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Effect of sulphur and boron nutrition and it method of application on growth, yield and economics of sunflower (*Helianthus annuus* L.)

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ABSTRACT: *The field investigation entitled "Effect of sulphur and boron nutrition and it method of application on growth, yield and economics of sunflower (Helianthus annuus L.)" under rainfed condition was conducted at Farm, Oilseeds Research Station, Latur. The experimental field was leveled and well drained. The experimental field was leveled and well drained. The soil was clayey in texture, low in nitrogen, medium in phosphorus and neutral in reaction. The environmental conditions prevailed during experimental period were favorable for normal growth and development of sunflower crop. The experiment was laid out in a randomized block design with three replications and hybrid LSFH-35 as a test crop along with nine treatment combinations. The treatments are T_1 :- RDF, T_2 :- RDF + S 20 kg/ha, T_3 :- RDF + S 30 kg/ha, T_4 :- RDF + B 1 kg/ha, T_5 :- RDF + B spray 0.2%, T_6 :- RDF + S 20 kg/ha + B 1 kg/ha, T_7 :- RDF + S 20 kg/ha + B spray 0.2%, T_8 :- RDF + S 30 kg/ha + B 1 kg/ha and T_9 :- RDF + S 30 kg/ha + B spray 0.2%.The gross and net plot size of each experimental unit was 4.8 m × 4.5 m and 3.6 m × 3.9 m respectively.Sowing was done by dibbling method on 06th August 2013 at a spacing of 60 cm × 30 cm. The recommended cultural practices and plant protection measures were undertaken. The recommended dose of fertilizer (90:45:45 NPK kg/ha) was applied, as per treatment half dose of nitrogen along with full dose of phosphorus, potassium and sulphur was applied as a basal dose and remaining half dose of nitrogen was applied at 30 days after sowing. Spraying of boron was done at ray floret stage. The crop was harvested on October 31, 2013. Application of RDF + S 30 kg ha^{-1} + B 1 kg ha^{-1}(T_8) recorded significantly higher growth, yield and quality contributing characters followed by application of RDF + S 20 kg ha^{-1}+ B 1 kg ha^{-1}(T_6), RDF + S 20 kg ha^{-1}+ B spray 0.2% (T_7) and RDF + S 30 kg ha^{-1}+ B spray 0.2% (T_9).*

Key word: sunflower, sulphur, boron, growth, economics

INTRODUCTION

Sunflower (*Helianthus annuus* L.) belongs to family compositae originated in Mexico and Peru, introduced into India in the 16th century. Sunflower is one of the most important oilseed crops; its oil is considered as premium because of its high polyunsaturated fatty acid (PUFA) content with high level of linoleic acid and absence of linolenic acid. Sunflower oil is a rich source (64%) of linoleic acid which helps in washing out cholesterol deposition in the coronary arteries of the heart and thus good for heart patients. The oil is used for culinary purposes, in the preparation of vanaspati and in the manufacture of paints, soaps and cosmetics. The oil cake contains 40-44% high quality protein. It is ideally suited for poultry and livestock rations. It can also be used for manufacturing baby foods. The sunflower kernels can be eaten raw or roasted.The importance of sunflower as an oilseed crop in India is of very recent origin and date backs to three decades. But its contribution towards attaining self-sufficiency in edible oil as well as to "yellow revolution" in the country is noteworthy (MangalaRai, 2002).

With the improvement of crop productivity through the adoption of high-yielding varieties and multiple cropping systems, fertilizer use has become more and more important to increase crops yield and quality. Among nutrients, nitrogen plays an important role in growth and yield of sunflower (Khaliq and Cheema, 2005). Sunflower crop is a photo and thermo-insensitive crop. During monsoon season, loss of N is quite obvious hence its rational application at right stages of crop growth is desired for higher productivity. Effects of N fertilization on sunflower yield and quality have come under scientific scrutiny because N is a major nutrient for plants and it increases total biomass production, yield and its components. Phosphorus is necessary to increase oil content and potash helps to grain filling and disease resistant. The micronutrients play an important role in cell division, cell elongation and regulation of nutrients from one part to other part of the plant. Micronutrient malnutrition now afflicts over 40% of the world's population and is increasing particularly in many developing countries.

