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International Seminar
on Horticulture to Support Food Security 2010

June 22-23 ,2010
Bandar Lampung, INDONESIA

Editors

Douglas Archbold
Michael Reed
Janet Paterson
Soesiladi Esti Widodo
Siti Nurdjanan
Darwin H. Pangaribuan

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TERNATIONAL SEMINAR ON HORTICULTURE TO SUPPORT FOOD SECURITY 2010

awards this certificate to

Ir. Merakati Handajaningsih, M.Sc.

recognition of valuable contribution to the seminar as

PRESENTER

Bandar Lampung, Indonesia, June 22-23, 2010

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Chair
Organizing Committee

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GROWTH ANALYSIS OF SWEET CORN AND ITS CORRELATION TO THE YIELD AT DIFFERENT RATE APPLICATION OF PALM OIL SLUDGE COMPOST

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ABSTRACT

Palm oil sludge (POS) is an organic waste from processing of CPO (Crude Palm Oil). With its high nutrient content, this material has been used as soil organic matter for agricultural practices. Its application, in its form of compost, on horticultural field would become valuable in supporting organic farming. POS in this study was composted with EM4 and applied on the field at the rate of 0, 10, 20, 30, or 40 tons / ha. Sweetcorn was grown without any other synthetic fertilizer or pesticide. Growth analysis included Relatif Growth Rate (RGR), Leaf Area Ratio (LAR), and Net Assimilation Rate (NAR), whereas yield components measured were weight of ear with and without. The data showed that RGRs of root, stem, and leaf at the fifth week (35 – 42 days after planting) had negatively linier relations to the compost rate which meant that the higher the compost rate, the smaller the relative growth rate. The same result was also found in NAR at the fourth week (28 – 35 days after planting) and LAR 35 days after planting. Weight of ear had positive linier relation to POS- compost application up to 40 tonnes/ha. The weight at 40 tonnes/ha compost was 232.87 g for ear without husk and 318.67 g for ear with husk. No correlation was observed between relative growth rate of vegetative organ components and yield of sweetcorn.

Keywords: Palm Oil Sludge, compost – EM4, sweet corn, RGR, LAR, NAR.

INTRODUCTION

Indonesia is one of the largest oil palm plantation and CPO (Crude Palm Oil) producer countries in the world along with Malaysia. In 2008, total area of planted oil palm in Indonesia was 6,5 million hectares with productive area was 4,6 million hectares (Sheil *et al.*, 2009). This position brings the situation where the waste is also produce in a large amount. Palm oil plants process the kernel to produce CPO with the waste in the form of sludge. From fruit bunches only 20% is in the form of palm oil, 2% of which is sludge waste (Satyawibawa and Yustina, 1992) The increasing volume of the waste should be managed properly and recycled for other advantageous usage. Organic waste could be recycled and put back into agricultural field to increase soil organic matter and improve land quality. Palm oil sludge (POS) contains high nutrients required for plant growth. Some researches had been done related the usage of this sludge in agriculture. Kalla (2010) found that POS cold be a good medium composition for ornamental plants. In its form of compost, its application on horticultural field would become valuable in supporting organic farming. The fact revealed that the same raw materials do not always have the same plant nutrient compositions since the difference of physical, chemical, and biological environments will influence the composting process. As shown in the earlier study, POS composted with vermin (vermicompost) at application rate up to 20 tonnes Ha-1 resulted 200.91 g weight of ear of sweet corn grown under organic system. The same POS composted with EM4 yielded 210.90 g of ear at the same rate.

Different response of crop plants does not only depend on the variations of the environment but also depend on the stage of plant growth and development. The consequences are that plants have unequally changes within a period of time. Plant growth analysis will help researchers in determining plant growth inhibitor so that strategy of improvement in growing crop plants could be more accurately decided. In addition, the study of growth analysis would also be valuable means in interpreting the plant processes encountered within a period of time so we can explain the differences of plant yield.

...Objectives of this research were to get growth analysis and to correlate the growth analysis ...components of sweetcorn grown at different rate of palm oil sludge application composted ...EM4.

