



Growth, yield, yield attributes and economics of summer groundnut (*Arachis hypogaea* L.) as influenced by integrated nutrient management

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Received: December 24, 2014; Revised received: March 15, 2015; Accepted: May 10, 2015

Abstract: A field experiment was conducted at Sardarkrushinagar Dantiwada Agricultural University Sardarkrushinagar to study the effect of integrated nutrient management on growth and yield attributes of summer groundnut in 2012. The soil of experimental field was loamy sand in texture, low in organic carbon (0.17 %) and available nitrogen (149 kg ha⁻¹), medium in available P₂O₅ (29.3 kg ha⁻¹) and rich in K₂O (287 kg ha⁻¹) status. Result revealed that the significantly highest pod yield (2650 kg ha⁻¹), haulm yield (4633 kg ha⁻¹), growth and yield parameters viz., plant height (43.9 cm), filled pods plant⁻¹(22.6), total pods plant⁻¹(31.4), pod weight plant⁻¹ (22.3 g) and 100 kernel weight (43.9 g) were recorded under the treatment which received 125 % recommended dose of nitrogen through vermicompost. While in case of phosphorus application @ 50 kg P₂O₅ ha⁻¹ recorded significantly higher pod (2824 kg ha⁻¹) and haulm yield (4655 kg ha⁻¹) over PSB only and 25 kg P₂O₅ ha⁻¹ which was at par with the application of phosphorus @ 25 kg ha⁻¹ + PSB for yield attributing characters viz., filled pods plant⁻¹, total pods plant⁻¹, pod weight plant⁻¹. Maximum net realization of 1,13, 056 ha⁻¹ with CBR 4.49 was obtained under application of 125 % RDN through vermicompost with 50 kg P₂O₅ ha⁻¹ (V₃P₄). Vermicompost and phosphorus did not exert its interaction effects during course of investigation. This concludes that the groundnut crop should be inoculated with PSB culture @ 200 g per 8 kg seeds before sowing and crop should be fertilized with 125% RDN through vermicompost and phosphorus @ 50 kg P₂O₅ ha⁻¹ loamy sand soil of North Gujarat agro-climatic condition.

Keywords: Economics, Phosphorus, PSB, Vermicompost, Yield, Yield attributes

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) seed contain high quality edible oil (48 per cent), easily digestible protein (26 per cent) and carbohydrates (20 per cent). The bulk of oil production in India is derived from groundnut, rapeseed, sesame, sunflower, soyabean and other minor oilseed crops, and among these crops, groundnut (*Arachis hypogaea* L) is the most dominant annual crop widely cultivated (Rathore and Kamble, 2008). In nutrition a new era is emerging that is characterized by search for dietary constituents that have benefits beyond those ascribed to the macro and micronutrients (Das *et al.*, 2005). The use of organic amendments such as traditional generally as an effective means for improving soil aggregation, structure and fertility, improving the moisture holding capacity and increasing crop yields (Marinari *et al.*, 2000). The vermicompost is reported to have hormone like activity and this has been hypothesized to result in greater root initiation, increased root biomass, enhanced plant growth and development and altered morphology of plants growth (Bachman and Mazger, 2007). Earthworms excreta is a

rich nutritive organic fertilizer due to rich in humus, NPK, micronutrients, beneficial soil microbes 'nitrogen fixing and phosphate solubilizing bacteria' and actinomycetes and growth hormones 'auxins', 'gibberlins and 'cytokinins'. The vermicompost promote growth from 50-100% over conventional compost and 30-40% over chemical fertilizers (Sinha *et al.*, 2010).

