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Original Research Article

Effect of Direction and Distance from Tree Base on Yield Attributes of Sesame (*Sesamum indicum*) under Bael (*Aegle marmelos*) Based Agroforestry System

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A B S T R A C T

The present study was conducted to evaluate the effect of direction and distance from tree base on the yield of sesame (*Sesamum indicum*) under bael based agroforestry system. The experimental results revealed that sesame showed better performance under partial shade and at a proper distance from the base in eleven year old bael (*Aegle marmelos*) plantation. The results showed that the effect of different direction and distance treatments were significant on seed yield. Significantly higher values of seed, stover and biological yield were recorded in south-west direction as compared to other directions. Likewise, the yield attributes of sesame increased significantly with the distance increase from tree base and the maximum seed, stover and biological yield was recorded at 2.5-3.25 m distance from tree base.

Keywords

Direction, Distance, Agroforestry system, Sesame, Bael

Introduction

Agroforestry system is an improved cropping system which had optimum utilization of natural resources thereby increased yield per unit area per unit time (Singh G.B., 1987). Agroforestry systems are dynamic, ecologically based, natural resource management systems that diversify and sustain production in order to increase social, economic and environmental benefits for land user at all scales (Leakey, 1996). Bael (*Aegle marmelos*) belonging to family Rutaceae is a slow growing and medium sized tree of Indian origin found upto an altitude of 1200 m. It has tolerance to arid condition as well as high rainfall (Chundawat, 1990). The bael tree is indigenous to Indian continent and found in tropical and sub-tropical region. Bael is a deciduous tree and propagates through seeds. Fruits are globuse with grey or yellowish hard woody shell and contain numerous seeds which are densely covered with fibrous hairs. *Aegle marmelos* is also a good source of gum, carotenoids, vitamins and nutritive oils. Oilseeds are backbone of agricultural economy of India and considered as the second largest agricultural commodity in India after cereals (Yadav, 2011). Sesame which is known as Til, Simsim, Benised etc. is one of the most and extensively grown oilseed crops in India. Being rich in protein, calcium, phosphorus and vitamin-E, the seed cake are valuable for cattle feed in farm and dairy animals. Sesame 'The queen of oilseed' by virtue of excellent quality of oil, flavor and taste. Oil content varies from 46- 52 %. Oil is edible and commercially used in

pharmaceutical industries and manufacturing of soaps. Sesame occupies an area of 1.7 million ha with total production of 0.7 million tones and productivity of 426 kg/ha. Average yield of sesame is very low (350-600 kg/ha). It stands 3rd position in terms of total oilseed area and 4th in terms of total oilseed production in India. Yield of agricultural crops in agroforestry systems are mainly affected by the planting direction and distance from tree base. Direction is effective in terms of increasing light intensity on the vegetation. Crop sown in proper direction in the agroforestry system increase the yield of crops through harvesting maximum solar radiation and also reduce the shading effect of tree. Also the higher distance from tree base increases the yield of crop as compared to near the tree base. As distance increases, availability of Photo-synthetic Active Radiation (PAR) increases and below ground competition of resources are decreased (Kumar *et al.,* 2013). However, increased productivity under tree canopies often suggest that due to ameliorating influence of shade in a hot and dry environment.

Materials and Methods

Site location

The experiment was conducted in 11 year old existing bael plantation at Agronomy Research Farm of Rajiv Gandhi South Campus, Banaras Hindu University, Varanasi during 2017-2018 situated in Vindhyan region (25º 10' latitude, 82º 37' longitude and altitude of 147 m MSL). Vindhyan region comes under agro-climatic zone III A (Semi-arid eastern plain zone). The experimental site characterized by a hot summer, rainfed condition and invariable poor fertility soil. The normal period for the onset of monsoon in this region is the third week of June and it lasts up to end of September or sometimes extends to the first week of October. On an average, 75% of the total annual rainfall is received from June to September. The mean annual rainfall is about 650-800 mm and the mean annual temperature ranges between 15-40^{o}C.

