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Effect of Varying Levels of Boron and Sulphur on Growth, Yield and Quality of Summer Groundnut (*Arachis hypogea* L.)

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ABSTRACT: *The field trial was carried out to Study of varying levels of boron and sulphur on growth, yield and quality of summer groundnut (*Arachis hypogea *L.) was conducted during summer 2010. The experiment comprising twelve-treatment combinations was laid out in factorial randomized block design (FRBD) with three replications. The treatment consisted of combinations of four levels of boron viz., no boron (B_0), 4 kg B ha^{-1} (B_1), 8 kg B ha^{-1} (B_2) and 12 kg B ha^{-1} (B_3) and three levels of elemental sulphur viz., no sulphur (S_0), 20 kg S ha^{-1} (S_1) and 40 kg S ha^{-1} (S_2). The results of the experiment revealed that the groundnut crop fertilized with 8 kg boron showed remarkably increased plant growth parameters viz., No. of pegs per plant (43.88) and No. of nodules at 50-55 DAS (102.00) and yield attributes viz., numbers of pods per plant (10.83), shelling (71.22) %, Kernel yield kg ha^{-1} (1214 kg ha^{-1}) were increased significantly when crop fertilized with 8 kg B ha^{-1} (B_2). and application of 40 kg ha^{-1} (S_2). sulphur results maximum number of pods per plant (10.44), shelling % (71.16), Kernel yield (1136 kg ha^{-1}). Also higher pod yield (1588 kg ha^{-1}), haulm yield (2196 kg ha^{-1}), oil content (52.04%) and protein content (23.14%) which were significantly higher than the control treatment.*

Key words: *Boron, Groundnut, Quality Sulphur and Yield.*

Groundnut (*Arachis hypogea* L.) is an important oilseed crop on which the country's vegetable oil economy depends very much. In India, groundnut is grown in 11 states, accounts for 29 percent of total production of oilseed. Oilseed occupies an important position in Indian economy by contributing about 4% Gross National Product (GNP). At the present level area and production, it occupies about 75.72 lakh tones and productivity is about 1210 kg /ha in India. Though the share of groundnut in the total oil seed production in India has been falling since 1950, when it was 70% to the present level of 33%, groundnut is still a major oilseed crop in India. Its production decides not only the price of groundnut oil in any year, but also the price of most of other edible oils.

kharif groundnut is grown under rainfed situations and the summer groundnut is grown under assured irrigated conditions. Hence summer groundnut is much less likely to suffer moister deficient and consequently the average productivity (about 1500 kg ha^{-1}) is higher to *kharif* groundnut (about 1000 kg ha^{-1}). As the *kharif* groundnut continuous to be risk prone due to vagaries of monsoon, opportunities of realizing further incremental growth in average national groundnut productivity of *rabi*, summer groundnut in India for the year 2007-08 were 9.80 lakh ha, 18.2 lakh ton and 1857 kg ha^{-1} respectively. In the past five years the area, under summer groundnut in Gujarat state has increased from 0.57 to 1.45 lakh ha. The increase in yield has also been registered in Gujarat state from 1641 to 1724 kg ha^{-1}. The average yield of groundnut in India has 980 Kg/ha., which is less than the average yield of groundnut in world has 1620 Kg/ha. (Anonymous, 2009).

Groundnut production in Saurashtra exhibited diminishing trend during last three decade, this may be partly because of nutritional disorder caused due to continuous monocropping of groundnut. Boron is one of them as the soils are calcareous, which restricts the boron availability. Boron is unique among the essential mineral micronutrients because it is the only element that is normally present in soil solution as a non -ionized molecule over the pH range suitable for plant growth. Boron is involved in the transformation of sugar and starch formation. It also influences cell development and elongation. Boron affects carbohydrate metabolisms and starch formation and synthesis of proteins of proteins. Addition of boron

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(2 ppm) in groundnut increased the yield by 18 per cent and improved the quality (Golakiya, 1988) through suitable changes in yield attributes. Sulphur as a plant nutrient is becoming increasingly important in dry land agriculture as it is the master nutrient of all oilseed crop and pulses. Among the field crops, oilseeds and pulses are more responsive to sulphur. sulphur play important role in synthesis of essential amino acids like Cysteine, Cystine, Methionine and certain vitamins like Biotin, Thiamine, Vitamin B_1 as well as formation of ferodoxin an iron-containing plant protein that acts as an electron carrier in the photosynthetic process and chlorophyll. This required for the production of oil. Similar results were also reported by Dimree and Dwivedi (1994), Patra *et al*., (1995a), Ranparia 2001, Mali *et al*., (2004) and Samui and Adhikary (2004) in groundnut.

The appropriate combination of Boron and Sulphur asses the productivity of groundnut under irrigated condition in summer season (Singh and Singh (1990) and Singh *et al*., (1996)) in groundnut is not well documented. Keeping these considerations in view an experiment was planned entitled "Response of summer groundnut (Arachis hypogaea L) to different level of boron and sulphur" at Junagadh Agricultural University Farm, Junagadh in 2009.

A field experiment entitled "Study Effect of varying levels of boron and sulphur on growth, yield and quality of summer groundnut (*Arachis hypogea* L.)" was carried out during summer 2010. On the farm of College of Agriculture, Junagadh. The soil of the experimental plot was clayey in texture and slightly alkaline in reaction with pH value 8.0. The soil has an organic carbon content of 0.54 per cent and was medium in available nitrogen, potash, and phosphorus also low in sulphur and boron. Summer Variety TPG-41 was selected for sowing. The experiment comprising of twelve treatments combination were laid out in Factorial Randomized block design with three replications with four levels of Born i.e. B_0 = Control, B_1 = 4 kg ha^{-1} B_2 = 8 kg ha^{-1} B_3 = 12 kg ha^{-1} and three levels of Sulphur i.e. S_0 = Control, S_1 = 20 kg ha^{-1}, S_2 = 40 kg ha^{-1}. Application of boron and sulphur at basal dose.

