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Effect of foliar application of chelated micronutrients on yield and quality of rabi sunflower (*Helianthus annuus* L.)

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ABSTRACT

An investigation entitled “Effect of foliar application of chelated micronutrients on growth, yield and quality of rabi sunflower (*Helianthus annuus* L.)” was carried out during rabi 2023-24 to 2025-26 at Oilseeds Research Centre, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola to study the effect of chelated micronutrients on yield and quality of sunflower. The experiment was framed with seven treatments viz., T1-Absolute control, T2- GRDF 80:60:30 NPK kg ha⁻¹ (P supplied through SSP) + 5-ton FYM/ha, T3- GRDF + foliar application of chelated micronutrients mixture 0.25 % at 35 & 55 DAS, T4 - GRDF + Foliar application of Zn EDTA @ 0.25 % at 35 & 55 DAS, T5 - GRDF + foliar application of Fe EDTA @ 0.25 % at 35 & 55 DAS, T6- GRDF + FA of Zn EDTA + Fe EDTA @ 0.25 % at 35 & 55 DAS and T7 - GRDF + foliar application of Zn EDTA + Fe EDTA @ 0.25 % + FA of 0.2% Boron at 35 and 55 DAS replicated thrice using randomized block design. The result indicated that, the growth, yield, quality and nutrient uptake of nutrients in sunflower significantly influenced by different treatments. The Application of GRDF (RDF 80:60:30 NPK kg ha⁻¹ + 5-ton FYM/ha) + foliar application of Zn EDTA + Fe EDTA @ 0.25 % + FA of 0.2% Boron at 35 and 55 DAS recorded significantly highest growth, seed and straw yield, oil and protein of sunflower. However, the significantly highest NPK, Zn, Fe and Bo uptake was also recorded in treatment GRDF + FA of Zn EDTA + Fe EDTA @ 0.25 % + FA of 0.2% Boron at 35 and 55 DAS.

Keywords: Sunflower (*Helianthus annuus* L.), Chelated micronutrients, GRDF, Zn & Fe EDTA

Introduction

Sunflower (*Helianthus annuus* L) is the important edible oilseed crop in importance after Soybean, Groundnut, Rapeseed and Mustard at the National and International level. It is cultivated in an area of 2.25 lakh ha with a production of about 2.70 lakh tonnes and productivity of 1201 kg ha⁻¹, which is lower than the world average of 1808 kg ha⁻¹ (Anonymous, 2025) [1], indicating wide scope for improving the yield potential. He has been proved as a highly promising crop under different agroclimatic zones of India because of thermo-sensitivity and high production potential. The application of micronutrients has positive effects on the growth of sunflowers, including plant height, number of leaves and dry matter production per plant (Siddiqui *et al.*, 2009) [2]. The application of micronutrient fertilizers in the cultivation zone may not reached the crop requirement for root growth and nutrient use. The use of micronutrients plays a crucial role in enhancing the percentage of seed setting and influencing the growth and yield of sunflower (Kumbhar *et al.*, 2017) [3]. Foliar application is the spraying of fertilizer solutions containing one or more nutrients on the foliage of growing plants. Several nutrients' elements are readily absorbed by leaves when they are dissolved in water and sprayed on them. Chelated micronutrients are essential metallic plant nutrients (Iron, Zinc, Copper and Manganese) bounded by an organic compound to protect them from soil interactions that rendered them unavailable. Though, these nutrients are required in low quantity, their deficiencies are responsible for low quality and low productivity of sunflower. Raghu *et al.*, 2017 [4] reported that nitrogen uptake by sunflower significantly improved with soil and foliar application of micronutrients along with RDF. In the present study, the efficacy of chelated micronutrients like Zn, Fe and Boron is evaluated.

