The Pharma Innovation Journal 2023; 12(3): 4379-4382

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(3): 4379-4382

www.thepharmajournal.com
Received: 01-12-2022
Accepted: 06-02-2023

Shovana Nayak
PG Scholar, Department of Agronomy, College of Agriculture, OUAT, Bhubaneswar, Odisha, India

Susanta Kumar Swain
Professor, Department of Agronomy, Directorate of Research, OUAT, Bhubaneswar, Odisha, India

Manoranjan Satapathy
Professor, Department of Agronomy, College of Agriculture, OUAT, Bhubaneswar, Odisha, India

Subhrasini Lenka
Junior Agronomist, AICRP on Groundnut, OUAT, Bhubaneswar, Odisha, India

Corresponding Author:
Shovana Nayak
PG Scholar, Department of Agronomy, College of Agriculture, OUAT, Bhubaneswar, Odisha, India

Productivity and profitability of summer groundnut (*Arachis hypogaea* L.) as influenced by phosphorus level, FYM and phosphorus Solubilising bacteria in East and South-eastern coastal plain zone of Odisha

Shovana Nayak, Susanta Kumar Swain, Manoranjan Satapathy and Subhrasini Lenka

Abstract
A field experiment was conducted at the Groundnut Research Station, Odisha University of Agriculture and Technology, Bhubaneswar to study the effect of phosphorus level, FYM and phosphorus solubilising bacteria on growth, yield attributes, yield and economics of summer groundnut (*Arachis hypogaea* L.) during 2018-19. The soil of the experimental site was sandy loam in texture, acidic in reaction, low in organic carbon and available nitrogen, medium in available phosphorus and potassium. The experiment was laid out in a randomized block design (RBD) with three replications and ten different nutrient management practices to groundnut, *viz*. T_1: Control (no application of phosphorus), T_2: Phosphorus @ 20 kg ha^{-1}, T_3: Phosphorus @ 40 kg ha^{-1}, T_4: Phosphorus @ 60 kg ha^{-1}, T_5: FYM @ 2.5 t ha^{-1}, T_6: Phosphorus @ 20 kg ha^{-1} + PSB seed inoculation 20 g ha^{-1}, T_7: Phosphorus @ 40 kg ha^{-1} + PSB seed inoculation 20 g kg^{-1}, T_8: Phosphorus @ 60 kg ha^{-1}+ PSB seed inoculation 20 g kg^{-1}, T_9: FYM @ 2.5 t ha^{-1}+ PSB seed inoculation 20 g kg^{-1}, T_{10}: Enriched FYM @ 100 kg ha^{-1}+ PSB seed inoculation 20 g kg^{-1} with uniform application of recommended dose of 20 kg N and 40 kg K2O per hectare. Groundnut variety 'Dharani' was used as the test material. Application of Phosphorus @ 60 kg ha^{-1} + PSB seed treatment @ 20 g kg^{-1} recorded significantly maximum plant height, dry matter accumulation at harvest and maximum LAI at 90 DAS. The same treatment also recored higher growth parameters like pods/plant, shelling percentage and 100- kernel weight. Maximum pod yield of 2190 kg/ha and haulm yield of 3878 kg/ha were recorded with combined application of Phosphorus @ 60 kg ha^{-1} + PSB seed treatment @ 20 g kg^{-1} which were about 38 and 30% higher, respectively from the production received without application of phosphorus and PSB seed treatment. Highest net return of Rs. 96,109 ha^{-1} and return per rupees invested of 2.16 were obtained from the groundnut crop fertilized with 60 kg phosphorus ha^{-1} along with PSB seed treatment.

