

Effect of biochar and compost application on kailan yield (*Brassica oleraceae*)

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Abstract. The objective of experiment was to study effect of biochar and compost application on the best yield of kailan. The research was conducted at Field Experiment of Provincial Agricultural Service (BPTP), Aceh Province. The experimental arranged in a randomized complete block design with two factors and four replications. Biochar consisted of two levels, i.e. without biochar and with biochar 30 ton ha⁻¹. Compost consisted of two levels, i.e. without compost and compost 30 ton ha⁻¹. The result showed that biochar application affected significantly to stem diameter 7 DAP and not significant to number of leaves and plant height 7, 14, 21, 28 DAP, stem diameter 14, 21, 28 DAP, the 6th of length and width leaf and plant fresh weight. Compost application affected significantly to number of leaves 14 DAP and the 6th of length leaf; and highly significant to number of leaves 7, 21, 28 DAP, plant height 7, 21, 28 DAP, stem diameter 7, 14, 21, 28 DAP, the 6th of width leaf and plant fresh weight, but not significant to plant height 14 DAP. There was significantly interaction between biochar and compost application to stem diameter 7 DAP. There were not interaction to number of leaves and plant height 7, 14, 21, 28 DAP, stem diameter 14, 21, 28 DAP, the 6th of length and width leaf and plant fresh weight.

Keywords : biochar, compost, kailan

Introduction

There is growing interest worldwide in the use of biochar as a soil amendment. Slow pyrolysis for biochar production has multiple benefits including waste management, renewable energy production, climate change mitigation and adaptation, and agricultural productivity (Gani, 2011). Biochar sequester C and enhance agricultural productivity. It can rehabilitate degraded soils. Biochar significantly improved plant growth. It increased pH in acidic soils, improved soil water holding capacity, reduced tensile strength of soil and improved nutrient availability (Gani, 2011).

Nisa (2010) said that biochar is one of option for soil tillage. In fact, biochar has used traditionally by farmers in Indonesia. Various of research showed that biochar has potential to improve soil fertility. Biochar was used as soil ameliorant not as fertilizer.

Compost is product of fermentation or decomposition of organic matters as plants, animals or other organic waste. Compost that used as fertilizer called organic fertilizer because its constituent are organic materials (Indriani, 2005). Compost weathering from plant materials or organic waste as straw, husk, leaves, grasses, factory processing organic waste, and organic domestic waste. Decomposition process can faster with add decomposer microorganism or activator (Musnamar, 2009). Kailan has unique shape and taste and has nutrient content that needed by human body as protein, minerals and vitamins. Nutrient content in kailan makes kailan is one of horticulture product that interested in community and high economic value (Purwanti, 2011). Tyndall (1986) said that kailan is the vegetable which high nutrients and good for consumption everyday. Kailan can grow in friable soil and rich of organic materials.

Materials and Methods

The field experiment was established at Balai Pengkajian Teknologi Pertanian (BPTP) Aceh, Indonesia on April to June 2012. This research has been experiment field and in laboratories with the the following step : (a) biochar analyze at Diagnostic and Analytical Services Environmental Laboratory WOLLONGBAR NSW, Australia; (b) compost analyze at Soil and Plant Laboratory, Agriculture Faculty, Syiah Kuala University; (c) field trial by planting kailan with biochar and compost treatment. The variables are : (a) number of leaves at 7, 14, 21 and 28 DAP; (b) stem diameter at 7, 14, 21 and 28 DAP; (c) plant height at 7, 14, 21 and 28 DAP; and (d) yield components (length and width of the 6th leaf and plant fresh weight at 30 DAP) The experimental arranged in a randomized complete block design with two factors and four replications. First factor was biochar application (B_0 = without biochar; and B_1 = 30 ton ha⁻¹). Second factor was compost application (K_0 = without compost; and K_1 = 30 ton ha⁻¹).

Results and Discussion

The experiment showed that biochar application only significant to stem diameter 7 DAP and not significantly to number of leaves and plant height 7, 14, 21, 28 DAP, stem diameter 14, 21, 28 DAP and yield components as the 6th length and width leaf, and plant fresh weight. There was not effect from biochar application to plant because biochar is not fertilizer and it can not add nutrients to soil. Nisa (2010) said that in long time biochar will not interfere carbon-nitrogen balance, can hold and make water and nutrient more available for plant. If biochar application with organic and anorganic fertilizer, biochar can increase the productivity, retention and nutrient available for plant.