Materials and Methods

A field experiment was conducted at the Oilseeds Research Centre, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola during rabi season from 2023-24 to 2025-26 to study the effect of chelated micronutrients on yield and quality of sunflower. This experiment was laid out in Randomized Block Design with three replications. The experiment was framed with seven treatments viz., T1-Absolute control, T2- GRDF 80:60:30 NPK kg ha⁻¹ (P supplied through SSP) + 5-ton FYM/ha, T3- GRDF + foliar application of chelated micronutrients mixture 0.25 % at 35 & 55 DAS, T4 - GRDF + Foliar application of Zn EDTA @ 0.25 % at 35 & 55 DAS, T5 - GRDF + foliar application of Fe EDTA @ 0.25 % at 35 & 55 DAS, T6- GRDF + FA of

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Zn EDTA + Fe EDTA @ 0.25 % at 35 & 55 DAS and T₇ - GRDF + foliar application of Zn EDTA + Fe EDTA @ 0.25 % + FA of 0.2% Boron at 35 and 55 DAS were laid out in plots of 5.4 m x 4.5 m. The experimental field was neutral in reaction (pH 7.70), Non saline (0.19 dSm⁻¹), low in organic carbon (4.59 g kg⁻¹), low in available N (210 kg ha⁻¹), medium in available (15.4 kg ha⁻¹), high in available K (387.6 kg ha⁻¹). Among the micronutrients Zinc (0.38 mg kg⁻¹), Iron (4.60 mg kg⁻¹) and Boron (0.39 mg kg⁻¹) are in deficient range. The recommended dose of fertilizer was 80:60:30 kg NPK ha⁻¹. Sunflower variety PDKVSH-964 was used for the study. After land preparation, the sunflower seed was sown at 60 x 30 cm. The desired plant population was maintained uniformly by thinning as well as by gap filling. Five plants were randomly selected by moving diagonally in the net plot for growth and yield attributes. Yield was recorded at harvest. Economics was worked out on the basis of yield, cost of inputs and selling prices of crops at that time. Pre sowing, post-harvest soil samples and micronutrients contents and quality parameters were analysed from Department of Soil Science and Agril. Chemistry, Dr. PDKV, Akola. Plant biometric observation and plant nutrient status at harvest was taken. The yield was recorded and expressed in kg ha⁻¹. Nitrogen percentage in seed of sunflower was estimated by micro-kjeldahal method (Piper, 1966) [5]. The protein percentage of seed was estimated by multiplying nitrogen percentage by 6.25. The oil content in seed was estimated by Soxhlet method (Chapman *et al.*, 1961) [6]. Analytical data of yield sample and computed data were subjected to statistical scrutiny as per the procedures given by Gomez *et al.* (1984) [7]. The treatment differences were worked out at five per cent probability level.

Results and Discussion

At the experimental site, this experiment was conducted in rabi season at Akola location with three consecutive years. The summarized results are presented below.

Seed yield

The data in respect of seed yield of individual year and pooled sunflower as influenced by foliar spray of chelated micronutrients in presented in table 1. It was evident from the data that, the application of RDF with 5 tons FYM + foliar application of Zn EDTA + Fe EDTA @ 0.25 % + FA of 0.2% Boron at 35 and 55 DAS (T₇) recorded significantly highest seed yield (2141 kg ha⁻¹) followed by treatment T₆ (1887 kg ha⁻¹). It was found due to the combine effect of GRDF and spraying chelated micronutrients Zn, Fe and Bo at 35 and 55 DAS as a synergistic effect. As regards to straw yield same trends are found. The Narayana Rao *et al.* (2020) [8] reported that seed yield of sunflower influenced by the foliar application of micronutrients. The Shete SA *et al.* (2020) reported that application of micronutrients through foliar spray was found more beneficial than the soil application for oilseed crops. Padma *et al.*, (2001) [9] concluded that, foliar spray of boron at 0.2% at ray floret stage in sunflower has recorded significantly higher seed set (84.2%), total number of seed per head (901), test weight (6.00g), seed yield (11.6 q ha⁻¹) as compared to control. Nzan Lotha *et al.* (2021) [10] reported that application of NPK +B (0.3%) +Zn @ (0.5%) will improve growth and yield of sunflower.

Stalk yield

The data in respect of stalk yield of sunflower as influenced by foliar spray of chelated micronutrients in presented in table 1. The significantly highest stalk yield of sunflower (4091 kg ha⁻¹) was observed with the application of RDF with 5 tons FYM + foliar application of Zn EDTA + Fe EDTA @ 0.25 % + FA of 0.2% Boron at 35 and 55

DAS (T₇) followed by treatment T₆ (3689 kg ha⁻¹). Micronutrients involved in increased auxin biosynthesis, IAA production and protein synthesis, which helps in promoting vegetative growth and ultimately the stalk yield. These results are in harmony with the research results of Swetha *et al.* (2020), Kumbhar *et al.* (2017) [3] and Narayana Rao *et al.* (2020) [8] reported that, the highest stalk yield of sunflower recorded in treatment with the foliar application of micronutrients.

