EFFECTS OF DIFFERENT FERTILIZERS ON CASSAVA ROOT YIELD, ROOT NUMBER PER PLANT AND AVERAGE ROOT WEIGHT PER PLANT AFTER SIX YEARS BUSH FALLOW IN SIERRA LEONE USING CUTTINGS OF DIFFERENT AGE

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SUMMARY

Effects of ammonium sulphate, basic slag, potassium sulphate, lime and magnesium sulphate on tuber yields, tuber number per plant and average tuber weight per plant from three differently-aged cassava cuttings have been studied. P (basic slag) significantly increased tuber yields for all types of cuttings. P and Ca with midstem cuttings and NPKMg with top stem cuttings showed significant effects on root number per plant. Effective treatments influenced yield through both tuber number and tuber weight.

RESUME

Les effets du sulfate D'ammonium, de la scorie basique, du sulfate de potassium, de la chaux et du sulfate de magnesium sur les rendements en tubercules, le nombre et le poids moyen des tubercules par pied à partir de trois boutures de manioc d'âges différents ont été exposés. P. (Scorie basique) fait augmenter d'une manière sensible les rendements en tubercules pour tous les types de bouture. Les effets de P et Ca sur les boutures de la partie centrale des tiges et de NPKMg sur les boutures de la partie extréme des tiges sont sensibles en ce qui concerne le nombre des racines par pied.

Des treatements adéquats influencent le rendement du point de vue du nombre des racines et de leur poids.

RESUMEN

Se ha estudiado el efecto del sulfato de amonio, escoria básica, sulfato de potasio, cal y sulfato de magnesio sobre el rendimiento de tubérculos, número de tubérculos por planta y peso promedio de tubérculos por planta utilizando estacas para siembra de tres edades diferentes. El P (de escoria básica) incrementó significativamente el rendimiento de tubérculos en todos los tipos de estacas. El P y el Ca con estacas de la parte media del tallo y NPKMg con estacas de la parte superior del tallo, mostraron efectos significativos en cuanto al número de raíces por planta. Los tratamientos más efectivos tubieron influencia sobre el rendimiento a través del número y peso de tubérculos.

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*The possible effects of sulphur were ignored.

INTRODUCTION

Bush fallow of varying duration has been used in peasant agriculture for the production of food crops in West Africa. In Sierra Leone a cereal and cassava crop mixture is often planted after the clearing and burning of a bush fallow of 4-8 years of age. The cereal is harvested leaving cassava as the dominant crop until this also is harvested, usually between 8-24 months after planting. Sometimes a cereal crop is planted and harvested before cassava is planted. The length of bush fallow preceding the growing of food crops by farmers is influenced by many factors but fertility is progressively restored in bush fallows with time. A six year fallow period would usually be considered to have fully 'restored' fertility.

MATERIALS AND METHODS

The experimental design was a 25 confounded factorial consisting of 32 plots, each plot measuring 12 x 10.8 m. Each plot was divided into three sub-plots, each sub-plot carrying either 33 basal, mid or top stem cuttings.

Fertilizer rates, applied singly or in combination (which were chosen on the basis of nutrient removal figures of Nijholt[6]) were as follows: 591 kg/ha sulphate* of ammonia, 578 kg/ha basic slag, 1217 kg/ha sulphate* of potash, 240 kg/ha lime and 71 kg/ha sulphate* of magnesium. These supplied respectively per hectare approximately 159 kg N, 153 kg P, 546 kg K, 172 kg Ca and 18 kg Mg.

Cropping history, soil and agronomy

The land, previously covered by a six-year bush fallow, was cleared, burnt, ploughed, disc-harrowed and ridged. Soil analysis figures obtained from composite core soil sampling at 10 cm deep were as follows: pH, 4.5: % carbon, 3.75: %N, 0.374: available P.ppm., 79.2: %K, 0.022: % Ca, 0.006: % Mg, 0.018.

The soil was a well-drained, gravelly exisol, i.e. a ferrallitic soil, that is strongly acid (pH 4-4.8), highly weathered, low in available plant nutrients and low in natural agricultural productivity[7]. Similar soils occur extensively in other tropical and sub-tropical areas.

Basal (0-60 cm), midstem (60-120 cm) and top (120 cm) cuttings taken from 12 month old plants of the cassava cultivar 'Cocoa', each 30 cm long, were buried to 22.5 cm depth in ridges 30 cm high and 120 cm apart. Fertilizers were applied as top dressings in four applications at 1, 3, 3 and 5 months after planting. The first and second applications consisted of one-sixth of the total amount and the third and fourth applications were of one third of the total amount. Basic slag and lime were applied a week before the corresponding application of the N-P-K mixture. Fertilizers were applied in rings 15 cm away from the plants in furrows 3.5 cm deep and 3 cm wide, and were covered immediately after application. The width of the ring was increased by 5 cm during subsequent applications, the final ring being 30 cm from the plants. Weeding was done as often as was necessary and always just before fertilizer applications.

