

EFFECT OF FERTILIZER LEVELS ON PLANT GROWTH AND BIOMASS PRODUCTION IN *ACACIA AURICULAEFORMIS*

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Abstract

A field experiment was conducted in the year 1995 to study the effect of varying levels of fertilisers on plant growth and dry matter accumulation in akashmani (*Acacia auriculaeformis*) at the Research Farm of Indian Lac Research Institute, Namkum, Ranchi. Fertility levels significantly increased all the growth attributes during all the periods under study. The magnitude of response to successive levels of fertiliser increased with increasing levels. The contribution of the above ground dry biomass was 80.0% and 83.0% in one and two years old plant respectively to the total biomass. RGR increased by 33.9% due to 120gN+160gP₂O₅+80gK₂O/plant over their zero level.

Introduction

Acacia auriculaeformis A. Cunn. (Leguminaceae) a fast growing, straight, medium sized tree, height up to 16 m, with slightly angular branches, native to Australia and introduced into semiarid regions of Bihar, West Bengal and Orissa and is also raised in the several parts of the country. It may thrive well on poor soil (Guha and Pant, 1966 and Anon., 1985). A good lac encrustation and survival of both strains of lac insects till maturity have been reported on the host (Kapur, 1954; Kumar and Srivastava, 1990). It can survive well on highly eroded, dry and rocky slopes, and gaining more and more importance by local people and industrialists for fuel, furniture making, paper pulp and oil, besides, its role in soil conservation. Despite diversified use, the host has immense potential to carry lac insect till maturity, has not been exploited so far in proper perspective to raise its plantation for systematic lac cultivation. It is, therefore, imperative to carry out a systematic trial for rapid raising of akashmani plantation in shortest possible time.

Materials and Methods

The experiment was carried out at the research farm of the Indian Lac Research Institute, Namkum, Ranchi (23°23' N, 85° 23' E and 650 m altitude) under

rain fed condition on well drained sandy loam soil with 0.57% organic matter, 294.78 kg/ha N, 24.15 kg/ha P and 157.3 kg/ha K and had a pH 5.4. The treatments consisted four fertiliser levels (0+0+0, 30+40+20, 60+80+40 and 120+160+80 g/plant of N+P₂O₅+K₂O), replicated four times and subjected to analysis of variances in RBD. The net plot size was 9.0 x 8.1 m for each treatment. N as urea, P₂O₅ as single super phosphate and K₂O as muriate of potash was applied one week before planting. The nursery raised seedlings were transplanted in pits (45 x 45 x 45 cm) during the monsoon season of 1995. The growth attributes recorded first after 8 months of planting and subsequent prior to destructive sampling at end of 1st and 2nd year. After destructive sampling, plants were thoroughly washed to remove the soil from root zone, thereafter, plant components were separated into roots, main stem, branches including twigs and leaves. All components were dried till the constant weights were obtained and then the dry weight of individual plant parts were recorded. Relative growth rate (R.G.R) was determined according to the standard procedure (Watson, 1952; Noggle and Fritz, 1986).

Results and Discussion

Effect of NPK on growth characters : The data on plant growth recorded first after 8 months of planting are presented in Table-1. The perusal of

Table-1 : Effect of varying levels of fertilizers on the growth (after 8 months of planting of akashmani)

Fertilizer levels (g/plant)	Plant height (cm)	Basal girth (cm)	Total shoot length (m/plant)
N+P ₂ O ₅ +K ₂ O			
0+0+0 (F ₀)	65.74	2.90	0.80
30+40+20 (F ₁)	86.67	3.66	1.57
60+80+40 (F ₂)	91.45	3.79	1.88
120+160+80 (F ₃)	93.43	3.86	1.91
CD at 5%	10.86	0.174	0.152

which indicated that increasing the levels of fertilisers resulted in a significant increase in growth attributes. Application of 120 g N+160 g P₂O₅+80 g K₂O per plant resulted in 42.1, 33.1 and 138.7 per cent increase in height, girth and total shoot length respectively as compare to control (no fertilisers).

The data presented in Table-2 showed considerable variation in plant height due to variation in fertility level. The magnitude of response increased with increasing fertility levels. However, the increase in height during both the years were not significant. Significant improvement in plant girth was noticed by the application of fertilisers at different levels. Maximum basal girth was recorded in the treatment with 120 g +160 g +80 g/plant of N+P₂O₅+K₂O during both the years and it was statistically superior to all other treatments in first year while in second year it was only over control.