MATERIALS AND METHODS

Field study was carried out in lowland of Bengkulu City. It was arranged in Radomized ...Block Design with 3 replications. Sweetcorn cv. Maduraksa was used, while palm oil ...was colected from P.T. Bio Nusantara Oil Palm Plant in Bengkulu. The treatments of palm ...compost rate in this experiment were 0 ton, 10 tonnes Ha^{-1}, 20 tonnes Ha^{-1}, 30 tonnes Ha^{-1} ...40 tonnes Ha^{-1}.

Palm oil sludge was composted according to this process: Effective Microorganism (EM)4, ...sugar and water were prepared with compositions of 200 ml EM4, 40 litres of water, and 200 ...palm sugar. All those materials were mixed altogether. This stock solution was left in closed ...for 2 days. Air dried palm oil sludge was sprayed with EM4 solution and covered with ...plastic. The pile was turned over in every other day. The composting process took 7 days ...sludge compost was ready to use.

Fifteen field plant beddings were prepared in 3.0 m x 3.0 m each bed, divided into 3 blocks ...ced 1.0 m between block. POS-compost was incorporated into the beds with the dose ...the treatments one week before planting. Seeds were planted 30 cm in rows and 75 cm ...rows. No synthetic fertilizer was applied to the field. The plants were sampled weekly from ...weeks after planting, two plants per replication. Plants were separated into leaves, stems, ...; air dried and then dried into oven at 80°C until the weight was constant. Harvesting was ...ed 65 days after planting, weighted and separated into vegetative organs and ears with and ...husk.

Growth analyses including relative growth rate (RGR), leaf area ratio (LAR) and net ...tion rate (NAR) were calculated according to Hunt (1990) and Guritno and Sitompul (1995). ...RGR was calculated for vegetative plant organs (leaves, stems, and roots). Correlation ...growth analysis components and yield was performed.

RESULTS AND DISCUSSION

The soil and POS-compost analyses for nutrients were presented in Table 1. Nitrogen and ...phor of soil level were low, while potassium was moderate.

...1. Laboratory analyses of soil and Palm Oil Sludge compost nutrients.

Component	Soil	Criteria	POS-compost
C organic	2.09 %	low	28.67 %
Nitrogen	0.13 %	low	0.98 %
Phosphor	18.34 ppm	low	0.32 %
Kalium	0.54 me/100g	moderate	1.15 %
Calsium	-	-	0.82 %
Magnesium	-	-	0.81 %
CEC	-	-	54.83 %
pH	4.2		7.0

This study revealed that RGR of sweetcorn organs and whole plants were significantly ...erent at 6 weeks after planting but not significant at the 4 and 5 weeks after planting. LAR and

NAR were significantly different 5 weeks after planting. Regressions showing the relation of different POS rates on growth rate, LAR, and NAR were negatively linier (Figure 1., Figure 2 and Figure 3.), which means that under low nutrient supply plant organs of sweetcorn tended to produce higher dry matter at the initial weight compared to dry matter produced under high nutrient supply. Sitompul and Guritno (1995) stated that large amount of soil nutrient does not always efficiently absorbed by plants in producing dry matter. The decline was more clear on RGRs of stem and leaf. Our earlier study on sweetcorn plant showed that RGR of plant organs was not different among different rates of compost although there was always tend that higher rate of compost resulted on higher RGRs during the first and second week of plant growth. On the other hand, plant growth under limited supply of nutrient (0 and 5 tonnes/ha) did not show significant growth rate during the first two weeks of life (Effendi, 2003). Compost is an organic matter in which nutrients are slowly released to become available to plant. Different response of RGR caused by different agricultural practice was also observed on tomato plant (Teasdale and Abdul-Baki, 1997). In that experiment fruit mass growth during the first 3 weeks was higher under black polyethylene even though the RGR was lower compared to those under hairy vetch production system.

