SEAS (Sustainable Environment Agricultural Science) E-ISSN 2614 – 0934
https://ejournal.warmadewa.ac.id/index.php/seas
Vol. 3, Number 1, April 2019, pages: 13 - 18 http://dx.doi.org/10.22225/seas.3.1.1335.13-18

Published: April 30th, 2019

Response of Cow Manure Dosage and KCl Fertilizer on Growth and Yield of Young Fruit of Okra (Abelmoschus esculentus L) Plants

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Abstract

This study aims to determine the effect of cow manure and KCl fertilizer and their interaction on the growth and yield of okra (Abelmoschus esculentus L.). This research was conducted in Sumerta Village, East Denpasar Subdistrict, Denpasar city from March to June 2018. The design used in this study was a Randomized Block Design (RBD) consisting of 2 factors, namely Treatment of cow manure dosage consists of 3 levels, namely: K1 (10 Tons ha-1), K2 (20 Tons ha-1) and K3 (30 Tons ha-1). Whereas treatment of KCl Fertilizer dosage consists of 4 levels, namely: M0 (0 kg ha-1), M1 (50 kg ha-1), M2 (100 kg ha-1) and M3 (150 kg ha-1). The results show that the highest fresh weight of fruit per plant was obtained at a dose of cow manure 30 Tons ha-1 (K3) 309.32 g, which was not significant with a dose of cow manure 20 Tons ha-1 (K2) 296.05 g, an increase of 35.08% and 29.44% when compared to the fresh weight of fruit per plant obtained in the treatment dose of cow manure 10 Tons ha-1 (K1) 228.98 g. The highest fresh weight of fruit per plant at a dose of KCl fertilizer 150 kg ha-1 (M3) 299.97 g was not significant with all other KCl fertilizer doses, increased by 18.37%, 11.64% and 8.98% when compared to the lowest fresh weight of fruit per plant at a dose of KCl 50 kg fertilizer ha-1 (M1) 253.41 g.

Keywords: Cow manure and KCl fertilizer; Okra plant,

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1. Introduction

The Okra (Abelmoschus esculentus L.) plant is a plant that belongs to the cotton family or Malvaceae. This plant has been long cultivated by farmers Chinese as a vegetable that is highly favored mainly for daily families' needs, supermarket, restaurant and hotel. The part of this plant which is used to be made of vegetables is part of its young fruit (baby okra) with a length ranging from 6.5 to 9 cm. The okra's young fruit contains 85.70% levels of water, 8.30% protein, 2.05% fat, carbohydrates 1.4% and 38.9% of calories per 100 g (1). Okra provides many nutrients which are almost half looks like soluble fiber in the form of lenders and pepsin which can help reduce cholesterol levels and reduce the risk of heart disease and the rest is insoluble fiber that can help maintain health conditions (2).

In the world, okra production reaches 6 million tons per year approximately, with the total area of okra which has increased over the years. In 1991-1992, the total area under cultivation of okra is 0.22 million hectares and production amounted to 1.88 million Tons, while in 2006 to 2007 the are increased to 0.396 million hectares and production was 4.07 million Tons (3).

According to the Regulation of Minister of Agriculture Number 70 of 2011 Article 1 concerning organic fertilizer, biological fertilizer and soil conditioner. Organic fertilizer is a fertilizer that is derived from animal matter, animal excreta, human excreta, and vegetable matter, waste organic and others who have been through the process of engineering, in the form of solid or liquid, can be enriched with

material mineral or microbes, are useful to improve the content of nutrients and ingredients of organic soil and improve physical, chemical and biological soil properties. Cow manure is an organic fertilizer which is derived from the results of the fermentation part of the liquid and solid from the dung of cow or cattle. However, the use of cow manure has drawbacks in which it has slow release fertilizer or release of nutrients in manure occurs slowly. Besides that, Kcl (Potassium Chloride) fertilizer is a type of fertilizer that consists of Potassium (K) and Chloride (Cl).

Balanced fertilization produces higher profits in agricultural cultivation and addition information on the results of the latest research on nutrient management in plants is very important to be known by farmers to increase productivity (4).

