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Effect of potassium and sulphur on growth, yield attributes and yield of summer groundnut in loamy sand

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Abstract
An experiment was conducted during summer season of the year 2020 at Agronomy Instructional Farm, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar to study the "Effect of potassium and sulphur on growth, yield and quality of summer groundnut (*Arachis hypogeal* L.) In loamy sand". Nine treatment combinations comprising three levels of potassium (0, 25 and 50 kg ha^{-1}) and three levels of sulphur (15, 30 and 45 kg ha^{-1}) were evaluated in randomized block design with factorial concept with three replication. An application of potassium @ 50 kg K_2O ha^{-1} recorded significantly higher number of pods per plant, pod weight per plant, seed index, pod yield and haulm yield of groundnut crop as compared to 0 kg K_2O ha^{-1}. Among different sulphur levels, application of 45 kg S ha^{-1} recorded significantly number of pods per plant, pod weight per plant, seed index, pod yield and haulm yield of groundnut crop as compared to 15 kg S ha^{-1}.

Keywords: Potassium, sulphur, growth, yield attributes, groundnut

Introduction
Groundnut (*Arachis hypogaea* L.) is an important summer oil seed crop and food grain legume. Groundnut cultivation occurs in 108 countries around the world, which is grown in all tropical and subtropical countries. It is a valuable cash crop planted by millions of small farmers because of its economic and nutritional value. About two thirds of world production is crushed for oil and remaining one third is consumed as food. Groundnut (*Arachis hypogaea* L.) is important oilseed crop belong to family *Leguminosae* and popularly called as Poor Man's Almond.
Groundnut (*Arachis hypogaea* L.) contains high quality edible oil (48 per cent), easily digestible protein (26 per cent) and carbohydrates (20 per cent) therefore considered as "king of oilseed" among the oilseed crops and botanically classified in family Fabaceae India ranks first in the world in respect of area and second in production after China. In India, total groundnut area was 39.31 lakh hectares and production of 68.62 lakh MT with productivity of 1745 kg ha^{-1} during the year of 2019 (IOPEPC). In Gujarat, summer and *kharif* groundnut area, production and productivity were 33,920 and 15.52 lakh hectares, 84,000 MT and 29.38 lakh MT and 2476 kg ha^{-1} and 1893 kg ha^{-1}, respectively during the year of 2019 (Anonymous, 2019-20) [1].
Potassium is one of the major essential nutrient elements required by plants. Among the three major nutrients, Potassium (K) has a special position as evident by its role in increasing the crop yield (Yadav, *et al*., 2003) [22] by adding tolerance to various biotic and abiotic stresses. Potassium plays a major role in improving growth and yield of crop as it is involved in assimilation, transport and storage tissue development (Cakmak, 2005) [5]. Potassium is the second most absorbed nutrient by the peanut crop (Tasso *et al*., 2004) [20]. Though potassium is not a constituent of any compound or structurally bound in groundnut, it is required for translocation of assimilates and involved in maintenance of water status of plant especially the turgor pressure of cells and opening and closing of stomata and increase the availability of metabolic energy for the synthesis of starch and proteins. Besides, it increased peg formation, nodulation, synthesis of sugar and starch and help in pod growth and development.
Sulphur is the fourth major nutrient and plays an important role in the nutrition of oil-seed crop and as a constituent of sulphur containing amino acids cysteine, cysteine and methionine (Gangadhara *et al*., 1990) [10]. They considered that the oil-seeds require more sulphur than other crops; its concentration and uptake vary with the availability of sulphur in soil.

The overall requirement of sulphur for oil seed crops is as high as phosphorus (Aulakh *et al*. 1988) [2]. In oil seed crops, it is also involved in the formation of glucocides or glucosinolates which on hydrolysis increase the oil content. One of the main functions of sulphur in proteins or polypeptides is the formation of disulphide bonds between polypeptide chains. The application of sulphur increased the uptake of various macro and micro nutrients in groundnut (Singh, 1999) [19].