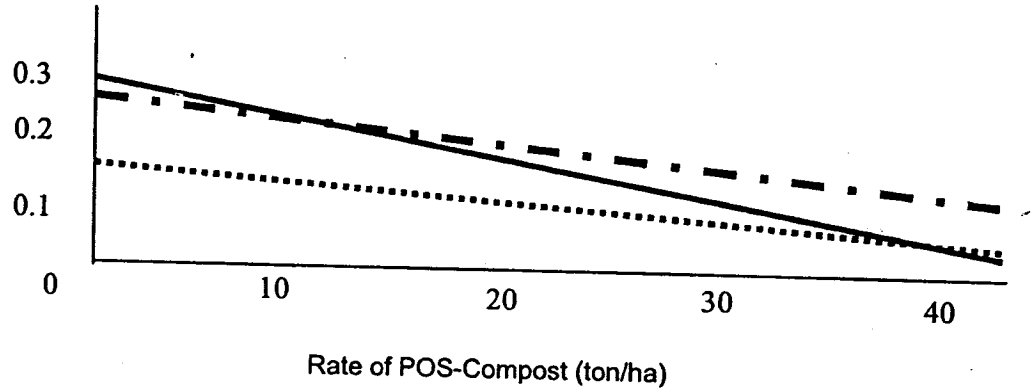


Figure 1. RGR (g week^{-1} g^{-1}) of root (dash dot), stem (solid line), and leaf (square dot) 42 days after planting at different rate of POS- compost.

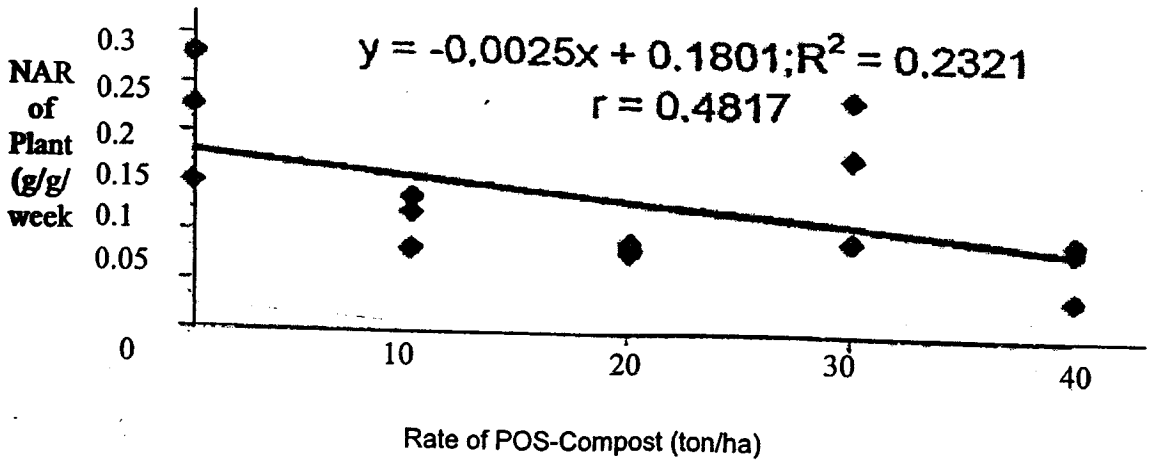
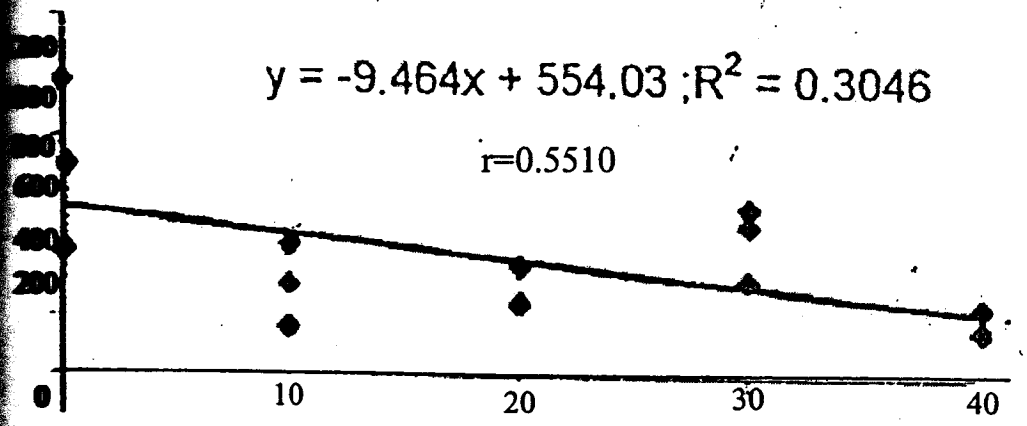
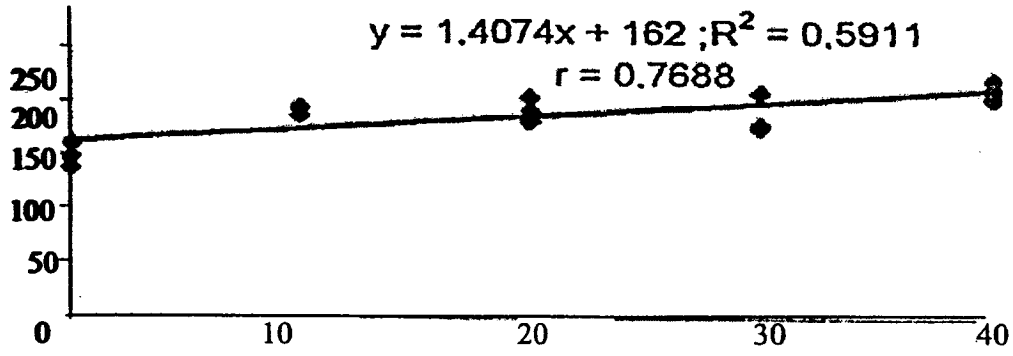


