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Effect of Boron, Calcium and Zinc Nutrition on Growth, Yield and its Attributes in Groundnut (*Arachis hypogaea* L.) under Costal Sandy Soils

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ABSTRACT

Two field experiments were conducted at Agricultural Research Station farm, Darsi, Prakasam District, A.P. to assess the effect of Boron, Calcium and Zinc nutrition on growth, yield and its attributes in groundnut under costal sandy soils in Prakasam district of Andhra Pradesh during 2018-19 and 2019-20. Pooled analysis of the experimental results that idicated there was significant difference among treatments except in plant height and number of branches per plant. The scrutiny of data on leaf area pertaining to the treatment T6 (RDF+Basal dose of Borax & $ZnSO_4$ and placement of Gypsum) significantly increased over other treatments during flowering (55%). The groundnut plants treated with RDF + Basal (Borax + $ZnSO_4$) + Gypsum at 35 DAS (T6) recorded significantly higher dry matter production (58.4 g/plant) over other treatments. The treatment with RDF + Basal (Borax + ZnSO4)+ Gypsum at 35 DAS (T6) produced significantly higher kernel yield (871.9 kg/ha). Results of this experiment suggested that basal application of RDF + (Borax + $ZnSO_4$) along with Gypsum placement at 35 DAS resulted in higher growth and yield of groundnut cv. TAG 24 during kharif season in the coastal sandy soils of Prakasam District of Andhra Pradesh state. Finally these findings will help our farmers to adopt location specific Integrated Nutrient Management practices which will be synchronized with crop demand and also will reduce the cost of production.

Keywords: *Boron, Calcium, Sandy soil and Zinc.*

Groundnut (*Arachis hypogaea* L) is one of the important oilseed and cash crops grown in India, which accounts for 45% to total area under oilseeds and 55% of total oilseed production. Groundnut is grown during *kharif* season and the area under groundnut is increasing in Prakasam district of Andhra Pradesh state. The optimization of the mineral nutrition is the key to optimize the production of groundnut, as it has very high nutrient requirement and the recently released high yielding varieties take away still more nutrients from the soil. On contrary severe mineral nutrient deficiencies due to inadequate and imbalance use of nutrients is one of the major factors responsible for low yield in groundnut (Rezaul Kabir *et. al*., 2013). in groundnut production, micronutrients are involved in the key physiological processes of photosynthesis and respiration (Marschner, 1995). However, micronutrient deficiencies can result in great deal of limitation in the physiological and metabolic processes even though the plants need only small amount of micronutrient for satisfactory crop growth and production, (Nasiri *et al.*, 2010).

Boron (B) plays an important role in the physiological process of plants, such as, cell elongation, cell maturation, meristematic tissue development and protein synthesis; because of which,

the application of Boron (B) in the soils is increasing now-a-days. The need for B application in groundnut is, therefore, to increase the growth, development and at the same time to increase the yield of crops. Boron also promotes the absorption of N by groundnut and increases the plant height, plant dry weight and the total number of pods. Calcium (Ca) is required by groundnut plants from peg initiation and it continues for fruit formation to pod maturation. Ca deficiency leads to high percentage of aborted seeds (empty pods), improperly filled pods and causes of the aborted or shriveled fruit and ill filled pods. In low Ca-content soils, application of gypsum can also increase seed-oil content. In addition, there are also indications that high level of soil Ca are associated with reduced incidence of various pod and root rots.

In order to increase production of crops with high yield and quality, an adequate fertilization of macro- and micronutrients should be implemented in plant nutrition, (Sawan, *et al.*, 2001).

Thus, the optimum fertilizers combination is the main concern for maximum yield of groundnut. Though groundnut is cultivated in many parts of India, very little research work has so far been conducted on the appropriate fertilizer management for groundnut cultivation. However, the farmers of coastal regions especially Kottapatnam and Ulavapadu mandals where the groundnut farmers are not getting higher yields. The identification of suitable recommendation of the foliar spray for this tract is necessary to improve the quality and quantity of groundnut yield.

Hence, the present study was conducted with the main objective of finding of suitable micronutrients application and also its combination having favourable physiological mechanism under water limited conditions so as to help the farmers in selecting the groundnut integrated nutrient management for sandy soils of Prakasam District of Andhra Pradesh.

MATERIAL AND METHODS

The improved variety of groundnut, TAG 24 was used for the present study which was collected from the Regional Agricultural Research Station, Tirupati, Andhra Pradesh. The seeds were sown in rows at a depth of 2-3 cm from the soil surface. The distances between row to row and seed to seed were 30 cm and 15 cm, respectively. The experiment was conducted in a randomized complete block design with 3 replications and the seven treatments *Viz:*

T1 : Control;

T2 : RDF;

T3 : RDF + Basal Borax@ 3kg/ac

T4 : RDF + Basal $ZnSO_4$ @20kg/ac

T5 : RDF + Gypsum @200kg/ac (at 35 DAS)

T6 : RDF + Basal (Borax + $ZnSO_4$) + Gypsum at 35 DAS and

T7 : RDF+foliar spray of (Borax @0.1%+$ZnSO_4$ 0.2%) at 35 DAS

[RDF : Recommended Dose of Fertilizers]

The recommended basal dose of N and P2O5 (25:50 kg ha-1) was applied to all treatments through Urea and Single Super Phosphate. After experimental layout, FYM and gypsum were applied as per the treatments well in advance before dibbling of groundnut seeds and well mixed in surface soil. The sampling for leaf area (destructive analysis) was done at 40 days after sowing. In destructive sampling five plants were uprooted carefully from each plot and were carried to the laboratory in properly labelled bags. Then the fully opened leaves are separated from the plants were washed in running tap water to remove dust and adhering water. Total leaf area of individual sample was measured by an electronic leaf area meter (Licor-13000, USA).

