Preface

Preface

The 4th Annual Applied Science and Engineering Conference (AASEC) 2019 is hosted by Technical and Vocational Education study program, School of Postgraduate Studies, Universitas Pendidikan Indonesia (UPI), UPI Publication Center, in collaboration Warmadewa University, Bali, Indonesia. The conference is also co-hosted by other twelve institutions as follows Universitas Islam Negeri Sunan Gunung Djati, Universitas Negeri Jakarta, Universitas Wijaya Kusuma Surabaya, Institut Pendidikan Indonesia, Sampoerna University, Sekolah Tinggi Teknologi Garut, Trisakti University, Politeknik Negeri Malang, Universitas Muhammadiyah Sidoardjo, Universitas Kanjuruhan Malang, Universitas Garut, and Universitas Komputer Indonesia.

This year's theme is "Integrating Innovations in Science and Engineering among Young Researchers" as a follow-up discussion topic from last year's theme "Ideas for Sustainable Energy". To bring up insightful knowledge, two keynote speakers were invited. The first speaker was Assoc. Prof. Abdulkareem Shafiq Mahdi Al-Obaidi, a lecturer at Taylor's University, Malaysia who has also been a member and chief of editorial board of several journals as Journal of Manufacturing and Industrial Engineering, International Journal of Computer Science and Communication Engineering, and Journal of Engineering Science and Technology (JESTEC). The other speaker was Prof. dr. Dewa Putu Widjana, DAP&E.Sp. Park., a professor of medicine who is currently the rector of Universitas Warmadewa, Bali, Indonesia, as well. In addition to keynote speakers, we have two invited speakers from Indonesia and abroad. The first invited speaker is Assoc. Prof. Asep Bayu Dani Nandiyanto, an expert of chemical engineering from Universitas Pendidikan Indonesia who is also an executive editor of Indonesian Journal of Science and Technology (IJOST), a Scopus-indexed journal published by Universitas Pendidikan Indonesia. The other invited speaker is Dr. Eng. Muhammad Aziz, an associate professor at the Department of Mechanical and Biofunctional Systems, Institute of Industrial Science, The University of Tokyo, Japan.

This year, the conference was divided into four sessions; plenary, parallel, roundtable, and oral presentation sessions. There are 875 papers published in the proceedings of the 4th AASEC 2019. The papers discuss several fields comprising mathematics, physics, computer science, material science, chemistry, mechanical engineering, chemical engineering, civil engineering, electrical engineering, electronics engineering, material engineering, environmental engineering, industry engineering, information engineering, computer and communication engineering, and architecture. All the published papers have been through a series of rigorous review process to meet the requirements and standards of international publication.

We would like to thank each co-host for the efforts to give significant contribution particularly on paper selection. We would also like to acknowledge vice rector on research, business, and partnership affairs of Universitas Pendidikan Indonesia for the endless support to the conference. Last but not least, we would like to express our most sincere gratitude to the international advisory board, scientific committee, steering committee, organizing committee, and everybody taking parts in the success of the conference. We hope to see you in the 5th AASEC 2020.

The Editors,

Dr. Ade Gafar Abdullah
Dr. Eng. Asep Bayu Dani Nandiyanto
Dr. Isma Widiaty
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Peer review statement

All papers published in this volume of *Journal of Physics: Conference Series* have been peer reviewed through processes administered by the proceedings Editors. Reviews were conducted by expert referees to the professional and scientific standards expected of a proceedings journal published by IOP Publishing.

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The 4th Annual Applied Science and Engineering Conference
Aston Hotel Denpasar Bali, 24 April 2019
Website: http://aasec.conference.upi.edu/2019
Email: aasec@upi.edu

Date: 13 August 2020

Letter of Invitation

Dear Authors: I Gusti Lanang Agung Alit Adi Putra, Yohanes Parlindungan Situmeang *, Made Sri Yuliartini, and I Gusti Bagus Udayana

We are pleased to inform you that your paper, entitled:

"Application of biochar and compost to changes in physical and chemical properties of soil and corn yield on dry land"

has been reviewed and accepted to be presented at AASEC 2019 conference to be held on 24 April 2019 in Bali, Indonesia.

