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Integrated sulphur management practices on growth and yield of sunflower

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Abstract

Field investigations were carried out during March 2012 and August 2012 at Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar, to study the effect of Integrated sulphur management practices on the growth and yield of hybrid sunflower Cv. sunbred. The experiments were laid out in randomized block design and replicated thrice. The experiment consisted of eleven treatments viz., T₁ – No sulphur / RDF alone (control), T₂ – 45 kg S ha⁻¹ through gypsum, T₃ – 45 kg S ha⁻¹ through vermicompost, T₄ – 45 kg S ha⁻¹ through poultry manure, T₅ – 45 kg S ha⁻¹ through lignite flyash, T₆ – 75% S ha⁻¹ through gypsum + 25% S ha⁻¹ through vermicompost, T₇ – 75% S ha⁻¹ through gypsum + 25% S ha⁻¹ through poultry manure, T₈ – 75% S ha⁻¹ through gypsum + 25% S ha⁻¹ through lignite flyash, T₉ – 50% S ha⁻¹ through gypsum + 50% S ha⁻¹ through vermicompost, T₁₀ – 50% S ha⁻¹ through gypsum + 50% S ha⁻¹ through poultry manure and T₁₁ – 50% S ha⁻¹ through gypsum + 50% S ha⁻¹ through lignite flyash. The results of the experiments revealed that, application of 75% S ha⁻¹ through gypsum + 25% S ha⁻¹ through vermicompost (T₆) significantly influenced the growth and yield attributes and yield in sunflower. This treatment recorded higher values for growth and yield attributes viz., plant height (152.37 and 154.38 cm), LAI (6.90 and 6.97 cm at flowering stage), DMP (4225.72 and 4328.81 kg ha⁻¹) at harvest stage, chlorophyll content (2.28 and 2.31 mg g⁻¹) at flowering and yield attributes viz., total number of seeds head⁻¹ (778.06 and 815.26), number of filled deeds head⁻¹ (634.45 and 672.28), seed filling percent (83.04 and 84.26%), and seed yield (1825.46 and 1927.39 kg ha⁻¹) and stalk yield (3800.63 and 3898.59 kg ha⁻¹) in both the crops. This was followed by T₇ (75% S ha⁻¹ through gypsum + 25% S ha⁻¹ through poultry manure) in both the crops. The lowest values for growth and yield attributes and yield were recorded in T₁-No sulphur / RDF alone (control) in both the crops.

Keywords: integrated, sulphur, practices, sunflower

Introduction

The oilseeds form essential part of human diet, besides it produces basic raw materials for agro-based industries. Sunflower has large acreage under various oilseeds in different agro-climatic zones of this country. The average Indian consumer uses relatively lesser quantities of edible oil, no doubt influenced by this modest level of income. Sunflower (*Helianthus annuus* L.) holds great promise as an oilseed crop because of its short duration, photo- in – sensitivity and wide adaptability to different agro-climatic regions and soil types. Sunflower seed contains about 48-53 percent edible oil, sunflower oil is a rich source of linoleic acid (64%) which is good for heart patients. The oil is also used for manufacturing hydrogenated oil. It can be grown at any time of year and can serve as an ideal catch crop during period when the land is otherwise fallow. The existing yield is very low, mainly because of the suboptimal 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) [13, 8]. Sulphur application has many advantages for sunflower regarding growth parameters and yield and quality. Each unit of fertilizer sulphur generates 3-5 units of edible oil, a commodity needed by every family. Sulphur can be rightly called as fourth major element of the plant because it is a constituent of three amino acids viz., Cysteine, Cystine and Methionine which are the building blocks of protein and helps in the formation of chlorophyll and synthesis of oils. Sulphur improves protein and oil percentage in seeds. Singh (1999) reported that application of sulphur increased the uptake of various macro and micro nutrients in groundnut. Sulphur is required to attain high yield, biological yield, harvesting index and oil content, as affected by biofertilizers and sulphur application. Application of 2 kg S ha⁻¹ increased seed yield by 38%.

Ever since the role of soil fertility in crop production has been recognized, the use of organic manures has become an imperative need for successful farming. It is a known fact that organic matter provides considerable amount of both macro and micronutrients. It improves soil structure through increased aggregation, which favourably influences the tilth, water infiltration, moisture retention, drainage, aeration, temperature and root penetration besides prevention of crusting. Utilization of all possible sources of organic matter such as vermicompost, FYM, poultry manure helps in improving the soil fertility status and also enhances the yield of oilseed crops. In addition, integration of organics with inorganic improves the physiological system of crop growth, provides adequate growth regulating substances, modifies physico-chemical properties of soil and thus augmenting crop yields. With this background the investigation was carried to enhance sunflower productivity by adopting integrated sulphur management.

