ISBN : 978-4-909365-04-0

PROCEEDINGS of IC-GU 12 UGSAS-GU

"6TH INTERNATIONAL WORKSHOP ON CROP PRODUCTION AND PRODUCTIVITY UNDER GLOBAL CLIMATE CHANGE"

Editors :

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DECEMBER 3-4, 2018

at FACULTY OF AGRICULTURE, LAMPUNG UNIVERSITY
BANDAR LAMPUNG, INDONESIA

Production and Harvested Nutrients of Sugarcane 1st Ratoon (*Saccharum officinarum* L.) Affected by Organic and Inorganic Fertilizer

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SUMMARY

Most of constraints in the cultivation of sugarcane in Indonesia can be low organic matter, low nutrient content and relatively acidic in pH. The combination of organic and inorganic fertilizers is one of the ways to overcome the problems. The objectives of this research were to study the effect of NPK inorganic fertilizer, organic fertilizer and its combination on the growth, production and N, P, K nutrient harvested by sugarcane 1st ratoon. This study consisted of 5 treatments A (100% inorganic fertilizer), B (100% Organic fertilizer), C (100% inorganic fertilizer + 50% Organic fertilizer), D (100% Organic fertilizer + 50% inorganic fertilizer) and E (No Fertilization). The results showed that the treatment of NPK inorganic fertilizer and its combination with, organic fertilizer were significantly increased the production and harvested nutrient of the sugarcane 1st ratoon. Treatments of 100% NPK, 100% NPK + 50% organic and 50% NPK + 100% organic were significantly affected N, P, K harvested nutrient and sugarcane plants but not significantly different. Their effects were significantly higher than that of 100% organic and without fertilization

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Introduction

Indonesian sugarcane productions from 2013 to 2015 are quite variative. In the year of 2013, sugar production reaches 2.55 million Mg and experiences an increase on 2014 to 2.53 million Mg (Badan Pusat Statistik, 2015). Therefore, to increase the total production of the soil are needed, one of such ways is by applying organic and inorganic (Kariyasa, 2005). Organic fertilizer has a very important roles in improving the physical, chemical and biological properties of the soil (Atmojo, 2003). One of the organic fertilizers that can be used is organonitrofos fertilizer which is made from 80% cow's manure and 20% nature phosphate rock and then N fixing and P solvent bacteria were added (Nugroho *et al*, 2012). This objectives of the study were to study the effect of the organonitrofos fertilizer and its combination with inorganic fertilizer on the production and harvested nutrient of sugarcane 1st ratoon.

Material and Methods

The experiment was conducted using completely randomized design with 5 treatments and 3 repetition with the total of 15 experiment plots. Each plots was 5 m x 4 m in size, the space between each plots was 1 m and space between each rows was 75 cm. The treatments of this experiment were A (Urea 300 kg ha^{-1}; TSP 150 kg ha^{-1}; KCl 300 kg ha^{-1}), B (Organonitrofos 10 Mg ha^{-1}), C (Urea 300 kg ha^{-1}; TSP 150 kg ha^{-1}; KCl 300 kg ha^{-1}; Organonitrofos 5 Mg ha^{-1}), D (Urea 150 kg ha^{-1}; TSP 75 kg ha^{-1}; KCl 150 kg ha^{-1}; Organonitrofos 10 Mg ha^{-1}), and E (without fertilizer). The weigh of the biomasss, oven-dried biomass, the soil's pH, some of the nutrients in the soil like available phosphor, total nitrogen, exchangeable of potassium, total carbon, and harvested nutrients by the plant had been measured using the methods described by Thom and Utomo (1991) and further statistically analysed using the methods described by Susilo (2013).

Results and Discussions

Table 1 showed that the A, B, C, and D treatments had not significantly affected on the sugarcane and sugar production. There was no significant effect of treatment B and treatment E on the sugar production.

This result was similar with the result of Satgada's (2017) experiment showed that the application of 100% NPK + 50% organonitrofos combination was the highest sugarcane production, but was not significantly difference from 100% NPK application. The result from Zulkarnain's (2017) experiment also showed that the application of 100% NPK has out the highest sugar production and has not significantly different with 100% organonitrofos. However, 100% NPK + 50% organonitrofos treatment showed the sugar production also has not significant with 50% NPK + 100% organonitrofos.

Table 1. The effect of NPK and organonitrofos fertilizer on the production of sugarcane

Treatment	Biomass *	Sugarcane production (Mg ha^{-1})	Sugar production (Mg ha^{-1})
A	8,05	158,38 b	12,75 b
B	7,93	115,47 ab	9,16 ab
C	7,47	161,46 b	12,06 b
D	7,11	150,37 b	10,69 b
E	7,03	81,58 a	5,73 a
LSD5%	-	3,95	4,10

Using LSD test 5% standard.

Influence on total harvested nutrients

Table 2 showed that the application of NPK, organonitrofos fertilizer and their combination were not significantly different with harvested carbon total but significantly different on the harvested nitrogen, phosphor, and potassium of sugarcane 1st ratoon.

