2013

PROCEEDINGS

International Seminar on Climate Change & Food Security

October 24th-25th, 2013
Palembang, South Sumatra

FACULTY OF AGRICULTURE
SRIWIJAYA UNIVERSITY

Proceedings of International Seminar on Climate Change & Food Security

Edited by:

Desi Aryani
Dwi Wulan Sari
Elly Rosana
Selly Oktarina

FACULTY OF AGRICULTURE
SRIWIJAYA UNIVERSITY
2013

Proceeding of 2013 International Seminar on Climate Change and Food Security

ISBN: 978-979-8389-19-1

Organizing Committees

Conference Chairs

Prof. Dr. Andy Mulyana, M.Sc.

Program Chairs

Dr. Andy Wijaya
Dr. Yunita
Dr. Yulia Pujiastuti
Dr. Edward Saleh
Dr. Lifianthi
Riswani, M.Si.
Dr. Dessy Adriani
Thirtawati, M.Si.
Henny Malini, M.Si.

Technical Committee

Prof. Fachrurrozie Sjarkowi
Dr. Sabaruddin
Dr. Kiki Yuliati
Dr. Mad Nasir Shamsudin
Dr. Negin Vaghefi
Dr. Olaf de Jongh
Dr. Perdinan
Dr. Rizaldi Boer

Faculty of Agriculture, Sriwijaya University
Address:
Jalan Palembang-Prabumulih, KM 32 Inderalaya (OI) 30662
Tel: (0711) 580069, 580225; Fax: (0711) 580276

Climate Change & Food Security

Selected peer reviewed papers from the
2013 International Seminar on Climate Change and Food Security
(ISCCFS 2013)
October 24-25, 2013, Palembang, Indonesia

FACULTY OF AGRICULTURE
SRIWIJAYA UNIVERSITY

WELCOME SPEECH
DEAN OF FACULTY OF AGRICULTURE, SRIWIJAYA UNIVERSITY

Assalamu'allaikum Wr. Wb.

Honorable Rector Sriwijaya University, represented by Vice rector 4, Dr. Muslim, South Sumatra government officers.
Honorable invited Speakers: Prof. Nasir Shamsudin, Dr. Negin Vaghevi, Dr. Perdinan, Dr. Olaf de Jongh.
Honorable committee of the conference led by Prof. Andy Mulyana.
Distinguished paper presenters, participants, Guests, Ladies and Gentlemen

Good Morning,
Praise to Allah, the Most Graciuos and the Most Merciful, which allow us to gather in this important activity.

It gives me great pleasure to speak to you this morning, to welcome you most at the afficial opening of the International Seminar on climate changeand food security with the theme of **Adapting Agriculture to Climate Change.** This seminar is organized by Faculty of Agriculture, Sriwijaya University in Management ini Southeast Asia Pacific (CCROM – SEAP) – IPB (Bogor Institute of Technology).This conference is part of many celebration activity of 50^{th} anniversary of Faculty og Agriculture, Sriwijaya University, the Faculty of Agriculture Sriwijaya University was established in 26^{th} September 1963.

Ladies and gentlemen,
Nowdays there are at least four hot topics that take more attention to everybody in the world. Those are: food, fuel or energy, water, and climate change. We can't escape from these problems. We have to find out solution how we deal with these challenges.

This conference is one of our efforts to do that by sharing our ideas, analysis, recommendations or proposals in order to ensure and sustain the food security fot the people today and the next generations.

Besides invite speakers, in this conference there will be 38 other papers on issues related to the topics that will be presented by the participants coming from sereval countries in two class sessions in the afternoon strating at 1.30 PM. On this occasion I would like to thank to the invite speakers, Prof. Mad Nasir Shamsudin, He is previous dean of Faculty of Agriculture, University Putra Malaysia, Dr. Negin Vaghefi, she come from Faculty of Agriculture

Mazandaran University Iran, Dr. Perdinan from Centre for Climate Risk and Opportunity Management in Southeast Asia Pacific (CCROM – SEAP) - Bogor Institute of Technology, Olaf de Jongh, Netherlands Senior Expert.

I want to express our thankfulness to CCROM – SEAP IPB for the collaboration and support to this seminar. Hopefully our mutual cooperation and relationship will be continued in the future. I would also like to thank the program chairs, staff of Faculty of Agriculture Sriwijaya University, and the member of the program committees for their hard work. We are grateful to all those who have contributed to the success of this conference.

Finally, I humbly request to Rector to deliver his speech and also open this conference. So, enjoy your time in this conference, we hope, you will find your time with us exciting.

Thank you very much.

Wassalamu'allaikum Wr. Wb.

OPENING SPEECH
RECTOR OF SRIWIJAYA UNIVERSITY

Good morning and Assalamu'allaikum Wr. Wb.

Honorable Governor of South Sumatera or the representative
Dean of Faculty of Agriculture, Sriwijaya University
Distinguished keynote speakers
Respected Guests
Dear participants, ladies and gentlemen

First of all, allow me on behalf of our rector to extend our warmest welcome to all of the participant in this International Seminar on Climate Change and Food Security (ISCCFS) 2013.

In this opportunity, I would like to express my profound gratitude especially to CCROM – SEAP – IPB for the excellent collaboration. Also dean of Agriculture, Sriwijaya University and the organizing committee of this Seminar, who are work hard to prepare and realize this big and prestige seminar. My thanks also go to all presenters for their valuable and meaningful contribution to this seminar.

Distinguish guest ladies and gentlemen,
Recently, the issue of Climate change and food security are still hot issue to be discussed. Issue on the climate change, global food, economic, and fuel crisis have become a major concern in sustaining wood food security. Food security is a complex sustainable development issues. Some approaches, strategies and policy implementation are important to guarantee and strengthen food security such as; maximizing and maintenance of water supply sustainable manner, agriculture innovation, management and maintenance of water supply systems, introducing improved varieties and cultural practices et cetera.

