# PRELIMINARY RESULTS OF A TWO-YEAR SORGHUM TRIAL ON A GRUMUSOL, WAIGANI, PAPUA NEW GUINEA

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## ABSTRACT

*Grain sorghum was grown on a grumusol at Waigani. One pot trial and a two-year field trial were carried out to test the response of the crop to nitrogen fertilizer. The yield was more than doubled with use of fertilizer. The plot trial showed that phosphorus and potassium were prerequisites for response to nitrogen.*

## INTRODUCTION

MINOR alluvial plains consisting of moderately well drained dark clay soils occupy a small proportion of the coastal hill zone around Port Moresby. Average annual rainfall at Jackson's Airport is 1150 mm (45.2 in), 85 per cent of which falls between November and April. The vegetation is Eucalyptus—Themeda savannah open woodland. Although the soils are not extensive it was thought some information as to their fertility would be desirable prior to the possible establishment of a department of Agriculture at the University of Papua New Guinea. The soils are not used extensively by native people; when done, however, a shifting type cultivation is used.

## MATERIALS AND METHODS

*Soil.*—The soil was a black clay of the Jackson family (Mabbutt *et al.* 1965). The profile was—

| Horizon | Depth (cm) | Description |
|---|---|---|
| A | 0-20 | Black (N4/0) hard fine blocky clay with occasional limestone concretions, sticky and plastic when wet; pH 6.5. |
| B | 20- | Black (N2/0) clay, hard massive, cracking when dry, sticky and plastic when wet; pH 6.5. |

Mechanical analyses and chemical data are given in *Table* 1.

*Pot trial.*—In 1970, a preliminary pot trial was made, primarily as a source of teaching material.

Seven kg of the A horizon of the soil were placed in 23 cm diameter pots and the following treatments in quadruplicate applied:—

0, 110 N, 110 N+34 P, 110 N+80 K, 34 P+80 K, 55 N+34 P+80 K, 110 N+34 P+80 K, 220 N+34 P+80 K.

The figures are in kg/ha. (Multiply by 0.9 to give lb/acre.) The treatments were randomized.

Nitrogen (N) was applied as ammonium sulphate, potassium (K) as potassium sulphate and phosphorus (P) as superphosphate. The 110 N and 220 N treatments were split into two equal applications, the second being applied 20 days after planting. The initial fertilizer was placed 5 cm below the seed, sorghum seed, Texas 608, was planted at a depth of 2 cm. The soil was kept at field capacity by daily adding distilled water.

*Field trial.*—The treatments were P+K, 55 N+P+K, 110 N+P+K, 220 N+P+K, where P and K were 34 kg and 80 kg/ha respectively. The fertilizer was broadcast 21 days before planting in 1970 and applied as a band in 1971 at planting. In 1971, half the 110 N and 220 N were applied as a side dressing 14 days after planting.

A randomized block with four replicates was used, each plot was 6 m (20 ft) by 6 m (20 ft). Sorghum seed, Texas 608 was broadcast by hand on 6th February, 1970.

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*Table* 1.—Physical and chemical analysis for the Jackson soil

| Horizon | % particle size | | | % Nitrogen | pH | Exchangeable cations | | | | Cation exchange capacity |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sand | Silt | Clay | | | Ca | Mg | K | Na | m-equiv/100 g |
| | | | | | | m-equiv/100 g | | | | |
| A | 34 | 22 | 40 | 0.07 | 6.6 | 39.8 | 2.2 | 0.38 | 0.3 | 45.6 |
| B | 32 | 17 | 41 | 0.03 | 6.6 | — | — | — | — | — |

In the second year, seeding was done on 15th December, 1970 with a seed drill. Rates of seeding were 8 kg/ha (7 lb/acre). The crop was harvested on 15th May, 1970 and 8th March, 1971.

## RESULTS AND DISCUSSION

The results are shown in *Tables* 2 and 3.

*Pot trial.*—From *Table* 2 (a) the yield of sorghum was increased 70 per cent on addition of 110 kg N fertilizer. This was not significant ($P>0.05$). The addition of 80 kg K with the same dressing of N however caused a further increase as did 34 kg P but to a lesser extent. When phosphorus and potassium carriers were applied together in the absence of applied nitrogen, the grain yield did not differ significantly ($P>0.05$) from the control.

*Table* 2 (*a*).—Pot trial sorghum yield (weight of head—g/head)

| Treatment | Control | 110 N | 110 N+80 K | 100 N+34 P | 34 P+80 K |
|---|---|---|---|---|---|
| Yield | 9.5 | 16.3 | 28.8 | 21.3 | 10.0 |

*Table* 2 (*b*).—Mean yield of grain (g/head) (all plots received 34 P + 80 K)

| Treatment | 0 N | 55 N | 110 N | 220 N |
|---|---|---|---|---|
| Yield | 10.0 | 28.5 | 29.3 | 35.5 |

L.S.D. at $P<0.05=14.7$

*Table* 3.—Mean yield grain (kg/ha)

| Year | 0 N | 55 N | 110 N | 22 N | L.S.D. |
|---|---|---|---|---|---|
| 1970 | 1910 | 2030 | 2780 | 4380 | For $P<0.05$, 1008 |
| 1971 | 2430 | 4500 | 6700 | 5730 | For $P<0.05$, 1749 |

To obtain lb/acre multiply by 0.9

The effect of P and K on N is isolated in *Table* 2 (b); the yields for all three levels of N are significantly higher than the controls ($P<0.05$). The increase in yield with 220 N however is not significantly greater than that with 55 N.

*Field trial.*—The yields of grain for the 1970 and 1971 seasons are given in *Table* 3.

In 1970, the maximum grain yield was obtained with 110 kg N/ha. This was statistically greater ($P<0.05$) than for any of the other treatments. The yields from the lower dressings of nitrogen did not differ statistically ($P>0.05$) among themselves. The small response to 55 kg N is probably explained by the heavy rain 415 mm (16.3 in) in February, 1970 which may have leached the fertilizer from the soil.

In 1971, maximum yield was obtained with 110 kg N/ha; 220 kg/ N/ha was excessive and depressed the yield. The overall yields were higher in this year due no doubt to the equal distribution of rain over the growing season and the banding of the fertilizer and seed. The yields from 110 lb N/ha and 220 lb N/ha were not statistically different ($P>0.05$).

No statistical comparison was made of the two years' trials.

The results of a two years' nitrogen fertilizer experiment on a dark tropical clay soil indicate that continuous cropping does not cause a rapid decline in soil nitrogen as the yield of sorghum from the 1971 control was greater than that in 1970. The results from a pot trial indicate that at least 80 kg K/ha and 34 kg P/ha are a prerequisite for response to ammonium sulphate fertilizer.

## REFERENCES

MABBUTT, J. A. *et al.* (1965). Lands of the Port Moresby-Kairuku Area, Territory of Papua and New Guinea. *Lands Res. Ser. CSIRO Aust.* 14.

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