Yield contributing characters

The data regarding the head diameter, number of seeds per head, 100 seed weight and volume weight are presented in table 2. From the results, it is revealed that, the highest head diameter, number of seeds per head, 100 seed weight and volume weight were recorded by the treatment RDF with 5 tons FYM + foliar application of Zn EDTA + Fe EDTA @ 0.25 % + FA of 0.2% Boron at 35 and 55 DAS (T₇) resulting highest head diameter (19.5 cm), No. of seed per head (1138), hundred seed weight (6.38 gm) and volume weight (40.1 gm). The foliar application of micronutrients particularly Boron (B), Zinc (Zn) and Iron (Fe) directly increases sunflower yield by improving seed setting, preventing chaffy seed and maximizing test weight. The Navale PS *et al.* (2025) [11] reported that, the highest number of filled seeds (888), seed yield⁻¹ (48.1g) and other attributes. He reported that, Boron aids in the transport of sugars and carbohydrates from source (leaves) to sink (developing seed). While zinc enhances the chlorophyll synthesis, improving photosynthesis and energy supply for seed filling. Zinc and boron synergistically improve reproductive success, nutrient flow and metabolic function leading to significant increase in the number of filled seeds per plant in sunflower. These finding were in agreement with the conclusions of Hakale (2014) [12].

Quality parameters

The data regarding protein content, protein yield, oil content and oil yield are presented in table 3 and 4. From the data, it is revealed that, the highest protein content (18.6%), protein yield (399 kg ha⁻¹), oil content (38.0%) and oil yield (768 kg ha⁻¹) are recorded by the treatment application of RDF with 5 tons FYM + foliar application of Zn EDTA + Fe EDTA @ 0.25 % + FA of 0.2% Boron at 35 and 55 DAS (T₇). However, it was found at par with treatment T₅ and T₆. Micronutrients help in synthesis of amino acid, nitrogen metabolism, enzyme activation which is vital for protein formation in plants. This confirms the findings of Narayan Rao *et al.* (2020) [8] reported that protein content was influenced by foliar application of micronutrients. The significantly lowest protein content (16.4%) was reported in absolute control. Oil yield improve due to sufficient nutrient supply ultimately nutrients involved in the formation of glycosides and activation of enzyme which aids to biochemical reaction in plant. Similar findings reported by Kumbhar *et al.*, 2017 [3] showed that oil content of sunflower significantly improved with the soil and foliar application of micronutrients along with RDF. The significantly lowest oil content (30.4%) and oil yield (242 kg ha⁻¹) by absolute control (T₁)

It may be concluded that, application of GRDF (RDF 80:60:30 NPK kg ha⁻¹ (P supplied through SSP) + 5-ton FYM/ha) + foliar application of Zn EDTA + Fe EDTA @ 0.25 % + FA of 0.2% Boron at 35 and 55 DAS recorded significantly highest seed and straw yield and all yield contributing characters of sunflower. The significantly highest protein content and yield and oil content and oil yield was recorded with treatment GRDF + FA of Zn EDTA + Fe EDTA @ 0.25 % + FA of 0.2% Boron at 35 and 55 DAS. Hence, for obtaining higher yield and quality up-gradation the, application of GRDF (80:60:30 NPK kg/ha + 5 tons FYM) with foliar application of Zinc EDTA 0.25 % (1.25 kg/ha), Fe EDTA 0.25% (1.25 kg/ha) along with 0.2 % Boron (1.00 kg/ha) respectively at 35 and 55 DAS is recommended.

Table 1. Grain yield, Straw yield of individual years and pooled (kg ha^{-1}) as influenced by different treatments (2023-24 - 2025-26)

