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The influence of weed control and sulphur fertilization on oil content and production of groundnut (*Arachis hypogaea* L.) in semi-arid region of Rajasthan

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Abstract
A field experiment was conducted during *kharif* season 2013 at SKNAU, Jobner in loamy sand soil of Rajasthan to study the effect of weed control and sulphur fertilization on oil yield and yield of groundnut. Results indicated that of weed free treatment results significantly higher pod yield, kernel yield, haulms yield, seed index, total S uptake and oil yield that was closely accompanied by application of pendimethalin at 0.75 kg/ha. Result further indicated that application of sulphur @ 60 kg/ha significantly higher pod yield and haulms yield over control. Highest total S uptake and oil yield found with sulphur @ 60 Kg/ha.

Keywords: Groundnut, oil yield, Sulphur uptake, yield

1. Introduction
Groundnut is one of the most important oilseed crops of India. Though India ranks first in the world with respect to area and production of oilseeds, it is not self-sufficient in the production of edible oil. In Rajasthan, groundnut is cultivated 5.1 lakh hectares with a total production of 10.4 lakh tonnes (Anonymous, 2015) [1]. Extensive weed infestation in groundnut is a serious problem that causes decreasing production. Because of its initial slow growth and short stature in comparison to fast growing weeds, weeds smother this crop at every stage by competing for water, nutrients, space and solar radiation (Jat *et al.*, 2011) [3]. Physical or mechanical methods are the traditional methods of weed control in groundnut which are cumbersome, time consuming and labour intensive, also. With increasing crisis of labour in the era of intensive cropping system, exploring the possibility of herbicidal weed control in groundnut derserves attention. Application of selective herbicides may control few species or group of weed in a diverse weed flora. So the weed management involving use of selective herbicide to keep the crop weed free during early stage of crop growth can be a good answer to such problem.
The importance of sulphur (S) in agriculture is being increasingly emphasized and its role in crop production is well recognized. For oilseed crops, S containing fertilizer is important because oilseed crops require more S than cereals. Sulphur is one of the essential plants nutrients which is best known for its role in the synthesis of sulphur containing amino acids like methionine (20% S) and cystine (27% S) and synthesis of proteins, chlorophyll and oil. Moreover, it is also associated with the synthesis of vitamins (biotine, thiamine). Hence a research trial was conducted to note down the effect of weed control methods sulphur based fertilizers on yield and oil content of ground nut in order to achieve the best combination of treatments in groundnut.

Material and method
A field experiment was conducted during *kharif* season of 2013 at research farm, SKNAU, Jobner, in a split plot design design (SPD) with three replications. The soil was loamy sand in texture, alkaline in reaction (pH 8.3), low in organic carbon (0.21%), low in available nitrogen (126.0 kg/ha), medium in available phosphorus (19.23 kg P2O5/ha), medium in potassium and low in sulphur (8.40 kg/ha). The experiment comprised six weed control treatments (Weedy check, weed free check, one hand weeding (HW) at 25 days after sowing (DAS), pendimethalin @ 0.75 kg/ha at 25 DAS, fluazifop-p-buty @ 0.20 kg/ha at 25 DAS and imazethapyr @ 100 g/ha) and four levels of sulphur (0, 20, 40 and 60 kg/ha). Fertilizers were applied through DAP, MOP, urea and gypsum at the time of sowing as basal dose. The groundnut cv. 'RG-382 was sown on 2nd July, 2013 using seed rate of 100 kg/ha with a row spacing of 30 cm. Three irrigations were applied during growing season.

Fully mature and develop pods from randomly selected five plants from each plot were plucked and number of seeds were counted. The average number of pods and seeds per plants was worked out. After threshing and winnowing the weight of seeds for each net plot area was recorded in kg per plot and then converted to kg/ha.

Results and Discussion

Effect of weed control

Total sulphur uptake and oil yield

The results indicated that all the treatment practiced for weed control recorded significantly higher S uptake and oil yield over weedy check. The maximum uptake of S was obtained under weed free treatment. It was followed by pendimethalin at 0.75 kg/ha and one HW at 25 DAS treatments (Table 2). As weedy check plots were heavily invaded by a number of fast growing weed species than crop right from emergence of crop upto harvest stage, the increasing rates of S depletion by rapidly growing weeds at subsequent stages under weedy check and some other treatments witnessing poor weed control efficiencies, offered maximum crop-weed competition for nutrients which is turn marginally but significantly reduced S concentration in kernel and haulm at harvest under these treatment. The highest oil yield was obtained under weed free treatment that was very closely followed by pendimethalin at 0.75 kg/ha. Improvement in oil yield under these superior treatment appears to be directly associated with the higher seed index under these treatments that produced bolder kernel under weed free conditions than weedy check. Favourable effect of weed control using mechanical and herbicidal measures on oil content of groundnut has also been reported by Suresh *et al*. (2010) [10].

