

The Effect of Bio Liquid Fertilizer Application on The Growth and Yield of Two Varieties of Maize (*Zea mays* L.)

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Abstract

The research was conducted at the experimental field of Assessment Institute for Agricultural Technology (BPTP) Lampineung Banda Aceh. The experimental arranged in a randomized complete block design in a factorial design with three replications. Bio liquid fertilizer Ultra Gen consisted of four levels, i.e. without liquid fertilizer (P_0), 0,8 liter ha^{-1} (P_1), 1,7 liter ha^{-1} (P_2), and 2,5 liter ha^{-1} (P_3). Varieties consisted of two levels, i.e. Pertiwi (V_1) and Local Aceh (V_2). Parameters observed in this research were plant height and number of leaves aged 15, 30, and 45 days after planting, corn length with cornhusk and without cornhusk, corn diameter with cornhusk and without cornhusk, corn weight with cornhusk and without cornhusk, weight of 100 grain dry seeds, shelled seeds weight dry per plant and yield. The result showed that concentration of 0.8 liter ha^{-1} gives better results compared to concentrations of other bio liquid fertilizer Ultra Gen, and Local Aceh variety of maize crop is better compared to Pertiwi variety

Key words: Bio fertilizer, maize, varieties

Introduction

Maize (*Zea mays* L.) is one commodity crops that have particular significance after rice in Indonesia. Efforts to further enhance the productivity of maize should be supported by seed supply superior and has a high adaptability to the environment sub-optimum. The low productivity of maize is due to several factors, including the use of quality seed and inorganic fertilizer use unbalanced.

Fertilization is one way to increase the production of corn. Fertilization is one activity that can improve physical, chemical and biological composition of the soil in increasing nutrient needs required by the plant. In general, the benefits of fertilizer is to provide nutrients that are less or not available in the soil to support plant growth (Lingga and Marsono, 2007).

The use of organic fertilizers can improve soil structure, pH, soil aeration and increases the growth of microorganisms in the soil. One of organic fertilizer used is biological liquid fertilizer Ultra Gen. Bio liquid fertilizer Ultra Gen is produced from nano technologies are made from a collection of microorganisms (*Rhizobium* sp, *Azospirillum* sp, *Azlotobacter* sp, *Pseudomonas* sp, *Bacillus* sp, *Lactobacillus* sp, *Accharomyces* sp, trichoderma, actinomycetes) which can cooperate with the plants in the absorption of nutrients. Also included within the fertilizer nutrients that can become a catalyst and triggers the growth of microorganisms and plants so that optimal performance of microorganisms. Concentration of bio liquid fertilizer recommendation for corn is 1 liter ha^{-1} Ultra Gen (POC Brochure Ultra Gen, 2014). In addition to the use of fertilizers which can increase the production of maize, the use of varieties is also crucial in terms of increasing production of maize is optimal. Yielding varieties have properties such as high yield, resistant to biotic and abiotic stress (Research and Development, 2004).

At this time Aceh has produced open pollinated seed corn or maize composite. The name of the maize is maize varieties composite Aceh (Local Aceh). Composite maize varieties Aceh is seeds produced by the Center for Horticulture Seeds Saree (Aceh) in cooperation with the International Corn Foundation (ICF). Composite maize is the result of a marriage between Arjuna varieties from Indonesia with Suwan 5 varieties from Thailand. Composite maize is not currently released to farmers because it is still in the stage of yield trials process, particularly influences agronomic practices such as crop density or spacing of planting and fertilization.

Based on these problems it is necessary to investigate the effect of bio liquid fertilizer Ultra Gen on growth and yield of two varieties of maize plants. This study aims to determine the effect of bio liquid fertilizer Ultra Gen on growth and yield of two varieties of maize plants as well as the interaction between the two factors (bio liquid fertilizer Ultra Gen and maize varieties).