Sulphur is an essential plant nutrient for crop production. For oil crop producers, S fertilizer is especially important because oil crops require more S than cereal grains. The amount of S required to produce one ton of seed is about 3-4 kg S for cereals (range 1-6); 8 kg S for legume crops (range 5-13); and 12 kg S for oil crops (range 5-20). In general, oil crops require about the same amount of S as, or more than, phosphorus for high yield and product quality (Jamal *et al*., 2010). Sulphur is best known for its role in the synthesis of proteins, oils, and vitamins. It performs many physiological functions like synthesis of cystein, methionine, chlorophyll and oil content of oilseed crops. It also responsible for synthesis of certain vitamins (B, biotin, thiamine), metabolism of carbohydrates, proteins and oil formation of flavored compounds. Sulphur application has many advantages for sunflower regarding growth parameters; yield and quality. Sulphur fertilization improves both the quantity and quality of oilseeds.

Boron is an essential micronutrient for plants. Boron has found a wider use for agronomic and horticultural crops. The most important functions of boron in plants are thought to be its structural role in cell wall development and stimulation or inhibition of specific metabolism pathways (Ahmad *et al*., 2009). Sunflower has been found to be particularly sensitive to boron deficiency and is sometimes used as an indicator for assessing available boron in soils.

Boron is an essential element for sunflower, playing many important roles like flowering, pollen germination, fruiting processes and seed setting. Boron has positive effect on seed yield and oil quality of sunflower. Boron also plays a vital role in cell wall synthesis, root elongation, glucose metabolism, nucleic acid synthesis, lignifications and tissue differentiation. Boron regulates photosynthesis and respiration by maintaining carbohydrates and protein metabolism. Boron deficiency symptoms usually appear on leaves, stems, and reproductive parts eventually manifesting as stem corkiness, deformed capitulum, poor seed set and lower seed yield.

MATERIAL AND METHOD

A field experiment was conducted during *kharif*, 2013 at Farms, Oilseeds Research Station, Latur. Geographically Latur is situated between 18°05' to 18°75' North latitude and between 76°25' to 77°25' East longitude. To study studies on growth, yield and economics of sunflower as influenced by sulphur and boron nutrition under rainfed condition with view to study the response of sunflower to different sulphur and boron fertilizer treatments.

The experimental field was leveled and well drained. The soil was clayey in texture, low in nitrogen, medium in phosphorus and neutral in reaction. The environmental conditions prevailed during experimental period were favorable for normal growth and development of sunflower crop.

The experiment was laid out in a randomized block design with nine treatment combinations. Each experimental unit was replicated three times. The treatments are T_1 :- RDF, T_2 :- RDF + S 20 kg/ha, T_3 :- RDF + S 30 kg/ha, T_4 :- RDF + B 1 kg/ha, T_5 :- RDF + B spray 0.2%, T_6 :- RDF + S 20 kg/ha + B 1 kg/ha, T_7 :- RDF + S 20 kg/ha + B spray 0.2%, T_8 :- RDF + S 30 kg/ha + B 1 kg/ha and T_9 :- RDF + S 30 kg/ha + B spray 0.2%.

The gross and net plot size of each experimental unit was 4.8 m × 4.5 m and 3.6 m × 3.9 m respectively. Sowing was done by dibbling method on 06th August 2013 at a spacing of 60 cm × 30 cm. The recommended cultural practices and plant protection measures were undertaken. The recommended dose of fertilizer (90:45:45 NPK kg/ha) was applied, as per treatment half dose of nitrogen along with full dose of phosphorus, potassium and sulphur was applied as a basal dose and remaining half dose of nitrogen was applied at 30 days after sowing. Spraying of boron was done at ray floret stage. The crop was harvested on October 31, 2013.

The biometric observations were recorded at various stages of crop growth on different characteristics viz., plant height, number of functional leaves, stem girth and head diameter on five plants selected from each net plot. The leaf area and dry matter were recorded on one plant samples which uprooted for dry matter studies from each gross plot.

Post harvest studies include number of filled seed per plant, number of unfilled seed per plant and weight of seed per plant were recorded on five plants samples from each net plot at the time of harvest. The seed index (g), total seed yield kg/ha, straw yield kg/ha, biological yield kg/ha and harvest index (%) were also calculated.

