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Sequel of various tillage and nutrient management practices on yield attributes and uptake of groundnut

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Abstract
Field experiment was conducted during kharif 2019 and 2020 at Krishi Vigyan Kendra, farm of Reddipalli, Anantapuramu, Andhra Pradesh. There were three main treatments and four subplots of different levels of nutrient managements and three replications. The experimental results revealed that significantly higher values of yield with the treatment T_3 125% RDF soil application followed by T_2 application of 100% RDF only. The experimental results also revealed that significantly higher concentration of N,P,K and uptake were higher with T_3 treatment i.e. 125% RDF soil application followed by T_2 application of 100% RDF only.

Keywords: Groundnut, nutrient management practices, yield, yield attributes, concentration and uptake

Introduction

Groundnut one of the principal economic crops, ranked as the second most important cultivated grain legume and the fourth largest edible oilseed crop in the world and it is grown in more than 100 countries. India is the second largest producer of groundnut in the world Tiwari *et al.* 2018 [9]. In India, though the area and production of groundnut are high, but great variation in productivity is observed. The productivity of groundnut in India is much less as compared to other leading countries due to soil heterogeneity, imbalanced fertilization, uncertainty of monsoons, poor cultural practices adopted by farmers, growing the energy crop groundnut under energy starved conditions like marginal and sub-marginal lands (mainly under rain fed condition), shortage of calcium, low soil pH, biological limitations, biotic and abiotic stress and many socio- economic factors. (Kumar, 2012) [5]. Improving the soil fertility by providing adequate nutrients to the crop could be a viable option to raise the productivity of groundnut. Various researchers working in this area opined that none of the inorganic and organic sources of nutrients alone can meet the total plant nutrient needs of the crop adequately. Hence, an integrated use of nutrients from chemical, organic manures, bio fertilizers is the most efficient way to supply plant nutrients for sustained crop productivity and improved soil fertility (Vala *et al.* 2018) [10]. Nutrient management ensures the plant nutrient supply through optimization of benefits from all possible sources of plant nutrients in an combined manner to achieve as well as sustain the desired crop productivity while maintaining soil fertility and can be considered as an important tool for sustainable agriculture to achieve the sustainable development goals (SDG) to ensure sustainable consumption and production patterns. This experiment was planned to study the effect of various nutrient management practices on yield, yield attributes, concentration and uptake of groundnut.

Materials and Methods

The field experiment was conducted with groundnut variety K-6 at KVK farm of Reddipalli village of Anantapuramu district, Andhra Pradesh during kharif 2019 and 2020 campus of Acharya N. G. Ranga Agricultural University, which is geographically situated at 13.5°N latitude and 79.5°E longitude with an altitude of 182.9 m above mean sea level in the Scarce Agro Climatic Zone of Andhra Pradesh.

According to Trolls classification, it is classified under Semi-Arid Tropics (SAT). The experiment was laid out in split plot with three replications and three main treatments and four subplots. The main treatments were *viz.*; M1 Chisel plough , M2 – Mould board plough M3 Conventional tillage, Sub plots S1- 75% RDF + 10 T FYM, S2 100% RDF + 10 T FYM, S3 125% 75% RDF + 10 T FYM, S4- Control. The soil of the experimental plot was sandy loam in texture, neutral in soil reaction, non-saline soils. The soil was also low in organic carbon (0.29%), available N (142 kg ha^{-1}) high in available phosphorus (20.4 kg ha^{-1}) and medium in available potassium (194 kg ha^{-1}) Well decomposed farmyard manure applied to the soil which contains 0.5% nitrogen, 0.2% P and 0.4% K. The recommended dose of fertilizers were given in the form of urea, Single Supar phosphate, and Muriate of potash. Seeds were treated with Imidachloprid @ 2.0 ml/kg seed and D.M.-45 @ 3gm kg seed before sowing. Yield and yield attributing parameters were recorded during harvest. Yield components in groundnut that composed of pod and kernel yield per unit area were collected from data analysis after harvest of the crop. The drawn randomly from shelling of the pod samples were calculated by standard procedure.

