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6th International Conference Sustainable Agriculture, Food, and Energy (SAFE2018). October 19-21, 2018 I'M Hotel, Makati. MANILA, PHILIPPINES

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Abstract

Preface

We are proud to inform you that the International Conference on Sustainable Agriculture, Food, and Energy (SAFE2018): Inclusive Agri-food Energy Production for Community Empowerment in a Changing Climate" was successfully conducted by SAFE-Network from October 19-21, 2018 in MANILA, Philippine. The host institution was Pampanga State Agricultural University (PSAU), Philippines Centre for Postharvest and Mechanization (PhilMech), and Central Bicol State University of Agriculture (CBSUA), Philippines This conference was the 6th conference after the 1st International Conference on Sustainable Agriculture, Food, and Energy (SAFE2013) in Padang, Indonesia (12-14 May 2014), the 2nd conference SAFE2014 in Bali, Indonesia (17-19 September

2014). The 3rd conference SAFE2015 in Ho Chi Minh City, VIETNAM (17-19 November 2015), The 4th conference SAFE2016, Colombo, Sri Lanka (October 20-22, 2016), and the 5th conference SAFE2017, Malaysia, August 22-24, 2017.

The objectives of the conference were:

1. To provide a forum for international researchers community to exchange and share the experiences, new ideas, sustainability concepts and research results on sustainable agriculture, food, and energy.

2. To promote collaboration in research on sustainable agriculture, foods, and energy production.

To establish a regional networking among participants on sustainable agriculture, food, and energy.

3. To increase awareness of the importance of living and working in the manner that enhances the economic, environmental and social well-being of our community through research, education, regional partnerships, and community engagement.

The committee accepted 150 papers of over 300 papers which were presented in SAFE2019 conference.

On behalf of SAFE-Network, we would like to convey our appreciation and thanks very much to the Pampanga State Agricultural University (PSAU), Central Bicol State University of Agriculture (CBSUA), and Philippines Centre for Postharvest and Mechanization (PhilMech) for co-hosting this conference.

We would like especially to thank Prof. Dr.Tafdil Husni, Rector of Andalas University for his strong support to this event, Dr. Norman de Jesus, local conference coordinator and the members of the local organizing committee who helped with all the preparations required to make the conference a success, as well as the session organizers who worked to ensure a high level of science presented at the meeting. Moreover, of course, we thank all honourable speakers and participants who have agreed to attend and discuss your work! Finally, please understand that while every effort was made to publish this proceeding, we know that unavoidable withdrawals and other changes will occur.

Looking forward to welcoming you to the SAFE2019 conference in Phuket, THAILAND!

Prof. Dr. Novizar Nazir

SAFE-Network Executive Chairman

SAFE NETWORK
Asia Pacific Network for Sustainable Agriculture Food and Energy

BECOMING BIGGER TOGETHER

Date : 18th SEPTEMBER 2018
Ref. No. : 510/SAFE-Network/SAFE2018/2018

Dr. Ir. Yohanes Parlindungan Situmeang
Universitas Warmadewa
E-mail: ypsitumeang63@gmail.com
INDONESIA

INVITATION TO PARTICIPATE IN THE CONFERENCE AND NETWORKING DISCUSSION

Dear Dr. Situmeang,

We are proud to inform you that the **International Conference on Sustainable Agriculture, Food, and Energy (SAFE2018): "Inclusive Agri-food Energy Production for Community Empowerment in a Changing Climate" (http://safe2018.safetainability.org)** which will be held from October 19-20, 2018 in MANILA, Philippines. The conference is an annual conference run by SAFE-Network, an Asia Pacific network for sustainable agriculture, food and sustainable. This organization member consists mainly of lecturers at universities and researchers at research institutes **(http://safe-network.org).**

The host institution are Pampanga State Agricultural University (PSAU), Philippines Centre for Postharvest and Mechanization (PhilMech), and Central Bicol State University of Agriculture (CBSUA), Philippines. This conference is the sixth conference after the 1st International Conference on Sustainable Agriculture, Food, and Energy (SAFE2013) in Padang, INDONESIA (12-14 May 2013) and the 2nd SAFE2014 in Bali, INDONESIA (17-19 September 2014), 3rd SAFE2015 in Nong Lam University HCMC, VIETNAM (17-20 November 2015), 4th SAFE2016 in Colombo, SRI LANKA and 5th Conference in Shah Alam, Malaysia August 22-24, 2017.

