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Effect of Variety and Sulphur on Growth and Yield of Groundnut (*Arachis hypogaea* L.)

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ABSTRACT: A field experiment was carried out during Kharif 2020 at Krishi Vigyan Kendra (KVK) to study effect of variety and sulphur on yield and yield components of groundnut (*Arachis hypogaea* L.). Treatments consists of 3 different varieties of groundnut *viz.* Kadiri Amaravathi, Dharani, Kadiri 6 and 3 levels of Sulphur *viz.* 20, 30 and 40kg/ha as basal. Each of the nine treatments was repeated three times and laid out in a randomised block pattern. The results revealed that treatment 9 (Kadiri 6 with 40kg/ha sulphur per hectare) recorded maximum plant height (59.31), number of nodules/plant (56.73), dry weight (47.53), number of pods per plant (22.65), number of kernels per pod (2.01), seed index (38.57), seed yield (2900.00), haulm yield (4479.00), gross returns (130763.00), net returns (81059.70) and B:C Ratio (1.63). It reveals from the study that application of sulphur in optimum doses i.e., 40 kg/ha contribute to enhance the rate of crop development, oil content and yield in groundnut by increasing pods per plant.

Keywords: Kadiri Amaravathi, Dharani, Kadiri 6, Sulphur, groundnut yield attributes.

INTRODUCTION

Groundnut is considered to be the most important food legume and oilseed crops of India, which is cultivated in 4.91 million ha area with the production of 9.18 million tonnes and average productivity of 1.86 t/ha (DES, 2018). Groundnut, being an unpredictable legume, its response to nutrient application is always not optimistic. Groundnut oil is composed of mixed glycerides and contains a high percentage of unsaturated fatty acids, such as oleic (50 to 65 percent) and linoleic acid (18 to 30 percent). Groundnut contains amino acids including cysteines which are essential for animal growth. The groundnut cake obtained after oil extraction is rich in protein and considered as valuable organic manure and animal feed, which contains 7 to 8% N, 1.5% P and 1% K. Important reasons for low average yield of groundnut at farmers field were the use of low seed rate and improper agronomic practices, to overcome this issue the appropriate utilization of micro nutrients like sulphur, gypsum etc are the most important which contribute substantially to the seed yield of groundnut.

Sulphur plays an important role in groundnut metabolism. It is essential for protein synthesis. It is essential for the formation of chlorophyll. Sulphur is a secondary essential plant nutrient factor that plays a role in the formation of protein alongside nitrogen and phosphorus. The application of Sulphur fertilizer and groundnut has been found effective through increasing the number of pegs and pods /plant, kernel to shell ratio etc.

Variety and Sulphur play a significant role in the physiological growth and yield of crops such as groundnut. Variety is the most important factor in groundnut production. Use of high yielding varieties has been increased remarkably in recent years and the country has reached almost a level of sufficiency in groundnut. The varieties which may be suited to early Kharif is quite different from rest of the seasons with respect to growth habit. Optimum plant population with unit area per hectare for a given variety at specific situation not only reduce the cost of cultivation but also augment to the full yield potential of the cultivar. Keeping above points in mind present investigation was conducted. The main objective of the investigation to study the effect of variety and sulphur on growth, yield of groundnut.

MATERIALS AND METHODS

The present investigation was undertaken at Research Farm, Krishi Vigyan Kendra, Yagantipalli, Kurnool District, Andhra Pradesh, during kharif 2020 which is located at 15° 32' 79" N latitude, 78° 18' 71" E longitude and 273m altitude above the mean sea level (MSL). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.2), low in organic carbon (0.48%), available N (171.48 kg/ha), available P (13.6 kg/ha) and available K (215.4 kg/ha). The treatments consist three levels of sulphur and three different varieties. The experiment was laid out in Randomized Block Design with nine treatments each replicated thrice. The treatments were T1: Kadiri

Amaravathi + 20 kg/ha Sulphur; T2: Kadiri Amaravathi + 30 kg/ha Sulphur; T3: Kadiri Amaravathi + 40 kg/ha Sulphur; T4: Dharani + 20 kg/ha Sulphur; T5: Dharani + 30 kg/ha Sulphur; T6: Dharani + 40 kg/ha Sulphur; T7: Kadiri 6 + 20 kg/ha Sulphur; T8: Kadiri 6 + 30 kg/ha Sulphur; T9: Kadiri 6 + 40 kg/ha Sulphur. The recommended dose of inorganic fertilizer (RDF) was 20 kg N + 40 kg P_2O_5 + 40 kg K_2O per ha and the sources were urea, single super phosphate and muriate of potash respectively. Treatment wise different varieties with required dosages of sulphur were applied during final land preparation of the experiment respectively with the spacing of 30 cm × 10 cm. Five random plants were selected from each plot to record observations on plant growth attributes. Similarly, five random plant samples were collected from each plot at the time of harvest for recording observations on plant yield attributes. Experimental data collected was subjected to statistical analysis by adopting Fisher's method of Analysis of Variance (ANOVA) as outlined by Gomez and Gomez (2010). Critical Difference value were calculated whenever the 'F' test was found significant at 5% level.

