Orignal Article

Indian Journal of Plant and Soil
Volume 6 Number 2, July - December 2019
DOI: http://dx.doi.org/10.21088/ijps.2348.9677.6219.3

Volume and Yield Model for Ailanthus (*Ailanthus Excelsa*) Grown in Cauvery Delta Zone of Tamil Nadu, India

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How to cite this article:
A Balasubramanian, CN Hari Prasath, M Sureshkrishnan. Volume and Yield Model for Ailanthus (*Ailanthus Excelsa*) Grown in Cauvery Delta Zone of Tamil Nadu, India. Indian J Plant Soil. 2019;6(2):79–82.

Abstract

A study was conducted to identify the volume of the *Ailanthus excelsa* plantation in the Cauvery delta zone and constructing the yield model for easy prediction of the yield, which helps farmers in knowing the value of trees. The study was carried out in Cauvery delta zone of Tamil Nadu by studying the biometric attributes namely tree height, bole height, diameter at breast height (DBH) for estimating the volume and to construct the yield model for *Ailanthus excelsa* in 5 age classes (Age class of 0–1 years, age class of 1–2 years, age class of 2–3 years, age class of 5–6 years and age class of 8–9 years). The volume of 0.169 m^3 was attained in the age class of 8–9 years in *Ailanthus excelsa* plantation. Yield model developed by using multiple linear regression for the *Ailanthus excelsa* plantations of Cauvery delta zone was $Y = (-0.062) + (0.01 \times X_1) + (0.77 \times X_2)$.

Keywords

Ailanthus excelsa, Biometric attributes; Farm plantation; Volume; Yield model.

Introduction

The forest wealth in our country is extremely diverse as a result of the huge variation in the topography of the country. Indian forests have undergone a tremendous change in the past few decades and are presently under a great threat. The excessive use of forest resources leads to forest degradation, which may become irreversible if not checked in time. Therefore, adequate protection and afforestation activities have contributed to the increase in the extent and quality of forest cover in country. The forest policy 1988 prohibited the felling of trees from natural forests and the raw material need of Indian wood based industries was compelled to meet from trees outside the forest. Hence, the farmers of country promoted to grow trees in their farm lands to meet the needs of wood based industries, such are furniture industries, paper & pulp industries, pencil industries, match industries, timber industries and bamboo based industries.

In the state of Tamil Nadu, the tree species such as Teak, Gmelina, Ailanthus and Kadamba were widely grown for timber and other purposes. Tamil Nadu has an area of 1,30,058 sq. km and is the eleventh largest state in India. The farmers are started growing trees in farmlands, to meet

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Received on 23.08.2019; **Accepted on** 23.10.2019

out the demand of wood and also to avoid the problem in scarcity of labours, water and etc. Eventhough farmers are growing tree species in farmlands, they are eager in knowing the volume of trees at different stages of growth. Therefore, the yield model for specific agro-climatic zones is needed for knowing or predicting the volume of trees at different growth stages (Lavhale and Mishra, 2007).

The yield model is used to predict changes in tree and stand values for periods between successive inventories, to predict the productivity and profitability of the farm whenever the farmer needs, to evaluate the impact of management policies on the sustainable use of forests, to understand the general tree growth responses in relation to habitat characteristics (Segura and Kanninen, 2005).

Studies of yield estimation and prediction for the trees planted in the farmer's plantation are very minimum, since these tree species are the basis of wood based industries of the country it is important to assess the productivity of tree species grown in farm settings. Yield modelling will be a suitable tool to assess and predict the yield of farm plantations and also it will be easy accessible to the tree cultivators. This study emphasizes the importance of constructing the yield model for *Ailanthus excelsa* in Cauvery delta zone of Tamil Nadu.

Materials and Methods

The research investigation was carried out in *Ailanthus excelsa* grown under farm settings of Tamil Nadu for studying biometric attributes and growth pattern for construction of yield model. *Ailanthus excelsa* is widely planted in Trichirappalli district with different age classes are available in Moovanur, Pulivalam of Trichirappalli district. Laser distance meter is an electronic device using laser beam to measure the height, diameter and volume of the particular. Laser distance meter facilitates the stem diameter measurement at any height of the stem by adopting the measure in picture technology. The measure of diameter at the different height helps in neglecting the form factor used in general volume table.

Farmer's Plantations of selected tree species of different age class were identified through a preliminary survey. Based on the existence of farmer's plantations, study area were determined for *Ailanthus excelsa*. Planting details such as area and age of the plantations were collected from the forest plantation register of Tamil Nadu Forest department and through farmer's information. Plantation chosen for the study was selected through random sampling method. Totally 4 hectare of farmer's plantation was studied for each age classes with 5% sampling intensity. In each age class, 20 Quadrats were randomly placed with the quadrant size of 10 m × 10 m.

