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RESEARCH ARTICLE

VEGETATIVE GROWTH AND YIELD PERFORMANCE OF *CASSIA ANGUSTIFOLIA* VAR. CIM-SONA UNDER SEVEN YEAR OLD *EMBLICA OFFICINALIS* GAERTN. BASED AGROFORESTRY SYSTEM

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ABSTRACT

The present study deals with Vegetative growth and yield performance of *Cassia angustifolia* under seven year old *Emblica officinalis* based Agroforestry system. Vegetative growth of *Cassia angustifolia* was significantly depressed under the canopy of 7 year-old Aonla based Agroforestry system as compared to control (without trees). On an average of two years, plant density, stem girth (cm), plant height (cm), the number of leaves per plant and the number of branches per plant reduced by 42.68%, 35.00%, 31.66%, 31.92% and 52.59%, respectively under tree canopy as compared to control. Specific leaf area (cm^2/g) was increased under the tree canopy while specific leaf weight (g/row in m^2) was decreased considerably under the trees canopy. On an average of two years, seed yield per plant reduced by 75.70%, length of pod per plant by 10.82%, number of seeds per pod by 15.84%, 100-seed weight by 8.91% under tree canopy as compared to control.

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INTRODUCTION

Agroforestry is a collective name for land-use systems and technologies, where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land management unit as agricultural crops and/or animals, either in some form of spatial arrangement or temporal sequence. In Agroforestry systems there are both ecological and economical interactions between the different components (ICRAF, 1993). Agroforestry is a modern tool to develop sustainable land use and to increase food production by growing woody species (trees, shrubs, palms; bamboos, etc.) with agricultural crops and/or animals in some form of spatial arrangement or temporal sequence (Rizvi *et al.,* 1999). Since two or more components co-exist in Agroforestry systems, there must have either positive or negative interactions between or among the components. To optimize the gains of Agroforestry, selection of suitable Agroforestry species is very important and such selection should be based on a number of important characters of Agroforestry species especially tree component such as fast growth rate, thorough passage of sunlight through canopy to the ground, rooting pattern and multipurposeness. In recent years the growing demand for medicinal plants has accelerated due to over exploitation of valuable resources by unscientific and destructive manner without considering sustainability and quality issues. Globally, millions of people dwelling in forests depend on Non Timber Forest Products (NTFPs) for subsistence income and livelihood security (Vedeld *et al.,* 2004). In India, over 50 million people are directly depend on NTFPs and about 500 million are indirectly depend on NTFPs for their sustenance (Tewari, l998). More than 80% of the forests dwellers are depend for their substances on NTFPs for their basic needs which contribute roughly one-third of their incomes (Government of India 2007). In the state of Madhya Pradesh (India) about 40-68% of total rural income comes from the collection and sale of NTFPs (Tewari, 1998) and in Orissa it is l5-30% and there relative contribution is highest amongst the poorest households (Mahapatra and Shackleton, 20ll). The NTFPs play an important role in both the local and national economies (Appasamy, 1998; Shiva and Mathur, 1990; Hegde *et al.,* 1996).

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Interest in traditional systems of medicine and herbal medicines has increased substantially in both developed and developing countries over the past two decades. According to the Secretariat of the Convention on Biological Diversity global sales of herbal products totaled an estimated US $ 60,000 million in the year 2000. As a consequence, the safety and quality of herbal medicines as well as traditional medicine therapies have become increasingly important concerns for health authorities and the public (WHO, 2002).

Thus present study was made to investigation, performance of *Cassia angustifolia* var. CIM sona as inter crop under canopy of seven year old plantation of *Emblica officinalis* Gaertn. were studied for two years.