Materials and Methods

Field investigations were carried out during March 2012 and August 2012 at Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar. The soil of experimental field was clay loam in texture. The soil was low in available Nitrogen, medium in available Phosphorous, high in available Potassium and low in available Sulphur. The sunflower cv. Sunbred was chosen for the study. The experiment was laid out in Randomized block design with three replications. The experiment consisted of eleven treatments viz., T₁ – No sulphur / RDF alone (control), T₂ – 45 kg S ha⁻¹ through gypsum, T₃ - 45 kg S ha⁻¹ through vermicompost, T₄ - 45 kg S ha⁻¹ through poultry manure, T₅ - 45 kg S ha⁻¹ through lignite flyash, T₆ - 75% S ha⁻¹ through gypsum + 25% S ha⁻¹ through vermicompost, T₇ - 75% S ha⁻¹ through gypsum + 25% S ha⁻¹ through poultry manure, T₈ - 75% S ha⁻¹ through gypsum + 25% S ha⁻¹ through lignite flyash, T₉ – 50% S ha⁻¹ through gypsum + 50% S ha⁻¹ through vermicompost, T₁₀ – 50% S ha⁻¹ through gypsum + 50% S ha⁻¹ through poultry

manure and T₁₁- 50% S ha⁻¹ through gypsum + 50% S ha⁻¹ through lignite flyash. The recommended dose of 60:90:60 kgs of NPK ha⁻¹ was applied in the form of urea, DAP and muriate of potash. Sulphur @ 20 kg ha⁻¹ was applied through Gypsum as per the treatments.

Results and Discussion

Growth attributes (Table 1)

The integrated sulphur management practices significantly influenced the growth attributes viz., plant height, LAI, DMP and chlorophyll content. All the sources of sulphur viz., gypsum, poultry manure, lignite fly ash alone and in integration with gypsum had marked influence on the growth attributes of hybrid sunflower over no S application.

Among the integrated sulphur management practices tried, application of 75% S through gypsum + 25% S ha⁻¹ through vermicompost (T₆) resulted in tallest sunflower plants, increased LAI, DMP and chlorophyll content at all the stages of crop growth. This was evidenced through the studies of Intodia and Tomar (1997) [1] and Raja *et al.* (2007) [6]. Presence of higher amount of readily available N in vermicompost and numerous active substances like enzymes and vitamins secreted by microbes in vermicompost (Jeyabal, 1996) [2] might have exerted a positive effect on metabolism of sunflower crop at early growth stage leading to higher growth components. Increased plant height, LAI, DMP due to integrated application of sulphur are in concordance with the reports of Vetrinurugan (2002) [12] and Menaka (2004) [4]. This is due to sulphur applied through gypsum along with RDF increased the availability of other nutrients and enhanced the growth attributes of sunflower in both the crops (Vaiyapuri *et al.*, 2004) [11]. This was followed by application of 75% S ha⁻¹ through gypsum + 25% S ha⁻¹ through poultry manure and 75% S ha⁻¹ through gypsum + 25% S ha⁻¹ through lignite flyash, the lowest growth attributes was observed under T₁ (Nosulphur) in both the crops. This is due to less of availability of sulphur which reduced the availability of other nutrients and finally resulted in lesser values for growth attributing characters.

Table 1: Effect of integrated sulphur management on growth attributes of sunflower

Treatments	Plant height (cm)		LAI at flowering stage		DMP (Kg ha ⁻¹) (at harvest)		Total Chlorophyll (mg g ⁻¹)	
	I crop	II Crop	I crop	II Crop	I crop	II Crop	I crop	II Crop
T ₁	117.32	123.17	4.49	4.52	2816	3447	1.23	1.25
T ₂	135.27	136.59	4.96	5.00	3737	3829	1.90	1.94
T ₃	132.23	133.47	4.84	4.89	3659	3752	1.88	1.91
T ₄	129.22	129.98	4.73	4.79	3579	3665	1.87	1.90
T ₅	126.20	126.78	4.64	4.68	3512	3588	1.85	1.88
T ₆	152.37	154.38	6.90	6.97	4226	4329	2.28	2.31
T ₇	148.39	150.12	6.44	6.51	4103	4206	2.12	2.15
T ₈	141.93	143.13	5.87	5.90	3878	3977	2.06	2.10
T ₉	145.12	146.48	6.15	6.20	3980	4087	2.09	2.12
T ₁₀	139.58	141.52	5.26	5.32	3871	3968	1.97	2.00
T ₁₁	138.55	139.27	5.14	5.20	3810	3906	1.93	1.96
S.Ed	1.40	1.46	0.125	0.14	33.61	37.15	0.05	0.07
CD (P = 0.05)	2.80	2.92	0.25	0.28	67.23	74.31	0.11	0.15

