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POST HARVEST SOIL NUTRIENT STATUS AS INFLUENCED BY VARIED DATES OF SOWING, PLANT SPACINGS AND NUTRIENT LEVELS IN GROUNDNUT

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ABSTRACT

A field experiment was carried out during *rabi,* 2019-20 and *rabi,* 2020-21 on sandy loam soils of Krishi Vigyan Kendra, Utukur, Kadapa, Andhra Pradesh. The experimentation was laid out with three replications by adopting split-split design. Groundnut variety Kadiri-6 was used for the investigation. The treatments include combination of three dates of sowing, four plant plant spacings and three nutrient levels. The highest post-harvest soil available nitrogen and potassium was estimated when the crop was sown during I fortnight of October (D_1) while the minimum values of above said nutrients was noticed with I fortnight of November (D_3) sowing. However, post-harvest phosphorus during both the years of study and in pooled mean was not affected due to dates of sowing. Crop sown with 22.5 cm x 10.0 cm plant spacing resulted in higher post-harvest soil available nitrogen, phosphorus and potassium while criss cross sown crop at 22.5 cm of row spacing in both the directions recorded significantly lower values of soil available nutrients. With regard to nutrient levels, significantly higher post-harvest soil available nitrogen, phosphorus and potassium was obtained with the application of 150% RDF (N_3) which was at par with application of 125% RDF and the lowest values were noticed with 100% RDF (N_1) during both the years of study and in pooled mean.

KEYWORDS: Dates of Sowing, Plant spacing, Nutrient levels, Nitrogen, Phosphorus, Potassium, Groundnut.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a predominant annual legume and protein-rich oil seed crop cultivated in tropical and sub-tropical agro climatic regions of Asia, Africa, and America. In India, groundnut contributes a larger share for the national edible oil economy. It is grown in an area of 4.89 million hectares contributing to the production of 9.25 million tonnes with a mean productivity of 1493 kg ha^{-1}. In Andhra Pradesh, groundnut is cultivated over an area of 0.74 million hectares with a production of 1.05 million tonnes and an average productivity of 1426 kg ha^{-1} (Anonymus, 2019-20). The cultivation of groundnut crop during *rabi* under irrigated conditions is much profitable and yields are almost twice or thrice to that of *kharif* due to elimination of moisture stress and high input use. The upper limit of *rabi* groundnut productivity depends on crop weather relations during the crop growth period, which in turn depends on the time of sowing and seasonal variations. Therefore, the optimum time of sowing decides the congenial weather conditions for optimum growth and development during different phenophases leading to higher productivity in *rabi* groundnut. Amongst the different agrotechniques adopted in groundnut, plant density in groundnut have significant effect on dry matter production and economic yield. The optimum spacing provides congenial environment for balanced plant growth which results in timely commencement of reproductive phase leading to increased yield attributes and ultimately enhancing the productivity of *rabi* groundnut. Since the land is stable, the only way to multiply the food production will be through high density planting, improved varieties, increasing cropping intensity and the matching production technology of crops to sustain soil fertilityand crop productivity. India is the world's largest producer of groundnut where nutrient deficiencies cause yield reduction to the tune of 30-70 per cent depending upon the soil types (Veeramani *et al.,* 2012). Imbalanced use of fertilizers like urea and diammonium phosphate in groundnut especially under high plant densities lead to increased deficiency symptoms which in turn reduced the productivity of crop. The optimization of the mineral nutrition is the key to enhance productivity of groundnut. Reinvestigating the nutrient requirement under increased plant population with different dates of sowing is necessary for enhancing yield and profitability of groundnut. Hence, there is a need to develop or identify the important agrotechniques for enhancing the productivity and profitability of *rabi* groundnut under

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high input management, to exploit the fullest possible potential in a given agroclimatic domain of Southern Agro climatic Zone of Andhra Pradesh. Keeping in view of the above aspects, the present investigation was taken up.