MATERIALS AND METHODS

Description of Experimental site

The experiment was undertaken in 7 year old *Emblica officinalis* Gaertn. plantation at two separate sites. Trees were planted in July 2001at site-2 at a spacing of 5x5 m. To make six replications, fifty four trees were selected at each site. Thus each replication had 9 trees in 3x3 orientations. The tree growth data were recorded on collar diameter (cd), diameter at breast height (dbh), tree height and crop diameter in each replication at each site at quarterly interval). Phenological observations in trees were taken at an interval of 15 days. At site-1, Tulsi *Ocimum basilicum* var. CIM Saumya and Kalmegh (*Andrographis paniculata*) var.- CIM- Megha it was sown as a understorey crop in all the six replications under 7/- year - old *Emblica officinalis* Gaertn. plantation as well as in adjacent open area (crop without tree as a control plot size of 15x15 m. At site-2 Senna (*Cassia angustifolia*)-var. CIM- Sona and Palmarosa (*Cymbopogon martinii*) var. CIM-. Harsh were sown as a under storey crop in all the six replications under 7 year old *Emblica officinalis* Gaertn. plantation as well as in adjacent open area (crop without tree as a control) in-the- adopting row to row distance 30 cm and plant to plant distance 15 cm. Thus maintain plot size of 15X15 m. Studies on tree-crop interface effects on the under storey crop were executed in Emblica *officinalis* Gaertn. plantations in cropping season for crop growth, yield components and soil moisture, These parameters were recorded at four distances (45, 60, 75, 100 cm for Palmarosa and Senna as well as 30, 45, 60, 75 cm for *Ocimum basilicum* and *Andrographis paniculata*) in west and east direction from centre line of the tree which was in north to south direction in each replication under the tree canopy and in open area (without tree).

Methodology

In this paper data on performance of *Cassia angustifolia* var. CIM sona as inter crop under canopy of seven year old plantation of *Emblica officinalis* Gaertn. are presented. Data on Vegetative Growth and Yield of *Cassia angustifolia* var. CIM sona as inter crop under canopy of seven year old plantation of *Emblica officinalis* Gaertn. were collected by following standard methodology.

RESULTS AND DISCUSSION

In present investigation, performance of *Cassia angustifolia* var. CIM sona as inter crop under canopy of seven year old plantation of *Emblica officinalis* Gaertn. were studied for two years. The crop data on the vegetative growth and yield components are presented in Table 1 to 5.

Tree - Crop interface in seven year old plantation of *Emblica officinalis* Gaertn.

Vegetative Growth

Plant Height (cm)

The effect of tree canopy on the height of *Cassia angustifolia* var. CIM sona has been presented in Table 1. A perusal of data indicated that mean plant height over the years was recorded lowest (39.70 cm) near the tree base and registered an increasing trend with increasing distances from the tree base (Table 1). The plant height was highest in control (71.92 cm) (without tree) as compared to crop under the tree canopy at different distances from tree base on the basis of mean value of both the years of study. In year 2008, lowest height (48.17 cm) was near the tree base **(45 cm)** and there was slight increase in height with increasing distances from tree base under tree canopy and maximum height was in control (85.83 cm). In the year 2009 also lowest plant height was recorded near the tree base (31.22 cm) and registered increasing trend with increasing distances from tree base and highest plant height was in control (58.00 cm). The distances from the tree base significantly affected the plant height. On the basis of mean of two years, the plant height under the tree canopy was 55.20, 67.63, **71.51** and 78.98 % of control at 45 cm, 60 cm, 75 cm and 100 cm distances from tree base, respectively.

Plant Girth (cm)

The effect of tree canopy on girth of *Cassia angustifolia* var. CIM Sona is presented in Table 1. It is seen from table that tree canopy had depressing effect on the plant girth as compared to control (crop without tree).

Details of the treatments and procedures adopted for recording of observations were as follows:

Site-1: 7 year old *Emblica officinalis* Gaertn. plantation with *Cassia angustifolia* and *Ocimum basilicum*		**Site-2: 7 year old Emblica officinalis Gaertn. plantation with *Cymbopogon martini* and *Andrographis paniculata***	
Treatments (Distance from tree base)		**Treatments (Distance from tree base)**	
T1	45cm	T1	30 cm
T2	60cm	T2	45cm
T3	75cm	T3	60cm
T4	100cm	T4	75cm
T5	without trees	T5	without trees
Replication = 6 Design = RBD		Replication = 6 Design = RBD	

Table 1. Tree crop interaction in 7 years old plantation of aonla for plant density, Stem Grith and plant height in Seena (Cassia angustifolia var. CIM sona) as under storey crop during 2008-2009

