IOP Conference Series: Earth and Environmental Science

COUNTRY

United Kingdom

Universities and research institutions in United Kingdom

Media Ranking in United Kingdom

SUBJECT AREA AND CATEGORY

Earth and Planetary Sciences
- Earth and Planetary Sciences (miscellaneous)

Environmental Science
- Environmental Science (miscellaneous)

Physics and Astronomy
- Physics and Astronomy (miscellaneous)

PUBLISHER

IOP Publishing Ltd.

H-INDEX

41

PUBLICATION TYPE

Conferences and Proceedings

ISSN

17551315, 17551307

COVERAGE

2010-2022

INFORMATION

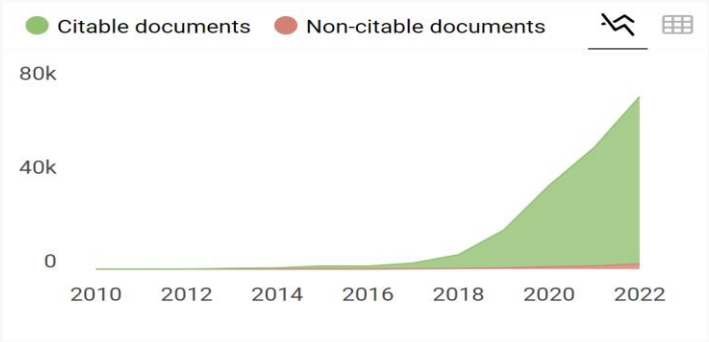
Homepage

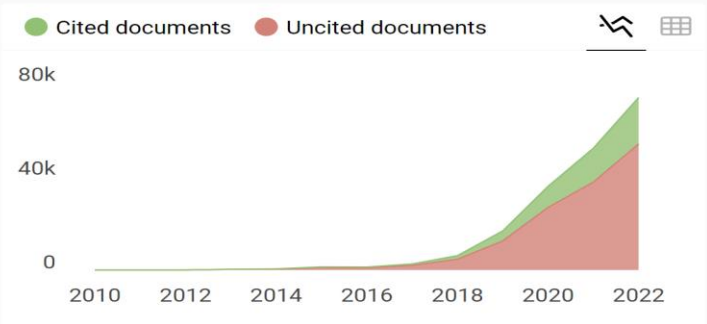
How to publish in this journal

ees@ioppublishing.org

SCOPE

The open access IOP Conference Series: Earth and Environmental Science (EES) provides a fast, versatile and cost-effective proceedings publication service.





← Show this widget in your own website

Just copy the code below and paste within your html code:

<a href="https://www.scimag

COVER

Daftar Isi

Papers

OPEN ACCESS 012001

Physical quality improvement of culled chicken meat with marinated technology using Gelugur acid (*Garcinia atroviridis*) biomass

P Patriani, H Hafid, T H Wahyuni and T V Sari

+ Open abstract View article PDF

OPEN ACCESS 012002

The use of vermicompost as an organic pond fertilizer in recirculating aquaculture system: effect on water quality and survival rate of catfish fry (*Clarias* sp.)

Erdawati, Ganjar Saefurahman, Syarif Hidayatuloh and M. Hakimi

+ Open abstract View article PDF

OPEN ACCESS 012003

Marination technology using kandis acid (*Garcinia xanthochymus*) biomass to improve the physical quality of culled chicken meat

H Hafid, P Patriani, Nuraini and S H Ananda

+ Open abstract View article PDF

OPEN ACCESS 012004

The growth, production and chemical compounds of *Chlorella* sp. in various concentrations of palm oil wastewater in laboratory culture media

Tengku Dahril, Aras Mulyadi and Eddiwan

+ Open abstract View article PDF

OPEN ACCESS 012005

Continuous extraction of *Spirulina platensis* biopigments using different extraction sequences

Ganjar Saefurahman, Ali Aulia Rahman, Syarif Hidayatuloh, Obie Farobie and Zaenal Abidin

+ Open abstract View article PDF

OPEN ACCESS 012006

Damage and loss magnitudes of *Eucalyptus pellita* and *Acacia mangium* stands due to 2D-seismic activity

H Agusta, P Budiyono and M Ridwansyah

+ Open abstract View article PDF

OPEN ACCESS 012007

The design of fresh fruit bunch palm oil purchase system from independent smallholders to support Indonesia's biodiesel development program

K Falgenti, Y Arkeman, E Hambali and K Syamsu

+ Open abstract View article PDF

OPEN ACCESS 012008

Potential of red fruit oil (*Pandanus conoideus* Lam.) as an antioxidant active packaging: A review

M S Sirait, E Warsiki and D Setyaningsih

+ Open abstract View article PDF

OPEN ACCESS 012009

Innovation of oxygen indicator for packaging leak detector: A review

A N A Sari, E Warsiki and I A Kartika

+ Open abstract View article PDF

OPEN ACCESS 012010

Production of high octane gasoline by catalytic cracking of petroleum gasoil with palm's triglyceride and oleic acid

Z Azis, B H Susanto and M Nasikin

+ Open abstract View article PDF

OPEN ACCESS 012011

Isotherm moisture sorption of composite desiccant made from rice husk biomass

E Warsiki, D Agriawati, E Noor and A Iskandar

+ Open abstract View article PDF

OPEN ACCESS 012012

Synthesis of mono diacyl glycerol from palm fatty acid distillate and glycerol as antistatic agents on plastics

Dwi Setyaningsih, Ihsan Nur Faqih, Neli Muna, Qatrinada Radiyatul Jannah and Syafira Salsabila

+ Open abstract View article PDF

OPEN ACCESS 012013

Kinetic and isotherm studies of Cu(II) adsorption by beads and film of alginate/zeolite 4A composites

Borneo Satria Pratama, Erliza Hambali, Mohamad Yani and Naoto Matsue

+ Open abstract View article PDF

OPEN ACCESS 012014

Physical and chemical properties of oil palm land which overgrown with weeds at different plant age

H Satriawan, Z Fuady and R Fitri

+ Open abstract View article PDF

Physical and chemical properties of oil palm land which overgrown with weeds at different plant age

Physical and chemical properties of oil palm land which overgrown with weeds at different plant age

H Satriawan[1], Z Fuady[1], R Fitri[2]

[1]Department of Agrotechnology, Faculty of Agriculture, Almuslim University, Bireuen, Aceh, Indonesia 24211
[2]Department of Landscape Architecture, Faculty of Landscape Architecture and Environmental Technology, University of Trisakti, Jakarta, Indonesia 11440

Email: satriawan_80@yahoo.co.id; zahrulfuady17@yahoo.com; rini.fitri@trisakti.ac.id

Abstract. Large plantations such as oil palm plantations are usually covered by several weed species which occasionally function as a land cover. Soil samples were obtained through Simple Random Sampling on various types of ground cover weeds, e.g *Asystasia intrusa, Eleusine indica, Cyperus kyllingia* Endl. and *Cyrtococcum oxyphyllum* Stapf., in 7-year old oil palm stands, and *Asystasia intrusa, Cyperus kyllingia* Endl., *Cyrtococcum oxyphyllum* Stapf. and *Cyperus rotundus*, in 6-year old stands. Each sample was randomly obtained from each replicate plot at a depth of 0-20 cm (layer 1) and 20-50 cm (layer 2) at 5 points. Variables of soil chemical properties observed were N-total, P-available, K-total, C-organic and soil pH, while the physical properties observed were water content (%) and volume weight, using the gravimetric method. The results showed that the presence of weeds beneath the oil palm stands in plantation areas did not continuously have a negative effect on the growing environment. In this study, the presence of 4 (four) weed species under 6 and 7 years old were found around old oil palm stands and classified as dominant existences actually have a positive tendency to influence the quality of physical and chemical properties of soil under oil palm stands.

