



YIELD, QUALITY, NUTRIENT UPTAKE AND POST HARVEST NUTRIENT STATUS OF SUNFLOWER GENOTYPES TO SULPHUR FERTILIZATION GROWN UNDER VEERANAMAYACUT REGIONS

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Abstract

Field investigations were carried out during December 2009 and June 2010 at Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar - 608 002, to study the yield, quality, nutrient uptake post harvest nutrient status of sunflower genotypes to sulphur fertilization grown under Veeranam Ayacut regions. Sunflower genotypes *viz.*, two varieties (CO4 and DRSF108) and three hybrids (KBSH53, sunbred and Jaya) were tried along with different sulphur levels (0, 20, 40 and 60 kg S ha⁻¹). The experiment consisted of twenty treatments and were laid out in factorial randomized block design with two replications.

Among the different genotypes, KBSH 53 was significant over other genotypes. KBSH 53 significantly recorded maximum values for yield attributes *viz.*, head diameter, total number of seeds head⁻¹, seed filling per cent and seed yield and stalk yield in both the crop seasons. KBSH 53 also favourably influenced the quality characters such as oil and protein content of seed and nutrient uptake (N, P, K and S) in both the crop seasons. The lowest growth and yield attributes and yield were recorded in the genotype CO4. CO4 also recorded lesser oil and protein content minimum nutrient uptake (N,P, K and S). With regard to post harvest nutrient status KBSH 53 recorded lowest nutrient status while CO4 recorded higher in available soil nutrients during both the crop seasons. The response ratio, apparent S recovery and agronomic efficiency were significantly increased in the genotype KBSH 53.

Among the S levels, application of 40 kg S ha⁻¹ favourably influenced the yield attributes and yield and quality, Nutrient uptake and post harvest nutrient status of sunflower. The quality characters such as oil content, protein content, nutrient uptake (N, P, K and S) were maximum in KBSH 53. The least values for growth and yield attributes yield, nutrient uptake and quality characters were recorded under 0 kg S ha⁻¹ during both the crops. The maximum post harvest soil available N, P, K was recorded under no sulphur applied plots while maximum available S was recorded under 20 kg S ha⁻¹.

The interaction effect between genotypes and S levels were significant. Among the treatment combinations, KBSH 53 with 40 kg S ha⁻¹ recorded maximum values for yield attributes and yield, nutrient uptake and quality characters in both the crops. The least values was recorded under CO₄ with no sulphur applied plots. CO₄ with 0 kg S ha⁻¹ recorded maximum availability of N, P, K and maximum S was noticed CO₄ with 20 kg S ha⁻¹ during both the crops.

Key words : Nutrient uptake, sulphur, sunflower, protein content, yield attributes.

Introduction

In India, oil seed crops constitute the second largest agricultural produce, next only to food grains and these are the important sources of our economy contributing 5% to GNP. India's contribution to the world productivity

of oilseeds is very low (9.54%) owing to low productivity of different oilseed crops. Edible oil is one of the basic requirement of our daily diet. India is encountered with deficiency of edible oil because of its increased consumption. Sunflower is the fourth important oilseed crop in India which can play important role in reducing the shortage of edible oil and produce high yields of good

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quality oil for human consumption. The practice of intensive cropping with high yielding varieties is a great endeavour to boost production and this has caused a marked depletion of inherent nutrient resources in soil. Consequently along with N, P and K, the deficiency of sulphur is frequently reported in large areas in India. Sulphur is the fourth important nutrient in crop production. Sulphur is involved in the synthesis of chlorophyll. Oilseeds are more responsive to S than pulses and cereals. The response to S application in oilseed crops is spectacular. Response of oilseeds to S application depends on crops, soil S status, yield potential of the cultivar, N level used, S content of irrigation water, growth conditions, management levels, soil types, location and sources of S. plant species and even cultivars within species differ in their nutrient efficiency. Efficient species or cultivars are those which are able to grow and yield under deficit conditions as compared to inefficient ones. The different genotypes respond differently to same or diverse S supply conditions.

