Print : ISSN 0970-7662
Online : ISSN 2455-7129

Journal of Tree Sciences
online available at www.ists.in

Volume 36 No. 2 December, 2017

Assessment of Biomass and Carbon Stock in *Azadirachta indica* Plantation of Northern Dry Zone of Karnataka

Chavan Raju L*. Rathod R.S. and Nayak B.G.[#]

College of Forestry, Sirsi, Karnataka; [#] College of Forestry, Ponnam pet, Karnataka
Email.com: rajuchavancof@gmail.com

DOI: 10.5958/2455-7129.2017.00028.0

ABSTRACT

Azadirachta indica plantation was established in Randomized Block Design during 2005 in two different sites *viz*., Shaktinagar and Raichur in the Northern Dry Zone of Karnataka. Carbon sequestration rate and total biomass has been measured at different ages of Neem by CHN analyzer during 2013. Neem is one of the fast growing tree species, which can grow up well under any diversified climatic condition. Results showed that at Shaktinagar the carbon sequestration values of 3.84 ton/ha, 5.07 ton/ha, 7.92 ton/ha, 10.29 ton/ha and 13.99 ton/ha in fifth year after planting, six year after planting, 7 year after planting, 8 year after planting and 9 year after planting respectively. However at site of Raichur, Carbon sequestration of 4.51 ton/ha in five year after planting, 6.09 ton/ha in 6 years after planting, 8.35 ton/ha in 7 year after planting, 10.57 ton/ha in 8 year after planting and 15.63 ton/ha in 8 year after planting was registered. In Northern Dry zone of Karnataka there was a good amount of Carbon sequestration by *A. indica* in ARS Raichur than the Shaktinagar among two sites, these will create a good long term sink of Carbon and reduces the global warming.

Key Words:

Azadirachta indica, Biomass, Carbon sequestration

INTRODUCTION

Neem (*Azadirachta indica* A. Juss) is one of the very few trees known in the Indian sub-continent. It has been described as the most researched tree in the world and the most promising tree of 21st century. Neem has great potential in the fields of pest management, environmental protection and medicine. Neem tree is noted for its drought resistance because it thrives in areas with sub-arid to sub-humid conditions with an annual rainfall between 400 and 1200 mm. The concept of carbon sequestration emerged in the 1980 due to consequences of steadily increasing level of CO_2 in the atmosphere. "Carbon sequestration is the process of extraction of atmospheric carbon dioxide and storing it as a carbon for a very long period of time in terrestrial ecosystems in the form of soil, vegetation and other forms". Due to drastic climatic change in the globe over several decades, carbon sequestration has generated interest and resulted to play a prominent role in the control of Green house effect due to Green House Gases (GHG_s) and to reduce carbon dioxide emission to

the atmosphere or to offset emissions by strong additional carbon in forest. Increasing concentration of greenhouse gases in the atmosphere and the adverse effects associated with climate change have necessitated the need for identification of systems with high carbon sink as a mitigation strategy. The increase in carbon emission is a major concern, and is well addressed in Kyoto Protocol of 1997. Trees are also one of the most significant elements of any landscape, both due to biomass and diversity. Trees are important sinks for atmospheric carbon because 50 per cent of their standing biomass is carbon itself. Neem is now planted almost in every corner of the country and is one of the major component species of afforestation programmes. With this background following objectives had been set, such as to estimate growth performance, biomass and amount of Carbon sequestration from the *A. indica* plantation.

MATERIALS AND METHOD

A field experiment was conducted during 2005 in Raichur taluka coming under Northern Dry zone of Karnataka, to evaluate the biomass yield and Carbon sequestration capacity of *A. indica* at different ages of growth selected in two different locations during 2009 to 2013, one at RTPS Shaktinagar on 5 ha. area and another was at ARS Raichur on 5 ha. area. These trees were planted at a spacing of 5 m x 5 m and observations were taken on Girth at breast height (GBH) and Height. Observations were taken at an interval of 12 months up to nine year period in order to determine the growth performance of the species at different stages of growth. By using GBH, Basal Area per ha was calculated by using the formulae Basal area (m^2) = $g^2/4$