RESULT AND DISCUSSION

1. **Growth and development**

Data in table 1 revealed that the beneficial effect of treatments T_8 recorded maximum growth attributes *viz*., plant height (184.89 cm), number of functional leaves (23.43), leaf area (635 dm^2), stem girth (7.69 cm), head diameter (16.35) and total dry matter (145.62 g day^{-1}) which was significantly superior overas compared to other treatments, but it was found to be at par with the application of RDF + S 20 kg/ha + B 1 kg/ha (T_6) and RDF + S 30 kg/ha + B spray 0.2% (T_9).The increase in growth attributes may be due to better uptake and translocation of plant nutrients to growing plants, adequate supply of sulphur resulted in higher production of photosynthate and their translocation to sink, which ultimately increased the plant growth and growth attributes. Similar kind of results was reported by Satish Kumar *et al*., (2011) and at all the crop growth stages. It may be due to better utilization of available resources at combination of sulphur and boron application which resulted in more photosynthesis and hence more dry matter was produced. Similar kind of results were reported by Sreemannarayana*et al*., (1994) and Intodia and Tomar (1997).

2. Yield and yield attributes

The yield attributing characters of sunflower *viz*. number of filled seeds, seed yield per plant, test weight were influenced significantly due to different sulphur and boron fertilizer treatments. The mean number of filled seeds per plant was 477, seed yield per plant was 22.30 g and seed index (g) was 5.12 g. Application of nutrient as per RDF + S 30 kg/ha + B 1 kg/ha (T_8) recorded maximum number of filled seeds per plant (544) followed by the treatment RDF + S 20 kg/ha + B 1 kg/ha (T_6). While, the lowest number of filled seeds per plant (433) were recorded with treatment T_1 i.e. RDF. It might be due to overall improvement in crop growth which empowered the plant to manufacture more quantity of photosynthate accumulating them in sink.Similar kinds of results were reported by Renukadevi*et al*., (2003) and Patil*et al*., (2006).

Seed yield1180 kg/ha, stalk yield, biological yield and harvest index (28.82) of sunflower was influenced significantly due to different sulphur and boron fertilizer treatments. These parameters were appreciably improved due to application of RDF + S 30 kg/ha + B 1 kg/ha (T_8) over other fertilizer treatment. It might be due to beneficial effect of balanced fertilizer application (N, P and K along with sulphur and boron). These finding were in confirmative with those reported by Harkal*et al.*, (1993) and Tamak*et al.*, (1997).

REFERENCE

Ahmad, W., A. Niaz, S. Kanwal, M. K. Rahmatullah, and M. K. Rasheed (2009).Role of Boron in Plant Growth: A Review. *Journal of Agric. Res.***47** (3).

Geetha, K. N., Y. G. Shadakshari, K. Karuna, K. S. Jagdish, K. T. Puttarangaswamy and S. B. Yognanda (2010). Effect of sulphur sources and levels on the productivity of sunflower (*Helianthus annuus*L.). *Journal of Oilseeds Res*. **27** (1): 60-61.

Harkal, S. R., B. G. Karle, A. S. Dhavan and V. N. Karad (1993). Response of sunflower to levels of nitrogen and sulphur in vertisols. *Journal of Maharashtra Agri.Univ.***18** (2): 320-321.

Intodia, S. K. and O. P. Tomar (1997). Effect of sulphur application on growth and yield of sunflower (*Helianthus annuus* L.). *Indian Journal of Agricultural Sciences*. **67** (1): 46-47.

Jamal Arshad, Yong-Sun Moon and Malik ZainulAbdin (2010). Sulphur -a general overview and interaction with nitrogen. *Australian Journal of Crop Science*. **4** (7): 523-529.

Khaliq, A. and Z. A. Cheema (2005). Influence of irrigation and nitrogen management on some agronomic traits and yield of hybrid sunflower (*Helianthus annuus*L.). *International Journal of Agri. and Bio.***7** (6): 915-919.

MangalaRai (2002). Oilseeds in India. *Andhra Pradesh Agric. Reg. Res. J.*, pp.13-15.

