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Effect of Nutrient Management Practices through Organics on Groundnut Productivity and Nutrient uptake in Bajra-Groundnut Cropping System

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ABSTRACT

The present investigation was conducted during 2014-15 and 2015-16 at Main Agricultural Research Station, UAS, Raichur to evaluate the productivity and nutrient uptake of ground nut through organics. The results of pooled data of two years indicated that application of RDF+FYM recorded significantly higher pod and haulm yield (1910 and 2892 kg ha^{-1}, respectively) and it was on par with organic manorial treatments of compost+vermicompost+panchagavya (1886 and 2828, kg ha^{-1}, respectively), compost+vermicompost+vermiwash (1867 and 2771 kg ha^{-1}, respectively) and RDF (1818 and 2794 kg ha^{-1}, respectively). Increase in pod yield with RDF+FYM over compost+vermicompost+panchagavya, compost+vermicompost+vermiwash and recommended dose of fertilizers (RDF) was to the tune of 1.27, 2.30 and 5.06 per cent respectively. Nitrogen uptake was significantly higher with RDF+FYM (100.30 kg ha^{-1}) over vermicompost (77.06 kg ha^{-1}), compost+vermiwash (87.91 kg ha^{-1}), vermicompost+panchagavya (86.95 kg ha^{-1}) and vermicompost+vermiwash (81.87 kg ha^{-1}) but was on par with rest of the treatments. Significantly higher uptake of phosphorus was recorded with the RDF+FYM (27.97 kg ha^{-1}) and as compared to all other treatments except compost+vermicompost (23.41 kg ha^{-1}), compost+vermicompost+GLM (22.65 kg ha^{-1}), compost+vermicompost+panchagavya (27.40 kg ha^{-1}), compost+vermicompost+vermiwash (26.24), compost+vermicompost+GLM+ panchagavya (25.05 kg ha^{-1}), compost+vermicompost+GLM+ vermiwash (24.74 kg ha^{-1}) and RDF (25.95 kg ha^{-1}). Uptake of potassium was significantly higher with RDF+FYM and it was on par with all treatments except vermicompost (37.79 kg ha^{-1}), vermicompost + vermiwash (39.95 kg ha^{-1}) and vermicompost+panchagavya (44.32 kg ha^{-1}).

Key words: *groundnut, nutrient, panchagavya, vermiwash, vermicompost, compost, uptake*

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INTRODUCTION

Organic farming aims at improving the agricultural production by retaining the natural equilibrium in soil, plant and animal interactive medium without dispersing the nature provided resistance mechanism in a given crop. It is also aimed to improve the *in situ* production of nutrients without disturbing the nutrient cycles provided in an eco-system. According to the global survey on organic farming carried out in 2013 by the Research Institute of Organic Agriculture and the International Federation of Organic Agriculture Movements (IFOAM), organic agriculture is now practiced in more than 170 countries with a total area of 43.1 million hectares. This constitutes about 1 per cent of total agricultural land of the world. Australia has largest area of 17.2 million hectares[2]. Maintaining and enhancing soil fertility for sustaining the crop production is the global concern. In organic production system, use of organic manures, green manures and crop residues is known to impart multiple benefits to crop growth and soil health by adding much needed organic and mineral matter to the soil. The organic matter added is an indispensable component of soil and plays an important role in maintenance and improvement of soil fertility and productivity. The proper management of soil fertility as well as soil productivity makes it possible to increase the efficiency of use of soil and added nutrients[8]. Combined application of green manures, crop residues and composts along with liquid manures in a more synchronized system can release the nutrients as per the need of crop/cropping systems to sustain higher productivity[4]. Further, soil harbors a dynamic microbial population, arthropods and others. This living phase is greatly stimulated by addition of organic matter which acts as carbon and energy source for proliferating micro-organisms and they may inturn alter the accompanying enzyme status. Interest in soil enzyme activity has increased recently since these activities are believed to reflect the potential capacity of soil to perform nutrient transformations. Since soil microbial and enzyme systems are associated with organic manure management, incorporation of organic manures into soil not only plays an important role in improving the soil physical, chemical and biological activities, but also affects the rate at which nutrients become available to crop plants. Groundnut [*Arachis hypogaea* (L.)] is one of the major oil seed crops of India produced in an area of 4.72 million hectare with the production of 4.70 million tonnes. In Karnataka, it ranks 5th in area with 0.59 m ha with a production of 0.4 mt and the productivity of 678 kg per hectare[1]. Of the total area under groundnut in the state as much as 49.2 per cent of the area is cropped under irrigation during *rabi* / summer seasons mainly in Raichur, Yadgir, Koppal and Ballari districts of Northern Karnataka. Groundnut seeds contain 40-50 per cent fat, 20-50 per cent protein, and 10-20 per cent carbohydrate apart from some essential minerals and vitamins[6].

