International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(1): 1290-1292

Received: 01-11-2017
Accepted: 02-12-2017

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Effect of foliar nutrition on soybean productivity

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Abstract
The field experiment was conducted in field at Regional Research Center, Amravati during *kharif* season to evaluate the effect of foliar spray of chemical nutrients on yield attributes and economics of soybean. Treatments comprising of RDF+water spray at pod initiation (T1), RDF+Urea 2% spray at pod initiation (T2), RDF+DAP 2% spray at pod initiation (T3), RDF+MOP 0.5% at pod initiation (T4), RDF+19:19:19 (NPK) 2% at pod initiation (T5), RDF+Molybdenum 0.5% at pod initiation (T6), RDF+Boron 0.5% at pod initiation (T7), RDF+Zinc chillated 0.5% at pod initiation (T8) and RDF only (T9). Yield attributes *viz*., branches plant^{-1}, pods plant^{-1}, seed index and seed yield Kg/ha and straw yield Kg/ha was recorded at the time of harvesting. Highest no. of pods per plant was observed in treatment RDF+DAP 2% at pod initiation stage (T3) i.e. 15.73 followed by T5 and T7. Seed and straw yield (1599 and 2131 kg/ha respectively) was recorded in treatment RDF+19:19: 19 (NPK) 2% at pod initiation stage (T5) but found at par with T2, T3 and T7.

Keywords: Foliar nutrition, Urea, DAP, MOP, 19:19:19, Molybdenum, Boron, Zinc

Introduction
Soybean [*Glycine max* (L.) Merill.] is known as Chinese pea or Manchurian bean which belongs to family Leguminaceae and originated in Asia. It is the miracle crop which has phenomenal growth and production. The vital importance in Indian Agriculture, but also plays a decisive role in oil economy of India. It is the cheapest and main source of dietary protein of majority vegetarian Indians. Soybean seed consists of 18-25 per cent oil and 30-50 per cent protein Vahedi (2011) [7]. The increasing cost of fertilizer nutrients have led to search for alternative practices of managing the fertilizer nutrients more judiciously, efficiently and in balance proportions. Such approach would reduce the depletion of macro and micronutrients from soil. Among the nutrients, macro-nutrients have been given the priority and little attention has been paid towards micronutrients. In the absence of micronutrients, plant shows physiological disorders which eventually lead to low crop yield and fair quality. Now a day's most of the farmers are alert regarding adoption of recommended dose of fertilizer, incorporation of FYM, compost and crop residues as well as seed treatment with bio-fertilizers etc. for getting maximum yield. Many references are quoted by scientist that supplemental nutrients applied at proper growth stage of crop through foliar application increases the yield of soybean. At reproductive growth stage i.e. flowering or pod initiation stage, crop requires more nutrients for development of reproductive organ along with sufficient soil moisture.
Foliar spraying is a new method for crop feeding in which micronutrients in the form of liquid are used into leaves (Nasiri *et al*., 2010) [10]. Foliar application of micronutrient is more beneficial than soil application. Since application rates are lesser as compared to soil application, same quantity of nutrient application could be supplied easily and crop reacts to nutrient application immediately. Foliar spraying of micronutrient is very helpful when the roots cannot provide necessary nutrients. Crop roots are unable to absorb some important nutrients such as zinc, because of soil properties, such as high pH, lime or heavy texture, and in this situation, foliar spraying is better as compared to soil application (Kinaci and Gulmezoglu, 2007) [7].
At reproductive growth stage, application of only major nutrients is not sufficient. The crop also required micronutrient for development. Considering their importance the present investigation is undertaken to supply the major and micronutrients at reproductive growth stage of soybean to get maximum seed yield.

Material and methods
The field experiment was conducted in field at Regional Research Center, Amravati during *kharif* season of 2015-16. The topography of experiment site was fairly uniform, leveled and

have medium black soil. The experiment was laid out in Randomized block design with three replications consisting of nine treatments comprising of RDF+water spray at pod initiation (T1), RDF+Urea 2% spray at pod initiation (T2), RDF+DAP 2% spray at pod initiation (T3), RDF+MOP 0.5% at pod initiation (T4), RDF+19:19:19 (NPK) 2% at pod initiation (T5), RDF+Molybdenum 0.5% at pod initiation (T6), RDF+Boron 0.5% at pod initiation (T7), RDF +Zinc chillated 0.5% at pod initiation (T8) and RDF only (T9)

Soybean cv JS 95-60 was used for the study. After seed bed preparation, sowing was done by dibbling. The net plot size was 5.0 m x 2.7 m. The observations on dry matter were recorded at 30 DAS, 45 DAS and 60 DAS, CGR and RGR on 30-45 and 45-50 DAS. Yield attributes *viz*., branches plant^{-1}, pods plant^{-1}, seed index and seed yield Kg/ha and straw yield Kg/ha was recorded at the time of harvesting.