Table 1: Pod and haulm yield (kg ha^{-1}) of groundnut as influenced by tillage and nutrient management practices during 2019 and 2020

Treatments	Pod yield (Kg/ha)		Haulm yield (Kg/ha)	
	2019	2020	2019	2020
Tillage practices				
M_1	1117.3	1260.0	1723.9	1970.3
M_2	993.7	1023.3	1723.3	1605.9
M_3	1097.1	1194.4	1472.8	1687.2
SEm±	15.718	35.080	39.237	26.571
CD (P=0.05)	61.717	137.740	**154.062**	**104.332**
Nutrient management practices				
S_1	1180.1	1306.6	1567.8	1758.4
S_2	1127.3	1202.7	1738.2	1674.0
S_3	1198.7	1286.7	1905.6	1910.8
S_4	770.9	841.0	1348.4	1674.6
SEm±	35.536	41.880	60.525	52.212
CD (P=0.05)	105.582	124.433	**179.828**	**155.130**
Interaction				
S at M				
SEm±	61.550	72.539	104.832	90.434
CD (P=0.05)	182.873	215.524	311.471	268.692
M at S				
SEm±	55.573	71.951	98.903	82.703
CD (P=0.05)	165.115	213.778	293.855	245.722

Pod yield of groundnut was significantly influenced by the tillage and nutrient management practices but not their interaction (Table 1).

Higher pod yield of groundnut was recorded with Chesil plough (M1) which was significantly higher than rest of the tillage practices that were investigated. This is in according with findings of Prieto *et al.*, 2009 [6] and Wiatrak *et al.*, 2004 [11]. Pod yield of groundnut mainly depends on yield promoting characters were significantly higher with chisel plough (M1) due to better partitioning of photosynthates to developing pods. This might be attributed to an increase in the quantum of nutrient absorption due to better root development under vertical tillage reflected in better development and expression of yield components, which ultimately resulted in higher pod yield. The next best treatment in recording higher groundnut pod yield was mould board plough (M2) and cultivator (M3) with significant disparity among them during the both years via 2019 and 2020 of experiment. Lower pod yield was observed with conventional tillage (M3) during both the years of investigation. This might be due to that in conventional tillage practice the compacted layer was not loosened, the rooting of groundnut was shallower resulting in lower moisture and nutrient uptake and a more rapid depletion of moisture in the rooting zone. These results are in agreement with findings of those Jordan *et al.*, 2008 [3] and Barbosa *et al.* (1989) [1].

Irrespective of tillage practices, higher pod yield of groundnut was recorded with 125% RDF which was statistically on par with 100% RDF during *kharif*, 2019 & 2020. These results are in accordance with findings of by Singh *et al.* (2010) [7]. This might be due to application of 125% RDF that increased significantly the pod yield and yield attributes of groundnut over 125% RDF. Fertilizer dose of 100% RDF was sufficient for realisation of higher pod yield of groundnut. This result indicated that with N, P and K fertilizer at recommended level brought about a positive effect on pod yield of groundnut. The next best treatment in recording higher yield of groundnut was 100% RDF followed by 75% RDF and control with a significant disparity among these treatments. Control treatment has recorded lower pod yield compared to all nutrient management practices for both the years of study.

Haulm Yield

Haulm yield of groundnut was significantly influenced by the nutrient management practices and with tillage practices (Table 1). The interaction effect between the tillage and nutrient management practices was not traceable.

Among the tillage practices investigated, higher haulm yield was obtained with chisel plough (M1) followed by mould board plough (M2), and conventional tillage (M_1) with significant disparity among tillage treatments during both the years of experiment. This might be due to increased vegetative growth interms of plant height, leaf area index and dry matter production resulting in increased haulm yield in M_4. These results were in conformity with Kumar *et al.* (2014) [4].

