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CONTENTS

Front cover: Bunches of diploid and triploid bananas (see article on page 8). The two small bunches are diploid bananas. The large bunches are triploid. The bunch on the far right is the hardy ABB triploid variety "yava", and the one second from right is Cavendish or "siana". It is an AAA variety.

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Department of Primary Industry
Port Moresby
Papua New Guinea

METHODS FOR COMMERCIAL BANANA GROWING

By D.P. Heenan*

The Department of Primary Industry made a study of banana-growing methods at Lejo in the Northern Province. As a result of this study, the following methods for banana cultivation are recommended.

It should be remembered that this paper is largely based on experience gained in one place, at Lejo. There were also only three varieties tested in the trails. The three varttties used were Dwarf Cavendish, Giant Cavendish and Tui, which is a tall robust type very similar to the Gros Michel grown overseas.

Climate and soils

Bananas grow everywhere in Papua New Guinea, from the lowlands to the highlands. They do not like places where there are frosts.

Bananas grow well on a wide range of soils, although very sandy, or hard clay soils are not preferred.

With heavy clay soils, root growth is retarded and water-logging can become a problem.

In very sandy soils bananas need a lot of water, and this can be a problem where there is a long dry season.

The soil should be slightly acid.

The banana roots are concentrated in the top 30 cm of soil, but a moist, open loamy soil allows roots to go deeper, thus ensuring a good anchoring system.

The amount of rainfall needed for bananas to grow is not very important, although on sandy soils where the rainwater quickly soaks away into the ground they will need more rain than in areas where the soil is heavier and the water stays in the ground longer.

Planting time

The time to plant depends on two factors, climate and market.

In dry areas, plants should be well rooted and actively growing before the dry season starts. It would therefore be advisable to plant during the wet season.

Another reason to plant at this time is to reduce the amount of leaf spot disease in the plant during the critical period when the bananas on the bunch are filling out.

Dry conditions are very effective in reducing leaf spot disease even when the plants are not being sprayed. As bananas can take up to 12 months from planting to harvest, the beginning of the wet season would therefore be the best time to plant.

However, bananas are required for the market throughout the year, so farmers will generally plant to suit the market, regardless of leaf spot disease problems.

Planting material

There are four different kinds of planting material. These are bullheads (or corms), bits, sword suckers and maiden suckers.

Bullhead

This is the underground part of the stem of a banana plant which has already borne a bunch. It is also called the corm.

The old trunk is cut down 20 to 30 cm above the ground, and the corm is dug out. This will be very heavy and hard to handle, and is not a popular form of planting material.

Bit

Instead of planting the whole bullhead, a section a bit only can be used (*Plate* 1). However, it must contain an eye or a bud before it can shoot.

The bit will grow readily under good moisture conditions. Its chief advantage is that it is easy to transport.

Sword sucker

Suckers are small plants growing up from the base of another plant. The sword sucker has narrow sword-like leaves (*Plate* 2).

Sometimes another kind of sucker known as a water shoot may be found. The water shoot is a similar size to the sword sucker, but it has broader leaves, a weak stem and a smaller corm. Water shoots are not good planting material (*Plate* 3).

Sword suckers are the most popular form of planting material as they can easily be cut

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Plate 1.—Bit showing a bud.

from the mother plant without disturbing the whole plant. They are also easy to transport.

Maiden sucker

These are simply suckers, which have grown past the sword sucker stage, but have not produced a bunch of fruit. If they are too big they are very hard to handle. Although they produce bunches early, these bunches will probably be small in size.

At Lejo, sword suckers were mostly used. These proved very satisfactory and produced good bunches. Bunches were ready for harvest 10 months after planting for Dwarf Cavendish, 12 months after planting for Giant Cavendish, and 13 months after planting for Tui. The period when they were grown included a very dry spell, and times may be shorter under better conditions

Treatment of planting pieces

When obtaining planting material one should treat for nematodes, and check for weevil borers, as follows.

Nematodes

Nematodes are tiny worms which cannot be seen without a microscope. They damage the roots and kill many plants

If possible planting material should come from a nematode-free area.

The planting material can be treated so as to kill any nematodes present. First of all, all roots and soil should be cleaned from the corm. The planting material can then be dipped in hot water at 53 °C (128 °F) for 20 minutes.

Alternatively, a mixture of nematicide and water can be used (e.g. 6.5 l DBCP per 100 l water).

Weevil borers

Weevil borers make tunnels through the corm. New planting material should be carefully inspected to make sure the weevils are not being introduced.

It is an advantage to have planting material of the same kind and size. If this can be achieved, the crop will be more uniform and bunches will be thrown at the same time.

Suckers and bits should be allowed to stand in the open under shade for at least 24 hours to allow the cut surfaces to dry. If this is not done, the corm may rot later.

Planting method

The land should be cleared, but not burnt.

It is important to dig holes at least 30 cm deep before planting. The hole should be of the dimensions 30 X 30 X 30 cm.

Plate 2.—Sword suckers.

Plate 3.—Water shoots.

If the soil is sandy the depth of the hole should be increased to 45 cm. This is to give the plants a better anchoring system and so decrease the chance of them being blown over.

After planting, some soil is then placed firmly on top of the corm but leaving a small hollow in the hole. As the corm swells the soil level will in fact rise with it.

Spacing

There is much variation depending on the variety and use of machinery. If machinery is to be used it is best to plant in rows.

North Queesland's recommendation for tall bananas (e.g. Gros Michel and Lacatan) are for rows 4 m apart and 1.5 m within the row. For shorter types (e.g. Dwarf Cavendish) a closer spacing such as 4 m by 1.2 m can be used. These high density plantings are said to have the advantages of weed control and good use of available land.

A popular system in the South Pacific is 3 to 4 m rows and 2 m within the row for short varieties, and 3 m square spacing for the tall varieties.

The spacings mentioned above should give good-sized bunches and yields. Closer plantings will most likely result in bunches of reduced size and quality, and could encourage leaf spot infection.

Removing suckers

Every month the bananas should be inspected and unwanted suckers removed. This can be done with a bush knife. The sucker is cut off at or below ground level, and the centre of the remaining portion is dug out with the point of the bush knife.

For densely spaced plants only two plants per stool is recommended, that is, the mother plant and one sucker.

The mother plant should be about 6 months old before a sucker is allowed to come through.

It is important, where machinery is being used, to allow suckers to come through only in such a way that the ratoon crop (crop from suckers) will still be in rows. Only suckers on the same side of the mother plant should therefore be kept.

For widely spaced plantings it will be possible to allow more suckers per stool. In some cases 3 or 4 suckers at different stages can be retained without reducing bunch weights.

By keeping suckers it is possible to maintain a plantation for a very long time.

The economic life of the plantation, however, will depend on a number of factors. Where machinery is used, it is important to keep bananas growing in rows. Usually 5 or 6 years is the normal life of a machine-operated plantation.

Hand-managed plantations can be left longer, even up to 20 years if yields can be maintained.

Weed control

Weeds, especially grasses, can severely reduce growth and production. It is therefore necessary to control weeds from the start.

As a newly planted area produces little competition, growth of weeds will be at its greatest. As the banana plants develop so does their power to compete with weeds.

Although slashing will decrease the competitive effect of the weeds, chemical weed control is more economical.

A popular practice in overseas countries is to use paraquat and dalapon. Paraquat is a contact herbicide. It kills all leaves or stems which it touches (but not underground stems or roots). Dalapon is more effective on perennial grasses which have underground stems and are not, therefore, completely controlled by paraquat.

Diuron is recommended soil-acting herbicide. It kills the weed seeds as they germinate. However, this chemical has produced toxicity symptoms (leaf yellowing) on a number of plants at Lejo. This has resulted in reduced growth and smaller bunches. It is suspected that some of the chemical leached into the root systems of the bananas following heavy rain.

Another means of controlling weeds is to use a low-growing cover-crop. Cover-crops do not seem to compete as strongly as grasses. They also do not get in the way like tall-growing weeds.

Cover-crops are usually legumes such as pueraria, which will add nitrogen to the soil. The nitrogen can then be taken up by the bananas.

The cover-crop will also prevent erosion.

At Lejo, the ground was already covered by *Momordica charantia*, and this weed seemed to be as effective a cover as pueraria. It was more effective than pueraria in controlling grasses.

Whatever cover-crop is used it must be cut back regularly from around the banana plants so that it will not cover them or get in the way of harvesting. The cuttings are used as a mulch. From such mulch and from natural leaf fall, covers improve the soil by continuous addition of organic matter.

Fertilizers

A block at Lejo was still producing good bunches without any fertilizer when it was four years old.

Fertilizers may improve yields, however.

Bananas are described as gross feeders and make large demands on soil nutrients, especially nitrogen and potassium. It has been found that the majority of these nutrients are taken up early in the life of the plant and fertilizers applied after 4 or 5 months from planting or sucker selection may not be taken up.

A suggested basic fertilizer programme is as follows:

Time of application	*Amount of fertilizer per plant*
As plants emerge or as selected ratoon suckers emerge	½ kg of NPK 6:5:25 plus 57 g of sulphur
4 or 5 weeks after first application	½ kg of NPK 6:5:25
4 or 5 weeks after second application	½ kg of NPK 12:4:16 plus 57 g of sulphur
4 or 5 weeks after third application	½ kg of NPK 12:4:16

In certain areas of Papua New Guinea there are soils that may also be deficient in other elements. Therefore other fertilizers may also have to be used to get maximum yields.

Although the programme indicated above should be applicable to most parts of Papua New Guinea it would be advisable to contact your Rural Development Officer to make sure of the fertilizer requirements for your particular area.

The actual timing of applications can be further apart during dry periods when growth will be much slower.

Where leaf spot is very severe, it may be wise to reduce fertilizer applications until the disease is brought under control.

Preserve organic matter

Another important factor is organic matter, that is, dead plant material in the soil, which gradually rots away and becomes part of the soil. The organic matter keeps the soil in good condition and stops the soil from becoming too acid

Stems of old bananas, etc., should be chopped up and dug into the soil, so that they can quickly rot into the soil.

Mulch should be placed on top of the soil if the soil is bare. This preserves the organic matter in the soil.

Fungicides

A spray programme, especially to control leaf diseases such as the Sigatoka complex and other fungal diseases of banana varieties such as Cavendish, is as follows.

In a motorized knapsack (mist blower) use—

100 g (4 oz) Benlate
4.5 l (1 gal) oil
7 l (1.5 gal) water
45 ml of X-45 (Lanes) emulsifier

This should be applied so that the operator covers ½ ha.

Aim the spray so that it goes above the plants, and falls down on them, and make sure that the youngest leaf especially is sprayed. It is best to apply the spray early in the morning before the wind blows. Spray every two weeks.

If you are growing Cavendish commercially, it is best to start spraying before the leaf spots appear.

Insecticides

Use of insecticides for insect control in bananas is not recommended.

Propping

Banana bunches can be very heavy. In a well-controlled plantation, weights of around 40 kg can be quite common. These weights cause a big strain on the banana stem and following heavy rain or wind the stems can bend or break in the middle or fall over from the base.

This is more likely to happen if the plants are tall. During heavy rains at Lejo many Tui bearing immature bunches were bent over when they had no prop to support them.

For this reason, it is advisable to use props after the bunches have emerged. The props can be a single pole with a forked end or two poles which cross under the bunch (*Plate* 4).

Bunch covers

Bunch covers have become very popular overseas. The type of cover used at Lejo is a blue polyethylene sleeve which is tied around the bunch stalk and also tied around the base, with a small opening left so that that the water can run out (*Plate* 5).

The advantages of using bunch covers are—

- Decreased time for bunch maturity. Covered bunches at Lejo were ready to harvest 5 to 14 days earlier than uncovered bunches.
- Protection against fruit fly.
- Protection against other factors causing skin blemishes, such as sucking insects, leaves, fungicide residue, fungus, birds etc. This results in more attractive-looking fruit.
- Greater size of fruit has been reported overseas. However, results at Lejo showed only a small increase in bunch weight.
- Protection against chilling in cold climates. This was one of the main reasons why bunch covers were introduced into eastern Australia. It may be important in highland areas of Papua New Guinea.

Plate 4.—Trees need to be propped with poles after the bunches have emerged.

Disadvantages are—

- Where the tree has fewer leaves due to leaf spot, sunburn of the bananas on the uppermost side of the bunch can be a problem. This can be prevented by enclosing the last emerged leaf (flag leaf) over the top of the bunch or by using tar paper or hessian placed inside the cover.
- Bunch covers used at Lejo definitely caused the skin to become softer. This can produce problems with transport.

