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Research Paper

Effect of nitrogen and phosphorus management on productivity and profitability of groundnut (*Arachis hypogaea*)

V.V. SAGVEKAR[1], B.D. WAGHMODE[2] AND A.S. KAMBLE[3]

Dr. B.S. Konkan Krishi Vidyapeeth, Agricultural Research Station, Shirgaon, Dist. Ratnagiri, Maharashtra 415 629

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ABSTRACT

A field experiment was conducted for 3 years at Agricultural Research Station, Shirgaon, Ratnagiri, Maharashtra during rainy season (*kharif*) of 2012–14 to evaluate the effect of different nitrogen and phosphorus ratios on productivity of rainy season (*kharif*) groundnut under Konkan conditions. Eleven combinations of nitrogen-phosphorus ratios were tested in randomized block design with 3 replications. Treatment receiving 0.40 NP ratio (30:75 NP kg/ha) produced significantly higher pod yield of 3.50 t/ha over rest of N:P ratios, but it was at par with 0.42 (25:60 NP kg/ha), 0.33 (25:75 NP kg/ha) and 0.50 (30:60 NP kg/ha) N:P ratios. Kernel yield was also noticed significantly higher under 0.40 NP ratio (2.63 t/ha) over all other N:P ratios except 0.42 NP ratio (2.31 t/ha). The increment in pod and kernel yield due to 0.40 NP ratio over the control was to the tune of 36.7% and 38.7% respectively. However, 0.50 NP ratio (30:60 NP kg/ha) recorded significantly higher haulm yield of 3.94 t/ha over the control. Application of N and P in 0.40 ratio also recorded significantly more number of pods/plant (30.7) and dry pod weight (34.2 g/plant) over all other treatments. Higher net returns of ₹58,826/- and benefit: cost ratio of 1:1.78 were also obtained with 0.40 NP ratio, which was followed by 0.42 NP ratio with net returns of ₹47,638/ha and benefit: cost ratio of 1.66.

Key words: Economics, Groundnut, Nitrogen-phosphorus ratio, Pod yield

Groundnut is a valuable cash crop planted by millions of small farmers because of its economic and nutritional value. Groundnut is rich in digestible protein, minerals and vitamins, so contributes significantly in food security and alleviating poverty in many countries.

Nitrogen and phosphorus are important elements for effective production of groundnut. Plastic response of plant to N and P supply cause up to 50-fold variation in biomass. N:P ratios associated with differences in root allocation, nutrient uptake, biomass turnover and reproductive output. Nitrogen is essential component of many compounds of plant, such as chlorophyll, nucleotides, proteins, alkaloids, enzymes, hormones and vitamins. Phosphorus is essentially required for healthy growth, efficient root system and profuse nodulation, which in turn can affect the N_2-fixation potential. Phosphorus is considered as a limiting factor in plant nutrition due to the deficiency of available soluble phosphate in the soil (Maheswar and Sathiyavani, 2012). Phosphorus is necessary for the proper functioning of the nodules and root growth (Naveen Kumar *et al.* 2015). Positive response of legume crop to fertilizer N indicates that N demand of the crop is not being fully met by nitrogen-fixation.

Intense rainfall in Konkan during rainy (*kharif*) season removed bases and nutrients from soil therefore, quantifying of precise with optimum fertilizer rate is essential to exploit profitability and to minimize the potential environmental impact in Konkan. The systematic and comprehensive research on the different proportions of nitrogen and phosphorus is inadequate or sporadic under such circumstances. Therefore, it is most essential to pay a great attention to the nutrition of groundnut to enhance its productivity. Hence, present investigation was undertaken to study different nitrogen and phosphorus ratios on groundnut productivity during rainy (*kharif*) season.

