EFFECT ~~ON~~ OF INTEGRATED NUTRIENT MANAGEMENT ON PRODUCTIVITY, QUALITY AND NUTRIENT UPTAKE ~~ON~~ IN SUMMER GROUNDNUT (*ARACHIS HYPOGAEA* L.)

ABSTRACT

~~—~~ A field experiment was conducted ~~T~~to study the effect of integrated nutrient management on productivity, quality and nutrient uptake ~~on~~ in summer groundnut (*Arachis hypogaea* L.) ~~field experiment was conducted~~ during summer ~~season of~~ 2018 at ~~Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar~~ Dantiwada ~~Agricutlural University, Sardarkrushinagar~~, Gujarat. ~~to study the effect~~ The ~~experiment~~ treatments consisted of ten different integrated nutrient management ~~treatments for application of recommended dose of nitrogen to summer groundnut i.e 25 kg nitrogen/ha through different source of organic fertilizers *viz.*(farm yard manure and vermicompost) inorganic fertilizer along with FYM and Vermicompost with *Rhizobium* and PSB.~~ practices. The ~~results revealed that the~~ integration of inorganic fertilizers along with seed inoculation of biofertilizers ~~i.e~~viz., *Rhizobium* and ~~PSB~~ phosphate solubilizing bacteria (PSB) recorded significantly ~~the highest~~higher pod and haulm yield of summer groundnut as compared to rest of the treatments. Combined application of 75 % ~~RDN~~ recommended dose of nitrogen (RDN) and 25 % RDN through vermicompost or farm yard manure (FYM) along with seed inoculation of *Rhizobium* and PSB recorded higher pod and haulm yield and also higher net ~~realization~~ returns and B:~~-~~C ratio ~~of~~ in summer groundnut.

Key words : Groundnut, INM, Bio-fertilizer, RDN, Vermicomost, FYM.

1. INTRODUCTION

Groundnut is ~~known to be~~ a unique and important legume cum oilseed crop ~~of~~ in India. ~~Groundnut is popularly known as nuts and i~~It is largely grown in Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra~~.~~. The ~~Kernel~~ kernels of groundnut are used ~~for~~ in many culinary preparations due to its ~~rich source~~high content of oil and protein. Groundnut naturally enriches the soil through ~~symbiosis~~biological nitrogen fixation. ~~.~~ Cultivation of groundnut during summer season is increasing ~~because of controlled~~owing to controlled moisture condition through irrigation, abundant sunshine and less ~~infection~~ infestation of pests and diseases. The continuous and imbalanced use of chemical fertilizers ~~creates problems in the~~affects production potential of summer groundnut. Use of chemical fertilizers

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in combination ~~of~~ with organic manures ~~might be recorded the~~ results in higher ~~production~~ productivity of groundnut crop and improves the soil health. Organic manures are good complimentary sources of nutrients. ~~and~~ They also improve the efficiency of applied mineral ~~(inorganic~~) nutrients through chemical fertilizers ~~in on hand~~ and improve the physical and biological properties of the soil. ~~on other hand.~~ A judicious and ~~combined~~ complementary use of organic and inorganic sources of plant nutrients plays an important role in ~~the economically the use of fertilizers under increasing cost of chemical fertilizers~~ decreasing the cost of production through reducing the cost of nutrient inputs. ~~Hence t~~The present experiment was carried out to ~~find out~~study the effect of organic and inorganic manures on ~~pod and haulm~~ yield and economics of summer groundnut.

