

SOME OBSERVATIONS ON THE EFFECT OF FOREST TREE SPECIES ON GROUND VEGETATION AT PABBI FOREST, KHARIAN

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ABSTRACT

Observations on the percent cover and forage production of ground vegetation under four years old plantation showed that *Eucalyptus camaldulensis*, *Acacia nilotica* and *Leucaena leucocephala* have a higher allelopathic effect on the growth of grasses under them as compared to *Zizyphus mauritiana*, *Acacia modesta*, *Dalbergia sissoo* and *Albizzia lebbek*. The cover percent of the vegetation was lowest (8.25%) under *Eucalyptus camaldulensis* and highest under *Zizyphus mauritiana* (83%). The cover percent under *Acacia modesta*, *Dalbergia sissoo*, *Albizzia lebbek*, *Acacia nilotica* and *L. leucocephala* was 64, 60, 53, 29 and 16% respectively. The forage production data also showed the same trend. It was

4675, 4050, 3200, 2450, 1775, 775 and 662 kg per hectare in the plots planted with *Z. mauritiana*, *A. modesta*, *D. sissoo*, *A. lebbek*, *A. nilotica*, *L. leucocephala*, and *E. camaldulensis* respectively.

INTRODUCTION

Pakistan is a wood deficit country with only 4.8% area under forests which is not sufficient to meet the fuelwood and timber demands of the country. Therefore Government of Pakistan is giving priority to increasing the forest area in the country. For this purpose, the government wastelands which are commonly used for grazing, are planted with trees to increase the fuelwood production. Selection of tree species for planting on wastelands is very important so that

fodder production is not adversely affected by planting trees and instead, both wood and fodder production are increased for meeting the needs of local population.

Presently, in addition to indigenous fodder and fuelwood tree species, some exotic fast growing tree species are planted extensively on the wastelands. Among these, *Eucalyptus camaldulensis* has been the most successful introduction in semi-arid areas not only in Pakistan but also in most of the countries of world having hot and dry climate. It is planted on both wastelands and farmlands. Its popularity is mainly due to its fast growth and low water requirement. It can easily be established under rainfed conditions in areas with average precipitation of 400 mm per annum. It is not browsed by cattle and therefore, does not need protection.

A controversy also exists about the introduction of *Eucalyptus* as agroforestry tree. Some authors are of the view that it is the best tree for the semi-arid area while other, are of the view that because of its allelopathic effect on agriculture and forage crops its planting on agriculture field should be avoided. It also enhances aridity. Of course all tree species do compete with the crops and ground vegetation for moisture, light, and nutrients and therefore, reduce crop yield to a variable extent particularly under their canopy. Some trees are known to increase crop yield under them in arid and semi-arid areas such as *Prosopis cineraria* and *Acacia albida*. On the other hand, many tree species have been reported to have allelopathic effect on the crops and grasses and *Eucalyptus* species is one of them.

A number of studies have been conducted to determine the allelopathic effect of *Eucalyptus* on crops and ground vegetation in the Indo-Pakistan subcontinent. Khattak *et al* (1980) found that yield of wheat was more under *Dalbergia*

sissoo than under *Eucalyptus citriodora*, *Populus deltoides* and *Bombax ceiba*. Similar effect of *E. tereticornis* on *Sorghum vulgare* var. Dale and *Sorghum vulgare* var. Wing, *Phaseolus mungo*, *Brassica chinensis*, *B. campestris*, *Sisymbrium irior*, *Nigella sativa*, *Raphanus sativa* and *Setaria italica* was observed by Ahmad *et al* (1982). A reduction of 21 and 18% in germination of sorghum and cowpea respectively was reported with the treatment of their seed with leaf extract of *Eucalyptus tereticornis* (Rao and Reddy, 1984). Similarly, Suresh and Rai (1987) also reported allelopathic effect of *E. tereticornis*, *Casuarina equisetifolia* and *Leucaena leucocephala* on germination, root and shoot growth of some agriculture crops. In an another study, Sharma, *et al* (1987) reported that *Morus alba* was more toxic than *D. sissoo*, *E. tereticornis* and *A. nilotica* to four crops. The most sensitive crop was Raya followed by lentils, field peas and wheat. In an another study an insignificant effect of *E. camaldulensis* on germination and growth of wheat was observed (Malik, 1991).