MATERIALS AND METHODS

Field experiments were conducted at Agricultural Research Station, Shirgaon on lateritic soil of Konkan during 3 consecutive rainy (*kharif*) seasons of 2012–2014. The experiment was conducted in randomized block design

[2]Corresponding author's Email: arsshirgaon@rediffmail.com; bharat_breed@yahoo.co.in

[1]Principal, ATS, Lanja, Maharashtra 416 712; [2]Officer Incharge, [3]Junior Agronomist, Agricultural Research Station, Shirgaon, Maharashtra 415 629

with 11 combinations of N and P, viz. 0:0 NP kg/ha, 25:75 NP kg/ha (NP ratio: 0.33), 18:46 NP kg/ha (NP ratio: 0.39), 30:75 NP kg/ha (NP ratio: 0.40), 25:60 NP kg/ha (NP ratio: 0.42), 25:50 NP kg/ha (NP ratio: 0.50), 30:60 NP kg/ha (NP ratio: 0.50), 25:45 NP kg/ha (NP ratio: 0.56), 30:45 NP kg/ha (NP ratio: 0.67), 25:30 NP kg/ha (NP ratio: 0.83) and 30:30 NP kg/ha (NP ratio: 1.0). Experimental site was high in organic matter content (1.41%), medium in nitrogen (290.1 kg/ha) and phosphorus (13.1 kg/ha), while high in potassium content (323.3 kg/ha). Groundnut cultivar '*Trombay Konkan Groundnut-Bold*' was sown with spacing of 30cm × 15cm. The plant population was maintained about 2,22,222 plants/ha. All the recommended packages of practices were adopted as per need of crop. The nitrogen to phosphorus ratio was managed through using urea and single super phosphate as a source of N and P, respectively. The total rainfall received during crop growth period in rainy season (*kharif*) 2012 was 3,085 mm with 86 rainy days, rainy season (*kharif*) 2013 was 1949.9 mm with 74 rainy days and 2247.2 mm with 68 rainy days in rainy season (*kharif*) 2014 respectively. At harvest, a random sample of 5 plants were taken from each plot to determine averages of plant height (cm), pods/plant, kernels/pod, dry pod yield/plant, haulm yield/plant (g), 100-seed weight (g), shelling percentage and sound mature kernels. Agronomic yield were determined plot basis and converted into per hectare yield. The economics was calculated based on standard prevailing market prices of inputs.

RESULTS AND DISCUSSION

Growth and yield attributes

Number of pods/plant and pod weight were significantly influenced due to different nitrogen and phosphorus ratios and ranged between 15.7 to 30.7 and 18.4 to 34.2 g/plant, respectively (Table 1). Plant height and branches/plant failed to exhibit any significant effect due to application of different N:P ratios to groundnut. Significantly higher pods/plant and pod weight recorded when nitrogen and phosphorus were applied in the proportion of 30:75 NP kg/ha i.e. 0.40 NP ratio over all other treatments except 0.33 NP ratio (25:75 NP kg/ha) and 0.50 NP ratio (30:60 NP kg/ha) for number of pods/plant and treatment 0.50 NP ratio i.e. 30:60 NP kg/ ha for dry pod weight, which were at par with 0.40 NP ratio. The untreated control treatment i.e. 0:0 NP kg/ha noticed the lowest number of pods/plant (15.7) and dry pod weight (18.4 g/plant) than rest of the treatments. Similar results were also reported by Hemalatha *et al.* (2013) and Shiva Kumar *et al.* (2014), who reported that optimal dose of NP had played significant role in higher uptake of nutrients and yield of crop.

Yield

Application of NP in 0.40 ratio (30:75 NP kg/ha) produced significantly higher pod yield (3.50 t/ha) over rest of NP ratios, except NP ratios of 0.42, 0.33, and 0.50. Likewise, kernel yield was significantly higher under NP ratio of 0.40 (2.63 t/ha), which was on par with 0.42 NP ratio (2.31 t/ha). Moreover, 0.50 NP ratio (30:60 NP kg/ha) produced significantly higher haulm yield of 3.94 t/ha over control, but it was statistically at par with most of the treatments. The increase in pod and kernel yields due to 0.40 NP ratio (3.50 and 2.63 t/ha, respectively) over control i.e. 0.0 NP ratio (2.22 and 1.61 t/ha, respectively) was to the tune of 36.7% and 38.7% respectively. While, the haulm yield in 0.50 NP ratio (30:60 NP kg/ha) treatment was 3.94 t/ha over control (2.75 t/ha), which was to the tune of 30.2%. The highest value of harvest index (0.36) was noticed with 0.40 NP ratio. As the soil was medium in N and P hence, its response was higher when 30 kg N and