Keywords: Groundnut, phosphorus, FYM, phosphorus solubilising bacteria

Introduction
Groundnut (*Arachis hypogaea* L.) is an important oilseed crop. It is also known as king of oilseed crops. It is a self-pollinated annual legume crop belonging to family Fabaceae. India is the second largest groundnut producing nation in the world after China with an annual production of 7.57 million tonnes. It covers an area of 5.31 million hectares and the average productivity of groundnut in India is 1424 kg ha^{-1}. In Odisha, the total area covered under groundnut is 1.92 lakh hectares with a production of 3.45 lakh tonnes and an average productivity of 1796 kg ha^{-1} in 2018-19 (Odisha Agricultural Statistics, 2018-19) [1]. Commercially, groundnut is the world's fourth most important source of edible oil and third most important source of vegetable protein. It is the most versatile legume crop because of drought tolerant characters, soil restoring properties, weeds smothering, multipurpose confectionery and dilatory uses. As a legume oil yielding crop, it fits well into most of the cropping systems. "Dharani" or TCGS- 1043 is a drought tolerant variety released by Acharya Ranga Agricultural University, Tirupati in the year of 2013. It can withstand up to 35 days dry spell, high SMK percentage (90%), uniform maturity, attractive pods, moderate stature and tolerant to low light conditions. It can be grown during both *kharif* and *rabi* crop which has yield potentiality of up to 16-26 q ha^{-1} and 37-43 q ha^{-1} respectively. It has high oil content i.e. 49% high and high shelling percentage i.e. 75-77%. In groundnut, Phosphorus known to play an important role in increasing root growth, nutrient and water use efficiency and also in

enhancing yield. The overall improvement in crop growth with phosphorus application seems to be on account of its significant role in early formation of roots, their proliferation and increased microbial activity in the root nodules. This has been shown to improve the effective utilization of soil nutrients by the crop and greater biological nitrogen fixation through enhancement in nitrogen activity (Venkateswaralu *et al*., 1998).

Materials and Methods

The experiment was conducted during the summer season of 2018 at AICRP on groundnut experimental field inside Horticulture Research Station, Odisha University of Agriculture and Technology, Bhubaneswar. The region is characterized by a sub-tropical climate with a hot and humid summer, hot and wet monsoon and a mild and dry winter. The soil of experimental plot was sandy loamy in texture, acidic in reaction (pH=4.86) low in organic carbon and available nitrogen, medium in available phosphorus and potassium. The experiment was conducted in a randomized block design with three replications to study the response of ten level of nutrient management practices in summer groundnut. The different treatments were i.e. T_1: Control (N @ 20 & K2O @ 40 kg ha^{-1}), T_2: Phosphorus @ 20kg ha^{-1}, T_3: Phosphorus @ 40kg ha^{-1}, T_4: Phosphorus @ 60kg ha^{-1}, T_5: FYM @ 2.5t ha^{-1}, T_6: Phosphorus @ 20kg ha^{-1} + PSB seed inoculation 20g kg^{-1}, T_7: Phosphorus @ 40kg ha^{-1} + PSB seed inoculation 20g kg^{-1}, T_8: Phosphorus @ 60kg ha^{-1} + PSB seed inoculation 20g kg^{-1}, T_9: FYM @ 2.5t ha^{-1} + PSB seed inoculation 20g kg^{-1}, T_{10}: Enriched FYM @ 100 kg ha^{-1} + PSB seed inoculation 20g kg^{-1}.

Uniform dose of N and K: 20 kg N and 40 kg K_2O ha^{-1}. The crop was sown on 1st December 2018 and harvested on 13th April 2019. Observations on various growth parameters, yield attributes and yield were recorded and data were analyzed statistically by following ANOVA technique.

Result and Discussion

Observations on various growth, yield parameters, yield and economics were recorded and analyzed statistically which are presented in Table 1 and Table 2 respectively.

Plant height was significantly influenced by effect of phosphorus level, FYM and phosphorus solubilising bacteria. Application of 60 kg phosphorus ha^{-1} + PSB seed treatment @ 20 g kg^{-1} resulted in highest plant height which was at par with T_7 and T_9. The results are also in conformity with the findings of several workers like Kausale *et al*. (2009) [2], Kumar *et al*. (2018) [3] and Amruth *et al*. (2017) [4] who observed that tallest plant with more number of branches per plot was recorded by application of phosphorus along with PSB and FYM.

