STUDIES ON THE EFFECT OF NITROGEN AND PHOSPHORUS ON THE YIELD AND QUALITY OF GROUNDNUT
(Arachis hypogaea. L) IN THE RED LOAM SOILS OF KERALA*

K. I. PUNNOOSE and C. M. GEORGE[1]

College of Agriculture Vellayani

Trials conducted in various parts of the country clearly indicate the possibility of increasing the per heptare yield of groundnut pods by adopting judicious manurial practices. Increase in the yield of groundnut by the application of nitrogenous fertilizers has been reported by Seshadri (1962), Katarki and Banahati (1965) and Maini and Nijhawan (1966). Trials conducted on groundnut by Panikkar (1961), Seshadri (1962), Jakate (1963) and Bodade and Rao (1967) using phosphatic fertilizers also have given promising results. The present investigation has been taken up with a view to study the effect of nitrogenous and phosphatic fertilizers on the yield and quality of the popular variety of groundnut (TMV-2) and to fix optimum and economic doses of these major nutrients for this crop in the red loam soils of Kerala.

Materials and Methods

The experiment was laid out in the farm attached to the College of Agriculture Vellayani. The soil is red loam of medium fertility status. The crop was grown during the south west monsoon season, from June to September in 1967. The bunch variety of groundnut, TMV-2 was used for the investigation. *Treatments*: The treatments consisted of factorial combinations of three levels of nitrogen (0, 10 & 20 kg N/ha and five levels of phosphorus (0, 25, 50, 75 & 100 kg P_2O_5/ha).

The experiment was laid out in a randomised block design and replicated thrice. The fertilizers were applied as basal dressing. The crop was harvested and the dry weight of pods was recorded. Samples of kernels were taken from each plot for the estimation of protien and oil contents. Nitrogen was estimated by Kjeldahl's method. The percentage of protein was calculated by multiplying the nitrogen percentage with the factor 6.25. Oil content was estimated by the cold percolation method (Kartha and Sethi, 1957).

Results and Discussion

Yield   of   Pods

          The data relating to the yield of pods and percentages of oil   and   protein contents of the kernel were statistically analysed and the mean values   are   presented in Tables 1 to 3.

          Table 1 furnishes the mean yield of pods as influenced by the various treat- ments.   Nitrogen both at 10 and 20 kg. levels has significantly increased the yield of pods over no nitrogen.   The 20 kg. level recorded a slight reduction in yield as compared to the 10 kg. level though this reduction was not statistically   significant. While the 10 kg. level of nitrogen gave 8.1   per cent increase in pod   yield over control, the 20 kg level gave only 7.30 per cent increase.   The response per Kg. of nitrogen was 15.45 kg. at 10 kg. level and 14.09 kg. at 20 kg. level of nitrogen application.   The increase in yield obtained in this investigation by nitrogen   may be due to the increased photosynthetic activity   leading to   production of   more carbohydrates, fats and proteins, thus ultimately increasing   the   pod yield.   The depressing effect of nitrogen on pod yield at higher levels of application was reported by Prabhakara Reddi and Sanyasi Rao (1965), and   Singh   (1962).   This tendency to reduce the pod yield at the higher levels of nitrogen application may be due to the effect of excess   nitrogen in   stimulating vegetative growth at the expense of flower and fruit development (Harris and Bledose, 1951 and Ebong, 1965).

Table 1

Yield of pods (kg. per hectare)

Levels of nitrogen Kg/ha	Levels of P_2O. kg/ha					Mean
	0	25	50	75	100	
0	1654.38	1845.27	1957.08	2017.98	2054.34	1911.45
JO	1790.73	1986.17	2167.97	2195.24	2181.60	2067,,98
20	1772.55	2000.89	2177.06	2154.33	2136.15	2054 ,34
Mean	1740.74	1945.26	2108.88	2122.52	2123.88	

C. D. (5%) for camparison between levels of nitrogen   67.136

P_2O.   = 86.681

          Application   of   phosphorus   at   all levels has progressively increased the yield of pods.   The increase was significant up to the 50 kg. level of P_2O_5, beyond which there was only slight increase.   It is observed that the response obtained per kg. of PA. applied, decreased progressively as the level of P_2O_5 was   increased.   The res- ponse per kg. of P_2O obtained were 8.18 kg. pods between the levels of 0 and 25kg., 6.54 kg between 25 and 50 kg., 0.55 kg. between 50 and 75 kg. and 0.05 kg. between 75 and 100 kg. levels of P_2O_5. similar results   were   obtained by Panikkar   (1961) and Seshadri (1962) in groundnut.