Table 1. Growth and yield attributes of groundnut as influenced by different treatments (pooled data of 3 years)

Treatment	Plant height (cm)	Branches/ plant	Pods/ plant	Pod weight (g/plant)	Shelling out turn (%)	Sound mature kernels (%)	100-kernel weight (g)
00:00 NP kg/ha, NP ratio: 0.00	50.3	3.3	15.7	18.4	72.4	84.6	58.9
25:75 NP kg/ha , NP ratio: 0.33	52.1	3.3	28.1	30.1	72.6	85.9	60.5
18:46 NP kg/ha , NP ratio: 0.39	54.7	3.4	23.2	28.9	74.4	83.6	61.0
30:75 NP kg/ha, NP ratio: 0.40	54.9	3.5	30.7	34.2	75.2	86.5	63.8
25:60 NP kg/ha, NP ratio: 0.42	53.3	3.3	25.6	28.8	74.0	87.1	61.1
25:50 NP kg/ha, NP ratio: 0.50	56.3	3.4	23.4	26.9	71.7	85.4	62.6
30:60 NP kg/ha, NP ratio: 0.50	55.4	3.4	27.7	32.7	72.5	85.2	64.9
25:45 NP kg/ha, NP ratio: 0.56	52.8	3.4	21.8	26.3	73.6	85.3	62.8
30:45 NP kg/ha, NP ratio: 0.67	54.2	3.6	23.2	27.0	73.7	86.5	62.9
25:30 NP kg/ha, NP ratio: 0.83	54.9	3.2	18.6	20.3	72.1	85.4	62.9
30:30 NP kg/ha, NP ratio: 1.0	56.5	3.4	19.7	22.5	74.7	85.7	64.8
SEm±	2.9	0.2	1.1	1.3	1.3	0.8	1.7
CD (P=0.05)	NS	NS	3.2	3.7	3.7	2.2	4.8

Table 2. Yield and economics of groundnut as influenced by different treatments (pooled data of 3 years)

Treatment	Dry pod yield (t/ha)	Kernel yield (t/ha)	Haulm yield (t/ha)	Harvest Index	Gross returns (×10³₹/ha)	Cost of cultivation (×10³₹/ha)	Net returns (×10³₹/ha)	Benefit: cost ratio
00:00 NP kg/ha, NP ratio: 0.00	2.22	1.61	2.75	0.32	86.4	62.8	23.6	1.38
25:75 NP kg/ha , NP ratio: 0.33	3.08	2.23	3.59	0.33	116.2	71.7	44.5	1.62
18:46 NP kg/ha , NP ratio: 0.39	2.78	2.06	3.58	0.32	107.2	69.1	38.2	1.55
30:75 NP kg/ha, NP ratio: 0.40	3.50	2.63	3.76	0.36	134.2	75.3	58.8	1.78
25:60 NP kg/ha, NP ratio: 0.42	3.13	2.31	3.67	0.34	120.0	72.4	47.6	1.66
25:50 NP kg/ha, NP ratio: 0.50	2.89	2.07	3.61	0.32	110.3	69.5	40.8	1.59
30:60 NP kg/ha, NP ratio: 0.50	3.07	2.22	3.94	0.32	117.3	71.2	46.1	1.65
25:45 NP kg/ha, NP ratio: 0.56	3.00	2.20	3.55	0.34	115.5	70.5	45.0	1.64
30:45 NP kg/ha, NP ratio: 0.67	2.70	1.99	3.34	0.33	104.3	68.8	35.4	1.51
25:30 NP kg/ha, NP ratio: 0.83	2.73	1.97	3.30	0.33	104.8	68.0	36.8	1.54
30:30 NP kg/ha, NP ratio: 1.0	2.78	2.07	3.41	0.34	106.9	68.5	38.4	1.56
SEm±	0.16	0.13	0.17	–	–	–	0.7	–
CD (P=0.05)	0.44	0.38	0.49	–	–	–	1.9	–

