Application of Jatropha Rind Compost as K Source in The Sweet Corn (*Zea mays saccharata* Sturt.) Cultivation

DOI: 10.18196/pt.2017.067.79-87

Bagus Arrasyid*, Gunawan Budiyanto, Titiek Widyastuti
Department of Agrotechnology, Faculty of Agriculture, Universitas Muhammadiyah Yogyakarta,
Jl. Lingkar Selatan, Kasihan, Bantul, Yogyakarta 55183, Indonesia Telp. 0274 387656,
**Corresponding author, email: bagusarrasyid@gmail.com*

ABSTRACT

Potassium is one of important soil nutrients. The content of potassium in the jatropha rind compost is quite high reaching 11.36%. The high content of potassium in the jatropha rind has potential to increase the productivity and fulfill the needs of soil nutrients in the cultivation process. The research aims to study the influence of jatropha rind compost as substitute KCl fertilizer on sweet corn (*Zea mays saccharata* Sturt.), and get the proper rate of the compost for increasing the growth and yield of sweet corn. This research was conducted using an experimental method with a single factor that was arranged in a completely randomized design. Treatments were combination of jatropha rind compost and KCl rate, consisting of four levels, 250 kg KCl/hectare + 0 KJP kg/hectare, 125 kg KCl/hectare + KJP 273.89 kg/hectare, 62.5 kg KCl/hectare + KJP 410.84 kg/hectare, 0 kg KCl/hectare + KJP 547.79 kg/hectare. Each treatment was replicated 3 times so that there were 12 experimental units and each unit consisting of three plants trial so that there were 36 plants. Each plot of the experimental unit was fertilized using manure 20 ton/hectare, urea 400 kg/hectare which was applied 2 times and SP-36 300 kg/hectare. Results indicate that the treatment of mix dose of compost rind jatropha and KCl does not affect significantly on growth and yield of sweet corn. Sweet corn plants fertilized with jatropha rind compost with the dose of 547.79 kg/ha had the same growth and yield those of 250 kg/ha KCl. The study concluded that jatropha rind compost can replace KCl fertilizer.
Keywords: Jatropha rind, Compost, Potassium, Sweet corn, *Zea mays saccharata* Sturt.

ABSTRAK

Kalium merupakan salah satu unsur hara yang sangat penting bagi tanaman. Kandungan kalium pada kompos kulit buah jarak pagar cukup tinggi yaitu sebesar 11,36 %. Tingginya kandungan kalium pada kulit buah jarak pagar sangat berpotensi untuk meningkatkan produktivitas tanah dan dapat memenuhi kebutuhan unsur hara pada proses budidaya. Penelitian ini bertujuan untuk mengkaji pengaruh kompos kulit buah jarak pagar sebagai penganti pupuk K terhadap tanaman jagung manis dan mendapatkan dosis kompos kulit buah jarak pagar yang tepat dalam meningkatkan pertumbuhan dan hasil tanaman jagung manis. Penelitian dilaksanakan menggunakan metode eksperimental dengan faktor tunggal yang disusun dalam rancangan acak lengkap. Perlakuan yang diujikan yaitu dosis kompos kulit buah jarak pagar (KJP) yang terdiri dari 4 aras yaitu, 250 kg KCl/hektar + 0 kg KJP/hektar, 125 kg KCl/hektar + 273,89 kg KJP/hektar, 62,5 kg KCl/hektar + 410,84 kg KJP/hektar, 0 kg KCl/hektar + 547,79 kg KJP/hektar. Setiap perlakuan diulang 3 kali sehingga terdapat 12 unit percobaan, setiap unit percobaan terdiri dari 3 tanaman sehingga terdapat 36 tanaman. Semua perlakuan masih diberikan pupuk kandang dengan dosis 20 ton/hektar, Urea 400 kg/hektar diberikan 2 kali, SP-36 300 kg/hektar. Hasil penelitian ini menunjukkan bahwa perlakuan dosis campuran kompos kulit buah jarak dan KCl tidak memberikan pengaruh yang berbeda terhadap semua parameter pertumbuhan dan hasil tanaman jagung manis. Penelitian ini dapat disimpulkan bahwa kompos kulit jarak pagar dapat menggantikan pupuk KCL.
Kata kunci: Kulit buah jarak pagar, Kompos, Kalium, Jagung manis, *Zea mays saccharata* Sturt.

