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EFFECT OF LEVELS OF NITROGEN AND BIOFERTILIZERS ON GROWTH AND YIELD OF GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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Abstract – The field experiment was conducted during Kharif season 2020 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj to study about the "Effect of Nitrogen levels and Bio-fertilizers on growth and yield of Groundnut (*Arachis hypogaea* L.)" The experiment was laid out in Randomized Block Design, with Nine treatments which are replicated thrice. The treatment consists of three levels of nitrogen and biofertilizers viz T1 (10Kg N/ha+ Rhizobium), T2 (10Kg N/ha + PSB), T3 (10Kg N/ha+ Rhizobium+ PSB), T4 (15Kg N/ha+ Rhizobium), T5 (15Kg N/ha+ PSB), T6 (!5Kg N/ha+ Rhizobium+ PSB), T7 (20Kg N/ha+ Rhizobium), T8 (20Kg N/ha + PSB), T9 (20Kg N/ha+ Rhizobium+ PSB), The maximum results showed in growth and yield attributing characters viz. plant height (102.19cm), dry weight (45.78g), nodules/plant (157.78), pods/plant (28.80), kernels/pod (2.07), seed index(47.06g), seed yield (2655.58 kg/ha), haulm yield (3587.20), harvest index (42.31) were recorded significantly higher in T9 (20 Kg N/ha +Rhizobium +PSB) while net returns (91858.24 Rs/ha) and B:C ratio (2.44) were also recorded in application of T9 was found to be more productive as well as economic.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop of India, popularly known as peanut, monkey-nut and locally called as "moongphali" It is widely grown in the tropical and subtropical, being important to both small and large commercial producers. Groundnut seeds contain high quality oil (48%), easily digestible protein (26%) and carbohydrates (20%). It is classified as both a grain legume and due to its high oil content, an oil crop. Like most other legumes, peanuts harbour symbiotic nitrogen-fixing bacteria in root nodules-containing fertilizer and also improve soil fertility, making them valuable in crop rotations. Total area of groundnut in Rajasthan is 3.46 lakh ha with total production of 6.81 lakh tons with productivity of 1963 Kg/ha (Anonoymous, 2011b).

Bio-fertilizers can play an important role in meeting the nutrient requirement of crop through biological nitrogen fixation (BNF), solubilization of insoluble phosphorus sources (PSB). Several bacteria belonging to genera *Pseudomonas* and *Bacillus* have the ability to solubilize inorganic phosphorus insoluble sources. Inoculation of seed with phosphate solubilizing bacteria (PSB) increases crop growth, nutrient availability, uptake and crop yield (Shrivastava and Ahlawat, 1993).

MATERIALS AND METHODS

A field experiment was conducted during Kharif season 2020 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) which is located at 25 degree 39′ 42′′N latitude, 81 degree 67′56′′E longitude and 98 m altitude above the mean sea level, during Kharif season 2020 on sandy loamy in texture nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36%), available N (171.48 Kg/ha), available P (15.2 Kg/ha), and available K (232.5 Kg/ha). The treatment consisted 3 levels of nitrogen and bio-fertilizers T1 (10 Kg N/ha + Rhizobium), T2 (10 Kg N/ha + PSB), T3 (10 Kg N/ha + Rhizobium +PSB), T4 (15 Kg N/ha + Rhizobium),

T5 (15 Kg N/ha + PSB), T6 (15Kg N/ha + Rhizobium + PSB), T7 (20 Kg N/ha + Rhizobium), T8 (20 Kg N/ha + PSB), T9 (20 Kg N/ha Rhizobium + PSB). The Experiment was laid out in Randomized Block Design, with nine treatments which are replicated thrice. The recommended dose of fertilizer is 20:50:40 Kg/ha NPK and applied at the time of sowing in the Urea, DAP and MOP. Collected soil samples were analysed for organic carbon by rapid titration method, available nitrogen was estimated by alkaline permanganate method by Subbiah and Asija (1956), available phosphorus by Olsen's method. Available potassium was determined by extracting with neutral normal ammonium acetate solution and estimating by using flame photometer (ELICO Model) as outlined by Jackson (1973) and available S was estimated by turbid metric method as described by sparks (1996). Experimental data collected was subjected to statistical analysis by adopting fisher's method of analysis of variance (ANOVA) as outlined by Gomez and Gomez (1984). Critical Difference (CD) values were calculated the 'F' test was found significant at 5% level.