75 kg P/ha was added in soil. Hossain and Hamid (2007) revealed that yield advantage increased from N_{30} and P_{60} kg/ha to N_{30} and P_{75} kg/ha fertilizer application may be due to optimal and higher root growth. These results are in harmony with Bhatol *et al.* (1994), who reported that, crop can grow without or by addition of lower levels of N and P which produced lowest yield. The appropriate elevated levels of N and P, had more nutrient availability to plant and resulted in greater utilization of assimilates into pods and ultimately increased number of pods, 100 seed weight and yield of groundnut.

The shelling out-turn, sound mature kernels (%) and 100-kernel weight were significantly influenced owing to different nitrogen and phosphorus ratios during tenure of experimentation. Application of 0.40 NP ratio noticed higher shelling per cent (75.2%) and sound mature kernels (86.5%), while more 100 kernel weight was recorded with 0.50 NP ratio i.e. 30:60 NP kg/ha (64.9 g).

Economics

The higher net returns of ₹58,826/- and benefit: cost ratio of 1:1.78 was realized under application of 0.40 NP ratio (30:75:00 NPK kg/ha) compared to other treatments ranging from ₹35,424 to ₹47,638/- and control ₹23,610/ ha with benefit: cost ratios of 1:1.51 to 1:1.66 and 1:1.38 respectively. Shiva Kumar *et al.* (2014) also reported higher net returns and benefit: cost ratio with increased dose of nitrogen and phosphorus in groundnut.

Application of different proportions of N and P had large scope for obtaining higher yield of groundnut under Konkan situation. The 30:75:00 NPK kg/ha i.e. NP ratio of 0.40 is most suitable for rainy season (*kharif*) groundnut to obtain higher productivity and profitability of crop in Konkan region.

REFERENCES

Bhatol, D.P., Patel, N.A. and Pavaya, R.P. 1994. Effect of nitrogen, phosphorus and zinc application on yield and uptake of nutrients by groundnut. *Indian Journal of Agricultural Research* **28**: 209–213.

Hemalatha, S., Praveen Rao S., Padmaja, J., and Suresh K. 2013. An overview on role of phosphorus and water deficits on growth, yield and quality of groundnut (*Arachis hypogaea* L.). *International Journal of Applied Biology and Pharmaceuticals Technology* **4**(3): 188–201.

Hossain Altab, M. and Hamid, A. 2007. Influence of N and P fertilizer application on root growth, leaf photosynthesis and yield performance of groundnut. *Bangladesh Journal of Agricultural Research* **32**(3): 369–374.

Maheswar Uma, N. and Sathiyavani, G. 2012. Solubilization of phosphate by *Bacillus* spp., from groundnut *rhizosphere* (*Arachis hypogaea* L.). *Journal of Chemical and Pharmaceutical Research* **4**(8): 4,007–4,011.

Naveen Kumar, B.T., Malligawad, L.H., Halikatti, S.I., Hiremath, S.M., Srineevasa, M.N. and Bidari, B.I. 2015. Effect of different ratios and levels of nitrogen and phosphorus fertilizers, and top dressing of nitrogenous fertilizers on growth and yield of groundnut. *Karnataka Journal of Agricultural Sciences* **28**(1): 8–11.

Shiva Kumar, L., Radder, B.M. and Malligawad, L.H. 2014. Yield and economics of groundnut as influenced by levels and ratios of nitrogen and phosphorus application in northern transition zone of Karnataka, India. *Annals of Biological Research* **5**(8): 36–39.

Shiva Kumar, L., Radder, B.M., Malligawad, L.H. and Manasa, V. 2014. Effect of nitrogen and phosphorus levels and ratios on yield and nutrient uptake by groundnut in northern transition zone of Karnataka. *The Bioscan* **9**(4): 1,561–1,564.