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Effect of different levels fertilizer and micronutrients on growth, yield and quality of soybean

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ABSTRACT

The field experiment was conducted at Department of Agronomy, College of Agriculture, Latur during kharif, 2011 to study the effect of fertilizer levels and micronutrients on growth, yield and quality of soybean. Application of 100 per cent RDF (F_3) recorded significantly higher growth, yield and quality contributing characters followed by application of 75 per cent RDF (F_2) and 50 per cent RDF (F_1).Application of Zinc (M_3) recorded significantly higher growth, yield, and quality contributing characters followed by Boron (M_1) and Fe (M_2). Application of 100 per cent RDF produced significantly higher seed yield (2972 kg ha^{-1}) than 50 per cent RDF (1986 kg ha^{-1}) and 75 per cent RDF (2527 kg ha^{-1}) and Zn application @ 10 kg ha^{-1} (2668 kg ha^{-1}) produced significantly higher seed yield than Fe @ 10 kg ha^{-1} (2290 kg ha^{-1}) but was found to be at par with B @ 2 kg ha^{-1}. In case of oil yield, 100 per cent RDF (608 kg ha^{-1}) recorded significantly higher oil yield than other treatments. In case of micronutrients Zn application @ 10 kg ha^{-1} recorded significantly higher oil yield (556 kg ha^{-1}) than Fe application @ 10 kg ha^{-1} (475kg ha^{-1}), but it was at par with the B application @ 2 kg ha^{-1} (513 kg ha^{-1}).

Keywords: Boron, fertilizer, growth, micronutrient, quality, sulphur, yield, zinc

A wonder crop soybean (*Glycine max.* (L.) Merill) is a leguminous crop which belongs to family leguminoaceae with sub family papilionaceae. Soybean was introduced in India probably as soon as it was domesticated in china (Tiwari and Karmakar, 2000). It is basically a pulse crop and gained the importance as an oilseed crop as it contains 20% cholesterol free oil. Soybean is of paramount important in human and animal nutrition, because it is a major source of edible vegetable oil and high protein feed as well as food in the world. Soybean is the cheapest source of proteins and it is known as "Poor man's meat".

Fertilizer is an important input for successful crop production. The Nitrogen is an essential constituent of protein and chlorophyll. Phosphorus plays an important role in growth as well as development and maturity of plant. It helps in flowering and fruiting. Inorganic fertilizers are used to supply essential nutrients for better growth. In soybean deficiency of B affects the development of meristematic tissue resulting in growth inhibition. Boron deficiency depresses growth, biomass, pod and seed yield. Zinc plays an important role in metabolism of nitrogen, synthesis of amino acid tryptophan, metabolism of starch, plants flowering and fruit set,. Iron plays an important role in nitrogen fixation and photosynthesis. Synthesis of chlorophyll, thylakoid and many ferrous proteins is dependent on this element.

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Recent research show that a small amount of nutrients, particularly Zn and Fe applied by foliar spraying increased significantly the yield of crops. The greater the use of high analysis chemical fertilizer and considerable decrease in recycling of crop residues and scarce use of bulk manures in present day agriculture result in greater depletion of micronutrients in soil led to decrease the productivity of crops. Keeping these in view the present investigation was undertaken to study the effect of fertilizer levels and micronutrient on growth, yield and quality of soybean.

A field experiment was conducted at Department of Agronomy, College of Agriculture, Latur during *kharif* 2011. The soil was clayey in texture (42.21%), moderate in nitrogen (193.55 kg ha^{-1}), moderate in phosphorous (15.82 kg ha^{-1}), high in potash (333.78 kg ha^{-1}), moderate in sulphur and alkaline in reaction. The environmental condition prevailed during experimental period were favorable for normal growth and development of soybean crop.

The experiment was laid out in a Split Plot Design with 9 treatment combinations, which included the treatments 50 per cent RDF (F_1), 75 per cent RDF (F_2), 100 per cent RDF (F_3) as main plot treatments and (M_1) B @ 2 kg ha^{-1}, (M_2) Fe @ 10 kg ha^{-1} and (M_3) Zn @ 10 kg ha^{-1} as sub plot treatments.Each experimental unit was replicated three times. The gross and net plot size of each experimental unit was 5.0 x 4.5 m and 4.0 x 3.6 m

respectively. Sowing was done by dibbling method on 9th July 2011 at spacing of 45 x 5 cm. The recommended cultural practices and plant protection measure were undertaken. The recommended dose of fertilizer (30:60:30 kg NPK ha^{-1}) was applied at the time of sowing through Urea, SSP and MOP. The crop was harvested on 9th October 2011.

Application of 100 per cent RDF produced significantly higher plant height, number of branches, leaf area, total dry matter and number of pods per plant in soybean followed by the application of 75 per cent RDF and 50 per cent RDF. The increased levels of fertilizers might have also provided more nutrients resulting in more growth attributes and higher uptake by plant. Similar results were reported by Jadhav *et al.* (2009) and Krishna *et al.* (1995).