We cordially invite you to attend our conference and present your research described in the paper.

Please make the payment for registration fee before the deadlines, visit our website for more information.

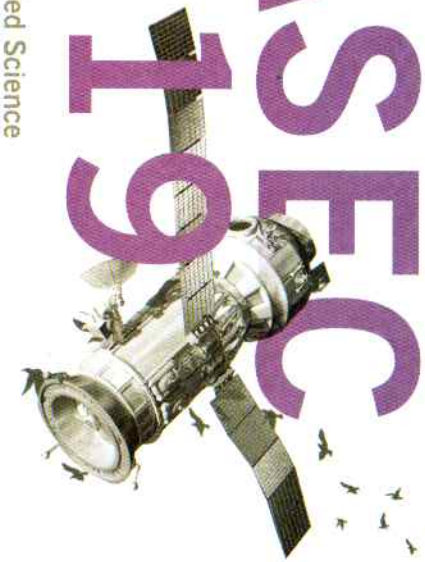
Thank You.

Best regards,

Dr. Ade Gafar Abdullah
AASEC 2019 Chairperson

AASEC 2019

The 4th Annual Applied Science and Engineering Conference
Bali, 24 April 2019



CERTIFICATE

This certificate is awarded to

I Gusti Lanang Agung Alit Adi Putra, Yohanes Parlindungan Situmeang, Made Sri Yuliartini and I Gusti Bagus Udayana

as

Presenter

Application of biochar and compost to changes in physical and chemical properties of soil and corn yield on dry land

in the **4th Annual Applied Science and Engineering Conference (AASEC) 2019**
"Integrating Innovations in Science and Engineering among Young Researchers"
Bali, Indonesia, April 24, 2019.

Prof. Dr. Didi Sukyadi, MA
Vice Rector for Research, Partnership, and Business
Universitas Pendidikan Indonesia

Prof. dr. I Dewa Putu Widjana, DAP&E.Sp. Park.
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Application of biochar and compost to changes in physical and chemical properties of soil and corn yield on dry land

Journal of Physics: Conference Series **1402** (2019) 055029 doi:10.1088/1742-6596/1402/5/055029

Application of biochar and compost to changes in physical and chemical properties of soil and corn yield on dry land

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Abstract. The purpose of this study was to determine the effect of biochar and compost fertilizer and their interactions on changes in the physical and chemical properties of soil and corn products on dry land. This experiment uses a randomized block design with factorial patterns. The first factor, the biochar dose consisted of 4 levels, namely: 0; 5; 10; and 15 tons ha^{-1}. The second factor, compost dosage consisted of 2 levels: 0 tons ha^{-1} and 20 tons ha^{-1}. The highest dry corn seed per ha was obtained from the treatment of 10 tons ha^{-1} biochar which was 9.21 tons which increased 35.56% compared to dry corn seeds per ha which were obtained from the treatment without biochar which was 6.79 tons. The treatment of compost doses of 20 tons ha^{-1} gave the highest value of dry corn seeds per ha, which was 8.73 tons, an increase of 16.58% compared to the lowest yield, which was 7.49 tons in the treatment without compost. The interaction between the treatment of biochar and compost dosages had no significant effect on all observed variables, except for organic C, available P, available K, and very significant CEC effect.

1. Introduction

Corn (*Zea mays* L.) is a food that is very important for humans and livestock. Distribution of corn cultivation continues to expand in various countries in the world as well as in Indonesia because these plants have extensive adaptability in the tropics [1]. Dryland is used for farming activities with limited water use, which usually comes from rainwater. Physically dry land is not irrigated or does not get irrigation water so the main source of water is rainfall and a small portion comes from groundwater [2].