In one-year-old plant, there was a trend of increasing the length of primary branches with increasing the fertiliser levels. However, treatment effects were not observed to be significant. Primary shoot length and total shoot length in two-year-old plants, were found maximum receiving 120 g N+160 g P₂O₅+80 g K₂O per plant and showed significant increase only over control. However, fertiliser treatments did not differ significantly among themselves. The perusal of data (Table-2) revealed that root length behaved differently in different periods with varying levels of fertilisers. Though, there was increase in root length due to increase in fertiliser levels over control, its effect was however,

not significant during both the years.

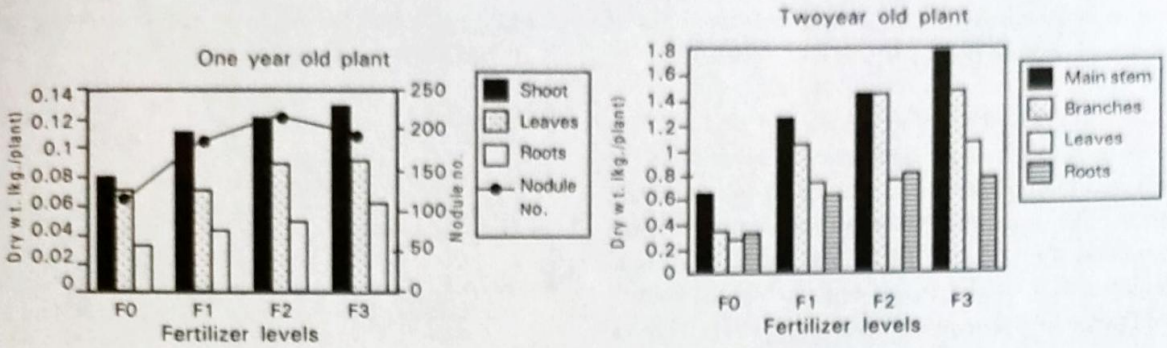
Effect of NPK on biomass production : The results pertaining to the dry matter accumulation in different plant organs and total biomass production at different periods in akashmani plant, raised at varying levels of fertilisers have been depicted in Fig.-1 and 3. The biomass of different plant parts (Fig.1) and total biomass (Fig. 3) as recorded after one and two years of planting, registered a progressive increase with increase in fertiliser levels except root biomass which was highest with the treatment 60 g N+80 g P₂O₅+40 g K₂O per plant in two-year-old plant. The increase in dry matter accumulation in different components of plant might be assigned by better growth and development at increasing fertility levels.

The contribution of different components of plants in one-year-old plant have been shown in Fig.-4. The contribution of the above ground biomass was 80% in one and 83.0% in two-year old plant to the total biomass. The productive and non productive ratio indicates that stem (main stem + branches + twigs) grows more in comparison to leaves. It was also noticed that production of leaves was less in two-year-old plant mainly due to the deciduous habit of the species. Similar trend was also observed for vegetative growth in *Colutea nepalensis*, a deciduous shrub of cold desert region of India (Singh and Jishtu, 1997).

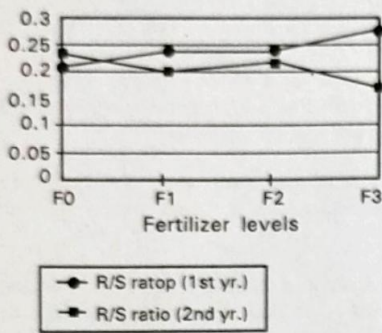
It was also clear that the increasing levels of fertilisers increased in R/S ratio in one-year-old plant but reverse was true in two-year-old plant (Fig.-2).

Table-2 : Growth attributes of akashmani plants as influenced by different fertilizer levels

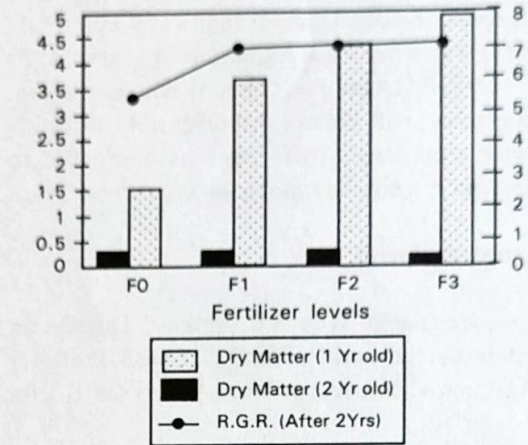
Fertilizer levels (g/plant)	After one year of planting				After two years of planting				
	Plant height (m)	Basal girth (cm)	Length of primary branches (m/plant)	Root length (cm)	Plant height (m)	Basal girth (cm)	Length of primary branches (m/plant)	Total shoot length (m/plant)	Root length (cm)
N+P ₂ O ₅ +K ₂ O									
0+0+0	1.25	5.36	5.36	58.50	2.87	12.75	12.03	15.80	70.00
30+40+20	1.45	6.87	5.38	63.50	3.54	18.50	19.83	30.20	93.75
60+80+40	1.45	7.37	6.47	69.25	3.59	18.87	25.12	39.88	84.25
120+160+80	1.56	8.87	7.39	64.50	3.57	19.25	26.32	39.58	94.25
CD (.05)	NS	1.27	NS	NS	NS	4.52	8.59	11.63	NS



