

Effect of nitrogen on growth, nodulation and seed protein content in soybean

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Replicated field experiment in F.R.B.D. was conducted during kharif 2002 to study the effect of soil and foliar application of nitrogen (N) at flowering in addition to basal N dose on nodulation, growth & seed protein content in soybean. Plant height was significantly increased due to N application. While nodulation was significantly decreased with increased dose of N. Maximum seed protein content (%) was recorded by application of 45 kg. + 30 kg. N ha⁻¹ at 40 D.A.S. Significantly increased and highest dry weight along with maximum Relative Growth Rate (RGR) was observed by 45 kg. N ha⁻¹ (basal dose). Where as, significant varietal differences were also noted in respect of Leaf Area Index (LAI), Leaf Area Ratio (LAR) and Net Assimilation Rate (NAR).

Key words : Soybean, Nitrogen nutrition, Growth, Nodulation and Seed protein.

INTRODUCTION

SOYBEAN (*Glycine max* L. Merrill) a well known oil seed, pulse crop and cheapest source of quality proteins requires large amount of nitrogen for optimum production due to high protein content. A good crop of soybean utilizes upto 240-250 kg. N ha⁻¹ out of which approximately 100-110 Kg. N ha⁻¹ is fixed symbiotically (Chandell & Saxena, 1988). Instead of giving nutrients at the time of sowing, as followed in present recommendations, split application may be advantageous for pod development. Successive increase in N lead to progressive and significant increase in grain yield (Nandurkar, *et al.* 2000). Nitrogen at 30 and 60 kg. ha⁻¹, exhibited significant influence on growth and yield of soybean (Krishna, *et al.* 1995). Protein content range from 35-40 per cent in soybean. Soybean with high protein content is preferred in international market. Seed protein content could be increased with increased level of N (Bishnoi and Dutt, 1980). The unique feature of soybean is that, most of the N fixation occurs after flowering. Increase in the supply of mineral nitrogen during post flowering stage proportionately retards symbiotic N fixation. Thus while planning a favorable regime for this nutrient, care should be taken that the added nitrogen should be completely assimilated by the plant up to mid flowering stage. Inoculation with *Rhizobium* strain and application of nitrogen have been reported to affect nodulation, oil and protein content in soybean (Verma & Tiwari, 1976).

Considering the effect of N on growth, nodulation and protein content, the present investigation, therefore, was under taken to assess the potentiality of soybean under variable N doses.

MATERIALS AND METHODS

The present research work captioned 'Effect of Nitrogen on Growth, Nodulation and Seed Protein Content in Soybean', was carried out during kharif 2002 at Department of Botany, Dr. PDKV, Akola. Seeds of soybean varieties TAMS-38 & MACS - 450 obtained from Regional Research Center, Amravati were inoculated with *rhizobium* culture @ 5 g kg⁻¹ and sown with 45 x 5 cm. Of spacing in each plot of size 1.35 x 1.45 m, fitted in Factorial Randomized Block Design with three replications and treatments as follows :

A) First factor treatment

i) V₁ - TAMS-38

ii) V₂ - MACS-450

B) Second factor treatment

N₀ - Control (N₀ nitrogen)

N₁ - 30 kg. N ha⁻¹ (basal dose)

N₂ - 30 kg. + 15 kg. N ha⁻¹ at 40 DAS

N₃ - 30 kg. + 30 kg. N ha⁻¹ at 40 DAS

N₄ - 45 kg. N ha⁻¹ (basal)

N₅ - 45 kg. + 15 kg. N ha⁻¹ at 40 DAS

N₆ - 45 kg. + 30 kg. N ha⁻¹ at 40 DAS

N₇ - 30 kg. + 2% urea spray at 40 DAS

N₈ - 45 kg. + 2% urea spray at 40 DAS

Observation were recorded on different characters viz. plant height (cm), number of root nodules plant⁻¹, crude protein (%) of seed, total dry weight plant⁻¹ (g), Leaf Area Index (LAI), Leaf Area Ratio (LAR), Net Assimilation Rate (NAR) and Relative Growth Rate (RGR) to assess the growth and yield potential of soybean under variable doses of nitrogen. The data on various characters were subjected to statistical analysis by employing standard statistical methods for F.R.B.D.

RESULTS AND DISCUSSION

Data collected on plant height (cm), number of root nodules plant⁻¹ and seed crude protein (%) of soybean are presented in Table 1.

Plant height (cm)

Plant height was significantly increased due to N application. Treatments N₂, N₃, N₄, N₅, N₆, N₇ and N₈ showed significantly higher height than control (47.48) with maximum plant height recorded in N₅ (52.16). Varietal and interaction effects were non-significant. Above findings are in confirmation with the results reported by Singh *et al.* (1971) & Mandal *et al.* (1997).

Number of root nodules plant⁻¹

Maximum and significantly greater number of root nodules plant⁻¹ was recorded in the control. Number of root nodules plant⁻¹ were significantly decrease with increased dose N fertilization (N₂, N₃, N₄, N₅ & N₆). Interaction effects were nonsignificant. Similar results were reported by Thakur & Hasan (1972) and Shrinivasulu (2000).

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