Experiment layout

The treatments (Fig. 1) consists of four direction viz. north-east, north-west, south-west and south-east and three distances viz. 0.5-1.25 m, 1.5-2.25 m and 2.5-3.25 m.The bael variety Narendra bael-5 was planted at 7m × 7 m spacing in 2006. Hybrid variety of sesame crop CO-1 was raised during *kharif* season in association with bael tree at 30 cm x20 cm spacing in split plot design with four replication. The seed was sown manually in the furrow opened by *Kudal* at 30cm × 20 cm spacing. The biometric observations on growth attributes were recorded at 20, 40 and 60 days after sowing and at harvest. For biometric observation all plants were selected in 1 m ×1 m area of each plot and the average data were recorded for yield attributing characters. Yield attributes of crop i.e., number of capsules/plant, capsule length, number of seeds/capsule, grain, straw and biological yield and harvest index were also recorded.

Results and Discussions

Effect of direction on yield attributes

The yield attributing parameters exhibited significant differences under different direction from tree base (Table-1). Performance of crop with respect to yield attributes in different direction was significantly highest in south-west direction whereas north-east direction was recorded lowest yield attributes parameters compared to rest of direction treatments. Amongst four direction treatments, highest number of capsules/plant (8.16), number of

seeds/capsule (63.72) and capsule length (2.41 cm) were recorded under south-west direction. South-west direction reduces the shading effect and provided proper light, which helps to increase crop yield (Jha *et al.*, 2012).The better development of various yield attributes might be due to the better availability of light which enhanced photo-synthesis and metabolic activities thereby increasing the seed yield of sesame crop. Significantly higher seed yield (443.88 kg/ha), stover yield (2291.74 kg/ha), biological yield (2935.20 kg/ha) and harvest index (22.55 %) were recorded in south-west direction from tree base as compared to other directions. This might be due to better performance of yield attributes in south-west direction due to less competition for light between tree and crop, modifying micro-climate in that direction, consequently increased the yield of sesame crop in the system. Highest yield was recorded in south-west direction due to increase light intensity and reduced the shading effect of tree canopy.

Effect of distance on yield attributes

The sesame yield attributes *viz*., number of capsules/plant, number of seeds/capsule and capsule length was significantly affected under different distances from tree base. The significantly highest number of capsules/plant (10.49), number of seeds/capsule (66.31) and capsule length (2.66 cm) were recorded in 2.25-3.25 m of distance from tree base. Increase in distance from tree base had positive effect on yield attributes of intercrop in the agri-horticulture system (Table 2).

Table.1 Effect of direction and distance from Bael tree base on sesame yield attributes

Treatment	No. of plant (m^2)	Capsules/plant (no.)	Seeds/capsule (no.)	Capsule length (cm)
Direction				
North – East	9.8	6.0	60.2	2.0
North – West	10.4	7.9	62.5	2.4
South- West	10.8	8.1	63.7	2.4
South – East	9.8	7.8	61.3	2.1
S.Em.±	0.2	0.2	0.7	0.07
CD at 5%	0.7	0.8	2.4	0.2
Distance				
0.5 – 1.25 m	9.8	4.6	56.9	1.7
1.5 – 2.25 m	10.2	7.1	62.5	2.3
2.5 – 3.25	10.6	10.4	66.3	2.6
S.Em.±	0.2	0.2	0.4	0.0
CD at 5%	0.5	0.6	1.3	0.1
Direction × Distance	NS	NS	NS	NS

Table.2 Effect of direction and distance from bael tree base on the yield of sesame

Treatment	Seed yield (kg/ha)	Stover yield (kg/ha)	Biological yield (kg/ha)
Direction			
North – East	404.5	1884.9	2178.4
North – West	441.5	2253.0	2520.4
South- West	443.8	2291.7	2935.2
South – East	419.0	2099.1	2414.7
S.Em.±	7.4	90.8	69.6
CD at 5%	23.9	290.7	222.9
Distance			
0.5 – 1.25 m	322.4	1732.6	1998.7
1.5 – 2.25 m	467.2	2183.8	259 7.2
2.5 – 3.25 m	492.3	2480.1	2940.6
S.Em.±	4.6	57.8	58.4
CD at 5 %	13.6	168.8	170.5
Direction × Distance	S	NS	S

