Pakistan J. Sci. Ind. Res., Vol. 20, No. 3, June 1977

EFFECT OF NPK FERTILIZERS ON POD FORMATION AND YIELD OF GROUNDNUT IN SOME BANGLADESH SOILS

Z.H. BHUIYA, M.S. HOQUE, A.H.M.M.MIAH and M.H.MIAN

Department of Soil Science, Bangladesh Agricultural University, Mymensingh(Bangladesh)

(Received April 29, 1977; revised September 25,1977)

Abstract. The effect of different levels of NPK fertilizers on pod formation and yield of Dacca-1 groundnut grown in pots in 4 different soils of Bangladesh, namely, Bangladesh Agrivarsity Farm Soil (S_1), Kuliar Char Soil (S_2), Sutiakhali Char Soil (S_3) and Madhupur Red Soil (S_4) were studied.

In all the soils, except S_4, the highest number of pods as well as the highest nut yield per plant was obtained by applying 30 kg N, 60 kg P_2O_5 and 60 kg K_2O/ha. The highest number of pods per plant was 42 and the highest nut yield per plant was 37.82 g, both obtained from the S_1 soil. In the S_4 soil, pod formation and nut yield increased with increases in the level of NPK fertilizers. The soils have a marked effect both on pod formation and nut yield. The soils ranked as follows: $S_1 > S_2 > S_3 > S_4$. according to their capability of producing pods and nut yield.

In recent years, increasing attention is being paid to the cultivation of groundnuts. This is an important oil crop, its kernel being used as food in various forms. There is an ample potential of cultivating this crop over wider areas in Bangladesh during the winter season without competing with the major field crops. The rational use of fertilizers can play an important role in boosting groundnut production. Research work on fertilizers requirements for successful production of groundnuts in various soils of Bangladesh are limited.

The present investigation was undertaken in order to evaluate the effect of various levels of NPK fertilizers on pod formation and yield of groundnuts in major soils of Bangladesh.

Materials and Methods

The experiment was conducted in pots in an open-net house using 4 soils of Bangladesh collected at different locations at a depth of 0-15 cm. The soil samples, collected from Bangladesh Agricultural University Farm; Kuliar Char; Sutiakhali Char; and Bangladesh Agricultural Staff Training Institute, Modhupur, are disignated, respectively, as S_1, S_2, S_3 and S_4 Mechanical analysis was done by the hydrometer method: organic matter, by the wet oxidation method of Walkley and Black; total nitrogen, by the Kjeldahl method: and available K_2O by Dyer's method as described by Piper.[6] The pH, nitrate nitrogen, ammonium nitrogen and available phosphorus were determined following the methods described by Black.[2] Soil samples were dried at room temperature and ground to pass through a 10-mesh sieve and thoroughly mixed. Each pot was filled with 6.25 kg of air dried soil. The characteristics of the soils are presented in Table 1.

The soils were treated with four levels of NPK fertilizers in the ratio of 1:2:2 (i.e. 1N $2P_2O_5$: $2K_2O$). The fertilizer sources and rates were as follows: urea-0, 20,30 and 40 kg N/ha; triple superphosphate-0, 40, 60 and 80 kg P_2O_5/ha; and muriate of potash - 0, 40,60 and 80 kg k_2O/ha. Fertilizers were placed in bands at a depth of 4 cm before sowing the seeds. Treatments were replicated 4 times for a total number of 64 experimental pots. The experiment followed a completely randomized design during the 1972 rabi season. Three shelled groundnuts of the high yielding Dacca-1 variety were planted in each pot after treating with ceresan. After the establishment of the seedilings in the pot only one healthy plant was allowed to grow in each pot; during the 1972 rabi season. Three shelled groundnuts of the high yielding Dacca-l variety were planted in each pot after treating with ceresan. After the establishment of the seedlings in the pot only one healthy plant was allowed to grow in each pot.

The nuts were harvested on April 30, 1973, after one hundred and forty days from sowing, at full maturity of the crop. Harvesting was done by uprooting the entire plant. Data were recorded on the pod number and nut yields.

