

Effect of Applied Fertilizers and FYM Levels on Productivity of Groundnut (*Arachis hypogaea*) and their Residual Effect on Succeeding Crop of Isabgol (*Plantago ovata* Forsk.)

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Abstract: Field study aimed to determine nutritional requirement of groundnut to exploit its full production potential and the residual effect of applied nutrients on succeeding crop of blond psyllium to obtain higher return from groundnut and groundnut-blond psyllium cropping sequence was conducted during the year 2007-08 and 2008-09. The study revealed that application of nutrients N: P₂O₅ 20:75 kg ha⁻¹ produced maximum pod yield of groundnut (2830 kg ha⁻¹), net return (Rs. 43,935 ha⁻¹) along with higher B:C ratio of 2.66. The crop responded to 7.5 t FYM ha⁻¹ only. The residual studies reveal that seed yield of blond psyllium enhanced when N: P₂O₅ applied up to 20:60 kg ha⁻¹ only. However, application of N: P₂O₅ 20:75 kg ha⁻¹ recorded significantly higher groundnut pod equivalent yield (5057 kg ha⁻¹), maximum net return (Rs. 92,214 ha⁻¹) with B:C ratio of 3.70. FYM applied @ 15 t ha⁻¹ gave highest GPEY (4885 kg ha⁻¹), net return (Rs. 87,857 ha⁻¹) along with higher B:C ratio of 3.57.

Key words: Groundnut, isabgol, crop sequence, GPEY, residual study, economics.

Groundnut is most important oil seed crop of India. However, the productivity of groundnut is quite low. One of the major reasons of low productivity of groundnut in India is its cultivation in marginal lands with low inputs and inadequate fertilization. With the availability of underground water for irrigation in western Rajasthan during the recent years, groundnut has become an important kharif season cash crop. The groundnut being an energy rich crop and its nutrient requirement is also higher than the other crops. Groundnut crop is new for the region and in absence of suitable recommendation of nutrients for this particular region, the farmers are not applying nutrients in the required quantity and as a result they are not getting good yield and economic returns from the crop. Higher cost of inputs (organic manures in particular) also restrains farmers for their application. As these nutrients are not being utilized in single season and considerable amount of them remains unused. The succeeding crop may get benefit of them. Blond psyllium/isabgol (an important medicinal crop of the region), having low nutrient requirement can successfully be taken after groundnut. This experiment was therefore, conducted to determine nutritional requirement of groundnut to exploit its full

production potential and study the residual effect of applied nutrients on succeeding crop of isabgol to obtain higher economic returns from groundnut isabgol crop sequence in arid region of western Rajasthan.

Materials and Methods

The experiment was conducted at Agricultural Research Station (SKRAU), Mandor, Jodhpur during the season 2007-08 and 2008-09. The soil of the experimental site was sandy loam in texture, low in organic carbon (0.3), medium in phosphorus and potassium and alkaline in nature (pH 8.2). The treatment comprised of three levels of fertilizers (N: P₂O₅) 10:45, 15:60 and 20:75 kg ha⁻¹ and three levels of organic manure (FYM t ha⁻¹) 0, 7.5 and 15. Whole amount of phosphorus and half amount of nitrogen was drilled below the seed at the time of sowing and remaining amount of nitrogen was top dressed about one month of sowing coinciding the availability of rain/moisture. Required quantity of organic manures was incorporated in soil about 15 days before sowing for proper decomposition. Groundnut variety GG-20 was sown during mid-June keeping 45 x 10 cm row x plant spacing. All agronomical operations were done as per the recommendation. Irrigations were applied as per need of the crop or prolong dry spell of the monsoon rain. The crop was harvested in

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second fortnight of November. After preparing the field, isabgol variety RI-89 was sown on the same layout as succeeding crop to utilize nutrient applied during groundnut cultivation. All recommended cultivation practices were adopted except the fertilizer. No fertilizers were applied in isabgol. The treatments were evaluated in RBD with four replications. Yield attributes and yield (pod and oil) were taken to assess the treatment effect. Groundnut pod equivalent yield (GPEY) was determined to assess the effect of treatments on the crop sequence.

Result and Discussion

Increase in the level of fertilizers caused successive enhancement in pod yield of groundnut (Table 1). Application of 20:75 kg N: P₂O₅ ha⁻¹ produced maximum pod yield (2823 kg ha⁻¹) which was found to be 39.2 and 19.6% higher over that produced due to application of 10:45 kg and 15:60 kg N: P₂O₅ ha⁻¹, respectively. This increase in pod and haulm yield of groundnut can be ascribed to the important role of these nutrients in plant metabolism, resulting in development of better yield attributes and yield. Oil content in kernel was found minimum at maximum level of fertilizer application. However, the oil yield registered significant increase with increasing level of fertilizer because of higher pod yield obtained with higher fertilizer levels.

Yield attributes of groundnut i.e. pod yield plant⁻¹ and seed index were improved

significantly with increase in the level of FYM from control to 15 t ha⁻¹. However, the pod and haulm yield of groundnut enhanced significantly up to application of 7.5 t FYM ha⁻¹ only. Further increase in the level of FYM did not cause significant improvement in groundnut productivity. The shelling per cent and oil content were improved significantly with application of 7.5 t FYM ha⁻¹ only. Oil yield exhibited significant improvement with increasing level of FYM to 15 t ha⁻¹. It was due to the higher oil content and pod yield obtained with application of 15 t FYM ha⁻¹. Beneficial effect of FYM on groundnut was due to increase in nutrient availability through enhanced microbial activity, conversion from unavailable to available form and due to improved physical, chemical and bio-chemical condition of the soil providing congenial conditions for better growth and yield of the crop. The results are in accordance with the findings of Panwar and Singh (2003); Varalaxmi *et al.* (2005) and Jat and Ahlawat (2010).

