Ann. Agric. Res. New Series Vol. 37 (3) : 310-315 (2016)

Effect of weed control methods and sulphur fertilization on growth and yield of groundnut

Pinki Pancholi*, S.S. Yadav[1], H.P. Verma[2], J.S. Meena[3], L.R. Yadav[4] and A.C. Shivran[5]

S.K.N. College of Agriculture, Jobner-303329, India
**e-mail: hppersoya.p@gmail.com*

Received : February 2016 ; Revised Accepted: July 2016

ABSTRACT

A field experiment was conducted at Agronomy Farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif* season of 2013. Results showed that application of pendimethalin at 0.75 kg ha^{-1} and one HW at 25 days after sowing (DAS) resulted in significant reduction in weed density, weed infestation and weed dry matter in comparison to most of the treatments. The further results indicated that weed free plots showed significantly higher dry matter accumulation, dry weight of nodules per plant, number of pods per plant but number of kernels per pod, seed index, pod yield and haulms yield, remained at par with the application of pendimethalin @ 0.75 kg ha^{-1}. The weed free plot showed significantly higher number of nodules per plant, fresh weight of nodules per plant and remained at par with application pendimethalin @ 0.75 kg ha^{-1} and one hand weeding at 25 DAS over control. But, weed free plot significantly increased shelling percentage and remained at par with application @ 0.75 kg ha^{-1}, one hand weeding at 25 DAS and imazethapyr @ 100 g ha^{-1} over control. Result further indicated that application of sulphur @ 60 kg ha^{-1} significantly higher weed dry matter, dry matter accumulation, dry and fresh weight of nodules, number of nodules per plant, number of pods per plant, number of kernels per pod, seed index, pod yield and haulms yield and shelling percentage over control. However, harvest index, weed density and weed infestation remained materially unchanged under different treatments of weed control and sulphur levels.

Key words: Groundnut, Growth, Imazethapyr, Pendimethalin, Sulphur, Weed free and Yield.

Groundnut (*Arachis hypogaea* L.) is an important edible oilseed crop of India popularly known as peanut, monkeynut and locally called as *'moongphali'*. It is world's largest source of edible oil, ranks 13th among the food crops as well as 4th most important oilseed crops of the world (Ramanathan, 2001). Groundnut kernels contain high quality edible oil, easily digestible protein (26%) and carbohydrates (20%). In India, 48 per cent of the total produce is used for oil extraction, 11 per cent as seed, 8 per cent as direct food and only 1 per cent produce is exported. The vegetable oil consumption in India is continuously rising and has sharply increased in the couple of years touching around 12.4 kg $capita^{-1}$ $year^{-1}$ but this is still lower than the world average of 17.8 kg/capita/year. The developed Western world has per capita consumption of 44-48 kg $capita^{-1}$ $year^{-1}$ (Hedge, 2002).

Heavey weed infestation appears to be most serious menace in groundnut production causing extensive losses. Because of its short sature and initial slow growth in comparison to fast growing weeds, weeds smother this crop at every stage by sharing water, nutrients, space, solar radiation

* *Corresponding author :* Research Scholar, Department of Agronomy, S.K.N. Agriculture University, Jobner (Rajasthan).

[1,4&5] Professor, Agronomy, S.K.N. Agriculture University, Jobner (Rajasthan).

[2 & 3] Research Scholar, Department of Agronomy, S.K.N. Agriculture University, Jobner (Rajasthan).

and other resources resulting in yield losses ranging between 15-75 per cent (Jat *et al.*, 2011). Giri *et al.* (1998) reported an average yield loss of 89% due to weed infestation in irrigated summer groundnut. Groundnut emerges 5 to 7 days after sowing and once the weeds overtake the crop and begin to shade it, the effect becomes more serious within this period. It is the most critical period for crop to be kept free of weeds. High yielding varieties of groundnut are highly responsive to higher fertility levels and susceptible to their associated weeds. Weed management is virtually important not only to check the losses caused by them but also to increase the fertilizer and moisture use efficiency. Physical or mechanical methods are the traditional methods of weed control in groundnut which are cumbersome, time consuming and labour intensive. However, additional advantages of improving aeration, making soil loose and porous and soil moisture conservation by physical or mechanical methods can not be ignored. But, with increasing crisis of labour in the era of intensive cropping system, exploring the possibility of herbicidal weed control in groundnut derserves attention.

Sulphur is one of the essential plant 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), metabolism of carbohydrates, proteins and fats. Sulphur is also known to promote nodulation in legumes thereby increasing N fixation and associated with the crops of spurious nutrition and market quality. Its efficiency results in poor flowering, fruiting, cupping of leaves, reddening of stem and petiole and stunted growth. Global reports of sulphur deficiency and consequent crop responses, particularly in oilseed crops like groundnut are quite ostensible. Gypsum is an effective and cheaper source of sulphur and huge deposits of it are available in Rajasthan.