Materials and Methods

Field experiments were conducted at Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar during December 2009 and June 2010 to study the Response of sunflower genotypes to sulphur fertilization on yield and quality, Nutrient uptake and post harvest nutrient status of sunflower. grown under Veeranam Ayacut regions. Sunflower genotypes *viz.*, two varieties (CO₄ and DRSF108) and three hybrids (KBSH53, sunbred and Jaya). The experiments were laid out in factorial Randomized block design with two replications. The treatments adopted are Sunflower genotypes *viz.*, two varieties (CO₄ and DRSF108) and three hybrids (KBSH53, sunbred and Jaya) were tried along with different sulphur levels (0, 20, 40 and 60 kg S ha⁻¹). 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.

Results and Discussion

Yield

All the genotypes significantly influenced the seed and stalk yield of sunflower in both the crop seasons. The genotype KBSH 53 significantly recorded higher seed yield of 2144.63 and 2293.10 kg ha⁻¹ and stalk yield of 4229.06 and 4445.76 kg h⁻¹ in first and second crop respectively This was followed by Sunbred with the seed yield of 1966.72 and 2090.32 kg ha⁻¹ and with stalk yield

of 4203.59 and 4276.50 kg ha in first and second crop respectively. The lesser seed and stalk yield were recorded by Co 4 in both the seasons. The yield increase in KBSH 53 over CO 4 are 41.90 and 42.28 per cent in first and second crop, respectively. This may be attributed to increase in head diameter more number of filled seeds head⁻¹ and maximum seed yield plant⁻¹ (Shivaprasad, 1994).

Sulphur levels significantly influenced the seed and stalk yield in both the crops. Application of S at 40 kg ha⁻¹ recorded maximum seed yield of 2177.69 and 2277.88 kg ha⁻¹ and stalk of yield 4422.27 and 4482.97 kg ha⁻¹ in first and second crop, respectively. This treatment registered higher seed yield over control (0 kg S ha⁻¹) with the yield increase being 42.02 and 42.54 per cent respectively in first and second crop. This increase in yield might be due to significant increase in yield attributes *viz.*, head diameter, total number of seeds head⁻¹, seed weight head⁻¹ and 100 seed weight. The yield increase might be also due to increased growth, which resulted in increased photosynthesis and assimilation rates, cell division of enzymes this in turn increased the seed yield. Similar findings were earlier reported by Mishra (1996) and Kapila Shekwat and Shivay (2008).

The interaction effect between genotypes and S levels was found to be significant. KBSH 53 with 40 kg S ha⁻¹ recorded higher seed yield (2538.65 and 2683.46 Kg ha⁻¹) and stalk yield (4733.19 and 4809.76 Kg ha⁻¹) in both the crops. This was followed by Sunbred. This might be due to genetic makeup along with S application, which ultimately lead to Sink in post flowering stage and resulted in higher seed yield and stalk yield in both the crops. This was in line with the reports by Seshadri Reddy *et al.* (2002). The lowest seed yield was recorded by Co 4 along with 0 kg S ha⁻¹. This might be due to non availability of required amount of sulphur and other nutrients. Similar trend of results were earlier was reported by Arora *et al.* (1987).

Quality characters

Oil content

Sunflower genotypes significantly increased the oil content. Among the genotypes, KBSH 53 recorded maximum oil content of 33.61 and 34.43 percent followed by sunbred with 33.44 and 34.27 per cent in first and second crop, respectively.

The oil content of sunflower seeds was significantly influenced by S application. The maximum oil content of 33.86 and 34.71 per cent was recorded with the optimum dose of sulphur (40 kg S ha⁻¹) and the least value was

Table 1 : Yield and quality of sunflower genotypes to sulphur fertilization.