RESULTS AND DISCUSSION

Plant height exhibited an increasing trend with corresponding increase in level of sulphur at all the growth stages. The significantly higher plant height (59.36 cm) was observed in treatment with application of Kadiri 6 + 40 kg/ha Sulphur whereas both Dharani + 40 kg/ha Sulphur and Kadiri 6 + 30 kg/ha Sulphur has shown at par results with treatment Kadiri 6 + 40 kg/ha Sulphur. Sulphur was applied at 40 kg ha-1recorded highest plant height, plant dry matter accumulation, pod yield. B. Rama Krishnaand Rajesh Singh (2019). Crop dry matter production increased significantly with increased level of sulphur. The significantly higher dry weight (56.73 g/plant) was obtained from Kadiri 6 + 40 kg/ha Sulphur treatment whereas Kadiri Amaravathi + 40 kg/ha Sulphur, Kadiri 6 + 30 kg/ha Sulphur and Dharani + 40 kg/ha Sulphur has shown at par results with Kadiri 6 + 40 kg/ha Sulphur treatment. Number of nodules per plant was also increased with increasing dose of Sulphur significantly higher number of nodules per plant (47.53) were observed in treatment Kadiri 6 + 40 kg/ha Sulphur whereas both Kadiri 6 + 30 kg/ha Sulphur and Dharani + 40 kg/ha Sulphur has shown at par results with Kadiri 6 + 40 kg/ha Sulphur Significantly higher crop growth rate (13.82 g/m^2/day) and relative growth rate (0.008) was observed in Kadiri Amaravathi + 40 kg/ha Sulphur whereas except Kadiri 6 + 20 kg/ha Sulphur and Dharani + 20 Kg/ha Sulphur has remaining all treatments shown at par results with Kadiri 6 + 40 kg/ha Sulphur.

Application of sulphur has been reported to improve not only the availability of sulphur itself but of other nutrients too, which are considered important for the growth and development of plant. It seems to have promoted meristematic activities causing higher apical growth and expansion of photosynthetic surface. Sulphur has also been reported to help in lowering the soil pH, which is the main reason for greater availability and mobility of nutrients especially P, Fe, Mn, and Zn. The present investigation is in cognizance with the findings of Raja *et al.,* (2007) and Rajiv *et al.,* (2012). Plants with higher sulphur content have been shown to have improved xylem and collenchyma tissue growth and thickening. Such beneficial effects may have resulted in stronger stems, resulting in more primary branches per plant. The improvement in overall vegetative growth of the crop with the application of sulphur in the present investigation is in cognizance with the findings of Allam (2001), Sarkar and Banik (2002) and Raja *et al.,* (2007) in sesame. Sulphur in the form of sulphate is involved in various metabolic and enzymatic activities of plant. It is also a constituent of glutathione, a compound supposed to play part in plant respiration and synthesis of oils (Jordon and Reisenaur, 2003). Further, sulphur also plays a vital role in chlorophyll formation as it is constituent of succynyl Co-A which is involved in chlorophyll synthesis (Pirson, 2005). The higher content of sulphur in plants is known to have role in better development and thickening of xylem and collenchyma tissues. The improved nutritional environment at the cellular level and leaf chlorophyll content appears to have increased the photosynthetic rate.

Table 1: Growth attributes of Groundnut as influenced by Variety and Sulphur.

Treatments	Plant height(cm) at harvest	Dry weight(g/plant) at harvest	No. of nodules per plant at harvest	Crop growth Rate(g/m^2/day) at harvest	Relative growth rate (g/g/day) at harvest
1. Kadiri Amaravathi + 20kg/ha Sulphur	54.33	49.16	41.24	8.91	0.006
2. Kadiri Amaravathi + 30kg/ha Sulphur	54.85	50.08	40.88	11.46	0.007
3. Kadiri Amaravathi + 40kg/ha Sulphur	52.04	54.46	42.32	13.82	0.008
4. Dharani + 20kg/ha Sulphur	54.19	49.56	43.01	3.35	0.002
5. Dharani + 30kg/ha Sulphur	53.43	51.74	41.59	6.36	0.004
6. Dharani + 40kg/ha Sulphur	57.85	54.78	46.08	10.27	0.006
7. Kadiri 6 + 20kg/ha Sulphur	52.89	48.80	42.34	3.22	0.002
8. Kadiri 6 + 30kg/ha Sulphur	56.64	54.57	45.63	9.84	0.006
9. Kadiri 6 + 40kg/ha Sulphur	59.31	56.73	47.53	8.41	0.005
SEm (±)	1.16	0.86	0.96	2.56	0.0022
CD (p=0.05)	3.47	2.59	2.87	7.61	0.005

Table 2: Yield attributes and Yield of Groundnut as influenced by Variety and Sulphur.

