



***Acacia nilotica* tree improvement Programme through tank bed plantations of Tamil Nadu to increase the green cover, enhance the rural livelihood and mitigate global warming**

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Received: 10.09.2018

Abstract

Revised and Accepted:
12.10.2018

Key words: *Acacia nilotica*, tree improvement, tank bed plantations and global warming.

Acacia nilotica is an important and multipurpose tree legume spread all over the India and World. It sustains and grows in many degraded lands and supporting to enrich the soil nutrients and soil fertility. *A. nilotica* grows well with different agriculture crops such as rice, wheat etc. *A. nilotica* is a rich nutritious tree species acts as a fodder crop for livestock cattle. *A. nilotica* is an ideal tree for silvipastoral systems with different intercrops. The tree builds up soil fertility under its canopy through leaf litter and dead roots etc. The field surveys done over a period of three years revealed that *A. nilotica* withstands high temperature, drought and water logging and suitable for flood prone areas and problematic soils such as saline, alkaline and sodic. It possesses biological nitrogen fixing ability and neutralizes water and soil pH. The study conducted in plantations of different age groups in Tamil Nadu has shown that there exists wide variation in morphometric featured among trees and therefore the productivity of the plantations is low. Socio-economic diagnosis of traditional as well as commercial agroforestry practices followed by farmers will support their lives and it also improves the green cover and forest health.

1. Introduction

Acacia nilotica Lam (Mimosaceae) indigenously known as 'Babul' or 'Kikar' is a proverbial, medium sized tree and is broadly scattered in tropical and subtropical countries. *A. nilotica* is a species of Acacia (wattle) native to Africa and the Indian subcontinent. In India, it is recognized worldwide as a multipurpose tree legume (National Academy of Sciences, 1980) and has

both nutritional and medicinal values based on the presence of numerous secondary metabolites and essential metals (Bwai *et al.*, 2015). The iron content in fermented *A. nilotica* seeds was noteworthy as diets in many developing countries are deficient in iron (Bressani, 2002). Legumes are the life-savers for millions of resource poor people where ensuring food and

nutritional security is one of the significant problems, particularly in traditional subsistence farming systems (Haq, 2002). It occurs from sea level to over 2000m and can withstand extremes of temperature ($>50^{\circ}$ C) and air dryness but it is frost sensitive when young. *A. nilotica* was established as very important economic plants since early times as source of tannins, gums, timber, fuel and fodder. The main advantage of this plant is its fast biological nitrogen fixation ability to establish on nitrogen- deficient and drought prone soils and suitability for rehabilitation of dry lands. They have significant pharmacological and toxicological effects in Africa and the Indian subcontinent; *A. nilotica* is extensively used as a fodder, timber and firewood species. The main uses include fodder for livestock, wood production for fuel, bark used as tannins and tooth powder, gum used in calico printing. *A. nilotica* is extensively planted in social forestry programme in tank bed, farmlands, watershed management projects on field bunds and wasteland.

2. Materials and Methods:

3. Results and Discussion

The *A. nilotica* is a multipurpose tree which can be useful for all types of soils. Such as saline, alkaline, black soil, red soil etc. It can sustain in dry land, wet land & partially waterlogged and supports in increasing the green cover. *Acacia nilotica* wood is very heavy, strong, very tough and extremely hard wood average weight $785\text{Kg}/\text{m}^3$ at 12% moisture content. It is cultivating through tank bed

Tamil Nadu has an area of $130,058\text{ km}^2$ and it has 17% of forest area, nearly 89% of the forests are owned by the national government. The Tamil Nadu Forest Department (TNFD) introduced *A. nilotica* as plantation in 1960-1981 under Social Forestry Programme in 8,296 tank beds covering an area of $1,37,623\text{ha}$ in, different Districts of Tamil Nadu. The survey is carried out in this forest areas owned by government.

Extensive field survey has been carried out in *Acacia nilotica* tank bed plantations in different parts of Tamil Nadu for selection of Plus trees based on physical characters such as girth, Clear Bole Height (CBH), total tree height, canopy diameter and appearance. The growth parameters and GPS reading of the selected trees were been collected. The collected data are compiled for the superior CPTs.