Treatments	Seed yield (I Kg ha ⁻¹)		Stalk yield (Kg ha ⁻¹)		Oil Content (%)		Protein Content %	
	I	II	I	II	I	II	I	II
Genotypes								
V ₁	1518.13	1573.82	3742.44	3790.84	38.37	39.87	25.84	26.85
V ₂	1668.58	1230.78	3898.34	3983.79	39.23	40.78	26.17	27.19
V ₃	2144.63	2293.10	4229.06	4445.76	41.99	43.70	27.31	28.24
V ₄	1966.72	2090.32	4203.59	4276.50	41.07	42.62	26.89	27.88
V ₅	1802.84	1921.34	4050.37	4105.42	40.17	41.75	26.58	27.53
S.Ed	34.24	30.96	37.27	35.7	0.20	0.19	0.074	0.07
CD (P=0.05)	68.51	71.10	74.56	73.2	0.41	0.40	0.15	0.16
S levels								
S ₁	1177.48	1275.09	3361.80	3393.62	38.60	40.10	24.42	25.47
S ₂	1809.0	1907.43	4062.25	4152.00	40.13	41.84	22.01	27.58
S ₃	2177.69	2277.88	4422.27	4482.97	41.12	42.63	22.81	28.61
S ₄	2116.57	2230.06	4252.73	4412.78	40.81	42.41	27.58	28.49
S.Ed	33.70	30.38	36.57	36.8	0.19	0.21	0.064	0.06
CD (P=0.05)	67.43	63.59	73.18	75.7	0.40	0.43	0.13	0.14

Table 2 : Nutrient uptake on sunflower genotypes to sulphur fertilization.

Treatments	Nutrient uptake (Kg ha ⁻¹)							
	I Crop				II Crop			
	N	P	K	S	N	P	K	S
Genotypes								
V ₁	71.89	18.30	65.44	10.43	74.49	18.90	68.79	10.30
V ₂	73.80	18.99	67.06	11.15	76.17	19.74	70.38	10.78
V ₃	79.68	16.41	72.24	13.22	82.59	22.46	77.34	12.26
V ₄	77.72	20.47	70.55	12.56	80.15	21.56	73.82	11.78
V ₅	75.78	19.74	68.84	11.82	78.20	20.69	72.29	11.28
S.Ed	0.44	0.16	0.39	0.20	0.44	0.17	0.40	0.19
CD (P=0.05)	0.91	0.34	0.82	0.42	0.92	0.37	0.84	0.41
S levels								
S ₁	69.31	17.37	61.96	8.48	70.42	17.97	63.45	10.49
S ₂	75.84	19.67	68.74	11.88	77.67	20.74	72.23	12.98
S ₃	79.32	21.12	72.66	13.90	82.95	22.18	77.49	12.34
S ₄	78.60	20.85	71.95	13.26	82.23	21.87	76.92	14.81
S.Ed	0.43	0.15	0.38	0.19	0.44	0.17	0.40	0.19
CD (P=0.05)	0.90	0.32	0.80	0.40	0.91	0.36	0.83	0.40

recorded under no S applied plot. This could be attributed to the influence of sulphur in rapid conversion of nitrogen to crude protein and finally resulting to oil. This same result was reported by Singh and Tiwari (1985)

With regard to interaction effect, KBSH 53 along 40 kg S ha⁻¹ recorded higher oil content in both the crop seasons. The increase in oil content due to application might be due to it's key role in biosynthesis of oil in plants (Mudd, 1967). The least value was recorded under CO 4 with 0 kg S ha⁻¹.

Protein content

The protein content of seeds was significantly increased by genotypes and S application in both the crops.

Among the genotypes, KBSH 53 registered the highest protein content of 27.31 and 28.24 per cent followed by Sunbred (26.89 and 27.88 per cent) and Jaya. The least protein content was registered under CO4. Similar findings were earlier reported by Mancuso (1992).

The protein content of seed was significantly

Table 3 : Post harvest nutrient status on sunflower genotypes to sulphur fertilization.

