Andhra Pradesh J Agril. Sci : 9(4): 257-261, 2023

EFFECT OF SOIL AND FOLIAR APPLICATION OF NUTRIENTS ON THE PERFORMANCE OF BOLD SEEDED GROUNDNUT (*Arachis hypogaea* L.)

C. BHARGAVI*, N. SUNITHA, B. SANDHYA RANI, G.P. LEELAVATHY AND V. CHANDRIKA

Department of Agronomy, S.V. Agricultural College, ANGRAU, Tirupati-517 502.

Date of Receipt: 02-09-2023 Date of Acceptance: 15-11-2023

ABSTRACT

A field experiment was carried out at dryland farm of S.V. Agricultural College, ANGRAU, Tirupati during *rabi*, 2022-23 to study the effect of soil and foliar application of nutrients on the performance of bold seeded groundnut. The experiment was laid out in randomized block design with three replications. The results revealed that soil application of 150 % RDF + foliar application of Multi K @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 % (T_9) exhibited superior performance across all growth parameters such as plant height, dry matter production at 60 DAS and at harvest, yield attributes like number of pods plant^{-1} and hundred pod weight. Which resulted in significantly higher yield and economics and remained on par with 100 % RDF + Multi K @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 % (T_8).

KEYWORDS: Foliar application, Bold seeded groundnut, Increasing RDF levels, Growth parameters and Yield attributes.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is known as king of vegetable oilseed crops and have vital role in meeting the demand of edible oil across the world. It is widely accepted as the most important source of nutrition to both human and animals due to its high oil (45-50%), protein (25%), carbohydrates (8-14%), minerals, vitamins A, B and some members of B_2 group especially thiamin and niacin.

Globally, it is cultivated in an area of 26.4 M ha with annual production of 37.1 M t and productivity of 1405 kg ha^{-1}. In India, groundnut covers an area of 6.09 M ha with a production of 10.21 M t and productivity of 1676 kg ha^{-1} (FAO, 2020-2021). In Andhra Pradesh, it is cultivated in an area of 8.69 lakh ha with a production of 7.74 lakh tonnes and productivity of 891 kg ha^{-1}. (Directorate of Economics and Statistics, Govt. of A.P, India, 2020-2021).

Zinc as a micro nutrient is largely act as an activator of several enzymes in plants and is directly play a role in the biosynthesis of growth substances such as auxin which aids in more plant cells. It had been reported that foliar spraying with Zn could correct Zn deficiency, improve plant growth, seed yield and oil with good quality in groundnut. Boron is associated with one or more of the processes viz:, calcium utilization, cell division, flowering and fruiting, water relations, and catalyst for certain reactions.

The iron fertilizers through foliar application also has been used to correct Fe chlorosis in certain situations with high pH or other environmental factors may affect by reducing root uptake of soil-applied Fe. Foliar feeding is usually the most effective and economical way to rectify plant nutrient deficiencies and enhance nutrient use efficiency with improved quality and lower environmental pollution through reduction of fertilizers added to soil.

Bold seeded groundnut kernels which are edible reffered as confectionary and hand picked selection and preferably consumed directly in view of its higher nutritive value. Hence premium edible groundnut has confectionary value with great demand all over the world. Large seeded groundnut in India has immense potential for exporting and earns foreign exchange. Exclusively lack of production techniques for confectionery groundnut in terms of plant density and nutrient management has restricted the scope for higher yields. Till today Hand Picked Selection (HPS) genotypes have been bred with an aim to obtain good varieties and however the attempt was not made for the generation of production technologies to exploit their potential.

The present experiment was conducted with an objective to find out an optimised nutrient management practice for higher yield of bold seeded groundnut.

MATERIAL AND METHODS

The present investigation was carried out at dryland farm of S.V. Agricultural College, ANGRAU, Tirupati during *rabi*, 2022-23. The soil was neutral in reaction (6.9 pH) low in available nitrogen (133 kg ha^{-1}) and high in available phosphorus (41 kg ha^{-1}) and medium in