1. Introduction

Oil palm (*Elaeis guineesis* Jacq) is an annual plant of the *palmae* family endemic in the tropics and is able to develop healthily at optimum temperatures ranging from 29-30^{o}C. The optimum rainfall required for its growth is between 2000-2500 mm per year with an even distribution of rain all year round without an arid month. The ideal land conditions for oil palm are those that have fertile loose soil, a pH between 5.0-5.5, an effective depth without solid layers, and slope between 0-15% [1]. The soil height required for its growth is between 0-400 m above sea level [2, 3].

The area of oil palm plantations in 2010 totaled 9 million hectares [4], and subsequently increased to 12.3 million hectares, consisting of 42% community plantations, 7% state-owned plantations and 51% private plantations. In Aceh Province, total cultivation area is 458,619 ha, with a proportion of 50.89% community and 39.87% private plantations [5]. Of the total national oil palm plantation area, about 2.7 million ha is immature oil palm, while 118,173 ha found in Aceh.

Large plantations such as oil palm are usually overgrown with several weed species that function as ground cover. Often, weeds found in these plantations are *Psophocurphus palutris, Pueraria javanica, Colopogonium mucunoides* [6], *Asystasia gangetica* [7], *Asystasia intrusa, Eleusine indica*

and Cynodon dactylon [8]. They are often used as Land Cover Crops (LCC), in addition to other ground cover species. Land cover crops on plantations protect the soil from erosion, reduce evaporation of water from the soil surface, help store water within the soil, and increase nutrients through weathering of organic matter [9]. The improvement of soil ecosystems will affect the physical, chemical, biological and microbiological properties within it. [10] Shows that Wedelia plants contribute higher amounts of available N to the soil than *Chromolaena* and *Melastoma*. Furthermore, [11] shows that *Chromolaena* increases soil C levels. Whereas in rubber plantations, the weed *Panicum muticum* and *Calopogonium mucunoides* have a better potential in the improvement of chemical properties than *Pueraria javanica* and *Wedelia trilobata* [12]. Such plants emerge as the dominant agricultural weeds. The best growth conditions are at an average temperature of 25^{o}C. Tubers or rhizomes germinate at temperatures ranging 10-40^{o}C. Soil pH for growing grass weeds is between 4.0 - 7.5 [13]. The purpose of this study is to show the effect of weeds on the physical and chemical properties of soils in oil palm stands.

2. Research Methods

2.1. Soil Sampling

This research was conducted in the community plantations at the Almuslim University in the South Peusangan Sub-dsitrict and Peusangan Siblah Krueng Sub-district, Bireuen District, Aceh. The area of the study site is 250 ha, while its height ranges between 100-200 m above sea level. There are two groups of oil palm plantations which were classified based on the year of planting, which included the crops planted in 2012 (7-year) and 2013 (6-years), respectively. Soil samples were obtained using Simple Random Sampling on various species of ground cover weeds, such as *Asystasia intrusa, Eleusine indica, Cyperus kyllingia* Endl. and *Cyrtococcum oxyphyllum* Stapf. in 7-year old stands, and *Asystasia intrusa*, *Cyperus kyllingia* Endl., *Cyrtococcum oxyphyllum* Stapf and *Cyperus rotundus* in 6-year old oil palm stands. The choice of weeds is based on the dominant weed in both plantation groups. The soil sampling plot is around 5x15 m, and each was subdivided into 3 small plots with a 5x3 m replication size, bringing the number of replicate plots to 24. Soil samples were obtained from each plot at a depth of 0-20 cm (layer 1) and 20-50 cm (layer 2) at 5 points randomly. Next, they were dried, composited, and filtered with a 0.5mm sieve. Analysis of samples was conducted at the Laboratory of Agriculture, Almuslim University in accordance with the observed variables.

2.2. Variables and Data Analysis

The soil chemical variables observed in this study include the N-total analyzed by the Micro Kjeldahl method, P-available analyzed by the Bray-Kurtz method, K-total by Gravimetry and Titration, C-organic using the Kurmies method and pH, analyzed via the electrometric method at a ratio of soil and water 1: 1. Meanwhile, the physical features observed were water content (%) measured using the gravimetric method of weighing each soil sample before and after drying (in the oven) at 105°C for 24 hours. Furthermore, the volume weight was obtained by gravimetric method. Rainfall was absent during the collection of samples.

3. Results and Discussion

3.1. General situation of research location

The research location was the community oil palm plantation in Almuslim University, South Peusangan Sub-district with Ultisol soil type. This soil has a pH range of 5.13-5.8, and a type B (wet) climate classified according to the Schmidt and Ferguson categories, with an average monthly rainfall of 209 mm. The age of cultivated oil palm plants varied between 2-7 years, but the soil sampling location ranged between 6 and 7 years.

3.2. Soil characteristics on oil palm stands

In general, the chemical and physical properties of soils at a depth of 0-50 cm in 7-year old oil palm plantations containing various weed species beneath their stands, are more favorable than those of 6-

year old plantations (Table 1-4). *Asystasia intrusa* contributes more C-organic, N-total, and P-available than other weed species. In addition, the physical characteristics show slightly better conditions, especially the soil volume weight and water content.

Table 1. Soil properties in the 0-20 cm layer of a 7-year-old oil palm plantations land which overgrown with several species of weeds (2012 planting year)

Weed Species	C-organic (%)	N-Total (%)	P-available (ppm)	K-exchanged (me / 100 gr)	pH	BV (gr/cm3)	Soil Water Content (%)
Cyperus kyllingia Endl	1.54	0.22	1.20	0.28	5.41	1.34	16.11
Eleusine indica	2.70	0.29	1.89	0.36	5.20	1.33	17.30
Cyrtococcum oxyphyllum Stapf	2.40	0.31	1.78	0.42	5.18	1.33	17.91
Asystasia intrusa	3.29	0.43	2.47	0.32	5.52	1.32	20.80

Table 1 shows that in the 0-20 cm layer soil, the N-total in *Asystasia intrusa* was nearly twice (95%) greater than that of *Cyperus kyllingia* Endl, whereas in *Asystasia intrusa*, it was only 48%; 38% greater than in Eleusine *indic*a and *Cyrtococcum oxyphyllum* Stapf. On the other treatment, an increase in N-total of the soil was consistent for both treatments. This phenomenon is in line with the results obtained by [14], that the presence of *Asystasia* land cover crops increases 43.7% N, 112.5% P_2O_5, and 162.6% K_2O. An increase in N-total is associated with increased amounts of organic matter (C-organic) which then experiences weathering. According to [15], the soil is categorized as fertile when C-organic content is above 3%. The main source of organic matter is litter / humus derived from leaf drops of *Asytasia intrusa*, which produces the highest value of C-organic content. Other study have equally affirmed that forage plants *Arachis glabrata* and *Stenotaphrum secundatum* in oil palm stands produced which increases soil P levels [16].

