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EFFECT OF INM ON GROWTH, YIELD AND QUALITY PARAMETERS OF IRRIGATED GROUNDNUT (*ARACHIS HYPOAGEA* L.) VAR.VRI-2 FOR SANDY LOAM SOILS

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Abstract

Field investigation was carried out during (December- April) the year of 2015-16 at the Farmer's field, Adagapadi village, Dharmapuri District, Tamilnadu and India to study the effect of Integrated nutrient management on the yield of irrigated groundnut grown in sandy loam soil. The experiment was laid out in randomized block design and replicated thrice. The experiment comprised of eight treatments with different INM sources and the treatment details are T_1 - Control, T_2 – RDF 17:34:54 kg ha^{-1} + Gypsum@ 400 kg ha^{-1}, T_3 - Vermicompost @ 6.25 t ha^{-1}, T_4 – Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application, T_5 - RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1}+ Vermicompost @ 6.25 t ha^{-1}, T_6 -RDF 17:34:54 kg ha^{-1}+ Gypsum@ 400 kg ha^{-1} + Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application, T_7 - Vermicompost @ 6.25 t ha^{-1} + Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application, T_8 - RDF 17:34:54 kg ha^{-1}+ Gypsum@ 400 kg ha^{-1} + Vermicompost @ 6.25 t ha^{-1}+ Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application. The results of the experiments revealed that application of RDF 17:34:54 kg ha^{-1}+ Gypsum@ 400 kg ha^{-1} + Vermicompost @ 6.25 t ha^{-1} + Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application (T_8) had a positive influence on all steady supply of nutrients and growth promoting substances and eventually increased the growth attributes *viz*., Plant height, LAI, DMP and number of nodules per plant, yield components and yield and quality parameters of groundnut viz., oil content and crude protein content.

Keywords: Groundnut, Gypsum, kernel yield, Oil content, Vermicompost.

Introduction

Groundnut (*Arachis hypogaea* L.) belongs to genus *Arachis*, family of Leguminaceae and it's the "King of Oilseed". In our country it is an important crop both for and confectionary. Among the oilseed crop grown in India groundnut occupies pre-dominant position. Edible oils are an important consumer item and are next to food grain in Indian diet. But its per capita consumption very less as compared to the world scenario (14.5 kg). Despite the poor level of consumption of oils and fats (7.13 kg) in India (Shodhganga, 2014). Groundnut being a major oilseed crop, an important food legume and also meet the requirements of oil and protein to ensure nutritional security to a population of over one billion in our country. The national average productivity of groundnut is 1040 kg ha^{-1} in India which was less than the world average of 1600 kg ha^{-1} (Malunjkar *et al*., 2012). At this level of contribution the projected demand of groundnut by 2020 will be reach near about 14 million tonnes while, the present production level are around the 6.9 million tones. Therefore, a gap of about 7.1 million tones need to be filled and this can be possible if the production rate will increase at about 2.2 per cent per annum.

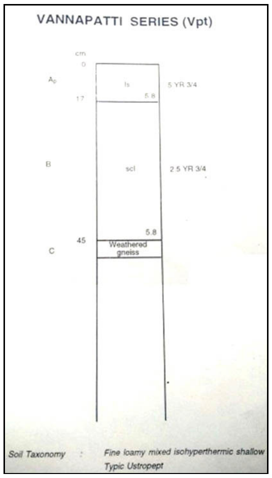
The use of chemical fertilizers cannot be ruled out completely. However, there is a need for integrated application of alternative sources of nutrients for sustaining the desired crop productivity (Tiwari, 2002). Among the various organic inputs, vermicompost is widely applied by the farming community to be use of organic amendments has been found effective for improving soil aggregation structure, fertility, increasing soil microbial diversity, population and enzymes, improving moisture holding capacity of the soils, increasing cat ion exchange capacity and finally increase the crop yield. Vermicompost are finely-divided fully-stabilized organic material supporting large microbial numbers and activity. They are produced in a mesophilic process through interaction between earthworms and microorganisms in breaking down organic wastes (Edwards *et al*., 2010). Biofertilizers also helps to reduce the adverse effects of the excessive and imbalanced use of the chemical fertilizers which can reduce the chemical fertilizers dose by 25-50 per cent (Pattanayak *et al*., 2007).

Integrated nutrient management with a mixture of chemical fertilizer, organic amendments and biofertilizers may be a helpful method in increasing the yield of groundnut as mentioned (Shri Janagard *et al*., 2013). The biofertilizers and organic manures as supplement to plant nutrients are gaining worldwide value in groundnut farming (Mathivanan, 2014).

