

CARBON SEQUESTRATION POTENTIAL OF YOUNG ANNONA
RETICULATE AND ANNONA SQUAMOSA FROM UNIVERSITY
CAMPUS OF AURANGABAD

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Abstract:

In the present investigation carbon sequestration potential of six year young age *Annona reticulata* and *Annona squamosa* species from the university campus of Aurangabad is measured. The rate of carbon sequestered above ground biomass was estimated using the ash method. The percentage of carbon content in the above ground biomass in leaves, stem, sub-branches and bark of *Annona reticulata* (except root) were $53.67 \pm 2.08\%$, $57.24 \pm 0\%$, $55.24 \pm 0.13\%$ and $53.08 \pm 1.17\%$ respectively, and in *Annona squamosa* there were $52.08 \pm 0.24\%$, $55.09 \pm 3.04\%$, $55.33 \pm 0.41\%$ and $56.01 \pm 2.45\%$ respectively. The total above ground biomass carbon stalk per hectare as estimated for *Annona reticulata* was $83.1 \text{ Kg C ha}^{-1}$ and for *Annona squamosa* it was $73.5 \text{ Kg C ha}^{-1}$ in University campus.

Key words: Above ground biomass, *Annona reticulata*, *Annona squamosa*, carbon sequestration potential, climate change, carbon stock.

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Introduction:

Carbon dioxide (CO₂) is a major contributing gas to the green house effect. It is one of the dominant greenhouse gases among them. Carbon sequestration is a natural method for the removal of carbon from the atmosphere by storing it in the biosphere (Dhruba, 2008; Chavan and Rasal, 2010). Biomass is defined as the total amount of aboveground living organic matter in trees expressed as oven-dry tons per unit area that reduces the concentration from atmospheric concentration of carbon dioxide (Brown, 1997; FORDA and JICA, 2005; Ravindranath and Ostwald, 2008). The atmospheric carbon dioxide is captured and stored in plants, soils, oceans, or atmosphere in the forms of biomass by photosynthesis process.

The amount of carbon sequestered continuously by a tree increases substantially over the time and age of tree till it matures. The process of carbon capture in photosynthesis is influenced by different factors including the tree age, leaf area and photosynthetic efficiency. The increasing carbon emission is of major concerns all over the world; it has been well addressed in Kyoto protocol (Ravindranath et al., 1997; Chavan and Rasal, 2010). The rate of carbon storage increases in young tree species, while it declines after full growth as the stand ages (Jana, et al., 2009). Above Ground Biomass (AGB) of tree includes all living biomass of all its parts above the soil, while Below Ground Biomass (BGB) includes all the plant biomass of live roots excluding the fine roots of sizes <2mm diameter (Ravindranath and Ostwald, 2008). Carbon sequestration in growing forests is known to be a cost-effective option for mitigation of global warming and global climatic change. The objective of this study is to measure sequestered carbon from selected plant species of *Annona reticulata* and *Annona squamosa* from university campus in Aurangabad city, Maharashtra in India.

Methodology:

Site and study area:

The study area selected in present investigation for the estimation of above ground biomass and carbon sequestration was University campus of Aurangabad, which is located at the latitude 19°53'47"N and longitude 75°23'54"E. The university campus is lush green and covers about 140 hectares area under the plantation program for selected tree species. The two species of *Annona reticulata* and *Annona squamosa* selected for present investigation are from the same, planted on the university campus. The weather of Aurangabad in general, can be said to be dry and moderately extreme. The average day temperature ranges from 27.7⁰ C to 38.0⁰ C, while it falls from 26.9⁰ C to

20.0°C during night. Relative humidity is extremely low for major part of the year 30% to 50%, while it is highest 85% during monsoon. The average rainfall is about 90 cm but it is rather variables from year to year (ESRAM, 2009).

Estimation of carbon sequestered in different parts of six year tree species:

The tree biomass includes the total of Above Ground Biomass (AGB) and Below Ground Biomass (BGB). The above ground biomass studied includes all above ground materials covering stem, braches, leaves, bark and below ground biomass consist coarse roots and stumps. The estimation of biomass in the plant was performed by measuring the tree height and diameter of plant species. Weight of the wood biomass has been calculated by multiplying the volume of biomass and specific gravity (SG) of the plant. The specific gravity (SG) considered is the ratio of oven dry weight and green volume of plant.

The organic carbon storage in selected tree species of *Annonaretiaculata* and *Annonasquamosa* was estimated by Ash Method as described elsewhere (Allen, et al., 1986; Negi, et al., 2003; Jana, et al., 2009). The leaves, stem, sub branches, bark and root of each species were separated to estimate carbon by Ash method. The fresh weight of each part of all species washed with distilled water and dried with tissue paper immediately was taken then oven dried for moisture removal at 80°C for 24 hrs. Oven dried sample were taken in pre-weighed crucible. The crucibles were placed in the Muffle furnace adjusted at 400°C, ignition was carried out for 2.30 hrs. The crucible was cooled slowly inside the desiccators. After cooling the crucible with ash were weighed and percentage of organic carbon were calculated as formulae given by Allen et al, (1986).

$$Ash \% = \frac{(W3 - W1)}{(W2 - W1)} \times 100 \dots \dots \dots (1)$$

$$C\% = (100 - Ash\%) \times 0.58 \dots \dots \dots (2)$$

Where, C is the organic carbon; W1 is weight of crucibles, W2 is weight of oven-dried grind samples + Crucibles, and W3 the weight of ash + Crucibles.

