Agriculture for Sustainable Development 1(1):13-15, 2013/Article *ISSN 2347-5358 (Print)*

Agriculture for Sustainable Development

http://www.sustainableagriculture.in

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON PRODUCTIVITY OF GROUNDNUT (*ARACHIS HYPOGAEA* L.) IN ARID WESTERN RAJASTHAN

BAJRANG LAL OLA, B. L. PAREEK, P. S. RATHORE AND AMIT KUMAWAT*

Department of Agronomy, College of Agriculture, Bikaner- 334 006, India

Received: 27.07.2013 **Revised accepted: 28.08.2013**

ABSTRACT

A field experiment was conducted during kharif, Season of 2011 to study the effect of integrated nutrient management in groundnut at Agronomy Farm, College of Agriculture, S. K. Rajasthan Agricultural University, Bikaner. The experiment comprised 15 treatment combinations having 5 fertility levels viz., Control, 100% RDF @ 20 kg N + 40 kg P2O5/ha, 50% RDF@ 10 kg N + 20 kg P2O5/ha, FYM @ 8 t/ha + 50% RDF, and Vermicompost @ 3 t/ha + 50% RDF, and 3 levels of bio-fertilizers viz., control, Rhizobium and PSB. Different fertility treatments had significant effect on growth, yield attributes, yield and quality of groundnut.

Keywords:
Rhizobium, PSB, INM, Biofertilizers, Groundnut

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is the premier oil seed crop of India. Nowadays, use of chemical fertilizer is increasing to boost up crop production to meet the need for increasing population of the nation. Simultaneously cost of chemical fertilizer has been increasing constantly, besides these; use of inorganic fertilizer alone is injurious to soil health and soil productivity. Use of bio and organic fertilizers enhances crop production and sustains soil fertility. Nitrogen fixers and phosphate solubilizers contribute through biological fixation of nitrogen, solubilization of fixed nutrients and enhanced uptake of plant nutrients (Gupta *et al*., 2003). Keeping these views in mind, an experiment was conducted to study the effect of integrated nutrient management on groundnut.

MATERIALS AND METHOD

A field experiment was conducted during *kharif* season of 2011 at Agronomy Farm, College of Agriculture, S.K. Rajasthan Agricultural University, Bikaner. The soil of the experimental site was loamy sand (83.3% sand, 10.2% silt and 6.3% clay), slightly above neutral in reaction (pH 7.8), low in organic carbon (0.07%), available nitrogen (90.1 kg/ha), available phosphorus (16.2 kg/ha) and medium in available potassium (190.4 kg/ha), respectively. The experiment comprised 15 treatment combinations having 5 fertility levels *viz.*, Control, 100% RDF @ 20 kg N + 40 kg P_2O_5/ha, 50% RDF@ 10 kg N + 20 kg P_2O_5/ha, FYM @ 8 t/ha + 50% RDF, and Vermicompost @ 3 t/ha + 50% RDF, and 3 levels of bio-fertilizers *viz.*, control, *Rhizobium* and PSB. These treatments were laid out in factorial randomized block design with three replications, using seed rate 80 kg/ha and sown on July 8, 2011 and harvested on November 18, 2011. The seed was divided in three seed lots for inoculation with bio-fertilizers. Out of these, one seed lot was kept uninoculated and rest two seed lots were inoculated separately with *Rhizobium* and PSB. The inoculated seed material was spread on a polythene sheet and allowed to air dry in shade for 3-4 hours. After air drying the seeds were sown immediately in the field. The FYM was applied 25 days before crop sowing. The entire quantity of well decomposed vermicompost was drilled in the field as per treatments as basal at 8-10 cm depth. The calculated quantity of chemical fertilizers as per treatment was applied at the time of bed preparation in respective treatment. Urea and SSP were used as source of nitrogen and phosphorus, respectively.

RESULTS AND DISCUSSION

Growth and yield attributes

Fertility levels had a significant effect on number of branches/plant, number of nodules/plant and total chlorophyll content (Table1).The maximum values of these parameters were observed under FYM @ 8 t/ha + 50% RDF followed by vermicompost @ 3 t/ha + 50% RDF. The research findings

Corresponding author e mail:amit.skn@rediffmail.com

indicate that a suitable combination of organic and inorganic fertilizers maintain a long term soil fertility and sustain high level of productivity (Pillai *et al.*, 1985). Application of fertility levels significantly increased the yield attributes such as number of pods/plant, kernels/pod and seed index (Table 2). The same trend was also observed in pod, haulm, biological yield and shelling per cent. The significantly highest values were obtained with farmyard manure @ 8 t/ha + 50% RDF which was at par with vermicompost @ 3 t/ha + 50% RDF but significantly higher over rest of the treatments. This might be attributed to the favourable effect of FYM on plant growth and consequently on yield attributes. Further, FYM increased the efficiency of humification. Humic acid in FYM enhanced the availability of both native and added macro and micronutrients in soil and thus stimulated plant growth and improved yield attributes and yield significantly.