Results and discussion

Yield attributes

Data presented in Table 1 show that number of branches plant^{-1} ranged from 1.47 to 2.43. The significantly maximum number of branches (2.43) was recorded in treatment T5 which received spraying of 19:19:19 (NPK) 2%. The lowest number of branches found in T9 (control) which received RDF alone. Highest no. of pods per plant was observed in treatment RDF+DAP 2% at pod initiation stage (T3) i.e. 15.73 followed by T5 and T7. Similar results were found by Vinoth Kumar *et al*. (2013) [8]. 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 plan^{-1} as reported by Ganapathy *et al*. (2008) [4]. Any treatment did not show significant effect on seed index.

Seed and straw yield (1599 and 2131 kg/ha respectively) was recorded in treatment RDF+19:19: 19 (NPK) 2% at pod initiation stage (T5) but found at par with T2, T3 and T7. 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) [1] and Das and Jana (2015) [3]. 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.

From Table 2 it is revealed that at 30 DAS, highest plant dry weight was recorded in treatment RDF+Molybdenum 0.5% at pod initiation (2.69 g), at 45 DAS, it was observed in RDF+water spray at pod initiation (7.92 g) while at 60 DAS, it was shown in treatment RDF+19:19:19 (NPK) 2% at pod initiation (9.60 g).

Economics

Highest CGR at 30-45 DAS was recorded in treatment RDF+water spray at pod initiation (19.07) while at 45-60 DAS it was observed in treatment RDF+19:19:19 (NPK) 2% at pod initiation (10.11) and highest RGR at 30-45 DAS was recorded in treatment RDF+water spray at pod initiation (0.13) while at 45-60 DAS it was observed in treatment RDF+Zinc chillated 0.5% at pod initiation (0.04). Maximum rain use efficiency 2.36 was recorded in treatment RDF+19:19:19 (NPK) 2% at pod initiation (T5).

Highest Harvest Index was observed in treatment RDF +Zinc chillated 0.5% at pod initiation i.e. 45.66.Maximum cost of cultivation of Rs. 39608 per ha was observed in treatment RDF+Molybdenum 0.5% at pod initiation while highest gross returns per ha was found in treatment RDF+19:19:19 (NPK) 2% at pod initiation (Rs. 52515). Highest Net monitory returns per ha and B:C ratio was recorded in RDF+DAP 2% spray at pod initiation (Rs. 22967 & 1.80 resp.)

Table 1: Effect of foliar nutrition on Branches/plant, Pods/plant, Seed index, Seed yield and Straw yield of soybean productivity

Treatment	Branches/ plant	Pods/ plant	Seed Index	Seed yield (kg/ha)	Straw yield (kg/ha)
T_1 RDF+water spray at pod initiation	2.00	14.53	12.67	1468	1970
T_2 RDF+Urea 2% spray at pod initiation	2.33	13.93	12.33	1368	1827
T_3 RDF+DAP 2% spray at pod initiation	2.07	15.73	12.37	1571	2084
T_4 RDF+MOP 0.5% at pod initiation	1.47	14.13	12.40	1424	1816
T_5 RDF+19:19:19 (NPK) 2% at pod initiation	2.43	15.40	12.73	1599	2131
T_6 RDF+Molybdenum 0.5% at pod initiation	2.03	11.87	12.27	1169	1539
T_7 RDF+Boron 0.5% at pod initiation	2.37	14.87	12.23	1454	1894
T_8 RDF+Zinc chillated 0.5% at pod initiation	2.00	12.87	12.13	1278	1520
T_9 RDF only	1.57	11.13	12.23	1108	1350
SE(m)+	0.13	0.87	0.13	91.22	118.46
CD (P=0.05)	0.39	2.61	NS	273.45	355.10

Table 2: Effect of foliar nutrition on Plant Dry weight, CGR, RGR and RUE in soybean