Table 2. Soil properties in the 20-50 cm layer of a 7-year-old oil palm plantations land which overgrown with several species of weeds (2012 planting year)

Weed Species	C-organic (%)	N-total (%)	P-available (ppm)	K-exchanged (me / 100 gr)	pH	BV (gr/cm3)	Soil Water Content (%)
Cyperus kyllingia Endl	1.65	0.15	3.93	1.10	5.61	1.33	13.41
Eleusine indica	1.47	0.14	2.39	0.93	5.50	1.32	14.60
Cyrtococcum oxyphyllum Stapf	1.30	0.17	1.95	0.91	5.30	1.33	13.20
Asystasia intrusa	2.72	0.24	4.07	1.16	5.80	1.31	18.32

The N-total in the 20-50 cm layer of soil has a lower value than the 0-20 cm layer (Table 2). The decrease of C-organic and nitrogen is due to leaching. This is supported by [17], which states that obstruction of the infiltration process results in surface runoff during rainfall; the resulting flow transports the soil, eroding it. This occurs because this species is a weed in the narrow leaf grass group. However, the levels of P-available and K-exchanged are higher in the 20-50 cm layer than the upper layers. Another possibility is that the C-organic content of the top soil is higher than the sub-soil which is related to the mineralization and nutrient absorption process occurring in the lower layer closer to the plant roots.

Based on the criteria for soil chemical fertility classification in a 7-year old oil palm stand, it is deduced that: a) the *Cyperus kylingia* Endl weed cover falls into the low category for C-organic, P and K, and moderate category for N-total with acidic pH; b) *Eleusine indica* and *Cyrtococcum oxyphyllum* Stapf. belong to the moderate category for C-organic and N-total, and low category for P and K with a slightly acidic pH; c) soil fertility in stands with *Asystasia intrusa* fall into the high category for C-organic, moderate category for N, and low category for P and K, with slightly acidic pH. In the 6-year old oil palm stand, the distribution value of soil properties is also almost equal to the 7-year old stand, although the values are significantly lower in the 6 year old stand (Table 3-4).

Table 3. Soil properties in the 0-20 cm layer of a 6-year-old oil palm plantations land which overgrown with several species of weeds (2013 planting year).

Weed Species	C-organic (%)	N-total (%)	P-available (ppm)	K-exchanged (me/100 gr)	pH	BV (gr/cm3)	Soil Water Content (%)
Cyperus kyllingia Endl	1.32	0.24	1.67	0.56	5.30	1.35	15.41
Cyperus rotundus	1.41	0.27	1.79	0.54	5.40	1.32	16.61
Cyrtococcum oxyphyllum Stapf	1.60	0.33	2.33	0.67	5.70	1.35	15.70
Asystasia intrusa	2.83	0.56	2.49	0.78	5.80	1.32	19.30

Table 3 shows that *Asystasia intrusa* at 6-year old stand influenced the levels of chemical elements and physical properties in the soil more than other weed covers. As in the 7-year old stand, the 0-20 cm layer in this group also contributes to sufficient C-organic, and N-total among the four weed species is in the medium category. Of these four species, *Asystasia intrusa* contributed the highest C-organic and N-total compared to the other three species.

The decrease in N-total in the sub-soil layer (20-50 cm) indicates denitrification of the N elements in the top layer. Leaching of N can be in the form of N-inorganic which is the result of decomposition of organic matter in the first layer and N-organic leaching of organic matter from the top layer. In addition to N, the presence of weeds among 6-year old oil palm plants also contribute to P-available of soil as shown in Tables 3 and 4. The presence of weeds does not affect the level of P-available, although there is a downward trend. From tables 3 and 4, it is safely deduced that *Asystasia intrusa* produces the highest levels of P-available, which means that its weathering contributes P into the soil better than other ground cover weeds.

In the 20-50 cm layer, land cover fails to provide a significant increase in P-available. It shows that P is not leached from layers 1 to 2. This is related to the reaction of P with chemical compounds in the above layer. The P element reacts with Al, Fe, and Ca compounds to form Al-P, Fe-P, and Ca-P complex compounds, thus P is not available to plants as reported by [18].

The K-total of soil in the 0-20 cm and 20-50 layers slightly fluctuated and increased in *Asystasia intrusa*, *Crytococcum oxyphyllum* Stapf and *Cyperus rotundus*, but decreased in *Cyperus kylingia* Endl (Tables 3 and 4). The K-total in the 6-year old oil palm with *Asystasia intrusa* was 50.9% higher than *Cyperus Kylingia* Endl. It therefore shows that the weathering of *Asystasia intrusa* contributes K into the soil better than other weeds.

Table 4. Soil properties in the 20-50 cm layer of a 6-year-old oil palm plantations land which overgrown with several species of weeds (2013 planting year).

Weed Species	C-organic (%)	N-total (%)	P-available (ppm)	K-exchanged (me/100 gr)	pH	BV (gr/cm^3)	Soil Water Content (%)
Cyperus kyllingia Endl	1.10	0.14	1.55	0.53	5.31	1.22	15.70
Cyperus rotundus	1.24	0.18	1.69	0.57	5.41	1.21	14.30
Cyrtococcum oxyphyllum Stapf	1.40	0.21	1.93	0. 7	5.72	1.25	14.20
Asystasia intrusa	1.69	0.36	2.12	0.8	5.81	1.20	17.81

In the 20-50 cm layer (Table 4), it is obvious that with increase in K-total, the soil does not experience leaching from layers 1 to 2. Tables 1 - 4 also shows that the presence of weeds is unable to significantly increase C-organic content both in 0-20 cm and 20-50 cm layers. Therefore, weathering of organic matter and release of organic acids and nutrients into the soil also emits CO_2 into the air, thus C-organics experience less leaching.

The results of the study in general showed that the various weed species did not have a significant effect on soil pH (Tables 1 and 2). Previous studies conducted by [10] also stated that pioneer plants had no effect on pH. Also, it was observed that each species of land cover crops gave a relatively different effect on soil nutrients. *Asyatasia intrusa* weeds increased C-organic and N-total of soil more than other weeds. Weeds from the Asystasia genus are used as land cover crops [19], which contain several nutrients including N, P, K, Ca, Mg, Fe and Zn in their plant tissues [20]. With this knowledge, Asystasia weeds are to be easily applied as green manure or cover crops during cultivation of plantations. In terms of improving soil physical properties, the application of Asystasia in laboratory scale is reported to increase the stability and percentage of soil aggregates formed [21]. Therefore, Tables 1-4 show that these weeds have a better potential in the improvement of the chemical properties of soil.