In order to generate location specific information on effect of potassium and sulphur on growth and yield of summer groundnut in loamy sand, the present study was conducted at Sardarkrushinagar.

Materials and Methods

The field experiment was conducted during summer season of 2020 to find out the effect of potassium and sulphur on growth and yield of groundnut at Agronomy Instructional Farm, Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Banaskantha (Gujarat).

Nine treatment combinations comprising here levels of potassium 0, 25 and 50 kg K_2O ha^{-1}) three levels of sulphur (15, 30 and 45 kg S ha^{-1}) were tried in factorial randomized block design with three replications. Groundnut variety Gujarat Groundnut 2 was used as a test crop. The soil of experimental field was loamy sand in texture, slightly alkaline in nature, low in organic carbon, available Zn and Cu; medium in available P_2O_5, available S, Fe and Mn and high in available K_2O, available nitrogen.

A common dose of nitrogen and phosphorus @ 25 kg ha^{-1} and 50 kg ha^{-1} were applied for all treatments. Potassium and sulphur were applied in form of murite of potash and bentonite sulphur, respectively as per the treatments. Other agronomic management practices were followed as per standard recommendations.

For all the growth and development studies during the crop growth period, five plants were selected randomly from net plot and tagged in each plot for recording plant height, number of pods plant^{-1}, pod weight plant^{-1} , 100 seeds were randomly taken from the bulk produce of each net plot and were counted and weighed. The weight was expressed as 100-seed weight in grams. The data on pod and haulm yield were recorded from net plot and converted on hectare basis. Data were statistically analyzed by the procedure suggested by Panse and Sukhatme (1985) [11].

Results and Discussion

Effect of potassium

Application of potassium produced non significant effect on plant population at 30 DAS an at harvest as well as plant height at harvest (Table 1). Application of 50 kg K_2O ha^{-1} gave significantly higher number of pods per plant (20.67) as compared to 0 kg K_2O ha^{-1}, but it was remained at par with application of 25 kg K_2O ha^{-1}. Potassium said to be important for quality parameters and helps in balance nutrition of crops, transport sugar and water hence its favourable effects on pod formation. Similar results are reported by Rathor *et al.* (2013) [16] and Hemeid *et al*. (2015) [12] in groundnut.

Significantly higher pod weight per plant (12.97 g) was recorded with application of 50 kg K_2O ha^{-1} as compared to of 0 kg K_2O ha^{-1} and 25 kg K_2O ha^{-1}. However, pod weight per plant was recorded from 0 kg K_2O ha^{-1} and 25 kg K_2O ha^{-1} was at par with each other (Table 1). The increase in pod weight might be due to the fact that K influenced the physiological processes that were directly related to symbiotic N_2 fixation, photosynthesis, and carbohydrate translocation for pod growth and due to increase in pod growth improved pod weight per plant. These results are in accordance with the findings of by Salve and Gunjal (2011) [18] and Rathor *et al.* (2013) [16].

Significantly highest seed index (44.84 g) recorded with application of potassium @ 50 kg ha^{-1} over 0 kg K_2O ha^{-1} but, it was at par with 25 kg K_2O ha^{-1} (Table 1). The improvement in the yield attributing characters like seed index might be due to the fact that potassium acts as a catalytic agent in activating a number of enzymes and synthesis to peptide bonds. Potassium plays a crucial role in meristematic growth through its effect on the synthesis of phytohormones. The results so obtained get support with those of Rathore *et al*. (2013) [16] in groundnut and Jadeja *et al*. (2016) in chickpea.