Climate change and agriculture are interrelated processes, both of which take place on a global scale. Climate change will after all four dimensions of food security: food availability, food accessibility, food utilization and food systems stability. It will also have an impact on human health, livelihood assets, food production and distribution channels, as well as changing purchasing power and market flows. Assessment of the effects of global climate changes on agriculture might help to properly anticipate and adapt farming to maximize agriculture production. At the same time, agriculture has been shown to produce significant effects on climate change, primarily through the production and release of greenhouse gases such as carbon dioxide, methane, and nitrous oxide.

We believe and feel confident that this seminar will stimulate a discussion and share the ideas of multi-disciplinary researchers, scientists, practitioners and policy makers will be a major contribution in the prevention and settlement of various problems due to climate change and food security.

Collaboration and mutualistic group works are needed to overcome the existing and potential problems related to climate change and food security. I hope this seminar could figure out some solution and applicable recommendations for sustaining our food security which insure some anticipating and adapting strategies to the climate change influences.

Distinguished guests, ladies and gentlemen
I wish you all an enjoyable time and success during this seminar. And we all wish a better life with clean, health, and save our environment and food security now and in the future.
I hope you enjoy the beauty of Palembang City as one of the oldest city in Indonesia which also have variety of interesting culture and places.

Finally, I declare this international seminar on climate change and food security in Palembang is officially opened.

May our God always guide and bless all of us, Aamiin.

Thank you very much,

Wassalamu’allaikum Wr. Wb.

PREFACE

Dear Readers,

The Organizing Committee would like to express our thank and appreciation to all invited speakers, paper presenters and guests for participating in the 2013 International Seminar on Climate Change and Food Security (ISCCFS 2013) held during October 24-25, 2013 in Palembang, Indonesia.

ISCCFS 2013 is sponsored by Faculty of Agriculture, Sriwijaya University, in accordance with the celebration of 50 years' birthday of the Faculty, in collaboration with Centre for Climate Risk and Opportunity Management in Southeast Asia Pasific (*CCROM* - SEAP)-IPB, Bogor. The theme of the Seminar **Adapting Agriculture to Climate Change,** with four topics discussed on the issues of (1) Climate Change Economics. (2) Climate Change Adaptation in Food and Agriculture Perspective, (3) Biodiversity and Food Security, and (4) Innovation to Address Climate Change Challenges.

As worldwidely known, today we hardly achieve an equilibrium position between producing sufficient food and feeding growing population. Extreme weather events such as droughts and floods are predicted to become frequent, adding to the global burden of hunger caused by poverty, improper governance, social and economic conflicts, and poor market access. We also already realized that Greenhouse gases (GHGs) in agricultural production are emitted by fertilizers, ruminant digestion, rice cultivation, land clearing for agriculture. Therefore, adapting to climate change to achieve and secure food security as well as trade commitments become both challenges and opportunities for our agriculture system in the future.

This is mean that agriculture is both part of the problem and part of the solution to climate change. However because of the multiple socio-economic and bio-physical factors affecting food systems and hence food security, the capacity to adapt food systems to reduce their vulnerability to climate change is not uniform in one to another region. We must therefore seize every opportunity to shift away from inefficient and Environmental unfriendly farm practices, supply chains and diet choices towards long-term sustainable, profitable and healthy system. Dependence of agriculture on the climate condition implies that agriculture has an important role to play in adaptation to climate change.

That is way we also believe that the ideas of multi-disciplinary researchers, scientists, practitioners and policy makers will be a major contribution in the prevention and settlement of various problems due to climate change and food security.

The purposes of this seminar are to: identify major barriers to achieve food security with consideration to current and evolving climate change; to identify required interventions (i.e. policy issues regarding planning, programming, resource mobilization and allocation, delivery services as well as monitoring and evaluation) that could reduce these barriers and promote sustainable food availability as a basic pillar of food security; and share lesson-learned related to cope with climate change to achieve food security.

We would like to thank the seminar chairs, staff of Faculty of Agriculture Sriwijaya University, and the member of the program committees for their hard work. We are also grateful to everyone who has contributed to the success of ISCCFS 2013. We hope that all participants and other interested readers would benefit scientifically from the proceedings and also find them stimulating in the process. Finally, we would like to wish you success in your technical presentations and social networking.

We hope you have a unique, rewarding and enjoyable days at ISCCFS 2013 in Palembang, Indonesia.

With our warmest regards,
The Organizing Committees
October 24-25, 2013
Palembang, Indonesia

TABLE OF CONTENTS

ISBN 978-979-8389-19-1
Proceeding of 2013 International Seminar on Climate Change and Food Security (ISCCFS 2013)
Palembang, South Sumatra-Indonesia, 24-25 October,2013

The Point of Zero Charge of Coal Fly Ash due to Chicken Manures Addition and Incubation Time

Agus Hermawan[1+], Sabaruddin[2], Marsi[2], and Renih Hayati[2]

[1]Graduate Student, Agricultural Sciences, Sriwijaya University

[2]Lecturer of Graduate Program, Sriwijaya University

Abstract. Fly ash as a coal combustion residue of thermal power plants has been regarded as a problematic solid waste all over the world. Due to the environmental problems created by large-scale fly ash generation, efforts are being made to recycle these materials. Generally, fly ash is a ferro-alumino-silicate mineral containing considerable quantities of Ca, K, and Na. They may, however, contain considerable quantities of minerals (aluminosilicate minerals like Mullite), which dissolve under strongly acidic conditions to provide liming function. Because of their chemical characteristics, fly ash have the potential to ameliorate soil chemical properties, such as the point of zero charge (PZC). Mixing fly ash with organic manure may enhanced the quality of the amelioran to improve the soils chemical properties. In the present study, the possibility to improving the status PZC in fly ash (FA) and chicken manure (CM) mixtures was investigated. Fly ash was mixed with organic matter in the form of cow chicken manure at 0:4, 1:3, 2:2, 3:1 and 4:0 ratios and incubated for 60 days. The FA+CM mixture with incubation time tended to decrease of the PZC status compared with the FA or CM alone. Among the different compositions of FA+CM mixtures, the 2:2 mixture at 45 days incubation time appeared to exhibit the lowest of the PZC compared with the other treatments. This composition could be use as an amelioran to improve the soils chemical properties in terms of soil fertility and lowering PZC, and it is necessary for further research.

