Effect of Nutrient Management on Productivity of Summer Groundnut (*Arachis hypogaea* L.) in Maharashtra

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Abstract

A field experiment was conducted during the summer season (May-October) of 2015 at College of Agriculture, Kolhapur to study the effect of nutrient management on productivity of summer groundnut (*Arachis hypogaea* L.). The experiment was laid out in randomized block design with 8 treatments and 3 replications. Increasing dose of fertilizers up to 125% recommended dose of fertilizers (RDF) significantly increased pod yield (35.42 q ha^{-1}) and haulm yield (29.15 q ha^{-1}). The higher plant height (30.70 cm), number of functional leaves plant^{-1} (54.64), leaf area (5.59 dm^2), number of branches plant^{-1} (11.73) and dry matter plant^{-1} (41.33 g) was recorded with 125% RDF and it was comparable with 100% RDF and 75% RDF through inorganic fertilizers + 25% N through vermicomposting. The different combinations of fertilizers and vermicompost had significant influence on the no. of pods plant^{-1} and weight of pods plant^{-1} only. Application of 125% RDF through inorganic fertilizers (T_1) recorded significantly the highest no. of pods plant^{-1} (35.00) and weight of pods plant^{-1} (26.43).

Keywords: Groundnut, vermicomposting, nutrient management, fertilizer doses, Yield, Organic manure.

Introduction

Groundnut (*Arachis hypogaea* L.) is one of the important oilseed cash crops of the country. Groundnut alone contributes 70% of the total edible oil production. For farmers it is a cash crop largely grown during summer and *kharif* season. India is one of the major producer and ranks, second in groundnut production after China.

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In Maharashtra, area under groundnut was 2.43 lakh ha in *kharif* season (2014-15) and production was 2.53 lakh tonnes with an average productivity of 1037 kg ha^{-1}, while in summer season (2014-15) area was 0.82 lakh ha and production was 1.2 lakh tones with an average productivity of 1521 kg ha^{-1} (Anonymous 2015). In the sub-montane region, Plant Sugarcane-Ratoon-Sunflower is the traditional cropping system. However, sunflower is exhaustive oilseed crop which results in depletion of soil fertility suggesting inclusion of legume oilseed (groundnut) to restore soilhealth.

Fertilizers are the major inputs in the present day agriculture. Application of vermicompost as an organic source is ideal for soil and crop management. Integrated nutrient management involves judicious use of organic and inorganic fertilizers to maintain soil fertility and productivity which may ultimately cause a significant reduction in use of cost-effective chemical fertilizer. The present study was undertaken to assess the effect of nutrient management on productivity of summer groundnut.

Material and Methods

The experiment was laid out during summer season of 2015 at the Post Graduate Research Farm, College of Agriculture, Kolhapur, Maharashtra. The soil was medium black (Vertisols) with 90 cm depth, medium in available N (235 kg ha$^{-1)}$, P_2O_5 (21 kg ha^{-1}) and K_2O (275 kg ha^{-1}). The status of organic carbon content was low (0.42%). The electrical conductivity and pH values were 0.12 dS m^{-1} and 7.2, respectively.

The experiment was laid out in a randomized block design with eight treatments *viz.,* T_1 (125% RDF through inorganic fertilizers), T_2-(100% RDF through inorganic

fertilizers), T_3 (75% RDF through inorganic fertilizers + 25% N through vermicompost), T_4(50% RDF through inorganic fertilizers + 50% N through vermicompost), T_5 (25% RDF through inorganic fertilizers + 75% N through vermicompost), T_6 (100% RDN through vermicompost, T_7 (125% RDN through vermicompost) and T_8 (control). Each experimental unit was replicated thrice with the plot size of 4.50 x 3 m^2 and 3.50 x 2.40 m^2 as the gross and net plot, respectively.

N and P were applied in the form of urea and SSP. Vermicompost was applied 15 days before sowing in respective treatments. Regular biometric observations were recorded at specific time intervals by selecting randomly 5 plants in each treatment. Crops were harvested during May, 2015 and yield observations were recorded from the net plots.