Plate 5.—**Bunch cover tied over a bunch of bananas.**

- If the covers are removed and bunches left in the sun they can be affected with sunburn. It is therefore advisable not to remove covers in the field following harvest. If possible the bunches should be carried to an open shed or other form of shade and unwrapped. They should then be left there for 24 hours. This should harden the skin and increase its resistance to sunburn and bruising.
- Covers must be inspected at fairly regular intervals as insects (particularly long-horned grasshoppers) and field mice can eat their way through the cover. These pests were found to be troublesome at Lejo. Hand-collection of the grasshoppers will help to reduce this problem.

Other forms of covers besides blue polyethylene bags have been tried at Lejo. Hessian bags and old fertilizer bags were tried first but these were often of the wrong size.

Clear plastic is often used but this is even more likely to produce sunburn effects on the fruit.

In the highlands, bunches are often covered with trash (leaves etc.).

When to cover

The best time to apply the covers is after the bracts have hardened and can be removed. If covers are put on before removal of bracts, the bracts will rot and stain the fruit.

After the bell has fully developed it is cut off and the cover tied at the bottom.

Harvesting and marketing

Bananas can be sold at local markets in most centres.

Both "sweet" and "cooking" bananas can be sold to the government Fresh Food Markets which operate in Port Moresby, Lae, Kainantu, Goroka, Mount Hagen, Alotau, Popondetta and Wewak.

The government market will buy as many bananas as it is able to sell again to its customers. At present some markets are short of bananas.

At local markets, most of the bananas sold are ripe or nearly ripe. At the government markets bananas are mostly wanted in the green stage so they can be stored and perhaps transported to other markets.

More people will want to buy bananas from the government market if they can get first-quality fruit. If bunches are brought in overripe, bruised or full of fruit fly no-one will want to buy them.

Bananas for the government market should be picked when they are still green, but three-quarters full. The bunches should be kept cool after they have been cut, and not bumped around or stacked under bags of other produce.

The amount of bananas that can be sold at any one time is limited. You should ask your agricultural officer to advise you on how many bananas to plant.

Yields

Results from the trial at Lejo indicate that average bunches weighing 28 kg can be obtained at 3.5 X 3.5 m spacing with moderate leaf spot infection. This would be equivalent to a yield of 3 tonnes per hectare.

As two bunches per stool per year would be harvested, this would be quivalent to a yield of 6 tonnes per hectare per year.

Higher yields can be expected with closer spacing as indicated in present trials being conducted at Lejo.

KNOW YOUR BANANAS

By R. Michael Bourke, Agronomist, Lowlands Agricultural Experiment Station, Keravat

***Musa maclayi*, a wild banana. Notice how the bunch points upwards like the edible Australimusa varieties. There are many types of wild bananas in PNG. Scientists interested in bananas have come from all over the world to study our bananas.**

Bananas are the most important food in parts of the Markham Valley, in the dry areas of the central Papuan coast, around Rabaul and in other localities such as on Cape Vogel. They tend to be more important in drier areas, but they are found almost everywhere in Papua New Guinea, in both the lowlands and the highlands. Probably only sweet potato is a more important crop on a national basis.

Many varieties

In Papua New Guinea we have very many more varieties of banana than in most other countries.

As well as edible varieties, there are many wild bananas in Papua New Guinea that do not produce edible fruits. Examples are *Musa maclayi, M. peekelii, M. acuminata, M. balbisiana, M. banksii, M. augustigemma* and *M. ingens*. This last one, from the highlands, is the largest herb in the world.

It is important that agriculturalists know something about the different groups of bananas. Different varieties have different properties. Some have high and others have low yield. Others show more tolerance to drought. Some varieties can remain in the same ground for many years.

Edible bananas

Each edible banana is a member of either one of two groups. These are the Australimusa and the Eumusa. The Eumusa group is the most important.

You can tell which group any banana belongs to by the way the bunches grow.

In the Australimusa, the bunches grow erect, as shown in *Figure* 1. In the Eumusa, the bunches bend over.

Australimusa bananas come from Papua New Guinea originally, but they are not important here now. You sometimes see them in gardens, in the bush, or in the market.

An Australimusa banana on the Lelet Plateau of New Ireland. This type of banana can be easily recognized because the bunch points upwards. In some places they are slightly important as food.

Diploid bananas. Note the upright leaves and small bunch.

Some of the Papua New Guinean names for Australimusa bananas are porek (Bainyik area), mo-pa (Kainantu area), avuro (Gazelle Pensinsula), and autafan, urtuk, nglas and kakongai (New Ireland).

An interesting thing about Australimusa bananas is that their juice is generally pink or red, and if you eat a lot of their fruit your urine goes red.

Eumusa

This is the most important group of bananas in the world.

Botanists have divided the Eumusa into two more main groups. They are known as "diploid" and "triploid" groups. (There is also a small group known as "tetraploids".) The differences between the two main groups are shown in *Figure* 2.

Diploid

Diploid bananas can be recognized because the leaves and petioles are stiffer than triploids and the leaves are more upright. The plants are not as big or as robust as the triploids. It is fairly easy to tell a diploid from a triploid.

Diploid bananas are most popular in Papua New Guinea. They are not as big or as strong as triploids. Usually they do not carry as big a bunch as triploids.

For most people in Papua New Guinea diploid bananas are the nicest ones because they are traditional.

Different varieties are used for different purposes. For example some may be considered food for babies or for old people.

Most varieties are cooking ones, and are cooked while they are still unripe and firm. Some varieties can be eaten uncooked as well, if they are allowed to ripen and go soft.

Diploid bananas are commonly used as temporary shade for young cocoa, especially on the Gazelle Peninsula of New Britain. They are very suitable as temporary shade because they do not last more than about a year in one location and so die out naturally.

Triploids

The triploids are the most important group in most parts of the world.

Triploid bananas. Note the leaves bending over and larger bunch. These trees are the yava variety.

Bunches of diploid (left and rear) and triploid (right) bananas. Note how the triploid bunch is bigger than the diploid. This triploid is the widespread variety yava.

They have a bigger bunch, and they are usually a bigger stronger plant. They also last longer in one place than the diploids.

Triploid bananas have been introduced fairly recently to Papua New Guinea, and people are starting to like them, but the diploid bananas are still most popular here.

Triploids are often planted around houses and along roads and as boundaries between gardens. They are planted in places where people want them to keep growing for many years.

Around Rabaul and in parts of the Markham Valley triploids have become the most important type of banana.

How to identify banana groups

When you see a banana plant, first of all decide whether it is an Australimusa (erect bunch) or a Eumusa (bunch bends over) (see *Figure* 1).

If it is a Eumusa, decide whether it is a diploid (leaves point upwards) or a triploid (leaves bend over more) (see *Figure* 2).

If it is a triploid, you can decide what type of triploid banana it is by looking at the *Table*. You look for such things as stem colour, the shape and colour of the bracts, and other things. The bracts are the reddish coloured leaves which cover the young bunch of bananas.

Notice that a bunch of bananas has two parts. The female part is the first part of the bunch, the bananas which you eat. The male part is the second part of the bunch, the last part to be uncovered. It consists of small flowers shaped like young bananas, but after a few days they fall off the plant.

The *Table* will tell you whether the banana belongs to the "A group" or the "B group". (Note that all diploid bananas belong to the A group.)

Figure 3 also shows some of the differences between A and B groups.

Characteristics of A and B groups of bananas

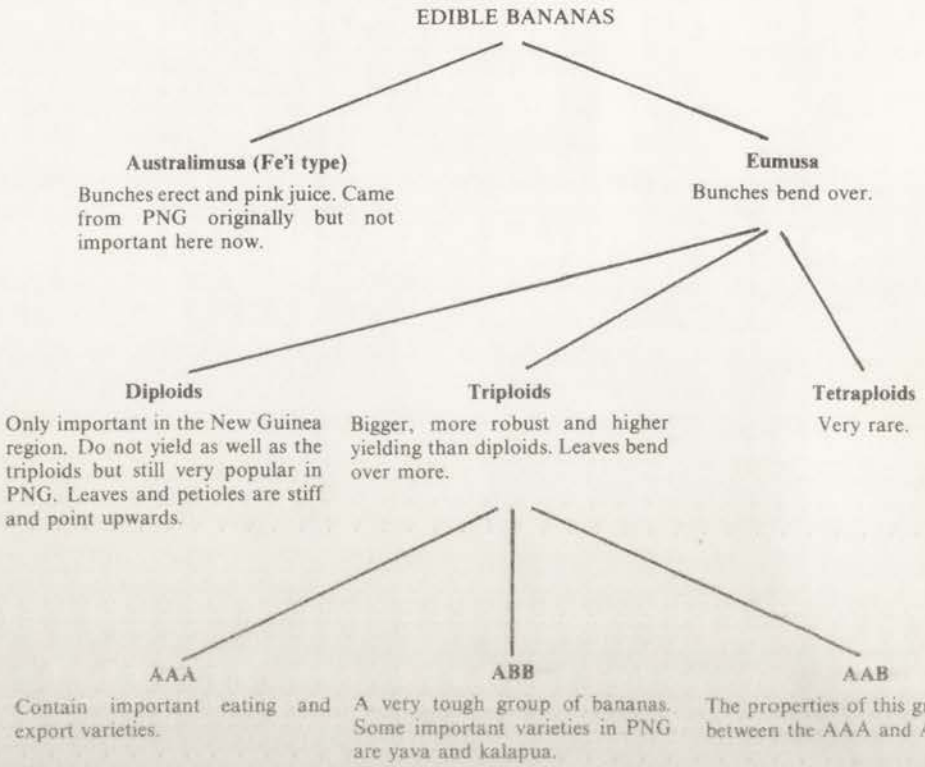
Things to look at	*"A group"*	*"B group"*
Stem colour*	A lot of black or brown blotches	Few or no blotches
Canal of petiole	Canal is open. The dry wings do not clasp the stem	Canal closed. No wings at the bottom
Stalk of bunch	Usually hairy	Not hairy
Stalk of fruit	Short	Long
Shoulder of bract	Near the top of the bract	Lower down on the bract
Bract curling*	Bracts curl up and roll back	Bracts lift up but do not roll
Bract shape	Pointed	Rounded
Bract point	Sharp	Blunt
Bract colour	Red, dull purple, yellow or green outside. Pink or yellow inside	Brownish purple outside. Bright crimson inside
Bract colour fading inside*	Inside colour is yellow towards the base	Inside the bract the colour is crimson towards the base
Scars from the bract	Large	Small
Male flower colour	White	Pink

*These are easy things to see.

Figure 1.—Australimusa and Eumusa bananas.

Figure 2.—Diploid and triploid groups of Eumusa bananas.

CLASSIFICATION OF EDIBLE BANANAS



Each edible banana is a member of either one of two groups, the Australimusa and the Eumusa.

The **Australimusa** group includes manilla hemp or abaca, *Musa textilis*. Of course this is not an edible banana. All bananas in this group, which is sometimes known as the Fe'i group because that is the name in Samoa, have bunches and male axes that point upwards (erect). The juice of the plant is generally pink or red.

Eumusa. Most of the members of this group come from crosses between two wild species, *Musa acuminata* and *M. balbisiana*, both of which are grown in Papua New Guinea. A few come from crosses between *M. acuminata* and *M. schizocarpa*.

They may be diploids, triploids or tetraploids. This means that they have 2, 3 or 4 sets of chromosomes.

Diploids. Most diploids come from a cross between one *Musa acuminata* and another *M. acuminata*. We call them AA bananas.

Diploid bananas can be recognized because their leaves and petioles are stiffer than triploids and the leaves are more upright.

Triploids. These can be AAA, AAB or ABB. An ABB banana for example received one set of chromosomes from *M. acuminata* and two sets from *M. balbisiana*. An AAA banana had three *M. acuminata* parents.

1. **AAA bananas.** Some of the things that are common to this group are given in the *Table*. The AAA bananas are described in the text as the "A group".

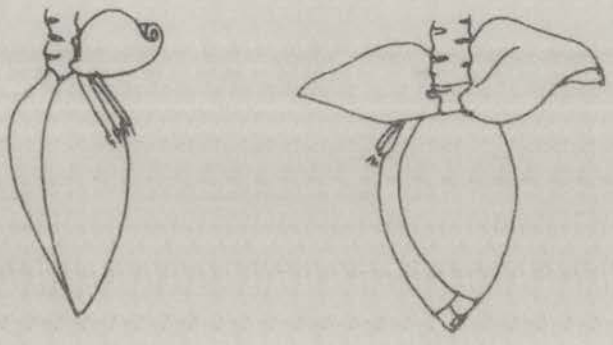
2. **ABB bananas.** These are described as the "B group" in the text. Some of the things that are common to this group are given in the *Table*.

