

**RESEARCH ARTICLE :**

# Effect of foliar nutrition on yield and economics of soybean [*Glycine max* (L.) Merrill] under rain fed condition

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**SUMMARY :** Field experiment was conducted on effect of foliar fertilization on yield and economics of soybean. The results of experiment revealed that the seed yield and biological yield of soybean was significantly influenced by foliar application of nutrients. Significantly higher seed yield (1072 kg. ha.) was recorded due to foliar application of 19:19:19 and 13:00:45 @ 1% at 40 and 60 DAS, respectively. However, it was at par with the treatments *i.e.* application of 19:19:19 and 13:00:45 @ 1.5 and 0.5% at 40 and 60 DAS, respectively. Similar trend was recorded due to foliar application of 19:19:19 and 13:00:45 @ 1% at 40 and 60 DAS, respectively in case of biological yield (2601 kg/ha.) of soybean; Highest harvest index of soybean was recorded by application of 19:19:19 and 13:00:45 @ 1% at 40 and 60 DAS, respectively. In case of economics of the soybean crop, the gross monetary returns and net returns were significantly influenced by various treatments. Foliar application of 19:19:19 and 13:00:45 @ 1% at 40 and 60 DAS, respectively recorded significantly higher gross as well as net monetary returns than the rest of treatments except with the foliar application of 19:19:19 and 13:00:45 @ 1.5 and 0.5% at 40 and 60 DAS, respectively. Further the results revealed that the cost of cultivation and B:C ratio of soybean were highest in case of foliar application of 19:19:19 and 13:00:45 @ 1% 40 and 60 DAS, respectively.

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## BACKGROUND AND OBJECTIVES

Soybean [*Glycine max* (L.) Merrill] is a leguminous crop and belongs to family *Leguminoaceae* with sub family *Papilionaceae*. It is popularly known as 'Wonder crop'. It is originated in China. It is self pollinated and short day plant. Soybean is an excellent health food and contains about 40 per cent quality protein, 23 per cent

carbohydrates and 20 per cent cholesterol free oil. Foliar spray of nutrients is the fastest way to boost up crop growth because the nutrients application is uniform and crop reacts to nutrient application immediately. Under rain fed condition when the availability of moisture becomes scarce, the application of fertilizers as foliar spray resulted in efficient absorption and usage which are economical in respect the other methods of fertilization. Flower

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senescence and ill filling of pods are the major drawbacks in soybean, which can be managed through foliar application of nutrient.

Water soluble fertilizers like 19:19:19, 13:00:45, 00:52:34 etc are the best foliar fertilizer for crops like paddy, wheat, pulses and vegetables for green house cultivation, nurseries, kitchen gardens and for all types of field crops. Use of 19:19:19 results in cost saving and at the same time significantly increases the yield. It contains 100% water soluble N, P and K in 19:19:19 ratio and it is free from salts like sodium and chlorides and neutral in nature. Hence, it is 100% soluble even in hard water and gets fully and immediately absorbed by plant.

Potassium is required for numerous plant growth processes *viz.*, enzyme activation, stomatal activity (water use) and photosynthesis, transport of sugars, water and nutrients. In general, Potassium helps to increase crop yield and improve crop quality. It maintains turgor pressure; reduces water loss and wilting, aids in photosynthesis and food formation, reduces respiration, preventing energy losses, enhances translocation of sugars and starch, produces grain rich in starch, increases protein content of plants, builds cellulose and reduces lodging. Use of 13:00:45 was found suitable for crops under water stress condition to reduce the loss of yield under rain fed condition.

## RESOURCES AND METHODS

The experiment was conducted during *Kharif*, season of 2015-16 at Research farm of Department of Agronomy, College of Agriculture, Latur to study the effect of foliar nutrition on yield and economics of soybean under rain fed condition. The topography of experimental field was uniform and levelled. The soil was clayey in texture, low in available nitrogen (118.86 kg ha<sup>-1</sup>), medium in available phosphorus (20.42 kg ha<sup>-1</sup>), very high in available potassium (385.89 kg ha<sup>-1</sup>) and alkaline in reaction having pH of 7.5. The rainfall during period of experiment was insufficient to growth and development of soybean which was resulted in lower yields. Water stress during pod formation stage of soybean forced early maturity of crop. Overall the thermo-aero-hydro-dynamic properties during crop season were not favourable for physiological activities of crop and its phenophysic development. The experiment was laid out in a Randomized Block Design

with 10 treatments replicated thrice. The treatments were T<sub>1</sub>- Control, T<sub>2</sub>- 19:19:19 @ 0.5% at 40 DAS, T<sub>3</sub>- 19:19:19 @ 1.0% at 40 DAS, T<sub>4</sub>- 19:19:19 @ 1.5% at 40 DAS, T<sub>5</sub>- 13:00:45 @ 0.5% at 60 DAS, T<sub>6</sub>- 13:00:45 @ 1.0% at 60 DAS, T<sub>7</sub>- 13:00:45 @ 1.5% at 60 DAS, T<sub>8</sub>- 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS, T<sub>9</sub>- 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS and T<sub>10</sub>- 19:19:19 @ 1.5% at 40 DAS + 13:00:45 @ 1.5% at 60 DAS. The gross and net plot size of each experimental unit was 4.8 m x 4.5 m and 4.5 x 3.6 m, respectively. Sowing was done by dibbling method on 11<sup>th</sup> August 2015. The RDF was applied before sowing. The recommended cultural practices and plant protection measures were under taken as per recommendation.

## OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

### Seed yield, biological yield (kg ha<sup>-1</sup>) and harvest index :

The data regarding seed yield biological yield and harvest index is presented in Table 1. The data revealed that the seed yield (kg ha<sup>-1</sup>) as influenced by different treatments was found to be significant. The treatment of foliar application of 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS (T<sub>9</sub>) recorded significantly higher seed yield (1072 kg/ha.) but it was at par with the foliar application of 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS (T<sub>8</sub>) and 19:19:19 @ 1.5% at 40 DAS + 13:00:45 @ 1.5% at 60 DAS (T<sub>10</sub>).

This might be due to application of nutrient through foliar application which resulted in better filling of pods hence, more pod yield plant<sup>-1</sup>(g) and number of seeds plant<sup>-1</sup> was obtained. Beneficial effect of foliar fertilization on crop yield was also reported by Haq and Mallarino (1998); Odeleye *et al.* (2007); Thiyageshwari and Ranganathan (1999) and Mevada *et al.* (2005).

The foliar application of 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS (T<sub>9</sub>) recorded significantly higher biological yield (2601 kg ha<sup>-1</sup>) followed by the foliar application of 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS (T<sub>8</sub>) and 19:19:19 @ 1.5% at 40 DAS + 13:00:45 @ 1.5% at 60 DAS (10). This might be due to the cumulative effect in favoring growth contributing

characters which have been clearly exhibited on the final produce *i.e.* seed and straw yield ha<sup>-1</sup>. This might be attributed to the superior values of morphological (*viz.*, plant height, leaf area, number of leaves and branches plant<sup>-1</sup>), yield contributing characters (*viz.*, number of flowers and pods plant<sup>-1</sup> and number of seeds pod<sup>-1</sup>) and also effect on chlorophyll content, photosynthetic rate in plants treated with foliar fertilizer. Results were in

confirmedly with Thiyageshwari and Rangnanathan (1999).

The effect of different treatments on harvest index in soybean crop was highest (41.22) due to foliar application of 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS (T<sub>9</sub>). Results were in conformity with Nagaraja and Mohankumar (2010).

**Table 1: Effect of foliar nutrition on seed yield, biological yield and harvest index of soybean**

Treatments	Seed yield (kg ha <sup>-1</sup> )	Biological yield (kg ha <sup>-1</sup> )	Harvest index (%)
T <sub>1</sub> - Control	834	2063	40.46
T <sub>2</sub> - 19:19:19 @ 0.5% at 40DAS	906	2114	40.83
T <sub>3</sub> - 19:19:19 @ 1.0% at 40 DAS	913	2128	40.88
T <sub>4</sub> - 19:19:19 @ 1.5% at 40 DAS	892	2197	40.59
T <sub>5</sub> - 13:00:45 @ 0.5% at 60 DAS	909	2221	40.92
T <sub>6</sub> - 13:00:45 @ 1.0% at 60DAS	922	2250	41.08
T <sub>7</sub> - 13:00:45 @ 1.5% at 60DAS	913	2205	41.09
T <sub>8</sub> - 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS	987	2400	41.20
T <sub>9</sub> - 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS	1072	2601	41.22
T <sub>10</sub> -19:19:19 @ 1.5% at 40 DAS + 13:00:45 @ 1.5% at 60 DAS	1003	2463	40.73
S.E. +	42	105	-
C.D. (P=0.05)	125	312	-
General mean	934	2264	41.35

**Table 2: Mean seed yield, gross monetary returns, cost of cultivation, net monetary returns and B:C ratio as influenced by different treatments**

Treatments	Gross return (Rs.ha <sup>-1</sup> )	Cost of cultivation (Rs. ha <sup>-1</sup> )	Net return (Rs. ha <sup>-1</sup> )	B:C ratio
T <sub>1</sub> . Control	33373	25070	8303	1.33
T <sub>2</sub> - 19:19:19 @ 0.5% at 40DAS	36226	25120	11107	1.44
T <sub>3</sub> . 19:19:19 @ 1.0% at 40 DAS	36506	25170	11337	1.45
T <sub>4</sub> . 19:19:19 @ 1.5% at 40 DAS	35666	25220	10447	1.41
T <sub>5</sub> . 13:00:45 @ 0.5% at 60 DAS	36360	25120	11240	1.45
T <sub>6</sub> - 13:00:45 @ 1.0% at 60DAS	36880	25170	11710	1.47
T <sub>7</sub> - 13:00:45 @ 1.5% at 60DAS	36506	25220	11287	1.45
T <sub>8</sub> . 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS	39466	25170	14297	1.57
T <sub>9</sub> . 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS	42866	25270	17597	1.70
T <sub>10</sub> -19:19:19 @ 1.5% at 40 DAS + 13:00:45 @ 1.5% at 60 DAS	40133	25370	14763	1.58
S.E. ±	1683	-	1683	0.06
C.D. (P=0.05)	5001	-	5001	0.19
General mean	37398	25190	12208	1.48

### Economics of the soybean crop :

Effect of nutrition fertilizer on gross and net monetary return (Table 2) was found to be significant. Foliar application of 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS ( $T_9$ ) gave significantly higher gross monetary returns and net monetary return which was at par with the application of 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS ( $T_8$ ) and 19:19:19 @ 1.5% at 40 DAS + 13:00:45 @ 1.5% at 60 DAS ( $T_{10}$ ). Similar highest B: C ratio was also recorded with the application of 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS ( $T_9$ ). Results were in conformity with Gowda *et al.* (2014).

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