The aim of this study is to find out the effect of giving a dose of cow manure and KCl as well as the interaction of the growth and yield of young fruit of okra (Abelmoschus esculentus l) plants. The hypothesis proposed in this study is the provision of giving cow manure with a dose of 20 Tons ha-1 and KCl at a dose of 100 kg ha-1 can increase growth and yield of young fruit of okra (Abelmoschus esculentus L.) plants.

2. Materials and methods

Time and Location of Research

This research was carried out at the Sumerta Village, East Denpasar sub-district, Denpasar city. This research was conducted on March to June 2018.

Materials and Instruments of Research

The materials used in this study were okra seeds, seedling media, KCl fertilizer and cow dung also as well-known as cow manure. The instruments used in this study are stationery, hoes, scythes, scissors, sprayers, rulers, foils, digital scales and analog scales.

Design of Research

The design of research used in this study was a factorial Randomized Block Design (RBD) consisting of 2 factors, namely: the treatment of cow manure doses consisting of 3 levels, namely K1 (10 Tons ha-1), K2 (20 Tons ha-1)) and K3 (30 Tons ha-1). Meanwhile, KCl fertilizer dosage treatments consist of 4 levels, namely M0 (0 Kg ha-1), M1 (50 Kg ha-1), M2 (100 Kg ha-1) and M3 (50 Kg ha-1). The variables were observed in this study is the higher plant maximum per plant (cm), the number of leaves maximum per plant (strands), the day of flowering (Hst), the day of harvest (hst), the weight of fresh fruit (g), the number of pieces (fruit), the fresh stover weight of fruit (g), the stover weight of dry oven (g) and the weight of the dry oven fruit (g).

Data Analysis

The data obtained is processed with the analysis of variance (test F) to determine the effect of treatment of cow manure dosage and treatment of KCl fertilizer doses along with their interactions on Okra plant, if the results show the influence significantly different real/very real then continued with LSD 5% test.

3. Results and Discussion

Finding

The significance of cow manure (K) and KCl (M) fertilizer and its interactions (KxM) on the observed variables is presented in Table 1.

Table 1
Significance of giving cow manure and Kcl fertilizer along with their interaction for all observed variables

No.	Variables	Treatment		Interaction (KxM)
		Cow manure (K)	KCl (M)	
1	Maximum plant height (cm)	ns	ns	ns
2	Maximum number of leaves (strands)	**	ns	ns
3	Day of flowering (hst)	ns	**	ns
4	Day of harvest (hst)	ns	*	ns
5	Number of fruits per plant (fruit)	**	ns	ns
6	Fresh weight of fruit per plant (g)	**	ns	ns
7	Fresh weight stover per plant (g)	*	ns	ns
8	Weight dry oven stover (g)	ns	ns	ns
9	Weight dry oven fruit per plant (g)	ns	ns	ns

Description:
* = significant effect (P <0.05)
** = very significant effect (P <0.01)
ns = no significant effect (P ≥0.05)

From Table 1 it can be seen that the interaction between doses of cow manure with KCl (KxM) has no significant effect (P≥0.05) on all observed variables. The treatment of cow manure (K) dose has no significant effect (P≥0.05) on the maximum plant height, the day of flowering, the day of harvest, the dry weight of the oven stover and the fruit oven dry. While the effect was very significant (P <0.01) on the number of leaves, the fresh weight of fruit per plant, and the number of fruits and had a significant effect (P <0.05) on the fresh weight stover. While the dose of KCl (M) fertilizer has no significant effect (P≥0.05) on plant height, number of leaves, fresh weight of fruit per plant, number of fruits, fresh weight of milled, Weight dry oven stover and Weight dry oven fruit per plant. While the effect was very significant (P <0.01) on the day of flowering and had a significant effect (P <0.05) on the day of harvest.

