Production Patterns of 180 Economic Crops in Papua New Guinea

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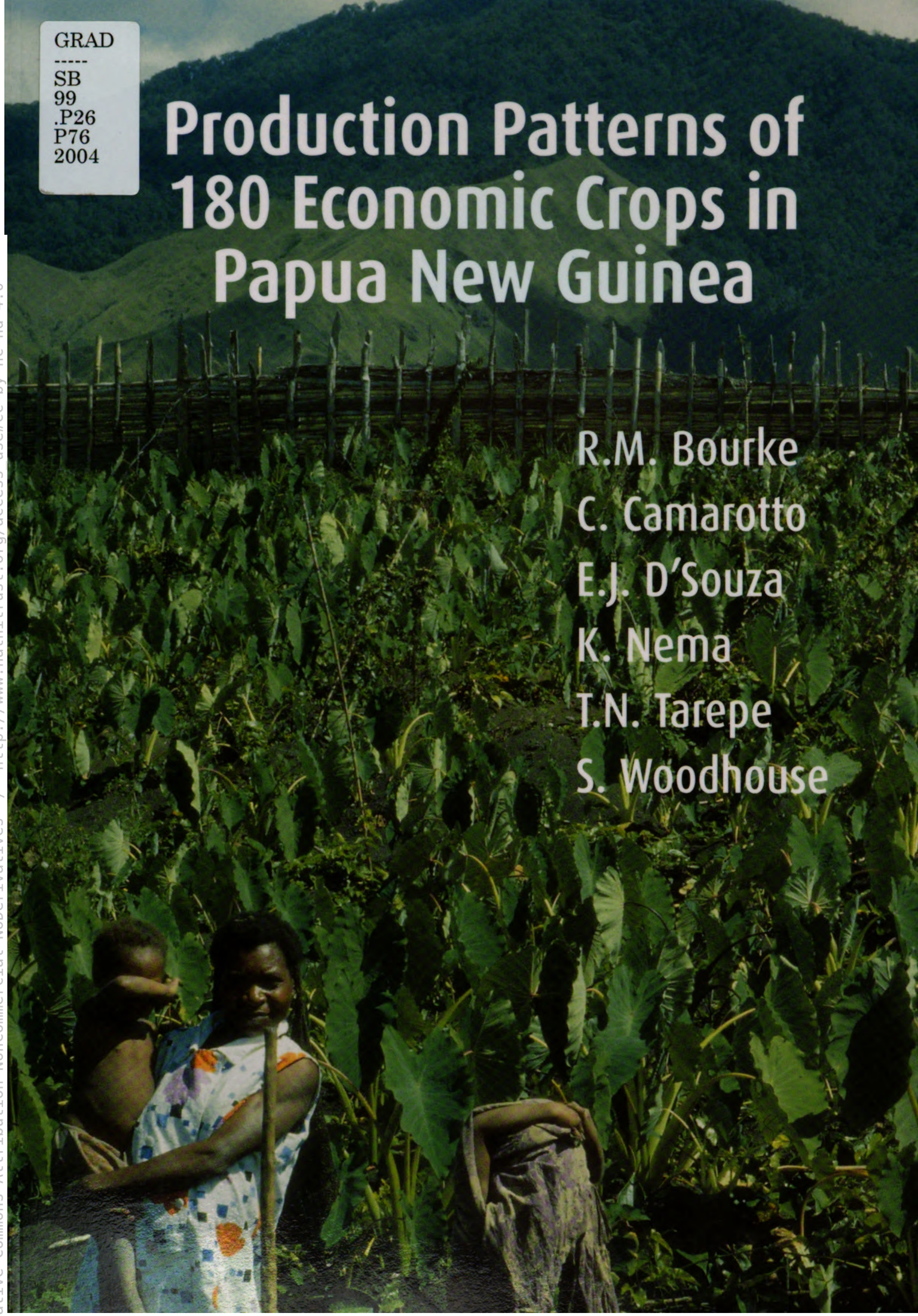

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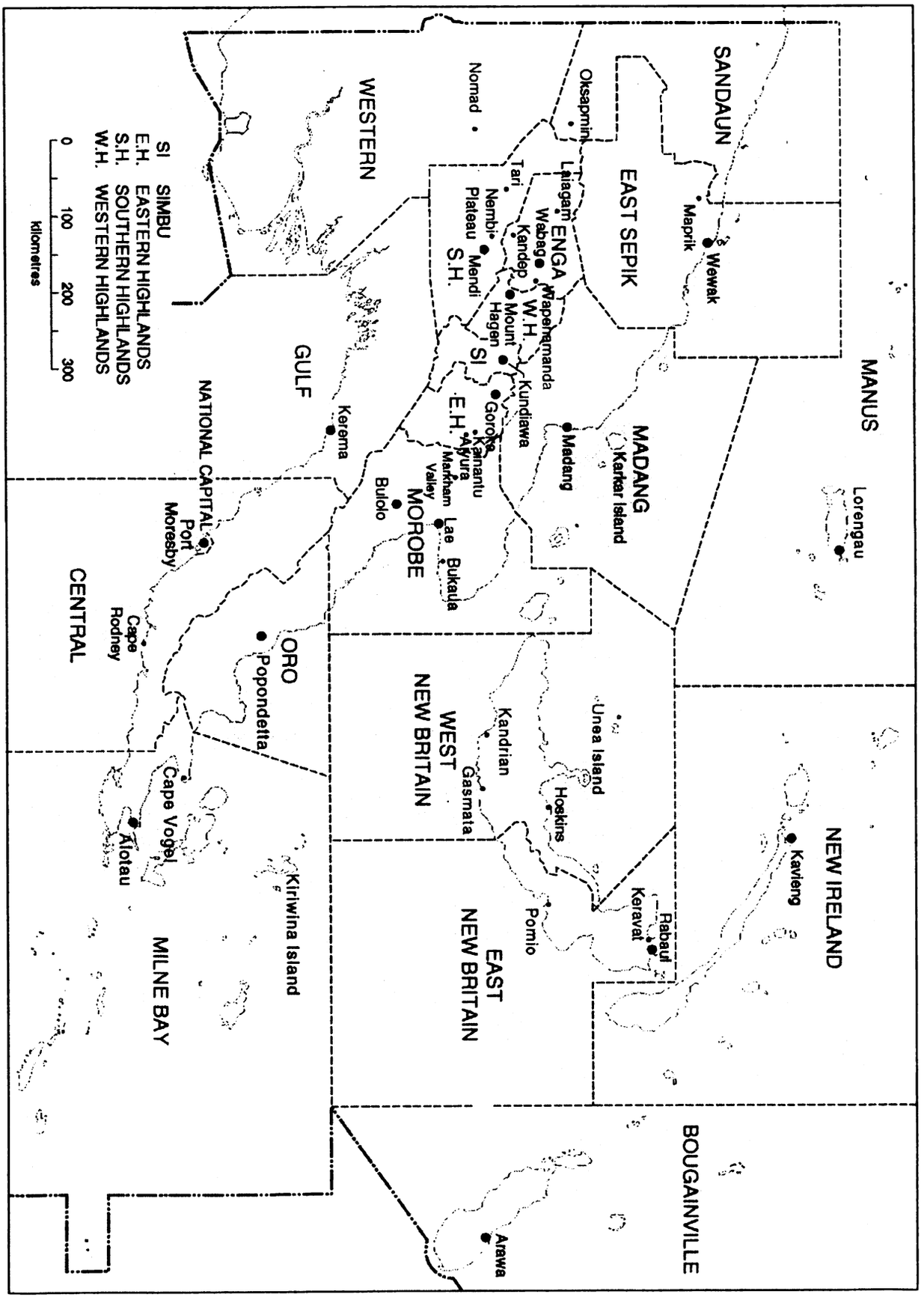
MAP 1. LOCATIONS WHERE LONG-TERM RECORDINGS WERE MADE



SUMMARY

Variation in the supply over time of 180 crops in Papua New Guinea is described. Aspects of production patterns considered are continuity of supply, seasonality and reliability of the start of the producing period (if seasonal) or regularity of supply (if non-seasonal). The crops are grouped into starchy foods (11 species), traditional (pre-European) vegetables (20 species), introduced (post-European) vegetables (33 species), fruit (74 species), nuts (27 species), narcotics (8 species) and export cash crops (7 species).

Data sources are: fortnightly or weekly surveys of the quantity of food offered for sale in five highland markets over a 2-3 year period (1979-1982); purchases of fresh food by the Food Marketing Corporation in Goroka over a five-year period (1976-1981); purchases of fresh food by the Food Marketing Corporation in six lowland and highland centres over a two-year period (1979-1981); prices in five lowland and highland markets recorded weekly over a 22-year period as part of data collected to compute the Consumer Price Index (1971-1992); experimental recordings at the Lowlands Agricultural Experiment Station at Keravat on New Britain on nine fruit and nut trees over 2-3 years (1990-1993); experimental recordings on pineapple at Keravat over 3-4 years (1973-1976) and at Saiho near Popondetta in Oro Province (1969-1971); observations on experimental plantings of other fruit and nut trees at Keravat (1989-1993); an observer network for pandanus nut at six highland locations for 7-10 years (1976-1985); observations at two locations over 4-7 years on wild pandanus nuts (1972-1986); an observer network for mango at three lowland locations for seven years (1979-1985); comments by villagers on crop production patterns in many locations in PNG (1979-2002), observations (published and unpublished) on production patterns for crops in many locations in PNG by agriculturalists, anthropologists and geographers. Overall, the range for recordings is 2-22 years, with most data sets covering 3-6 years, except for recordings by fieldworkers where they are often for one year only.

Many perennial species bear seasonally in PNG, as do some annual species. For crops where there is sufficient data to generalise, the following seasonal patterns apply. For the starchy foods, two species bear seasonally, six are non-seasonal, and for one, the pattern varies with the agricultural system; for traditional vegetables, eight species bear seasonally and five are non-seasonal; for introduced vegetables, only two species bear seasonally, 20 are non-seasonal, and for four species, the pattern depends on the environment; for fruit, 44 species bear seasonally, 21 are non-seasonal, and for four, the pattern depends on the environment; for nuts, 13 species bear seasonally, three are non-seasonal, and for three, the pattern depends on the environment; for narcotics, four species bear seasonally and one is non-seasonal; for the export crops, four species bear seasonally, one is non-seasonal and for one, the pattern depends on the environment.

Three major environmental factors trigger flowering in plants, being changes in photoperiod (daylength), temperature and moisture. Seasonal changes in temperature and daylength are generally very small in PNG, except at locations further from the equator (8-12°S) where they are somewhat greater. Seasonal rainfall changes are usually larger, often over short distances, with three major seasonal rainfall patterns. There are marked differences in temperature with changes in altitude. Where there is sufficient reliable data, these differences make it possible to explore possible environmental influences on fruiting behaviour. Seasonal change in daylength is likely to be the main trigger for flowering of many perennial trees. For some species, production is seasonal at locations further from the equator (8-12°S) and non-seasonal at locations closer to the equator, suggesting that seasonal changes in daylength, and possibly temperature, initiate flowering at locations further from the equator, but not where seasonal changes are very small.

For several perennials, temperature change associated with altitude has no apparent influence on the production pattern. For three perennial species, production is non-seasonal in the lowlands, but seasonal in the highlands. For one fruit species, temperature (altitude) has a marked influence on the start and duration of the producing period. Two introduced vegetables bear in a non-seasonal manner in the lowlands, but are seasonal in the highlands. Another introduced vegetable appears to display the opposite pattern.

Rainfall has only a limited influence on seasonality for most perennial species. However, it has a marked effect on the agricultural system in some locations in that it influences the timing of clearing of fallow land and planting of food gardens after fallows. In these locations, the availability of certain annual crops is determined by the timing of clearing of land after fallow and planting of food gardens. In the highlands, this is dependent on the intensity of land use, rather than annual rainfall or temperature seasonality. There are indications that the incidence of pest and diseases, which is influenced by rainfall seasonality, determines the planting and harvesting seasonal pattern for three fruit and vegetable species.

ABBREVIATIONS

CPI	Consumer Price Index
CRI	Coffee Research Institute
DPI	Division of Primary Industry
EHP	Eastern Highlands Province
ENB	East New Britain Province
ESP	East Sepik Province
FMC	Food Marketing Corporation
HAES	Highlands Agricultural Experiment Station, Aiyura
Is	Island
LAES	Lowlands Agricultural Experiment Station, Keravat
MBP	Milne Bay Province
Mts	Mountains
PNG	Papua New Guinea
Prov	Province
R	River
Ra	Range
RMB	R. M. Bourke
SHP	Southern Highlands Province
SW	Steve Woodhouse (Observations at LAES Keravat)
V	Valley
WHP	Western Highlands Province
WNB	West New Britain Province

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INTRODUCTION

The purpose of this publication is to define how the supply of food crops, narcotics and export crops varies over time in Papua New Guinea. Because most food is grown for subsistence consumption, direct measurement of village food production is extremely difficult, especially over several years. Hence it is necessary to use surrogate data to understand how production changes over time. Here we collate and analyse a number of diverse, long-run data sets. These include estimates of the quantity of food offered for sale in markets, market prices, crop yield records on research stations, and observations made by villagers and outsiders on village production patterns.

The origin of the project is a study of the causes of food shortages in the Highlands by Mike Bourke (RMB) assisted by Euclid D'Souza and Kiage Nema (Bourke, 1988). As part of this study, regular weekly or fortnightly surveys were conducted in four food markets in the Eastern Highlands and Southern Highlands over three years. Using the same techniques, Tevo Tarepe surveyed the quantity of certain types of food offered for sale in Goroka market. The other data sets analysed here are:

1. Records of the quantities of fresh food purchased by the government-run Food Marketing Corporation (FMC) for six highland and lowland buying centres.
2. Market prices recorded by Division of Primary Industry (DPI) staff in four lowland towns and one highland town. These are collated by the National Statistical Office (NSO) and, together with other figures, used to compute the Consumer Price Index (CPI).
3. Experimental recordings made by Steve Woodhouse on crop yield for a number of fruit and nut tree species at the Lowlands Agricultural Experiment Station, Keravat, East New Britain; and experimental plantings of pineapple at Keravat (RMB) and Saiho in Oro Province (John Horne).
4. Observations on the harvest season of karuka nut pandanus at six highland locations and on mango at three lowland locations by a network of observers over long periods.
5. Statements made by villagers in many parts of PNG about production patterns and recorded by one of us (RMB); and published statements by outside observers.

Claudia Camarotto was employed as a Research Assistant in 1992-1993 by the Land Management Group at the Australian National University to collate the large volume of data. The first draft of this document was written by RMB in 1994, but not revised until late 2001-early 2002, with assistance from Matthew Allen. In a related project, the production patterns for 57 fruit and five nut species in PNG were compared with those in four other nearby countries (Camarotto and Bourke, 1994). The purpose of the second study was to examine the potential for exporting fruit from PNG to other countries during their off-season.

The main locations discussed are shown in Map 1. Information on the data sources used is summarized in Table la. Information on rainfall, rainfall seasonality and the altitudinal range of the market supply areas for locations where longitudinal data are available is given in Table 2. Data on production patterns was mainly recorded over a 26-year period (April 1969 to July 1995), although they are concentrated in the four-year period 1979 to 1982 and there are several observations after 1995.

The supply of a commodity can vary over time for one or more of the following reasons:

1. Changes in the planting rate over time. This is especially the situation for annual crops.
2. Changes in yield per unit area per unit time. This is responsible for much of the variation in supply over time for perennial crops, such as fruit trees.
3. Changes in harvesting and marketing behaviour by villagers.

Changes in the planting rate and crop yield over time are influenced by environmental factors, in particular by rainfall, daylength and temperature changes. However they are also dependent on the

farming system in which the crop is grown. Some of the results to be presented here illustrate this clearly. In certain highland locations, there is greater regular variation in the supply of many crops in very weakly seasonal environments than in more seasonal environments. This variation occurs because of changes in planting rates which are dependent on the proportion of a particular crop which is planted in certain garden types.

Information on production patterns over time is of value for a number of reasons:

1. It is needed by professional agriculturalists, planners and wholesalers who need to understand changes in crop supply over time in different environments.
2. It indicates regional differences, particularly those associated with differences in temperature (altitude), rainfall, latitude and farming system.
3. It may indicate the relative importance of climatic factors, planting rates and agricultural systems in influencing the supply pattern.
4. It may suggest the environment triggers for flowering and fruit production in some species.

Data Sources

Market Survey Techniques

Food markets are a relatively recent institution in Papua New Guinea. In the Highlands, they commenced in the 1950s in several larger urban areas. By the late 1970s, there were numerous market places in each province. These were located in all major and minor urban locations, as well as in many villages, other rural sites such as mission stations and roadside locations.

Surveys of the volume and prices of produce offered for sale in food markets provide a relatively easy method of examining changes in village food production over time. The assumption here is that the volume of produce sold reflects the volume available in the market sellers' catchment area. Most food offered for sale is grown by non-specialist village producers, and is generally sold directly to the consumer by the producer. Hence the assumption of a reasonable link between the volume offered for sale and that available within the market catchment area is likely to be valid.

Nevertheless, there are limits to the linkage between village supply and the volume offered for sale in markets. The market sellers' catchment area is usually not known exactly. This is likely to change over a period of several years as road transport improves or deteriorates. There are also reasons why villagers might increase or decrease the quantity of a particular crop that they harvest and sell over shorter time periods. These include changes in their perception of consumer demand, transport constraints, inter group tension and changes in their cash requirements.

Market prices are a surprisingly sensitive index of supply given that only a small proportion of most commodities is marketed. The reason for this is that, as the supply decreases, some rural producers become consumers. Demand increases as the supply falls and prices increase accordingly.

Five Highland Markets

Surveys were conducted regularly in five highland markets between 1979 and 1982. Details of the surveys are given in Table lb. Kainantu and Goroka are urban markets where produce is sold by rural villagers to urban and rural people. Aiyura market is located on the Highlands Agricultural Experiment Station and caters for station workers. Ukarumpa serves staff (mostly expatriate) at the headquarters of the Summer Institute of Linguistics in the Aiyura Basin near Kainantu. Hol is a remote rural market on the Nembi Plateau west of Mendi and almost all sales are made to other villagers. Surveys have also been conducted by other researchers of Asaro, Wabag and Wau markets using the same techniques. We have not presented these results because the survey periods are short

(only one year) and there are numerous gaps in the data that make interpretation difficult. However, the Wau market survey data obtained by J. Swift in 1981 is discussed for some crops. Price surveys have been conducted in a number of PNG markets for the Fresh Produce Development Company in the 1990s. These results are not reviewed here.

The same technique was used in all surveys to record the quantity of produce. Food is offered for sale in lots or bundles of a fixed price in PNG markets. People vary the price (per kilogram) of a commodity by altering the size of the bundle rather than the price per bundle. This sort of pricing behavior is characteristic of markets in Melanesia and elsewhere in the Pacific (see Brookfield, 1969; McGee *et al.*, 1980; Epstein, 1982; Griendl, 1997; Allen, 2001). The number of bundles and asking price for all commodities on display was recorded at the time of the survey. This was converted into a kina value. For example if there were 100 bundles of sweet potato on display at 10 toea per bundle and 40 bundles at 20 toea per bundle, this was recorded as K18 worth. This technique is adequate to indicate quantities offered for commodities that are very seasonal, such as certain fruits and nuts. However it is a less sensitive index of total produce offered for sale for commodities that exhibit less variation over time. The technique does not take into account produce kept in bags prior to display nor does it allow for variation in the size of bundles with a fixed price. Hence the data presented here are not a record of the total value for each commodity offered for sale or sold.

The value of all commodities offered for sale was recorded at Aiyura, Kainantu, Ukarumpa and Hol markets. At Goroka, starchy foods, fruits and nuts were surveyed, but not vegetables and narcotics. Results for Aiyura, Kainantu and Ukarumpa markets have been combined. This is because the three market places are within 10 km of each other and the area where produce is grown for the two smaller markets lies within the producing area for Kainantu market. The most important commodity group in Ukarumpa market is introduced vegetables because of the largely expatriate buyers. Hence these data compliment those from the other two markets which cater mainly for Papua New Guinean buyers.

Two or three surveys were made each month (4-5 for Hol market). These figures were averaged to give a mean monthly value and this is presented in Tables 3 to 11. The data are graphed as three month running means (Figures 1-19). The number of commodities (84) is not identical to the number of species because some species provide more than one commodity. For example, winged bean provides tubers, leaves, green beans and dried seed.

FMC Purchase Figures

In 1974, the PNG government set up the Fresh Food Project, later renamed the Food Marketing Corporation (FMC) (McKillop, 1981). It operated until September 1981. The FMC purchased fresh food from villagers at buying centres and resold them to retailers and other consumers. The emphasis was on introduced vegetables and fruit, although some staples such as sweet potato were also purchased.

FMC staff in Port Moresby made available purchase records for six buying centres for a 26 month period (July 1979 to August 1981). The buying centers were Port Moresby, Lae, Wau, Kainantu, Goroka and Mt Hagen. Goroka-based staff made available their buying records for a five and a half-year period (April 1976 to August 1981). These data are presented in tabular form as weight of produce purchased per week for each month and as a three month running means in graphs (Tables 12-23, Figures 20-70).

Again it is assumed that these records are a reasonable reflection of the availability of food in the catchment area for each buying point. This assumption is more tenuous than for surveys of local markets. This is because there were undocumented changes in FMC buying policy. There are a number of other problems with these data. There are some missing figures. There are also some differences between the figures for the two data sets for the Goroka buying centre. This casts doubts on the accuracy of the records.

Despite these reservations, it is believed that they provide an indication of the availability of various foods for the catchment areas and are thus analysed here.

CPI Market Surveys

Prices of 14 fresh foods and betel nut are recorded in five urban markets every week by provincial DPI staff. The markets are Rabaul, Port Moresby, Lae, Madang and Goroka. They are compiled by the National Statistical Office and used to compute the consumer price index (CPI). The weight and price are recorded for six lots of produce for each commodity. Continuous data are available from January 1971 (or late 1970) until the present. The quality of the data collected appears reasonable, at least until the mid-1980s after which it deteriorates. There are numerous gaps in the record by the early 1990s, especially for Lae. Data has not been recorded for Rabaul after the mid-1990s. The sample size of 24 (or 30) price records per month is adequate, provided prices were recorded from separate sellers.

We compiled prices for 15 commodities for the five towns for each month for the period January 1971 to December 1992. Where prices were recorded for only one week in a month, this was treated as a missing figure and the monthly mean was not computed. Where there were two to five weeks' recordings in a month, a monthly average was computed. Recorded values were converted into constant kina using two series of consumer price index (1971 to 1977; 1977 to 1992). Results are presented as monthly means and standard deviation for each commodity and town (Tables 24-27, Figures 71-85).