Keywords: chicken manure, coal fly ash, point of zero charge (PZC)

1. Background

Coal fly ash is a combustion by-product that is produced during the combustion of coal at thermal power stations during the generation of electricity. Fly ash is the residue from coal combustion that enters the flue gas stream and collected from gas stack using specialized devices. It is composed predominantly of fine particles, and is either collected in emission control devices, such as electrostatic precipitators or mechanical filters, or released from the stack (Carlson and Adriano, 1993). The fly ash generation is expected to grow further as coal would continue to remain as major source of energy. It is estimated that approximately 600 million tons of fly ash is produced globally every year out of which only 20 to 25% is utilised in the construction industry largely as a replacement of cement for concrete production, fill material for embankments and as grout (Shafiq *et al.*, 2007). The disposal of such a huge amount of fly ash is one of the major problems of developing countries and is usually disposed in basins or landfills near the power plants. Due to the environmental problems created by large-scale fly ash generation, efforts are being made to recycle these materials (Kishor *et al.*, 2010).

Fly ash is a heterogeneous mixture of amorphous and crystalline phases and is generally contain considerable quantities of minerals, eg up to 40 % aluminosilicate minerals like Mullite (El-Mogazi *et al.*, 1988; Yunusa, 2006). Chemically, fly ash contains oxides, hydroxides, carbonates, silicates, and sulfates of calcium, iron, aluminum, and other metals in trace amount i.e. almost all the nutrients present in the soil with exception to nitrogen (Carlson and Adriano, 1993; Kishor *et al.*, 2010). Composition of some oxides contained in coal fly ash is as follows: SiO_2 54,59 %; Al_2O_3 31,69 %; MgO 4,38 %; CaO 4,27 % dan Fe_2O_3 3,19 % (Jumaeri *et al.*, 2007). All the fly ash products contain very fine particles of which more than 80% fell within the fine sand – silt category (<0.02 mm), suggesting they easily react with the soil (Yunusa *et al.*, 2006). Because of its physico-chemical characteristics (as explained above), fly ash has a vast potential for use as a soil amelioran that may improve soils physical, chemical and biological properties.

[+] Corresponding author. Tel.: +628127824414
E-mail address: agush_unsri@yahoo.co.id

US-EPA has determined that coal ash is not a hazardous waste (non-hazardous). The chemical constituents of coal ash are commonly found in many everyday products and natural materials. They are present in soil, rock and other parts of the earth's crust. The ranges of major elements in coal fly ash and soils have been evaluated .The comparison shows that the constituents in coal fly ash fall within the typical ranges of those in soils (American Coal Ash Association Educational Foundation, 2009). Various research results indicate that coal fly ash is relatively safe to use as ameliorant on agricultural land and is known to increase crop production (Mitra *et al*., 2003; Aggarwal *et al*., 2009; Kishor *et al*., 2010; Pandey and Singh, 2010).

Numerous studies revealed that the lower coal fly ash incorporation in soil modifies the physico-chemical, biological and nutritional quality of the soil. However, the higher dosage of coal fly ash incorporation results in heavy metal pollution and hinders the microbial activity (Pandey and Singh, 2010). The use of fly ash as an ameliorant can be enhanced by blending it with organic matter such as chicken manure. The latter contains significant amounts of N and P. Consequently, fly ash may serve as a composting ingredient, along with organik manures (Sajwan *et al*., 2006). The benefits may include better nutrient balance, reduction in toxins or contaminants, improved moisture content, improved economic value, improved soil conditioning effects, etc (Hanani *et al*., 2010).

Several studies focused mainly on the general characteristics of ashes that are essential for the soil treatments and their benefits to the growth and yield of crops. Therefore, the objectives of this study were to evaluate the effect of coal fly ash and chicken manure mixtures on the changes of the the point of zero charge (PZC) of the mixtures. Soil surface charge is often characterized by net positive charge, therefore, cations are easily leached and soil fertility conditions deteriorate. Theoretically, cation loss can be prevented by developing negative surface charge and thus creating additional cation exchange capacity (CEC) (Uehara and Gillman 1981; Marcono-Martinez and McBride, 1989). This can be obtained either by raising soil pH or lowering the PZC. PZC is a point, where the net charge of variable charge components is zero due to the equal H^+ and OH^- adsorption on them (Sakurai *et al*., 1988). Soil amendments that may affect these soil properties include the application of the material with low PZC such as lime, phosphate, silicate and organic matter. Through this study are expected to be obtained by the composition of the mixture of coal fly ash and chicken manure that has a low PZC and will hopefully be used as ameliorant to improve soil chemical properties and crop production, particularly soils with high PZC such as Ultisol.

