



Liquid Organic Fertilizer Alcohol Waste Enriched Manure Effect on Growth and Yield of Chili (*Capsicum Annum L.*)

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ABSTRACT

Alcohol factory waste which still contains a number of nutrients when enriched with manure is good enough to increase the growth and yield of chili. This research was conducted in Jengglong, Jatisobo Village, Polokarto District, Sukoharjo Regency which took place from September 2019 to January 2020. This study used a completely randomized design with two factors and three replications. The first factor consists of 3 levels of Liquid Organic Fertilizer: waste alcohol + EM4, waste alcohol + EM4 + goat manure, alcohol waste + EM4 + a combination of 3 manure (chicken, goat, cow). The second factor dosage of liquid organic fertilizer consists of 4 levels: 0, 1000, 2000, 3000 l/ha. The results of the study showed that the kind and dosage of liquid organic fertilizer enriched with manure did not significantly affect the growth and yield of chili, but the interaction of the two treatments had a significant effect on the yield of chili. The highest weight of red chili was obtained in the treatment of waste alcohol + EM4 + a combination of 3 manure (chicken, goat, cow) with a dose of 3000 l/ha. In conclusion, the use of alcohol waste for fertilization, especially chili plants, should be combined with manure in order to obtain maximum results. The implication of this research is that for fertilizing chili plants, it is better to use alcohol waste, EM4 and a combination of chicken, goat and cow manure at a dosage of 3000 l/ha.

Keywords: Alcohol waste , growth, Liquid Organic Fertilizer, Chili, yield

1. INTRODUCTION

Chili is one of the strategic horticultural vegetable commodities that have high economic value and has been cultivated in Indonesia for a long time. People use chili as a spice in their daily cooking. In addition, chili can also be consumed in fresh or processed form and can also be used as raw material for the food and pharmaceutical industries (Munandar et al., 2017). Chili also has health benefits because of the nutritional content in it (Utami, 2011). Chili contains carbohydrates, fats, protein, calcium, vitamins A, B1 and vitamin C needed by the body and contains lasparaginase as an anti-cancer (Agustina et al., 2014). The content in chili can cure several diseases such as relieving colds and nasal congestion. The increase in the price of chili occurs



every year and many people complain and are restless about the condition of the increase in the price of chili every year.

Based on data from the Regional Inflation Control Team, the demand for red chili in Surakarta City has increased. The price of large red chili commodities reached Rp. 60,000 per kg from the previous price of Rp. 27,000, - per kg. The decreasing supply of red chilies has resulted in the price of red chili soaring. The decrease in red chili supply occurred due to weather factors (Wahyudi et al., 2018). To suppress the price of chili which continues to increase, it is necessary to increase the availability of chili. This results in a high level of demand for red chili, and at certain times the price of red chili increases, for example on Hari Raya or at the time of the new year (Nurvitasari et al., 2018).

One of the efforts to increase the availability of chili is to increase chili production by planting and fertilizing (Hariyadi et al., 2019). Fertilization has the aim of increasing the availability of nutrients needed by plants (Rastiyanto et al., 2013). As stated by Lingga and Marsono (2008) that organic and inorganic fertilizers can add nutrients to the soil which will increase plant growth optimally.

The addition of manure to the soil can also improve soil structure (Arifah, 2013), and increase water and air permeability in the soil (Amara and Mourad, 2013). Provision of manure can help the decomposition process which can increase nutrients so that plants more easily absorb water from the soil (Rohmawati, 2015).

The use of animal manure helps provide nutrients needed by plants, and can increase the cation exchange capacity and as a buffering agent for soil pH (Usman, 2015). Dosage of manure can also increase plant growth and yield (Uwah and Eyo, 2014). The composition of organic matter contained in livestock manure, organic fiber content derived from plant feed in livestock which causes the decomposition process of organic matter to take place slowly so that the nutrients contained in livestock manure can be absorbed slowly during the growth and development process. plant. The use of organic fertilizer can increase chili yields, but the availability of organic fertilizer in the form of manure is limited due to limited livestock.

In addition, organic matter can improve the physical, chemical and biological properties of the soil so that the soil becomes more crumbly and the exchange of cations and anions becomes faster so that nutrients can be absorbed by plants properly which makes for good plant growth and production (Hadi et al., 2015).

