

Original Research Article

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Influence of Organic and Inorganic Sources of Nutrients on Growth, Yield and Economics of Summer Groundnut (*Arachis hypogaea* L.)

J. P. Joshi* and A. G. Patel

Department of Agronomy, C. P. College of Agriculture, S.D. Agricultural University,
Sardarkrushinagar- 385 506, Gujarat, India

*Corresponding author

ABSTRACT

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A field experiment was conducted during summer season of 2018 at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat to study the effect of organic and inorganic sources of nutrients on growth, yield and economics of summer groundnut (*Arachis hypogaea* L.). The experiment consists of ten different treatment combinations for application of recommended dose of nitrogen to summer groundnut i.e. 25 kg nitrogen/ha through different organic source viz.(farm yard manure and vermicompost), inorganic fertilizer along with organic sources, *Rhizobium* and PSB. The results revealed that the integration of inorganic fertilizers along with seed inoculation of biofertilizers i.e. *Rhizobium* and PSB recorded significantly the highest pods and haulms yield as compared to rest of treatments combinations. Combined application of 75 % RDN and 25 % RDN through vermicompost or FYM along with seed inoculation of *Rhizobium* and PSB recorded higher pods and haulms yield and also higher net realization and B: C ratio of summer groundnut.

Introduction

Summer groundnut has emerged as one of the major oilseeds crops in India. The production of groundnut in India is 6.77 million tonnes from 4.56 million hectare area with a productivity of 1486 kg/ha (DOA, 2018). Whereas in Gujarat, its productivity is 2140 kg/ha. Groundnut is popularly known as nuts and is an important legume crops grown in Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra. The Kernels of groundnut is used for many culinary preparation due to its rich source of oil (45.50

%) and protein. Groundnut is helps in maintaining the soil fertility by fixing the nitrogen symbiotically. The low productivity of the crop is primarily due to uncontrolled climatic conditions, low organic matter in the soil due to low use of organic fertilizers and continuous cropping system. The continuous and imbalance use of chemical fertilizers creates problems in the production potential of summer groundnut. Use of chemical fertilizers in combination of organic manures is required for high production of groundnut crop and to improve the soil health. Moreover, organic manures are good

complimentary source of nutrients and improve the efficiency of applied mineral (inorganic) nutrient one hand and improve the physical and biological properties of the soil on other hand. Therefore, judicious and combined use of organic and inorganic sources of plant nutrients plays important role in the economizing the use of fertilizers under increasing cost of chemical ferti out to find out the effect of organic and inorganic sources of nutrients on growth, yield and economics of summer groundnut.

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 the effect of organic and inorganic sources of nutrients on growth, yield and economics of summer groundnut (*Arachis hypogaea* L.)

The experiment was conducted on loamy sand soil having pH 7.42, organic carbon (0.23%) and available nitrogen (158 kg/ha), available P₂O₅ (37 kg/ha) and available K₂O (286 kg/ha) in 0-15 cm soil depth. There was ten treatments combinations viz., 100% RDF (25: 50 N and P₂O₅ kg/ha) (T₁), 50% RDN + 50% N through FYM (T₂), 75% RDN + 25% N through FYM (T₃), 50% RDN + 50% N through vermicompost (T₄), 75% RDN + 25% N through vermicompost (T₅), 50% RDN + 50% N through FYM + *Rhizobium* + PSB (T₆), 75% RDN + 25% N through FYM + *Rhizobium* + PSB (T₇), 50% RDN + 50% N through vermicompost + *Rhizobium* + PSB (T₈), 75% RDN + 25% N through vermicompost + *Rhizobium* + PSB (T₉), 100% RDF + *Rhizobium* + PSB (T₁₀) were evaluated in randomised block design with four replications. The nutrient sources viz. FYM (0.5 % N, 0.25 % P₂O₅ and 0.5 % K₂O) and

vermicompost (3 % N, 1.0 % P₂O₅ and 1.5 % K₂O) as well as required quantity of nitrogen and phosphorus in the form of urea and single super phosphate were applied as per treatments at the time of sowing. The organic sources of fertilizers i.e FYM and vermicompost were applied 15 days before sowing.

Groundnut variety TG 37 was sown with 100 kg/ha seed rate at inter row spacing of 30 cm and intra row spacing of 10 cm on 19th February 2018. All the cultural operations was carried out as per the recommendation of summer groundnut. Randomly five plants per net plot were selected and tagged for recording the growth and yield attributes characters. 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 and pods yield was recorded. The soil sample were collected from each plot after harvesting groundnut crop to a depth of 0-15 cm and analysed using standard procedure.

The total nitrogen content of pod and haulm of groundnut plants was analysed by micro Kjeldahl method and phosphorus by Vanado molybdophosphorus 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 by Soxhlet extraction methods following standard procedure as per Association of Official Analytical Chemists (AOAC, 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 pod and haulm were determined by using following formula.