3. **AAB bananas.** The characters of this group are in between those of the AAA and ABB ones. In general AAB bananas have the good eating qualities of the AAA ones and the toughness of the ABB ones. There are not very many AAB varieties in PNG. Some varieties are alumba, avundumong, balus and darip.

Tetraploids. These are very rare, but two are known from New Britain, called atan and kudu-kudu. They are members of the AAAB group. From Bougainville is known an AABB banana called kalamagol.

A group
A lot of blotches

B group
Few blotches



A group
Bracts curl and roll back

B group
Bracts lift but do not roll

Figure 3.—Some of the differences between "A" and "B" groups of triploid bananas.

"A group"

These bananas include some important eating varieties such as Gros Michel and Cavendish types. These are the most important types of bananas that are exported from one country to another.

Varieties of Gros Michel known in Papua New Guinea include avabakor and disu varieties.

Varieties of Cavendish known here include siana and siana vavina varieties.

The red banana (samo variety) and green-red banana (warabia or ineve varieties) also belong to this group.

"B group"

There are only a few varieties of the B group bananas in Papua New Guinea, but they are very important because they are "tough" bananas. They can withstand drought and are tolerant of shade and nematodes. They still bear well when the soil is poor.

Yava is a very common variety, particularly on the Gazelle Peninsula. It is a very tough banana plant and does not get much leaf spot disease. This is important because leaf spot can stop the fruit from growing properly in other varieties, such as Cavendish.

Other common varieties are kalapur, which is important in the Markham Valley, and sukuru.

Members of this group will probably become more important in the future because they can be grown where other bananas, such as the diploids, cannot be grown.

There is another group, which has characters in between those of the A and B groups. Bananas of this group in general have the good eating qualities of the A group and the toughness of the B ones. There are not many varieties in Papua New Guinea. Some varieties are alumba, avundumong, balus and darip.

Naming

Latin names for bananas are very mixed up. It is best just to call them *Musa* sp. rather than *Musa cavendishii* or *M. paradisiaca*. Europeans sometimes call cooking bananas by the name "plantain" but this is incorrect. Plantains are a certain sort of banana only.

Further reading

N.W. Simmonds' book *Bananas* goes into the subject thoroughly and is well worth reading. The book was published in 1959 by Longmans, Bristol.

Other publications by N.W. Simmonds for persons with specialized interest are—

A banana collecting expedition to South East Asia and the Pacific. *Tropical Agriculture, Trinidad,* 33(4): 251-271 (1956).

The Evolution of the Banana. Longmans, Green & Company, London (1962).

This paper has been written from LAES Information Bulletin No. 6 of May 1975 "Know your bananas" by R. Michael Bourke.

BANANA PRODUCTION IN THE SOUTH PACIFIC

This Handbook published by the South Pacific Commission contains detailed information about all aspects of commercial banana production.

The language is simple. The book is well illustrated.

The Chapters on harvesting and packing methods, pest control and control of diseases described are not known at present in PNG, while others which occur are not discussed in this book.

This book can be ordered from the

South Pacific Commission Publications Bureau
PO Box 306
Haymarket NSW 2000
Australia.

The cost is $A1.00, post free. Airmail postage extra.

SPC Handbook No. 5 (1970). "Banana production in the South Pacific." Edited by M. Lambert. South Pacific Commission, Noumea. 70 pages.

TEACHING TO TEACH

By Fritz Robinson, Lecturer, and 2nd year Students at Highlands Agricultural College

A request for help from villagers has given students at the Highlands Agricultural College an opportunity for practical extension experience.

In 1974 village farmers of the Roni-Pingiri group helped students from the Highlands Agricultural College to learn about subsistence crops. Students spent a week living with the people, working with them, and getting to see for themselves the problems that a subsistence farmer has, from the inside.

Later the students thanked the Roni-Pingiri people at a mumu at HAC. It was then that the villagers asked the students if they could help them the following year. They said that their aim was to drain their swamp to prepare it for cropping.

This approach from the Roni-Pingiris was most welcome, as staff at the college felt that teaching should be combined with practical experience.

We undertook to assist the Roni-Pingiris for a period of two years.

The Roni-Pingiri group

The Roni-Pingiris are a small group of about 250 Medpla-speaking people living about 20 km south of Mount Hagen. They are divided into a number of haus-lains; despite this they live and work together very happily.

They have recently divided their 70 hectares of swamp land into 36 blocks. Their aim is to develop this land for business. They are changing their lives from customary ways of living to more modern ways of life.

The programme

In 1975 we started our course with a week's patrol and a series of meetings.

After this, first year students began work with the group. Courses in extension, farm management, perennial crops, livestock and surveying all included practical experience with the Roni-Pingiris.

In the second half of 1975, annual crops, farm buildings and mechanics were included. One of the projects completed was the bridge over the Kuna River. Students and villagers

Wimp of Kaip and his family with student Mukate Lapemu, of Finschhafen (the man on the left). Wimp is an economic leader in the area.

Building the bridge over the Kuna River.

A new house on the blocks. People are moving to the blocks gradually as old houses decay.

both contributed labour and materials to build the bridge.

Students spent half a day a week on the programme, although some of us thought that half a day a week was not long enough. Future courses may have a full day, or even an overnight patrol.

What we learned

We have learned about the culture and some of the beliefs of the Roni-Pingiri group, and this is important. We have stayed with them, ate and slept with them.

We have also learned a lot about the subsistence gardening system in the area, how it is organized, and what plants are grown. We did a nutrition survey at the same time.

We also learned some practical lessons from the farmers in organization—how some jobs are organized to be done by the whole group, and how other jobs are run by individuals. Finally we were able to watch group decision-making in action. It takes a long time but it works.

The major problem was that of communication. Although we used young people with standard 6 education in the village, this was not always useful. We propose to change our college course work so that the students learn the communication part of the extension course early in the year, and also to introduce a unit of Pidgin so that Motu speakers can have fewer problems.

What we taught the farmers

It is very hard to change everything at once; and it is very easy to confuse people by teaching too much all at once. Wherever it was possible we taught the people the simplest and cheapest ways of doing things. For example, we taught people ways of making their own compost, rather than buying artificial fertilizer.

Among the things we taught in 1975 were:

- Methods of planting vegetables.
- How to use some useful chemicals—herbicides, fungicides, insecticides. This meant that we had to teach people all about safety, as well as how to use the knapsack spray.
- How to use their knowledge and skills that they already have.
- Simple record-keeping.
- How they can solve their own problems.
- Technical skills involved in coffee husbandry.
- Better nutrition, using mostly the foods that they already have.
- Basic pig husbandry skills, drenching, girth measuring and ear-tagging.

LIKLIK BUK BILONG KAIN KAIN SAMTING

Many agricultural officers will already be familiar with *Liklik Buk Bilong Kain Kain Samting*, that extremely handy book of information for village development.

Liklik Buk is published by the Melanesian Council of Churches in Lae. It contains short articles from many contributors on a wide range of topics, including agriculture, health, machinery, and so on.

Liklik Buk has already sold out its first 5 000 copies, and the MCC is working on the 1977 edition now. The new edition will be an updated version of the 1976 edition, with new material added.

The Agricultural Secretary of the Melanesian Council of Churches, Mr David Williams, is now asking all persons interested in contributing to the new edition to write to him as soon as possible.

The closing date for contributions will be 15 August, 1976. Write to—

Agricultural Secretary
Melanesian Council of Churches
PO Box 80
Lae
Papua New Guinea.

SOILS AND AGRICULTURAL POTENTIAL OF THE MARKHAM VALLEY

Some comments on the recent survey

By R.S. Holloway*

The Land Utilization Branch of the Department of Primary Industry recently undertook a survey of the soils and agricultural potential of the Markham Valley. The area studied covered 120 000 hectares on the northern side of the Markham River extending from the Erap River (48 km from Lae) to the Ramu River (177 km from Lae).

The approach taken in the survey was to study in detail the natural resources of the valley, and from this determine the potential of the land for a range of agricultural activities.

Field work commenced in July, 1970 and was largely completed by the end of 1971. Other investigations continued beyond this time and these have now been finalized. A detailed written report has been prepared: *DASF Research Bulletin* No. 14.

Soil survey was the most time-consuming exercise of the resource investigations. About twelve thousand soil profiles were examined and classified in the field, and results were used to construct a soils map. This was done by grouping soils having similar characteristics, and using the patterns that could be seen on aerial photographs as a basis for delineating soil unit boundaries on the map. Investigations into geology and geomorphology, hydrology, vegetation and current land use, and a detailed analysis of climatic conditions were also undertaken to provide the necessary background knowledge of physical resources used in the assessment of agricultural potential.

Suitability ratings for agriculture were determined by examining 27 factors. Results were expressed on separate maps for each of four agricultural activity groups, namely: arable crops, tree crops, improved pastures and irrigated rice.

The relative importance of the various factors as limitations to agriculture depends mainly on location in the valley and the type of enterprise being considered. In general terms however, it can be stated that the major limitations are: seasonal wetness of the medium and fine textured soils; alkalinity associated with high levels of soil carbonates; seasonal dryness mainly of the coarser textured soils; and graveliness.

Land and crop management factors as a group are of over-riding significance to the attainment and maintenance of agricultural productivity.

One of the most significant findings of the survey has been that the suitability of the Markham Valley for most agricultural enterprises depends strongly on the degree of investment in land improvement measures. The two maps given here of the area between the Leron and Rumu Rivers show an example of the large amount of land which can be added to the arable area by land improvement measures.

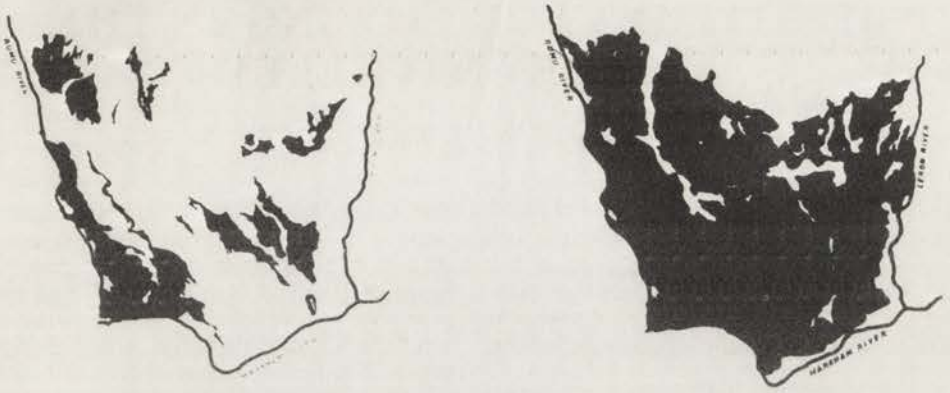
Improvement measures include:

drainage, overflow protection, reduction of bicarbonate hazards;
use of fertilizers;
protective management of crops (weed, pest and disease control);
protective management of land (maintenance of organic matter, erosion prevention, use of rotations).

Drainage is the most important single component of the land improvement measures mentioned above. A large proportion of the nongravelly soils are seasonally wet and are thus not suitable for cropping over extended periods of every year. In the Erap to Lerom area this condition is associated with strongly alkaline soils, and sensitive crops (such as rice) cannot be grown with any certainty of success. A map has been prepared which indicates in general terms the requirements for drainage in different areas of the valley if full agricultural potential is ever to be realized.

Results of climatic analyses have been used to determine optimum sowing dates for different crops at various locations in the valley. All available rainfall records were processed by computer, and results were used to calculate the time of the year when the

*Former Land Utilization Officer, DPI



These two maps show the increase in arable land possible in the area between the Erap and Rumu Rivers with improvement measures. Map A shows the area of arable land before improvement, and Map B shows the area after improvement, including drainage.

chances are greatest for the occurrence of both ideal soil moisture conditions during crop growth, and satisfactory weather conditions at harvest time.

The survey will also provide a framework for thinking about the problems and prospects for land drainage, removal of soil chemical limitations, and irrigation. Some results will be useful in the planning of future agronomic research; some enable an appreciation of the problems that arise as a result of certain farm management practices; and others suggest the types of management practices that might be appropriate to different soils and locations in the valley, and at different times of the year.

Over the course of this survey it has become clear that the attention given over the long term to land management and crop or grazing management will be of utmost importance in determining whether or not the Markham Valley land will be maintained as a productive agricultural resource. Detailed economic, social, agronomic and engineering investigations will be necessary to determine the degree of investment in land improvement measures which would enable the most efficient but realistic use of these land resources for the benefit of the country in future years.

