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Response of Different Nutritional Foliar Sprays on Growth and Yield of Soybean

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A B S T R A C T

A field experiment was carried out to study the suitable water soluble fertilizer and its concentration for spraying on soybean at Regional Research Centre, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Amravati, Mahrashtra during *kharif* season of the year 2017-18. A set of eight treatments control RDF (30 kg N, 75 kg P_2O_5 and 30 kg K_2O per hectare at the time of sowing) + (No spray), RDF + water spray, RDF + spray of 19:19:19 (0.5 %), RDF + spray of 13:00:45 (0.5 %), RDF + spray of 00:52:34 (0.5 %), RDF + spray of 12:61:00 (0.5 %), RDF + spray of urea (02 %), and RDF + spray of DAP (02 %), were taken (one at flower initiation and second at pod filling stage) under Randomized Block Design with three replication. The experimental results revealed that application of nutritional foliar spray treatment RDF + spray of DAP (2%) recorded significantly higher grain yield (1736 kg/ha) over treatment control RDF + (No spray) (1355 kg/ha) and RDF + water spray (1397 kg/ha) but at par with treatment RDF + spray of 19:19:19 (0.5 %), RDF + spray of 13:00:45 (0.5 %), RDF + spray of 00:52:34 (0.5 %), RDF + spray of 12:61:00 (0.5 %) and RDF + spray of urea (2 %). The same trend was observed in straw yield. Treatment RDF + spray of DAP 2% showed significantly higher gross monetary returns (52155 Rs/ha), net monetary returns (23748 Rs/ha) and B:C ratio (1.81) over treatment control RDF + (No spray) and RDF + water spray but at par with treatment RDF + spray of 19:19:19 (0.5 %), RDF + spray of 13:00:45 (0.5 %), RDF + spray of 00:52:34 (0.5 %), RDF + spray of 12:61:00 (0.5 %) and RDF + spray of urea (02 %).

Introduction

Soybean (*Glycine max* L.) Merrill is a dual purpose, most important rainy season crop to meet the pulse and oil requirements. It has 40 per cent protein with well-balanced essential amino acids and 20 per cent oil with polyunsaturated fatty acids, 6-7 per cent minerals, 5-6 per cent crude fiber and 17-19 per cent carbohydrates.

Soybean is the major oilseed crop in the world, accounting for nearly 50% of the total oilseeds acreage as well as production. It

stands third in vegetable oil economy in India, after groundnut and rapeseed-mustard.

Foliar feeding is a technique of feeding plants by applying fertilizer directly to their leaves. Plants are able to absorb essential elements through their leaves. The absorption takes place through their stomata and also through their epidermis. Transport is usually faster through the stomata, but total absorption may be as great through the epidermis. Plants are also able to absorb nutrients through their bark.

Efficiency of fertilizers applied to soil is generally low due to various losses and due to fixation. Foliar application of nutrients eliminates the problems of fixation and immobilization. Hence, foliar nutrition is recognized as an important method of fertilization in modern agriculture.

Keeping this point in view, a study was undertaken to study the effect of water soluble fertilizers sprays on growth and yield of soybean and find out the suitable water soluble fertilizers for spraying on soybean crop.

Materials and Methods

A field experiment was carried out at Regional Research Centre, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Amravati, Mahrashtra during *kharif* season of the year 2017. The soil of experimental field was medium deep black with pH of 8.49, bulk density 1.38 g cm^2, organic carbon 4.53 g/kg, total nitrogen 202.94 kg/ha, available phosphorus 18.54 kg/ha and 382 kg/ha available potassium content. The crop (Variety JS-335) was raised using RDF @ 30 kg N, 75 kg P_2O_5 and 30 kg K_2O per hectare at the time of sowing. Seeds were sown at the rate of 75 kg ha^{-1} by dibbling method at a spacing of 45 cm x 05 cm. The experiment was laid out in Randomized Block Design with three replications. The treatments were allotted in field follow the random methods. The eight treatments consisted of various combination of nutrition application sprayed at flower initiation and pod filling stage of RDF + Control (No spray), RDF + Water spray, RDF + spray of NPK (19:19:19) 0.5 %, RDF + spray of 13:00:45 (0.5%), RDF + spray of 00:52:34 (0.5 %), RDF + spray of 12:61:00 (0.5%), RDF + spray of urea (2 %) and RDF + spray of DAP (2 %). The data on plant height, no. of branches per plant and no. of pods per plant were collected from randomly selected five plants per plot at the time of harvest. From the total produce of each plot, 100 grains were counted and weighed to express test weight. The crop was harvested when the pods were matured, bundles were sun dried for few days and then threshed manually. The data on biological and grain yield were collected at the time of harvest. The data were analysed by statistical method as suggested by Panse and Sukhatme (1954).

Results and Discussion

Data presented in Table 1 indicated that treatment RDF + spray of DAP (2 %) showed significantly superior over the treatment RDF + (Control-no spray) but at par with treatments RDF + spray of 19:19:19 (0.5%), RDF + spray of 13:00:45 (0.5%), RDF + spray of 00:52:34 (0.5%), RDF + spray of 12:61:00 (0.5%) and RDF + spray of urea (2 %) in respect of plant height and number of branches per plant.

Number of pods per plant was found significantly superior in treatment RDF + spray of DAP (2%) over the treatment RDF + (No Spray-Control), RDF + water spray, RDF + spray of 19:19:19 (0.5%), RDF + spray of 13:00:45 (0.5%) and RDF + spray of 00:52:34 (0.5) but at par with treatment RDF + spray of 12:61:00 (0.5%) and RDF + spray of urea (2%).