The physical properties however, on tables 1-4 show the ability of certain weeds to indirectly affect the physical condition of the soil that supports plant growth. Volume weight <1.2 for mineral soil is suitable for root development, especially where the formation of a soil pore is balanced, thus affecting the water content. It means that, with this volume weight value, there has been a compaction process on both top soil and sub-soil. This compaction occurs due to human activities on it, or is influenced by pore closure due to runoff erosion, especially during rainfall. Hence, it is consistent with [22] theory which states that BV> 1.2 g / cm^3 exceeds the critical value for healthy agricultural soils, especially those containing clay. This high volume weight correlates with the water content which is below the optimal field capacity (25%), which is about 14.2 - 20.8% in top soil. However, in this condition, moisture is maintained in sufficient levels during the dry season. The results of this study when directly compared with the application of land cover crops from *Mucuna bracteata* in oil palm

plantations, obtained the same pattern, which is an improvement in soil physical properties such as water content and volume weight [23], although not as good as its influence [24]. Therefore, the weakness point of this study is the absence of a comparison with land conditions not planted with oil palm.

4. Conclusions

The presence of weeds beneath oil palm stands in plantations does not usually have a negative effect on their growing environments. In this study, the presence of 4 (four) weed species found under 6 and 7-year old oil palm stands classified as dominant, and actually had a positive influence on the quality of the physical and chemical properties of the soil. This research needs to be continued to obtain information related to the balance of nutrients between soil and oil palm plants, water balance, weed control and soil loss, and what is no less important is the dynamics of oil palm production.

Acknowledgments

The research was funded by the Directorate of Research and Community Service Deputy for Research and Technology Strengthening Ministry of Research and Technology / Research and Innovation Agency with LLDIKTI Region XIII Number 235 / SP2H / LT / DRPM / 2020.

References

[1] Setyamidjaja D 1993 Budidaya Kelapa Sawit. Kanisius, Yogyakarta.
[2] Sugiyono I, Harahap Y, Winarna, Koedadiri A D, Purba A, Purba P 2003 Penilaian Kesesuaian Lahan Kelapa Sawit. Pusat Penelitian Kelapa Sawit Medan.
[3] Pambudi D T, Hermawan B 2010 Hubungan antara Beberapa Karakteristik Fisik Lahan dan Produksi Kelapa Sawit *Akta Agrosia* **13** 35 – 39
[4] Putra E T S, Simatupang A F, Supriyatna, Waluyo S, Indradewa D 2012. The growth of one year-old oil palms intercropped with soybean and groundnut *Journal of Agricultural Science.* **4**:169-180
[5] Direktorat Jenderal Perkebunan 2018. Statistik Perkebunan Indonesia 2015-2017
[6] Sukman, Yakub Y 2002 Gulma dann Teknik Pengendaliannnya (edisi revisi). PT Raja Grafindo Persada. Jakarta.
[7] Asbur Y, Purwaningrum Y, Ariyanti M 2015 Growth and nutrient balance of Asystasia gangetica (L.) T. Anderson as cover crop for mature oil palm (Elaeis guineensis Jacq.) plantations *Chilean Journal of Agricultural Research* **78** 486-494 doi:10.4067/S0718-58392018000400486
[8] Satriawan H, Fuady Z 2019 Analysis of weed vegetation in immature and mature oil palm plantations *Biodiversitas* **20**: 3292-3298. https://doi.org/10.13057/biodiv/d201123
[9] Setyamidjaja D 1993 Budidaya Kelapa Sawit. Kanisius, Yogyakarta.
[10] Sehan N 2005 Pengaruh budidaya tumbuhan pioneer dan pupuk organic terhadap kesuburan tanah lahan alang-alang. Skripsi Fakultas Pertanian Universitas Bengkulu
[11] Syerni A D 2005 Potensi pertumbuhan pioneer dan pupuk organik dalam mereklamasi lahan bekas alang-alang. Skripsi Fakultas Pertanian Universitas Bengkulu
[12] Muktamar Z, Prawito P, Nugroho T 2006. Selected Soil Chemical Properties under Various Species of Land Cover Crop in Rubber Plantation. http://repository.unib.ac.id/2001/ [Accessed on 30 September 2019].
[13] Sugiono CM, Nuraini Y, Handayanto E 2014 Potensi Cyperus kyllingia Endl. untuk Fitoremediasi Tanah Tercemar Merkuri Limbah Tambang Emas. *Jurnal Tanah dan Sumberdaya Lahan.* **1**: 1-8

14] Asbur Y, Yahya S, Murtilaksono K, Sudrajat, Sutarta E S 2015 Study of Asystasia gangetica (L.) Anderson Utilization as Cover Crop under Mature Oil Palm with Different Ages. *International Journal of Sciences: Basic and Applied Research (IJSBAR),* **19**: 137-148.

[15] Sari N P, Santoso T I, Mawardi S 2013 Sebaran tingkat kesuburan tanah pada perkebunan rakyat kopi Arabika di Dataran Tinggi Ijen-Raung menurut ketinggian tempat dan tanaman penaung. *Pelita Perkebunan.* **29**: 93 - 107

[16] Fazrin D A, Hanum C, Irsal 2014 Kadar N, P dan K Tanah Pada Tanaman Kelapa Sawit Menghasilkan dengan Berbagai Komposisi Penanaman Tanaman Sela di Bawah Tegakan. *Jurnal Online Agroekoteknologi,* **3**: 1164 – 1172

[17] Satriawan H, Fuady Z, Mayani N 2016 Soil Conservation By Vegetative Systems On Oil Palm Cultivation. *Polish Journal of Soil Science*, **49**:223-235. **DOI:** 10.17951/pjss/2016.49.2.223

[18] Pujiyanto S, Rahim A, Sabiham S, Sastiono A, Baon J B 2004 Pengaruh bahan organikdan jenis tanaman penutup tanah terhadap bentuk-bentuk P dalam aggregate tanah. *Jurnal Tanah Tropika,* **18**:117-126

[19] Adetula O A 2004 Asystasia gangetica (L.) Anderson. Record from PROTA4U. Grubben GJH and Denton OA (Editors). PROTA (Plant Resources of Tropical Africa/Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. www.prota4u.org/search.asp. [Accessed on 26 September 2019]

[20] Odharva B, Beekrumb S, Akuala U, Baijnathc H 2007 Preliminary assessment of nutritional leafy vegetables in Kwa Zulu-Natal, South Africa. *Journal of Food Composition and Analysis*, **20**: 430-435

[21] Junedi H, Myrna N, Fathia E 2015. Peningkatan Kemantapan Agregat Tanah pada Ultisol melalui Aplikasi Ara Sungsang (Asystasia gangetica (L.) T. Anders.). Prosiding Seminar Nasional Lahan Suboptimal 2015, Palembang 8-9 Oktober 2015. ISBN. 979-587-580-9

[22] Brouwer D, Jenkins A 2015 Managing for Healthy Soil: A Guide – A Practical Handbook. NSW Agriculture, Tocal - New South Wales.