Table 1. Average of Number of Leaves Kailan 7, 14, 21, 28 DAP

Biochar (ton ha ⁻¹)	Compost (ton ha ⁻¹)		Average
	0	30	
7 DAP (number)			
0	4,30	4,90	4,60 a
30	4,40	4,70	4,55 a
Average	4,35 a	4,80 b	
14 DAP (number)			
0	6,25	6,85	6,55 a
30	6,18	6,45	6,32 a
Average	6,22 a	6,65 b	
21 DAP (number)			
0	7,85	8,70	8,28 a
30	7,83	8,25	8,04 a
Average	7,84 a	8,48 b	
28 DAP (number)			
0	8,23	9,23	8,73 a
30	8,45	9,43	8,94 a
Average	8,34 a	9,33 b	

Table 2. Average of Plant Height Kailan 7, 14, 21, 28 DAP

Biochar (ton ha ⁻¹)	Compost (ton ha ⁻¹)		Average
	0	30	
7 DAP (cm)			
0	4,33	5,32	4,83 a
30	4,69	5,20	4,95 a
Average	4,51 a	5,26 b	
14 DAP (cm)			
0	6,81	6,48	6,65 a
30	5,59	6,04	5,82 a
Average	6,20 a	6,26 a	
21 DAP (cm)			
0	6,38	7,57	6,98 a
30	6,67	7,17	6,92 a
Average	6,53 a	7,37 b	
28 DAP (cm)			
0	7,61	9,75	8,68 a
30	8,34	9,56	8,95 a
Average	7,80 a	9,66 b	

Compost application 30 ton ha⁻¹ (K₁) give the best plant growth and yield. Number of leaves, plant height, stem diameter, the 6th leaf length and width, and plant fresh weight were better on compost application (K₁) than no compost application (K₀). Indriani (2008) said that compost has some favorable properties, such as : (a) improve soil structure; (b) increase sandy soil holding capacity, so it can not disperse; (c) increase water holding capacity; (d) drainage repairing and soil air; (e) increase soil holding capacity to nutrients; (f) contain complex nutrient (depend on organic matter source); (g) help decomposition of mineral matter; (h) provide food for microorganisms; and (9) decrease activity of pathogens. There was significantly interaction between biochar and compost application to stem diameter 7 DAP, but there were not interaction to number of leaves and plant height 7, 14, 21, 28 DAP,

stem diameter 14, 21, 28 DAP, the 6th of length and width leaf and plant fresh weight. Component yield showed that the highest kailan production was on B₁K₁ treatment (96.87 gr). Its showed that biochar and compost application can increase soil fertility, so plant production will better. One of factor that can increase the soil fertility is increasing number of microorganisms in soil. Biochar as carbon source can increase microorganisms activities in soil considering carbon is food source for soil microorganisms. It is appropriate with Harahap (2008) said that carbon is food source for soil microorganisms, so carbon in soil will accelerate decomposition process and other chemical reaction that need microorganisms help.

Table 3. Average of Stem Diameter Kailan 7, 14, 21, 28 DAP

Biochar (ton ha ⁻¹)	Compost (ton ha ⁻¹)		Average
	0	30	
	7 DAP (mm)		
0	2,68 a	3,75 c	-
30	3,40 b	3,78 c	-
Average	-	-	-
	14 DAP (mm)		
0	4,58	5,75	5,17 a
30	5,30	5,88	5,59 a
Average	4,94 a	5,82 b	
	21 DAP (mm)		
0	7,08	9,05	8,07 a
30	7,75	9,25	8,50 a
Average	7,42 a	9,15 b	
	28 DAP (mm)		
0	8,43	11,25	9,84 a
30	9,55	11,93	10,74 a
Average	8,99 a	11,59 b	

Conclusions

Biochar application affected significantly to stem diameter 7 DAP and not significant to number of leaves and plant height 7, 14, 21, 28 DAP, stem diameter 14, 21, 28 DAP, the 6th of length and width leaf and plant fresh weight. Compost application affected significantly to number of leaves 14 DAP and the 6th of length leaf; and highly significant to number of leaves 7, 21, 28 DAP, plant height 7, 21, 28 DAP, stem diameter 7, 14, 21, 28 DAP, the 6th of width leaf and plant fresh weight, but not significant to plant height 14 DAP. There was significantly interaction between biochar and compost application to stem diameter 7 DAP. There were not interaction to number of leaves and plant height 7, 14, 21, 28 DAP, stem diameter 14, 21, 28 DAP, the 6th of length and width leaf and plant fresh weight.

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