Treatments	Seed yield (kg ha^{-1})				Stalk yield (Kg ha^{-1})			
	2023-24	2024-25	2025-26	Pooled	2023-24	2024-25	2025-26	Pooled
T ₁ : Absolute control	909	712	692	771	2201	1791	1475	1822
T ₂ : RDF 80:60:30 NPK kg ha^{-1} (P supplied through SSP) + 5 ton FYM/ha	1730	1712	1536	1659	3787	3006	2890	3227
T ₃ : T ₂ + FA of chelated micronutrients mixture 0.25 % at 35 & 55 DAS	1934	1910	1760	1868	4075	3398	3398	3624
T ₄ : T ₂ + FA of Zn EDTA @ 0.25 % at 35 & 55 DAS	1868	1825	1799	1831	4154	3283	3527	3654
T ₅ : T ₂ + FA of Fe EDTA @ 0.25 % at 35 & 55 DAS	1794	1756	1854	1801	4009	3073	3704	3595
T ₆ : T ₂ + FA of Zn EDTA + Fe EDTA @ 0.25 % at 35 & 55 DAS	1993	1805	1862	1887	4147	3114	3805	3689
T ₇ : T ₂ + FA of Zn EDTA + Fe EDTA @ 0.25 % + FA of 0.2% Boron at 35 and 55 DAS	2087	2132	2205	2141	4511	3643	4119	4091
SE $\pm$	88	96	70	45	166	130	130	94
CD ($p = 005$)	271	296	215	139	512	400	401	288
CV (%)	8.67	9.83	7.22	7.71	7.49	7.4	6.89	6.94

Table 2. Yield contributing characters of sunflower as influenced by different treatments of chelated micronutrients (Pooled 2023-24 to 2025-26)

Treatments	2023-24				2024-25				2025-26			
	Head Diameter (cm)	No of seed/head	100 seed weight (g)	Volume weight (g)	Head Diameter (cm)	No of seed/head	100 seed weight (g)	Volume weight (g)	Head Diameter (cm)	No of seed/head	100 seed weight (g)	Volume weight (g)
T ₁	9.73	369	3.92	29.77	9.3	389	4.02	28.93	9.7	379	4.52	26.7
T ₂	15.90	599	4.97	33.03	16.4	814	5.40	34.70	16.6	829	5.97	34.2
T ₃	18.00	724	5.47	37.10	18.1	1045	6.30	39.90	17.3	951	6.40	36.7
T ₄	16.93	739	5.13	35.47	16.7	950	6.17	36.20	17.8	996	6.47	35.7
T ₅	16.43	752	5.08	36.00	16.6	869	5.48	36.43	17.4	957	6.17	37.2
T ₆	17.00	799	5.07	36.83	17.0	927	6.03	37.13	18.8	1068	6.27	36.7
T ₇	18.83	970	5.67	37.93	18.8	1142	6.57	41.77	21.0	1301	6.90	40.6
SE±	0.85	44.2	0.27	1.39	0.69	43.4	0.27	1.48	0.77	43.3	0.25	1.46
CD (<i>p</i> = 005)	2.63	136.1	0.84	4.29	2.11	133.6	0.84	4.55	2.37	133.4	0.77	4.50
CV (%)	9.18	13.9	9.33	7.86	7.37	8.6	8.26	7.02	7.88	8.1	7.06	7.15

Table 3. Protein content (%) and Protein yield of sunflower as affected by different treatments of chelated micronutrients (Pooled 2023-24 to 2025-26)

Treatments	Protein content (%)				Protein yield (Kg/ka)			
	2023-24	2024-25	2025-26	Pooled	2023-24	2024-25	2025-26	Pooled
T ₁ : Absolute control	16.3	16.5	16.4	16.4	148	118	112	126
T ₂ : RDF 80:60:30 NPK kg ha ⁻¹ (P supplied through SSP) + 5 ton FYM/ha	17.5	17.9	17.6	17.7	321	306	268	298
T ₃ : T2 + FA of chelated micronutrients mixture 0.25 % at 35 & 55 DAS	17.7	17.8	17.8	17.8	343	339	312	331
T ₄ : T2 + FA of Zn EDTA @ 0.25 % at 35 & 55 DAS	17.8	16.7	17.9	17.5	345	224	323	297
T ₅ : T2 + FA of Fe EDTA @ 0.25 % at 35 & 55 DAS	19.1	18.3	19.1	18.8	324	322	355	334
T ₆ : T2 + FA of Zn EDTA + Fe EDTA @ 0.25 % at 35 & 55 DAS	18.9	17.9	18.4	18.4	375	323	342	347
T ₇ : T2 + FA of Zn EDTA + Fe EDTA @ 0.25 % + FA of 0.2% Boron at 35 and 55 DAS	19.0	18.1	18.8	18.6	398	386	414	399
SE±	0.52	2.06	0.5	0.2	15.4	14.5	14.2	16.3
CD (<i>p</i> = 005)	1.60	NS	NS	0.6	47.6	44.4	43.9	50.3