RESULTS AND DISCUSSION

Effect on growth parameters

The application of boron 12 kg/ha (B_3) & sulphur 40 kg/ha (S_2) obtained best performance at final plant population per hectare (285000 and 282475), plant height (33.60 and 31.95), number of branches at harvest 3.90 and 3.70). This treatment proved superior because unique among the essential nutrients. It is the only element for plant growth present in soil solution as a non ionized molecule over the PH range also involved in starch formation. Boron is essential for nodule forming bacteria. Hence number of nodules per plant is increased. (Table 1) These results are in agreement with the work of Mudller 1949, Pradhan & Sarkar 1993.

Table 1
Effect of Boron and Sulphur on growth contributin Characters of summer Groundnut

Treatments	*Plant population at harvest*	*Plant height (cm)*	*No. of branches plant^{-1} at harvest*	*No pegs*	*No nodules*
Boron (Kg ha^{-1})					
B_0 (0)	278844	27.61	3.10	35.88	90.33
B_1 (4)	281778	29.78	3.14	38	93.88
B_2 (8)	284278	32.22	3.67	43.88	102.00
B_3 (12)	285000	33.60	3.90	39.00	98.88
S. Em ±	1217	0.61	0.10	1.05	1.9
C.D. (0.05)	NS	1.8	0.29	3.1	5.7
Sulphur (kg ha^{-1})					
S_0 (0)	282783	29.38	3.07	36.50	91.75
S_1 (20)	282167	31.08	3.59	39.67	96.83
S_2 (40)	282475	31.95	3.70	42.17	100.25
S. Em ±	1217	0.53	0.087	0.9	1.6
C.D. (0.05)	NS	1.8	0.25	2.68	4.9
C V (%)	1.49	6.0	8.7	8.04	6.0
Interaction					
S × B	NS	Sig.	Sig.	Sig.	Sig.

Sulphur play important role cell division, photosynthetic processes & chlorophyll formation. Also in increase root nodules due to this ultimately plant height & number of branches per plant.

Effect on yield contributing characters

Different levels of boron & sulphur significantly increase attributes of groundnut crop. The application of these higher levels remarkably increased yield attributing character are number of pod per plant, number of mature pod per, kernel yield, plant, shelling %, pod yield kg/ha, halum yield, kernel yield. Because of Sulphur & Boron helps in formation of chlorophyll, photosynthetic process & activation of enzymes as well as grain formation. They also involves in carbohydrates metabolism which ill terms to increase the uptake of nutrients & ultimately resulted increases the yield of groundnut. (Table 2).

These results are in close conformity with the findings of Patra *et al*., (1995a), Chaubey *et al*., (2000),

Kalaiyarasan *et al*., (2002), Tripathi and Hazra (2003) in groundnut.

Table2
Effect of Boron and Sulphur on yield and quality Contributing characters of summer Groundnut.

Treatments	*Number of pods plant^{-1}*	*Shelling (%)*	*Pod yield (Kg ha^{-1})*	*Halum yield (Kg ha^{-1})*	*Kernel yield (Kg ha^{-1})*
Boron (Kg ha^{-1})					
B_0 (0)	8.69	63.88	1344	1617	862
B_1 (4)	9.72	67.11	1507	1939	1012
B_2 (8)	10.83	71.22	1706	2133	1214
B_3 (12)	9.88	67.88	1586	2517	1078
S. Em ±	0.25	1.19	56.75	75.86	43.76
C.D. (0.05)	0.73	3.4	166	222	128
Sulphur (kg ha^{-1})					
S_0 (0)	8.98	64.50	1427	1896	923
S_1 (20)	9.92	66.91	1588	2063	1065
S_2 (40)	10.44	71.16	1592	2196	1136
S. Em ±	0.22	1.0	49	65.70	37.90
C.D. (0.05)	0.63	3.0	144	192	111
C V (%)	7.65	5.2	11.09	11.09	12.6
Interaction					
S × B	Sig.	Sig.	Sig.	NS	NS

Effect on quality parameter

The application of boron 8 kg & sulphur 40 kg/ha increased protein (23.14 & 23.89), oil contain (52.33 & 52.04) increased significantly as compared to controlled treatment. Because they plays important role in synthesis of essential amino acids like cysteine, methionine, & certain vitamin like biotine, thymine, Vit. B_1 as well as the formation of ferodoxin & iron containing plants. Protein that act as electron carrier in photosynthetic process. (Table 3) Which required for production of oil. Similar results were also reported by Patra *et.al*., (1995a), Chakraborthy and Das (2000), Bhagiya *et al*., (2005) and Naset *et al*., (2006). Mali *et al*., (2004) and Samui and Adhikary (2004) in groundnut.

Table 3
Effect of Boron and Sulphur on quality parameter characters of summer Groundnut.

Treatments	*Oil content (%)*	*Protein content (%)*
Boron (Kg ha^{-1})		
B_0 (0)	45.77	20.46
B_1 (4)	48.66	21.50
B_2 (8)	52.33	23.89
B_3 (12)	50.83	22.29
S.Em ±	0.852	0.35
C.D. (0.05)	2.4	1.026
Sulphur (kg ha^{-1})		
S_0 (0)	46.50	20.56
S_1 (20)	49.66	22.40
S_2 (40)	52.04	23.14
S.Em ±	0.738	0.03
C.D. (0.05)	2.1	0.88
C.V. (%)	5.17	6.43
Interaction		
S × K	NS	NS

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