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Carbon Sequestration of Fast Growing Tree

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Abstract

These greenhouse gases cause global warming. The way to reduce greenhouse gases is planting trees. Because a tree absorbs carbon dioxide through photosynthesis process and to sequestrate in different parts of a tree to reduce the amount of carbon dioxide in the atmosphere.The current crude oil prices tend to be increasing. Need to study and research for the new energy sources to replace the suitable and consistent with national energy policy. Biomass energy uses a wood as raw materials instead of petroleum. The research purpose is to look for the amount of carbon sequestration in a part of biomass in the form of fast growing, 5 forms, of 3 types of woods are Anthocephalus Chinensis, Eucalyptus K7, Leucaena salvadore. And to estimate the size of areas for planting fast growing. By design, 5 forms (Pattern 1 Planted Leuceana Salvador, Pattern 2 Planted Leuceana Salvador and Anthocephalus Chinensis (Planted from the beginning of every shift), Pattern 3 Planted Anthocephalus Chinensis, Pattern 4 Planted Anthocephalus Chinensis and Eucalyptus K7 (Planted from the beginning of every shift), Pattern 5 Planted Eucalyptus K7 of planting and the area planted is Ban Sub Moo 4 Tumbon Serng Sang, Amper Serng Sang, Nakhon Ratchasima Province. Soil is a sandy loam soil. The rainfall was more than 1,000 mm/year. The sample area size is 20 x 75 square meters and spacing of 2.5 m x 2.5 m and a biomass

conversion plant of fast growing 5 forms of 3 types of woods at the age of 3 years and to measure carbon in a part of trees. The study found that the trees grow faster at 3 years. Average of biomass of fast growing plants as a form of 1,2,3,4 and 5 are equal to 2.235, 5.009, 4.939, 8.889, and 12.832 tons/rai by order. Statistical tests found the average value of this biomass was difference and important ($p<0.05$) from the biomass measure. From the above, to mention about the amount of biomass carbon storage in biomass of fast growing trees pattern 1,2,3,4 and 5 are equal to a 1.0854, 2.3687, 2.3415, 4.3658 and 6.3275 tonC/rai. The mass of carbon sequestered and the amount of carbon dioxide in biomass of fast growing trees pattern 1,2,3,4 and 5 are equal to 3.9798, 8.6853, 8.5856, 16.0081 and 23.2010 tonCO_2/rai. and followed by forest planting projects in order to obtain quantities of carbon about 16,000 tons of CO_2/year the plot 5 (Eucalyptus) using least fast growing trees areas equal to 2,068.88 rai. To use as a basis for calculating of carbon sequestered quantities. Planting fast growing trees are able to absorb carbon dioxide in the air. To reduce global warming, the trend rate of increase of the volume of the carbon in patterns is the majority at the age of 3 years has increased the amount of carbon reduction. The fifth form of carbon as possible. Therefore, growth should be cut at the age of 3 years.

Keywords: Carbon Sequestration, Biomass, Biomass Energy, Rural Electrification

1. Introduction

Of the world's growing population Economic development and This resulted in a greater amount of energy. Most of the energy use of fossil raw materials. And the use of fossil fuels In production of industrial and human activities. Resulted in a release. greenhouse gases into the atmosphere in quantities that exceed the balance of nature. These greenhouse gases cause global warming. This is not to keep the heat out of the earth's surface the surface temperature rise. The deforestation, which is one of human activity. This reduces the potential of the carbon cycle by cycle. Because trees absorb carbon dioxide through photosynthesis process and carbon sequestration in different parts of the tree to reduce the amount of carbon dioxide in the atmosphere global warming. With the establishment of the UN Convention on Climate Change and the Kyoto Protocol to determine their commitment to international cooperation and action to reduce greenhouse gas emissions (Department of Meteorology, 2008). The fast-growing trees will absorb carbon dioxide in the air. This makes the amount of carbon dioxide reduced global warming.

To quantification of carbon sequestered carbon in of biomass plantations in 5 patterns of 3 types of woods are Anthocephalus Chinensis, Eucalyptus K7, Leucaena Salvadore . The data which of this study can be used to read basic information and associate with information on other basic information related to the carbon cycle. This will lead to the estimation of the output of carbon, carbon credits and the net of ecosystem in Thailand. And the size of the plants grow faster. For use as fuel in the power generation in the community.