The data given in Table 1 revealed that application of potassium @ 50 kg K_2O ha^{-1} recorded significantly higher pod yield (2281 kg ha^{-1}) as compared to 0 kg K_2O ha^{-1}, but it was at par with application of potassium @ 25 kg K_2O ha^{-1}. The lowest pod yield (2040 kg ha^{-1}) was recorded with treatment receiving 00 kg K_2O ha^{-1}. Beneficial effect of potassium on pod production is attributed to its role in plant nutrition, physiological and metabolic processes, including photosynthesis, transport of nutrients, transport and storage of carbohydrates from which fat has synthesized, nitrogen absorption and synthesis of proteins and starch. The present result is in close agreement with the result obtained by Hadwani *et al.* (2005) [11], Chandra *et al.* (2006) [6] and Hemeid (2015) [12].

Application of 50 kg K_2O ha^{-1} recorded significantly higher haulm yield (3390 kg ha^{-1}) which was at par with treatment 25 kg K_2O ha^{-1}. The lowest haulm yield (3058 kg ha^{-1}) was recorded with 00 kg K_2O ha^{-1}. Potassium also make a pronounced role in carbohydrates synthesis, photosynthesis cell elongation, stomatal activity and higher nutrient uptake under this level resulted in higher plant height and number of branches per plant and ultimately helped in realization of higher haulm yield. The similar result was obtained by Hadwani *et al.* (2005) [11] and Chandra *et al.* (2006) [6] in groundnut.

Effect of sulphur

Sulphur application did not not significantly influenced on plant population at 30 DAS an at harvest as well as plant height at harvest (Table 1). Among different sulphur levels, application of 45 kg S ha^{-1} recorded significantly higher number of pods per plant (20.67), but it was at par with treatment receiving 30 kg S ha^{-1}. Treatment reciving 15 kg S ha^{-1} recorded the lowest number of pods per plant (18.00). This might be due to sulphur plays vital and important role in energy storage & transformation, carbohydrate metabolism and activation of enzymes also increase the photosynthetic activity of plant. Hence its favourable effects on development of pods. These results are in accordance with the results of Pawar *et al*., (2015) [16], Banu *et al.*, (2017) [4] and Aier and Nongmaithem (2020) [3].

Application of sulphur @ 45 kg ha^{-1} recorded significantly higher pod weight per plant (12.75 g) as compared to 15 kg S ha^{-1} (Table 1). Improvement in vegetative structures for nutrient absorption and photosynthesis, strong sink strength through development of reproductive structures and production of assimilates under influence of applied S maintained balance source-sink might have resulted in increased yield attributes. Similar result was also found by Giri *et al.* (2014) [9] and Dutta *et al.* (2015) [7].

The data summarized in Table 1 revealed that application of sulphur @ 45 kg S ha^{-1} recorded significantly higher seed index (44.58 g) over 15 kg S ha^{-1} but it was at par with 30 kg S ha^{-1}. The positive effect of sulphur fertilization on seed index ascribed to more availability of sulphur during vegetative and reproductive stages of the crop. Sulphur helps in chlorophyll formation, photosynthetic process, and activation of enzymes and grain formation and various metabolic activities. Similar findings were observed by Rao *et al*. (2013) [17], Aier and Nongmaithem (2020) [3] and Dudekula *et al.* (2021) [8].

Significantly higher pod yield (2267 kg ha^{-1}) was noted with treatment receiving 45 kg S ha^{-1}, but it was at par with treatment receiving 30 kg S ha^{-1}. However, pod yield of groundnut was recorded from 30 kg S ha^{-1} and 15 kg S ha^{-1} was at par with each other. Maximum availability of sulphur helps in stimulating photosynthesis and seed formation as well as synthesis of sulphur containing amino acids, proteins, chlorophyll, and promoting nodulation may be assigned to increase total biomass production which was finally reflected in increment in pod yield of groundnut. Similar results were also found by Vaghasia *et al.* (2007) [21], Yadav *et al.* (2017) [23] and Dudekula *et al.* (2021) [8].