2. Methods

This research was conducted in the Laboratory of Chemistry and Soil Fertility, Soil Department, Faculty of Agriculture, Sriwijaya University in November 2012 through March 2013. Coal fly ash obtained from Bukit Asam power plant, Tanjung Enim, South Sumatra. Chicken manure obtained from chicken farms in the area Inderalaya, Ogan Ilir, South Sumatra. Fly ash was mixed with organic matter in the form of chicken manure at 0:4, 1:3, 2:2, 3: 1 and 4:0 ratios and incubated for 60 days. Each treatments arranged in completely randomized design (CRD) with 3 replications. The mixture of coal fly ash and chicken manure in every pot is equivalent to 1 kg on the basis of absolute dry weight.

Analysis of the chemical characteristics of the mix include: pH H_2O and pH KCl (1:1), C-organic (Walkley-Black), cation exchange capacity (CEC) (1 N NH_4OAc pH 7) and available P (Bray I). pH measurement is done by using a pH meter, P and CEC with a spectrophotometer (Sulaiman *et al*., 2005). Value of the point of zero charge (PZC) for each treatment carried out by salt titration methods (Sakurai *et al*., 1988). Determination of P sorption is done with reference to the Fox and Kamprath (1970).

3. Results and discussion

3.1. The characteristics of coal fly ash and chicken manure

Results of laboratory analysis of samples of coal fly ash and chicken manure are presented in Table 1. The fly ash used in this study is alkaline (pH 8.75), with the content of bases such as Na, Ca, Mg and K were relatively high. Cation exchange capacity (CEC) (9.53 $cmol_{(+)}kg^{-1}$) and the solubility of Al in the coal fly ash is relatively low, as well as levels of C- organic and N-total. Coal fly ash has been reported to have very low CEC (Bilski *et al*. 1995). The burning processes of coal at high temperatures resulting in organic C and nitrogen levels in ash produced has collapsed (Bhattacharya and Chattopadhyay, 2004). Meanwhile, available P levels in coal fly ash is relatively low, and most of the P is in the form of bonds with Al, Fe and P-organic, as well as the P sorption capacity of 626.61 µg g^{-1}. P content in coal fly ash is generally low and therefore the efforts are needed to increase the P availability in their utilization for crop production (Kumar *et al*., 1998; Bhattacharya and Chattopadhyay, 2002). In addition, the used of coal fly ash is dominated by silt and clay-sized particles (71.20%), suggesting that they easily react with the chicken manures.

Table 1. The results of a preliminary analysis of coal fly ash and chicken manure

Type of Analysis	Unit	Analysis Results	
		Coal Fly Ash	Chicken Manure
pH H_2O (1:1)	-	8,75	8,14
pH KCl (1:1)	-	8,70	7,54
Organic C	%	0,11	9,22
Total N	%	0,04	1,12
Available P	µg g^{-1}	10,35	109,05
Exch.K	$Cmol_{(+)}kg^{-1}$	0,06	31,95
Exch.Na	$Cmol_{(+)}kg^{-1}$	2,72	21,75
Exch.Ca	$Cmol_{(+)}kg^{-1}$	4,80	0,28
Exch.Mg	$Cmol_{(+)}kg^{-1}$	21,00	1,80
CEC	$Cmol_{(+)}kg^{-1}$	9,53	39,15
Exch.Al	$Cmol_{(+)}kg^{-1}$	nd*	nd
Exch.Fe	µg g^{-1}	10,73	18,82
P Sorption	µg g^{-1}	626,61	657,82
Al-P	µg g^{-1}	1,13	19,13
Fe-P	µg g^{-1}	16,5	37,95
Organic-P	µg g^{-1}	19,34	31,20
Fraction:			
Sand	%	28,80	
Silt	%	56,13	
Clay	%	15,07	

*) nd. - not detected

Furthermore, chicken manure used in this study also had a relatively alkaline pH (pH 8.14), levels of P-available and high bases, solubility of Al, Fe and C/N ratio is low. Cation exchange capacity (CEC) of chicken manure used is relatively high (31.95 $cmol_{(+)}kg^{-1}$). Meanwhile, the P sorption capacity of chicken manure used is relatively high (657.82 µg g^{-1}). Despite this, P availability is high and most of P are in the form of a bond as Al-P, Fe-P and organic-P. Mixing of coal fly ash and chicken manure with relatively different characteristics is expected to be able to improve its quality as ameliorant to improve soil quality and crop production.

3.2. Some Chemical Charactheristics of Coal Fly Ash and Chicken Manure Mixture

Changes in pH, organic C, cation exchange capacity (CEC), and avilable P in different combinations of fly ash-chicken manure mixture are presented in the Table 2. The mixed of fly ash-chicken manure had a lower pH, which may be due to the accumulation of organic acids from microbial metabolism during decomposition processes (Sajwan *et al*., 2006).

The pH values for all treatments tend to decreased with incubation time, and the decrease in pH was greater with higher rates of chicken manure. pH decreased up to 45 days of incubation is relatively larger than the decrease in pH at 60 days of incubation. The results suggest that chicken manures and fly ash play a significant role in decomposition processing, which tend to increase up to 45 days of incubation. In 45 and 60 days of incubation, solution pH for the composition of fly ash-chicken manure 2:2 was the lowest (7.77 – 7.69) compared to other treatments. In this pH range, the solubility of trace elements would be low, as adsorption and precipitation reactions would decrease their solubilities (Sajwan *et al*. 2006).

Furthermore, P-available, C-organic and cation exchange capacity value tends to increase due to the addition of chicken manure on coal fly ash. P-available, C-organic and mixed cation exchange capacity tends to increase with increasing ratio of chicken manure added up to the composition of the 1:3 mixture. Microorganisms activity were reported to increased with the addition of organic matter and caused the increases of plant nutrients availability (Bhattacharya and Chattopadhyay, 2002; Sajwan et al., 2006).