Total Drymatter Production: Plant samples from each plot in each replication were selected for biomass measurement and the mean of three

Table 1. Effect of Boron, Calcium and Zinc nutrition on growth, yield and its attributes in groundnut under costal sandy soils cultivation

Treatment	Days to 50% flowering	LA at 40 DAS	PH (cm)	branches / pl	TDM (g/pl)	pods/pl	100 Seed wt (g)	kernel Yield (kg/ha)
T1: Control	31.5	36.7	28.7	3.87	40.8	19.4	2.9	584.7
T2: RDF	32.4	42.9	31.3	4.12	42.7	21.7	3.1	620.1
T3: RDF + Basal Borax@ 3kg/ac	28.7	38.7	32.9	4.19	47.9	25.8	4.1	746.8
T4: RDF + Basal $ZnSO_4$ @20kg/ac	30.7	42.3	32.7	4.82	44.3	26.1	3.5	685.8
T5: RDF + Gypsum @200kg/ac (at 35 DAS)	34.8	39.7	31.9	4.33	49.7	21.1	3.4	783.4
T6: RDF + Basal (Borax + $ZnSO_4$) + Gypsum at 35 DAS	32.9	54.6	32.1	4.27	58.4	20.7	3.7	871.9
T7: RDF+foliar spray of (Borax @0.1%+$ZnSO_4$ 0.2%) at 35 DAS	31.8	42.9	31.9	4.71	44.1	21.1	3.2	649.7
Mean	31.83	42.54	31.64	4.33	45	22.27	3.41	688.91
Sem±	1.21	2.43	0.61	1.9	2.7	2.6	1.18	1.7
CD	2.31	13.7	NS	NS	2.2	10.8	2.59	68.2
CV(%)	5.54	19.8	5.4	8.5	9.4	14.3	6.27	10.4

replications was computed. Plant samples were collected by uprooting whole plant by soil excavation at harvesting periods. After excavation, the samples were slaked by dipping it into water and washed by gently flowing water. For dry biomass, the collected plant samples were oven dried at 60°C for more than 48 h till constant weight of the samples was observed. Computed total dry matter was expressed as g/plant.

RESULTS AND DISCUSSION

Significant difference has been observed among treatments except in plant height and number of branches per plant (Table 1). Regarding leaf area, it denotes the activity of photosynthesis by regulating the interception of sunlight. There was continuous increase of leaf area over time from vegetative to maturity. The data on leaf area at 40 DAS were ranged from 36.7 m^2/plant to 54.6 m^2/plant. Though at vegetative stage, application of Zn and B either singly or in combination did not affect the leaf area significantly. Leaf area of T6 (RDF+Basal dose of Borax & $ZnSO_4$ and placement of Gypsum) significantly increased over other treatments during flowering (55%). The higher leaf area was also noticed in RDF+Basal (borax + ZnSO4) + Gypsum-54.6 sq.cm at 40 DAS). Three result clearly indicated the effect simultaneous Zn and B application was better than application of higher doses of Zn or B separately. This might be due to the synergistic interaction between Zn and B which was corroborated with findings of Nandi *et al*., 2020.

In case of total drymatter production at harvest the highest (58.4 g/plant) was recorded by T6: RDF + Basal (Borax + $ZnSO_4$) + Gypsum at 35 DAS and it was significantly different over other treatments. The drymatter production by groundnut

at maturity was affected due to various levels of Zn and B application to plants. The uptake of N, P and K increased with the increase in concentration of Zn and B either combined or sole application. However, the combined application of Zn and B enhanced the uptake of nutrients showing more efficient utilization of nutrients per unit dry matter production. The reason behind that may be due to the increase in growth that ascribed to better peg formation leading to more pod yield.

Kernel yield: A mean value of 688.91 kg/ha groundnut kernel yield was obtained in the experiment. The treatment RDF + Basal (Borax + ZnSO4)+ Gypsum at 35 DAS produced significantly higher kernel yield (871.9 kg/ha) and the results are in conformity with the findings of Kishore Babu *et al.*, 2007.

This study showed that the omitting of Zn and B retarded plant growth, reduced nutrient uptake and ultimately the yield. Spraying of Zn and B increased plant biomass and leaf area noticeably and with the increase in concentration of Zn and B in spray, the increment became quite intense. Relatively, sole application of Zn had influenced physiological processes of the plant physiology than that of B application alone. The combined application of Zn and B increased the plant growth as well as nutrient content in pod. The leaf area was influenced by higher dose of Zn and B resulted higher nutrient uptake and pod yield. Results of this experiment suggested that basal application of RDF + (Borax + $ZnSO_4$) along with Gypsum placement at 35 DAS resulted in the best growth and yield of groundnut cv. TAG 24. The findings of the study also have brought an expectation that further investigation on different levels of fertilizers along with different varieties, growing seasons and soil types can be a step forward to identify more realistic effect of different fertilizers on the growth and yield of groundnut.

CONCLUSION

Finally these findings will help our farmer to apply balanced fertilizer application which will be synchronized with crop demand and also will reduce the cost of production

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