Results and Discussion

Growth attributes: Groundnut growth components were significantly influenced by different nutrient management (Table 1). Significantly higher plant height plant^{-1} (30.70cm), number of functional leaves plant^{-1}(54.64), leaf area (5.59 dm^2), number of branches plant^{-1} (11.73) and dry matter plant^{-1} (41.33 g) were recorded with 125% RDF through inorganic fertilizers. The results confirm the findings of Sabale (2002), Karunakaran *et al*. (2010) and Gagare *et al*. (2011). The lowest values of growth components were observed under the control plot.

The increase in plant height with an application of 125% RDF through inorganic fertilizers, 100% RDF through inorganic fertilizers and 75% RDF through inorganic fertilizer and 25% N through vermicompost may be attributed to ready availability of nitrogen through inorganic fertilizers and vermicompost during the vegetative crop growth. These findings are in close conformity with Karunakaran *et al*. (2010) and Gagare *et.al*. (2011). Application of 125% RDF through inorganic fertilizer recorded significantly higher number of functional leaves during all growth stages and was at par with 100% RDF through inorganic fertilizers. It was due to increase in assimilation rate, cell division and metabolic activities in plant because of faster release of nutrients in soils (Sabale, 2002). The association of nutrient elements from inorganics and organics produced more number of leaves resulting in higher leaf area.

Table 1 : Effect of nutrient management on growth parameters of groundnut.

Treatment Nos.	Treatment details	Plant height (cm)	No. of functional leaves	Leaf area (dm^{-2})	No. of branches plant^{-1}	Dry matter (g plant^{-1})
T_1	125% RDF through inorganic fertilizers	30.70	54.64	5.59	11.73	41.33
T_2	100% RDF through inorganic fertilizers	29.53	54.21	5.30	10.63	39.76
T_3	75% RDF through inorganic fertilizers + 25% N through vermicompost	29.37	52.66	5.35	10.80	40.56
T_4	50% RDF through inorganic fertilizers + 50% N through vermicompost	28.07	52.33	4.96	10.37	38.33
T_5	25% RDF through inorganic fertilizers + 75% N through vermicompost	27.87	50.28	4.83	10.30	37.66
T_6	100% RDN through vermicompost	27.43	49.30	4.85	10.33	39.02
T_7	125% RDN through vermicompost	28.13	52.57	4.93	10.40	40.00
T_8	Control	25.47	47.61	3.67	8.67	33.20
	S.E. ±	0.57	0.65	0.16	0.43	0.55
	C.D.at 5%	1.75	1.98	0.50	1.31	1.67

RDF: Recommended dose of fertilizers; RDN, Recommended dose of nitrogen

Particularly, association of phosphorus nutrients with cell division, cell elongation and photo synthesis helped the plants to produce more leaf area. These findings are collaborative with earlier reported by Sabale (2002) and Karunakaran *et al*. (2010). The increase in number of branches with integrated nutrient management was mainly due to its influence on the vegetative growth resulting in higher number of branches which finds support from other works (Gagare *et al*. 2011). The maximum dry matter production was recorded under integrated nutrient management treatments due to increased plant height, functional leaves, and leaf area because of maximum nutrient availability as was reported earlier (Karunakaran *et al.* 2010).

Yield attributes: Groundnut yield components *viz*., no. of pods plant^{-1} and weight of pods plant^{-1} were significantly influenced by different nutrient management (Table 2). Application of 125% RDF through inorganic fertilizers (T_1) recorded significantly the highest no. of pods plant^{-1} (35.00) and weight of pods plant^{-1} (26.43). The lowest yield components were observed under the control plot.

Application of 25% extra level of fertilizers over RDF might have promoted higher growth rate from early stage onwards in terms of plant height, leaf area as well as dry matter. Thus, the optimum growth of the plant due to favourable nutritional environment and higher uptake of nutrients might have favoured significant increase in number of pegs per plant and thus more number of pods per plant. The results confirm the findings of Karunakaran *et al.* (2010) and Gagare *et al.* (2011).

The mean weight of pods per plant were significantly higher with 125% RDF (26.43 g) through inorganic fertilizer (T_1) and it was at par with 100% RDF (23.00 g) through inorganic fertilizer (T_2) and 75% RDF through inorganic fertilizer + 25% N (24.67) through vermicompost (T_3). Lowest mean weight of pods per plant 14.61 were obtained in absolute control. It might be due to readily available nitrogen and phosphorus through the inorganic fertilizer as compared to natural organic sources for the nitrogen and phosphorus which enhance the growth attributing characters and finally resulted in higher weight of pods per plant. The results confirm the findings of Gagare *et al*. (2011) and Deshmukh *et al*. (2012).