The foliar applications of nutrients through 2% DAP at flower initiation and pod formation stage might have reduced flower drop. This might have significantly increased the number pods plant^{-1} as reported by Ganapathy *et al.*, (2008).

Test weight was recorded significantly higher in treatment RDF + spray of DAP (2%) over the treatment RDF + (Control-no spray), RDF + water spray and RDF + spray of 19:19:19 (0.5%) but at par with treatment RDF + spray of 13:00:45(0.5%), RDF + spray of 00:52:34 (0.5 %), RDF + spray of 12:61:00 (0.5%) and RDF + spray of urea (2%).

Table.1 Yield attributes of soybean as influenced by various treatment

Treatments	Plant height (cm)	No. of branches / plant	No. of pods / plant	Test weight (g)
T1: RDF+ Control (No Spray)	44.13	2.46	9.73	8.56
T2: RDF+ Water spray	44.60	2.48	10.86	8.84
T3: RDF+ 19:19:19 - 0.5 %	52.86	3.16	11.06	10.07
T4: RDF+ 13:00:45 - 0.5 %	53.20	3.23	11.60	10.27
T5: RDF+ 00:52:34 - 0.5 %	53.93	3.16	11.46	10.30
T6: RDF+ 12:61:00 - 0.5 %	57.46	3.46	14.83	10.80
T7: RDF+ Urea - 2 %	57.13	3.46	13.86	10.61
T8: RDF+ DAP - 2 %	60.43	3.53	14.53	11.15
SE± (M)	**2.62**	**0.21**	**0.72**	**0.31**
CD at 5 %	**7.90**	**0.64**	**2.16**	**0.93**

Table.2 Effect of different nutritional foliar sprays on grain yield, straw yield and economics of soybean

Treatments	Grain Yield (kg/ha)	Straw yield (kg/ha)	GMR (Rs/ha)	NMR (Rs/ha)	B:C ratio
T1: RDF+ Control (No Spray)	1355	1648	42344	12597	1.43
T2: RDF+ Water spray	1397	1677	42598	13418	1.46
T3: RDF+ 19:19:19 - 0.5 %	1629	2248	49695	20215	1.68
T4: RDF+ 13:00:45 - 0.5 %	1635	2256	49867	20238	1.68
T5: RDF+ 00:52:34 - 0.5 %	1630	2250	49735	20105	1.67
T6: RDF+ 12:61:00 - 0.5 %	1700	2407	51860	22230	1.75
T7: RDF+ Urea - 2 %	1701	2403	51870	22665	1.77
T8: RDF+ DAP - 2 %	1736	2420	52155	23748	1.81
SE± (M)	**79.28**	**117.51**	**2412.55**	**2417.93**	**--**
CD at 5 %	**238.93**	**345.13**	**7271.12**	**7287.31**	**--**
CV %	**8.59**	**9.41**	**8.57**	**21.59**	**--**

Similar result reported by Kumar *et al.*, (2013) with foliar spray of 2% DAP twice at flower initiation and pod formation stages of crop growth in respect of number of pods^{-1}

(62.50), number of seeds pods^{-1}, seed index and higher grain yield (1460 kg ha^{-1}).

The Table 2 revealed that application of nutritional foliar spray treatment RDF + DAP (2%) recorded significantly higher grain yield (1736 kg/ha) over treatment control RDF + (No spray) (1355 kg/ha) and RDF + water spray (1397 kg/ha) but at par with treatment RDF + spray of 19:19:19 (0.5 %), RDF + spray of 13:00:45 (0.5 %), RDF + spray of 00:52:34 (0.5 %), RDF + spray of 12:61:00 (0.5 %) and RDF + spray of urea (2 %). The same trend was observed in straw yield.

Similar result reported by Kumar *et al.*, (2013) in soybean with foliar spray of 2% DAP twice at flower initiation and pod formation stages of crop growth in respect of higher grain yield (1460 kg ha-1).

Treatment RDF + spray of DAP 2% showed significantly higher gross monetary returns (52155 Rs/ha), net monetary returns (23748 Rs/ha) and B:C ratio (1.81) over treatment control RDF + (No spray) and RDF + water spray but at par with treatment RDF + spray of 19:19:19 (0.5 %), RDF + spray of 13:00:45 (0.5 %), RDF + spray of 00:52:34 (0.5 %), RDF + spray of 12:61:00 (0.5 %) and RDF + spray of urea (02 %).

The positive effect of supplying soybean with supplementary nitrogen to have beneficial effects on enhancing growth and increasing seed yield. Similar observations were also reported by Ashour and Thalooth (1983) and Das and Jana (2015). According to Mannan (2014), foliar spraying during the pod filling stage is more effective than during vegetative stage because nutrients applied during pod filling is readily used for photosynthesis and assimilates quickly mobilized for grain filing and protein accumulation in grain.

The increase in gross and net return is obviously due to higher seed yield. Less input cost and higher economical yield might be resultant in increase the B: C ratio. Similar result was also reported by (Kumar *et al.*, 2013) spray of DAP @ 2% twice at flower initiation and pod formation stages of crop growth recorded higher gross returns and net returns with B:C ratio.

The results of present investigation suggests that RDF + spray of DAP 2 % (one at flower initiation and second at pod filling stage) leads to highest plant height, no. of branches / plant, no. of pods/plant, test weight, seed and straw yields of soybean with more GMR, NMR and B:C ratio.

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