The CPI figures and graphs have to be interpreted differently from the other market data or FMC purchases, where the data are for quantities offered for sale or purchased. For the CPI data, high prices indicate poor supply and lower prices suggest a better supply.

Experimental Recordings

Yield of nine fruit and nut species were recorded by Steve Woodhouse for individual trees at the Lowlands Agricultural Experiment Station (LAES) at Keravat between January 1989 and March 1993. Each species was grown at up to four locations on the research station, with a different number of trees and crop history at each location (Tables 28 and 29). The individual tree yields were combined to derive a species mean which was weighted for the number of trees. The yield per tree was converted to yield per hectare using the tree spacings of these plots. The data are presented as weighted monthly means in graphical form and monthly means for each location in tabular form (Tables 28 and 29, Figures 86-89). As far as is known, there are no errors in the recordings apart from suspected theft of galip nuts. This may have reduced the recorded yield for galip.

Long-term, longitudinal yield data from experiment stations are also available for pineapple. John Horne recorded yield from a block at Saiho near Popondetta in Oro Province between April 1969 and October 1971; and RMB recorded yield from a block at Keravat between January 1973 and April 1976. Woodhouse also noted the fruiting pattern of a number of fruit and nut tree species at LAES Keravat during the late 1980s and early 1990s, without recording crop yield. These observations are indicated in the text as (SW).

These experimental recordings provide better quality data on how crop yield varies over time in that they are not influenced by changes in planting rate or in marketing behaviour by villagers. Because records are available from individual trees at Keravat, more detailed analysis could be done on these data than has been done here.

Observer Network

A network of observers was set up in 1980 by RMB for mango in three lowland locations (Rabaul, Markham Valley and Port Moresby); and for karuka nut pandanus in 1979 at six highland locations (Kainantu, Goroka, Wabag, Mendi, Tari and Oksapmin). The observer at each location was contacted

several times a year for a report on the start and finish of the mango or karuka nut harvesting season. Observations were also available on the karuka season at three of the highland locations for up to three years before the network was established. The observers of the karuka harvest also provided a subjective comment on the harvest size. The network was maintained until early 1986. Details on type of observations, observers and the data for each location are given in Tables 30-33 and results in Figures 90-91.

The quality of these observations is somewhat uneven because of changes in the observers at locations and the subjectivity of the assessment of production. The most consistent karuka data is for Kainantu and Tari. The Kainantu data, and those for three years for Goroka, are based on market surveys rather than on villagers' harvesting and consumption behaviour. Because stored nuts are sold in markets after the harvest has been completed, market surveys indicate a somewhat longer production season than more direct observations.

Villagers' Statements and Literature

Villagers in many parts of PNG were asked about the producing season for certain crops by RMB. Their responses are summarized in Tables 34a-50 and in the results section. The quality of the statements by the villagers is uneven. People in nearby locations frequently made slightly different statements about the start and finish of the harvesting season. This is not unexpected given that year-to-year variation occurs and many species produce at least some food throughout the year. Published recordings on crop seasonality made by outside observers are also assembled here. A comprehensive search of the PNG literature has been made, but it is not exhaustive. These observations were generally made by anthropologists and geographers who were residing in villages for at least a year. These records are based on their own observations or statements by villagers.

The value of this data set is that it provides information for numerous locations in diverse environments. It thus extends the observations from the catchment area of urban markets and experiment stations. These data are surprisingly consistent given the diverse sources and that, in the case of statements by villagers to RMB, they were usually based on brief conversations only.

We have not summarized general statements about crop seasonality from the literature where there is no indication of the location referred to or the source of the information, for example, data given by French (1986) on crop seasonality. Peekel (1984:598-603) provides information on the flowering behaviour of many species on New Ireland and the Gazelle Peninsula of New Britain. This is not summarized here.

Data Organization

Where information for a crop is available for more than one location, the order of presentation for locations is from east to west, and the sequence is market surveys, FMC purchase figures and observer networks. Information from villagers' statements and the literature is organized by increasing altitude of the location. For low altitude locations (0-400 m), it is also ordered by increasing latitude.

Data Computer Files

All of the raw data used in the project are available in electronic form on 3 1/2 inch disks.
The Consumer Price Index data are available in IBM format and other data sets are in Macintosh format. All numeric files are in Excel 4. Copies of the disks and further information are available from: Dr. R. M. Bourke, Department of Human Geography, Research School of Pacific and Asian Studies, Australian National University, Canberra ACT 0200, Australia.

Definitions

The following terms are used to describe the production pattern for each commodity, where commodity is defined as the main economic product of a particular species:

Continuous: The commodity is available in most or all months of a calendar year.

Discontinuous: The commodity is available in only some months of a calendar year. Note that for some commodities and locations, a discontinuous supply reflects the small quantity marketed rather than discontinuous village production.

Seasonal: The commodity is usually more abundant at about the same time in each calendar year.

Non-seasonal: The commodity is not more abundant at about the same time in each calendar year.

Where the availability of a commodity is **seasonal**, the following terms are used to describe the supply pattern:

Constant: The start of the main production period occurs at about the same time each year, that is, within plus/minus a month of the long-term mean.

Non-constant: The start of the main production period occurs at a somewhat different time each year, that is, within plus/minus three months of the long-term mean.

Where the availability of a commodity is **non-seasonal**, the following terms are used to describe the supply pattern:

Regular: The supply of the commodity is about the same in each month of the year.

Irregular: The supply of the commodity varies somewhat between months in a year.

Very irregular: The supply of the commodity varies considerably between months in a year.

The following terms are used for different altitude zones:

Lowland	0-600 m
Intermediate	601-1200 m
Highland	1201-1800 m
High altitude	1801-2400 m
Very high altitude	2401-3000 m

RESULTS AND DISCUSSION

Starchy Foods

Banana, cooking *(Musa* cvs)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 1, Table 3); Goroka market survey (Fig 1, Table 3); Hol market survey (Fig 1, Table 3); FMC purchases, six buying centres (Fig 32, Table 17); CPI market survey (Fig 72, Table 24).

Longitudinal data are available for Rabaul, Port Moresby, Lae, Wau, Madang, Kainantu, Goroka and the Nembi Plateau. The supply is continuous at all of these locations. It is non-seasonal and irregular in the Rabaul, Port Moresby, Lae, Wau, Madang, Kainantu and Goroka areas. On the Nembi Plateau in the Southern Highlands, the Hol market survey indicates a weakly seasonal supply pattern with the best supply in March-August and the poorest in September-February. The CPI market surveys suggest a possible weakly seasonal pattern in the Port Moresby area with a somewhat poorer supply in March-May. However, given that the FMC purchasing figures did not show this pattern and that the CPI market survey prices are very variable, this is unlikely to be a real seasonal effect.

Banana, eating (*Musa* cvs)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 1, Table 3); Goroka market survey (Fig 1, Table 3); Hol market survey (Fig 1, Table 3); FMC purchases, Goroka (Fig 20, Table 12); FMC purchases, six buying centres (Fig 33, Table 17); CPI market survey (Fig 73, Table 24).

The supply is continuous, non-seasonal and regular to irregular in all locations.

Breadfruit (*Artocarpus altilis*) and breadnut (*Artocarpus camansi*)

See Nuts.

Cassava (*Manihot esculenta*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 2, Table 3); Goroka market survey (Fig 2, Table 3); CPI market survey (Fig 76, Table 25).

Longitudinal data are available for Rabaul, Port Moresby, Lae, Wau, Madang, Kainantu and Goroka. Supply is continuous, non-seasonal and irregular at all of these locations. CPI market surveys show that in the Port Moresby area, there is a tendency for supply to be poorer between September and March, but there is considerable variation from year to year. Similarly, the CPI market surveys show a tendency for supply to be poorer in Goroka between October and January, but the pattern is not regular and the supply could not be defined as seasonal.

Corn (*Zea mays*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 2, Table 3); Goroka market survey (Fig 2, Table 3); Hol market survey (Fig 2, Table 3); FMC purchases, Goroka (Fig 23, Table 13); FMC purchases, six buying centres (Fig 44, Table 19); CPI market survey (Fig 78, Table 25).

Supply is usually continuous but it is sometimes discontinuous at some locations. Production is seasonal and non-constant at all locations for which good quality data are available (Rabaul, Port Moresby, Lae, Wau, Madang, Kainantu, Goroka and the Nembi Plateau). The period of best supply usually commences in December or January and continues until about March, but the pattern varies

somewhat between locations and between years. Seasonality of supply is weakest in the Lae and Madang areas and most pronounced on the Nembi Plateau. The better supply earlier in the calendar year reflects increased planting rates in the October-December period. In the highlands, this occurs because mixed gardens and some sweet potato gardens planted after fallow are made at this time.

Potato (*Solanum tuberosum*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 2, Table 3); Goroka market survey (Fig 2, Table 3); Hol market survey (Fig 2, Table 3); FMC purchases, Goroka (Fig 28, Table 15); FMC purchases, six buying centres (Fig 59, Table 21).

Longitudinal data are available for Port Moresby and Lae (highland production), Wau, Kainantu, Goroka, Mt Hagen and the Nembi Plateau. The main buying centre for the FMC was Mt Hagen, reflecting production at high and very high altitude locations in Enga and the Western Highlands. Supply is continuous for all locations where moderate to large quantities are available. It is non-seasonal and irregular. FMC purchases in Goroka (Figure 28), Lae and Mount Hagen (Figure 59) suggest that supply tends to be best in the January-March period but the pattern varies considerably from year to year. This reflects plantings made in gardens cleared from fallow in October-December. Since these data were recorded, potato production in the highlands has expanded greatly and monocrops are now common in high and very high altitude locations in the Enga and Western Highlands Provinces. The tendency for supply to be best early in the calendar year may no longer hold.

Sugar cane (*Saccharum officinarum*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 3, Table 3); Goroka market survey (Fig 3, Table 3); Hol market survey (Fig 3, Table 3).

Longitudinal data are available for the Wau, Kainantu and Goroka areas and the Nembi Plateau. At these locations, the supply is continuous, non-seasonal and irregular. In the Dogura area of Milne Bay Province (MBP), the best supply is reported in February-May (Kahn, 1986:50).

Sweet potato (*Ipomoea batatas*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 3, Table 3); Goroka market survey (Fig 3, Table 3); Hol market survey (Fig 3, Table 3); FMC purchases, Goroka (Fig 29, Table 16); FMC purchases, six buying centres (Fig 67, Table 23); CPI market survey (Fig 84, Table 27).

Longitudinal data are available for Rabaul, Port Moresby, Lae, Wau, Madang, Kainantu, Goroka and the Nembi Plateau. The supply is continuous, non-seasonal and regular to irregular at these locations.

At all locations for which longitudinal data are available, there is a tendency for sweet potato to be more available at certain periods of the year. These periods vary between locations. When long-term data runs are averaged, as with the CPI market survey prices presented here, this can give the impression of annual seasonality. In practice the supply situation varies considerably from year to year as the standard deviations presented in Tables 24-27 indicate. Thus, there is a tendency for supply to be better in certain months, but this happens in certain years only and there is considerable variation in the pattern between years.

A major study of the supply pattern in the Eastern and Southern Highlands was done by Bourke (1988). That analysis used the data presented here, other market price data and comments on sweet potato supply in patrol reports over a 20-50-year period. It concluded that the supply of sweet potato does not vary in a regular annual cycle in these two provinces. Nevertheless, episodes of particularly good or particularly poor supply tend to occur at about the same time of the calendar year. In the Eastern Highlands the best supply tends to occur in March-July and the poorest supply in October-January. The corresponding periods in the Southern Highlands are several months earlier (Bourke, 1988:81-83).

Taro (*Colocasia esculenta*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 4, Table 3); Goroka market survey (Fig 4, Table 3); Hol market survey (Fig 4, Table 3); CPI market survey (Fig 85, Table 27).

Longitudinal data are available for Rabaul, Port Moresby, Lae, Wau, Madang, Kainantu, Goroka and the Nembi Plateau. At these locations, the supply is continuous, non-seasonal and irregular to very irregular, except on the Nembi Plateau where it is discontinuous.

The seasonality of taro planting in PNG is dependent on the agricultural system where it is grown. In the New Guinea Islands, where taro was previously an important staple crop, it is generally not planted seasonally. In contrast, in New Guinea north coast locations, including much of East Sepik and Madang Provinces, it is planted and harvested seasonally. For example, in the Simbai Valley, new taro-yam gardens are cleared in the drier period (June-September) and then planted (Clarke, 1971:160); on Karkar Island, taro is planted in June-August; in the Yangoru area of East Sepik Province (ESP), taro is planted in July-October (Allen *et al.*, 1993); and on the Karimui Plateau, taro is harvested mainly in May-August (Hide *et al.*, 1984:213). In both the Port Moresby/Rigo and the Madang areas, the main taro harvesting period is about May-June (G. Wiles, pers. comm., 1995). On the south-west coast of Goodenough Island, taro is available throughout the year, but it is most abundant in May-November (Mogina, 2002:159).

Taro, Chinese (*Xanthosoma sagittifolium*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 4, Table 3); Goroka market survey (Fig 4, Table 3); Hol market survey (Fig 4, Table 3).

Longitudinal data are available for Wau, Kainantu, Goroka and the Nembi plateau. In the Wau, Kainantu and Goroka areas, the supply is continuous, non-seasonal and irregular. There is a weak suggestion from Goroka market that the poorest supply tends to occur between about December and April, but this is probably not a real effect.

Yam, greater and lesser (*Dioscorea alata and Dioscorea esculenta*)

Data sources: Goroka market survey (Fig 4, Table 3), literature and authors' surveys.

Survey data from Goroka market indicates that the supply of yam is discontinuous, non-seasonal and very irregular. Some of the yams sold in this market are grown in the Markham Valley, particularly lesser yam *(D. esculenta),* while some are locally grown. Hence the seasonal patterns are likely to be mixed in these data. In the Asaro Valley, Benabena Valley, Kainantu area and Lamari Valley of the Eastern Highlands, yams *(D. alata* and some *D. bulbifera* and *D. nummularia)* tend to be planted in June-July, and as late as September. Hence, the supply pattern is likely to be much more seasonal than these limited surveys indicate. In the main valleys of Enga Province below 2000 m, mixed gardens containing some yams *(D. alata* and *D. bulbifera)* are planted towards the end of the drier period, especially in October (Bourke and Lea, 1982:82; Waddell, 1972:50).

Throughout the PNG lowlands, yams are planted and harvested seasonally. In ESP, the planting period varies somewhat between locations but is generally in the September-January period for both *D. esculenta* and *D. alata* (Allen *et al.,* 1993). In the Madang area, the planting season for yam *(D. esculenta)* is reported as October and for the nearby Bogia area as November-December (Allen *et al.,* 1994). To the east in the Sialum area of Morobe Province, they are planted in September-December, while on the west coast of Umboi Island the planting season is given as September-October for *D. esculenta* and as August-September for *D. alata* (Bourke *et al.,* 1997).

In MBP, both *D. esculenta* and *D. alata* are planted seasonally with the greatest concentration of planting in October-December. *D. esculenta* yams are typically harvested in July-August, and *D. alata* somewhat earlier, usually May-July. In the Trobriand and Marshall Bennett Islands, small early

yam gardens are also planted in June-August (Hide *et al.,* 1994). On the south-west coast of Goodenough Island, both species are planted in September-October. They are harvested in March-May. On Cape Vogel on the nearby New Guinea mainland, they are planted in October-November and harvested in April-August. In both locations, the *D. alata* are harvested earlier than the *D. esculenta* (Mogina, 2002:159, 164).

At four locations in Central Province, the planting season for yam (mainly *D. esculenta)* is reported as October-November or October-December. These are for the yam producing areas on Yule Island and the nearby areas on the mainland, on the Sogeri Plateau, the Port Moresby area and the Kwikila area (Allen *et al.,* 1996). In the Namatanai area of New Ireland, the first planting of *D. esculenta* takes place in September with another planting in January-February. They are planted in October-December on Tanga Island (Hide *et al.,* 1996).

Everywhere that yams are grown in PNG, they are planted and harvested seasonally. The most common planting period in the lowlands is at the end of the drier months and start of the wetter months, that is, in September-December. However, people in MBP plant at different periods in the early and main yam gardens and the planting periods in Enga and the Eastern Highlands are different. This suggests that people have some flexibility in the planting time and this is chosen to facilitate management as well as to maximize crop yield.

Traditional Vegetables

Aibika (*Abelmoschus manihot*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 5, Table 4); Hol market survey (Table 4); CPI market survey (Fig 71, Table 24).

The supply is continuous and seasonal at all highland and lowland locations for which data are available, except on the Nembi Plateau where only very limited quantities are grown. It is constant in Port Moresby, Kainantu and Goroka, and non-constant in Rabaul, Lae and Madang. At Rabaul, Port Moresby, Lae, Wau, Madang, Kainantu and Goroka, the best supply is centred on January-March, but it may commence as early as December and finish as late as June. The period of poorest supply is usually within the period July-October, but it may occur at any time between June and December. In the Anguganak area of Sandaun Province, the best supply is reported to be March-April (Lewis, 1975:54).

Amaranthus (*Amaranthus* spp.)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 5, Table 4); Hol market survey (Fig 5, Table 4).

In the Wau and Kainantu areas and on the Nembi Plateau, the supply of amaranthus (mostly *A. tricolor* and *A. cruentus)* is discontinuous, markedly seasonal and constant. The best supply in the Wau and Kainantu areas occurs in October-December, and on the Nembi Plateau the corresponding period is somewhat later (January-March). The Nembi Plateau pattern occurs because amaranthus is only planted in mixed vegetable gardens, which are planted in October-January annually. In the Anguganak area of Sandaun Province, amaranthus is available in October-January (Lewis, 1975:54).

Cucumber (*Cucumis sativus*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 5, Table 4); Hol market survey (Fig 5, Table 4); FMC purchases, Goroka (Fig 23, Table 13), FMC purchases, six buying centres (Fig 45, Table 19); CPI market survey (Fig 79, Table 26).

Longitudinal data are available for Rabaul, Port Moresby, Lae, Wau, Madang, Kainantu, Goroka and the Nembi Plateau. The main buying centres for the FMC were Port Moresby, Lae and Wau. Supply is usually continuous in the lowlands (except for Madang), and discontinuous in the highlands. It is seasonal and constant at all locations. Seasonality of supply is more marked in the highlands than in the lowlands and is particularly marked on the Nembi Plateau. It is only weakly seasonal in the Rabaul area. The period of best supply varies a little between locations and between data sets for the same location. It is centred on the December-February period, and the range is November-March.

There is abundant evidence of the seasonal nature of cucumber planting. In the Simbai Valley of Madang Province, cucumbers are more abundant in October-November (Clarke, 1971:160, 182-183). In the Mount Bosavi area of the Southern Highlands, cucumbers are planted in May-July (Freund, 1977:294) and thus would be maturing from August onwards. In the Aiyura Valley near Kainantu, villagers plant cucumbers seasonally in May-July (Bourke, 1988:218). In the Nankina Valley on the north side of the Finisterre Range in Madang Province, they are planted in July-September and eaten in October-January (Villagers, October 1991).

Cucumber seed (*Cucumis sativus*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 5, Table 4).

Very small quantities of cucumber seed are sometimes sold seasonally in Kainantu market in the first few months of the year.

Cyanotis moluccana

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 7, Table 4).

In the Kainantu area, the supply is discontinuous, non-seasonal and very irregular.

Fern

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 5, Table 4).

In the Kainantu area, the supply is continuous, non-seasonal and very irregular. This irregularity in market supply is likely to reflect irregular harvesting of self-sown plants rather than the production of new fronds.

Ginger (*Zingiber officinale*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 7, Table 4); Hol market survey (Fig 7, Table 4); FMC purchases, Goroka (Fig 24, Table 13); FMC purchases, six buying centres (Fig 47, Table 19).

Longitudinal data are available for the Port Moresby, Wau, Kainantu and Goroka areas. The Kainantu market surveys indicate a continuous supply; the FMC purchase figures indicate a discontinuous supply but this is probably a reflection on the data source rather than the actual situation. Supply is weakly seasonal and non-constant at these locations. The best supply tends to occur in the first half of the year (January-June), but the pattern changes considerably each year.

Gourd, bottle (*Lagenaria siceraria*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Table 4).

In the Kainantu area, only small quantities are offered for sale. Here the supply is discontinuous, non-seasonal and irregular.

Highland kapiak leaves (*Ficus dammaropsis*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 5, Table 4).

In the Kainantu area, the supply is discontinuous, seasonal and non-constant. The best supply occurs sometime in the April-August period, and the worst between December and February.

Kumu musong leaves (*Ficus copiosa*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 7, Table 4); Hol market survey (Table 4).

In the Kainantu area, the supply is discontinuous, seasonal and constant with the best supply in October-November. In the Sinasina area of Chimbu Province, leaves are eaten seasonally in September-November (Hide *et al.,* 1979:11). Villagers were asked about the seasonality of new leaves at three locations on Normanby and Fergusson Islands in MBP in February 1994. The most commonly stated period was January-March (range: December-April).

Mushroom

Data sources: Hol market survey (Fig 7, Table 4).

In the Kainantu area, mushroom sales were recorded for one year only. The supply was continuous, non-seasonal and irregular. On the Nembi Plateau, very small quantities are sold in Hol market and the supply is discontinuous. It may be seasonal, with mushrooms available in October-December, but there are insufficient data for definite conclusions to be drawn. In the Haiyapugwa area west of Tari in the Southern Highlands, mushrooms are gathered seasonally between February and April (Powell with Harrison, 1982:5).

Nasturtium schlechteri

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 6, Table 5).

In the Kainantu area, the supply is continuous, seasonal and non-constant, with the best supply in August-October.

Nightshade (*Solanum nodiflorum*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 7, Table 4).

In the Kainantu area, the supply is discontinuous, non-seasonal and very irregular. Nightshade is self-sown in food gardens.

Oenanthe (*Oenanthe javanica*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 6, Table 5); Hol market survey (Table 5).

Oenanthe is one of the most important vegetables sold in food markets in the Kainantu area. Here, the supply is continuous, non-seasonal and fairly regular.

Pitpit, highland (*Setaria palmifolia*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 7, Table 4); Hol market survey (Fig 7, Table 4).

In the Wau and Kainantu areas, the supply is discontinuous, non-seasonal and irregular. On the Nembi Plateau, where it is a more important vegetable, the pattern contrasts with the Kainantu and Wau situation. Here, supply is continuous, seasonal and constant with the best supply in April-May.