Table 2 .The effect of NPK and Organonitrofos fertilizer on total harvested nutrients

Treatment	C (Mg ha^{-1})	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})
A	10,04	317,46bc	76,70c	230,05c
B	5,72	270,29ab	51,77ab	138,63ab
C	12,48	397,67c	70,67bc	247,06c
D	9,23	292,53bc	61,37bc	203,15bc
E	6,27	157,22a	33,42a	90,47a
F test	tn	*	*	*
LSD 5%	-	116,24	24,12	74,32

The results showed that the application of NPK, organonitrofos fertilizer and their combination had no significant influenced on the harvested carbon total. This result was similar to that of the experiment of Amalia (2017) which showed the combination of 100% NPK + 50% organonitrofos produced the highest amount of harvested carbon in the leaves compared to other treatments, and 100% NPK was produced the second highest of harvested carbon. Carbon has a important roles in the formation of organic materials, about 47% of plant's dry mass is carbon (Utomo *et al*, 2016).

The C treatment was capable to producing the highest harvested nitrogen in the plant and had no significant different to that of treatment A and D. The effect of treatment B on harvested nitrogen was not significant different to that of treatment E. This results also showed that the application of 100% NPK was the same influence on harvested nitrogen as 50% NPK + 100% organonitrofos and 100% NPK + 50% organonitrofos. Amalia (2017) showed that the combination of 100% NPK + 50% organonitrofos produced the highest total harvested nitrogen and was not significant different to that of 100% NPK treatment. And 50% NPK + 100% organonitrofos was produced the second highest harvested nitrogen.

Treatment A produced the highest of harvested phosphor of the sugarcane but was not significant different from that of treatment C and D. The application of 100% organonitrofos was able to compensate 50% NPK application (D) since the harvested phosphor on the treatment was not significant different from that of treatment A. This result was similar with reported by Satgada (2017) wich showed the application of 100% NPK or combination between NPK and organonitrofos fertilizer produces the highest amount of harvested phosphor compared to that of the application of 100% organonitrofos treatment and no fertilizer treatment. The results of Dermiyati *et al* (2014) experiment also showed that the addition of organonitrofos to the combination of Urea 150 kg ha^{-1}, SP-36 50 kg ha^{-1}, KCl 100 kg ha^{-1}, Organonitrofos 1000 kg ha^{-1} produced the highest harvested phosphor on the corn when compared to other treatments.

Treatment C produced the highest harvested potassium of the sugarcane but it was not significant different from that of treatment A and D. The treatment B produced harvested potassium having not significantly different compre to that of treatment E. This result was similar to that of Agustina (2017) wich showed the 100% NPK treatment combined with 50% organonitrofos produced the highest harvested potassium of sugarcane of the 1st

harvest but it was not significant different compare to that of 100% NPK treatment. Harvestad potassium in the stem was higher compared to the harvested potassium in the leaves. This can be as a result of potassium being accumulated mostly in the sugarcane stem. On the average, a healthy sugarcane contains more than 200 kg ha^{-1} of potassium and the application of potassium around 120 kg ha^{-1} can increase sugarcane production to 4,81% on its 1st ratoon (Kwong, 2002).

Correlation between soil nutrient contents and nutrient absorption

The contents of N-Total in the soil had a positive correlation to the harvested nitrogen in 1st ratoon of sugarcane (r = 0.71; Table 3). This showed that the increase of soil's N-total was caused by the addition of inorganic fertilizer NPK, organonitrofos fertilizer and their combination will increase nitrogen absorption by plant. Available Phosphor was in soil also had a positive correlation to harvested phosphor of sugarcane 1st ratoon (r = 0.68; Table 3). Satgada's experiment result (2017) showed the available phosphor in soil has a positive correlation to the harvested phosphor by the sugarcane on its harvest (r = 0.79). Furthermore, Table 3 also showed that exchangeable of potassium of the soil had a positive correlation to the harvested potassium by the plant. This result was similar to the result reported by Agustina's experimentation (2017) showing that the addition of NPK fertilizer and organonitrofos fertilizer or their combination between the two can increase the amount of exchangeable potassium inside the soil and in turn increase potassium absorption by sugarcane 1st ratoon.

Table 3. Correlation between soil nutrient contents and nutrient absorption

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No	Correlation test	Equation	R
1	N-total with transported N	y=-179,44+186,49x	0,71*
2	Available P with transported P	y=15,43+4,85x	0,68*
3	Exchangable K with transported K	y=-69,40+1036,62x	0,78**

* = significant on 5% r; ** = significant 1%

Conclusion

1. The effect of 100% NPK , 100% NPK +50% organonitrofos and 50% NPK + 100% organonitrofos on the sugar production and harvested nutrients (NPK) were not significant different, but showed a significantly higher result compared to that of the 100% organonitrophos and non fertilizer treatment.
2. The soil contents of total Nitrogen, available Phosphor and exchangeable of potassium had a positive correlations with harvested N, P, K by sugarcane 1st ratoon.

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