RESULTS

Plant height

Observations regarding the plant height of groundnut are given in Table 1 and there was an increasing trend of the values at successive stages. The analysis of plant height was significantly higher in all different growth intervals. At harvest, the highest significant plant height (102.19 cm) was recorded with application of 20Kg N/ha+ Rhizobium+ PSB which was statistically on par with application of 20 kg N/ha plus PSB.

No of nodules/plant

Observation regarding the root nodules per plant of Groundnut are given in Table 2 and there was an increasing tendency of the values at successive stages. The analysis of maximum root nodules per plant (157.78) was recorded in application of 20 Kg N/ha plus Rhizobium plus PSB which was significantly superior over rest of the treatments. However the minimum root nodules per plant (85.78) was recorded in application of 10 Kg N/ha

Table 1. Influence of nitrogen levels and biofertilizers on plant height of groundnut.

Treatment combinations	20 DAS	40 DAS	60 DAS	80 DAS	100 DAS
10 kg N/ha + *Rhizobium*	8.86	29.36	61.78	87.82	91.84
10 kg N/ha + PSB	8.78	31.55	63.55	90.44	94.29
10 kg N/ha + *Rhizobium* + PSB	7.35	32.38	65.41	90.76	94.74
15 kg N/ha + *Rhizobium*	8.76	34.46	67.49	92.84	96.17
15 kg N/ha + PSB	8.77	36.76	69.94	93.11	97.11
15 kg N/ha + *Rhizobium* + PSB	8.00	38.51	71.64	95.94	99.93
20 kg N/ha + *Rhizobium*	8.97	37.51	70.76	94.39	98.36
20 kg N/ha + PSB	9.46	38.68	72.64	97.08	101.05
20 kg N/ha + *Rhizobium* + PSB	10.44	39.61	73.77	98.20	102.19
SEm(±)	0.33	0.33	0.39	0.50	0.40
CD (P=0.05)	0.99	0.99	1.17	1.50	1.36

Table 2. Influence of nitrogen levels and biofertilizers on root nodules per plant of groundnut.

Treatment combinations	20 DAS	40 DAS	60 DAS	80 DAS	100 DAS
10 kg N/ha + *Rhizobium*	28.33	52.22	93.89	110.00	85.78
10 kg N/ha + PSB	30.33	56.33	96.67	120.78	95.22
10 kg N/ha + *Rhizobium* + PSB	31.11	62.33	102.22	128.22	97.11
15 kg N/ha + *Rhizobium*	31.67	63.67	107.11	137.89	89.11
15 kg N/ha + PSB	33.11	65.44	114.45	142.89	102.78
15 kg N/ha + *Rhizobium* + PSB	34.33	70.78	121.59	168.11	119.22
20 kg N/ha + *Rhizobium*	35.00	73.00	117.00	158.22	125.00
20 kg N/ha + PSB	35.89	74.78	121.67	169.86	147.00
20 kg N/ha + *Rhizobium* + PSB	37.22	76.11	123.89	175.78	157.78
Sem(±)	0.36	1.07	0.93	1.98	0.86
CD (P=0.05)	1.08	3.20	2.78	5.95	2.59

plus *Rhizobium* in groundnut.

Yield attributes and yield

Application of 20 kg N/ha plus *Rhizobium* plus PSB recorded significantly maximum no of pods perplant (28.80), no of kernels per pod (2.07), seed index (46.26g), seed yield (2655.58 kg/ha), haulm yield (3587.20 kg/ha), harvest index (42.31%) which were significantly superior over rest of all the treatments.

Economics

Experimental results revealed that application of 20 kg N/ha plus *Rhizobium* plus PSB recorded higher gross returns (12,940,91.24 INR) net returns (91,858.24INR) and benefit: cost ratio (2.44) and minimum gross returns (76,649.51 INR), minimum net returns (39,378.51 INR) and minimum benefit: cost ratio (1.06) were recorded with the treatment of 10 kg N/ha plus Rhizobium.

