

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

Prayitno, M.B^{1*}, Sabaruddin², D. Setyawan² and Y. Parto²

¹Post graduated Student, Agricultural Sci, Faculty of Agriculture, Sriwijaya University, Palembang, Indonesia. Mobile Phone: 081373291625.

²Lecture, Faculty of Agriculture, Sriwijaya University, Palembang, Indonesia.

*Corresponding author : prayitno_muhbambang@yahoo.com.

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, CO₂ 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 CO₂ fixation show that increasing age of the plant will be followed by increasing plant biomass, carbon mass and CO₂ fixation. CO₂ 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 CO₂ fixation capacity of the plant at the age of 26, 38 and 56 months shows an increasing rate of biomass, carbon mass on and CO₂ 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 CO₂ fixation in plants aged 26, 38 and 56 months are ranged from 43.788 to 454.110 kg CO₂ e per plant, equivalent to 5,692 up to 59.034 tons CO₂ e per ha. The age of plant has a significant effect on plant biomass ($y = 0.024 e^{1.4643x}$, $R^2 = 0.9038$), carbon mass ($y = 0.014 e^{1.4643x}$, $R^2 = 0.9038$) and CO₂ 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. CO₂ fixation at the same age are respectively 273.53; 593.48; 936.91 and 1105.06 g per plant. Ability of CO₂ fixation in plants aged 26, 38 and 56 months are ranged from 43.788 to 454.110 kg CO₂ e per plant, equivalent to 5,692 up to 59.034 tons CO₂ e per ha. The age of plant has a significant effect on plant biomass ($y = 0.024 e^{1.4643x}$, $R^2 = 0.9038$), carbon mass ($y = 0.014 e^{1.4643x}$, $R^2 = 0.9038$) and CO₂ fixation ($y = 0.0068 e^{1.4643x}$, $R^2 = 0.9038$).

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