Materials and Methods

The field experiment was conducted in farmer's field at Adagapadi village of Dharmapuri district during 2015-2016 (December - April). The experimental field is geographically located at 12^{o} 03" East longitude and at an altitude of 495 m above MSL. The weather of Adagapadi village in Dharmapuri is moderately warm with hot summer months. The mean annual rainfall received was 853.1 mm. The experimental field soil belongs to Vannapatti series (Vpt) and the soil taxonomy is *Fine loamy mixed isohyperthermic shallow Typic Usteropept*. The textural class of experimental soil was sandy loam with 12.5% of clay, 22.7% silt and 64.4% of sand in the surface (0-15cm) soil. The surface soil posses pH 7.2, Electrical conductivity 0.48, organic carbon of 0.42 and the available N, P and K Viz., 185.4, 12, 194.7 kg/ha respectively. The experiments were laid in RBD, comprising 8 treatments with three replications. T_1 - Control, T_2 – RDF 17:34:54 kg ha^{-1} + Gypsum@ 400 kg ha^{-1},T_3 - Vermicompost @ 6.25 t ha^{-1}, T_4 – Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application, T_5 - RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1}+ Vermicompost @

6.25 t ha^{-1}, T_6 -RDF 17:34:54 kg ha^{-1}+ Gypsum@ 400 kg ha^{-1} + Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application, T_7 - Vermicompost @ 6.25 t ha^{-1} + Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application, T_8 - RDF 17:34:54 kg ha^{-1}+ Gypsum@ 400 kg ha^{-1} + Vermicompost @ 6.25 t ha^{-1}+ Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application.



Crop Management

The experimental field was ploughed to a depth of 15 to 20 cm two weeks before sowing by tractor and leveled. The soil in the field was brought in to a fine tilth. Laying of plots and allocation of treatments were carried out according to the treatment schedule which were randomized. Channels were laid to facilitate irrigation of plots individually. The fertilizer recommendation for groundnut is 17:34:54 kg of N, P_2O_5 and K_2O ha^{-1} respectively. Nitrogen was applied as urea (46 per cent N), phosphorous as single super phosphate (16 per cent P_2O_5) and potassium as murate of potash (60 per cent K_2O) half dose of N and half dose of K_2O were applied on 20 DAS only on the controlled plot. All treatments are supplemented with respective materials. Five plants from each plot were chosen by simple random sampling method and were tagged. These tagged plants were used for recording all biometric observations at different stages of crop growth.

Statistical Analysis

The data recorded were statistically analysed and whenever the results were found significant, the critical differences were arrived at 5 per cent level and drawn statistical calculations (Panse and Sukhatme, 1978).

Results and Discussion

Effect of INM on the Growth components of irrigated groundnut

The nutrition through inorganic and different sources of organic manures registered a remarkable influence in various growth parameters of groundnut viz., Plant height, LAI, DMP and number of nodules per plant of 2015-16 are presented in Table.1

The application of RDF 17:34:54 kg ha^{-1}+ Gypsum@ 400 kg ha^{-1} + Vermicompost @ 6.25 t ha^{-1}+ Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application (T_8) recorded increased plant height, LAI, DMP, number of nodules $plant^{-1}$ at all the stages of crop growth. Application of RDF 17:34:54 kg ha^{-1}+ Gypsum@ 400 kg ha^{-1} + Vermicompost @ 6.25 t ha^{-1}+ Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application (T_8) recorded the higher values of plant height (43.1 and 72.4 cm), LAI (5.8 and 4.2), DMP (5210 and 7300 kg ha^{-1}) at 60 DAS and harvest and number of nodules $plant^{-1}$ 62.3 at harvest during the year of 2015-16. This was followed by (T_5) RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1}+ Vermicompost @ 6.25 t ha^{-1} recorded the higher values of growth attributes Viz., plant height (39.2 and 66.3 cm), LAI (5.1 and 3.7), DMP (4700 and 6600 kg ha^{-1}) at 60 DAS and harvest and number of nodules $plant^{-1}$ 57.1 at harvest during the year of 2015-16.

