

EFFECT OF APPLIED NITROGEN AND PHOSPHORUS ON THE NODULATION IN GROUNDNUT (*Arachis hypogaea* L.*

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The elements nitrogen and phosphorus have been found to have profound influence on the nodulation and the subsequent nitrogen fixation by groundnut. Excess of nitrogen leads to retardation in nodulation. Hence the present experiment was taken up with a view to studying the influence of N and P on the nodulation in groundnut in red loam soils of Kerala.

Materials and Methods

The experiment was laid out at the Agricultural College Farm Vellayani with TMV.2 groundnut. The treatment combinations of three levels of 0, 40 and 20 kg N/ha and five levels of 0, 25, 50, 75 and 100 kg P, O₅/ha fitted in a randomised block design with 3 replications were adopted in the experiments.

Nitrogen as urea and phosphorus as super phosphate were applied as basal dressing. A uniform dose of 30 kg/ha of K₂O as muriate of potash, lime (Ca(OH)₂) at 1000 kg/ha, magnesium carbonate at 500 kg/ha, sodium molybdate at 0.5 kg/ha and sodium borate at 20 kg/ha were applied to all the plots. The observation on weight and number of nodules was taken at three different stages of two weeks four weeks and six weeks after sowing.

Results and Discussion

The data were statistically analysed and the mean values are given in Tables 1 to 6. It is seen that nitrogen has significantly reduced the number and dry weight of nodules at all the three stages of observation. The reduction was significant at the 10 and 20 kg doses of nitrogen. Identical results were obtained by Allas and Bartholomeu (1959), Cowling (1961), Tiwari (1964), Nair (1966) and Vijayakumar (1967). This may probably be due to the fact that nitrogen fixing bacteria when supplied with readily available nitrogen became inactive and less efficient in fixing atmospheric nitrogen thereby retarding the formation of nodules (Russel, 1961).

Contrary to the behaviour of nitrogen, phosphorus application has significantly increased the mean number and dry weight of nodules at all the three stages of observations the maximum number and dry weight of

Table 1

Mean number of nodules per plant at two weeks after planting

Levels of N (kg/ha)	Levels of P ₂ O ₅ (kg/ha)					Mean
	0	25	50	75	100	
0	118.67	167.40	176.27	184.67	195.47	168.50
10	99.53	154.27	161.47	172.93	182.00	150.04
20	87.33	106.87	130.47	141.87	150.07	123.32
Mean	101.84	142.85	156.07	166.49	175.85	

C. D. (5%) for comparison between levels of N = 3.90

" " " P₂O₅ = 5.03

" " combinations = 8.71

Table 2

Mean number of nodules per plant at four weeks after planting

Levels of N (kg/ha)	Levels of P ₂ O ₅ (Kg/ha)					Mean
	0	25	50	75	100	
0	148.37	195.47	208.40	237.73	249.33	207.86
10	133.07	183.20	191.67	210.07	219.20	187.44
20	126.63	140.27	150.53	162.20	174.33	150.81
Mean	136.07	172.98	183.53	203.03	214.29	

C. D. (5%) for comparison between levels of N = 6.82

" " " P₂O₅ = 8.50

" " combinations = 5.25

nodules being noticed at the 100 kg level of P₂O₅. This observation is in conformity with findings of Janes *et al* (1944), Vyas and Desai (1953), Sen and Bains (1955), Nair *et al* (1957), Deshpande and Bathkal (1965), Nair (1966). The applied phosphorus might have stimulated the rapid multiplication of rhizobia which has led to the formation of more of root nodules per plant.

Table 3

Mean number of nodules per plant at six weeks after planting

Levels of N (kg/ha)	Levels of P ₂ O ₅ (kg/ha)					Mean
	0	25	50	75	100	
0	104.20	157.93	167.86	174.27	185.40	157.93
10	84.47	137.67	148.47	160.40	171.40	140.48
20	74.60	96.37	110.80	119.53	128.27	105.91
Mean	87.76	130.66	142.38	151.40	161.69	

C. D (5%) for comparison between levels of N = 2.92

" " " " P = 3.77

" combinations = 6.52

Table 4

Mean dry-weight of nodules per plant at two weeks after planting

Levels of N (kg/ha)	Levels of P ₂ O ₅ (kg/ha)					Mean
	0	25	50	75	100	
0	147.67	209.67	220.00	231.33	245.00	210.74
10	124.00	193.67	201.00	215.33	227.67	192.33
20	109.00	133.67	162.67	180.33	187.00	154.53
Mean	126.89	179.00	194.56	209.00	219.00	

C. D. (5%) for Comparison between levels of N = 4.91

" " " " P = 6.33

" combinations = 10.97

The interaction between nitrogen and phosphorus also was significant at 1 % level. The tendency of phosphorus to increase the mean number and dry-weight of nodules was retarded by nitrogen in all the treatment combinations.

