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RESPONSE OF FERTILIZER APPLICATION (N, P & N+P) ON SEEDLING GROWTH OF TEAK (*Tectona grandis LINN.F.*)

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ABSTRACT

Performance of seedlings of *Tectona grandis* were examined for six months under three different doses of N and P (50,100, 150 and 25, 50 , 75 mg respectively) and their combinations for six months under sodic soil condition. Teak seedlings when treated with different doses of N, P, K and their combination exhibited maximum growth at maximum dose of N (150 mg) among individual fertilizer and overall maximum growth for N+P (100 + 75 mg) among combination of fertilizer.

KEY WORDS: Teak, Seedlings, Fertilizer, Growth, Biomass

INTRODUCTION

High quality tree seedlings are a pre-requisite to the successful establishment of hardwood plantations particularly on substandard soils (Pankaj et al., 1998). Judicious use of fertilizers is virtually important for healthy juvenile plants under nursery condition. However, their optimal requirement for the different fertilizers varies, depending on the nature of species and prevailed status of soil fertility. Rapid early growth of seedlings under nursery condition enables them for early field establishment. Improved mineral nutrition during establishment of seedlings may increase their growth rate (Ruaysoongnern *et al.*, 1984). Further, an important factor in evaluating the benefits of nursery fertilization is its effect on the survival of seedlings in the field plantations. As a general rule, fertilized seedlings are larger and sturdier indicating better survival than unfertilized ones. Proper use of fertilizer has in some instances reduced one year than the actual length of time required for trees to attain plantable size in Ponderosa pine, Red pine, white pine and certain junipers (Stockeler,1960)

MATERIAL & METHODS

In order to see the effect of different levels of fertilizers, on nursery raised teak seedlings, the present study was laid out in randomized block design at Agro-forestry field station at Kumargunj, Faizabad (26^0 47' N lat. and 82^0 12' E long.). In all there were 5 replication (each replication was a unit of 5 seedlings) of 16 treatments (three each of N and P and nine for N+P combinations including a control). The treatments were: three levels of nitrogen viz., 50, 100 and 150 mg plant^{-1}; 3 levels of phosphorus viz., 25, 50 and 75 mg plant^{-1} (elemental dose of fertilizer) and their combinations. Basal dose of urea and single super phosphate plant^{-1} was given to similar sized well-established one-month-old seedlings in first week of April, 1999. The quantity of fertilizer was weighed in electric balance. Urea was given in two splits i.e., first in the beginning and second after one month. The bags containing seedlings were weeded and irrigated as and when required. Observations on growth shoot height and collar diameter were recorded at monthly interval, whereas seedling dry weight (leaf, stem and root) was taken at 3 months interval. Leaf weight ratios (LWR), relative growth rate (PGR) and net assimilatory rate (NAR) were determined following Evans (1972). Sturdiness Quotient (S.Q.) (Thomson, 1985) and Quality Index (Q.I.) (Dickson *et al.*,1960) were also determined under present investigation

RESULT & DISCUSSION

On application of varied levels of nitrogen viz., 50, 100 and 150 mg seedling^{-1}, in growth media, it was observed that seedling growth increased along treatments. Seedling height ranged from 18.2 to 23.4 cm seedling^{-1}. Leaf dry weight and seedling dry weight also followed similar growth pattern i.e., ranging from 8.19 to 12.46 g seedling^{-1} and 22.49 to 31.96 g seedling^{-1}, respectively. Increase in seedling height and collar diameter in response to N is understandable as nitrogen is an important constituent of protoplasm, enzymes, nucleoproteins and amino acids. Similar growth response for other plant species have also been reported by Malik (1987) for *Eucalyptus tereticornis*, Reinsvold and Pope, 1987 for *Robinia pseudoacacia*, Hussain et al., 1980 for *Acacia mearnsii* and Bhardwaj et al., 1986 for *Bahunia variegata.* In case of individual P application also, growth increased along treatments and maximum growth was recorded for maximum application of P (75 mg seedling^{-1}) *Table 1a*. On comparison of individual effect of N and P application, seedling height, collar diameter and dry weight in case of N seemed to be superior to P application. Increased growth in seedling (height, collar diameter and dry weight) in response to nitrogen and phosphorus application has been observed by many workers in species other than teak (Brar and Katoch, 1980; Dutt and Pathania, 1984; Moloney et al., 1986; Reinsvold and Pope, 1987; and Koul et al., 1995; Raina et al. 1990 and Singh et al., 1989).

For N+P trial, when minimum (50 mg) and intermediate (100 mg) level of nitrogen were combined with different phosphorus levels (25,50 and 75 mg P seedling^{-1}), growth assumed a straightforward increase along the treatments and the maximum growth and biomass was recorded (34.6 cm height, 11.48 mm collar diameter and 65.62 g seedling^{-1}) at 100:75 N:P Table 1.

