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Study The Effect of Plant Geometry and Sulphur Levels on Growth, Yield and Oil Content of Sunflower (*Hellianthus Annus L*)

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ABSTRACT: *A field experiment was conducted during kharif season of 2012-13 at Crop Research Farm, Allahabad School of Agriculture, SHIATS, Allahabad (U.P.) To study the effect of 3 plant geometry (60 × 45 cm, 55 × 35 cm and 50 × 25 cm) and 3 sulphur levels (20,30, and 40 kg S ha^{-1}) on the performance of sunflower (*Helianthusannus L.*). The result indicated that the highest yield (13.8 qt ha^{-1}), oil content (40.58%),straw yield (28.8 qt ha^{-1}) ,net return (₹23,586.8) and B:C ratio (1.85) were obtained when the crop was sown at 60×45 cm spacing; with application of 40 kg S ha^{-1}.*

Keywords: *Sunflower, plant geometry, sulphur, growth, yield, oil content and Economics.*

INTRODUCTION

Sunflower holds promising position among edible oil-seed crops due to its premium oil quality and fits well in cropping system due to its short duration.

Among the four major oilseed crops in the world *viz*., soybean, brassicas, sunflower and groundnut (Fernandez Martinez *et al*., 2004), sunflower ranks third in the total area planted and fourth in total production. The annual planting area of sunflower in the world at present is around 23 M. ha with a production of about 33 M. tonnes of seed (USDA 2013). In India, during 2010-11 sunflower was cultivated in 0.90 M. ha with a production of 0.62 M. tonnes. The average yield of 696 kg ha^{-1} in India is one of the lowest as compared to world average of 1322 kg ha^{-1} (Anonymous, 2011). The important sunflower growing states in the country are Karnataka, Andhra Pradesh, Maharashtra and Tamil Nadu. Almost 50% of the area and production is accounted by Karnataka followed by Andhra Pradesh, Maharashtra and Tamil Nadu (GAIN Report 2012).

Sulphur is the component of the amino acids, cystine, cysteine and methionine, needed for chlorophyll. It increases the oil percentage of oil (Hassan *et al*., 2007) .

The establishment of an optimum planting density is very important for achieving best results. Since the correct spacing need to be standardized hence the optimum spacing needs to be worked out. Keeping those aspects in view, a field experiment was planned to study the effect of plant geometry and levels of sulphur on growth, yield and oil content of sunflower (*Helianthus annus* L).

MATERIALSAND METHODS

The experiment was carried out during kharifseason 2012 at the Crop Research Farm, Department of Agronomy, Allahabad School of Agriculture, SHIATS, Allahabad (U.P.). The sandy loam soil, was low in organic carbon (0.39%),available nitrogen (185.5 kg ha^{-1}), available phosphorus (36 kg ha^{-1}) and potassium (98 kg ha^{-1}) slightly saline in reaction (pH 7.4). The experiment was conducted in Randomized Block Design (RBD) consisting of 9 treatments in combinations with 3replication and was laid out with the different treatments allocated randomly in each replication. There were 27 treatment combinations comprised of 3 plant geometry (60 × 45 cm, 55 × 35 cm and 50 × 25 cm) and 3 sulphur levels (20,30, and 40 kg S ha^{-1}). Gross plot size was 3×3m.the NPK applied at the rate of 60-40-20 kg ha^{-1}. Half dose of nitrogen and full dose of phosphorus and potassium

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was given as basal through urea, diammonium phosphate and muriate of potash respectively. The sulphur was also applied as per treatment at the time of sowing. Remaining half dose of nitrogen was top dressed at the flowering stage of sunflower. The crop was sown on 4 September 2012. The biometric observations were taken from 5 selected plants from net plot area. After harvesting the post harvest observations were taken from selected plants. The seeds head^{-1} were counted and recorded. The weight of seeds was recorded from each net plot of five randomly selected plants in grams. After through drying, one thousand seeds were counted from each net plot and their weights were recorded in grams as test weight. Weight of sun dried seed was in gm net^{-1} plot was recorded and presented in q ha^{-1}. Oil percentage was estimated by solvent extraction method in soxhlet's apparatus with petroleum ether (BP 40-60°C)as solvent (AOAC, 1980).

RESULTS AND DISCUSSION

The growth, and yield parameters of sunflower cultivars such as plant height, stem girth, dry weight, diameter of head^{-1}, number of seeds head^{-1}, test weight, seed yield(q ha^{-1}), stover yield (q ha^{-1}) and oil content (%) were significantly influenced due to plant geometry and sulphur levels. The relevant data are presented in table and discussed as below.