Sulphur application @ 45 kg ha^{-1} produces significantly highest haulm yield (3399 kg ha^{-1}) as compared to 15 kg S ha^{-1}, but it was at par with 30 kg S ha^{-1} (Table 1). The lowest haulm yield (3028 kg ha^{-1}) was recorded in treatment receiving 15 kg S ha^{-1}. These results can be ascribed to effect of sulphur application on cell division, enlargement and elongation resulting in overall improvement in plant organ associated with faster and uniform vegetative growth of the crop. The results were in line of results of those reported by Rao *et al.* (2013) [17], Noman *et al.* (2015) [13], Pawar *et al.* (2015) [15] and Aier and Nongmaithem (2020) [3].

Table 1: Effect of potassium and sulphur on growth parameter, yield attributes and yield of summer groundnut

Treatments	Plant population (per meter raw length)		Plant height at harvest (cm)	Number of pods per plant	Pod weight per plant (g)	Seed Index (g)	Pod yield (kg ha^{-1})	Haulm Yield (kg ha^{-1})
	At 30 DAS	At harvest						
Levels of Potassium (K)								
K_0: 00 kg K_2O ha^{-1}	9.18	8.61	41.16	18.22	11.14	41.49	2040	3058
K_1: 25 kg K_2O ha^{-1}	9.27	8.40	41.37	19.11	11.74	43.44	2104	3199
K_2: 50 kg K_2O ha^{-1}	9.91	9.21	42.33	20.67	12.97	44.84	2281	3390
S.Em. ±	0.28	0.27	1.14	0.64	0.35	0.87	59	86
C. D. at 5 %	NS	NS	NS	1.92	1.06	2.61	177	259
Levels of Sulphur (S)								
S_1: 15 kg S ha^{-1}	9.32	8.41	40.81	18.00	11.41	41.07	2023	3028
S_2: 30 kg S ha^{-1}	9.43	8.84	41.81	19.33	11.69	44.12	2136	3220
S_3: 45 kg S ha^{-1}	9.60	8.98	42.25	20.67	12.75	44.58	2267	3399
S.Em. ±	0.28	0.27	1.14	0.64	0.35	0.87	59	86
C. D. at 5 %	NS	NS	NS	NS	1.06	2.61	177	259
Interaction: K × S								
S.Em. ±	0.480	0.473	1.97	1.11	0.61	1.51	102	150
C. D. at 5 %	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %	8.80	9.37	8.18	9.42	8.87	6.04	8.27	8.07

Conclusion

Based on present investigation, it can be concluded that for getting higher yield of summer groundnut the crop should be fertilized with 25 kg K_2O ha^{-1} and 30 kg S ha^{-1} along with recommended dose of nitrogen and phosphorus (25:50 N:P_2O_5 Kg ha^{-1}) in loamy sand.

References

1. Anonymous. Crop wise area, production and productivity of Gujarat state, Directorate of Agriculture, Gandhinagar, 2019-20.
2. Aulakh MS, Pasricha NS, Dev G. Sulphur fertilization of oilseeds for yield and quality. Proc. TSI-FAI. Symposium on sulphur in Indian Agriculture, held at New Delhi. 1988;S-II/3:1-14.
3. Aier I, Nongmaithem D. Response of groundnut (*Arachis hypogeal* L.) to lime and different levels of sulphur. International Journal of Bio-resource and Stress Management. 2020;11(6):585-589.
4. Banu R, Jagruti C, Shrrof C, Shah SN. Effect of sources and levels of sulphur and bio-fertilizer on growth, yield and quality of summer groundnut. International Journal of Agricultural Sciences. 2017;13(1):67-70.
5. Cakmak. Effect of N, P and K levels on yield, nutrient content, uptake and quality of summer groundnut grown on typic haplustepts. Journal of the Indian Society of Soil Science. 2005;53(1):125-128.
6. Chandra, Pradyut, Samui RC, Bordolut Sanjoy Kumar. Growth, yield attributes and yield of different cultivars of groundnut as affected by potassium application. Journal of Crop and Weed. 2006;2(1):37-39.
7. Dutta D, Duttamudi D, Murmu P, Thentu TL. Response of groundnut (*Arachis hypogaea* L.) to irrigation schedules, sulphur levels and sources in alluvial zone of West Bengal. Indian Journal of Agronomy. 2015;60(3):443-449.
8. Dudekula D, Singh V, Tiwari D, George SG, Padachala S. Effect of variety and sulphur on growth and yield of