INTRODUCTION

Nutrient is one of the factors that influence plants growth and development. Potassium is one of important soil nutrients. Based on the crop needs nutrients, potassium is third element that is important after nitrogen and phosphorus. However, the cessation of chemical fertilizer subsidy by the government causes the increase of fertilizer price. Due to the high price of potassium fertilizer, farmers are forced to reduce, even not apply potassium fertilizer at all It leads to the efforts to increase crop production. Alternative fertilizer that can be substitution for chemical fertilizer with low prices and easy to be obtained is the crop residues (waste).

Jatropha is one of oil producing plants. It gained the government and experts attention in supporting energy policies through the development of fuel. The obstacles in developing jatropha include the low productivity, so that when farmers only use the oil, the income from jatropha is very limited. In fact, the yield of jatropha biomass is relatively abundant. K elements in each material varies depending on the origin of the material. The content of potassium in the jatropha rind compost is quite high at 11.36% (Muhammad *et al.*, 2009). The high content of potassium in jatropha rind has potential to increase the productivity and fulfill the needs of soil nutrients in the cultivation process.

Corn is a food or feed crops that are quite important for human and animal. Corn has a crude fiber content of nutrients and adequate as a staple food instead of rice. Besides as staple food, corn also can be used as feedstock. Based on the increasing level of consumption per capita per year and the increasing of the population in Indonesia, the demand for corn in Indonesia continues to rise. According to the data from the Central Statistics Agency (BPS), Indonesia, the corn production in 2012 was originally 19,387,022 tons and decreased to 19,032,667 tons in 2013 and 2014. Therefore, it is necessary to increase the corn production so that the demand for corn could be fulfilled.

It is recommended to use organic fertilizer (manure or compost) as much as 20 tons/hectare in corn crop cultivation. As for inorganic fertilizers, it is prompted to apply urea 400 kg/hectare, SP-36 300 kg/hectare, KCI 250 kg/hectare. While the recommended basic fertilizer is 20 tons/hectare of organic fertilizer before planting, 200 kg/hectare of urea, 300 kg/hectare SP-36, and 250 kg/hectare KCl which were applied two weeks after planting. Supplementary fertilizer needs to be applied 3-4 weeks after planting in the form of urea 200 kg/hectare (Bilman et al., 2002). Since the requirements of KCl fertilizer in the cultivation of corn is high, jatropha rind compost with K has high potential to reduce the use of potassium fertilizers. It can also help farmers reduce the production costs. Compost also improve physical, chemical and biological properties of soil, does not lower the pH, and can make soil crumbly.

The research aims to study whether jatropha rind compost can reduce or substitute the role of KCl fertilizer in sweet corn (*Zea mays saccharata* Sturt.) and get a proper rate of the compost in increasing the growth and yield of sweet corn.

MATERIALS AND METHODS

This research was conducted at the Soil Research Laboratory and Experimental Farm of Faculty of Agriculture, Universitas Muhammadiyah Yogyakarta, Tamantirto Village, Kasihan, Bantul, Yogyakarta from October 2015 to March 2016. The experiment was arranged with single factor in a completely randomized design. The treatment tested was the various doses of jatropha rind compost (KJP) consisting of four levels: 250 kg KCl/hectare + 0 KJP kg/hectare; 125 kg KCl/hectare + KJP 273.89 kg / ha; 62.5 kg KCl/hectare + KJP 410.84 kg/hectare; 0 kg KCl/hectare + KJP 547.79 kg/hectare. Each treatment was replicated 3 times so there were 12 experimental units, each unit consisting of three plants so that there were 36 plants. All treatment were supplemented with manure (20 tons/hectare), Urea (400 kg/hectare which was given 2 times), and SP-36 (300 kg/hectare).

This research was conducted through the 10 stages: making jatropha rind into little pieces and preparing activator, composting jatropha rind, incubating compost, observing compost, building shade, testing germination, preparing planting medium, planting and applying compost, maintenance (watering, thinning and replanting, fertilizing, shading, and controlling pest), harvesting and analyzing data.

Compost analysis included measurement of pH using a pH meter, levels of C-Organic using the method of Walkley and Black, levels of N-total with Kejdahl method. Sweet Corn crops analysis included measurement of plant height (cm), number of leaves, stem diameter (cm), crop fresh weight (gram), crop dry weight (gram), roots fresh weights (gram), roots dry weight (gram), the fresh weight of ear with husk (gram), the fresh weight of ear without husk (g) and ear diameter (cm).

The data analyzed using ANOVA at 5% error level, and then subjected to Duncan's multiple range test with 5% error level.