The plus trees are further selected for candidate plus trees which posses superior physical characters such as maximum height, CBH and girth are selected and marked for seed collections and future tree improvement programme.

plantations of Tamil Nadu. In Tamil Nadu there are 41,948 numbers of tanks (Season and crop Report (2001) Statistics and Economics, Chennai). So, through tank bed plantations of *A. nilotica* the accumulated atmospheric CO_2 can be reduced easily and it is one of major atmospheric nitrogen fixing tree and a good fodder for goats can improve the rural livelihood.

With use of appropriate planting techniques and salt-tolerant



species, the salt-affected lands can be brought under viable vegetation cover (Chanchal Kumari et al., 2018). Being a drought resistance species *A. nilotica*; a multipurpose legume can be used for rehabilitation of dry lands. It increases soil organic carbon, total and available forms of N and P under its canopy so it can be used in soil amelioration. The chances of nitrogenous fertilizer use in various afforestation programmes are very bleak in the near future. The only alternative is to select such species that can meet their nitrogen requirements from soil as well as atmosphere. The nutrient generated by *A. nilotica* tree by biological nitrogen fixation, can be exploited within production system, either simultaneously as an intercropping plant or sequentially as in rotational fallow systems (Kiran Bargali et al., 2009).

The extensive field survey conducted in Tamil Nadu and the Candidate plus trees were selected based on various parameters such as Girth, Clear Bole Height (CBH), Tree height, Canopy height and the trees

which are free from any pests and diseases etc. The trees in the districts such as Coimbatore, Salem, Thiruvallur and Viruthunagar showing wide range of variations in the tank bed plantations.

The growth of *A. nilotica* in various tank bed plantations are collected and represented in statistical data using tables, bar charts and graphs. The trees of *A. nilotica* with superior and inferior characters in Tamil Nadu tank bed plantations

In Coimbatore 20years tank bed plantations possess nearly 25,000 lakh trees, from that population merely a 4-6 CPTs were been able to select. Here the minimum girth of the trees at the age of 20 years is 30cm and the CBH is 1.8m with the total tree height 4.1m (Table 1). Similarly in Salem the minimum girth is 29cm with clear bole height of 2.7m and the total height of 6.2m and the maximum girth found was growth with 116cm with 2.25 CBH and 10.5m total height (fig 1).

Table no: 1- Growth of *A. nilotica* at kolarampathy tank bed plantation of Coimbatore of 20 years old trees.

Sl.no	Girth (cm)	Cbh (m)	Height (m)
1	30	2.0	4.1
2	43	1.8	6.7
3	28	2.7	5.3
4	32	1.2	3.7
5	29	1.1	2.8

6	230	3.3	11
7	208	2.5	10
8	187	3.75	12
9	218	4.2	8
10	213	2.4	10

Fig 1: Growth of 10 year old trees at Edapadi tank bed plantation in Salem district

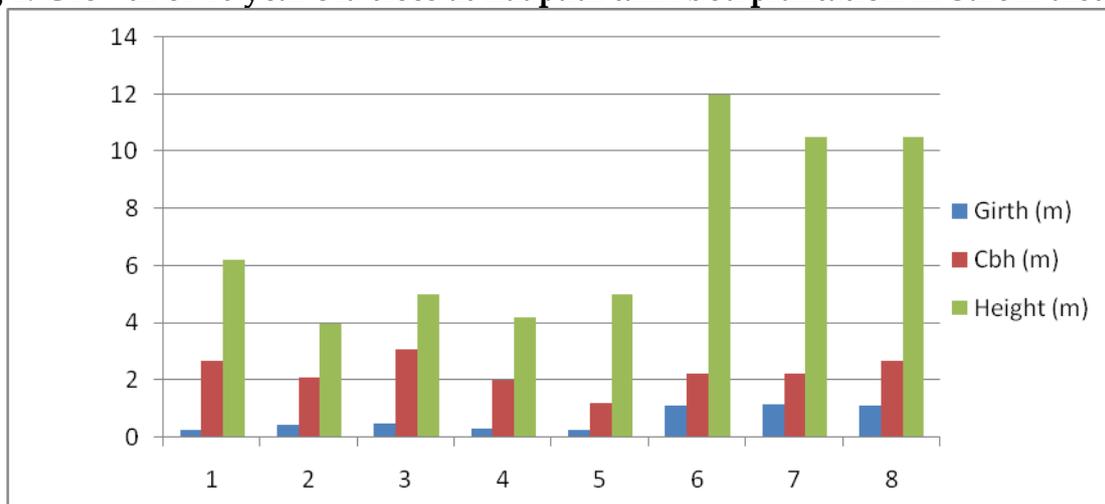


Fig 2: Growth of 10 year old trees at Vanjivakkam tank bed plantation in Tiruvallur district