Distance from tree (cm)	Plant density per meter row				Plant grith (cm)				Plant height (cm)			
	2008	2009	Mean	% of cont.	2008	2009	Mean	% of cont.	2008	2009	Mean	% of cont.
45	14.9	15.16	15.03	47.84	0.19	0.23	0.21	52.50	48.17	31.22	39.70	55.20
60	16.67	18.00	17.34	55.19	0.25	0.29	0.27	67.50	61.93	35.35	48.64	67.63
75	19.50	17.00	18.25	58.08	0.24	0.28	0.26	65.00	63.57	39.28	51.43	71.51
100	19.83	23.00	21.42	68.17	0.27	0.26	0.27	67.50	72.47	41.13	56.80	78.98
Mean	17.73	18.29	18.01	57.32	0.24	0.27	0.26	65.00	61.54	36.75	49.15	68.34
Control (crop without tree)	30.83	32.00	31.42		0.42	0.38	0.40		85.83	58.00	71.92	
SEm±	2.44	3.37			0.024	0.022			3.71	4.62		
CD (5%)	7.16	9.88			0.07	0.064			10.88	13.55		

Table 2. Tree crop interaction in 7 years old plantation of Aonla trees for Number of Leaves, Specific Leaf Area and Specific Leaf Weight of Seena (*Cassia angustifolia* var. CIM Sona) as understorey crop during 2008-2009

Distance from tree (cm)	Number of Leaves per plant				Specific Leaf Area (cm^2)				Specific Leaf Weight (g/cm^2)			
	2008	2009	Mean	% of cont.	2008	2009	Mean	% of cont.	2008	2009	Mean	% of cont.
45	10.67	5.90	8.29	62.57	408.86	520.83	464.85	167.46	.0023	.0019	.0021	55.26
60	12.68	6.20	9.44	71.25	394.85	466.99	430.92	155.24	.0026	.0022	.0024	63.16
75	11.78	6.92	9.35	70.57	415.84	459.35	437.60	157.64	.0025	.0022	.0024	63.16
100	11.70	6.28	8.99	67	386.99	430.28	408.64	147.21	.0027	.0024	.0026	68.42
Mean	11.71	6.33	9.02	85	401.64	469.36	435.50	156.89	.0025	.0022	.0024	63.16
Control (crop without tree)	14.00	12.50	13.25	68.08	303.32	251.85	277.59		.0033	.0042	.0038	
SEm±	NS	0.89			19.64	18.11			NS	NS		
CD (5%)		2.61			57.75	53.11						

Cont. = Control
Ns = Non- significant

Table 3. Tree crop interaction in 7 years old plantation of Aonla trees for Number of Branches, Yeild per plant (g) in Seena (Cassia angustifolia var. CIM sona) as understorey crop during 2008-2009

Distance from tree (cm)	Number of Branches per plant				Yield per plant (g)			
	2008	2009	Mean	% of cont.	2008	2009	Mean	% of cont.
45	2.52	1.76	2.14	39.63	2.18	0.64	1.41	20.64
60	3.19	2.02	2.61	48.33	2.51	0.71	1.61	23.57
75	3.08	2.25	2.67	49.44	2.12	1.04	1.58	23.13
100	3.46	2.20	2.83	52.41	2.50	1.53	2.02	29.58
Mean	3.06	2.06	2.56	47.41	2.33	0.98	1.66	24.30
Control (crop without tree)	5.90	4.89	5.40		9.65	4.00	6.83	
SEm±	0.26	0.20			0.28	0.17		
CD (5%)	0.76	0.59			0.82	0.50		

Table 4. Tree-crop interaction in 7-yar-old plantation of Aonla trees for number of pods, length of pod and number of seeds in Seena (*Cassia angustifolia* var. CIM sona) as under storey crop during 2008-2009

Distance from tree (cm)	Number of pods per plant				Length of pod per plant				Number of seeds per pod			
	2008	2009	Mean	% of cont.	2008	2009	Mean	% of cont.	2008	2009	Mean	% of cont.
45	8.28	3.33	5.81	31.07	3.78	3.41	3.60	86.54	6.20	5.01	5.61	82.26
60	10.65	3.81	7.23	38.66	3.89	3.48	3.69	88.70	6.37	4.88	5.63	82.55
75	9.98	4.08	7.03	37.59	3.93	3.57	3.75	90 14	6.23	5.38	5.81	85.19
100	10.43	4.18	7.31	39.09	4.06	3.54	3.80	91.35	6.33	5.50	5.92	86.80
Mean	9.84	3.85	6.85	36.63	3.92	3.50	3.71	89 18	6.28	5.19	5.74	84.16
Control (crop without tree)	16.60	20.80	18.70		4.30	4.01	4.16		6.83	6.80	6.82	
SEm ±	1.00	1 06			0.09	0.08			0.12	0.28		
CD (5%)	2.99	3 11			0.27	0.22			0.35	0.82		