Fig. 1: 1–2 year old *Ailanthus excelsa* plantation

Growth of trees was assessed by measuring the biometric traits of the trees. The following biometric traits were observed and recorded namely Tree height (m), Bole Height (m), Collar diameter (m), Diameter at Breast Height (m) and Diameter of 2 m segments of main bole from the ground level to the bole height. The merchantable volume denotes that the volume of tree from the base up to the crown height. In the present study, the accurate volume of main bole up to the crown height was computed using the biometric data. The volume of every 2 m section was estimated using the formula given by Chaturvedi and Khanna, (1982).

$$V = \pi r^2 h$$

Where, V = Volume, r = Radius, h = Top height

Linear Multiple Regression method is used to model the relationship between the dependant and independent variable, (Whittaker and Woodwell, 1968). In this study age and average diameter of the tree were defined as the independent variables, and Yield (Merchantable volume) was defined as dependant variable. The general equation developed through the Linear multiple regressions is detailed below

$$Y = a + b_1 x_1 + b_2 x_2$$

Where, Y – Yield (m^3), a – intercept, b_1 – age of the tree in years b_2 – Average Diameter & x_1, x_2 – Coefficients of b_1 and b_2

Results and Discussion

The volume production and MAI were studied in the *Ailanthus excelsa* for different age classes in Cauvery zone. The average volume of 0.003 m^3, 0.021 m^3, 0.023 m^3, 0.072 m^3 and 0.169 m^3, were recorded in the age class of 0–1 years, age class of 1-2 years, age class of 2–3 years, age class of 5-6 years and age class of 8–9 years respectively (Table 1).

Table 1: Volume of *Ailanthus excelsa*

Age class (years)	Bole height (m)	Average Diameter (m)	Average Volume (m^3/tree)	MAI (m^3/tree/year)
0–1	1.12	0.054	0.003	0.003
1–2	2.75	0.083	0.021	0.011
2–3	3.53	0.090	0.023	0.008
5–6	5.76	0.099	0.072	0.012
8–9	6.82	0.176	0.169	0.019
		Average		0.010

Among the different age classes studied, maximum MAI (0.019 m^3/year) was observed in the age class of 8-9 years followed by age class of 5–6 years (0.012 m^3/year), age class of 1–2 years (0.011 m^3/year) and minimum MAI (0.003 m^3/year) was recorded in the age class of 0–1 years (Fig. 2). A result of the study confirms the results obtained by Jat *et al.* (2011) from the study on the productivity of Ailanthus plantations in Rajasthan. He revealed that rotation age of the *Ailanthus excelsa* goes up to 50 years.

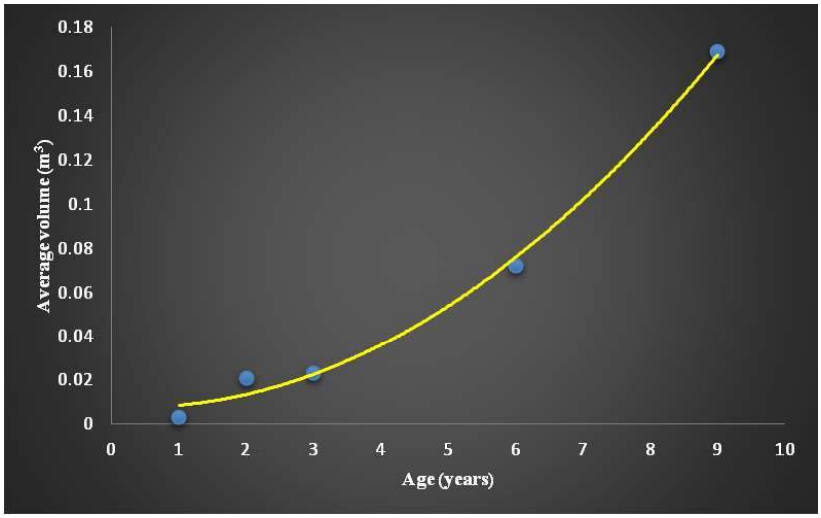

Fig. 2: Volume increment in *Ailanthus excelsa*

Yield model developed by using multiple linear regression for the *Ailanthus excelsa* plantations of Cauvery delta zone was

$$Y = -0.062 + (0.01 \times X_1) + (0.77 \times X_2)$$

Regression co-efficient of the above constructed yield model was $r^2 = 0.98$ and the standard error was SE = 0.014 percent. Bermejo *et al.* (2003) classified the study area into site classes to develop yield model for *Tectona grandis* plantations in Costa Rica. On contrary, Krishnankutty, (2011) employed the diameter and breast height as the predictor variable to develop the commercial volume predictions for the tree species Teak and Mango.

Conclusion

Yield model developed by using multiple linear regression for the *Ailanthus excelsa* plantations of Cauvery delta zone was $Y = -0.062 + (0.01 \times X_1) + (0.77 \times X_2)$. Deviation of the model from the actual merchantable volume was estimated to 13 percent.

References

1. Ivan B, Isabel C, and Miguel AS. Growth and yield models for Teak plantations in Costa Rica. Forest Ecology and Management. 2003;189(3):97–110.
2. Jat HS, Singh KR, and Mann JS Ardu (Ailanthus sp) in arid ecosystem: A compatible species for combating with drought and security livelihood security of resource poor people. Indian Journal of Traditional Knowledge. 2011;10:102–13.
3. Krishnankutty CN. Commercial volume table for Selected Home Garden trees of Kerala. Kerala Forest Research Institute. Peechi, Kerala, India. 2011.
4. Lavhale MS and SH Mishra. Nutritional and therapeutic potential of Ailanthus excelsa: A review. Pharmacognosy Rev. 2007;1:105–13.
5. Segura O and M Kanninen. Allometric models for estimating volume and total aboveground biomass of seven dominant tree species in a tropical humid forest in Costa Rica. Biotropica. 2005;37:2–8.
6. Whittaker RH and GM. Woodwell. Dimensions and production relations of trees and shrubs in the Brookhaven forest. Journal of Ecology. 1968;56:1–25.