2. MATERIALS AND METHODS

A field experiment was conducted during summer season of 2018 at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, ~~Sardarkrushinagar~~ Dantiwada Agricultural University, Sardarkrushinagar, to study effect of ~~Integrated~~ integrated nutrient management on productivity, quality and nutrient uptake ~~on~~ in summer groundnut (*Arachis hypogaea* L.) The experiment was conducted on loamy sand soil having slightly alkaline pH (7.42), low in organic carbon (0.23%) and available nitrogen (158 kg/ha), high in available phosphorus~~P_2O_5~~ (37 kg/ha) and high in available ~~K_2O~~ potassium (286 kg/ha) in 0-15 cm soil depth. There ~~was~~ were ten ~~treatments~~ treatment combinations *viz.*, 100% recommended dose of fertilizers (RDF) (25 kg N ~~:~~ 50 ~~N and~~kg P_2O_5 ~~kg~~/ha) (T_1), 50% recommended dose of nitrogen through fertilizers (RDN) ~~+~~ 50% N through farm yard manure (FYM) (T_2), 75% RDN + 25% N through FYM (T_3), 50% RDN + 50% N through vermicompost (T_4), 75% RDN + 25% N through vermicompost (T_5), 50% RDN + 50% N through FYM + *Rhizobium* + phosphate solubilizing bacteria (PSB) (T_6), 75% RDN + 25% N through FYM + *Rhizobium* + PSB (T_7), 50% RDN + 50% N through vermicompost + *Rhizobium* + PSB (T_8), 75% RDN + 25% N through vermicompost + *Rhizobium* + PSB (T_9), 100% RDF + *Rhizobium* + PSB (T_{10}) ~~.~~ ~~Ten treatments~~They were evaluated in randomised block design with four replications. The nutrient sources viz. FYM (0.5 % N, 0.25 % P_2O_5 and 0.5 % K_2O) and vermicompost (3 % N, 1.0 % P_2O_5 and 1.5 % K_2O) as well as required quantity of nitrogen and phosphorus in the form of urea and single super phosphate, respectively were applied as per treatments at the time of sowing. The organic sources of ~~fertilizers~~ nutrients ~~i.e~~viz., FYM and vermicompost ~~was~~ were applied 15 days before sowing.

Groundnut variety TG 37 was sown with 100 kg/ha seed rate at inter raw spacing of 30 cm and intra raw spacing of 10 cm on 19th February 2018. All the cultural operations ~~was~~ were

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carried out as per the ~~recommendation~~ recommended package of practices for~~of~~ summer groundnut. ~~Randomly~~ F~~f~~ive plants per net plot were selected randomly from the net plot area and tagged for recording the growth and yield attributes ~~characters~~in each treatment.. ~~The cost of cultivation and returns were calculated by taking account the prevailing cost of inputs and price of produce.~~

The crop was manually ~~harvested, threshed~~uprooted, pods were seperated and pod yield was recorded. The cost of cultivation and returns were calculated on the basis of prevailing cost of inputs and price of produce.

The soil sample were collected from each plot after harvesting groundnut crop at 0-15 cm depth and analysed ~~using~~ as per standard procedures. The total nitrogen content of kernel and haulm of groundnut plants was analysied by micro Kjedahl method and phosphorus by Vanado molydophosphorus acid yellows colour methods (Jackson, 1967). Total nitrogen values thus obtained were multiplied with a factor of 6.25 to obtain protein content. The estimation oil content was ~~determined~~ done by soxhlet extraction methods following standard procedure ~~as per association of official Analytical Chemists~~ (A.O.A.C., 1970). The total oil yield per hectare was also worked out by multiplying kernel yield (kg/ha) with oil percent in kernel and divided by 100. The uptake of nitrogen and phosphorus in kernel and haulm were determined by using following formula.

$$\text{Nutrients uptake (kg/ha)} = \frac{\text{Nutrient content (\%)} \times \text{Kernel yield (kg/ha)}}{100}$$

3. RESULT AND DISCUSSION ~~:~~

Yield attributes and yield ~~attributes~~

Significantly higher number of pods per plant and dry weight of pods per plant were recorded by the application of RDF + *Rhizobium* + PSB. ~~and i~~It was followed by 75% RDN + 25% N through vermicompost + *Rhizobium* + PSB and 75% RDN + 25% N through FYM + *Rhizobium* + PSB. ~~Since t~~The plants were healthy ~~under treatments of during~~with the application of combination FYM, vermicompost and biofertilizers ~~then~~ and it was reflected in their yield attributes viz. number of pods and dry weight of pods per plant. The ~~minimum~~ lower number of pods per plant and dry weight of pods per plant were recorded by 50% RDN + 50% N through FYM. Application of fertilizer along FYM and vermicompost increased the number of pods and dry weight of pods per plant significantly~~,~~ and~~which~~ further increased the pod and haulm yield of summer groundnut. Mohapatra and Dixit (2010)

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also reported that pod and haulm yield were significantly higher ~~by~~ with the application of FYM, vermicompost and biofertilizers.