Among the micronutrient, Zn application recorded maximum values of the above mentioned growth

Table 1 : Effect of different levels of fertilizer and micronutrients on growth characters of soybean at harvest

Treatment	Plant height (cm)	No. of branches $plant^{-1}$	Leaf area $plant^{-1}$	Dry matter $plant^{-1}$	No. of pods $plant^{-1}$
Main plot (Fertilizer)					
F_1=50% RDF	49.11	4.54	8.70	25.09	24.34
F_2=75% RDF	51.89	4.71	9.03	28.81	27.52
F_3=100% RDF	57.09	5.83	12.11	33.32	34.69
SEm(±)	**0.65**	**0.15**	**0.25**	**0.60**	**0.71**
LSD(0.05)	**2.01**	**0.46**	**0.77**	**1.84**	**2.18**
Sub plot (Micronutrient)					
M_1= B @ 2 kg ha^{1}	52.17	4.98	8.75	29.17	28.94
M_2= Fe @ 10 kg ha^{1}	50.60	4.69	9.71	27.04	26.94
M_3= Zn @ 10 kg ha^{1}	55.32	5.41	11.37	31.02	30.67
SEm(±)	**1.13**	**0.13**	**0.28**	**0.91**	**0.82**
LSD(0.05)	**3.49**	**0.39**	**0.86**	**2.82**	**2.51**
Interaction (S x V)					
SEm(±)	**1.96**	**0.22**	**0.48**	**1.58**	**1.41**
LSD(0.05)	**NS**	**NS**	**NS**	**NS**	**NS**
General mean	**52.70**	**5.03**	**9.95**	**29.08**	**28.85**

Table 2 : Effect of different levels of fertilizer and micronutrients on yield and quality of soybean

Treatment	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Protein content (%)	Oil content (%)	Oil Yield (kg ha^{-1})
Main plot (Fertilizer)						
F_1=50% RDF	1986	3432	5418	38.81	20.79	414
F_2=75% RDF	2527	4088	6615	39.55	20.65	522
F_3=100% RDF	2972	4529	7501	40.05	20.86	608
SEm(±)	**54**	**108**	**153**	**0.11**	**0.10**	**8.94**
LSD(0.05)	**166**	**334**	**471**	**0.33**	**NS**	**27.55**
Sub plot (Micronutrient)						
M_1= B @ 2 kg ha^{-1}	2526	4081	6606	39.62	20.78	513
M_2= Fe @ 10 kg ha^{-1}	2290	3739	6029	39.21	20.68	474
M_3= Zn @ 10 kg ha^{-1}	2668	4230	6898	39.58	20.85	556
SEm(±)	**67**	**140**	**212**	**0.11**	**0.08**	**16.10**
LSD(0.05)	**207**	**430**	**654**	**0.34**	**NS**	**49.61**
Interaction (S x V)						
SEm(±)	**116**	**242**	**367**	**0.19**	**0.09**	**27.88**
LSD(0.05)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
General mean	**2495**	**4017**	**6511**	**39.47**	**20.77**	**514**

parameters followed by application of B and the lowest values of parameters were recorded by application of Fe. The application of 100 per cent RDF recorded significantly higher mean seed yield (2972 kg ha^{-1}) , straw yield (4529 kg ha^{-1}), biological yield (7501 kg ha^{-1}), protein per cent (40.05), oil per cent (20.86) and oil yield (608 kg ha^{-1}) followed by the application of 75 per cent RDF and 50 per cent RDF. This might because of the cumulative effect in increasing growth contributing characters which have been clearly exhibited on the final produce *i.e.* seed and straw yield ha^{-1}. Similar results were reported by Bhakare and Sonar (2000) and Bhosale *et al.* (1995).

Among the micro nutrients, the application of Zn recorded significantly higher mean seed yield (2668 kg ha^{-1}), straw yield (4230 kg ha^{-1}), biological yield (6898 kg ha^{-1}), protein per cent (39.58), oil per cent (20.85) and oil yield (556 kg ha^{-1}) followed by the application of B and Fe. Application of Zn increased the yield mainly due to early flowering and greater pod setting.). Zinc is also vital for the oxidation process in plant cells and helps in transformation of carbohydrates and regulation of sugar in plants. Similar results were recorded by Sharma and Dixit (1987), Deosker *et al.* (2001), Ghosh *et al.* (2006) and Patra and Bhattacharya (2009).

Hence, application of 100 % RDF (30 kg N + 60 kg P_2O_5 + 30 kg K_2O) was found to be the most effective and ideal for increasing productivity of soybean than 75 % RDF and 50 % RDF. Among the micronutrients, application of Zinc @ 10 kg ha^{-1} was found beneficial in increasing seed yield than iron whereas zinc and boron recorded comparable seed yield.

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