Though different tree species are planted extensively in the scrub zone under different development projects, still, no study has been conducted so far to find the effect of these tree species on ground vegetation. Therefore a study was conducted to find the effect of commonly planted tree species on the ground vegetation in the scrub zone. The results of this study are reported in this paper.

MATERIAL AND METHOD

Observations were made in October 1992 on cover percent and forage production of ground vegetation under different tree species in an experimental plot in Pabbi forest, Kharian. Planting was done in plots at 2x1 m spacing in 4 lines for each species during spring 1989. At the time of observations the plantation was fully

established with full canopy closure except in *Acacia modesta* plots. The other tree species in the study were *E. camaldulensis*, *Dalbergia sissoo*, *Acacia nilotica*, *Albizia lebbek*, *Zizyphus mauritiana* and *Leucaena leucocephala*.

Line transects were drawn in the centre of middle two tree lines and cover percent was determined according to standard method of range analysis. For forage production one square meter quadrates were laid out along the transect lines and grasses were cut and weighed and then air dried and dry weight was determined. The data were also analysed statistically on personal computer by using SPSS programme.

RESULTS AND DISCUSSION

The data in the Table 1 show that minimum cover percent of ground vegetation was 8% under *E. camaldulensis* plantation while maximum was 83% under *Z. mauritiana*. The cover percent recorded under other tree species was 16%, 29%, 52%, 60% and 64% under *L. leucocephala*, *A. nilotica*, *A. lebbek*, *D. sissoo* and *A. modesta* respectively.

Table 1. Average effect of different forest tree species on cover percent of ground vegetation in scrub zone (4 replications)

Species	<i>D.sissoo</i>	<i>A.nilotica</i>	<i>A.modesta</i>	<i>E.camaldulensi</i> <i>s</i>	<i>Z.mauritiana</i>	<i>L.leucocephala</i>	<i>A.lebbek</i>
<i>Cenchrus</i> sp	46.2	5.5	52.5	0.7	77.5	7.5	34.5
<i>Cynodon</i> sp	12.0	17.5	0.7	1.5	1.2	2.0	11.5
<i>L.leucocephala</i>	1.0	0.2	0.2	0.5	1.2	6.5	0.5
<i>Heteropogon</i> sp	-	5.00	10.7	4.2	1.2	-	5.5
<i>Cymbopogon</i> sp	-	-	-	1.00	-	0.2	0.7
<i>Artimisia</i>	0.5	1.0	0.2	0.2	-	-	-
<i>Chrysopogon</i> sp	-	-	-	-	1.2	-	-
Total	59.7	29.2	64.2	8.2	82.7	16.2	52.5
	60.0	29.0	64.0	8.0	83.0	16.0	82.0

Table 2. Average forage production of the ground vegetation under different tree species (kg/ha dry weight)

	<i>D.sissoo</i>	<i>A.nilotica</i>	<i>A.modesta</i>	<i>E.camaldulensis</i>	<i>Z.mauritiana</i>	<i>L.leucocephala</i>	<i>A.lebbek</i>
R-I	2800	400	3300	600	5700	1200	3100
R-II	3000	1800	2400	150	1900	1100	1900
R-III	6800	2100	6000	1700	5300	300	2400
R-IV	3000	2800	4500	200	5800	1300	2400
Total	12800	7100	16200	2650	18700	3900	9800
Average	3200	1775	4050	662	4675	975	2450

The same trend was observed in forage production under different tree species. From the Table 2 it can be seen that lowest forage production was 662 kg/ha under *E. camaldulensis* and maximum was 4675 kg/ha under *Z. mauritiana*. The forage production under *L. leucocephala*, *A. nilotica*, *A. lebbek*, *D. sissoo* and *A. modesta* was 975, 1775, 2450, 3200 and 4050 kg/ha respectively.