*Corresponding author, E-mail: bhargavichinnapogula6708@gmail.com

available potassium (228 kg ha^{-1}) status. The experiment was laid out in Randomized block design with three replications. Treatments includes : Soil Test Based Fertilizer application (T_1), 100 % RDF (30:40:50 N, P_2O_5, K_2O) (T_2), 150 % RDF (45:60:75 N, P_2O_5, K_2O) (T_3), 100 % RDF + 50 kg $ZnSO_4$ ha^{-1} + 10 kg Boric acid ha^{-1} (T_4), 150 % RDF + 50 kg $ZnSO_4$ ha^{-1} + 10 kg Boric acid ha^{-1} (T_5), 100 % RDF + Multi K (13-0-45) @ 0.5 % (T_6), 150 % RDF + Multi K (13-0-45) @ 0.5 % (T_7), 100 % RDF + Multi K (13-0-45) @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 % (T_8) and 150 % RDF + foliar application of Multi K (13-0-45) @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 % (T_9).The crop was sown at 30 × 15 cm spacing with a seed rate of 225 kg ha^{-1}. In the experiment, the nutrients i.e, N, P_2O and K_2O were applied in the form of urea, single super phosphate and muriate of potash respectively. For the treatment of Soil Test Based Fertilizer application (T_1) 30 per cent higher nitrogen and 30 per cent lesser phosphorus to the RDF were applied as soil is lower in nitrogen and higher in phosphorus. However, the recommended dose of potassium was applied in T_1 as the soil was medium in status. In T_2, the Recommended Dose of Fertilizers (30 : 40 : 50 kg N, P_2O_5, K_2O ha^{-1}) were applied where as in T_3, 150 % RDF (45 :60 :75 kg N, P_2O_5, K_2O ha^{-1}) were applied. In treatments of T_4 and T_5, $ZnSO_4$ @ 50 kg ha^{-1} and Boric acid @ 10 kg ha^{-1} were applied at the time of ploughing, before basal fertilizer dose application. In treatments of T_6 and $T_{7,}$ Multi K (13-0-45) @ 5 ml l^{-1} applied as foliar application at 30 DAS and 60 DAS. In treatments T_8 and $T_{9,}$ Multi K (13-0-45) @ 5 ml l^{-1} + zinc sulphate @ 2 g l^{-1} + ferrous sulphate @ 5 g l^{-1} + boric acid @ 1 g l^{-1} were applied as foliar application at 30 and 60 DAS.The data recorded on various parameters of crop was statistically analysed following the analysis of variance for randomized block design as suggested by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Growth parameters

Application of 150 % RDF + foliar application of Multi (13-0-45) K @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 % (T_9) resulted in the tallest plants and highest dry matter production which was significantly superior over rest of treatments. however on par with 100 % RDF + Multi (13-0-45) K @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 % (T_8). The next best treatments were 150 % RDF + 50 kg $ZnSO_4$ ha^{-1} + 10 kg Boric acid ha^{-1} (T_5), which was however comparable with 150 % RDF + Multi K @ 0.5 % (T_7), 100 % RDF + 50 kg $ZnSO_4$ ha^{-1} + 10 kg Boric acid ha^{-1} (T_4) and 100 % RDF + Multi K @ 0.5 % (T_6), Growth characters were found to be lowest with 150 % RDF (T_3) however which comparable with 100 % RDF (T_2) and Soil Test Based Fertilizer application (T_1) might be due to improvement in nutrient availability in a balanced proportion, in particular of iron, zinc ,boron nitrogen and potassium supplied through foliar application might have substantially improved photosynthetic activity and inturn plant growth and dry matter. Further, the better performance of the crop could be attributed due to more cell division, carbohydrates metabolism and increased growth of meristem tissues. The shortest plants lowest dry matter observed with the Soil Test Based Fertilizer application (T_1) might be due to lesser availability of sufficient quantity of nutrients for crop growth compared to supply of 100 per cent RDF and 150 per cent RDF. The results are in close conformity with the findings of Padagasali *et al.* (2019), Baloch *et al*. (2015) and Keerio *et al*. (2020).

