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Papua New Guinea's Food Problems.

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ABSTRACT

Papua New Guinea faces serious food problems. Food imports have increased dramatically in recent years and malnutrition levels are high.

This paper deals with the food crops situation in P.N.G. A brief review of government attitudes to and action on food and nutrition is given. Steps taken to implement the Food and Nutrition Policy are critically evaluated. Rice imports are examined, particularly the 40% increase in import volume since 1975/76. The recently announced rice import quota is endorsed.

Action needed to increase food production is discussed in detail for both the subsistence and commercial sectors. Attitudinal change to support domestic producers is seen as critical to success. Action required in the following areas is discussed: processing, storage, transport, wholesaling, retailing, training, research and data collection. A list of food items which can be progressively banned as imports is proposed. It is essential that the effect of actions suggested on food supply and nutritional status be monitored. It is proposed that a food and nutrition working group be established.

BRIEF HISTORY OF GOVERNMENT POLICY AND ACTION ON FOOD AND NUTRITION

Pre Pacific War

Under the German and Australian administrations in pre-war New Guinea and Papua, direct intervention in food production was largely confined to introduction and distribution of new food crops. Some of these, such as maize, peanuts and a variety of fruits, have been widely accepted in the villagers' diet. Many other introductions have not been accepted despite repeated seed distribution. In addition, rice production was encouraged in the pre-war period but the projects which were implemented were not successful (McKillop, 1976).

Considerable research was undertaken on traditional and introduced food crops at Keravat (E.N.B.) before the work was interrupted by the war in 1942 (Green, 1941; Department of Agriculture, 1941). McKillop (1976) gives a valuable history of the agricultural philosophy and action from this period up to self-government in 1973.

Food Crop Phase (1946 to early-late 1950s)

During 1947 a major food and nutrition survey was conducted (Dept. External Territories, 1950). Following the survey the Department of Agriculture, Stock and Fisheries extension staff introduced improved pig and poultry strains and several major rice growing projects were commenced. This phase was short lived and from 1951 a shift in emphasis by extension staff away from food crops to plantation crops had occurred (McKillop, 1976), although the distribution of introduced vegetable seed continued.

Immediately Keravat was reopened after the war, research on food crops recommenced and continued through the 1950s. Many trials on farming systems, introduced vegetables, yams sweet potato and other crops were conducted. Farming system trials were also done at Aiyura.

Cash Crop Phase (Early-late 1950s to early 1970s)

From 1951 onwards extension efforts concentrated almost exclusively on cash crops. Research into food crops continued at Keravat but at a reduced level from the lat 1950s to 1970. A considerable amount of rice research was conducted at Epo (Bereina, C.P.) and later at Bubia near Lae. Food crop research at the other stations picked up towards the end of the 1960s at Aiyura (E.H.P.) or was initiated at this time at Bubia and Tambul (W.H.P.).

Import Replacement Phase (1970s)

Extension efforts with food crops have concentrated on rice, introduced vegetables and potatoes in the 1970s but the greater emphasis on export cash crops has continued. Sporadic efforts have been made to increase sweet potato production. The South Coast Food Production Project, which was begun in 1978, is concentrating on providing tomatoes, cabbages, potato and sweet potato to Port Moresby and has achieved some success with tomatoes and cabbages. This is viewed by the Department of Primary Industry (D.P.I.) as a pilot project for other parts of the country. In addition the large scale production of rice and sugar cane by overseas companies is planned to commence in either 1979 or 1980. There has also been considerable effort with cattle.

Supporting the extension efforts, marketing services, which purchased, stored, freighted, sold and, where necessary, processed the output of an increasing number of smallholder producers were developed from the 1950s onwards. The national government still acts as a "buyer of last resort" in over a dozen cash crops. The Fresh Foods Project was initiated in 1973 as a marketing service for food crops and this is continuing as the Food Marketing Corporation (F.M.C.)

Similarly, institutions to encourage production, savings and credit to smallholder export crop producers as well as training schemes for staff were encouraged by the Government in the post war years. Large training colleges as well as inservice and overseas training opportunities were initiated during the 1960s. Very little emphasis was given to the food crops, particularly traditional ones, in staff training.

A considerable amount of research on food crops has been undertaken during the 1970s by the D.P.I. and the University of Papua New Guinea (U.P.N.G.). Most work has been done on rice and those vegetables and fruit familiar to expatriates, and food crops for use as stockfeed or export. Except for sweet potato and winged beans, the major subsistence crops have received little attention compared with commercial food crops (Table 1). The clear imbalance in research priorities over the last 50 years between traditional and introduced food crops is evident. An even more dramatic imbalance has occurred between research inputs into food crops and export crops.

Concern about levels of malnutrition in rural Papua New Guinea was voiced in 1973. From this point research and staffing programmes increased, and the 1975 Nutrition Survey was the first attempt to compile

a national picture of the levels of malnutrition in all provinces. The school lunch programme, more surveys, provincial staff appointments and community education schemes have stressed the importance of good nutrition.

The 1975 P.N.G. Food Crops Conference brought together many people involved in research on, and production of, the food crops and created a greater awareness of the magnitude and the problems of the industry. An interdepartmental food and nutrition committee was set up about this time.

Concern over rising levels of food imports and high malnutrition levels culminated in the 1978 National Food and Nutrition Policy.

NATIONAL FOOD AND NUTRITION POLICY

The National Food and Nutrition Policy (N.F.N.P.) is a detailed document which squarely faces the issues regarding Papua New Guinea's food requirements. It estimated that in 1976 23% of the total food consumed in Papua New Guinea was imported and 24% came from marketed domestic production. The remaining 53% was supplied by subsistence production. Therefore, over three-quarters of the nation's food requirements were produced domestically, but the N.F.N.P. noted, "..... rural and urban population increases ..... could very well result in production not keeping pace with increasing demand. This would in turn give rise to increasing food imports. This must be avoided". (N.F.N.P., p2).

To avoid this a number of recommendations were made which included -

- D.P.I. will develop in the next twelve months policies which emphasise the cost effective production of nutritious foods as well as prepare a paper for National Planning Office on the allocation of resources necessary to achieve this objective.

- Production techniques should be encouraged which are more suited for marketed production. Suitable land, groups and individuals should be identified and assisted with setting up commercial market gardening.

- D.P.I. be the co-ordinating agency for developing projects to process foods.

- F.M.C. and other organisations be asked to begin development marketing.

- High priority be given in the next five years to increasing domestic food supplies to Port Moresby.