In the present study we have estimated the aboveground biomass stocks and aboveground biomass carbon of nine species by taking volume of biomass and specific gravity (SG) of the tree, as described by (Rajput et al., 1996; Jana et al., 2009; Negi et al., 2003).

$$SG = \frac{Ovendryweight}{Greenvolume}$$

$$Biomass = Volume\ of\ Biomass\ (cm^3) \times Specific\ Gravity\ (SG)$$

$$\text{Carbon} = \text{Biomass} \times \text{Carbon}\%$$

Result and Discussion:

The estimation of the above biomass in the selected tree species was performed by estimating carbon percentage and by knowing the tree height, diameter, and girth size.

Biomass carbon content:

The above ground biomass of the tree such as leaves, stems, sub-branches and bark have been collected and dried at laboratory. The results of biomass analysis by ash method are presented in Table 1 and Fig.1. Total carbon stalk of a tree has been evaluated by the sum of all the carbon contents of leaves, stem, sub-branches and bark of the tree. The carbon concentration of different tree parts was rarely measured directly, but generally assumed to be 50% of the dry weight (Losi et al., 2003; Jana et al., 2009). The content of carbon in woody biomass any component of forest on average is around 50% of dry matter (Paladinic et al., 2009).

Table 1: Carbon percentage in *Annonareticulata* and *Annonasquamosa*

Plant parts	Average C% of <i>Annonareticulata</i>	Average C% of <i>Annonasquamosa</i>
Leaves	53.67 ± 2.08	52.08 ± 0.24
Stem	57.24 ± 0	55.09 ± 3.04
Sub-branches	55.24 ± 0.13	55.33 ± 0.41
Bark	53.08 ± 1.17	56.01 ± 2.45

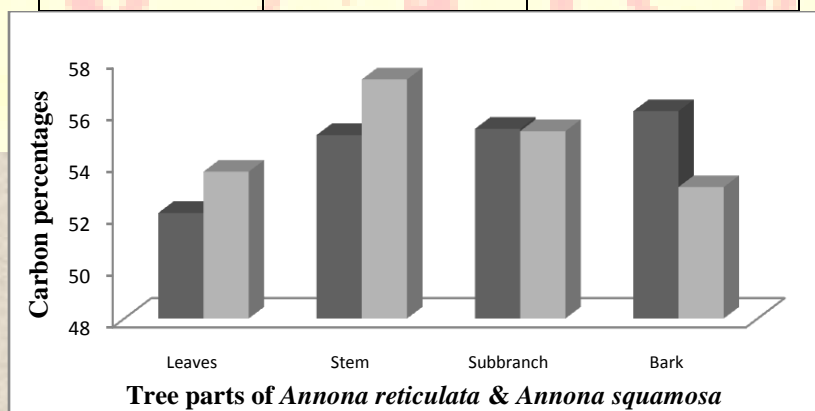


Fig.1: Carbon percentage in tree parts of *Annonareticulata* and *Annonasquamosa*

It is observed for *Annonareticulata* that leaves, stem, Sub-branch and bark contained 53.67 ± 2.08 %, 57.24 ± 0 %, $55.24 \pm 0.13\%$ and $53.08 \pm 1.17\%$ carbon percentage respectively and for *Annonasquamosa* the leaves, stem, Sub-branch and bark contained $52.08 \pm 0.24\%$, $55.09 \pm 3.04\%$, $55.33 \pm 0.41\%$ and $56.01 \pm 2.45\%$ carbon respectively.

Table2: Total biomass and carbon in above ground trees

Species	Specific gravity	Biomass (Kg/tree)	Biomass (Kg/ha)	Carbon (Kg/ha)
<i>Annonareticulata</i>	0.43	0.102	153	83.1
<i>Annonasquamosa</i>	0.50	0.090	135	73.5

The average specific gravity, total biomass and total carbon content of six years age *Annonareticulata* and *Annonasquamosa* is shown in Table 2. It is estimated that the total above ground biomass content in *Annonareticulata* and *Annonasquamosa* per hectare observed were 153 Kg ha^{-1} and 135 Kg ha^{-1} respectively. The total above ground biomass carbon stalk per hectare as estimated for *Annonareticulata* was $83.1 \text{ Kg C ha}^{-1}$ and in *Annonasquamosa*, it was $73.5 \text{ Kg C ha}^{-1}$.

Conclusion:

The study reveals that the above ground biomass carbon of *Annonareticulata* and *Annonasquamosa*. The total carbon content of *Annonareticulata* and *Annonasquamosa* from Dr. B.A.M. University area were $83.1 \text{ Kg C ha}^{-1}$ and $73.5 \text{ Kg C ha}^{-1}$ respectively.

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