2. Research Method

Type of fast growing trees is used in the study. 3 types of fast growing trees are (Anthocephalus Chinensis), (Eucalyptus K 7) ,(Leuceana Salvador) as well as 3 types of trees fast growing than plants grown in soil can be more easily degraded. With low fertility, and 3 types can be grown in almost all areas in Thailand. Because thailand locates in turmoil, the average rainfall over 1,000 mm/year

Site selection and plant station design. This study was conducted in area of the field experiment. District serngsang. Nakhon Ratchasima province. Soil is a sandy loam soil. Planted by rainfall, on average, more than 1,000 mm/year by the conversion of the wood coming out of the 3 patterns of 100 m X 25 m to plot the same 3 patterns (pattern A converter B to C) and at a large sub-divided into five sub-plots to cultivate and grow a size 5 to a 20 m X 25 m, and then set the plants grow

faster. The spacing between rows and 2.50 m (256 trees/rai) by the characteristics of fast growing trees 5 patterns looks like this

Pattern 1 Planted Leuceana Salvador

Pattern 2 Planted Leuceana Salvador and Anthocephalus Chinensis (Planted from the beginning of every shift.)

Pattern 3 Planted Anthocephalus Chinensis

Pattern 4 Planted Anthocephalus Chinensis and Eucalyptus K7 (Planted from the beginning of every shift.)

Pattern 5 Planted Eucalyptus K7

Estimation of the dry matter by estimating the biomass of the rudder and the pinewood and the giant tree leaves. To cut wood at the age of 3 years since the transplant. Is growing rapidly at a distance of 2.50 x 2.50 meters, made of wood fast growing bushes a ousting together. And slow growth. With the demand for wood as fuel in electricity generation needs of the communities in which short-term on investment.

2.1. Estimation of Biomass

The estimation of biomass of Anthocephalus Chinensis, Eucalyptus K7, Leuceana, salvadore at the age of 3 years by dividing the tree into classes according to their high level of 1 m measured diameter at ground level (Do) level. Height 0.30 m (D_{30}) at an altitude of 1.30 m (D_{BH}) and height from ground level to the peak (H) of fast growing trees for every tree in the plot. Of the logging and sampling. The logs of each piece. I weighed the various branches of the stems, leaves and roots of the different parts of the sample was dried in an oven at 80 ° C for 48 hours to weigh the components of the total dry weight. Then calculate the total dry weight. Each part of each sample tree, including the dry weight (biomass), stem (Ws), branch (W_B), leaf (W_L), root (W_R) and some above ground (W_A) of trees for every tree. And analyze the relationships between different parts of the biomass of trees with diameter at different levels in the equation exponentially Financial (Chonlatida Chernkhuntod and Thiti Wisarut, 2007). using Eq. 1

$$y = ax^h \quad (1)$$

Where, Y is the biomass of the various parts of the tree (Ws, W_B, W_L, W_R, and WA (kg)). **X** is the diameter measured by a various of trees, including D_0, D_{30}, D (cm). **a** and **h** is a constant of the equation.

The equations the relationship between size and biomass of different parts of the plants fast growing with the r^2 (Coefficient of Determination) and independent variables with the maximum performance. The equation used to estimate the biomass of different parts of the tree.

2.2. Analysis Carbon of Content

Carbon was storage in wood growth. And planting of fast growing trees for the credit. Analysis of carbon in the stems, branches, leaves and roots, using the example coming from plantation wood as well as 3 species were analyzed for carbon, all with a CHNS-932 is the amount of carbon in different parts of the wood, growth and the amount of carbon stored in trees. Calculated from the concentration of carbon in different parts of the plant multiplied by the biomass in each section of the tree, then the value that was in, but the combination is calculated as the amount of stored carbon (tons/rai) (Todsapon Wadcharangkoon, Chingchai Wiriyabuncha and Kuntinun Piwsaart 2005). And estimates the area of fast growing trees for the credit. The trees grow faster, which is around 3 years, with the field cut to 5 to be able to maintain a constant carbon content ranging from 3 years onwards, and the carbon content of the wood is dry. When cutting out the year at 3 new shoots will not grow without new planting. Calculate the carbon content of 5 to the amount of carbon tons/ha and conversion of CO_2 by multiplying by 3.6667 to get tons of CO_2/rai/3 years, so the trees grow to the storage of carbon dioxide,

about 16,000 tons. CO_2/year will be the fastest growing areas in the wood (16,000 tons of CO_2/year divided by the amount of carbon dioxide retention. Tons of CO_2/rai/3 years) and fixed carbon to about 16,000 tons CO_2/year must be multiplied by 3 years to grow trees fast growing area (rai) by forest planting small.