Table 2. Some chemical characteristics of the coal fly ash and chicken manure mixture at each incubation time

Treatments	15 DI					30 DI				
	pH (1:1)		C-org	CEC	P-avail	pH (1:1)		C-org	CEC	P-avail
	H_2O	KCl	(%)	(Cmol$_+$ kg^{-1})	(μg g^{-1})	H_2O	KCl	(%)	(Cmol$_+$ kg^{-1})	(μg g^{-1})
Alone	9,02	8,91	0,11	12,75	6,00	8,98	8,85	0,14	13,05	14,45
CM Alone	8,25	8,07	9,22	35,25	98,40	8,07	7,76	8,50	38,75	124,05
FA:CM (3 : 1)	8,34	8,07	2,62	18,00	44,40	8,22	7,97	2,77	19,15	49,65
FA:CM (2 : 2)	8,28	8,13	4,25	23,50	77,70	8,09	7,83	4,47	23,50	83,70
FA:CM (1 : 3)	8,34	8,09	6,91	28,73	88,65	8,11	7,76	6,91	32,20	97,80
	45 DI					60 DI				
Alone	8,81	8,70	0,14	14,70	14,25	8,82	8,80	0,12	15,23	17,40
CM Alone	7,96	7,62	9,93	45,68	133,95	7,87	7,63	9,93	39,15	134,10
FA:CM (1 : 3)	7,93	7,70	2,98	19,28	51,55	7,84	7,64	2,69	17,40	68,55
FA:CM (2 : 2)	7,77	7,45	4,82	26,10	94,80	7,69	7,42	4,75	21,75	88,35
FA:CM (3 : 1)	7,81	7,48	7,80	39,15	118,35	7,73	7,45	7,62	30,45	105,45

DI =Days of Incubation

In addition, levels of available P, organic C and CEC on chicken manure is relatively high (Table 1), thus contributing to the increased availability of P, C-organic content and CEC value of the mixture. Composting of coal fly ash and organic manure has been an effective way to improve the nutritional status of the mixture, via increases in cation exchange capacity (CEC) and by provision of some essential nutrients (Carlson and Adriano, 1993; Bhattacharya and Chattopadhyay, 2002; Sajwan *et al*., 2006).

3.3. pH and Point of Zero Charge (PZC) of Coal Fly Ash and Chicken Manure Mixture

One of the obstacles in the soil with heavy weathering intensity has a high value of PZC and at low pH tend to have a positive charged. Therefore, cations are easily leached and soil fertility conditions deteriorate. Theoretically, cation loss can be prevented by developing negative surface charge and thus creating additional cation exchange capacity (CEC) (Uehara and Gillman 1981). This can be obtained either by raising soil pH, increasing the electrolyte concentration in the soil solution or lowering the PZC. PZC is a point, where the net charge of variable charge components is zero due to the equal H^+ and OH^- adsorption on them. If the pH of a soil is above its PZC the soil surface will have a net negative charge and predominantly exhibit an ability to exchange cations (CEC— exchange of one positive ion by another), while the soil will mainly retain anions (electrostatically) if its pH is below its PZC (AEC—exchange of one negative ion for another) (Sakurai *et al*., 1988). Soil amendments that may affect these soil properties include lime, phosphate, silicate and organic matter application. Fly ash is considered to be a rich source of Si, thereby potentially for lowering the value of PZC. Organic matters have a low PZC value, so it can function to lower the PZC and increasing negative charge (Uehara and Gillman, 1981). In addition, the ionization of functional groups of organic compounds can produce a number of negative charge on the surface of colloidal so PZC value will decrease (Stevenson, 1982).

Changes in pH and point of zero charge (PZC) value in different combinations of fly ash-chicken manure mixture are presented in the Table 3. Results of analysis of variance showed that the mixture of coal fly ash and chicken manure with 2:2 composition at 45 and 60 days of incubation have a lowest PZC and pH values and significantly different composition than the other mixed. Meanwhile, at the 15 and 30 days incubation, between each of the all composition does not show any significant differences. Cyclic changes in soil pH with time possibly a result of the changes in soil microbial activity (respiration, decomposition of organic matter and mineralization of C and N) controlling the release of H^+ (Bloom *et al.*, 2005). This also suggests that the incubation period for 45 days has reduced the value of PZC. It also seems that chicken manure has a role in lowering the PZC of the mixtures. Organic acids result from weathering of organic material, can reduce the value of the PZC. PZC is expected to decline due to the sorption of organic anions by oxide-hidrus Al and Fe (Ali and Sufardi, 1999). This indicates that manure can reduce the status of PZC, increasing the amount of negative charge and CEC after 45 days of incubation. Overall these studies showed that mixture of fly ash and chicken manure (2:2) as a soil amendment could provide benefits in terms of soil fertility and lowering PZC.

Table 3. pH and point of zero charge (PZC) value of the coal fly ash-chicken manure mixture at each incubation time (Days of Incubation)

Treatments	PZC				pH H_2O (1:1)			
	15 DI	30 DI	45 DI	60 DI	15 DI	30 DI	45 DI	60 DI
FA Alone	8,70 B	8,73 B	8,68 C	8,50 C	9,02 B	8,98 B	8,81 C	8,82 C
CM Alone	7,47 A	7,04 A	6,71 B	6,89 B	8,25 A	8,07 A	7,96 B	7,87 B
FA:CM (1 : 3)	7,90 A	6,77 A	6,66 B	6,74 B	8,34 A	8,22 A	7,93 B	7,84 B
FA:CM (2 : 2)	7,33 A	6,67 A	5,84 A	5,76 A	8,28 A	8,09 A	7,77 A	7,69 A
FA:CM (3 : 1)	7,40 A	6,79 A	6,58 B	6,55 B	8,34 A	8,11 A	7,81 AB	7,73 A
Sig.	**	**	**	**	**	**	**	**
LSD(0,01)	0,70	0,53	0,33	0,41	0,11	0,15	0,15	0,05

Means followed by a same letter are not significantly different at the 1% level by LSD

4. Conclusion

The coal fly ash and chicken manure mixture with incubation time tended to decrease of the PZC status compared with the coal fly ash and chicken manure alone. Among the different combinations of coal fly ash and chicken manure mixtures, the 2:2 mixture at 45 days incubation time appeared to exhibit the lowest of the PZC compared with the other treatments. This composition could be use as an amelioran to improve the soils chemical properties in terms of soil fertility and lowering PZC, and it is necessary for further research.