Table 5. Tree-crop interaction in 7-year-old plantation of Aonla trees for test weight of seed and yield of oil per meter row in Seena (*Cassia angustifolia* var. CIM Sona) as under storey crop during 2008-2009

Distance from tree (cm)	100 - Seed weight (g)				Fruit yield of Aonla (t/ha)			
	2008	2009	Mean	% of Cont.	2008	2009	Mean	% of Cont.
45	3.70	2.76	3.23	89.97	7.56	8.65	8.10	93.64
60	3.71	2.79	3.25	90.53	7.96	8.94	8.45	97.69
75	3.69	2.89	3.29	91.64	7.88	8.78	8.33	96.30
100	3.62	2.94	3.28	91.36	7.89	8.80	8.35	96.53
Mean	3.68	2.85	3.27	91.09	7.82	8.79	8.30	95.95
Control (crop without tree)	4.13	3.05	3.59					
Sole Aonla Crop					8.1	9.2	8.65	
SEm ±	0.08	0.06						
CD (5%)	0.23	0.17						

Cont. = Control

The higher depressing effect was recorded near the tree base and it reduced with increasing distances from tree base. The means of girth over all distances (0.24 and 0.27 cm) were at lower side as compared to control (0.42, 0.38 cm) in year 2008 and 2009, respectively. Distances from tree base significantly affected the plant girth in both the two years of study. On the basis of mean for years, the plant girth was 52.50%, 67.50%, 65.00% and 67.50% of control at 45, 60, 75 and 100 cm distances from tree base, respectively.

Plant Density

The plant density recorded at various distances from tree base under tree canopy and in control (crop without tree) is presented in Table 1. The perusal of data indicated that there was inhibitory effect of tree canopy on plant density as compared to control in both the two years of study. The plant density was recorded lowest at 45 cm and showed increasing trend with increasing distances from tree base. The mean plant densities per meter row under tree canopy for different distances were 17.73 and 18.29 plants which were less than values recorded in control 30.83 and 32.00 in the year 2008 and 2009, respectively. Distance from tree base significantly affected the plant densities. On the basis of mean over years, the plant densities was 47.84, 55.19,58.08 and 68.17 per cent of control at 45 cm, 60 cm, 75 cm and 100 cm distances from tree base, respectively.

Number of Leaves per Plant

Perusal of data on number of leaves per plant has been presented in Table 2. It is seen from table that maximum number of leaves were recorded in control (crop without tree). The number of leaves was reduced under the tree canopy with lowest number of leaves at **45** cm distance from tree base. The mean of all the four distances (11.71 and 6.33) were less than number of leaves recorded in control (14.0 and 12.50 cm) in 2008 and 2009, respectively. Distance from tree base significantly affected the number of leaves per plant in the year 2009 but not in 2008. On the basis of mean over the years, the number of leaves was 62.57, 71.25, 70.57 and 67.85 per cent of control at 45 cm, 60 cm, 75 cm and 100 cm distances from tree base under tree canopy, respectively.

Specific Leaf Area (cm^2/g)

The specific leaf area (SLA) recorded under the tree canopy at different distances from tree base and control (crop without tree) is presented in table 2. The specific leaf area of plant was lowest in control. On the basis of mean value of different distances (401.64, 469.36 cm^2/g) were on higher side as compared to mean value of control area (303.32, 251.85 cm^2/g) for the year of 2008, 2009, respectively. Distances from the tree base significantly affected the specific leaf area of the under storey crop in both the year of study. On the basis of mean over the years, the specific leaf area was 167.46, 155.24, 157.64 and 147.21 per cent of control at 45, 60, 75 and 100 cm distances from tree base.

Specific Leaf Weight (g/row in m^2)

Results on specific leaf weight (SLW) have been shown in Table 2. It is seen from table that specific leaf weight had reverse trend to specific leaf area (SLA). It was higher in control and lower in under storey crop. The mean value of different distances (0.0025, 0.0022 g/cm^2) were on lower side as compared to mean value of control area (0.0033, 0.0042 g/cm^2) for the years of 2008 and 2009, respectively. However, the results were no significant for both the years. On the basis of mean of years, the SLW was 55.26, 63.16, 63.16 and 68.42 per cent of control at different distances 45 cm, 60 cm, 75 cm and 100 cm from tree base, respectively.