Treatments	No. of pods/plant	No. of kernels/pod	Shelling(%)	Seed index (%)	Seed yield (kg/ha)	Haulm yield (kg/ha)	Harvest index (%)
Kadiri Amaravathi + 20kg/ha Sulphur	19.31	1.63	66.23	37.42	2540.00	4189.00	37.76
Kadiri Amaravathi + 30kg/ha Sulphur	17.21	1.48	66.90	35.92	2452.00	3583.00	40.67
Kadiri Amaravathi + 40kg/ha Sulphur	20.00	1.60	68.56	36.10	2548.00	3775.00	40.32
Dharani + 20kg/ha Sulphur	18.29	1.63	69.43	36.72	2707.00	3543.00	43.32
Dharani + 30kg/ha Sulphur	18.79	1.66	69.38	35.80	2454.00	3728.00	39.71
Dharani + 40kg/ha Sulphur	21.53	1.95	72.22	36.63	2831.00	4207.00	40.23
Kadiri 6 + 20kg/ha Sulphur	19.43	1.73	67.13	37.83	2664.00	3627.00	42.35
Kadiri 6 + 30kg/ha Sulphur	21.62	1.91	69.57	35.95	2851.00	4276.00	40.00
Kadiri 6 + 40kg/ha Sulphur	22.65	2.01	70.83	38.57	2900.00	4479.00	39.32
SEm (±)	0.46	0.104	1.51	0.84	57.90	95.10	0.57
(p=0.05)	1.38	0.31	-	-	173.58	285.11	-

Thus, it is obvious that the improved growth and development of the crop plants in the present investigation might be the result of enhanced metabolic activities and photosynthetic rate resulting in improvement in the accumulation of dry matter at the successive growth stages further leads to increase the crop and relative growth rates in all stages of plants. Present investigation is in cognizance with the findings of Sarkar and Banik (2002).

The balanced nutritional climate appears to be responsible for the improved yield attributes. Another possible cause is effective and greater metabolite partitioning, as well as sufficient nutrient translocation to evolving reproductive structures, i.e., sink. Wareing and Patrick (2005) 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 primordia i.e., reproductive parts, which results in the development of capsules and seeds in plant. The application of sulphur thus might have increased the yield attributing parameters in sesame. The yield of a crop is the cumulative effect of yield attributing characters such as capsules per plant, seeds per capsule and test weight. Thus, the seed yield of ground nut also increased significantly due to application of sulphur as a consequence of highest values of above parameters (Anonymous, 2006 and 2009). The improvement in yield attributes of groundnut might be due to better nutritional environment in root zone for growth and development. Yadav *et al.*, (2018).

Table 3: Economics of groundnut as influenced by Variety and Sulphur.

Treatments	Gross return (INR/ha)	Net return (INR/ha)	B:C ratio
1. Kadiri Amaravathi + 20kg/ha Sulphur	115058.00	66396.60	1.36
2. Kadiri Amaravathi + 30kg/ha Sulphur	110155.00	61222.50	1.25
3. Kadiri Amaravathi + 40kg/ha Sulphur	114571.00	65367.70	1.33
4. Dharani + 20kg/ha Sulphur	120766.00	72704.50	1.51
5. Dharani + 30kg/ha Sulphur	110515.00	62182.50	1.29
6. Dharani + 40kg/ha Sulphur	127329.00	78726.00	1.62
7. Kadiri 6 + 20kg/ha Sulphur	119134.00	69972.20	1.42
8. Kadiri 6 + 30kg/ha Sulphur	128280.00	78847.50	1.60
9. Kadiri 6 + 40kg/ha Sulphur	130763.00	81059.70	1.63

Plate 1. Spraying of insecticides and Measuring dry weight in Groundnut at Krishi Vigyan Kendra, Yagantipalli (A.P).

The combined application of sulphur (30 kg S ha^{-1}) along with recommended dose of nitrogen and potash increased the nutrient availability, plant growth, yield & yield attributes of groundnut (Kumar and Vikram Singh 2019). The increase in stalk yield due to sulphur application might be due to the cumulative effect of increased plant height, number of nodules per plant and dry matter production i.e., increased growth parameters. The seed and stalk yields combined together showed significant increase in biological yield of ground nut. The results of the present investigation are in close conformity with the findings of Sriramchandrasekharan (2004), Saren *et al.*, (2004), Sarkar and Saha (2005), Tripathi *et al.*, (2007) and Rajiv *et al.*, (2012). Application of 40 kg/ha Sulphur through gypsum fetched significantly higher net returns and B: C ratio due to cost effective in nature and the Ground nut variety Kadiri 6 proved significantly superior in respect of the above parameters, yield attributes, yield as well as economics.

This might be due to high return to investment of the above treatments. The maximum gross return (49,703.3 Rs/ha), net return (1,30,763 Rs/ha) and benefit cost (1.63) ratio was obtained with the application of Kadiri 6 + 40 kg/ha Sulphur treatment.

CONCLUSION

It can be concluded that higher yield with better quality of ground nut (Kadiri 6) was found with application of variety Kadiri 6 with 40 Kg/ha Sulphur in terms of more productivity (2900.00 Kg/ha) as well as net returns (Rs.81059.7/ha).

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