The treatment combination of 10 kg. nitrogen and 75 kg. P_2O_5 has recorded the maximum yield of pods, while the lowest yield was for the combination of no nitrogen and no P_2O_5. The interaction between nitrogen and phosphorus in increasing the yield of nods was not significant though there was a positive trend noticed. Similar results have been reported by Huber (1957). The highest mean yield of pods was noticed for the combination of 10 kg. nitrogen and 75 kg. P_2O_5. increasing the level of nitrogen to 20 kg. has resulted in a decrease in yield. Wahab and Muhammed (1958) reported that nitrogen at higher levels in combination with phosphorus reduced the beneficial effect of phosphorus on the pod yield of groundnut.

QUALITY

Oil *Content of kernel:*

The mean values for the treatment combinations are given in Table *2*. The application of nitrogen has significantly reduced the percentage of oil in kernels both at 10 and 20 kg. levels. On the other hand, phosphorus has given

Table 2

Percentage of oil in kernels

Levels of nitrogen kg ha	Levels of phosphorus kg/ha					Mean
	0	25	50	75	100	
0	44.37	46.14	46.98	47.58	48.11	46.64
10	43.18	45.28	46.32	46.93	47.52	45.85
20	42.87	44.16	45.28	46.10	46.84	45.05
Mean	43.44	45.19	46.19	46.87	46.84	

C. D. (5%) for comparison between levels of nitrogen = 0.092
P_2O_5. = 0.118
„ combinations = 0.205

a progressive and significant increase in the percentage of oil upto the highest level tried. The interaction between nitrogen and phosphorus also was found significant. The combination of no nitrogen and 100 Kg. P_2O has given the maximum oil content while the combination of 20 Kg. nitrogen and no P_2O has recorded the lowest value. The favourable effect of phosphorus in increasing the oil content obtained in this trial is in agreement with the results obtained by Oram (1950), Dalai (1950) and Nijhawan (1962) in groundnut.

Protein   content   of   kernel

It is seen from Table 3 that nitrogen has significantly increased the protein content both at 10 and 20 Kg. levels. Similar results were reported by Nijhawan (1962) in groundnut.

Table 3

Percentage of protein in kernels

levels of nitrogen kg/ha	0	Levels of Phosphorne kg/ha 25	50	75	100	Mean
0	24.58	24.51	24.62	24.70	24.68	24.62
10	25.03	25.16	25.11	25.25	25.38	25.19
20	55.40	25.43	• 25.56	25.48	25.58	25.49
Mean	25.00	25.03	25.10	25.14	25.21	

C. D.   (5%) for comparison between levels of nitrogen = 0.063

>.   combinations   0.081 — 0.140

Phosphorus also has significantly increased the protein content with in-Creasing levels of its application. The 100 Kg. level of P_2O_5 gave the maximum per cent of protein. This increase in protein content of seed with application of phosphorus may be due to its beneficial role in protein synthesis. It can also be due to the increased uptake of nitrogen by the plant in the presence of phosphorus. Though the combined effect of nitrogen and phosphorus application was not significant, there was a positive trend to increase the protein content. This is due to the additive effect of these two nutrients.

Response Curve and Economics of Manuring

The yield-dose relationship obtained in this investigation is presented in Fig. 1 and 2. Quadratic response curves were fitted to the data for both nitrogen and phosphorus and are shown below:

Nitrogen   Y   1913.450 + 23.8615 N - 0.54085 N^2

Phosphorus   Y   1740.075 + 10.132 P - 0.063578 P

The average expected yields at different levels of nitrogen and phosphorus and the economics of manuring were worked out and presented in Table 4. From the response curve for nitrogen given in Fig. 1, it is evident that the optimum dose of nitrogen is 14.18 Kg/ha while for phosphorus it is 79.65 Kg P_2O_5/ha as seen from Fig. 2.