The outcome of the investigation revealed that the plant height is higher (125.97 cm) in treatment T3 (20 kg S ha^{-1} + 50 × 25cm) but there was no significant difference.

Stem girth (1.30 cm) higher was found in treatment 7(40 kg S + 60 × 45cm), while treatment 5(30 kg S + 55 × 35 cm) and 3(20 kg S + 50 × 25 cm) were statistically at par with the treatment 7 (40 kg S + 60 × 45 cm).

Highest plant dry weight (15.37 g) was found in treatment 7(40kg S ha^{-1} + 60 × 45 cm) but there was no significant difference.

Stem girth, dry weight was superior under spacing 60 × 45cm with 40 kg S ha^{-1}. Due to better resource availability and reduced interplant competition in the community. Higher sulphur dose increases cell multiplication, elongation and cell expansion thought the entire period of crop. This might be ascribed to adequate supply of sulphur that resulted in higher production of photosynthates and their translocation to sink, which ultimately increased the plant growth, and growth attributes. These results are in conformity with those obtained by V.I.O.Olowe (2005) and to Ahmad and Abdin (2000).

Higher head diameter, number of seeds head^{-1}, test weight, seed and stover yields and oil content was noticed at a spacing 60 × 45 cm with 40 kg S ha^{-1} which was significantly higher than other treatments., number of seeds head^{-1} (399.60), seed yield (13.80 q ha^{-1}), Stover yield (28.80 q ha^{-1}) and oil content (40.58%) were found to be higher than other treatments.

Better distribution of plants over the cropped area, coupled with better interception of solar radiation encouraged the effective use of resources, leading to increase growth and biomass production. Whichin turn increased yield attributes and yield. Reported by Kumar *et al*., (2011)

Table 1
Comparative Performance of Yield and Yield attributes of different treatments on Sunflower.

		Yield and yield attributes										
	Treatments	*Plant height (cm)*	*Dry weight (gm plant^{-1})*	*Stem girth (cm)*	*Head diameter (cm)*	*No. of Seeds head^{-1}*	*Oil Content (%)*	*Test weight (gm)*	*Seed yield (qt ha^{-1})*	*Straw yield (qt ha^{-1})*	*Net Return (₹ ha^{-1})*	*B:C Ratio*
T1	20 kg S ha^{-1} +60 × 45 cm	106.03	14.38	1.05	10.91	273.00	37.30	39.87	9.57	21.33	8,139.76	1.30
T2	20 kg S ha^{-1} +55 × 35 cm	119.63	12.77	1.11	12.05	315.93	37.51	40.85	10.13	23.97	10,222.86	1.37
T3	20 kg S ha^{-1} +50 × 25 cm	125.97	14.57	1.17	11.93	306.13	37.33	39.05	9.30	19.60	7,151.86	1.26
T4	30 kg S ha^{-1} +60 × 45 cm	121.90	15.00	1.06	12.17	318.33	38.28	42.41	10.77	24.63	12,483.32	1.45
T5	30 kg S ha^{-1} +55 × 35 cm	106.47	15.05	1.18	12.73	327.20	38.54	43.79	12.23	25.27	17,885.32	1.65
T6	30 kg S ha^{-1} +50 × 25 cm	118.83	14.48	1.08	12.05	313.47	38.13	41.41	12.07	24.20	17,293.32	1.63
T7	40 kg S ha^{-1} +60 × 45 cm	124.67	15.37	1.30	13.84	399.60	40.58	46.13	13.80	28.80	23,586.8	1.85
T8	40 kg S ha^{-1} +55 × 35 cm	124.20	14.43	1.05	13.07	372.67	40.30	44.78	12.73	26.20	19,627.8	1.71
T9	40 kg S ha^{-1} +50 × 25 cm	121.67	13.62	1.10	12.50	360.67	39.38	43.82	12.27	25.53	17,925.8	1.65
	F-test	NS	NS	S	S	S	–	S	S	S	–	–
	SEm (±)	12.73	1.19	0.066	0.27	33.17	–	1.87	0.69	2.03	–	–
	CD(P = 0.5)	–	–	0.14	0.59	70.33	–	3.97	1.47	4.31	–	–

Application of 40 kg S ha^{-1} through gypsum recorded significantly maximum seed yield and yield attributes of sunflower. Sulphur deficiency can affect yield and quality of crops, as it is involved in protein and enzyme synthesis as well as it is a constituent of the amino acids methionine, cystine and cysteine. Sulphur depletion in soil is mainly caused by leaching. It takes place when the water-moving vertical downward in soil profile is higher than that of the water uptake of the plants. In general, sulphur demand of oilseed crops are higher than those of cereal crops as they contain more sulphur containing compounds needed for oil biosynthesis as reported by Hassan *et al.*, (2007).