DISCUSSION

The increase in height of plants seems to have been brought about by increase in amount of growth substances and naturally occurring photo hormones with increased nitrogen supply. Nitrogen is one of the major essential plant nutrients for growth. Nitrogen is constituent of chlorophyll, which harnesses solar energy and fixes atmospheric CO_2 has carbohydrates and amino acids. These results are in confirmation with the findings of Anonymous 2008, Barik *et al*., (1994) Nitrogen application positively affect the start of root nodules formation and influenced its performance consequently increase in biological nitrogen. These Result are in close conformity with the findings of (Rekhi *et al*., 2000) in groundnut. An increase in yield by inoculation of bio fertilizers could be attributed to synergistic interaction among phosphate solubilizing microorganism and Brady Rhizobium which led to increased nodulation and nitrogen fixation was also reported by Jain and Trivedi (2005). The present investigation because of increased N content in kernel which might be the result of increased availability of nitrogen to plants. Higher nitrogen in kernel is directly responsible for higher protein because it is a primary component of

Table 3. Influence of Nitrogen levels and biofertilizers on yield attributes and yield of groundnut.

Treatment combinations	No. of pods/ plant	No. of kernels/ pod	Seed index (g)	Seed yield (kg/ha)	Haulm yield (kg/ha)	Harvest index (%)
10 kg N/ha + *Rhizobium*	22.20	1.60	40.84	1454.45	2393.00	37.81
10 kg N/ha + PSB	22.27	1.67	42.17	1537.81	2559.63	39.36
10 kg N/ha + *Rhizobium* + PSB	23.00	1.67	42.34	1588.17	2682.02	39.95
15 kg N/ha + *Rhizobium*	25.93	1.73	42.99	1945.64	3067.43	40.14
15 kg N/ha + PSB	26.87	1.80	43.89	2164.76	3181.66	40.42
15 kg N/ha + *Rhizobium* + PSB	27.20	1.73	45.42	2266.82	3473.14	41.86
20 kg N/ha + *Rhizobium*	28.60	1.67	45.10	2239.16	3240.08	40.85
20 kg N/ha + PSB	28.67	1.84	46.05	2266.55	3341.95	40.43
20 kg N/ha + *Rhizobium* + PSB	28.80	2.07	46.26	2655.58	3587.20	42.31
SEm±	0.95	0.082	0.82	104.71	111.63	0.60
CD (P=0.05)	2.84	0.24	2.48	313.93	334.68	1.82

Table 4. Influence of Nitrogen levels and biofertilizers on Economics of groundnut.

Treatment combinations	Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net return (INR/ha)	B: C ratio
10 kg N/ha + *Rhizobium*	37251	76649.51	39378.51	1.06
10 kg N/ha + PSB	37281	81042.76	43771.76	1.17
10 kg N/ha + *Rhizobium* + PSB	37491	83696.56	46275.56	1.24
15 kg N/ha + *Rhizobium*	37321	102535.06	65157.39	1.74
15 kg N/ha + PSB	37351	114083.03	76742.03	2.06
15 kg N/ha + *Rhizobium* + PSB	37561	124520.79	87029.79	2.32
20 kg N/ha + *Rhizobium*	37391	118003.73	80556.07	2.15
20 kg N/ha + PSB	37391	119447.36	82056.36	2.19
20 kg N/ha + *Rhizobium* + PSB	37631	129409.24	91858.24	2.44

amino acids which constitute the basis of protein. These results are in close conformity with the findings of Malligawad *et al.* (2000) and Singh *et al*. (2011) in groundnut. Nitrogen fertilizer is an important factor in achieving better growth and development of vegetative and reproductive organs of groundnut and with increases of photosynthesis rate and photosynthetic matters production, seed yield and yield components of groundnut was increase (Abdzad Gohari, and Amiri, 2010). If might be due to mineralization of organic form of nutrients and better utilization of both macro and micronutrients fertilizers in the presence of organics. The increased supply of N and P and their higher uptake by plants might have stimulated the rate of various physiological processes in plant and led to increased growth and yield parameters and resulted in increased pod and haulm yields. The application of micronutrients and organics helped in slow and steady rate of nutrient release in to soil solution to match the required absorption pattern of groundnut thereby increase the yield. This Results similar under Srivastava (2002); Sharma *et al*. (2005); Mohan Kumar *et al*. (2005) and Kamdi (2014).

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