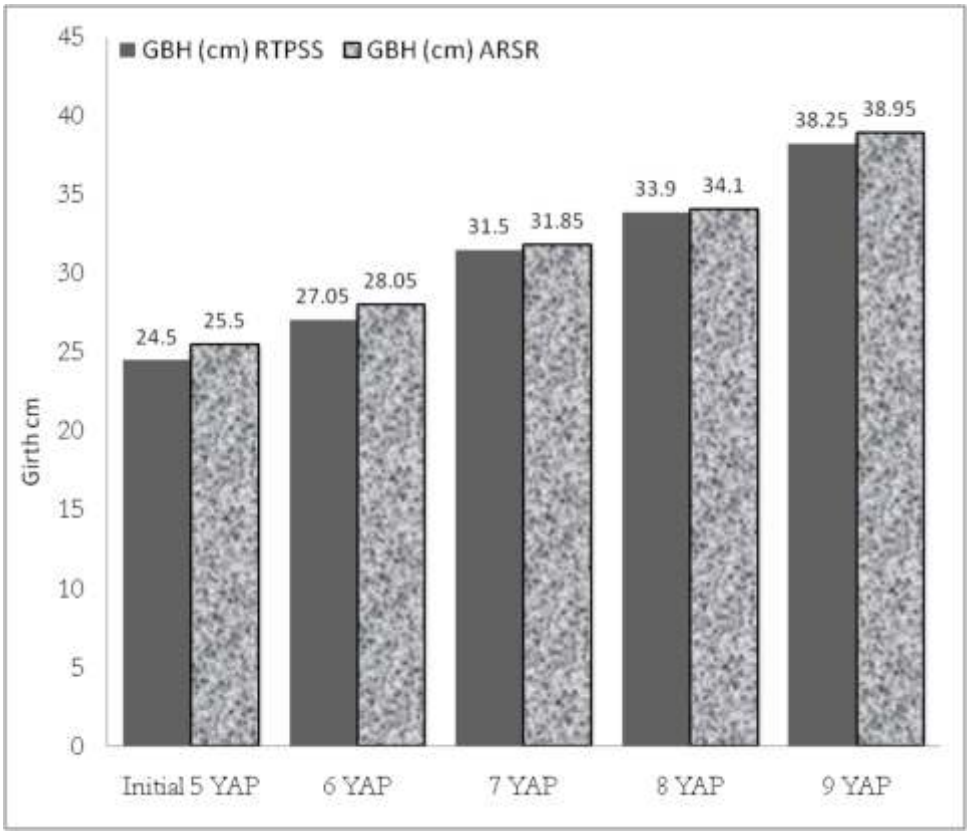

Fig. 1. Effect of site on girth at breast height of *A. indica* at different ages

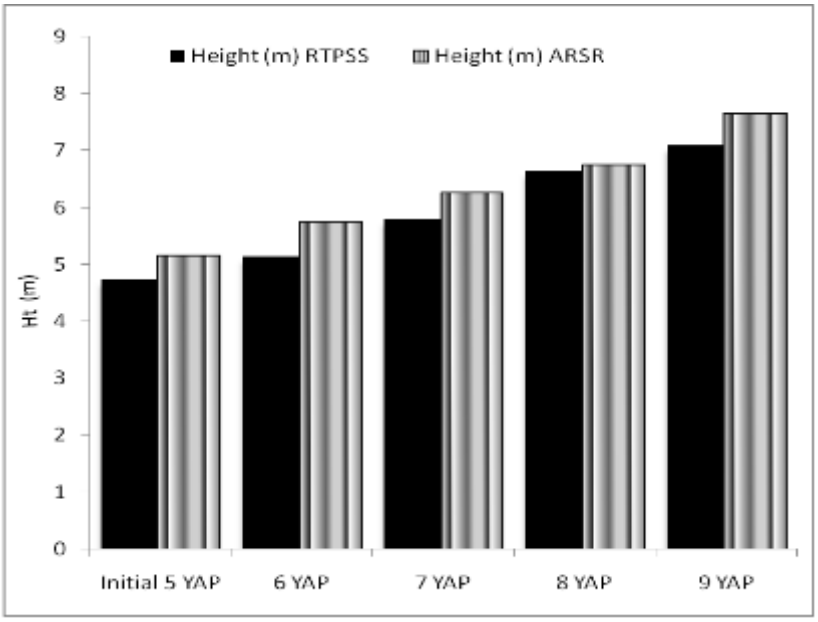

Fig. 2. Effect of site on height growth of *A. indica* at different ages

RTPS = Raichur Thermal power Shaktinagar, ARS –Agricultural research station YAP - Years after Planting

At RTPS Shaktinagar annual increment in GBH was worked out. The annual increment varied from of 1.06 cm at 8th year to 1.17 cm at 7th year of plantation. The MAI over the experimental period was 1.11 cm. Similarly height of 1.08 m, 1.13 m, 1.15 m, 1.07 m and 0.21 m were registered in 6, 7, 8 and 9th year after planting, respectively with mean annual increment of 1.12 m (Table 1). At ARS Raichur, in *A. indica* increment in GBH varied from 1.08 in 8th year to 1.14 cm at 9th year after plantation. Increment in height varied from 1.08 to 1.13 m with a MAI of 1.10 m during the observation period (Table 1).

