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# Effect of foliar nutrition on growth of soybean (*Glycine max* L.) under Rainfed Condition

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**ABSTRACT**

A field experiment onEffect of Foliar Application on Growth, Yield and Quality of Soybean (*Glycine max* L.) Under Rainfed Condition was conducted at the Crop Research Centre, School of Agriculture, ITM University Gwalior (M.P.) during the *Kharif* season of 2022. The experiment was laid out in a randomized block design with 10 treatment combinations, which includes include RDF(100%)@ at the timeofsowing, NPK (19:19:19) @ 0.5% at 40 DAS, NPK (19:19:19) @ 1.0% at 40 DAS, NPK (19:19:19) @ 1.5% at 40 DAS, NPK (13:0:45) @ 0.5% at 60 DAS, NPK (13:0:45) @ 1.0% at 60 DAS, NPK (13:0:45) @ 1.5% at 60 DAS, NPK (19:19:19) @ 0.5% at 40 DAS + NPK (13:0:45) @ 0.5% at 60 DAS, NPK (19:19:19) @ 1.5% at 40 DAS + NPK (13:0:45) @1.5 % at 60 DAS and RDF (20:60:20) + Sulphur, and one absolute control, and each treatment was replicated thrice. The result of the experiment revealed that an increase in the foliar fertilizer application had significantly increased the growth and growth analysis of soybeans plant population viz., plant height (cm), No. of leaves per plant, leaf area index, No of branches per plant, dry weight (g plant$^{-1}$), Days taken in 50 % flowering, AGR, CGR and RGR, Highest recorded with the application NPK (19:19:19) @ 1.5% at 20 DAS + NPK (13:0:45) @1.5% at 40 DAS, being *at par* with NPK (19:19:19) @ 1.0% at 20 DAS + NPK (13:0:45) @1.0% at 40 DAS, which was closely *at par* with NPK (13:0:45) @ 1.0% at 40 DAS, and NPK (13:0:45) @ 1.5% at 40 DAS. The lowest was recorded in the control.

***Key points:*** *Foliar application of N, P, and K, Growth, and yield of soybean, js-9560*

## Introduction

Soybean (*Glycine max* L. Merill.) is known as Chinese pea or Manchurian bean which belongs to family Leguminosae. In India from last few years processing and value addition trading in Soybean had brought the revolution in rural economy. Soybean has vital importance in Indian Agriculture hence it plays a decisive role in oil economy of India. It is the cheapest and main source of dietary protein of majority vegetarian Indians.

World soybean production in 2020-21 is 353.47 million tonnes from a total area of 136.82 million ha. Brazil ranks first in soybean production with 121.80 million tonnes followed by United States of America (112.55 million tonnes), Argentina (48.80 million tonnes), China (19.60 million tonnes) and India (11.23 million tonnes) accounting for 34%, 32%, 14%, 6% and 3 % of world production. India ranks fourth in area with 12.12 million hectares (29.94 million acres) accounting for 8.86% of the world area and fifth in production with 11.23 million tonnes in 2020-21 (Anonymous, 2022).

In India, area under soybean during 2022-23 was 120.90 lakh hectares as against 120.86 lakh hectares during 2021-22. Among the states, Madhya Pradesh stood first with 50.18 lakh ha followed by Maharashtra (49.10 lakh ha), Rajasthan (11.51 lakh

ha), Karnataka (4.43 lakh ha), Gujarat (2.22 lakh ha) and Telangana (1.75 lakh ha) (Anonymous, 2022). The Madhya Pradesh is known as "Soybean state".