The objectives of the conference are:

1. To provide a forum for international researchers community to exchange and share the experiences, new ideas, sustainability concepts and research results on sustainable agriculture, food and energy..
2. To promote collaboration in research on sustainable agriculture, foods and energy production.
3. To establish a regional networking among participants on sustainable agriculture, food and energy.
4. To increase awareness of the importance of living and working in manner that enhances the economic, environmental and social well being of our community through research, education, regional partnerships and community engagement.

We would like to invite you to participate in the Conference and join the Networking Discussion. We will discuss the programs, cooperation and join action of SAFE-Network in Networking discussion.

Some important points to note are listed below for your reference.

Program	Date
Pre-Conference Tour	October 19, 2018
Conference & Networking Discussion	October 20, 2018

Thank you very much for your kind cooperation. SAFE-Network will provide your accommodation during your participation in SAFE2018. Looking forward to welcoming you in Makati!

Regards,

Dr. Paul Kristiansen
Head of Advisory Board

Dr.Novizar Nazir
SAFE-Network Coordinator

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IOP Conf. Series: Earth and Environmental Science **347** (2019) 011002 doi:10.1088/1755-1315/347/1/011002

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Peer review statement

All papers published in this volume of *IOP Conference Series: Earth and Environmental Science* 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.

Table of contents

Volume 347

2019

Previous issue Next issue

6th International Conference on Sustainable Agriculture, Food and Energy 18–21 October 2018, Manila, The Philippines

Accepted papers received: 11 September 2019
Published online: 11 November 2019

Open all abstracts

Preface

OPEN ACCESS 011001
6th International Conference Sustainable Agriculture, Food, and Energy (SAFE2018). October 19-21, 2018 I'M Hotel, Makati. MANILA, PHILIPPINES
+ Open abstract View article PDF

OPEN ACCESS 011002
LIST OF COMMITTEE
+ Open abstract View article PDF

OPEN ACCESS 011003
Peer review statement
+ Open abstract View article PDF

Papers

Innovation on Sustainability related to Agriculture, Food, and Energy

OPEN ACCESS 012001
The Growth of Native Yeasts on Mozzarella Cheese Whey with the Resistance towards High Glucose and Ethanol Contents

Antibiotic potency of *Straptomyces drozdowiczii* on white Rattus norvegicus which is infected with *Acinobacter baumanii*

R Kawuri, I B G Darmayasa and C Gading

+ Open abstract View article PDF

OPEN ACCESS 012053

Antimicrobial activity of lactic acid bacteria isolated from fermented durian flesh (tempoyak) against pathogenic and spoilage bacteria during storage

A Nizori, A Sukendra and Surhaini Mursyid

+ Open abstract View article PDF

OPEN ACCESS 012054

Bioactive compound of Streptomyces capoamus as biocontrol of Bacterial Wilt Disease on Banana Plant

R Kawuri and I B G Darmayasa

+ Open abstract View article PDF

OPEN ACCESS 012055

Application of coconut biochar and organic materials to improve soil environmental

Susila Herlambang, AZ.Purwono Budi S, Heru Tri Sutiono and Susanti Rina N

+ Open abstract View article PDF

OPEN ACCESS 012056

Effects of *Bacillus thuringiensis-based* bio-insecticides on the presence of *Aphis gossypii* and Coccinellid predators on intercropping cultivation

Yulia Pujiastuti, Irmawati, Arsi Arsi and Dwi Probowati Sulistiyani

+ Open abstract View article PDF

OPEN ACCESS 012057

The application of biochar in improving the nutrition quality and production of sorghum plant

Ni Made Yudiastari, Ni Ketut Etty Suwitari, Luh Suariani and Yohanes Parlindungan Situmeang

