

Original Research Article

Effect of Foliar Fertilizer Application on Growth and Yield of Soybean (*Glycine max* (L.) Merrill) under Rainfed Condition

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ABSTRACT

The experiment was conducted during *kharif* season of the year 2015-16 at Experimental Farm, Agronomy Section, College of Agriculture, Latur to study the studies on foliar fertilizer application in soybean. The experimental field was leveled and well drained. The soil was clay loam in texture, low in available nitrogen ($118.86 \text{ kg ha}^{-1}$), low in available phosphorus (20.42 kg ha^{-1}), very high in available potassium ($384.74 \text{ kg ha}^{-1}$) and alkaline in reaction (7.45 pH). The environmental conditions were moderately congenial for normal growth and maturity of soybean crop. The foliar fertilizer application 19:19:19 @ 1.0% at 40 DAS +13:00:45 @ 1.0% at 60 DAS recorded significantly higher growth, yield attributes and yield of soybean as compare to other treatments which was at par with application 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS, and 19:19:19 @ 1.5% at 40 DAS +13:00:45 @ 1.5% at 60 DAS.

Keywords

Soybean,
Foliar
fertilizer,
Growth, Yield,
Rainfed

Introduction

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

Fertilizer 19:19:19 is 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.

Materials and Methods

The experiment was conducted during *khariif*, 2015-16 at Farms, Department of Agronomy, College of Agriculture, Latur to study the studies on foliar fertilizer application in soybean. The topography of experimental field was uniform and levelled. The soil was clayey in texture, low in available nitrogen (118.86 kg ha⁻¹), medium in available phosphorus (20.42 kg ha⁻¹), very high in available potassium (385.89 kg ha⁻¹) and alkaline in reaction having pH of 7.5. The rainfall during period of experiment was insufficient to growth and development of soybean which resulted in lower yield. Water stress during pod formation stage resulted in forced 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 T₁- Control, T₂- 19:19:19 @ 0.5% at

40 DAS, T₃- 19:19:19 @ 1.0% at 40 DAS, T₄- 19:19:19 @ 1.5% at 40 DAS, T₅- 13:00:45 @ 0.5% at 60 DAS, T₆- 13:00:45 @ 1.0% at 60 DAS, T₇-13:00:45 @ 1.5% at 60 DAS, T₈- 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS, T₉- 19:19:19 @ 1.0% at 40 DAS +13:00:45 @ 1.0% at 60 DAS and T₁₀. 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 11th August 2015. The RDF was applied before sowing.

The recommended cultural practices and plant protection measures were under taken as per recommendation.

Results and Discussion

Growth attributes of soybean

The effect of different treatments was noticed on important growth parameters *viz.*, plant height, leaf area, and total dry matter per plant was influenced significantly due to foliar application of fertilizers.

The highest plant height was recorded by the foliar application of 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% spray 60 DAS (T₉) which followed by the foliar application of 19:19:19 @ 0.5% spray 40 DAS + 13:00:45 @ 0.5% at 60 DAS (T₈) and 19:19:19 @ 1.5% at 40 DAS + 13:00:45 @ 1.5% at 60 DAS (T₁₀)as compared to other treatments.

The increase in growth attributes may be due to better uptake and translocation of plant nutrients to growing plants.

Similar kind of observations was recorded by Nagaraja and Mohankumar (2010) and Ghare (2014).

Table.1 Growth attributes of soybean as influenced by different treatments

Treatments	Plant height (cm) at harvest	Leaf area (dm ²) Plant ⁻¹ at 60 DAS	Total dry matter (g) plant ⁻¹ at harvest
T ₁ - Control	27.07	7.90	11.47
T ₂ - 19:19:19 @ 0.5% at 40 DAS	29.70	8.27	13.30
T ₃ - 19:19:19 @ 1.0% at 40 DAS	29.00	8.81	13.93
T ₄ - 19:19:19 @ 1.5% at 40 DAS	30.07	8.01	12.23
T ₅ - 13:00:45 @ 0.5% at 60 DAS	27.93	8.40	13.53
T ₆ - 13:00:45 @ 1.0% at 60 DAS	29.40	9.11	14.13
T ₇ - 13:00:45 @ 1.5% at 60 DAS	29.83	8.08	12.47
T ₈ - 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS	33.30	10.20	14.30
T ₉ - 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS	35.17	10.80	15.80
T ₁₀ - 19:19:19 @ 1.5% at 40 DAS + 13:00:45 @ 1.5% at 60 DAS	32.17	10.69	14.47
SE ±	1.52	0.48	0.54
CD (P= 0.05)	4.49	1.42	1.62

Table.2 Number of pods, number of seeds, seed yield (g) plant⁻¹, seed yield and biological yield of soybean as influenced by various treatments at harvest