Data Recording

Ten plants were harvested at random from each sub-plot at 14 months and average root yield, root number per plant and average root weight per plant were recorded and statistically analysed.

Economics of production

Value/cost ratios were computed for all treatments and their corresponding root yields, assessing the value of one tonne fresh cassava roots at le 22.05* and taking the subsidized costs per kg of fertilizer as follows:

Sulphate of ammonia	4 Sierra Leone cents
Basic slag	3 Sierra Leone cents
Sulphate of potash	5 Sierra Leone cents
Lime	2 Sierra Leone cents
Sulphate of magnesium	3 Sierra Leone cents

RESULTS

Yield responses

For plants grown from basal cuttings basic slag (P) significantly increased effect on root yield (P = 0.05). All other main treatments increased root yields but not statistically significant , except K and NPK which did not differ from the control. Mg application gave the highest economic returns, followed by Ca (Table 1).

*2 le = £1 sterling in 1972

With plants grown from midstem cuttings, basic slag (P) again showed highly significant effects on root yields at P = 0.01 level. Application of N or K depressed yields, but the application of Ca on Mg increased yields. The application of PMg did not increase root yields over the control. Mg application gave the highest economic returns followed by Ca (Table 2).

With the plants from top stem cuttings, basic slag (P) showed highly significant effect on root yields at P = 0.01 level. All other main treatments N, K, Ca and Mg increased yields (non-significantly), but application of NCa did not increase yield over the control. Mg application gave the highest economic returns (Table 3).

P consistently increased yields, and NMg depressed yields no matter which age or type of cassava cutting was used. Mg without N however gave some remarkably attractive economic returns.

Responses in root number per plant

Most of the treatments applied to basal cuttings did not show any significant effect on root number per plant; however, Mg increased the root number for plants grown from basal cuttings by 63%. P and Ca applications to midstem cuttings gave significant effects on root number per plant (at P = 0.05). NPKMg applied to plants grown from top stem cuttings showed a significant positive effect on root number per plant (at P = 0.05). Mg increased the root number per plant from the top stem cuttings by 46.6%.

Responses in average root weight per plant

None of the treatments applied to plants grown from basal cuttings showed any significant increase on average root weight per plant. Mg applied to plants grown from basal cuttings depressed average root weight per plant by about 17%. Application of K to plants grown from midstem cuttings was significant at P = 0.05. P application on plants grown from top stem cuttings showed highly significant effects on the average root weight per plant (P = 0.01). Mg application on top stem cuttings increased average root weight per plant by 18%.

The application of Mg gave considerable effects on root yield for plants grown from all types of cuttings. When applied on midstem cuttings, Mg increased average root yields.

The value/cost ratios for the rather low Mg treatments made the use of this nutrient a very profitable investment.

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TABLE 1

Effects of fertilizers on cassava root yields (tonnes/ha) from basal cuttings, and corresponding value/cost ratios at 14 months

Treatment per ha.	Yield Tonnes/ha	Value/cost ratio *
0	10.97	0
159 kg N	15.42	3.58
153 " P	12.05	-
159- 153 " NP	16.70	2.72
546 " K	10.97	-
159-153-546 " NPK	10.97	27.02
172 " Ca	18.91	36.86
18 Mg	14.94	-
159-18 NMg	8.09	-
172-18 CaMg	9.42	-
Mean	13.41	* for significant positive effects
s.e. ±	1.0	
l.s.d. (*P = 0.05)	2.16	
(**P = 0.01)	3.01	

TABLE 2

Effects of fertilizers on cassava root yields (tonnes/ha) midstem cuttings and corresponding value/cost ratios at 14 months

Treatment per ha.	Yield Tonnes/ha	Value/cost ratio*
0	11.90	0
159 kg N	-	-
153 " P	12.96	-
546 " K	10.82	-
172 " Ca	15.27	11.36
18 " Mg	13.18	11.44
159-18 " NMg	8.84	-
153-18 " PMg	11.90	-
172-18 " CaMg	14.94	-
Mean	13.79	* for significant positive effects
s.e.	± 0.70	
l.s.d.	1.51 (P = 0.05)	
l.s.d.	2.11 (P = 0.01)	

TABLE 3

Effects of fertilizers on cassava root yields from top stem cuttings, and corresponding values/cost ratios at 14 months

Treatment per ha.	Yield Tonnes/ha	Value/cost ratio*
0	9.77	0
159 Kg N	14.04	4.34
153 " P	15.75	6.47
546 " K	11.15	-
172 " Ca	10.52	-
159-172 " NCa	9.77	-
18 " Mg	16.77	60.94
159-18 " NMg	6.73	-
172-18 " CaMg	8.84	-
Mean	13.63	* for significant positive effects
s.e. ±	0.98	
l.s.d. (P=0.03)	2.11	
l.s.d. (P=0.01)	2.94	