Discussion

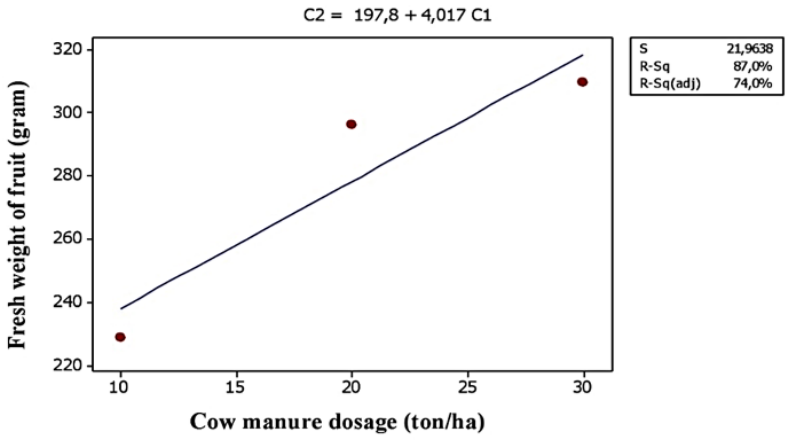
The highest fresh fruit weight per plant was obtained at 30 Tons ha-1 (K3) 309.32 g cow manure dosage which was not significantly different from 20 Tons ha-1 (K2) cow manure dose 296.05 g which experienced an increase of 35.08% and 29.44 %, if considered to the fresh weight of planted fruit obtained on the treatment of cow manure 10 Tons ha-1 (K1) 228.98 g. The high fresh weight of fruit per plant 30 Tons ha-1 (K3) is supported by tall plant (r = 0.967 **), number of leaves (r = 0.991 **) and number of fruits (r = 0.988 **) (Table 2).

The high fresh weight of fruit per plant by applying cow manure is increasing up to a dose of 30 Tons ha-1 due to cow manure which has the ability to improve the physical properties of the soil and fertilize the soil, the effect of doses of cow manure on soil fertility includes increasing soil porosity, holding capacity of water, increasing organic C, adding nutrients and activating microbial activity in the soil (5–7). Improvement of soil physical properties is also supported by the very high C-organic cow manure shown in Table 1, which can increase soil organic matter in the low land area shown in Table 2, so that plant growth can be better as seen from the number of leaves, and the number of fruit per plant which is increasing with the provision of cow manure and supported by the day of flowering (r = - 0.674

*) and the day of harvest (r = - 0.687 *). According to (8), the role of cow manure is able to improve the performance of the fruit as well as being able to increase the fresh weight of okra fruit obtained at a dose of cow manure 20 Tons ha-1.

The maximum number of leaves per plant at a dose of cow manure 30 Tons ha-1 (K3) increased 16.21% when compared with the lowest maximum number of leaves. The high number of leaves affects the photosynthesis process so that the higher photosynthates produced are transferred to generative organs which can be seen from the increasing number of fruits per plant (9). The highest number of fruits per plant was obtained at 20 Tons ha-1 (K2) and 30 Tons ha-1 (K3) cow manure with a value of 23.48 fruits experiencing an increase of 20.04% when compared with the lowest number of fruits per plant.

Results of regression analysis between cow manure dosage with fresh weight of fruit per plant showed a linear relationship with the regression equation: $\hat{Y}$ = 197.8 + 4,017 x; which means that giving cow manure up to 30 Tons ha-1 gives the fresh fruit weight of the growing crop and the optimum dose of cow manure has not yet been obtained.



Picture 1.
Relations of cow manure dosage with the fresh weight of fruit per plant (linear)

Furthermore, the highest fresh weight of fruit per plant at 150 kg ha -1 (M3) 299.97 g KCl fertilizer dose was not significantly different from all other treatments of KCl fertilizer dosage, experiencing an increase of 18.37%, 11.64% and 8.98% when compared to lowest fresh fruit weight per plant at 50 kg ha -1 (M1) KCl fertilizer dose 253.41 g. The high fresh weight of fruit per plant at a dose of 150 kg KCl ha -1 (M3) was supported by plant height (r = 0.644 *), number of leaves (r = 0.649 *) and number of fruits (r = 0.930 **). (Table 3). The high fresh weight of fruit per plant up to a dose of KCl fertilizer up to 150 kg ha -1 indicates that the increase in the dose of KCl fertilizer administered has an effect on the day of flowering (r = -0,674 *) and the day of harvest (r = -0,687 *), and supported by the increasing number of fruits per plant. Potassium content functions to stimulate carbohydrate translocation from leaves to other plant parts and improve fruit quality and chloride in KCl fertilizer can help increase crop yields, namely by increasing plant resistance to attack so that increasing plant resistance to disease will trigger plants to grow and accelerate the generative period of plants including the day of flowering and the day begins to harvest. The day of the fastest flowering was obtained at the treatment of KCl 150 kg ha -1 (M3) 26.89 hst. This will affect the process of fruit formation which is increasing so that it can speed up the day of