~~An a~~Application of recommended dose of ~~fertilizers~~ nutrients through ~~various~~ different sources ~~(~~viz. chemical fertilizers, FYM, ~~+ V~~vermicompost etc.~~)~~ along with biofertilizers ~~(~~ viz. *Rhizobium* ~~+~~ *and* PSB~~)~~ significantly increased the ~~pods~~ pod and ~~haulms~~ haulm yield of summer groundnut. ~~The a~~Application of RDF along with biofertilizers (*Rhizobium* + PSB) resulted in significantly ~~highest~~ higher ~~pods~~ pod and ~~haulms~~ haulm yield ~~, but~~and it was closely followed by 75% RDN + 25% N through vermicompost + *Rhizobium* + PSB and 75% RDN + 25% N through FYM + *Rhizobium* + PSB. In ~~case of~~case of ~~pods~~ pod and ~~haulms~~ haulm yield, the latter two treatments in combination ~~of~~ with FYM and vermicompost were found statistically ~~alike~~at par. The increase in ~~pods~~ pod yield was 22.8, 22.0 and 20.9 per cent (Table ~~2~~1) than that of 50% RDN + 50% N through FYM.

This might be attributed to rapid mineralization of chemical nitrogen and slow~~ly~~ supply of nitrogen from FYM and vermicompost along with biofertilizers which might have met the nitrogen requirement of crop at critical stages of growth. Further, FYM and vermicompost act as ~~a~~ nutrient reservoirs and upon decomposition produce organic acid~~e~~s, thereby absorbed ions are released slowly during entire growth period leading to improvement in ~~different~~ crop yield attributes ~~characters~~ and ultimately ~~pods~~ pod and haulms yield of groundnut. ~~increased.~~ The percent increase in ~~pods~~ pod yield by fertilizing the crop with 100% RDF + *Rhizobium* + PSB (T_{10}), 75% RDN + 25% N through vermicompost + *Rhizobium* + PSB (T_9) and 75% RDN + 25% N through FYM + *Rhizobium* + PSB (T_7) was tune to the tune of 22.8, 22.0 and 20.9 per cent, respectively over 50% RDN + 50% N through FYM. Similar trend was ~~found~~ observed by Abraham and Thenua (2010). Dhadge and Satpute (2014) also reported significantly ~~heigher~~higher ~~the~~ ~~pods~~ pod and ~~haulms~~ haulm yield due to integration of inorganic and organic sources of nutrients.

Quality

The protein content in summer groundnut was influenced markedly by different integrated nutrient management treatments (Table 2). As ~~the~~ nitrogen is the basic constituent of protein and with the increase in the availability of nitrogen by the application of organic manures and *Rhizobium* inoculants, the uptake of nitrogen increased which resulted in ~~heigher~~higher protein content in kernel. Oil content was not significantly influenced by different integrated nutrient management treatments, as oil content is a genetic~~al~~ character~~s~~ ~~which was~~ and is not much influenced by agronomical practices. But oil yield was influenced by different integrated nutrient management treatments due to higher kernel yield of the groundnut.

Lowest oil content and oil yield was recorded in 50% RDN + 50% N through FYM. Bhosale *et al.* (2017) also ~~reported maximum~~reported higher oil content and oil yield under organically manured plots.

Soil fertility

Integrated ~~Application of~~ nutrient~~s~~ management treatments had a mark~~ed~~ effect on available nitrogen and ~~available~~ phosphorus in soil but ~~it failed to reached the level of significance but with respect to~~they were at par in available potassium. ~~An a~~Application of 50 % RDN + 50 % nitrogen through FYM along with biofertilizers **(***Rhizobium* + PSB) resulted in significantly higher available nitrogen (151 kg/ha) and available phosphorus (38.63 kg/ha) followed by 50 % RDN + 50 % nitrogen through FYM along with biofertilizers **(***Rhizobium* + PSB) and 50 % nitrogen through vermicompost. ~~An a~~Application of 100 % RDF recorded significantly lower content of available nitrogen and phosphorus ~~levels~~ as compared to organically manured plots. This might be due to the fact that in organically manured plots microbial population might have be increased and as a result soil aggregation and decomposition have resulted in increased organic content in soil leading to higher available nitrogen in soil. ~~the~~ The higher uptake of nitrogen by groundnut with the incorporating of manured with *Rhizobium* + PSB may be due to release of higher amount of nitrogenous compounds by root nodules at early stage of growth and their subsequent decomposition at lower stages. Moreover, FYM increases the absorptive power of the soil for cations and anions particularly phosphates and nitrates. The increase in available phosphorus might be due to ~~the~~ organic acids which are released during microbial decomposition of organic matter which helped in ~~solubilising~~ solubilisation of native phosphorus as a result of which the availability of phosphorus content in soil increased. The beneficial effects of organic ~~manured~~ manures and biofertilizers on increased availability of nitrogen and phosphorus to soil ~~as~~ were also reported by Choudhary *et al.* (2011).

