planting by mixing animal manure fertilizer with the planting medium in a polybag.

3. Nursery

Seeding is carried out by carrying out a seed equalization process, namely: (a) selecting Katokkon chili plant seeds of uniform size, intact, dense, and without defects, then soaking the seeds in water for ± 12 hours. After soaking, the floating Katokkon chili seeds are discarded and the sunken seeds are taken; (b) The seeds are germinated in a 200seed potray, then after 2 weeks they are transferred to a small polybag measuring 10 cm x 15 cm containing soil media and the seeds are planted at a depth of around 1 cm. During seedlings, water is carried out every day in the morning or evening to maintain humidity, so don't water too hard because it will damage the seeds, such as breaking, breaking, and falling.

4. Planting stage

Planting is carried out after the seeds are 2 weeks old (the seedlings have 2-3 leaves), then seeds are selected that are not broken, fresh, not torn, and sturdy. Planting is carried out in the afternoon, 1 seed of uniform size is planted in each polybag.

5. Plant maintenance

includes watering, installing stakes, and controlling weeds, pests, and diseases.

6. Harvest stage

The characteristics of a plant that is ready to harvest are physiologically ripe chili fruit characterized by the fruit changing color to red and the fruit being dense. The harvest process is carried out by picking the fruit along with the stalk. Harvesting is done in the morning, and harvesting is done four times.

E. Observed Variables

Observation variables consisted of plant height (cm) at 15, 30, 45, and 60 days after transplanting and at first harvest, number of primary branches, age at flowering, age at first harvest, number of fruit per plant, fruit length, fruit diameter, and fruit weight per plant.

F. Data Analysis

The research data were analyzed using analysis of variance, to compare the two treatment averages followed by the Duncan's Multiple Range Test (DMRT) at the 5% level [6].

RESULTS AND DISCUSSION

A. Plant Vegetative Phase

The results of the analysis of variance showed that the type and dose of livestock manure had affected significantly to very significantly the average height of plants aged 15, 30, 45, and 60 days after planting and at the first harvest, but had no significant on the average number of branches primary. Recapitulation of data on average plant height and number of primary chilies for Katokkon chilies in various types and doses of livestock manure fertilizer is presented in Table 1.

Table 1. Research Results on Height Growth and Number of Primary Branches of Katokkon Chili Plants on Various Treatment Types and Doses of Animal Manure Fertilizer

Treatments	Plant Height (cm)					Number of Branches Primary
	15 DAP	30 DAP	45 DAP	60 DAP	at the first harvest	
Analysis of variance	**	**	*	**	**	tn
d_0	4,67^{d}	9,05 ^{c}	16,02^{c}	22,58^{c}	26,95^{c}	3,33
d_1	5,85^{bc}	12,35^{ab}	19,08^{ab}	32,00^{ab}	38,87^{ab}	4,33
d_2	5,57^{bc}	12,65^{ab}	21,12^{ab}	31,50^{ab}	38,88^{ab}	4,50
d_3	6,53^{ab}	12,88^{ab}	21,23^{ab}	31,58^{ab}	38,07^{ab}	4,33
d_4	7,02^{a}	14,25^{a}	23,53^{a}	35,30^{a}	40,72^{a}	4,50
d_5	5,98^{bc}	12,83^{ab}	21,22^{ab}	31,32^{ab}	38,12^{ab}	4,00
d_6	5,82^{bc}	11,82^{b}	21,00^{ab}	31,10^{ab}	38,25^{ab}	4,17
d_7	5,65^{bc}	11,85^{b}	21,18^{ab}	31,38^{ab}	38,52^{ab}	4,33
d_8	5,57^{bc}	11,87^{b}	21,32^{ab}	32,77^{ab}	40,58^{a}	3,50
d_9	5,72^{bc}	11,50^{b}	20,55^{ab}	30,25^{ab}	35,53^{ab}	3,83
d_{10}	5,62^{bc}	11,65^{b}	19,67^{b}	30,15^{ab}	35,45^{ab}	3,67
d_{11}	5,60^{bc}	11,57^{b}	19,80^{ab}	30,07^{ab}	35,42^{ab}	3,50
d_{12}	5,37^{cd}	10,85^{bc}	19,08^{bc}	28,87^{b}	34,40^{b}	3,50

