Jurnal

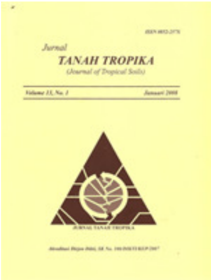
TANAH TROPIKA

(Journal of Tropical Soils)

ISSN 0852-257X

Volume 18, No. 1, Januari 2013

Terakreditasi Berdasarkan Keputusan Dirjen Dikti Depdiknas
No. 51/DIKTI/KEP/2010, tgl. 5 Juli 2010



ISSN: 0852-257X E-ISSN: 2086-6682
Jurnal TANAH TROPIKA
(Journal of Tropical Soils)
Member of: DOAJ Directory of Open Access Journals, crossref

EDITORIAL POLICIES

» Focus and Scope
» Section Policies
» Peer Review Process
» Publication Frequency
» Jurnal TANAH TROPIKA (Journal of Tropical Soils)
» EDITORIAL BOARDS
» Publication Ethics and Malpractice Statement

FOCUS AND SCOPE

JTS publishes all aspects in the original research of soil science (soil physic and soil conservation, soil mineralogy, soil chemistry and soil fertility, soil biology and soil biochemical, soil genesis and classification, land survey and land evaluation, land development and management environmental), and related subjects in which using soil from tropical areas.

ISSN 0852-257X, established in 1995, accredited by Indonesian Directorate General of Higher Education (DGHE) since 1998, last accredited No. 58/DIKTI/KEP/2013, 22 August 2013, valid until 21 August 2018.
Granted for Internationalization Program of Scientific Journal by DGHE No. 017/SP.SIP/DP2M/2010.
Jurnal TANAH TROPIKA (Journal of Tropical Soils) published three times a year (January, May and September), covers wide range of research article in which using tropical soils. Review article does not allow except it was invited by editor.

SECTION POLICIES

ARTICLES

☐ Open Submissions ☑ Indexed ☑ Peer Reviewed

NEW SUBMISSION

☑ Open Submissions ☑ Indexed ☑ Peer Reviewed

PEER REVIEW PROCESS

All submissions are reviewed by one of the editor and at least two reviewers. The JTS uses anonymous reviewing, in which the identities of authors and reviewers are kept confidential (double blind reviewer). Authors are requested not to suggest reviewers with whom they have a personal or professional relationship, especially if that relationship would prevent the reviewer from having an unbiased opinion of the work of the authors. A working e-mail address for each reviewer is essential for rapid review in the event that reviewer is selected from those that are identified by the authors. You may also select reviewers you do not want to review your manuscript, but please state your reason for doing so.

PUBLICATION FREQUENCY

Published three times a year in January, May and September. Articles are written in English. Print ISSN 0852-257X, online ISSN 2086-6682

OPEN ACCESS POLICY

This journal provides immediate open access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge. Because JTS is an open access journal so the copyright remains with the authors.

JURNAL TANAH TROPIKA (JOURNAL OF TROPICAL SOILS)

JTS publishes all aspects in the original research of soil science (soil physic and soil conservation, soil mineralogy, soil chemistry and soil fertility, soil biology and soil biochemical, soil genesis and classification,

land survey and land evaluation, land development and management environmental), and related subjects in which using soil from tropical areas.

ISSN 0852-257X, established in 1995, accredited by Indonesian Directorate General of Higher Education (DGHE) since 1998, last accredited No. 58/DIKTI/KEP/2013, 22 August 2013, valid until August 2018. Granted for Internationalization Program of Scientific Journal by DGHE No. 017/SP.SIP/DP2M/2010.
Jurnal TANAH TROPIKA (Journal of Tropical Soils) published three times a year (January, May and September), covers wide range of research article in which using tropical soils. Review article does not allow except it was invited by editor.

EDITORIAL BOARDS

PUBLICATION ETHICS AND MALPRACTICE STATEMENT

Journal of Tropical Soils (*J. Trop. Soils - JTS*) is a peer-reviewed electronic international journal. This statement clarifies ethical behaviour of all parties involved in the act of publishing an article in this journal, including the author, the chief editor, the Editorial Board, the peer-reviewer and the publisher (University of Lampung). This statement is based on COPE's Best Practice Guidelines for Journal Editors.

Ethical Guideline for Journal Publication

The publication of an article in a peer-reviewed *JTS* journal is an essential building block in the development of a coherent and respected network of knowledge. It is a direct reflection of the quality of the work of the authors and the institutions that support them. Peer-reviewed articles support and embody the scientific method. It is therefore important to agree upon standards of expected ethical behavior for all parties involved in the act of publishing: the author, the journal editor, the peer reviewer, the publisher and the society.

University of Lampung as publisher of *Journal of Tropical Soils* takes its duties of guardianship over all stages of publishing extremely seriously and we recognize our ethical and other responsibilities. We are committed to ensuring that advertising, reprint or other commercial revenue has no impact or influence on editorial decisions. In addition, the *Department of Soil Science, the University of Lampung* and Editorial Board will assist in communications with other journals and/or publishers where this is useful and necessary.

Publication decisions

The editor of the *Journal of Tropical Soils* is responsible for deciding which of the articles submitted to the journal should be published. The validation of the work in question and its importance to researchers and readers must always drive such decisions. The editors may be guided by the policies of the journal's editorial board and constrained by such legal requirements as shall then be in force regarding libel, copyright infringement and plagiarism. The editors may confer with other editors or reviewers in making this decision.

Fair play

An editor at any time evaluate manuscripts for their intellectual content without regard to race, gender, sexual orientation, religious belief, ethnic origin, citizenship, or political philosophy of the authors.