5. Acknowledgements

The data presented at the this paper is a subset of the data from the research activities funded by the Competitive Research Featured, Sriwijaya University for Fiscal Year 2013, for that we say thank you. Thanks are also extended to Mr. Yuda Nopriandi and Ricky F Sembiring, a graduate student in the Department of Soil Science, Agricultural Faculty Sriwijaya University, who have helped and are directly involved in the implementation of this study.

6. References

[1] Aggarwal, S, G.R. Singh and B.R. Yada. 2009. Utilization of fly ash for crop production: Effect on the growth of wheat and sorghum crops and soil properties. J. Agricultural Physics, 9:20-23.
[2] Ali, S. A. dan Sufardi. 1999. Pengaruh beberapa amandemen tanah terhadap muatan koloid dan sifat fisikokimia tanah typic haplohumults (ultisols). J. Tanah Tropika. 8:139-152.
[3] American Coal Ash Association Educational Foundation. 2009. CCP Fact Sheet 2: Coal Combustion Products: Not a Hazardous Waste. ACAA.
[4] Bhattacharya, S. S. and G. N. Chattopadhyay. 2002. Increasing bioavailability of phosphorus from fly ash through vermicomposting. J. Environ. Qual. 31:2116-2119
[5] Bhattacharya,S.S and G.N. Chattopadhyay. 2004. Transformation of nitrogen during vermicomposting of fly ash. Waste Manag Res. 22; 488.
[6] Bilski, J. J., K. Alva and K. S. Sajwan. 1995. Fly Ash. In: Rechcigl, J.E. (Editor). Soil Amendments and Environmental Quality. Boca Raton, Florida: Lewis Publisher.
[7] Bloom, P.R., Skyllberg, U.L, and M.E. Sumner. 2005. Soil acidity. *In* Tabatabai, M.A, and D. L. Sparks (Eds). Chemical processes in soils, SSSA Book series 8. Soil Science Society of America, Inc, Madison, WI.
[8] Carlson, C.L. and D.C. Adriano. 1993. Environmental impacts of coal combustion residues. J. Environ. Qual. 22:227-247.
[9] Fox, R. L. and Kamprath, E. J. 1970. Phosphate sorption isotherm for evaluating the phosphate requirements of soils. Soil Sci. Soc. Amer. Proc. 34:902-907

[10] Hanani, M.N, I.C. Fauziah, A.W. Samsuri and S. Zauyah. 2010. Formulation of Coal Fly Ash and Sewage Sludge Mixtures to Reduce Impacts on the Environment When Used as Soil Ameliorant for Acidic Tropical Soils. Malaysian Journal of Soil Science. 14: 53-70.
[11] Jumaeri, W. Astuti dan W.T.P. Lestari. 2007. Preparasi dan karakterisasi zeolit dari abu layang batubara secara alkali hidrotermal. Reaktor, 11(1):38-44.
[12] Kishor P, A.K. Ghosh and D. Kumar. 2010. Use of flyash in agriculture: A way to improve soil fertility and its productivity. Asian Journal of Agricultural Research, 4(1):1-14.
[13] Kumar, A., A.K. Sarkar, R.P. Singh, and V.N. Sharma. 1998. Characterization of fly ash from steel plants of eastern India. J. Indian Soc. Soil Sci. 46:459–461.
[14] Marcano-Martinez, E., and M.B. McBride. 1989. Comparison of the titration and ion adsorption methods for surface charge measurements in Oxisols. Soil Sci. Soc. Am. J. 53:1040–1045.
[15] Mittra, B. N., S. Karmakar, D. K. Swain, and B. C. Ghosh. 2003. Fly ash - a potential source of soil amendment and a component of integrated plant nutrient supply system. 2003 Internasional Ash Utilization Symposium. University of Kentucky, Paper #28.
[16] Pandey, V.C and N. Singh. 2010. Impact of fly ash incorporation in soil systems. Agriculture, Ecosystems and Environment. 136:16–27.
[17] Sajwan, K.S, S. Paramasivam, A.K. Alva and S.V. Sahi. 2006. Fly ash-organik byproduct mixture as soil amandment. Soil and Water Pollution Monitoring, Protection and Remediation, 3–23.
[18] Sakurai, K., Y. Ohdate and K. Kyuma. 1988. Comparison of salt titration and potentiometric titration methods for the determination of zero point of charge (ZPC). Soil Sci. Plant Nutr., 34 (2):171-182.
[19] Shafiq, N, Nuruddin, M.F., and I. Kamaruddin. 2007. Comparison of engineering and durability properties of fly ash blended cement concrete made in UK and Malaysia. Advances in Applied Ceramics.106 (6):314-318.
[20] Stevenson, F.T. 1982. Humus Chemistry. John Wiley and Sons, New York.
[21] Sulaeman, Suparto, dan Eviati. 2005. Petunjuk Teknis Analisis Kimia Tanah, Tanaman, Air, dan Pupuk. Balai Penelitian Tanah, Balitbangtan, Departemen Pertanian.
[22] Uehara, G and G.P. Gillman. 1981. The mineralogy, chemistry and physics of tropical soils with variable charge clays. Westview Press. Colorado.
[23] Yunusa, I. A. M., Eamus, D., DeSilva, D.L., Murray, B.R., Burchett, M.D., Skilbeck, G. C, and C. Heidrich. 2006. Fly-ash: An exploitable resource for management of Australian agricultural soil. Fuel. 85:2337-2344.