Materials and Methods

A field experiment was conducted during *kharif* season of 2013 at Department of Agronomy, College of Agriculture, Jobner, in a split-plot 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^{-1}), medium in available phosphorus (19.23 kg P_2O_5 ha^{-1}), medium in potassium and low in sulphur (8.40 kg ha^{-1}). The experiment consisted sex weed control treatments (Weedy check, weed free check, one hand weeding (HW) at 25 days after sowing (DAS), pendimethalin @ 0.75 kg ha^{-1} at 25 DAS, fluazifop-p-buty @ 0.20 kg ha^{-1} at 25 DAS and imazethapyr @ 100 g ha^{-1}) and four levels of sulphur (0, 20, 40 and 60 kg ha^{-1}). 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^{-1} with a row spacing of 30 cm. The crop was harvested on 26 November, 2013. 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 kgha^{-1}.

Results and Discussion

Weed study

Weed control : The results indicated that all the treatment practiced for weed control recorded significantly lower weed density and weed infestation at all the stages of observation in comparison to weedy check. After weed free check, the lowest density at all the stages was recorded under pendimethalin at 0.75 kg ha^{-1} (PE) treatment (Table 1). Remaining at par with one HW at 25 DAS, it reduce the weed density by comparison to imazethapyr at 100 g ha^{-1}, fluazifop-p-butyl at 0.20 kg ha^{-1} and weedy check treatments, respectively. The weed control treatments differed significantly in their effect on periodical weed dry matter production. After weed free, pre-emergence application of pendimethalin at 0.75 kg ha^{-1} treatment recorded the significantly lowest weed dry matter. However, it was found at par with one HW at 25 DAS over imazethapyr at 100 g ha^{-1}, fluazifop-

Table 1. Effect of weed control and sulphur levels on weed density, weed infestation and weed dry matter.

Treatments	Weed density (per 0.25 m^2)			Weed infestation (%)			Weed dry matter (kg ha^{-1})		
	35 DAS	70 DAS	At harvest	35 DAS	70 DAS	At harvest	35 DAS	70 DAS	At harvest
Weed control									
Weedy check	6.86 (46.58)	6.30 (39.13)	5.43 (28.99)	51.1	48.3	45.1	946.0	2284.9	2729.0
Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.0	0.0	0.0	0.0	0.0	0.0
One HW at 25 DAS	2.83 (7.49)	2.66 (6.60)	2.46 (5.55)	28.4	26.0	26.3	149.8	378.3	546.8
Pendimethalin @ 0.75 kg ha^{-1}	2.64 (6.47)	2.42 (5.35)	2.21 (4.38)	26.3	24.5	23.5	140.2	324.3	457.9
Fluazifop-p-butyl @ 0.20 kg ha^{-1}	3.43 (11.24)	3.32 (10.52)	3.20 (9.75)	33.6	33.1	31.9	199.8	655.5	892.8
Imazethapyr @ 100 g ha^{-1}	3.00 (8.48)	2.98 (8.40)	2.86 (7.66)	30.3	30.6	28.8	174.3	498.8	702.1
SEm±	0.09	0.09	0.10	1.5	1.50	1.15	7.3	20.2	29.6
CD (P = 0.05)	0.28	0.27	0.32	4.7	4.73	3.61	22.9	63.5	93.3
Sulphur level (kg ha^{-1})									
0	9.65 (3.19)	2.93 (8.10)	2.72 (6.90)	29.8	28.1	27.5	254.2	586.9	760.3
20	3.24 (10.00)	3.04 (8.75)	2.81 (7.40)	29.7	28.3	27.4	267.1	697.9	898.5
40	3.27 (10.20)	3.13 (9.30)	2.85 (7.60)	29.7	28.9	27.4	274.1	723.2	936.7
60	3.28 (10.23)	3.16 (9.51)	2.87 (7.75)	29.7	28.6	27.4	278.0	753.0	956.8
SEm±	0.07	0.07	0.05	0.77	0.77	0.91	4.5	12.9	19.6
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	12.0	34.3	52.0

p-butyl at 0.20 kg/ha and weedy check treatments, respectively. This profound increase in density and dry matter production of weeds under weedy check treatment might be attributed to uninterrupted growth of weeds throughout the crop season coupled with greater competitive ability than crop that was almost smothered due to fast growing of weeds. Heavy weed infestation and dry weight of weeds under unweeded control. Pendimethalin is known to be adsorbed by germinating weeds and disrupts the cell division, especially mitotic prosess mostly in meristematic tissue of weeds which are responsible for lateral and secondary root formation. Hence, thus it is fairly conceivable that such inhibitory effects of pendimethalin might have reduced the weed population and weed dry matter production. The results are in close conformity with finding of Kumar *et al.* (2004).