RESULTS AND DISCUSSIONS

Jatropha Rind Compost

Water content is the percentage of water content of a material that can be expressed based on the weight of fresh or dry weight (Budi et al., 2015). Water content influences the activity of microorganisms in decomposing organic matter. If the moisture content is below 30%, the biological reactions will run slower and reduce because of the limited available habitat. The increased moisture in jatropha rind compost shows that the compost can improve soil structure when applied, especially water storage capacity needed by crops in the process of absorption of nutrients so that the process of plant growth and development goes well. The analysis results of compost in showed that water content of the compost is in conformity with SNI compost (Table 1). The data were resulted from compost analysis conducted in the laboratory same as Muhammad et. al. (2009) reported that jatropha compost had potassium content of 11.36% (Table 1).

The level of acidity or pH is one of the critical factors for the growth of microorganisms involved in the composting process. Compost analysis serves as an indicator of the decomposition process of the compost. On the first week, jatropha rind had neutral pH because the material was still fresh and had not been decomposed by microbes. Start from the first week to the third week the pH increased which was caused by the addition of lime at the start of composting. Then in the fourth week and fifth week there was a decrease in pH because there was an overhaul process of organic materials into organic acids by microbes, causing the pH to decrease. The same thing occurred on the sixth week and seventh week in which the pH increased because the decomposition activity was reduced, nitrogen was decreased and most of the microorganisms were dead. According to Ruskandi (2006) in Fahruddin and Abdullah (2010), pH which is too alkaline will release unpleasant ammonia smell. Too much alkaline or acidic odors will invite flies. In this process, the expected biological activity was reduced, nitrogen was reduced and most of the microorganisms were dead.

Table 1. Analysis Results of Jatropha Rind Compost

Parameter	Jatropha Rind Before Composting	Jatropha Rind After Composting	SNI Compost	Note
Water content	22.49 %	45.79 %	≤ 50 %	Appropriate
pH	7.05	8.02	4-8	Appropriate
Level of C-Organic	10.01	5.11	9,8-32 %	Not Appropriate
Organic matter	17.42 %	8.81 %	27-58	Not Appropriate
N-Total	0.97 %	2.69 %	< 6 %	Appropriate
c/n Ratio	10.44	1.90	≤ 20	Appropriate
Potassium	-	11.36 %	< 6 %**	Appropriate

Note: **) Certain material substances derived from organic matter are allowed to contain levels of P_2O_5 and K_2O > 6% (as evidenced by the results from laboratory).

On the ninth week the pH became neutral, because the organic acids produced in the previous phase was consumed by the microorganisms, thus pH became neutral until the compost was mature. The final pH of jatropha rind compost had become neutral, and it was in accordance with the SNI stating that the pH range for organic fertilizer was 6-8, so that the jatropha compost was ready or safe for use.

Organic matter contained in the compost which is used by crops as nutrients for growth will improve soil structure. According to Mirwan (2015) C-Organic is an indicator of the occurrence of decomposition process in composting and compost maturity. In the process of decomposition, the carbon is used as an energy source for preparing cellular material of microbial cells by releasing CO_2 and other substances that evaporate. The addition of an activator encourages the decomposition process organic matter to run fast causing a decrease in the carbon content. The results of the analysis of the content of C-organic matter and organic jatropha compost were not in accordance with SNI presented in Table 1.

Total nitrogen content was related to levels of carbon compost. Both of these contents will determine the levels of C / N ratio of compost. According to Yuli et. al. (2008), total N elements of the compost obtained from the composting of organic matter degraded by microorganisms degrading compost substance. Total N of jatropha rind compost increased the levels of N from 0.97% to 2.69%. The content of N total was in accordance with the SNI for compost.

The principle of composting is to reduce the ratio of C/N of organic matter to the same ratio C/N of soil (<20) (Dewi and Tresnowati, 2012). The speed of reduction in C/N ratio is highly dependent on the content of C and N matter to be composted. The analysis results of C/N ratio of Jatropha rind compost showed a decrease from 10.44 to 1.90. The decrease of the carbon (C) elements was because the organic carbon compounds were used as a source of energy for the organism and then the carbon was lost as CO_2. C/N ratio of the Jatropha compost used in this research was in accordance with SNI for compost (Table 1).

The result showed that the proportion of the rind of jatropha fruits is 29 - 32%, while that of beans is 71%, 36.5 to 44.9% for eggshell 58.0 to 65.7% for kernel (Martinez et al., 2006). The content of K substance in every material depends on the origin of the material. Cow manure shows the K content of 0.10%, while sheep and goats manure has higher content reaching 0.45% and 0.40%, respectively. Based on the research results of Muhammad et al (2009), the K content of jatropha rind was 11.36%, while according to the research results of Suwarno (2011), the potassium content in the jatropha rind compost was 5.89 to 11.36%.