Table 1. Increment on different growth parameters of *A indica* at different ages

Different site	Parameters	6 YAP	7 YAP	8 YAP	9 YAP	MAI
RTPS Shaktinagar	Annual Increment of GBH (cm)	1.1	1.17	1.06	1.12	1.11
	Height (m)	1.08	1.13	1.15	1.07	1.12
ARS Raichur	Annual Increment of GBH (cm)	1.10	1.12	1.08	1.14	1.11
	Annual Increment of Height (m)	1.12	1.09	1.08	1.13	1.10

RTPS = Raichur Thermal power Shaktinagar, ARS –Agricultrual research station YAP- Years after Planting

At Shaktinagar volume and biomass accumulation of 0.018 m^3 and 8.0 ton/ha in 5 year after planting (initial), 0.024 m^3 and 10.57 ton/ha in 6 year after planting, 0.037 m^3 and 16.50 ton/ha in 7 year after planting, 0.048 m^3 and 21.44 ton ha^{-1} in 8 year after planting and 0.065 m^3 and 25.14 ton/ha of growth in 9 year after planting respectively (Table 2). Carbon sequestration of 3.84 ton ha^{-1}, 5.07 ton ha^{-1}, 7.92 ton ha^{-1}, 10.29 ton ha^{-1} and 13.99 ton ha^{-1} was registered at 5^{th}, 6^{th}, 7^{th}, 8^{th} and 9^{th} year after planting, respectively (Table 2). At ARS Raichur, in *A. indica* there was volume accumulation of 0.021 m^3, biomass accumulation of 9.39 ton ha^{-1} and Carbon accumulation of 4.51 ton ha^{-1} were observed at 5 year after planting (initial). At 6 year after planting there was a volume, biomass and carbon accumulation was 0.028 m^3, 12.69 ton ha^{-1} and 6.09 ton ha^{-1} respectively. At 9 year after planting volume accumulation of 0.073 m^3, biomass accumulation of 32.55 ton ha^{-1} and Carbon sequestration of 15.63 ton ha^{-1} was registered (Table 2). Similar results on the carbon sequestered were reported by Khajuria and Chauhan (2003) in the marketing direct and indirect Carbon fixation. The results with respect to carbon sequestered were similar to the findings of Shivanna et al. (2006) in *Pongamia pinnata*. The findings of the present study are in conformity with other trees species by Vijay Rawat and Negi (2000), Siva Kumar et al. (2000) reported in rubber plantation. In northern Dry zone of Karnataka there was a good amount of Carbon is sequestration by the *A. indica* planted in farm lands of ARS Raichur than the Shaktinagar among two places in the Zone, which will create a good long term sink of Carbon and reduces the global warming.

Table 2. Volume, Biomass and amount of Carbon sequestered by *A indica* at different ages of growth.

Different site	Parameters	Initial (5 YAP)	6 YAP	7 YAP	8 YAP	9 YAP
RTPS Shaktinagar	Volume (m^3)	0.018	0.024	0.037	0.048	0.065
	Biomass (ton ha^{-1})	8.00	10.57	16.50	21.44	29.14
	Carbon sequestration (ton/ha)	3.84	5.07	7.92	10.29	13.99
ARS Raichur	Volume (m^3)	0.021	0.028	0.039	0.049	0.073
	Biomass (ton ha^{-1})	9.39	12.69	17.40	22.02	32.55
	Carbon sequestration (ton ha^{-1})	4.51	6.09	8.35	10.57	15.63

Where, RTPS = Raichur Thermal power Shaktinagar, ARS –Agricultural research station
YAP- Years after Planting

REFERENCES

Banerjee AK 1973. Plantations of *Acacia auriculiformis* (BENTH.) A.CUNN. In West Bengal. Indian For. 99 (9): 533-540.

Boland DJ and Pinyopusarek K 1988. *Acacia auriculiformis* International Provenance Trials – a guide for research co – operators, Council of Scientific and Industrial Research Organization, Division of Forestry Products, Canberra. pp. 13.

Chaturvedi AN and Khanna LS 1984 Forest Mensuration, International Book

Distributors, Dehradun, p.153.

Devarnavadagi SB, Patil SB and Ashvathama VH 2005 Cultivation of oil yielding tree species. Tree Borne oil seed species, Pp 1-15.

Khajuaria HN and Chauhan SK 2003 Marketing direct and indirect carbon fixation, National symposium on Agroforestry in 21st centaury, 2003. pp.11-14

Kushalapa KA 1991 Performance of *Acacia auriculiformis* in India. Journal of Tropical Forestry, **7** (2) : 81-91.

Shivanna H, Janagiri P, Balachandra HC and Kyatappanavar S 2006 Potential of *Pongamia pinnata* in Carbon sequestration – An Important Bio-Diesel plant. My For., 42 (1): 5 -11.

Siva Kumar S, Kheoon YK, Hassan J and Rahman 2000 Carbon sequestration in rubber implications and economic model to continued cultivation. Proc, Indonesian Rubb.Conf and IRRDB Symp, Pp: 79 - 102.

Rawat Vijay and Negi JDS 2004, Biomass production of *Eucalyptus tereticornis* in different agroecologiacal regions of India. Ind For. 130 (7): 762 – 770.