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# Effect of different levels of boron and molybdenum on growth and yield of summer groundnut (*Arachis hypogaea* L.) under medium black calcareous soils of south Saurashtra region of Gujarat

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## Abstract
An field experiment was conducted at Net house, Department of Agricultural Chemistry and Soil Science, College of Agriculture, Junagadh Agricultural University, Junagadh during summer season of 2016 to evaluate soil application of boron and molybdenum and effect on growth and yield components of summer groundnut (*Arachis hypogaea* L.) under south Saurashtra region of Gujarat. The experiment comprising of five levels of boron viz., 0, 2, 4, 8 and 10 kg B ha$^{-1}$ and three levels of molybdenum viz., 0, 1, 2 kg Mo ha$^{-1}$ and experiment was laid out in Factorial Completely Randomization Design and replicated thrice. The results of the experiment revealed that the groundnut crop fertilized with 8 kg boron showed remarkably increased plant growth parameters viz., Plant height (23.30 cm), no. of pegs per plant (26.04), no. of nodules (91.57), nodule dry weight (0.231 g) and yield attributes viz., No. of pods per plant (10.55), shelling % (67.15), pod yield (19.75 g plant$^{-1}$) were increased significantly when crop fertilized with 8 kg B ha$^{-1}$ (B4). Application of 1 kg ha$^{-1}$ ($Mo_2$) molybdenum results maximum number of pegs per plant (21.78), No. of nodules (95.01), nodule dry weight (0.236 g), pods per plant (9.58), shelling % (68.89). Also higher pod yield (18.23 g plant$^{-1}$), haulm yield (18.64 g plant$^{-1}$) which were significantly higher than the control treatment.

**Keywords:** *Arachis hypogaea*, boron, molybdenum.

## Introduction
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 is annually grown on about 24 M ha of land in about 120 countries under different agro-climatic zones between $40^0$S and $40^0$N (Anon., 2013) [1]. In India, it is cultivated on an area of 5.53 M ha with production of 9.67 M tonnes and productivity of 1750 kg ha$^{-1}$ during 2013-2014 (Anon., 2015) [3]. Gujarat produce 6.84 M tonnes of oilseed with the share of 20.80 % Gujarat is leading state in term of total oilseed production. In India total groundnut production is 9.67 M tonnes from area of 5.5 M ha, with Gujarat produce 4.92 M tonnes which share 50% of total groundnut production (Anon., 2014) [2].

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 (2 ppm) in groundnut increased the yield by 18 per cent (Golakiya and Patel, 1986a) [9] and improved the quality (Golakiya, 1988) [8] through suitable changes in yield attributes (Sutaria and Golakiya, 1990) [18]. Molybdenum is required for the formation of the nitrate reductase enzyme and in the legume it plays an additional role in symbiotic nitrogen fixation. The nitrogen fixing enzyme, nitrogenase is composed of molybdenum and iron and without adequate quantities of these elements, nitrogen fixation can't occur. Muralidharan and George (1971) [11] found that Mo increased the vegetative growth and weight of nodular materials and finally the yield of groundnut. The studies by Noor *et al.*, 1997 indicated that application of molybdenum increased the yield, nodulation and oil content in groundnut. The functions of molybdenum in leguminous plants include nitrate reduction, nodulation, nitrogen fixation and general metabolism (Togay *et al.*, 2008) [19].

Groundnut is most important crop cultivated in *kharif* as well as in summer season. It is short duration crop, hence, it is most convenient under intensive cropping in Saurashtra region of Gujarat. Under continuous intensive cropping, the mining of major as well as micro nutrients by the crops but renew only required major nutrients through chemical fertilizer. Under such circumstances, the soils of some pockets of the region falls in micronutrient deficiency. For determining the needs of micronutrient particularly B and Mo by groundnut was taken which become helpful for further study on balance as well as INM in groundnut through organic or inorganic materials.