APPENDIX

Notulency of International Seminar on Climate Change and Food Security (ISCCFS 2013) Palembang, South Sumatra-Indonesia 24-25 October 2013

KEYNOTE SPEECH PRESENTATION

Speaker : Dr. Perdinan and Dr. Rizaldi Boer (CCROM-SEAP/PERHIMPI)
Session Chair : Dr. Sabaruddin
Topic : Innovation to address the Potential Impacts of Climate Change on Agriculture in Indonesia: Research Needs

Contents :

1. In a few last decades, ASEAN countries have been exposed to increasing trends of extreme climate hazards which has been considered due to global warming and climate change.
2. Late action to address this will lead to more severe impact and the adaptation will be very costly and may be impossible to be handled.
3. A global study by Cline (2007) suggested that in 2080, the economic loss due to global warming (worse scenarios) on agriculture sector would be equivalent to about 6.33 billion USD (without CO_2 fertilization) and 1.967 billion USD (with CO_2 fertilization).
4. Innovations to Address the CC Impacts
   a. Critical issue on climate change assessments
   b. The development and application of climate models
   c. The application of information technology
   d. Climate-agricultural technology

   Climate Forecast Application
   - The benefits of progress in computer power and understanding on global teleconnection
     a. development of methods to predict the onset dates of the rainy season based on global forcing factors (e.g., MJO, IOD, SST, SOI)
     b. evaluation of the skill of forecast for Indonesia
     c. development of dynamic cropping calendar based on the global forcing factors

   Climate Index Insurance
   - Philosophy and initial application
     a. payment will be made on the basis of unexpected climate condition regardless of crop loss/failure
     b. has been developed in developing countries, i.e., africa, India, and the Phillipines
   - Research needs:
     a. development of climate index and the insurance package (i.e., claim policies) in Indonesia
     b. the inclusion of climate index into farming management in Indonesia as an adaptation option
   - Management of Pest Infestations
     a. Understanding on climate change and pest infestations
     b. an increase in pest infestations under climate change
     c. invasion of pest and disease to a new region
     d. Research needs:
     e. development of climate-pest/disease models to estimate pest infestations under the 'new' climate regime
     f. development of climate index insurance for pest infestations

Discussion :

1. Prof. Supli Effendi Rahim
   how to improve agriculture related to climate change, and how the connection with the cultivation of cassava.
2. Mrs. Hera
   suggestions for the Indonesian government in terms of climate changes and food security.
3. Dr. Suwandi
   how climate change correlation with the increase in pests and plant diseases.

Speaker : Olaf de Jongh (Netherlands Senior Expert)
Session Chair : Dr. Sabaruddin
Topic : Crop production management (with focus climate change and food security)

Contents :

1. Crop production management refers to the various processes applied toward the effective cultivation and harvesting of crops.
2. A crop is the same kind of plants grown and cultivated on a large scale at a certain place.
3. Production is the **making of goods** or products. However, the word production refers to the process as well as to the **result of the process**.
4. Management - in general - is combining labor and capital.
5. In relation to crop production we talk about management systems; this usually includes considerations regarding:
   - the selection of the crop and a certain cultivar to plant,
   - the preparation of the land,
   - the application of fertilizers
   - the application of biocides (herbicides, fungicides, insecticides etc.) and growth regulators
   - practices like sprinkling or flooding
   - the involvement of people and machinery
6. One of the first considerations in crop production management is of the determination of the type of crop to be planted.
7. Every crop requires specific (growing) conditions:
   - soils
   - climate
   - geographical area
   - market conditions.
8. More Maintenance
   - **nutrient management**: this can be done by fertilizer or manure; a fertilizer is an inorganic chemical salt and manure is a natural substance obtained by decomposition of cattle dung, human waste and plant residues (green manure)
   - **disease and pest management**: this is to fight pathogens or pest in crops. It can by application by pesticides that target the particular pest for that particular crop. (image ..)
   - **herbicide application or weeding**: this is the process of removal of weeds or unwanted plants from the fields.
   - weeding is important because the weeds compete with the crop plants with water, nutrients, space and light.
   - **irrigation management**: irrigation is a means of providing moisture when this is an issue.
9. **Levels" of crop production management**
   - Scientific or academic level
   - Vocational level
   - Farmers level

   The farm structure covers these elements, and also includes the ownership and organization of farm businesses; the links among farms, farm households, buyers, input providers, and contractors; and the mix of inputs and products on farms. The economics of the farmer and their households and low and higher levels of wealth. The farm management includes all the aspects.
10. **green revolution**
    - The '**green revolution**' and industrialization of agriculture is leading to increases in crop production around the world.
    - The 'green revolution' which combined use of high-yielding varieties, the application of fertilizers and pesticides, the increased use of irrigation and cheap transport fuels, has led to huge increases in food crop production.
    - Climate change may affect food systems in several ways ranging from direct effects on crop production (e.g. changes in rainfall leading to drought or flooding), or warmer or cooler temperatures leading to changes in the length of growing season, etc. Often, higher temperatures occur which speed up development, shorten the growing season and so reduce yields. The relative importance of climate change for food security differs between regions.
    - Population grows will affect food systems maybe more

- Food security (enough food available) in general is most influenced by economics and policy. Prices and markets are very important for the magnitude of production; reserves are essential to withstand the minor yield variations by climate change. The effects on yields per ha of climate change will indeed be marginal, unless the climate change implies matters as floods, tsunami's, persistent droughts, etc.