Pitpit, lowland (*Saccharum edule*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 6, Table 5); Villagers' statements and literature (Table 35).

Longitudinal data are available for the Wau and Kainantu areas. Here the supply is discontinuous, seasonal and constant, and the best supply is in February-April. Information on the supply pattern is available for 16 other lowland and intermediate altitude locations (Table 35). At all locations except for the Anguganak area of Sandaun Province, lowland pitpit is reported as being available seasonally. The stated season occurs between November and May and particularly in January-March. The length of the harvesting season is reported as between two to six months. There is no apparent relationship between the harvesting season and altitude, rainfall seasonality or latitude.

For the Baining people of New Britain, the word for year is the same as the word for pitpit as the seasonal harvest most clearly delineates an annual cycle (Fajans, 1985:73). In the Eastern Baining mountains of ENB, villagers interpreted the word for pitpit as "New Year" because it bears in January-February (Villagers, June 1995). From the Nomad River area of Western Province comes another indication that the start of the season is fairly constant from year to year. Here the Samo people use the word "hiyanlin" for the wetest season, for the crop pitpit, for feasts that mark the pitpit harvest and also for an annual cycle that is the period between the pitpit feast. The crop itself is planted between September and January in this area (Shaw, 1990:39-41, 53).

Rungia (*Rungia klossii*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 6, Table 5); Hol market survey (Fig 6, Table 5).

In the Kainantu area and on the Nembi Plateau, the supply is continuous and non-seasonal. It is irregular in the former area and regular in the latter. There is an indication in the data for the Kainantu area that supply is poorest for a number of months centred on August. If this is a real seasonal effect, it is consistent with the report by Majnep and Bulmer (1983:41) that rungia does not

grow well in the drier months in the Simbai area. However, a twelve-month time-of-planting trial at Aiyura in 1980-81 did not indicate that yield variation was related to variation in rainfall (RMB, unpublished data).

Trichosanthes pulleana

Data sources: Goroka market survey (Table 5).

The very limited supply to the Goroka market is discontinuous and non-seasonal. In the Simbai area, trichosanthes fruit ripen during the drier season (June-September) (Clarke, 1971:160, 222).

Tulip (*Gnetum gnemon*)

Data sources: Wau market survey; Villagers' statements and literature (Table 36).

The supply of young leaves to Wau market is discontinuous and seasonal, with the best supply in November-December. The edible young leaves and fruits (nuts) are reported as being harvested seasonally in various locations (Table 36). The main harvesting season for leaves is November-December and for fruit it is December-February. No reports are available on the seasonality of leaves near sea level, but the available data do not suggest any relationship between the harvesting period of leaves and fruit with altitude, rainfall seasonality or latitude.

Winged bean, tuber, green bean, leaves and seed (*Psophocarpus tetragonolobus*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 8, Table 5); Hol market survey (Fig 8, Table 5).

Winged bean tubers, green beans, leaves and seed (for planting) are sold in markets in the Kainantu area; tubers and green beans are sold at Hol market on the Nembi Plateau. Production of all plant parts is discontinuous, seasonal and constant at both locations, except for tubers in the Kainantu area where the start of the season is non-constant. In the Kainantu area, tubers and leaves are in best supply in January-March, seed in February-May, and green beans in March-April. Production of both tubers and green beans is very seasonal on the Nembi Plateau, with the best supplies in March-April.

In the Kainantu area, winged bean are planted in well-drained sites between May and August each year. (The stated ideal in the Aiyura area is May-July. Plantings made between August and November are said to produce leaves and beans but no tubers). These plots are managed to maximize tuber production, but they also produce some beans. Winged bean are also interplanted with other crops in mixed gardens in moist sites in September-December each year. These plantings produce both beans and some tubers. On the Nembi Plateau, winged bean are planted in mixed gardens only in October-January each year (Bourke, 1988:213-221, 358-364).

In the Kainantu area, the period from planting to harvesting tubers and green beans is about seven and four months respectively. Tubers sold in the Kainantu area in January-March appear to be mostly coming from plots planted in drier locations in May-August. The timing of the sale of leaves indicates that green beans which are sold in March-April are mostly coming from mixed gardens planted in September-December, and not from plots planted earlier in drier sites. On the Nembi Plateau, both tubers and green beans come from plantings in mixed gardens made in October-January. Here it appears that both beans and tubers are harvested after about four months.

A twelve-month time-of-planting trial at Aiyura in 1980-81 suggests why plantings managed for tuber production are made in the May-July period. In this trial, the best tuber yields were obtained from plantings made in May and June; those made between September and December yielded no tubers at all. There was a significant negative correlation between tuber yield and rainfall during the growing period, that is, the best tuber yields were obtained from plantings which grew during the drier months of the year (RMB, unpublished data). These experimental data confirm local villagers' beliefs about the optimum time of planting. Two plantings in the Port Moresby area made at different times gave a similar result. Here, tuber yields for three cultivars were very much greater in the dry season planting than in the wet season planting (Bala and Stephenson, 1980:66).

A number of authors comment on the seasonality of planting and harvesting winged bean in PNG. Writing on the highlands in general, and the Western Highlands in particular, Khan *et al.* (1977:212) give the usual planting season as June-August. In the Western Highlands, winged bean is reported to be planted seasonally when a certain ground dwelling insect emerges from its burrow; this occurred in July in one year (Strathern, 1976:146-147). Pods are available in the Anguganak area of Sandaun Province in February-April (Lewis, 1975:54). In the Port Moresby area, beans are reported as available in February-April and September-November (Bala and Claydon, 1976). These authors give the planting time as December-January in the Trobriand Islands with the beans harvested in about April. Leaf spot caused by *Pseudocercospora psophocarpi* and powdery mildew *(Oidium* sp.) appears to be more prevalent at the end of the dry season (November) than at the end of the wet season (April) in the Eastern and Western Highlands (Price *et al.,* 1982:480).

Introduced Vegetables

Bean, common (*Phaseolus vulgaris*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 9, Table 6); Hol market survey (Fig 9, Table 6); FMC purchases, Goroka (Fig 20, Table 12); FMC purchases, six buying centres (Fig 34, Table 17); CPI market survey (Fig 74, Table 24).

Longitudinal data are available for Rabaul, Port Moresby, Lae, Wau, Madang, Kainantu, Goroka, Mount Hagen and the Nembi Plateau. The supply is continuous (except on the Nembi Plateau), seasonal and non-constant at all locations, although the FMC purchase figures reflect this at Goroka only. The period of best supply varies somewhat between locations and between data sets for the same location. The best supply occurs at some time between September and April, and most commonly in December-February.

Beetroot (*Beta vulgaris subsp. vulgaris*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 9, Table 6); FMC purchases, Goroka (Fig 20, Table 12).

Beetroot is a very minor vegetable and very small quantities are offered for sale in some highland markets. There is an indication in the available data that the best supply is in September-October in Goroka and Kainantu, but this is probably not a real seasonal effect.

Broccoli (*Brassica oleracea var. botrytis*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 9, Table 6); FMC purchases, Goroka (Fig 21, Table 12); FMC purchases, six buying centres (Fig 35, Table 17).

Broccoli is a minor vegetable in parts of the highlands, but it is a cash crop in high and very high altitude locations in Enga. This is reflected in the FMC purchase figures for Mount Hagen. The supply is discontinuous at all centres except Mount Hagen. It is non-seasonal and very irregular, although the best supplies in the Kainantu, Goroka and Mount Hagen (Enga) buying centres tend to be in the July-November period.

Cabbage, Chinese (*Brassica pekinensis*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 9, Table 6); FMC purchases, Goroka (Fig 21, Table 12); FMC purchases, six buying centres (Fig 36, Table 17).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. The main buying centres for the FMC were Wau and Port Moresby. The supply is continuous at all locations (except Lae where the supply is small), non-seasonal and irregular.

Cabbage, head (*Brassica oleracea var. capitata*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 9, Table 6); Hol market survey (Fig 9, Table 6); FMC purchases, Goroka (Fig 21, Table 12); FMC purchases, six buying centres (Fig 37, Table 18).

Longitudinal data are available for Port Moresby (mostly from production in mountainous parts of Central Province), Lae, Wau, Kainantu, Goroka, Mount Hagen and the Nembi Plateau. Mount Hagen was the main FMC buying centre, reflecting production at high and very high altitude locations in Enga and the Western Highlands.

The supply is continuous at all locations. Market survey data for the Kainantu area and the Nembi Plateau indicate a seasonal pattern, but FMC purchase figures do not suggest this for other locations. It is not clear to what degree this reflects the poorer quality of the FMC purchase figures as an index

of village production or real differences between locations. In the Kainantu area, the supply appears to be weakly seasonal and non-constant with cabbage more abundant in September-December. On the Nembi Plateau, the pattern is very seasonal and constant with the best supply in December-April.

Capsicum (*Capsicum annuum var. grossum*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 9, Table 6); FMC purchases, Goroka (Fig 21, Table 12); FMC purchases, six buying centres (Fig 38, Table 18).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. Port Moresby and Wau were the main buying centres for the FMC, reflecting the fact that capsicum grow best in dry lowland and intermediate altitude locations. At the highland centres of Kainantu, Goroka and Mount Hagen the supply is discontinuous, non-seasonal and irregular to very irregular. In contrast, the supply in the Port Moresby and Wau areas is continuous and appears to be seasonal. In the Port Moresby area, the best supply tends to be in July-September, and in the Wau area, it is in January-March. The data run is short (26 months) but if the apparent pattern for Port Moresby and Wau is valid over longer periods, it suggests that the seasonal production patterns in the Port Moresby and Wau areas are complementary. Both of these locations are seasonally dry in contrast with most highland locations where rainfall seasonality is weaker or non-existent.

Carrots (*Daucus carota*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 10, Table 6); FMC purchases, Goroka (Fig 22, Table 12); FMC purchases, six buying centres (Fig 39, Table 18).

Longitudinal data are available for Lae, Wau, Kainantu, Goroka and Mount Hagen. Mount Hagen was the main buying centre for the FMC, reflecting production at high altitude locations in Enga and the Western Highlands. At all centres, the supply is continuous, non-seasonal and irregular. The apparent seasonality of supply in Lae is not a real effect. It possibly reflects sales there by highlanders who travel to Lae during the coffee harvesting season.

Cauliflower (*Brassica oleracea var. botrytis*)

Data sources: FMC purchases, Goroka (Fig 22, Table 13); FMC purchases, six buying centres (Fig 40, Table 18).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. Mount Hagen was the main buying centre for the FMC, reflecting production at high altitude locations in Enga and the Western Highlands. Supply at all centres is discontinuous, non-seasonal and very irregular, although there is a weak suggestion that the best supply occurs between August and November.

Celery (*Apium graveolens var. dulce*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 10, Table 6); FMC purchases, Goroka (Fig 22, Table 13); FMC purchases, six buying centres (Fig 41, Table 18).

Longitudinal data are available for Wau, Kainantu and Goroka. The main buying centre for the FMC was Wau. Here the supply is continuous, non-seasonal and regular. In the Kainantu and Goroka areas, the supply is discontinuous, non-seasonal and very irregular.

Chillies (*Capsicum frutescens*)

Data sources: FMC purchases, Goroka (Fig 22, Table 13).

The only available data are FMC purchase figures for Goroka for a two-year period. Here the supply was discontinuous, non-seasonal and very irregular, although most sales occurred between December and May.

Choko fruit (*Sechium edule*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 10, Table 6); FMC purchases, Goroka (Fig 23, Table 13); FMC purchases, six buying centres (Fig 42, Table 18).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu and Goroka. The main buying centre for the FMC was Wau, reflecting the significance of choko in the intermediate altitude zone in PNG. The supply is continuous at Wau, but discontinuous at other centres. It is seasonal and constant at Wau, Kainantu and Goroka, with the best supplies in January-March. Supply of fruit to the FMC depot at Port Moresby was non-seasonal and very irregular.

Choko tips (*Sechium edule*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 10, Table 6).

In the Wau and Kainantu areas, the supply is continuous, non-seasonal and irregular.

Corn (*Zea mays*)

See Starchy Foods.

Eggplant (*Solanum melongena*)

Data sources: FMC purchases, Goroka (Fig 23, Table 13); FMC purchases, six buying centres (Fig 46, Table 19).

Longitudinal data are available for the Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen areas. The main supply centres for the FMC were Port Moresby and Wau, reflecting the fact that eggplant grows best in lowland and intermediate altitude locations with a seasonal rainfall distribution. In the Wau and Port Moresby areas, the supply is continuous, non-seasonal and irregular. In the Kainantu and Goroka areas, the supply is discontinuous, seasonal and constant, with the best supply in December-February.

Garlic (*Allium sativum*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 10, Table 6).

The only available data are from market surveys in the Kainantu area where small quantities are sold, particularly in Ukarumpa market. Here the supply is discontinuous, non-seasonal and very irregular. At Aiyura, the best crops were obtained from plantings that grew during extended dry periods in 1979 and 1982.

Kohlrabi (*Brassica oleracea var. gongylodes*)

Data sources: FMC purchases, Goroka (Table 14).

The only available data are FMC purchase figures at Goroka. Here the supply is discontinuous, non-seasonal and very irregular.

Leek (*Allium ampeloprasum var. porrum*)

Data sources: FMC purchases, Goroka (Fig 24, Table 14); FMC purchases, six buying centres (Fig 49, Table 20).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. Wau was the most important buying centre for the FMC. The supply is continuous at Wau and discontinuous at other locations. At all centres, the supply is non-seasonal and irregular.

Lettuce (*Lactuca sativa*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 10, Table 6); FMC purchases, Goroka (Fig 25, Table 14); FMC purchases, six buying centres (Fig 51, Table 20).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. The most important buying centre for the FMC was Wau. At all locations, the supply is continuous, non-seasonal and irregular.

Marrow *(Curcurbita* sp.)

Data sources: FMC purchases, Goroka (Fig 25, Table 14).

Data are available for Goroka only. Here the supply is discontinuous and apparently seasonal, with the best supply in December-January.

Pak choi (*Brassica chinensis*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 10, Table 6); FMC purchases, Goroka (Fig 26, Table 14); FMC purchases, six buying centres (Fig 54, Table 20).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. FMC purchases came mainly from Wau, Port Moresby and Kainantu. The supply is continuous at all locations where market sales or FMC purchases are reasonably large. Market surveys in the Kainantu area show supply to be very seasonal and non-constant, with the best supply in August-October. In contrast, the FMC purchase figures indicate a non-seasonal and irregular supply at all centres.

Parsley (*Petroselinum crispum*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 10, Table 6); FMC purchases, Goroka (Fig 26, Table 14); FMC purchases, six buying centres (Fig 55, Table 21).

Longitudinal data are available for Port Moresby, Wau, Kainantu and Goroka. FMC purchases came mainly from Wau, Kainantu and Goroka. Supply is continuous where the quantities sold are greater, and discontinuous where they are smaller. It is non-seasonal and irregular to very irregular at all centres, except at Goroka. Here the FMC purchase figures suggest that it is seasonal and non-constant, with the best supply in November-February. It is not clear if this is a real effect.

Parsnip (*Pastinaca sativa*)

Data sources: FMC purchases, Goroka (Fig 27, Table 15).

Data are available for Goroka only where very limited quantities were purchased by the FMC. The supply is discontinuous, non-seasonal and very irregular.

Peas (*Pisum sativum*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 12, Table 7); FMC purchases, Goroka (Fig 27, Table 15).

Peas are sold in very small quantities at Ukarumpa market and to the FMC at Goroka. Supplies are continuous at Ukarumpa and discontinuous in Goroka. They are non-seasonal and irregular to very irregular.

Pumpkin fruit (*Curcurbita moschata*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 12, Table 7); Hol market survey (Fig 12, Table 7); FMC purchases, Goroka (Fig 28, Table 15); FMC purchases, six buying centres (Fig 61, Table 21); CPI market survey (Fig 82, Table 26).

Longitudinal data are available for Rabaul, Port Moresby, Lae, Wau, Madang, Kainantu, Goroka, Mount Hagen and the Nembi Plateau. The most important buying centre for the FMC was Port Moresby. The supply is continuous at all locations. It is seasonal and non-constant in the intermediate

altitude and highland centres, with the best supply occurring some time between September and April, particularly in January-March. The most marked seasonality in supply occurs in the least seasonal environment, that is, the Nembi Plateau. FMC purchase figures indicate a non-seasonal and very irregular supply in the Port Moresby and Lae areas. However, the CPI market surveys show a very weak to weak seasonality in supply in the lowland centres of Rabaul, Port Moresby, Lae and Madang with the best supplies tending to be in January-March and the poorest in July-September. In the Dogura area of MBP, pumpkin are available between August and March (Kahn, 1986:49-50).

Pumpkin fruit, Queensland blue *(Curcurbita moschata)*

Data sources: FMC purchases, six buying centres (Fig 60, Table 22).

Separate purchase records were kept by the FMC for Queensland Blue pumpkin fruit for the Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen buying centres. Purchases in Port Moresby and Lae probably came from production at higher altitude locations. At all centres the supply is discontinuous and seasonal with the best supply in December-January.

Pumpkin tips (*Curcurbita moschata*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 12, Table 7); Hol market survey (Fig 12, Table 7); CPI market survey (Fig 83, Table 27).

Longitudinal data are available for Rabaul, Port Moresby, Lae, Wau, Madang, Kainantu, Goroka and the Nembi Plateau. In markets in the Kainantu area and on the Nembi Plateau, the supply is continuous, non-seasonal and irregular. The CPI market surveys for Rabaul, Port Moresby, Lae, Madang and Goroka indicate that the supply is non-seasonal, but with a tendency for the best supply to be in January-March and the poorest supply some time in the second half of the year. This pattern is somewhat more pronounced at Goroka than at the lowland centres.

Radish (*Raphanus sativus*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 12, Table 7); FMC purchases, Goroka (Fig 28, Table 15); FMC purchases, six buying centres (Fig 62, Table 22).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. The most important buying centres for the FMC were Port Moresby and Wau. At all locations, the supply is discontinuous, non-seasonal and very irregular.

Rhubarb (*Rheum rhaponticum*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 12, Table 7); FMC purchases, Goroka (Fig 29, Table 15); FMC purchases, six buying centres (Fig 63, Table 22).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. The main buying centres for the FMC were Wau and Kainantu. Here the supply is continuous, elsewhere it is discontinuous. At all centres the supply is non-seasonal and irregular to very irregular.

Shallot (*Allium cepa var. aggregatum*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 12, Table 7).

Shallot was distinguished from spring onion in market surveys in the Kainantu area. It is only a minor vegetable and the FMC did not distinguish between shallot and the more important spring onion. In the Kainantu area, the supply is discontinuous, non-seasonal and irregular.

Silverbeet (*Beta vulgaris var. cicla*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 11, Table 7); FMC purchases, Goroka (Fig 29, Table 16); FMC purchases, six buying centres (Fig 65, Table 22).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. The main buying centres for the FMC were Wau and Kainantu. At all centres, the supply is continuous, non-seasonal and irregular to very irregular.

Spring onion (*Allium cepa var. cepa*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 11, Table 7); Hol market survey (Table 7); FMC purchases, Goroka (Fig 26, Table 16); FMC purchases, six buying centres (Fig 66, Table 22).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. The main buying centres for the FMC were Goroka, Wau, Kainantu and Port Moresby. At all locations, the supply is continuous, non-seasonal and irregular.

Tomato (*Lycopersicon esculentum*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 11, Table 7); Hol market survey (Fig 11, Table 7); FMC purchases, Goroka (Fig 30, Table 16); FMC purchases, six buying centres (Fig 68, Table 23).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka, Mount Hagen and the Nembi Plateau. The main buying centre for the FMC was Wau. Supplies are continuous at all centres, except on the Nembi Plateau where it is a very minor vegetable. In the Kainantu area, market surveys indicate a weakly seasonal and non-constant pattern, with the best supplies tending to be between October and January. FMC purchase figures do not indicate a seasonal pattern except for Port Moresby where supply appears to be somewhat seasonal and non-constant with more produce tending to be available in the August-October period.

Turnip (*Brassica rapa*)

Data sources: FMC purchases, Goroka (Fig 30, Table 16).

Minor quantities of turnip were purchased by the FMC at Goroka. Here, the supply is non-continuous, non-seasonal and very irregular.

Watercress (*Nasturtium officinale*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 11, Table 7); Hol market survey (Table 7).

Small amounts are sold in markets in the Wau and Kainantu areas and on the Nembi Plateau. The supply is continuous in the Kainantu area and discontinuous at Wau and on the Nembi Plateau. It is non-seasonal and irregular at these three locations.

Zucchini (*Curcurbita pepo var. medullosa*)

Data sources: FMC purchases, Goroka (Fig 30, Table 16); FMC purchases, six buying centres (Fig 70, Table 23).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. The main supply area for the FMC was Wau. The supply is discontinuous at all centres, except for Wau where it is continuous. Supplies are weakly seasonal and non-constant at all locations. The best supply tends to occur between August and January and the poorest between March and June.

Fruit

Abiu (*Pouteria caimito*)

At the Lowlands Agricultural Experiment Station (LAES) at Keravat, abiu produces fruit in a discontinuous and non-seasonal pattern (observations by Steve Woodhouse, hereafter SW).

Apple *(Malus* sp.)

At the Highlands Agricultural Experiment Station (HAES) at Aiyura, experimental plantings fruited in March 1979 and again in March 1980 (Tarepe and Bourke, 1982:95), although they failed to fruit in the following two years. Experimental plantings at Kuk Agricultural Station in the Western Highlands fruited in March-April and again in August-September in one year (E. Groedl, pers. comm., 1981). These very limited observations suggest that the fruiting season, when it does occur, is most likely in March-April.

Avocado (*Persea americana*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 13, Table 9); Goroka market survey (Fig 13, Table 9); FMC purchases, Goroka (Fig 20, Table 12); FMC purchases, six buying centres (Fig 31, Table 17).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. As well, a number of generalized statements on the production pattern are available. The main fruiting period for the highlands is given as February-May by Tarepe and Bourke (1982:89). The same period is also given for Enga Province by Naki (1991:39). At Keravat, Aburu (1982:119) gives a fruiting season as November-May or August-November. In contrast, Woodhouse reports the main fruiting period at Keravat to be January-March, with lesser production in May-August and November-December, and no fruit maturing in September-October. Aburu's report is not consistent with other data and may be based on short-term observations only.