[23] Aleksandro P, Wawan, Wardati 2016 Sifat Fisik Tanah Dystrudepts di Bawah Tegakan Kelapa Sawit (*Elais Guineensis* Jacq.) Fakultas Pertanian Universitas Riau yang Diaplikasi Mulsa Organik *Mucuna bracteata. Jom Faperta,* **3**: 1-9

[24] Sakiah, Sembiring M, Sari N 2017 Physical and Chemical Characteristics of Soil on Oil palm Plantation *(Elaeis guineensis* Jacq) with Legum Cover Crop *Mucuna bracteata. Jurnal AgroEstate,* **1**: 34-42

RF Artikel_IOP

by Rini Fitri

Submission date: 10-Apr-2023 08:22AM (UTC+0700)
Submission ID: 2059977871
File name: Bukti_Pendukung_Artikel_IOP.pdf (984.84K)
Word count: 3979
Character count: 20501

COVER

Daftar Isi

Papers

OPEN ACCESS 012001

Physical quality improvement of culled chicken meat with marinated technology using Gelugur acid (*Garcinia atroviridis*) biomass

P Patriani, H Hafid, T H Wahyuni and T V Sari

+ Open abstract View article PDF

OPEN ACCESS 012002

The use of vermicompost as an organic pond fertilizer in recirculating aquaculture system: effect on water quality and survival rate of catfish fry (*Clarias* sp.)

Erdawati, Ganjar Saefurahman, Syarif Hidayatuloh and M. Hakimi

+ Open abstract View article PDF

OPEN ACCESS 012003

Marination technology using kandis acid (*Garcinia xanthochymus*) biomass to improve the physical quality of culled chicken meat

H Hafid, P Patriani, Nuraini and S H Ananda

+ Open abstract View article PDF

OPEN ACCESS 012004

The growth, production and chemical compounds of *Chlorella* sp. in various concentrations of palm oil wastewater in laboratory culture media

Tengku Dahril, Aras Mulyadi and Eddiwan

+ Open abstract View article PDF

OPEN ACCESS 012005

Continuous extraction of *Spirulina platensis* biopigments using different extraction sequences

Ganjar Saefurahman, Ali Aulia Rahman, Syarif Hidayatuloh, Obie Farobie and Zaenal Abidin

+ Open abstract View article PDF

OPEN ACCESS 012006

Damage and loss magnitudes of *Eucalyptus pellita* and *Acacia mangium* stands due to 2D-seismic activity

H Agusta, P Budiyono and M Ridwansyah

+ Open abstract View article PDF

OPEN ACCESS 012007

The design of fresh fruit bunch palm oil purchase system from independent smallholders to support Indonesia's biodiesel development program

K Falgenti, Y Arkeman, E Hambali and K Syamsu

+ Open abstract View article PDF

OPEN ACCESS 012008

Potential of red fruit oil (*Pandanus conoideus* Lam.) as an antioxidant active packaging: A review

M S Sirait, E Warsiki and D Setyaningsih

+ Open abstract View article PDF

OPEN ACCESS 012009

Innovation of oxygen indicator for packaging leak detector: A review

A N A Sari, E Warsiki and I A Kartika

+ Open abstract View article PDF

OPEN ACCESS 012010

Production of high octane gasoline by catalytic cracking of petroleum gasoil with palm's triglyceride and oleic acid

Z Azis, B H Susanto and M Nasikin

+ Open abstract View article PDF

OPEN ACCESS 012011

Isotherm moisture sorption of composite desiccant made from rice husk biomass

E Warsiki, D Agriawati, E Noor and A Iskandar

+ Open abstract View article PDF

OPEN ACCESS 012012

Synthesis of mono diacyl glycerol from palm fatty acid distillate and glycerol as antistatic agents on plastics

Dwi Setyaningsih, Ihsan Nur Faqih, Neli Muna, Qatrinada Radiyatul Jannah and Syafira Salsabila

+ Open abstract View article PDF

OPEN ACCESS 012013

Kinetic and isotherm studies of Cu(II) adsorption by beads and film of alginate/zeolite 4A composites

Borneo Satria Pratama, Erliza Hambali, Mohamad Yani and Naoto Matsue

+ Open abstract View article PDF

OPEN ACCESS 012014

Physical and chemical properties of oil palm land which overgrown with weeds at different plant age

H Satriawan, Z Fuady and R Fitri

+ Open abstract View article PDF

Physical and chemical properties of oil palm land which overgrown with weeds at different plant age

Physical and chemical properties of oil palm land which overgrown with weeds at different plant age

H Satriawan[1], Z Fuady[1], R Fitri[2]

[1]Department of Agrotechnology, Faculty of Agriculture, Almuslim University, Bireuen, Aceh, Indonesia 24211
[2]Department of Landscape Architecture, Faculty of Landscape Architecture and Environmental Technology, University of Trisakti, Jakarta, Indonesia 11440

Email: satriawan_80@yahoo.co.id; zahrulfuady17@yahoo.com; rini.fitri@trisakti.ac.id

Abstract. Large plantations such as oil palm plantations are usually covered by several weed species which occasionally function as a land cover. Soil samples were obtained through Simple Random Sampling on various types of ground cover weeds, e.g *Asystasia intrusa, Eleusine indica, Cyperus kyllingia* Endl. and *Cyrtococcum oxyphyllum* Stapf., in 7-year old oil palm stands, and *Asystasia intrusa, Cyperus kyllingia* Endl., *Cyrtococcum oxyphyllum* Stapf. and *Cyperus rotundus*, in 6-year old stands. Each sample was randomly obtained from each replicate plot at a depth of 0-20 cm (layer 1) and 20-50 cm (layer 2) at 5 points. Variables of soil chemical properties observed were N-total, P-available, K-total, C-organic and soil pH, while the physical properties observed were water content (%) and volume weight, using the gravimetric method. The results showed that the presence of weeds beneath the oil palm stands in plantation areas did not continuously have a negative effect on the growing environment. In this study, the presence of 4 (four) weed species under 6 and 7 years old were found around old oil palm stands and classified as dominant existences actually have a positive tendency to influence the quality of physical and chemical properties of soil under oil palm stands.

1. Introduction

Oil palm (*Elaeis guineesis* Jacq) is an annual plant of the *palmae* family endemic in the tropics and is able to develop healthily at optimum temperatures ranging from 29-30ºC. The optimum rainfall required for its growth is between 2000-2500 mm per year with an even distribution of rain all year round without an arid month. The ideal land conditions for oil palm are those that have fertile loose soil, a pH between 5.0-5.5, an effective depth without solid layers, and slope between 0-15% [1]. The soil height required for its growth is between 0-400 m above sea level [2, 3].