Effect of INM on yield components and yield

Integrated nutrient management practices significantly influenced the yield components and yield during the research period are presented in the Table.2. Among the different treatments T_8 (RDF 17:34:54 kg ha^{-1}+ Gypsum@ 400 kg ha^{-1} + Vermicompost @ 6.25 t ha^{-1}+ Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application) recorded the higher values of yield components Viz., number of pods $plant^{-1}$ (41.3) and hundred kernel weight and yield (50.2g) viz., pod yield (2200 kg ha^{-1}), kernel yield (1720 kg ha^{-1}) , haulm yield (6450 kg ha^{-1}) and shelling percentage of (78.1) during the year of 2015-16 and that was closely followed by T_5 (RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1}+ Vermicompost @ 6.25 t ha^{-1}).

Quality parameters

The INM imposed treatments registered a remarkable influence in various quality parameters of groundnut viz., oil content and crude protein content of 2015-16 are presented in Table.3. Application of RDF 17:34:54 kg ha^{-1}+ Gypsum@ 400 kg ha^{-1} + Vermicompost @ 6.25 t ha^{-1}+ Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application (T_8) recorded the higher values of oil content (49.3%) and crude protein content (25.6%) the year of 2015-16. This was followed by RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1}+ Vermicompost @ 6.25 t ha^{-1} (T_5) recorded the higher values of quality attributes Viz., oil content (49.0) and crude protein content (24.6%) during the year of 2015-16.

Discussion

Effect of INM on the growth components of irrigated groundnut

Application of vermicompost recorded high degree of aggressiveness with inorganic fertilizers. This might be due to better enhancement of physico-chemical properties of soil which leads to imparting soil structure as well as slow releasing pattern and steady supply of nutrients thorough out the period of crop growth. Application of vermicompost produced in a mesophilic process through interaction between earthworms and micro-organism in breaking down organic wastes (Edwards *et al*., 2010)

In addition to that the influence of biofertilization through Rhizobium and Phosphobacteria increased biological nitrogen fixation and availability of phosphorus in the soil on LAI could be attributed by increment of metabolic process in plants which seems to have promoted meristematic activities through thorough supply of enzymes causing apical growth. This result is in agreement with the findings of Singh *et al*. (2011) and Chaudhary *et al*. (2015).

Effect of INM on the yield components and yield of irrigated groundnut

The treatment imposed with INM practices (T_8) significantly increased the yield components and yield of groundnut. This might be due to wide availability of nutrients throughout its growth period resulting in huge biomass production that leads to availability of photosynthates, metabolites and nutrients to develop reproduction structure. This present results are in line with the findings of El-saady *et al*. (2014).

The higher yield (pod and haulm yield) in T_8 received plots could be due to better interception, absorption and utilization of radiation energy leading to higher photosynthetic rate and finally more accumulation. The overall improvement reflected into better source- sink relationship, which in turn enhanced the yield and yield attributes. This was in concomitant with the findings of Singh *et al.,* (2011) and Patil *et al.* (2015).

Effect of INM on quality parameters of irrigated groundnut

The increased oil content and crude protein content registered in the treatment supplemented with RDF 17:34: 54 kg ha^{-1}+ Gypsum@ 400 kg ha^{-1} + Vermicompost @ 6.25 t ha^{-1}+ Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application (T_8). This might be due to higher photosynthetic rate, uptake of nutrients, particularly nitrogen and better translocation of assimilates could be reflected in higher crude protein content of seed in the above treatment combination. This result was in line with earlier reports of Ghosh *et al*. (2002) and El-Habbasha *et al*. (2005).

Conclusion

Based on the results of the experiment, it is concluded that application of RDF 17:34:54 kg ha^{-1}+ Gypsum@ 400 kg ha^{-1} + Vermicompost @ 6.25 t ha^{-1}+ Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application (T_8) was found to be the most efficient INM practice for increasing the seed yield of groundnut crop in sandy loam soils.

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Figures in parenthesis are Arc-sine transferred values.