The role of organic matter is divided into: (1) physical function, helping the formation of good soil structure and water content, (2) chemical function, contributing to the active nature of soil colloids, (3) nutrient function, contributing to nutrient sources, especially N, P and S for plant



growth, and (4) physiological functions either directly or indirectly, this is due to organic compounds that can function as body hormones (Anwar and Sudadi, 2013).

One of the wastes that can be used as organic fertilizer is alcohol waste. Alcoholic waste has the potential to be used as organic fertilizer containing beneficial nutrients for plants. This waste contains residual carbohydrates, protein, fat, and vitamins, so that when fermented it will become a liquid fertilizer which is very useful for increasing soil fertility. Liquid waste from the manufacture of alcohol is a liquid waste that has the potential to be used as organic fertilizer. The availability of this waste is quite large, namely 44.2 liters in a day, so that if it is not managed it can pollute the environment, both the agricultural and aquatic environments (www.kompas.com). Therefore, in this study, we will try to utilize alcohol waste in the agricultural sector, especially for fertilizing chili plants.

2. MATERIALS AND METHODS

Study area

This research was conducted in Jengglong Hamlet, Jatisobo Village, Polokarto District, Sukoharjo Regency from September 2019 to January 2020. With an altitude of 98 meters above sea level.

Experiment design

This study used a completely randomized design with two factors and three replications. The first factor consists of 3 levels of Liquid Organic Fertilizer: waste alcohol + EM4, waste alcohol + EM4 + goat manure, alcohol waste + EM4 + a combination of 3 manure (chicken, cow, goat). The second factor dose of liquid organic fertilizer consists of 4 levels: 0, 1000, 2000, 3000 l/ha.

Research procedure

The media for seeding is a mixture of soil and pepper in a ratio of 1:1. Media sterilization by drying in the sun, cooled, put into a seeding container and watered. Planting media in polybags is a mixture of soil and pepper with a ratio of 1: 1. Polybag size 40cm x 50 cm, seedling age 14 days or 4-5 leaves. Fertilize once a week according to the treatment. Spraying pesticide dose of 2.5 cc / liter of water to control whitefly pests that cause yellow virus (Gemini virus). Manual weed control by cutting or pulling weeds. Harvesting the age of the plant is 100 days with the characteristics of the fruit being reddish. Harvesting is done 8 times with stages every 3 days.

Parameter observed

The parameters observed were plant height, fresh weight of stover, dry weight of stover, root volume, number of green fruits, number of red fruits, weight of green fruit, and weight of red fruit,



Statistical analysis

Statistical was performed using the standard ANOVA SAS 9.1 program. If there is a significant difference between treatments, then proceed with the Duncan new multiple range test (DMRT) at the 5% significance level.

3. RESULT AND DISCUSSION

Based on the analysis of variance (Table 1), the type and dose of liquid organic fertilizer did not significantly affect all observation parameters, but the interaction of the two treatments had a significant effect on yield parameters including the number of fruits and fruit weight, both green and red fruits.

Table 1. Analysis of variance all parameters

Parameter	Liquid Organic Fertilizer		Interactions by kind and dosage Liquid Organic Fertilizer
	Kind	Dosage	
Growth Parameters			
Height of plant	1.40 ns	1.57 ns	2.31 ns
Fresh weight of crown	1.00 ns	1.50 ns	2.45 ns
Dry weight of crown	1.00 ns	1.50 ns	2.45 ns
Volume of Root	0.44 ns	0.35 ns	1.83 ns
Yield Parameters			
Number of green fruit	0.21 ns	1.64 ns	40.92 **
Number of red fruit	0.12 ns	1.17 ns	56.77 **
Weight of green fruit	0.15 ns	1.15 ns	50.98 **
Weight red fruit	0.13 ns	1.30 ns	50.78 **

Chili Growth

Based on Table 2, it appears that the type, dose and interaction of liquid organic fertilizer did not significantly affect the growth of chili plants such as plant height, fresh weight of stover, dry weight of stover and root volume. The absence of this difference is suspected to be due to virus



attacks on the research area, namely the yellow virus and curly virus that affect the growth of chili plants, because the yellow virus and curly virus have high transmittance as the main obstacle to the development of chili plants (Semangun, 2008).