The use of fertilizers in the world continues to increase in accordance with the increase in the agricultural area, population growth, increase in the level of intensification and the increasingly diverse use of fertilizers as an effort to increase agricultural yields. Organic fertilizers are environmentally friendly fertilizers, have long-term effects that are good for soil fertility, and produce agricultural products that are safe for health. Giving organic fertilizer can quickly overcome nutrient deficiency, has no problem in nutrient washing and is able to provide nutrients quickly. The organic fertilizers have many advantages when compared to inorganic fertilizers, namely fertilizers that have more complete nutrients, both macronutrients and micronutrients and organic fertilizers contain organic acids [3].

Compost is a type of organic fertilizer that comes from agricultural waste, municipal waste, industrial waste which has a major contribution to improving the physical, chemical and biological

properties of the soil. This is because compost contains a lot of organic material. Organic matter is an important ingredient in fertilizing soil because it functions to stabilize soil aggregates. In addition, organic matter has a number of latent energies as heating plant residues above the soil surface, i.e. 4-5 kilos cal g^{-1} of dry matter [4].

Biochar bamboo has a very micro-porous structure, with adsorption efficiency around ten times higher than traditional wood biochar [5]. Biochar has higher stability characteristics for decomposition and is able to absorb ions well than other organic materials, due to its larger surface area, negative surface and density [6]. The effect of biochar as soil enhancers on plant productivity is highly dependent on the dose used. The results of the research in the field showed that the utilization of bamboo waste biochar with a dose of 10 tons ha^{-1} gave a significant influence on plant height and total wet weight of corn plants [7]. Furthermore, the results of research on biochar and compost showed that the giving of 10 tons of ha^{-1} biochar and 20 tons ha^{-1} cow manure compost could increase the growth and yield of bisi-2 hybrid maize plants [8-11].

Based on this, it is necessary to conduct research to increase the productivity of maize plants as well as to develop the utilization of biochar and compost widely, with various experiments on biochar dose levels in corn plants. This study aims to determine the effect of biochar and compost and their interactions on changes in the physical and chemical properties of soil and maize crops on dry land.

2. Materials and methods

The materials used in this study were corn seeds, compost cow manure, biochar, and pesticides, while the tools used were hand tractors, hoes, shovels, scratches, machetes, meters, raffia ropes, and stationery.

This experiment used a randomized block design with factorial patterns. The treatment consisted of two factors: the dose of biochar (B) and compost (C). The first factor, the dose of biochar (B) consists of 4 levels, namely: 0 tons ha^{-1} (B0), 5 tons ha^{-1} (B1), 10 tons ha^{-1} (B2), 15 tons ha^{-1} (B3). The second factor, the dosage of compost (C), consisted of 2 levels: 0 tons ha^{-1} (C0) and 20 tons ha^{-1} (C1). Thus there were 8 combination treatments and each treatment was repeated 3 times, so there were 24 trial plots.

The variables observed were the physical properties of soil, soil chemistry, growth, and yield of corn plants, which included moisture content, weight volume, porosity, pH, organic C, N-total, available P, K-available, CEC, plant height, the yield of dry corn seeds per ha.

3. Results

Significance of the effect of the treatment of doses of biochar (B) and compost (C) and interaction (BxC) on the observed variables is presented in Table 1. Based on Table 1, the dose treatment of biochar (B) had a significant effect ($P<0.05$) to very significant ($P<0.01$) in all observed variables except bulk density, porosity, N, and P had no significant effect ($P> 0.05$). The treatment of compost doses (C) had no significant effect ($P> 0.05$) on all variables variables observed except for P-available and K-available, plant height, and the yield of dry corn seeds per ha, which had a very significant effect ($P<0.01$). The interaction between biochar and compost (BxC) dosage treatments had no significant effect ($P>0.05$) on all observed variables, except for organic C, P-available, K-available, and CEC, which had very significant effect ($P < 0.01$). The average of all variables was observed because the effect of biochar doses from bamboo and compost can be seen in Table 2.

Table 1. The significance of the effects of biochar and compost and their interactions on all observed variables.