The significant effect on number of branches/plant, number of nodules/plant and total chlorophyll content was observed due to seed inoculation with *Rhizobium* or PSB over control. Inoculation of seed with symbiotic nitrogen fixers might have increased the number of efficient and healthy nodules of *Rhizobium* in *Rhizosphere*, which in turn resulted in greater fixation of atmospheric nitrogen in soil for use by the plants and consequently resulting into higher growth. Mundra and Bhati (1994) and Yadav and Malik (2005), also reported similar results in groundnut. Seed treatment with *Rhizobium* and PSB significantly increased the yield attributes such as number of pods plant^{-1}, kernels pod^{-1} and seed index (Table 2). The same trend was also observed in pod, haulm, biological yields and shelling per cent over control. The beneficial effects of *Rhizobium* as explained earlier might have increased the availability of nitrogen which in turn resulted in to higher production of assimilates as well as their balanced partitioning between source and sink and ultimately increased the pod yield as well as haulm yield. These findings corroborate with the results of Basu (2011).

Yield

The pod yield, being a function primarily of cumulative effect of the yield attributes, increased due to FYM @ 8 t/ha + 50% RDF application significantly by 35.13% over control. The cumulative effect of these parameters on pod yield was also substantiated by significant and positive correlation on pod yield and number of pods/plant, number of kernels/pod, seed index and kernel yield (Table 2). These results are in agreement with the findings of Singh *et al*. (2011). Significant improvement in haulm yield with the addition of FYM @ 8 t/ha + 50% RDF seems to be on account of greater accumulation of dry matter right from the early stage of crop growth and at harvest by virtue of increased photosynthetic efficiency under this treatment.

Inoculation of seeds with PSB also significantly enhanced the yield and yield attributes. The beneficial effect of phosphate solubilizing bacteria increased the availability of phosphorus. Greater root extension under higher availability of phosphorous might have helped in greater uptake of other nutrients especially micronutrients and secondary nutrients. Enhanced photosynthesis, production of photosynthates and their partitioning between vegetative and reproductive structure might have helped in improving the yield attributes and finally the pod and haulm yield. These results are in accordance with the findings of Mohapatra and Dixit (2010).

Table 1 Effect of fertility levels and bio-fertilizers on growth characters of groundnut.

Treatment	Nodules/ plant at 45 DAS	Total chlorophyll content at 45 DAS (mg/ g)	Branches/ plant at harvest
Fertility levels			
Control	76.22	1.44	6.40
100 % RDF(20 kg N + 40 kg P_2O_5/ha	83.56	1.60	7.14
50% RDF(10 kg N+20 kg P_2O_5/ha)	80.56	1.53	6.63
FYM @ 8 t/ha + 50% RDF	87.33	1.66	7.67
Vermicompost @ 3 t /ha + 50% RDF	89.00	1.69	7.84
CD (*P*=0.05)	3.30	0.04	0.30
Biofertilizers			
Control	80.47	1.55	6.74
Rhizobium	85.60	1.61	7.43
PSB	83.93	1.60	7.23
CD (*P*=0.05)	2.86	0.03	0.26

Quality

Oil content, oil yield and protein content in groundnut increased significantly due to application of FYM @ 8 t/ha + 50% RDF (Table 3). As, oil bio synthesis is a complex process it is always difficult to modulate its content in plant through management practices. Probable reason for increase in protein is that the nitrogen is an integral part of protein and phosphorus is an integral part of certain co-enzyme involved in protein synthesis. The increase in protein synthesis in groundnut is mainly due to cumulative effect of pod yield (Kachot *et al.*, 2001). Similar results were also noted by Zalate and Padmani (2010).