Patil, S. B., B. S. Vyakaranahal, V. K. Deshpande and M. Shekhargouda (2006). Effect of boron and zinc application on seed yield and quality of sunflower restorer line, RHA-857. *Karnataka Journal of Agric. Sci.***19** (3): 708-710.

Renukadevi, A., P. Savithri and K. Andi (2003). Sources, levels and methods of micronutrients application on the dry matter production, yield attributes and yields of sunflower (*Helianthus annuus*L.)crop.*Crop Research Hisar.* **25** (3): 436-440.

Satish Kumar and R. Singh (2011). Economics of sunflower (*Helianthus annuus*L.) as influenced by phosphorus and sulphur. *Agron. Digest***6** and **7**: 35.

Sreemannarayana, B., A. S. Raju and V. Satyanarayana (1994). Effect of sulphur on yield and quality of sunflower. *Journal of Maha.Agric.Univ.***20** (1): 63-65.

Tamak, J. C., H.C. Sharma and K.P. Singh (1997). Effect of phosphorus, sulphur and boron on seed yield and quality of sunflower (*Helianthus annuus*L.). *Indian Journal of Agron.***42** (1):173-176.

Table 1: Effect of different treatment on growth and growth attributes character of soybean

Treatment	Plant height (cm)	Number of Functional leave	Leaf area (dm^2)	Stem girth (cm)	Dry matter (g day^{-1})	Head diameter (cm) $plant^{-1}$
T_1 - RDF	163.08	17.90	474	6.50	100.92	13.81
T_2 - RDF + S 20 kg/ha	175.80	19.90	562	6.97	115.65	15.04
T_3 - RDF + S 30 kg/ha	174.48	21.10	582	7.08	123.96	15.21
T_4 - RDF + B 1 kg/ha	169.32	19.08	539	6.86	113.32	14.26
T_5- RDF + B spray 0.2%	167.48	18.33	514	6.64	109.09	13.98
T_6 - RDF + S 20 kg/ha + B 1 kg/ha	182.32	22.28	604	7.39	140.02	15.83
T_7 - RDF + S 20 kg/ha + B spray 0.2%	179.07	21.07	562	7.18	136.96	15.54
T_8 - RDF + S 30 kg/ha + B 1 kg/ha	184.89	23.43	635	7.69	145.62	16.35
T_9 - RDF + S 30 kg/ha + B spray 0.2%	180.63	21.57	580	7.18	137.79	15.78
S.Em$\pm$	3.195	0.76	25	0.22	3.01	0.30
C.D. at 5 %	9.578	2.26	74	0.65	9.03	0.91
Mean	**175.23**	**20.52**	**561**	**7.05**	**124.82**	**15.09**

Treatment	**No. of filled seeds per plant**	**No. of unfilled seeds per plant**	**Seed yield $plant^{-1}$ (g)**	**Seed index (g)**	**Seed yield (kg/ha)**	**Stalk yield (kg/ha)**	**Biological yield (kg/ha)**	**Harvest Index (%)**
T_1 - RDF	433	172	19.69	4.93	1035	2928	3964	26.12
T_2 - RDF + S 20 kg/ha	457	162	20.81	5.06	1073	2841	3914	27.49
T_3 - RDF + S 30 kg/ha	455	155	21.30	5.15	1125	2997	4122	27.30
T_4 - RDF + B 1 kg/ha	440	139	20.44	5.03	1077	2933	4011	26.91
T_5- RDF + B spray 0.2%	437	135	20.27	5.01	1052	2936	3989	26.42
T_6 - RDF + S 20 kg/ha + B 1 kg/ha	521	144	24.71	5.20	1328	3397	4724	28.13
T_7 - RDF + S 20 kg/ha + B spray 0.2%	498	128	23.34	5.18	1251	3291	4542	27.62
T_8 - RDF + S 30 kg/ha + B 1 kg/ha	544	139	26.34	5.37	1377	3402	4779	28.82
T_9 - RDF + S 30 kg/ha + B spray 0.2%	506	126	23.76	5.14	1303	3366	4670	27.93
S.Em$\pm$	16	6	1.06	0.07	52	171	220	--
C.D. at 5 %	47	19	3.18	0.22	156	NS	660	--
Mean	**477**	**144**	**22.30**	**5.12**	**1180**	**3121**	**4301**	**27.42**