Yield attributes

Regarding the yield attributes *viz*., number of filled pods $plant^{-1}$, hundred pod weight and hundred kernel weight were obtained with application of 150 % RDF + foliar application of Multi (13-0-45) K @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 % (T_9) followed by application of 100 % RDF + Multi (13-0-45) K @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 % (T_8). The next best treatment was 150 % RDF + 50 kg $ZnSO_4$ ha^{-1} + 10 kg Boric acid ha^{-1} (T_5). However on par with 150 % RDF + Multi K @ 0.5 % (T_7), 100 % RDF + 50 kg $ZnSO_4$ ha^{-1} + 10 kg Boric acid ha^{-1} (T_4) and 100 % RDF + Multi K @ 0.5 % (T_6). The deflated stature of all the above yield attributes were recorded with 150 % RDF (T_3) which was in parity with 100 % RDF (T_2) and Soil Test Based Fertilizer application (T_1). This might be due to the increased dry matter production and efficient translocation of photosynthates to the pod as a result of better availability coupled with efficient utilization of both macro and micro nutrients owing to ample supply of nutrients through soil and foliar application during pod development stage. Further highest pod weight might be due to zinc, iron and boron supplied through foliar sprays. Zinc helps in proper functioning of many enzymes involved in synthesis of nucleic acids required for crop growth and development and increased starch accumulation in seed. These results are in agreement with the findings of Muzzammil Hussain Siddiqui *et al*. (2009).

Yield

The highest pod and haulm yield of bold seeded groundnut was recorded with 150 % RDF + foliar application of Multi K @ 0.5 % + $ZnSO_4$ @ 0.2 % +

Table 1. Growth and yield attributes of bold seeded groundnut as influenced by nutrient management practices

Treatments	Plant height (cm)		Dry matter (kg ha^{-1})		No. of filled pods $plant^{-1}$	Hundred pod weight (g)	Hundred kernel weight (g)
	60 DAS	At harvest	60 DAS	At harvest			
T_1 : Soil Test Based Fertilizer (STBF) application	19.8	36.2	1460	4340	12.0	160	72
T_2 : 100 % Recommended Dose of Fertilizer (RDF)	20.2	36.5	1500	4533	12.3	163	76
T_3 : 150 % RDF	20.7	37.0	1552	4773	12.7	166	79
T_4 : 100 % RDF + 50 kg $ZnSO_4$ + 10 kg Boric acid	24	41.7	1785	5422	14.6	183	90
T_5 : 150 % RDF + 50 kg $ZnSO_4$ + 10 kg Boric acid	25.3	43.4	1913	5781	15.4	190	96
T_6 : 100 % RDF + Multi K (13-0-45) @ 0.5 %	23.6	41.2	1747	5323	14.3	180	88
T_7 : 150 % RDF + Multi K (13-0-45) @ 0.5 %	24.8	42.8	1868	5629	15.1	187	93
T_8 : 100 % RDF + Multi K (13-0-45) @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 %	28.2	47.6	2123	6331	17.0	203	104
T_9 : 150 % RDF + Multi K (13-0-45) @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 %	28.7	48.3	2186	6547	17.3	209	107
SEm±	0.90	1.23	60	164	0.48	4.4	2.8
CD (P=0.05)	2.6	3.6	177	486	1.4	12	8

Table 2. Pod yield, haulm yield (kg ha^{-1}) and economics of bold seeded groundnut

Treatments	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Net returns (Rs. ha^{-1})	B : C ratio
T_1 : Soil Test Based Fertilizer (STBF) application	1950	2390	55375	2.24
T_2 : 100 % Recommended Dose of Fertilizer (RDF)	2053	2480	60225	2.34
T_3 : 150 % RDF	2173	2600	64223	2.36
T_4 : 100 % RDF + 50 kg $ZnSO_4$ + 10 kg Boric acid	2462	2960	73725	2.40
T_5 : 150 % RDF + 50 kg $ZnSO_4$ + 10 kg Boric acid	2641	3140	80723	2.48
T_6 : 100 % RDF + Multi K (13-0-45) @ 0.5 %	2423	2900	69583	2.66
T_7 : 150 % RDF + Multi K (13-0-45) @ 0.5 %	2569	3060	77535	2.70
T_8 : 100 % RDF + Multi K (13-0-45) @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 %	2881	3450	100438	3.13
T_9 : 150 % RDF + Multi K (13-0-45) @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 %	3007	3540	106076	3.21
SEm±	76	99	4056	0.140
CD (P=0.05)	223	391	123130	0.40