- Four instrumentalities (Commerce, Transport, D.P.I., Labour and Industry) should give high priority to projects which develop marketing, processing, storage, transport, wholesaling and retailing of food.

- A nutrition education policy should be implemented.
- Regular nutrition surveys are to be conducted and N.P.O. would co-ordinate the N.F.N.P. and report to the National Planning Committee.

These recommendations were the result of an Interdepartmental Working Group which had been set up in February 1977, and they became national policy one year later on 8th February, 1978.

The N.F.N.P. stressed that a major aim was to increase the proportion of total food supplies produced domestically. Speaking of the three-quarters of total food consumption which in 1976 came from domestic production, the N.F.N.P noted that this proportion "should be increased to 85% by 1986 provided adequate increases in domestic food production are achieved and if food imports do not increase above their 1976 volume. However, every effort must be made to reduce imports below this volume". (N.F.N.P., p8).

Two years further on, not only are the signs of the hoped for internal increases very limited, but the volume of food imports has increased in the order 30% and efforts to reduce imports have to date been found wanting. Table 2 provides a comparison of the 1975/76 and 1978 level of imports of main food items. Note that rice imports have increased from 40% to 43% of the volume of main imported foodstuffs in the last two years.

Detailed examination of the complete N.F.N.P. recommendations, which are now national government policy, is required. Greater progress must be made to implement the recommendations of the policy. In particular, the clear call of the N.F.N.P. that "all future increases in food consumption must be met from domestic production" must be followed up.

We would like to comment here on only one key aspect - the policies for achieving increased marketed food production. A range of factors were stressed and production, marketing and processing were underlined. In general the N.F.N.P. recognised that a mobilisation of existing and new resources (that is, man power and investment) would be necessary to increase domestic food production. A working paper to the N.F.N.P. concluded "A mix of short term rapid-action projects and longer term national projects is therefore recommended". (N.P.O. n.d.)

This view was endorsed in the N.F.N.P. in several recommendations, which called for departmental initiatives in respect of production (encouragement of production techniques "more suited to marketed production") marketing, processing, storage and transport of marketed production, viz.,

"The Department of Commerce, the Office of Transport, the Department of Primary Industry (will) give high priority to promotion of projects aimed at development of marketing, processing, transport, wholesaling, and retailing of food". (N.F.N.P., p6).

The main avenue for new projects is through the National Public Expenditure Plan (N.P.E.P.). As work was in train towards the N.F.N.P from early 1977, N.P.E.P. projects in these areas could have begun at the earliest in 1978 and of those which were started, nearly all were carried on into 1979. A look at the N.P.E.P. projects for 1979 is therefore useful. The projects approved under the category Food and Nutrition are presented in Table 3. Other categories of the N.P.E.P. do have projects with a direct involvement in increasing the availability of domestically produced food, such as the sugar industry and hybrid coconuts projects, transport (road improvement) and research, particularly in the fish industry. But for research into foods at least, the budgetted programme for expenditure is well behind schedule. Fisheries research had a 1978 allocation of over K1,000,000 yet spent just over 3% of it. It should be pointed out that with the exception of small provincial N.P.E.P. projects in the Western Highlands, Simbu and New Ireland Provinces, there are no projects for the production of traditional staple crops (sweet potato, taro, yam, sago, banana). There is only one new processing project for smallholder rice. Similarly, apart from F.M.C., there are no specific storage, wholesaling or retailing projects.

There could be some debate over whether more than the 13 out of 20 projects we have selected will really contribute directly to food availability. The projects listed in Table 3 may be individually sound and extremely useful to those areas they serve, but they are not enough. A systemic and co-ordinated programme is required to fully implement the N.F.N.P.

In relation to the policy and its implementation, a responsibility disproportionate to its staff and resources has been given to the F.M.C. The Food Marketing Corporation is identified as being the agency responsible for development marketing and is linked to policies related to transport, storage, wholesaling and retailing. F.M.C. has only an annual grant of K500,000. Its finances are scrutinised with much more rigour than the larger departments and even though it has drastically streamlined its staffing and improved its operations, it is far from guaranteed a long term future.

The low level of direct support for the F.M.C. from government investment is all the more unfortunate considering the substantial level of production of traditional vegetables plus increases now being achieved by small growers of introduced vegetables. Growers from such places as Rigo, Wau, Kainantu and Laiagam are doing their best to achieve an increase in domestic marketed food surplus. Growth is rapid in supplies of both "soft" vegetables such as tomatoes, capsicum, lettuce and cabbage as well as "hard" vegetables such as potatoes, onions, carrots and pumpkins. It is largely left in the hands of F.M.C. to channel the flow from producer to consumer, trying to predict just what will be presented at any buying depot in any given week, then hurriedly moving it on after making all the commercial deductions en route. Consider, for example, the extreme case of the cabbage grower in Enga Province. He now receives 10t/kg at the F.M.C. depot in Mount Hagen, at least three hours drive away. His product is often freighted by air to, say, Port Moresby (@ 28t/kg), handled several times, transported to storage, sold wholesale or transported again for retailing, with additional margins plus administration charges costed in, making a final sale price of over 70t/kg. Up to February 1979 that cabbage then competed with imported ones. Other vegetable growers face a similar situation.

Contrast this with the grower of perennial crops such as tea or rubber, or for that matter, small rice producer. Many of these producers enjoy farm gate collection, subsidised marketing, and guaranteed sales.

On the production side these crops and all other tree crops, receive much more extension advice, easier credit, and better planting material than do our food producers.
There could not be greater contrast between the level of support given to the export crop industries and the completely commercial transactions, unsure markets and stiff competition faced by most food producers in Papua New Guinea. The front line agency which deals with the growing thousands of vegetable producers, F.M.C., is far from assured of permanency, as it must account in full for its operations year by year. Unrestricted subsidies are not called for here, but rather putting into practice some of the sense of urgency one feels in the N.F.N.P. document.

RICE CONSUMPTION

The growth in rice imports in recent years has been substantial but the growth in domestic production has been inconsequential. Rice production and imports for the period 1963-64 to 1978-79 are given in Table 4. The level of imports at the beginning of the period was just over 24000 tonnes but for the year 1978-79 it is anticipated to be in the order of 82000 tonnes (Rice Industries Pty. Ltd., pers. comm.). Since

1975-76 the volume of rice imports has risen by 40% and by value the current consumption of imported rice is approximately 26% of the value of all imported foodstuffs, the highest ranking food item.

