View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Journal of Applied and Natural Science

Journal of Applied and Natural Science 7 (1) : 369 – 372 (2015)

JANS

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

J. H. Chaudhary[1]*, Ramdev, Sutaliya[2] and L. J. Desai[1]

*[1]Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari, (Gujarat), INDIA
[2]Department of Agronomy, College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Tharad (Gujarat), INDIA
*Corresponding author. E-mail: jivraj89@gmail.com

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

Abstract: A field experiment was conducted at Sardarkrishinagar 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 P_2O_5 (29.3 kg ha^{-1}) and rich in K_2O (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 P_2O_5 ha^{-1} recorded significantly higher pod (2824 kg ha^{-1}) and haulm yield (4655 kg ha^{-1}) over PSB only and 25 kg P_2O_5 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 P_2O_5 ha^{-1} (V_3P_4). 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 P_2O_5 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

 All Rights Reserved © Applied and Natural Science Foundation www.ansfoundation.org

are used to increase plant growth and yield (Chen *et al*., 2006). Among biofrtilizers, 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 P_2O_5 (29.3 kg ha^{-1}) and rich in K_2O status (287 kg ha^{-1}). The experiment comprising of twelve treatment combinations comprising three levels of vermicompost (V_1: 75% RDN through VC, V_2: 100% RDN through VC and V_3: 125% RDN through VC) and four levels of phosphorus [P_1 **:** PSB @ 200 g per 8 kg only, P_2 : 25 kg P_2O_5 ha^{-1}, P_3 : 25 kg P_2O_5 ha^{-1} + P_1, P_4 : 50 kg P_2O_5 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 P_2O_5/ 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 (V_3) 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 innoculum.

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_2O_5 ha^{-1})	27.5	41.8	20.6	29.2	20.8	2378	4288	42.7
P_3 : (25 kg P_2O_5 ha^{-1} + P_1)	28.0	42.3	22.1	30.8	21.8	2576	4449	43.6
P_4 : (50 kg P_2O_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_1P_1	2053	3878	98187	25863	72324	3.80
V_1P_2	2277	4092	108603	26911	81692	4.04
V_1P_3	2483	4274	118131	27211	90920	4.34
V_1P_4	2649	4408	125817	28159	97658	4.47
V_2P_1	2190	4078	104652	27947	76705	3.74
V_2P_2	2382	4221	113536	28995	84541	3.92
V_2P_3	2463	4338	117357	29295	88062	4.01
V_2P_4	2757	4569	130933	30243	100690	4.33
V_3P_1	2279	4257	108941	30131	78810	3.62
V_3P_2	2474	4549	118154	31179	86975	3.79
V_3P_3	2780	4736	132218	31479	100739	4.20
V_3P_4	3067	4989	145483	32427	113056	4.49

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

(V_3) over the application of 75% RDN through vermicompost, which was at par with 100% RDN through vermicompost (V_2). 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, (V_3) over rest of the treatments. Treatment, which received 125% RDN through vermicompost, (V_3) gave significantly higher haulm yield (4633 Kg ha^{-1}) over 75% RDN through vermicompost (V_1) but remained at par with 100% RDN through vermicompost (V_2). 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, P_4 (50 kg P_2O_5 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 P_2 (25 kg P_2O_5 ha^{-1}) and P_3 (25 kg P_2O_5 ha^{-1} + PSB). The lowest plant height at 60 DAS and at harvest was observed under the treatment P_1 (Only PSB). Treatment P_3 (25 kg P_2O_5 ha^{-1} + PSB) gave significantly the higher filled pods plant^{-1} (22.1) than treatment P_1 (PSB only) and P_2 (25 kg P_2O_5 ha^{-1}) but remained at par with treatment P_4 (50 kg P_2O_5 ha^{-1}). Among the levels, significantly higher number of total pods per plant (31.4) were recorded with P_4 being at par with P_3 (25 kg P_2O_5 ha^{-1} + PSB). P_1 (PSB only) showed the lower performance (29.2) than P_4 (50 kg P_2O_5 ha^{-1}) but remained at par with P_2 (25 kg P_2O_5 ha^{-1}) and P_3. Significant variation in pod yield due to phosphorus application. Treatment P_4 (50 kg P_2O_5 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 P_1 (PSB only) to P_3 (50 kg P_2O_5 ha^{-1}). Maximum haulm yield (4655 Kg ha^{-1}) was recorded under treatment P_4 (50 kg P_2O_5 ha^{-1}) over treatment P_1 (PSB only) but it was at par with treatments P_2 (25 kg P_2O_5 ha^{-1}) and P_3 (25 kg P_2O_5 ha^{-1} + PSB). Among the levels, P_4 (50 kg P_2O_5 ha^{-1}) gave significantly higher 100 kernel weight over treatment P_1 (PSB only) standing at par with treatment P_3 and P_2. Though treatment P_1 remained at par with P_2 (25 kg P_2O_5 ha^{-1}) recorded significantly lower weight of 100 kernels (41.7 g) than P_3 (25 kg P_2O_5 ha^{-1} + PSB) and P_4. 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 V_3 (125% of RDN through VC) and treatment V_1 (75% of RDN through VC), respectively. The lowest net realization (₹ 87,107 ha^{-1}) was obtained with treatment V_1 and BCR (4.2) was recorded by treatment V_1 and V_2. While due to phosphorus, treatment P_4 (50 kg P_2O_5 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 P_1 (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 V_3P_4 (125 % RDN through vermicompost + 50 kg P_2O_5 ha^{-1}), while lowest net profit of ₹ 72324 ha^{-1} was registered under treatment combination V_1P_1(75 % RDN