Note: The average numbers followed by the same letter in the same column are not significantly different according to the DMRT test at the 5% level

Referring to the research results in Table 1 show that treatment with various types and doses of livestock manure (chicken, goat, and cow) resulted in higher Katokkan chili plant height at 15, 30, 45, and 60 days after planting and higher plant height at the first harvest. and a greater number of primary branches compared to the treatment without livestock manure (control). This is because the provision of organic fertilizer can increase the availability of nutrients, especially nutrient Nitrogen (N), which is needed to stimulate plant vegetative growth. As stated by [7] the element N is a constituent of amino acids, proteins, and nucleic acids as well as chlorophyll; with an adequate supply of N elements for plants, it can stimulate/encourage plant vegetative growth.

The research results in Table 1 also show that applying chicken manure fertilizer with various treatment doses produced higher plants compared to treatments with types and doses of goat and cow manure fertilizer. This is because chicken manure has a higher content (1.0% N) compared to the content in goat manure (0.6% N) and cow manure (0.4% N). The results of this research are by the report [8] that the application of three types of manure (chicken, goat, cow) can increase plant height growth and branching levels.

B. Generative Phase

The results of the analysis of variance showed that the type of fertilizer and dose of manure had affected significantly to very significantly on the age of flowering and the age of first harvest of Katokkon chili plants, number of fruit, and weight of fresh fruit per plant, but had no significant effect on fruit length and fruit diameter. Recapitulation of data on average plant age at flowering, at first harvest, number of fruit, fruit length, fruit diameter, and fresh fruit weight per plant in various types and doses of livestock manure fertilizer are presented in Table 2.

Table 2. Research Results on Age at Flowering, Age at First Harvest, Number of Fruit, Length of Fruit, Fruit Diameter and Fruit Weight per Katokkon Chili Plant on Various Treatment Types and Doses of Animal Manure Fertilizer

Treatments	Age of Flowering (DAP)	Age of Harvest (DAP	Number of Fruit	Length of Fruit (cm)	Diameter of Fruit (cm)	Fruit Weight per Plant (g)
Analysis of Variance	**	*	*	tn	tn	*
d_0	73,50^{c}	119,67^{b}	10,00^{b}	3,02	3,08	94,67^{b}
d_1	66,83^{ab}	108,67^{a}	15,00^{a}	3,28	3,40	120,83^{ab}
d_2	66,00^{ab}	108,50^{a}	15,33^{a}	3,30	3,46	128,50^{ab}
d_3	66,17^{ab}	106,67^{a}	15,83^{a}	3,32	3,58	128,33^{ab}
d_4	64,50^{a}	101,00^{a}	16,00^{a}	3,52	3,60	136,00^{a}
d_5	66,83^{ab}	108,00^{a}	15,17^{a}	3,16	3,21	135,50^{a}
d_6	66,33^{ab}	108,17^{a}	15,33^{a}	3,23	3,17	126,83^{ab}
d_7	64,67^{a}	103,33^{a}	15,67^{a}	3,38	3,45	135,83^{a}
d_8	66,17^{ab}	103,17^{a}	15,83^{a}	3,18	3,31	121,17^{ab}
d_9	70,33^{bc}	109,33^{a}	14,50^{a}	3,08	3,13	113,00^{ab}
d_{10}	70,67^{bc}	110,83^{ab}	14,33^{a}	3,22	3,11	112,50^{ab}
d_{11}	67,50^{ab}	110,33^{ab}	13,33^{ab}	3,05	3,09	102,83^{ab}
d_{12}	70,50^{bc}	111,50^{ab}	12,33^{ab}	3,04	3,18	103,67^{ab}