Treatments	Post harvest nutrient status (Kg ha ⁻¹)							
	ICrop				IICrop			
	N	P	K	S	N	P	K	S
Genotypes								
V ₁	216.23	19.69	326.49	19.74	224.40	23.83	342.37	20.66
V ₂	212.67	19.03	323.69	19.00	220.44	23.12	339.63	20.44
V ₃	201.80	16.96	315.32	16.93	208.40	21.33	330.8	17.75
V ₄	205.41	17.68	318.08	17.77	166.74	21.68	33.82	18.52
V ₅	209.05	18.36	320.90	18.34	216.49	22.40	336.73	19.32
S.Ed	0.81	0.14	0.54	0.90	0.86	0.23	0.59	0.16
CD (P=0.05)	1.75	0.30	1.18	1.92	1.92	0.34	1.26	0.34
S levels								
S ₁	229.95	21.15	342.88	14.48	238.69	25.47	351.72	14.99
S ₂	210.21	18.60	318.51	21.23	218.57	22.59	336.8	22.58
S ₃	246.51	16.92	249.78	18.71	203.50	20.63	328.62	19.83
S ₄	198.57	16.70	311.63	18.78	204.54	20.91	329.5	19.64
S.Ed	0.79	0.13	0.51	0.88	0.88	0.15	0.58	0.15
CD (P=0.05)	1.72	0.29	1.17	1.88	1.88	0.32	1.24	0.32

increased by S application. Among the different S levels, the higher protein content of 22.81 and 28.61 per cent were registered with 40 kg S ha⁻¹ in both the crops. The lowest protein content was observed at 0 kg S ha⁻¹ in both the crops. The substantial increase in protein content with S application might be due to increased availability of S for subsequent synthesis of oil and protein. Similar findings were reported by Chitkala and Reddy (1991).

Among the different treatment combinations KBSH 53 along 40 kg S ha⁻¹ produced maximum protein content. This might be due genetic make up with nutrient availability (Tamak *et al.*, 1997).

Nutrient uptake

Nutrient uptake of N, P, K and S were significantly influenced by genotypes. Among the genotypes, KBSH 53 recorded higher N, P, K and S uptake as compared to other genotypes due to increase of its concentration in plant tissues. The results are in line with the reports of Seshadri Reddy *et al.* (2002).

Among the sulphur levels, maximum N,P,K and S uptake was registered under 40 kg S ha⁻¹. This might be due to optimum rate of sulphur application and recorded higher uptake of N,P,K and S. This may be attributed to increased uptake of N,P,K and S ultimately more utilization of these nutrients, which enhanced their concentration and uptake (Bhagat *et al.*, 2003). The least uptake of N,P,K and S was observed with 0 kg S ha. The results are in conformity with the findings of Thorat *et al.* (2003).

The interaction effect between genotypes and S levels were significant. The highest nutrient uptake of N,P,K and S was noticed under KBSH 53 with application of 40 kg S ha⁻¹. This could be due to optimum quantity of sulphur and its easy availability to the crops. Increased uptake of S was mainly due to increase of its concentration in plant tissues (Martre *et al.*, 2009). The least nutrient uptake of N, P, K and S was recorded under CO 4 with no sulphur application. This might be due to limited supply and uptake of nutrients. Similar results were reported by Tripathi (1992) and Sreemannaryana and Raju (1994).

Post harvest soil available nutrients

The genotypes significantly influenced the post harvest soil nutrient status *viz.*, N, P, K and S. Among the genotypes, CO4 recorded highest N, P, K and S available status due to poor nutrient uptake compared to other genotypes. Similar results were also reported by Sushanta Kumar Naik and Sankara Rao (2001).

Among the S levels, 0 kg ha⁻¹ S registered the maximum post harvest soil available nutrient of N,P,K and 20 kg S ha⁻¹ recorded the maximum S in post harvest soil. This might be due to no S applied plot recorded poor uptake of N,P and K compared to other S levels. 20 kg S ha⁻¹ recorded the lesser uptake of S in post harvest soil due to poor uptake of S compared with other S levels. Similar results were also reported by Krishnaprabu (2006).

The interaction effect between genotypes and sulphur levels were found to be significant. The maximum amount

of N, P, K and S was available in C0 4 with 0 kg S ha⁻¹ because of poor nutrient uptake in both crops. The least value was recorded under KBSH 53 with application of 40 kg S ha⁻¹ due to maximum uptake of N, P, K and S.

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