+ Open abstract View article PDF

OPEN ACCESS 012058

Antifungal activity of leaf extract of Mansoa alliacea against Colletotrichum acutatum the cause of anthracnose disease on chili pepper

Sang Ketut Sudirga, I Ketut Ginantra and Ida Bagus Gede Darmayasa

+ Open abstract View article PDF

OPEN ACCESS 012059

Analysis of Fibre Fraction of Palm Oil Frond Fermented with Different Microbes and Soluble Carbohydrates Addition as Ruminant Feeding

+ Open abstract View article PDF

OPEN ACCESS 012075

Phytochemical content, extract standardization and antioxidant activity of *Calliandra calothyrsus* Meissn leaf, a potential phytoestrogen source

I Setyawati, Npad Wijayanti and NI Wiratmini

+ Open abstract View article PDF

OPEN ACCESS 012076

Potential Tempe Product of Universitas Sumatra Utara in Supporting Food Security in North of Sumatera, Indonesia

Ameilia Zuliyanti Siregar, Tulus and Liana Dwi Sri Hastuti

+ Open abstract View article PDF

OPEN ACCESS 012077

Synergistic effectivity of Mansoa alliacea and *Allamanda cathartica* leaf extracts controlling stem rot disease in peanut plant (*Arachis hypogaea*) at the greenhouse

N M S Parwanayoni, D N Suprapta and K Khalimi

+ Open abstract View article PDF

OPEN ACCESS 012078

Agronomic effectiveness of biochar and fertilizer type in increasing the results of sweet corn

Yohanes Parlindungan Situmeang, Ida Bagus Komang Mahardika and Anak Agung Sagung Putri Risa Andriani

+ Open abstract View article PDF

OPEN ACCESS 012079

Development of Partial Least Square (PLS) Prediction Model to Measure the Ripeness of Oil Palm Fresh Fruit Bunch (FFB) by Using NIR Spectroscopy

Zaqlul Iqbal, Sam Herodian and Slamet Widodo

+ Open abstract View article PDF

OPEN ACCESS 012080

Consumer Acceptance of Spicy Fried Dry Potato and Shrimp Sambal for Condiments Instant Uduk Rice

Dwi Kristiastuti Suwardiah and Febriani Lukitasari

+ Open abstract View article PDF

OPEN ACCESS 012081

Analysis of consumer acceptance on instant uduk rice reviewed from variant taste

Niken Purwidiani, Dwi Kristiastuti Suwardiah and Yuyun Irawati

+ Open abstract View article PDF

Agronomic effectiveness of biochar and fertilizer type in increasing the results of sweet corn

IOP Conf. Series: Earth and Environmental Science **347** (2019) 012078 doi:10.1088/1755-1315/347/1/012078

Agronomic effectiveness of biochar and fertilizer type in increasing the results of sweet corn

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Abstract. This study aims to examine the effectiveness of biochar from bamboo and coconut shell combined with compost and NPK fertilizer on the growth and yield of sweet corn. In this study, we used a randomized block design with factorial patterns consisting of two factors and 3 replications. The first factor is the treatment of biochar types (3 types), namely: without biochar, bamboo biochar, and coconut shell biochar. The second factor is the treatment of fertilizer types (4 types), namely: without fertilizer, compost, NPK, and compost+NPK. The results showed that the interaction of bamboo biochar with compost+NPK significantly increased the total fresh weight of the highest plant 297.97 g when compared to without biochar, compost, and NPK 184.63 g or increased by 61.38% with an agronomic effectiveness of 132.10%. Likewise, the coconut shell biochar interaction with compost+NPK significantly increased the highest total fresh weight of 295.83 g when compared to the lowest yield without biochar, compost and NPK 184.63 g with an increase of 60.23% and agronomic effectiveness of 103.76 %. The application of compost+NPK fertilizer treatment significantly gives the highest fresh weight of cob without husk 79.26 g increased by 51.54% when compared with the lowest yield on 52.30 g fertilizer without fertilizer. From the results of this study, biochar from bamboo and biochar from coconut shell combined with compost+NPK can be used to improve the yield of sweet corn.