The available information may be summarized as follows. The fruiting pattern is similar at all lowland, intermediate altitude and highland locations over a wide range of environments. The supply is continuous (or nearly so), seasonal and non-constant. The main fruiting period usually occurs between January and April but major harvests may occur as late as July. The size and timing of the harvest varies from year to year for any location. The pattern in the Kainantu and Goroka areas, which are 60 km apart, is similar but not identical in any given year. The similar production pattern in locations in seasonally dry lowland, seasonally dry intermediate altitude, weakly seasonal highland and non-seasonal highland environmental zones suggests that rainfall does not have a major influence on bearing, but that daylength and small seasonal temperature differences are the triggers for flowering.

Banana, eating *(Musa* cvs)

See Starchy Foods.

Brazil cherry (*Eugenia uniflora*)

At Keravat, fruiting is discontinuous and non-seasonal (SW).

Bukabuk (*Burckella obovata*)

Fruit are available seasonally in a number of lowland areas, particularly on the Gazelle Peninsula of New Britain, elsewhere in the Islands Region, and on the islands and mainland of MBP. The fruiting season for the Gazelle Peninsula is reported as January-March by SW, and December-January for 1980-81 by RMB. On Unea (Bali) Island north of New Britain, the season is reported as December to January (Villagers, July 1995). In February 1994, people in MBP were asked about the harvesting

season in 11 locations on the following islands: Normanby, Fergusson, Kiriwina, Kitava, Iwa, Gawa and Ianaba. Responses were quite consistent with the period December-February most commonly given as the harvesting season. The range of responses was October-February .

The statements by villagers in the islands of MBP are consistent with observations from New Britain and suggest that the harvesting season occurs between December and March. The consistency of statements in MBP suggests that it may not vary greatly from year to year. The rainfall distribution pattern varies between the Milne Bay locations. The consistent production pattern suggests that seasonal changes in daylength, rather than rainfall, trigger flowering.

Bullock's heart (*Annona reticulata*)

At Keravat, the fruiting season is given as December-March by Aburu (1982:117). However, SW records that fruiting is non-seasonal and production varies throughout the year.

Canistel (*Pouteria campechiana syn. Lacuma nervosa*)

At Keravat, Aburu (1982:119) reported that experimental plantings fruited twice a year with the harvesting season in April-May and July-September. However, SW observed that fruiting is continuous and non-seasonal, with more fruit maturing in December-March than in other months.

Cape gooseberry (*Physalis peruviana*)

Casual observations at Aiyura and the Ukarumpa market survey, where cape gooseberry is sold in very small quantities, suggest that production is continuous and non-seasonal.

Carambola (Five corner) *(Averrhoa carambola)*

Data sources: Experimental recordings (Fig 87, Table 29).

At Keravat, the fruiting season for experimental plantings was given as November-May by Aburu (1982:117). However, yield records from three trees at LAES over a three-year period show production to be continuous, non-seasonal and very irregular (Fig 87, Table 29). At the Wau Ecology Institute (1200 m), fruiting is reported as seasonal, with the harvest in March (A. Allison, pers. comm., 1991). A small number of fruit appear in Goroka market in March-April in some years from trees growing at ca 1400 metres.

It appears that carambola production is continuous, non-seasonal and very irregular at Keravat. It is probably seasonal when grown at 1200-1400 m near the crop's upper altitudinal limit.

Cherimoya (*Annona cherimolia*)

A producing tree on Korona Plantation near Kainantu bears between June and September each year. Aburu (1982:117) reports a similar fruiting season at Keravat (July-October). At Wapenamanda and Laiagam in Enga Province, trees produce in May-June (V. Older, pers. comm., 1994).

Custard apple (*Annona squamosa*)

At Keravat, trees are reported to bear seasonally between December and February (SW); or between December and May (Aburu, 1982:117).

Durian (*Durio zibethinus*)

Data sources: Experimental recordings (Fig 86, Table 28).

Experimental recordings in three blocks at LAES Keravat show fruiting to be discontinuous, seasonal and non-constant. The main producing period occurs some time between November and April and most commonly in February-March. In some years, some trees produce a second crop in the middle of the year (Woodhouse, 1991:162). Aburu's observations on the same trees at Keravat a decade

earlier are similar. He gives the harvesting season as December-February (Aburu, 1982:118). In the Philippines, the production period commences later at higher altitudes, being May-June at sea level, but November-December at the crop's upper altitudinal limit at 600 metres (R. Coronel, pers. comm., 1994). This pattern has not been noted in PNG because most bearing trees are growing near sea level.

Eggtree (*Garcinia xanthochymus*)

Data sources: Experimental recordings (Fig 87, Table 29).

Experimental records from five trees at LAES Keravat indicate that fruiting is discontinuous, non-seasonal and very irregular.

Elder (*Sambucus nigra*)

In the highlands, fruit production is continuous and non-seasonal (Tarepe and Bourke, 1982:88).

Golden apple (*Spondias cytherea*)

Malinowski gives the harvesting season for "menoni" (golden apple) on Kiriwina Island in the Trobriand Group as December-January (Malinowski, 1935:50-51, 311). In February 1994, villagers were asked about the fruiting season at 11 locations on the following islands in MBP: Dobu, Fergusson, Goodenough, Kiriwina, Kitava, Iwa and Gawa. The most commonly stated harvesting period was January-February and the range was October-April. The consistency of responses suggests that the fruiting season is fairly constant in MBP from year to year. In the inland Pomio area of New Britain, the harvesting season is reported as February-March (Villagers, June 1995). The season in the Musau Islands is reported as August-December by Lepofsky (1992:203).

The available information suggests that golden apple fruit production is discontinuous and seasonal, with the harvesting season in about December-February.

Cherry (*Prunus* sp.)

At Laiagam in Enga, a capuli cherry tree fruits in May-July (V. Older, pers. comm., 1994).

Governor's plum (*Flacourtia indica*)

At Keravat, fruiting is continuous and non-seasonal with peaks in November-February and June-July (SW).

Granadilla (*Passiflora quadrangularis*)

At Keravat, fruiting is continuous and non-seasonal (SW).

Grapefruit (*Citrus paradisi*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 13, Table 9); Goroka market survey (Fig 13, Table 9); FMC purchases, Goroka (Fig 24, Table 13); FMC purchases, six buying centres (Fig 48, Table 19).

Data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. The main buying centres for the FMC were Wau and Mount Hagen. The supply is discontinuous at all locations, except Wau where it is continuous. In the highlands and the Wau area, the supply is weakly seasonal and non-constant. Some fruit may be available in all months, but the best supply is usually March to August.

Guava (*Psidium guajava*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 13, Table 9); Goroka market survey (Fig 13, Table 9); FMC purchases, Goroka (Fig 24, Table 13).

Survey data are available for the Kainantu and Goroka areas only and long-term casual observations have been made at Keravat and on the Gazelle Peninsula. At Keravat, the supply is continuous and non-seasonal with somewhat more fruit available in about August-September (SW). Aburu (1982:119) reported the harvesting season as October-May for experimental plantings at Keravat, but this pattern has not been observed for other trees.

In contrast to the humid lowlands, guava are only available seasonally in the Eastern Highlands. In the Kainantu and Goroka areas, the supply is discontinuous, very seasonal and constant. They are in best supply in February-April in the Goroka area and somewhat later (April-May) in the Kainantu area. This difference is consistent between years and probably reflects the fact that guava are grown at a somewhat higher altitude in the Kainantu area (ca 1600 m) than in the Goroka area (1400-1600 m).

Guava, cherry (*Psidium cattleianum*)

Very limited information is available on the production pattern. At Keravat, fruit are reported to be available seasonally, with the best supply in October-January (Aburu, 1982:119). At Bulolo, the main production period is reported to be in April (J. Simpson, pers. comm., 1981). At Aiyura, fruiting is discontinuous. In one year (1980), fruit ripened in April, but it is not known if this occurs in most years.

Guava, sour (*Psidium friedrichsthalianum*)

At Keravat, production is continuous and non-seasonal (SW).

Jackfruit (*Artocarpus heterophyllus*)

At Keravat, the fruiting season is reported to be October-May by Aburu (1982:117); but more recent observations by SW at Keravat indicate that production is continuous and non-seasonal.

Kumquat (*Fortunella japonica*)

At Keravat, the season is reported to be December-May (Aburu, 1982:118) or December-February (SW).

Kumu musong fruit *(Ficus copiosa)*

Villagers were asked about the seasonality of fruit production at three locations on Normanby and Fergusson Islands in MBP in February 1994. The range of months given was December-April, with January-February the most commonly claimed period. In Chimbu, fruit are reported as ripening about November by Whiteman (1965:310).

Langsat (*Lansium domesticum*)

At Keravat, the harvesting season is reported as January-February by Aburu (1982:118) and slightly later (March-April) by Woodhouse (1991:165). Both authors report that langsat tends to biennial bearing, that is, to produce a crop only every second year.

Lemon (*Citrus limon*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 13, Table 9); Goroka market survey (Fig 13, Table 9); FMC purchases, Goroka (Fig 25, Table 14); FMC purchases, six buying centres (Fig 50, Table 20).

Lemons were distinguished from limes in market surveys in the Kainantu area but not in the Goroka market survey or the FMC purchase figures. Lemon and lime grow in both the lowlands and the highlands but lemons are less common below 400 m altitude. Hence, it is likely that data from lowland centres refers mainly to limes, but where no distinction is made, it is not clear whether highland data are for lemon or lime.

The only unambiguous longitudinal data for lemon are from the Kainantu market surveys. Here, the supply is continuous, apparently weakly seasonal and non-constant, with the best supply in two of the three survey years in the May-August period. At Wapenamanda in Enga, Mayer lemons bear in July-October (V. Older, pers. comm., 1994).

Lime (*Citrus aurantifolia*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Table 9); Goroka market survey (Fig 13, Table 9); FMC purchases, Goroka (Fig 25, Table 14); FMC purchases, six buying centres (Fig 50, Table 20).

FMC purchase figures for Port Moresby, Lae and Wau are interpreted as referring mainly to lime, not lemon (see under lemon above). In the Port Moresby and Wau areas, the supply is continuous, seasonal and non-constant, with the best supplies in the February-May period. FMC purchase figures at Goroka indicate a continuous, seasonal, non-constant pattern with the best supply in January-March. This is similar to the Port Moresby and Wau areas and the pattern for the very limited supply of lime in Kainantu markets. It differs from the Kainantu lemon pattern, suggesting that the main supply to Goroka FMC was lime, not lemon. In the Dogura area of MBP, the season for lemon is given as February-May by Kahn (1986:168), although this is very likely a misidentification for lime.

At Keravat, production of experimental lime plantings is continuous and non-seasonal (Aburu, 1982:117). Yields from a fertiliser trial at Keravat over a seven-year period (1969-1975) clearly show variations in yield over time, but no seasonal patterns (Unpubl. data, LAES, Keravat). Published experimental figures for twelve-month periods at Keravat and Popondetta confirm that production is continuous and somewhat variable. At Keravat, the supply was somewhat better in November-December in 1971 and at Popondetta it was better in March-April in 1971-72 (Byrne, 1984:236-240). At Laloki, citrus leaf miner is reported to be more severe in June and July than in August or November (Brough, 1983), although longer term data than presently available are required to confirm this conclusion.

The available information for lime is somewhat ambiguous. Overall, it seems that lime supply in the seasonally dry lowlands and intermediate altitude zone is continuous and somewhat seasonal with a better supply in February-May. The Eastern Highlands data are less clear, but a similar seasonal pattern to the seasonally dry lowlands is likely. At Keravat, in a non-seasonal humid lowland environment, production is continuous, non-seasonal and irregular.

Loquat (*Eriobotrya japonica*)

In the Kainantu area, the supply of fruit is discontinuous, seasonal and non-constant. The producing season occurs at some time between March and July, particularly in April-May. Over the six-year period 1978 to 1983, the best production was in 1980 and 1983 following droughts in the previous years. At Wapenamanda in Enga, fruiting is reported to occur in February-March (V. Older, pers. comm., 1994).

Mabewa (*Baccaurea papuana*)

At Keravat, production is discontinuous and seasonal, with fruit produced in March-July (SW).

Malay apple (*Syzygium malaccense*)

Data sources: Villagers' statements and literature (Table 37).

Most reports in the literature and statements by villagers indicate that fruit ripen seasonally at some time between September and February, particularly in December-January (Table 37). However, at Keravat the season was observed by SW to be June-August and villagers at six locations in the Kandrian and Gloucester Districts of West New Britain (WNB) gave a similar period when asked in May 1993. In the Talasea area of WNB, people stated in mid-1995 that two seasons occur each year, one in about July and the other in about January. In June 1995, villagers on the Gazelle Peninsula gave the harvesting season as

December-February, even though there was a minor crop at the time of the survey (June). In the Eastern Baining Mountains of the Gazelle Peninsula, people said that Malay apple bears in both May-June and December-January. It seems that the main harvesting season occurs in about December-January and that some production occurs in the May-August period. The available data do not indicate a relationship between the harvesting season and rainfall seasonality or latitude (Table 37).

Malay apple, giant (*Syzygium megacarpa*)

The conflicting information noted for Malay apple also occurs for giant Malay apple. At Keravat, Aburu (1982:118) gives the season as January-February, but SW has observed it to be June-August. Kahn (1986:49-50) identified Malay apple as *Syzygium megacarpa*, not *S. malaccense* and gives the season in the Dogura area as December-February.

Mandarin (*Citrus reticulata*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 14, Table 9); Goroka market survey (Fig 14, Table 9); FMC purchases, Goroka (Fig 25, Table 14); FMC purchases, six buying centres (Fig 52, Table 20).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. The main buying centres for the FMC were Port Moresby (production from mountainous areas of Central Province), Lae and Wau.

At all locations, the supply is discontinuous, markedly seasonal and constant. The period of best supply is May-August, and the production usually lasts for about three months. There is only limited fruiting in other months of the year. Information from other locations also indicates that production is very seasonal. Reported producing periods are June-August on the Kokoda Trail in Central Province (Brough and Rogers, 1982:172); April-August at Karimui in Chimbu (A. Poka, pers. comm., 1989); and March-June at Pindiu on the Huon Peninsula (Villagers, October 1991).

These data do not indicate a relationship between mandarin seasonality and altitude. However, it was observed in the Kainantu area in 1983 that the producing period commenced progressively later at increasing altitudes over the range 1400 to 1800 metres.

Mango (*Mangifera indica*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 14, Table 9); Goroka market survey (Table 9); Observer network (Fig 90, Table 30); Villagers' statements and literature (Table 38).

The market survey data for Kainantu and Goroka reflects production in the Markham and Ramu Valleys. It is not discussed here as direct observations are available over a longer period for the Markham Valley. Reasonably good longitudinal observations are available for the Rabaul area, Markham Valley and Port Moresby area for a six-year period and generalized statements on mango seasonality are available for 13 other lowland locations.

At all locations production is discontinuous, markedly seasonal and constant. The fruiting season usually occurs at some time between October and January, but it may start as early as July and finish as late as February. For the Kandrian area on the south coast of New Britain, there are inconclusive reports by villagers of a second smaller season in April-June.

The detailed observations from the Rabaul, Markham Valley and Port Moresby areas are now considered (Fig 90, Table 30). In the Rabaul area, the harvesting season generally starts in November or December and continues into January. This is a little later than the other two locations. The fruiting season is about two months long, excluding the exceptional 1984-85 season. The season in the Markham Valley usually commences in October or November. The average length of the season (1.5 months) is shorter than for the Rabaul or Port Moresby areas. However, it is not clear whether this is a real effect or whether it reflects differences in interpretation of the length of season by different observers.

The start of the fruiting season varies more from year to year in the Port Moresby area than at the other two locations. Over the six-year period of observations, it commenced as early as August and as late as November. As at Rabaul and the Markham Valley, the length of the fruiting season is quite variable. It averaged two months, excluding the 1984 season. In that year, the harvesting season commenced in July-August and was exceptionally long in the Rabaul and Port Moresby areas, but not in the Markham Valley. It is not known why this occurred.

Some preliminary conclusions are now made about the relationship between climatic factors and the timing and size of the fruiting season. Mango fruit regularly in lowland and intermediate altitude environments where there is some rainfall seasonality. This occurs even where the total annual rainfall is very high (3000-4000 mm) and no months are really dry (less than 100 mm per month on average). Examples of such locations are Kandrian, Finschhafen, Madang and Kiriwina Island. Mango trees rarely fruit where the rainfall is very evenly distributed throughout the year, for example at Keravat. In the highlands, some fruit are produced at up to about 1600 m altitude in locations where rainfall distribution is seasonal, for example, the Wahgi Valley, Kundiawa area, Asaro and Arona Valleys. The best mango production in PNG occurs in lowland locations that have a marked dry season, for example, coastal Central Province, the southern part of Western Province, the Rabaraba area of MBP, the upper Markham Valley, the Sialum area on the Huon Peninsula, the western end of Umboi Island and the eastern part of the north-east lowlands of the Gazelle Peninsula of New Britain.

In general, the producing season is similar at all locations, that is, the October-January period, irrespective of when the dry season occurs (Table 38). Thus, the season is similar at Finschhafen (driest months are January-March) and nearby Sialum (marked seasonal rainfall distribution; driest months May-October); it is similar at Kandrian (drier months January-February) and Gloucester (May-September) on New Britain; and in MBP it is similar at Dogura (markedly seasonal rainfall; driest months June-November), in the area of Milne Bay (reversed seasons; driest months November-January) and in the D'Entrecasteaux, Trobriand and Marshall Bennett Islands where rainfall is only weakly seasonal (drier months November-December). There is no apparent relationship between the producing season and altitude or latitude.

At locations where the driest months occur during the South-East wind season (May-September), there is a relationship between the period of lower rainfall and the start of the harvesting season. This relationship holds both for different locations and for different years in the same location. For example, the driest months in the Markham Valley and the Port Moresby area usually start in April or May and the mango season starts in October or November. The drier period starts a little later in the Rabaul area (May-July) and the mango season also tends to start a little later (November-December). For the Port Moresby area over the period 1980-85, there was a five-six month lag between the start of the drier period (recorded rainfall <100 mm/month) and the commencement of the producing season. This is consistent with the period between flowering and fruit harvesting for the annual phenological cycle in mango (Cull, 1991:60).

However, the relationship between the start of the drier months and the harvesting season does not hold for locations where the South-East wind season (May-September) is the wettest part of the year and the drier period occurs in December-February. These locations include Kandrian, Finschhafen, Bukaua and Milne Bay area. This suggests that some other factor such as lower temperatures also initiate flowering. In the Kandrian area, informants at a number of locations indicated that a second smaller harvesting season occurs. This statement was not consistently given by informants at different locations and it is not clear how significant or regular the second season is.

There were indications that the harvest was poor in years when the dry season was brief, for example, in the Markham Valley in 1981. Following a drought in 1982, good production was reported in the Rabaul area and the Markham Valley. The 1979 and 1982 droughts also induced flowering and fruit set at highland locations where fruiting does not usually occur, such as at Aiyura. The very severe drought in the mid- and upper-Markham Valley in 1987 was followed by an

exceptionally good mango harvest. The usual back-up staple crops, such as yam and cassava, failed because of the drought and villagers relied on cash from mango sales to purchase food and survive the food shortage (H. Holzknecht, pers. comm., 1993).

Productivity in mango is determined by both the stored carbohydrate and current carbohydrate production (Cull, 1991). Thus, production in any given year will be determined by the previous history of bearing and environmental conditions during the current year's growing period. The available data on production are too subjective for further analysis.

Mango, traditional (*Mangifera foetida* and *Mangifera minor*)

Reports from various parts of PNG indicate that the traditional mangoes bear seasonally and at about the same time as the introduced species (Fig 90, Tables 30, 38). On Kiriwina Island, it ripens in September-December (Malinowski, 1935:50, 314). On Goodenough, Fergusson and Normanby Islands, villagers gave the harvesting season as November-December when asked in February 1994. In the Kandrian and Gloucester Districts of WNB, villagers say that the traditional mango bears in about December-January. In the Eastern Highlands, the traditional mango bears a little later than the introduced mango in the Markham Valley where fruit ripen in October-December (Tarepe and Bourke, 1982:87).

Mangosteen (*Garcinia mangostana*)

Data sources: Experimental recordings (Fig 86, Table 28).

Experimental recordings are available for four plots over five seasons at LAES, Keravat. Here, fruiting is discontinuous, seasonal and non-constant. Fruit usually mature at some time between November and March, but the start of the harvesting season can be as early as September and as late as February. The size of the harvest varies considerably from year to year. Trees in the four plantings have a similar fruiting pattern each year (Table 28). This suggests that the trees come from uniform genetic material. Aburu (1982:118) observed the same trees a decade earlier and recorded the harvesting season as December-April.

Marita pandanus (*Pandanus conoideus*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 14, Table 9); Goroka market survey (Fig 14, Table 9); Hol market survey (Fig 14, Table 9); Villagers' statements and literature (Table 39).

Longitudinal data are available for the Wau, Kainantu and Goroka areas and the Nembi Plateau. Statements by villagers and outside observers are also available for 22 locations in the lowland, intermediate altitude and highland zones (Table 39). In the highlands at 1500-1700 m altitude, the supply is discontinuous, very seasonal and constant. Fruit ripen over about a four-month period. This usually occurs between January and April, but the season may commence in November or December.

There is a clear relationship between the length of the fruiting season and altitude in PNG. This is illustrated in Fig 92 where the length of the main harvesting season is plotted against altitude. Near sea level, production is usually reported as continuous and non-seasonal, although shorter producing seasons are reported for two locations at low altitudes. At intermediate altitude locations, some fruit are commonly reported as being available for all or most months of the year. However, the main producing period commences later and is shorter with increasing altitude.

The fact that the marita-producing season commences earlier and lasts longer at lower altitudes has been reported at a local level by a number of observers. This has been noted, for example, in the Ivori Valley in Gulf Province over an altitudinal range of 600-1500 m (Bonnemère, 1992:41); in the Simbai Valley in Madang Province at up to 1200 m (Buchbinder, 1973:107); and in the Mount Sisa area in the Southern Highlands Province (SHP) (800-1100 m) (Dwyer, 1990:148, 160). The seasonal differences at different altitudes are exploited by villagers living on the highland fringe and in lower altitude valleys. In the last two or three months of the calendar year, it is common to encounter

villagers from lower altitude locations carrying marita fruit into the main highland valleys to sell or trade. The main producing period does not appear to be influenced by rainfall seasonality or latitude.