Inoculation of seed with Rhizobium recorded higher protein content (Table3) due to more nitrogen fixation and better utilization by plants. As nitrogen is an integral part of protein, higher availability and uptake of nitrogen under Rhizobium inoculation resulted in higher protein content of seed. Significant increase oil content of seed was observed with PSB inoculation. PSB enhanced the availability of phosphorus to plants, which might have utilized by the crop in greater root development and nodulation that in turn resulted in higher uptake of other nutrients. Thus, increased availability of phosphorus ultimately increased the oil content in seeds. Basu (2011) in groundnut also reported similar results.

Table 2 Effect of fertility levels and bio-fertilizers on yield attributes and yield of groundnut.

Treatments	Pods/ plant	Kernel / pod	Kernel yield (kg/ha)	Pod yield (kg/ ha)	Haulm yield (kg/ha)
Fertility levels					
Control	26.49	1.95	1598	2512	4148
100 % RDF(20 kg N + 40 kg P_2O_5/ha	31.77	2.13	2039	3086	5024
50% RDF(10 kg N+20 kg P_2O_5/ha)	28.32	2.01	1842	2809	4609
FYM @ 8 t/ha + **50% RDF**	34.51	2.20	2364	3394	5410
Vermicompost @ 3 t /ha + 50% RDF	36.13	2.23	2430	3468	5443
CD (*P*=0.05)	2.60	0.06	106	92	182
Biofertilizers					
Control	29.43	2.05	1897	2923	4787
Rhizobium	33.04	2.15	2182	3170	5060
PSB	31.86	2.11	2084	3069	4934
CD (*P*=0.05)	2.25	0.05	92	80	157

Table 3 Effect of fertility levels and bio-fertilizers on oil content, oil yield and protein content in groundnut kernels.

Treatments	Oil content (%)	Oil yield (kg/ ha)	Protein content (%)
Fertility levels			
Control	47.25	756	24.08
100 % RDF(20 kg N + 40 kg P_2O_5/ha	48.28	985	25.53
50% RDF(10 kg N+20 kg P_2O_5/ha)	47.43	874	24.64
FYM @ 8 t/ha + **50% RDF**	49.52	1171	25.99
Vermicompost @ 3 t /ha + 50% RDF	50.28	1223	26.16
CD (*P*=0.05)	1.09	59	0.36
Biofertilizers			
Control	47.80	910	24.91
Rhizobium	48.80	10689	25.56
PSB	49.07	1027	25.37
CD (*P*=0.05)	0.95	51	0.31

REFERENCES

Basu, T.K. 2011. Effect of Cobalt, *Rhizobium* and Phosphobacterium inoculations on growth, yield, quality and nutrient uptake of summer groundnut (*Arachis hypogaea* L.). *American Journal of Experimental* Agriculture. 1(1): 21-26.

Gupta, R.K., Kaushik, S., Sharma, P. and Jain, V.K. 2003. Biofertilizers: An eco-friendly alternative to chemical fertilizers. Environmental Challenges of the 21st Century, APH Publishing Corporation, New Delhi, pp 275-287.

Kachot, N.A., Malavia, D.D., Solanki, R.M. and Sagarka, B.K. 2001. Integrated nutrient management in rainy-season groundnut (*Arachis hypogaea* L.). *Indian Journal of Agronomy*, 46 (3): 516-522.

Mohapatra, A.K.B. and Dixit, L. 2010. Integrated nutrient management in rainy season groundnut (*Arachis hypogaea* L.). *Indian Journal of Agronomy*, 55(2): 123-127.

Mundra, S.L. and Bhati, D.S. 1994. Effect of, iron: manganese and *Rhizobium* inoculation on growth, nodulation, iron: manganese ratio and protein content of cowpea. *Farming Systems.* 10: 38-40.

Pillai, K.G., Devi, S.L. and Setty, T.K.P. 1985. Research achievements of All India Co-ordinated Agronomic Research Project. *Fertilizer News.* 30: 26-34.

Singh, G.P., Singh, P.L. and Panwar, A.S. 2011. Response of groundnut (*Arachis hypogaea* L.) to biofertilizers, organic and inorganic sources of nutrient in North East India. *Legume Research.* 34(3): 196-201.

Yadav, R.D. and Malik, C.V.S. 2005. Effect of *Rhizobium* inoculation and various sources of nitrogen on growth and yield of cowpea. *Legume research.* 28(1): 38-41.

Zalate, P.Y. and Padmani, D.R. 2010. Quality and nutrient uptake pattern of groundnut (*Arachis hypogaea* L.) as influenced by integrated nutrient management. *GAU Research Journal.* 35(2): 94-96.