Introduction

Sweet corn (*Zea mays saccharata* Sturt.) has an important role in fulfilling food for some Indonesian people. Sweet corn plants can adapt to extreme temperatures, are easy to cultivate, and can be harvested in a short time, so that this plant has the potential to be developed, especially on dry land. To achieve the maximum yield of sweet corn on dry land, balanced fertilization can be done using biochar, compost, and NPK fertilizer.

Biochar is made with pyrolysis technology, namely by incomplete combustion of biomass or agricultural waste in anaerobic conditions that produce stable biological charcoal. Biochar is difficult to decompose in the soil so that a single application of biochar can provide beneficial effects for several growing seasons on the land. Biochar can maintain a long balance of carbon and nitrogen in the soil, adding biochar soil enhancers can also increase P and N absorption, and increase CEC and soil pH [1]. The using of biochar to agricultural land can improve carbon content in the soil, water and nutrient retention ability in the soil, and increase soil quality [2]. Biochar can increase nutrient availability of N, P, K, and cation exchange capacity (CEC) in the soil, as well as yields, and can reduce the risk of leaching nutrients in the soil, especially nutrients N and K [3].

The effectiveness of biochar in improving soil quality is highly dependent on the chemical and

physical properties of biochar which are determined by the type of raw material and the method of carbonization, and form [4]. Biochar is more effective at holding nutrients to their availability for plants than other organic materials. Biochar has many pores because of its large surface area so that it has a high water holding capacity. Biochar from bamboo has a very micropore structure with a wide surface, which causes the adsorption efficiency of bamboo biochar to reach 10 times greater than that of wood biochar [5].

Compost is an organic fertilizer derived from agricultural waste which has undergone weathering processes and has a large contribution to increasing soil fertility. Biochar can be added to the composting process, which functions as a bulking agent that increases the humification process and the final quality of compost in producing humic acid and fulvic acid. Biochar is also useful as an important ingredient in the compost to help absorb nutrients and form humus and accelerate many processes that occur on the ground. Biochar can be decomposed by microbes at least ten times longer in most soils. Biochar has an important role when added to compost, making compost richer in nutrients, more biologically diverse, more moist, and stable [6].

The results of the study [7], the application of 15 tons ha^{-1} of coconut shell biochar gave a positive response to the yield of corn crops, obtained corn seed yield in the three cycles of the growing season reached 5.54 tons ha^{-1}. The application of 10 tons ha^{-1} of bamboo biochar has a significant effect on the growth and yield of corn plants [8]. The results [9,10, 11], the application of bamboo biochar (10 tons ha^{-1}), Compost from cow dung (20 tons ha^{-1}), and NPK phonska fertilizer (300 kg ha^{-1}) could increase growth and corn yield on dry land. Based on the description above, a research is conducted that aims to obtain the agronomic effectiveness of various types of biochar and fertilizer types and their interactions in increasing the growth and yield of sweet corn crops.

2. Materials and Methods

This research was carried out at the Experimental Station of the Agriculture Faculty, Warmadewa University, Denpasar, Bali.Soil analysis was carried out in the Land Laboratory of the Faculty of Agriculture, Udayana University, Denpasar, Bali. This research has been going on from March to July 2018. The materials used are sweet corn seeds, compost from cow manure, biochar from coconut shell waste, and biochar from bamboo waste, and pearl NPK fertilizer **(**16 % N, 16 % P_2O_5, 16% K_2O).

This study used a Randomized Block Design (RBD) factorial pattern. The first factor is the type of biochar treatment (3 types), namely: Bo (control / without biochar),Bb (Biochar bamboo), Bs (Biochar coconut shell). The second factor is the treatment of various types of fertilizers (F) consisting of 4 levels, namely: Fo (without fertilizer), Fc (compost), Fn (NPK fertilizer), and Fcn (compost+NPK). Of the two factors above obtained 12 treatment combinations. This treatment combination was repeated 3 times to obtain 36 experimental pots. Variables observed in pots (per plant) in this study include plant height of 49 days after planting, number of leaves 49 days after planting, fresh weight of plant roots, the total fresh weight of plants, oven dry weight total plants, fresh weight of corn without cob skin, and dry weight of seeds.

