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Effect of integrated nitrogen management and foliar spray of iron on nutrient content & uptake of groundnut (*Arachis hypogaea* L.)

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Abstract
An field experiment was conducted during kharif season of 2011 and 2012 at S.K.N College of Agriculture, Jobner to study the effect of integrated nutrient management levels on growth parameters and yield of groundnut (*Arachis hypogaea* L.) Treatments consisted of the eight levels of organic manures and fertilizers in main plots (control, RDF (25kg, N+45kg P2O5 kg ha^{-1}), FYM 15 t ha^{-1}, FYM 7.5 t ha^{-1}+1/2 RDF, Poultry manure 6 t ha^{-1}, Poultry manure 3 t ha^{-1}+1/2 RDF, vermicompost 5 t ha-1, and vermicompost 2.5 t ha-1+1/2 RDF) and four levels of iron in sub plots [0.0, 5.0,10.0 and 15.0 kg ha^{-1}] were compared. Application of poultry manure @ 3 t/ha + ½ RDF was recorded significantly higher nitrogen, phosphorus, potassium and iron content in seed kernel and haulm which being at par with vermicompost. Significantly higher total uptake of nitrogen, phosphorus, potassium and iron was observed with the application of poultry manure @ 3 t/ha + ½ RDF over rest of the treatments except vermicompost @ 2.5 t/ha + ½ RDF. The uptake of nitrogen, phosphorus, potassium and iron by groundnut were increased significantly with the application of 15 kg Fe/ha over control and 5 kg Fe/ha.

Keywords: Poultry manure, vermicompost, iron, nutrient content

Introduction
Indian agriculture is a gamble of monsoon and crop failure due to erratic rainfall is most common in arid regions. As these regions contributes nearly half of the national food grain production, where around 90% of sorghum and millets and about two third of oilseeds and three fourth of pulses are grown. This region is important for the economy of the country and likely to continue till turn of the century and even beyond (Sharma *et al.*, 2011) [9]. Status of organic carbon and available nitrogen content in majority of the soils is very low. Improper nitrogen management and iron chlorosis, especially in calcareous soils of arid region of Rajasthan mainly affect the productivity of groundnut crop due to low nutrient uptake from hunger soils of this region. Therefore, integrated nutrient management along with soil test-based fertilization will serve the purpose for practicing sustainable groundnut production in the region. The domestic demand for vegetable oils and fats has been rising rapidly, @ 6 per cent per annum, but our domestic output has been increasing at just about 2 per cent per annum. In India, the average yield of most oilseeds are extremely low as compared to other countries of the world.

Among nine major oilseeds crops, groundnut occupies a preeminent position in the national edible oil economy. India ranks first in acreage and second in production of groundnut in the world, after China (FAOSTAT, 2018) [4]. Groundnut is the 3rd most important oilseed crop of the world cultivated in 96 countries in tropical, sub-tropical, and warm temperate regions of the world (Rai *et al*., 2016). In India, there is great fluctuation in production from year to year, whereas area remaining almost constant under the crop. Groundnut ranks third position among oilseeds in India after soybean and rapeseed-mustard, occupying 4.91 mha area $^{-1}$ producing 9.18 million tonn with average productivity of 1868 kg ha (Anonymous, 2018). Groundnut containing one and half times more protein requires more nitrogen than cereals for its growth. As a legume, it can fix atmospheric nitrogen and improve soil fertility by adding about 150 kg N ha to soil through its root nodules (Kabir *et al*., 2013) [5]. The demand of nitrogen for groundnut is large in the synthesis of seeds with high protein concentration (Choudhary *et al.* 2021) [3]. Though, it is called as a self-fertilizing crop, it is very exhaustive crop as compared to other legumes as very little portion of the plant is left in the soil after harvesting. It removes fairly large quantities of nutrients from the soil. Cultivation of groundnut, therefore,

depletes the soil rapidly unless the crop is adequately manured, although it is capable of fixing atmospheric nitrogen. Widespread occurrence of yellowing due to iron deficiency is also being observed in several crops including groundnut mainly grown on high pH calcareous soils in arid regions and irrigated with high bicarbonate containing water and this is particularly true for the coarse textured soils. Probably, the crop may be suffering from hidden hunger for iron and, thus, are not able to express their potential productivity. Depending upon the management practices, the yield losses due to iron chlorosis in groundnut, in India, was 20 to 41%, which is a very high amount and has to be looked seriously (Choudhary *et al.* 2013) [2]. The problem gets enhanced in light textured calcareous soils with low organic matter content and alkaline reaction, which are common features in arid Rajasthan. Demand for edible oil is increasing day by day which can only be met out by increased oilseed production in the country. The present experiment was carried out to delineate the effect of integrated nitrogen management and foliar spray of iron on productivity, quality and economics of groundnut in arid regions.