Confidentiality

The editor and any editorial staff must not disclose any information about a submitted manuscript to anyone other than the corresponding author, reviewers, potential reviewers, other editorial advisers, and the publisher, as appropriate.

Disclosure and conflicts of interest

Unpublished materials disclosed in a submitted manuscript must not be used in an editor's own research without the express written consent of the author.

Duties of Reviewers

Contribution to Editorial Decisions

Peer review assists the editor in making editorial decisions and through the editorial communications with the author may also assist the author in improving the paper.

Promptness

Any selected referee who feels unqualified to review the research reported in a manuscript or knows that its prompt review will be impossible should notify the editor and excuse himself from the review process.

Confidentiality

Any manuscripts received for review must be treated as confidential documents. They must not be shown to or discussed with others except as authorized by the editor.

Standards of Objectivity

Reviews should be conducted objectively. Personal criticism of the author is inappropriate. Referees should express their views clearly with supporting arguments.

Acknowledgement of Sources

Reviewers should identify relevant published work that has not been cited by the authors. Any statement that an observation, derivation, or argument had been previously reported should be accompanied by the relevant citation. A reviewer should also call to the editor's attention any substantial similarity or overlap between the manuscript under consideration and any other published paper of which they have personal knowledge.

Disclosure and Conflict of Interest

Privileged information or ideas obtained through peer review must be kept confidential and not used for personal advantage. Reviewers should not consider manuscripts in which they have conflicts of interest resulting from competitive, collaborative, or other relationships or connections with any of the authors, companies, or institutions connected to the papers.

Duties of Authors

Reporting standards

Authors of reports of original research should present an accurate account of the work performed as well as an objective discussion of its significance. Underlying data should be represented accurately in the paper. A paper should contain sufficient detail and references to permit others to replicate the work. Fraudulent or knowingly inaccurate statements constitute unethical behaviour and are unacceptable.

Data Access and Retention

Authors are asked to provide the raw data in connection with a paper for editorial review, and should be prepared to provide public access to such data (consistent with the ALPSP-STM Statement on Data and Databases), if practicable, and should in any event be prepared to retain such data for a reasonable time after publication.

Originality and Plagiarism

The authors should ensure that they have written entirely original works, and if the authors have used the work and/or words of others that this has been appropriately cited or quoted.

The authors are obliged to provide a statement letter, stating that their works are original and have not been published elsewhere (partly or in full), together with the manuscript during the submission process. In addition, the reviewers should help the editors to check the originality of the submitted manuscripts online. Further, editor will scan for plagiarism the submitted manuscripts using online plagiarism checker or detector.

Multiple, Redundant or Concurrent Publication

An author should not in general publish manuscripts describing essentially the same research in more than one journal or primary publication. Submitting the same manuscript to more than one journal concurrently constitutes unethical publishing behaviour and is unacceptable.

Acknowledgement of Sources

Proper acknowledgment of the work of others must always be given. Authors should cite publications that have been influential in determining the nature of the reported work.

Consequences of Misconduct

If there is a suspicion of misconduct (i.e. plagiarism or redundant publication) on a submitted manuscript or a published manuscript, the journal editor will investigate the case following the COPE (Commitee on Publication Ethics) guidelines (http://publicationethics.org/resources/flowcharts), which were developed for COPE by Liz Wager of Sideview (www.lizwager.com), 2013 - What to Do if You Suspect Plagiarism and 2016 - What to Do if You Suspect Redundant (Duplicate) Publication.

Consequences of misconduct include the following actions:

- If the manuscript is under reviewing process, the manuscript will be rejected for publication and returned to the authors.
- If the manuscript has been published in *JTS*, the manuscript will be retracted from the journal, providing published statement of redundant publication.
- Considering to inform author’s institution

Authorship of the Paper

Authorship should be limited to those who have made a significant contribution to the conception, design, execution, or interpretation of the reported study. All those who have made significant contributions should be listed as co-authors. Where there are others who have participated in certain substantive aspects of the research project, they should be acknowledged or listed as contributors. The corresponding author should ensure that all appropriate co-authors and no inappropriate co-authors are included on the paper, and that all co-authors have seen and approved the final version of the paper and have agreed to its submission for publication.

Hazards and Human or Animal Subjects

If the work involves chemicals, procedures or equipment that have any unusual hazards inherent in their use, the author must clearly identify these in the manuscript.

Disclosure and Conflicts of Interest

All authors should disclose in their manuscript any financial or other substantive conflict of interest that might be construed to influence the results or interpretation of their manuscript. All sources of financial support for the project should be disclosed.

Fundamental errors in published works

When an author discovers a significant error or inaccuracy in his/her own published work, it is the author’s obligation to promptly notify the journal editor or publisher and cooperate with the editor to retract or correct the paper.

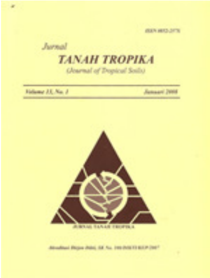
Dermiyati

Editor-in-Chief *Journal of Tropical Soils*

Journal of Tropical Soils (JTS: E-ISSN 2086-6682), published by Department of Soil Science, University of Lampung

https://doaj.org/

Print ISSN 0852-257X, Online ISSN 2086-6682



ISSN: 0852-257X E-ISSN: 2086-6682
Jurnal TANAH TROPIKA
(Journal of Tropical Soils)
Member of: DOAJ Directory of Open Access Journals, crossref

VOL 18, NO 1

JANUARY 2013

TABLE OF CONTENTS

ARTICLES

Effectiveness of Direct Application of Phosphate Rock in Upland Acid Inceptisols Soils on Available-P and Maize Yield — PDF
. Nurjaya, Dedi Nursyamsi — 1-9

