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COMPARATIVE GROWTH OF SEVEN YEARS OLD *GREVILLEA ROBUSTA* A. CUNN. GROWN UNDER TAUNGYA SYSTEM AND PURE PLANTATION

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ABSTRACT : The paper summerizes the data on height, diameter and estimated bole volume of seven years old trees of *Grevillea robusta* grown under taungya system and in pure plantation. The maximum height of 12.5 m with mean annual increment (M. A. I.) of 1.5 m was attained by the trees grown under taungya, while those in plantation attained 11.3 m with M. A. I. of 1.4 m. The maximum diameter of 27 cm was found under taungya system with M. A. I. of 3.1 cm while in pure plantation was 23.7 cm with M. A. I. of 2.6 cm. The bole volume was greater under taungya system with a mean of 0.15 m^3 while in plantation it was 0.1 m^3. The overall growth was better under taungya system than on pure plantation.

Keywords : Taungya, pure plantation, height, diameter (dbh), mean annual increment (mai).

INTRODUCTION

Taungya system was started long time ago in Malaysia (King 1968) and has been adopted by many tropical countries for raising forest plantations. It is a system whereby the natural forest is cleared and the land is used for growing agricultural crops Later trees are interplanted with agricultural crops till the canopy closes up making it unproductive for agricultural crops and leaving the trees to make a forest. In Kenya this period takes 5-7 years depending on the species. Taungya was started in Kenya as early as 1910 (Kenya Forest Department, 1967) for raising plantations of Pines, Cypress and Vitex (Konuche and Kimondo 1990). There are no pure plantations of *Grevillea* in the forests yet, but due to its current popularity and publicity it might find a place as a forest plantation species in the near future.

Grevillea robusta A. cunn. silver oak originated from Australia (Queensland and New South Wales). It was introduced in Kenya in early 1950. *Grevillea* is a fast growing species widely used as avenue and shade tree, mainly between 1300 m-2500 m above sea level in areas of good rainfall and well drained fairly deep soil (Grahm, 1949). Grahm estimated that to produce logs of 50 cm or more in diameter a rotation of 40-50 years is required. He recommended *Grevillea* robusta to be grown in stands at initial spacing at 2.6m x 2.6m.

The tree is much suited in plantations for timber but if cultivated in non forest situations it could also be valuable for firewood (NAS 1980). It is easily grown and popular with farmers as the wood is easily worked, the leaves are used as fodder for cattle during dry spells and it does not reduce the yields of crops when grown on farm (Sagwal, 1986). Due to firewood and timber demands the tree's potential needs to be explored more for better utilization

and commercialization. Therefore an attempt has been made to compare the growth of *Grevillea* under pure stand and taungya system. This paper compares the growth made in height, diameter and tree volume by *Grevillea* under taungya system and in a pure plantation within a period of seven years.

MATERIAL AND METHODS

The studies were conducted at Kenya Forest Research Institute, Station Muguga (1.1° S latitude, 36.3° E longitude, 2200 m altitude). The soils are deep friable humic clay with dark subsoil. The mean temperature is 16° C. An area of about 2.6 ha under taungya was planted with *Grevillea* seedlings at a spacing of 2.5m x 2.5m. Maize and beans were interplanted with *Grevillea* until the crowns touched each other during the sixth year. The trees in this site under taungya were given all cultural operations necessary like those of agricultural crops.

Another 2.6 ha adjacent area which was covered with natural bush and a few Eucalyptus trees was cleared for pure plantation trial. *Grevillea* seedlings were planted at a spacing of 2.5m x 2.5m, No weeding was done on this plot except slashing when the seedlings were less than 2m in height (the first two years). It should be hoted that the size of the tree seedlings for both trials when planting were between 30–45 cm tall and planting

Table 1 : Mean height, diameter (dbh) and bole volume of *Grevillea robusta* grown on pure plantation in Kenya.