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

Results and Discussion

Growth parameters

Fertilizing the groundnut crop with recommended dose of fertilizers along with *Rhizobium* + PSB recorded significantly taller plants, however plant height in the plot treated with 75% RDN + 25% N through vermicompost + *Rhizobium* + PSB and 75% RDN + 25% N through FYM + *Rhizobium* + PSB was more or less equal to the RDF + *Rhizobium* + PSB treatments. Significant the lower plant height was recorded by the application of 50% RDN + 50% N through FYM (Table 1).

The effect of FYM and vermicompost in combination with biofertilizers was more pronounced with the advancement of crop growth indicating better effect on periodically plant height upto the harvest of the crop.

This may be owing to continuous availability of nutrition to summer groundnut plants because of slow release of nutrients from FYM and vermicompost during crop season. More over, FYM and vermicompost added NPK in soil, besides the supply of other essential macro and micro nutrients. RDF + *Rhizobium* + PSB recorded the tallest plant than all other treatments combinations.

The higher number of branches per plant and dry matter accumulation per plant was recorded with RDF + *Rhizobium* + PSB followed by 75% RDN + 25% N through vermicompost + *Rhizobium* + PSB and 75% RDN + 25% N through FYM + *Rhizobium* +

PSB. Significantly the lowest number of branches per plant and dry matter per plant was recorded by the application of 50% RDN + 50% N through FYM. More or less, similar results were obtain on number of root nodules per plant and fresh root nodules weight per plant.

In the present study, better nutrition of the plant owing to FYM, vermicompost and biofertilizers (*Rhizobium* + PSB) might have resulted in improvement of the number of branches per plant and dry matter per plant.

The association of soil microorganism, organic manures are known to help in synthesis of certain phytohormones and ultimately which promotes the growth and development of crops. The slow release of nutrients due to with FYM and vermicompost might have resulted in higher concentrates of nutrients in plant cell resulting in higher dry matter accumulating per plant.

Yield attributes

Significantly higher number of pods per plant and dry weight of pods per plant were recorded with combined application of RDF + *Rhizobium* + PSB followed by 75% RDN + 25% N through vermicompost + *Rhizobium* + PSB and 75% RDN + 25% N through FYM + *Rhizobium* + PSB. Since the plants were healthy under treatments of having combination of FYM, vermicompost and biofertilizers, they produced more dry matter which was then reflected in their yield attributes viz. number of pods per plant and dry weight of pods per plant.

The minimum number of pods per plant and dry weight of pods per plant were recorded by 50% RDN + 50% N through FYM. Organic manure did not influence the shelling percentage being varietal characters, which is less sensitive to management levels.

Table.1 Effect of organic and inorganic sources of nutrients on growth parameters of summer groundnut

Treatments	Plant height (cm)				No. of branches / plant	Dry matter/ plant (g)	No. of root nodules / plant	Fresh root nodules weight/ plant (mg)
	30 DAS	60 DAS	90 DAS	At harvest				
100% RDF (25:50 N and P₂O₅ kg/ha)	9.7	21.3	35.6	38.5	7.7	35.31	27.7	107.26
50% RDN + 50% N through FYM	8.3	18.4	32.5	34.5	6.8	30.82	23.8	88.53
75% RDN + 25% N through FYM	9.2	21.2	35.2	38.0	7.4	35.27	27.6	106.54
50% RDN + 50% N through vermicompost	8.6	19.7	33.3	35.4	7.2	31.80	27.5	104.80
75% RDN + 25% N through vermicompost	9.3	21.3	35.2	38.0	7.5	35.28	27.7	106.80
50% RDN + 50% N through FYM + <i>Rhizobium</i> + PSB	8.8	20.4	33.5	35.7	7.2	34.03	27.6	105.00
75% RDN + 25% N through FYM + <i>Rhizobium</i> + PSB	10.0	22.1	37.6	41.4	8.0	39.44	29.0	112.52
50% RDN + 50% N through vermicompost + <i>Rhizobium</i> + PSB	9.1	20.7	34.1	36.4	7.4	35.04	27.6	105.44
75% RDN + 25% N through vermicompost + <i>Rhizobium</i> + PSB	10.2	22.8	38.8	42.9	8.2	39.60	29.1	113.97
100% RDF + <i>Rhizobium</i> + PSB	10.3	23.8	39.8	44.9	8.5	40.62	31.1	117.95
S.Em. ±	0.46	0.85	1.40	1.74	0.24	1.81	1.13	3.57
C.D. at 5 %	NS	2.46	4.07	5.06	0.70	5.26	3.28	10.37
C.V. %	9.97	8.02	7.90	9.04	6.36	10.15	8.12	6.69

Table.2 Effect of organic and inorganic sources of nutrients on yield of summer groundnut

