Effect of Lime and Potash on the Yield and Quality of Groundnut (*Arachishypogae* Linn.) in the Red loam Soils of Kerala State*

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Received for publication December 30, 1965

The importance of calcium and potassium in the nutrition of legumes including groundnut has been reported by many investigators. It has been emphasised that the status of calcium and potassium in soils greatly influencespod production in groundnut. ColwelS *el al* (1946) observed that response to application of potassium increased when it was combined with lime in soils which were low in both the plant nutrients.

Though consistent results by way of increased yields and better quality have been achieved by the application of lime, it has been observed by many workers that mere application of potash in the absence of lime has a depressing effect on the yield and quality of the crop. In U. S. A. investigations have shown that positive response could be obtained by a judicious combination of these nutrients. In India, studies on the combined application of lime and potash are rather limited.

The soils of Kerala generally are characterised by poor lime and potash status. Under such conditions a crop like groundnut, the area of which is gaining every year, is likely to respond very favourably to the application of lime and potash. The present investigation has therefore been taken up to study the effect of graded doses of lime and potash on groundnut in the red loam soils and to assess how far a combined optimum dose of these two nutrients could influence the yield and quality of the crop for obtaining maximum economic returns.

Review of Literature

A. Studies on calcium nutrition in groundnut

Results obtained by the use of lime on peanuts by various investigators indicate that the quality of peanuts is affected much more than the quantity. Peanuts grown on soil having sufficient lime are usually better filled, the shells are whiter, and they have greater weight per bushel.

Strauss and Grizzard (1946) studying, ten fields of five soil types, showed that the percentage calcium saturation of the exchange complex was correlated with the average weight of nuts produced by a plant. Brady *et a!* (1948) stated that of the various

* Condensed from the Thesis submitted by P. G, Veeraraghavan to the University of Kerala for the M. Sc. (Agri.) degree in Agronomy, 1964. Published by kind permission of the University of Kerala, Trivandrum.

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nutrients added to the fruiting zone, calcium was the only one which consistently increased fruit filling. Bledsoe and Harris (1950) noted that the pods absorbed potassium and calcium in larger quantities than phosphorus or magnesium from the growing medium.

Puh (1953) found that application of lime at 1500-3000 kilograms per hectare could increase peanut yield by more than 40 per cent. According to Venkatarao and Govindarajan (1960), results of manurial experiments in the red loam soils of Hebbal have shown that the treatment with lime alone at half ton per acre increased the yield of pods by over 10 per cent while the combined application of lime with phosphoric acid at 60 ib per acre increased the yield by 20 per cent. Kothandaraman (1960) from his pot culture studies found that liming acid soil (pH 4.5) increased the yield of pods by nearly 43 per cent. Chakrabarthy *et al* (1961) reviewing the liming experiment at Ranchi, report that liming a soil of pH 5.3 with 3600 lb of lime alone per acre increased groundnut yield by 123 per cent as against 18 per cent by NPK fertilizers alone. The combined applications of lime and NPK fertilizers has recorded 154 per cent increased yield over the control.

B. Studies on potassium nutrition in groundnut

Investigations in the United States have shown that despite the relatively large amount of K absorbed by peanuts, the yield responses to applications of potash fertilizers are often small or negligible even on soils of low potassium content. Brady *et al* (1946) found in North Carolina that on a soil low in both potassium and calcium there was significant increase in yield from the addition of potash when adequate calcium was supplied. Without the addition of calcium, potash was found to decrease the yield of peanuts. It was observed that potash stimulated vegetative growth but caused a reduction in peanut quality.

Panikkar (1961) reviewing the results of manurial experiments on groundnut in India has reported that an average response of 4.8 lb nuts per pound of K_2O was obtained in 15 trials at Akola for the application of 25 to 35 lb K_2O as sulphate of potash.

At Tindivanam the application of 25 lb K_2O per acre was found to give a response of 4,5 lb nuts per pound of K_2O.

Materials and Methods

The experiment was laid out in a red loam soil with pH 5.7. The chemical analysis of the soil showed the following values for potash and lime.

Total potash : 124lb per acre (low)
Available potash : 11 lb per acre (very low)
Lime (Ca 0) : 2480 lb per acre (low)
Available calcium: 1.25 m. e. per 100 g; of soil.

The groundnut strain TMV2, a short duration strain with bunchy habit, was selected for the investigation.