No	Variable	Treatment		
		Biochar (B)	Compost (C)	Interaction (B x C)
1.	Water content (%)	*	ns	ns
2.	Bulk density (g m^{-3})	ns	ns	ns
3.	Porosity (%)	ns	ns	ns
4.	pH	**	ns	ns
5.	C-organic (%)	**	ns	**
6.	N-total (%)	ns	ns	ns
7.	P-available (ppm)	ns	**	**
8.	K-available (ppm)	**	**	**
9.	CEC (me/100g)	**	ns	**
10	Plant height (cm)	**	**	ns
11	The yield of dry corn seeds per ha (ton)	**	**	ns

* = significant effect, ** = very significant effect, ns = not significant effect

Table 2. The average of all variables observed due to the effect of doses of biochar from bamboo and compost.

Treatment	Bamboo Biochar (B)				Compost (C)	
	B0 (0 ton ha^{-1})	B1 (5 ton ha^{-1})	B2 (10 ton ha^{-1})	B3 (15 ton ha^{-1})	C0 (0 ton ha^{-1})	C1 (20 ton ha^{-1})
Water content (%)	7.71 b	9.03 ab	9.46 a	10.00 a	8.62 a	9.48 a
Bulk density (g m-3)	0.96 a	0.91 ab	0.90 ab	0.87 b	0.92 a	0.90 a
Porosity (%)	63.95 b	65.53 ab	66.19 ab	67.08 a	65.28 a	66.09 a
pH	6.63 ab	6.74 a	6.71 a	6.55 b	6.65 a	6.66 a
C-Organic (%)	4.01 a	3.83 a	3.82 a	3.39 b	3.69 a	3.83 a
N-total (%)	0.16 a	0.16 a	0.17 a	0.18 a	0.17 a	0.16 a
P-available (ppm)	35.52 b	37.65 b	46.89 a	39.45 ab	31.77 b	47.98 a
K-available (ppm)	592.18 d	836.24 c	978.88 b	1036.44 b	772.19 b	949.67 a
CEC (me/100g)	18.70 ab	16.84 b	12.16 c	19.71 a	16.62 a	17.09 a
Plant height (cm)	275.98 b	279.33 b	302.72 a	301.58 a	281.01 b	298.80 a
The weight of corn dried seeds per ha (ton)	6.79 b	7.66 b	9.21 a	8.79 a	7.49 b	8.73 a

Description: The average value followed by the same letter in the same treatment and row, means that it is not significantly different from the LSD 5% test level

4. Discussion

The results of this study indicate that the highest yield of dry corn seeds per ha was obtained from the treatment of 10 tons ha^{-1} biochar dose of 9.21 tons which increased by 35.56% compared to without biochar which was 6.79 tons.

The high yield of dried corn seeds per ha in the treatment of 10 tons of ha^{-1} biochar is caused by changes in the physical and chemical properties of biochar in the soil which can improve soil properties and yields of corn plants. The nature of biochar which has a porous structure with a larger surface area causes the soil to have the ability to retain nutrients and water in the soil. This is in line with the results of the pre-experimental soil analysis which when compared with the results of the analysis after treatment, showed a change in the improvement of soil physical properties and soil chemistry for the better (Table 2).

Biochar is very important to improve the ability of soil to store carbon, increase soil fertility, and maintain the balance of soil ecosystems, increase plant growth and yield by providing and maintaining nutrients [12,13].

The treatment of compost doses of 20 tons ha^{-1} gives the highest value of dry corn seed yield per ha, which is 8.73 tons, increasing by 16.58% compared to without compost, which is 7.49 tons. The high yield of dry corn seeds per ha is thought to be due to the nature of compost which can improve the physical and chemical properties of soil, this condition can be seen from the decrease in soil volume weight or soil compaction, increased soil porosity, soil water content, pH, organic C, P-available, K-available, and land CEC when compared to without compost treatment (Table 2). The compost can improve soil structure, improve porosity, enhance soil binding capacity to nutrients and water, help the weathering process of mineral materials, and increase the activity of microorganisms in the soil [14].