The word for marita also defines a certain season of the year in all language groups in the mountainous southern side of the central highlands from the Angan speaking area in Gulf Province to the Great Papuan Plateau (R. Hide, pers. comm., 1993). For example, in the Lake Kutubu area, the marita season ("abari") contrasts with the "anumu" (lowland pitpit), the "waria" tree, the "pango" fruit and the "mist" seasons (Williams, 1976:166-167; Weiner, 1983:26-27). In the Mount Sisa area, people divide the year into two seasons, the "cloud exists" season and the "fruit pandanus exists" season (Dwyer, 1990:23). A similar phenomenon has also been recorded on the northern side of the central highlands. In the Simbai Valley, the ripening of different marita cultivars is used to mark various periods of the year (Rappaport, 1968:174-176). The widespread use of marita as a temporal marker in traditional society highlights both the importance of the fruit, particularly in intermediate altitude locations, and the regular commencement of the main harvesting season.

***Microcitrus* sp.**

At Keravat, a planting of Microcitrus sp. (known as "kamokuku" on Manus Island) bear in December-March (SW).

Mon (*Dracontomelon dao*)

In the Madang area, fruiting is discontinuous. Fruit were sold in Madang market in October-November 1981, but it is not known whether this is the usual producing period. On the Duke of York Islands off New Britain, the fruit are reported to ripen in October-December (Villagers, June 1995).

Mulberry (*Morus nigra*)

In the Kainantu area, fruiting is discontinuous, seasonal and constant. Observations made over a five-year period indicate that fruit ripen between September and December each year.

Naranjilla (*Solanum quitoense*)

At Aiyura, fruit production is continuous and non-seasonal (Tarepe, 1982:184).

Nectarine (*Prunus persica var. nectarina*)

At Taluma on the Sirunki Plateau west of Wabag in Enga, the main bearing period is May-July (V. Older, pers. comm., 1994).

Orange (*Citrus sinensis*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 14, Table 9); Goroka market survey (Fig 14, Table 9); FMC purchases, Goroka (Fig 26, Table 14); FMC purchases, six buying centres (Fig 53, Table 20).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. The best supply for the FMC was at Lae (reflecting production in the Snake River-Mumeng area), Port Moresby and Wau. At all locations the supply is discontinuous, seasonal and non-constant. The best supply usually occurs at some period between April and August. Production is quite variable from year to year and significant fruiting may also occur in January-March. The pattern is the same at intermediate altitude and highland locations.

Observations from other locations confirm the conclusions from the longitudinal data. At Karimui (1200 m), oranges ripen in April-August (A. Poka, pers. comm., 1989). At Pindiu (700-900 m), villagers say that oranges are only weakly seasonal and that the best supply occurs in March-June. In the Western Highlands, the main producing period is April-July but navel oranges often produce a smaller crop in November-December (Rogers and Movis, 1991:153). At Wapenamanda in Enga, most

fruit are available in May-June, with some in December (V. Older, pers. comm., 1994). On the Mamusi Plateau in WNB, at an altitude of about 800 m, the harvesting period is April-June (Villagers, July 1995).

Parartocarpus venenosa

This obscure fruit is common on New Britain, except on the north-east lowlands of the Gazelle Peninsula. Information is restricted to statements by villagers in various locations on New Britain.

In the Kandrian area of WNB, villagers say that there is no particular harvesting season (May 1993). On the coast north of the Baining Mountains, at Lassul Bay, villagers stated that production is discontinuous and non-seasonal, and the same pattern was described for the inland Kandrian area, the Cape Hoskins area and the Talasea area on the north coast. A slightly different interpretation was given by villagers in the Eastern Baining Mountains who described the pattern as continuous and non-seasonal (Villagers, June 1995). At two locations a seasonal production pattern was claimed. These were east of Pomio (August-September) and Uvol on the south coast (March-April).

The available information suggests that fruiting on New Britain is discontinuous, non-seasonal and irregular.

Passionfruit, banana (*Passiflora mollissima*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Table 9); Goroka market survey (Table 9).

In the Kainantu and Goroka areas, small quantities of fruit appear in the markets occasionally. Casual observations were made on fruiting in the Kainantu area, at Tambul in the Western Highlands and at various locations in Enga Province. Fruiting is discontinuous and appears to be non-seasonal.

Passionfruit, highland yellow (*Passiflora ligularis*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 15, Table 8); Goroka market survey (Fig 15, Table 8).

In the Kainantu and Goroka areas, the supply is discontinuous, non-seasonal and very irregular.

Passionfruit, lowland yellow (*Passiflora edulis f. flavicarpa*)

At Keravat, production is continuous and non-seasonal (RMB, SW). In the Dogura area of MBP, Kahn (1986:46, 164) gives the fruiting season as October-February.

Passionfruit, purple (*Passiflora edulis f. edulis*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 15, Table 8); Goroka market survey (Fig 15, Table 8); FMC purchases, Goroka (Fig 27, Table 15); FMC purchases, six buying centres (Fig 56, Table 21); Literature (Table 40).

Longitudinal data are available for Wau, Kainantu and Goroka. Some data are also available for Port Moresby and Lae, reflecting production in mountainous areas in these cities' hinterlands. Generalized statements on passionfruit seasonality are collated in Table 40. The main buying centres for the FMC were Goroka and Wau.

At all locations, production is discontinuous, very seasonal and constant. The main harvesting period is usually between January and April, commencing in either January or February. The pattern is similar at all centres and there is no influence of altitude or rainfall seasonality on the main production period. The regular commencement of the fruiting season in January or February suggests that daylength is the main influence on flowering.

Pawpaw (*Carica papaya*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 15, Table 8); Goroka market survey (Fig 15, Table 8); Hol market survey (Table 8); FMC purchases, Goroka (Fig 27, Table 15); FMC purchases, six buying centres (Fig 57, Table 21).

Longitudinal data are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen. Most of the FMC supply came from Port Moresby and Lae. In the PNG lowlands, the supply is continuous, non-seasonal and irregular. This also appears to be the case in the Wau area. In contrast, production is continuous but seasonal and non-constant in the Kainantu and Goroka areas. Here fruit are more available between August and October.

Peach (*Prunus persica*)

At Taluma in Enga, the main bearing period for peach is May-July (V. Older, pers. comm., 1994).

Persimmon (*Diospyros kaki*)

A tree at Laiagam in Enga bears in June-July (V. Older, pers. comm., 1994).

Pineapple (*Ananas comosus*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 17, Table 8); Goroka market survey (Fig 17, Table 8); Hol market survey (Fig 17, Table 8); FMC purchases, Goroka (Fig 28, Table 15); FMC purchases, six buying centres (Fig 58, Table 21); CPI market survey (Fig 81, Table 26); Experimental recordings, Keravat (ENB) and Saiho (Oro Province) (Fig 89); Villagers' statements and literature (Table 41).

Longitudinal data are available for Rabaul, Keravat, Port Moresby, Saiho, Lae, Wau, Madang, Kainantu, Goroka, Mount Hagen and the Nembi Plateau. Market surveys of Gordons market in Port Moresby by the FMC have been published by Rogers and Levett (1994). Generalized statements are available for other lowland and intermediate altitude locations. Port Moresby was the most important buying centre for the FMC.

In our surveys of Wau, Kainantu, Goroka and Hol markets, a distinction was made between rough and smooth leaf pineapples. The experimental data (Keravat and Saiho) is for the rough leaf type. No distinction was made between the two types for FMC purchases, the CPI market surveys and villagers' statements. In the highlands, the smooth leaf type is much more important than the rough leaf type. The opposite applies in the lowland and intermediate altitude zone where the rough leaf type dominates. Where no distinction is made, the highland data refer mainly to the smooth leaf type; and the lowland and intermediate altitude data to the rough leaf type.

In the highlands, the supply of smooth leaf pineapple is continuous, seasonal and non-constant. Market surveys and FMC purchases indicate that the best supply occurs at some period between September and March, and particularly in January-February, and the poorest supply is between April and August. The CPI market survey in Goroka indicates that the best supply is in January-March and the worst in May-September. There is considerable variation in the pattern between years. In the Eastern Highlands, the supply of rough leaf pineapples is discontinuous, seasonal and non-constant. The best supply occurs between October and February and the pattern appears to be more regular than for the smooth leaf type.

In the lowlands and intermediate altitude zone, the supply of rough leaf pineapples is continuous, seasonal and non-constant. The best supply usually occurs at some period between October and March and particularly between November and January. The poorest supply is usually between April and September. The different data sets indicate slightly different periods of best and worst supply. This reflects the considerable variation in the pattern from year to year. This year-to-year variation is well illustrated by the experimental records from Keravat and Saiho (Fig 89).

A study at Keravat by Bourke (1976b) concluded that flowering in rough leaf pineapples is initiated by low night temperatures and not by variation in sunshine hours, rainfall or maximum temperature. Data presented here supports this conclusion. In the lowlands, the fruiting pattern is similar in locations where the driest months occur between May and September (most locations) and those where the driest months occur between November and March, for example, the Kandrian area and Normanby Island. This indicates that flowering is not initiated by dry conditions. The large variation in the year-to-year pattern suggests that changes in daylength, which is constant between years, is not responsible for flower initiation.

Plum, Japanese *(Prunus* sp.)

At Aiyura, fruiting is discontinuous (L. Schultz, pers. comm., 1980). It is not known if it is seasonal. At Sopas in Enga, five trees of unknown varieties bear in a discontinuous and apparently non-seasonal pattern; and at Taluma, several varieties fruit in May-June (V. Older, pers. comm., 1994).

Pomegranate (*Punica granatum*)

Fruit are produced between December and March in the Rabaul area and between December and May at Keravat (Aburu, 1982:111, 119).

Pomelo (*Citrus maxima*)

Fruit production is continuous and non-seasonal at Keravat (RMB, SW).

Pouteria (*Pouteria maclayana*)

On Karkar Island, villagers claimed in October 1991 that production was discontinuous and seasonal with fruit maturing in August-October. Mature fruit were available at the time of fieldwork but no other data on seasonality are available.

Pulasan (*Nephelium mutabile*)

Data sources: Experimental recordings (Fig 88, Table 29).

At Keravat, fruit production from 10 trees in an experimental planting is discontinuous, seasonal and non-constant. Fruit ripen between November and March; production varies considerably from year to year; and very few fruit were produced in one of the four years for which data are available.

Rambutan (*Nephelium lappaceum*)

Data sources: Experimental recordings (Fig 87, Table 28).

At Keravat, fruit production is discontinuous, seasonal and constant. The fruiting season lasts for about three months and occurs between February and May, but it may start as early as November. Production levels are reasonably stable from year to year. Aburu (1982:113, 119) gives the season at Keravat and in the Rabaul market as November-March.

Raspberry, black (*Rubus lasiocarpus*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Table 8).

In the Kainantu area, fruit production is continuous and appears to be non-seasonal. This fruit was sold in Ukarumpa market for only the final year of the survey period, and here the supply was non-seasonal and irregular.

Rockmelon (cantaloupe) *(Cucumis melo*)

Data sources: FMC purchases, six buying centres (Fig 64, Table 22).

Only limited data are available as rockmelon is a minor crop in PNG and plantings are commonly affected by fungal disease. The FMC purchased some five tonnes in September-November 1980 in Lae and limited quantities in Port Moresby and Wau. The supply is discontinuous, non-seasonal and

very irregular. At Keravat, it is necessary for plantings to be made in May to produce fruit in August-November, otherwise fungal diseases destroy crops (SW). The recommended planting period for the Markham Valley is towards the end of the wet season (April-May) (Antonio, 1986:6). The available information suggests that successful crops are most likely to be harvested at the end of the drier months, that is, August to November in most locations.

Rollinia (*Rollinia deliciosa*)

At Keravat, fruit production is continuous and non-seasonal (SW).

Rukam (*Flacourtia rukam*)

In January-February 1994, villagers at seven locations on Normanby, Dobu, Fergusson and Goodenough Islands in MBP were asked about the seasonality of rukam. Fruit were available at this time. No consistent responses were obtained to RMB's questions, suggesting that fruiting may be discontinuous and non-seasonal.

Santol (*Sandoricum koetjape*)

Data sources: Experimental recordings (Fig 88, Table 29).

There are three trees in an experimental plot at Keravat. Production is discontinuous, seasonal and constant. Fruit are produced over a two-month period each year at some time between December and March.

Sapote, white (*Casimiroa edulis*)

At Laiagam in Enga, the main fruiting season is reported to be May-September. At Wapenamanda, it is reported as May-September or February-March (V. Older, pers. comm., 1994).

Soursop (*Annona muricata*)

Production is continuous and non-seasonal in the PNG lowlands, including at Keravat (Aburu, 1982:117).

Star apple (cainito) (*Chrysophyllum cainito*)

At Keravat, experimental plantings are reported as producing fruit in December-January in a biennial pattern (Aburu, 1982:117).

Strawberry *(Fragaria* sp.)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 15, Table 9); Goroka market survey (Fig 15, Table 9); FMC purchases, Goroka (Fig 29, Table 16).

Data are available for the Eastern Highlands only. As well as market surveys and FMC purchase figures, observations are available from the Awande Vocational School near Okapa and records from experimental plots at HAES, Aiyura for 1980-1981. In the Eastern Highlands, production is discontinuous, seasonal and probably non-constant. Most fruit ripen between May and November, particularly in June-September. The supply varies greatly from year to year, probably because of large variations in the area planted due to changing perceptions of marketing opportunities by villagers.

Tamarind (*Tamarindus indica*)

At Keravat, the production season is reported to be April-June (Aburu, 1982:119).

Taun (*Pometia pinnata*)

Data sources: Villagers' statements and literature (Table 42).

Thirteen generalized statements are available on the main harvesting period in PNG as well as Santa Cruz Island in the Solomon Islands and Vanuatu. The PNG observations are from the New Guinea Islands and from inland areas of East Sepik and Sandaun Provinces, reflecting locations where taun is important. These reports indicate that fruiting is discontinuous and seasonal. The reported harvesting season occurs at some time between August and April and most commonly in November-February. The season is most commonly given as 2-3 months in duration. There is no apparent relationship between the reported harvesting period and altitude, rainfall seasonality or latitude.

Tree cucumber (*Averrhoa bilimbi*)

At Keravat, fruit production is discontinuous and non-seasonal (SW).

Tree tomato (tamarillo) *(Cyphomandra betacea*)

Data sources: Aiyura/Kainantu/Ukarumpa market survey (Fig 16, Table 8); Goroka market survey (Fig 16, Table 8); FMC purchases, Goroka (Fig 30, Table 16).

Limited information is available for the Kainantu and Goroka areas where the supply is discontinuous. There is an indication that the best supply occurs in March-April, particularly from the FMC purchases, but there is insufficient data for definite conclusions to be drawn. At Wapenamanda and Taluma in Enga, fruiting is reported to be continuous (V. Older, pers. comm., 1994).

Velvet apple (*Diospyros discolor*)

At Keravat, fruit production is discontinuous and non-seasonal (Aburu, 1982:118; SW).

Watermelon (*Citrullus lanatus*)

Data sources: Wau market survey; FMC purchases, six buying centres (Fig 69, Table 23); Villagers' statements and literature (Table 43).

Longitudinal observations are available for Port Moresby, Lae, Wau, Kainantu, Goroka and Mount Hagen and generalized statements for four other locations. Most of the FMC supplies came from the Lae (Markham Valley) and Port Moresby buying centres. The supply is continuous in the Port Moresby area and the Markham Valley and discontinuous at other locations for which data are available. At all locations the supply is seasonal and constant, with the best supply occurring between November and March.

At two locations (Obo, Fly/Strickland Rivers Junction and Kandrian, WNB), villagers stated that they plant watermelon in the drier months because insect damage to leaves is excessive in the wetter months. The claimed planting seasons were September-October and November-December at the two locations respectively.

Watery rose apple (*Syzygium aqueum*)

The supply to Goroka market is discontinuous and non-seasonal (data not presented). On Dobu Island in MBP, villagers claimed in February 1994 that production was discontinuous and non-seasonal. Earlier observations recorded the supply at Keravat as seasonal (December-May) (Aburu, 1982:118); but more recent observations at Keravat are that production is discontinuous and non-seasonal (SW). Overall, the limited information available indicates that the supply is discontinuous and non-seasonal in the lowlands and highlands.

Nuts

Breadfruit (*Artocarpus altilis*)

Data sources: Villagers' statements and literature (Table 34a).

The main economic product of breadfruit is the flesh, but the seeds are also eaten. Some cultivars recently introduced from the Eastern Pacific are seedless. Breadfruit is grown on all island groups just north of the New Guinea mainland, in the Admiralty Group, New Britain, New Ireland, Solomon Island chain and the islands of MBP. It is also widely grown elsewhere in the Pacific. Breadfruit is grown on the New Guinea mainland in the coastal part of MBP, that is from about Cape Vogel to about East Cape, in the Rigo area of Central Province and possibly in other coastal locations. However, it is not common on the New Guinea mainland. A related species, or possibly a different form of this species, is grown on the island of New Guinea, as well as in the Moluccas west of New Guinea and in the Philippines. This is breadnut *(Artocarpus camansi)* and only the nuts are eaten for this species (Coronel, 1994; Ragone, 1997). The production pattern for breadnut is considered separately.

Statements about breadfruit harvesting seasons are available for some 25 locations on Vokeo Island, Karkar Island, New Britain, Bougainville, and mainland and island MBP (Table 34a). The production period for Milne Bay is usually given as commencing in October or November and extending for 4-6 months. The statement by Malinowski (1935) that breadfruit is mature in April-May in the Trobriand Islands is an exception to this generalisation. These locations are at 9-11°S, where seasonal changes in daylength are more marked. It is possible that differences in daylength in MBP are sufficiently large to impose a more-or-less regular seasonal flowering pattern.

In response to questions by RMB about breadfruit seasons, different villagers in the same area often gave conflicting information. For example, in a village on the western side of Umboi Island, people claimed that breadfruit produces seasonally but could not clearly identify the season. In a village on the eastern side of the same island, one group of informants claimed February as the harvesting period, but another group were uncertain. There is also some confusion in the literature about breadfruit seasonality for other Pacific island countries where statements are made by Coenan and Barrau (1961) and by Massal and Barrau (1956:19-20). However in Vanuatu, the pattern seems to be similar to that in Milne Bay. There the producing period is given as from November onwards for Malo Island (Allen, 2001:87) or more generally as November-January with a minor crop in June-August (Weightman, 1989:112).

In contrast to the Milne Bay area, there is no consistent seasonal pattern for the other locations for which data are available (Table 34a). It is likely that flowering and fruiting vary from year to year in an irregular manner. There is no relationship between the seasonality of rainfall distribution and the production pattern for these locations, including Milne Bay. In Milne Bay, the pattern is probably discontinuous, seasonal and constant. At other locations closer to the equator in PNG, the pattern appears to be discontinuous, non-seasonal and probably very irregular.

Hogbin's (1938-39:128) statement that breadfruit bear at irregular intervals on Wogeo Island and that periods for the harvest cannot be accurately forecast is a good summary of the production pattern, at least for locations nearer the equator in PNG.

Breadnut (*Artocarpus camansi*)

Data sources: Villagers' statements and literature (Table 34b).

The main economic product of breadnut is the large seed which is cooked before eating. In PNG, it is widely grown on the New Guinea mainland up to an altitude of 1250 m, and occasionally as high as 1450 metres. Over 20 statements on the breadnut production pattern are available from villagers or the published literature (where the name "breadfruit" is generally used). It is reported to bear in all

months of the year at different locations. There is no relationship between the claimed production period and altitude or latitude. There is insufficient data from locations with contrasting rainfall seasonality patterns, but there does not appear to be a relationship between rainfall seasonality and production. At a number of locations, different sources give different "production seasons", including the Mogulu area of Western Province, the inland Gulf Province area (Swanson and Ivori Valleys) and the Simbai area of Madang Province. In contrast, two authors give the same period for the Karimui Plateau of Simbu Province (Table 34b).

A number of authors comment further on the pattern. Dornstreich (1973:222) could not determine whether breadnut bore seasonally in the area of the southern tributaries of the Sepik River. He recorded production in March, July and October during his year's fieldwork. In the Dreikikir area, Obrist van Eeuwijk (1992:108) noted that breadnut was available all year but more matured in the May-July period.

It is clear that breadnut production is discontinuous in PNG, but the available information does not indicate any general pattern. The lack of consistency suggests that the producing period varies from year to year at any one location. It is not clear whether there is a tendency for the producing period to occur during certain months for any given location or whether production may occur during any month.

***Buchanania* sp.**

In the Mogulu area near Nomad in Western Province, "hotuna" *(Buchanania* sp.) nuts ripen in about December (van Beek, 1987:20, 23).

Canarium (*Canarium acutifolium* and *Canarium vitiense*)

(see "Galip" for *Canarium indicum*)

Nuts of these two species are reported as being eaten in parts of Western Province. The taxonomy of the species is close and unreliable in the field (Evans, 1994:12) so the possibility of misidentification exists. In the Mogulu area near Nomad, nuts of *C. acutifolium* are reported to ripen in about December by van Beek (1987:20, 23). On the Oriomo Plateau, nuts of *C. vitiense* are harvested and eaten in September-November (Ohtsuka, 1983:89-90). In the Strickland Valley north of Nomad, there are two canarium species with edible nuts, one with nuts much larger than the other (P. Dwyer and M. Minnegal, pers. comm., 1993). Nuts of the large-seeded type were available in August (?)-December 1986 and also in October-November 1991.

Candle nut (*Aleurites moluccana*)

Data sources: Goroka market survey (Fig 18, Table 10).

Small quantities are offered for sale in Goroka market. The supply is discontinuous, seasonal and constant. They appear in the market in August-November. In Sinasina District in Simbu Province, they were sold in markets in September-December 1972, peaking in November (Hide, 1981:400). Peekel (1984:602) records fruiting in August on the Gazelle Peninsula and New Ireland. These scattered and limited records indicate that nuts are available seasonally between August and December.

Cashew (*Anacardium occidentale*)

At Keravat, nuts are reported to produce in October-January each year (Aburu, 1982:120) or in December-January (G. Ling, pers. comm., 1995). The period of October-January was also reported for the 1988-89 fruiting season at Numanuma on Bougainville (Allen, 1991:171).

Castanopsis (*Castanopsis acuminatissima*)

Data sources: Villagers' statements and literature (Table 44).

Seven generalized statements on castanopsis production are available. These indicate that nuts are available seasonally, that the season lasts for about two months, and that it commences at some time between July and December (Table 44). There is an indication from the available data that the producing season commences earlier (July-September) at 800-1200 m than at higher altitudes (1600-2000 m) where it commences in November-December.