Irrespective of tillage practices, haulm yield was increased significantly with increasing fertilizer dose from control to 125% RDF. Higher haulm yield was produced with 125% RDF, which was significantly higher than rest of nutrient management practices tested during both the *kharif* seasons. This might be due to increased plant height and more quantity of dry matter production because of increased availability of nutrients. These findings are in agreement with the results reported by Elayaraja and Singaravel (2011) [2]. The next best treatment in producing significantly higher haulm yield was 100% RDF followed by 75% RDF and control, with a significant disparity between them. Lower haulm yield was obtained with control treatment which was significantly lesser than with rest of the nutrient management practices tried during both the *kharif* seasons.

Nutrient (NPK) uptake. Deep tillage (DT) recorded significantly higher N uptake (36.2 and 39.9 kg ha^{-1}) over control (28.5 and 37.3 kg ha^{-1}), respectively in the year 2019 and 2020. The highest nitrogen uptake was observed under DT but it did not differ statistically with control since nitrogen uptake is directly proportional to the accumulation of dry matter in the plant and its nitrogen content according Sunil kumar *et al.* (2005).

Table 2: Effect of various nutrient management practices on concentration and uptake of nutrients

Treatments	Nitrogen (Kg/ha)		Phosphorus (Kg/ha)		Potassium (Kg/ha)	
	2019	2020	2019	2020	2019	2020
Tillage practices						
M_1	36.2	39.9	13.0	14.9	29.2	44.7
M_2	36.0	35.5	10.0	12.5	36.2	36.9
M_3	28.5	37.3	9.6	12.0	32.7	32.9
SEm±	0.586	0.651	0.478	0.559	1.134	1.297
CD (P=0.05)	2.299	2.556	1.876	S	4.451	5.092
Nutrient management practices						
S_1	32.5	35.4	10.7	11.6	27.9	35.5
S_2	35.7	38.2	12.2	12.9	32.9	35.6
S_3	40.5	41.8	13.1	14.8	45.8	48.8
S_4	25.5	34.8	8.3	13.2	24.3	32.8
SEm±	1.245	1.429	0.926	0.406	2.276	2.491
CD (P=0.05)	3.700	4.247	2.752	S	6.763	7.400
Interaction						
S at M						
SEm±	2.157	2.476	1.605	0.703	3.943	4.314
CD (P=0.05)	6.408	7.356	4.767	2.088	11.714	12.817
M at S						
SEm±	1.957	2.241	1.469	0.826	3.598	3.954
CD (P=0.05)	5.816	6.657	4.366	2.455	10.689	11.749

Fertilizer management practices S3 uptake (40.5 and 41.8 kg ha^{-1}) over control (25.5 and 34.5 kg ha^{-1}), respectively the year 2019 and 2020. The highest P uptake (13.0 and 14.9 kg ha^{-1}) was noted under DT practice which showed significant edge over control (9.6 and 12.0 kg ha^{-1}), in the year of 2019 and 2020. Phosphorus uptake increased significantly by applying nutrient management practices S3 to S2 over control (S4) and maximum values of 13.1 and 14.8 kg ha^{-1} formed in S3 and S2 treatment and minimum P uptake values (8.3 and 13.2 kg ha^{-1}) noted under control during 2019 and 2020. Deep tillage exhibited significantly higher K uptake (29.2 and 44.7 kg ha^{-1}) during 2019 and 2020 over shallow tillage (ST). Higher P uptake due to higher number of branches, dry matter production, pod yield, haulm leads to higher p uptake or may be due to solubilization of fixed phosphorus by P-solubilizer due to secretion of organic acids. Similar findings corroborate with the study of Bhatt (2012). Application of S3 (RDF + 10 T FYM ha^{-1}) significantly higher potassium uptake (45.8 and 48.8 kg ha^{-1}) and it was at par with S2 in both the years.

Conclusions

Based on the results of the field experiment, it is concluded that among the different treatments tried, the application NPK 125% RDF + 10 t FYM /ha was superior in performance with respect to yield and yield attributes of groundnut and also found to be effective in improving soil physical, chemical and biological properties. It improves the concentration and uptake of nutrients. It can be recommended to the farmers to achieve more benefit cost ratio.

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