Sulphur levels : The result further indicates (Table 1) that different levels of sulphur did not result any significant variation in weed density and weed infestation at any stage of crop growth. The application of sulphur at 60 kg ha^{-1} produced the highest weed biomass over control and 20 kg S/ha at these three stage, respectively. However, it remained at par with 40 kg S ha^{-1}. The better availability of S achived by its increasing addition to soil sustained the growth of large number of rapidly growing weeds that would have otherwise been exterminated away under poor fertility levels. These finding are in close conformity with those reported by Chaubey *et al.* (2003).

Growth parameters

Weed control : Results revealed that weed free check significantly increased dry matter

accumulation per meter row length, dry weight of nodule per plant and remained at par with the application of pendimethalin @ 0.75 kg ha^{-1} (Table 2). The comparative weed free environment provided by these treatments minimized the crop-weed competition to the extent of their efficacy in weed control that led to better growth of crop in terms of dry matter production and nodulation. Weed free environment also saved the growth inputs like moisture, nutrients, light and space and provided better edaphic and nutritional environment in the root zone, as a consequence, inhanced the growth of groundnut significantly as compared to weedy check (Bhalerao *et al.,* 2011). However, weed control treatments in weed free plot significantly increased number of nodules per plant and fresh weight of nodule per plant but remained at par with the application of one hand weeding (HW) at 25 DAS and pendimethalin @ 0.75 kg ha^{-1}.

Sulphur levels : Application of sulphur @ 60 kg ha^{-1} significantly highest dry matter accumulation per meter row length, number of nodules per plant, fresh and dry weight of nodule per plant over rest of treatments (Table 2). Sulphur in the form of sulphate is involved in various metabolic and enzymatic activities of plants. It is also a constituent of glutathione, a compound supposed to play part in plant respiration and synthesis of oils (Jordon and Reisenaur, 1957). Further, sulphur also plays a vital role in chlorophyll formation as it consititutes succynyl Co-A which is involved in synthesis of chlorophyll. It engages in activation of a number of enzymes participating in dark reaction of photosynthesis improvement in general and their activation at cellular level by promoting greater photosynthesis and merismetic activity seemed to have stimulated vegetative growth of crops in terms of dry matter accumulation, number and weight of nodules per plant significantly the similar result were also reported by Singh *et al.* (2008) in groundnut.

Yield attributes and yield

Weed control : Weed free check produced

Table 2. Effect of Effect of weed control and sulphur levels on growth and yield attributes of groundnut.

Treatments	Dry matter accumulation / m row length	Nodules plant^{-1}	Weight of nodules plant^{-1} (mg)		Pods plant^{-1}	Karnels pod^{-1}	Seed index (g)
			Fresh weight	Dry weight			
Weed control							
Weedy check	294.4	45.7	134.9	67.7	9.87	1.64	52.5
Weed free	495.2	64.3	195.2	93.7	20.6	2.25	71.1
One HW at 25 DAS	439.8	61.4	188.9	87.2	18.9	2.09	65.9
Pendimethalin @ 0.75 kg ha^{-1}	466.8	63.4	192.9	90.6	19.2	2.16	68.4
Fluazifop-p-butyl @ 0.20 kg ha^{-1}	354.9	52.6	158.2	74.8	13.9	1.82	57.3
Imazethapyr @ 100 g ha^{-1}	397.9	57.6	177.9	78.9	16.9	1.96	61.9
SEm+	11.55	1.49	3.90	1.88	0.47	0.05	1.42
CD (P = 0.05)	36.41	4.69	12.28	5.93	1.49	0.15	4.48
Sulphur level (kg ha^{-1})							
0	244.9	47.2	142.2	67.6	9.82	1.66	55.2
20	363.3	55.2	167.4	79.1	16.3	1.96	61.6
40	471.2	62.3	190.4	88.7	19.2	2.10	65.6
60	553.2	65.3	198.8	93.2	20.8	2.20	68.9
SEm+	7.11	0.92	3.12	1.42	0.34	0.04	1.11
CD (P = 0.05)	18.88	2.45	8.28	3.77	0.89	0.09	2.94

significantly higher number of pods per plant, number of kernels per pod, seed index, pod yield, haulm yield, biological yield and kernel yield of groundnut and remained at par with the application of pendimethalin @ 0.75 kg ha^{-1} over rest of treatments (Table 2 & 3). The increase in pod yield of groundnut 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. The one hand weedings and pendimethalin with regard to yield attributes and yield. But weed control in weed free treatment significantly increased the shelling percentage and remained at par with one hand weeding at 25 DAS, pendimethalin @ 0.75 kg ha^{-1} and imazethapyr @ 100 g ha^{-1} over weedy check and fluazifop-p-butyl @ 0.20 kg ha^{-1}. The most severe crop-weed competition throughout the crop season due to unrestricted weed growth under weedy check plots increased the depletion of nutrients and moisture by weeds, thus adversely affecting the crop growth. It also declined the translocation of photosynthates towards seed formation affecting yield attributes adversely, which is turn reduced the yield to the lowest level. These results are strongly supported with the finding of Chaitanya *et al.* (2013). However, harvest index remained materially unchanged under different treatments of weed control.