Effect of crop geometry and sulphur levels on head diameter, no. of seeds $head^{-1}$, test weight, seed yield, stover yield and oil content were found to be significant.

ECONOMICS

The net return (₹) of sunflower grown under different treatment combinations presented in the table. In spite of the fact that treatment T7(40 kg S ha^{-1} + 60 × 45 cm) recorded the highest gross return it also recorded the maximum net return (₹ 23,586.8 ha^{-1}) because of very high yield and cost of cultivation.

REFERENCES

Ahmad, A. and Abdin, M.Z., (2000), Photosynthesis and its related physiological variables in the leaves of Brassica genotypes as influenced by sulphur fertilization. *Physiol. Plants* **110**: 144-149.

Anonymous., (2011), Annual report of oilseed crops. Directorate of Oilseeds, Hyderabad.

A.O.A.C., (1980), Official Methods of Analysis, 13th ed. Association of Official Analytical Chemists. Washington D.C. pp. 376-84.

Barros, J.F.C., M. deCarvalho. and G.Basch., (2004), Responce of sunflower (*Helianthus annus* L.) to sowing date and plant density under Mediterranean condition. *Eup. Agron.* **21**: 347-356.

Bhalerao, P.D., Dhawse, M.R., Jadhao, P.N. and Fulzale, G.R., (1993), Responce of sunflower hybrid to N levels and spacing during rabi. *J.of Maharashtra agricultural Universities*. **18**(3): 462-464.

Chaubey, A.K. and Paraye, P.M., (2010), Effect of nutrient management and plant density on growth, yield attributes and yield of sunflower (*Helianthus annus* L.). *Pantnagar J.of Research.* **8**(2): 148-150.

Dhage, Shubhangi. J. and Ptil, Poonam., (2008), Effect of sulphur sources and their rates on yield, growth parameters, uptake of nutrients and quality of sunflower. *Asian. J. of Soil Science*. (3)**2**: 323-325.

Global Agricultural Information Network, (2013), USDA Foreign Agriculture Service.

Gudade, B.A., Thakur, M.R., Bomble, D.L. and Ulemale, R.B., (2010), Responce of sunflower to integrated nutrient management. *J. Soils and Crops*. **20**(1): 94-98.

Hassan, F., Hakim, S., Qadir, G. and Ahmad, S., (2007), Responce of sunflower (*Helianthus annus* L.) to sulphur and seasonal variations. *Int. J. of Agri. and Bio*. **9**(3): 499-503.

Kabade, D.V., Kalegore, N.K., Pawar, H.D., Thakur, B.D. and Karanjikar, P.N., (2006), Effect of plant spacing and sulphur levels on seed yield and quality of sunflower. *J. Soils and Crops*. **16**(1): 131-134.

Kene, H.K., Thosar, V.R., Ulemale, R.B. and Kale, M.R., (1993), Effect of plant population and fertility levels on sunflower yield. *PKV Research J.* **17**(2): 210-211.

Kumar, Satish., Tewari, S.K. and Singh, S.S., (2011), Effect of sources and levels of sulphur and spacing on the growth, yield and oil quality of spring sun flower (*Helianthus annus* L.). *Indian J. of Agronomy*. **56**(3): 242-246.

Patra, Paritosh., Patil, Biplab. Kumar, Ghosh, Gautam. Kumar, Mura, S.S. and Saha, A., (2013), Effect of biofertilizers and sulphur on growth,yield and oil content of hybrid sunflower (Helianthus annus L.) in a typical lateritic soil. *Open Access Scientific Reports*. **2**.

Samui, R.C., Bhattacharyya, P. and Roy, A., (1987), Effect of nutrients and spacing on oil yield and uptake of nutrients by sunflower. *J. of Indian Soc.Soil Sci.* **35** (1): 69-73.

V.I.O Olowe., (2005), Effect of plant population density on growth and yield of sunflower (Helianthus annus L.) in the transition zone of south west Nigeria. Tropical Agricultural Research and Extension **8**.

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