High potassium substance in jatropha rind compost was because the compost material used contained fiber and high lignin. Besides, the content of potassium was abundant in stems and fruits on a plant. This is in accordance with Afandie and Nasih (2002) who states that the functions of potassium is to the develop cells and regulate the osmotic pressure. Parts of plants which are in desperate need of potassium during the growth process are the stem and fruit, thus content of potassium in jatropha fruit was higher compared to other organic matter.

Vegetative Growth of Sweet Corn Crop

Analysis of variance performed 8 weeks after planting showed that the substitution of KCl using jatropha rind compost does not give different effects on the plant height. This showed that the potassium substance in jatropha rind compost also stimulated the development of root. Since root is the part of plant that is used to absorb nutrients, with the formation of a good root, then the function of the roots will be optimal in absorbing the nutrients provided. With the improvements of the roots function, the growth process will be better especially the plant height. The average plant height of sweet corn crops every week are presented in Figure 1a.

Figure 1a shows that the effects of the compost doses on the plant height are relatively the same, but in the beginning of the 7th week, application of jatropha rind compost especially at doses KJP 547.79 kg/hectare showed better plant height. In addition to potassium, the jatropha rind compost ~~is~~ applied also has a value of C/N ratio < 20 leading to the release of N from organic matter into the soil. Hamoda et. al. (1998) revealed that the value of C/N ratio of 25 - 35 was considered to be within the limits of feasibility. Responses to jatropha compost doses on plant height showed that during vegetative growth, the compost provided the important nutrient for plant growth.

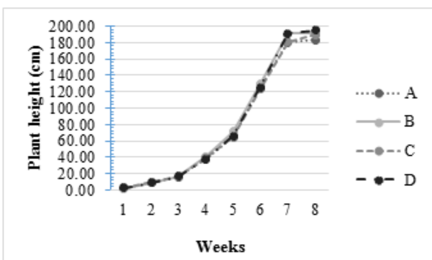
The efficient use of jatropha rind compost that are slow release tends to be able to supply the needs of nutrients, especially K for the growth of sweet corn crops and substitute inorganic potash fertilizer derived from KCl and ZK commonly used by farmers in the cultivation of sweet corn.

Table 2. Plant Height, Stem Diameter and Number of Leaves of Sweet Corn

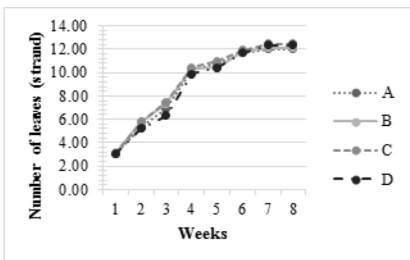
Treatments	Plant Height (cm)	Number of Leaves	Stem Diameter (cm)
A = 250 kg KCl/hectare + 0 kg KJP/hectare	183,23	12,00	1,542
B = 125 kg KCl/hectare + 273,89 kg KJP/hectare	192,18	12,11	1,650
C = 62,5 kg KCl/hectare + 410,84 kg KJP/hectare	189,56	12,44	1,622
D = 0 kg KCl/hectare + 547,79 kg KJP/hectare	195,48	12,33	1,620

Note: The numbers in the table indicate no significant difference based on the analysis of variance of at 5%.

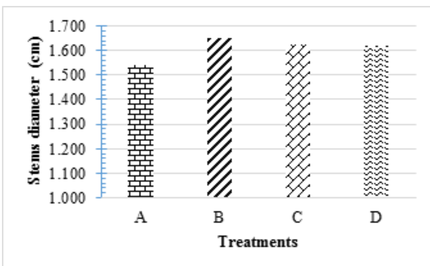
Analysis of variance showed that the substitution of KCl using Jatropha rind compost does not give different effects on the number of leaves of sweet corn plants. The number of leaves increased with the increasing of plant height and the rate of leaf formation increased with the increasing age of the crops. Figure 1b shows that the number of leaves increased from the 1st week to the 7th week and stopped increasing on the 8th. This is because sweet corn crop is classified as determinate plants where the vegetative period will be halted or stagnant when the plant has entered a period of generative growth, usually marked by the appearance of flowers. Based on table 2, it



(a)



(b)



(c)

Figure 1. Sweet corn plant height (a), Sweet corn plant number of leaves (b), and Sweet corn plant stem diameter (c)

Note : A = 250 kg KCl/hectare + 0 kg KJP/hectare
B = 125 kg KCl/hectare + 273.89 kg KJP/hectare
C = 62.5 kg KCl/hectare + 410.84 kg KJP/hectare
D = 0 kg KCl/hectare + 547.79 kg KJP/hectare

is better to use jatropha rind compost on sweet corn cultivation because the requirement for potassium which is usually fulfilled by inorganic fertilizer that is KCl and ZK has been able to be met by jatropha rind compost.