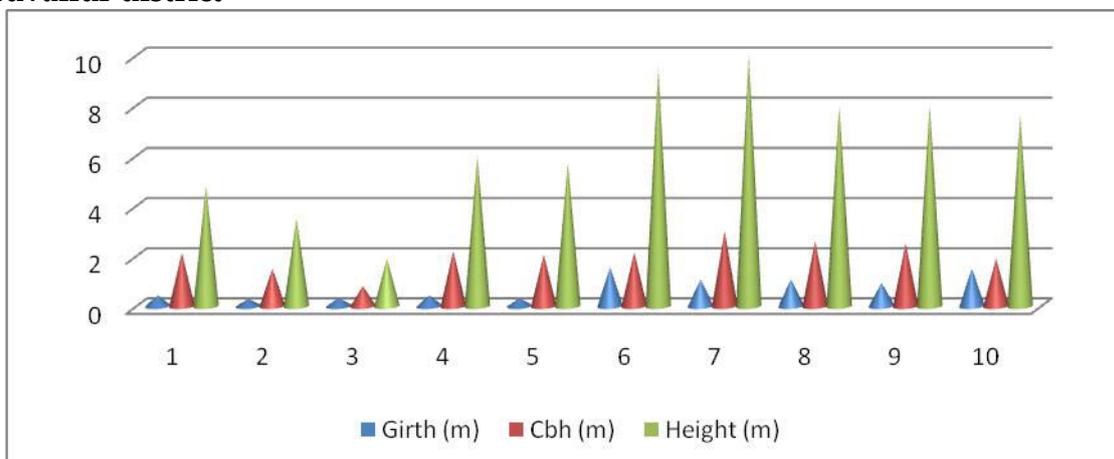




Table no: 2- Growth of 20 year old trees at Bethireddipatti tank bed plantation in Viruthunagar district

Sl. no	Girth (cm)	Cbh (m)	Height (m)
1	40	1.4	8
2	46	2	2.8
3	53	2.2	3.2
4	27	2.3	6
5	32	2.8	7.2
6	204	3	13.5
7	256	2.2	14.5
8	140	2.3	14
9	150	3	12
10	150	3	15

In Tiruvallur district, the plantation possess superior trees with maximum girth of 155cm and the CBH of 2.15m and the total height is about 9.5m and minimum girth of 43cm with 2.13m CBH and 4.8m height (fig 2). In Virudhunagar district, the minimum girth of the plantation was 40cm with 1.4m CBH and 8m height and the maximum girth of 256cm and 2.2m CBH and height of 14.5m (Table 2). It acts as carbon sink for the removal of CO₂ from the atmosphere and supports the carbon sequestration.

Therefore, through tank bed plantations of *A. nilotica* will support to fix the atmospheric nitrogen in the soil and increase the soil fertility similarly it can sustain almost all types

of the problematic soil such as saline, alkaline etc. the accumulated atmospheric CO₂ can be reduced easily through the *A. nilotica* and improves the green cover even under the water logged conditions.

4. Conclusion

The genetically superior trees of *A. nilotica* are to be selected for better quality of growth, sustainability, yield etc similarly agroforestry is an intensive approach towards afforestation and also to mitigate global warming. The mitigation role of forest sector can broadly be classified into sequestration, storage and substitution. Sequestration includes increasing the flow of removal of CO₂ from the atmosphere planting of *Acacia*



nilotica can support the carbon sequestration.

The subspecies *A. nilotica indica* sustains its life 5-6 months under waterlogged conditions. Whereas subspecies *A. nilotica variana* and *A. nilotica jaganciana* survives up to 8 months in waterlogged conditions. The genetically superior variety selected can provide better timber yield, uniform timber yielding variety, uniform growth. It can sustain even in waterlogged condition resistant to drought and all types of soils through that large sum of accumulated carbon in the atmosphere can get sequestered by *Acacia nilotica* plantations. Planting the genetically superior material can also increase the yield up to 3 to 5 fold and increase the green cover under Trees Outside Forest, enhance the rural livelihood and combat the global warming.

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