For further information about the Markham Valley survey, write to—

The Chief Land Utilization Officer,
P.O. Box 1863,
Boroko,
Papua New Guinea.

PROHIBITION OF TEA IMPORTS

The Minister for Defence, Foreign Affairs and Trade, Sir Maori Kiki, has announced his intention of placing a total prohibition on imports of tea in small packets and containers as from 1 September this year.

Sir Maori Kiki said it was his intention to totally prohibit the importation of tea in containers less than 10 kg net weight.

This action has been taken in the interest of greater self-reliance—primarily to transfer the packaging profit to local industry and to provide additional local employment.

Sir Maori Kiki's office also said that is has become clear that the Papua New Guinea tea industry can produce a satisfactory product and that it had found it possible to compete at price levels set by imported tea.

Sir Maori Kiki said that a series of products and packaged goods now being imported would be progressively examined to see if similar action would be desirable.

BEST TIMES FOR SOWING IN THE MARKHAM VALLEY

By R.S. Holloway*

Rain-grown cropping enterprises are an important feature of agriculture in the Markham and Ramu Valleys. On those soils which are well drained during the wet season, the sowing of crops can be timed to coincide with optimum soil moisture conditions during growth, and suitably dry weather at harvest time.

Climatically optimum sowing dates are suggested for dryland rice, grain sorghum, maize and peanuts at a number of locations in the valley.

When is the right time to sow crops in the Markham-Ramu Valley so that there is the best chance of getting the highest yield? Is there a "best" sowing period when good yields could be confidently expected over a run of seasons?

The Land Utilization Section of the Department of Primary Industry has been studying this question as part of its survey of the agricultural potential of the Markham Valley.

The timing of cropping could be affected by a number of factors, and these are described briefly as follows.

Location. Rainfall records from various places in the valley show that there are significant differences from one place to another. For example, areas close to the hills such as Kaiapit (94 inches per year) receive more rain on average than the valley centres (e.g. Mutsing, 63 inches per year). Also there are changes along the valley: Erap has an annual average of 48 inches but Gusap receives 75 inches on average. This suggests that if there is a "best" time for sowing crops, some differences might be expected from one location to another.

Soil conditions. The natural drainage condition of soils is one important factor which must be considered when deciding the time of planting. If the soils are free-draining, without surface water or subsoil water tables, then the best time of cropping depends chiefly on the rainfall. In poorly drained areas on the other hand it is not possible to plough during the wet season and hence ploughing must be delayed until the land dries out.

*Former Land Utilization Officer, DPI

For example, in the area between the Erap and Leron Rivers, well-drained soils occupy about 13 500 hectares but this represents only 27 per cent of the total area. A further 7 700 hectares are moderately well drained and can probably be ploughed during a break in the wet conditions, although some delays are likely. The rest of the land, 28 700 hectares, which makes up 57 per cent of the total, is poorly drained and most areas could only be used for cropping during the dry weather.

Type of crop. Different crops have different water requirements. For dryland rice, the growing period is about 19 weeks; for grain sorghum and maize, it is about 14 weeks. For cereals such as dryland rice, grain sorghum and maize, the plants need water most from just before flowering through flowering to early grain formation. In dryland rice this corresponds roughly to weeks 9 to 13 after sowing, and in grain sorghum and maize to weeks 6 to 9 after sowing. For peanuts the first 8 weeks after sowing is the time when water is needed most. Rainfall during the last 7 or 8 weeks of the growing season has little effect on yields.

Crop health. Most crops will grow faster in the wet season than in the dry season and unfortunately the same is true of weeds. It is also true of insect pests and of organisms causing disease. On the whole rates of insect and disease damage are much greater during the rainy season.

A farmer may decide to avoid cropping a particular section of land during the wet season if he knows it has a bad weed problem. Also he may choose to avoid certain types of crops during the wet season if he feels that the extra management costs in controlling weeds, insect pests or disease problems will not be worthwhile. This is a complex factor and is being examined by the agronomists.

Best sowing times

Taking the first three of the above points into consideration and ignoring the weeds, insect pests and disease risks, it is possible to match the water requirements of the crop with a period of high soil moisture levels and at the same time avoiding excessively wet conditions at harvest time. In this way it is possible to

decide what is the best time to plant a crop in a particular place in order to get the greatest chance of a good yield. This "best time for planting" is called "the climatically optimum sowing date".

Rainfall registrations have been recorded at seven stations in the Markham and Ramu Valleys for varying lengths of time—Erap 20 years, Sasiang 9, Leron 11, Mutsing 5, Kaiapit 20, Gusap 12 and Dumpu 10 years. The rainfall figures were processed by a computer to estimate the moisture content of soils over the whole period for which records are available. Allowances were made for losses by evaporation, transpiration (loss of water from leaves of plants) and water runoff.

After taking into account the general moisture requirements of different crops, and the risk of conditions being too wet at harvest time, the best times for sowing were determined. *Table* 1 gives these times for dryland rice, *Table* 2 for grain sorghum and maize and *Table* 3 for peanuts. Early and late limits for the growing season are suggested.

Sowing should not commence before the date given in the first column. In the case of Erap, this is because there is a risk that conditions will be too dry for good growth of the crop; for other stations the risk is that conditions at harvest time will be too wet. Likewise sowing should not be continued later than the date given in the third column.

Table 1. Dryland rice—climatically optimum sowing date on freely draining soils

Place	*Do not sow before*	*Optimum sowing period*	*Do not sow later than*
Erap (20 years)	Dec. 25	Jan. 1 - Jan. 10 May 28 - June 3*	Jan. 26
Sasiang (9 years)	Dec. 27	Jan. 1 - Feb. 1	Feb. 12
Leron (11 years)	Jan. 7	Jan. 20 - Feb. 10	Feb. 25
Mutsing (5 years)	Jan. 1	Jan. 14 - Feb. 1	Feb. 18
Kaiapit (20 years)	Jan. 10	Feb. 4 - Feb. 20	Mar. 18
Gusap (12 years)	Jan. 8	Jan. 20 - Feb. 14	Mar. 5
Dumpu (10 years)	Jan. 20	Feb. 10 - Feb. 22	Mar. 25

*A second rice crop is not recommended because soil moisture storage is too low in most seasons.

The length of time during which rainfall records have been kept is shown in brackets.

In this case the risk is that there will not be enough water available at the time when the crop needs water most.

As a general rule it is suggested that the freely draining coarser textured soils (sandy soils or shallow soils on gravel) should be the first ones sown, since these are least likely to have wetness problems at harvest time. Sandy loams and well-drained loamy soils should be sown at the beginning of the optimum sowing period (centre column in the tables) but not before this period. The finer textured soils (clayloams and clays) should also be sown as early as possible after the start of the optimum period, but in many cases it will be necessary to wait until the soils become drier before planting can begin.

Table 2. Grain sorghum and maize—climatically optimum sowing date on freely draining soils

Place	*Do not sow before*	*Optimum sowing period*	*Do not sow later than*
Erap (20 years)	Jan. 11 Jun. 20	Jan. 29 - Feb. 18 Jun. 25 - Jul. 3	Mar. 10 Jul. 26
Sasiang (9 years)	Feb. 1	Feb. 10 - Mar. 1	Mar. 15
Leron (11 years)	Feb. 15	Feb. 25 - Mar. 10	Mar. 25
Mutsing (5 years)	Feb. 11	Feb. 20 - Mar. 1	Mar. 10
Kaiapit (20 years)	Mar. 5	Mar. 12 - Mar. 25	Apr. 15
Gusap (12 years)	Feb. 20	Mar. 5 - Mar. 18	Apr. 5
Dumpu (10 years)	Feb. 25	Mar. 3 - Mar. 25	May. 1

Table 3. Peanuts—climatically optimum sowing date on freely draining soils

Place	*Do not sow before*	*Optimum sowing period*	*Do not sow later than*
Erap (20 years)	Jan. 28 Jun. 18	Feb. 15 - Feb. 25 Jul. 7 - Jul. 25	Mar. 12 Aug. 4
Sasiang (9 years)	Feb. 8	Feb. 18 - Mar. 10	Mar. 25
Leron (11 years)	Feb. 20	Mar. 1 - Mar. 18	Apr. 20
Mutsing (5 years)	Feb. 20	Feb. 26 - Mar. 12	Apr. 15
Kaiapit (20 years)	Mar. 5	Mar. 12 - Apr. 1	May. 14
Gusap (12 years)	Feb. 26	Mar. 5 - Apr. 9	Apr. 28
Dumpu (10 years)	Mar. 5	Mar. 18 - Apr. 9	May. 20

To get good yields from dryland rice and maize, it is particularly necessary to have the right amount of moisture in the soil during the growing season. If it is not possible to plant these crops at the times suggested in the tables, it would be better not to plant them at all, because at other times the risk is high that the soil will be too dry to get a good crop. Good soil moisture conditions are also important for grain sorghum and peanuts; however the risk of a poor crop because of dry weather is not as high as for rice and maize. Thus it is suggested that if for any reason cropping is delayed until after the optimum period, grain sorghum or peanuts should be sown in preference to rice or maize.

Unfortunately, the time when the crop grows best is also the time when weeds, insect pests and diseases are most likely to be a problem. Cropping programmes bases on these tables will mean more work for the farmer. In order to get a bigger yield he will have to give more attention to crop health factors, and especially to weed control. Generally speaking weed problems can be minimized by early ploughing, carefully timed cultivation prior to sowing, and also by the use of chemicals and crop rotations.

The sowing dates given in the tables are not meant to suggest that crops sown at other times of the year will yield poorly. There certainly is a risk of dry conditions especially on the freely draining soils, but this is offset to some extent by lower management costs. Again, some soils may still be too wet to plough during the "optimum sowing period". It is suggested however, that provided correct attention can be given to crop health factors, the most consistent crop yields on well-drained soils will be achieved if the schedules (*Tables* 1 to 3) are used as a guideline for sowing.

The recommendations given above are based on the highest chances of ideal soil moisture conditions occurring, and these in turn depend on rainfall records available at each station.

Normally a period of 30 years is considered to be the minimum period for reliability. Most rainfall records from the Markham Valley cover only short periods and there is a chance that the optimum dates may change somewhat as more records come to hand. Even for the stations with the longest records (Kaiapit and Erap) it is emphasized that the decision on sowing dates in any given year should be made in consideration of the particular weather, soil and weed conditions prevailing at the time.

An experimental irrigated rice crop in the Markham Valley. Photo: Office of Information.

SHIFTING CULTIVATION— HOW IT AFFECTS THE SOIL ENVIRONMENT

By Roger L. Parfitt, Senior Lecturer in Soil Science, University of Papua New Guinea

Shifting cultivation has been carried out for thousands of years in Papua New Guinea. This article describes some possible reasons for different aspects of shifting cultivation such as burning off the bush fallow and the planting of casuarina groves.

Shifting cultivation is widely practised in many tropical countries of the world including large parts of Africa, south-east Asia and America. Forest and grassland are cut and burned, food crops are planted for one or two years and then the garden is left to return to forest or grassland.

Each year, fresh areas are cleared and new gardens are planted. The old garden often is left for 10 or 20 years before it is cleared again and replanted.

Although shifting cultivation appears wasteful it has provided man in the tropics with his livelihood over the centuries.

Burning off

The clearing stage often involves burning off, although this not always the practice. For instance, in the Western Province of Papua New Guinea, the undergrowth is cleared, the garden is planted and then the forest is cut down on top of the garden and, surprisingly, 90 % of the garden plants are not damaged by falling trees.

In grassland areas, if machinery is not available, gardens are prepared by burning the grasses and tilling the soil by hand. Although the fire has a temperature of 500 °C, the temperature in the soil is only 100 °C at a depth of 1 cm since the soil is a good insulator.

The fire and the ashes do, in fact, improve the soil in several ways. The ash that remains is rich in minerals such as potassium (potash K), phosphate (P) and calcium (Ca) *(Table* 1). These are dissolved by rain water and are added to the soil. They are immediately available to plants. The ashes also contain potassium carbonate (K_2CO_3) which neutralizes acid soils, increases the pH and this in turn increases the amount of nitrogen (N) that becomes available from the humus since the micro-organisms that mineralize the nitrogen function better when the soil is neutral. However, some valuable nutrients are lost to the air during burning off. Nitrogen and sulphur that are stored in the grass and trees are lost as oxides in the smoke and some of the organic matter in the top few centimetres is also burned away.

The loss of nitrogen and sulphur is quite serious in grass savanna where burning occurs every year. This often results in nitrogen and suphur deficiency in grassland areas. Nitrogen is one of the major plant nutrients and if the soil is deficient in nitrogen, the plants will be small and yellow in colour and the yield will be seriously affected.