The consumption of rice in Papua New Guinea has mostly been seen in an urban context and the limited literature which does exist has only discussed this sector (Sackett, 1976; Hale, 1978). In 1970-71, when over 47000 tonnes were imported, Sackett (1976) calculated an urban per caput demand of 56 kg per annum which, when scaled up to the national urban population of that year, gave a total consumption figure of approximately, 13000 tonnes. This figure could be an under-estimate, making no allowance for higher consumption levels at institutions such as hospitals and educational establishments. Even increasing the estimate by 50% to nearly 20000 tonnes to allow for consumption at institutions leaves over 27000 tonnes unaccounted for. This means approximately 57% of the total imports for that year were probably consumed in non-urban areas.

The Household Expenditure Survey 1975-76 allows these calculations to be updated. Appendix 1 shows that the urban, non urban split was very close to 50/50. Here, allowing for increased institutional demand, the balance would probably swing in favour of urban areas being the main consumers of imported rice.

Since then rice imports have increased in volume by 40% and retail sales have boomed in the highlands, so much so that Rice Industries Pty. Ltd., the main importer and distributor of rice, has opened two more distribution terminals at Mount Hagen and Goroka. Their turnover is such that they have quickly become the third and fifth ranking terminals in the country. Total sales through these two terminals have more than doubled in the last two years. It is fair to assume that in 1979 the consumption split between urban and non urban sectors is at least 50/50, and possibly higher in rural areas.

As this increase in rice sales in the highlands has far exceeded the rate of increase in the urban highlands populations, or in their incomes, it seems clear that most of the additional sales are to village populations who have, at the same time, had a spectacular increase in real disposable incomes as a result of the rise in coffee prices since 1975. Indeed, monthly sales of rice in the highlands during 1976-78 showed a close relationship to monthly coffee deliveries (P.Heywood, unpublished data).

In the early 1960s in highlands villages cash income was low and rice consumption was almost unknown. By the late 1960s much of the non-urban population had a regular, even if not particularly high, cash income from

coffee. This, combined with an extensive road network and a rapidly expanding distribution system through tradestores, meant that non-urban highlanders began to participate strongly in the cash economy. Although rice consumption initially was low it appears to have been an attractive food because of its widespread availability, storage capacity, efficient marketing, adaptive taste, low relative price, ease of preparation and status attributes.

This food was introduced into a subsistence setting in which food production is relatively labour intensive and seasonal food shortages sometimes occurred. At the same time coffee cultivation was becoming more common and provided an increasing source of cash income which allowed participation in the cash economy. It is still the only significant cash crop available to most of the highlanders. The high coffee prices of recent years have resulted in substantial increases in real income for many non-urban highlanders. At the same time rice, a status food which was easily stored and prepared, was readily available at a low relative price. In these circumstances it is not surprising that a food of this type should achieve such rapid and widespread acceptance and that a taste for it was acquired.

Despite the absolute magnitude of the recent increases in rice consumption, per capita consumption is relatively low. Howevever, a taste for rice has been acquired and because the consumption base in the rural areas is low, the potential demand is vast.

The point we wish to make is that changes in food consumption patterns do not occur in isolation - they occur within, and are influenced by, the prevailing economic and social climate. In this case the climate in Papua New Guinea, and particularly in the highlands, has been particularly conducive to a rapid change in food behaviour. To modify the direction of this change it will be necessary to alter the social and economic climate. The net effect of the changes in food behaviour which have already occurred has been to increase the dependency of Papua New Guinea on imported foods.

We are opposed to this growing food dependency and base our opposition on the following criteria:

- it is an imported food and hence supply is dependent upon events outside of Papua New Guinea's control;
- it will generate an increasing food bill;
- its increased consumption means a loss of food traditions;
- consumption of imported staples means a loss of production and marketing opportunity for local food producers;

- long-term dependence on imported food (e.g. 20 years) will mean that most subsistence farmers will lose their ability to produce their own food;

- once established, trends towards greater food dependence cannot be easily reversed:

- in most rural areas an acceptable alternative, the traditional staple, is available.

Although the literature which has addressed the question of P.N.G.'s food supplies and rice imports has mostly seen the situation in an urban context, ignoring the 50% non-urban consumption of rice imports, it has been unequivocal on two points:

(i) That to avoid further large increases in rice imports considerable attention must be paid to lifting domestic market supplies of traditional staples,

(ii) P.N.G's capacity to replace imported rice with locally produced rice is very limited.

So far support for (i) through the N.P.E.P. is insufficient and it is doubtful whether a significant change will occur without a change in the economic climate; and (ii) remains unrefuted.

There are voices in favour of increased dependency on rice imports. They note that trade is important and that P.N.G. is a growing producer of exportable cash crops which can be readily exchanged for food. Also, it is asked, is rice not a popular addition to an otherwise traditional diet not noted, in some parts of the country, for its wide variety?

Our response is that P.N.G. is a rural society and will permanently rely on a strong rural economy, with its cash crop and subsistence sectors. Trade is critical and so are self reliance and the retention of basic Papua New Guinean ways, two of the five National Goals and Directive Principles.

Internal trade is just as important as international trade and the increasing institutional demand for rice is shrinking the trade prospects for local growers of sweet potato. This is particularly evident in rural areas where schools, corrective institutions and health centres are consuming more and more rice. The annual expenditure on rice by government institutions in the Enga Province is now of the order of K30,000. This sum purchased 100 tonnes of rice and could purchase approximately 430 tonnes of sweet potato. The scope for increasing commercial production of sweet potatoes in an area with very limited economic opportunities, makes a switch away from rice to this locally available and cheaper alternative, worth considering. Similar opportunities exist in other provinces.

Variety should always be encouraged in cash crops, domestic goods and imports. But for a rural society such as P.N.G. to not be able to feed itself is cause for concern.

We do not suggest that P.N.G. has severe food supply problems. To the contrary, high export prices have allowed a continuing rapid growth in food imports and an increasing number of local food producers are helping to increase the marketed domestic food surplus called for in the N.F.N.P. We do suggest that it is time to act while the country is enjoying high export incomes to solve the fundamental issue of domestic food supplies before dependency increases.

The main method to prevent this growing dependency is to implement the N.F.N.P. The recently announced rice quota is acknowledgement of this. However, we believe a price rise is to be preferred both as a distributive mechanism and as an essential change in the economic and social climate in which food behaviour occurs. As a first step, we suggest that the full freight costs be added to the price of rice for all centres. Because the price elasticity of rice is likely to be higher in rural areas, where the potential for growth in consumption is greatest, an increase in price should have an immediate effect on consumption and provide an economic climate in which increased reliance on traditional staples will occur.

