GROWING CASSAVA FOR FUEL ALCOHOL

By Barry Holmes, Agronomist
Kuk Agricultural Research Station

INTRODUCTION

This is the second article in a series (see HARVEST 6 (1):18-22) describing the progress of the Papua New Guinea alcohol fuels project.

During 1980 and 1981, 600 hectares of cassava will be planted in the Baiyer River Valley of the Western Highlands Province, to supply starch for a two million litre per year alcohol distillery. To provide sufficient planting material, five hectares of cassava were planted at Kuk Agricultural Research Station in mid-1979.

Secondary objectives of this work were to test:-

1) Different cassava cultivars to determine their suitability for food and industrial starch production;

2) Possible methods of mechanical cultivation and their effect on cassava growth;

3) Basic agronomic factors such as the optimum length of planting material and the necessary rates and timing of fertilizer application.

In this article, cultivation methods used at Kuk will be described and some general recommendations for cassava production will be made.

SITE

Cassava is usually grown as a lowland crop in tropical and sub-tropical regions, with maximum yields being achieved at altitudes below 1200 m and under an average annual rainfall of 500 to 1500 mm. Ideally, soils are deep, well drained, friable loams of pH 5.5 to 6.5. Optimum temperatures for cassava growth are in the range 25 to 29°C.

Kuk Agricultural Research Station is situated 20 km east of Mt. Hagen, at an altitude of 1550 m. The average annual rainfall is over 2300 mm and minimum and maximum temperat-

Young cassava growing at Kuk

ures are 14.9°C and 25.9°C, respectively. Kuk is therefore not an ideal site for the production of cassava.

However, the soil is a deep, peaty clay of pH 4.5-6.0 and is rich in organic matter. It also has good drainage characteristics and, was shown by earlier studies to be suitable for cassava production. Therefore, as land, equipment and supervision were available, Kuk was chosen as the site for cassava multiplication.

PLANTING MATERIAL

There has been no careful study of cassava varieties in Papua New Guinea, but there were reports showing that cultivars with the potential to produce high starch yields were available in the country. These cultivars were used for the initial stages of the multiplication and evaluation in preference to special cultivars from other countries which might have introduced new pests and diseases into Papua New Guinea.

Material was obtained from Kuk Agricultural Research Station, the area around Baiyer River, the Highlands Agricultural College, and the Highlands Agricultural Experiment Station at Aiyura. A further 18 cultivars were sent by the Lowlands Agricultural Experiment Station at Kerevat. Where possible, only cultivars with white tuber flesh were used.

Preparation

When sufficient cassava is available, only hardwood parts of mature stems should be selected for planting material. However, at Kuk where it was essential to get as many plants growing as possible, all stem

Cutting planting setts by hand

pieces with less than 50% pith were used. Small end pieces and broken stems were also planted at the rate of 2-3 per planting hole. In this way the maximum number of plants was obtained from a limited source of planting material.

Planting setts were cut either by hand using small hand saws, or semi-mechanically using a sawbench. The second method is preferred as large quantities of material can be prepared rapidly with a minimum of labour. The method using the sawbench also leads to better callus and root formation at the cut surface.

Although, for optimum yield, planting setts of 20-25 cm are recommended, shorter setts were used at Kuk to increase the number of plants obtained.

Sett lengths of between 5 and 25 cm were compared and it was found that a significantly higher percentage of setts cut at 25 cm grew into plants (emerged) than of those cut at 5 cm. However, more plants could be grown from one long piece of

cassava stem if it was cut into a lot of 5 cm pieces than if it was cut into a few 25 cm pieces. Sett lengths of 12 cm were finally chosen for the main part of the planting at Kuk because they gave satisfactory multiplication rates (number of plants/stem) with high (95%) emergence.

It is generally recommended that setts are treated with fungicide before planting to reduce the chance of attack by disease organisms living in the soil. At Kuk, the setts were dusted with 5% Captan. However, good disease control can also be achieved by soaking the setts in a 0.3-0.5% fungicide solution for 3-5 minutes. Suitable fungicides include Thiram, Benomyl 1, Captan and Maneb.