Table 4

Economics of application of nitrogen and phosphorus for groundnut

Level of nutrient in Kg./hectare	Yield of pods in Kg./hectare	Valu of produce Rs. Ps.	Increase or decrease over the lowest level Rs. Ps.	Cost of fertilizers Rs Ps.	Extra cost of fertilizer over that of ihe lowest level Rs. Ps.	Profit due to fertilizer application over the lowest level Rs. Ps
1. Nitrogen						
0	1914.00	1434.00		—	—	—
10	2068.00	1551.00	117.00	18.30	18.30	98.70
12.72	2081 00	1561.00	127.00	23.28	23.28	103.72*
20	2054.00	1541.00	107.00	36.00	36.00	70.40
2. Phosphorus						
0	1740.00	1305.00				
25	1954.00	1466.00	161.00	59.75	59.75	101.25
50	2088.00	1566.00	261.00	119.50	119.50	141 50
54.04	2102 00	1577.00	272.00	129.00	129.00	143.00*
75	2142.00	1607.00	302.00	179.25	179.25	122.75
100	2118.00	1589.00	284.00	239.00	239.00	45.00

Cost of Kg. of nitrogen = Rs. 1.83

P 0 Rs. 2.39

Value of 1 Kg. of pod = Rs. 0.7S

* Economic dose of nutrients

The economics of manuring also was worked out. It is seen that the economic dose of nitrogen is 12.72 Kg./ha and for phosphorus it is 54.04 Kg/ha. From Table 4, it is evident that of the two nutrients tried, phosphorus has given a better profit. The profit for phosphorus was Rs. 143.CO and that for nitrogen Rs. 103.72 at their respective economic levels.

Summary

A trial was conducted in the red loam soils of the farm attached to the College of Agriculture Vellayani, Kerala State, during the year 1967 to study the response to graded doses of nitrogen and phosphorus on the yield and quality of groundnut variety.

The data relating to the yield and quality factors were studied. Quadratic response curves were fitted to the yield data and the optimum as well as the economic doses of nitrogen and phosphorus were determined. There was significant positive response in yield to nitrogen and phosphorus application. The 10kg. level of nitrogen gave the highest yield. Phosphorus has progressively increased the yield with incremental doses. A combination of 10 Kg. nitrogen and 75 kg. P_2O has given the maximum pod yield of 2195.24 Kg/ha. The oil content of kernel was significantly depressed by nitrogen application. But phosphorus application has resulted in a significant increase in oil content. Graded doses of nitrogen and phosphorus could markedly increase the protein content of kernel. The economic doses were found to be 12.72 kg. nitrogen and 54.04 kg. P_2O_5/ha.

സംഗ്രഹം

കേരളത്തിലെ വെള്ളായണിയിലുള്ള കാർഷിക കോളേജിന്റെയും, ഗവേഷണസ്ഥാപന ത്തിന്റെയും തോട്ടത്തിലെ ചുവന്ന ലോം മണ്ണിൽ ടി. എം. വി—2 എന്ന ഗ്രൗണ്ട ഇനം നിലക്ക ടല കൃഷിചെയ്ത് 1967—ൽ ഒരു പരീക്ഷണം നടത്തുകയുണ്ടായി. ഹെക്ടാറൊന്നിന് 0, 10, 20 കിലോഗ്രാം വീതം നൈടജനും, 0, 25, 50, 75, 100 കിലോഗ്രാം വീതം ഫോസ്ഫാറസ്സും സാ ധ്യമായ എല്ലാ ചേരുവകളിലും ചേർത്ത്, നിലക്കടലയുടെ വിളവിലും, ഗുണത്തിലുമുണ്ടാകുന്ന പ്രതികരണങ്ങളും മനസ്സിലാക്കി.

ഈ മൂലകങ്ങൾ നിലക്കടലയുടെ വിളവിലുണ്ടാകുന്ന പ്രതികരണങ്ങൾ പഠിക്കുകയും, നൈടജന്റെയും, ഫോസ്ഫാറസ്സിന്റെയും പരമാവധി തോത്തും, ആദായകരമായ തോത്തും നിശ്ചയി ക്കുകയും ചെയ്തു. ഇതിൽ നിന്നും ഈ രണ്ട് മൂലകങ്ങളും നിലക്കടലയുടെ വിളവിൽ അനുകൂല പ്രതികരണങ്ങൾ ഉണ്ടാക്കുന്നു എന്ന് മനസ്സിലാക്കി. നൈടജൻ ഹെക്ടാറൊന്നിന് 10 കിലോഗ്രാം എന്ന തോത് പരമാവധി വിളവ് നൽകിയപ്പോഴും ഫോസ്ഫാറസ്സ് അതിന്റെ തോത് കൂടുന്ന തനുസരിച്ച് ക്രമമായ വിളവുവർദ്ധനവുണ്ടാക്കി. നൈടജൻ 10 കിലോഗ്രാമും, ഫോസ്ഫാറസ്സ് 75 കിലോഗ്രാമും ചേർത്ത് ഉപയോഗിച്ചപ്പോഴും ഹെക്ടാറൊന്നിന് 2195.24 കിലോഗ്രാം എന്ന തോതിൽ പരമാവധി വിളവ് ലഭിക്കുകയുണ്ടായി.