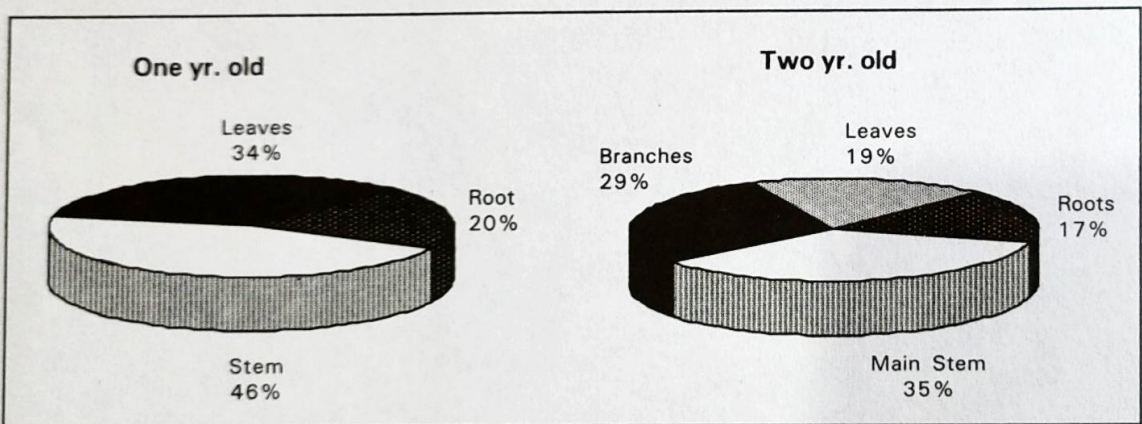
Figs. 1. Partitioning of dry matter and nodule number



Figs. 2. Root : Shoot ratio as influenced by different fertilizer levels



Figs. 3. Total dry matter accumulation and R.G.R. as affected by different fertilizer levels



Figs. 4. Partitioning of different plant organs in akashmani (*Acacia auriculaeformis*) Plant

It may be ascribed to better growth and development of above ground plant parts in later stage.

Effect of NPK on nodule formation and relative growth rate : Nodule numbers increased with the advancement in fertiliser levels in one-year-old plant. The maximum value of nodule number was obtained at 60 g +80 g +40 g/plant of $N+P_2O_5+K_2O$ which was 83.4 and 16.1% higher over the control and preceding dose of fertiliser respectively. (Fig. 1).

The relative growth rate (R.G.R.) determined after two years of planting, is depicted in Fig.-3. It could be found that maximum values of R.G.R. (7.07 g/g/day) was recorded at highest fertility level (120 g N+160 g P_2O_5 +80 g K_2O /plant) whereas lowest (5.28 g/g/day) with control. All other fertiliser levels showed remarkable difference as compared to control but did not vary much among themselves.

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References

- Anon. (1985). *The Wealth of India. Raw materials*. (revised Ed.) Publications and Information Directorate, CSIR. New Delhi, Vol. I-A: 23-24 .
- Kapur, A.P. (1954). Some unrecorded host plants of the lac insects, *Laccifer lacca* (Kerr.). (Homoptera: Lacciferidae). *J. Bombay Nat. Hist. Soc.* 52 (2-3): 645.
- Kumar, P. and Srivastava, S.C. (1990). Record of *Acacia auriculaeformis* A. Cunn. ex Benth. as a Kusmi lac host. *Indian Forester*, 116(11): 927.
- Noggle, G.R. and Fritz (1986). *Method of measuring growth and differentiation. Introductory plant physiology*. pp. 518-526.
- Guha, S.R.D. and Pant, P.C. (1966). Pulping of *Acacia auriculaeformis* A. Cunn. *Indian Forester*, 92(1): 51-55.
- Singh, R.P. and Jishtu, V. (1997). *Colutea nepalensis* Sims. - An important shrub of cold desert region of India. *Indian Forester*, 129(7): 637-641.
- Watson, D.J. (1952). The physiological basis of variation in yield. *Adv. Agron.*, 4: 101-144.