The main argument against a price rise to date has been its effect on the Consumer Price Index (C.P.I.) The intention to decrease the weighting accorded rice in the C.P.I. from 13% to 5% from the third quarter of this year, means that for the first time in 8 years price can be used to allocate rice. A 20% rise in the price of rice would, under the new system, increase the C.P.I. by 1%. Certainly, this would still be inflationary as the rise passes on in public servants' wages. However, we believe that an increase of this magnitude would have a significant effect on rice consumption. The issue is whether some increase in the C.P.I. is too high a cost to bear in return for eventual greater self-sufficiency in food. We suggest that it is not and that an import tax on rice, at a level sufficient to increase the retail price by 20% should be levied. Such a tax would be administratively simple and in order to allow time for an increase in the domestic food supply to occur, should be phased in over a 12 month period.

A potential side-effect of restrictions on rice, or a rise in price, is an increase in the demand for wheat and wheat products. If this occurs the benefits of the limitations on rice imports will be quickly lost. It is important that import restrictions and the proposed price increase are not introduced in isolation from moves to increase the availability of

locally produced staple foods and considerable comment is made on actions which could be taken in the remainder of this paper.

ACTION NEEDED

Attitudes

A fundamental change of attitude is needed to reverse the declining status of traditional foods. This must start with politicians and senior public servants and extend to other public servants and opinion moulders. When the Minister for Agriculture has his photograph in the Post-Courier showing him growing aibika and not cabbage and lettuce, then people may value the traditional vegetables more highly. When he eats the aibika at the Papua Hotel or on an Air Niugini flight, they might grow and buy more traditional vegetables.

There is much scope for a well planned publicity campaign using the radio stations. Manufacturers of exotic foods and drinks, such as Pepsi Cola, use sophisticated radio advertisements to promote imported food products, but nothing is done to promote locally produced foods. When prominent sportsmen advertise the qualities of traditional products, such as green coconut milk ("kulaus"), rather than introduced food and alcoholic beverages, and when traditional foodstuffs are as readily available as the western ones, then the average citizen will alter his consumption patterns.

The sensitivity of educated people to large scale advertising campaigns which stress the imagined properties of certain consumption items to enhance personal prestige is well known. Once urban demand is established, its spread into rural areas is very fast. With sufficient commitment, this phenomenon can be used to reverse increasing consumption of western foods and to encourage traditional foods.

Increased Production

The technology to increase production of certain traditional staples is available, but it is not being applied. This is particularly so for sweet potato, maize, peanuts, and certain introduced vegetables. In certain regions, factors such as land rights, markets or environmental problems are limiting production, e.g. in the Central Province. Nevertheless we believe that a modest but effective input by the government, especially D.P.I., would result in greatly increased domestic production. Production of staples and vegetables in the various sectors is considered below.

A. Subsistence sector

(i) Village dwellers. There are a number of technical innovations that could be promoted to increase subsistence production in both the highlands and the lowlands. These are particularly relevant where people are under stress because of increasing land pressure or high malnutrition rates. Experience indicates that these people are very willing to accept innovations that they perceive as relevant, particularly superior varieties of staples. Available technology that could be applied immediately includes:

- superior varieties of sweet potato and certain other crops;
- use of coffee pulp and animal manure as fertilizer;
- more intensive land utilisation, including greater use of composting, and use of casuarina fallows in the highlands.

It is difficult to increase the production of subsistence village dwellers because production is in the hands of very many producers and there is increasing doubt about the effectivness of government agricultural extension services.

(ii) Institutions. The technical information is available to increase self sufficiency in institutions such as schools and corrective institutions in both the lowlands and highlands, but institutions are receiving very little help from D.P.I. The information for the lowlands has been published (Bourke, 1978a) and courses for highlands institutional farmers will commence at Aiyura in 1979. For the corrective institutions in particular, there is much that can be done to reduce dependence on imported food and to improve the diet of the inmates.

In addition, it is suggested that consumption of locally produced food at institutions be encouraged. The recent instruction from the government to all residential institutions to cut rice use by 20% is clear evidence of a renewed commitment to this aim. This food could come from food grown by the institution itself or locally purchased food. The funding for institutions may require alteration to accommodate these changes, for example, the provision of funds for garden tools and fertilizer. As well as the import considerations and associated cost savings, greater use of local food at institutions has a valuable demonstration effect. If students at Vudal Agricultural College consumed deserts made from local foods rather than tinned Australian peaches, as they have done in recent years, a small start would have been made with these potential didimen's consumption patterns.

(iii) Urban dwellers. There is a limit to the amount of food that can be grown by urban dwellers because of land availability. Nevertheless greater food production by the sector could have a significant effect on food requirements for the towns. An urban agricultural development project is planned for Port Moresby, and the National Fruit and Nut project should eventually have some impact in urban areas. But much more could be done in all urban centres. For example, other large towns could follow the example of Lae City Council and appoint a horticulturist to encourage urban food production. Even simple inputs such as making suitable fruit seedlings and planting material available and demonstrating the use of compost heaps could have a significant effect.

B. Commercial Sector

Sweet potato. The technology for commercial sweet potato production is largely available, especially for the highlands. An urgent priority is for D.P.I. extension officers to identify actual and potential large scale producers near urban markets, particularly those where seasonal or perennial production shortages occur, e.g. Port Moresby, Kavieng, Goroka, Daru, Kerema, Alotau, Kieta. In some cases these producers belong to particular ethnic groups, such as Simbu squatters, and this must be acknowledged.

It is suggested that D.P.I. concentrate on medium size (1-10ha) sweet potato producers. Mechanisation, marketing and sometimes credit for the farmers and extension staff at Aiyura (E.H.P.) and at Laloki (Central Province). The research staff are in a position to provide planting material of high yielding suitable varieties and advice on rotations, fertilizer and pest control. Much of the necessary information is available but it remains the private property of a selected few public servants and entrepreneurs. Research on traditional staples has proceeded with little contact with commercial producers. A greater interaction between these two groups is needed so that research staff are stimulated to seek solutions to the grower's real problem.