In the savanna areas burning early in the dry season is better because it produces a less intense fire than a late burn and it allows fresh growth to occur before the heavy rains begin and this will reduce erosion.

The loss of nitrogen on burning forest timber is less serious because larger amounts of bases such as K, Ca and Mg are added to the soil which increases the soil pH and makes more nitrogen available from humus.

The soil organic matter (humus) decreases during gardening because very little leaf litter is added to the soil and microbial decomposition of the humus is rapid at temperatures of 30 to 40 °C. This is particularly true in coastal and lowland areas where temperatures are high. It is advisable to cover the soil with a straw mulch because this can reduce the temperature of the topsoil at midday by more than 10 °C. The mulch also reduces erosion and damage from heavy rains, and helps to prevent weed growth and evaporation of soil water during the dry spells.

The fallow

Gardens are abandoned after two or three years but this may not be because of loss of soil fertility. In lowland Africa, gardens are abandoned because of problems with weeds, insects and plant diseases. However, in the highlands of Papua New Guinea, sweet potato can be grown almost continuously in some minerals soils. If the yields decline to levels that are not worthwhile a grass fallow or a peanut crop is established and sweet potato

Casuarina trees.

Leucaena trees.

Table 1.—**Soil changes after burning (from Nye and Greenland 1960).**

	pH before burning	*pH after burning*	*Nutrients added to the soil in ashes (kg per hectare)*				
			P	*K*	*Ca*	*Mg*	*N*
400 year forest	5.2	7.9	25	750	160	190	-110 (lost in smoke)
Grass savanna			8	45	34	25	- 28 (lost in smoke)

Table 2.—**Soil nitrogen under different crops.**

Site	*Crop*	*Cropping period*	*%N*
Goroka (EHP)	Sweet potato	4 years	0.24
	Casuarina	2 years	0.27
	Casuarina	20 years	0.54
Aiyura (EHP)	Grass fallow	-	0.29
	Coffee and casuarina	2 years	0.26
	Coffee and casuarina	6 years	0.33
Banz (WHP)	New garden	-	0.25
	Coffee and casuarina	5 years	0.34
	Coffee and casuarina	10 years	0.43
Sialum Mlorobe)	Kunai	-	0.35
	Sweet potato	1 year	0.23
	Leucaena	2 years	0.75

can then be planted in the following seasons. The fallow or peanut crop does seem to allow nutrients (possibly nitrogen) to build up to required levels.

In the lowland areas, there are several factors that determine the length of the bush fallow. In African savanna, the grass fallow is important for eliminating undesirable weeds and a period of 10 years is adequate. A forest fallow allows humus to build up in the topsoil because of large additions of dead leaves. The tree roots bring up nutrients from the subsoil and they are returned to the soil during leaf fall. In parts of Asia, the forest fallow is used to prevent the build-up of kunai grass *(Imperata cylindrica)* and a fallow of 10 years is needed.

Casuarina trees

In shifting cultivation, the soil is left for a number of years under a bush fallow. In the highlands, casuarina trees are often planted in old gardens. Not only do they act as windbreaks and a source of timber, but they fix nitrogen from the atmosphere in a similar way to legumes.

Soil samples were collected under casuarina trees of different age on adjacent sites in the highlands and analysed for nitrogen. The results are given in *Table* 2. The soil nitrogen increases under casuarina trees that are 5 or 6 years old and continues to increase as the trees grow larger and form a thicker root mat and deeper layer of leaf litter. Therefore, the practice of planting casuarina trees is important in improving soil fertility and is a sensible practice where a fallow of 5 to 10 years is used. It is very useful as a shade tree in coffee plantations since it also adds nitrogen to the soil.

Leucaena

Leucaena trees in the lowlands grow extremely quickly given adequate rainfall. They are legumes and at Sialum (Morobe), they increased the soil nitrogen from 0.23 % to 0.75 % after only two years (*Table* 2), and this would improve the yield of later garden crops. The root mat is particularly dense, full of nodules and there is no undergrowth so it is easy to clear. Leucaena would seem to be a very valuable crop for improving soil fertility in just one or two years in the lowland and coastal areas.

Given low population density and moderately fertile soils, shifting cultivation is the best system that could be devised, for the labour inputs are low compared with the size of the harvest and the fertility of the soil is restored quickly by regrowth of forest. In areas where there is a dense population such as in Chimbu, in the Gazelle Peninsula and near Maprik, casuarina and leucaena could be planted during the fallow to restore soil nitrogen and organic matter.

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GROWTH OF PIGS IN CROWDED CONDITIONS

By G.L. Malynicz, Senior Veterinary Officer, Tropical Pig Breeding and Research Centre, Goroka

In this experiment, not much difference was found between the growth of pigs in large or small rooms.

During 1972 a small experiment was conducted at the Department of Primary Industry piggery at Goroka to look at the effect of different sized room on growth rate and food eaten by young pigs.

The experiment was carried out in a local materials house which had bush timber walls and a kunai roof. The floor was made from dried elephant grass which was thrown in every day to make a deep litter.

There were three rooms in the house. These had the following areas: 2.50, 5.38 and 11.52 sq m. Six eleven-week-old pigs of about the same weight were put into each pen.

The pigs were all fed as much as they could eat of the same ration every day. The ration consisted of 1 kg of protein concentrate mixed with 10 kg of cooked sweet potato. The protein concentrate contained 55 % protein and all the vitamins and minerals that pigs need. To see how quickly the pigs were growing, they were weighed every week. The experiment lasted for ten weeks.

The table shows the results of the experiment. There was not much difference between the three pens in the growth rate. The pigs in the smallest room grew more quickly. However they required more food to put on a kilogram of weight, that is they had a higher food-conversion ratio. The pigs in the biggest room grew a little more slowly than the pigs in the other rooms, but their food-conversion ratio was good.

The experiment showed that there was not much effect of crowding on performance, so that in deep litter houses we can use small rooms.

The Effect of Floor Space on Pig Performance

	Floor space of rooms (square metres)		
	2.50	*5.38*	*11.52*
Weight at beginning (kg)	20.5	19.8	20.0
Weight after ten weeks (kg)	68.2	65.3	58.5
Daily weight gain (kg)	0.68	0.65	0.55
Food consumed per pig per day (kg)	7.5	5.9	4.9
Food conversion ratio[1]	4.0	3.26	3.26

[1]Food conversion ratio is the amount of food eaten (expressed on a dry matter basis) divided by the weight gain.

EAST SEPIK PROVINCE

By Miri Setae, Provincial Rural Development Officer

Miri Setae was born at Tapala village in the Malalaua subprovince of the Gulf Province. He went to primary school at home, then to Kerema high school, and Sogeri secondary high school, then to Vudal Agricultural College in 1967. After graduating in 1969 he spent some time working at Vudal, mostly in livestock work—cattle, poultry and piggery. In January 1972 he went to a livestock course at the East-West Centre in Hawaii, for six months. After he came back from Hawaii he was posted to 3-mile Livestock Station, Lae, then to Finschhafen and Kabwum in the Morobe Province, before going to Wewak in February 1974. He became PRDO in October 1974.

Mr Setae is married with one child. His wife has recently taken a job in Community Development in Wewak.

The province has a dry season from June to September, and a wet season from November to March. Average rainfall is 1 980 mm, with the highest in the Amboin foothills at 3 048 mm. Inland areas are very dry in July and September.

The average temperature ranges from 25 °C to 34 °C.

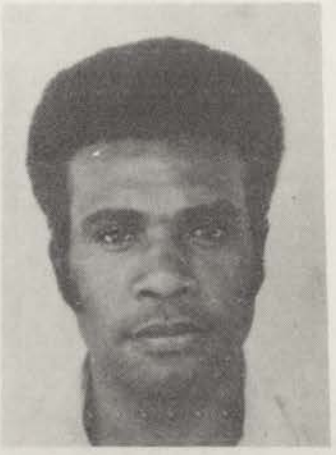
Between the West Sepik border and the Murik Lakes the terrain is undulating to mountainous within 30 km of the coast. The remainder of the province is 70 % flat with 50 % of that swampy. The dominant feature is the Sepik River and flood plain, approximately 480 km long.

About 25 % of the province is arable, mainly in foothill country. As swamps dry seasonally, areas are planted with subsistence crops.

The total province area is 57 000 sq km.

The vegetation is rainforest on the mountain slopes, with sago and rainforest near rivers, and mangroves on the coastline, particularly round the Murik Lakes. The flood plains are mainly grasslands.

Road systems combined with the river system and a number of airstrips give all areas good accessability. STD telephone links Wewak, Maprik and Angoram with the rest of the country. All other stations have regular radio schedules.



Miri Setae

People

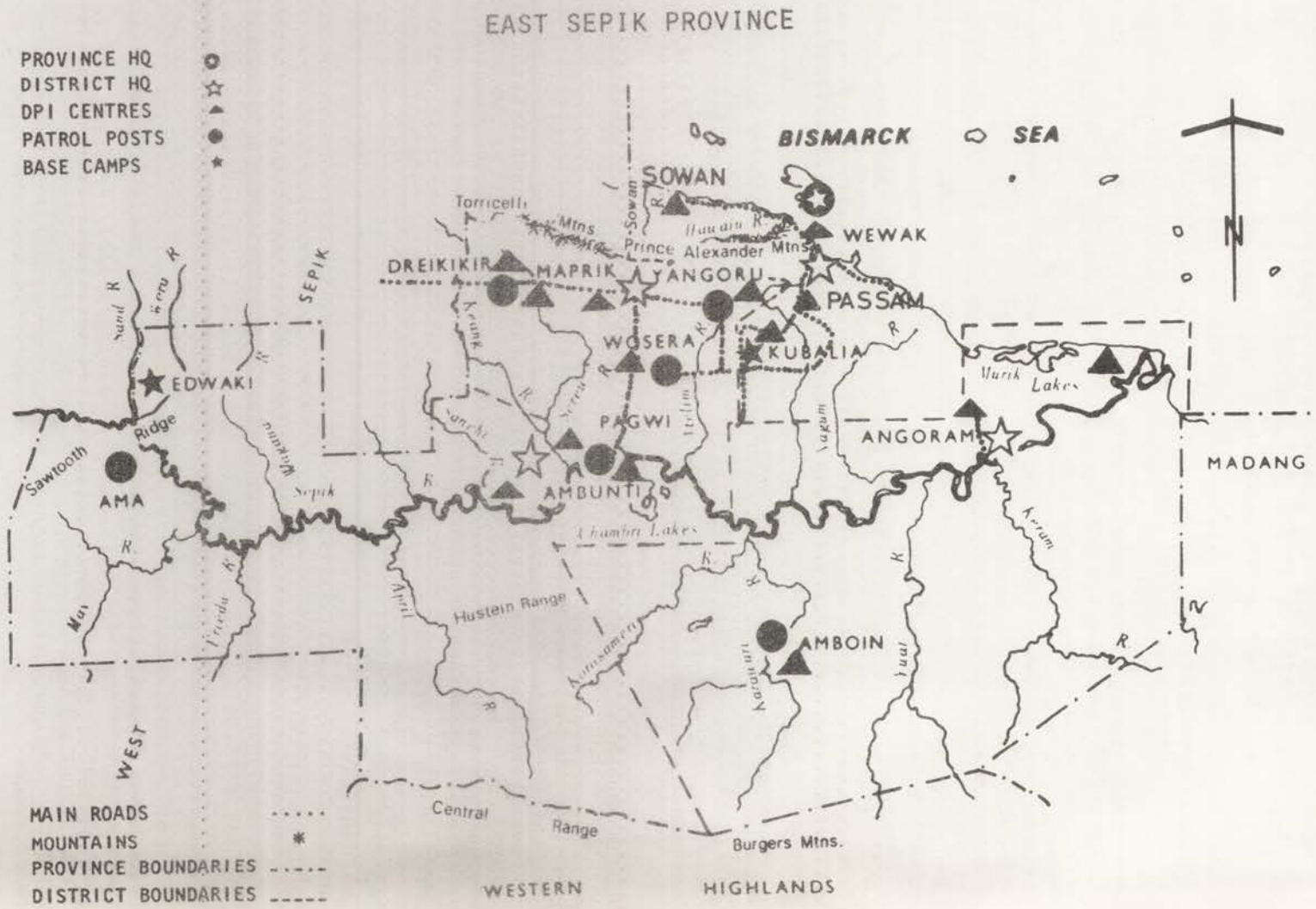
The population is 214 000. Maprik is the most densely populated subprovince with 25.6 people per sq km.