Analysis of variance showed that the substitution of KCl using Jatropha rind compost does not give different effects on the stem diameter. This is because the doses of jatropha rind compost containing potassium highly influenced the development of stem diameter. Figure 1c shows that the effects of the jatropha rind compost doses on the stem diameter are relatively the same. Various doses of compost applied to the plants showed that potassium in the compost and inorganic potassium were utilized optimally by the corn plant. Organic matter causes the efficiency of nutrients absorption by plants. Besides, potassium played important roles in the hardening of straw and parts of woody plants (Mul Mulyani, 2002). The addition of organic matter in the form of Jatropha rind compost into the soil aimed to add macro and micro nutrients needed by plants, so that fertilization with inorganic fertilizer commonly done by farmers may be reduced in quantity because some requirements are met by organic material in sufficient quantity.

Generative Growth of Sweet Corn Crop

Analysis of variance showed that the substitution of KCl using jatropha rind compost does not give different effects on the diameter of ear (Table 3). This indicates that the organic matter provided nutrients for plants. Direct role of organic matter such as jatropha rind compost can provide nutrients for crops. Afandie and Nasih (2002) explained that Potassium (K) play an important role in the formation of carbohydrates and enzyme activity. Besides, K substance also increased the size and weight of the grains. Potassium nutrient deficiencies in plants will lead to the slump production, although the symptoms are often not shown. Potassium deficiency reduced carbohydrate content and sweetness of fruit.

The developed ears were affected by the amount of cell division that occurs in the ear itself. Nutrients in jatropha rind compost including potassium and other nutrients will meet the needs of the cell for the cell division process. The same results were observed on all doses given. Thus, it is better to use jatropha rind compost with the dose of 547.79 kg/hectare, because the needs for potassium during the vegetative and generative phase have been fulfilled with the dose.

Table 3. Ear Diameter, Fresh Weight of Ear with Husk, and Fresh Weight of Ear without Husk

Treatments	Ear Diameter (cm)	Fresh Weight of Ear with Husk (g)	Fresh Weight of Ear without Husk (g)
A = 250 kg KCl/hectare + 0 kg KJP/hectare	4.248	250.58	146.63
B = 125 kg KCl/hectare + 273,89 kg KJP/hectare	4.558	373.53	255.41
C = 62,5 kg KCl/hectare + 410,84 kg KJP/hectare	4.981	338.01	212.93
D = 0 kg KCl/hectare + 547,79 kg KJP/hectare	4.707	263.32	189.16

Note: The numbers in the table indicate no significant difference based on the analysis of variance of at 5%.

Analysis of variance showed that the substitution of KCl using jatropha rind compost does not give different effects on the fresh weight of ear with husk (Figure 2a, Table 3). This is because jatropha rind compost is capable of creating optimum growing environment for plants, especially in the provision of water and nutrients needed by the plants, especially elements of K functioning in the formation of ear and grain. Therefore, the use of inorganic KCl fertilizer used by farmers can be substituted by jatropha rind compost. Potassium given by the nutrients caused the accumulation of carbohydrates and increased starch in the ears. Figure 2b shows that the effects of the doses of jatropha rind compost on the fresh weight of ear with husk are relatively the same, but at the dose of 125 kg KCl/hectare + KJP 273.89 kg/hectare produced the potential yield of ears with husk that was in accordance with Gendis variety description

Analysis of variance showed that the substitution of KCl using jatropha rind compost does not give different effects on the fresh weight of ear without husk (Table 3). Figure 2c shows that the effects of the doses of jatropha rind compost on the fresh weight of ear without husk are relatively the same, but at the dose of 125 kg KCl/hectare + KJP 273.89 kg/hectare produced the potential yield of ears without husk approaching the yield of ears without husk of Gendis variety. According to Adri and Veronica (2009), potassium (K) fertilizer including nitrogen (N) and phosphorus (P) is balanced in sweet corn plants to make better plant growth and hold of lodging. In addition, the efficiency of potassium fertilizer is also noteworthy. The use of inorganic potassium (KCl and ZK) can be substituted by using jatropha rind compost to make better chemical structure and biology of soil.