3. The Results of Research

3.1. Biomass of Trees Grow Faster

The study of the relationship between the diameter of the biomass of the three different kinds of trees grow faster at the age of 3 years by the equation r^2 values in different parts of the wood as shown in Table 1

Table 1: The relationship between diameter and height and biomass of different parts of the wood in 3 types, the age of 3 years

Biomass	Anthocephalus Chinensis		Eucalyptus K7		Leuceana Salvadore	
W_S	$0.0253(D^2H)^{0.9088}$	r^2= 0.996	$0.0864(D^2)^{1.1845}$	r^2= 0.999	$0.036(D^2H)^{0.917}$	r^2= 0.995
W_B	$0.0001(D_0^2)^{2.0168}$	r^2= 0.948	$0.0009(D_0^2)^{1.6334}$	r^2= 0.974	$0.017(D^2)^{1.329}$	r^2= 0.988
W_L	$0.0074(D_{30}^2)^{1.2332}$	r^2= 0.959	$0.0342(D^2H)^{0.7122}$	r^2= 0.994	$0.003(D_{30}^2)^{1.325}$	r^2= 0.836
W_R	$0.0025(D_{30}^2H)^{1.0834}$	r^2= 0.990	$0.0213(D^2H)^{0.8484}$	r^2= 0.978	$0.005(D_{30}^2)^{1.322}$	r^2= 0.989

When W_S = The biomass of stems (Kg) H = Height (Meters)
W_B = The biomass of branch (Kg) D_0 = Diameter at a height of 0.00 meter
W_L = The biomass of leaf (Kg) D_{30} = Diameter at a height of 0.30 meter
W_R = The biomass of root (Kg) D = Diameter at a height of 1.30 meters
r^2 = Coefficient of the set

A study of biomass fast growing plants of 3 types all 5 models at the age of 3 years are summarized in Table 2

Table 2: Biomass of three types of fast growing tree plantations at the age of 3 years

Age of 3 years	Pattern 1	Pattern 2		Pattern 3	Pattern 4		Pattern 5
Biomass (ton/rai)	Leuceana Salvadore	Leuceana Salvadore	Anthocephalus Chinensis	Anthocephalus Chinensis	Anthocepha Lus Chinensis	Eucalyptus K7	Eucalyptus K7
Stem W_S	1.4763	0.7416	1.8394	2.7257	0.6288	4.1189	6.9684
Branch W_B	0.4403	0.2274	0.8842	0.6271	0.7849	0.6992	1.0972
Leaf W_L	0.1201	0.0561	0.4500	0.5613	0.1531	1.0672	1.7547
RootW_R	0.1979	0.0925	0.7177	1.0244	0.2424	1.9014	3.0114
Surface W_A	2.0367	1.0252	3.1736	3.9142	0.8604	5.8853	9.8202
Total	**2.2346**	**1.1177**	**3.8913**	**4.9386**	**1.1028**	**7.7867**	**12.8317**
All Total	**2.2346**	**5.0090**		**4.9386**	**8.8895**		**12.8317**

At the age of 3 years of the Anthocephalus Chinensis, Eucalyptus K7, Leuceana Salvadore. The biomass of tree fast growing patterns 1,2,3,4, and 5 were 2.235, 5.009, 4.939, 8.889, and 12.832 tons/rai, respectively, and found Anthocephalus Chinensis (128 trees) planted together with Leuceana salvadore have the most biomass, and Anthocephalus Chinensis (128 trees) planted with eucalyptus, (128 trees) have the least biomass and to the fourth plot (256 trees) and Anthocephalus Chinensis (128 trees) that planted with Eucalyptus (128 trees) have the most biomass when compared to pattern 2 and 3.