MATERIAL AND METHODS

A field investigation was carried out during *rabi,* 2019-20 and *rabi,* 2020-21 at Krishi Vigyan Kendra, Utukur campus of Acharya N.G. Ranga Agricultural University, Andhra Pradesh which is geographically located at 14.4^o N latitude and 78.8^o E longitude at an altitude of 147.0 meters above mean sea level categorised as Southern Agro Climatic Zone of Andhra Pradesh. The soil of experimental field was sandy loam in texture, soil reaction is neytral, organic carbon and available nitrogen are low in availability and available phosphorus and potassium are medium in availability. The investigation was laid out in a split-split plot design which was replicated thrice. The treatments include combination of three dates of sowing viz., I fortnight of October (D_1), II fortnight of October (D_2) and I fortnight of November (D_3), four plant spacings (plant densities) that include 22.5 cm × 10 cm (4.44 lakh ha^{-1}) (P_1), 15.0 cm × 10 cm (6.66 lakh ha^{-1}) (P_2), 15.0 cm × 7.5 cm (8.88 lakh ha^{-1}) (P_3) and criss cross sowing with 22.5 cm of row spacing in both the directions (P_4) and three levels of nutrients of 100% RDF (N_1), 125% RDF (N_2) and 150% RDF (N_3). RDF was fixed based on soil test results. As per the soil test results of the experimental field, available nitrogen was low (193.5 kg ha^{-1}) and therefore, additional 30% over the recommended dosage of nitrogenous fertilizer was applied. Whereas available phosphorus and potassium were medium (27.4 kg ha^{-1} and 185.2 kg ha^{-1} respectively), hence recommended doses were applied. Nitrogen was supplied to the crop in the form of urea, phosphorus through single super phosphate and potassium by using murate of potash. Phosphorus and potassium fertilizers were applied as basal application whereas, nitrogen was applied in 2 splits *viz.,* two thirds of nitrogen was applied as basal at sowing time and remaining one third of nitrogen was applied as top dressing at 30 DAS. Gypsum was applied @ 500 kg ha^{-1} at 40 days after sowing. Required quantity of sound Kadiri-6 kernels were selected based on the crop geometry adopted and utilised for sowing after carrying out seed treatment with Mancozeb @ 3 g kg^{-1} of seed as a prophylactic measure against seed borne diseases. After harvesting of groundnut, soil samples were collected from each net plot and analysed to find out the post-harvest nutrient status of the soil

RESULTS AND DISCUSSION

The soil available nutrients was significantly influenced by the dates of sowing, plant spacings and nutrient levels, but any of the interaction effects were not found significant, during both the years of study and in pooled mean (Table 1).

Soil Available Nitrogen

Post harvest soil available nitrogen was progressively decreased with delay in sowing from I fortnight of October (D_1) to I fortnight of November (D_3) with significant disparity between any two dates of sowing during both the years of study and in pooled mean. The highest soil available nitrogen was estimated with I fortnight of October (D_1) and least was recorded with I fortnight of November (D_3). Reduction in soil available nitrogen with late sown crop might be due to higher nutrient use efficiency of the crop and increase in dry matter production. Increase in post harvest soil available nutrients with varied dates of sowing as resulted from the present experiment is similar with the findings of Meena and Yadav (2015).

Among the plant spacings studied, the post harvest soil available nitrogen was significantly higher with plant spacing of 22.5 cm × 10 cm (P_1) than rest of the crop geometric alterations tried. This might be due to maintenance of lesser plant population which reduced the uptake of nitrogen and increased the status of post harvest soil available nitrogen. These results are in accordance with the findings of Sunilkumar *et al.* (2020). The next best plant spacing in recording higher post harvest soil available nitrogen was 15.0 cm × 10.0 cm (P_2) spacing which was at par with criss cross sowing with 22.5 cm of row spacing in both the directions (P_4) which in turn was comparable with 15.0 cm × 7.5 cm (P_3). The lowest post harvest soil available nitrogen was registered with 15.0 cm × 7.5 cm (P_3) during both the years of investigation and in pooled mean.