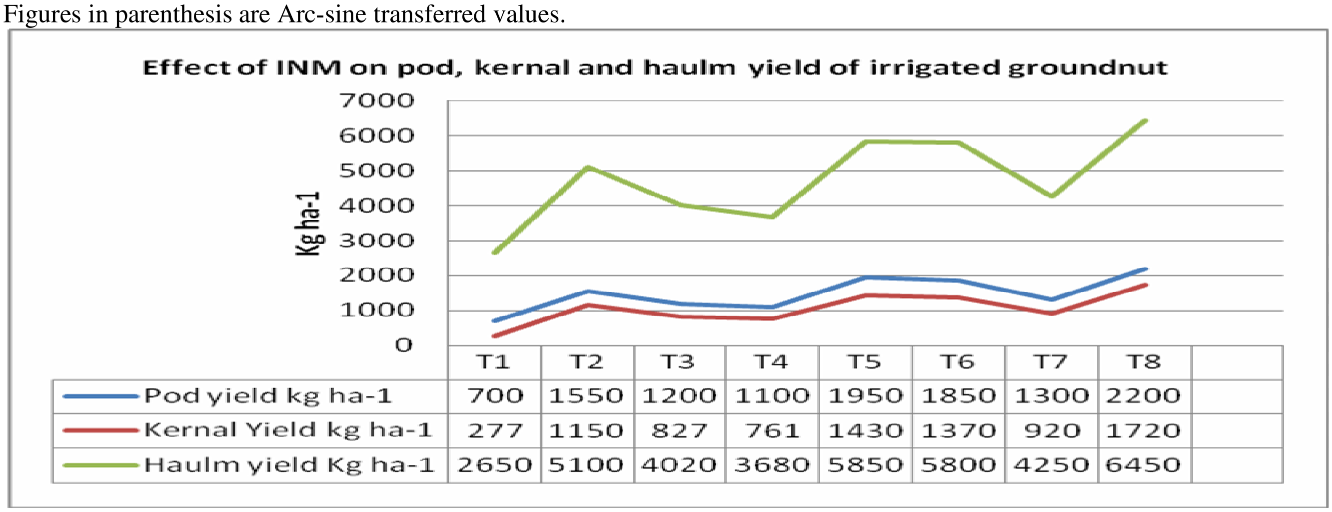

Fig. 1 : Effect of INM on pod, kernel and haulm yield of irrigated Groundnut

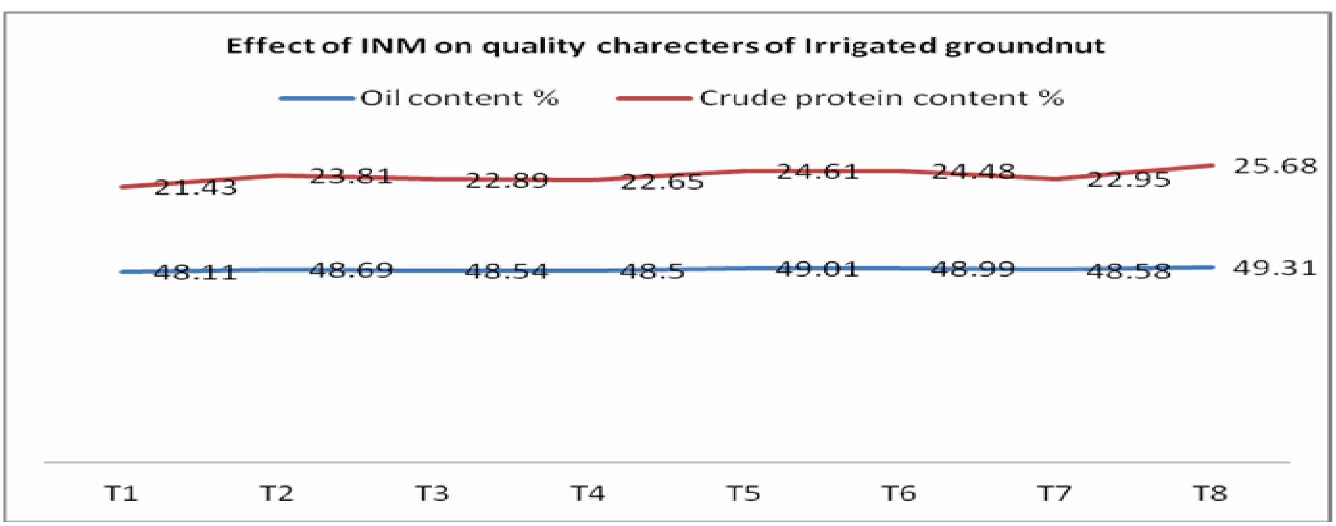

Fig. 2 : Effect of INM on quality characters of irrigated Groundnut

Table 1 : Effect of INM on the growth components of irrigated groundnut

Treatments	Plant height (cm)		LAI		DMP kg ha^{-1}		Nodules $plant^{-1}$
	60DAS	Harv.	60DAS	Harv.	60DAS	Harv.	
T_1 - Control	20.2	37.9	1.9	1.1	1700	3450	30.3
T_2- RDF 17:34:54 kg ha^{-1} + Gypsum @ 400 kg ha^{-1}	35.3	60.1	4.4	3.1	4150	5800	51.9
T_3 - Vermicompost @ 6.25 t ha^{-1}	30.7	53.9	3.6	2.2	3600	4900	45.1
T_4 - Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application	28.4	49.5	3.3	2.1	3300	4500	41.5
T_5 - RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1}+ Vermicompost @ 6.25 t ha^{-1}	39.3	66.3	5.1	3.7	4700	6600	57.1
T_6 - RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1} + Rhizobium + Phosphobacteria @ 2 Kg ha^{-1} as soil application	38.9	65.9	5.0	3.7	4600	6500	56.9
T_7 - Vermicompost @ 6.25 t ha^{-1} + Rhizobium + Phosphobacteria @ 2 Kg ha^{-1} as soil application	31.5	54.5	3.8	2.4	3700	5100	46.9
T_8 - RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1} + Vermicompost @ 6.25 t ha^{-1} + Rhizobium + Phosphobacteria @ 2 Kg ha^{-1} as soil application	43.1	72.4	5.8	4.3	5210	7300	62.3
SE(m)	1.21	2.28	0.19	0.12	152	224	2.01
CD (P=0.05)	2.60	4.88	0.42	0.25	326	480	4.31

Table 2 : Effect of INM on the yield components and yield of irrigated groundnut

Treatments	Number of Pods $plant^{-1}$	100 kernel weight (g)	Pod yield Kg ha^{-1}	Kernel yield kg ha^{-1}	Haulm yield kg ha^{-1}	Shelling per cent
T_1 - Control	15.3	46.2	700	277	2650	67.49 (55.23)
T_2- RDF 17:34:54 kg ha^{-1} + Gypsum @ 400 kg ha^{-1}	30.4	48.6	1550	1150	5100	74.01 (59.34)
T_3 - Vermicompost @ 6.25 t ha^{-1}	22.5	35.2	1200	827	4020	70.11 (56.85)
