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Impact of Pruning Intensity on Tree Biomass Production of *Dalbergia sissoo* Roxb and Fresh Yield of Turmeric

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ABSTRACT

A field experiment was conducted at the Research Farm, of New Dusty Acre Area, Department of Forestry, College of Agriculture, JNKVV, Jabalpur (M.P.) during, 2015-16. The experiment involve four pruning intensities+open condition (only crop) in main plot and three different dates of planting in sub plot under strip plot design with four replications. The results revealed that, 25 per cent pruning recorded higher yield (27.3 q ha^{-1}), as compared to 50 per cent pruning (25.3 q ha^{-1}), over the open condition recorded significantly lowest yield.

Key words: *Pruning intensities, Different date of planting, Tree biomass.*

INTRODUCTION

Dalbergia sissoo is a medium large sized tree belonging to family leguminosae. It has been grown since long times in combination with agricultural crops, field boundaries, around fruit orchards. It is having multiple uses such as fuel, wood, fodder, shade, and nitrogen fixing ability[24]. The potential benefits of growing trees with annual and perennial crops are to uphold and sustain soil productivity and fertility[24,25,5]. The increasing demand and high prices of wood (fuel, timber, pulp) unlike the agriculture crops is a foremost reason for the farmers to integrate fast growing trees on their farmland in close alliance with agricultural crops. Trees on farm can be made popular, especially fast growing like sissoo which also provide fodder, fuel and timber. Pruning provides woody biomass for fire wood, leaf biomass and fodder. The turmeric (*Curcuma longa* L.) plant is a herbaceous perennial belonging to the family *Zingeberaceae*[18]. In India turmeric grown area 186000 ha, production (943 MT) and productivity (5.07 MT ha^{-1}) while, Madhya Pradesh have grown area 142000 ha, production (1.61 MT ha^{-1}) and productivity (1.33 MT ha^{-1})[1]

Turmeric is valued for its under ground orange coloured rhizomes which are used as natural coloring agent for food, cosmetics and dyes. Curcuminoids the active principles in turmeric rhizomes is known to have some medicinal properties and has been used efficiently in the treatment of circulatory problems, liver diseases, dermatological disorders and blood purification[13].

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Apart from the rhizomes, richness in curcuminoid pigmentrs (6%) and essential oils (5%), it also contains 69.4% carbohydrate, 6.30% protein, 3.50% mineral and other important elements on dry weight basis[17].

Pruning is a common silvicultural practice to increase wood production, improve tree shape and potentially uses to obtain poles and firewood without decrease in wood productivity. It involves removal of live or dead branches or multiple leaders from the tree. Pruning of tree component is a powerful approach to regulate light, nutrients and other resource competition[10,8]. Pruning is cutting of branches or even younger stem. Its helps in minimizing shade effects of intercrops and to maintain the quality of timber, frits *etc.* Pruning of Multipurpose trees (MPTS) during each year reduce the competition with crop and produced good amount of biomass. Pruning has become an essential practice for reducing both above and below ground competition with associated crops[23,3]. The components of the system interact with one other to influence the microclimate and soil conditions[12]. The quality of solar radiation transmitted by tree canopy decides growth and productivity potential of the field crops[9]. Thus the field experiment entitled. Impact of optimum pruning intensity for getting higher tree biomass production of *Dalbergia sissoo* Roxb and fresh yield of turmeric

MATERIAL AND METHODS

A field experiment was conducted at Dusty acre area, Department of Forestry Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.). Jabalpur during 2015-16. lies between 22°49' to 2408' North Latitude and 78021' to 80058' East Longitude with an attitude of 411.78 m MSL. The climate of the region is semi and with hot dry summer and cold dry winter. The soil of the experimental area was medium black, clay loam in texture, neutral in reaction (pH 7.21), medium in organic carbon (0.46%), medium in available nitrogen(207 kg ha^{-1}), medium in available phosphorus (16.26 kg ha^{-1}) and very low in Potash (172 kg ha^{-1}). The experiment was conducted during rainy season under 16 years old *Dalbergia sissoo* planted at a distance of (5×5 m^2). The experiment involve four pruning intensities *viz*., no pruning, (25%, 50% and 75%) pruning in *Dalbergia sissoo* + open condition (only crop) in main plot and three different date of planting 20 June 2015, 27 June 2015 and 03 July 2015 in sub plot under strip plot design with four replications. All the observations were recorded and common package of practices recommended by JNKVV, Jabalpur.

RESULTS AND DISCUSSION

Different date of planting significant effect on number of fingers per rhizomes, fresh yield (kg ha^{-1}) first date of planting (D_1) significantly highers number of fingers per rhizomes (7.2), fresh yield (2890.6) at par with second date of planting (D_2) over the 3rd planting (D_3). The similar results also recorded by Gill and Kumar[11] and Singh *et al*.[25].

Yield attributing characters viz., number of fingers per rhizomes, fresh yield (kg ha^{-1}) were affected significantly by different pruning treatments. 25 per cent pruning *i.e.* crop grown with tree recorded highest number of fingers per rhizomes (6.1) fresh yield (2734.4) as compared to crop grown with trees under different pruning intensities. Among different pruning intensities, 50 per cent pruning recorded significantly number of fingers per rhizomes (5.9), fresh yield (2535.4). Hence, open condition is having significantly lowest number of fingers per rhizomes (5.5), fresh yield (2088.5) as compared to 50 per cent pruning. The result recorded with[15,7].