Years	Root Collar Diameter (cm)	Height (m)	DBH (cm)	Bole volume (m^3)
1	3.8	1.9 ± 0.3	—	—
2	—	2.4 ±	2.5 ± 5	0.0004
3	—	4.4 ± 0.5	6.2 ± 0.6	0.005
4	—	6.3 ± 0.5	8.7 ± 1.2	0.015
5	—	6.9 ± 0.4	10.5 ± 0.7	0.025
6	—	8.9 ± 0.8	14.7 ± 1.3	0.057
7	—	9.9 ± 1.5	18.3 ± 1.8	0.10
	M. A. I.	1.4	2.6	

± — Represents standard error of mear n = 260.

was done on the same day in April when long rains prevail.

At the end of first year the observations were recorded for root collar diameter and height. And there after every year height, diameter (dbh) and mean annual increment were recorded. A random selection was made for comparing the growth performance of trees and thus only 260 trees in each system were measured.

Estimation of bole volume of the trees was calculated using the mean height and dbh, from Spurrs (1952) volume equation.

$$\frac{Vp = \Pi / r^2 h}{2}$$

Where r is bole radius at breast height and h is tree height. The estimated tree volume was cross checked using another formula by Osoria (1967).

$$V = 0.00003^2 H$$

Where V = Tree volume

D = Diameter (Dbh) (cm)

H = Height in (m)

The data were analyzed statistically (Freese 1962).

RESULTS AND DISCUSSION

The data revealed that under taungya system maximum height, and dbh were 12.0m and 27.0 cm respectively (Table-2). Whereas under pure plantation the mean values were 9.9m and 18.3m respectively (Table-1). The dbh mean annual increment varied between the two systems with taungya system scoring 3.1 cm and pure plantation 2.6 cm. The difference was significant at 5 per cent level. There was no statistical significant difference in height M. A. I. between the two systems. Spurrs' 1952 formula for bole volume gave taungya system a mean of 0.15m³ per tree and 0.10m³ in pure plantation. The performance was comparble to the growth recorded by other workers at similar conditions and age groups. Six year old ***Grevillea*** trees at Muguga arboretum (Kenya) recorded mean height of 9.2m and 2.5 cm respectively (Silviculturist 1988). At lower altitudes 548m above sea level in India. Tokyo and Khosla (1984) recorded mean height of 9.2m, and dbh of 17.4 cm with height and dbh M. A. I, of 1.3 and 2.5 cm respectively, In semi arid areas of Kenya where rainfall is below 700 mm and mean annual temperature of 19.2°. Bashir, ***et al.,*** (1989) found out that ***Grevillea*** attained maximum height of 6.1 m with M. A. I. of 0.9m within six years. Chirchir (1990) found out that 3 years old ***Grevillea*** attained mean height of 2.8m with M. A. I. of 0.9 m. Although the growth is less in semi arid areas probably due to less rainfall, the growth rate is still about 1.0m per year.

Although the difference in growth was not very much pronounced between the two systems for the ***Grevillea***, other species grown under taungya system have shown that taungya system improves growth rate. Pudden (1953) found that trees of ***Cupressus lusitanica*** grown under taungya system attained a mean height of 1.8m, Ochieng (1969) found that taungya gave up to 20 per cent better growth, Konuche and Kimondo (1990) recorded that mean

Table 2 : Mean height, diameter (dbh) and bole volume of *Grevillea robusta* grown under taungya system.

Years	Root Collar Diameter (cm)	Height (m)	DBH (cm)	Bole volume (m^3)
1	3.8	1.9 ± 0.6	—	—
2	—	2.5 ± 0.5	3.9 ± 0.7	0.001
3	—	4.6 ± 0.5	6.8 ± 0.5	0.005
4	—	6.5 ± 0.4	0.9 ± 0.4	0.016
5	—	7.5 ± 0.4	12.5 ± 0.6	0.035
6	—	9.3 ± 0.4	16.7 ± 0.8	0.077
7	—	10.9 ± 0.9	21.5 ± 0.3	0.151
	M. A. I.	1.5	3.1	

± — Represents standarn error of mean n = 260.

height in taungya system improved by 18 per cent by the third year. *Grevillea* is a faster growing species than cypress and therefore it overcomes the weed competition at earlier age (two years) that the cypress, this might be the reason for the pronounced difference in growth between the trees grown in taungya system and pure stand. Thus taungya has an edge over the pure stand where association of crops and cultural operations are lacking. Since the tree is non-leguminous it implies that tree got advantage of cultural operations.

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