Leaf area index (LAI) may be defined as the sum of the leaf area per unit ground area. It is often used for biomass estimation, crop growth diagnosis and yield diagnosis. The leaf area increased steadily and reached a maximum at 90 DAS and declined rapidly later because of advancement in growth, senescence of leaves and leaf fall. Highest leaf area index was recorded with application of 60 kg Phosphorus ha^{-1} + PSB seed treatment @ 20 g kg^{-1} (3.16) at 90 DAS which was at par with application of 40 kg phosphorus ha^{-1} + PSB seed treatment @ 20 g kg^{-1} (3.13). Lowest leaf area index was observed under no application of phosphorus. Halder *et al*. (2014) [5] revealed that the application of phosphorus at level of 80 kg ha^{-1} observed maximum leaf area index (2.45) at 75 DAS in groundnut. Also the index was the highest (1.98) in 60 kg phosphorus ha^{-1} followed by 40, 20 and 0 kg phosphorus ha^{-1}, respectively from the findings of Mouri *et al*. (2018) [6]. The result is in agreement with the findings of Jadhav and Narkhede (1983) [7], Dhadge and Satpute (2014) [8] and Shree Ganesh *et al*. (2015) [9]. Highest dry matter accumulation was found under the treatment 60 kg Phosphorus ha^{-1} + PSB seed treatment @ 20 g kg^{-1} (21.15 g $plant^{-1}$) at harvest. The plant supplied with only nitrogen and potash (control) accumulated significantly least dry matter at all the growth stages. The increases in plant growth and total dry weight due to phosphorus application may be attributable to the fact that phosphorus is known to help in the development of more extensive root system and nodulation, and thus enables plants to absorb more water and nutrients from depth of the soil. This in turn could enhance the plant's ability to produce more assimilates which were reflected in the high dry weight. Similar results have been reported by El-Habbasha *et al*. (2005) [10] and Gobarah *et al*. (2006) [11].

The yield attributing characters like number of pods $plant^{-1}$ (20.6), shelling percentage (76.5%) and 100 kernel weight (34.6 g) were maximum with application of 60 kg phosphorus ha^{-1} + PSB seed treatment @ 20 g kg^{-1}, which also produced the highest pod and haulm yield of 2190 kg and 3878 kg ha^{-1}, respectively being at par with application of 40 kg phosphorus ha^{-1} + PSB seed treatment @ 20 g kg^{-1} The yield and the yield attributing characters were increased with increasing phosphorus level whether applied sole or in combination with PSB. The significant improvement of yield and yield parameters found particularly in the presence of PSB strains might be due to their higher ability to solubilise mineral phosphate. These results are close in conformity with the findings of Bouhraoua *et al*. (2015) [12], Jat and Ahlawat (2010) [13], Abraham and Thenua (2010) [14] and Bala *et al*. (2015) [15]. Highest value of harvest index (37.3%) was recorded under the treatment (T_9) with FYM @ 2.5 t ha^{-1} + PSB seed treatment @ 20 g kg^{-1} whereas the lowest value was recorded under control (34.7%).

Combined application of 60 kg Phosphorus + PSB seed treatment @ 20 g kg1 recorded the highest gross return (₹96109 ha^{-1}) and net return (₹51569 ha^{-1}) with return per rupees invested of 2.16. As net return is computed by multiplying the pod and haulm yield by substracting the cost of cultivation including treatment cost, it seems to be directly associated with significantly higher pod and haulm yields obtained under these superior treatments as well as comparatively lower additional cost of cultivation over control in comparison to added output. A similar finding has been reported by Amruth *et al*. (2017) [16].