The NSPP potato planter in action in the cassava field

CULTIVATION

Land preparation

The land was divided into 12 blocks of about 0.4 ha each in area. Previously, the blocks had either been left fallow and become covered by grass, or had been cropped with sweet potato. Fallow ground was broken with a disc harrow, a rotovator and a chisel plough. After the sweet potato was harvested from the other blocks, the ground was first rotovated and then chisel ploughed. Both methods gave suitable ground preparation.

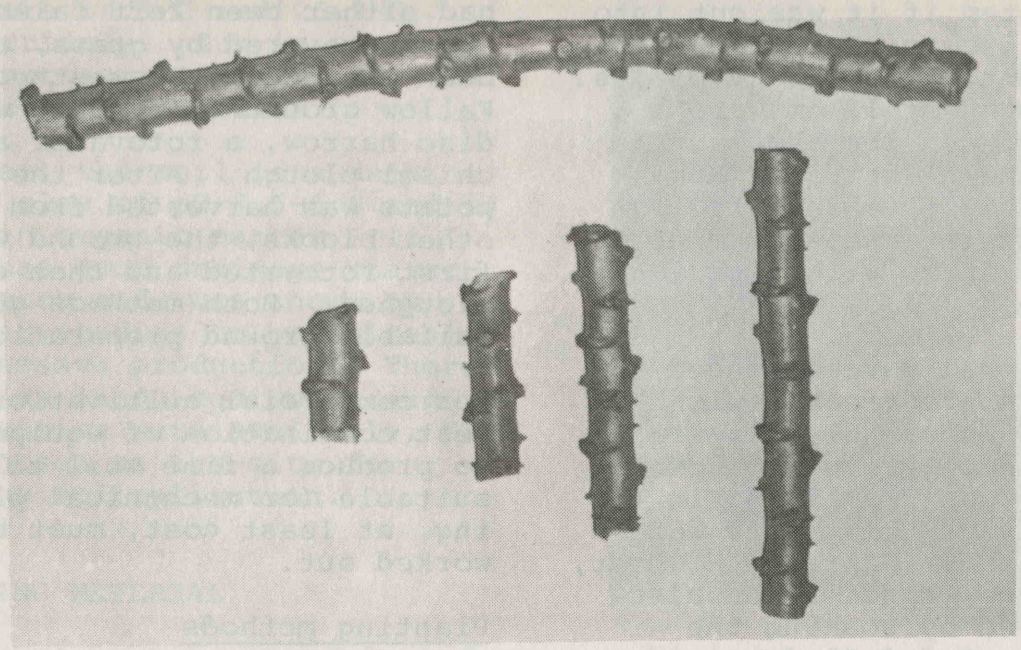
For commercial cultivation, the best combination of equipment to produce a fine soil tilth suitable for mechanical planting, at least cost, must be worked out.

Planting methods

To develop cassava as an industrial or commercial crop, it is necessary to move away from the present, labour-intensive methods of hand planting and harvesting. Therefore, setts were planted with a potato planter to find out the effects of mechanical planting on cassava emergence and early growth. This also meant that the cassava was planted as rapidly as possible with the minimum of labour.

The National Seed Potato Project (NSPP) "portaplanter" is an automatic, in-one-operation, two-row potato planter, which opens the furrow, applies fertilizer, places the potato and then forms a ridge. This planter was modified by the NSPP manager and his staff, to accept woody stem pieces of up to 28 cm in length. The planting setts were placed in the planting cup by hand, and laid horizontally in the open furrow and covered with soil to a depth of 10 cm by the machine. In this way up to 2 ha per day could be planted by only five men.

Trials comparing the effects of hand and mechanical planting on early growth and development



This photograph shows different sizes of cassava sett - 50, 25, 15, 10 and 5 cm lengths.

did not show any differences between these two methods. Therefore, there is no reason why cassava should not be planted mechanically using specialized equipment now available in Australia and through agents in Papua New Guinea.