Ameliorant Application on Variation of Carbon Stock and Ash Content on Peatland South Kalimantan — PDF
Siti Nurzakiah, Fahmuddin Agus, Haris Syahbuddin — 11-16

Soil Chemical and Biological Characteristics for Diagnostic the Potency of Acid Dry Land for Soybean Extensification — PDF
. Prihastuti, . Sudaryono — 17-24

Growth and Yield of Rice Plant by the Applications of River Sand, Coconut and Banana Coir in Ustic Endoaquert — PDF
. Nurdin, Fauzan Zakaria — 25-32

Fresh Organic Matter Application to Improve Aggregate Stability of Ultisols under Wet Tropical Region — PDF
. Yulnafatmawita, Febrian Anggriani — 33-44

Relationship between Water Content and Mineralization of Carbon and Nitrogen in Soils Varying in Physical and Chemical Characteristics — PDF
Akhmad Rizalli Saidy — 45-52

The Role of Indigenous Mycorrhiza in Combination with Cattle Manure in Improving Maize Yield (Zea Mays L) on Sandy Loam of Northern Lombok, Eastern of Indonesia — PDF
Wahyu Astiko, Ika Rochdjatun Sastrahidayat, Syamsuddin Djauhari, Anton Muhibuddin — 53-58

Coal Waste Powder Amendment and Arbuscular Mycorrhizal Fungi Enhance the Growth of Jabon (Anthocephalus cadamba Miq) Seedling in Ultisol Soil Medium — PDF
Sri Wilarso Budi, Fiona Christina — 59-66

Isolation, Characterization, and Molecular Identification of Phosphate Solubilizing Bacteria from Several Tropical Soils — PDF
Fahrizal Hazra, Etty Pratiwi — 67-74

Inoculation Effect of N2-Fixer and P-Solubilizer into a Mixture of Fresh Manure and Phosphate Rock Formulated as Organonitrofos Fertilizer on Bacterial and Fungal Populations — PDF
Sutopo Ghani Nugroho, . Dermiyati, Jamalam Lumbanraja, Sugeng Triyono, Hanung Ismono — 75-80

Assessment Erosion 3D Hazard with USLE and Surfer Tool: A Case Study of Sumani Watershed in West Sumatra Indonesia — PDF
. Aflizar, Roni Afrizal, Tsugiyuki Masunaga — 81-92

Print ISSN 0852-257X, Online ISSN 2086-6682

Available online at:
http://journal.unila.ac.id/index.php/tropicalsoil
DOI: 10.5400/jts.2012.18.1.25

Growth and Yield of Rice Plant by the Applications of River Sand, Coconut and Banana Coir in Ustic Endoaquert

Nurdin and Fauzan Zakaria

Agrotechnology Department, Faculty of Agriculture, Gorontalo State University
Jl. Jend. Sudirman No.6 Kota Gorontalo 96122, Indonesia, e-mail: nurdin@ung.ac.id

Received 8 October 2012 / accepted 7 January 2013

ABSTRACT

The research aimed to study effect the application of river sand (RS), coconut coir (CC), and banana coir (BC) on growth and yield of rice (*Oryza sativa* L.) in Ustic Endoaquert. The research was carried out in a green house using 3 × 3 × 3 factorial design. The RS factor consists of three treatment levels which were 0% RS, 25% RS, and 50% RS. Meanwhile, the CC and BC consist of three treatment levels, where each level were 0 Mg ha^{-1}, 10 Mg ha^{-1} and 20 Mg ha^{-1}. The results showed that RS, CC and BC applications did not have significant effect on plant height. On the other hand, all ameliorant applications had significantly increase leaf length and the highest percentage increasing was in BC (13.49%). The leaf numbers and tiller numbers had relatively similar pattern, except BC that had significantly increased leaf numbers by 77.69% and amount of tiller numbers by 49.45%. Furthermore, for yield components, RS, CC and BC applications had significant increased panicle numbers by 37.76%. It was only RS and BC that increased panicle lenght and the best increasing of 26.82% on RS. Meanwhile, the BC application only increased the rice grain numbers.

Keywords: Banana coir, coconut coir, rice plant, river sand, Vertisols

INTRODUCTION

The rate of population growth with a percentage of about 2% per year has resulted in increasing demand for rice. Until 2012, the national rice demand reached 34.055 million Mg and paddy production reached 68,956,292 Mg (BPS RI 2012) or equivalent to 37 million Mg of rice (Suswono 2012). Sudaryatno *et al*. (2010) predicted that the need of national rice in 2015 as many as 35,123,000 Mg and 37,021,000 Mg in 2020, or an average rate of rice consumption increasing 0.92% per year. Viewing statistics in 2012, it is apparently still a surplus as much as 3-4 million Mg of rice at this time. Although the current national rice need was adequate and surplus, but considering Indonesia's populations that were about 247 million and the increasing rate of population growth, it needs to be maintained and improved availability, one through the increasing productivity of paddy soil.

Rainfed paddy soil (RPS) is ecosystems which water source are dominantly from rain and as second national rice sources after paddy soil which coverages 2.1 million ha (Toha and Pirngadi 2004). In Paguyaman, Gorontalo province, RPS areas are dominantly classified as Vertisol soil that developed from lacustrine deposition materials (Hikmatullah *et al*. 2002; Prasetyo 2007; Nurdin 2011). From chemically aspect, Vertisol is classified as nutrient-rich soil that has high nutrient sources (Deckers *et al.* 2001). However, the physical properties are limiting factor for the plant growth which are heavy clay texture, swelling and shrinking properties, lowest water infiltration, and slow drainage (Mukanda and Mapiki 2001). As a result, it has stunted plant growth and low yield. It is necessary to repair these properties by giving ameliorant materials.