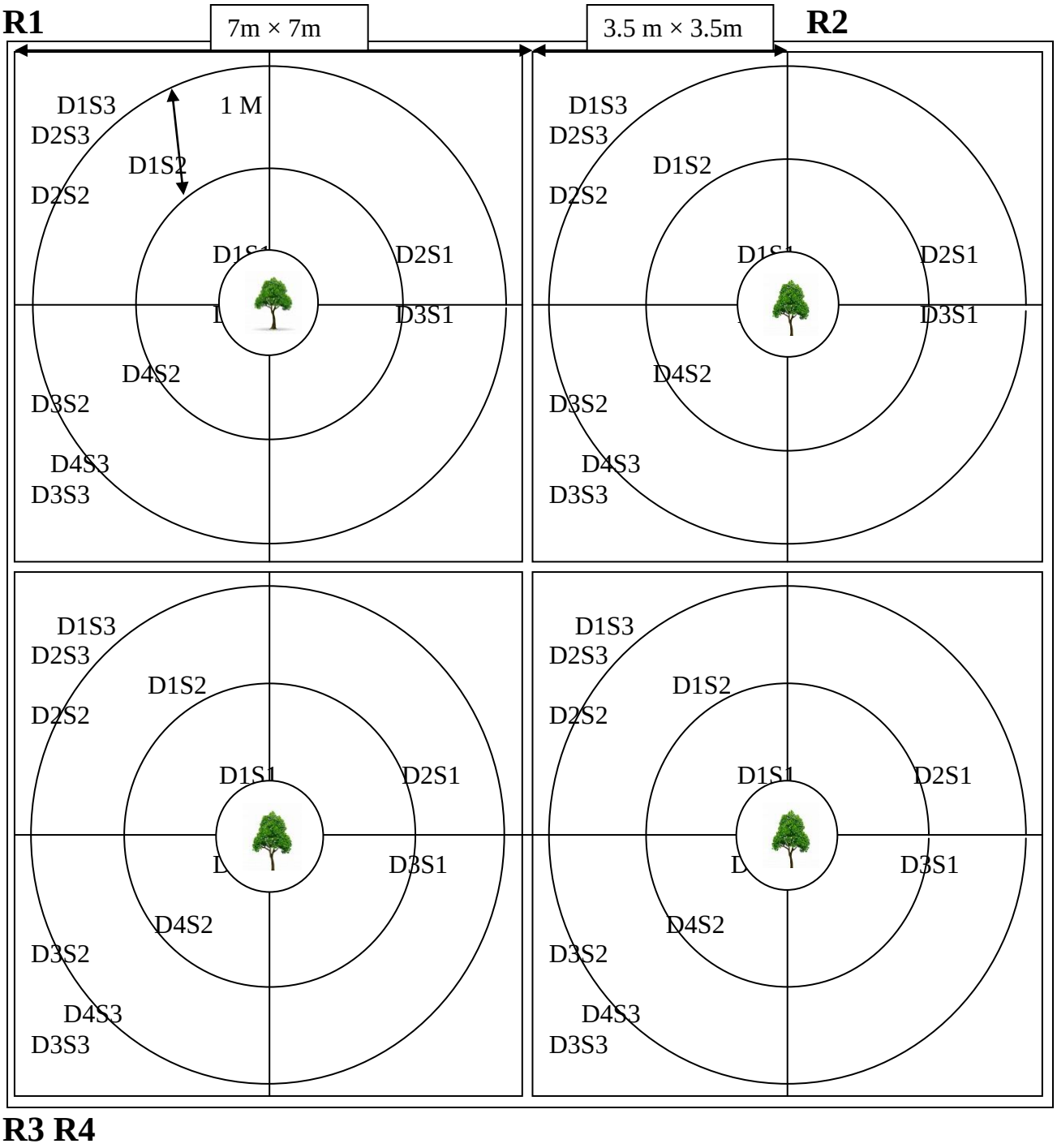
Table.3 Effect of direction and distance from tree base on seed yield (kg/ha) of sesame

Treatment	Distance from tree base (m)		
	0.5-1.25	1.5-2.25	2.5-3.25
Direction from tree base			
North – East	395.0	572.0	651.1
North – West	425.8	674.0	667.6
South- West	426.6	678.0	670.8
South – East	472.3	567.8	636.0
	S.Em.±	**CD at 5%**	
Distance at same direction level	**9.3**	**27.3**	
Direction at same/different distance level	**15.1**	**32.6**	

Table.4 Effect of direction and distance from tree base on biological yield (kg/ha) of sesame

Treatment	Distance from tree base (m)		
	0.5-1.25	1.5-2.25	2.5-3.25
Direction from tree base			
North – East	2154.0	3009.4	3550.1
North – West	2589.8	3706.4	3785.5
South- West	3120.7	4202.3	4417.7
South – East	2795.5	2933.6	3929.7
	S.Em.±	**CD at 5%**	
Distance at same direction level	**116.8**	**341.1**	
Direction at same/different distance level	**167.1**	**356.4**	