The morphological characters (except tree height) were significantly affected by pruning treatment. 25 per cent pruning recorded significantly higher dbh (24.6), It may be the reason of lower dbh of tree under 75 per cent pruning as compared to 50 per cent pruning, 25 per cent pruning and unpruned trees. The removal of the 40-50 per cent of lower green crown length in depressed diameter increment. The present study tree growth interms of dbh, height and crown diameter was lowest in 75 per cent pruning

and increased with reduced pruning intensities[19]. Canopy spread in both N-S and E-W direction was maximum in no pruning (9.88 and 9.95) where as lowest in 75 per cent pruning (6.41 and 6.46). Overall tree growth was better in the agrisillviculture system than pure tree (without crop), probably due to fact that trees also benefited from irrigation, fertilizer and tillage operations given to the crop. A similar result was given by Couto and Gomes[4] and Newaj *et al*.[16].

Pruned biomass (Table 2) was significantly influenced by different pruning treatment. Trees having heavy pruning *i.e*., 75 per cent pruning recorded highest pruned biomass (1085 kg ha^{-1}) as compared to 50 per cent pruning (932 kg ha^{-1}) and 25 per cent pruning (701 kg ha^{-1}). Biomass production is directly correlated with pruning intensity. Hence, pruned trees tended to produce more biomass as compared to lightly pruned trees. The reason is simple that more foliage was removed in 75 per cent pruning which increased the pruned biomass. Similar results have also been reported by Zeng[27] Uotila and Mustonen[26]. Cylindrical volume (249 m^3 ha^{-1}) Significantly highest cylindrical volume recorded in 25 per cent pruning intensities and lowest in 75 per cent pruning (107.4 m^3 ha^{-1}). This was due to fact that trees are commonly pruned by removing leaves and branches from lower part of the crown which changes the stem shape to a more cylindrical form and increases the clear bole length, resulting in more biomass allocation in bole than other components. Shepherd[21] and Muhairwe[14] have hypothesized that pruning change stem shape to a more cylindrical form. Pinkard *et al.*[20] and stand biomass (191730 Kg ha^{-1}) as compared to 50 per cent pruning. Biomass production in N_2- fixing leguminous trees might be influenced by frequency and height of pruning. Similar results have been also reported by Duguma *et al*.[6] and Sanginga *et al.*[22]. Due to decreased assimilate production, the growth of pruned trees is generally reduced[19,20,2]. Stand biomass was significantly influenced by different pruning intensities, at the age of 16 years, 25 per cent pruning recorded significantly highest stand biomass (191730 kg ha^{-1}) at par with no pruning (169862 kg ha^{-1}) and was significantly superior to 50 per cent (140910 kg ha^{-1}) and 75 per cent pruning (82698 kg ha^{-1}) due to the diminished photosynthesis of pruned trees, because pruning of branches leads to a decrease in remaining leaf area and to a decrease in the number of buds from which new branches and leaves can be produced. Similar results also reported by Pinkard *et al*.[20].

Table1 1: The turmeric yield influence by pruning intensity & different date of planting at the age of 16 years

Treatment	Number of fingers per rhizomes	Fresh yield (kg ha^{-1})
Pruning intensities		
P_0 Control (No pruning)	5.6	2182.3
P_1 - 25% pruning	6.1	2734.4
P_2 – 50% pruning	5.9	2535.4
P_3- 75% pruning	5.7	2427.1
P_4- Only crop	5.5	2088.5
SEm±	**0.1**	**140.2**
CD (P = 0.05)	**0.3**	**432.1**
Date of planting		
D_1-20/06/2015	7.2	2890.6
D_2- 27/06/2015	5.6	2590
D_3 -03/07/2015	4.5	1700
SEm±	**0.1**	**99.43**
CD (P = 0.05)	**0.5**	**344.0**

Table 2: Morphological growth characters and biomass influence by pruning intensity & different date of planting at the age of 16 years

Treatments	Tree height (m)	dbh -1.37 (cm)	Canopy spread (m)		Pruned biomass (Kg ha^{-1})	Cylindrical Volume (m^3 ha^{-1})	Stand biomass (Kg ha^{-1})
			N-S	E-W			
Pruning intensities							
P_0 no pruning	12.4	23.8	9.88	9.95		220.6	169862
P_1 -25% pruning	13.1	24.6	8.34	8.61	701	249	191730
P_2 -50% pruning	12.1	22	7.48	7.53	932	183	140910
P_3 -75% pruning	11.3	17.4	6.41	6.46	1085	107.4	82698
SEm±	0.62	2.7	1.0	0.5	151	14.3	1227.8
CD (P = 0.05)	NS	7.9	3.5	1.6	478	44.7	3931.8
Date of planting							
D_1 -20/06/2015	12.5	22.7	8.69	8.59	903.8	202.3	155771
D_2 -27/06/2015	12.6	22.9	7.83	8.15	789.4	207.5	159775
D_3 -03/07/2015	13.1	20.5	8.11	8.18	580	172.9	133133
SEm±	0.73	1.0	0.3	0.4	163.6	7.8	1450
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS

CONCLUSION

It may be concluded that the 25 per cent pruning intensities recorded high fresh yield (2734.4 kg ha^{-1}) over the another treatments. Different date of planting significantly higher fresh yield (2890.6 kg ha^{-1}) 25 per cent pruning led to record the highest dbh (24.6 cm), cylindrical volume (249 m^3 ha^{-1}) and stand biomass (191730 kg ha^{-1}).

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