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Biomass production and status of *Acacia nilotica* species in Bilaspur region

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ABSTRACT
Trees of grown for maximum biomass production under the same climatic (1220mm mean annual rainfall and 30^0 C mean annual air temperature) and edaphic and conditions in the Bilaspur region (lat. 22.1293^{0}N, Long. 82.1360^{0}E) management was very intensive during early growth and establishment phases there were no. of trees present 595. The estimation was done allometric equation. The trees were total no. of 400 and total taken 10 no of sample plot. The total average diameter was came 24.45cm. And average height was 13.3 m. biomass was 475.94 kg. Carbon stock was 237.97kg.
Keywords:-*Biomass Estimation, Allometric Equation, Tree Height, Wood Density, Specific Gravity, Carbon Stocks.*

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INTRODUCTION

Plant plays an important role in an ecosystem. Biomass of plants strongly affects the structure and function of ecosystem. Trees plays vital role in mitigating the diverse effect of environmental carbon degradation and on reducing global warming. Trees promote sequestration of carbon into soil and biomass therefore, tree based land use practice could be viable alternatives to store atmospheric carbon di oxide due to their cost effectiveness, high potential of carbon uptake and associated environmental as well as social benefits due to as forest maintain over 86% of the terrestrial carbon stock on earth during photosynthesis and storing excess carbon as biomass. An accurate estimate of forest carbon storages including natural forest plantation etc. separately for different trees land of various locality will be of great significant to the research on the productivity of terrestrial ecosystem [1-2]. Carbon cycle and global warming determination of above ground biomass (AGB) is an important step in planning the protection and sustainable use of deciduous trees resources. Biomass determination can be in or direct way by cutting and weighing all the plants in sample areas. This requires considerable efforts and time. Destroys vegetation in these areas and in some situation is not desirable or may even be illegal. Therefore, allometric relationships for estimating (AGB) of deciduous trees from measurement of stem diameter at breast height (DBH) and tree height (H). Have been devised and reported by a no. by workers [12-19]. To evaluate such uses and effects data on biomass production and nutrients demands on the site are needed. Here we present results of an experiment in which five tree species were intensively managed under identical environmental conditions to compare their efficiency of biomass production and nutrients utilization. A forthcoming companion article will contain the nutrition aspects of study. Studies such as these are needed to assess species suitability for sustained yield energy plantation in the tropics.

Acacia nilotica-
Family- Leguminosae – Momisoideae
Synonym-- *Acacia Arabica* Var. indica
Local Names- Hindi- Babul,
Common Names- Babul, Indica gum, Arabic tree

DISTRIBUTION
Babul is indigenous to the Western part of India-Gangetic plains and northern part of Deccan plateau, including Andhra Pradesh, Maharashtra, Rajasthan and Gujarat. It is widely planted or self-sown throughout the hot regions of India, Punjab, Haryana, Uttar Pradesh, Madhya Pradesh, and Karnataka. It is an important constituent of southern dry mixed deciduous tropical forest, Northern and Southern tropical thorn forests of India, at an elevation range of 200-500m.

PARTICULARS ABOUT SEEDS
Babul flowers June to September, pods ripen April to June, are collected from the ground or 5-7 years old trees, dried in the sun and seed separated by beating with stick, cleaned by winnowing. Seed weight: 7000 to 11000 seeds/kg. Properly collected, dried, tins, or baskets, in a cool dry place if stored in air tight containers, there is a little loss in germination for up to 3 years. Pre-sowing treatment is necessary to soften the hard seed coat, by-

(i) Soaking the seed in water for 48hrs at room temperature.
(ii) Immersing the seed in the hot water at 80^0C, and allowing it to soak until cool.
(iii) Keeping the seed in moist cow-dung heap for 2-3 days.
(iv) Putting the seed in concentrated sulphuric acid for 10-15 min.
(v) Feeding the pot to sheep and goat and then collecting the seed from their droppings treated seed should be shown promptly.

Germination varies 30 to 92%, plant percent 16 to 75.

METHODS OF PROPAGATION
(1) NATURAL REPRODUCTION-
Babul reproduces naturally mainly through seed and to a limited extent by seedling coppice. Ripe pods are dispersed by wind and seed by animals which feed on pods. Germination take place during rains complete over-head light, freedom from weeds, sufficient moisture supply and well- drained porous soil are favorable conditions for its germination and establishment. Effective fencing for protection against domestic and wild animals is necessary.