Phosphorus is most indispensable mineral nutrient for legume crop as it helps in better root growth and development and thereby making them more efficient in biological nitrogen fixation. It involves in metabolic activities as a constituent of nucleoproteins, nucleotides and also plays a key role in the formation of energy rich phosphate bond like ADP and ATP. Bio-fertilizers (PSB) can play an important role in meeting the phosphorus requirement of crops solubilization of insoluble phosphorus sources (PSB). Plant growth promoting bacteria (PGPR) are a group of free living microorganisms that use different methods to increase plant growth (Glick and Bashan, 1997). Some of these bacteria increase P uptake by the plant belongs to the group of phosphate solubilizing bacteria (PSB) and as biological fertilizers

are used to increase plant growth and yield (Chen *et al.*, 2006). Among biofertilizers, application of phosphorous solubilizing bacteria (PSB) being at par with each other, significantly increased nitrogen and phosphorus concentration in both kernel and haulm (Sharma *et al.*, 2014). Keeping in view, the present investigation was conducted to study growth, yield, yield attributes and economics of summer groundnut (*Arachis hypogaea* L.) as influenced by integrated nutrient management.

MATERIALS AND METHODS

The experiment was conducted at Instructional Farm, Department of Agronomy, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during summer season of 2012 to study the effect of integrated nutrient management on growth and yield attributes of summer groundnut (*Arachis hypogaea* L.). The soil of experimental field was loamy sand in texture, low in organic carbon (0.17%) and available nitrogen (149 kg ha⁻¹), medium in available P₂O₅ (29.3 kg ha⁻¹) and rich in K₂O status (287 kg ha⁻¹). The experiment comprising of twelve treatment combinations comprising three levels of vermicompost (V₁: 75% RDN through VC, V₂: 100% RDN through VC and V₃: 125% RDN through VC) and four levels of phosphorus [P₁: PSB @ 200 g per 8 kg only, P₂: 25 kg P₂O₅ ha⁻¹, P₃: 25 kg P₂O₅ ha⁻¹ + P₁, P₄: 50 kg P₂O₅ ha⁻¹], which was replicated three times and laid out in factorial randomized block design with factorial concept.

The recommended dose of fertilizers (RDF) was 25 kg N and 50 kg P₂O₅/ ha. The nitrogen was applied through vermicompost as per the treatments and

phosphorus was drilled as per treatments requirement as basal application at the time of sowing. The seeds were treated with PSB as per treatments. Groundnut variety 'GG-2' was sown on 21st February 2012 at spacing of 30 cm X 10 cm with 100 kg seed/ha. The crop was grown as per recommended practices and was harvested on 7th June, 2012. Five plants were selected from net plots for observation on yield attributes. At maturity, the net plots were harvested, dried and biomass yield was recorded. The haulm yield was obtained by subtracting pod yield from biological yield and expressed in kg ha⁻¹. The net returns were calculated by subtracting cost of cultivation from gross returns. All the data obtained were statistically analyzed by using the Panse and Sukhatme (1985) procedure.

RESULTS AND DISCUSSION

Effect of vermicompost: The results of statistical analysis (Table 1) showed that the yield and yield attributing characters *viz.*, periodical plant height, number of total pods per plant, number of filled pods plant⁻¹, pod weight per plant, weight of 100 kernels, pod yield and haulm yield were of groundnut significantly influenced by the application of organic and inorganic sources. Application of 125 % RDN through Vermicompost (V₃) produced significantly the highest plant height (30.5 and 43.9 cm) at 60 days after sowing (DAS) and at harvest, respectively. Significantly highest number of total pods plant⁻¹ (31.5), number of filled pods plant⁻¹ (22.6), pod weight plant⁻¹ (22.3 g) and weight of 100 kernels (43.93 g) were obtained under the treatment which received 125 % RDN through Vermicompost

Table 1. Plant height, yield and yield attributes as influenced by vermicompost, phosphorus and PSB inoculum.