The Relative Agronomic Effectiveness Analysis (RAE) was carried out to obtain a percentage value from achieving an increase in the yield of bamboo biochar compared to the increase in the yield of standard fertilizers. Variance analysis was used to test the effect of various types of biochar on fertilizer types on the observed variables. Furthermore, if the results of the analysis of variance are obtained real results, then proceed with the Least Significant Difference test and Duncan's test level 5%.

3. Results

3.1 Soil characteristics, compost, biochar bamboo, and biochar coconut shell

The results of the laboratory analysis of soil characteristics before research, compost, and biochar made from bamboo and coconut shell as shown in Table 1.

Table 1. Results Soil analysis, compost, bamboo biochar*[9], and coconut shell biochar

Type of Analysis	Soil Research	Compost	Biochar* Bamboo	Biochar Coconut Shell
pH H_20	6.90 (N)	7.11 (N)	7.48 (N)	7.40 (N)
C-organic (%)	0.39 (VL)	11.32 (VH)	3.08 (M)	8.51 (VH)
N-total (%)	0.06 (VL)	0.78 (VH)	0.06 (VL)	0.05 (VL)
C/N ratio	6.50	14.51	51.33	170.20
P-available (ppm)	75.59 (VH)	5300 (VH)	451.78 (VH)	251.99 (VH)
K-available (ppm)	1086.75 (VH)	8900 (VH)	36.07 (VL)	4258.68 (VH)
Water content:				
Dry Air (%)	17.41	27.19	5.48	9.19
Field Capacity (%)	44.70	-	-	-
Tekstur	(Loam)			
Sand (%)	39.77			
Dust (%)	47.51			
Clay (%)	12.72			

Description: N= Neutral, VL=Very Low, M=Moderato, VH=Very High

Nutrients needed for growth and development of sweet corn plants are strongly influenced by nutrient availability or soil nutrient status. The results of the soil characteristics analysis at the study site (Table 1) showed that organic C and total N were very low, while P and K were available at very high status. With such nutrient status, the land where the research was conducted was unable to provide enough C and N nutrients for corn plants to grow properly, therefore it needed the addition of organic matter or soil enhancers such as compost and biochar and inorganic materials such as pearl NPK fertilizer to improve soil fertility. From such soil conditions after research shows that the administration of biochar, compost and NPK (Table 1) can significantly and effectively improve the growth and yield of sweet corn compared to no treatment (Tables 2, 3, 4, 5, 6).

3.2 Significance of the influence of biochar type and fertilizer type on all observed variables.
The importance of the effects of various types of biochar (B) and fertilizer (F) and their interactions (BxF) as in Table 2.

Table 2. The significance of the effects of various types of biochar (B), type of fertilizer (F), and their interaction (BxF) on all variables observed.

	Variable	Treatment		
		Biochar Type (B)	Fertilizer Type (F)	Interaction (BxF)
1	The height of the corn plant (cm)	ns	**	ns
2	Number of plant leaves (strands)	ns	**	ns
3	Fresh weight of plant roots (g)	**	ns	ns
4	The total fresh weight of plants (g)	**	**	**
5	The total dry weight of plants (g)	*	**	ns
6	Fresh weight of cob without husk (g)	ns	**	ns
7	Harvested dry seed weight (g)	ns	**	ns

ns (no significant), * (significant), ** (very significant)

Table 2 shows that (1) the interaction the type of biochar and the type of fertilizer (BxF) does not have a real effect ($P \geq 0.05$) for all variables observed, except for total fresh weight of plants, (2) significant ($P \geq 0.05$) in most plants except for fresh root weight, total weight of fresh plants, and total weight of dry oven plants, (3) treatment of fertilizer types had a very real effect for all variables of plant observed, except for fresh weight from the root.