Nitrogen and phosphoric acid were applied in all the plots at a uniform rate of 10 lb and 20 lb per acre as ammonium sulphate and superphosphate respectively. Potash was applied as muriate of potash at three levels of 25 lb, 50 lb and 75 lb K_2O per acre. Lime was applied as hydroxide of lime at three levels of 0 lb, 750 lb and 1500 lb. per acre.

The different levels of nutrients are denoted by the following symbols,

0 lb CaO K_1 : 25 tt> K_2O
750 !b CaO K_2 : 50 lb K_2O
1500 lb CaO K_3 · 75 lb K_2O

The full quantity of the three fertilizers was applied in a single dose prior to sowing. Lime was applied in a single dose 30 days before sowing and thoroughly incorporated into the soil.

Layout

Design : 3 x 3 Factorial experiment in randomi sed block design
Replication ! Four.
Plot size : Gross- 28' × 16'
Net- 26' x 14'
Spacing : 6" × 6"

Results and Discussion

Results of some of the characters studied in the investigation are given below :

/. *Yield ofpods*

The data on yield of dry pods (kg) per plot furnished in Table I reveal that lime has significantly increased the pod yield showing an increase of 6 per cent for I_1 and 12 per cent for L_2 over L_0. The increase in yield corresponding to the different levels of potash are not statistically significant. There was lack of response to potash at higher levels. There is definite indication that combinde application of lime and potash contribute to general increase in the yield of pods. The treatment combination of 1300 lb lime plus 50 lb K_2O per acre has recorded the maximum increase in yield of 20 per cent over the control (25 lb K_2O alone).

The results of the present study indicate that there exists a quantitative relationship between lime and potash for their optimum utilisation and a judicious combination of the two is absolutely essential to get the maximum yield response in groundnut.

TABLE 1

Yield of Pods (Kilograms per plot)

Dose of lime	Dose of potash K_1	K_2	K_3	Average
Lo	10.285	11.197	10.037	10.506
L_1	10.747	11.770	10,897	11.138
L_2	11.322	12.247	11.S15	11.761
Average	10.784	11.738	10.916	11.135 g. m.

C. D. (5 per cent) for fertilizer means — 1.07
C. D. (do.) for combined treatment means - 1.85
Conclusion : L_2 L_1 L_0

2. Yield of shoot (hay)

The data furnished ffl Table II show that lime increases shoot yield also. The level L_2 has recorded an increased yield of 31 percent over L_0. Increasing levels ofpotash have also contributed to slight variation in shoot yield.

The beneficial effect of lime on the increased hay yield may be attributed to the indirect effect of lime in stimulating the activities of root nodule and other nitrogen fixing bacteria. The nitrogen thus fixed might have stimulated the vegetative growth of the plant contributing to higher hay yield.

TABLE II

Yield of Shoot (Kilograms per plot)

Dose of lime	Dose of potash K_1	K_2	K_3	Average
L_0	29.06	35.81	33.00	32.62
L_1	35.50	37.50	30.00	34.33
L_2	45.00	42.25	40.87	42.70
Average	36.52	38.52	34.62	36.55 g., m.

C. D. (1 per cent) for fertilizer means—7.10

C. D. (do.) for combined treatment means—12.30

Conclusion: L_2 L_1 L_0

3, Shelling percentage

The results in Table III show that there is significant increase in shelling percentage corresponding to the levels of potash. The precentage increase recorded is 4.4 for K_2 and 5.3 for K_3 over K_1.

It has been established that one of the beneficial effects of adding lime to ground-nut growing soils is due to its influence in enhancing the shelling percentage of the produce. The present study has revealed that potash also greatly influences shelling percentage. However, the combination of lime and potash at the highest levels has recorded the maximum shelling percentage of 85 per cent which records an increase of 12 per cent over the control (K_1).

TABLE III

Shelling percentage

Dose of lime	Dose of potash K_1		K,	Average
L_0	75.81	82.10	82,09	80.00
L_1	78.06	81.38	80.67	80.04
	81.43	80.69	85.05	82.39
Average	78.43	81.39	82.60	80.81 g. m,

C. D. (5 percent) for fertilizer means—3.06

C. D. (do. } for combined treatment means—5.30

Conclusion: K_3 K_2 K_1

4. Oil yield

The effect of potash in increasing oil yield is found statistically significant at the level K while at K_3 there is considerable decrease in oil yield (Table IV). Corresponding to levels of lime there is depression in oil yield.