Other staples. The Department of Primary Industry is in a very weak position to assist subsistence or commercial producers of other staples, other than potato and maize and to a lesser degree cassava. However, all these are relatively minor crops. Urgent research work is needed on taro and Chinese taro (Xanthosoma), bananas and the yams to provide superior varieties and cultural methods and solutions to pest and disease problems.

Vegetables. There is little government encouragement of traditional green or yellow vegetables. Yet local vegetables are in general nutritionally superior to introduced species. In the lowlands they are much easier to grow and have fewer pests and disease problems. Production of introduced vegetables is in general more dependent on energy demanding fertilizer and pesticide inputs than production of traditional species, although as intensity of production of any food crop increases, the tendency is to become more dependent on additional inputs.

Research is urgently needed to solve production problems of traditional vegetables, but much can be done to encourage production by assisting growers with market outlets and certain technical inputs, such as the provision of insecticides where necessary.

Production of introduced vegetables has increased dramatically in recent years. Much research has been done to identify superior varieties for local conditions (Table 1) but the seed of these has not necessarily been made available to growers. Seed importers appear to choose vegetable varieties on the basis of the attractiveness of the seed pack rather than on the results of D.P.I. and U.P.N.G. research. Making seed of superior varieties available to growers could have a major impact on the industry.

The real meaning of import figures must be examined. For example, canned pineapple, sweet corn, beetroot and beans are convenient and cheap food for urban dwellers, particularly institutions and expatriates. Increasing production of fresh beetroot, for example, as suggested by Densley (1978), is unlikely to alter the consumption behaviour of beetroot consumers who want the convenience of the canned product. The chances of Papua New Guinea producing a canned product competitive in price and quality are negligible. In terms of priorities, substituting for such minor consumption items as these has low importance.

Fruit and nuts. The National Fruit and Nut project (N.P.E.P. No. 241-3-709/79) has been commenced but progress to date has been slow, in part because of staffing problems. The project and associated research work is concentrating on crops familiar to and popular with expatriates such as cashews, citrus, eating bananas, strawberries, avocado and Chinese gooseberries (Kiwi fruit). It must be expanded to include crops that are nutritious and popular with Papua New Guineans such as guava, mango, pawpaw and pandanus and galip nut (Canarium indicum).

Assistance with provision of fruit and nut seedlings for planting material must be increased immediately, particularly to institutions and urban dwellers. The lowlands Agricultural Experiment Station at Keravat provides a very good seed supply service. A seed supply service must be commenced for the highlands. In the long term, it is too expensive to supply seed from one or two locations only and seed of selected varieties must be produced within each province. It is suggested that much greater use could be made of the facilities of the Office of Forests to produce fruit and nut seedlings.

Certain fruit and nuts are not harvested fully and are not sold outside the immediate area of production. There is some scope for increasing retailing of these fruit and nuts immediately. Examples include oranges in the Karamui area of the Simbu Province and in certain parts of the Morobe Province and pandanus nuts from very high altitude areas, particularly in the Enga. Distribution of planting material in conjunction with assistance with marketing is the main action needed to increase production.

Significant quantities of canned pineapples are imported every year. Densley (1978) considers that most of the imports could be replaced by increased availability of fresh pineapples, especially in the Port Moresby and Lae areas. Use of hormones to regulate fruit supply throughout the year is possible (Bourke, 1976) and would largely overcome problems of seasonal supply of fruit. The technology for commercial production has been worked out.

Grain crops. Smallholder rice production has failed to contribute significantly to the nation's rice requirements (Hale, 1978) (Table 4.) There is not reason to believe this will alter. Large scale mechanised production may produce a significant portion of the demand, but experience with large scale rice production elsewhere in the humid tropics (Surinam, Solomon Islands) is not encouraging. These overseas example plus the history of our own industry should make one sceptical of the future for rice in Papua New Guinea.

It is not possible to grow wheat commercially in Papua New Guinea to replace imported wheat flour because the highlands are too wet for successful production (Kimber, 1977).

Maize grows well in many parts of the country and the crop has received a lot of research input (Table 1). There is much scope for partial replacement of wheat flour by maize (and sweet potato) flour by biscuit makers and at institutions. A consultant Food Technologist supplied by FAO made recommendations on this question in 1978 and further UNDP/FAO assistance, particularly for flour substitution is likely in 1979.

Processing

Import replacement possibilities exist for certain commodities using "traditional" rather than exotic crops. For example, local small scale fruit juice industries based on five corners (carambola), limes and pineapples blended using portable electric mixers could reduce the demand for aerated soft drinks and imported fruit juice. The direct linkage to sellers of fruits in local markets makes this possibility attractive. In Micronesia a recent campaign to increase consumption of coconuts based on the theme "things go better with coconuts" resulted in a decline in the sale of aerated soft drinks. Coconuts were retailed through small stores and a prominent local person advocated their use in mass media advertisements.

Yams (Dioscorea alata) can make superior chips to those made from potatoes and varieties especially suited for fried products have been selected in Puerto Rico (Martin, 1976). In coastal towns such as Wewak and Madang that do not have easy access to highland potatoes and where yams are a traditional staple, promotion of yam production for chips is logical.

Processing of staples in storable form, such as "kaukau rice" and "banana figs", must continue to receive top priority.

In South America, West Africa and Polynesia, cassava and other staples are fermented to make a storable product. Similar processes for traditional staples should be investigated in P.N.G. The problems of cost and constancy of supply which will, no doubt, continue to be encountered with many of the staples should not be allowed to hinder investigation of processing possibilities (see Densley 1978 p.51) which may have an effect on cost structures. Greater emphasis on commercial production of staples may well have an effect on constancy of supply.

Storage

Both storage and production techniques to avoid storage losses are critical areas in the commercialisation of domestic market surplus of foodstuffs. It is common knowledge that most tubers (sweet potato, taro, cassava) are difficult to store, but yams, processed sago and potatoes can be stored for at least several months.

The rapid development of potato growing in the Enga, Western Highlands and Eastern Highlands Provinces will soon be inhibited by the present harvesting techniques. These potatoes are nearly always picked "new", without time for an outer skin to properly develop. As such they will not store for long under lowland conditions. The few loads of potatoes which have been sent from Lae to Rabaul by ship have mostly been in poor condition on arrival.

Transport

Development marketing, such as truck services to make purchases in major producing areas, or at least considering ways to encourage local entrepreneurs to do so, must attract additional resources.