Nitrogen, phosphorus and potassium content and uptake

~~integrated application of nutrients failed to reach the level of significance with respect to potassium content in kernel and haulm (Table 3).~~ Marked differences were observed in nitrogen and phosphorus content and uptake in kernel and haulm of groundnut. Significantly higher content and uptake of nitrogen and phosphorus was recorded with the application of 100% RDF along with biofertilizers **(***Rhizobium* + PSB) followed by 75% RDN + 25% N through vermicompost + *Rhizobium* + PSB and 75% RDN + 25% N through FYM + *Rhizobium* + PSB. Integrated application of nutrients failed to reach the level of significance with respect to potassium content in kernel and haulm (Table 3). The content and uptake of

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nitrogen and phosphorus was more in vermicompost treated plots, than that of FYM treated plots owing to better availability of phosphorus in crop root zone resulting from solubilisation caused by the organic acids, produced from decaying organic matter and also increased uptake by the groundnut roots due to their association with microrrhizal filaments increasing in the ascribing active area of roots. The increased increase in nitrogen uptake might be due to enhanced activity of nitrogenease and nitrate reductase enzyme in the soil. Choudhary *et al.* (2011) also recorded the highestr content and uptake of nitrogen and phosphorus by showed thatwith the application of 100% RDF + *Rhizobium* + VAM + PSB.

4. CONCLUSION :

Fertilizing the crop withIt may be concluded that application of 100% RDF + *Rhizobium* + PSB recorded results in significantly higher pod and haulm yield, protein content, oil yield and also higher net realization and B:C ratio of summer groundnut. .

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Table 1. ~~:~~ Effect of integrated nutrient management ~~treatments~~ practices on ~~productivity on~~yield parameters and yield of summer groundnut

Treatments	Number of pods per plant			Dry weight of pods~~/ plant~~(g/plant)	Pod yield (kg/ha)	Haulm yield (kg/ha)	Shelling (%)
	Filled	Unfilled	Total				
100% RDF (25 kg N:50 ~~N and~~kg P_2O_5 ~~kg~~/ha) (T_1)	17.0	6.2	23.2	12.15	2751	4878	68.03
50% ~~-~~RDN + 50% ~~-~~N through FYM (T_2)	13.0	5.4	18.4	10.66	2543	4201	65.24
75% RDN + 25% N through FYM (T_3)	15.0	5.5	21.0	11.90	2726	4634	67.25
50% RDN + 50% N through vermicompost (T_4)	13.9	5.4	19.3	10.76	2576	4301	65.46
75% RDN + 25% N through vermicompost (T_5)	15.7	5.8	21.5	12.14	2737	4742	67.86
50% RDN + 50% N through FYM + *Rhizobium* + PSB (T_6)	14.4	5.5	19.9	11.47	2603	4422	65.62
75% RDN + 25% N through FYM + Rhizobium + PSB (T_7)	18.4	6.4	24.8	12.90	3075	5100	68.22
50% RDN + 50% N through vermicompost + *Rhizobium* + PSB (T_8)	14.6	5.5	20.1	11.76	2723	4607	66.91
75% RDN + 25% N through vermicompost + *Rhizobium* + PSB (T_9)	18.3	6.9	25.1	13.01	3104	5236	69.09
100% RDF + *Rhizobium* + PSB (T_{10})	19.4	7.2	26.6	13.43	3122	5438	70.82
S.Em. ±	0.98	0.28	0.97	0.43	124	192	2.36
C~~.~~D~~.~~ at 5 %	2.85	0.81	2.81	1.26	360	558	NS
~~C.V. %~~	~~12.31~~	~~0.38~~	~~8.83~~	~~7.21~~	~~8.87~~	~~8.09~~	~~7.00~~

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Table 2. : Effect of integrated nutrient management practices treatments on quality parameters of summer groundnut