T_4 - Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application	21.2	47.1	1100	761	3680	69.81 (56.67)
T_5 - RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1}+ Vermicompost @ 6.25 t ha^{-1}	36.3	50.1	1950	1430	5850	75.61 (60.41)
T_6 - RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1} + Rhizobium + Phosphobacteria @ 2 Kg ha^{-1} as soil application	35.8	49.2	1850	1370	5800	74.21 (59.48)
T_7 - Vermicompost @ 6.25 t ha^{-1} + Rhizobium + Phosphobacteria @ 2 Kg ha^{-1} as soil application	24.3	48.0	1300	920	4250	70.61 (57.17)
T_8 - RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1} + Vermicompost @ 6.25 t ha^{-1} + Rhizobium + Phosphobacteria @ 2 Kg ha^{-1} as soil application	41.3	50.2	2200	1720	6450	78.10 (62.09)
SE(m)	0.96	-	60	56	214	-
CD (P=0.05)	2.05	NS	130	120	460	NS

Table 3 : Effect of INM on the quality characters of irrigated groundnut

Treatments		Oil Content (%)	Crude Protein (%)
T_1 - Control		48.11 (43.91)	21.43 (27.57)
T_2- RDF 17:34:54 kg ha^{-1} + Gypsum @ 400 kg ha^{-1}	48.69 (44.24)	23.81 (29.20)	
T_3 - Vermicompost @ 6.25 t ha^{-1}	48.54 (44.16)	22.89 (28.58)	
T_4 - Rhizobium + Phosphobacteria @ 2Kg ha^{-1} as soil application	48.50 (44.14)	22.65 (28.43)	
T_5 - RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1}+ Vermicompost @ 6.25 t ha^{-1}	49.01 (44.43)	24.61 (29.74)	
T_6 - RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1} + Rhizobium + Phosphobacteria @ 2 Kg ha^{-1} as soil application	48.99 (44.42)	24.48 (29.65)	
T_7 - Vermicompost @ 6.25 t ha^{-1} +Rhizobium + Phosphobacteria @ 2 Kg ha^{-1} as soil application	48.58 (44.18)	22.95 (28.62)	
T_8 - RDF 17:34:54 kg ha^{-1}+ Gypsum @ 400 kg ha^{-1} + Vermicompost @ 6.25 t ha^{-1} + Rhizobium + Phosphobacteria @ 2 Kg ha^{-1} as soil application	49.31 (44.60)	25.68 (30.44)	
SE(m)	0.023	0.116	
CD (P=0.05)	0.049	0.25	

Figures in parenthesis are Arc-sine transferred values

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