Coconut, dry (*Cocos nucifera*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 16, Table 10); Goroka market survey (Fig 16, Table 10); FMC purchases, six buying centres (Fig 43, Table 19); CPI market survey (Fig 77, Table 25).

Longitudinal data are available for Rabaul, Port Moresby, Lae, Wau, Madang, Kainantu and Goroka. Market sales in highland centres reflect production in the Markham and Ramu Valleys. The main buying centre for the FMC was Port Moresby.

In the lowlands, the supply of dry coconuts is continuous, non-seasonal and irregular to very irregular. It is not known whether irregular supplies reflect changes in production or changes in the quantity offered for sale. The very even CPI market prices for most centres suggest that supply is fairly constant throughout the year. For Port Moresby only, market prices tend to be higher in August-October than in other months, suggesting a weakly seasonal supply pattern. However, there is considerable variation from year to year in market prices and this apparent seasonal pattern in Port Moresby only occurs in some years. National level data for copra production for a nine-year period (1977 to 1985) are given by Jolly *et al.* (1990:100-101, 109). These figures do not indicate any consistent seasonal pattern, although average production was slightly higher for March and December for this particular period.

Supply in highland markets is discontinuous, non-seasonal and very irregular, but the lack of continuity of supply reflects marketing constraints rather than production changes in the lowlands. Very minor quantities of sprouted dry coconuts are sold in markets in the Kainantu area (Table 10). The supply is discontinuous, non-seasonal and irregular. In the Imonda area in Sandaun Province, coconut palms are not very common. Here villagers restrict harvesting until the festive season in May-June (Gell, 1975:161-166).

Coconut, green (*Cocos nucifera)*

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 16, Table 10).

In markets in the Wau and Kainantu areas, the supply of green coconuts ("kulau") is discontinuous, seasonal and constant. The best supply is in September-November in both locations. Green coconuts sold in the Kainantu area originate in the Markham and Ramu Valleys and most of those sold in Wau probably come from the Markham Valley. These data suggest that, in the Markham Valley, the best supply of green coconuts occurs in September-November. Further data are required to confirm this.

Daucia (*Terminalia megalocarpa*)

On Kiriwina Island, the harvesting season is given as December-January by Malinowski (1935:50, 311) who uses the Kiriwina name "gwadila". (The common name adopted here, "daucia", is from Misima Island where the species is very common). Villagers on four islands in MBP (Kitava, Iwa, Gawa and Ianaba) were asked in February 1994 about the producing period. Responses were quite consistent. The nut was said to be available seasonally with the harvesting period between December and February (or March). In a number of locations, fruit had been harvested in January-February 1994 and these were being processed to remove toxin from the seed before consumption.

Elaeocarpus (*Elaeocarpus womersleyi*)

In the upper Karawari River area of ESP, nuts are available in June-September (our interpretation of information in Dornstreich [1973:364]).

Finschia (*Finschia chloroxantha*)

In the Hindenberg Range of Western Province, nuts are gathered in November-December (Hyndman, 1979:211). Nuts are sold very occasionally in markets in the Eastern Highlands, but our limited observations do not clearly indicate the production pattern.

Galip (*Canarium indicum*)

Data sources: Experimental recordings (Fig 88, Table 29); Villagers' statements and literature (Table 46).

Longitudinal recordings are available for two plantings at Keravat. (The data are presented as nut-in-shell [NIS]. The kernel content of NIS is 17-21 per cent [Evans, 1994]). In one planting, there are eight trees some 30 years old. Production from these trees is discontinuous, seasonal and constant with the harvesting period in June-October. In the other planting, there are three trees some 40 years old. Here production is discontinuous, weakly seasonal and constant, with nuts produced some time between July and January (Table 29). The production pattern varies somewhat between years. For example, there was a shorter more intensive production period in 1991 and a more extended one in 1990 and 1992. The report by Aburu (1982:120) that there are two production seasons at Keravat presumably reflects a very extended season with a short break during his period of observation.

Generalized statements on galip seasonality are available for over 21 locations in PNG, the Solomon Islands, Queensland, Vanuatu and Fiji (Table 46). The reported producing period is typically three months long (range 2-5 months). The available data indicate that latitude has a strong influence on the start of the harvesting season. The harvest starts progressively later at locations further from the Equator, so that at Vanuatu (ca 17° 30'S) it starts as late as October (with a second smaller producing period in June-July). The relationship is illustrated in Figure 93 where the data from Table 46 for PNG and Solomon Islands locations is plotted against latitude. The pattern at three locations at 3-4°S (Tanga [3°25'S], Anguganak [3°40'S] and Dreikirkir [3°25'S]) does not fit this relationship and these points have been excluded from Figure 92. There is no apparent relationship between harvesting season and rainfall seasonality. The season is similar in locations with contrasting rainfall seasonality, for example, Kandrian and Gloucester on New Britain.

In some locations, galip are reported to be the only crop that bears seasonally. This is the case in south Bougainville where the annual cycle is known by the local name for galip ("moi") (Oliver, 1949:57-58); and most feasts were held in the month following galip ripening (Oliver, 1955:29). On Wogeo Island in ESP, galip is also reported to be the only crop to provide an annual rhythm (Hogbin, 1938-39:131). In the Morovo Lagoon area of New Georgia Island in the Solomon Islands, the word for year ("buruburu") is also the term for canarium nut tress and this signifies the role of canarium harvests in time reckoning (Hviding and Bayliss-Smith, 2000:45). In the Kandrian area of WNB, the galip season is said by villagers to commence in the Gasmata area and to move progressively west along the coast towards Kandrian (Villagers, February 1990).

Karuka (*Pandanus julianettii*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 18, Table 10); Goroka market survey (Fig 18, Table 10); Hol market survey (Fig 18, Table 10); Observer network (Fig 91, Table 31); Patrol reports, Southern Highlands (Table 32) and Simbu Provinces.

Longitudinal data are available for Kainantu, Goroka, Wabag, Mendi, Tari and Oksapmin for 6-10 years (Figure 91, Table 31). Comments made in patrol reports on karuka bearing are an unexpected, although low quality data source. (The patrol officers were interested in karuka harvests because of disputes over trees). These comments have been assembled for the Southern Highlands (Table 32)

and for Simbu (Hide, 1981:284). There are numerous generalized statements on karuka harvesting seasons in the literature, but these are not collated here because they add little to other data. The reported harvesting seasons in the literature cover all months of the year with more claims for the December-March period than for other months and reports of June-July season also common.

The available data are now summarized. At all locations, production is discontinuous. The nuts may mature during any month of the year, but this is most likely between January and March and least likely between September and November. The size of the crop varies considerably from harvest to harvest and large crops are more likely during the January-March period than at other times. Karuka nuts mature in a more regular manner in the Kainantu and Goroka areas, and production there could be described as seasonal and constant.

In the western part of the highlands (Wabag, Mendi, Tari, Oksapmin areas and Nembi Plateau), production is less regular and would be described as non-seasonal and very irregular. Following the exceptionally large harvest in early 1983, there was no significant production for two or more years at all six locations for which longitudinal data are available. Shorter observations, for example for the period 1983-1985, suggest an apparent biennial bearing pattern, and claims in the literature for biennial production are common. However, the long-term observations reported here do not support these claims.

There are many statements in the literature and in patrol reports that villagers survived on karuka nuts after frost had damaged sweet potato gardens. There were exceptionally good karuka harvests following drought and severe frosts in 1941, 1972 and 1982 (Waddell, 1989; D. Eastburn, pers. comm., 1987; Table 31; Figure 91). It could be inferred from this association of frosts and good harvests that frosts initiate very heavy flowering and bearing. The issue is complicated because the most severe frosts are associated with drought, but drought and frost do not necessarily coincide in the PNG highlands (Allen, 1989a:275-278).

It is much more likely that water stress rather than low temperature is a more important trigger for flowering. It is also likely that exceptionally good harvests follow drought, which may or may not coincide with frosts, provided that plants have accumulated sufficient carbohydrate reserves since the previous producing period. Evidence for this reasoning is now presented. Detailed data on the occurrence of frosts and soil moisture levels over long periods are presented in Bourke (1988:170-180, 348-356) and Allen (1989a).

In the Eastern Highlands where rainfall distribution is seasonal, production is more regular and approaches a regular seasonal pattern. In the western part of the highlands where production is much less regular, rainfall seasonality is very weak or non-existent. A second line of evidence is that fruiting was only synchronized twice at all six locations between 1978 and 1985. The first time that this happened (early 1980) followed mild water stress in the western part of the highlands and a drought in the Eastern Highlands in late 1979. The second occasion (early 1983) followed a widespread drought in 1982. In the Southern Highlands, a drought in 1965 was followed by widespread reports of karuka harvests in late 1965 and early 1966 (Table 32); mild water stress in August-September 1976 was followed by a particularly good harvest in early 1977 (Rose, 1982:165); and water stress in 1979 and a drought in 1982 preceded good harvests early in the following years. In contrast, frost in September-October in 1958, 1961 and 1981 that occurred without associated soil moisture stress were not followed by average or above average harvests.

There is some evidence for differences in the bearing pattern of different cultivars. In the Tari Basin, the relative performance of two cultivars varied somewhat between years over the period 1976-1980 (Rose, 1982:165). In the Oksapmin area, the cultivar "lindel" consistently bears a little earlier than other recognized cultivars, such as "kwal". In the very good harvest of late 1982-early 1983, "lindel" bore two to three weeks earlier at 1700 m than at 2100 m altitude (J. Darby, pers. comm., 1983).

Karuka, wild (*Pandanus antaresensis*)

In the Hindenberg Range area of Western Province, *Pandanus antaresensis* is reported to bear continuously throughout the year (Hyndman, 1984:296).

Karuka, wild (*Pandanus brosimos*)

Data sources: Observer network (Table 33).

Longitudinal data are restricted to observations from very high altitude locations near Kandep in Enga and the fringe of the Tari Basin in SHP (Table 33). As with the cultivated karuka in this region, production is discontinuous and non-seasonal.

Fruiting has been recorded in most months of the year, although it is more likely in January-February than in other months. Good harvests have also been recorded in May-July in Kandep and other areas. Claims in the literature for annual or biennial bearing are not supported by the available data.

The producing season may coincide with that for cultivated karuka at lower altitudes in the same region (Tables 31, 32). This occurred in early 1983 and mid-1985 in the Kandep and Tari areas. However, as the 1984 records for Enga show, this does not always occur. Producing periods for wild karuka in the upper Simbu Valley in May-July 1989 and in the Hindenberg Wall area of Western Province in May-June 1992 did not coincide with the harvest of cultivated karuka at these locations (RMB).

Macadamia (*Macadamia integrifolia* and *M. tetraphylla*)

In the Aiyura area, nuts drop in December-April (L. Schultz, pers. comm., 1980). At Karimui, the large-seeded type drops its nuts in December-March but production is reported to be non-seasonal for the small-seeded type (K. Aburu, pers. comm., 1982).

Okari (*Terminalia kaernbachii*)

Data sources: Experimental recordings (Fig 86, Table 28); Villagers' statements and literature (Table 47).

Experimental records are available for two plantings at Keravat over a four-year period (Figure 86, Table 28); and for one of the plantings for an earlier two-year period (Aburu, 1982:121). (The data in Figure 86 and Table 28 is for nut-in-shell [NIS]. The kernel content of NIS is about 14 per cent). There are 22 trees in one planting, some of which are 40 years old. Production in this series is discontinuous, seasonal and constant with the main producing period commencing in March or April and lasting for about three months. There are ten trees in the other planting about 30 years old. The pattern is similar to the first planting, but the main producing season is less well defined and most nuts mature between April and July. Total nut yield varies considerably from year to year in both plantings. Aburu (1982:121) gives the fruiting season for ten individual trees of the second planting for 1978 and 1979. Nuts matured in March-May for all trees in both years. He recorded significant variation in yield per tree between years.

Overall, the experimental data from Keravat indicate that production is discontinuous, seasonal and constant. The main harvesting period extends over about three months and starts in March or April. There is significant year-to-year variation in yield for individual trees and groups of trees.

Generalized statements on the main harvesting season for okari are available for 14 locations in PNG and the Solomon Islands (Table 47). Responses from different informants asked about the okari producing season in the same area are usually fairly consistent. The harvesting period is reported as being two to four months in duration. There is no apparent relationship between the start of the harvesting season and rainfall seasonality. For example, the season is similar in the Swanson Valley and the Bereina area, which are in the same general region but which have different rainfall patterns.

There is a very clear relationship between latitude and the stated start of the harvesting period. Nearer the Equator, harvesting commences in about March. At the latitude of Bereina (8° 40' S), or Guadacanal Island in the Solomon Islands (9° 30' S), it commences several months later in June or July (Table 47). This relationship is illustrated in Figure 93 where the data for lowland locations (0-400 m) is plotted against latitude.

The influence of altitude on the harvesting season is not known. Data are available for four higher altitude locations (Mount Dayman, Swanson Valley, Mount Sisa and the Karimui Plateau). For two of these locations (Mount Dayman and Karimui), the harvesting season is said to commence at about the same time as at other locations at a similar latitude. At the other two locations (Swanson Valley and Mount Sisa), it reportedly commences later, suggesting that the start of the harvesting period is further delayed at higher altitudes as well as at higher latitudes. Better quality data are needed to test this relationship.

Another indication of yield variation between individual trees comes from Gwaimasi Village in the Strickland Valley north of Nomad in Western Province. Here P. Dwyer and M. Minnegal kept detailed records on 14 trees in 1987 (pers. comm., 1993). Of the 14 trees, five failed to bear in that year, five produced a poor crop (<50 nuts), and four produced between 80 and 490 nuts per tree. Most of the yield of three of the four most productive trees was obtained when villagers climbed these trees and shook most of the nuts off. The nuts from the forth tree were obtained over a longer period because they were harvested as they fell.

Okari, wild (*Terminalia impediens*)

Howcroft (1992:33) states that fruit mature in July-August at Bulolo. In the Angoram area of ESP, nuts matured in March-April in 1989 (RMB).

Omphalea gageana

The fruiting season is given as August-September for the Gazelle Peninsula and New Ireland by Peekel (1984:602). On Anir and Tanga Islands in New Ireland Province, the harvesting season is reported as December to about May (R. Croyden, pers. comm., 1981).

Pao (*Barringtonia procera, Barringtonia edulis* and *Barringtonia novae-hiberniae*)

B. procera is the most important edible species in the New Guinea Islands region, but it is uncommon on the New Guinea mainland. In the Kandrian area of WNB, informants at four locations stated in February 1990 and May 1993 that production of *B. procera* is discontinuous and non-seasonal. Villagers on the Gazelle Peninsula and the Pomio area of ENB made similar statements in mid-1995, that is, flowering and fruiting is intermittent and non-seasonal. In the Mussau Islands, Lepofsky (1992:203) indicates that production of *B. procera* (previously known as *B. magnifica)* is continuous throughout the year. Nut maturity of the traditional type of pao nut *(B. edulis)* was reported as being seasonal in the Pomio area of New Britain in June 1995.

At Keravat, Aburu (1982:120) gives the fruiting season for *Barringtonia* sp. as November-January; but Rogers and Movis (1994:8) give the season as March-July. Peekel (1984:600) recorded fruit of *B. novae-hiberniae* in May for the Gazelle Peninsula and New Ireland. In the Solomon Islands, edible *Barringtonia* species *(B. edulis, B. procera* and *B. novae-hiberniae)* fruit two to three times a year with no apparent inter-species pattern (Evans, 1991:56). In the Santa Cruz Islands in the Solomon Islands, Yen (1974:270) reported that flowering occurred up to four times a year and supplies of nuts were available throughout the year. In Vanuatu, the producing period of *B. edulis* commences later at locations further from the Equator, but the production period of *B. procera* and *B. novae-hiberniae* is not latitude dependent (A. Walter, pers. comm., 1994).

To summarize, production of *B. procera* is discontinuous and non-seasonal, but further observations are needed on the patterns of both individual trees and populations of trees.

Peanut (*Arachis hypogaea*)

Data sources: Wau market survey; Aiyura/Kainantu/Ukarumpa market survey (Fig 18, Table 10); Goroka market survey (Fig 18, Table 10); Hol market survey (Fig 18, Table 10); CPI market survey (Fig 80, Table 26).

Longitudinal data are available for Rabaul, Port Moresby, Lae, Wau, Madang, Kainantu, Goroka and the Nembi Plateau. The supply is continuous and seasonal at all locations except the Nembi Plateau. It is weakly seasonal at some locations such as Madang and quite seasonal at others such as Kainantu.

In the Eastern Highlands, the supply is continuous, seasonal and constant in the Kainantu area and continuous, seasonal and non-constant in the Goroka area. The best supply is usually in January-March and the poorest is between May and about September. The marked seasonality of supply in the Eastern Highlands perhaps reflects variation in planting rate rather than regular changes in crop yield over time. If this was the case, the highest planting rate would occur in August-October. However, a longitudinal study of planting rates in one community in the Kainantu area between 1979 and 1982 did not show any regular variation in the planting rates of peanut, although this did occur for mixed gardens, winged bean and cucumber (Bourke, 1988:215, 218, 358). The limited data for Wau indicate a similar seasonal pattern to the Eastern Highlands locations with the best supply in October-February in 1980-81.

CPI market surveys show that the supply of peanuts varies seasonally in the lowland centres of Rabaul, Port Moresby, Lae and Madang. The pattern varies somewhat between centres and changes considerably between years, that is, supply is continuous, seasonal and non-constant. In general, the best supply occurs at some time between November and May, particularly in January-February. The poorest supply occurs at some time between July and November. Seasonal differences are less marked in Madang than in the other centres.

Polynesian chestnut (*Inocarpus fagifer*)

Data sources: Villagers' statements and literature (Table 48).

Generalized statements about the main harvesting period are available for 15 locations (Table 48). The reported harvesting periods fall into two groups, one centred on May-July and the other on October-February. There is no consistent pattern for all locations nor is there any obvious relationship between the harvesting season and rainfall seasonality or latitude. In the Kandrian and Gloucester areas of WNB, villagers were asked about the harvesting season at four locations in May 1993. Responses were not consistent.

Four people have recorded similar harvesting periods in various parts of MBP, that is, the main production period commencing in September-November and continuing for 3-4 months (Table 48). One of us (RMB) asked villagers about the production pattern at 15 locations on eight islands in MBP in 1993. Responses were fairly consistent, with the range of months as October-March and with November-February as the most commonly claimed months. The starting period was usually given as November or December and the season said to last for two or three months. The consistency of the data for MBP suggests that here, at least, nuts are produced seasonally. Within MBP, there is no relationship between the reported harvesting season and rainfall seasonality.

It is possible that Polynesian chestnut fruits seasonally at locations further from the Equator, such as MBP, but production is discontinuous and non-seasonal at locations nearer the Equator where daylength variation is less. The season is given as December-April in Vanuatu by A. Walter (pers. comm., 1994), which is consistent with this hypothesis. Further data are needed to test this.

Sea almond (*Terminalia catappa*)

Data sources: Villagers' statements and literature (Table 45).

Generalized statements about the harvesting season are available from four regions in PNG and one in Papua (Irian Jaya), with the MBP observations covering 16 locations (Table 45). The available information is similar with the reported supply being discontinuous and seasonal, with the producing period occurring at some time between November and May. In the 16 locations in MBP, the season was given as two or three months long, with December-February as the most commonly reported period. In the Solomon Islands, Evans (1991:56) reports that *T. catappa* fruit sporadically throughout the year.

Sis (*Pangium edule*)

Data sources: Villagers' statements and literature (Table 49).

Generalized statements on the main harvesting season are available for 12 locations. Peekel (1984:384) gives two harvesting periods per year for New Ireland, but all other observers report one main harvesting period only. Apart from New Ireland and the MBP islands, the main harvesting period is reported to be similar for all other locations. The most common reported start of the harvesting season is May or June, but July and August are also given, and the season extends for two to four months. It is not clear why the apparently consistent MBP information differs from other locations. There is no apparent relationship between the reported main harvesting period and altitude, rainfall seasonality or latitude.

On the Karimui Plateau, two main seasons of the year are distinguished by villagers on the basis of trees with distinctive seasonal fruiting patterns. One of these seasons, "siburu" is named after *P. edule,* the other for the marita pandanus (Hide *et al.,* 1984:213; Wagner, 1967:11). The association between periods of the year and certain crops suggests that the start of the sis harvesting season is fairly constant from year to year.

Tulip (*Gnetum gnemon*)

See Traditional Vegetables.

Narcotics

Betel nut (*Areca catechu*)

Data sources: Aiyura/Kainantu market survey (Fig 19, Table 11); CPI market survey (Fig 75, Table 25); Villagers' statements and literature (Table 50).

Longitudinal data are available for Rabaul, Port Moresby, Lae, Madang, Kainantu and Goroka. Betel nut sold in markets in Kainantu and Goroka is grown in the Markham Valley and elsewhere in Morobe and Madang Provinces. There are very large differences in market prices between centres. Of the five towns included in the CPI market surveys, betel nut is cheapest in Rabaul, and most expensive in Port Moresby and Goroka. (The price difference between remote supply centres in the lowlands and remote urban areas in the highlands may be as great as 100 times.)

At all centres, the supply is continuous, seasonal and constant. The supply is less seasonal in Madang and most seasonal in Lae. In general, the best supply occurs between April and August, and the worst supply between September and December. There are some regional differences. The best supply in the Madang area occurs in the January-March period and this is the time of poorest supply in the Port Moresby area. This difference occurred consistently between 1971 and 1985, after which the CPI market survey data are of limited value. Generalized statements on the period of best supply at five locations support conclusions from the long-term market survey data (Table 50).

Betel nut, highland (*Areca macrocalyx*)

Data sources: Aiyura/Kainantu market survey (Fig 19, Table 11); Hol market survey (Fig 19, Table 11).

Of the locations surveyed, the highland betel nut is important only in the Kainantu area where the monetary value of the highland and lowland species sold in markets was similar in the early 1980s. However, by 2000, the Kainantu market was dominated by lowland betel nut, with very little highland betel nut being sold (M. Allen, pers. comm., 2002). Elsewhere in the highlands, it is a minor commodity, for example, on the Nembi Plateau. In the Kainantu area, the supply is continuous, seasonal and constant, with the best supply in the October-December period. This complements the supply pattern of the lowland species which is brought up from the Markham Valley. As a result, the combined supply of the two species in the Kainantu area was reasonably regular throughout the year in the early 1980s.

Highland betel pepper fruit *(Piper gibbilimbum)*

Data sources: Aiyura/Kainantu market survey (Table 11).

Very minor quantities of the fruit of highland betel pepper are sold in Kainantu market. The supply is discontinuous and apparently non-seasonal.