Note: Average numbers followed by the same letters in different columns are not significant according to the DMRT test at the 5% level

The research results in Table 2 show that treatment with various types and doses of livestock manure resulted in a plant age at flowering between 64.50 - 70.67 days after planting, and a plant age at first harvest between 101.00 - 111.50 days after planting. was faster than the treatment without animal dung fertilizer (control) with ages at flowering and first harvest, namely 73.50 and 119.67 days after planting. This is because the nutrient content P in the soil cannot meet the nutrient needs of chili plants so that by applying livestock manure fertilizer can increase the availability of nutrient P. It was stated by [9] that the nutrient P can speed up the flowering and harvesting process.

The results of the research also show that there is no real difference between types of animal manure fertilizer in the parameters of plant age at the time of first harvest, but there is a tendency that the treatment of chicken manure fertilizer is faster compared to goat manure fertilizer and cow manure fertilizer.

The research results in Table 2 show that the treatment of various types and doses of livestock manure fertilizer shows that it produces a greater number of fruits per plant (12.33 - 16.00 fruits), and longer fruits (3.04 - 3.52 cm). , larger fruit diameter (3.09 - 3.60 cm), and higher fresh fruit weight per plant (102.83 - 136.00 g), whereas the treatment without livestock manure only produced more fruit components. low/little and the lowest fresh fruit weight per plant, namely 94.67 g. This situation is caused by the application of livestock manure fertilizer which can increase the availability of nutrients, besides that the application of animal manure fertilizer can also improve the physical and biological properties of the soil. As stated the benefits of applying solid organic fertilizer (such as animal dung) are that it can increase plant fertility, improve the chemical, biological, and physical properties of the soil, and not pollute the environment.

The results of the study also showed that the application of chicken manure fertilizer produced the highest fruit weight per plant ranging from 120.83 - 136.00 g), followed by the goat manure fertilizer treatment, namely 121.17 - 135.83 g, and the lowest was produced in the treatment cow dung fertilizer, namely 102.83 - 113.00 g. This situation is similar to the results of the research reported by [11] that the fruit weight of red chili plants given chicken manure was significantly different compared to the fruit weight of red chili plants given cow manure, goat manure, and duck manure.

Apart from that, from this research it is also known that in the chicken manure fertilizer treatment, fruit weight per plant increased with increasing fertilizer doses given; In the goat manure fertilizer treatment, fruit weight per plant showed varying results related to increasing fertilizer doses given; whereas in the cow dung fertilizer treatment, increasing the dose of fertilizer given tended to reduce fruit weight per plant. The highest fruit weight per plant was produced in the chicken manure fertilizer treatment with a dose of 240 g polybag^{-1}, namely 136 g plant^{-1}, and the lowest in the control treatment, namely 94.67 g plant^{-1}. This is related to the quality of each animal manure fertilizer. The quality of livestock manure is determined by the C/N ratio, for chicken manure it is 9 - 11, for goat manure it is 20 - 25 and for cow manure, it is > 40 [12]. This shows that the C/N ratio of chicken manure is lower than that of goat manure and cow manure so the nutrients contained in chicken manure are absorbed more quickly by plant roots [13].

The decrease in fruit weight per plant with cow dung fertilizer treatment was due to cow dung fertilizer not being properly decomposed and other factors, namely the high C/N ratio (>40). The high C/N ratio levels are the cause of the slow decomposition process, so nutrients are slowly available to plants. High levels of C in cow manure fertilizer can suppress plant growth [14].

CONCLUSION

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

1. Providing the type and dose of livestock manure fertilizer has a significant to very significant effecton the height of Katokkon chili plants at 15, 30, 45, and 60 days after planting, flowering age and first harvest age, number of fruit and fruit wetness, but the effect is not significant on the number of primary branches, fruit length and fruit diameter of Katokkon chilies.
2. The dose of livestock manure that can provide better growth for Katokkon chili plants is 240 g polybag^{-1} chicken manure or the equivalent of 40 Mg ha^{-1}.

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