3.2. Carbon Content in Fast Growing Trees

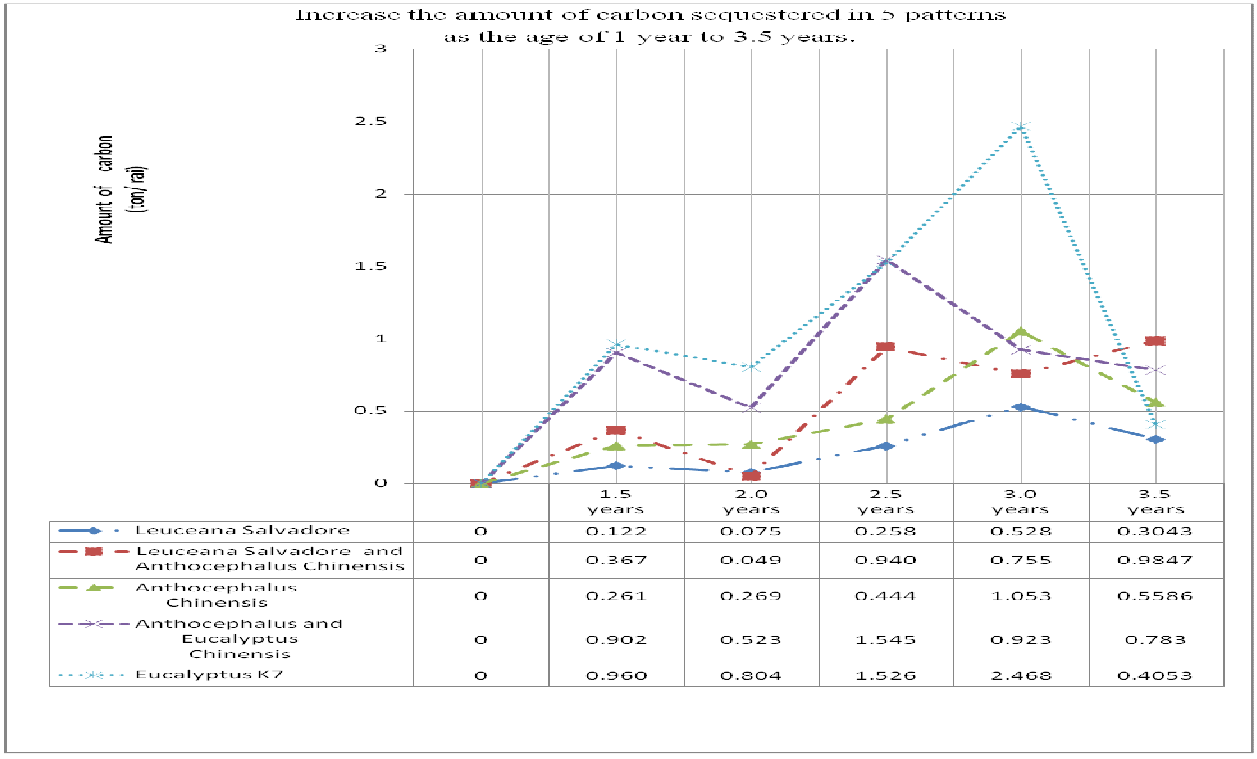
Analysis of the amount of carbon in fast growth trees. The concentration of carbon storage in different parts by a CHNS-932, the study found that Anthocephalus Chinensis and the Eucalyptus and the Leuceana Salvadore at concentrations of 3 years. Of carbon in the trunk. Average Stem (48.51, 48.86,

49.80), Branch (43.24, 53.95, 45.34), Leaf (47.90, 52.29, 51.03) and Root (46.78, 46.93, 45.09) percent, respectively, statistical tests showed that the average of all four of these The difference is significantly greater ($p < 0.05$).

The study found that the quantity of carbon sequestered in biomass of the Anthocephalus Chinensis of the Eucalyptus K7 and the Leuceana Salvadore age of 3 years store the amount of carbon. And the amount of carbon dioxide sequestered in tree growth patterns 1,2,3,4 and 5 are summarized in Table 3.

