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EFFECT OF DIFFERENT SULPHUR SOURCES ON GROWTH AND GROWTH CHARACTERS OF SUNFLOWER *(HELIANTHUS ANNUUS* L.)

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Abstract

Field investigations were carried out during *kharif* season at Experimental farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar, to study the effect of different sulphur sources on growth and growth characters of Sunflower variety (Co_{-4}). The experiment was laid out in randomized block design and replicated thrice. The experiment consisted of nine treatments *viz.*, T_1- Control (No sulphur only NPK as DAP and MOP), T_2-20 kg sulphur ha^{-1} through Ammonium sulphate, T_3 -20kg Sulphur ha^{-1} through single Super phosphate, T_4- 20kg Sulphur ha^{-1} through Gypsum, T_5 -20kg Sulphur ha^{-1} through Elemental sulphur, T_6-40kg Sulphur ha^{-1} through Ammonium sulphate, T_7 -40kg sulphur ha^{-1} through Single super phosphate, T_8-40kg Sulphur ha^{-1} through Gypsum, T_9 -40kg Sulphur ha through Elemental sulphur. The results of the experiments revealed that application of 40 kg Sulphur ha through Ammonium sulphate (T_6) significantly influenced the growth attributes in sunflower. This treatment recorded higher values for growth attributes *viz.*, Plant height, LAI, and DMP. This was followed by T_7 (40kg sulphur ha^{-1} through Single super phosphate) in crops. The lowest values for growth attributes were recorded in T_1-Control (no sulphur only NPK as DAP and MOP).

Key words : Sulphur Sources, Growth of sunflower.

Introduction

The oilseeds finds an important part of human diet, besides it produces basic raw materials for agro-based industries, Indian vegetable oil economy is the fourth largest in the world, accounting for about 14.5 per cent of world's oil seeds area and 6.65 per cent of the production and plays the second important role in the agricultural economy, next only to food grains in terms of area and production. Oil seeds crops occupy an area 27.86 million hectares with 27.98 million tonnes of production registering a productivity level of 1004kg ha. This has been primarily due to phenomenal increase in human population and lower rate of productivity of these crops. Sunflower has large acreage covering 14.5 million ha in different agro-climatic zones of this country.

Sunflower (*Helianthus annuus* L.) holds great promise as an oil seed of its short duration, photo-in-sensitivity, and wide adaptability to different agro-climatic regions and soil types. Sunflower oil is a rich source of linoleic acid (64 per cent) which is good for heart patients. The oil is also used for manufacturing hydrogenated oil. It can be grown at any time of the year and can serve as an ideal catch crop during the period when the land is otherwise fallow. Sunflower best suits such conditions, with chances of area expansion and horizontal intensification for improving oil seed production in India. Sunflower can play an important role in meeting out the shortage of edible oils in the country. The total world production of sunflower seeds during 2012-2013 amounts to approximately 36.36 Million Tonnes. (40.29 Million Tonnes in 2011-2012). In India it covers 2.34 M.ha and provides 1.44 M.T. Total productions with 615 kg ha^{-1} as average productivity (Anonymous, 2007).

The total area and production of sunflower in Tamil Nadu during 2011-2012 was, around 20000 hectares and 30000 tonnes respectively and with a productivity of 1742 kg ha^{-1}. The existing yields is very low, mainly because of the sub optimal soil fertility. After N, P and K, S is the

fourth nutrient, whose deficiency is widespread in India (Yadav *et al*., 2000; Sakal *et al.*, 2001). Results from 12 Indian states co-operative study from TSI, FAI, and IFA in association with agronomists at national centres showed that an average 30 to 35 per cent of cropped soils were deficient in S and another 35 per cent potentially deficient in it, increasing widespread soil S hunger (Morris, 2006). Sulphur deficiency is observed primarily due to high crop yield and therefore higher rate of S removal by crops, and lesser use of S- containing fertilizers (Messick, 2003).

Sulphur application has many advantages for sunflower regarding growth parameters, yield and quality. Each unit of fertilizer sulphur generates 3-5 units of edible oil, a commodity needed by every family. Sulphur improves protein and oil percentage in seeds. Sulphur application also has marked effect on soil properties and is used as soil amendment to improve the availability of other nutrients in soil. It is essential for the growth and development of all crops. Sulphur ranks thirteenth in terms of abundance in earth's crust. Among the 16 essential elements, sulphur plays predominant role in improving the grain quality of sunflower crop. It also improves the use efficiency of nitrogen and phosphorus. 'S' application influences crop yields and also quality by increased synthesis of sulphur containing amino acids such as cystine and methionine.

