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YIELD RESPONSE OF PEANUTS TO FERTILIZER NITROGEN, PHOSPHORUS AND POTASSIUM ON THE "BROWN SANDS" OF GUYANA

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Since 1963, investigations were started to determine the suitability of Groundnuts (Arachis hypogea) as a crop for the "Brown Sands" situated in the Intermediate Savannahs of Guyana. Unfortunately, the fertilizer investigation* were confined to the comparison to complete fertilizers that were commercially available. This program had serious limitations as no estimation of the nutrient requirements of the crop has been obtained.

The present studies, done during the short rainy season 1968 and the long wet season of 1969, were designed to obtain an indication of the requirements of groundnuts of nitrogen, phosphorus and potassium.

MATERIALS AND METHODS

SOIL: The experiments were carried out on the soil, Ebini sandy loam a Red-yellow podzol (Typic normachrult), at the Ebini Crop Station, - Berbice River. Some of the chemical and physical features of the top - 15 cm (six inches) are presented in table 1.

Table 1. Some chemical and physical properties of the top 15 cm (six inches) of Ebini sandy loam.

pH	Truog-P (ppm)	Total N %	PBS	m.e./100 g				%		
				Exch. K	Exch. Ca	Exch. Mg	C.E.C.	Sand	Silt	Clay
5.3	1.1	0.04	61	0.02	0.30	0.30	1.22	60	24	16

The experiments were of a 3^3 factorial design replicated twice. Each replicate was divided into three blocks of nine plots each with the (W) and (X) components of the N P K interation confounded in replications one and two respectively. The treatments within each block were randomised.

The experimental variables are shown in table 2. Nitrogen, potassium and phosphorus was applied as ammonium suphate, potassium chloride and triple superphosphate respectively.

Plots were six by three metres (20 x 10 feet). The rows were 60 cms (two feet) apart and the plants 20 cms (eight inches) within the row.

Table 2. Rates of experimental variables in kg per hectare.

Levels	Experiment 1			Experiment 2		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O
1	108	108	100	36	55	165
2	133	165	143	72	110	220
3	165	222	177	108	165	275

*Wagenaar, G.W., 1965. Report of the Soil Survey Project of British Guiana, Vol.2.
Soil Chemistry and Soil Management, U.N.S.F.; F.A.O Rome.

The site used was under natural savannah grass (Trachypogon plumosus) vegetation. Before planting the area was disced twice and any remaining savannah grass was raked off. Dolomitic limestone (1680 kg/ha) was broadcast about three weeks prior to planting of the first experiment. Three seeds treated with Agrosan were planted per hole and then thinned to two on germination. Plants were sprayed against Cercospora sp with zinc-propylenebis-dithiocarbamate (Antracol) when two weeks old and then at weekly intervals. Gypsum, (504 kg/ha) was applied to the rows at flowering.

The nitrogen and potassium fertilizers were put on in two equal applications, at planting and at 35 days after. All phosphorus were applied at planting.

The plants were harvested and the yields of sun-dried pods per plot recorded. The results were statistically analysed according to Cochran and Cox (1957).

Soil samples were taken before the planting of the first and second experiments and again at harvest of the second experiment. Soil samples were analysed for N by the micro-kjheldahl method; available-P colorimetrically after extracting with Truog's solution (o.002 N-H_2SO_4, buffered with $(NH_4)_2SO_4$ at pH3); and potassium flame-photometrically after extracting with IN-NH_4OAC at pH 7.0.

RESULTS AND DISCUSSION

YIELDS

EXPERIMENT 1. The yield results are presented in the two-way tables of mean yields (table 3).

Table 3. Two-way tables of mean yields of sun-dried pods (kg/ha)

		Nitrogen			Potassium			
		N_1	N_2	N_3	K_1	K_2	K_3	Means
Phosphorus	P_1	615	661	581	433	638	786	619
	P_2	444	421	359	313	410	501	408
	P_3	421	604	479	570	285	649	501
				Means	439	441	645	
Potassium	K_1	490	479	348				
	K_2	342	569	422	S.E.(mean of 18 plots)± 33			
	K_3	649	638	649	S.E.(mean of 6 plots)± 57			
Means		494	662	473				

NITROGEN: Increasing nitrogen from 110 to 168 kg/ha had no significant effect on the peanut yield. The yield at the highest level was lower than those at the second level; although this difference was not significant, it does indicate that high levels of nitrogen tend to depress yields.