Number of Branches per Plant

The effect of tree canopy on number of branches of under storey crop is presented in Table 3. A perusal of data indicated that number of branches per plant was maximum in control and lower in the crop under the tree canopy. The lowest number of branches was recorded at 45 cm distances from tree base and registered an increasing trend with increasing distances from tree base. The mean value of all the 4 distances (3.06 and 2.06) in the years of 2008 and 2009 were lower than the value recorded in control (5.90 and 4.89). The distances from tree base significantly affected the number of branches per plant. On the basis of mean of years, the number of branches was 39.66, 48.33, 49.44 and 52.41 percent of control at 45, 60, 75 and 100 cm distances from tree base, respectively.

Yield Components

Seed Yield per plant

Results pertaining to the effect of tree canopy on the yield of single plant are presented in Table 3. Results indicated that yield of single plant reduced under the tree canopy comparison to control. The mean values of all the 4 distances in the two years (2008, 2009) of study (2.33 and 0.98 gm.) were lower than value recorded in control (9.65 and 4.0 gm). Distances from tree base significantly affected the yield per plant. On the basis of mean over the years, the seed yield per plant was 20.64, 23.57, 23.13 and 29.58 per cent of control at 45 cm, 60 cm, 75 cm, and 100 cm distances from tree base, respectively. It is further seen from table that plant yield decreased under the tree canopy with increasing age of tree and minimum value of seed yield was recorded closer to the tree and it increased with increasing distances from tree base.

Number of Pods per Plant

Table 4 contains result on the effect of tree canopy on number of pods per plant in *Cassia angustifolia* var. CIM sona. Result indicated that distances from tree base significantly affected the number of pods per plant. The maximum number of pods per plant was observed in control. The tree canopy had depressing effect on number of pods per plant in under storey *Cassia angustifolia* var. CIM sona crop. On the basis of mean value over the years, the minimum numbers of pods were recorded near tree base **(45 cm)** and it registered an increasing trend with increasing distances from tree base. It is further seen from table that number of pods under the tree canopy was higher in previous year of the study 2008 (9.84) and decreased in 2009 (3.85). This showed that increasing an age of trees also had inhibitory effect on number of pods per plant. In general, number of pods was 36.63 per cent of control in under storey crop.

Length of Pod (cm)

Results on length of pod per plant are presented in Table 4. Length of pod was found maximum in control while under storey crop had low magnitude of this parameter. The mean value of all the 4 distances (3.92 an 3.50 cm) were less than values recorded in control (4.30 and 4.01 cm) in the year of 2008 and 2009, respectively. The distance from tree base, significantly reduced the length of pod per plant. On the basis of mean of the years, the length of pod per plant was 86.54, 88.70, 90.14 and 91.35 per cent of control at 45, 60, 75 and 100 cm distances from the tree base, respectively. It is further seen from table that increasing age of the trees is also causing depressing effect on length of pod, as length of pod was reduced more in 2009 (3.50 cm) than 2008 (3.92 cm).

Number of Seeds per Pod

Table 4 represented the effect of tree canopy on number of seed per pod. Results indicated that number of seeds per pod was slightly lower under the tree canopy as compared to control. The mean value of all the 4 distances (6.28 and 5.19) were lower than value recorded in the control (6.83 and 6.80) in the year 2008 and 2009, respectively. The mean of the year showed that there was lower number of seeds at closer distances **(45 cm)** from tree base. Distances from tree base effected significantly number of seeds per pod in both the year of study. On the basis of mean over the years, number of seeds was 82.26, 82.55, 85.19 and 86.80 per cent of control at 45, 60, 75 and 100 cm distances from tree base, respectively. Table further revealed with an increasing age of trees, number of seeds per pod decreased, Hence it was higher in 2008 (6.28) and decreased in 2009 (5.19) but was not significant.