Language groups are very diversified. For example, in the Wewak area there are three types. Saussi is spoken in Wewak coastal area, inland and in the Sepik plains. River people speak various other dialects.

There are 86 primary schools of which 53 are run by the Catholic Mission. There are three high schools in the Wewak area and two in the Maprik area. There is one vocational centre at Wewak, one at Maprik and two at Angoram. There is a teachers' college at Wewak.

The province has a main hospital at Wewak and smaller hospitals at Maprik and Angoram. There are five other major health centres and over 100 aidposts.

Health problems are malaria throughout the province, and tuberculosis in the Angoram area. A major problem is malnutrition—possibly 40 % of children under six years old are malnourished. The Sepik River people can improve their diet with tilapia, but inland people have difficulty as the main foods are sago, yams, etc.


EAST SEPIK PROVINCE
PROVINCE HQ
DISTRICT HQ
DPI CENTRES
PATROL POSTS
BASE CAMPS
BISMARCK SEA
SOWAN
WEWAK
DREIKIKIR
MAPRIK
YANGORU
PASSAM
WOSERA
KUBALIA
EDWAKI
PAGWI
ANGORAM
MADANG
AMA
AMBUNTI
AMBOIN
Torricelli Mtns
Prince Alexander Mtns
Sawtooth Ridge
Chambri Lakes
Hustein Range
Central Range
Burgers Mtns.
WEST SEPIK
WESTERN HIGHLANDS
MAIN ROADS
MOUNTAINS
PROVINCE BOUNDARIES
DISTRICT BOUNDARIES

Missions

There are about 12 denominations in the province. The oldest missions in the area are the Catholic and the Assemblies of God. The Catholic Mission provides services such as air services, health, education and agriculture to the province.

Political

The Prime Minister, Michael Somare, represents the regional electorate of East Sepik. The other members of parliament are William Eichhorn (Angoram), Sno O'Shannesy (Wewak), Pita Lus (Maprik, Minister for Corrective Institutions and Liquor Licensing), Lainus Hepau (Yangoru-Saussia), Tormble Kabai (Dreikikir), John Matik (Wosera-Gaui) and Anskar Karmel (Upper Sepik).

Other leaders include local government council presidents Beri (Wewak), Wongiwon and Garu (Maprik), Amoben and Watum (Angoram), traditional leaders Labu (Wewak) and others, and Sepik Producers' Co-operative Association directors Akiro, Lipan and Wongu.

Self-help groups in the province include, in the Maprik and Ambunti area, the Sepik Producers' Co-operative Association, and in the Wewak area, the Cattlemen's Co-operative, the Cocoa Growers' Co-operative, and the Wholesale Co-operative.

There are 12 councils in the area. The highest tax rate is paid in Wewak (K12 male, K5 female) and the lowest in Ambunti (K3 villages, K5 station). All councils are actively implementing the rural improvement programme.

Maprik, Wewak and Ambunti councils have established agricultural committees.

There is no area authority, but its functions are being handled by the East Sepik Province Co-ordinating Committee.

Economy

Land disputes are common wherever there is a shortage of arable land, mainly in the Wewak area where fights occur.

As roads extend, and the cash economy becomes established, people are becoming business-minded. They own PMVs, road maintence equipment for hire, etc. Ambunti people have little business interest as yet.

Agricultural development in the province is most successful. Dryland rice and coffee together earn K1 million per year, with 20 000 growers. There is rapid expansion in livestock, wildlife, cocoa, rubber, fishing and coconuts.

A development scheme, mainly rubber, is planned for Gavien. There is a government buffalo farm with 600 head. All agriculture is in the hands of local people.

Tourism is becoming important. There are houseboat cruises from Ambunti to Angoram tied in with large sales of artifacts.

There is little mining. There are three sawmills. The main one is Sepik Timbers at Wewak, and two small ones in Angoram.

The Department of Forests has a research trial at Kunginzini near Maprik, to find what type of tree will grow best on the Sepik plains. Seed distribution is carried out from a nursery at Maprik. They are also investigating minor forest products — copal gum and massoy bark.

The East Sepik Agricultural Development Proposal

The Asian Development Bank is providing technical assistance to the Papua New Guinea government for a study of the East Sepik's agricultural and agro-industrial development potential. A group of Belgian consultants working in collaboration with the government and private interests has been investigating possible avenues of development, and is currently drawing up a draft report for discussion with the government and the Bank.

If agreement is reached, the scheme will be ready for funding to start in the financial year 1977-78. At this stage developments proposed are two types—

1. An improvement and upgrading in the support resources available to settled village and river people in their cash cropping, for example coffee and cocoa, and in the processing and marketing of Sepik tilapia.

The coffee and cocoa work would involve field trial experimentation and extension leading to increased yeilds from existing plantings, and further expansion of the crop areas. Field station facilities are likely to be placed in the Angoram, Bainyik to Maprik, Urimo and Wewak areas to assist this work.

2. The expansion and initiation of smallholder settlement schemes.

A livestock settlement scheme based on water buffalo and utilizing the grasslands of Sepik plains is envisaged. The present herd based on Urimo is being built up.

The Gavien scheme is likely to receive Bank funding in its expansion and will now involve other tree cash cropping, cocoa, in addition to rubber.

Assistance is also likely in the improvement of infrastructure, health and nutrition services, and in the incorporation of a relevant agriculture content in primary education.

AGRICULTURAL DEVELOPMENT PROGRAMME

Coffee

Coffee is the major cash earner of the province—it earned well over K1 million in 1974-75, with a production of 1 815 tonnes of parchment.

There are 8 789 growers. Maprik subprovince is the main area with 6 456 growers.

The only problems with this crop are that it is tedious to harvest and process, and most gardens have never been pruned back and maintained properly because of people's lack of understanding of the importance of this.

The Department of Primary Industry's extension effort is concentrated on encouraging increased production by pruning and better maintenance in the old gardens.

New gardens are being established in Ambunti, Wewak, Angoram and Maprik areas.

A three-week course in all aspects of coffee-growing and processing will be held for farmers in September.

The department is encouraging coffee growers to buy pulpers where needed. In the present year 35 coffee pulpers will be made available for the Bainyik, Ambunti and Angoram areas.

The Sepik Producers' Co-operative buys coffee in the Ambunti and Maprik areas. Coffee purchases in the Angoram area will be handed over to a local group in 1977-78.

In 1978-79 the department will investigate the possibilities of a factory to make instant coffee in the province. If this is proved feasible, a start will be made with coffee roasting plant in 1979-80.

Extension efforts will continue as at present, provided price is maintained.

Rice

Rice is the second most important crop in the province. There are about 10 ha planted at Ambunti, 25 ha at Angoram, 9 ha at Wewak, and some at Maprik.

Last year, production aims were not achieved, and production dropped 50 % in Maprik. This year an intensive campaign is being conducted on radio, in meetings, demonstrations, etc. to encourage people to increase their plantings.

The department assists the Sepik Producers' Co-operative Association to buy rice, and buys rice in the Angoram area where the SPCA is not operating.

The department arranges distribution of seed. In 1977-78 a new variety of seed will be introduced. The possibilities of planting wet rice will also be investigated, and 10 gardens of wet rice as a trial only will be established at Maprik. Equipment such as winnowers, threshers and milling equipment are made available where needed. The Bainyik rice mill is to be replaced in 1977. Two small rice mills will be supplied to villagers at Porapora and Ambunti in 1977. In 1978-79 a medium-sized rice mill will be installed at Angoram, and a small mill will be supplied to Amboin.

The long term aim is to increase production each year up to 2 500 tonnes by 1981.

Cocoa

Cocoa is mostly grown along the coast, in the Wewak subprovince. There is some activity at Maprik, and cocoa will be introduced to Angoram once the road is through.

There are 1 159 growers, with 416 ha in the Wewak area, and 177 growers, with mainly immature trees, in the Maprik area. Production is approximately 300 tonnes.

Expansion will follow the interest of the people. At Angoram, Marienberg planting will be enlarged to 12 ha, and 4 new gardens of ½ ha each will be started along the new road. A clonal propogation garden will be set up at Gavien.

Planting will continue in the Maprik area where people are interested. In the Wewak area 50 ha of coconuts will be interplanted with cocoa in the coming year. Seedling distribution will be continued. A clonal propogation garden will be set up at Passam.

A course will be conducted this year on

Stockman at Urimo Livestock Station keeping watch over mixed herd of buffaloes and some cattle.

growing, maintenance and processing.

Growers will be encouraged to join the Sepik Cocoa Growers' Co-operative. The co-operative handles fermenting, drying and shipping of all cocoa to Madang.

Expansion will continue along these lines, and production is expected to reach 300 tonnes by 1980-81.

Cattle

At Ambunti, there are 376 head on 25 projects. At Angoram there are 1 200 head on 17 projects. At Maprik there are 1 646 head on 120 projects. At Wewak there are 6 380 head on 123 projects.

About K5 000 is paid every month to the farmers, for sale of their cattle, and the interest of the people is increasing each day. The greatest achievement so far is establishing two rural slaughter floors, at Maprik and Angoram. A chillroom will be installed at Maprik this year, and one is planned for Angoram in 1979.

In 1976-77 new projects will be established and existing projects expanded in each area. Pasture improvement by planting with stylo, para grass and pueraria will be carried out in selected areas.

A project management course will be conducted once a year, and the advisory service to farmers and the Cattlemen's Co-operative will be continued.

Cattle project numbers are expected to reach 376 by 1979.

Buffalo

Buffalo will be introduced to 18 interested farmers near Urimo this year. The number of buffalo projects will be increased to 25 in 1977-78, and in the following year buffalo will be introduced to Ambunti and Angoram areas.

Poultry and pigs

In the Angoram area there is one chicken and one duck project. In 1976-77 a 20-breeder duck pen and a 100 meat bird chicken pen will be set up.

In 1977-78 24 peanut hand-grinders will be introduced, and production of locally grown stock feed will be encouraged. With the availability of locally grown feed, an increase in pig and poultry projects to 15 or 20 is planned. Two dozen more hand-grinders will be introduced the following year, and pig or poultry projects will be increased to 30.

Marui crocodile farm. Sago swamp in the background is to be used for a breeding place.

Coconut

Coconuts are mostly grown along the coast, mainly in the Wewak subprovince. There is also a little at Angoram.

The low price for copra has caused people to lose interest in this crop.

In the Angoram area there are about 1 100 growers with 1 122 ha, and 15 copra driers. In the Wewak area there are 468 growers, with 3 024 ha (685 ha immature) and 2 permanent driers. There are other driers which are below standard. Production from the Wewak area was 2 269 tonnes last year.

The Copra Marketing Board has a subdepot at Wewak, handling copra from both East and West Sepik provinces.

Plans for this crop are as follows.

In the Angoram area, place cattle under coconuts in five gardens each year; organize a group to buy the copra.

In the Wewak area, plant 50 ha of coconuts this year, interplant 50 ha with cocoa each year for the next three years, construct 10 permanent copra driers this year (funded by the Development Bank), and five driers per year in the following four years.

A farmer training course on processing of copra will be conducted in the Wewak area this year.

In 1977 the Department of Primary Industry will look into the possibility of establishing a small copra crushing mill; if feasible this will be set up in 1978-79.

Wildlife

Wildlife extension activities are new in the area, but gaining interest from the people both near the water and inland.

Wildlife management

In 1976-77 a management area is to be established in both Ambunti and Angoram subprovinces. In the Wewak subprovince, people will be encouraged to set up wildlife management areas at Sepik Plains and a forest area. A wildlife sanctuary in the Wewak subprovince is planned for 1978-79, and one for Ama in 1980-81.

Crocodile farms

In the Angoram area there are 36 village crocodile farms. There are two demonstration farms, one at Angoram and one at Amboin.

In the Ambunti area there is one farm at Marui and one proposed. In the Wewak area one crocodile farm project is to be started as a trial.

Plans for crocodiles in 1976-77 are as follows.

In the Angoram area, construct demonstration farms at Amboin and Angoram, establish nine more crocodile farms and increase stock to 250. At Ambunti, complete one farm, and establish two more village farms. In the Wewak area establish one crocodile farm.

In 1977-78 five farms are planned for Ambunti subprovince and two for Wewak.

Annual courses, starting this year, will be conducted for government officers and villagers.

Butterflies

In the Maprik area 1 500 butterfly specimens valued at K1 000 have been raised in 6 months.

Planting of butterfly feed plants will be encouraged in 1976-77. The department will maintain quality control, establish a small collection of butterfly specimens at Bainyik, and assist committees.

Cassowaries

Cassowary farms will be established near Marui, in the Ambunti subprovince, and at Terebu Bush, in the Wewak subprovince, in 1976-77. Another farm is planned in the Wewak area the following year.