Highland betel pepper leaves *(Piper gibbilimbum)*

Data sources: Aiyura/Kainantu market survey (Fig 19, Table 11); Hol market survey (Table 11).

In the Kainantu arca, the supply is continuous, weakly seasonal and constant, with the best supply in September-November.

Lowland betel pepper fruit *(Piper betle)*

Data sources: Aiyura/Kainantu market survey (Fig 19, Table 11).

In Kainantu market, produce is sold which originates in the Markham Valley. The supply is continuous, seasonal and constant. The best supply is in January-March and the poorest in September-October.

Lowland betel pepper vine *(Piper betle)*

Data sources: Aiyura/Kainantu market survey (Fig 19, Table 11).

Minor quantities are sold at irregular intervals in Kainantu market. The supply is discontinuous and apparently non-seasonal.

Marijuana (*Cannabis sativa*)

Plantings grown for observation by police in a green-house at Keravat in 1970-72 produced leaves throughout the year (RMB).

Tobacco (*Nicotiana tabacum*)

Data sources: Aiyura/Kainantu market survey (Fig 19, Table 11); Hol market survey (Fig 19, Table 11).

The supply in Kainantu and Hol markets is continuous, non-seasonal and irregular.

GENERAL DISCUSSION

Data Reliability

A large number of data sources have been used here. The strengths and limitations of each data source were discussed in the Introduction under the heading Data Sources. Here some comments are offered on the reliability of information on different crops. For many species, information is available from a number of different sources, over different time periods and from different locations. For these crops, we can be more confident about general conclusions about the plant's behaviour. Commonly, the recordings and observations come from locations with different daylength (latitude), temperature (altitude) and rainfall regimes. These differences, often over short distances, allow us to explore possible environmental influences on flowering.

For other crops, there is less available information and it comes from a more limited number of environments. Here the conclusions are firm, but there is less scope to generalise. For some crops, there is only information from one or two locations. This is particularly the case with many of the fruit species grown experimentally at Keravat but not elsewhere in PNG, and for some other fruits. For these crops, only tentative conclusions are possible.

In many of the data sets, it is apparent that some of the early recordings are not consistent with most other information. This applies to some of the observations reported by Peekel (1984) and by Aburu (1982), but also for some observations by anthropologists and geographers. It is likely that these reports were based on shorter observations or in atypical years. For a number of crops, there is little agreement on the production pattern between observers at different locations, or even the same location, where observers made their recordings for one year or less. These crops include karuka nut (*Pandanus julianettii*) (Tables 31 and 32), breadfruit (*Artocarpus altilis*) (Table 34a), and breadnut (*Artocarpus camansi*) (Table 34b). This suggests that production is irregular, and a 6-10 year data run for six locations for karuka nut show this to be the case in the western part of the highlands (Figure 91).

For most of PNG, seasonal differences in daylength and temperature are small to negligible, although rainfall seasonality is often more marked. Hence the start and finish of the production season for most crops is not well defined. Even for crops that are markedly seasonal in their production pattern, such as purple passionfruit (*Passiflora edulis f. edulis*) in the highlands, the start of the producing period varies somewhat from year to year and this is reflected in the published literature and comments by villagers assembled here. Many crops produce some of the economic product in many or most months of the year, even some crops for which production is markedly seasonal.

The information reported here is at the species level. There is very little known about variation between individual plants or cultivars at the same location. Occasionally there are indications of differences between cultivars in their behaviour. For example, on the north coast of New Britain, in the Hoskins and Ulamona areas, villagers stated that the traditional type of lowland pitpit (*Saccharum edule*) bears seasonally, as is generally reported in PNG, but that recently introduced types bear in an irregular and non-seasonal manner. Likewise, there are reported consistent differences in the bearing pattern for different cultivars of karuka nut (*Pandanus julianettii*) at Oksapmin and in the Tari Basin. While not considered here, the experimental recordings on individual trees of galip nut (*Canarium indicum*) and eight other fruit and nut tree species at the Lowlands Agricultural Experiment Station at Keravat would allow variation between individual trees to be examined for these species.

Environmental Influences

Only three major physical environmental factors have been identified as cues that initiate onset of flowering. These are photoperiod, temperature and moisture (Rathcke and Lacey, 1985:190). Where longitudinal data on crop production patterns are available from locations with a range of environments, it is possible to make some suggestions as to the influence of these three environmental factors on the production pattern. The three factors are now considered.

A crop is said to be producing in a seasonal manner if its economic product is usually more abundant at about the same time each year. The term is often used loosely to describe variation in supply. (See definitions of terms used at the beginning of the Results Section).

Daylength

Photoperiod is the duration of an organism's daily exposure to light. It is dependent on daylength. There are only small differences in daylength during the year in most of PNG. The difference is very small at locations nearer the equator, such as on Manus or Mussau Islands, and somewhat greater at locations further south, such as the southern part of Western Province and much of Central, Oro and Milne Bay Provinces, which lie between 8° and 12° South. At Lorengau (2° 1'S) on Manus Island, the difference between the longest day (in December) and the shortest day (in June) is only 14 minutes. In contrast, at Port Moresby (9° 27'S), the difference is 1 hour 6 minutes (McAlpine *et al.*, 1983: 119). Differences are greater still in the southern part of Milne Bay Province.

A number of species flower and fruit in a predictable manner from year to year. These include sis (*Pangium edule*) where the harvesting season for nuts is most commonly reported as commencing in May or June (Table 49); marita pandanus fruit (*Pandanus conoideus*) where the start of the harvesting period is dependent on altitude (temperature), but appears to be constant from year to year for each location (Table 39, Figures 14 and 92); and purple passionfruit (*Passiflora edulis f. edulis*) where the fruit are available in the highlands from January or February for several months (Figures 15, 27 and 56; Table 40). Daylength varies in a predictable manner from year to year, whereas seasonal temperature and rainfall changes are generally more variable and somewhat less predictable, except for temperature changes at locations further from the equator. Hence, it is likely that daylength is the main determinant of flowering for species that have a predictable and marked seasonal production pattern. A number of environmental factors may interact to determine flowering onset (Rathcke and Lacey, 1985:190). This may be the situation in the case of marita pandanus. For that crop, it is likely that both changes in daylength and temperature differences associated with altitude determine the start and duration of the fruiting season.

For a number of species, there is no predictable season in much of PNG, except in the far south-east in MBP, where these species appear to fruit seasonally. This seems to be the situation for breadfruit (*Artocarpus altilis*) (Table 34a) and Polynesian chestnut (*Inocarpus fagifer*) (Table 48). It is likely that changes in daylength are sufficiently great at these latitudes to create a seasonal fruiting pattern. However, changes in daylength at locations nearer the equator are likely to be too small to induce a regular flowering season.

For okari nut (*Terminalia kaernbachii*), there is a very clear relationship between latitude and the start of the harvesting period, with the season commencing earlier nearer the equator and progressively later at higher latitudes (Figure 93). A similar pattern occurs with galip nut (*Canarium indicum*) where this relationship holds as far south as Vanuatu at about 17° 30'S. (Figure 93). Some observations for galip nut do not fit this pattern at 3-4°S and the relationship between the start of the production period and latitude may only hold south of 4°S.

Temperature

Altitude has the greatest influence on temperature regime in PNG (McAlpine *et al.*, 1983:91-92). There is a regular rate of decline of temperature with altitude above 500 m, with a 0.5° C decline in temperature for every 100 m increase in altitude. Other factors which have a relatively small influence on temperature are physiography (physical geography) and latitude. Seasonal temperature ranges are somewhat greater at locations further from the equator and these differences are reinforced where most rainfall occurs in the south-east wind season (May-September) which coincides in time with the Southern Hemisphere winter (McAlpine *et al.*, 1983: 96-97).

The marked differences in temperature associated with altitude change allow the influence of temperature (altitude) to be examined. For a number of fruit trees, altitude has no apparent influence on the start and duration of the production period. This is the case for avocado (*Persea americana*) where the fruiting pattern is similar in all lowland, intermediate altitude and highland locations over a wide range of rainfall regimes (Figures 13, 20 and 31). Data on mandarin (*Citrus reticulata*) are available from a number of locations in the lowlands, intermediate altitude zone and the highlands (Figures 14, 25 and 52). For all locations, the main producing period is May-August, with no indication of significantly different patterns in these three altitude zones. Recordings are available for orange (*Citrus sinensis*) for a number of intermediate altitude and highland locations (Figures 14, 26 and 53). As with mandarin, the producing pattern appears to be similar in both altitudinal zones. Purple passionfruit (*Passiflora edulis f. edulis*) bears over an altitudinal range of 800 to 2300 m in PNG. Data from locations in the highland and intermediate altitude zones do not suggest that the fruiting season varies with altitude (Figures 15, 27 and 56; Table 40).

In contrast, a number of fruit bear in a non-seasonal manner in the lowlands, but bear seasonally in the highlands. Pawpaw *(Carica papaya),* guava *(Psidium guajava)* and carambola (five corner) *(Averrhoa carambola)* do not appear to bear in a seasonal pattern in the lowlands, but are seasonal near the crops' upper altitudinal limits in the highlands. More pawpaw fruit are available in August-October in the Goroka and Kainantu areas at 1400-1600 m than during other periods (Figures 15, 27 and 57); while guava supply is very seasonal in the Goroka and Kainantu areas (Figures 13 and 24). Carambola production is non-seasonal at Keravat in the wet lowlands (Figure 87), but seasonal in the Wau and Goroka areas at 1200-1400 metres. However for guava and carambola, lowland longitudinal data are restricted to Keravat where rainfall seasonality is very weak. It is possible that these two crops may display a greater seasonal pattern in lowland locations with a more marked seasonal rainfall distribution.

The data for lime (*Citrus aurantifolia*) is somewhat ambiguous because of possible mis-identification in some of the surveys. It seems that the supply of limes is somewhat seasonal in the seasonally dry lowlands and the intermediate altitude zone, and probably in the seasonally dry highlands (Figures 25, 50). In one weakly seasonal lowland environment at least (Keravat), long-term experimental data indicates that the supply varies over time, but not in a seasonal manner.

There is also an interaction between temperature and the start/duration of the fruiting period for marita pandanus (*Pandanus conoideus*). For that crop, observations are available over a wide altitudinal range, which increases one's confidence in the relationship (Figure 14; Table 39). Near sea level, production is continuous and non-seasonal. The producing period becomes shorter with increasing altitude, and it is only four months long at 1600-1700 m near the crop's upper altitudinal limit (Figure 92).

For three introduced vegetables, the supply pattern appears to depend on the environment in which they are grown. For eggplant (*Solanum melongena*), the supply appears to be non-seasonal in the seasonally dry and lower altitude Wau and Port Moresby areas, but clearly seasonal in the highland

locations of Kainantu and Goroka (Figures 23 and 46). Pumpkin fruit (*Curcurbita moschata*) exhibit a similar pattern. Production is seasonal in the intermediate altitude or highland centres of Wau, Kainantu, Goroka, Mt Hagen and the Nembi Plateau, but only weakly seasonal in the lowland centres of Rabaul, Madang, Lae and Port Moresby (Figures 12, 28, 61 and 82). The supply of capsicum (*Capsicum annuum var. grossum*) appears to exhibit the opposite pattern. It seems to be non-seasonal in the highland areas of Kainantu, Goroka and Mt Hagen but seasonal in the seasonally drier, and lower altitude, locations of Wau and Port Moresby (Figures 9, 21 and 38). However, the data for capsicum may be less reliable than for eggplant and pumpkin as there are fewer observations.

An experimental study at Keravat on environmental triggers to flowering of rough leaf pineapple concluded that flowering is initiated by low night temperatures, and not other environmental changes (Bourke, 1976b). The data presented here is consistent with that conclusion, particularly the very inconsistent start to the fruiting period between years and the similar fruiting pattern at locations with very different rainfall patterns (Figures 17, 28, 58, 81 and 89; Table 41). Changes in minimum temperature at the latitude of Keravat (4° 21'S) are small throughout the year, but are sufficient to initiate flowering. For that study, the mean minimum temperatures ranged from 20.4° to 23.3° C (Bourke, 1976b).

Rainfall

Papua New Guinea is one of the wettest regions on earth. Average annual rainfall varies from about 1000 mm (at Port Moresby) to nearly 10,000 mm, with most of PNG receiving 2000-4000 mm per year. There is no association between rainfall and altitude on a country-wide level, but there is commonly a relationship at a local level. Three broad patterns of rainfall seasonality distribution can be distinguished. In most of PNG, rainfall distribution is seasonal with the maximum in January-April and the minimum in May-August. Parts of the country have the reverse pattern, with the highest rainfall in May-August. In the third pattern, there is little rainfall seasonality, that is, all months are wet (after McAlpine *et al.*, 1983:61-70).

Changes in the rainfall patterns frequently occur over short distances, often with all three patterns occurring in nearby locations, for example, between the north and south coast of New Britain; on the Gazelle Peninsula of New Britain; in Milne Bay Province; in the eastern part of Gulf Province and the western part of Central Province; in the Lae-Nadzab area or the Finschhafen-Sialum area of Morobe Province; on Bougainville and Buka Islands; and between the Eastern Highlands and locations further to the west. Over short distances of some tens of kilometres only, changes in daylength and seasonal temperature differences (latitude related) are negligible. Thus the major changes in the rainfall seasonality pattern allow the influence of rainfall on crop seasonality to be examined for certain crops.

In general, rainfall seasonality has only a limited effect on the flowering and fruiting behaviour of perennials, such as fruit and nut trees. For example, in Milne Bay Province, the production period is the same for many fruit and nut species in locations which receive more rain in January-April, such as the Cape Vogel-Rabaraba area; those which receive most in May-August, such as the Alotau-Suau coast area; and locations where rainfall distribution is only very weakly seasonal, such as most of the islands of the province. Similarly there is no change in seasonal production patterns in many other locations in PNG where the rainfall seasonality varies markedly over a short distance.

However, rainfall seasonality does influence the timing of clearing fallow land for food gardens and the planting of these "new" gardens. (This is distinct from replanting of existing gardens which are rarely planted seasonally, except for certain crops such as yam, cucumber, winged bean and watermelon). In much of PNG, fallow land is cleared at the end of the drier months and then planted in about October-December. This results in the seasonal availability of many traditional vegetables, for example aibika (*Abelmoschus manihot*) and amaranthus (*Amaranthus* spp.). However, for a significant part of PNG, gardens are not planted seasonally and the supply of arable foods is generally not seasonal.

For a limited number of crops, rainfall seasonality influences disease and insect pests and thus determines the optimum time for planting. This appears to be the situation for a number of cucurbits, including cucumber (*Cucumis sativus*), watermelon (*Citrullus lanatus*) and rockmelon (*Cucumis melo*). The limited information indicates that successful rockmelon crops can be had from plantings made at the end of the wetter months in about April-May and harvested towards the end of the drier months in August-November. The situation for watermelon is similar, where it is necessary to plant in the drier months and harvest during the wetter months in December-March to obtain a successful crop.

In the case of winged bean (*Psophocarpus tetragonolobus*), the seasonal planting pattern is influenced by the main economic product which in turn is dependent on soil moisture. In the highlands, winged bean are grown primarily for the green beans. They are cultivated seasonally in the mixed vegetable gardens which are planted at the start of the wetter months in September-December. Beans are harvested some four months later. In parts of the Eastern and Western Highlands, other plantings are made in different sites and are managed primarily to produce tubers, although they do produce some green beans also. These plantings are made in better drained sites; they are grown on short (ca 1 m) stakes rather than the taller (1.5-1.8 m) stakes used when green beans are the main product; flowers are often pruned to promote tuber production; and they are planted in the drier months in May-July in the Eastern Highlands rather than at the start of the wetter months in September-December.

Development and maturation of mango (*Mangifera indica*) fruit is dependent on both seasonal temperature and rainfall changes (Cull, 1991:60). In PNG, mango bear during the same period (October-January) in all locations, irrespective of the timing of the rainfall seasonality pattern, although the pattern varies from year to year for any location (Figure 90; Table 38). Rainfall does have an influence in that the highest yields occur in locations with a marked dry season, such as coastal Central Province, the southern part of Western Province, the Rabaraba-Cape Vogel area of Milne Bay Province, the upper Markham Valley, the Sialum area on the Huon Peninsula, the western end of Umboi Island and the eastern part of the north-east lowlands of the Gazelle Peninsula of New Britain. This may be related to the incidence of disease. The fact that the seasonal production pattern is broadly similar in locations with very different rainfall seasonality patterns suggest that seasonal temperature changes are an important flowering trigger for mango in PNG.

For the three locations where observations are available over a six-year period (Rabaul, Markham Valley and the Port Moresby area) (Figure 90, Table 30), there exists a relationship between the period of lower rainfall and the start of the harvesting period. This relationship holds between locations and between years for any given location. For example, for the Port Moresby area for the period 1980-1985, there was a 5-6 month lag between the start of the drier months each year and the start of the harvest period.

Periods of lower soil moisture influence the bearing of karuka nut (*Pandanus julianettii*). In the Eastern Highlands, where rainfall distribution is seasonal, production is more regular and approaches a regular seasonal pattern. In the western part of the highlands, where rainfall seasonality is very weak or non-existent, production is much less regular. Where observations are available for six widely scattered highland locations for the period 1978-1985, fruiting was only synchronised twice at all six locations. Both occasions followed a drought.

Influence of the Agricultural System

For some annual crops, the seasonality is very dependent on the agricultural system. Taro (*Colocasia esculenta*) is a case in point. In much of PNG, the supply of taro does not vary seasonally. However, for many locations, especially on the north side of the central highlands and along the north coast, taro tends to be planted at the start of the wetter months in about October-November and is thus most abundant for a number of months from May onwards. The supply of sweet potato varies throughout the year in highland locations, sometimes very markedly. This is determined by environmental changes,

especially in soil moisture, and the planting rate which can vary significantly within a year. Despite there being a tendency for the best supply to occur at about the same time of the year, there is no predictable seasonal variation in sweet potato supply.

The pattern for common bean (*Phaseolus vulgaris*) also illustrates the influence of the agricultural system on crop seasonality. Common bean tend to be planted on more fertile sites and particularly in seasonally-planted mixed vegetable gardens in the highlands. Where soil fertility is low in the sweet potato gardens in the highlands, as on the Nembi Plateau, beans are only planted in the mixed gardens. Hence the supply at this location is markedly seasonal (Figure 9). Where soil fertility in the sweet potato gardens is greater, as in much of the Eastern Highlands, they are planted in both the non-seasonal sweet potato gardens and in the seasonal mixed gardens. In the case of traditional vegetable production in the highlands, there also appears to be a relationship between the intensity of land use and the seasonality of supply. Where land use is more intensive, there is a tendency for most vegetables to be planted seasonally in mixed gardens and thus the supply of these foods is more seasonal. Where land use is less intensive, there is less or no use made of this garden type and the supply of vegetables is less seasonal.

Hence in the Goroka and Kainantu areas, production of common bean is seasonal, but less so than on the Nembi Plateau (Figures 9, 20 and 34). This is despite the fact that rainfall is seasonally distributed in the Goroka and Kainantu areas, but it is non-seasonal on the Nembi Plateau. Thus production of common bean, as with many other annuals, is more seasonal in this non-seasonal environment than in other highland locations where rainfall is distributed seasonally. The difference reflects variation in how crops are managed within the agricultural system rather than seasonal environmental changes.

The supply of corn (maize) varies seasonally in all environments for which data are available in PNG (Figures 2, 23, 44 and 78). Again this reflects planting of gardens after fallows in October-December, especially mixed gardens in the highlands, rather than any inherent seasonality in the crop itself. Under experimental conditions, good yields of corn can be achieved with plantings made throughout the year, provided that soil moisture is adequate.

Seasonality within Commodity Groups

Comment is now offered on the seasonal production patterns for the different commodity groups. In general the perennial crops, that is trees and vines, tend to produce flowers, fruit and sometimes new leaves in a seasonal manner. There is less real seasonality in production of annual crops in PNG, although some do produce seasonally. In general, the agricultural system, rather than environmental factors, has a greater influence on the production pattern for annual crops. Note, however, that the agricultural system devised by villagers is partly a response to seasonal environmental changes, mainly in rainfall.

Starchy Foods

The supply of most of the starch foods does not vary seasonally. This is the case for banana, cassava, potato, sugarcane, sweet potato and Chinese taro. As noted above, taro is planted and harvested seasonally in some locations but not in others, depending on the agricultural system. Yams are planted and harvested seasonally everywhere in PNG. The most common planting period is September-December with some variation between locations. For some places, people make certain plantings earlier (early yam gardens) than the main gardens, suggesting some flexibility in management of the crop. In contrast, the supply of corn is seasonal for all locations for which data are available, and it is suggested that this is a result of the agricultural system rather than the cycle of the crop itself.

Traditional Vegetables

Most of the data are for highland locations although, for lowland pitpit (*Saccharum edule*) and aibika (*Abelmoschus manihot*), there is data from both lowland and highland locations. Of the most important species, five are available in a non-seasonal manner and eight are available seasonally.

Introduced Vegetables

Production of most (20 species) of the important introduced vegetables is non-seasonal. Common bean is the only introduced vegetable where production is markedly seasonal in both the lowlands and the highlands. The supply of tomato appears to be weakly seasonal in two locations only (Port Moresby and Kainantu), but this may not be a real effect. The supply of zucchini is weakly seasonal in both the lowlands and highlands. For a number of vegetables, the pattern differs between the lowlands and highlands. This is the case for eggplant, pumpkin fruit and capsicum, as discussed above.

Fruit

About two thirds (44 species) of fruit trees produce fruit seasonally in PNG and one third in a non-seasonal manner. For two fruits, the pattern is only weakly seasonal. These are lemon (*Citrus limon*) and grapefruit (*Citrus paradisi*). Of the 21 species where the available information does not indicate a seasonal pattern, 12 are restricted to experimental plantings in a weakly seasonal environment at Keravat, and it is possible that they may bear seasonally in other environments. Five highland species do not bear seasonally, being cape gooseberry (*Physalis peruviana*), elder (*Sambucus nigra*), naranjilla (*Solanum quitoense*), highland yellow passionfruit (*Passiflora ligularis*) and black raspberry (*Rubus lasiocarpus*). The other non-seasonal fruit species are *Parartocarpus venenosa* on New Britain, rukam (*Flacourtia rukam*) in Milne Bay, soursop (*Annona muricata*) and pomelo (*Citrus maxima*). As discussed above, a number of species have a different pattern in different environments. These are pawpaw, guava, carambola and lime.