It is noticed from the Tables that the number and weight of nodules have increased from the first stage to the second stage and thereafter decreased in the third stage of observation. In the first stage the root growth might have

Table 5

Mean dry-weight of nodules per plant at four weeks after planting (in mg)

Levels of N (kg/ha)	Levels of P ₂ O ₅ (kg/ha)					Mean
	0	25	50	75	100	
0	185.33	244.00	260.00	296.67	311.00	259.40
10	166.67	228.67	236.67	262.33	273.33	233.33
20	156.33	175.67	188.00	203.00	218.00	188.20
Mean	169.44	216.11	228.22	253.33	267.44	

C. D. (5%) for comparison between levels of N = 2.603

" P = 3.360

" combinations = 5.820

Table 6

Mean dry-weight of nodules per plant at six weeks after planting (in mg)

Levels of N (kg/ha)	Levels of P ₂ O ₅ (kg/ha)					Mean
	0	25	50	75	100	
0	130.00	197.00	210.33	218.00	232.00	197.47
10	106.33	172.00	185.67	200.00	214.00	175.67
20	92.33	120.00	138.67	149.67	160.00	131.13
Mean	109.55	163.00	178.22	189.33	202.00	

C. D. (5%) for comparison between levels of N = 3.624

" P = 4.686

" combinations = 8.104

been too less to accommodate more number of nodules, which has increased considerably in the second stage resulting in maximum nodulation. Also it might have been too early for the bacteria and the plant to mobilise the activity of nodulation to have the maximum number of nodules established at the first stage. Again in the third stage a decrease was noticed. Russel (1961) stated

•that nodule production is associated with extensive root formation and that nodules of annual legumes tend to die out during active flowering and seed setting stages.

Summary

An experiment was conducted in red loam soils of the farm attached to the Agricultural College Vellayani, with the object of studying the effect of applied nitrogen and phosphorus on the nodulation in groundnut. The levels of nitrogen were 0, 10 and 20 kg/ha and those of phosphorus 0, 25, 50, 75, and 100 kg/ha. The number and dry weight of nodules per plant observed at three stages of 2, 4, and 6, weeks after planting were studied. Application of nitrogen significantly reduced and the phosphorus application significantly increased the mean number and dry - weight of nodules at all the three stages of observation. It was also noticed that both the mean number and dry - weight of nodules have increased from the first stage of observation to the second stage and thereafter decreased in the third stage.

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സംഗ്രഹം

നിലക്കടലയിൽ മൂലാർബുദങ്ങൾ ഉണ്ടാക്കുന്നതിൽ നൈട്രജനും, ഫോസ്ഫറും ഉള്ള പ്രേരണ പാഠിക്കുന്നതിനായി, കേരളത്തിലെ വെള്ളായണിയിലുള്ള കാർഷിക കോളേജിന്റെ തോട്ടത്തിലുള്ള ചുവന്ന ലോം *mgpfjta flios* പരീക്ഷണം നടത്തുകയുണ്ടായി. നൈട്രജൻ ഹെക്ടറിന് 0, 10, 20 കിലോഗ്രാം കണക്കിലും, ഫോസ്ഫറസ് 0, 25, 50, 75, 100 കിലോഗ്രാം എന്നീ കണക്കിലും എല്ലാചേരുവകളിലും നൽകുകയുണ്ടായി. നിലക്കടല നട്ടു 2, 4, 6, ആഴ്ചകൾക്കുശേഷം മൂലാർബുദങ്ങളുടെ എണ്ണവും, തൂക്കവും, പരിശോധിച്ചതിൽ നിന്നും താഴെപറയുന്ന വിവരങ്ങൾ ലഭിക്കുകയുണ്ടായി. നൈട്രജൻ എല്ലാതോതിലും മൂലാർബുദങ്ങളുടെ എണ്ണവും, തൂക്കവും കുറയ്ക്കുകയും, ഫോസ്ഫറസ് ഇവ രണ്ടും വർദ്ധിപ്പിക്കുകയും ചെയ്തു. മേൽപറഞ്ഞ വ്യത്യാസങ്ങൾ മുൻപറഞ്ഞ മൂന്നുദശകളിലും ദർശിക്കുകയുണ്ടായി. മൂലാർബുദങ്ങളുടെ എണ്ണവും തൂക്കവും $\text{rosn}^{\circ}(5ra)^{\wedge}ca)1^{\ast}3i$ നിന്നും, നാലുആഴ്ച പ്രായമായപ്പോൾ പൊതുവേ വർദ്ധിക്കുകയും, വീണ്ടും ആദ്യ ആഴ്ച പ്രായമായപ്പോൾ കുറയുകയും ചെയ്തു.

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