Fish and fishmeal

Fishing is carried out in the rivers and along the coast of the province.

There are 17 commercial fishermen at Wewak, and production last year was 120 tonnes. An ice-making machine will be installed at Wewak this year, and one smokehouse will be constructed. The aim is to raise production of fish in the Wewak area to 200 tonnes in 1976-77. Two courses per year will be conducted on net fishing, net mending, and fish processing techniques.

At Angoram, two smokehouse are operating, and one is newly completed. Two fish salting projects have been set up. This year five new fish smokehouse are planned, and two new village fish salting projects.

Department of Primary Industry staff will provide general net mending and extension services to the people.

The Sepik River is to be divided into four areas within which fish salting will be encouraged. A market for salted fish has been established now in highland areas.

Fishmeal is being produced at Pagwi in the Maprik subprovince. Production was 1.1 tonne last year. The New Zealand government has shown interest in an aid project for fish processing at Pagwi.

There is little activity at present at Ambunti. In 1976-77 two or three smokehouses will be constructed, and the department will provide an outlet at Maprik for Ambunti people's smoked fish.

Fishermen on rivers and sea will be encouraged to form a co-operative in 1977-78.

There has been a lot of survey work done on fisheries in the province, but no definite propositions have been drawn up to date. A restriction to development is the shortage of suitable staff.

Subsistence crops and vegetables for sale

The aim of this programme is to establish fresh food supplies to markets and to combat nutritional problems. Seed propogation plots have been established at Angoram, Ambunti, Maprik and Wewak.

Extension officers are encouraging people to introduce new vegetables to their diet, and are demonstrating methods of growing, rotation and harvesting.

The Fresh Food Market at Wewak buys fresh vegetables. In 1977-78 two local farmers in the Wewak area will be encouraged to go into commercial gardening, to supply the Wewak Fresh Food Market.

Rubber

Rubber is only grown in the Angoram subprovince at Inmanmeri and Gavien. There are 40 growers, with 35 ha. There are 8 ha bearing, 17 ha immature, and 10 ha new plantings.

In the coming year 5 ha will be introduced to Biwat, and 1 more hectare planted at Inmanmeri. Polyclonal budded materials will be used for village planting. The following year, 2½ ha will be introduced at Blackwater in the Amboin area.

The development of this programme depends on the interest of the people and attitude of the staff.

Project management

New extension centres will be established at Ama, Gwanga, Bongos, Timbunke, Sowam and Porapora areas. Staff will be decentralized and put on these stations so that the community is serviced properly.

GULF PROVINCE

By Jeffrey Tauaole, Provincial Rural Development Officer

Jeffrey Tauaole is from Dobu village in the Esa'ala subprovince of the Milne Bay Province. He attended primary school at the United Church school at Salamo, then did correspondence lessons to Standard 9. In 1963 he went to Popondetta Agricultural Training Institute, and graduated in 1965. He was posted first to Kapogere, in the Central Province, then Misima, Alotau and Raba Raba in the Milne Bay Province. In 1974 he was posted to Tapini in the Central Province, and in 1975 to Kerema as PRDO.

Mr Tauaole is married with one child. His wife Agnes was formerly the postmistress at Tapini.

The area of the province is 42 540 sq km. More than one-third of the total area of the province is water and mangrove swamps.

The south-east season from January to July brings rainfall throughout the province. Average rainfall in the east is 2 328 mm per annum, although higher rainfall is received towards the west.

There is a truck road from Kerema to Malalaua. It will be connected to the Hiritano Highway to Port Moresby in the near future.

There are airstrips at Malalaua, Iokea, Kerema, Murua, Kaintiba, Ihu, Baimuru and Kikori.

There is only one government workboat operating in the province. Villages have a number of outboard motors for travelling on rivers, beside canoes.

Installation of STD at Kerema makes telephone communication to other provinces easier. Reception on VHF radios in the outstations is not very good.

People

The total population is 61 942. Approximately one-third of the population is away from the province, or in paid employment within the province, and the agricultural population is thought to be about 41 000.

Most people belong to the United Church covering all coastal areas. The Catholic Mission occupies most of the inland areas. The Salvation Army has taken a small population in Kerema Bay. Missions play a major part in running schools and health services.

Jeffrey Tauaole

There are four main local languages, namely Toaripi, spoken by East Kerema, Orokolo, spoken by West Kerema and Vailala, Koriki and Koroa spoken by Baimuru and Kikori, and Kavea spoken by Kaintiba area.

Besides the local languages, Motu is spoken in the whole province. Most of the young people speak English and Pidgin is only a very minor language in the province.

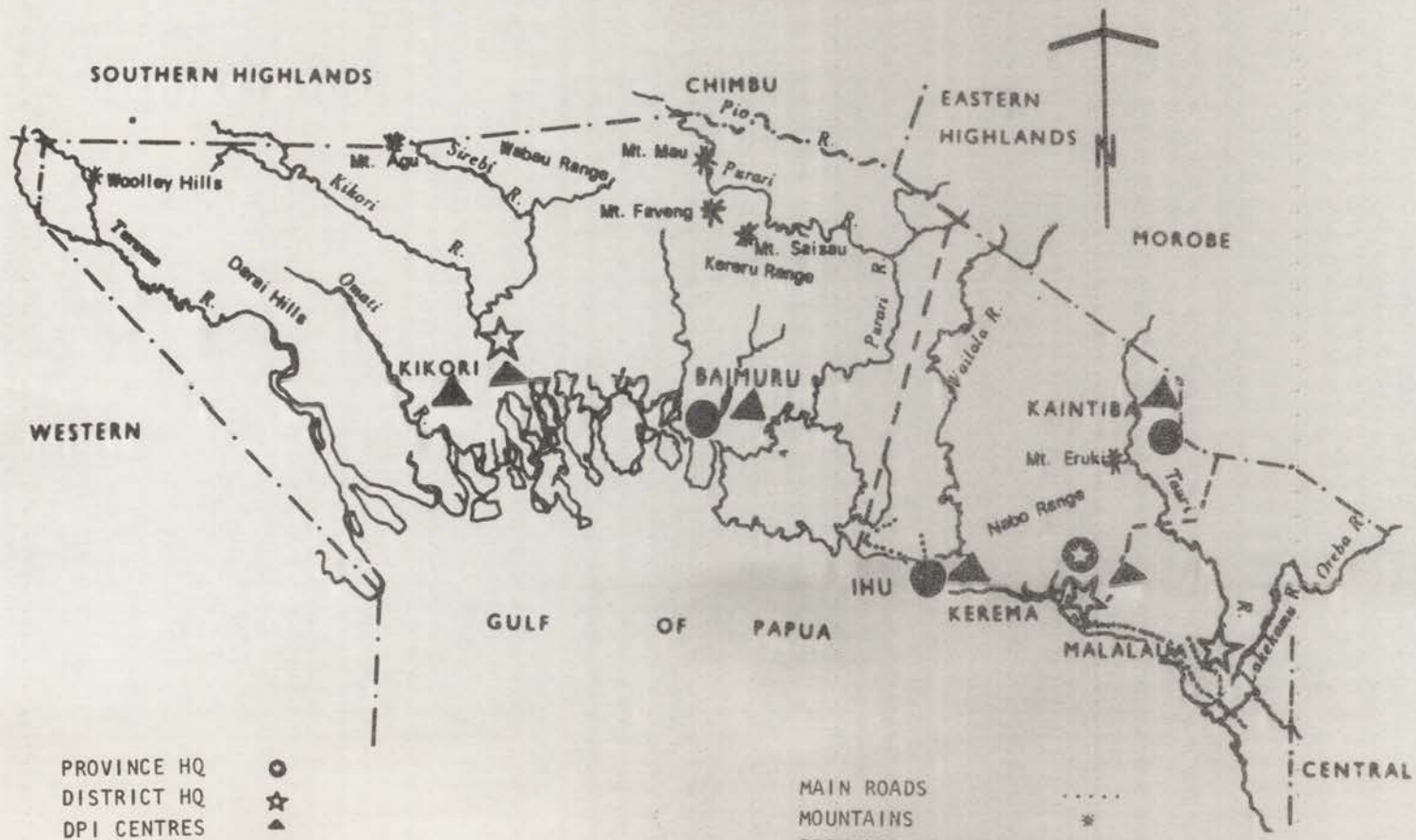
The people in the villages are self-sufficient and there has been only a small resporse to national development. However, more and more village groups are now trying to organize themselves to get financial assistance to improve their village affairs.

Land disputes are very common in the province due to the general shortage of land. Agricultural development is held back by this problem between the clans in some villages.

The highest education level in the province is Form 4. There are vocational centres at Malalaua, Ihu, Baimuru and at Veiru in Kikori. They all teach agricultural subjects such as fishing, crocodile farming, piggeries and cattle farming.

A number of Form 4 leavers are living in the villages and are helping in village development as well as leavers from primary school. Unfortunately they are only young people, so they have few rights to land

GULF PROVINCE



ownership. This discourages many educated people from agricultural development projects so instead they decide to go into town to look for employment.

The main staple foods in the Gulf are sago, banana, sweet potato and taro. People along the coast get their protein from fish and shellfish from the swamp.

Malnutrition is the main health problem in the province, due to lack of protein. More starchy food is consumed than protein. Malaria and chest infections are also problems in the province.

Self-help groups

The Erema Co-operation is a group which was organized by Tom Koraea, MP, in Kerema Bay. They fish and run a PMV from Kerema to Malalaua.

Nearly every village has its own women's club which provides accommodation and other hospitalities to government patrolling teams.

There is a co-operative society in nearly every village. They serve villagers by buying produce from the people and buying stock from Port Moresby for resale to the people in the village.

Political

There are seven local government councils in the province. The councils are having problems on their development projects because they have only small incomes and rely on rural improvement programme funds.

Economy

The Department of Primary Industry is playing a big part in the rural economy of the province. At present the province is short of experienced staff to do effective extension work. Shortage of accommodation is the main cause of staff shortage.

The province has good fishing potential, so more and more emphasis has been put on the fishing industry. Many groups and individuals have started fishing projects and are doing well under the supervision of the fisheries staff.

Tore Lokoloko, MP, and Tom Koraea, MP, have their own agricultural projects which are the biggest locally owned business in the province. They both have great influence on the people in taking up businesses.

The main agricultural activities in the province are listed here in their order of priority: crops—coconut, rubber, coffee, chilli, vegetables; livestock—fishing, cattle, crocodile farming.

Two local sawmills have been established, one at Moveave village in the Malalaua subprovince, and one at Baimuru.

A proposal to establish a hydroelectric scheme at Wabo in the upper reaches of the Purari River is being studied. This scheme will have a great effect on the development of the province and even the country. It will provide employment to the people of the province and the people around the area will have somewhere to sell their produce to get money. An agricultural extension centre is planned to be set up there in 1978-79.

Banking is a problem in the Gulf, through not having a bank branch. Banking services are operated by the Finance Department in main centres, but are insufficient to meet the demand.

Land settlement schemes have been established at Murua, Kupla and Kaiam in Kikori. The blocks are mainly planted with rubber. Murua and Kupla are producing rubber now. Vegetables are being promoted at Murua, to supply Kerema town.

The Papua New Guinea Development Bank has given ten agricultural loans in the province. These projects are working well so far.

Purari hydro-electric power

In the medium to long term future the proposed Purari power scheme should have a big impact on agricultural development in the Gulf Province.

Even if the scheme does not go ahead for many years there is likely to be some effect on the villagers' agricultural outlook because of the activity of investigating teams. Their presence in recent years has already provoked questions as to what sort of agricultural and industrial development the province can expect, and it seems likely that there will be a continuing debate on this topic. Important factors will be the extent to which new marketing opportunities are made available and the extent to which dam and road construction will make agricultural land unavailable for cultivation.

Right now, however, some of the urgency has gone out of these questions, for although feasibility studies will continue, estimates of

the earliest dates for major construction work range from 1981 to 1996.

AGRICULTURAL DEVELOPMENT PROGRAMME

Coconuts

There are over 2 000 ha of coconuts planted in the province. The annual copra production exceeds 1 225 tonnes.

However, copra production dropped last year due to low prices.

This year a coconut census will be conducted in all areas. New plantings will be at Ihu (20 ha), Baimuru (12 ha) and Malalaua (20 ha). At Malalaua 20 ha of overcrowded coconuts will be renovated.

Four new copra driers will be built at Ihu, three at Baimuru, five at Kikori and two at Malalaua.

In following years, 40 ha of coconuts will be planted each year. A seed garden with high-yielding hybrid nuts will be established in 1980-81.