The area of oil palm plantations in 2010 totaled 9 million hectares [4], and subsequently increased to 12.3 million hectares, consisting of 42% community plantations, 7% state-owned plantations and 51% private plantations. In Aceh Province, total cultivation area is 458,619 ha, with a proportion of 50.89% community and 39.87% private plantations [5]. Of the total national oil palm plantation area, about 2.7 million ha is immature oil palm, while 118,173 ha found in Aceh.

Large plantations such as oil palm are usually overgrown with several weed species that function as ground cover. Often, weeds found in these plantations are *Psophocurphus palutris, Pueraria javanica, Colopogonium mucunoides* [6], *Asystasia gangetica* [7], *Asystasia intrusa, Eleusine indica*

and Cynodon dactylon [8]. They are often used as Land Cover Crops (LCC), in addition to other ground cover species. Land cover crops on plantations protect the soil from erosion, reduce evaporation of water from the soil surface, help store water within the soil, and increase nutrients through weathering of organic matter [9]. The improvement of soil ecosystems will affect the physical, chemical, biological and microbiological properties within it. [10] Shows that Wedelia plants contribute higher amounts of available N to the soil than *Chromolaena* and *Melastoma*. Furthermore, [11] shows that *Chromolaena* increases soil C levels. Whereas in rubber plantations, the weed *Panicum muticum* and *Calopogonium mucunoides* have a better potential in the improvement of chemical properties than *Pueraria javanica* and *Wedelia trilobata* [12]. Such plants emerge as the dominant agricultural weeds. The best growth conditions are at an average temperature of 25°C. Tubers or rhizomes germinate at temperatures ranging 10-40°C. Soil pH for growing grass weeds is between 4.0 - 7.5 [13]. The purpose of this study is to show the effect of weeds on the physical and chemical properties of soils in oil palm stands.

2. Research Methods

2.1. Soil Sampling

This research was conducted in the community plantations at the Almuslim University in the South Peusangan Sub-dsitrict and Peusangan Siblah Krueng Sub-district, Bireuen District, Aceh. The area of the study site is 250 ha, while its height ranges between 100-200 m above sea level. There are two groups of oil palm plantations which were classified based on the year of planting, which included the crops planted in 2012 (7-year) and 2013 (6-years), respectively. Soil samples were obtained using Simple Random Sampling on various species of ground cover weeds, such as *Asystasia intrusa, Eleusine indica, Cyperus kyllingia* Endl. and *Cyrtococcum oxyphyllum* Stapf. in 7-year old stands, and *Asystasia intrusa*, *Cyperus kyllingia* Endl., *Cyrtococcum oxyphyllum* Stapf and *Cyperus rotundus* in 6-year old oil palm stands. The choice of weeds is based on the dominant weed in both plantation groups. The soil sampling plot is around 5x15 m, and each was subdivided into 3 small plots with a 5x3 m replication size, bringing the number of replicate plots to 24. Soil samples were obtained from each plot at a depth of 0-20 cm (layer 1) and 20-50 cm (layer 2) at 5 points randomly. Next, they were dried, composited, and filtered with a 0.5mm sieve. Analysis of samples was conducted at the Laboratory of Agriculture, Almuslim University in accordance with the observed variables.

2.2. Variables and Data Analysis

The soil chemical variables observed in this study include the N-total analyzed by the Micro Kjeldahl method, P-available analyzed by the Bray-Kurtz method, K-total by Gravimetry and Titration, C-organic using the Kurmies method and pH, analyzed via the electrometric method at a ratio of soil and water 1: 1. Meanwhile, the physical features observed were water content (%) measured using the gravimetric method of weighing each soil sample before and after drying (in the oven) at 105°C for 24 hours. Furthermore, the volume weight was obtained by gravimetric method. Rainfall was absent during the collection of samples.

3. Results and Discussion

3.1. General situation of research location

The research location was the community oil palm plantation in Almuslim University, South Peusangan Sub-district with Ultisol soil type. This soil has a pH range of 5.13-5.8, and a type B (wet) climate classified according to the Schmidt and Ferguson categories, with an average monthly rainfall of 209 mm. The age of cultivated oil palm plants varied between 2-7 years, but the soil sampling location ranged between 6 and 7 years.

3.2. Soil characteristics on oil palm stands

In general, the chemical and physical properties of soils at a depth of 0-50 cm in 7-year old oil palm plantations containing various weed species beneath their stands, are more favorable than those of 6-

year old plantations (Table 1-4). *Asystasia intrusa* contributes more C-organic, N-total, and P-available than other weed species. In addition, the physical characteristics show slightly better conditions, especially the soil volume weight and water content.

Table 1. Soil properties in the 0-20 cm layer of a 7-year-old oil palm plantations land which overgrown with several species of weeds (2012 planting year)

Weed Species	C-organic (%)	N-Total (%)	P-available (ppm)	K-exchanged (me / 100 gr)	pH	BV (gr/cm3)	Soil Water Content (%)
Cyperus kyllingia Endl	1.54	0.22	1.20	0.28	5.41	1.34	16.11
Eleusine indica	2.70	0.29	1.89	0.36	5.20	1.33	17.30
Cyrtococcum oxyphyllum Stapf	2.40	0.31	1.78	0.42	5.18	1.33	17.91
Asystasia intrusa	3.29	0.43	2.47	0.32	5.52	1.32	20.80

Table 1 shows that in the 0-20 cm layer soil, the N-total in *Asystasia intrusa* was nearly twice (95%) greater than that of *Cyperus kyllingia* Endl, whereas in *Asystasia intrusa*, it was only 48%; 38% greater than in Eleusine *indic*a and *Cyrtococcum oxyphyllum* Stapf. On the other treatment, an increase in N-total of the soil was consistent for both treatments. This phenomenon is in line with the results obtained by [14], that the presence of *Asystasia* land cover crops increases 43.7% N, 112.5% P_2O_5, and 162.6% K_2O. An increase in N-total is associated with increased amounts of organic matter (C-organic) which then experiences weathering. According to [15], the soil is categorized as fertile when C-organic content is above 3%. The main source of organic matter is litter / humus derived from leaf drops of *Asytasia intrusa*, which produces the highest value of C-organic content. Other study have equally affirmed that forage plants *Arachis glabrata* and *Stenotaphrum secundatum* in oil palm stands produced which increases soil P levels [16].

Table 2. Soil properties in the 20-50 cm layer of a 7-year-old oil palm plantations land which overgrown with several species of weeds (2012 planting year)

Weed Species	C-organic (%)	N-total (%)	P-available (ppm)	K-exchanged (me / 100 gr)	pH	BV (gr/cm3)	Soil Water Content (%)
Cyperus kyllingia Endl	1.65	0.15	3.93	1.10	5.61	1.33	13.41
Eleusine indica	1.47	0.14	2.39	0.93	5.50	1.32	14.60
Cyrtococcum oxyphyllum Stapf	1.30	0.17	1.95	0.91	5.30	1.33	13.20
Asystasia intrusa	2.72	0.24	4.07	1.16	5.80	1.31	18.32

The N-total in the 20-50 cm layer of soil has a lower value than the 0-20 cm layer (Table 2). The decrease of C-organic and nitrogen is due to leaching. This is supported by [17], which states that obstruction of the infiltration process results in surface runoff during rainfall; the resulting flow transports the soil, eroding it. This occurs because this species is a weed in the narrow leaf grass group. However, the levels of P-available and K-exchanged are higher in the 20-50 cm layer than the upper layers. Another possibility is that the C-organic content of the top soil is higher than the sub-soil which is related to the mineralization and nutrient absorption process occurring in the lower layer closer to the plant roots.