Residual effect of fertility levels and FYM

Residual effect of levels of fertilizer and FYM was found significant on succeeding crop of isabgol (Table 2). Biological yield of isabgol increased with increasing level of fertilizers and maximum biological yield (3830 kg ha⁻¹) was recorded with application of 20:75 kg N: P₂O₅ ha⁻¹, though significant improvement in seed yield was noticed up to 15:60 kg N: P₂O₅ ha⁻¹ only. Similar results were also observed

Table 1. Effect of different fertility levels and FYM application on productivity and economic return of groundnut (pooled data of 2007-08 and 2008-09)

Treatment	Pod yield g plant ⁻¹	Seed index (g)	Shelling %	Oil %	Oil yield (kg ha ⁻¹)	Pod yield (kg ha ⁻¹)	Haulm yield (kg ha ⁻¹)	Net return (Rs ha ⁻¹)	B:C ratio
Fertility levels (N: P ₂ O ₅ kg ha ⁻¹)									
10:45	26.9	44.0	563.0	50.0	1012	2028	3590	24,696	1.95
15:60	33.1	53.1	58.2	49.1	1157	2360	4080	33,551	2.33
20:75	36.5	55.9	62.1	44.5	1253	2823	4210	43,935	2.66
SEm ±	0.44	0.49	1.19	0.36	22.7	67	123	1186	0.05
CD (P=0.5)	1.22	1.35	3.50	1.0	62.9	186	341	3286	0.14
FYM (t ha ⁻¹)									
Control	28.9	47.9	56.9	47.0	1062	2170	3640	30,957	232.0
7.5	32.8	51.5	58.7	48.2	1145	2447	4000	35,754	2.41
15	34.9	53.7	61.1	48.3	1215	2593	4230	35,471	2.21
SEm ±	0.44	0.49	1.19	0.36	22.7	67	123	1186	0.05
CD (P=0.5)	1.22	1.35	3.50	1.0	62.9	186	341	3286	0.14

Table 2. Residual effect of different fertility levels and FYM application on groundnut-isabgol cropping sequence (pooled data of 2007-08 and 2008-09)

Treatment	Seed yield of isabgol (kg ha ⁻¹)	Biological yield of isabgol (kg ha ⁻¹)	GPEY of sequence (kg ha ⁻¹)	Net return (Rs ha ⁻¹)	B:C ratio
Fertility levels (N: P ₂ O ₅ kg ha ⁻¹)					
10:45	987.0	3234	4003.0	65,813	2.93
15:60	1126.0	3544	4613.0	81,019	3.67
20:75	1117.0	3830	5057.0	92,214	3.70
SEm±	15.1	113	59.0	1470	0.04
CD (P=0.5)	42.0	313	163.0	4073	0.11
FYM (tones ha ⁻¹)					
Control	1019.0	3142	4208.0	71,000	3.08
7.5	1065.0	3717	4577.0	80,189	3.34
15	1146.0	3749	4885.0	87,857	3.57
SEm±	15.1	113	59.0	1470	0.04
CD (P=0.5)	42.0	313	163.0	4073	0.11

by Ahlawat *et al.* (2005) and Aishwath *et al.* (2005) on medium soil fertility. The GPEY of the crop sequence increased significantly with successive increase in the level of fertilizers. Maximum GPEY (5057 kg ha⁻¹) was obtained by applying N: P₂O₅ @ to 20:75 kg ha⁻¹ and this was found to be 20.8 and 8.8% more over those obtained by applying 10:45 and 15:60 kg N: P₂O₅ ha⁻¹, respectively.

Application of 15 t FYM ha⁻¹ produced significantly higher seed yield of isabgol (1146 kg ha⁻¹) and GPEY (4885 kg ha⁻¹) of crop sequence. In comparison to no FYM application (1019 kg ha⁻¹), seed yield of isabgol was improved by 4.5 and 12.5 and GPEY to the extent of 13.5 and 16.1% due to application of 7.5 and 15.0 t FYM ha⁻¹, respectively. Application of 7.5 t FYM ha⁻¹ recorded significantly higher net return (Rs. 35,754 ha⁻¹) along with numerically higher B:C ratio (2.41) in comparison to no FYM application. Further increase in the level of FYM could not enhanced net income and B:C ratio.

Economic evaluation

Application of N: P₂O₅ @ 20:75 to groundnut gave maximum net return (Rs. 43,935 ha⁻¹) along with higher B:C ratio of 3.7. The net return in groundnut crop enhanced significantly with application of FYM up to 7.5 t ha⁻¹ only. It was due to the fact that the increase in pod yield was low and could not compensate the expenses incurred in applying FYM to the level of 15 t ha⁻¹. However, the economic analysis of groundnut-isabgol crop sequence

showed significant increase in net return with increasing level of fertilizers and FYM. Application of 20:75 kg N: P₂O₅ ha⁻¹ produced highest net income of Rs. 92,214 ha⁻¹ along with B:C ratio of 3.7. Similarly application of 15 t FYM ha⁻¹ recorded significantly higher net return (Rs. 87,857 ha⁻¹) along with higher B:C ratio of 3.57.

Conclusion

On the basis of two seasons pooled data it can be concluded that to obtain higher yield and net return from groundnut and groundnut-isabgol crop sequence, the groundnut crop should be fertilized with 20:75 Kg N: P₂O₅ ha⁻¹ and 15 t FYM ha⁻¹.

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