Test Weight (g)

Effect of tree canopy on test weight (100-seed) is presented in Table 5. A perusal of data indicated that during the study period, 100- seed weight was lower under tree canopy as compared to control in both the year of study. The distances from the tree base significantly affected the test weight of seed. The mean value over the years showed that test weight of the seed was lower near the tree base at 45 cm distance and increasing slowly with increasing distances from tree base. On the basis of mean over the years, the test weight was 89.97, 90.53, 91.64 and 91.36 per cent of control at 45, 60, 75 and 100 cm distances from tree base, respectively. Table further revealed that test weight was decreasing with the increasing age of trees, as it was 3.68 g in 2008 and 2.85 g in 2009.

Yeild Crop of *Emblica officinalis* Gaertn. with intercropping of *Cassia angustifolia* var. CIM sona

Results showed that the distances from tree base had significant effect on the fruit yield of ***Cassia angustifolia* var. CIM sona** (Table 5). In general, the yield of ***Cassia angustifolia* var. CIM sona** crop was significantly lower near the tree base, but increased progressively with increasing distances from tree base under tree canopy. The fruit yield was higher at 60 cm distance from tree base on the basis of mean value of both the years of study. The rate of increase in fruit yield t/ha away from tree base is visible in Table 5. The increasing age of trees had also depressing effect on fruit yield of under storey crop as it was 7.82 t/ha in 2008 and 8.79 t/ha in 2009. On the basis of mean over the years, the yield per meter row was 93.64, 97.69, 96.30 and 96.53% of control at 45, 60, 75 and 100 cm distances from tree base, respectively.

DISCUSSION

Vegetative growth of *Cassia angustifolia* was significantly depressed under the canopy of 7 year-old Aonla based Agroforestry system as compared to control (without trees). On an average of two years, plant density, stem girth (cm), plant height (cm), the number of leaves per plant and the number of branches per plant reduced by 42.68%, 35.00%, 31.66%, 31.92% and 52.59%, respectively under tree canopy as compared to control. This showed that tree shade has adverse effect on vegetative performance of Senna. Specific leaf area (cm^2/g) was increased under the tree canopy while specific leaf weight (g/row in m^2) was decreased considerably under the trees canopy. Earlier workers found similar type of results in different tree-crop combinations (Canell, 1983; Venkateswarlu and Subramnayam, 1990; Sato and Dalmacio,

1991; Hay *et al*., 1985). On an average of two years, seed yield per plant reduced by 75.70%, length of pod per plant by 10.82%, number of seeds per pod by 15.84%, 100-seed weight by 8.91% under tree canopy as compared to control. The herb age yield of Senna per meter row under the trees canopy was 21.21%, 25.24%, 27.29% and 30.71% of control' at 45cm, 60cm, 75 cm and 100 cm distances from tree base, respectively which showed that the reduction was maximum near the tree base where light intensity was minimum and increased with increasing distances from tree base. The yield reduction in Senna crop under the tree canopy of Aonla might be due to intercepted light by Aonla trees. There was not much difference in soil moisture and nutrients under tree canopy and in control (without trees), thus moisture and nutrient factors not seems to be constraints in production potential of *Cassia*. Studies have been conducted on performance of understory crops in combination with different tree species in India and abroad. In general, crop yield remains same during initial years of tree planting, then after starts decreasing, (Anonymous, 1986 & 2000). Srivastva and Narain (1980) found that serious reduction in crop yield was noticed up to 10 m from the tree base in the case of green gram, up to 5 m in black gram and only 2 m in the case of sorghum. Dhukia *et al*. (1988) observed reduction in yield of gram and wheat in the 3', 4th and 5' year of trees planting. Gulam *et al*. (1990) reported that yield of wheat increased with increasing distances from tree base. Bashir and Amare (1991) observed that declines in grain yield was more severe in the 2 m and 4 m row spacing than in 8 m. Khybri *et al*. (1992) reported that under different tree species the reduction in crop yield was 39% upto 1 m, 33% from 1 - 2 m, 25% from 2 - 3 m and 12% from 3 - 5 m distance from tree base. Ralhan *et al*. (1992) observed that 23.3% reduction in wheat yield under three year poplar planting. Singh and Pathak (1993) observed that crop height of pigeon pea reduced by 24 - 33%, branching by 36 -46%, pod formation by 60% and seed yield by 67% under canopy of Albizia lebbek. Similar results were also reported by other workers (Chauhan *et al*., 1995; Dagar *et al*., 1995; Dhyani *et al*., 1995)

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