# EFFECT OF DIFFERENT SULPHUR SOURCES ON YIELD ANDYIELD ATTRIBUTESOF 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-608002,to study the effect of different sulphur sources on yield,yield attributes 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, $T_3$ –20 kg Sulphur ha$^{-1}$ through single Super phosphate , $T_4$- 20 kg Sulphur ha$^{-1}$ through Gypsum,$T_5$ –20 kg Sulphur ha$^{-1}$ through Elemental sulphur ,$T_6$ –40 kg Sulphur ha$^{-1}$ through Ammonium sulphate,$T_7$ –40 kg sulphur ha$^{-1}$ through Single super phosphate,$T_8$-40 kg Sulphur ha$^{-1}$ through Gypsum, $T_9$ -40 kg Sulphur ha$^{-1}$ through Elemental sulphur. The results of the experiments revealed that application of 40 kg Sulphur ha$^{-1}$ through Ammonium sulphate($T_6$) significantly influenced the yield and yield attributesin sunflower.This treatment recorded higher values for both yield and yield attributes viz., head diameter cm (17.48), total no of seeds head$^{-1}$(782.53), no of filled seeds head$^{-1}$(689), percentage of seed filling (82.14), 100 seed weight g(5.85),seed yield (1790 kg ha$^{-1}$), stalk yield (3550 kg ha$^{-1}$), harvest index (33.50 % ).This was followed by $T_7$(40 kg sulphur ha$^{-1}$ through Single super phosphate) in crops.The lowest values for Yield attributes were recorded in $T_1$-Control(no sulphur only NPK as DAP and MOP).*

***Key Words:*** *Sulphur, Yield &.yield attributes of Sunflower.*

## Introduction:

Sunflower (*Helianthus annuus L.*) holds great promise as an oilseed of its short duration, photo-in-sensitivity and wide adaptability to different agro-climatic regions and soil types. Sunflower has large acreage covering 14.5 million ha in different agro-climatic zones of this country. 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 anytime of the year and can serve as an ideal catch cropduring 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 totalworld production of sunflower seeds during 2012-2013 amounts to approximately 36.36 Million Tonnes. (40.29 Million Tonnesin 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 TamilNadu during 2011-2012 was, around 20000 hectares and 30000 tonnes respectively and with a productivity of1742 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 etal.,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.'S' application influences crop yields and also quality by increased synthesis of sulphur containing amino acids such as cystine and methionine.

Sulphur is required to attain high yield, biological yield, harvesting index, and oil content. Sulphur added to S- deficient soils increased seed yield upto 13 kg ha$^{-1}$. Application of 25 kg S ha$^{-1}$ increased seed yield by 38% per cent. An average increase of 3.8 per cent in the oil content of seeds were observed due to S application.In alloacine, clay soil having 12 ppm available S, application of 10 kg S ha$^{-1}$ doubled the seed yield and increased the oil yield.N+S application produces largest heads. Soils which are deficient in sulphur

cannot on their own provide adequate S to meet the crop demand resulting in S deficient crops and sub optimal yields. Hence, sulphur is one of the essential plant nutrients and its contribution in increasing the crop yields is well documented.

Sulphur helps in increasing the content of oil seeds and also improves the quality, colour and uniformity of crop.Application of sulphur stimulates the photosynthetic activity and synthesis of protein. Sarkar and Mallick (2009) reported Sulphur had favourable effect on yield attributes due to proper partitioning of photosynthates from source to sink. The experiment was carried to study the effect of different sulphur sources on yield and Yield attributesof sunflower.

**Materials and methods:**

Field experiment was conducted at the Experimental Farm, Department of Agronomy, Faculty of agriculture, Annamalai University, Annamalai Nagar, TamilNadu, during Kharif to study the effect of different sources of sulphur on yield and yield 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) , $T_2$-20 kg Sulphur $ha^{-1}$ through Ammonium sulphate, $T_3$ –20 kg Sulphur $ha^{-1}$ through Single super phosphate , $T_4$-20 kg Sulphur $ha^{-1}$ through Gypsum,$T_5$ –20 kg Sulphur $ha^{-1}$ through Elemental sulphur ,$T_6$ –40 kg Sulphur $ha^{-1}$ through Ammonium sulphate,$T_7$ –40 kg Sulphur $ha^{-1}$ through Single super phosphate,$T_8$-40 kg Sulphur $ha^{-1}$ through Gypsum, $T_9$ -40 kg Sulphur $ha^{-1}$ through Elemental sulphur.