Materials and Methods

The research was conducted at the experimental field of Assessment Institute for Agricultural Technology (BPTP) Lampineung Banda Aceh. The experimental arranged in a randomized complete block design in a factorial design with three replications. Bio liquid fertilizer Ultra Gen consisted of four levels, i.e. without liquid fertilizer (P_0), 0,8 liter ha^{-1} (P_1), 1,7 liter ha^{-1} (P_2), and 2,5 liter ha^{-1} (P_3). Varieties consisted of two levels, i.e. Pertiwi (V_1) and Local Aceh (V_2). Parameters observed in this research were plant height and number of leaves aged 15, 30 and 45 days after planting, corn length with cornhusk and without cornhusk, corn diameter with cornhusk and without cornhusk, corn weight with cornhusk and without cornhusk, weight of 100 grain dry seeds, shelled seeds weight dry per plant and yield.

Results and Discussion

Effect of Bio Liquid Fertilizer Ultra Gen on Growth and Yield of Maize

The average value of the observed variables can be seen in Table 1.

Table 1. The average growth of maize plants in the vegetative and generative phase due to the influence of bio fertilizers Ultra Gen

Variables	Age	Bio Liquid Fertilizer Ultra Gen (liter ha^{-1})			
		P_0	P_1	P_2	P_3
Plant height (cm)	15 DAP	35.30	40.73	43.06	40.25
	30 DAP	88.67	104.36	98.91	94.09
	45 DAP	175.26	185.80	188.63	176.20
Leave number (total)	15 DAP	5.15	7.00	7.18	6.95
	30 DAP	9.69	10.78	10.67	10.06
	45 DAP	14.20 a	15.32 b	15.06 ab	14.95 a
Corn length (cm)	with cornhusk	24.01	24.54	25.21	23.29
	without cornhusk	17.41	17.74	17.59	17.03
Corn diameter (cm)	with cornhusk	4.83	4.74	4.77	4.66
	without cornhusk	4.41	4.35	4.37	4.26
Corn weight (g)	with cornhusk	195.82	200.86	202.52	185.73
	without cornhusk	150.98	155.96	157.11	142.18
Weight of 100 grains dry seed (g)		28.14	28.63	34.38	31.67
Dry seed weight per plant (g)		163.65	169.89	173.54	174.12
Yield (ton ha^{-1})		5.84	6.07	6.20	6.22

The result showed that fertilizer treatment significantly affected the number of leaves 45 days after planting (DAP) and not significantly affected on plant height 15, 30, and 45 DAP, leave number 15 and 30 DAP, corn length with cornhusk and without cornhusk, corn diameter with cornhusk and without cornhusk, corn weight with cornhusk and without cornhusk, weight of 100 grains dry seed, dry seed weight per plant, and yield.

Table 1 shows that the number of leave 45 DAP more prevalent in Ultra Gen fertilizer 0.8 liter ha^{-1} (P_1) treatment . It is suspected that bio liquid fertilizers Ultra Gen applied to the soil may stimulate the growth of maize plants, bio liquid fertilizer also contains macro and micro nutrients and microorganisms that are symbiotic with plants. This is appropriate with Mashar (2008) opinion that the bio liquid fertilizer will provide better growth because of the fertilizer containing macro and micro nutrients and hormones that can supply nutrients for maize crops. It is also stated by Novizan (2002) fertilizer containing nutrients N, P, K can increase growth and yield of corn and protein content in corn seed. Lingga and Marsono (2007) states that the fertilizer with excessive concentration or deficiencies can harm plants, proper dosage is able to improve and enhance plant growth.

The results showed that the bio liquid fertilizer Ultra Gen not significantly effect on plant height at the age of 15, 30, and 45 days after planting, leaf number age 15 and 30 DAP, corn length with cornhusk and without cornhusk, corn diameter with cornhusk and without cornhusk, corn weight with cornhusk and without cornhusk, weight of 100 grain dry seeds, shelled seeds weight dry per plant and yield. This is presumably because bio liquid fertilizer Ultra Gen are not well established to improve the soil physical, biological and chemical properties. Stepniewski *et al.* (2000) suggest that the decreasing of biological activity in the soil more influenced by management of tillage and improve soil fertility. In line with the statement Sutedjo (2002) and Alexander (2003) which states that the plant will not provide maximum results if the necessary nutrients are not available.