The application of liquid organic fertilizer cannot prevent plants from being infected with the virus. Plants that have been infected cannot be returned to healthy plants even if the fertilizer is given in excess of the dose. In the study area, whitefly activity was still low at the beginning of planting after transplanting. Its activity began to increase at 5 weeks after transplanting. The percentage of infected plants 6 weeks after transplanting only reached 5%. Whitefly activity increased after the plants began to flower until the beginning of fruit filling. The increased activity of these vectors is due to the increasing amount of available food (Nur Aeni, A, 2007).

Table 2. Duncan's 5% multiple Range test of kind and dosage of alcohol waste liquid organic fertilizer and their interactions on chili growth.

Treatment	Observation			
	Height of plant (cm)	Fresh weight of crown (g)	Dry weight of crown (g)	Volume of root (cm ³)
Kind of liquid organic fertilizer				
Alcohol waste +EM4 (L1)	26.95	194.10	61.58	1.09
Alcohol waste +EM4+goat manure (L2)	28.62	200.35	63.70	1.22
Alcohol waste +EM4+ combination of chicken, goat and cow manure (L3)	29.80	204.35	65.09	1.31
Dosage of liquid organic fertilizer (l/ha)				
0 (D0)	25.63	189.23	60.00	1.10
1000 (D1)	28.82	200.70	63.90	1.30
2000 (D2)	30.67	206.23	65.55	1.32
3000 (D3)	28.64	202.24	64.33	1.12



Interaction of kind and doses of liquid organic fertilizer				
L ₁ D ₀	21.87	178.00	56.00	0.63
L ₁ D ₁	26.60	197.70	63.00	1.07
L ₁ D ₂	29.47	199.00	63.00	1.37
L ₁ D ₃	29.87	201.70	64.33	1.30
L ₂ D ₀	30.70	204.70	65.00	1.70
L ₂ D ₁	29.33	197.70	63.00	1.20
L ₂ D ₂	24.93	186.70	59.33	0.80
L ₂ D ₃	29.53	212.33	67.33	1.20
L ₃ D ₀	24.33	185.00	59.00	0.97
L ₃ D ₁	30.53	206.70	65.70	1.63
L ₃ D ₂	37.60	233.00	74.33	1.80
L ₃ D ₃	26.53	192.70	61.33	0.87

Description: The treatment followed by different letters in the same column showed very significant different results in Duncan's Multiple Range test at the 5% level.

Chili Yield

The results of the DMRT test showed that the administration of waste alcohol + EM4 + a combination of chicken, cow, goat manure at a dose of 3000 l/ha obtained the highest yield, namely the red fruit weight of 486.33 g and the lowest was 292.00 g achieved without liquid organic fertilizer (Table 3). This is influenced by the provision of liquid organic fertilizer in accordance with the appropriate dose the results will be more effective (Hardjowigeno, 2003). The combined dose of liquid organic fertilizer showed a much greater increase than without using liquid organic fertilizer. Liquid organic fertilizer stimulates fruit growth (Lakitan, 2004). The K element contained in goat manure increased the content of vitamins, sugar, total acid and increased fruit weight, so that the combination treatment of liquid organic fertilizer in the L3D3 treatment obtained the highest results. In accordance with the results of research by Ariani (2009), that the number of fruit and fruit weight increased with the high dose of liquid organic fertilizer given to chili with the best treatment dose of 3000 L/ha.

Table 3. Duncan's 5% multiple Range test of kind and dosage of alcohol waste liquid organic fertilizer and their interactions on chili yield

Treatment	Observation			
	Number of green fruit	Number of red fruit	Weight of green fruit	Weight of red fruit (g)



			(g)	
Kind of liquid organic fertilizer				
Alcohol waste +EM4 (L1)	28.34	38.91	96.43	376.75
Alcohol waste +EM4+goat manure (L2)	31.08	41.00	103.34	400.70
Alcohol waste +EM4+ combination of chicken, goat and cow manure (L3)	29.10	41.25	98.26	399.75
Dosage of liquid organic fertilizer (l/ha)				
0 (D0)	23.90	38.93	83.70	327.70
1000 (D1)	28.55	40.50	98.01	384.23
2000 (D2)	30.55	42.00	104.47	415.90
3000 (D3)	34.90	45.55	111.22	441.78
Interaction of kind and doses of liquid organic fertilizer				
L ₁ D ₀	19.70 a	31.70 a	70.00 a	292.00 a
L ₁ D ₁	30.33 d	40.33 d	104.70 ef	394.70 d
L ₁ D ₂	31.00 d	41.70 d	104.70 ef	420.00 ef
L ₁ D ₃	32.33 e	42.00 d	106.33 f	400.33 de
L ₂ D ₀	29.00 d	38.00 c	102.33 e	362.33 c
L ₂ D ₁	29.33 d	39.70 cd	100.00 e	387.00 d
L ₂ D ₂	30.00 d	41.00 cd	102.70 e	414.70 e
L ₂ D ₃	36.00 f	45.33 f	108.33 ef	438.70 f
L ₃ D ₀	23.00 b	34.33 b	78.70 b	328.70 b
L ₃ D ₁	26.00 c	38.33 c	89.33 c	371.00 c
L ₃ D ₂	30.70 d	43.00 e	106.00 ef	413.00 e
L ₃ D ₃	36.33 f	49.33 f	119.00 g	486.33 g