Sand is one type of the ameliorant materials that can be applied to high clay soils. Ravina and Magier (1984); Narka and Wiyanti (1999) showed that application of the sand had significantly effect to decline COLE value, soil plasticity index, and soil permeability become large, but the water content availability was low. However, paddy soil cultivation requires medium permeability with sufficient water content, so it needs another ameliorant to fix these properties, such as by using coconut coir and banana coir. Coconut coir (CC) has been used as water storage on farms (Subiyanto *et al.* 2003), while the banana coir (BC) is still relatively underused. Though BC absorption is relatively high when it is dried because it has pores that are interconnected (Indrawati 2009). Applications of the three ameliorant materials were allegedly able to mutually improve soil physical and chemical properties of Vertisol under rice cultivation on RPS, so that productivity can be improved. This study aimed to determine the response of plant growth and yield components with RS, CC, and BC application in Ustic Endoaquert.

MATERIALS AND METHODS

Study Sites

The experiment was conducted in the green house of Mathematics and Natural Sciences Faculty of Gorontalo State University starting in April-August 2012. Meanwhile, the growing media was taken from the Vertisol with Ustic Endoaquert sub groups (Table 1).

Coconut and Banana Coir Preparation

Materials were obtained from the dried coconut husk that was surrounded the coconut shell inside. Coconut husk was peeled and separatly from coconut shell, and then a smooth outer skin was peeled again until remaining coconut coir (CC). Furthermore, CC was milled to 1 mm. Banana coir (BC) materials were obtained from dried banana bark. Banana bark was peeled and separated from the trunk up to 10 sheets of rods into the core of the BC. Furthermore, the banana peel was grounded into powder with a size of 0.05 mm. The CC and BC obtained were weighed according to the dosage of each treatment. Before application, the water absorption capacity (WAC) of CC and BC were tested through immersion. Immersion was used to determine the maximum WAC of the ameliorant material. Calculation of WAC followed the equation:

$$WAC\ (\%) = [\text{Pre Weight}\ (w_0) / \text{Dry weight}\ (w_1)] \times 100\%$$

Experimental Design

The study used a 3 × 3 × 3 factorial design. There were 3 factors in this study and each factor consisted of 3 dosages treatment and each treatment had 3 replications, so 81 pot experiments were obtained. River sand (RS) factors consisted of 0% RS (S_0), 25% RS (S_1), and 50% RS (S_2). Furthermore, the CC factor consisted of 0 Mg ha^{-1} CC (C_0), 10 Mg ha^{-1} CC (C_1), and 20 Mg ha^{-1} CC

Table 1. Soil description and classification of Ustic Endoaquert.

Location	:	Sidomukti village, Mootilango district, Gorontalo regency
Soil classification		
Taxonomy (USDA, 2010)	:	*Ustic Endoaquert*
PPT	:	*Eutric Grumusol*
FAO/UNESCO	:	*Cambisol*
Parent materials	:	Lake deposits/lacustrine
Physiographic Position	:	Foot slopes, Depression
Topography	:	Flat-ramps; slopes < 2%
Elevation	:	58 m sl
Drainage	:	Poor
Soil water depth	:	Shallow
Vegetation	:	Paddy (*Oryza sativa* L.)

Depth (cm)	Horizon	Descriptions
0-12	Apg1	Gray (10YR 5/1); clay loamy; massive structure; very sticky, plastics; smooth rooting, a lot; clear flat.
12-31	Apg2	Gray (10YR 5/1); clay loamy; angular blocky structure, smooth, weak; very sticky, plastics; rusty brown (10YR 5/3), plain, smooth, clear, spots, sharps; smooth rooting, a lot; gradually flat.
31-53	Bwg1	Gray (10YR 5/1); clay; angular blocky structure, moderate, weak; very sticky, plastics; smooth rooting, slightly; frosted flat.
53-71/92	Bwg2	Gray (10YR 6/1); clay; angular blocky structure, rough, weak; very sticky, plastics; obviously choppy.
71/92-119	Bwssg	Dark gray (10YR 4/1); clay; angular blocky structure, moderate, very sticky, plastics; slickenside; rusty brown (10YR 5/3), plain, smooth, clear, tubes, clear; frosted flat.
119-150	BCg1	Dark gray (10YR 4/1); clay; angular blocky structure, rough, strong; very sticky, plastics; rusty brown (10YR 5/3), plain, smooth, clear, tube, clear; clear flat.
150-200	BCg2	Dark gray (10YR 4/1); clay; very sticky, very friable; frosted flat.

(C_2). While, the BC factors consisted of 0 Mg ha^{-1} BC (B_0), 10 Mg ha^{-1} BC (B_1), and 20 Mg ha^{-1} BC (B_2).

Rice Planting and Maintainance

Before planting, a basicstarter fertilizer was weighed. Fertilizers used consisted of 125 kg Urea ha^{-1} which were given twice at ages 0 day after planting (DAP) and 60 DAP, respectively as much as 62.5 kg ha^{-1} each. Meanwhile, SP36 fertilizers in the amount of 100 kg ha^{-1} were given twice at age 0 DAP and 60 DAP, respectively as much as 50.0 kg ha^{-1} each, whereas KCl fertilizers in the amount of 50 kg ha^{-1} were given twice at ages 0 DAP and 60 DAP respectively as much as 25 kg ha^{-1} each.