groundnut (*Arachis hypogaea* L.). Biological Forum- An International Journal. 2021;13(1),0975-1130.
9. Giri U, Hedayetullah M, Saha A, Nanda MK, Bandyopadhyay P. Productivity and nutrient uptake of summer groundnut (*Arachis hypogaea* L.) towards different levels of irrigation and sulphur. Journal of Crop and Weed. 2014;10(2):248-251.
10. Gangadhara GA, Manijunathaiah HM, Stayanarayana T. Effect of sulphur on yield, oil content of sunflower and uptake of micronutrient by plants. Journal of Indian Society of Soil Science. 1990;38:693-695.
11. Hadwani GJ, Gundalia JD. Effect of N, P and K Levels on Yield, Nutrient Content, Uptake and Quality of Summer Groundnut Grown in Typic Haplustepts. Journal of the Indian Society of Soil Science. 2005;53(1):125-128.
12. Hemeid NM. Effect of different sources and levels of potassium fertilization on productivity of peanut grown under sandy soil conditions. Journal of Soil Science and Agricultural Engineering. 2015;6(12):1441-1454.
13. Noman, Heba Mohamed, Rana DS, Rana KS. Influence of sulphur and zinc levels and zinc solubilizer on productivity, economics and nutrient uptake in groundnut (*Arachis hypogaea* L.). Indian Journal of Agronomy. 2015;60(2):301-306.
14. Panse VC, Sukhatme PV. Statistical methods for agricultural workers. (4th Ed)ICAR, New Delhi, 1985, pp. 97-164.
15. Pawar RG, Naiknaware MD, Murumkar SB. Effect of varying levels of boron and sulphur on growth, yield and quality of summer groundnut (*Arachis hypogaea* L.). National Academy of Agricultural Science (NAAS). 2015;33(2):471-474.
16. Rathore S, Chaudhary DR, Bhatt BP. Scheonite and Potassium Sulphate: Indigenous Potassic Fertilizer for Rainfed Groundnut. International Journal of Traditional Knowledge. 2013;13(1):222-226.
17. Rao KT, Rao AU, Sekhar D. Effect of sources and levels of sulphur on groundnut. Journal of Academia and Industrial Research. 2013;2(5):2278-5213.
18. Salve YV, Gunjal BS. Effect of different levels of phosphorus and potassium on summer groundnut (*Arachis hypogaea* L.). International Journal of Agricultural Science. 2011;7(2):352-355.
19. Singh AL. Mineral nutrition of groundnut. In: Advances in plant physiology scientific publisher, India. 1999;2:161-200.
20. Tasso NM, Chaudhary VN. Schoenite and potassium sulphate: Indigenous potassic fertilizer for rainfed groundnut. Indian Journal of Traditional Knowledge. 2004;13(1):222-226.
21. Vaghasia PM, Khanpara VD, Mathukia RK. Impact of in-situ moisture conservation and sulphur nutrition on yield, quality and nutrient uptake by groundnut. International Journal of agricultural Sciences. 2007;3(1):151-153.
22. Yadav IS, Kumar MN, Bhuiyan MS. Role of Potassium and Sulphur on the Growth, Yield and Oil Content of Soybean (*Glycine max* L.). Academic Journal of Plant Sciences. 2003;3(2):99-103.
23. Yadav Nagesh, Yadav SS, Yadav Neelam, Yadav MR, Kumar Rakesh, Yadav LR, *et al*. Growth and productivity of groundnut (*Arachis hypogaea* L.) under varying levels and sources of sulphur in semi-arid conditions of Rajasthan. Legume Research, 2017. DOI: 10.18805/LR-3853.