Rubber

There are 90 rubber blocks, 142 ha at Murua and 40 ha in other centres throughout the province. There are 182 ha in production, plus 61 ha immature. The value of rubber sold to the Department of Primary Industry last year was K60 000.

Low prices for rubber last year caused a drop in production. Only a small percentage of mature rubber trees is being tapped regularly.

The 1976-77 aims for the various subprovinces are as follows.

At Murua, plant 20 ha, established 30 000 common seedlings in a nursery for budgrafting, and distribute seedling to other centres.

At Hevoro, open up 350 trees to tapping, and plant 4 ha.

At Kikori, establish six smokehouse factories.

At Baimuru, plant 14 ha of new rubber.

At Ihu, plant 300 trees in a new block, and take a girth census in five existing blocks.

Rubber processing will commence at Baimuru and Kikori in 1977-78.

Cattle

There are 30 individually owned and 10 group owned projects. Seven new projects are being established. There are 236 cattle owned by Papua New Guinean farmers.

The Catholic Mission at Kaintiba and the United Church at Terapo own cattle projects. They help in providing stock and encourage villages to set up smallholder cattle projects.

The demand for cattle is increasing. This year, 11 projects will be fenced at Kaintiba, 1 project will be stocked at Baimuru, and 4 loan applications will be processed at Malalaua.

Six new projects will be investigated at Malalaua, four at Kaintiba and four at Ihu.

At Malalaua, six stock yards will be completed. Investigations for a slaughter slab at Iokea will be carried out.

Improved pasture will be established on existing projects in the Kaintiba area. A cattle breeding centre will be established this year at Bema mission.

Coffee

There are 40 ha of Arabica coffee in the Kaintiba area, and 20 ha of Robusta coffee in coastal areas.

Interest in coffee is very low. An intensive extension programme is needed to inform people about better prices. Coastal people have other means of earning income that are more attractive to them.

A programme of expansion of coffee plantings is planned. New nurseries will be established at six inland villages in the Malalaua area, and at eight villages in the Kikori area. New coffee will be planted at Kikori (2.4 ha) and at Kaintiba (40 ha).

In the Hevoro area, 8 ha of old coffee will be stumped back and renovated, and in the Ihu area, 5 ha of coffee will be stumped back and renovated.

Regular buying of coffee will be organized for Malalaua, Kaintiba and the Wena valley.

A coffee factory will be established at Komaro in the Kikori area.

Twenty ha of coffee will be planted each year in the Kaintiba area for the following four years. In 1978 six village coffee factories are planned for the Wena valley.

Chillies

Interest is increasing in this crop. In coastal areas there are 40 ha planted, and in the Kaintiba area 4 ha.

New plantings of this crop are planned during the coming year. Six ha will be planted at Ihu, 2.4 ha at Baimuru, 12 ha at Kaintiba, 5

Jeffrey Tauaole, PRDO, with the Chairman of the Gulf Province Area Authority, Ope Oeaka, visiting a poultry neat bird raising project.

ha at Kikori, 10 ha at Hevoro, and at Malalaua the area planted to chillies will be doubled.

At Murua, ½ ha will be planted and harvested for seed distribution. A storage shed will be built at Ihu. At Kaintiba buying points will be established and a regular buying schedule started. A chilli drier will be constructed at Kikori.

After this year, no further expansion is planned for the next five years.

Rice

The total area planted to rice in the province is less than 4 ha. Interest is increasing in this crop. Attempts to promote rice-growing in the Ihu area, however, were not successful.

A rice-growing training programme is planned for Murua. A seed multiplication area will be planted there, and a demonstration area will be used to promote interest in rice-growing.

Interest in rice is increasing in the Malalaua area. In 1976-77 1.6 ha of rice will be planted in four villages in the area.

In the Kikori area, 4 ha will be planted at Kumaio, and a rice mill will be established. Four more hectares will be planted the following year.

In 1978 a rice mill will be installed in the Malalaua area, and in the following year, a tractor and machinery hire service will be introduced there. Mechanical harvesting is planned for the Malalaua area in 1980-81.

Pigs

This programme was mainly confined to the Ihu area last year. A lack of staff qualified in pig husbandry hampered development. Pig projects in the area remain in a primitive condition.

There is one project financed by the Development Bank and three projects self-financed.

Pig feed is expensive and hard to get in this area.

In 1976-77 a pig breeding and distribution centre will be established at Murua.

Loans for two new projects will be processed, and four proposed projects will be investigated this year. Two new projects will be added each year.

By 1980, if the Purari Hydroelectric Scheme is going ahead, its workforce will provide a ready market for pig meat. Pig production will then be encouraged in all areas.

Poultry

At the request and with the assistance of the Area Authority a trial introduction of 200 chickens and 43 Muscovy ducks was made. About 20 % of the chickens died from coccidiosis and kidney disease. They were also very expensive to feed and are not suited to the wet conditions.

All of the ducks survived and as they seem well suited to the local conditions, a programme of distribution will be commenced aiming at placing 200 ducks in the villages in 1976-77 and a further 1 000 up to 1980.

Fishing

Last year freezers were installed at two villages in the Kikori area, and commercial fishing was established on a regular basis. About 140 kg of fish from Kikori is sold on the Kerema market each week.

This year 20 new fishermen will be trained to fish in a commercial way in the Kikori area. Four more freezers will be installed in Kikori villages, and a holding freezer will be built at Kikori. Difficulties in getting transport for fish from Kikori will be tackled, and a market for Kikori barramundi will be investigated at Mendi. Marketing of barramundi in Mendi is expected to begin in 1978. With the development of the Purari Hydroelectric Scheme, expansion of the Kikori fishery is planned for 1978-80.

A deep freezer for fish storage has been installed at Malalaua. Holding freezers at Kerema and Wabo (Purari site) are planned for 1980-81.

This year two deep freezers will be installed at Baimuru. Further expansion is planned for this fishery in 1979.

A fisheries survey will be conducted along the coast at Ihu, and 12 local fishermen will be trained to set and mend nets. Two smokehouses will be built.

One commercial fishing group has been established at Hevoro. This year two smokehouses will be built. Four 3-week training courses will be held at Hevoro, for fishermen from all areas.

Vegetables

Last year demonstration plots were planted at Murua. Field extension work was commenced and interest in vegetables is growing. Vegetable seeds were distributed in selected centres. The aim is to make these areas self-supporting in vegetables. Some surplus production has been sold in the Kerema market.

In 1976-77 vegetable markets will be established in all main centres. A government Fresh Food Market will be set up in Kerema.

The needs of the Purari Scheme will be ascertained, and a programme to supply sufficient vegetables for employees working on the scheme will be begun.

One hundred vegetable gardens totalling 24 ha will be established in the Kerema, Malalaua and Kaintiba areas. One tonne of English potato seed will be distributed in the Kaintiba area.

In the Baimuru and Kikori areas new crops will be promoted to help overcome malnutrition problems.

In 1977 vegetable trials in the Purari area will be commenced, and vegetable gardens will be established there in 1978.

By 1980-81 the road link to Port Moresby will probably be completed. Vegetable plantings in the Malalaua area will be increased and vegetables from there will be marketed in Port Moresby.

Cardamoms

Two gardens totalling 2.4 ha of cardamoms have been planted in the Kaintiba area. Interest in this crop has been increasing in the area.

This year four nurseries will be established to increase the supply of planting material, and an additional 3 ha of cardamoms will be planted in the Kaintiba area.

A series of demonstrations will be held to teach people proper harvesting techniques. A marketing system for cardamoms will be arranged.

Plantings in the Kaintiba area will be increased by 5 ha each year. A centrally situated cardamom drier will be built in the Kaintiba area in 1977-78.

Sago

Sago marketing is a new activity. Large areas of sago have been established in the Malalaua area. This year 40 sago growers will be encouraged to produce 45 kg of sago each for sale. These growers will be advised on cleaning and thinning their sago areas.

Improved processing methods will be introduced, to produce cleaner, drier sago with longer storage capacity.

In 1977-78 commercial sago production in the Baimuru and Kikori areas will be established.

This programme is, however, restricted by present poor prices for sago, and lack of markets.

Corn

Corn is grown in most subsistence gardens, and small amounts are sold in local markets.

A corn seed multiplication plot has been established at Murua, and 500 kg of seed will be available for distribution this year. Ten demonstration plots will be established, and 100 growers will be taught how to grow and use corn to better advantage.

Corn seed will be distributed to 20 settlers in the Murua area, who will be encouraged to grow this crop for sale at the Kerema market.

Plantings will be increased to 8 ha in the following year. In 1979-80 planting of corn as stock food will be commenced.

Crocodile farms

There are four Department of Primary Industry crocodile farms, stocked with 300 crocodiles. Twenty-nine village crocodile farms have been established. Twenty are in the Kikori area and 9 in the Baimuru and Ihu areas.

Interest in crocodile farms is increasing.

This year at Kikori, stock in the existing 20 farms will be increased from 10 to 50 crocodiles, and 10 new farms will be established.

At Baimuru 12 new farms each stocked with 50 crocodiles will be established. Two 1-week training courses will be conducted for 20 farmers.

Six farms will be constructed at Hevoro.

Next year 12 crocodile farms will be established in the Malalaua area, and the number of farms in other areas will be increased to 50. Twelve new farms will be established each year for the following three years.

POULTRY RESTRICTIONS LIFTED

The Minister for Primary Industry, Mr Boyamo Sali, has lifted restrictions on the importation of poultry products from Australia.

The ban which was imposed following outbreaks of the disease Fowl Plague in poultry in Victoria, had meant that no chickens or poultry products had been permitted entry into Papua New Guinea between 23 January and 11 March.

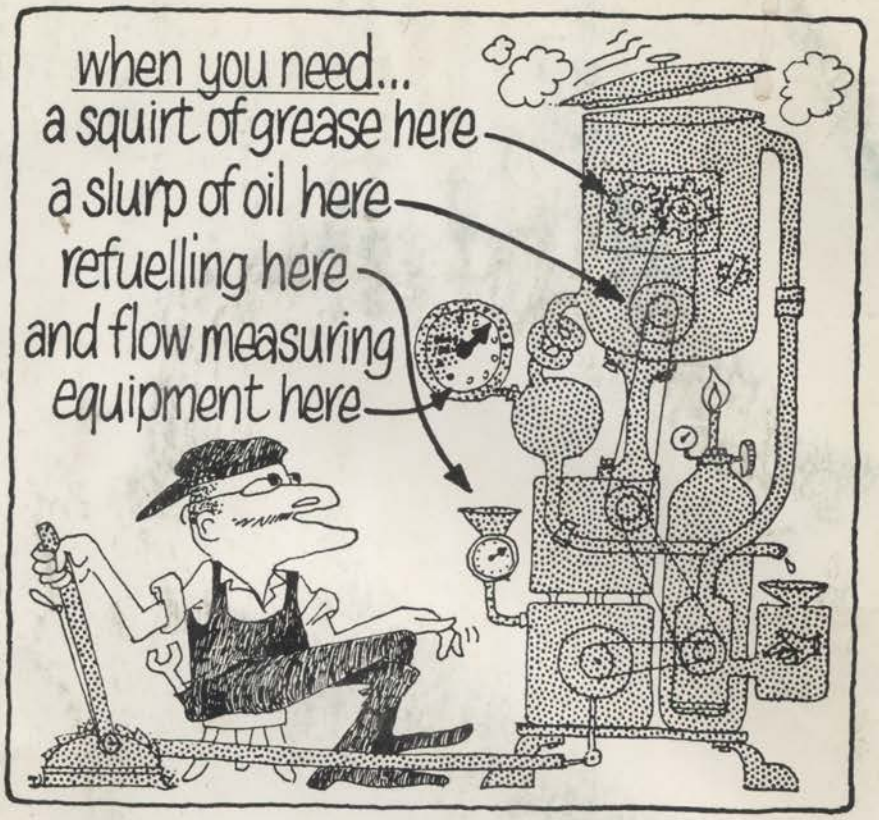
Mr Sali said that it was fortunate Australian animal health authorities had been able to contain the outbreak to a few farms in Victoria.

"If the outbreak had spread it could have had very serious consequences for our developing poultry industry in Papua New Guinea because we still rely very heavily on the importation of live chickens", he said.

Mr Sali said this recent crisis in Australia highlighted the need for Papua New Guinea to achieve self-sufficiency in poultry products, particularly poultry meat.

He said this could be achieved using smallholder farmers in the growing phase of broiler production.

Mr Sali said Papua New Guinean smallholder farmers had shown they were capable of producing a good quality product economically and therefore should receive every encouragement to take their rightful place at the centre of this rapidly expanding industry.



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