Spacing

Cassava, as a sole crop, should be planted at desities of 10,000 - 15,000 plants per hectare. Generally, spacings of either 1 m by 1 m (10,000 plants/ha) or 91 cm by 91 cm (12,000 plants/ha) are recommended. At Kuk, the cassava was planted at either 92 cm by 98 cm (11,091 plants/ha) or 87 cm by 115 cm (9995 plants/ha) as these spacings were best suited to the mechanical planter. The optimum plant density and, perhaps more importantly, the plant arrangement for maximum tuber yield should be worked out separately for each cultivar used.

Fertilizer

A compound fertilizer, containing nitrogen, phosphate, potash and magnesium (12:12:17:2 + trace elements), was applied at planting. This was done to encourage rapid stem development and so reduce the time to first stem harvest. However, the use of mineral fertilizers is not currently recommended for either commercial or traditional cassava production.

Feeding the cassava sett into the planter

Weed control

Cassava development and final tuber yield are severly reduced by weed competition, particularly during the first three months of growth. Therefore it is essential to control weeds, at least until the full leaf canopy has formed.

Mechanical weed control with post-planting cultivation was attempted at Kuk. A simple tool-bar-mounted chisel plough was used, fitted with either needle, or ducks-feet blades. Unfortunately this was not completly successful and some hand weeding was still necessary. However, with the use of the more sophisticated equipment now available, such as high-clearance, narrow-wheeled tractors and inter-row rotary cultivators, complete mechanical weed control should be possible.

Pest control

Cassava has many potential insect pests but only a few are important in traditional systems. No serious pest problem was found at Kuk except for a small outbreak of cutworms (*Agrotis* spp.) These were controlled by spraying a combination of Diazinon (1.5 L/ha) and Lindane (1.0 L/ha) around the base of each plant.

Disease control

Cassava was once considered to be resistant to diseases but it is now accepted that diseases can cause economic losses. In fact, there are over 30 disease-causing organisims (pathogens) which can attack this crop. Serious disease symptoms, however, were noted in only one cultivar grown on Kuk. The pathogen was identified as *Colletotrichum manihotis*, a form of anthracnose, although the symptoms were not like those usually seen in plants affected by this disease. Plants of the affected cultivar were pulled up and burnt. Remaining plants in the neighbouring plots were sprayed, as a precaution, with Propineb (1.75 kg/ha).

Various leaf spot symptoms have been found on most plants grown at Kuk and on those in local gardens. These are caused by either *Cercospora caribaea* or *Colletotrichum* spp. However, these are not considered serious.

Absolute control of all cassava diseases will be impossible on a commercial scale but it is generally recommended that planting material should not show any signs of disease and should be treated before transport, storage and planting by soaking in 0.3% to 0.6% fungicide solutions.

Harvesting

In order to get enough planting material for the Baiyer River farm from five hectares of cassava at Kuk, stem material will be harvested up to four times before the end of 1981. The root-stock and bottom of the stem will be left in the ground so that new shoots can develop.

Harvesting will begin twelve months after planting and will be repeated every 6-9 months. It is expected that 30 setts, each 20 cm long will be obtained per plant at the first harvest. This will be enough to plant 150 ha. If the following harvests yield similar amounts of material, then there will be enough to plant a total of 600 ha.

GENERAL RECOMMENDATIONS

It is not the purpose of this article to give recommendations

for commercial and traditional cassava production. However, a number of general points can be made which are relevant to any farming system involving cassava.

1) Highly fertile soils are not needed but soil should be free draining and fairly deep.

2) Planting material should be chosen from the bottom of woody stems taken from mature, disease-free mother plants.

3) Setts should be 20-30 cm in length and should be cut straight across with a sharp blade.

4) Good weed control, by any suitable method, is essential during the first 3 to 4 months of growth.

5) The best method of disease control is to plant disease-free material chosen from disease-resistant cultivars.

6) A careful study of cultivars and agronomic practices is necessary if cassava is to be successfully developed as either a commercial food crop or an industrial crop.

FUTURE ARTICLE

The next article is this series will be on sago as a source of fuel alcohol. It will be included in the next issue of HARVEST (6 (4)).

Photograph on page 129 by J.W.J. Wankowski; at bottom of page 131 by Kath Perry.