Based on the criteria for soil chemical fertility classification in a 7-year old oil palm stand, it is deduced that: a) the *Cyperus kylingia* Endl weed cover falls into the low category for C-organic, P and K, and moderate category for N-total with acidic pH; b) *Eleusine indica* and *Cyrtococcum oxyphyllum* Stapf. belong to the moderate category for C-organic and N-total, and low category for P and K with a slightly acidic pH; c) soil fertility in stands with *Asystasia intrusa* fall into the high category for C-organic, moderate category for N, and low category for P and K, with slightly acidic pH. In the 6-year old oil palm stand, the distribution value of soil properties is also almost equal to the 7-year old stand, although the values are significantly lower in the 6 year old stand (Table 3-4).

Table 3. Soil properties in the 0-20 cm layer of a 6-year-old oil palm plantations land which overgrown with several species of weeds (2013 planting year).

Weed Species	C-organic (%)	N-total (%)	P-available (ppm)	K-exchanged (me/100 gr)	pH	BV (gr/cm3)	Soil Water Content (%)
Cyperus kyllingia Endl	1.32	0.24	1.67	0.56	5.30	1.35	15.41
Cyperus rotundus	1.41	0.27	1.79	0.54	5.40	1.32	16.61
Cyrtococcum oxyphyllum Stapf	1.60	0.33	2.33	0.67	5.70	1.35	15.70
Asystasia intrusa	2.83	0.56	2.49	0.78	5.80	1.32	19.30

Table 3 shows that *Asystasia intrusa* at 6-year old stand influenced the levels of chemical elements and physical properties in the soil more than other weed covers. As in the 7-year old stand, the 0-20 cm layer in this group also contributes to sufficient C-organic, and N-total among the four weed species is in the medium category. Of these four species, *Asystasia intrusa* contributed the highest C-organic and N-total compared to the other three species.

The decrease in N-total in the sub-soil layer (20-50 cm) indicates denitrification of the N elements in the top layer. Leaching of N can be in the form of N-inorganic which is the result of decomposition of organic matter in the first layer and N-organic leaching of organic matter from the top layer. In addition to N, the presence of weeds among 6-year old oil palm plants also contribute to P-available of soil as shown in Tables 3 and 4. The presence of weeds does not affect the level of P-available, although there is a downward trend. From tables 3 and 4, it is safely deduced that *Asystasia intrusa* produces the highest levels of P-available, which means that its weathering contributes P into the soil better than other ground cover weeds.

In the 20-50 cm layer, land cover fails to provide a significant increase in P-available. It shows that P is not leached from layers 1 to 2. This is related to the reaction of P with chemical compounds in the above layer. The P element reacts with Al, Fe, and Ca compounds to form Al-P, Fe-P, and Ca-P complex compounds, thus P is not available to plants as reported by [18].

The K-total of soil in the 0-20 cm and 20-50 layers slightly fluctuated and increased in *Asystasia intrusa*, *Crytococcum oxyphyllum* Stapf and *Cyperus rotundus*, but decreased in *Cyperus kylingia* Endl (Tables 3 and 4). The K-total in the 6-year old oil palm with *Asystasia intrusa* was 50.9% higher than *Cyperus Kylingia* Endl. It therefore shows that the weathering of *Asystasia intrusa* contributes K into the soil better than other weeds.

Table 4. Soil properties in the 20-50 cm layer of a 6-year-old oil palm plantations land which overgrown with several species of weeds (2013 planting year).

Weed Species	C-organic (%)	N-total (%)	P-available (ppm)	K-exchanged (me/100 gr)	pH	BV (gr/cm^3)	Soil Water Content (%)
Cyperus kyllingia Endl	1.10	0.14	1.55	0.53	5.31	1.22	15.70
Cyperus rotundus	1.24	0.18	1.69	0.57	5.41	1.21	14.30
Cyrtococcum oxyphyllum Stapf	1.40	0.21	1.93	0. 7	5.72	1.25	14.20
Asystasia intrusa	1.69	0.36	2.12	0.8	5.81	1.20	17.81

In the 20-50 cm layer (Table 4), it is obvious that with increase in K-total, the soil does not experience leaching from layers 1 to 2. Tables 1 - 4 also shows that the presence of weeds is unable to significantly increase C-organic content both in 0-20 cm and 20-50 cm layers. Therefore, weathering of organic matter and release of organic acids and nutrients into the soil also emits CO_2 into the air, thus C-organics experience less leaching.

The results of the study in general showed that the various weed species did not have a significant effect on soil pH (Tables 1 and 2). Previous studies conducted by [10] also stated that pioneer plants had no effect on pH. Also, it was observed that each species of land cover crops gave a relatively different effect on soil nutrients. *Asyatasia intrusa* weeds increased C-organic and N-total of soil more than other weeds. Weeds from the Asystasia genus are used as land cover crops [19], which contain several nutrients including N, P, K, Ca, Mg, Fe and Zn in their plant tissues [20]. With this knowledge, Asystasia weeds are to be easily applied as green manure or cover crops during cultivation of plantations. In terms of improving soil physical properties, the application of Asystasia in laboratory scale is reported to increase the stability and percentage of soil aggregates formed [21]. Therefore, Tables 1-4 show that these weeds have a better potential in the improvement of the chemical properties of soil.

The physical properties however, on tables 1-4 show the ability of certain weeds to indirectly affect the physical condition of the soil that supports plant growth. Volume weight <1.2 for mineral soil is suitable for root development, especially where the formation of a soil pore is balanced, thus affecting the water content. It means that, with this volume weight value, there has been a compaction process on both top soil and sub-soil. This compaction occurs due to human activities on it, or is influenced by pore closure due to runoff erosion, especially during rainfall. Hence, it is consistent with [22] theory which states that BV> 1.2 g / cm^3 exceeds the critical value for healthy agricultural soils, especially those containing clay. This high volume weight correlates with the water content which is below the optimal field capacity (25%), which is about 14.2 - 20.8% in top soil. However, in this condition, moisture is maintained in sufficient levels during the dry season. The results of this study when directly compared with the application of land cover crops from *Mucuna bracteata* in oil palm

plantations, obtained the same pattern, which is an improvement in soil physical properties such as water content and volume weight [23], although not as good as its influence [24]. Therefore, the weakness point of this study is the absence of a comparison with land conditions not planted with oil palm.