Sulphur levels : The increasing levels of sulphur upto 60 kg ha^{-1} produced significantly higher number of pods per plant, number of karnels per pod, seed index, pod yield, haulm yield, biological yield, karnel yield and shelling percentage over rest of the treatments (Table 2 & 3). Wareing and Patrick (1975) also reported that improvement in yield parameters was attributed to diversion of greater proportion of assimilates to the developing pods due to increased sink strength reflected through its larger demand of photosynthates. Supply of sulphur in adequate amount also helps in the development of floral primordial i.e. reproductive parts, which results in the development of pods and kernels in plants. However, harvest index remained materially unchanged under different levels of sulphur.

Table 3. Effect of Effect of weed control and sulphur levels on yield and shelling percentage of groundnut.

Treatments	Yield (kg ha^{-1})		Harvest index (%)	Shelling percentage
	Pod yield	Haulm yield		
Weed control				
Weedy check	977	1788	35.1	64.2
Weed free	1971	3671	34.7	72.8
One HW at 25 DAS	1750	3259	34.7	70.8
Pendimethalin @ 0.75 kg ha^{-1}	1854	3456	34.7	71.4
Fluazifop-p-butyl @ 0.20 kg ha^{-1}	1343	2590	33.9	67.1
Imazethapyr @ 100 g ha^{-1}	1555	2864	35.0	69.1
SEm±	48	73	0.81	1.51
CD (P = 0.05)	151	230	NS	4.77
Sulphur level (kg ha^{-1})				
0	908	1855	32.9	64.6
20	1558	2789	35.9	67.9
40	1835	3429	34.9	70.0
60	1999	3679	35.2	73.2
SEm±	26	54	0.58	0.86
CD (P = 0.05)	70	144	NS	2.27

Conclusion

Based on one year experimentation, it may be concluded that weed free check and sulphur @ 60 kg ha^{-1} significantly increased in respect of pod and haulms yield but remained at par with pendimethalin @ 0.75 kg ha^{-1}.

References

Bhalerao, S.N., Shaikh, A.R., Landge, S.A. and Romade, B.D. 2011. Effect of different weed management treatments on growth of groundnut. *International Journal of Forestry and Crop Improvement*, **2**(1): 33-35.

Chaitanya, S., Shankaranaryana, V. and Nanjappi, H.V. 2013. Influence of different herbicides on growth and yield of kharif groundnut. *Mysore Journal of Agriculture Science*, **47**(2): 280-284.

Chaubey, A.K., Singh, S.B. and Kaushik, M.K. 2003. Response of groundnut (Arachis hypogaea) to sources and levels of sulphur fertilization in mid-western plains of Uttar Pradesh. *Indian Journal of Agronomy*, **45**(1): 166-169.

Giri, A.N., Bhonsle, R.H. and Shelke, D.K. 1998. Weed management in cotton-groundnut sequence. *Indian Journal of Agronomy*, **43**: 50-56.

Hedge, D.M. 2002. Measures to turn self-reliant. The Hindu Survey of India: 71-74.

Jat, R.S., Meena, H.N., Singh, A.L., Surya, M. J. and Mishra, J.B. 2011. Weed management in groundnut in India- A review. *Agriculture Reviews*, **32**(3): 155-171, 2011.

Jordon, H.V. and Reisenaur, H.M. 1957. Sulphur and soil fertility. (In) Soil Year Book Agriculture, USDA, *Washington*: 107-111.

Kumar, R., Thakral, S.K. and Kumar, S. 2004. Response of greengram (*Vigna radiata* L.) to weed control and fertilizer application under different planting systems. *Indian Journal of Weed Science*, **36**(1&2): 131-132.

Singh, S., Kumar, Y., Gill, O.P., Singh, S. and Kumar, Y. 2008. Growth characteristics of summer groundnut (*Arachis hypogaea* L.) as influenced by sulphur levels, irrigation schedules and organic manures. *Annals of Agriculture*, **19**(2): 135- 139.

Wareing, P.F. and Patrick, J. 1975. Sources- sink relation and partitions of assimilates in the plant. (In) Photosynthates and Productivity in Different Environment (Ed. J.P. Copper) Cambridge University Press, London: 481-499.