Table 3: The amount of carbon sequestered, and the amount of carbon dioxide storage capacity in 5 patterns

Age of 3 years	**Pattern 1**	**Pattern 2**		**Pattern 3**	**Pattern 4**		**Pattern 5**
Amount of carbon (ton/ rai)	**Leuceana Salvadore**	**Leuceana Salvadore**	**Anthocephalus Chinensis**	**Anthocephalus Chinensis**	**Anthocephalus Chinensis**	**Eucalyptus K7**	**Eucalyptus K7**
Stem W_S	0.7352	0.3693	0.8923	1.3222	0.3050	2.0125	3.4048
Branch W_B	0.1996	0.1031	0.3823	0.2712	0.0339	0.3772	0.5919
Leaf W_L	0.0613	0.0286	0.2155	0.2689	0.0733	0.5580	0.9175
Root W_R	0.0892	0.0417	0.3358	0.4792	0.1134	0.8923	1.4133
Surface W_A	0.9961	0.5011	1.4901	1.8623	0.4123	2.9477	4.9142
Total	1.0854	0.5428	1.8259	2.3415	0.5257	3.8401	6.3275
All Total	**1.0854**	**2.3687**		**2.3415**	**4.3658**		**6.3275**
Amount of CO_2(Ton.CO_2/ rai)	**3.9798**	**8.6853**		**8.5856**	**16.0081**		**23.2010**



The amount of carbon sequestered. The carbon in the fast growing trees 5 formats at the age of 3 years showed that the fifth plot (Eucalyptus K7) have the most amount of carbon and carbon dioxide. The first plot Leuceana Salvadore with carbon and carbon dioxide are minimum. Planting Amount of fast growing area (rai) to get the 16,000 tons of carbon dioxide CO2 / year by planting a small forest. are summarized in Table 4. Of this rate increase storage of carbon in 5 patterns the age of 1 year to 3.5 years, the trend rate of increase of the volume of the carbon in patterns is the majority at the age of 3 years has increased. The amount of carbon reduction. The fifth form of carbon as possible. Therefore, growth should be cut at the age of 3 years.

Table 4: Amount of fast growing tree plantation (rai) to get the amount of carbon dioxide about 16,000 tons.CO2/year

Pattern	Pattern 1	Pattern 2	Pattern 3	Pattern 4	Pattern 5
The type of fast growing trees	Leuceana salvadore	Leuceana Salvadore and Anthocephalus Chinensis	Anthocephalus Chinensis	Anthocephalus Chinensis and Eucalyptus K7	Eucalyptus K7
Planting fast-growing area. (rai / 3 years.)	**12,060.91**	**5,526.58**	**5,590.76**	**2,998.48**	**2,068.88**

Found that The fast-growing plantation areas for getting the carbon content of approximately 16,000 tons of CO2/year by planting a small forest of the pattern 1 (LeuceanaSalvadore) using most of 12,060.91 rai, and the pattern 5 (Eucalyptus) using the plantation fast growing area a minimum of 2,068.88 rai.

4. Summary and Concluding Remarks

Thailand has the potential to grow 3 types of Anthocephalus Chinensis, Eucalyptus K7, Leuceana Salvadore. There are three types of fast growing, easy planting and drought resistant. 0.74 to 4.28 tons per rai can be produced per year. By carbon storage is accounted for directly of biomass. Types and characteristics of planting fast growing trees shown that the age of 3 years and the pattern 5 (Eucalyptus K7) shown the maximum amount of carbon, and the pattern 1 (Leuceana Salvadore) with the minimum carbon. And the fast-growing tree plantations areas (rai) to get the amount of carbon dioxide about 16,000 tons of CO2 / year by a small reforestation project conveys pattern 1 (Leuceana Salvadore) using the most of 12,060.91 rai of land and pattern 5 (Eucalyptus K7) using the least of 2,068.88 rai of land.

The planting fast growing trees can help absorb and reduce carbon dioxide in the air, reduce global warming. By pattern 5 (the Eucalyptus K7) can absorb carbon dioxide 23.2010 Tons.CO2/ rai, and can be stored in a data base for the calculation of Carbon credits. And bringing the amount of biomass of the fast growing trees as a basis for calculating the area of fast growing trees. For use as fuel in a biomass power plant. This is an alternative to the development of electric power to rural communities.

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