Table 1: Effect of phosphorus level, FYM and phosphorus solubilising bacteria on growth characteristics and yield attributes of summer groundnut

Treatment		Maximum plant height (cm) at harvest	Maximum Leaf area index (LAI) at 90 DAS	Maximum dry matter accumulation (g/plant) at harvest	Pods/ plant	Shelling percent (%)	100-kernel weight (g)
T_1	Control (N @ 20 & K2O @ 40 kg ha^{-1})	21.4	2.69	9.42	9.7	60.6	31.7
T_2	Phosphorus @ 20 kg ha^{-1}	21.6	2.77	10.66	11.2	61.3	32.1
T_3	Phosphorus @ 40 kg ha^{-1}	24.8	3.04	14.84	15.2	66.3	32.7
T_4	Phosphorus @ 60 kg ha^{-1}	27.7	3.12	17.79	17.5	72.5	34.0
T_5	FYM @ 2.5 t ha^{-1}	25.7	3.02	13.22	14.0	64.6	34.4
T_6	Phosphorus @ 20 kg ha^{-1} + PSB seed treatment @ 20 g kg^{-1}	22.6	2.91	11.80	13.2	63.5	34.0
T_7	Phosphorus @ 40 kg ha^{-1} + PSB seed treatment @ 20 g kg^{-1}	31.2	3.13	18.39	18.6	74.3	34.1
T_8	Phosphorus @ 60 kg ha^{-1} + PSB seed treatment @ 20 g kg^{-1}	34.5	3.16	21.15	20.6	76.5	34.6
T_9	FYM @ 2.5 t ha^{-1} + PSB seed treatment @ 20 g kg^{-1}	31.8	3.05	16.48	15.4	70.4	33.3
T_{10}	Enriched FYM @ 100 kg ha- 1 + PSB seed treatment @ 20 g kg^{-1}	22.4	2.85	11.16	12.3	63.0	32.7
S.Em(±)		1.29	0.023	0.46	0.58	0.51	1.16
CD (P=0.05)		3.2	0.06	1.1	1.4	1.2	NS

Table 2: Effect of phosphorus level, FYM and phosphorus solubilising bacteria on yield and economics of summer groundnut

Treatment		Pod yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest Index (%)	Net return (Rs. ha^{-1})	Return per rupee invested
T_1	Control (N @ 20 & K2O @ 40 kg ha^{-1})	1590	2989	34.7	28879	1.70
T_2	Phosphorus @ 20 kg ha^{-1}	1782	3379	34.5	36775	1.89
T_3	Phosphorus @ 40 kg ha^{-1}	1990	3619	35.5	44759	2.05
T_4	Phosphorus @ 60 kg ha^{-1}	2091	3763	35.7	47554	2.07
T_5	FYM @ 2.5 t ha^{-1}	1882	3266	36.5	34319	1.71
T_6	Phosphorus @ 20 kg ha^{-1} + PSB seed treatment @ 20 g kg^{-1}	1888	3461	35.2	41074	1.98
T_7	Phosphorus @ 40 kg ha^{-1} + PSB seed treatment @ 20 g kg^{-1}	2100	3766	35.8	49263	2.15
T_8	Phosphorus @ 60 kg ha^{-1} + PSB seed treatment @ 20 g kg^{-1}	2190	3878	36.1	51569	2.16
T_9	FYM @ 2.5 t ha^{-1} + PSB seed treatment @ 20 g kg^{-1}	2010	3383	37.3	39582	1.82
T_{10}	Enriched FYM @ 100 kg ha^{-1} +PSB seed treatment @ 20 g kg^{-1}	1785	3321	34.9	36965	1.89
S.Em(±)		103.93	171.79	0.45		
CD (P=0.05)		254.9	421.3	1.1		

Conclusion

Based on the result of thisexperiment, it is concluded that for maximizing productivity and profitability of summer groundnut (Dharani), application of phosphorus @ 60 kg ha^{-1} along PSB seed treatment @ 20 g kg^{-1} can be recommended for East and South- eastern coastal plain zone of Odisha.