Foliar spray of fertilizers is the fastest way to boost up crop growth because, nutrients are available to plants in critical stages and the nutrients will reach the site of food synthesis directly leading to no wastage and quick supply of food, thereby reduce the requirement of fertilizers. Foliar application resulted in efficient absorption and usage which is economical in respect to other methods of fertilization. It is also known that active nodulation of soybean or any pulse crop stops 45-50 days after sowing and at that time for legume plants if supply nutrients through foliar spray found to be beneficial effects on enhancing growth, increasing seed yield and quality parameters. Specific in soybean leaf senescence starts much before completion of pod maturity and which breaks source sink relationship finally led to unfilled pods and pods with shriveled seeds are major drawbacks in soybean which can be managed through foliar application of fertilizers. Nutrient spray at later stages has been found to delay leaf senescence and improved yield.

Foliar application of nutrients for increasing and exploiting genetic potential of the crop is considered as an efficient and economic method of supplementing the nutrient requirement. Application of inorganic fertilizers spray will also enhance the nutrient availability, quick absorption and in turn increases the productivity. Fertilizers applied through foliage play a pivotal role in increasing the seed yield in soybean (Chandrasekhar and Bangaruswamy, 2003). The use of alternative fertilizer application strategies to achieve maximum yield and enhance nutrient use efficiency has been proposed for decades. This may be corrected through some combination of starter and booster dose of foliar fertilizer application, fertilizer rate adjustment of both macro and micronutrients.

## Materials and Methods

During the Kharif season of 2022-2023, a field experiment titled "effect of foliar nutrition ongrowth of soybean (*Glycine max* L.) under rainfed condition"was conducted at CRC-1, School of Agriculture, ITM University Gwalior (M.P.). The research farm is situated at latitude of 26.1378° N and a longitude of 78.2082° E, with an elevation of 197 meters above the mean sea level. The region experiences an annual rainfall ranging up to 764.4 mm. Gwalior receives maximum rainfall during southwest monsoon period i.e., June to September.The mean relative humidity recorded in the morning and evening ranged between 76.5 to 95.4 and 47.0 to 76.2 percent, respectively. A total rainfall of 663.8 mm in 22 rainy was received during the crop period. The pan evaporation (mm/day) ranged between 2 to 9.4 mm/day during experimentation from July to October 2022. The experiment was laid out in a Randomized Block Design on Effect of Foliar Application on Growth of Soybean (*Glycine max* L.) in experimental plots with three replications. which include RDF(100%)@ at the timeofsowing, NPK (19:19:19) @ 0.5% at 40 DAS, NPK (19:19:19) @ 1.0% at 40 DAS, NPK (19:19:19) @ 1.5% at 40 DAS, NPK (13:0:45) @ 0.5% at 60 DAS, NPK (13:0:45) @ 1.0% at 60 DAS, NPK (13:0:45) @ 1.5% at 60 DAS, NPK (19:19:19) @ 0.5% at 40 DAS + NPK (13:0:45) @ 0.5% at 60 DAS, NPK (19:19:19) @ 1.5% at 40 DAS + NPK (13:0:45) @1.5 % at 60 DAS and RDF (20:60:20) + Sulphur, and one absolute control and each treatment were replicated thrice. The soybean variety "JS9560" was sown by line sowing (seed drills) method. And the recommended dose of fertilizer is 20:60:20 kg $ha^{-1}$ NPK. Observations are taken while carrying out the experiment, growth parameters like Initial plant population, plant height (cm), No. of leaves per plant, Number of branches per plant, Leaf area index (LAI), Days taken in 50 % flowering, Dry matter per plant (g), AGR, CGR and RGR.

## Results and Discussion

The present investigation of the experiment revealed that an increase in the applicationof foliar nutrient, gradually impacted on growth parameters like plant height (cm), no. of leaves, leaf area index (LAI), and no. of seed pods, no. of pods per plant, 50% flowering, and dry matter accumulation (g). In all the growth parameter aspects maximum basal and foliar fertilizer application of N, P, and K show maximum growth. with an Initial plant population, plant height (cm), No. of leaves per plant, Number of branches per plant, Leaf area index (LAI), Days taken in 50 % flowering, Dry matter per plant (g), AGR, CGR and RGR, Superior with the application NPK (19:19:19) @ 1.5% at 20 DAS + NPK (13:0:45) @1.5% at 40 DAS, while it was *at par* with NPK (19:19:19) @ 1.0% at 20 DAS + NPK (13:0:45) @1.0% at 40 DAS, where was nearby*at par* with NPK