4. Conclusions

The presence of weeds beneath oil palm stands in plantations does not usually have a negative effect on their growing environments. In this study, the presence of 4 (four) weed species found under 6 and 7-year old oil palm stands classified as dominant, and actually had a positive influence on the quality of the physical and chemical properties of the soil. This research needs to be continued to obtain information related to the balance of nutrients between soil and oil palm plants, water balance, weed control and soil loss, and what is no less important is the dynamics of oil palm production.

Acknowledgments

The research was funded by the Directorate of Research and Community Service Deputy for Research and Technology Strengthening Ministry of Research and Technology / Research and Innovation Agency with LLDIKTI Region XIII Number 235 / SP2H / LT / DRPM / 2020.

References

[1] Setyamidjaja D 1993 Budidaya Kelapa Sawit. Kanisius, Yogyakarta.
[2] Sugiyono I, Harahap Y, Winarna, Koedadiri A D, Purba A, Purba P 2003 Penilaian Kesesuaian Lahan Kelapa Sawit. Pusat Penelitian Kelapa Sawit Medan.
[3] Pambudi D T, Hermawan B 2010 Hubungan antara Beberapa Karakteristik Fisik Lahan dan Produksi Kelapa Sawit *Akta Agrosia* **13** 35 – 39
[4] Putra E T S, Simatupang A F, Supriyatna, Waluyo S, Indradewa D 2012. The growth of one year-old oil palms intercropped with soybean and groundnut *Journal of Agricultural Science.* **4**:169-180
[5] Direktorat Jenderal Perkebunan 2018. Statistik Perkebunan Indonesia 2015-2017
[6] Sukman, Yakub Y 2002 Gulma dann Teknik Pengendaliannnya (edisi revisi). PT Raja Grafindo Persada. Jakarta.
[7] Asbur Y, Purwaningrum Y, Ariyanti M 2015 Growth and nutrient balance of Asystasia gangetica (L.) T. Anderson as cover crop for mature oil palm (Elaeis guineensis Jacq.) plantations *Chilean Journal of Agricultural Research* **78** 486-494 doi:10.4067/S0718-58392018000400486
[8] Satriawan H, Fuady Z 2019 Analysis of weed vegetation in immature and mature oil palm plantations *Biodiversitas* **20**: 3292-3298. https://doi.org/10.13057/biodiv/d201123
[9] Setyamidjaja D 1993 Budidaya Kelapa Sawit. Kanisius, Yogyakarta.
[10] Sehan N 2005 Pengaruh budidaya tumbuhan pioneer dan pupuk organic terhadap kesuburan tanah lahan alang-alang. Skripsi Fakultas Pertanian Universitas Bengkulu
[11] Syerni A D 2005 Potensi pertumbuhan pioneer dan pupuk organik dalam mereklamasi lahan bekas alang-alang. Skripsi Fakultas Pertanian Universitas Bengkulu
[12] Muktamar Z, Prawito P, Nugroho T 2006. Selected Soil Chemical Properties under Various Species of Land Cover Crop in Rubber Plantation. http://repository.unib.ac.id/2001/ [Accessed on 30 September 2019].
[13] Sugiono CM, Nuraini Y, Handayanto E 2014 Potensi Cyperus kyllingia Endl. untuk Fitoremediasi Tanah Tercemar Merkuri Limbah Tambang Emas. *Jurnal Tanah dan Sumberdaya Lahan.* **1**: 1-8

14] Asbur Y, Yahya S, Murtilaksono K, Sudrajat, Sutarta E S 2015 Study of Asystasia gangetica (L.) Anderson Utilization as Cover Crop under Mature Oil Palm with Different Ages. *International Journal of Sciences: Basic and Applied Research (IJSBAR),* **19**: 137-148.

[15] Sari N P, Santoso T I, Mawardi S 2013 Sebaran tingkat kesuburan tanah pada perkebunan rakyat kopi Arabika di Dataran Tinggi Ijen-Raung menurut ketinggian tempat dan tanaman penaung. *Pelita Perkebunan.* **29**: 93 - 107

[16] Fazrin D A, Hanum C, Irsal 2014 Kadar N, P dan K Tanah Pada Tanaman Kelapa Sawit Menghasilkan dengan Berbagai Komposisi Penanaman Tanaman Sela di Bawah Tegakan. *Jurnal Online Agroekoteknologi,* **3**: 1164 – 1172

[17] Satriawan H, Fuady Z, Mayani N 2016 Soil Conservation By Vegetative Systems On Oil Palm Cultivation. *Polish Journal of Soil Science*, **49**:223-235. **DOI:** 10.17951/pjss/2016.49.2.223

[18] Pujiyanto S, Rahim A, Sabiham S, Sastiono A, Baon J B 2004 Pengaruh bahan organikdan jenis tanaman penutup tanah terhadap bentuk-bentuk P dalam aggregate tanah. *Jurnal Tanah Tropika,* **18**:117-126

[19] Adetula O A 2004 Asystasia gangetica (L.) Anderson. Record from PROTA4U. Grubben GJH and Denton OA (Editors). PROTA (Plant Resources of Tropical Africa/Ressources végétales de l'Afrique tropicale), Wageningen, Netherlands. www.prota4u.org/search.asp. [Accessed on 26 September 2019]

[20] Odharva B, Beekrumb S, Akuala U, Baijnathc H 2007 Preliminary assessment of nutritional leafy vegetables in Kwa Zulu-Natal, South Africa. *Journal of Food Composition and Analysis*, **20**: 430-435

[21] Junedi H, Myrna N, Fathia E 2015. Peningkatan Kemantapan Agregat Tanah pada Ultisol melalui Aplikasi Ara Sungsang (Asystasia gangetica (L.) T. Anders.). Prosiding Seminar Nasional Lahan Suboptimal 2015, Palembang 8-9 Oktober 2015. ISBN. 979-587-580-9

[22] Brouwer D, Jenkins A 2015 Managing for Healthy Soil: A Guide – A Practical Handbook. NSW Agriculture, Tocal - New South Wales.

[23] Aleksandro P, Wawan, Wardati 2016 Sifat Fisik Tanah Dystrudepts di Bawah Tegakan Kelapa Sawit (*Elais Guineensis* Jacq.) Fakultas Pertanian Universitas Riau yang Diaplikasi Mulsa Organik *Mucuna bracteata. Jom Faperta,* **3**: 1-9

[24] Sakiah, Sembiring M, Sari N 2017 Physical and Chemical Characteristics of Soil on Oil palm Plantation *(Elaeis guineensis* Jacq) with Legum Cover Crop *Mucuna bracteata. Jurnal AgroEstate,* **1**: 34-42

RF Artikel_IOP

ORIGINALITY REPORT

13%	12%	9%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

7%

★ A I Sulistiani, M A Chozin, D Guntoro, Suwarto. "The effectiveness of bioherbicide made from nutsedge tuber powder (Cyperus rotundus l.) in various dosage and application time", IOP Conference Series: Earth and Environmental Science, 2021

Publication

Exclude quotes	On	Exclude matches	< 25 words
Exclude bibliography	On		