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Land for Sustaining Food and Energy Security

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FOREWORD

Soil and land could never be separated, they are together as one entity in supporting the living. Therefore discussing of soil is always related to land. All lives require support of soil, because the soil has very unique characteristics and properties. Soil provides elements and water to plants, wildlife and also human. Soil and plant communities together, either in the form of forest vegetation, plantations, rice fields, moor or others, set the water cycle, carbon cycle and the cycles of elements that determine the quality of the environment. Soil and water in together support of plant and animal life in producing food, fibre and energy, medicines that are strongly needed by humans. In addition, the land surface is field, which is not only needed by humans, but also by other life.

Furthermore, the human population on Earth's surface is constantly increasing, while the land area is relatively fixed. As a result we currently are faced with landuse competition for the conservation, safety and comfort of the environment, production food and the energy, as well as for infrastructure development. As a results of the current competition, we are faced with various problems such as land degradation, food and energy insecurity, global warming and other environmental problems, community conflict and disputes related to the ownership, occupation, use and utilization of the soil.

With respect to the various problems faced by the current and future life are always associated with soil and land, meanwhile food and energy security is the peak of those issues, and at the same time we have to manage our soil and land in sustainable manner, therefore the theme of the 11th ESAFS Conference is **"Land for Sustaining Food and Energy Security"**. In this Conference will be discussed various efforts related to land productivity and food production; land degradation and remediation plant nutrition, biological cycle and soil quality, sustainable lowland and peatland management; hydrology and water management; landuse and climate change; and soil database and digital soil mapping.

We recieved over 210 scientific papers voluntary from 15 countries to be presented by oral (106) and poster (104) presentations. All papers were carefully reviewed by panel of reviewers to find feedback and suggestion for improvements. Extended abstract of revised papers are published in the Proceeding of the 11th ESAFS Conference. In addition, 15 papers of invited speakers from FAO, IUSS, and representatives member countries are also included in this proceedings.

Dr. Suwardi
Editor in Chief
11th ESAFS Conference

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ESTIMATING CO2 FIXATION CAPACITY AT EARLY GROWTH OF OIL PALM IN PEAT SOIL

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Introduction

Peatland areas are one of the main natural resources in South Sumatra Province. The peatlands are widely distributed in several districts (Ogan Komering Ilir 500,000 ha; Musi Banyuasin 250,000 ha; Banyuasin 200,000 ha; Muara Enim 45,000 ha and Musi Rawas 35,000 ha) (SSFFMP, 2005), and huge area of peatlands in OKI district are degraded condition (Prayitno, 2005a,b; 2010).

Mostly degraded peatlands in South Sumatra Province are now used for oil palm plantation activities. Total area of oil palm plantations in South Sumatra Province achieve 532, 400 ha (Business Competition Supervisory Commission of the Republic of Indonesia, 2007). The number of estates and land areas will continue to growing in the future.

Land use change from peatlands into plantations provide positive and negative effects on vegetation and soil. Positive effects are able to increase the ability of the land to productive land, reducing the incidence of land fires and increasing carbon uptake by oil palm plantations. On the other hand, the negative impacts are change in the ecosystem from natural forest to plantation type, carbon loss during the opening and land management activities. The research objective was to determine the carbon sequestration and fixation on young plants.

Keywords: Oil palm plantation, peat soil, CO_2 Fixation.

Materials and Methods

This study is part of research on "the carbon balance on oil palm plantation in peatlands". The study was conducted on the Palm Oil Plantation of PT Gading Cempaka Graha, OKI District, South Sumatra Province, started from October 2012 to February 2013.

The carbon measurement used the method of destruction to plant nurseries and non-destructive method for plant in the field. Number of sample plots using Winrock equation. Parameter observations in the field refer to the World Agroforestry Centre Practice Field and carbon analysis performed in SEMEO Biotrop, Bogor.

Results and Discussion

Carbon Sequestration Palm Oil Plant at the age of 8, 10, 12 dan 14 months

The result of biomass plant measurement at the age of 8, 10, 12 and 14 months on each part of the plant show that biomass plants in leaf, stem, stems and roots have different weight on each plant age. Highest biomass at the age of 8 months is 50.78 g or 28.11%)(stem); at the age of 10 months is 143.9 g or 37.36% (trunk);, at the age of 12 months is 180 g or 30.21 % (stem), and at the age of 14 months is 206.7 g or 31.62% (stem). Highest carbon mass on the stem because most of the carbon is the main constituent stem wall (Hilmi, 2003).

Total plant biomass on plant age 8, 10, 12 and 14 months are respectively 180.64 g, 385.31 g, 595.80 g and 730.72 g and the addition of biomass with increasing age of the plant. The relationship between plant biomass, carbon mass and CO_2 fixation show that increasing age of the plant will be followed by increasing plant biomass, carbon mass and CO_2 fixation. CO_2 fixation at the age of 8, 10, 12 and 14 months were respectively 273.53; 593.48; 936.91 and 1105.06 grams per plant.