Yield attributes and Yield (Table 2)

The integrated sulphur management practices significantly influenced the yield attributes viz., head diameter, total number of seeds head⁻¹, number of filled seeds head⁻¹, seed filling percent and 100 seed weight and seed and stalk yield in both the crops. As discussed in growth attributes integrated application of sulphur through gypsum along with organics significantly increased the yield attributes in the both the

crops when compared to treatments received sulphur without integration.

Application of 75% S through gypsum + 25% S ha⁻¹ through vermicompost (T₆) significantly increased the head diameter, total number of seeds head⁻¹, number of filled seeds head⁻¹, seed filling percent and 100 seed weight and seed and stalk yield over the other treatments. Sulphur is known to play a vital role in the formation of aminoacids. It had favourable effect on yield attributes due to proper partitioning of

photosynthates from source to sink. These findings were earlier reported by Syed Shajat Hussain *et al.* (2011)^[10]. The least values for yield attributes were recorded under T₁ (Nosulphur – RDF alone), could be due to poor availability of S and other nutrients. These findings were earlier reported by Poonkodi and Poomurugesan (2005)^[5]. The increase in yield under this treatment might be due to significant increase in yield attributes leads to seed and stalk yield. This might be

due to the influential role played by sulphur in increasing both growth yield attributes. Supply of S in addition to N, P and K might be the lifting factor behind the increased seed and stalk yield (Kapilashkehawat and Shivay, 2008)^[3]. T₁ (Control) recorded lesser seed and stalk yield in both the crops. This might be due absence of sulphur resulted in reduced growth and yield attributing characters finally seed and stalk yield. These finding are in line with Ravikumar (2001)^[7].

Table 2: Effect of integrated sulphur management on yield attributes and yield of sunflower

Treatments	Head Diameter		Total No. of Seeds head ⁻¹		No. of filled seeds head ⁻¹		Seed filling%		100 seed at (g)		Seed yield (Kg ha ⁻¹)		Stalk Yield (kg ha ⁻¹)	
	I Crop	II Crop	I Crop	II Crop	I Crop	II Crop	I Crop	II Crop	I Crop	II Crop	I Crop	II Crop	I Crop	II Crop
T ₁	12.60	13.42	489.47	534.35	310.35	337.28	63.40	63.86	3.83	3.90	1266	1302	2872	2957
T ₂	14.50	15.32	608.39	628.31	442.17	460.11	72.67	73.22	4.85	4.92	1514	1560	3489	3564
T ₃	14.27	15.11	579.27	585.25	405.15	421.13	69.94	71.95	4.68	4.68	1467	1511	3431	3499
T ₄	13.98	14.81	545.14	550.16	371.12	390.07	68.07	70.90	4.45	4.43	1399	1435	3385	3435
T ₅	13.50	14.45	515.12	523.08	342.07	361.03	66.40	69.02	4.20	4.21	1371	1403	3327	3371
T ₆	18.67	19.72	860.58	934.37	714.68	787.35	83.04	84.26	6.20	6.42	1825	1927	3800	3898
T ₇	17.45	18.53	778.06	815.26	634.45	672.28	81.54	82.15	5.74	5.87	1765	1850	3735	3805
T ₈	15.50	16.58	677.38	705.23	520.19	548.12	76.79	77.72	5.33	5.36	1656	1721	3602	3683
T ₉	16.37	17.44	725.16	757.21	568.27	601.21	78.36	79.39	5.52	5.60	1702	1780	3668	3746
T ₁₀	14.85	15.77	658.47	687.25	500.47	525.29	76.00	76.43	5.28	5.32	1601	1654	3590	3662
T ₁₁	14.68	15.56	642.99	673.19	486.25	512.18	75.62	76.08	5.16	5.14	1555	1613	3540	3595
S.Ed	0.30	0.36	7.75	7.92	7.59	8.42	0.20	0.22	0.08	0.09	24	35	27	31
CD (P = 0.05)	0.61	0.73	15.50	15.84	15.18	16.85	0.41	0.45	0.16	0.19	48	25	55	62

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