Figure 2. NAR of sweet corn plant 35 days after planting at different rate of POS compost



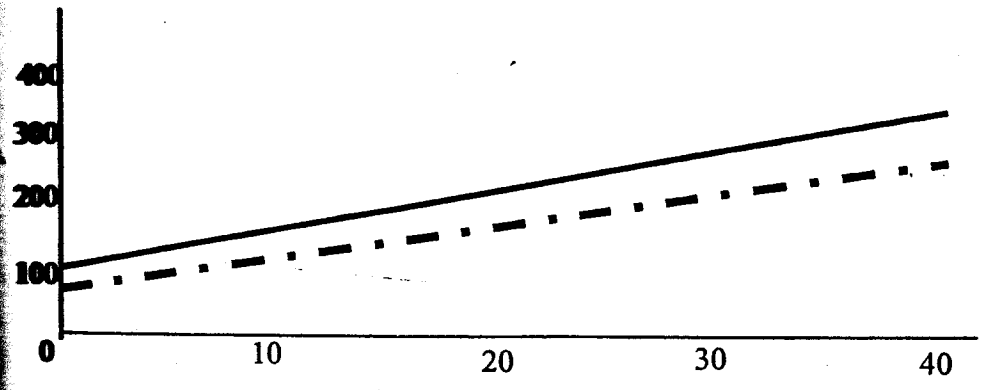
Rate of POS-Compost (ton/ha)

3. LAR of Sweet Corn plant 35 days after planting at different rate of POS compost



Rate of POS-Compost (ton/ha)

Figure 4. Height of Sweet Corn plant at different rate of POS compost



Rateof POS-compost (ton/ha)

Weight of ear with husk (solid line), and without husk(dash dot) at different rate of POS-compost

2. Correlation between growth analysis variables and weight of ear of sweetcorn.

Growth Variable	With husk	Without husk
GR of root	- 0.013	- 0.046
GR of stem	- 0.002	- 0.003
GR of leaf	- 0.012	- 0.033
eaf Area Ratio	0.013	0.013
et Assimilation Rate	- 0.444	- 0.427

Relative growth rate of plant organs did not correlate significantly to yield of sweetcorn. Table 2 showed that the values were all negative except for LAR. These data indicated that the growth rate of vegetative organs was not as an inhibitor factor to the growth of ear. Allocation of photosyntate to the ear was determined from total photosyntate, while RGR showed the rate of dry matter produce at certain period of time. Figure 4 and Figure 5 presented the positive relation of plant height and weight of ear to the increasing rate of POS compost application.

CONCLUSION

Relative growth rate of root, stem, and leaf, net assimilation rate, and leaf area ratio were mainly negative at the POS compost rate applications from 0 to 40 tonnes Ha^{-1}. No correlation was observed between relatif growth rate of vegetative organ components and yield of sweetcorn.

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