MATERIAL AND METHODS

A Field experiment was conducted to study the effect of nutrient management practices through organics on groundnut productivity and nutrient uptake in bajra-groundnut cropping system at Main Agricultural Research Station, University of Agricultural Sciences, Raichur, during *kharif* (July to October) and *rabi* (December to April) seasons of 2014-15 and 2015-16. The experiment was carried out at the Main Agricultural Research Station Farm, UAS, Raichur, which is situated between 16^{o} 12' N latitude and 77^{o} 20' E longitude with an altitude of 389 meters above the mean sea level. The chemical test values of soils were 7.35 pH, 0.54 dS^{-1} EC, 0.43% organic carbon, 272.2 kg available N ha^{-1}, 32.5 kg available P ha^{-1} and 292.4 kg available K ha^{-1}. The experiment was conducted with fourteen treatments during *kharif* and *rabi* seasons of 2014-15 and 2015-16 with bajra-groundnut cropping sequence. The experiment consisted of fourteen

treatments comprised of compost (100% RDN), vermicompost (100% RDN), compost (50% RDN) +vermicompost (50% RDN) and compost (37.5% RDN)+vermicompost (37.5% RDN)+GLM (25% RDN) alone and in combination with 3.0% panchagavya spray and 10 % vermiwash spray along with RDF and RDF+FYM. Green leaf manure, compost and farm yard manure were incorporated into the soil two weeks before the sowing as per the treatments. The recommended dose of fertilizer for groundnut is 25:75:25 NPK kg ha^{-1}. The deficit P after application of organic manures was supplemented through rock phosphate. The experiment was laid out on fixed site in two consecutive years in Randomized Complete Block Design (RCBD) and the treatments were replicated thrice. In all the organic treatments groundnut seeds were treated with bio-fertilizers such as *rhizobium*, phosphate solubilising bacteria in both the years. Organic treatments also received 250 kg ha^{-1} of neem cake. The nutrient compositions of inputs on N equivalent basis used in the experiment are furnished in the Table 1.

RESULTS AND DISCUSSION

Application of RDF+FYM recorded significantly higher pod yield (1910 kg ha^{-1}) as compared to all other treatments except compost+vermicompost+panchagavya (1886 kg ha^{-1}), compost+vermicompost+vermiwash (1867 kg ha^{-1}) and RDF (1818 kg ha^{-1}). All organic manurial treatments except compost +vermicompost+panchagavya, compost +vermicompost+vermiwash and compost +vermicompost+GLM+vermiwash were on par with each other with respect to pod yield. Significantly lower pod yield was recorded with the application of compost alone (1435 kg ha^{-1}). The treatment receiving RDF+FYM recorded significantly higher haulm yield (2892 kg ha^{-1}) and it was on par with compost+vermicompost+panchagavya (2828 kg ha^{-1}), RDF (2794 kg ha^{-1}) and compost+vermicompost+vermiwash (2771 kg ha^{-1}). Significantly lower haulm yield was recorded with the application of compost alone (2169 kg ha^{-1}) (Table 2). This was might be due to the enhanced soil microbial activity and improved soil physico-chemical parameters. Several workers have also reported higher crop yields with recommended NPK fertilizers over organics application[9,3,7,5].

Nitrogen uptake was significantly higher with RDF+FYM (100.30 kg ha^{-1}) over vermicompost (77.06 kg ha^{-1}), compost +vermiwash (87.91 kg ha^{-1}), vermicompost +panchagavya (86.95 kg ha^{-1}) and vermicompost +vermiwash (81.87 kg ha^{-1}) but was on par with rest of the treatments. Significantly lower uptake of nitrogen was noticed with supplementation of compost alone (73.85 kg ha^{-1}) but was found on par with vermicompost (77.06 kg ha^{-1}). All organic manurial treatments except compost and vermicompost were on par with each other.

