Original Research Article

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Effect of Levels of Sulphur and Plant Growth Regulators on Growth, Yield and Oil percentage of Summer Groundnut (*Arachis hypogaea* L.)

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ABSTRACT

Keywords

Groundnut, Zaid, Sulphur, Yield attributes, Gypsum, Kernel weight, Oil content

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The experiment was conducted during the *Zaid* season 2018 at Prayagraj to study the Sulphur and Plant Growth Regulators on Growth, Yield and Oil percentage of Summer Groundnut (*Arachis hypogaea* L.). The experiment comprised of 2 factors and 13 treatments viz. Sulphur (30, 40, 50 kg ha⁻¹) and Plant growth regulators (NAA 50 ppm (at 20 DAS alone & at 20, 40 DAS), GA₃ 30 ppm (at 20 DAS alone & at 20, 40 DAS)) and control. Sulphur and Plant growth regulators application significantly influenced the growth, yield attributing characters, yield and oil content over control. Addition of sulphur at 40 kg ha⁻¹ along with foliar application of 50 ppm NAA twice at 20 DAS and 40 DAS recorded highest plant height (38.47 cm), plant dry weight (82.15 g), pod yield (1.97 t ha⁻¹) and oil content (47.23 %) sulphur at 50 kg ha⁻¹ along with foliar application of GA₃30 ppm at 20 & 40 DAS was seen in the kernels.

Introduction

Groundnut is annually grown on about 24 m ha of land in about 120 countries under different agro-climatic zones between 40° S and 40° N (DGR, 2013). It occupies premier position with regards to area and production in India. India accounts about 20 per cent area and less than 10 per cent production of oilseed of the world. Whereas, groundnut accounts for 40 per cent of the area and 30 per cent of the production of total oilseeds grown in the

country (Anonymous, 2009-10). Currently, six states viz: Gujarat, Andhra Pradesh, Karnataka, Tamil Nadu, Maharashtra and Rajasthan account for more than 90 per cent of the total groundnut area and 89.3 per cent of total production. Gujarat ranks first in area and production of this crop. In the recent years, the area under summer groundnut has increased due to assured and higher profit and productivity as it is grown under assured irrigation facility and lesser incidence of a biotic and abiotic stresses on crop as

compared to rainy season (Rana *et al.*, 2014). Despite of being such an important oilseed crop, the average productivity in the state is lower than nation level as well as its production potential. Hence, our efforts should be aimed to remove the constraints responsible for its poor productivity. Sulphur is also known to promote nodulation in legumes there by N fixation and associated with the crops of spurious nutrition and market quality. Its application increases drought and cold tolerance in plant by process of disulphide linkage. Gypsum is another material huge deposits of which are found in the state of UP and being excavated at large scale. It has been the endeavour of crop physiologists to influence crop growth and production by the exogenous application of the growth regulators. Spraying of NAA during early crop growth stage, especially before flower initiation have been found to result in a higher fertility of flower, early fruit set and increasing the number of filled pods per plant (Gopalakrishnan and Srinivasan, 1975; Valliappan *et al.*, 1985 and Rao, 1997). Gibberellic acid has been used as a growth regulator to increase yields in different crops like paddy (Sinha, 1969).

Materials and Methods

The experiment was conducted during the *Zaid* season of 2018 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj (U.P.) India. Soil was sandy clay loam having pH 7.2, organic carbon around 0.42%, available nitrogen at 245 kg ha⁻¹, available P₂O₅ at 14.8 kg ha⁻¹ and K₂O at 343.2 kg ha⁻¹. The experiment was laid out in Randomized Block Design consisting of 13 treatment combinations each replicated three times. Different levels of Sulphur (30, 40 and 50 kg ha⁻¹) and different Plant growth regulators (NAA 50 ppm at 20 DAS, NAA 50

ppm twice at 20 & 40 DAS, GA₃ 30 ppm at 20 DAS, GA₃ 30 ppm twice at 20 & 40 DAS). Treatments were randomly arranged in each replication. Data on different growth parameters, yield attributes and yield were recorded from randomly selected ten tagged plants from net plot. The percentage of oil content in seed was determined by solvent extraction method in Soxhlet apparatus with petroleum ether as solvent (AOAC, 1980).