Sr. No.	Treatments	Number of pods per plant			Dry weight of pods/plant	Pod yield (kg/ha)	Haulm yield (kg/ha)	Shelling (%)
		Filled	Unfilled	Total				
T ₁	100% RDF (25:50 N and P ₂ O ₅ kg/ha)	17.0	6.2	23.2	12.15	2751	4878	68.03
T ₂	50% RDN + 50% N through FYM	13.0	5.4	18.4	10.66	2543	4201	65.24
T ₃	75% RDN + 25% N through FYM	15.0	5.5	21.0	11.90	2726	4634	67.25
T ₄	50% RDN + 50% N through vermicompost	13.9	5.4	19.3	10.76	2576	4301	65.46
T ₅	75% RDN + 25% N through vermicompost	15.7	5.8	21.5	12.14	2737	4742	67.86
T ₆	50% RDN + 50% N through FYM + <i>Rhizobium</i> + PSB	14.4	5.5	19.9	11.47	2603	4422	65.62
T ₇	75% RDN + 25% N through FYM + <i>Rhizobium</i> + PSB	18.4	6.4	24.8	12.90	3075	5100	68.22
T ₈	50% RDN + 50% N through vermicompost + <i>Rhizobium</i> + PSB	14.6	5.5	20.1	11.76	2723	4607	66.91
T ₉	75% RDN + 25% N through vermicompost + <i>Rhizobium</i> + PSB	18.3	6.9	25.1	13.01	3104	5236	69.09
T ₁₀	100% RDF + <i>Rhizobium</i> + PSB	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

Table.3 Effect of organic and inorganic sources of nutrients on economics of summer groundnut

Sr. No.	Treatments	Gross realization (₹/ha)	Cost of cultivation (₹/ha)	Net Realization (₹/ha)	BCR
T ₁	100% RDF (25:50 N and P ₂ O ₅ kg/ha)	143307	55565	87742	2.57
T ₂	50% RDN + 50% N through FYM	131239	56892	74347	2.31
T ₃	75% RDN + 25% N through FYM	141206	56229	84977	2.51
T ₄	50% RDN + 50% N through vermicompost	133124	57892	75232	2.30
T ₅	75% RDN + 25% N through vermicompost	142133	56729	85404	2.51
T ₆	50% RDN + 50% N through FYM + <i>Rhizobium</i> + PSB	134823	57132	77691	2.36
T ₇	75% RDN + 25% N through FYM + <i>Rhizobium</i> + PSB	158775	56469	102306	2.81
T ₈	50% RDN + 50% N through vermicompost + <i>Rhizobium</i> + PSB	140963	58132	82831	2.43
T ₉	75% RDN + 25% N through vermicompost + <i>Rhizobium</i> + PSB	160624	56969	103655	2.82
T ₁₀	100% RDF + <i>Rhizobium</i> + PSB	162242	55805	106437	2.91

Application of fertilizer along FYM and vermicompost increased the number of pods and dry weight of pods per plant significantly, which further increased the pod and haulm yield of summer groundnut. Mohapatra and Dixit (2010) also reported that pods and haulms yield were significantly higher by the application of FYM, Vermicompost and biofertilizers.

An application of recommended dose of fertilizers through various sources (viz. FYM + Vermicompost) along with biofertilizers (*Rhizobium* + PSB) significantly increased the pod and haulm yield of summer groundnut. The application of RDF along with biofertilizers (*Rhizobium* + PSB) resulted in significantly highest pod and haulm yield, but it was closely followed by 75% RDN + 25% N through vermicompost + *Rhizobium* + PSB and 75% RDN + 25% N through FYM + *Rhizobium* + PSB (Table 2). In case of pod and haulm yield, the latter two treatments in combination of FYM and vermicompost were found statistically alike. This might be attributed to rapid mineralization of nitrogen and slowly 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 reservoir and upon decomposition produce organic acids, thereby absorbed ions are released slowly during entire growth period leading to improvement in different yield attributes characters and ultimately pod and haulm yield of groundnut. The percent increase in pod yield by fertilizing the crop with 100% RDF + *Rhizobium* + PSB, 75% RDN + 25% N through vermicompost + *Rhizobium* + PSB and 75% RDN + 25% N through FYM + *Rhizobium* + PSB 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 by Abraham and Thenua

(2010). Dhadge and Satpute (2014) reported significantly higher pod and haulm yield by application of 75% RDF + 25% N through FYM + *Rhizobium* + PSB.

Economics

Significantly higher net realization and net return per rupee invested (BCR) were obtained from the crop fertilized with RDF + *Rhizobium* + PSB followed by 75% RDN + 25% N through vermicompost + *Rhizobium* + PSB and 75% RDN + 25% N through FYM + *Rhizobium* + PSB. The lowest net realization and net return per rupee invested (BCR) were recorded in the 50% RDN + 50% N through FYM. High cost of FYM and vermicompost resulted in increased the cost of cultivation without too much increase in net returns, thus overall effect of FYM and vermicompost reflected in net returns per rupee increased. The 50% RDN + 50% N through FYM recorded significantly lower net realization and net return per rupee invested. This result confirms the finding of Datta *et al.*, (2014).

In conclusion the nutshell, fertilizing the groundnut crop either by 100% RDF (25:50:00 kg N:P₂O₅:K₂O kg/ha) along with *Rhizobium* + PSB or 75% RDN + 25% nitrogen either through vermicompost or FYM along with *Rhizobium* + PSB produced higher yield and monetary returns.

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