Whereas in case of the combinations of maximum N level (150 mg N seedling^{-1}) with different phosphorus doses, growth however showed a quite reverse trend in

Table - 1a. Effect of chemical nutrient (fertilizers) application on seedling growth of teak.

Treatment	Elemental proportion of fertilizer (mg plant-1)	Seedling growth after 6 months		Dry weight/seedling (g) after 6 months			
		Height (cm)	Collar diameter (mm)	Leaf weight	Stem weight	Root weight	Total weight
Control	**0.00**	15.48	6.61	4.80	2.07	6.74	13.61
N1	**50**	18.20	6.98	8.19	5.30	9.00	22.49
N2	**100**	21.40	7.56	11.05	6.70	11.22	29.47
N3	**150**	23.40	8.21	12.46	8.34	11.16	31.96
P1	**25**	16.70	7.63	5.57	3.26	6.45	15.28
P2	**50**	17.40	7.95	8.10	5.02	8.90	22.02
P3	**75**	19.20	8.01	10.07	6.89	9.62	26.58
N1P1	**50:25**	23.10	8.95	10.63	7.95	14.08	32.66
N1P2	**50:50**	25.90	9.95	13.01	9.67	15.39	38.07
N1P3	**50:75**	27.50	10.25	20.14	13.18	22.04	55.36
N2P1	**100:25**	24.60	9.50	21.10	12.02	21.08	54.20
N2P2	**100:50**	28.80	11.03	23.85	11.41	21.44	58.70
N2P3	**100:75**	34.60	11.48	27.05	13.95	23.62	65.62
N3P1	**150:25**	23.20	8.98	12.30	6.99	14.94	34.23
N3P2	**150:50**	21.80	8.92	7.50	4.61	9.87	21.98
N3P3	**150:75**	18.60	7.89	5.66	5.55	9.50	20.71
		**	**	**	**	**	**
	Sem	**1.42**	**0.64**	**0.37**	**0.13**	**0.18**	**0.45**
	CD 1%	**5.35**	**2.46**	**1.40**	**0.47**	**0.68**	**1.70**
	CD 5%	**4.02**	**1.85**	**1.05**	**0.36**	**0.51**	**1.27**

Table - 1b. Effect of chemical nutrient (fertilizer) application on growth indices of teak seedlings.

Treatment	Elemental proportion of fertilizer (mg plant^{-1})	Root : shoot ratio	RGR	LWR	NAR	RWR	SQ	QI
Control	**0.00**	0.98	0.004	0.35	0.011	0.49	2.34	4.05
N1	**50**	0.67	0.005	0.36	0.015	0.40	2.61	5.47
N2	**100**	0.63	0.005	0.37	0.016	0.38	2.83	6.68
N3	**150**	0.53	0.006	0.39	0.019	0.35	2.85	6.78
P1	**25**	0.73	0.004	0.36	0.013	0.42	2.19	4.29
P2	**50**	0.68	0.005	0.37	0.014	0.40	2.19	6.01
P3	**75**	0.57	0.005	0.38	0.015	0.36	2.40	6.38
N1P1	**50:25**	0.76	0.005	0.32	0.018	0.43	2.58	8.37
N1P2	**50:50**	0.68	0.005	0.34	0.019	0.40	2.60	9.34
N1P3	**50:75**	0.66	0.005	0.36	0.019	0.40	2.68	13.21
N2P1	**100:25**	0.64	0.006	0.39	0.018	0.39	2.59	13.02
N2P2	**100:50**	0.61	0.006	0.41	0.019	0.36	2.61	13.80
N2P3	**100:75**	0.58	0.006	0.41	0.020	0.36	3.01	13.83
N3P1	**150:25**	0.77	0.006	0.36	0.019	0.44	2.58	8.84
N3P2	**150:50**	0.81	0.005	0.34	0.019	0.45	2.44	5.99
N3P3	**150:75**	0.85	0.005	0.27	0.018	0.46	2.36	5.85