A major complaint is the lack of regular coastal shipping services to main centres as well as the lack of any reasonable services to many of the smaller coastal centres. The freezer storage capacity of coastal shipping services is especially lacking. Insufficient freezer containers exist and the attitude of shipping lines is not totally constructive to moving a greater volume of foodstuffs from growing centres in the highlands through Lae to major urban markets in Rabaul, Kavieng, Wewak, Madang and Port Moresby. Better shipping services between Rabaul, Kavieng and Kieta would also facilitate trade in foodstuffs.

Wholesaling

With the spread of retailing into rural areas the companies which supply them assume an increasing importance. Influencing wholesalers by stressing the importance of stocking Papua New Guinea made and processed foodstuffs is a key step in increasing the availability of these products.

Provincial governments, if they wish to influence the consumption of certain foods in their provinces (such as reducing the sale of sweet biscuits to help stop the spread of dental decay), can do so by advising wholesalers of their policies.

In processing, storage, transport and wholesaling there is, as was called for in the N.F.N.P., a clear need for new initiatives. Very few resources were mobilised via the N.P.E.P. in 1979. Enquiries in all these areas, followed by project design for N.P.E.P. funding in 1980, should be developed immediately.

Retailing

The negative attitudes of some major retail outlets (hotels, supermarkets, restaurants, Air Niugini) to being willing to make the necessary adjustments to retailing locally grown traditional foods should be reversed. Garuda Airlines, Indonesia's flag carrier, serves high quality traditional Indonesian meals, and most national airlines advertise their traditional foods and drinks in this way.

Similarly, hotels could make greater use of traditional foods. We acknowledge that large retail outlets such as hotels face real problems in obtaining regular supplies, but in a truly independent nation the development of traditional foods in a modern context in essential.

Supermarkets, particularly the large chains, are the most obvious example of entrenched attitudes to what retail marketing now means in urban Papua New Guinea. Setting standards of product presentation which can only be met by imported lines and not being sufficiently willing to give local produce the prominence it deserves, tends to create demand for imported items, which is to the detriment of the local item. Again we acknowledge supply difficulties and the lack of variety of reasonably priced locally produced consumer goods available. For example, highland honey marketed by the F.M.C. retails in Kainantu for significantly more than better quality Australian honey. But we consider that this largely reflects the lack of concerted efforts within Papua New Guinea to try to replace imported lines.

Training

The agricultural training colleges have in general failed to produce graduates competent to assist the food crop industries. They have been particularly weak on subsistence production and traditional crops. This deficiency must be rectified. We suggest that much greater emphasis must be given at the agricultural colleges to subsistence and commercial food crop production, with particular emphasis on problem indentification and on technologies that can be applied immediately.

Research

A comprehensive review paper on priorities in agronomic food crop research has been prepared (Bourke, 1978b). At the moment active research is being done by D.P.I. on sweet potato and other crops and on winged beans by U.P.N.G. Certain other crops such as rice, maize, peanuts, potatoes, soyabean, tomatoes and cabbage have been well covered by previous research although results have mostly not been published nor disseminated to producers. There has been very little agronomic research done on most of the traditional staples, vegetables, fruits and nuts (Table 1).

A particularly distressing aspect is the small proportion of research results which have been published, particularly for work done in the highlands. It is essential that this work is published before the officers leave the position or the country. New national agronomists who, upon appointment to D.P.I. are faced with interpreting many years of unpublished or even uncollated result, are placed in an especially difficult position.

One of the recommendations of the 1975 Food Crops Conference was that subsistence reports compiled by newly appointed extension staff during the 1950s and 1960s be compiled, edited andpublished. These reports contain much valuable information and this should be done immediately.

A modified sumary of the recommendations from Bourke's review of food crop research priorities paper is given in Appendix 2.

Data Collection

Figures are needed on local production to make decisions. We know Papua New Guinea rice and cocoa production to the nearest tonne but cannot even say which are the most important traditional vegetables, much less what their production is. The proposed D.P.I. Crops Survey for 1979 offers provinces a maximum choice of five crops. It is likely that most provinces will choose more cash crops than food crops. Even a choice of five food crops would not give a full picture of food production in any province and as the choice of crop will not be the same throughout the nation, no complete statement will be made on any one food crop. A national Food Crops Survey should be submitted as an N.P.E.P. project for funding in 1980. The survey must be designed in sufficient detail to quantify production of staples, vegetables, fruits and nuts for each crop at the district level. The only previous national survey of this nature was the survey of Indigenous Agriculture, 1961/2 (Walters, 1963). Accompanying the survey a monitoring procedure should be designed and offered to provincial governments as well as for use by national field departments such as D.P.I.

Apart from data gathered by the Bureau of Statistics for the quarterly Consumer Price Index, food market surveys have rarely been conducted on a regular, systematic basis and a programme needs to be developed to begin this work. Although the food market studies which have been done are intermittent and mostly the preserve of private researches and data gathering departments, such as the Bureau of Statistics, the information they contain is invaluable for planning for increased food production.

Any systematic data gathering in the area of domestic food production and consumption will be of immediate value to planners, nutritionists, agronomists and all field workers throughout the country.

Banning imports of fresh vegetables

In consultation with F.M.C. a list of introduced vegetables which can be progressively banned from entering Papua New Guinea should be drawn up. It is suspected that most of the following vegetables could be banned without a major loss of domestic supply in 1979: beans, broccoli, Brussels sprouts, cabbage, capsicums, carrots, cauliflower, celery, corn, cucumbers, eschallots, leeks, lemons, lettuce, parsley, rhubarb, silver beet, tomatoes and zucchini.

In 1980 onions and potatoes could be added to this list and frozen vegetables, particularly corn and peas, considered for banning as well.

The objective of this exercise would be to stress the seriousness of the food supply question in Papua New Guinea. We do not make this recommendation to penalise urban consumers who are used to the quality of the imported product, but rather to lift the status of our own producers. The amount of money concerned in such an import replacement policy is negligible, but the message of approval it would contain for the local market gardeners all over Papua New Guinea would be unmistakable.

Nor do we imagine that such a policy could be implemented free of problems. Periodic shortages in some lines probably would occur as would periodic gluts; such is the nature of the industry in all countries. The chief advantage of such a policy would be the pressure it would apply to the marketing chain to keep up supplies and to look for alternative forms of buying, wholesaling and retailing. Of perhaps equal importance would be the publicising of domestic food supplies and the beginnings of a genuine search for domestic self sufficiency.

Nutrition

The proposals outlined in this paper have implications for nutrition.