Fig.1 Layout of experiment site showing allocated treatments



Reduction in the yield attributes of sesame was attributed to higher above and below ground competition near tree base as compared to away from tree base. Tree created the maximum competition near the tree base (0.5-1.25 m) and reduces the yield of sesame as compared to away from tree base (2.5-3.25 m). Similar results were also

reported by Pandey *et al.*, (2015) and Thakur and Singh (2008). The seed yield (492.30 kg/ha) was recorded maximum in 2.5-3.25 m of distance from tree base. Due to the competitive effect of tree canopy, seed yield was lowest near to the tree base. As the distance increased because of more availability of light, use efficiency of other resources like soil moisture and nutrients might have been increased resulting better performance of crop. yield (2480.12 kg/ha) and biological yield (2940.62 kg/ha) were also revealed significantly maximum in 2.5-3.25 m of distance from tree base. Under tree canopy, PAR (Photo-synthetic Active Radiation) availability varies with the tree species and this affects the under-storey crop growth and productivity (Jha *et al.*, 2012).There is reduction of yield of crop in adjoining tree line was due to effect of shade from the tree and their root competition with crop (Nadagoud, 1990).The tree canopy which restricts sunlight and impart shade also caused poor growth in crop plants (Yadav *et al.*, 2003).

Interaction effects

The interaction between direction and distance from tree base on seed yield also revealed that the maximum seed yield was found in treatment combination of south-west direction and 2.5-3.25 m of distance significantly as compared to other treatment combination (Table 3). The interaction between direction and distance from tree base on biological yield also revealed significantly (Table 4). Biological yield was found significantly maximum in treatment combination south-west direction and 2.5-3.25 m distance as compared to rest of treatment combinations. South-west direction received maximum sunlight and as the distance increased from tree base, it also increased the light intensity and reduced the shading effect of tree canopy thus increase the yield of sesame crop.

From the experimental findings it was concluded that the south-west direction and 2.5 m -3.25 m of distance from tree base performed better for obtaining higher seed yield of sesame under eleven year old Bael based agro-forestry system of Vindhyan region in semi-arid zone of India.

References

Chundawat R.S. (1990). Lynx Survey in Nubra valley, Ladakh. *Wildlife Institute of India Newsletter,* 5(2): 42-44.

Jha S., Sehgal V.K. and subbarao Y.V. (2012). Effect of direction of sowing and crop phenotype on radiation interception, use efficiency, growth and productivity of Mustard (*Brassica juncea*), *Journal of Oilseed Brassica*, 6 (2): 257-264.

Kumar, S., Meena, R.S., Kumar, P., Dadhich, R. and Singh, A. (2013). Effect of different spacing and fertilizer levels on yield parameters of mungbean under guava based agri-horti system. *Journal of Progressive Agriculture*, 4(2): 14-16.

Leakey R.R.B. (1996). Definition of agroforestry revisited. *Agroforestry today*, 8(1), 5-7.

Nadagouda, V.B. (1990). Performance of tree species and their influence on seasonal crops in agro forestry systems under irrigation. Ph. D. thesis, University of Agricultural Sciences, Dharwad, India.

Pandey, C.B., Begum, M. and Saha, D. (2014). Coconut-based home gardens: mechanism of complementarity in sharing of growth resources among homegarder trees in the south Andaman Islands of India. *Tropical Ecology*, 55 (3): 339-348.

Singh G.B. (1987). Agroforestry in Indian sub-continent: Present, past and

future. *Agroforestry a decade of development.* (H.A. Stappler and P.K.R. Nair, eds). ICRAF, Pp:117-138.

Thakur P.S. and Singh S. (2008). Effect of *Morus alba* canopy management on light transmission and performance of *Phaseolus mungo* and *Pisum sativum* under rainfed agroforestry. *Indian Journal of Agroforestry,* 4(1): 25-29

Yadav J.P., Sharma K.K. and Khanna P. (2003). Effect of *Acacia nilotica* on mustard crop. *Agroforestry Systems,* 21(1): 91-98.

Yadav, Kiran (2011). Oilseed scenario in India. Retrieved from http://agropedia.iitk.ac.in