A Ciherang rice seed variety that was used was tested its quality by soaking in saline solution, then planted in trays which were covered by leaves and soil media containing organic material with a ratio of 1:1 until 10 days. A day before planting, the planting medium was watered so that compounds which were toxic to rice seedlings moved down to the bottom of the pot. Rice seeds that had been 10 days aged were transferred into the plant growing media. Planting was done in the planting hole as deep as 8 cm. At planting time, it was followed by the application of basic fertilizers as much as half of the total dose of fertilizer. During the growth and development of plants, the maintenance performed was weeds clearing, watering at 30 DAP and 60 DAP, and subsequent fertilization at age 60 DAP. Harvesting was done when the plants had been aged less than 115 days after planting. Observations of plant growth components were plant height, leaf length, leaf number, and tiller numbers. Meanwhile, the observations of yield components were panicle length, panicle number, and rice grain numbers.

Statistical Analysis

Analysis of Variance (ANOVA) for factorials design were done to study the growth and yield response of rice plants due to application of ameliorant materials. If there was a significant effect, then it was continued by the least significant difference (LSD) test at 5% level.

RESULTS AND DISCUSSION

Soil Physical and Chemical Properties

Soil physical and chemical properties of the soil at a depth of 0-20 cm are presented in Table 2. Vertisol soil with an Ustic Endoaquert has clay loamy textures, slow of soil permeability and real of

Table 2. Soil physical and chemical properties of Ustic Endoaquert.

Soil properties	Value	Criterion*
Texture		
Sand (%)	27	
Clay (%)	35	Clay loamy
Silt (%)	38	
Soil permeability (cm hr^{-1})	1.59	Low
Cole index	0.98	Real swell-shrinking
Water content availability	8.47	
Organic-C (%)	0.69	Very low
Total-N (%)	0.06	Very low
Ratio C/N	11.62	Moderate
Available-P, Bray 1 (mg P kg^{-1})	3.80	Very low
pH H_2O	6.48	Rather acid
NH4OAc 1 *N* pH 7 Extraction:		
K (cmol+ kg^{-1})	0.24	Very low
Ca (cmol+ kg^{-1})	14.90	High
Mg (cmol+ kg^{-1})	6.05	High
Na (cmol+ kg^{-1})	0.50	Moderate
CEC (cmol+ kg^{-1})	30.93	High
Base saturation (%)	70.08	High
Extract KCl 1 *M*		
Al^{3+} (cmol+ kg^{-1})	0.00	
H^+ (cmol+ kg^{-1})	0.06	

*= Center for Soil Research (1983).

swelling and shrinking. Furthermore, the chemical properties of the soil indicates that the organic matter, total N, available P, and K can be exchanged are very low. Relatively mildly acidic soil pH, cation exchange capacity is very high and high base saturation. Thus, based on the criterion of soil fertility status (Center for Soil Research 1983), the soil fertility was classified as moderate.

Growth Components of Rice Plant

The results of variance analysis for rice growth component on Ustic Endoaquert showed that river sand (RS), coconut coir (CC) and banana coir (BC) had not significantly effect to plant high (Table 3). However, each treatment had shown an increase in plant high. The highest plant height was shown by the application of 20 Mg ha^{-1} BC and had not significantly effect with other treatments. It seems that plant height was still lower than normal and it was in aggreement with Supriatno *et al*. (2007), plant heigh of Ciherang varieties were ranged from 107-115 cm.

The greatest increasing in plant height indicated that the application of 20 Mg ha^{-1} BC was able to increase plant height by 4.99%, while the lowest was shown on the application of 25% RS that was increased by 0.14% only. In the growth phase, especially plant height needs sufficient water availability. While, the water retention capabilities of sand was lower than CC and BC. Water shortages do not apparent at the beginning of the vegetative phase and it still can stimulate root development, but when this happens in the next vegetative phase, plant will be stunted (Sholeh and Riajaya 2000).

Water stress can reduce leaf area according to the speed of photosynthesis and allocation of assimilate from the canopy to the roots (Earl and Davis 2004). On the other hand, Berkelaar (2001) stated that aerobic soil conditions can make the plant roots get more oxygen, so the development is getting better, and in turn the plants will grow better and deliver optimal results. Furthermore, Yakup (2008) reported that plant height was significantly affected by soil water availability. In the water-saturated state, despite resistance by soil particles, no water can be absorbed by the soil except in certain plants such as paddy (Kasli and Effendi 2011).

Based on the test results of water absorption capacity (WAC) of both ameliorant showed that CC had a high WAC (71.77%), while BC was only 28.23%. Wuryaningsih *et al*. (2008) who conducted a study of growth *Anthurium andraeanum* in the pot by using coconut bulk media reported the physical properties were: a very high water content (1,314.41%), low-bulk density (0.09%), high total porosity (120.31%), and high pore water holding (116.6%). In addition, soil texture was classified as clay loamy (Table 2), so the soil puddling and flooding will become more easily dispersible and soil relatively compact (Isnaini and Suwarno 2005).

Then, application of RS, CC and BC had significant effect to leaf length (Table 3). The largest increasing of leaf length was shown on BC application as much as 20 Mg ha^{-1} (13.49%) and it

Table 3. The rice plant growth components by the application of river sand, coconut coir and banana coir in Ustic Endoaquert.

