Performance of some populations of maize (*Zea mays* L.) on peat soil applied *Sludge* and ash of oil palm

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Abstract. The objective of this study obtained the appearance of the vegetative and reproductive character of some maize populations on peat soil with pH criteria of 5.9 and application of sludge and ash of oil palm. The research was conducted at Tanjung Rejo, Medan city from April to August 2017. This research used a Randomized Block Design (RBD) with 2 treatment factors. The first factor was the population consisting of 5 levels: A (NEI9008 x CLA46), B: (NEI9008 x CLA106), C: (CLA106 x NEI9008), D: (CLA16 x CLA84), E: (CLA84 x NEI9008) and the second factor was planting medium consisting of 3 levels is M1 (peat), M2 (peat + ash of oil palm), M3 (peat + sludge). The results showed that the interaction between planting media with some populations of maize had a significant effect on plant height character. The best media was found in M3 (peat + sludge). The best population based of the highest plant were population C (CLA106 x NEI 9008) and D (CLA 16 x CLA 84).

1.Introduction

Today, most of the agricultural land has changed its functions to become a residential housing, tourist park, factory, etc. So that agriculture began to shift to marginal land. One type of marginal land that become target of developing agricultural today is peatland. Peatlands in Indonesia reach 20.96 million ha [1]. Peatlands as land farming there are various obstacles both physical, chemical and biological. Peatland is a land with low productivity. The main obstacle in the physical properties of peat is irreversible drying, so that peat cannot function anymore as an organic colloid. Low productivity of peatlands due to the lack of macro and micronutrients available for plants [2].

The availability of nutrients needs to be improved to get good growth and increase production through improved soil conditions and organic fertilizer. Waste from oil palm that has been discharged, the ash of oil palm can be used to neutralize acidity and increase soil pH and can improve yield and quality of production and be able to increase nutrients [3].

The fermentation result is sludge then settles on the bottom of the tub which has a percentage of about 23% / ton Fresh Fruit Bunches (FFB), solid waste can be used as organic material with an average potential nutrient content per ton sludge is 0.37% N (8 kg Urea), 0.04% P (2.90 kg RP), 0.91% K (18.30 kg MOP), and 0.08% Mg (5 kg Kieserite). The main components of oil palm sludge are cellulose and lignin, so this waste is referred to as lignocellulose waste. Ash of oil palm and sludge is a large amount of solid waste [4-5].

The use of peat soil in this research is the early stage of plant breeding programs to design tolerant plants to acidity using palm waste. This research use some of maize populations results of crosses (F1) of introduction and local lines [6].

2. Materials and Methods

This research was conducted in Setiabudi farm, Medan Sunggal, North Sumatra, Medan, from April 2017 to August 2017. The material used was some of maize populations crossed from introduced and local lines that have been tested on acid soil conditions in the origin region.

Table 1. Parents of some populations [6]

No.	Lines	Region
1.	CLA 46	CIMMYT
2.	CLA 84	CIMMYT
3.	CLA 16	CIMMYT
4.	CLA 106	CIMMYT
5.	NEI 9008	Balitsereal Maros

The material used in this study is the seed of Maize (*Zea mays*, L.) derived from the crossing of the CLA84 x NEI 9008, NEI 9008 x CLA 84, CLA 84 x CLA 106, CLA 106 x CLA 84, and NEI 9008 x CLA 46 as plant material used, sludge, ash and peat soil as much as 10 kg/polybag as treatment material.

This experiment used a Randomized Block Design (RCBD) with two factors. The first factor is population A: (F1) NEI9008 x CLA46; B: (F1) NEI9008 x CLA106; C: (F1) CLA106 x NEI9008; D: (F1) CLA16 x CLA84; E: (F1) CLA84 x NEI9008 Crossing.

The second factor is the planting medium with three treatment levels, namely: M1: 100% peat media M2: 50% peat medium + 50% ash ash M3: 50% peat media + 50% sludge. So, there are 15 treatment combinations each treatment repeated three times. Each test consists of 2 polybags so that there are 90 plants.