## Materials and Methods

The experiment was conducted at Net house, Department of Agricultural Chemistry and Soil Science, College of Agriculture, Junagadh Agricultural University, Junagadh during summer season of 2016. The soil of the experimental field was clayey in texture and alkaline in reaction (pH of 8.00 and EC of 0.58 dS m$^{-1}$). The soil was low in available nitrogen (212 kg ha$^{-1}$), medium in available phosphorus (28.63 kg ha$^{-1}$), medium in available potassium (257 kg ha$^{-1}$), medium in available sulphur (10.02 ppm), medium in iron (5.24 ppm), high in manganese (12.78 ppm), medium in zinc (0.74 ppm), and high in copper (1.21 ppm). The experiment comprised of total fifteen treatment combinations in which five levels of boron (0, 2, 4, 8 and 10 B kg ha$^{-1}$) and three levels of molybdenum (0, 1 and 2 Mo kg ha$^{-1}$) were laid out in Completely Randomization Design having factorial concept with three replications. The fertilizer application was done with fixed doses of nitrogen at 25 kg ha$^{-1}$, phosphorus at 50 kg ha$^{-1}$ and potassium at 50 kg ha$^{-1}$. Boron and molybdenum application was done according to the treatments. The nutrients of N, P, K, B and Mo were applied by using sources of Urea, DAP, MOP, Boric acid and Ammonium molybdate, respectively. The Groundnut variety "Gujarat Groundnut-31" was planted in fourth week of February. A week after germination five plants per each pot were maintained under normal practices. The crop was raised with all the standard package of practices and protection measures also timely carried out as they required. The experimental data recorded for growth parameters, yield attributes and yield parameters were statistically analyzed for level of significance.

## Results and Discussion

### Growth, yield attributes and yields

### Effect of boron

The data revealed that the maximum plant height (23.30 cm) was obtained with boron application of 8 kg ha$^{-1}$, which was statistically at par with application of 4 and 10 kg B ha$^{-1}$. Maximum number of primary branches (3.89) per plant was recorded in 10 kg boron per hectare (Table 1), which was statistically at par with application of 4 and 8 kg B ha$^{-1}$. The number of pegs per plant (Table 1) showed that different levels of boron exerted their significant influence on number of pegs at harvest; the application of 8 kg B ha$^{-1}$ significantly recorded with maximum number of pegs per plant (26.04), which was found statistically at par with 10 kg B ha$^{-1}$. The application of 1 kg B ha$^{-1}$ resulted in significantly the higher number of nodules per plant (91.57) and nodules dry weight (0.231 g plant$^{-1}$), which remained at par with 10 kg B ha$^{-1}$ at harvest. Boron is important for root and shoots growth, flower fertility and responsible for the cell wall formation and stabilization. Boron is essential nutrient for nodule forming bacteria therefore, increased nodule count. These findings were also collaborated with Patra and Bhattacharya (2009) [16], Ansari *et al.* (2014) [4] and Srinivasan *et al.* (2008) [17].

A perusal of data (Table 1) revealed that different levels of boron exerted their significant influence on numbers of pods and number of mature pods. Application of 8 kg B ha$^{-1}$ recorded significantly the maximum numbers of pods per plant (10.556) and maximum number of mature pods per plant (7.572), which was remain statistically at par with 10 kg B. Application of 8 kg B ha$^{-1}$ recorded significantly the higher shelling percentages (67.15%) and 100-seed weight (43.40 g), which was remain statistically at par with 4 and 10 kg B ha$^{-1}$. Similar findings were recorded by Nandini *et al.* (2012) [13] and Crak *et al.* (2006) [7].

Pod yield affected significantly by boron levels up to the 8 kg ha$^{-1}$ and beyond that level the differences were remained on par (Table 1). The highest pod yield (19.75 g plant$^{-1}$) was obtained with 8 kg ha$^{-1}$ B. However, application of 10 kg B ha$^{-1}$ recorded significantly the highest haulm yield (18.56 g plant$^{-1}$), which was remain statistically at par with 10 kg B.

**Table 1:** Effect of boron and molybdenum on growth parameter of summer groundnut

| Treatments | Plant height (cm) | No. of branches per Plant | No. of pegs per plant | No. of nodules per plant | Nodules dry weight per plant (g) |
|---|---|---|---|---|---|
| Boron levels (kg B ha$^{-1}$) | | | | | |
| $B_0$- Control | 15.14 | 3.20 | 14.67 | 74.68 | 0.178 |
| $B_1$ – 2 | 21.33 | 3.58 | 16.89 | 84.91 | 0.207 |
| $B_2$ – 4 | 22.40 | 3.71 | 20.05 | 89.87 | 0.222 |
| $B_3$ – 8 | 23.30 | 3.80 | 26.04 | 91.57 | 0.231 |