$FeSO_4$ @ 0.5 + Boric acid @ 0.1 % (T_9), which was on par with 100 % RDF + Multi K @ 0.5 % + $ZnSO_4$ @ 0.2 % +$FeSO_4$ @ 0.5 % + Boric acid @ 0.1 % (T_8) significantly higher than rest of treatments. The next best treatment was 150 % RDF + 50 kg $ZnSO_4$ ha^{-1} + 10 kg Boric acid ha^{-1} (T_5), which was however, comparable with 150 % RDF + Multi K (13-0-45) @ 0.5 % (T_7), 100 % RDF + 50 kg $ZnSO_4$ ha^{-1} + 10 kg Boric acid ha^{-1} (T_4) and 100 % RDF + Multi K @ 0.5 % (T_6). These were distinctly superior to 150 % RDF (T_3) and 100 % RDF (T_2) which were statistically on par with each other. Application of Soil Test Based Fertilizer application (T_1) resulted in lowest pod, kernel and haulm yield of bold seeded groundnut. The increase in pod yield, haulm and kernel yield of bold seeded groundnut attributed to the concomitant influence of available nutrients from soil and their efficient extraction by the plant, which appears to have provided the plants with a favourable nutritional environment. Application of boron, zinc and iron might have lead better growth and development of pods and dry matter accumulation. As boron plays a vital role in the reproductive development of the bold seeded groundnut crop there by increased the pod yield. These results are in agreement with the findings of Gowthami *et al.* (2004). Lowest pod yield observed with Soil Test Based Fertilizer application (T_1) might be due to the situation of insufficient macro and micronutrients availability to meet the crop demand for pod development

Economics

The highest net returns and benefit- cost ratio were realized with 150 % RDF + foliar application of Multi K @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 % (T_9) which was on par with 100 % RDF + Multi K @ 0.5 % + $ZnSO_4$ @ 0.2 % +$FeSO_4$ @ 0.5 % + Boric acid @ 0.1 % (T_8) which were significantly higher compared to rest of the treatments. The next best treatment was 150 % RDF + 50 kg $ZnSO_4$ ha^{-1} + 10 kg Boric acid ha^{-1} (T_5) which was however on par with the 150 % RDF + Multi K @ 0.5 % (T_7) followed by 100 % RDF + 50 kg $ZnSO_4$ ha^{-1} + 10 kg Boric acid ha^{-1} (T_4) and 100 % RDF + Multi K @ 0.5 % (T_6). The gross returns, net returns and benefit cost ratio obtained with 150 % RDF (T_3) were in parity with 100 % RDF (T_2) and Soil Test Based Fertilizer application (T_1), which resulted in the lowest net returns.

In conclusion, the investigation revealed that higher pod yield of groundnut as well as economic returns could be realized with application of 150 % RDF + foliar application of Multi (13-0-45) K @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 % (T_9) was proved to be promising nutrient management practices for higher yield and economics of groundnut which was however comparable with 100 % RDF + Multi (13-0-45) K @ 0.5 % + $ZnSO_4$ @ 0.2 % + $FeSO_4$ @ 0.5 % + Boric acid @ 0.1 % (T_8).

LITERATURE CITED

Baloch, R.A., Baloch, S.U., Baloch, S.K., Baloch, A.B., Baloch, H.N., Bashir, W., Shahab-u-din Kashani, S.Z., Baloch, M., Akram, W., Badini, S.A and Ahmed, M. 2015. Effect of zinc and boron in combination with NPK on sunflower (*Helianthus annuus* L.) growth and yield. *Journal of Biology Agriclutural Healthcare*. 5(19): 101-107.

Keerio, R.A., Soomro, N.S., Soomro, A.A., Siddiqui, M.A., Khan, M.T., Nizamani, G.S., Kandhro, M.N., Siddiqui, M., Khan, H and Soomro, F.D. 2020. Effect of foliar spray of zinc on growth and yield of sunflower (*Helianthus annuus* L.). *Pakistan Journal of Agricultural Research*. 33(2).

Padasalagi, R.M., Lalitha, B.S., Jayadeva, H.M and Raddy, G. 2019. Effect of sulphur and boron on growth and yield of sesame (*Sesamum indicum* L.). *Journal of Pharmacognosy and Phytochemistry*. 8(6): 1426-1431.

Panse, V.G and Sukhatme, P.V. 1985. *Statistical Methods for Agricultural Workers*. ICAR, New Delhi. 100-174.

Siddiqui, M.H., Oad, F.C., Abbasi, M.K and Gandahi, A.W. 2009. Zinc and boron fertility to optimize physiological parameters, nutrient uptake and seed yield of sunflower. *Sarhad Journal of Agriculture*. 25(1): 53-57.

Gowthami, V and Ananda, N. 2017. Effect of zinc and iron ferti-fortification on growth, pod yield and zinc uptake of groundnut (*Arachis hypogaea* L.) genotypes. *International Journal of Agriculture, Environment and Biotechnology*. 10(5): 575-580.