The statistical analysis of cover percent and forage production data showed that the ground vegetation under different tree species were highly significantly different from each other. However, there was no significant differences within the replications. The LSD test showed that ground vegetation under *E. camaldulensis* *L. leucocephala* and *A. nilotica* had no significant differences but its values were significantly different from that under *D. sissoo*, *A. modesta* and *Z. mauritiana*. The LSD test also indicated that there was no significant difference in ground vegetation under *A. nilotica* and *A. lebbek*.

The data showed that after four years of planting at a spacing of 1x2 m, *E. camaldulensis*, *L. leucocephala*, and *A. nilotica* had suppressed ground vegetation to a considerable extent. *Albizia lebbek* also suppressed the ground vegetation

significantly. On the other hand, *Z. mauritiana*, *A. modesta* and *D. sissoo* showed little effect on the ground vegetation although the canopy cover of *Z. mauritiana* and *D. sissoo* was almost the same as that of *A. nilotica*, *L. leucocephala* and *A. camaldulensis*. It may be mentioned here that ground vegetation under tree plantations is always suppressed due to competition for moisture, light and nutrients with trees but in this study the ground vegetation showed different interaction in association with different tree species. This indicates that suppression of ground vegetation under three tree species is not only due to competition for light, moisture and nutrients but it may also be due to their allelopathic effect.

In this study in addition to *E. camaldulensis*, negative effect has also been observed in *L. leucocephala* and *A. nilotica*, although both these species are leguminous. *Z. mauritiana*, *A. modesta* and *D. sissoo* did not show injurious effect on the ground vegetation after four years of their planting.

The results indicate that care should be taken in selecting the tree species for agroforestry and silvopastoral systems. The study confirms the results of earlier studies about the allelopathic effect of *E. camaldulensis*. Though *E.*

camaldulensis has fast growth, small crown and grows without irrigation water in scrub zone still, it should not be planted in monoculture in the rangelands. It should always be planted in mixture with other tree species which have low allelopathic effect as compared to *E.camaldulensis*.

CONCLUSIONS

This study has shown that *E. camaldulensis*, *L. leucocephala* and *A. nilotica* should be planted in combination with other tree species in the rangelands of scrub zone, if forage production is the main objective of management. The best combination will be *E. camaldulensis* and *A. modesta*, *Eucalyptus camaldulensis* and *Z. mauritiana* or *A. nilotica* and *A. modesta* or *L. leucocephala* and *A. modesta*. Mix planting will be useful in maintaining the forage production potential of the pastures as well as in enhancing the fuelwood and fodder production. It will also be beneficial to combine the fast growing tree species with *A. modesta* and *Zizyphus mauritiana* to conserve the ground vegetation which plays an important role in erosion control in this tract.

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REFERENCES

- Ahmed, N., F. Hussain and M. Akram. 1982. The allelopathic potential of *Eucalyptus tereticornis* sm. Pak. J. Bot. 14(Abs.): 15-16; Abs. No.034, Abs in First All Pak. Conf. Plant Scientists. Deptt. Bot. Univ. Karachi, 23-26 Feb. 1982.
- Khattak, G.M., Sheikh, M.I. and Khaliq, A. 1980. Growing trees with agricultural crops. Pak. Journal of Forestry 31: 95-97.
- Malik, F.B. 1991. Allelopathic effect of *Eucalyptus camaldulensis* on wheat crop, (*Triticum aestivum*). M.Sc. Thesis Department of Botany, University of Agriculture, Faisalabad.
- Rao, N.S., Reddy, P.C. 1984. Studies on the inhibitory effects of *Eucalyptus hybrid* leaf extracts on the germination of certain food crops. Indian Forester (1984) 110(2): 218-222.
- Sharma, K., Dhillon, M.S., Dhingra, K.K. 1987. Presence of germination inhibitors in the leaf leachates of some farm grown trees. Ind. For. (1987) 113(12): 816-820.
- Suresh, K.K. and Rai, R.S.V., 1987. Studies on allelopathic effect of some agroforestry tree crops. The international tree crop journal, 4(1987):109-115.