Carbon sequestration Palm Oil Plant at the age of 26, 38 and 56 months

Average content of biomass, carbon mass and CO_2 fixation capacity of the plant at the age of 26, 38 and 56 months shows an increasing rate of biomass, carbon mass on and CO_2 fixation with increasing age of the plant. Biomass values at the age of 26 to 56 months is around 25.961 up to 269.235 kg per plant or approximately 3.375 to 35.001 tons per ha. Compared to the research by Yulianti (2009) shows that oil palm at the age of 1, 2 and 9 years have dry biomass of 1.28; 1.83 and 22.09 tons per ha respectively.

The ability of oil palm plantations could sequester carbon between 11.942 to 123.848 kg C per plant or equal to 1,553 up to 16.11 tonnes C per ha. Oil palm plantations in Indonesia were able to save an average of about 5 Mg C per ha (Lasco, 2002), and in Malaysia around 46.4 tonnes C per ha (Henson, 1999). Carbon biomass will continue to increase with increasing age, and the maximum at age 19-24 years with a carbon content of 27.168 tons per ha (Henson, 1999). Activities of oil palm plantations on peatland is able to absorb carbon about 100 tons per ha in the period 15 to 25 years (Agus, 2007).

Ability of CO_2 fixation in plants aged 26, 38 and 56 months are ranged from 43.788 to 454.110 kg CO_2 e per plant, equivalent to 5,692 up to 59.034 tons CO_2 e per ha. The age of plant has a significant effect on plant biomass ($y = 0.024\ e^{1.4643\ x}$, $R^2 = 0.9038$), carbon mass ($y = 0.014\ e^{1,\ 4643x}$, $R^2 = 0.9038$) and CO_2 fixation ($y = 0.0068\ e^{1,4643x}$, $R^2 = 0.9038$).

Conclusions

Biomass of oil palm plant at the ages 8, 10, 12 and 14 months are 180.64 g, 385.31 g, 595.80 g and 730.72 g. CO_2 fixation at the same age are respectively 273.53; 593.48; 936.91 and 1105.06 g per plant. Ability of CO_2 fixation in plants aged 26, 38 and 56 months are ranged from 43.788 to 454.110 kg CO_2 e per plant, equivalent to 5,692 up to 59.034 tons CO_2 e per ha. The age of plant has a significant effect on plant biomass ($y = 0.024\ e^{1.4643\ x}$, $R^2 = 0.9038$), carbon mass ($y = 0.014\ e^{1,\ 4643x}$, $R^2 = 0.9038$) and CO_2 fixation ($y = 0.0068\ e^{1,4643x}$, $R^2 = 0.9038$).

References

Agus, F. 2007. Cadangan, Emisi, Dan Konservasi Karbon Pada Lahan Gambut. Bunga Rampai Konservasi Tanah Dan Air. Pengurus Pusat Masyarakat Konservasi Tanah Dan Air Indonesia 2004-2007. Hal. 45 – 52.

Henson, I . 1999. Comparative Ecophysiology Of Oil Palm And Tropical Rain Forest. Oil Palm And The Environment - A Malaysian Perspective . *In* Gurmit, S; Lim, K H; Teo Leng And Lee Kow Eds. Malaysian Oil Palm Growers Council, Kuala Lumpur. P. 9-39.

Hilmi, E. 2003. Model Pendugaan Kandungan Karbon Pada Pohon Kelompok Jenis *Rhizophora* Spp. *Bruguierai* Spp Dalam Tegakan Hutan Mangrove Di Indragiri Hilir Riau. [Disertasi]. Bogor: Program Pascasarjana, Institut Pertanian Bogor.

Komisi Pengawas Persaingan Usaha Republik Indonesia. 2007.Evaluasi Kebijakan Perkebunan Kelapa Sawit. Position Paper KKPU Terhadap Perkembangan Perkebunan Kelepa Sawit.

Lasco, R.D. 2002 Forest Carbon Budgets In Southeast Asia Following Harvesting And Land Cover Change. Science In China. Vol 45 Supp Oktober 2002. P 55-64.

Prayitno, M.B. 2005a. Laporan Survai Inland Peat Survey In District Ogan Komering Ilir, South Sumatra. South Sumatra Forest Fire Management Project. Tidak Dipublikasi.

Prayitno, M.B. 2005b. Laporan Survai Peat Dome Survey In District Ogan Komering Ilir, South Sumatra. South Sumatra Forest Fire Management Project. Tidak Dipublikasi.

Prayitno, M.B. 2010. Dampak Degradasi Lahan Gambut Terhadap Karaktersitik Lahan Dan Hidrologi Di HPT Kayuagung, Kabupaten Ogan Komering Ilir, Sumatera Selatan. Laporan Penelitian Fundamental Tahun I. Lembaga Penelitian Universitas Sriwijaya.

South Sumatra Forest Fire Management Project (SSFFMP). 2005. Sistem Informasi Kebakaran Hutan Dan Lahan. Tidak Dipublikasikan.

Yulianti, N. 2009. Cadangan Karbon Lahan Gambut Dari Agroekosistem Kelapa Sawit PTPN IV Ajamu, Kabupaten Labuhan Batu, Sumatera Utara. Tesis. Sekolah Pascasarjana Institut Pertanian Bogor. Bogor.