Treatments	No. of pods Plant ⁻¹	No. of seeds plant ⁻¹	Seed yield Plant ⁻¹ (g)	Seed yield (kg ha ⁻¹)	Biological yield (kg ha ⁻¹)
T ₁ - Control	18.83	26.00	2.33	834	2063
T ₂ - 19:19:19 @ 0.5% at 40DAS	20.13	27.80	2.60	906	2114
T ₃ - 19:19:19 @ 1.0% at 40 DAS	21.13	30.07	2.90	913	2128
T ₄ - 19:19:19 @ 1.5% at 40 DAS	19.80	27.00	2.40	892	2197
T ₅ - 13:00:45 @ 0.5% at 60 DAS	20.80	28.33	2.77	909	2221
T ₆ - 13:00:45 @ 1.0% at 60DAS	21.33	30.33	3.07	922	2250
T ₇ - 13:00:45 @ 1.5% at 60DAS	19.80	27.33	2.42	913	2205
T ₈ - 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS	22.23	31.67	3.15	987	2400
T ₉ - 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS	23.93	34.00	3.53	1072	2601
T ₁₀ - 19:19:19 @ 1.5% at 40 DAS + 13:00:45 @ 1.5% at 60 DAS	22.53	32.17	3.30	1003	2463
SE ±	0.86	1.17	0.12	42	105
CD (P= 0.05)	2.58	3.49	0.38	125	312

Foliar fertilizer application of 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS (T₉) recorded maximum leaf area at 60 DAS (10.80 dm²) which was par with the foliar fertilizer application of 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS (T₈) and 19:19:19 @ 1.5% at 40 DAS + 13:00:45 @ 1.5% at 60 DAS (T₁₀) and found significantly superior over rest of the treatments.

Foliar fertilizer application of 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS (T₉) recorded maximum dry matter accumulation at harvest (15.80 g) which was par with the foliar fertilizer application of 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS (T₈) and 19:19:19 @ 1.5% at 40 DAS + 13:00:45 @ 1.5% at 60 DAS (T₁₀) and found significantly superior over rest of the treatments. It may be due to increase in plant height, number of functional leaves, leaf area plant⁻¹ by foliar fertilizer which are of vital part of the plant where the photosynthate takes place and thereby build up more photosynthesis, which reflected ultimately on dry matter accumulation. Similar kinds of results were reported by Govindan and Thirumurugan (2000).

Yield Attributes and Yield

The foliar application of 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS (T₉) recorded higher mean number of pods per plant, number of seeds per plant and seed yield per plant, however, it was at par with the application of 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS (T₈) and 19:19:19 @ 1.5% at 40 DAS + 13:00:45 @ 1.5% at 60 DAS (T₁₀) and found significantly superior rest of the treatments. The increase in yield attributes per plant might be due to application of foliar fertilizer which increased the number of

flower, seed and promote fully mature the seed resulted into increase in pods per plant in soybean. Results are in conformity with the finding of Odeleye *et al.*, (2007), Gowthami and Rama Rao (2014).

The foliar application of 19:19:19 @ 1.0% at 40 DAS + 13:00:45 @ 1.0% at 60 DAS (T₉) recorded higher mean seed and biological yield and it was followed by the foliar fertilizer application of 19:19:19 @ 0.5% at 40 DAS + 13:00:45 @ 0.5% at 60 DAS (T₈) and 19:19:19 @ 1.5% at 40 DAS + 13:00:45 @ 1.5% at 60 DAS (T₁₀).

This might be due to the cumulative effect in favouring growth contributing characters which have been clearly exhibited on the final produce i.e. seed and straw yield ha⁻¹. This might be attributed to the superior values of morphological (viz, plant height, leaf area), yield contributing characters (viz, number of pods plant⁻¹ and number of seeds pod⁻¹) and also effect on chlorophyll content, photosynthetic rate in plants treated with foliar fertilizer. Results were in confirmedly with Thiyageshwari and Rangnanathan (1999).

References

- Ghare, S.T. 2014. Studies on response of soybean to zinc, iron and magnesium application. M.sc. (Agri.) Thesis, Marathwada Agril. Univ., Parbhani (India).
- Govindan, K. and Thirumurugan, V. 2000. Response of green gram to foliar nutrition of potassium, *J. Maha. Agric. Univ.*, 25: 302-303.
- Gowthami, P. and Rama Rao, 2014. Influence of foliar application potassium, boron and zinc on growth and yield of soybean. *Intern. J. of food Agri. And Veterinari Sci.*, 4 (3): 81-86.
- Nagaraja, A.P., Mohankumar H.K. 2010.

- Effect of micronutrient and bio-inoculants on growth and yield of soybean. *Mysore J. Agric. Sci.* 44(2): 260-265.
- Odeleye, F. O., Odeleye, M. O., Animashaun, M. O. 2007. Effects of nutrient foliar spray on soybean growth and yield (*glycine max* (L.) Merrill) in south west Nigeria. *Not. Bot. Hort. Agrobot. Cluj*, 35 (2): 22-32.
- Thiyageswari, S. and Ranganathan G. 1999. Micronutrients and cytozyme on grain yield and dry matter production of soybean. *Madras Agric.J.* 86(7-9): 496-498.