Description: The treatment followed by different letters in the same column showed very significant different results in Duncan's Multiple Range test at the 5% level.

This is influenced by the high levels of K contained in goat manure. The K element in goat manure is higher than the K element contained in cow manure and chicken manure. The K element in goat manure is 0.25%, while cow manure is 0.15%, and chicken manure is 0.08%. The element K itself is very important for metabolism in plant body parts. Cell division and the process of protein synthesis play a role in the formation of fruit for plants (Silvia et al., 2012).

State of Research Land

One of the factors that affect the growth of chili is the rainfall factor. Rainfall in Polokarto Subdistrict, Sukoharjo Regency is presented in Table 4.

Table 4. Rainfall in 2018 and 2019

No.	Month	Year	
		2018	2019
1	January	293	252
2	February	799	222
3	March	464	198
4	April	115	114
5	May	0	38
6	June	0	0
7	July	0	0
8	August	0	0
9	September	28	0
10	October	12	0
11	November	157	40
12	December	144	142
	Total	2 012	1 006

Data Source: Polokarto District Agriculture Office Branch, Sukoharjo.

From Table 4, it is known that rainfall is low in September – November 2019 and in December 2019 moderate rainfall. The low rainfall causes chili plants to suffer from curly yellow disease. The intensity of yellow virus attack is closely related to the environment. This research took place during the summer season, resulting in a large percentage of disease occurrence and whitefly population. This jaundice attacks at all ages of the plant. The intensity of the Gemini virus



attack in the field is related to the physical environment, namely temperature and humidity as well as cropping patterns. The development of vector insect populations is influenced by the long summer (Sulandri, 2004).

The whitefly is a very effective yellow virus vector insect capable of transmitting the yellow virus (Gemini Virus). This virus is characterized by yellow and curling leaves starting from the shoot leaves developing a clear yellow color, the leaf bones thicken and roll up so that the physiological function of the plant is inhibited which results in chlorophyll not functioning.

The spread of jaundice in chili plants is influenced by the spread of the gemini virus. The spread of the Gemini virus is related to the population of the whitefly, which is the insect vector of this virus. An increase in the whitefly population will increase the spread of the gemini virus, which is followed by an increase in the occurrence of jaundice. The incidence of jaundice by the gemini virus increases when rainfall is low (Suhardjo, 2001).

The tick acquires the virus when it takes food from an infected plant (acquisition). Viruses taken from diseased plants circulate through the digestive tract and then penetrate the intestinal wall, circulate in the insect's body fluids (haemolymph) and then in the salivary glands. When insects suck food from healthy plants, the virus enters the plant's body along with the fluids from the insect's mouth. Retention of this virus in the insect body is very long and can even be transferred transovarially through eggs to progeny bodies (Blackman and Eastop, 2007).

4. CONCLUSION

Based on the results and discussion of the research "Effect of Alcoholic Waste Liquid Organic Fertilizer Enriched with Manure on the Growth and Yield of Chili (*Capsicum annum L.*)" it can be concluded as follows: The treatment of liquid organic fertilizer and its dosage were not significantly different for all parameters. The interaction of types and doses of liquid organic fertilizer was not significantly different for all growth parameters, but significantly different for all yield parameters, namely the number of green fruits, the weight of green fruits, the number of red fruits and the weight of red fruits. The highest red fruit weight per plant was achieved in the L3D3 treatment, which was 486.33 g and the lowest was in the L1D0 treatment, which was 292.00 g.

SUGGESTION

The research should be carried out in January or when the rainfall is stable and research in other areas with low intensity of disease and pest attacks.



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