through vermicompost + Only PSB) and lowest CBR 3.62 was obtained under treatment combination V_3P_1.

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 P_2O_5 ha^{-1} as basal dose under North Gujarat Agro Climatic Condition which increases growth, yield and yield parameters of groundnut crop.

REFERENCES

Akbari, K.N., Sutaria, G.S., Vora, V.D., Hirpana, D.S. and Padmani, D.R. (2010). Effect of periodal application of phosphorus with and without FYM on yield of groundnut on Vertic Ustrochrepts under rainfed agriculture. *Legume Research,* 33 (1): 64-66.

Bachman,G.R. and Metzger, J.D. (2007). Growth of bedding plants in commercial potting substrate amended with vermicompost. *J. Bioresource Tech.,* 99: 3155-3161.

Chen, Y.P., Rekha P.D., Arun, A.B., Shen, F.T., Lai W.A., and Young, C.C. (2006). Phosphate solubilizing bacteria from subtropical soil and their tricalcium phosphate solubilizing abilities. *Applied Soil Ecol.,* 34: 33-41.

Chaudhari, S.R. and Patel, D.B. (2007). Response of sesamum to different level of phosphorus and sulphur under north Gujarat agro climatic condition. *GAU, Research Journal,* 32 (1-2): 31-33.

Das, P., Laishram, P.D. and Gogoi, M. (2005). Nutrient composition of some nuts and oil seeds based recipes of Assam. *India. J. Hum. Ecol.,* 18 (2): 161-165.

Dhawale, M.B. and Charjan, Y.D. (2005). Response of groundnut grown after rabi sorghum to levels of fertilizer and plant densities. *Journal of soil and crops,* 15 (1): 199-200.

Glick, B.R. and Bashan, Y. (1997). Genetic manipulation of plant growth promoting bacteria to enhance biocontrol of phytopathogens. *Biotechnol. Adv.,* 15: 353-78.

Kumar, S.H.A. and Uppar, D.S. (2007). Influence of integrated nutrient management on seed yield and quality of moth bean [*Vigna acconitiflia* (Jacq.) Marchel]. *Acad. Sci.* (*Anim.Sci*.), 95: 341-351.

Marinari, S., Masciandaro, G. and Grego, S. (2000). Influence of organic and mineral fertilizers on soil biological and physical properties. *Bioresource Technology*, 1317-1320.

Panse, V.G. and Sukhatme. P.V. (1985). Statistical methods for agricultural workers. *ICAR Pub.* New Delhi, pp: 296.

Ramesh, P., Singh, M., Panwar, N.R., Singh, A.B. and Ramana, S. (2006). Response of pigeon pea (*Cajanus cajan)* varieties to organic manures and their influenceon fertility and enzyme activity of soil. *Indian Journal of Agricultural Sciences,* 76 (4): 252-254.

Rathore, P.K. and Kamble, B.M. (2008). Integrated nutrient management in summer groundnut. *Adv. Plant Sci.,* 21: 329-331.

Sharma, Sheela., Jat, N.L., Puniya, M.M., Shivran, A.C. and Choudhary, Shripal (2014). Fertility levels and biofertilizers on nutrient concentrations, uptake and quality of groundnut. *Ann. Agric. Res.,* 35(1): 71-74.

Sinha, R.K., Agarwal, S., Chaudhan, K. and Valani, D. (2010). The wonders of earthworms and its vermicomposting in farm production: Charles Darwin's friends of farmers', with potential to replace destructive chemical fertilizers from agriculture. *Agri. Sci.,* 1(2): 76-94.

Wagadre, N., Patel, M.V. and Patel, H.K. (2010). Response of summer greengram (*Vigna radiata* L.) to vermicompost and phosphorus with and without PSB inoculation. *State Level Seminar on Organic Farming,* Navsari, Gujarat. 111-114.