Materials and Methods

An field experiment was conducted at S.K.N College of Agriculture, Jobner. The soil of the experimental field was loamy sand, low in organic carbon (013 and 0.15%) as analyzed by walkley and Black's rapid titration method (Jeckson, 1973) available nitrogen 130.3 and 130.7 kg ha^{-1}) by alkaline permanganate method (Subbiah and Asija, 1956), phosphours (16.5 and 16.5 kg ha^{-1}) by Olsen's method (Olsen *et al*., 1954) and iron (2.2 and 2.4 mg kg^{-1}) by Lindsay and Norvell (1978) but medium in potassium content (175.2 and 175.3) as analysed by Flame photometer method (Metson, 1956) and alkaline in reaction (8.2). The seed treatment was done with bavistin @ 2 g/kg followed by Rhizobium culture as per treatments. The amount of rainfall during the crop growth period was 281.6 mm and 533.6 mm in 2011 and 2012, respectively. Nutrient content in plant samples were analyzed as per procedure suggested by Snell and Snell (1959). The data were statistically analyzed as procedure given by Gomez and Gomez (1989) and presented on pooled basis for both the years of study.

Results and Discussion

The integrated use of different organic and inorganic amendments could significantly improve nutrient content in kernel & haulm and uptake by crop. Application of poultry manure @ 3 t/ha + ½ RDF was recorded significantly higher nitrogen, phosphorus, potassium and iron content in seed kernel and haulm which being at par with vermicompost. Significantly higher total uptake of nitrogen, phosphorus, potassium and iron was observed with the application of poultry manure @ 3 t/ha + ½ RDF over rest of the treatments except vermicompost @ 2.5 t/ha + ½ RDF both the year as well as pooled basis (Table 1).

Protein content, nitrogen and iron concentration in kernel and haulm significantly increased with the application of 15 kg Fe/ha over control and 5 kg Fe/ha. The varying levels of Fe failed to influence the phosphorus and potassium concentration in kernel and haulm. The uptake of nitrogen, phosphorus, potassium and iron by groundnut were increased significantly with the application of 15 kg Fe/ha over control and 5 kg Fe/ha. The improved effect on quality of peanut could be due to the increased nutrients uptake particularly of N, and better translocation of assimilates (Ravikumar *et al*. 2019).

It was demonstrated that applying organic manure can boost photosynthetic efficiency and nutrient availability. This might be due to increased availability of nutrients due to build-up of soil micro flora resulting in increased bacteria, fungi, actinomycetes, P- solubilizers and N fixers population in the soil. Similar results have been reported by Boraiah *et al* (2017) [1] wherein application of poultry manure with iron resulted in higher N, P and K per cent kernel & haulm due to supply of nutrients through liquid manures having beneficial microbes and enzymes. Similarly, A significant influenced on these nutrients uptake by kernel & haulm due to application of organic manure with chemical fertilizers increased microbial respiration and resulted in increased carbon and plant nutrient mineralization rates in soil (Patil *et al.*, 2016) [8].

Table 1: Effect of integrated use of organic manures and fertilizers under varying levels of iron on nutrient content in kernel and haulm and total uptake of groundnut

	Nitrogen Content (%)		Iron content (ppm)		Total uptake	
	Kernel	Haulm	Kernel	Haulm	Total nitrogen uptake (kg/ha)	Total iron uptake (g/ha)
Manures and fertilizers						
No fertilizer (control)	2.95	1.19	19.68	12.26	91.64	75.36
RDF (25-45)	3.33	1.47	20.67	12.49	126.16	90.83
FYM @ 15 t	3.29	1.44	19.93	12.36	115.47	82.64
FYM @ 7.5 t + ½ RDF	3.31	1.46	20.63	12.44	124.29	89.70
Poultry manure @ 6 t	3.70	1.66	20.93	12.63	153.12	99.46
Poultry manure @ 3 t + ½ RDF	4.06	1.83	21.58	12.85	196.80	118.96
Vermicompost @ 5 t	3.69	1.65	20.79	12.59	152.63	99.09
Vermicompost @ 2.5 t + ½ RDF	4.05	1.77	21.36	12.80	189.53	115.37
S.Em +	0.07	0.03	0.46	0.30	2.76	2.99
CD (P = 0.05)	0.19	0.08	NS	NS	7.98	8.66
Fe (kg/ha)						
0	3.28	1.37	18.19	8.98	116.60	68.82
5	3.50	1.52	20.37	11.20	138.31	88.09
10	3.66	1.66	21.85	14.73	155.65	111.02
15	3.76	1.69	22.38	15.30	164.26	117.77
S.Em +	0.04	0.02	0.30	0.21	1.99	2.09
CD (P = 0.05)	0.12	0.06	0.84	0.59	5.58	5.86

FYM= Farm yard manure, RDF= Recommended dose of fertilizer

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