References

1. Odisha Agriculture Statistics, Government of Odisha; 2018-19.
2. Kausale SP, Shinde SB, Patel LK, Borse NS. Effect of integrated nutrient management on nodulation, dry matter accumulation and yield of summer groundnut at South Gujarat conditions. Legume Research. 2009;32(3):227-229.
3. Kumar N, Kumar A, Shukla A, Ram A, Bahadur R, Chaturvedi OP. Effect of application of bio-inoculants on growth and yield of *Arachis hypogaea* L. And *Sesamum indicum* L. International Journal of Current Microbiology and Applied Science. 2018;7(1):2869-2875.
4. Amruth B, Thippeshappa GN, Chandra Sheker B. Effect of phosphorus levels through integrated nutrient management (INM) packages on different parameters of groundnut crop. Bulletin of Environment, Pharmacology and Life Science. 2017(a);6(1):107-112.
5. Halder D, Rabindra KP. Determination of appropriate sowing date and phosphorus fertilization strategy for peanut in Eastern India. Africa Journal of Agriculture Research. 2014;9(32):2475-2487.
6. Mouri SJ, Sarkar MAR, Uddin MR, Sarker UK, Kaysar MS, Hoque MMI. Effect of variety and phosphorus on the yield components and yield of groundnut. Progressive Agriculture. 2018;29(2):117-126.
7. Jadhav AS, Narkhede RN. Pattern of dry matter accumulation of groundnut as influenced by nitrogen and phosphorus fertilization. Madras Agricultural Journal. 1983;69:756-566
8. Dhadge SJ, Satpute NR. Effect of integrated nutrient management on growth, yield and quality of summer groundnut (*Arachis hypogaea* L.). International Journal of Agricultural Science. 2014;10(1):314-316.
9. Shree Ganesh S, Sharma MK, Narwade AV, Neethu TM. Effect of biofertilizers and micronutrients on morpho-physiological and biochemical parameters of groundnut (*Arachis hypogaea* L.). International Journal of Tropical Agriculture. 2015;33(2):0254-8755.
10. El-Habbasha SF, Kandil AA, Abu-Hagaza NS, Abd-El-Haleem AK, Khalfallah MA, Gh. Behairy T. Effect of phosphorus levels and some biofertilizers on dry matter, yield and yield attributes of groundnut. Bulletin of Faculty of Agriculture, Cairo University. 2005;56:237-252pp.
11. Gobarah ME, Mohammad MH, Tawfik MM. Effect of phosphorus fertilizer and foliar spraying with zinc on growth, yield and quality of groundnut under reclaimed sandy soils. Journal of Applied Science Research,

Pakistan. 2006;2:491-496pp
12. Bouhraoua D, Aarab S, Laglaoui A, Bakkali M, Arakrak A. Phosphate Solubilizing Bacteria Efficiency on Mycorrhization and Growth of Peanut in the Northwest of Morocco. American Journal of Microbiological Research. 2015;3(5):176-180.
13. Jat RA, Ahlawat IPS. Effect of organic manure and sulphur fertilization in pigeon pea (*Cajanus cajan*) + groundnut (*Arachis hypogaea*) intercropping system. Indian Journal of Agronomy. 2010;55(4):276-281
14. Abraham T, Thenua OVS. Influence of organic and inorganic sources of nutrient and their methods of application on growth and yield attributes of groundnut (*Arachis hypogaea* L.). Indian Journal of Agricultural Research. 2010;44(3):216-220
15. Bala M, Nath K. Maximization of groundnut (*Arachis hypogaea* L.) yield by nutrient management practices. Journal of Experimental Biology and Agricultural Sciences. 2015;3(3):241-245.
16. Amruth B, Thippeshappa GN, Chandra Sheker B. Effect of phosphorus levels through integrated nutrient management (INM) packages on different parameters of groundnut crop. Bulletin of Environment, Pharmacology and Life Science. 2017(b);6(1):107-112.