PHOSPHORUS: Increasing phosphorus from 108 to 222 kg/ha had a very significant depressing effect on yields. The yield of the third level was higher than that of the second level but the difference was not significant.

POTASSIUM: Potassium had a very significant positive effect on peanut yields. Increasing K from 100 to 177 kg/ha caused an increased of 207 kg peanuts per hectare, 204 kg of which was caused by the increase of K from 143 to 177 kg/hectare. Indications are that higher levels of K will cause further yield increases.

P K INTERACTION: This was the only significant two-factor interaction. Examination of the interaction showed that increasing K from 100 to 177 kg/ha caused a significant increase in peanut yield only at the lowest level of phosphorus. This is in agreement with the general finding that the higher levels of P depressed the yields of peanuts.

These results indicate that with the exception of potassium the range of nutrient levels tried was too high. As a result, no exact recommendation could be given for optimum levels of N and P, as these may be considerably lower than the lowest level tried in this experiment. For K it appeared that levels greater than 177 kg/ha will give increased yields.

EXPERIMENT 2: Yield results are presented in table 4. Examination shows that neither applied N, or K within the ranges tested, had any significant effects on yield. There were also no significant two-factor interactions.

Table 4. Two-way tables of mean yields of sun-dried pads (kg/ha).

		Nitrogen				Potassium			
		n_1	n_2	n_3		k_1	k_2	k_3	Means
Phosphorus	p_1	1238	1434	1509		1293	1445	1444	1393
	p_2	1183	1199	1478		1238	1352	1279	1290
	p_3	1439	1428	1481		1496	1205	1647	1449
Potassium	k_1	1371	1258	1395	Mean	1341	1334	1457	
	k_2	985	1675	1341	S.E. (Mean of 18 plots) ± 94				
	k_3	1503	1127	1740	S.E. (Mean of 6 plots) ± 162				
Means		1287	1354	1492					

The lack of response to N and K may be attributed to the increase of the levels of these two nutrients in the soil (table 5); this was caused by the heavy applications in the previous experiment. The reason given above cannot explain the lack of response to P (table 5); it is therefore probable that the levels of P tested were still too high.

Table 5. Levels of N, P and K before planting Expts. 1 and 2.

Nitrogen (%)				Truog-P (ppm)				Available-K (ppm)			
Native	Before planting Expt. 2			Native	Before planting Expt. 2			Native	Before planting Expt. 2		
	n_1	n_2	n_3		p_1	p_2	p_3		k_1	k_2	k_3
0.04	0.10	0.12	0.11	1.1	1.9	1.8	1.4	7.8	19.5	19.5	19.5

The yields obtained in this experiment were generally higher than those of experiments. Probable reasons for this difference are:

1. The supply of rain during this growing period was more adequate than during the growing period of experiments, compared to 32 cm.

2. A build up of active Rhizobia in the soil. This suggests that the belief that inoculation has no effect on the yields of peanuts on "Brown sands" will have to be tested.

3. The application of the elements in better balanced ratios.

From the work reported, it is not yet possible to give absolute recommendations for the optimum levels of N, P and K for peanuts on the "brown sands"

RESUMEN

Durante la breve temporada de las lluvias del 1968 y la larga sequía del 1969 se llevaron a cabo, en los terrenos franco-arenosos de Ebini, Guyane, dos experimentos con NPK 3 x 3 x 3. En el primer experimento el nitrógeno (110 a 168 kg/ha) no produjo significativamente el rendimiento, y el potasio (100 a 177 kg/ha) los aumentó grandemente. En el segundo experimento los rendimientos por lo genral fueron mayores aunque no fueron efectuados por las aplicaciones de N.P y K. Se dan las posibles explicaciones.