Treatments	Plant height (cm)	Leaf length (cm)	Leaf number	Tiller number
River Sand				
0%	29.21 ns	22.63 a	18.74 ns	9.70 ns
25%	29.25	24.08 ab	18.77	11.00
50%	29.33	24.34 b	19.51	11.44
Coconut coir				
0 Mg ha^{-1}	28.60 ns	22.12 a	17.81 ns	9.92 ns
10 Mg ha^{-1}	28.87	24.31 b	19.40	10.96
20 Mg ha^{-1}	30.31	24.63 b	19.81	11.25
Banana coir				
0 Mg ha^{-1}	29.00 ns	22.38 a	13.51 a	10.01 a
10 Mg ha^{-1}	29.31	23.28 a	19.51 b	12.25 b
20 Mg ha^{-1}	29.48	25.40 b	24.00 c	14.96 c
Interaction	ns	ns	ns	ns
LSD 0.05%		1.65	2.73	1.76

Number that followed by the same letter in the same column has not significant effect on the LSD level of 0.05, ns= not significant effect on the F level test 0.05.

was significantly different with 10 Mg ha^{-1} application and control. While, the lowest was shown on the RS (1.08%) and did not significantly different with 50% RS and control. This suggests that the water availability becomes a dominant factor in rice cultivation. Effect of a turn single of water availability will reduce growth (Fazeli *et al*. 2007). Furthermore, Kasli and Effendi (2011) stated that the effects of water shortages on some physiological processes of plants were seen in a slow accumulation of dry matter, decreasing leaf expansion rate, and limiting stomata closure photosynthesis. In addition, short-term leaves and leaf area in plants were thought to be influenced by the intensity of the light received in green house where the research took place. The present of trees around the green house allegedly indirectly affected the reception of light by the plant, eventhough the distance was about 6 feet from the green house. Anggarwulan *et al*. (2008) stated that light played an important role in the physiological processes of plants, especially photosynthesis, respiration, and transpiration. The plants required quite diverse intensity of light.

The application of RS and CC did not have significantly effect to leaf numbers and tiller numbers, but had significant effect with BC (Table 3). Application of 20 Mg ha^{-1} BC had significantly increased to leaf numbers by 77.65% and has significantly increased tiller numbers by 49.45% compared to application of 10 Mg ha^{-1} BC and control. This is presumably due to the ability of BC to maintain soil moisture and water availability. Indrawati (2009) stated that the stem of BC is a strong fiber and resistant to water. It also have pores that are interconnected, and when dry a material will be having absorption and high shelf. In addition, the growing media flooding as high as 5 cm was also associated in the formation of tiller numbers. This is in line with reports by Utomo and Rudi (2000) *in* Kasli and Effendi (2011) that the flooding up to approximately 3-5 cm above the ground was a condition that had been considered good for the formation of tillers and if in the high-growth phase the flooding increased more than 5 cm it would inhibit seedling establishment. The results are reinforced by reports Astuti (2010) that the tiller numbers produced from crops by flooding system more than the intermittent and kemalir system. However, in contrast with the results of Shi *et al.* (2002) that the maximum tillering growth phase, the highest tiller numbers were in on kemalir water management compared to intermittent and continuous flooding. According to Sumardi *et al.* (2007) that water use efficiency for rice cultivation without flooding condition was much as 19.581%, while with flooding continuously its efficiency was as much as 10.907% only. In this study also showed that the higher the plant will be followed by a greater tiller numbers. This is in contrast with the results of Aldi *et al.* (2004); Hartati and Suwarto (2004); Rahayu and Harjoso (2010) that the tiller numbers showing contrary to the values of plant height, where the higher tiller numbers the plant high was turning. Furthermore, Rahayu and Harjoso (2010) explained that according to the concept of source-sink, photosynthetic resulting plants will be distributed to all parts of the organ and a variety has the same capacity, so that when the distribution is much to the establishment of seedlings will be followed by low plant height, as well otherwise. Meanwhile, although it was not significantly affect to leaf number and tiller numbers, but giving 20 Mg ha^{-1} BC increased the leaf numbers by 11.23% and increased the tiller numbers by 13.42% compared to control. This is related to the ability to absorb water of BC is high, so that it will enough moisture and water availability. Ramesh *et al*. (2010) reported that combination application of soil and coconut coir as much as 4% showed changes in the nature of Catton black soil compactness better than control. In general, for all plant growth components based on the contributions of each ameliorant material can be prepared series as follows: BC > CC > RS.

Yield Components of Rice Plant

The analysis of variance for rice yield components on Ustic Endoaquert resulted that application of river sand (RS), coconut coir (CC) and banana coir (BC) had significantly increased panicle numbers of rice plants. It seems that the pattern of the percentage increase of the panicle numbers with RS and BC applications were relative similar, however the different between treatments increased the percentage figures. The application 50% RS had significantly increased the panicle numbers by 13.93% compared to control (0% RS), but it had not significantly different with 25% RS application. Level of soil sand fraction was 27% with clay loamy textures, so that the application of 50% RS fraction in the soil could reduce weight to light, particularly the declining of COLE index. Sand texture is very influential on the status and distribution of water, so affecting the root system and root depth (Walter *et al*. 2000; Oliver and Smettem 2002). Thus, the plant root system is not disturbed due to the possibility of soil cracking is not the case anymore, so the process of water and nutrients absorption can be better. Along with these, Cepy and Wangiyana (2011) stated that the ground

Table 4. The rice yield components by the application of river sand, coconut coir and banana coir inUstic Endoaquert.

Treatments	Panicle numbers	Panicle length (cm)	Rice grain numbers
River Sand			
0%	2.44 a	7.72 a	13.80 ns
25%	2.04 ab	8.87 b	12.98
50%	2.78 b	9.79 c	15.14
Coconut coir			
0 Mg ha^{-1}	2.37 a	8.45 ns	12.89 ns
10 Mg ha^{-1}	2.11 ab	8.74	13.06
20 Mg ha^{-1}	2.78 b	9.18	15.97
Banana coir			
0 Mg ha^{-1}	1.96 a	8.30 a	9.07 a
10 Mg ha^{-1}	2.59 b	8.39 a	13.18 b
20 Mg ha^{-1}	2.70 b	9.69 b	14.68 b
Interaction	ns	ns	ns
LSD0.05	0.59	0.83	3.36

Number that followed by the same letter in the same column has not significant effect on the LSD level of 0.05, ns= not significant effect on the F level test 0.05

state is a very hard and difficult to penetrate dense root cause soil aggregates and limit the exploration of the roots, and the roots may even be damaged. If power is hampered exploration roots, it will reduce the total root surface area that can be connected directly to the ground.