(2) ARTIFICIAL REPRODUCTION
(i) By direct showing: easy and most common method, this is done by broad casting, dibbling in lines, patches or mounds in June.
(ii) By planting container- raised plants: 2 or 3 treated seed are shown in each polythene bag about 1.5 cm deep in February-march, 3-5 months before transplanting. Avoid excessive watering in the first month, shading necessary to prevent surface drying. Planting pits are 30-50 cm^3, spaced 3m**x**3m or 4m**x**4m. When planted on bunds of field boundaries, linear spacing is 5 to 10m. It is also a common method for planting along road side stripe, for which one- year old seedlings are used.

NURSERY TECHNIQUE
Babul seedlings are raised in polythene bags (5cm**x**22cm, 150-200 gauge), filled with soil mixed. Treated seed are shown, about 1.5cm deep, 2-3 seeds in each in February–March and regularly watered and weeded. Excessive watering should be avoided surface cracking. Seedlings are fit for panted out in July-august of the same year. For obtaining bigger plants, seed is sown in June- July in bigger bags and one year old seedling is planted out.

TENDING
Young crops have to be weeded systematically for 2-3 years, seedling are also spaced simultaneously. Regular thinning are done on a 5 years cycle in 5^{th}, 10^{th} and 20^{th} years, a thumb rule being to space the planted out.

INJURIES, PESTS AND DISEASES
INJURIES- babul seedlings are susceptible to shade, fire and frost; in younger stages it is liable to browsing damage by goats and camels. Hares and rates also damage young seedlings.

INSECTS- it is attacked by *Psilptera fastuosa*, a leaf defoliator, *Celosterna scabrator*, a root boring beetle, and many wood borers attack standing and felled trees. Pods are damages by a pod borer.

FUNGI- heavy seedlings mortality is caused by damping off. The heartwood of the stem and branches is damaged by fungi causing the wood to become brittle. It a also suffer from root-rot, spongy heart-rot by *Fomes badius*, white spongy rot by *Ganoderma lucidum*.

RATE OF GROWTH

Babul is a fast growing tree when soil moisture is not limiting factor, such as on canal banks or tank foreshore plantations. Rate of growth recorded for average plantations is a tabulated below:

AGE (years)	NO. OF TREES (per ha)	AV.D.B.H.(cm)	AV.HEIGHT (m)
10	246	13.7	11.6
15	155	18.8	14.6
20	120	22.6	16.1
25	99	25.1	17.7

Study site:

The study was conducted in the Bilaspur region Chhattisgarh Lat.22.1293^{0}N, 82.1360^{0}E at less than 264m elevation. The climate is pleasant and mild in the winter minimum temperature 10^{0}C and maximum temperature 45^0. The relative humidity is higher during the monsoon season being generally over 75%after monsoon season humidity decreases and during the winter air is fairly dry. The month of July and august the heaviest rainfall month and nearly 95% of annual rainfall is received during June- September months. The rainfall is unevenly distributed and also the amount of rainfall varies from year to year and experiences and a not semi humid climate.

MATERIAL AND METHODS

Volume of the tree was measured by the formula

$V = \pi r^2 h$ ..... (1)

Where, V= volume of the tree in m^3, r= radius of the trunk in m, h = Height of the tree. As very less taper was observed in trees, hence average volume was estimated by using above formula.

AGB (Above ground biomass) includes the all living biomass above the soil. AGB are calculated by multiplying volume to the green wood density of the tree species.

AGB= V**x**D ..... (2)

Where, AGB= Above Ground Biomass, V= Volume of the tree in M^3 and D= Wood Density of species. Wood density is used from global wood density database. The standard average density of 0.6 g/cm^3 is applied wherever the density value is not available for tree species.

BGB (Below Ground Biomass) has been calculated by the multiplying the AGB by 0.26, as per factor prescribed by Hangarge *et al* [10].

BGB= AGB**x**0.26 ..... (3)

TB (Total Biomass) has calculated by the sum total of AGB and BGB.