| | | | | | |
|---|---|---|---|---|---|
| $B_4$- 10 | 22.10 | 3.89 | 25.72 | 91.18 | 0.227 |
| S.Em± | 0.63 | 0.07 | 0.51 | 1.16 | 0.003 |
| C.D. at 5% | 1.82 | 0.20 | 1.47 | 3.36 | 0.009 |
| Molybdenum levels (kg Mo $ha^{-1}$) | | | | | |
| $Mo_0$- Control | 19.87 | 3.22 | 18.79 | 70.28 | 0.170 |
| $Mo_1$- 1 | 21.50 | 4.02 | 21.78 | 95.01 | 0.236 |
| $Mo_2$- 2 | 21.19 | 3.67 | 21.45 | 94.04 | 0.232 |
| S.Em± | 0.49 | 0.05 | 0.40 | 0.90 | 0.002 |
| C.D. at 5% | NS | 0.15 | 1.14 | 2.60 | 0.007 |
| Interaction (B×Mo) | | | | | |
| S.Em± | 1.09 | 0.12 | 0.88 | 2.01 | 0.005 |
| C.D. at 5% | NS | NS | NS | 5.81 | 0.016 |
| C.V.% | 9.0 | 5.6 | 7.4 | 4.0 | 4.3 |

$ha^{-1}$. This result also in conformity with those of Naiknaware *et al.* (2015) [12], Patil *et al.* (2006) [15] and Bhagiya *et al.* (2005) [5].

**Effect of molybdenum**

The application of 1 kg Mo $ha^{-1}$ recorded significantly the maximum number of primary branches per plant (4.02). The number of pegs per plant (Table 1) showed that different levels of molybdenum exerted their significant influence on number of pegs at harvest; the application of 1 kg Mo $ha^{-1}$ significantly recorded with maximum number of pegs per plant (21.78), which was found statistically at par with 2 kg Mo $ha^{-1}$. The application of 1 kg Mo $ha^{-1}$ resulted in significantly the higher number of nodules per plant (95.01) and nodules dry weight (0.236 g $plant^{-1}$), which remained at par with 2 kg Mo $ha^{-1}$ at harvest. Molybdenum can play a vital role in increasing the nitrogen fixation process by *Rhizobium*

**Table 2:** Effect of boron and molybdenum on yield attributes and yield of summer groundnut

| Treatments | No. of pods per plant | No. mature pods per plant | No. of immature pods per plant | Shelling % | Test weighz (g) | Pod yield per plant (g) | Haulm yield per plant (g) |
|---|---|---|---|---|---|---|---|
| Boron levels (kg B $ha^{-1}$) | | | | | | | |
| $B_0$- Control | 7.018 | 3.961 | 3.057 | 61.83 | 41.03 | 13.05 | 13.48 |
| $B_1$ – 2 | 7.320 | 4.253 | 3.067 | 64.83 | 42.74 | 14.99 | 16.34 |
| $B_2$ – 4 | 9.928 | 6.924 | 3.003 | 66.14 | 43.02 | 19.31 | 17.08 |
| $B_3$ – 8 | 10.556 | 7.572 | 2.983 | 67.15 | 43.40 | 19.75 | 17.59 |
| $B_4$- 10 | 10.534 | 7.541 | 2.993 | 66.55 | 43.22 | 19.28 | 18.56 |
| S.Em± | 0.176 | 0.121 | 0.058 | 0.87 | 0.58 | 0.34 | 0.41 |
| C.D. at 5% | 0.509 | 0.348 | NS | 2.52 | 1.67 | 0.99 | 1.17 |
| Molybdenum levels (kg Mo $ha^{-1}$) | | | | | | | |
| $Mo_0$- Control | 8.576 | 5.510 | 3.066 | 62.52 | 40.78 | 16.04 | 14.44 |
| $Mo_1$- 1 | 9.589 | 6.625 | 2.964 | 68.89 | 44.40 | 18.23 | 18.64 |
| $Mo_2$- 2 | 9.048 | 6.016 | 3.032 | 64.49 | 42.87 | 17.56 | 16.76 |
| S.Em± | 0.137 | 0.093 | 0.045 | 0.68 | 0.45 | 0.26 | 0.31 |
| C.D. at 5% | 0.395 | 0.270 | NS | 1.96 | 1.29 | 0.76 | 0.91 |
| Interaction (B×Mo) | | | | | | | |
| S.Em± | 0.306 | 0.209 | 0.100 | 1.51 | 1.00 | 0.59 | 0.70 |
| C.D. at 5% | NS | 0.603 | NS | NS | NS | 1.71 | 2.03 |
| C.V.% | 5.8 | 5.9 | 5.7 | 4.02 | 4.0 | 5.93 | 7.32 |

and is responsible for the formation of nodule tissue and increase in $N_2$ fixation. Similar result was also concluded by Mohamed *et al.* (2011) [10], Togay *et al.* (2008) [19].

