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EFFECT OF NITROGEN APPLICATION ON THE GROWTH OF *SESBANIA BISPINOSA*

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Abstract

Effect of nitrogen in the form of urea @ 0, 10, 20, 30, 40, and 50kg N ha^{-1} by broadcast application, on the growth of *Sesbania bispinosa* (Dhancha) was studied. An increase in plant height at 15, 30, 45, and 60 days after germination was observed with maximum @ 50 kg Nha^{-1} in the first cutting and @40 kg N ha^{-1} in the last three cuttings. Maximum increase in air dry and oven dry weight was found at harvesting where 50 kg N ha^{-1} was used.

Introduction

Leguminous plants in assoication with *Rhizobium* species have the potential to fix large amounts of N_2 which contributes to the soil N pool provided that the N_2 fixation is not restricted by other environmental or microbiological factors (Jefing *et al.*, 1992). These plants which are normally rich in nitrogen by 2-5%, (Gutteridge & Akkasenge, 1985) are grown as avenue crops on hedges, without affecting the yield of other crops. The leaves of such plants when added as green manures can produce 175-230kg N ha^{-1} $year^{-1}$ (Budoski *et al.*, 1986), and also result in greater phosphorus availability in calcareous soils which is due to the release of organic acids by green manure (Yash-Pal *et al.*, 1993). Besides, the leaf and twig prunings can be left to produce firewood or used as animal fodder during non-cropping periods (Kang *et al.*, 1990).

Of the leguminous plants sesbania can fix 542kg N ha^{-1} (FAO, 1984) in symbiosis with *Rhizobium* sp., the root nodule bacterium and hence it fulfils its own requirement for N but also enriches the soil with N for succeeding crops. Although legume rhizobial symbiosis can produce maximum nitrogen under optimal growing conditions but soil deficiencies of this element can decrease the crop yield (Ladha *et al.*, 1993). Early growth of many nitrogen fixing trees has been found to be slow (Bray *et al.*, 1985), however, nitrogen seems to have beneficial effect during early stages of legume growth. A starter dose of nitrogen induces the activity of nitrogen fixing bacteria in most legumes (Jefing *et al.*, 1992). Subsequent nitrogen applications after the establishment of nitrogen fixing bacteria might further improve crop yield.

Although the effect of nitrogen on the growth of legumes has been studied (Jefing *et al.*, 1992; Ladha *et al.* 1993) but very little is known about the influence of nitrogen on their growth under field conditions (Peoples & Herridge, 1990; Peoples & Craswell, 1992). Experiments were, therefore, carried out to study the effect of nitrogen application on the growth of *Sesbania bispinosa*.

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Table 1. Physical and chemical properties of soil.

A.	**Mechanical analysis**	
	Sand	57 %
	Silt	21 %
	Clay	22 %
	Textural class	Sandy clay loam
B.	**Chemical analysis**	
	Moisture	1.3 %
	pH_s	7.9 %
	EC_e	2.5 ds m^{-1}
	$Ca^{2+} + Mg^{2+}$	6.2 me L^{-1}
	Na^{-} Soluble	10.0 me L^{-1}
	SAR	5.68 (m.mole L^{-1})½
	Total nitrogen	0.035 %
	Organic matter	0.66 %
	Available phosphorus	6.8 mg kg^{-1}
	Extractable potassium	72.0 mg kg^{-1}

Materials and Methods

A quadruplicated field experiment was conducted using randomized complete block design with a plot size of 4x4m. Soil samples from 0-30cm depth were randomly taken from the field for routine soil chemical and mechanical analysis (Table 1). Nitrogen in the form of urea @ 0,10, 20,30,40 and 50kg N ha^{-1} was broadcast before sowing of Dhancha (*Sesbania bispinosa*). During the growth period, plant height (cm), oven dry wt. per plant (gm) were studied after germination at 15 days intervals upto two months. Air dry and oven dry wt. (tons ha^{-1}) were recorded after 60 days of germination. The data was statistically analyzed using DMR test (Duncan, 1955).

Results and Discussion

Effect of nitrogen on plant height: Plant height at every cutting was significantly influenced by N-application (Table 2). Differences in increase in plant height due to different treatments were not significant except for first cutting where it was found

Table 2. Effect of nitrogen on the growth of *Sesbania bispinosa*.

Nitrogen (Kg/ha)	Plant Height (cm)				Oven Dry Weight (g/plant)				Dry Weight (tons/ha) after 60 days	
	Days after Germination									
	15	30	45	60	15	30	45	60	Air Dry Weight	Oven Dry Weight
0	12.0d	33.28b	76.13b	154.9c	0.25b	1.65b	6.44a	15.20b	6.25b	5.40b
10	14.55c	35.55ab	85.63ab	167.2bc	0.21b	1.83ab	7.00b	16.32b	6.22ab	5.85b
20	15.13bc	42.53ab	92.25ab	174.1ab	0.26b	2.38ab	7.90ab	17.55ab	7.19b	6.63b
30	16.75ab	43.18ab	98.13ab	179.6ab	0.38ab	2.65ab	8.49ab	18.96ab	7.74b	7.22b
40	17.50a	45.78a	104.65a	185.1ab	0.42ab	2.78ab	8.69a	19.24ab	8.26ab	7.63ab
50	18.43a	44.0a	99.65ab	183.6a	0.53a	2.92a	9.86a	21.50a	10.26a	9.60a

Means sharing the same letter (s) do not differ significantly.

significant. All the treatments increased plant height as compared to control with an optimum increase in plant height observed in the last three cuttings where 40kg N ha^{-1} was used. Plant height increased proportionately with the increase in dose of nitrogen. This is in agreement with the reports of Zimmerman *et al.*, (1983), who found an increase in height and diameter of black locust proportional to the increasing rates of nitrogen. Similar increase in plant height due to N was also reported on *Leucaena* (Dutt & Pathania, 1986) and *Albizia procera* (Hussain *et al.*, 1986). It is interesting to note that nitrogen application did not affect plant height in *Acacia melanoxyion* (Messina & Barton, 1985).

Effect of nitrogen on plant dry weight: Total dry weight of plant increased proportionately with an increase in rate of nitrogen application with significant increase found @ 50kg N ha^{-1} (Table 2). It is evident from the results of four cuttings taken during a period of two months that small addition of nitrogen to Sesbania increased the total plant dry weight with maximum at 50kg N ha^{-1}. Such similar reports have been made on Leucaena (Jones, 1985), faba bean (Mohammad *et al.*, 1989), and on soybean (Jefing *et al.*, 1992), where low rate of nitrogen gave less total plant dry weight but higher rates of nitrogen gave higher total plant dry weight. However, our results are in contradiction with the findings of Caldwell & Richardson (1986) and Moloney *et al.* (1986) who reported that total plant dry weight in *Adenanthera pavonina* was not increased until 100kg N ha^{-1} was applied.

Effect of nitrogen on air and oven dry weight at 60 days after germination: Differences in air and oven dry weight of plants due to different treatments were significant. Application of N @ 20, 30, 40 and 50kg ha^{-1} showed an increase in air and oven dry weight of plants over control. This indicates a proportional relation of plant weight to the doses of nitrogen applied. Similar increase in plant weight with nitrogen application were also reported on Leucaena (Jones, 1985) and soybean (Jefing *et al.*, 1992) where increasing levels of N increased the weight of tops and roots, at 10 weeks and after 30 weeks there was still an yield response to high rates of N where 200kg N ha^{-1} doubled the plant yield as compared to control.

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