Table 4. Oil content (%) and Oil yield of sunflower as affected by different treatments of chelated micronutrients (Pooled 2023-24 to 2025-26)

Treatments	Oil content (%)				Oil yield (Kg/ka)			
	2023 -24	2024 -25	2025- 26	Pooled	2023 -24	2024 -25	2025- 26	Pooled
T ₁ : Absolute control	30.3	30.7	30.2	30.4	274	244	209	242
T ₂ : RDF 80:60:30 NPK kg ha ⁻¹ (P supplied through SSP) + 5 ton FYM/ha	34.7	35.0	36.1	35.3	634	610	554	599
T ₃ : T ₂ + FA of chelated micronutrients mixture 0.25 % at 35 & 55 DAS	36.2	36.4	37.9	36.8	700	631	667	666
T ₄ : T ₂ + FA of Zn EDTA @ 0.25 % at 35 & 55 DAS	35.2	36.1	36.5	35.9	644	671	656	657
T ₅ : T ₂ + FA of Fe EDTA @ 0.25 % at 35 & 55 DAS	36.0	36.1	35.7	35.9	653	615	662	643
T ₆ : T ₂ + FA of Zn EDTA + Fe EDTA @ 0.25 % at 35 & 55 DAS	35.8	36.4	37.5	36.6	661	672	717	683
T ₇ : T ₂ + FA of Zn EDTA + Fe EDTA @ 0.25 % + FA of 0.2% Boron at 35 and 55 DAS	36.8	37.6	39.6	38.0	761	716	826	768
SE±	0.7	1.24	1.6	0.3	40.9	28.6	28	20.5
CD (<i>p</i> = 005)	2.1	3.81	4.9	1.1	126	88.1	87	63.2

References

- Anonymous. 3rd advance estimates, Indian Agristat, New Delhi, India : Ministry of Agriculture. 2025.
- Siddiqui MH, Oad FC, Abbasi MK, Gandahi AW. Zinc and Boron fertility to optimize physiological parameters, nutrient uptake and seed yield of sunflower. *Sarhad J Agric.* 2009;25(1):53-57.
- Kumbhar CS, Indulkar BS, Jadhav SM. Effect of micronutrients application on uptake, yield and quality of sunflower (*Helianthus annuus* L.). *Prog Res An Int J.* 2017;12(3):286-290.
- Raghu MS, Manjunatha Chari K, Tuppad GB, Upperi SN. Effect of Secondary and micronutrients on growth, yield parameters and nutrient uptake of Sunflower (*Helianthus annuus* L.). *Int J Med Plants Res.* 2017;6(3):228-231.
- Piper CS. Soil and plant analysis. Bombay : Hans Publishers; 1966.
- Chapman HD, Pratt PF. Methods of analysis for soils, plants and waters. University of California, Los Angeles; 1961. p. 60-61, 150-179.
- Gomez KA, Gomez AA. Statistical procedures for agricultural research. 2nd Singapore: John Wiley and Sons; 1984.
- Narayana Rao K, Rajath E, Kumara K. Yield, quality parameters and economics of sunflower (*Helianthus annuus* L.) as influenced by micronutrients mixture foliar application. *INT j Curr Microbiol Appl Sci.* 2020;9(1):1999-2005.
- Padma B, Jagadeshwar K, Bharti M. Improvement of seed yield and quality through nutrient management in sunflower (*Helianthus annuus* L.). *Journal of Oilseeds Research.* 2001;18:48-50.
- Lotha N, Dawson J. Effect of micronutrients on growth and yield of sunflower (*Helianthus annuus* L.). variety DRSH-1. *The Pharma Innovations J.* 2021;10(11):1023-1026.
- Navale PS, Aglave BN, Kanawade SA, Patil BJ, Yewale RD. Effect of application of Micronutrients on yield attributes and economics of Sunflower (*Helianthus annuus* L.). *Plant Archives.* 2025;25(2):1160-1164.
- Hakale DP. Physiological studies as influenced by zinc and boron in Hybrid Sunflower (*Helianthus annuus* L.) LSFH 171(Master thesis). Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani; 2014.
- Swetha E, Karthikeyan A, Babu S, Dhanasekharan K. Investigation on the influence of soil and foliar nutrients on the growth characteristics and yield of hybrid sunflower. *Int J Res Agron.* 2024;7(2):413-415.

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