Results and Discussion

Pod Formation. Data on pod formation and yield in groundnuts are presented in Table 2. Results of statistical analysis of pod formation in groundnut are also reported in Table 2.

TABLE 1. CHARACTERISTICS OF THE SOILS.

Soil properties	Univ. farm soil (S_1)	Kuliarchar soil (S_2)	Sutiakhali char soil (S_3)	Modhupur red soil (S_4)
Sand, %	9	85	88	26
Silt, %	65	12	10	33
Clay, %	26	3	2	41
Textural class	Silt loam	Loamy sand	Sand	Clay
pH	6.9	6.9	7.3	6.6
Organic matter (%)	1.73	0.22	0.03	0.79
Nitrate nitrogen (mg/100 g soil)	0.82	0.12	0.09	0.65
Ammonium nitrogen (mg/100 g soil)	0.40	0.08	0.03	0.30
Total nitrogen (%)	0.1	0.03	0.02	0.07
Available P (mg P_2O_5/ 100 g soil)	5.95	3.42	2.02	1.68
Available K (mg K_2O/ 100 g soil)	5.2	2.0	1.5	3.75

TABLE 2. EFFECT OF NPK FERTILIZERS ON POD FORMATION AND NUT YIELD[1]

Soils	Treatments				Mean[2]
	$N_0P_0K_0$	$N_{20}P_{40}K_{40}$	$N_{30}P_{60}K_{60}$	$N_{40}P_{80}K_{80}$	
(a) Pod formation (no./plant)					W0.05 = 4.64
S_1	37	42	42	32	37.81 a
S_2	16	17	18	21	17.87 b
S_3	9	10	11	10	9.75 c
S_4	5	10	10	15	9.81 d
(b) Nut yield (g/plant)					W0.05 = 3.17
S_1	28.99	28.58	37.82	19.78	26.29 a
S_2	14.02	11.53	14.90	13.86	13.58 b
S_3	7.61	6.38	9.22	7.77	7.75 c
S_4	4.05	5.66	5.86	9.33	6.22 d

[1]Results are the average of 4 replications. [2]Figures having a letter in common do not differ significantly.

There was a marked increase in pod formation in S_1 soil due to application of $N_{20}P_{40}K_{40}$. The application of $N_{30}P_{60}K_{60}$ did not produce significant change in pod number compared to the results for $N_{20}P_{40}K_{40}$. With the application of $N_{40}P_{80}K_{80}$ there was a sharp decrease in pod number in S_1 soil, but an increase in S_2 and S_4 soils (Table 2). The highest number of pods was found in S_1 and pod formation was very low in S_3 and S_4 soils. Satyanarayana and Krishna Rao[8] observed an increase in pod number per plant of groundnut by applying N, P_2O_5 and K_2O each at the rate of 24 kg/ha . The results of Tukey's W-test presented in Table 2 reveal that S_1 significantly differs from all the soils while S_2 differs significantly from S_3 and S_4 soils in pod formation.

Nut Yield. The results recorded in Table 2 indicate that, except in S_4, there was no definite trend in nut yield due to the applications of different levels of NPK fertilizers. It may be mentioned here that there were more unfilled pods for the treatment $N_{20}P_{40}K_{40}$ in

the S_1, S_2 and S_3 soils. In S_4 soil, the nut yield showed a continuous increase due to the application of increasing amount of NPK fertilizers. But only the performance of the treatment $N_{40}P_{80}K_{80}$ was significantly different from the rest three treatments (Table 3). The results in Table 2 show that the highest nut yield of 37.82 g per plant was recorded for $N_{30}P_{60}K_{60}$ treatment in S_1 soil. It may be mentioned here that the highest number of pod per plant was also obtained in the same soil for the same fertilizer treatment. The highest nut yields in S_2, S_3 and S_4 were, respectively, 39, 24 and 25% of the highest yield in S_1. Rahman[7] conducted an experiment

TABLE 3. TUKEY'S W-TEST ON THE EFFECT OF SOIL-FERTILIZER INTERACTION ON GROUNDNUT YIELD.