**Results and Discussion:**

Different sources of sulphur significantly enhance the yield attributes of sunflower. Among them application of 40 kg Sulphur $ha^{-1}$ through Ammonium sulphate($T_6$) obtained maximum head diameter cm (17.48), total no of seeds $head^{-1}$(782.53), no of filled seeds $head^{-1}$(689), percentage of seed filling (82.14), 100 seed weight g (5.85),seed yield (1790 kg $ha^{-1}$), stalk yield (3550 kg $ha^{-1}$), harvest index (33.50 % ).This is due to Sulphur applied through Ammonium sulphate along with RDF which increases the availability of other nutrients and increased the seed and stalk yield. Sulphur addition increased the chlorophyll content in leaf and gave a significant positive correlation between chlorophyll content in leaf and crop yield. This was reported by Sinha et al.,1995.Kumar et al., (2011) reported that higher yield and oil content with increased application of sulphur enzyme synthesis as it is a constituent of sulphur containing amino acids namely methonine, cysteine, and cystine.

This treatment was followed by application of 40 kg Sulphur $ha^{-1}$ through Single super phosphate ($T_7$).The lowest yield attributes was observed under $T_1$- (no sulphur).This might be due to absence of sulphur resulted in reduced growth and yield attributing characters finally seed and stalk yield. Similar findings were reported by Ravi kumar et al., (2001); Renugadevi and Balamurugan (2002); Chitkala and Reddy (1991).

**Table: 1 Effect of different sulphur sources on yield and yield attributes of Sunflower**

| Treatment | Head diameter (cm) | Total no of seeds $head^{-1}$ | No of filled seeds $head^{-1}$ | Percentage of seed filling | 100 seed weight (g) | Seed yield (kg $ha^{-1}$) | Stalk yield (kg $ha^{-1}$) | Harvest index (%) |
|---|---|---|---|---|---|---|---|---|
| T1 | 13.08 | 604.07 | 502 | 76.71 | 4.97 | 933 | 3116 | 23.04 |
| T2 | 15.25 | 695.75 | 598 | 78.84 | 5.41 | 1366 | 3334 | 29.06 |
| T3 | 14.68 | 670.32 | 573 | 78.36 | 5.26 | 1256 | 3276 | 27.71 |
| T4 | 13.64 | 629.48 | 531 | 77.29 | 5.10 | 1049 | 3173 | 24.83 |
| T5 | 14.23 | 654.91 | 557 | 77.94 | 5.22 | 1161 | 3231 | 26.42 |
| T6 | 17.48 | 782.53 | 689 | 82.14 | 5.85 | 1790 | 3550 | 33.50 |
| T7 | 16.89 | 756.19 | 664 | 81.59 | 5.71 | 1681 | 3494 | 32.48 |
| T8 | 15.83 | 716.17 | 624 | 79.96 | 5.54 | 1475 | 3390 | 30.32 |
| T9 | 16.43 | 741.58 | 650 | 81.16 | 5.69 | 1582 | 3447 | 31.45 |
| S.Ed | 0.24 | 9.77 | 9.72 | 0.21 | 0.03 | 49 | 24 | 0.072 |
| CD (p=0.05) | 0.52 | 20.43 | 20.32 | 0.44 | 0.08 | 103 | 51.29 | 0.152 |

**Conclusion:**

This study examined the application of different sources of sulphur that had positive effect on yield of sunflower. The results shows that application of 40 kg Sulphur $ha^{-1}$ through Ammonium sulphate along with RDF($T_6$) was most beneficial and viable technology for enhancing the sunflower yield attributes and Yield.

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