Significantly higher uptake of phosphorus was recorded with the RDF+FYM (27.97 kg ha^{-1}) and as compared to all other treatments except compost+vermicompost (23.41 kg ha^{-1}), compost+vermicompost+GLM (22.65 kg ha^{-1}), compost+vermicompost+panchagavya (27.40 kg ha^{-1}), compost+vermicompost+vermiwash (26.24 kg ha^{-1}), compost +vermicompost +GLM+panchagavya (25.05 kg ha^{-1}), compost+vermicompost+GLM+vermiwash (24.74 kg ha^{-1}) and RDF (25.95 kg ha^{-1}).

Uptake of potassium was significantly higher with RDF+FYM and it was on par with all treatments except vermicompost (37.79 kg ha^{-1}), vermicompost+vermiwash (39.95 kg ha^{-1}) and vermicompost+panchagavya (44.32 kg ha^{-1}). The treatment supplemented with compost alone recoded significantly lower uptake of potassium and it was at par with vermicompost (37.97 kg ha^{-1}), compost +vermicompost+panchagavya (39.95 kg ha^{-1}), vermicompost+vermiwash (44.32 kg ha^{-1}), compost+panchagavya (44.74 kg ha^{-1}) and compost+vermiwash (45.17 kg ha^{-1}) (Table 2).

Table 1: Average Nutrient composition of organic manures or amendments used in the experiment

S. No.	Organic manures	Nitrogen (%)	Phosphorus (%)	Potassium (%)
1	Compost	1.14	0.35	1.01
2	Vermicompost	1.57	0.65	1.22
3	Green leaf manure (*Glyricidia*)	0.76	0.14	0.54
4	Farm yard manure	0.40	0.25	0.40
5	Neem cake	4.80	1.01	1.33
6	Panchagavya	0.08	0.01	0.09
7	Vermiwash	0.15	0.01	0.02

Table 2: Pod yield, haulm yield and nutrient uptake of groundnut as influenced by nutrient management practices through organics in bajra-groundnut cropping system (Pooled data of 2014-15 and 2015-16)

Treatments	Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Uptake of nutrients (Kg ha^{-1})		
			N	P	K
T_1: Compost (100% RDN)	1435	2169	73.85	14.38	36.48
T_2: Vermicompost (100% RDN)	1485	2243	77.06	15.73	37.79
T_3: Compost (50% RDN)+Vermicompost (50% RDN)	1590	2430	91.13	23.41	46.74
T_4: Compost (33.3% RDN)+ Vermicompost (33.3% RDN) +GLM (33.3% RDN)	1559	2399	89.87	22.65	46.41
T_5: T_1 +3% Panchagavya	1529	2348	88.83	21.43	45.17
T_6: T_1 +10% Vermiwash	1519	2330	87.91	21.36	44.74
T_7: T_2 +3% Panchagavya	1511	2285	86.95	18.77	44.32
T_8: T_2 +10% Vermiwash	1487	2252	81.87	18.28	39.95
T_9: T_3 +3% Panchagavya	1886	2828	97.59	27.40	52.50
T_{10}: T_3 +10% Vermiwash	1867	2771	94.97	26.24	50.32
T_{11}: T_4 +3% Panchagavya	1650	2518	92.99	25.05	47.65
T_{12}: T_4 + 10% Vermiwash	1609	2501	92.14	24.74	47.15
T_{13}: Recommended dose of fertilizers (RDF)	1818	2794	94.17	25.95	49.14
T_{14}: RDF+FYM	1910	2892	100.30	27.97	53.46
S. Em±	67.66	97.98	4.04	1.76	2.90
C. D. at 5%	205.2	297.2	12.3	5.3	8.8

CONCLUSION

The organic manorial treatments *i.e.*, compost+vermicompost+panchagavya and compost+vermicompost+vermiwash recoded significantly higher and on par yield with RDF+FYM. Increase in pod yield with RDF+FYM over RDF and organic manurial treatments was 4.8% and 13.6 to 24.9% respectively. Significantly higher uptake of NPK by groundnut at harvest was noticed with application of RDF+FYM which was closely followed by the treatments receiving compost+vermicompost+panchagavya, compost+vermicompost+vermiwash and RDF.

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