Then, application of 20 Mg ha^{-1} CC had significantly increased the panicle numbers by 17.30% compared to control (0 Mg ha^{-1} CC), but it had not significantly different than the panicle numbers with application as much as 10 Mg ha^{-1} CC. This is presumably related to soil water availability. The WAC level of CC is high and will be able to absorb and retain water availability in the soil, so that more BC will be followed by the greater panicle numbers. This is consistent with the statement Dachban (2012) that the rice shortage water for 4 days in the generative period and the next 2 weeks was a period that was sensitive to water shortages. Furthermore, he said that the yield components showed the most dramatic decline was the panicle numbers.

The highest increasing of panicle numbers had shown by application of as much as 20 Mg ha^{-1} BC that it significantly increased by 37.76% compared to control (0 Mg ha^{-1} BC), but it had not significantly different with 10 Mg ha^{-1} BC. This suggests that BC application is able to maintain the water availability due to the ability to absorb water is high. The BC rods quite strong and resistant to water, and has pores that are interconnected, and when dry a material will be having absorption and high shelf (Indrawati 2009).

In addition, the RS and BC had significantly increased to panicle length, except the CC which did not significantly increase panicle length. The application of as 20 Mg ha^{-1} BC had significantly increased panicle length by 16.75% compared to control (0 Mg ha^{-1} BC) and by 15.49% compared to 10 Mg ha^{-1} BC. This is presumably related to the water availability of each treatment. The research results by Dachban (2012) showed that the panicle length at breast level 3 mm, 2 mm and 1 mm had decreased long paniclesby 0.77%, 5.80%, 45.10% respectively, due to the reduction in yield because to lack of water. In fact, the research results by Astuti (2010) showed that the panicle length and rice grain numbers were not affected by irrigation, but each variety had panicle length and rice grain numbers per panicle significantly different according to the genetic. Meanwhile, 20 Mg ha^{-1} BC had significantly increased the rice grain numbers by 61.85% compared to control and did not have significantly different with 10 Mg ha^{-1} BC (Table 4). Apparently, the longer panicles will be followed by a greater rice grain numbers. It is in line with the revelation Setiobudi *et al.* (2008) that the rice grain numbers was determined by the genetic properties of plants especially panicle length, tassel branch, and a differentiation rice grains.

CONCLUSIONS

The application of river sand, coconut coir, and banana coir did not have significant effect on plant height. On the other hand, all ameliorant applications had significantly increased leaf length with the highest increasing percentage of 13.49% in 20 Mg ha^{-1} BC application. The leaf numbers and tiller numbers were relatively similar pattern, but only banana coir application had significant by increased of 77.69% to leaf numbers and amount of 49.45% to tiller numbers. Furthermore, the application of banana coir had significant for increasing a panicle numbers up to 37.76% compared to control. It was only river sand and banana coir increased panicle length and the best increasing up to 26.82% compared to coconut coir applications and it was only banana coir increased the rice grain numbers.

ACKNOWLEDGEMENTS

The research team would like to thank Directorate General of Higher Education (DGHE), the Ministry of Education and Culture, Jakarta that had given us the opportunity to examine simultaneously Competitive Grant research funding in fiscal year 2012 with contract number was 33/UN47.D2/PL/2012.

REFERENCES

Aldi MA, Darjanto and ADH Totok. 2004. Effect of weed control methods on the results of four upland rice cultivars. *J Agrin* 8: 100-107.

Anggarwulan E, Solichatun and W Mudyantini. 2008. Physiological characters of purse (*Xanthosoma sagittifolium* L. Schott) in several of light intensity (shading) and water availability. *J Biodiver* 9: 264-268.

Astuti DN. 2010. Effect of irrigation systems on the growth and productivity of some varieties of rice (*Oryza sativa* L.). [BSc thesis] Bogor Agricultural University, Bogor (in Indonesian).

Berkelaar D. 2001. The system of rice intensification (The System of Rice Intensification-SRI): Few can give more. http://www.elsppat.or.id/download/file/SRI-echo% 20note.htm. Access on December 25, 2012.

BPS RI [Badan Pusat Statistik Republik Indonesia]. 2012. Statistics Indonesia in 2012. Central Bureau of Statistics, Jakarta.

Center for Soil Research. 1983. Terms of Reference of Soil Capability Survey No 22/1983. Transmigration Supporting Agricultural Research Project Agency for Agricultural Research and Development Ministry of Agriculture, Bogor (in Indonesian).

Cepy and W Wangiyana. 2011. Growth and yield of rice (*Oryza sativa* L.) in the media and entisols vertisol at different water management techniques and types of fertilizers. *J Agro Crop* 4: 49-56.

Dachban SMB. 2012. Effect of giving water level on the growth and yield several varieties of upland rice. *J Sci Higher Edu* 5: 6-15.

Deckers J, O Spaargaren and F Nachtergaele. 2001. Vertisols: Genesis properties and soilscape management for sustainable development. In: JK Syers, FWT Penning De Vries and P Nyamudeza (eds). The Sustainable Management of Vertisols. *IBRSAM Proceeding No*. 20, pp. 3-20.