Treatment	Plant height (cm)		Filled pods/plant	Total pods/plant	Pod weight/plant (g)	Pod yield (kg ha ⁻¹)	Haulm yield (kg ha ⁻¹)	100 Kernel weight (g)
	60 DAS	At harvest						
Vermicompost								
V ₁ : (75 % RDN through VC)	25.2	40.2	20.0	29.0	19.4	2365	4163	41.8
V ₂ : (100 % RDN through VC)	27.6	41.9	21.3	29.9	20.5	2448	4301	43.4
V ₃ : (125 % RDN through VC)	30.5	43.9	22.6	31.4	22.3	2650	4633	43.9
S.Em. ±	0.66	0.89	0.43	0.64	0.49	59.3	116.7	0.51
C.D. (P=0.05)	1.9	2.6	1.2	1.8	1.4	173.9	342.3	1.5
Phosphorus								
P ₁ : (PSB only)	26.1	39.6	19.8	29.1	18.1	2174	4071	41.7
P ₂ : (25 kg P ₂ O ₅ ha ⁻¹)	27.5	41.8	20.6	29.2	20.8	2378	4288	42.7
P ₃ : (25 kg P ₂ O ₅ ha ⁻¹ + P ₁)	28.0	42.3	22.1	30.8	21.8	2576	4449	43.6
P ₄ : (50 kg P ₂ O ₅ ha ⁻¹)	29.5	44.3	22.8	31.4	22.2	2824	4655	44.2
S.Em. ±	0.66	1.0	0.49	0.74	0.57	68.4	134.8	0.58
C.D. (P=0.05)	2.2	3.0	1.4	2.1	1.6	200.8	395.3	1.7
Interaction (V×P)	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %	8.3	7.4	6.9	7.3	8.1	8.6	9.2	4.1

RDN: Recommended Dose of Nitrogen, C.D.: Critical Difference, C.V.: Co-efficient of variance, NS: Non significant

Table 2. Economics of summer groundnut as influenced by vermicompost, phosphorus and PSB.

Treatment	Pod yield (kg ha ⁻¹)	Haulm yield (kg ha ⁻¹)	Gross return (₹/ha)	Cost of cultivation (₹/ha)	Net return (₹/ha)	BCR (Benefit: Cost Ratio)
V ₁ P ₁	2053	3878	98187	25863	72324	3.80
V ₁ P ₂	2277	4092	108603	26911	81692	4.04
V ₁ P ₃	2483	4274	118131	27211	90920	4.34
V ₁ P ₄	2649	4408	125817	28159	97658	4.47
V ₂ P ₁	2190	4078	104652	27947	76705	3.74
V ₂ P ₂	2382	4221	113536	28995	84541	3.92
V ₂ P ₃	2463	4338	117357	29295	88062	4.01
V ₂ P ₄	2757	4569	130933	30243	100690	4.33
V ₃ P ₁	2279	4257	108941	30131	78810	3.62
V ₃ P ₂	2474	4549	118154	31179	86975	3.79
V ₃ P ₃	2780	4736	132218	31479	100739	4.20
V ₃ P ₄	3067	4989	145483	32427	113056	4.49

Sale price: Groundnut pod: 45 per kg, Groundnut haulm: 1.5 per kg

(V₃) over the application of 75% RDN through vermicompost, which was at par with 100% RDN through vermicompost (V₂). The tune of increase in percentage for these parameters was 8%, 13%, 14%, 5% respectively. Significantly the highest Pod yield (2650 Kg ha⁻¹) was produced by the application of 125% RDN through vermicompost, (V₃) over rest of the treatments. Treatment, which received 125% RDN through vermicompost, (V₃) gave significantly higher haulm yield (4633 Kg ha⁻¹) over 75% RDN through vermicompost (V₁) but remained at par with 100% RDN through vermicompost (V₂). The percent increase in pod and haulm yield under the application of 125 % RDN through vermicompost was to the tune of 12% and 11% over 75 % RDN through vermicompost. These findings are in agreement with those of Kumar and Uppar (2007), Ramesh *et al.* (2006) and Wagadre *et al.* (2010).