3.3 The height of the corn plant

The interaction between biochar and fertilizer (BxF) and biochar (B) treatment did not have a real effect ($P \geq 0.05$) on plant height (Table 2), but the application of various types of fertilizer (F), was very significant ($P < 0.01$) effect on the height of corn plants. Bamboo biochar (Bb) application gives a maximum plant height of 110.70 cm, which is not significantly different from the treatment biochar of coconut shell (Bs) and without biochar (Bo). The treatment of compost + NPK (Fcn) gives maximum plant height as high as 117.13 cm, which is real increased 16.08% compared treatment without fertilizer (Fo), which has a height of 100.91 cm (Table 3).

Table 3. The average plant height, number of leaves, and fresh weight of roots of sweet corn plants on biochar dose treatment and type of fertilizer

Treatment	Plant Height (cm)	Number of leaves (strands)	Fresh root weight (g)
Biochar Type (B):			
Without Biochar (Bo)	104.26 a	8.00 a	32.69 b
Biochar Bamboo (Bb)	110.70 a	8.50 a	33.33 b
Biochar Coconut Shell (Bs)	110.59 a	8.58 a	35.01 a
LSD 5%	-	-	1.81
Fertilizer Type (F):			
Without Fertilizer (Fo)	100.91 b	7.56 b	32.61 a
Compost Fertilizer (Fc)	105.53 b	8.22 b	33.49 a
NPK Fertilizer (Fn)	110.49 ab	8.67 ab	34.18 a
Compost+NPK Fertilizer (Fcn)	117.13 a	9.00 a	34.43 a
LSD 5%	11.89	1.03	-

3.4 Number of leaves

The biochar of coconut shell application (Bs) gives the maximum number of leaves is 8.58 strands (Table 3) which are not significantly different from the treatment of bamboo biochar (Bb) and without biochar (Bo) with 8.50 leaves and 8.00 strands. The treatment of the type of compost + NPK (Fcn) gave the highest value of leaves of 9.00 strands the real increase was 19.12% compared to treatment without fertilizer (Fo) with a leaf number of 7.56 strands.

3.5 Fresh weight of root

The highest weight of root fresh (Table 3) was obtained in coconut shell biochar (Bs) which was 35.01 g which differed significantly from bamboo biochar (Bb) and without biochar (Bo) treatment with fresh root weight 33.33 g and 32.69 g. In the treatment of compost + NPK (Fcn), the highest fresh root weight was obtained 34.43 g, which was not a real difference when compared to NPK (Fn), compost (Fc), and without fertilizer (Fo) treatment with fresh root weights of 34.18 g , 33.49 g, and 32.61 g.

3.6 Total fresh weight of corn plant

The total fresh weight highest (Table 4) was obtained from the interaction between bamboo biochar and compost + NPK (BbFcn) 297.97 g the real increase was 61.38% compared to the interaction without the application of biochar and fertilizer (BoFo) with the total weight of fresh plants 184.63 g. Likewise in

the interaction between coconut shell biochar and compost + NPK (BsFcn), the highest value of the total fresh weight was 295.83 g (an increase of 60.23%) if compared to the interaction without biochar and fertilizer (BoFo) with a total fresh weight of 184.63 g.

Table 4. Effect of interaction of various types of biochar and types of fertilizers on the total fresh weight of corn plants

Treatment	Fo	Fc	Fn	Fcn
Bo	184.63 i	235.87 of	253.80 def	262.67 cd
Bb	191.77 hi	227.10 fg	262.60 cd	297.97 a
Bs	214.87 gh	259.53 cde	286.00 abc	295.83 ab

The numbers followed by the same letters in the same column show no significant difference in the 5% level of the Duncan test.

3.7 Total dry weight of corn plants

The application of coconut shell biochar (Bs) gives the highest of a total dry weight of corn plants 46.68 g, which is significantly increased 10.69% compared to treatment without biochar (Bo) 42.17 g. The application of compost + NPK (Fcn) gave the highest total oven dry weight of corn plants 52.97 g which significantly increased 56.30% when compared without fertilizer (Fo) with a total oven dry weight of 33.89 g (Table 5).