Observed variables consist of: Plant Length (cm), Number of Leaf (pcs), stem diameter (cm), male flowering age (days), female flowering age (days), root length (cm), root volume (mL), ear length (cm), crop production weight (g), weight 100 Seeds (g). Data Analysis, the data obtained were analysed using variance analysis at $\alpha = 1\%$ and 5%. If the treatment has a significant effect based on variance analysis, it is continued with Duncan's Multiple Area Test (DMRT) at the 5% level using Costat.

3. Results and Discussion

Based of analysis variance, it was found that the genotype was significantly different to the character of plant height, but not significantly different in the character of the number of leaves, stem diameter, root volume, root length, ear length, production weight, 100 seed weight, male flower age and female flower age (Table 2). The results showed that the interaction between planting media with some populations of maize had significant effect on plant height character.

The medium was significantly different to the character of plant height, the number of the leaf, stem diameter, root volume, and root length. The significant effect medium to some character allegedly becausesludge and ash palm oil give different effect to vegetative growth plants sludge can be used as fertilizer because it has a high macro nutrient content. Concentration of macronutrient can increase with increasing sludge weight. So, it can be concluded that oil palm sludge can be used as fertilizer [7]. Ash palm oil can be used to increase soil pH [2].

Table 2. Analysis variance of maize character

Character	Genotype MS	Env MS	GxE MS
Plant height (cm)	101.88*	2301.49*	283.24*
Number of the Leaf (pcs)	0.73	10.07*	0.54
Stem diameter (cm3)	0.06	1.55*	0.10
Root Volume (cm)	45.69	360.31*	39.76
Root Length (cm)	121.84	1159.12*	54.57
Ear Length (cm)	0.95	0.92	0.84
Production weight (g)	222.64	121.91	78.00
Weight of 100 seed (g)	21.65	12.60	19.17
Male Flowering age (d)	1.80	0.54	2.46
Female Flowering age (d)	3.28	17.07	6.77

Description: * = significantly different $\alpha = 0.05$, ** = significantly different $\alpha = 0.01$

Table 3 shows that the interaction between the population and medium with the highest of plant height is found in population C (CLA106 x NEI9008) with M1 is 115.21 cm. But, not significantly different to population D (CLA16 x CLA84) with M3 that is 109.33 cm [8].

The results of statistical analysis showed that the interaction of planting media with F1 population significantly affected the character of plant height, but each F1 population gave a variety of responses, according to the planting medium used. Each variety has different adaptive abilities in each environment. This is consistent with the opinion of [7], [11] which that genotype and environmental interactions provide different phenotypic appearance between character of plant height, number of the leaf, stem diameter, root volume, root length, but no significant effect on the character of ear length, weight of production, weight of 100 seeds, age of male flowers and age of female flowers.

Table 3. Interaction between of media planting and some of populations to character of plant height

Populations	M1 (peat)	M2 (peat+ash)	M3 (peat+*sludge*)	Mean
A (NEI9008 x CLA46)	91.43^{bc}	84.6^{cd}	93.68^{b}	89.90
B (NEI9008 x CLA106)	95.33^{b}	75.75^{e}	96.41^{b}	89.16
C (CLA106 x NEI9008)	115.21^{a}	62.96^{f}	97.15^{b}	91.77
D (CLA16 x CLA84)	96.53^{b}	78.8^{de}	109.33^{a}	94.88
EC (LA84 x NEI9008)	91.00^{bc}	77.91^{de}	88.36^{bc}	85.76
Mean	97.90	76.01	96.99	

4. Conclusion

The results showed that the interaction between planting media with some populations of maize had significant effect on plant height character. The best media was found in M3 (peat + sludge). The best population based of the highest plant were population C (CLA106 x NEI9008) and D (CLA 16 x CLA 84).

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