Treatments	Mean*	
S_1 – $N_{30}P_{60}K_{60}$	37.82	a
S_1 – $N_0P_0K_0$	28.99	b
S_1 – $N_{20}P_{40}K_{40}$	28.58	b
S_1 – $N_{40}P_{80}K_{80}$	19.78	c
S_2 – $N_{30}P_{60}K_{60}$	14.91	cd
S_2 – $N_0P_0K_0$	14.02	cd
S_2 – $N_{40}P_{80}K_{80}$	13.86	cd
S_2 – $N_{20}P_{40}K_{40}$	11.28	cd
S_4 – $N_{40}P_{80}K_{80}$	9.33	cd
S_3 – $N_{30}P_{60}K_{60}$	9.22	d
S_3 – $N_{40}P_{80}K_{80}$	7.77	d
S_3 – $N_0P_0K_0$	7.61	d
S_3 – $N_{20}P_{40}K_{40}$	6.38	d
S_4 – $N_{30}P_{60}K_{60}$	5.91	e
S_4 – $N_{20}P_{40}P_{40}$	5.66	e
S_4 – $N_0P_0K_0$	4.05	e

W0.05 = 8.62

*Figures which have a letter in common do not differ significantly.

in S_1 (Agrivarsity) soil and found the highest groundnut yield for $N_{30}P_{60}K_{60}$ treatment. Thus, the finding of Rahman is in good agreement with the result obtained in the present investigation. In the present study, the application of $N_{30}P_{60}K_{60}$ produced 30% increase in nut yield over control in S_1 soil while there was 130% increase in nut yield over control in S_4 soil due to $N_{40}P_{80}K_{80}$. Gillier[5] observed 20-50% increase in groundnut yield due to the application of NPK fertilizers.

It is important to note that the results on pod number and nut yield per groundnut plant obtained from different soil were in the order of $S_1 > S_2 > S_3 > S_4$ except for $N_{40}P_{80}K_{80}$ treatment. With the exception of S_4 soil, such a trend in the results on pod formation and nut yield may be explained by the nutrient contents in the soils which were in the decreasing order in S_1, S_2 and S_3 soils. The lowest pod formation and nut yield in S_4 soil is, probably, due to very low content of available P (1.68 mg P_2O_5/100 g soil) and high content of clay (41%) that might have acted as limiting factors. Evelyn and Thomton[4] conducted NPK factorial trials on 3 upland sandy loam soils and reported a significant effect of P on nut yield. A reference to soil characteristics in Table 1 shows that S_1 is a silty loam, S_2 a loamy sand, S_3 a sand and S_4 a clay soil. As per Tukey's W-test, the fertilizer teratment $N_{30}P_{60}K_{60}$ in S_1 soil has been found to be significantly superior to all other soil fertilizer combinations (Table 3). The best performance of the friable well drained silt loam Agrivarsity Farm soil (S_1) complies with the argument of de Geus[3] who reported that friable well-drained soil is the best producer of groundnut. Patten[1] stated that soil type and drainage are particularly important in groundnut production.

References

1. E.T. Batten, Pea Nut Production 8th Plant. **110**, 16 (1949), Cited from Field Crop Abstracts, **2**, 4/5, (1964).
2. C.A. Black, *Methods of Soil Analysis,* Part II. *Chemical and Microbiological Properties,* (Am. Soc. Agron. Inc., Madison, Wisconsin, U.S.A., 1965).
3. J.G. de Geus, *Fertilizer Guide for Tropical and Subtropical Farming* (Conzetl & Huber, Zurich, Switzerland, 1967).
4. S.H. Evelyn and I. Thomton, Emp. J. Expt. Agric., **32**, 153 (1964).
5. P. Gillier, Oleagineux, **11**, 1 , 7-13, Cited from Field Crop Abstracts, **9**, 2,92 (1956).
6. C.S. Piper, *Soil and Plant Analysis* (Adelaide University Press, Australia, 1950).
7. L. Rahman, Abstract Section of Agril. 21st and 22nd Pakistan Sci. Conf., p. 75 (1970).
8. P .Satyanarayana and D.V. Krishna Rao, Andhra Agric. J., **9**, 6,329 (1962).