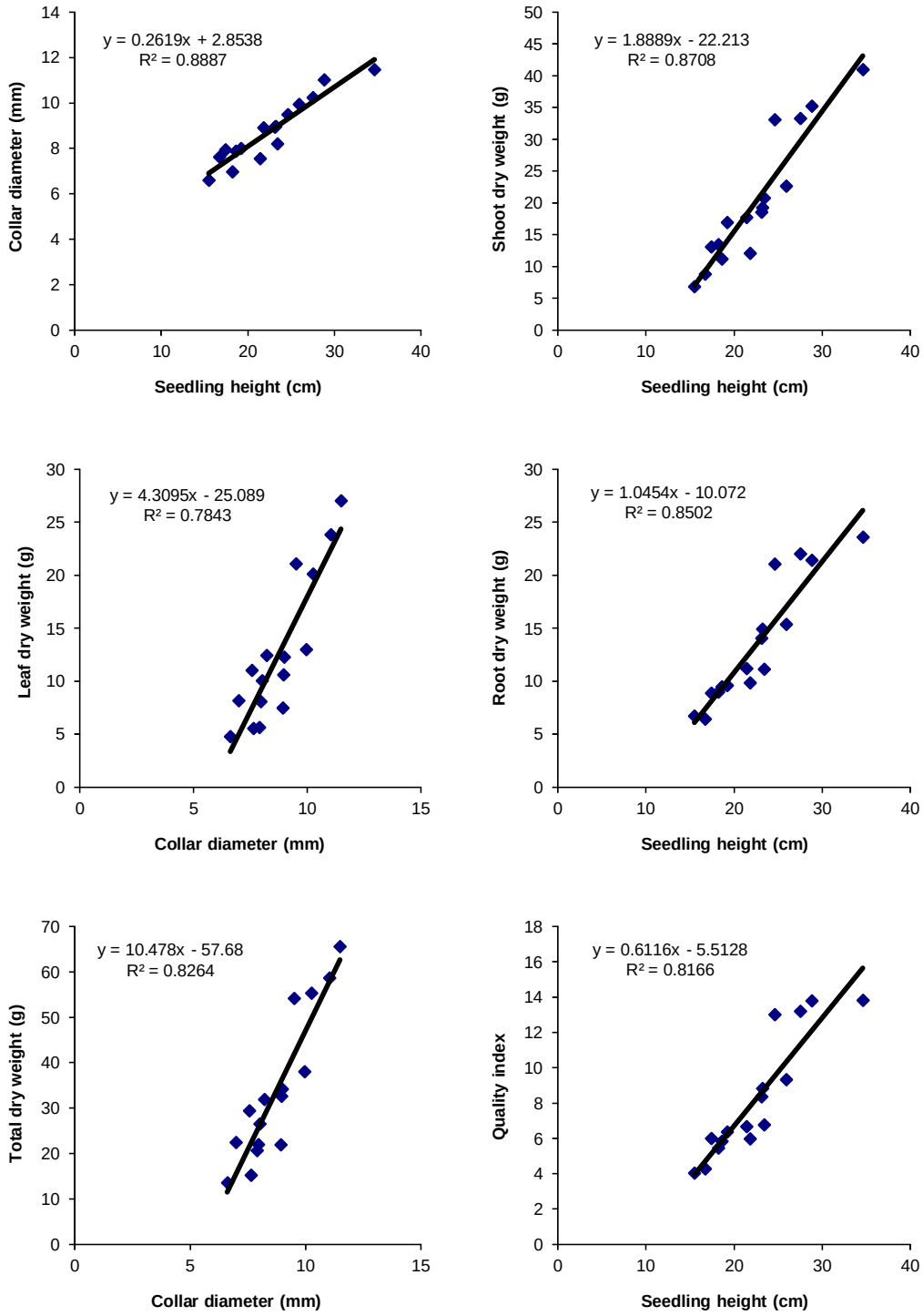

Fig.1: Correlations and regression analyses for certain seedling parameters under conditions of varied combinations of chemical fertilizer levels in the nursery.

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this study. Higher seedling height (23.20 cm seedling^{-1}); collar diameter (8.96 mm seedling^{-1}) and dry weight (34.23 g seedling^{-1}) were recorded for 150:25 mg N:P seedling level, while lower seedling height (18.60 cm seedling^{-1}), collar diameter (7.89 mm seedling^{-1}) and dry weight (20.70 g seedling^{-1}) were recorded for higher combination (150:75 mg N:Pseedling^{-1}). The values RGR, LWR, NAR, SQ and QI exhibited almost similar pattern as in case of seedling growth (*Table 1b*), while root shoot ratio and RWR exhibited reverse trend. Highly significant linear relationship (r^2 = 7.8 to 8.8; $p<0.01$) was evident for different parameters under study (Fig1).

Better seedling growth in case of N+P in the present investigation is in conformity with several other workers. Singh et al,1990 reported that *P. juliflora* performed better due to N with P application. Increased growth due to N with P application on *E. terreticornis* (Mohan et al., 1990; Prasad et al., 1984, 1990) and *E. grandis*

(Prasad et al., 1985) has been reported. Our results are in conformity with the findings of Ahlawat and Dagar, 1980, that generally nitrogen and to some extent phosphorus bring abut pronounced influence on meristematic activity, by the way of protein synthesis. Lack of positive response to higher dose of nitrogen in combination with different phosphorus dose, may be due to insufficient quantities of available potash and phosphorus in the growth medium as they are necessary to ensure proper development of the root system that can subsequently absorb nitrogen and moisture for successful plant growth (Qureshi and Yadav, 1967).

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