3.8 Fresh weight of corn cob without husk

Biochar application of bamboo (Bb) obtained the fresh weight of cob without husk that is 68.87 which is not really different from coconut shells biochar treatment (Bs) or without biochar (Bo). The application of compost + NPK (FCN) gave a fresh weight of corn cob without husk of 79.26 g (increased 51.54%) compared to the treatment without fertilizer (Fo) (Table 5).

3.9 Weight of seeds dry harvest

The results of statistical tests of the weight of dried seeds harvested showed that the interaction between biochar and fertilizer (BxF) and the treatment of single biochar (B) did not have a significant effect, while fertilizer application (F) is very real effect to a weight of dried seeds harvested (Table 2). In Table 5, we can see the average weight of dried seeds harvested in the treatment of biochar types and types of fertilizers.

Table 5. Application effects of various types of biochar and types of fertilizers on the yield of corn plants

Treatment	Total dry weight oven plant (g)	Fresh weight of cob without husk (g)	Seed weight dry harvest (g)
Biochar Type (B):			
Without Biochar (Bo)	42.17 b	63.38 a	50.68 a
Biochar Bamboo (Bb)	41.58 b	68.87 a	52.04 a
Biochar Coconut Shell (Bs)	46.68 a	65.59 a	53.16 a
LSD 5%	5.51	-	-
Fertilizer Type (F):			
Without Fertilizer (Fo)	33.89 d	52.30 b	41.78 b
Compost Fertilizer (Fc)	39.96 c	62.10 b	49.02 b
NPK Fertilizer (Fn)	47.08 b	70.13 ab	57.07 ab
Compost+NPK Fertilizer (Fcn)	52.97 a	79.26 a	59.98 a
LSD 5%	6.36	18.01	11.41

The highest dry weight of seeds harvested (Table 5) obtained in bamboo biochar (Bb) 53.16 g was not really different from the application of coconut shell biochar (B) or without biochar (Bo) with dry seed weight 52.04 g and 50.68 g. The treatment of compost + NPK (Fcn) gave the highest dry weight of seeds harvested at 59.98 g which real increased by 43.58% when compared with no fertilizer with dry seed weight 41.78 g.

3.10 Relative agronomic effectiveness of the combination of biochar with compost and NPK

The results of the analysis of relative agronomic effectiveness (RAE) combination of biochar types with the type of fertilizer on all observed variables such as Table 6. The best average RAE values for all plant variables observed (103.76% -166.67%) were obtained in bamboo biochar and coconut shell biochar combined with compost+NPK (BbFcn and BsFcn) compared to other combination treatments. Bamboo biochar application combined with compost+NPK (BbFcn) on all observed plant variables gave the highest RAE value with a range of 106% -167%. Likewise, coconut shell biochar combined with compost+NPK (BsFcn) on all observed variables gave the highest RAE value with a range of 103.76% -166.67%.

Table 6. The average RAE percentage of all variables observed due to the influence of biochar combination with fertilizer type

Treatment	Relative Agronomic Effectiveness (RAE)						
	Plant Height	Number of leaves	Fresh root weight	Total dry weight oven plant	Total dry weight oven plant	Fresh weight of cob without husk	Seed weight dry harvest
	---------- % ----------						
BbFc	87.66	100.00	41.46	68.97	56.12	47.47	61.80
BbFn	86.77	100.00	61.40	102.41	80.94	82.29	133.77
BbFcn	110.25	166.67	124.44	136.10	105.69	120.05	151.87
BsFc	82.47	100.00	51.22	87.18	74.26	24.12	82.40
BsFn	91.29	133.33	85.96	102.84	112.87	104.83	126.44
BsFcn	122.32	166.67	140.00	103.76	120.11	110.91	156.61

4. Discussion

The interaction between bamboo biochar and compost+NPK (BbFcn) gave the highest total fresh weight of plants, namely 297.97 g (Table 4) which increased by 61.38% with RAE 136.10% (Table 6) if compared with the interaction without biochar and fertilizer (BoFo) 184.63 g. Likewise, the interaction between coconut shell biochar and compost+NPK (BsFcn) gave the highest total fresh weight of plants 295.83 g or an increase of 60.23% (Table 4) with RAE value of 103.76% (Table 6) when compared with interactions without biochar and fertilizer (BoFo) 184.63 g.

