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RESEARCH ARTICLE

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Evaluation of soil and foliar application effects of nitrogen on yield attributes of lentil (*Lens culinaris* M.) under teak based agri-silviculture system

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ABSTRACT : In order to study the effects of soil and foliar application of nitrogen on yield attributes of Lentil (*Lens culinaris*, M.) under Teak based, an experiment was carried out at SHIATS, Allahabad, U.P., India during 2015- 2016 growth season. An experiment based on a Randomized Block Design with three replications was used. Nitrogen treatments included eight levels with Control, traits including plant height, number of pods/ plant, number of seeds/ pod, 1000 seed weight, seed yield and stover yield were measured. Analysis of variance showed that they were statistically significant. Basal application of N (98.5%) + foliar spray 1.5 % N significantly increases the yield parameters.

KEY WORDS : Lentil, Basal application, Foliar application, Nitrogen, Urea

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INTRODUCTION

Agroforestry is the combination of agriculture and silviculture in one system where the species changes between perennials, annuals and utilization of, for example green manure, coppicing, diverging crop rotation, mulching, contour hedgerows or alley cropping (Mercer, 2004). In agroforestry systems complementarily between the components is crucial to its success, and avoiding competition between different crops and trees are therefore one of the important factors to take into account when choosing species. This means that every agroforestry system must be adapted to the specific environment and socio-economic context (Nair, 1993).

Teak is a very valuable timber species of Central India. Due to its high demand in world trade and unsustainable supply from forests large scale teak plantations have been taken up outside forests. To encourage plantations and their scientific management unique schemes of *Lok Vaniki* was adopted in Madhya Pradesh to encourage farmers and owners of trees for

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Table A : Soil characteristics of the site

Sand (%)	Silt (%)	Clay (%)	Textural class	Organic carbon (%)	Nitrogen (N) kg ha^{-1}	Phosphorus (P) kg ha^{-1}	Potassium (K) kg ha^{-1}	Soil pH	EC (dSm^{-1})
70.4	12.0	17.6	Sandy loam	17	43	14.6	245	7.6	0.17

efficient management and marketing. Teak has so far been the monopoly of large landholders. Its potential for small landholders as a tree based livelihood option for the poor has recieved less attention. It can also contribute to poverty reduction and enhance livelihood in rural areas, some models of Teak plantation in the State were analysed. Some discusses the issues relating to adoption of Teak under agroforestry by different landholders, technology packages suitable for small farmers, market access, information and viability. The current policies, legal and regulatory framework, innovations and suitable technology are outlined (Pramod, 2014).

Lentil is a valuable protein-rich food (Bagheri *et al*., 1997). As one of the oldest human food resources, it is a very important crop among legumes because of its digestibility, good food value and high protein content (Asgarian, 1990). Average seed yield of lentil is very low in dry land areas. One reason of low productivity could be related to poor application of fertilizers, particularly nitrogen which does not meet the requirements of crop. Lentil by producing almost 25 per cent protein in a grain yield of 750 kg ha^{-1} absorbs almost 37.5 kg net N, 10.5 kg net phosphor and 28.2 kg potassium per hectare (Azad and Gill, 1989). Nitrogen is actually the most important element in crop production. Nitrogen deficit occurs almost everywhere except when the fertilizer is added. Nitrogen plays an important role in cereal tillering. It increases grain number, seed weight, grain number per pod, seed weight and pod number in legumes (Hashemi Dezfuli *et al*., 1999). In this study, highest yield in lentil was obtained when basal application of N (98.5%) + foliar spray 1.5 % N was applied.

Foliar application of nutrients is highly beneficial, as crop benefits are achieved when the roots are unable to meet the nutrient requirement of the crop at a critical stage (Brar and Brar, 2004). Foliar application of deficient nutrients may be considered as an immediate solution to nutritional problems of plants when the nutrients are not available for root uptake (Randall *et al*., 1985). The timing of foliar spray, especially during the vegetative growth stages, is critical for the optimum efficiency of the foliar treatment. In this study Lentil was chosen to study about the effect of different pattern of nitrogen application on its performance under Agrisilviculture System to find out on its yield attributes.

EXPERIMENTAL METHODS

The experiment was carried out in the School of Forestry and Environment, Department of Agroforestry, SHIATS, Allahabad-211007, India during the growing season of 2015- 2016. The soil characteristics of the experiment is shown in Table A. An experiment based on Randomized Block Design with three replications was

Table 1 : Effect of nitrogen on the growth and yield components of lentil (*Lens culinaris* M.) during the cropping year (2015-2016)

Treatments	Plant height			Number of pods per plant	Number of seeds per pod	1000 seed weight (g)	Seed yield(q/ha)	Stover yield(q/ha)
	30 DAS	60 DAS	90 DAS					
T_0	12.95	16.81	25.47	32.933	1.007	42.00	8.720	15.910
T_1	15.45	21.89	28.40	37.600	1.013	44.50	11.480	21.430
T_2	15.01	21.31	28.28	37.200	1.013	43.2	11.430	21.330
T_3	15.59	22.09	28.53	37.730	1.020	44.60	11.910	22.290
T_4	16.25	22.29	28.78	40.400	1.023	45.20	12.710	23.890
T_5	16.21	22.19	28.64	39.670	1.020	44.70	12.620	23.710
T_6	14.53	20.90	28.10	37.070	1.013	42.7	11.083	20.636
T_7	14.33	20.87	27.52	35.800	1.013	43.6	10.290	19.050
T_8	14.29	17.47	27.20	33.800	1.010	42.5	9.520	17.510
F- test	NS	S	S	S	NS	S	S	S
S.E. (±)	2.036	0.444	0.174	1.457	0.007	0.429	0.376	0.450
C.D. (P = 0.05)	4.202	0.916	0.359	3.007	0.014	0.885	0.776	0.929

NS=Non-significant S=Significant

used. Treatments included eight levels of Nitrogen (basal + foliar) with Control. Each replications consisted of 9 plots. When the field was prepared, lentil seeds were sown on October 16 and foliar spray of urea was given at 20, 40 and 60 DAS. Data were recorded for plant height, number of pods/ plant, number of seeds/ pod, 1000 seed weight, seed yield and stover yield. Data collected were analysed statistically using ANOVA table. The means differences among the treatments were compared by least significant difference test (LSD) at 0.05 levels.

EXPERIMENTAL RESULTS AND ANALYSIS

The analysis of variance showed that Nitrogen levels significantly affect yield components *i.e.*, plant height, number of pods/ plant, number of seeds/ pod, 1000 seed weight, seed yield and stover yield (Table 1). All the yield parameters were recorded to be maximum through basal application of N (98.5%) + foliar spray 1.5 % N and minimum was recorded in Control. From these findings it indicates clearly that maximum number of pods/ plant and number of seeds/ pod increased with the application of the above mentioned concentration of fertilizers. Kumar *et al.* (2012) and Sharar *et al.* (2003) found similar findings. Sadeghi and Noorhosseini (2014) and Muhammad Kakar *et al.* (2014) also reported similar findings.

Conclusion :

Soil application of fertilizers combined with foliar application, marginally improved yield in lentil and the study shows that significantly highest seed yield was released with the basal application of N (98.5%) + foliar spray 1.5 % N. The said treatment, from the economic point of view also released highest benefit cost ratio. To arrive at final conclusion the investigation need to be conducted at multinational sites of the valley for sustaining productivity.

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