The highest soil available nitrogen was resulted with 150% RDF (N_3) which was significantly higher than rest of the nutrient levels studied. Inspite of higher nutrient uptake with 150% RDF (N_3), considerable quantities of nutrients were left over in the soil, which might have

Table 1. Post-harvest soil nutrient status (kg ha^{-1}) of groundnut as influenced by varied dates of sowing, plant spacings and nutrient levels

Treatments	Available N			Available P_2O_5			Available K_2O		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
Dates of sowing (D) - 3									
D_1 : I Fortnight of October	175	184	177	33.5	35.5	34.0	183	207	195
D_2 : II Fortnight of October	154	161	155	32.5	34.3	33.3	161	186	174
D_3 : I Fortnight of November	123	140	136	31.7	32.2	32.0	143	160	152
SEm ±	3.6	2.9	3.3	0.26	0.64	0.55	3.4	3.5	2.6
CD (P = 0.05)	14	11	13	NS	NS	NS	13	14	10
Plant spacings (P) - 4									
P_1 : 22.5 cm × 10.0 cm (4.44 lakh ha^{-1})	173	184	179	34.5	36.5	35.7	187	202	195
P_2 : 15.0 cm × 10.0 cm (6.66 lakh ha^{-1})	153	164	159	32.6	34.3	33.5	163	189	176
P_3 : 15.0 cm × 7.5 cm (8.88 lakh ha^{-1})	131	140	136	30.3	32.1	31.2	145	168	157
P_4 : Criss cross sowing with 22.5 cm row spacing in both the directions	143	155	149	31.4	33.2	32.3	154	179	166
SEm ±	3.7	4.0	3.8	0.46	0.44	0.47	4.5	4.2	4.3
CD (P = 0.05)	11	12	11	1.4	1.3	1.4	13	12	13
Nutrient levels (N) - 3									
N_1 : 100% RDF	120	140	135	30.0	32.1	31.1	140	165	153
N_2 : 125% RDF	152	163	157	32.1	34.3	33.2	165	186	176
N_3 : 150% RDF	170	181	176	34.5	35.7	35.1	182	202	192
SEm ±	3.9	3.5	3.5	0.49	3.42	0.37	4.6	4.3	3.9
CD (P = 0.05)	11	10	10	1.4	1.2	1.1	13	12	11
Interaction									
D × P									
SEm ±	6.4	6.9	6.6	0.80	0.77	0.78	7.8	7.2	7.5
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
D × N									
SEm ±	7.0	6.3	6.2	0.89	0.74	0.64	8.1	7.4	7.0
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
P × N									
SEm ±	8.0	7.3	7.2	0.99	0.85	0.74	9.3	8.5	8.1
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
D × P × N									
SEm ±	13.9	11.1	12.4	0.17	1.47	1.28	16.1	14.7	14.0
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

remained after meeting the maximum requirement of the crop. These results are in conformity with the findings of Meena and Yadav (2015) and Lakshmi *et al.* (2020). Application of 125% RDF and 100% RDF were significantly differed with each other and the latter nutrient level recorded the lowest post harvest soil available nitrogen status.

Soil Available Phosphorus

Post harvest soil available phosphorus was not influenced by the varied dates of sowing and all the interaction effects, but plant spacing and nutrient levels showed significant influence on post harvest soil available phosphorus during both the years of study and in pooled mean.

Significantly higher soil available phosphorus was observed with wider spacing of 22.5 cm × 10 cm (P_1) than rest of the plant spacings tried. This might be due to lower uptake by the crop because of lower plant density that resulted in increased availability of available phosphorus in the soil after harvest of crop. These results are in conformity with the findings of Sunilkumar *et al.* (2020). The next best plant spacing in recording higher post harvest soil available phosphorus was 15.0 cm × 10.0 cm (P_2) spacing which was at par with criss cross sowing with 22.5 cm of row spacing in both the directions (P_4) which in turn was comparable with 15.0 cm × 7.5 cm (P_3). The lowest post harvest soil available phosphorus was registered with 15.0 cm × 7.5 cm (P_3) during both the years of investigation and in pooled mean.

The highest soil available phosphorus was resulted with application of 150% RDF (N_3) followed by 125% RDF (N_2) with significant disparity between them. Considerable quantity of phosphorus left over in the soil by groundnut crop. These results are in line with the findings of Reddy *et al.* (2011), Suneetha (2013) and Sunilkumar *et al.* (2020). The lowest post harvest soil available phosphorus was obtained with 100% RDF (N_1) due to exhaustion of nutrients from the soil.