Due to Papua New Guinea's high, and increasing, level of dependence on imported food it is dependent on events outside its control. A decrease in supply and/or increases in price could lead to serious and acute food shortages, particularly when the short-term supply of locally grown staples is inelastic. Greater independence with respect to food would help to insulate the population against these problems.

The limitation of rice imports may lead to serious, localised food shortages where frost and drought damage of traditional staples occurs. Effective responses to these situations will depend on an ability to monitor food supply and nutritional status and emergency plans which enable actions to be taken quickly, including, where necessary, a temporary increase in the supply of imported staples. Research and extension services, particularly in D.P.I. must also be in a position to respond to these situations with improved varieties and other technological changes appropriate to the situation.

Food and nutrition working group

Given the peculiar problems confronting the Government in general, and the Departments of Primary Industry and Health in particular, in implementing the National Food and Nutrition Policy, the proposals outlined herein, and the recommendations of the 1975 Food Crops Conference we suggest that a working group be convened urgently to complement the work of the National Food and Nutrition Policy Implementation Committee. The group must include

representatives of agencies concerned with nutrition and with production, consumption and distribution of food in Papua NewGuinea. We also suggest that a well-planned food and nutrition conference be convened in 1980.

CONCLUSIONS

Papua New Guinea is in a position to build on traditional technology, crops and institutions to feed the non-subsistence sector. It is not necessary to replace the traditional ways with large scale, energy and capital dependent technology. Nor is the choice only between cheap, convenient food from overseas and expensive locally grown food. To a large extent the technology is already available in Papua New Guinea to produce staples at reasonable prices.

Priorities must be reassessed and more resources devoted to food production. At the same time the social and economic climate must be made more favourable to local food producers. A bold step has been made in limiting rice imports. Further intervention directly in the market and through technological and infrastructural support is needed.

It is essential that the effects of these changes on food supply and nutritional status be monitored and a mechanism established for rapid emergency action.

Because food dependency, once established, is very difficult to reverse it is imperative that the proposals outlined here be acted on as soon as possible.

An earlier draft of this paper was recently considered in Port Moresby and was instrumental in accelerating moves to design more projects in the food area for submission to the 1980 N.P.E.P. However, due to the lack of skilled management to staff new projects they are not likely to be successful unless some fundamental changes occur in priorities for resource allocation and are matched by an increased awareness of the value of "eating Papua New Guinean".

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Table 1. Annual production and agronomy research input for certain crops.

Crop group	Annual production (tonnes)	Number of agronomic field trials (1)
Staples		
Sweet potato	1,223,000 (2)	129
Taros, yams and cassava	757,000 (2)	45
Maize	62,000 (2)	95
Potato	1,800 (3)	66
Rice	800 (4)	229
Wheat	0	17
Vegetables		
Traditional	- (5)	16
Introduced	- (5)	195
Fruits and nuts		
Traditional	- (5)	2
Introduced	- (5)	65

(1) R.M. Bourke, unpublished data. Pre Pacific War to 1978.

(2) Walters (1963). 1961-62 data.

(3) R.A. Nitschke, pers. comm. 1978 data.

(4) Hale (1978). Milled tonnes. 1975-76 data.

(5) Production is not known, but productionof traditional vegetables and nuts greatly exceeds that of introduced vegetable and nut crops.

Table 2. Imports of food and food preparation.

Item	1975/76 Quantity (tonnes)	1975/76 Value (K000)	1978 (estimated (1) Quantity (tonnes)	1978 (estimated (1) Value (K000)
Rice, total	54,847	13,249	77,584	16,603(2)
Flour, total	25,695	3,968	30,026(3)	4,744
Potatoes, fresh	2,741	352	3,096	406
Sugar, total	19,402	6,691	22,502	5,870
Coffee, instant	151	1,039	152	1,576
Peanut butter	127	208	92	152
Beef, fresh	2,353	2,046	6,064	4,142
Beef, canned	1,896	3,241	3,848	6,506
Pork, fresh	499	807	624	654
Chicken, fresh	3,440	3,260	2,262	2,512
Meat, canned total	4,517	4,283	6,262	6,308
Fish, canned	21,592	7,552	28,600	14,656
TOTAL	137,260	46,696	181,112	64,129

(1) All 1978 estimates are made from Jan-June 1978 figures and are probably under-estimates, not allowing for seasonal demand. (Figures from Koley, 1978).

(2) Calendar year 1978. Quantities from Rice Industries Pty. Ltd., Lae. Price information, average of six months Jan-June 1978 of K211 per tonne. (Figures from Koley, 1978, and Koley personal communication.)

(3) Includes 21,791 tonnes of wheat expressed as flour equivalent (1.3. tonnes wheat yields 1 tonne flour). Both quantity and price information is approximate.

N.B. These figures do not represent all the food imported into Papua New Guinea. For example, fresh vegetables (apart from potatoes) are omitted as are fruit juices, frozen and tinned vegetables and fruits. In 1975/76 the value of all these extra items imported was approximately K1.5 million. As is noted above, the 1978 estimates are preliminary only. From these 1978 estimates, rice was 26% of the value of all imports.

Table 3. National Publis Expenditure Plan projects - Food and nutrition 1978/79.

N.P.E.P. No.	Project	Period	Budget (Kx1000)	Immediate contribution to production marketing, processing, storage, transport, wholesaling or retailing of domestically produced food.	
1-5-302	Rice farming & seed production	1979	25	YES:	Seed only.
1-5-903	Food production - Simbu	1979	38.4	YES:	Dev. soil conservation and production techniques.
1-5-801	Food production - W. Highlands	1979/82	24	YES:	Extension on settlement scheme
1-5-1601	Nutrition - New Ireland	1979	20	YES:	Inservice, extension work.
9-1-201	Nutrition adviser	1979/82	36	NO:	Co-ordination of school programmes.
1-5-902	Luk Luk Theatre	1979	15	NO:	Theatre for public, schools.
1-3-709	National Fruit & Nut Project	1979/82	230.5	NO:	Stocktake of attitudes, planting materials. Future extension, distribution.
1-3-709	Ranch Dev'ment	1979	100	NO:	Consultancy: feasibility studies.
1-5-602	Nutrition rehab-ilitation, Daru	1979	95.1	YES:	Helping malnourished children.
1-5-701	Potatoes, Enga	1979/82	44.2	YES:	Seed distribution; production end 1979.
1-3-719	Field Horticul-turists	1979/82	338	YES:	Food production at major resource projects, e.g. Ok Tedi.
1-3-501	Urban Agricultural	1979/82	185.5	YES:	Hopefully by demonstration plots, extension & seed distribution.
1-3-718	Food processing, handling	1979	25	NO:	Research and development.
1-3-608	Improved Live-stock	1979/82	403	NO:	Poultry centre under construction. Pig research.
1-3-606	Feral cattle eradication	1979/80	149.9	YES:	Shooting, processing for sale of feral cattle.
1-5-601	National Nutrition Programme	1979/82	462.7	YES:	Education, production nutritious foods.

able 3. National Public Expenditure Plan projects - Food and nutrition 1978/9.