Effect of Maize Varieties on Growth and Yield of Maize

The result showed that the varieties treatment very significantly effect on plant height at 15, 30, and 45 days after planting, the number of leaves at the age of 30 and 45 DAP, corn length with cornhusk, corn diameter with cornhusk and without cornhusk; and significantly affect on the number of leaves on age 15 DAP, corn length without cornhusk; and not significantly effect on corn weight with cornhusk and without cornhusk, weight of 100 grain dry seeds, shelled seeds weight dry per plant and yield. The value of the observed variables can be seen in Table 2.

Table 2. The average growth of maize plants in the vegetative and generative phase

Variables	Age	Varieties	
		V ₁	V ₂
Plant height (cm)	15 DAP	32.94 a	46.74 b
	30 DAP	81.23 a	111.79 b
	45 DAP	163.56 a	199.38 b
Leave number (total)	15 DAP	5.76 a	7.38 b
	30 DAP	9.31 a	11.28 b
	45 DAP	14.38 a	15.38 b
Corn length (cm)	with cornhusk	22.40 a	26.12 b
	without cornhusk	16.56 a	18.33 b
Corn diameter (cm)	with cornhusk	4.97 b	4.53 a
	without cornhusk	4.61 b	4.09 a
Corn weight (g)	with cornhusk	205.78	186.68
	without cornhusk	144.13	158.98
Weight of 100 grains dry seed (g)		31.44	29.97
Dry seed weight per plant (g)		168.55	172.04
Yield (ton ha ⁻¹)		6.02	6.14

Table 2 showed that Local Aceh variety (V₂) provide the best growth compared to Pertiwi variety (V₁). It is presumably because Local Aceh variety has high growth potential and yield, adaptability to the environment compared to Pertiwi variety. This is in accordance with the opinion Hardjadi (1996) that each variety is always there are differences in genotype response to the environmental conditions at the place growth. Gardner *et al.*, (1991) adds that in addition to the high and low growth and production of maize is influenced by two factors: internal factors and external factors. Internal factors are factors that are influenced by genetic trait or traits derivatives such as age of the plant, plant morphology, yield, capacity to store food reserves, resistance to diseases and other external factors. External factors are environmental factors, such as climate, soil and biotic factors.

Based on the above explanation that the Local Aceh variety has a power level of environmental adaptation of higher and more rapid vegetative growth compared with Pertiwi variety. This is can be seen in the growth and yield of maize was significantly higher in Local Aceh variety in accordance with a local environmental condition. Djoko (2003) states that the maximum production on each variety is influenced by genetic factors and the local environment, but at the time of filling the seed in the cob is affected by environment factors. Plant weight, seed formation until maturation is also influenced by climatic factors (Karamoy, 2009).

The observation of corn weight with cornhusk and without cornhusk, weight of 100 grain dry seeds, shelled seeds weight dry per plant and yield do not show a significant effect on the treatment of varieties. It is suspected that these varieties have not been able to adapt to the environment and the growth of. The environment is not the same in a place also affect the development and adaptability of some varieties is also influenced by genetic factors and environmental factors on the character of these varieties. Sitompul and Guritno (1995) research results that the appearance of crop diversity may result from differences in plant traits (genetics) or differences in environmental conditions or both.

Interaction Between Treatment Fertilizer and Varieties

Results of research conducted in the field showed that there was no significant interaction between bio liquid fertilizer Ultra Gen and varieties for all the observed variables. It is alleged that bio liquid fertilizer Ultra Gen does not depend on the varieties tested, because the exact concentration of bio liquid fertilizer Ultra Gen can increase soil fertility and also provide nutrients for better growth and yield of maize plant. Varieties treatment does not depend on a given bio liquid fertilizer and vice versa.

Conclusions

1. Concentration of 0.8 liter ha⁻¹ gives better results compared to concentrations of other bio liquid fertilizer Ultra Gen.
2. Local Aceh variety of maize crop is better compared to Pertiwi variety.

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