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SULPHUR AND BORON NUTRITION: IMPACT ON SUNFLOWER GROWTH, DEVELOPMENT AND PRODUCTIVITY

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ABSTRACT

The field investigation entitled "Effect of sulphur and boron nutrition on performances of growth and yield of Sunflower (*Helianthus annuus* L.)" under rainfed condition was conducted at, Agricultural Research Station. 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 2023 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. Application of RDF + S 30 kg ha^{-1} + B 1 kg ha^{-1}(T_8)recorded significantly higher yield and quality

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 $kgha^{-1}$+ B spray 0.2% (T_9).

KEYWORD: Sunflower, Sulphur, Boron, Yield, Quality.

INTRODUCTION

Sunflower (*Helianthus annuus* L.) belongs to family Asteraceae 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.[4]

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. Sunflower crop is a photo and thermo-insensitive crop.[3] 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 analysis 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. 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.[1] 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

To study studies on growth, yield and yield attributes of sunflower as influenced by sulphur and boron nutrition under rain fed 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, and 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 2023 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, 2023.

RESULT AND DISCUSSION

Yield

Effect of different sulphur and boron fertilizer levels on seed yield was found to be significant. The highest seed yield (1180 kg ha^{-1}) was recorded with the application of nutrients as per RDF + S 30 kg/ha + B 1 kg/ha (T_8) which was at par with treatment RDF + S 20 kg/ha + B 1 kg/ha (T_6), RDF + S 20 kg/ha + B spray 0.2% (T_7) and RDF + S 30 kg/ha + B spray 0.2% (T_9) in that descending order. 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. Lowest seed yield of sunflower was recorded with application of only recommended dose of fertilizer in treatment T_1 i.e. (1035 kg ha^{-1}). Application of treatment RDF + S 30 kg/ha + B 1 kg/ha (T_8) observed the highest stalk yield whereas, application of treatment RDF + S 20 kg/ha (T_2) recorded the lowest stalk yield. Biological yield was significantly influenced by different sulphur and boron treatments. Application of treatment RDF + S 30 kg/ha + B 1 kg/ha (T_8) produced highest biological yield which was at par with treatmentRDF + S 30 kg/ha(T_3), RDF + S 20 kg/ha + B 1 kg/ha (T_6),RDF + S 20 kg/ha + B spray 0.2% (T_7) and RDF + S 30 kg/ha + B spray 0.2% (T_9) and was found significantly superior over the rest of the treatments.

Oil content and oil yield

As the oil yield is the function of seed yield and oil content in seed (30.42 %), the maximum oil yield (419 kg/ha) was recorded with the application of treatment RDF + S 30 kg/ha + B 1 kg/ha (T_8).[5,6] These results are in confirmative with the findings of. Lowest amount oil content and oil yield was recorded in treatment T_1 where only recommended dose of fertilizer was given to crop.

Table 1: Effect of Different Treatment on Yield and Oil Content Character of Sunflower.

Treatment	Seed yield (kg/ha)	Stalk yield (kg/ha)	Biological yield (kg/ha)	Oil content (%)	Oil yield (kg/ha)
T_1 - RDF	1035	2928	3964	27.33	289
T_2 - RDF + S 20 kg/ha	1073	2841	3914	28.89	310
T_3 - RDF + S 30 kg/ha	1125	2997	4122	29.06	327
T_4 - RDF + B 1 kg/ha	1077	2933	4011	27.85	300
T_5- RDF + B spray 0.2%	1052	2936	3989	26.90	283
T_6 - RDF + S 20 kg/ha + B 1 kg/ha	1328	3397	4724	28.99	385
T_7 - RDF + S 20 kg/ha + B spray 0.2%	1251	3291	4542	28.96	362
T_8 - RDF + S 30 kg/ha + B 1 kg/ha	1377	3402	4779	30.42	419
T_9 - RDF + S 30 kg/ha + B spray 0.2%	1303	3366	4670	30.08	392
S.Em±	52	171	220	0.004	15
C.D. at 5 %	156	NS	660	NS	44
Mean	**1180**	**3121**	**4301**	28.72	340.77

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