The weight of corn dried seeds at the treatment dose of biochar on changes in physical and chemical properties of soil and yields of maize on dry land was supported by a real correlation in the observed variables such as soil moisture content (r = 0.89**), weight of soil volume (r = -0.89**), porosity (r = 0.89**), organic C (r = -0.63*), N-total (r = 0.62*), P-available (r = 0.87**), K-available (r = 0.94**).

The results of the regression analysis of biochar doses with dry corn seed weight showed a quadratic relationship with the regression line equation: $Y = 6.659 + 0.3444X – 0.0129X^2$ with a coefficient of determination (R^2) of 57.30% (Figure 1). From the results of the regression analysis, the optimum dose was 13.35 tons ha^{-1}, with dry corn seed weight per hectare maximum of 8.96 tons. Based on the results of the regression analysis showed that the higher the increasing dose of biochar to optimum, then decreased when it exceeds the optimum dose. The results showed that the treatment of compost doses of 20 tons ha-1 (C1) gave the highest value of dry corn seed weight of 8.73 tons, increased by 16.58% compared to the lowest yield of 7.49 tons in the treatment without doses of compost fertilizer 0 tons ha^{-1} (C0).

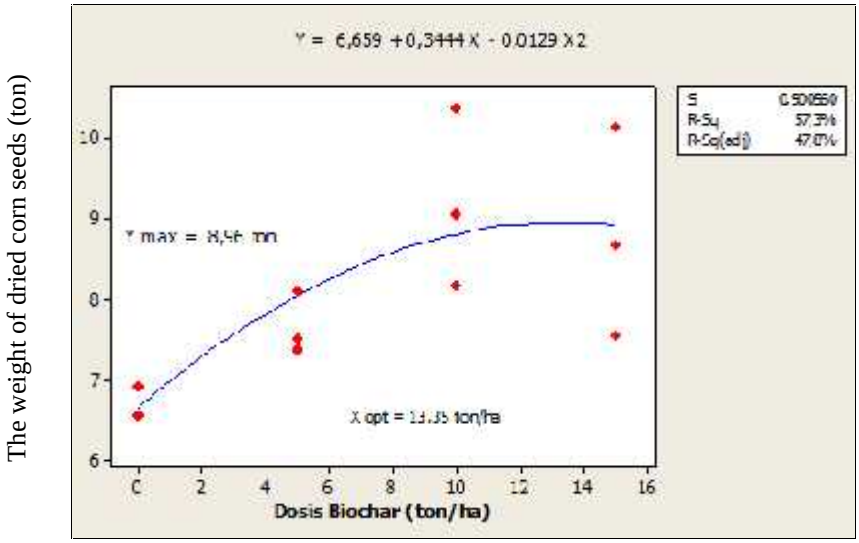

Figure 1. Relationship between the dose of biochar and the weight of dried corn seeds.

5. Conclusion

The interaction of doses of biochar and compost had no significant effect on all observed variables, except for organic C, available P, available K, and CEC having a very significant effect. The treatment of biochar doses had a significant effect on all variables observed except the weight of soil volume, porosity, N, and P had no significant effect. The treatment of compost doses has no significant effect on soil properties variables observed except for total N-and P-available soils which are very real, whereas compost doses have a significant effect on all plant variables observed.

The highest dry corn seed weight per ha was obtained from the treatment of 10 tons ha^{-1} biochar which was 9.21 tons which increased by 35.56% compared to the lowest dry corn seed weight per ha obtained from the treatment without biochar which was 6.79 tons.

The treatment of compost doses of 20 tons ha^{-1} gives the highest value of dry corn seed weight per ha, which is 8.73 tons, increasing by 16.58% compared to the lowest yield of dry corn seed per ha, which is 7.49 tons in the treatment without compost. The results of the regression analysis showed that the optimum dose was 13.35 tons ha^{-1}, with the weight of dry corn seeds per ha of maximum of 8.96 tons.

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