Growth Accumulation of Sweet Corn Crop

Analysis of variance showed that the substitution of KCl using jatropha rind compost does not give different effects on the fresh weight of the roots of sweet corn crop (Table 4). This indicated that the fresh weight of the roots was associated with the higher ability of roots to absorb water and nutrients. The amount of water absorption and nutrients uptake, especially potassium, led to the development of the ears. Figure 3a shows that the effects of the doses of jatropha rind compost on the roots fresh weight are relatively same. According to Gardner et al (1991), the absorption of water and minerals primarily occurs through the root tip and root hairs. Roots fresh weight show the influence that is consistent with of the fresh weight of ears with husk and without husk. The higher weight of fresh root caused nutrients absorption, especially potassium, become s more optimal so that the size and weight of the ears were increased.

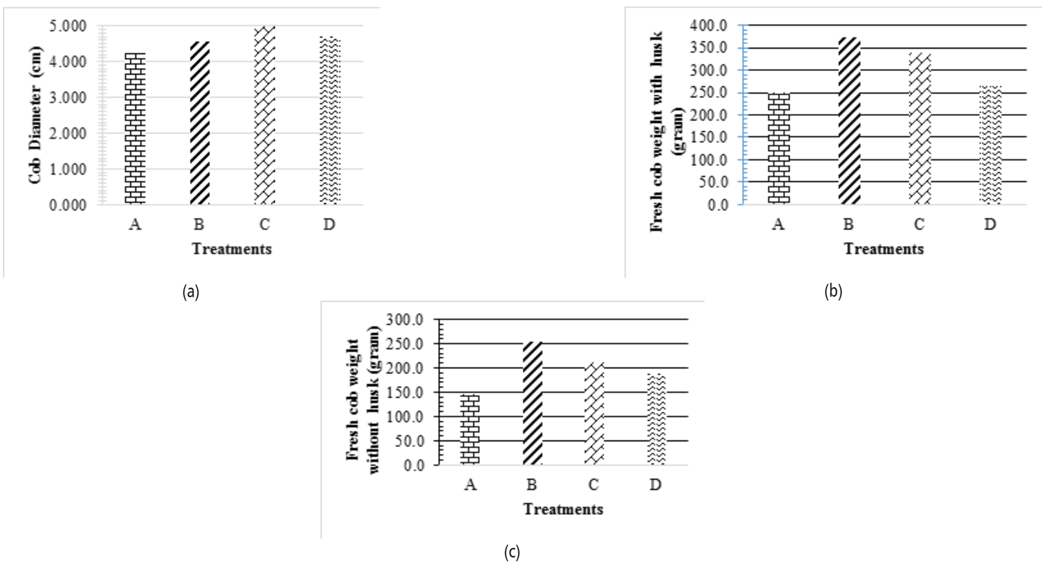


Figure 2. Diameter of Ear (a), Fresh Weight of Ear with Husk (b), and Fresh Weight of Ear without Husk (c)

Note : A = 250 kg KCl/hectare + 0 kg KJP/hectare; B = 125 kg KCl/hectare + 273.89 kg KJP/hectare; C = 62.5 kg KCl/hectare + 410.84 kg KJP/hectare; D = 0 kg KCl/hectare + 547.79 kg KJP/hectare

The availability of water in the soil will be able to maximize the crop growth and increase the crop weight, especially the roots. Figure 3b shows that the effects of the doses jatropha rind compost on the roots dry weight of sweet corn crops are relatively the same. Water absorbed by the roots was translocated throughout the plant organs (Handoyo, 2010). Analysis of variance showed that the doses of jatropha rind compost does not give different effects on the roots dry weight of sweet corn crops. This shows that the roots dry weight was associated with ~~to~~ the ability of roots to absorb more water and nutrients. The amount of absorption of water and nutrients, especially potassium, led to the formation of ears.

Analysis of variance showed that the substitution of KCl using Jatropha rind compost does not give different effects on the fresh weight of the crops (Figure 3c). The same things happened to the parameters of stem diameter and fresh weight of roots which showed relatively similar response. The yield synthesized and stored in the photosynthesis process can be determined by knowing the fresh weight of the crops. One of the conditions for photosynthesis that is good for plants is sufficient water for the plants absorbed through the roots. Sunaryo (2009) explained that the fresh weight of a crops canopy depends on the water contained in the plant organs such as stems, leaves and roots, so that the amount of water content can increase the fresh weight of the crops canopy.