Treatments	Plant dry weight (g)			CGR		RGR		RUE
	30 DAS	45 DAS	60 DAS	30-45 DAS	45-60 DAS	30-45 DAS	45-60 DAS	
T_1 RDF+water spray at pod initiation	1.56	7.92	8.48	19.07	1.69	0.13	0.01	2.16
T_2 RDF+Urea 2% spray at pod initiation	2.67	6.66	8.63	11.97	5.90	0.07	0.02	2.01
T_3 RDF+DAP 2% spray at pod initiation	2.32	6.91	8.78	13.78	5.61	0.09	0.02	2.31
T_4 RDF+MOP 0.5% at pod initiation	1.83	6.10	6.87	12.83	2.31	0.10	0.01	2.10
T_5 RDF+19:19:19 (NPK) 2% at pod initiation	2.35	6.23	9.60	11.65	10.11	0.08	0.03	2.36
T_6 RDF+Molybdenum 0.5% at pod initiation	2.69	5.59	7.80	8.70	6.63	0.06	0.03	1.72
T_7 RDF+Boron 0.5% at pod initiation	1.80	5.22	7.72	10.28	7.50	0.08	0.03	2.14
T_8 RDF+Zinc chillated 0.5% at pod initiation	2.32	5.51	8.61	9.57	9.31	0.07	0.04	1.88
T_9 RDF only	1.70	5.10	7.78	10.22	8.02	0.09	0.03	1.63
SE(m) ±	0.14	0.39	0.46	1.18	1.75	0.01	0.01	0.13
CD (P=0.05)	0.42	1.16	1.37	3.53	5.24	0.02	0.02	0.40

Table 3: Effect of Foliar Nutrition on Economics of Soybean

Treatment	HI (%)	Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C ratio
T_1 RDF+water spray at pod initiation	42.68	28146	48205	20059	1.71
T_2 RDF+Urea 2% spray at pod initiation	42.87	28026	44916	16890	1.60
T_3 RDF+DAP 2% spray at pod initiation	42.98	28591	51558	22967	1.80
T_4 RDF+MOP 0.5% at pod initiation	43.91	28238	46682	18444	1.65
T_5 RDF+19:19:19 (NPK) 2% at pod initiation	42.93	29583	52515	22932	1.78
T_6 RDF+Molybdenum 0.5% at pod initiation	43.20	39608	38360	-1248	0.97
T_7 RDF+Boron 0.5% at pod initiation	43.36	28711	47692	18981	1.66
T_8 RDF+Zinc chillated 0.5% at pod initiation	45.66	29964	41768	11805	1.39
T_9 RDF only	45.14	27138	36255	9116	1.34
SE(m) ±	--	--	2985.48	2985.48	--
CD (P=0.05)	--	--	8949.51	8949.51	--

Urea=Rs 6/kg, DAP=Rs. 26/kg, MOP=Rs. 17.32/kg, 19:19:19=Rs. 120/kg, Mo=Rs. 4000/kg, Boron=Rs. 480/kg, Zinc=Rs. 760/kg

References

1. Ashour NI, Thalooth AT. Effect of soil and foliar application of nitrogen during pod development on the yield of soybean (*Glycine max* L.). Field Crop Res., 1983; 6:261-266.
2. Mannan MA. Foliar and soil fertilization effect on seed yield and protein content of soybean. Bangladesh. Agron. J. 2014; 17(1):67-72.
3. Das SK, Jana K. Effect of foliar spray of water soluble fertilizer at pre flowering stage on yield of pulses. Agricultural Science Digest, 2015; 35(4):275-279.
4. Ganapathy M, Baradhan G, Ramesh N. Effect of foliar nutrition on reproductive efficiency and grain yield of rice fallow pulses. Legume Res., 2008; 31:142-144.
5. Kinaci E, Gulmezoglu N. Grain yield and yield components of triticale upon application of different foliar fertilizers. Interciencia 2007; 32(9):624-628.
6. Nasiri Y, Zehtab-Salmasi S, Nasrullahzadeh S, Najafi N, Ghassemi-Golezani K. Effects of foliar application of micronutrients (Fe and Zn) on flower yield and essential oil of chamomile (*Matricaria chamomilla* L.). J. Med. Plants Res. 2010; (17):1733-1737.
7. Vahedi A. The effects of micronutrient application on soybean seed yield and on seed oil and protein content. J. American Sci., 2011; 7(6):44-49.
8. Vinoth Kumar C, Vaiyapuri K Mohamed, Amanullah M, Gopalaswamy G. Influence of Foliar Spray of Nutrients on Yield and Economics of Soybean (*Glycine max* L. Merill). Journal of Biological Sciences, 2013; 13:563-565.