harvest. This is supported by getting the fastest harvest start day at a dose of 150 kg KCl ha -1 (M3) 33.44 hst. The faster fruit formation, it will impact on the number of fruits formed per plant. The highest number of fruits in the KCl 150 kg ha -1 (M3) fertilizer treatment 23.06 fruits experienced an increase of 13.09%, when compared with the lowest number of fruits.

Table 2.
Correlation coefficient value among variables plants (r) due to the effect of cow manure

No	1	2	3	4	5	6	7	8	9
1	1								
2	0.992 **	1							
3	-0.594 ns	-0.689 *	1						
4	-0.877 **	-0.929 **	0.908 **	1					
5	0.917 **	0.995 **	-0.866 **	-0.996 **	1				
6	0.967 **	0.991 **	-0.779 *	-0.970 **	0.988**	1			
7	0.596 ns	0.690 *	-1**	-0.909 **	0.867**	0.780 *	1		
8	0.935 **	0.885 **	-0.271 ns	-0.650 ns	0.716 *	0.815 **	0.273 ns	1	
9	0.557 ns	0.654 ns	-0.999 **	-0.888 **	0.842 **	0.749 *	0.999 **	0.226 ns	1

r (0,05; 7; 1) = 0,666 r (0.01; 7; 1) = 0.789

Table 3.
Correlation coefficient value between variables plants (r) due to the influence of KCl fertilizer

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1	1								
2	0.719 **	1							
3	-0,911 **	-0,941 **	1						
4	-0,436 ns	-0,916 **	0.745 **	1					
5	0.320 ns	0.428 ns	-0.380 ns	-0,606 *	1				
6	0.644 *	0.649 *	-0,674 *	-0,687 *	0.930 **	1			
7	0.363 ns	0909 **	-0,713 **	-0,971 **	0.402 ns	0.499 ns	1		
8	0993 **	0.796 **	-0,953 **	-0,538 ns	0.360 ns	0.678 *	0.472 ns	1	
9	-0,200 ns	0.469 ns	-0.193 ns	-0,571 ns	-0.203 ns	-0.202 ns	0.738 **	-0,097 ns	1

r (0,05; 7; 1) = 0,666 r (0.01; 7; 1) = 0.789

Description:

1 = Maximum plant height
2 = Maximum number of leaves
3 = Days of flowering
4 = Day of harvest
5 = Mumber of fruit crops
6 = Fresh weight of fruit per plant
7 = weight of fresh stover
8 = weight of dry oven fruit
9 = weight of dry oven stover
* = Significant effect (P <0.05)
* * = Very Significant effect (P<0.01)
Ns = No significant effect (P ≥0,05)

4. Conclusion

Based on the results of this study several things can be said is the interaction between cow manure with KCl fertilizer does not significantly affect all observed variables. The highest fresh fruit weight per plant was obtained at a dose of cow manure 30 Tons ha -1 which was 309.32 g was not significantly different from the dose of cow manure 20 Tons ha -1 which was 296.05 g which experienced an increase of 35.08% and 29.44% when compared to fresh weight of planted fruit obtained at the treatment

of cow manure dose 10 Tons ha -1 that is 228.98 g. KCl fertilizer treatment has a very real and real effect on the day of flowering and the day of harvest. The highest fresh weight of fruit per plant was obtained at 150 kg ha $^{-1}$ KCl fertilizer treatment that was not significantly different from other treatments; increased by 18.37%, compared with the lowest fresh weight of fruit per plant.

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