Sulphur is increasingly being recognised as the fourth major plant nutrient after NPK. Crops in general, require as much sulphur as they need phosphorus. Sulphur highly influences the quality of many crops such as oil seeds, pulses and tubers. It helps in increasing the content of oil seeds and also improves the quality, colour and uniformity of crop. Sulphur deficiency maturity was observed in different states of India. In India, Eighty eight of four hundred odd districts were identified as sulphur deficient in varying degrees (Tandon, 1986). 'S' deficiency have been reported over 70 countries worldwide, of which India is one, Tamil Nadu is one of the agriculturally important states with very little data on soil sulphur status. It has been found that 80 per cent of the samples obtained from 15 bench mark clay soil in Cuddalore District were reported to be 'S' deficient (Balasubramanian *et al.*, 1990). The districts having proven or probable 'S' deficiencies are Coimbatore and Cuddalore.

Further, due to the crises in the availability of raw materials required for the production of fertilizers, shortage of fertilizers is also being faced by our country. The cost of production of major fertilizers has also gone high. Hence, it is felt worthwhile to try the response of this crop under moderate and economics levels of sulphur with different sulphur sources.

Materials and Methods

Field experiment was conducted at the Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, during *Kharif* to study the effect of different sources of sulphur on growth and growth attributes of sunflower variety cv. CO_4. The soil is clay loamy in texture with pH (8.1), EC 0.41 dsm^{-1}, low available Nitrogen (211.2 kg/ha), medium in available P_2O_5 (25.6 kg/ha), high in available K_2O (329.7 kg/ha). The crop was laid out in Randomized Block Design (RBD) with three replications and nine treatments include., T_1-Control (No sulphur only NPK as DAP and MOP), T_2-20kg Sulphur ha^{-1} through Ammonium sulphate, T_3-20kg Sulphur ha^{-1} through Single super phosphate, T_4-20kg Sulphur ha^{-1} through Gypsum, T_5-20kg Sulphur ha^{-1} through Elemental sulphur, T_6-40kg Sulphur ha^{-1} through Ammonium sulphate, T_7-40kg Sulphur ha^{-1} through Single super phosphate, T_8-40kg Sulphur ha^{-1} through Gypsum, T_9-40kg Sulphur ha^{-1} through Elemental sulphur.

Results and Discussion

Different sources of sulphur significantly enhance the growth and growth attributes of sunflower. Among them application of 40 kg Sulphur ha^{-1} through Ammonium sulphate (T_6) obtained highest plant height, (174.24 Cm), maximum leaf area index (5.07 Cm at Flowering), and increased DMP (5438.28 Kg ha^{-1}) table 1. This is due to Sulphur applied through Ammonium sulphate along with RDF which increases the availability of other nutrients and attained highest growth and growth attributes of sunflower.

This increased height may be due to improved availability of nutrient by Sulphur application. The increase in LAI and DMP may be due to better crop growth as evidenced by taller plants. The reason might be that the readily available Sulphur in Ammonium sulphate applied along with RDF was found to form suitable base for free living microbes whose activity is essential for the release of nutrients to higher plants growth characters. (Ress and Cairns, 1982). Similar findings were reported by Vetrimurugan (2002) and Menaka (2004).

This treatment was followed by application of 40kg Sulphur ha^{-1} through Single super phosphate (T_7). The lowest growth attributes was observed under T_1-(no sulphur). This is due to less availability of sulphur which reduced the availability of other nutrients and resulted in lesser plant growth characters.

Conclusion

Based on the above results, it may be concluded that

Table 1: Effect of different sulphur sources on growth attributes of sunflower.

Treatments	Plant height (cm)			Leaf area index (LAI)			Dry matter production (DMP) kg ha^{-1}			Seed Yield (Kg ha^{-1})
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	
T_1	29.54	80.02	107.29	1.37	3.64	3.51	531.40	2720.55	4119.43	933
T_2	56.41	119.9	140.64	1.87	4.34	4.18	663.33	3145.30	4777.48	1366
T_3	47.85	106.96	129.99	1.72	4.14	3.98	627.38	303.67	4608.05	1256
T_4	37.64	92.88	117.87	1.52	3.48	3.68	566.23	2830.16	4288.93	1049
T_5	46.33	105.27	128.23	1.57	4.04	3.88	600.86	2940.81	4456.52	1161
T_6	82.18	159.23	174.24	2.42	5.07	4.90	798.45	3569.60	5438.28	1790
T_7	73.93	147.00	163.68	2.26	4.85	4.68	761.80	3461.04	5269.72	1681
T_8	64.86	132.63	151.43	2.17	4.55	4.38	699.42	3254.97	4946.01	1475
T_9	72.98	145.44	161.82	2.20	4.75	4.58	735.51	3362.97	5115.43	1582
S.Ed	1.50	2.00	2.22	0.04	0.07	0.07	14.55	48.99	76.89	49
CD (p=0.05)	3.15	4.20	4.65	0.10	0.16	0.15	30.42	102.40	160.72	103

application of 40kg Sulphur ha^{-1} through Ammonium sulphate along with RDF (T_6) holds promise as an agronomically sound and viable technology for enhancing the sunflower growth and its attributes.

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