Like wise, application of 1 kg Mo $ha^{-1}$ recorded significantly the higher number of pods per plant (9.589) and mature pods per plant (6.62). Application of 1 kg Mo $ha^{-1}$ recorded significantly the higher shelling percentages (68.89%) and 100-seed weight (44.40 g). Application of 1 kg Mo $ha^{-1}$ recorded significantly the highest pod yield (18.23 g $plant^{-1}$), which was remained at par with 2 kg Mo $ha^{-1}$. However, application of 1 kg Mo $ha^{-1}$ recorded significantly the highest haulm yield (18.64 g $plant^{-1}$). This result also in conformity with those of Bhagiya *et al.* (2005) [5] and Bhuiyan *et al.* (2008) [6].

**Conclusion**

It can be concluded that for obtaining higher yield components with better growth of summer groundnut (*cv.* GJG-31) should be fertilized with boron 8 kg B $ha^{-1}$ and molybdenum 1 kg Mo $ha^{-1}$ in medium black calcareous soils of South Saurashtra region of Gujarat.

**References**

1. Anonymous. Annual Report of AICRP on Groundnut Kharif, Directorate of Groundnut Research, Junagadh, 2012, 2013.
2. Anonymous. Pocket Book of Agricultural Statistics. Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, 2014.
3. Anonymous. Groundnut area, production and productivity, USDA Foreign Agriculture Service, 2015.
4. Ansari MA, Prakash N, Singh IM, Sharma PK. Efficacy of boron sources on groundnut production under north east hill regions. Indian Res. J Ext. Edu. 2014; 14(2):123-126.
5. Bhagiya SR, Polara KB, Polara JV. Effect of B and Mo on yield, quality and nutrient absorption by groundnut. Advances in Plant Sciences. 2005; 18(2):803-806.

6. Bhuiyan MMH, Rahman MM, Afroze F, Sutradhar GNC. Bhutyan MSI. Effect of phosphorus, molybdenum and rhizobium inoculation on growth and nodulation on mungbean. Journal of Soil and Nature. 2008; 2(2):25-30.
7. Crak C, Odabas Kevseroglu MS, Karaca K, Gulumser EA. Response of soyabean (*Glycine max*) to soil and foliar applied boron at different rates. Indian Journal of Agricultural Science. 2006; 76(10):603-606.
8. Golakiya BA. Boron an important department of groundnut quality. Seeds and Grains. 1988; XIV(4):24-25.
9. Golakiya BA, Patel MS. Effect of calcium carbonate and boron on yield of groundnut. Indian J Agric. 1986; 56(4):41-44.
10. Mohamed MA, Elsherif MH, Amira Hegazi, Nadia Gad, Sayed Ahmed GS. Reducing N doses by enhancing nodule formation in groundnut plants via Co and Mo. Aust. J Basic & Appl Sci. 2011; 5(12):2568-2577.
11. Muralidharan A, George CM. Effect of phosphorus and molybdenum on the growth and nodulation of groundnut. Agric. Res. J Kerala. 1971; 9:48-53.
12. Naiknaware MD, Pawar GR, Murumkar SB. effect of varying levels of boron and sulphur on growth, yield and quality of summer groundnut *Arachis hypogeal* L. International Journal of Tropical Agriculture. 2015; 33(2):471-474.
13. Nandini K, Singh KN, Singh SM, Singh KK. Influence of sulpher and boron fertilization on yield, quality, nutrient uptake of soybean (*Glycine max*). J Agric. Sci. 2012; 4:1-9.
14. Noor S, Hannan MA, Islam MS. Effect of molybdenum and boron on the growth and yield of groundnut. Indian J Agric. Res. 1997; 31(1):51-58.
15. Patil SR, Gite Tike AN, Shelke BM. Impact of zinc and boron on growth and yield of sunflower. Annals of Plant Physiology. 2006; 20(1):82-85.
16. Patra PK, Bhattacharya C. Effect of different levels of boron and molybdenum on growth and yield of mungbean *Vigna Radiata* L. Wilczek (*cv. Baisakhi mung*) in red and laterite zone of west bengal. Journal of Crop and Weed. 2009; 5(1):111-114.
17. Srinivasan S, Tike T, Angayarkanni A. Groundnut yield, dry matter production and nodule number as influenced by different levels of phosphorus and boron. Mysore Journal of Agricultural Sciences. 2008; 42(1):129-131.
18. Sutaria GS, Golakiya BA. Mechanism of yield control in groundnut by boron. Adv. Pl. Set. 1990; 3:53-60.
19. Togay Y, Togay N, Dogan Y. Research on the effect of phosphorus and molybdenum applications on the yield and yield parameters in lentil *Lens culinaris* Medic. African Journal of. Biotechnology. 2008; 7(9):1256-1260.