**Table 1.** Growth parameters of soybean as influenced by foliar fertilizer application.

| Treatment combination | Plant height (cm) | No. of leaves per plant | No. of branches per plant | Leaf area index | Dry matter accumulation per plant (g) | AGR | CGR | RGR |
|---|---|---|---|---|---|---|---|---|
| Control | 27.14 | 21.14 | 5.62 | 3.53 | 12.40 | 0.12 | 0.13 | 0.0047 |
| NPK (19:19:19) @ 0.5% at 20 DAS | 33.60 | 26.65 | 7.22 | 4.44 | 15.34 | 0.10 | 0.16 | 0.0051 |
| NPK (19:19:19) @ 1.0% at 20 DAS | 39.68 | 31.07 | 8.80 | 5.07 | 17.99 | 0.10 | 0.23 | 0.0062 |
| NPK (19:19:19) @ 1.5% at 20 DAS | 41.23 | 31.86 | 8.99 | 5.31 | 18.49 | 0.08 | 0.24 | 0.0063 |
| NPK (13:0:45) @ 0.5% at 40 DAS | 39.00 | 32.31 | 9.10 | 4.53 | 17.08 | 0.09 | 0.17 | 0.0046 |
| NPK (13:0:45) @ 1.0% at 40 DAS | 44.86 | 36.86 | 10.79 | 5.13 | 19.59 | 0.09 | 0.18 | 0.0042 |
| NPK (13:0:45) @ 1.5% at 40 DAS | 45.61 | 37.65 | 10.98 | 5.37 | 20.61 | 0.09 | 0.21 | 0.0049 |
| NPK (19:19:19) @ 0.5% at 20 DAS + NPK (13:0:45) @ 0.5% at 40 DAS | 41.91 | 35.66 | 10.10 | 5.38 | 20.64 | 0.09 | 0.25 | 0.0057 |
| NPK (19:19:19) @ 1.0% at 20 DAS + NPK (13:0:45) @1.0% at 40 DAS | 48.59 | 40.26 | 11.22 | 5.99 | 23.27 | 0.17 | 0.26 | 0.0054 |
| NPK (19:19:19) @ 1.5% at 20 DAS + NPK (13:0:45) @1.5% at 40 DAS | 49.83 | 41.02 | 11.40 | 6.12 | 23.82 | 0.16 | 0.27 | 0.0054 |
| **S. Em±** | 1.76 | 1.46 | 0.36 | 0.18 | 0.80 | 0.01 | 0.07 | 0.0018 |
| **C.D.(P=0.05)** | 5.22 | 4.35 | 1.06 | 0.55 | 2.38 | 0.04 | 0.22 | 0.0053 |

(19:19:19) @ 1.5% at 20 DAS and NPK (19:19:19) @ 1.0% at 20 DAS while the minimum was found with control and NPK (13:0:45) @ 0.5% at 40 DAS, NPK (13:0:45) @ 1.0% at 40 DAS, NPK (13:0:45) @ 1.5% at 40 DAS. increased chlorophyll content along with more functional leaves and leaf area may have improved the interception, absorption, and utilization of radiant energy. This in turn may have improved photosynthesis, which in turn increased plant height, and no. of leaves ultimately leading to better growth.The results are in close conformity with the findings ofVenkatesh and Bashu (2012), while the least number of branches plant$^{-1}$ were found with control. More number of branches was due to improved growth of morphological character like plant height resulted in a greater number of pods per plant leading to a greater number of branches. These results corroboratedthe findings of Trivedi *et al.* (2011) and Mondal (2012).

## Conclusion

Based upon one year study, it is concluded that application of NPK (19:19:19) @ 1.5% at 20 DAS + NPK (13:0:45) @1.5% at 40 DAS recorded significantly highest growth

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