.P.E.P. No.	Project	Period	Budget (Kx1000)	Immediate contribution to production marketing, processing, storage, transport, wholesaling or retailing of domestically produced food.	
1-3-701	South coast Food Production	1979/81	640	YES:	Port Moresby to be sufficient in tomatoes & cabbages end 1979.
1-3-707	Mekeo Irrigated Rice Production	1979	500	NO:	Establishment of pilot farm, but will produce after 1979.
1-3-704	Smallholder rice production	1979	131	YES:	Smallholding processing
1-3-601	Animal diseas control	1979	88	YES:	Reduction in disease of Village pigs.

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Table 4. Papua New Guinea production and imports of rice 1963-1979.

Year	P.N.G. produced rice (3)	Imported rice	Price of imported rice (Kina/tonne) (2)
1963-64		24 021	123.60
1964-65		28 119	123.60
1965		33 781	124.00
1966-67	730	32 816	132.00
1967-68	765	38 678	142.00
1968-69	978	38 260	150.00
1969-70	884	45 188	152.00
1970-71	1213	47 069	148.00
1971-72	884	48 552	127.00
1972-73	554	61 648	138.00
1973-74	802	41 659	240.00
1974-75	697	54 906	300.00
1975-76	821	54 847	283.00
1976-77	n.a. (4)	67 000	n.a.
1977-78	n.a.	75 000	n.a.
1978-79	n.a.	77 584 (est)	213.00

(1) Figures for 1963-64 to 1975-76 from Hale (1978) and from 1976-77 to 1978-79 from Rice Industries Pty. Ltd.

(2) Price data is from Hale (1978), 1963-64 to 1975-76; and for 1978-79 is an average of Jan-March 1978 price per tonne (C.I.F.).

(3) P.N.G. milled rice production has been converted from paddy @ 55%.

(4) Not available.

APPENDIX 1.

Calculation of crude consumption of rice in urban and non-urban areas.

(1) The level of imported rice in 1975/6 was 54 847 tonnes (Hale, 1978).

(2) The number of nationals in urban Papua New Guinea in 1975/6 was 393,100 (N.P.O., n.d.).

(3) The weighted urban average fortnightly expenditure on rice in 1975/6 per household was K6.37 x 26 = K165.62 p.a. (Sampson, n.d.).

(4) The average household size in urban Papua New Guinea in 1975/6 was approximately 6 persons (Sampson, n.d.).

(5) The retail price of rice at the time of the 1975/6 Household Expenditure Survey was 40t/kg.

(6) Dividing (3) by (5) and then dividing by (4) gives 69 kg/head/year.

(7) Multiplying 69 kg/head x 393, 100 people = 27 124 tonnes.

(8) This is 49% of the total rice imports for 1975/6.

(9) On the basis of these figures, half the 1975/6 imports were consumed outside the urban areas.

APPENDIX 2.

Summary of food crop agronomic research priorities (after Bourke, 1978b).

Aiyura, East Highlands Province.

1. Publish research on: sweet potato varieties (including an extension article on current releases); the highland sweet potato fertilizer work and plant population studies; peanut plant density and method of cultivation trials; and soyabean variety trials.

*2. Maintain sweet potato variety trials, and initiate a series of regional trials.

*3. Expand the project on highland farming systems. A national horticulturist should be appointed.

4. Maintain the fruit and nut project with emphasis on species for subsistence use and local sale. Take over the U.P.N.G. apple project.

5. Evaluate coffee/food crop farming systems.

6. Initiate a new project on traditional vegetables.

Angoram, East Sepik Province.

* When the station is established here, conduct research onyams and sago, concentrating on selecting superior varieties.

Bubia, Morobe Province.

1. Evaluate rust resistant peanut varieties.

2. Continue soyabean trials, but terminate the project if an industry does not develop.

3. Write up soyabean plant density trials.

4. Evaluate maize varieties resistant to downy mildew.

5. Continue the rice variety trials. Review previous P.N.G. rice work if possible.

6. Maintain the sugar cane trials for the moment.

7. Plant a sago observation block.

*8. Initiate a new cassava variety evaluation and banana varietal evaluation project.

*New or replacement staff required.

Keravat, East New Britain Province.

The following projects should be maintained:

1. Sweet potato variety evaluation.

*2. Taro variety and fertilizer work. No professional staff at present. Tap priority.

3. The cassava variety work (short term project).

4. The traditional vegetable project.

*5. The long term farming systems trials. New senior staff member needed.

6. The fruit and nut project, including work on traditional species.

The following new project should be initiated:

7. New systems of growing cocoa and coconuts including interculture with food crops should be investigated.

Kuk, Western Highlands Province.

*1. A replacement for the food crop agronomist should be made. An experienced person should be recruited who would conduct a comprehensive review of all research on introduced vegetables, including growers' experience; and publish papers and extension articles as appropriate. He may be able to do a similar review for potatoes.

2. Continue with some potato research such as sprout stimulation and fertilizer trials.

Kundiawa, Simbu Province.

*1. Initiate a soil conservation and erosion control project.

Laloki, Central Province.

1. Analyse and write reports on completed trials.

2. Continue sweet potato and cassava variety trials, doing some in the urban area if possible.

*3. Continue with the introduced vegetable project, but expand this into wetter areas.

4. Develop expertise in commercial systems for sweet potato and other food crops including off-season production

*5. Investigate problems associated with urban food production, including supply of planting material.

* New or replacement staff required.

Tambul, Western Highlands Province.

1. Write up the lupin work and any other work suitable for publication.

*2. Continue sweet potato varieties for high altitude areas, but conduct work off the station because of soil fertility problems.

3. Introduce and evaluate frost resistant root crops from the Andes.

University of Papua New Guinea.

1. Maintain the winged bean project.

2. Complete and write up the maize (and sorghum) projects.

3. Write up the introduced vegetable work.

4. Initiate a new project on introduced vegetables.

5. Initiate a new yam project.