Table 4. Fresh and Dry Weight of Crops and Roots

Treatments	Roots Fresh Weight (g)	Roots Dry Weight (g)	Crop Fresh Weight (g)	Crop Dry Weight (g)
A = 250 kg KCl/hectare + 0 kg KJP/hectare	4.248	250.58	146.63	87,09
B = 125 kg KCl/hectare + 273,89 kg KJP/hectare	4.558	373.53	255.41	107,16
C = 62,5 kg KCl/hectare + 410,84 kg KJP/hectare	4.981	338.01	212.93	105,89
D = 0 kg KCl/hectare + 547,79 kg KJP/hectare	4.707	263.32	189.16	100,77

Note: The numbers in the table indicate no significant difference based on the analysis of variance of at 5%.

Analysis of variance showed that the substitution of KCl using Jatropha rind compost does not give different effects on the dry weight of the crops (Table 4). Figure 3d shows that the effects of jatropha rind compost doses on the dry

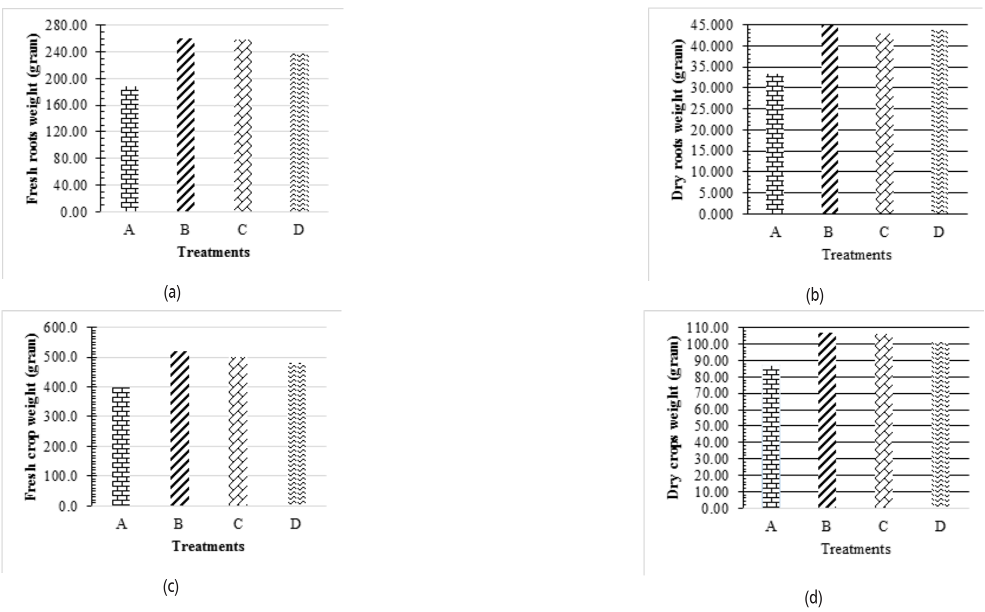


Figure 3. Sweet corn Fresh roots weight (a), Sweet corn Dry roots weight (b), Sweet corn Fresh crops weight (c), and Sweet corn Dry crops weight (d)

Note : A = 250 kg KCl/hectare + 0 kg KJP/hectare
B = 125 kg KCl/hectare + 273.89 kg KJP/hectare
C = 62.5 kg KCl/hectare + 410.84 kg KJP/hectare
D = 0 kg KCl/hectare + 547.79 kg KJP/hectare

weight of sweet corn crops are relatively same. This was caused by water in the root zone served as a solvent of nutrients to be absorbed by plants through the roots, which was then translocated from the roots to the leaves as photosynthesis substance. Provision of potash inorganic fertilizer i.e. KCl and ZK can be changed using organic matter like jatropha rind compost because it is slow in releasing K nutrients and the rate of photosynthesis can run well because the nutrients requirement, especially K, can be met throughout the growth of the crops so that the assimilates produced is quite available for plant growth and development. Jatropha rind compost could increase the amount of nutrients available so that it will produce larger crops dry weight. This is because the K substance affected the vegetative and generative growth, thus the plants achieved the optimum growth.

CONCLUSION

Based on the results of the research showed that all treatment doses of the mixture of Jatropha rind compost and KCl gave the same effect on all parameters of growth and yield of sweet corn (*Zea mays saccharata* Sturt). Therefore, the study can be concluded that jatropha rind compost can replace KCl fertilizer. Sweet corn plants fertilized with jatropha rind compost with the dose of 547.79 kg/ha had the same growth and yield those of 250 kg/ha KCl.

ACKNOWLEDGMENTS

We thanks to Indofood Research Nugraha for providing research funding.

REFERENCES

Adri Haris dan Veronica Krestiani. 2009. Studi Pemupukan Kalium terhadap Pertumbuhan dan Hasil Jagung Manis (*Zea mays saccharata* Sturt.) Varietas Super Bee. *Jurnal Sains dan Teknologi* 2(1): 1-5.