Effect of phosphorus: A perusal of data revealed that phosphorus application had significant influence on periodical plant height at 60 DAS and at harvest, number of filled pods plant⁻¹, total pods plant⁻¹, pod weight plant⁻¹, weight of 100 kernels, pod and haulm yields. Among the treatments, P₄ (50 kg P₂O₅ ha⁻¹) registered significantly the tallest plants at 60 DAS and at harvest, as well as higher pod weight plant⁻¹ (22.3g) and remained at par with treatment P₂ (25 kg P₂O₅ ha⁻¹) and P₃ (25 kg P₂O₅ ha⁻¹ + PSB). The lowest plant height at 60 DAS and at harvest was observed under the treatment P₁ (Only PSB). Treatment P₃ (25 kg P₂O₅ ha⁻¹ + PSB) gave significantly the higher filled pods plant⁻¹ (22.1) than treatment P₁ (PSB only) and P₂ (25 kg P₂O₅ ha⁻¹) but remained at par with treatment P₄ (50 kg P₂O₅ ha⁻¹). Among the levels, significantly higher number of total pods per plant (31.4) were recorded with P₄ being at par with P₃ (25 kg P₂O₅ ha⁻¹ + PSB). P₁ (PSB only) showed the lower performance (29.2) than P₄ (50 kg P₂O₅ ha⁻¹) but remained at par with P₂ (25 kg P₂O₅ ha⁻¹) and P₃. Significant variation in pod

yield due to phosphorus application. Treatment P₄ (50 kg P₂O₅ ha⁻¹) produced significantly the highest pod yield (2824 kg ha⁻¹) over rest of the treatments. Linear increase in pod yield was observed with increase in level from P₁ (PSB only) to P₃ (50 kg P₂O₅ ha⁻¹). Maximum haulm yield (4655 Kg ha⁻¹) was recorded under treatment P₄ (50 kg P₂O₅ ha⁻¹) over treatment P₁ (PSB only) but it was at par with treatments P₂ (25 kg P₂O₅ ha⁻¹) and P₃ (25 kg P₂O₅ ha⁻¹ + PSB). Among the levels, P₄ (50 kg P₂O₅ ha⁻¹) gave significantly higher 100 kernel weight over treatment P₁ (PSB only) standing at par with treatment P₃ and P₂. Though treatment P₁ remained at par with P₂ (25 kg P₂O₅ ha⁻¹) recorded significantly lower weight of 100 kernels (41.7 g) than P₃ (25 kg P₂O₅ ha⁻¹ + PSB) and P₄. These results are in accordance with the findings of Chaudhari and Patel (2007) and Dhawale and Charjan (2005). Application of phosphorus was found beneficial in respect of plant height and number of pods/plant was recorded by Akbari *et al.* (2010).

Economics: The details of gross and net realization as well as cost of cultivation of groundnut as affected by different treatments are presented in Table 2. The effect of vermicompost, results revealed that higher net realization of ₹96,369 ha⁻¹ and BCR of 4.4 was obtained with treatment V₃ (125% of RDN through VC) and treatment V₁ (75% of RDN through VC), respectively. The lowest net realization (₹ 87,107 ha⁻¹) was obtained with treatment V₁ and BCR (4.2) was recorded by treatment V₁ and V₂. While due to phosphorus, treatment P₄ (50 kg P₂O₅ ha⁻¹) recorded the highest net return (₹1,12,352 ha⁻¹) and BCR (6.2). Lowest net return (₹84,522 ha⁻¹) and BCR (5.4) was recorded with treatment P₁ (PSB only). In case of treatment combination, maximum net realization of ₹1,13,056 ha⁻¹ with CBR 4.49 was obtained from treatment combination V₃P₄ (125 % RDN through vermicompost + 50 kg P₂O₅ ha⁻¹), while lowest net profit of ₹ 72324 ha⁻¹ was registered under treatment combination V₁P₁ (75 % RDN

through vermicompost + Only PSB) and lowest CBR 3.62 was obtained under treatment combination V₃P₁.

Conclusion

The present investigation concluded that to achieve better production of summer groundnut cv. GG 2, supremacy was found in inoculation of seeds with PSB culture @ 200 g per 8 kg seeds before sowing and crop fertilized with 125% RDN through vermicompost and phosphorus @ 50 kg P₂O₅ ha⁻¹ as basal dose under North Gujarat Agro Climatic Condition which increases growth, yield and yield parameters of groundnut crop.

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