Total biomass= AGB+BGB ..... (4)

In present study, we have calculated carbon with assumption, that any tree species contain 50% of its biomass.

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Carbon storage = Biomass **x** 50% ..... (5)

DIAMETER: It is double the radius. Generally, the diameter of a tree is measured at its DBH (diameter at breast height), which is 1.37 m.

Mathematically,

Diameter=2r

Where, r=radius.

Conversion for diameter:

1. **from girth:**

GIRTH, it is the circumference of circle i.e. perimeter.

Mathematically,

GIRTH=2Πr

Whereas calculation of diameter from girth is done by,

GBH=DBH x π

Or, DBH=GBH/π

2. from CGS to FPS:

1 m=100 cm

1 inch= 2.54 cm

Table1. Carbon storage

Species: *Acacia nilotica*

No. of trees Present: 400 trees.

Sample taken: 10 trees.

Diameter		**height**		**volume (in m³)**	**biomass (in kg)**
(in cm)	**(in inch)**	**(in m)**	**(in feet)**		
23.56	9.27	13	42.65	0.44	498.07
25.47	10.03	14	45.93	0.56	627.92
27.07	10.65	14	45.93	0.63	707.92
19.74	7.77	12	39.37	0.28	323.01
20.06	7.8	13	42.65	0.32	352.63
14.33	5.64	12	39.37	0.15	170.18
29.61	11.66	14	45.93	0.75	509.16
21.01	8.27	13	42.65	0.35	396.40
33.75	13.29	14	45.93	0.98	661.47
29.93	11.7	14	45.93	0.77	512.66
24.45		**13.3**		**0.523**	**475.94**

Evaluation of complete site:

Average diameter:

23.56+25.47+27.07+19.74+20.06+14.33+29.61+21.01+33.75+29.93=24.45

Average diameter:=24.45cm

Average height:

13+14+14+12+13+12+14+13+14+14=13.3

Average height:=13.3m

Volume:

0.44+0.56+0.63+0.28+0.32+0.15+0.75+0.35+0.98+0.77=0.523

Average volume =0.523

Biomass:

498.07+627.92+707.92+323.01+352.63+170.18+509.16+396.40+661.47+512.66

Average biomass=475.94

Carbon storage:

Carbon storage = Biomass **x** 50%

= 475.94x 50%

237.97**kg/ha**

RESULT AND DISCUSSION

The estimation of the aboveground and belowground biomass in the selected tree species was performed by estimating carbon percentage and by measuring the tree height, DBH and wood density. The carbon concentration of different tree parts was rarely measured directly, but generally assumed to be 50% of the dry weight on the basis of literature [3-9] as the content of carbon in woody biomass in any component of forest on average is around 50% of dry matter [14, 11].

The trees were total no. of 400 and total taken 10 no of sample plot. The total average diameter was came 24.45cm. And average height was 13.3 m. biomass was 475.94 kg. Carbon stock was 237.97kg.

CONCLUSION

Total standing biomass of *Acacia nilotica*in 284 hectares of Bilaspur are475.94kg ha-[1]. The carbon stocks in aboveground and belowground standing biomass of *Acacia nilotica* were

237.97kg ha-^{1}, while total standing biomass of *Acacia nilotica* in 284 hectares area was. The average carbon sequestration and carbon dioxide of *Acacia nilotica* intake is 237.97kg ha-^{1}. The CO_2intake percentage in *Acacia nilotica* shows highest (20%) at 6th sector, while lowest (1%) at 1st sector.Research on carbon aboveground estimations in seedlings and reforested areas in the tropics is still in an early stage. Therefore, this study is a valuable contribution to increase knowledge on this topic. This study is possibly the first of its type in Ecuador and is of crucial importance for establishing a base line for future monitoring campaigns on the reforested areas of the project, but as it is the first estimation (only one point in time) the scope of the analysis remains limited.

The above ground biomass estimations based on allometric equations for secondary forest introduced error in the estimations performed. Firstly because these equations were performed for consolidated forest, and secondly because the equations used diameter a breast height as single predictor variable and this parameter was not available in all of the cases as the majority of trees were smaller than 1.3 m. Also, the correction used for DBH in the allometric models introduced another source of the error in the estimation. As an alternative, basal area and tree height performed well as biomass indicators.

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