The high total fresh weight of plants was also supported by a positive, strong and very real correlation on all observed variables (Table 7), namely plant height (r = 0.91 **), number of leaves (r = 0.96 **), fresh weight of roots (r = 0.82 **), total oven dry weight of plants (r = 0.95 **), fresh weight of cob without cornhusk (r = 0.90 **), and dry weight of seed (r = 0.95 **). The strong and very real relationship between the total fresh weight of plants and all observed variables is in line with the yield of fresh cob without weight in the application of compost + NPK which gave the highest value of 79.26 g, increased 51.54% when compared with treatment without fertilizer 52.30 g.

RAE assessment or relative agronomic effectiveness of biochar made from bamboo and coconut shell combined with compost+NPK on all observed plant variables gave the best RAE value or agronomic effectiveness with a range of 103.76% -166.67%. The treatment combination from bamboo biochar, compost, and NPK phonska provides the highest RAE of 113.99% which was classified as very effective [12], also produced very good soil quality with Soil Quality Rating (SQR) 18 on plants corn cultivation in the dryland [13].

Table 7. Correlation coefficient value (r) between plant variables due to the influence of interactions between biochar types and fertilizer types

	Plant Height	Number of leaves	Fresh root weight	Total fresh weight of plant	Total dry weight oven plant	Fresh weight of cob without husk
Number of leaves	0.96**					
Fresh root weight	0.75**	0.80**				
The total fresh weight of plants	0.91**	0.96**	0.82**			
Total dry weight oven plant	0.90**	0.91**	0.78**	0.95**		
Fresh weight of cob without husk	0.92**	0.93**	0.60**	0.90**	0.90**	
Seed weight dry harvest	0.89**	0.93**	0.68**	0.95**	0.95**	0.94**
r (0.05, 34, 1) = 0.329			r (0.01, 34, 1) = 0.424			

Increased percentage of RAE or very effective interactions between biochar made from bamboo and coconut shell with compost+NPK (BpFcn and BsFcn) on the total fresh weight of plants is due to the improvement of soil characteristics due to biochar application added with compost and NPK on plant growth media. The very low C-organic and N-total contents in the soil media used were able to respond well to compost and biochar which had very high C-organic content (Table 1) and NPK nutrients needed by corn plants. The high C-organic in biochar and compost has encouraged improvements in soil physical properties, increasing soil aggregation from micro aggregation to larger aggregates, more porous and loose, increase water and nutrient absorption in the soil, increase soil pH, nitrogen, phosphorus, potassium, cation exchange capacity, base saturation, and total soil microorganisms [14]. Furthermore [15, 16], This states that biochar can increase soil fertility such as aggregation, groundwater capacity, pH, CEC, and soil biological activity. The application of biochar can increase the ability of the soil to store carbon, increase soil fertility, maintain the balance of soil ecosystems, provide and maintain nutrients in the soil and increase crop yields [17, 18].

5. Conclusions

The application of various types of biochar does not have a significant effect on most plants except on fresh root weight, total plant weight, and oven dry weight total of corn plants. However, the application of fertilizers type has a very real effect on all variables except the root weight is not significant. While the interaction of biochar and fertilizer on the observed variables was not significant, except for the total fresh weight of plants.

The application of bamboo biochar with compost + NPK obtained the highest value of 297.97 g from the total fresh weight of the plant which increased 61.38% compared to the application without biochar and fertilizer (184.63 g). From the results of this study obtained the highest agronomic effectiveness on the total fresh weight of corn plants with RAE values of 136.10%.

Biochar application made from bamboo and coconut shell combined with compost + NPK on all plant variables observed gave the best RAE value with agronomic effectiveness 103.76% -166.67%. The interaction between coconut shell biochar and compost + NPK obtained the highest percentage increase of 60.23% from the total fresh weight of corn plants with an RAE value of 103.76%.

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