Afandie Rosmarkam dan Nasih W. Y. 2002. *Ilmu Kesuburan Tanah*. Kanisius. Yogyakarta. 224 p.

Bilman W. S., A.D. Nusantara dan Faradilla F. 2002. Peran EM5 dan Pupuk NPK dalam Meningkatkan Pertumbuhan dan Hasil Jagung Manis pada Lahan Alang-Alang. *Jurnal Ilmu-Ilmu Pertanian Indonesia* 4(1): 56-61.

BPS. 2014. *Statistik Indonesia*. Badan Pusat Statistik. Jakarta. Diakses l8 Mei 2015. www.bps.go.id

Budi Nining Widarti, Wardah Kusuma Wardhini dan Edi Sarwono. 2015. Pengaruh C/N ratio Bahan Baku Pada Pembuatan Kompos dari Kubis dan Kulit Pisang. *Jurnal Integrasi Prose* 5(2): 75-80.

Dewi Yusriani Sapta dan Tresnowati. 2012. Pengolahan Sampah Rumah Tangga Menggunakan Metode Komposting. *Jurnal Ilmiah Fakultas Teknik LIMIT'S* 8(2): 35-48.

Fahruddin dan Abdullah, A. 2010. Pendayagunaan Sampah Daun di Kampus UNHAS Sebagai Bahan Pembuatan Kompos. *Jurnal Alam dan Lingkungan* 1(1): 9-17.

Gardner, F. P., R. B. Dearce dan R. L. Michell. 1991. *Fisiologi Tanaman Budidaya* (terjemahan Herawati Susilo). UI Press. Jakarta. 428 p.

Hamoda, M. F., H. A. Abu Qudais, and J. Newham. 1998. Evaluation of Municipal Solid Waste Composting Kinetics. *Resource, Conservation and Recycling* 23(4): 209-223.

Handoyo, G. C. 2010. Respon Tanaman Caisin (*Brassica chinensis*) Terhadap Pupuk Daun NPK (16-20-25) di Dataran Tinggi. *Skripsi*. Fakultas Pertanian. Jurusan Budidaya Pertanian. Institute Pertanian Bogor. Bogor. 56 p.

Martinez-Herrera, J, Siddhuraju, P. Francis, G. Davila-Ortiz, G. and Becker, K. 2006. Chemicalcomposition, Toxic Antimetabolic Constituents And Effects Of Different Treatments On Their Levels, in Four Provenances of *Jatropha Curcas* L. from Mexico. *Food Chemistry* 96(1): 80-89.

Mirwan, M. 2015. Optimasi Pengomposan Sampah Kebun dengan Variasi Aerasi dan Penambahan Kotoran Sapi Sebagai Bioaktivator. *Teknik Lingkungan*. 4(6): 61-66.

Muhammad Syakir, David Allorerung, Sumanto dan Jati Purwani. 2009. Dekomposisi Limbah Jarak Pagar dan Pemanfaatannya Untuk Pupuk Organik. Laporan Penelitian Insentif Riset. Pusat Penelitian dan Pengembangan Perkebunan. Bogor.

Mul Mulyani Sutejo. 2002. *Pupuk dan Cara Pemupukannya*. Rineka Cipta. Jakarta. 177p.

Ruskandi. 2006. Teknik Pemupukan Buatan dan Kompos pada Tanaman Sela Jagung diantara Kelapa. Sukabumi: Teknisi Litkayasa Pelaksana Lanjtan. *Buletin Teknik Pertanian*. 10(2):73-77.

Sunaryo. 2009. Pertumbuhan dan Hasil Padi Sistem Intensifikasi Pada Berbagai Populasi. *Skripsi*. Mahasiswa Fakultas Pertanian UMY. Tidak Dipublikasikan.

Suwarno, M. 2011. Respon Tanaman Jagung (*Zea mays* L.) terhadap Aplikasi Pupuk Organik dari Limbah Kulit Buah Jarak Pagar (*Jatropha curcas* L.) yang Diinkubasikan dengan 4 Jenis Biodekomposer. *Skripsi*. Departemen Agronomi dan Hortikultura Fakultas Pertanian Institut pertanian Bogor.

Yuli Astuti Hidayati, Ellin Harlia dan E. T. Marlina. 2008. Analisis kandungan N, P, K Pada Lumpur Hasil Ikutan Gasbio (*Sludge*) yang Terbuat Dari Feses Sapi Perah. *Seminar Nasional Teknologi Peternakan dan Veteriner*. Bogor. 271-275.