A number of investigators have shown that fertilizer potassium increased the oil content of certain crops. Nelson *et al* (1945) reported that the liberal application of potash fertilizer to a soil low in potassium increased the oil content In soyabeans by 1.5 percent. Drosdoff *et al* (1947) and

TABLE IV

Oil yield (per cent)

Dose of lime	Dose of potash K_1	K_2	K_3	Average
L_0	46.08	47.75	44.41	46.08
L_1	45.00	44.33	42.25	43,86
L_2	43.66	43.11	42.08	42.95
Average	44,91	45.06	42.91	44.29 g, m.

C, D. (5 per cent) for fertilizer means—1.63

C. D. (do.) for combined treatment means—2.82

Conclusion : L_0 L_1 _ L_2
K_2 K_3

Brown and Potter (1949) have reported significant increases in yield and oil content of fruits from tung trees fertilized with potassium.

Houg (1953) has stated that oil content of seeds in groundnut generally increases in response to potassium. Sivappah (1960) has reported a slight increase in oil content in sesame by potash fertilization.

In the present investigation a slight increase in oil yield was noted upto 50 lb K_2O level. It was also noted that the weight of kernels increased due to potash application,

5. Natural-test-weight

The data in Table V indicate that there is increase in weight of pods corresponding to levels of lime as well as potash.

TABLE V

Natural-test-weight (Grams)

Dose of lime	Dose of potash K_1	K_2	K_3	Average
L_0	476.00	472.00	479.00	475.66
L,	471,00	493.00	483.00	482.33
L_2	476.00	484.00	492.00	48400
Average	474.33	483.00	484.00	480.66 g. m.

C. D. (5 per cent) for fertilizer means—11.60.

The Natural-test-weight determines the quality and market value of groundnut pods and kernels. Though it is a purely varietal character, it is reported to be influenced by environmental conditions and manuring particularly with lime and potash. A lack of calcium adversely affects the kernel development, resulting in poor quality pods. The present study thus indicates that lime and potash application considerably enhances the quality of the produce,

Summary and Conclusions

An experiment was carried out to study the effect of graded doses of lime and potash over a basal dose of 10 lb N and 20 lb PA on the yield and quality attributes of TMV.2 groundnut. The soil in which the experiment was carried out was a red loam (pH 5.7) characterised by very poor potash and lime status. Three levels of potash at 25 lb, 50 lb, and 75 lb K_2O alone per acre and in combination with three levels of lime at 0 lb, 750 lb and 1500 lb per acre, were the treatments adopted for the investigations.

Plant characters, such as height at maturity, number and weight of pods per plant, number of root nodules, pod yield, shoot yield, natural-test-weight, shelling percentage and oil yield were studied. The results were statistically analysed and the following conclusions were drawn on some of the important characters studied.

1. There was progressive increase in the number of two-seeded pods corresponding to the levels of lime,

2. Liming was found to have a pronounced effect on the yield of pods. The pod yield increased corresponding to the levels of lime, the increase being 6 per cent for 750 lb lime and 12 per cent for 1500 lb lime per acre over no lime. Corresponding to levels of potash there was increase in pod yield up to 50 lb K_2O while at the higher level of 75 lb K_2O per acre there was no substantial increase. The treatment combination of 1500 lb lime plus 50 lb K_2O per acre had recorded the maximum yield of 1465 kilograms per acre as against 1230 kilograms by control (25 lb K_2O alone per acre).

3. The yield of hay was considerably increased by the application of lime, the increases being 5.2 per cent for 750 !b lime and 31 per cent for 1500 lb lime per acre over no lime. There was no significant difference among potash levels,

4. Shelling percentage was found to increase progressively corresponding to the levels of lime and potash. The effect of potash in increasing shelling percentage was more pronounced than that of lime.

5. There was slight increase in oil yield due to potash application upto the level of 50 lb K_2O. The mean percentage of oil yield recorded was 44.91 for 25 lb K_2O, 45.06 for 50 lb K_2O and 42.91 for 75 lb K_2O. Liming was found to have a highly depressing effect on the oil yield,

6. Lime and potash at higher levels were found to increase the quality attributes like natural-test-weight, weight of kernels etc.

7. The results of the experiment have indicated that TMV2 groundnut respond best in the redloam soils of Kerala to a dose of potash at 50 lb K_2O per acre supplied as muriate of potash. As regards the combination of lime and potash the treatment with 750 lb lime plus 50 lb K_2O per acre appears to be the best from a consideration of the net profit and also favourable effects on some of the quality attributes of the produce.

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