Table 2 : Effect of nutrient management on yield parameters of groundnut.

Treatment	No. of pods plant^{-1}	Wt . of pods plant^{-1} (g)	No. of kernels pod^{-1}	100 kernels wt. (g)	Shelling %	Sound Mature Kernel (SMK)
T_1 125% RDF through inorganic fertilizers.	35.00	26.43	2.57	50.96	73.73	2.38
T_2 100% RDF through inorganic fertilizers.	33.13	23.00	2.41	50.63	73.17	2.33
T_3 75% RDF through inorganic fertilizers + 25% N through vermicompost.	34.17	24.67	2.48	50.29	72.45	2.28
T_4 50% RDF through inorganic fertilizers + 50% N through vermicompost.	28.17	22.56	2.55	47.40	70.24	2.30
T_5 25% RDF through inorganic fertilizers + 75% N through vermicompost.	24.73	17.94	2.53	46.70	67.50	2.45
T_6 100% RDN through vermicompost.	22.83	16.45	2.31	46.74	68.52	2.28
T_7 125% RDN through vermicompost.	32.50	22.66	2.53	49.37	69.30	2.30
T_8 Absolute control.	21.90	14.61	2.16	44.81	63.64	2.07
S.E. ±	0.81	1.18	0.09	2.96	2.45	0.07
C.D.at 5%	2.45	3.57	NS	NS	NS	NS

RDF: Recommended dose of fertilizers; RDN, Recommended dose of nitrogen

Table 3 : Effect of growth attributes on yield of groundnut.

Treatment Nos.	Treatment details	Pod yield (q) ha^{-1}	Haulm yield (q) ha^{-1}
T_1	125% RDF through inorganic fertilizers	35.42	29.15
T_2	100% RDF through inorganic fertilizers	33.01	27.46
T_3	75% RDF through inorganic fertilizers + 25% N through vermicompost	32.06	26.59
T_4	50% RDF through inorganic fertilizers + 50% N through vermicompost	31.87	26.59
T_5	25% RDF through inorganic fertilizers + 75% N through vermicompost	28.37	23.21
T_6	100% RDN through vermicompost	26.70	20.75
T_7	125% RDN through vermicompost	27.98	21.47
T_8	Control	22.30	16.12
	S.E. ±	1.76	1.41
	C.D.at 5%	5.34	4.28

Yield : The mean pod yield to the tune of 35.42 q ha^{-1} recorded with treatment of 125% RDF through inorganic fertilizer (T_1) was significantly superior over other treatments except T_2, T_3 and T_4. Minimum pod yield was recorded in control (22.30 q ha^{-1}) (Table 3). Higher pod yield could be attributed to favourable changes in physical and chemical characteristics of the soils which might have enabled better pod formation. Moreover, the positive influence of these treatments through immediate supply of nutrients from inorganic sources especially at the early stage of the crop and slow and steady supply of nutrients from vermicompost throughout the crop growth period improved adequate biomass production and improvement in yield parameters resulting in higher pod yield (Kathmale *et al.* 2000; Karunakaran *et al.* 2010).

The significantly superior haulm yield (29.15 q ha^{-1}) was recorded with treatment of 125% RDF through inorganic fertilizer (T_1); however, it was comparable with T_2, T_3 and T_4. Minimum haulm yield was recorded in the control plot (16.12 q ha^{-1}) (Table 3).

Higher haulm yield was attributed to easy availability of nitrogen and phosphorus which led to more meristematic activities of the plant leading to production of more number of leaves which ultimately increased haulm yield. Similar results were reported by Karunakaran *et al*. (2010) and Gagare *et al.* (2011).

Though the differences in no. of kernels pod^{-1} (2.57), test weight (50.96), shelling per cent (73.73) and sound mature kernel (2.38) among the treatments were not significant, 125% RDF through inorganic fertilizer (T_1) recorded numerically the highest value.

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