Treatments	Protein content (%)	Oil content (%)	Oil yield (kg/ha)
100% RDF (25 kg N:50 kg P_2O_5 /ha) (T_1)100% RDF (25:50 N and P_2O_5 kg/ha)	22.9	47.63	892
50% RDN + 50% N through FYM (T_2)50% RDN + 50% N through FYM	20.9	44.96	752
75% RDN + 25% N through FYM (T_3)75% RDN + 25% N through FYM	22.0	46.81	850
50% RDN + 50% N through vermicompost (T_4)50% RDN + 50% N through vermicompost	21.3	45.22	769
75% RDN + 25% N through vermicompost (T_5)75% RDN + 25% N through vermicompost	22.7	47.11	876
50% RDN + 50% N through FYM + *Rhizobium* + PSB (T_6)50% RDN + 50% N through FYM + *Rhizobium* + PSB	21.4	46.02	791
75% RDN + 25% N through FYM + Rhizobium + PSB (T_7)75% RDN + 25% N through FYM + Rhizobium + PSB	23.6	47.95	999
50% RDN + 50% N through vermicompost + *Rhizobium* + PSB (T_8)50% RDN + 50% N through vermicompost + *Rhizobium* + PSB	21.6	46.33	849
75% RDN + 25% N through vermicompost + *Rhizobium* + PSB (T_9)75% RDN + 25% N through vermicompost + *Rhizobium* + PSB	23.9	48.22	1029
100% RDF + *Rhizobium* + PSB (T_{10})100% RDF + *Rhizobium* + PSB	24.0	48.52	1074
S.Em. ±	0.45	1.49	54.6
CD at 5 %C.D. at 5 %	1.30	NS	158.5
C.V. %	3.98	6.35	12.30

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Table 3~~:~~. Effect of integrated nutrient management practices on N, P and K uptake by kernel and haulm

Treatments	Nutrient uptake by kernel (kg/ha)			Nutrient uptake by haulm (kg/ha)		
	N	P	K	N	P	K
100% RDF (25 kg N:50 kg P_2O_5 /ha) (T_1)~~100% RDF (25:50 N and P_2O_5 kg/ha)~~	67.87	8.62	11.79	27.55	3.67	12.37
50% RDN + 50% N through FYM (T_2)~~50% RDN + 50% N through FYM~~	56.34	7.20	10.07	20.39	2.92	10.16
75% RDN + 25% N through FYM (T_3)~~75% RDN + 25% N through FYM~~	64.89	8.26	11.51	26.05	3.45	11.64
50% RDN + 50% N through vermicompost (T_4)~~50% RDN + 50% N through vermicompost~~	57.56	7.41	10.27	21.71	3.00	10.55
75% RDN + 25% N through vermicompost (T_5)~~75% RDN + 25% N through vermicompost~~	67.08	8.40	11.66	26.91	3.54	11.92
50% RDN + 50% N through FYM + *Rhizobium* + PSB (T_6)~~50% RDN + 50% N through FYM + *Rhizobium* + PSB~~	58.67	7.55	10.60	23.25	3.09	10.69
75% RDN + 25% N through FYM + Rhizobium + PSB (T_7)~~75% RDN + 25% N through FYM + Rhizobium + PSB~~	79.10	9.67	13.21	31.15	4.23	13.89
50% RDN + 50% N through vermicompost + *Rhizobium* + PSB (T_8)~~50% RDN + 50% N through vermicompost + *Rhizobium* + PSB~~	63.14	8.16	11.40	25.41	3.34	11.49
75% RDN + 25% N through vermicompost + *Rhizobium* + PSB (T_9)~~75% RDN + 25% N through vermicompost + *Rhizobium* + PSB~~	82.28	10.07	13.62	32.24	4.42	14.38
100% RDF + *Rhizobium* + PSB (T_{10})~~100% RDF + *Rhizobium* + PSB~~	85.14	10.56	14.29	33.39	4.72	14.83
S.Em. ±	4.37	0.49	0.70	1.53	0.26	0.70
CD at 5 %~~C.D. at 5 %~~	12.68	1.43	2.04	4.45	0.74	2.03
~~C.V. %~~	~~12.80~~	~~11.51~~	~~11.86~~	~~11.43~~	~~14.06~~	~~11.49~~

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