Soil Available Potassium

Among the dates of sowing, the highest post harvest soil available potassium was recorded with crop sown during I fortnight of October (D_1) which was significantly higher over the other two dates of sowing. The next best date of sowing in recording higher soil available potassium was II fortnight of October (D_2). The lowest soil available potassium was observed with I fortnight of November (D_3) sowing. This might be attributed to higher nutrient uptake by the crop sown in I fortnight of November (D_3) resulting in greater reduction of soil available potassium after harvest of groundnut crop. These results are in conformity with Meena and Yadav (2015).

Higher post harvest soil available potassium was estimated with plant spacing of 22.5 cm × 10 cm (P_1) which was significantly superior to rest of the plant spacings. This might be due to lower uptake of potassium by the crop because of lower plant density and thereby increased the availability of soil available potassium compared to higher plant densities. These results are in conformity with the findings of Sunilkumar *et al.* (2020). The lowest soil available potassium was noticed with 15.0 cm × 7.5 cm (P_3)) which was comparable with criss cross sowing at 22.5 cm of row spacing in both the directions (P_4) which in turn was at par with 15.0 cm × 10 cm (P_2) plant spacing.

Among the nutrient levels tried, application of 150% RDF (N_3) recorded significantly higher post harvest soil available potassium than rest of the nutrient levels tried during both the years of study and in pooled mean. This might be due to increased availability of potassium in the soil after meeting the crop requirements. The lowest post harvest soil available potassium was noticed with 100% RDF. These results are in conformity with earlier findings of Bunsa *et al.* (2004) and Suneetha (2013).

From the present experimentation, it was concluded that the highest post-harvest soil available nitrogen and potassium was estimated when the crop was sown during I fortnight of October (D_1), while the minimum values of above said nutrients was noticed with I fortnight of November (D_3) sowing. However, post-harvest phosphorus during both the years of study and in pooled mean was not affected due to dates of sowing. Crop sown with 22.5 cm × 10.0 cm plant spacing resulted in higher post-harvest soil available nitrogen, phosphorus and potassium while criss cross sown crop at 22.5 cm of row spacing in both the directions recorded significantly lower values of soil available nutrients. With regard to nutrient levels, significantly higher post-harvest soil available nitrogen, phosphorus and potassium was obtained with the application of 150% RDF (N_3) which was at par with application of 125% RDF and the lowest values were noticed with 100% RDF (N_1) during both the years of study and in pooled mean.

LITERATURE CITED

Anonymous, (2019-20). *www. indiastat.com.*

Bunsa, P.B., Golakiya, B.A and Polaraj, V. 2004. Influence of potassium along with nitrogen and phosphorus on yield and nutrient uptake by groundnut. *Proceeding of National Symposium on Enhanching Productivity of Groundnut for Sustaining Food and Nutritional Security*. Pp: 11-13.

Lakshmi, M.V., Rao, Ch. P., Prasad, P.V.N., Rani, P.P and Rani, Y.A. 2020. Studies on yield, nutrient content and nutrient uptake of groundnut as influenced by phosphorus management practices in rice-groundnut sequence. *Journal of Pharmacognosy and Phytochemistry*. 9(2): 257-263.

Meena, R.S and Yadav, R.S. 2015. Yield and profitability of groundnut (*Arachis hypogaea* L.) as influenced by sowing dates and nutrient levels with different varieties. *Legume Research*. 38(6): 791-797.

Reddy, S.T, Srinivasulu Reddy, D and Prabhakara Reddy, G. 2011. Influence of fertilizer management practices on growth, yield and quality of export oriented groundnut (*Arachis hypogaea* L.). *The Andhra Agricultural Journal*. 58(1): 105-109.

Suneetha (2013). Nutrient management for sustained productivity of newly developed groundnut genotypes. *M.Sc.(Ag.) Thesis*. Acharya N.G. Ranga Agricultural University, Lam, Guntur, Andhra Pradesh.

Sunilkumar, T., Sumathi, V., Reddiramu, Y., Kumar, A.R.N and Sagar, G.K. 2020. Evaluation of yield and quality of groundnut under high density plantations with graded levels of phosphorus. *Indian Journal of Pure and Applied Bioscencesi. 8*(4), 184-189.

Veeramani, P., Subrahmaniyan, K and Ganesaraja, V. 2012. Organic manure management on groundnut-A review. *Wudpecker Journal of Agriculture Sciences*. 1(7): 238-243.