നിലക്കടലയിലെ എണ്ണയുടെ അളവു് നൈട്രജൻറ തോതു് വർദ്ധിപ്പിച്ചതനുസരിച്ചു് കൂട്ടുകയും, ഫോസ്ഫറസ്സിൻറ തോതു് വർദ്ധിപ്പിച്ചതനുസരിച്ചു് കൂടുകയും ffl/ijcg). എന്നാൽ നിലക്കടലയിലെ പ്രോട്ടീൻറ അളവു്, ഈ rosni മൂലകങ്ങളുടേയും തോതു് വർദ്ധിപ്പിച്ചതനുസ 54.04 രിച്ചു് ക്രമമായി ഉയരുകയുണ്ടായി. നൈട്രജൻ 12.75 കിലോഗ്രാമും ഫോസ്ഫറസ്സ് കിലോഗ്രാമും ആദായകരമായ തോതുകളാണെന്നു് മനസ്സിലാക്കവാൻ സാധിച്ചു.

REFERENCES

Bodade, H. N. and Rao, S. B. P. 1967. Groundnut can put up a better show. *Indian. Fmg.* **17**, 41-42

Dalai, J. L. 1950. Effect of manuring on groundnut. *Fast Pb. Fanner. 2,* 4-6

Ebong, V. V. 1965. Cowpea production in Nigeria. *Mem. Food. Dep. Agr. Res.* Field Dept. Nigeria. 80, 1-9

Harris, H. C. and Bledose, R. W. 1951. The peanut, the unpredictable legume. The Nationa. Fertilizer Association, Washington, D. C.

Huber, A. 1957. Some observations on the correlated influence of fertilizers on peanut yields and vegetative development on the plant. *Plant and soil.* 8, 126-131

Jakete, P. N. 1963. A pacakage programme for groundnut. *Fert. News.* 8, 13-16

Katarki, B. H. and Banahathi, A. L. 1965. Effect of N, P and K on yields of groundnuts in black soils of Mysore State. *Indian Oilseeds J. 9,* 50-57

Maini, N. S. and Nijhawan H. L. 1966. Factors that affect groundnut quality. *Indian Fmg.* **15**, 31-33

Nijhawan, H. L. 1962. Response of groundnut to fertilizers. 1. C. A. R. Proceedings Series pp. **135-145**

Oram, P. A. 1950. High quality of groundnut for direct consumption. *World Crops 9, 5.*

Panikka, M. R. 1961. Balanced fertilizer application gives record groundnut yields. *Fert. News* *6,* 22-26

Prabhakara Reddy, G. and Sanyasi Rao. 1965. Fertilizer response in groundnut. *Indian Oilseeds J.* 9, 274-279

Seshardri., C. R. 1962. Groudnut - a monograph. Indian Oilseeds Committee

Singh, G. 1962. Thesis submitted to the University of Saugar for M. Sc. (Ag.) degree examination.

Wahab, A. and Muhammed, F. 1958. *Agron J. SO,* 1978-1980

(M. S. received: 16-11-1973)

RESPONSE CURVE FOR LEVELS OF NITROGEN
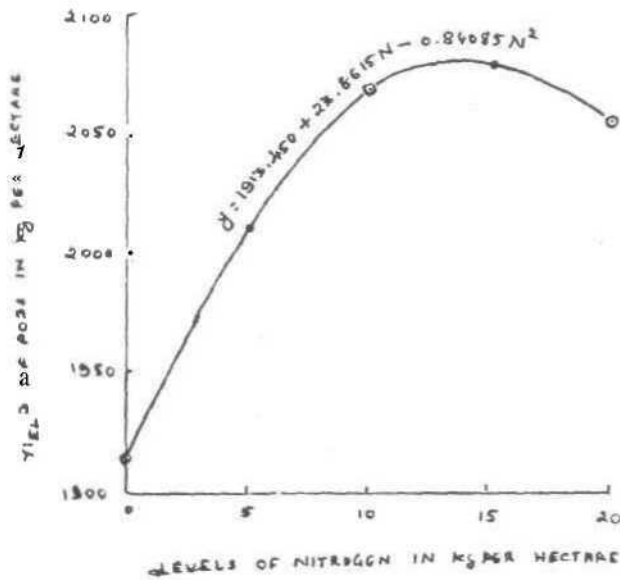
RESPONSE CURVE FOR LEVELS OF PHOSPHORUS