Earl HJ and RF Davis. 2004. Effect of drought stress on leaf and whole canopy radiation use efficiency and yield of maize. *J Agron* 95: 688-696.

Fazeli F, M Ghorbanli and V Nikham. 2007. Effects of drought on biomass, protein content, lipid peroxidation and antioxidant enzymes in two sesame cultivars. *Biol Plantarum* 5: 98-103.

Hartati and Suwarto. 2004. Yield and quality of two varieties of upland rice grown intercropped with biofertilizer treatments. *J Agronomika* 4: 1-9.

Hikmatullah, BH Prasetyo and M Hendrisman. 2002. Vertisol from Gorontalo areas: physical properties of the chemical and mineralogical composition. *Soil Water J* 3: 21-32 (in Indonesian).

Indrawati E. 2009. Sound absorption coefficient of acoustic materials of banana with different densities. [BSc Thesis] Islamic University Maliki, Malang.

Isnaini S and P Suwarno. 2005. Rice cultivation with no-tillage systems for ten seasons in Kerjaloman, Talangpadang, Lampung. *J Stigma* 8: 551-554 (in Indonesian).

Kasli and AAR Effendi. 2011. High influence on plant growth puddle rice (*Oryza sativa* L.) in pots. *J Jerami* 4: 206-212.

Mukanda N and A Mapiki. 2001. Vertisols management in Zambia. In: JK Syers, FWT Penning De Vries and P Nyamudeza (eds). The sustainable management of vertisols. *Proceedings IBRSAM No* 20, pp. 129-127.

Narka IW and Wiyanti. 1999. Effect of sand and organic materials against each Vertisol soil physical properties. *J Agritrop* 18: 11-15.

Nurdin. 2011. Development and rainfed paddy soils potency derived from lacustrine material in Paguyaman, Gorontalo. *J Trop Soil* 16: 267-278. doi: 10.5400/jts.2011.16.3.267

Nursyamsi D. 2009. Effect of potassium and corn varieties for organic acids from root exudates, uptake of N, P, and K production plants and corn stover (*Zea mays* L.). *J Agron Indon* 37: 107-114.

Oliver YM and KRJ Smethem. 2002. Predicting water balance in a sandy soil: model sensitivity to the variability of measured saturated and near saturated hydraulic properties. *Aust Soil Res* 43: 87-96.

Prasetyo BH. 2007. Differences vertisol soil properties from a variety of parent materials. *J Agric Sci* 9: 20-31.

Rahayu AY and T Harjoso. 2010. Agronomist and physiological characters of upland rice grown in soil husky media on water conditions in the lower capacity field. *J Akta Agrosia* 13: 40-49.

Ramesh HN, KVM Krishna and HV Mamatha. 2010. Compaction and strength behavior of lime-treated coir fiber Black Cotton soil. *J Geomech Eng* 2: 19-28.

Ravina I and J Magier. 1984. Hydraulic conductivity and water retention of clay soil containing coarse fragments. *Soil Sci Soc Am J* 48: 736-740.

Setiobudi D, B Abdullah, H Sembiring and IP Wardana. 2008. Peningkatan hasil padi tipe baru melalui pengelolaan hara pupuk nitrogen. Prosiding Simposium V Tanaman Pangan – Inovasi Teknologi Tanaman Pangan. Pusat Penelitian dan Pengembangan Tanaman Pangan, Badan Penelitian dan Pengembangan Pertanian 2: 345-353 (in Indonesian).

Shi Q, X Zeng, M Li, X Tan and F Xu. 2002. Effects of different water management practices on rice growth. In: BAM Bouman, H Hengsdijk, B Hardy, PS Bindraban, TP Tuong and JK Ladha (eds). Water-wise rice production. International rice research institute, Los Banos, pp. 3-13.

Sholeh M and PD Riajaya. 2000. Anticipating climate storage on the cultivation of tobacco. *Monogr Balittas* 6: 12-15.

Subiyanto B, R Saragih and E Husin. 2003. Utilization of coconut coir dust as water and oil absorbent materials such as particle board panels. *J Trop Wood Sci Tech* 1: 26-34.

Sudaryatno T, R Kustiari and HP Saliem. 2010. Estimates food needs in 2010-2050. In: Book Analysis of Land Resources towards Sustainable Food Security. Agency Research and Development of Agriculture, Jakarta, pp. 1-23.

Sumardi, Kasli, M Kasim, A Syarif and N Akhir. 2007. Respon padi sawah pada teknik budidaya secara aerobik dan pemberian bahan organik. *J Akta Agrosia* 10: 65-71 (in Indonesian).

Supriatno B, AA Daradjat, Satoto, SE Baehaki, N.Widiarta, SD Indrasari, OS Lesmana and H Sembiring. 2007. Description rice varieties. Rice Research Institute, 80 p.

Suswono. 2012. Indonesia rice consumption too much. http://www.republika.co.id/berita/nasional/ umum/ 12/04/03/m1wj1n-mentan-konsumsi-beras-indonesia-terlalu-banyak. Accessed on 18 December 2012.

Toha HM and K Pirngadi. 2004. Effect of plant density and weed control on the results of some rice varieties seeded systems in rainfed land. *J Agrivigor* 3: 170-177.

Walter A, WK Silk and U Schur. 2000. Effect of soil pH on growth and cation deposition in the root tip of *Zea mays* L. *J Plant Growth Regul* 19: 65-76.

Wuryaningsih S, T Sutater and B Tjia. 2008. Growth *Anthurium andraeanum* pot plants on coconut bulk media. *J Agric Res* 18: 31-38.

Yakup. 2008. Effect of soil water availability and the time interval mulching on the growth and development of upland rice crop. *J Agria* 5: 5-8.