Discussion :

1. Prof. Zainal Ridho
   Provide suggestions on how to develop sustainable agriculture with regard to climate change and food security. as we know Indonesia is a country that is potentially in the development of organic farming, how to improve organic agriculture on climate change
2. Double degree Students
   The basic thing what should be improved in order to create agricultural farms that can improve people's economy and government.

SUPPORTING PAPER PRESENTATION

SESSION 1

Session Chair : Dr. Kiki Yuliati

Panel 1

Presenter:
1. Maman Rahmansyah
2. Supli Effendi Rahim
3. Najib Asmani

Discussion:

1. Marlina: What was the variety of rice used in the tillage system?
   (Najib Asmani): Ciherang.
2. Marlina: What policy that Government or other agricultural communities' have related to the climate change impacts on agriculture? Is there any possibility to get a funding for research especially for student?
   (Supli Effendi Rahim): The opportunity is wide open as long as we have a good proposal and an intensive communication with them.
   (Najib Asmani): HTI offers research grant for undergraduate and post graduate student.

Panel 2

Presenter:
1. Nandika Pratiwi
2. Yudhi Zuriah WP
3. Lazarus Dawa

Discussion:

1. Dr. Umar Harun (to presenter 3): How to increase soy production considering the soil in Indonesia is high in acidity?
   We can try to do some treatments to the soil for example, increasing the pH of the soil; using a good soy bean variety.
2. Erni Purbiyanti (to presenter 1): What is the explanation for the negative sign of the average labor wages?
   The negative sign represents the decreasing of average labor wages as other variables (cost) increase.

3. Dr.Najib Asmani (to presenter 3): How to overcome the decreasing of soy bean production in Indonesia?
   Applying and improving technology for soy bean farming. Government should increase the incentive for soy bean farmer through the soy bean price control policy, so the farmer will be encouraged to plant soy bean.
4. Prof. Supli Effendi Rahim (to presenter 2): Why the efficiency of the land differ from each other?
   Because each types of the tidal land has a different condition as the impacts of typologies differences.

Panel 3

Presenter:
1. Erni Purbiyanti
2. Edison
3. Dessy Adriani
4. Faharuddin

Discussion:

1. Puspitahati (to presenter 1): How to decide whether the model created is fit to the real condition/ problem? Can we use the model for other areas?
   The model was developed based on the experimental data and the theoretical approach. It can be used for other areas with some adjustment.
2. Prof. Supli Effendi Rahim (to presenter 3): What is the level of total consumption and production of rice in Indonesia? How is it impact the decision whether to import or export the rice?
   The approximate data of total production of rice and the level of consumption in Indonesia show a surplus condition. However, the important thing is how to make sure the policy is working.

Panel 4

Presenter:
1. Marwan Sufri
2. Umar Harun
3. Puspitahati

Discussion:

1. Prof. Supli Effendi Rahim (to presenter 3): What is the proper water management in swampland?
   It depends on the typology, characteristic of the soil and water table level.
2. Marlina (to presenter 2): how the open and shading area affected the growth of the plant?
   The open area and shading condition influence the soil condition, such as temperature and humidity, thus affected the plant growth.
3. Prof. Supli Effendi Rahim (to presenter 1): Why you use money as the standard for hedonistic?
   It's refers to Indonesia Labor Department standard.

SESSION 2

Session Chair : Dr. Andi Wijaya

Panel 1

Presenter:
1. Edi Armanto
2. Suwandi
3. Nurhayati

Discussion:

1. Prof. Ridho Djafar (to presenter 3): Which the climate factors that the most impact for the pest growth?
   Temperature and humidity are the climate change that effect the pest growth.

Panel 2

Presenter:
1. Agus Hermawan
2. Tamrin
3. Mohd. Ghazali

Discussions:

1. Dr. Suwandi (to presenter 1): Did you apply the measure of chicken-swamp rice? Because it maybe contains of silicat.
   Maybe next will corporate and combine with others reasercher to measure the silicat contain.
2. Dr. Suwandi (to presenter 3): Can you tell the name of microbia formula (product), its contain and how it's mechanism?
   The formulation is secret "depend on the constitution, it is normal aquatic microba that can reduce "pencemaran in the water. It can develop with nutrient as it food in the environment.
3. Prof. Filli Pratama (to presenter 3): How many dosis and can it apply to all water?
   Yes it can do. This probiotic is already served in the market with dosis.

Panel 3

Presenter:
1. Filli Pratama
2. Prima Septika
3. Railia Karneta

Discussions:
1. Dr. Marsi (to presenter 1): How long the minimum time to produce non significant standart quality?
   It's less than 7 days

Panel 4

Presenter:
1. Zaid Subrata
2. Yuanita Windusari
3. Neni Marlina

Discussions:
1. Prof. Filli Pratama (to presenter 2): How can the capture CO2 happened? How if the carbon is too much on the air? How the mechanism capture?
   2 can estimated in plant because the highest plant, easier plants to result CO2.
2. Someone (to presenter 1): There was no data, the effect climate change that show the growth of climate change as long as 5 years until 10 years (suggestion).
   (to presenter 3): When the fertilizer is given? How many spesies of bacteria that can used as fertilizer? (suggestion) make clear the method.

Panel 5

Presenter:
1. Chandra Irsan
2. Ria Liuhartana

Discussions:
1. Cristin (to presenter 1): Is there any direct impact parasitism plant on Duku?
2. Prof. Ridho Djafar: How to protect parasitic plants by AA, ABA as hormone?