Yield parameters

The results further revealed that all the treatment practiced for weed control recorded significantly higher pod yield, seed index, haulm yield, biological yield and kernel yield of groundnut and remained at par with the application of pendimethalin @ 0.75 kg/ha over rest of treatments. That was closely followed by one HW treatment at 25 DAS (Table 1.). The higher yield with these treatments was also largely due to high harvest indices that showed high partitioning coefficient towards sink in the weed free environment. In the presence of weeds, although the vegetative growth occurred to a level but the sink was not sufficient enough to accumulate the meaningful food assimilates translocating towards pod formation. Presence of weeds throughout the growing season caused poor crop growth and yield reduction in unweeded check. The results are in accordance with the findings of Singh and Singh (2009) [4]. However, harvest index remained materially unchanged under different treatments of weed control.

Effect of Sulphur levels

Total sulphur uptake and oil yield

With the every increase in level of sulphur resulted significant enhancement in S uptake by crop upto its highest level of 60 kg/ha over lower levels. The significant variation in S uptake can be attributed to higher functional activity of roots for longer duration under higher levels of S. Increased biomass production of the crop at harvest in terms of kernel and haulm yield together with higher S concentration might have resulted in significantly higher uptake of S by crop due to S fertilization upto 60 kg/ha. These finding corroborate the result of Poonia *et al*. (2013) [6, 9] in groundnut. Application of sulphur at 60 kg/ha provided the oil yield of 684.5 kg/ha that is highest among all the levels (Table 2). As sulphur is an integral part of oil, the increased availability of sulphur might have favourably influenced the synthesis of essential metabolism responsible for higher oil content. The higher oil yield due to sulphur application is the outcome of higher oil content in kernel and significantly higher pod yield of groundnut. These results are close to conformity with Sahu *et al*. (2001) [7] Kalaiyarasan *et al.* (2007) [5] in groundnut.

Yield parameters

Results further indicated that all the levels of S fertilization significantly enhanced the pod yield, kernel yield, haulm yield, biological yield, seed index and harvest index of crop in comparison to control. Application of S at 60 kg/ha provided the highest pod yield, kernel yield, haulm yield, biological yield and seed index as compare to preceding levels (Table 1.). Supply of sulphur in adequate amount helps in the development of floral primordial i.e. reproductive parts, which results in the development of pods and kernels in plants. Similar finding have also been reported earliar by Patel *et al*. (2009) [8] in groundnut.

Table 1: Effect of weed control and sulphur levels on yield and harvest index

Treatments	Yield (kg/ha)				
	Pod yield	Haulm yield	Biological yield	Harvest index (%)	Kernel yield (kg/ha)
Weedy check	977	1788	2765	35.13	635
Weed free	1971	3671	5643	34.73	1453
One HW at 25 DAS	1750	3259	5009	34.73	1254
Pendimethalin @ 0.75 kg/ha	1854	3456	5310	34.71	1339
Fluazifop-p-butyl @ 0.20 kg/ha	1343	2590	3933	33.93	912
Imazethapyr @ 100 g/ha	1555	2864	4419	34.99	1088
SEm±	48.07	73	130	0.81	38
Cd (P = 0.05)	151.47	230	410	NS	119
CV (%)	10.57	9.0	10.0	8.12	12
Sulphur levels (kg/ha)					
0	908	1855	2763	32.87	592
20	1558	2789	4347	35.85	1067
40	1835	3429	5264	34.87	1314
60	1999	3679	5678	35.22	1480
SEm±	26.29	54	78	0.58	27
Cd (P = 0.05)	69.81	144	207	NS	71
CV (%)	7.08	8.0	7.0	7.14	10

Table 2: Effect of weed control and sulphur levels on total S uptake and oil yield of crop

Treatments	Total S uptake (Kg/ha)	Oil yield (kg/ha)
Weed control		
Weedy check	5.22	247.0
Weed free	15.15	652.9
One HW at 25 DAS	12.67	549.0
Pendimethalin @ 0.75 kg/ha	13.93	600.3
Fluazifop-p-butyl @ 0.20 kg/ha	8.55	379.2
Imazethapyr @ 100 g/ha	10.33	466.9
SEm±	0.45	17.34
Cd (P = 0.05)	1.43	54.65
CV (%)	11.76	12.45
Sulphur levels (kg/ha)		
0	5.00	222.7
20	10.14	445.7
40	13.39	577.2
60	15.37	684.5
SEm±	0.29	13.39
Cd (P = 0.05)	0.76	35.55
CV (%)	9.10	11.77

Conclusion

Based on the one year experiment it may be concluded that highest kernel yield and haulm yield, S uptake and oil yield obtained with weed free check and sulphur @ 60 kg/ha significantly increased in respect of pod and haulms yield but remained at par with pendimethalin @ 0.75 kg/ha.

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