Results and Discussion

Application of Sulphur at the rate of 40 kg ha⁻¹ along with foliar application of NAA at the rate of 50 ppm ha⁻¹ at 20 & 40 DAS gives highest plant height (38.47 cm). The results are confirmed by Singh *et al.*, (2008), Kalaiyarasan *et al.*, (2003) that plant height increases with increased application of sulphur and GA₃ and NAA. Highest plant dry weight (82.15 g) was found in which Sulphur was applied at the rate of 40 kg ha⁻¹ along with foliar application of NAA at the rate of 50 ppm ha⁻¹ at 20 & 40 DAS. A significant increase in plant dry matter at different stages of growth due to increase in Sulphur levels GA₃ and NAA. It engages in activation of a number of enzymes participating in dark reaction of photosynthesis via improvement in general and their activation at cellular level by promoting greater photosynthesis and meristematic activity seemed to have stimulated vegetative growth of crops in terms of dry matter accumulation. Maximum Pod yield (1.97 t ha⁻¹) was recorded in Treatment Sulphur was applied at the rate of 40 kg ha⁻¹ along with foliar application of NAA at the rate of 50 ppm ha⁻¹ at 20 & 40 DAS. Supply of sulphur and GA₃ and NAA 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. Similar findings have also been reported earlier by Gupta and Singh (1982) and Patel *et al.*, (2009).

Table.1. Plant growth, Yield & Oil Content of Groundnut as effected by different treatments at Harvest

S. No.	Treatments	Plant height (cm)	Dry weight (g)	Pod yield (t ha ⁻¹)	Oil content (%)
1	30 kg ha ⁻¹ S & NAA 50 ppm at 20 DAS	33.80	70.40	1.80	43.20
2	30 kg ha ⁻¹ S & NAA 50 ppm at20 & 40DAS	33.40	71.50	1.79	42.57
3	30 kg ha ⁻¹ S & GA ₃ 30 ppm at 20 DAS	33.21	71.59	1.79	42.70
4	30 kg ha ⁻¹ S & GA ₃ 30 ppm at20 & 40 DAS	36.13	73.80	1.81	45.87
5	40 kg ha ⁻¹ S & NAA 50 ppm at 20 DAS	34.25	71.53	1.82	42.70
6	40 kg ha ⁻¹ S & NAA 50 ppm at 20 &40 DAS	38.47	82.15	1.97	46.80
7	40 kg ha ⁻¹ S & GA ₃ 30 ppm at 20 DAS	36.13	77.83	1.81	45.97
8	40 kg ha ⁻¹ S & GA ₃ 30 ppm at 20 & 40 DAS	38.02	81.67	1.93	46.21
9	50 kg ha ⁻¹ S & NAA 50 ppm at 20 DAS	36.40	78.26	1.89	43.67
10	50 kg ha ⁻¹ S & NAA 50 ppm at 20 & 40 DAS	37.60	80.95	1.90	46.80
11	50 kg ha ⁻¹ S & GA ₃ 30 ppm at 20 DAS	35.83	79.53	1.90	46.10
12	50 kg ha ⁻¹ S & GA ₃ 30 ppm at 20 & 40 DAS	37.10	80.67	1.92	47.23
13	Control	33.75	71.31	1.75	44.00
	SEm _±	0.91	2.51	0.03	0.55
	CD (P=0.05)	2.67	9.41	0.09	1.61

Maximum oil content (47.23 %) was recorded in which sulphur was applied at the rate of 50 kg ha⁻¹ along with foliar application of GA₃ at the rate of 30 ppm ha⁻¹ at 20 & 40 DAS. 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 about 90% of plant sulphur is present in these amino acids (Tandon and Messick, 2002). The increase in oil content due to sulphur fertilization might be the outcome of better availability of nutrients owing to favourable environment created by sulphur application. 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 (Jordon and Reisenaur, 1957).

In conclusion, sulphur application significantly influenced the growth, yield attributing characters and yield. Treatment in which Sulphur was applied at 40 kg ha⁻¹ along with foliar application of 50 ppm NAA twice at 20 DAS and 40 DAS recorded highest plant height, plant dry matter accumulation, pod yield and oil percentage in sulphur at 50 kg ha⁻¹ along with foliar application of GA₃ 30 ppm at 20 & 40 DAS.

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