Nuts

Most nut bearing plants produce nuts seasonally. Fourteen species, 13 trees and peanuts, bear seasonally in PNG. Another three species bear in a non-seasonal pattern. Coconuts bear continuously, while breadnut (*Artocarpus camansi*) and pao nut (*Barringtonia procera*) bear in an intermittent, but non-seasonal manner. As discussed above, another three species seem to bear seasonally in some environments, but non-seasonally in others. These are breadfruit, Polynesian chestnut and karuka nut.

Narcotics

Four crops used as narcotics bear seasonally in PNG. These are betel nut (*Areca catechu*), highland betel nut *(Areca macrocalyx),* highland betel pepper leaves (*Piper gibbilimbum*) and lowland betel pepper fruit (*Piper betle*), although betel nut supply is not markedly seasonal. The supply of tobacco *(Nicotiana tabacum)* in two highland locations at least is non-seasonal.

Export Cash Crops

All of the main export crops produce throughout most of the year in PNG, with production being markedly seasonal for Arabica coffee, somewhat seasonal for cocoa and weakly seasonal for pyrethrum (Appendix 1). Robusta coffee is not seasonal at Keravat in a weakly seasonal environment, but it is reported to be seasonal in a more seasonal environment in Milne Bay at about 10° S. Flowering and seeding of *Casuarina oligodon* is also seasonal in the Eastern Highlands at least. In contrast, coconut does not produce in a seasonal manner and there is insufficient data available for cardamom to make a judgement.

REFERENCES

Aburu, K. (1982). Notes on some fruit and nut trees in the Keravat area of East New Britain. In: Bourke, R.M. and Kesavan, V. (eds) *Proceedings of the Second Papua New Guinea Food Crops Conference.* Department of Primary Industry, Port Moresby. pp 101-122.

Allen, B. (1989a). Frost and drought through time and space, Part 1: the climatological record. *Mountain Research and Development* 9(3):252-278.

Allen, B.J. (1989b). Dynamics of fallow successions and introduction of Robusta coffee in shifting cultivation areas in the lowlands of Papua New Guinea. In: Nair, P.K.R. (ed) *Agroforestry Systems in the Tropics.* Kluwer Academic Publishers, Dordrecht. pp 277-290.

Allen, B.J. and Bourke, R.M. (1988). Some observations on expenditure and consumption patterns in rural Papua New Guinea. *Pacific Economic Bulletin* 3(1):26-29.

Allen, B.J., Hide, R.L., Bourke, R.M., Fritsch, D., Grau, R., Lowes, E., Nen, T., Nirsie, E., Risimeri, J. and Woruba, M. (1993). East Sepik Province: Text Summaries, Maps, Code Lists and Village Identification. *Agricultural Systems of Papua New Guinea Working Paper No. 2.* Department of Human Geography, Australian National University, Canberra.

Allen, B.J., Hide, R.L., Bourke, R.M., Fritsch, D., Grau, R., Hobsbawn, P., Levett, M.P., Majnep, I.S., Mangi, V., Nen, T. and Sem, G. (1994). Madang Province: Text Summaries, Maps, Code Lists and Village Identification. *Agricultural Systems of Papua New Guinea Working Paper No. 7.* Department of Human Geography, Australian National University, Canberra.

Allen, B.J., Nen, T., Bourke, R.M., Hide, R.L., Fritsch, D., Grau, R., Hobsbawn, P., and Lyon, S. (1996). Central Province: Text Summaries, Maps, Code Lists and Village Identification. *Agricultural Systems of Papua New Guinea Working Paper No. 15.* Department of Human Geography, Australian National University, Canberra.

Allen, M. (1991). Cashews in Papua New Guinea. In: Bala, A.A. (ed) *Proceedings of the Papua New Guinea First International Fruit Conference.* Department of Agriculture and Livestock, Port Moresby. pp 169-180.

Allen, M.G. (2001). *Change and continuity: land use and agriculture on Malo Island, Vanuatu.* MSc Thesis. The Australian National University, Canberra.

Antonio, W.C. (1986). Rock melons as a cash crop in the Markham Valley. *Harvest* 12(1):5-9.

Askin, D.C., Boland, D.J. and Pinyopusarerk, K. (1990). Use of *Casuarina oligodon* subsp. *abbreviata* in agroforestry in the North Baliem Valley, Irian Jaya, Indonesia. In: El-Lakany, M.H., Turnbull, J.W. and Brewbaker, J.L. (eds) *Advances in Casuarina Research and Utilization: Proceedings of the Second International Casuarina Workshop.* Desert Development Center, Cairo. pp 213-219.

Ataia, A. (1983). *Casuarina oligodon* in the Eastern Highlands Province - Papua New Guinea. In: Midgley, S.J., Turnbull, J.W. and Johnson, R.D. (eds) *Casuarina Ecology Management and Utilization.* Commonwealth Scientific and Industrial Research Organisation, Melbourne. pp 80-88.

Bala, A.A. and Claydon, A. (1976). The winged bean in Papua. *Science in New Guinea* 4(3):142-144.

Bala, A.A. and Stephenson, R.A. (1980). The genetics and physiology of tuber production in winged bean. In: *The Winged Bean.* Philippine Council for Agriculture and Resources Research, Los Baños. pp 63-70.

Bawa, K.S. (1983). Patterns of flowering in tropical plants. In: Jones, C.E. and Little, R.J. (eds) *Handbook of Experimental Pollination Biology.* Von Nostrand Reinhold Co., New York. pp 394-410.

Bell, F.L.S. (1948). The place of food in the social life of the Tanga. *Oceania* 18(3):233-247.

Bonnemère, P. (1992). *Le casoar, Ie pandanus rouge et l'anguille: difference des sexes, substances et parenté chez les Ankave-Anga (Papouasie Nouvelle-Guinée).* Ph. D. Thesis. E.H.E.S.S., Paris.

Bourke, R.M. (1976a). Making pineapples fruit. *Harvest* 3(4):122-126.

Bourke, R.M. (1976b). Seasonal influences on fruiting of rough leaf pineapples. *Papua New Guinea Agricultural Journal* 27(4):103-106.

Bourke, R.M. (1988). Taim hangre: *Variation in subsistence food supply in the Papua New Guinea highlands.* Ph. D. Thesis. The Australian National University, Canberra.

Bourke, R.M. and Lea, D.A.M. (1982). Subsistence horticulture. In: Carrad, B., Lea, D.A.M. and Talyaga, K.K. (eds) *Enga: Foundations for Development.* University of New England, Armidale. pp 76-92.

Bourke, R.M. and Nema, P.K. (1985). Surveys of three food markets in the Kainantu area, Eastern Highlands. *Technical Report 85/6.* Department of Primary Industry, Port Moresby.

Bourke, R.M., Allen, B.J., Hide, R.L., Fereday, N., Fritsch, D., Gaupu, B., Grau, R., Hobsbawn, P., Levett, M.P., Lyon, S., Mangi, V. and Sem, G. (1997). Morobe Province: Text Summaries, Maps, Code Lists and Village Identification. *Agricultural Systems of Papua New Guinea Working Paper No 19.* Department of Human Geography, Australian National University, Canberra.

Brass, L.J. (1956). Results of the Archbold Expeditions. No. 75. *Bulletin of the American Museum of Natural History* 111(2):77-152.

Bridgland, L.A. (1953). Study of the relationship between cocoa yield and rainfall. *Papua and New Guinea Agricultural Gazette* 8(2):7-14.

Brookfield, H.C. (1969). *Pacific Market-Places.* Australian National University Press, Canberra.

Brough, E.J. (1983). Seasonal changes in the damage caused by the citrus leaf miner, *Phyllocnistis citrella* (Lepidoptera: Phyllocnistidae) in a lowland orchard in Papua New Guinea. *Science in New Guinea* 10(3):166-171.

Brough, E.J. and Rogers, A. (1982). Citrus cultivation in villages on the Kokoda Trail in Central Province. *Science in New Guinea* 9(3):167-175.

Buchbinder, G. (1973). *Maring microadaptation: a study of demographic, nutritional, genetic, and phenotypic variation in a highland-New Guinea population.* Ph. D. Thesis. Columbia University, New York.

Byrne, P.N. (1984). *Department of Primary Industry Crop Research Report for the Period July 1969 to December 1982*. Department of Primary Industry, Port Moresby.

Camarotto, C. and Bourke, R.M. (1994). Potential for exporting fruit from Papua New Guinea to overseas markets during their off-seasons. *Papua New Guinea Journal of Agriculture, Forestry and Fisheries* 37(2):2-13.

Cape, N. (1981). Agriculture. In: Weeks, S.G. (ed) Oksapmin: Development and Change. *E.R.U. Occasional Paper No. 7.* Educational Research Unit, Port Moresby. pp 149-190.

Carrad, B. (1982). The economy. In: Carrad, B., Lea, D.A.M. and Talyaga, K.K. (eds) *Enga: Foundations for Development.* Department of Geography, University of New England, Armidale. pp 146-178.

Charles, A.E. (1972). Passionfruit industry. In: Ryan, P. (ed) *Encyclopaedia of Papua and New Guinea.* Melbourne University Press, Melbourne. pp 892-894.

Cheung, P. (1980). Subsistence agriculture in Milne Bay Sub-District. In: Six Studies in Subsistence Agriculture. *Extension Bulletin. No. 11.* Department of Primary Industry, Port Moresby. pp 9-14.

Christie, M. (1980). Changing Consumer Behaviour in Papua New Guinea: its Social and Ecological Implications. *Report No. 3.* Centre for Resource and Environmental Studies, Australian National University, Canberra.

Clarke, W.C. (1971). *Place and People. An Ecology of a New Guinean Community.* Australian National University Press, Canberra.

Coenan, J. and Barrau, J. (1961). The breadfruit tree in Micronesia. *South Pacific Bulletin* Oct. 1961:37-39.

Coronel, R.E. (1994). *Promising Fruits of the Philippines.* College of Agriculture, University of the Philippines, Los Baños.

Crocombe, R.G. and Hogbin, G.R. (1963). Land, work and productivity at Inonda. *New Guinea Research Bulletin No 2.* New Guinea Research Unit, Australian National University, Canberra.

Cull, B.W. (1991). A whole plant approach to productivity research for mango. In: Bala, A.A. (ed) *Proceedings of the Papua New Guinea First International Fruit Conference.* Department of Agriculture and Livestock, Port Moresby. pp 57-65.

Densley, D.R.J. (1978). Marketed fruit and vegetables. In: Densley, D.R.J. (ed) *Agriculture in the Economy.* Department of Primary Industry, Port Moresby.

Dornstreich, M.D. (1973). *An ecological study of Gadio Enga (New Guinea) subsistence.* Ph. D. Thesis. Columbia University, New York.

DPI (1983). *Lowlands Agricultural Experiment Station Annual Report 1982.* Department of Primary Industry, Port Moresby.

Dwyer, P.D. (1985). The contribution of non-domesticated animals to the diet of Etolo, Southern Highlands Province, Papua New Guinea. *Ecology of Food and Nutrition* 17:101-115.

Dwyer, P.D. (1990). *The Pigs that Ate the Garden: A Human Ecology from Papua New Guinea.* University of Michigan Press, Ann Arbor.

Dwyer, R.E.P. (1940). Some investigations on coco-nut diseases associated with soil conditions in New Guinea. *New Guinea Agricultural Gazette* 6(1):2-37.

Epstein, T.S. (1982). *Urban Food Marketing and Third World Development.* Croom Helm, London.

Evans, B.R. (1991). A variety collection of edible nut tree crops in Solomon Islands. *Research Bulletin No. 8.* Dodo Creek Research Station, Ministry of Agriculture and Lands, Honiara.

Evans, B.R. (1994). *Marketing Galip Nut* (Canarium *spp.) in Kandrian & Gloucester Districts, West New Britian, Papua New Guinea.* Project Design & Management Pty Ltd, Canberra.

Fajans, J. (1985). *They make themselves: life cycle, domestic cycle and ritual among the Baining.* Ph. D. Thesis. Stanford University, California.

French, B.R. (1986). *Food Plants of Papua New Guinea: a Compendium.* Published privately, Sheffield, Tasmania.

Freund, P.J. (1977). *Social change among the Kasua, Southern Highlands, Papua New Guinea.* Ph. D. Thesis. University of Iowa, Iowa City.

Gell, A. (1975). Metamorphosis of the Cassowaries. Umeda Society, Language and Ritual. *London School of Economics Monographs on Social Anthropology No. 51.* Athlone Press, London.

Greindl, D. (1997). Du village à la ville. In: Galipaud, J.C. and Walter, A. (eds) *Forets Insulaires: rapport intermediaire du programme "Se nourrir à Santo".* Office de la Recherche Scientifique et Technique Outre-Mer and Avenir des Peuples des Forets Tropicales, Port Vila. pp 113-170.

Grossman, L.S. (1984). *Peasants, Subsistence Ecology, and Development in the Highlands of Papua New Guinea.* Princeton University Press, Princeton.

Grossman, L.S. (1991). Diet, income, and subsistence in an Eastern Highland Village, Papua New Guinea. *Ecology of Food and Nutrition* 26:235-253.

Harding, P.E. (1991a). Foliar nutrient level studies in fertilised coffee in the Eastern and Western Highlands Provinces of Papua New Guinea. *Coffee Research Report No. 7.* PNG Coffee Research Institute, Aiyura.

Harding, P.E. (1991b). Foliar nutrient level studies in smallholder coffee gardens in the Kainantu area of Papua New Guinea. *Coffee Research Report No. 6.* PNG Coffee Research Institute, Aiyura.

Hide, R.L. (1981). *Aspects of pig production and use in colonial Sinasina, Papua New Guinea.* Ph. D. Thesis. University of Columbia, New York.

Hide, R.L. (1985). Notes on subsistence agriculture (farming systems) in West New Britain and New Ireland Provinces: Report on a field trip to Papua New Guinea, 14 November 1984 to 14 December 1984. Unpublished report, Division of Water and Land Resources, CSIRO, Canberra.

Hide, R., Kimin, M., Kora, A., Kua, G. and Kua, K. (1979). A checklist of some plants in the territory of the Sinasina Nimai (Simbu Province, Papua New Guinea), with notes on their uses. *Working Papers in Anthropology, Archaeology, Linguistics and Maori Studies No. 54.* Department of Anthropology, University of Auckland.

Hide, R.L., with Goodbody, S. and Gertru, G. (1984). Agriculture. In: Hide, R.L. (ed) *South Simbu: Studies in Demography, Nutrition, and Subsistence.* Research Report of the Simbu Land Use Project, Volume VI. Institute of Applied Social and Economic Research, Port Moresby. pp 207-289.

Hide, R.L., Bourke, R.M., Allen, B.J., Betitis, T., Fritsch, D., Grau, R., Kurika, L., Lowes, E., Mitchell, D.K., Rangai, S.S., Sakiasi, M., Sem, G. and Suma, B. (1994). Milne Bay Province: Text Summaries, Maps, Code Lists and Village Identification. *Agricultural Systems of Papua New Guinea Working Paper No. 6.* Department of Human Geography, Australian National University, Canberra.

Hide, R.L., Bourke, R.M., Allen, B.J., Akus, W., Fritsch, D., Grau, R., Hobsbawn, P., Igua, P., Kameata, R., Lyon, S. and Miskaram, N. (1996). New Ireland Province: Text Summaries, Maps, Code Lists and Village Identification. *Agricultural Systems of Papua New Guinea Working Paper No 17.* Department of Human Geography, Australian National University, Canberra.

Hogbin, H.I. (1938-39). Tillage and collection: a New Guinea economy. *Oceania* 9:127-151,286-325.

Howcroft, N.H.S. (1992). Multipurpose tree species profile *Terminalia impediens* Coode. (Combretaceae). *Klinkii* 4(4):30-37.

Howlett, D., Hide, R. and Young, E. with Arba, J., Bi, H. and Kaman, B. (1976). *Chimbu: Issues in Development.* Development Studies Centre, Australian National University, Canberra.

Hviding, E. and Bayliss-Smith, T. (2000). *Islands of Rainforest: Agroforestry, logging and eco-tourism in the Solomon Islands*. Ashgate Publishing Ltd, Aldershot.

Hyndman, D.C. (1979). *Wopkaimin subsistence: cultural ecology in the New Guinea highland fringe.* Ph. D. Thesis. University of Queensland, Brisbane.

Hyndman, D.C. (1984). Ethnobotany of Wopkaimin *Pandanus:* significant Papua New Guinea plant resource. *Economic Botany* 38(3):287-303.

Jeffries, D. J. (1978). From Kaukau to Coke: A Study of Rural and Urban Food Habits in Papua New Guinea. *Report No. 1.* Centre for Resource and Environmental Studies, Australian National University, Canberra.

Jolly, L., Beck, A. and Bodman, P. (1990). Commodity price stabilisation in Papua New Guinea. *ABARE Discussion Paper 90.2.* Australian Bureau of Agricultural and Resource Economics, Canberra.

Kahn, M. (1986). *Always Hungry, Never Greedy. Food and the Expression of Gender in a Melanesian Society.* Cambridge University Press, Cambridge.

Khan, T.N., Bohn, J.C. and Stephenson, R.A. (1977). Winged beans: cultivation in Papua New Guinea. *World Crops and Livestock* 39(5):208-214.

Kelly, R.C. (1977). *Etoro Social Structure. A Study in Structural Contradiction.* University of Michigan Press, Ann Arbor.

Kesavan, V. and Kambuou, R.N. (1991). Fruit crop genetic resources of Papua New Guinea. In: Bala, A.A. (ed) *Proceedings of the Papua New Guinea First International Fruit Conference.* Department of Agriculture and Livestock, Port Moresby. pp 19-27.

Lepofsky, D. (1992). Arboriculture in the Mussau Islands, Bismarck Archipelago. *Economic Botany* 46(2):192-211.

Lea, D.A.M. (1964). *Abelam land and subsistence. Swidden horticulture in an area of high population density, Maprik, New Guinea.* Ph. D. Thesis. The Australian National University, Canberra.

Lewis, G. (1975). *Knowledge of Illness in a Sepik Society. A Study of the Gnau, New Guinea.* Athlone Press, London.

Luyken, R. and Luyken-Koning, F.W.M. (1955). Nutritional state of the Marind-Amin tribe in South New Guinea. *Documenta de Medicina Geographica et Tropica (Amsterdam)* 7:315-339.

Majnep, I.S. and Bulmer, R. (1983). Some food plants gathered in our Kalam forests, Papua New Guinea. *Working Papers in Anthropology, Archaeology, Linguistics and Maori Studies No. 63.* Department of Anthropology, University of Auckland.

Malinowski, B. (1935). *Coral Gardens and their Magic. Volume 1. Soil-Tilling and Agricultural Rites in the Trobriand Islands.* Indiana University Press, Bloomington.

Massal, E. and Barrau, J. (1956). Food Plants of the South Sea Islands. *Technical Paper No.* 94. South Pacific Commission, Noumea.

McAlpine, J.R. and Keig, G. with Falls, R. (1983). *Climate of Papua New Guinea.* Australian National University Press, Canberra.

McGee, T.C., Ward, R.G. and Drakis-Smith, D.W. (eds). (1980). Food Distribution in the New Hebrides. *Development Studies Centre Monograph No. 25.* The Australian National University Development Studies Centre and the University of the South Pacific Centre for Applied Studies in Development, Canberra.

McKillop, R.F. (1981). Agricultural policy-making. In: Ballard, J.A. (ed) *Policy-making in a New State. Papua New Guinea* 1972-77. University of Queensland Press, Brisbane. pp 238-256.

Miklouho-Maclay, N. de (1885). List of plants in use by the natives of the Maclay-coast, New Guinea. *Proceedings of the Linnean Society of NSW* 10(3):346-358.

Mogina, J. (2002). *Changing knowledge of plants in transitional societies at Milne Bay, Papua New Guinea.* Ph. D. Thesis. The Australian National University, Canberra.

Morren, *G.E.B.* (1979). Seasonality among the Miyanmin: wild pigs, movement and dual kinship organization. *Mankind* 12(1):1-12.

Naki, G. (1991). Enga fruit and nut project. In: Bala, A.A. (ed) *Proceedings of the Papua New Guinea First International Fruit Conference.* Department of Agriculture and Livestock, Port Moresby. pp 36-42.

Nitsche, J.J. (1971). The growing of passion fruit. *Harvest* 1(2):56-60.

Obrist van Eeuwijk, B. (1992). Small but Strong. Cultural Contexts of (Mal-) Nutrition among the Northern Kwanga (East Sepik Province, Papua New Guinea). *Basler Beiträge zur Ethnologie Band 34.* Ethnologisches Seminar der Universität und Museum für Völkerkunde, Basel.

Ohtsuka, R. (1983). *Oriomo Papuans. Ecology of Sago-Eaters in Lowland Papua.* University of Tokyo Press, Tokyo.

Oliver, D.L. (1949). Land tenure in northeast Siuai, southern Bougainville, Solomon Islands. *Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University* 29(4):1-97.

Oliver, D.L. (1955). *A Solomon Island Society. Kinship and Leadership among the Siuai of Bougainville.* Harvard University Press, Cambridge.

Panoff, F. (1972). *Maenge gardens. A study of Maenge relationship to domesticates.* Ph.D. Thesis. The Australian National University, Canberra.

Peekel, P.G. (1984). *Flora of the Bismarck Archipelago for Naturalists.* E.E. Henty (translator). Office of Forests, Lae.

Powell, J.M. with Harrison, S. (1982). *Haiyapugwa: Aspects of Huli Subsistence and Swamp Cultivation. Occasional Paper No. 1 (New Series).* Department of Geography, University of Papua New Guinea.

Price, T.V., Drinkall, M.J. and Munro, P.E. (1982). Studies of the incidence, severity and distribution of false rust *(Synchytrium psophocarpi),* leaf spot *(Pseudocercospora psophocarpi)* and powdery mildew *(Oidium* sp.) on winged bean *(Psophopcarpus tetragonolobus)* in Papua New Guinea. *Annals of Applied Biology* 101(3):473-482.

Ragone, D. (1997). *Promoting the Conservation and Use of Underutilized and Neglected Crops. 10. Breadfruit* Artocarpus altilis *(Parkinson) Fosberg.* International Plant Genetic Resources Institute, Rome.

Rappaport, R.A. (1968). *Pigs for the Ancestors. Ritual in the Ecology of a New Guinea People.* Yale University Press, New Haven.

Rathcke, B. and Lacey, E.P. (1985). Phenological patterns of terrestrial plants. *Annual Review of Ecological Systems* 16:179-214.

Rogers, A.F. and Levett, M.P. (1994). Why pineapples grow. *Fresh Produce News* 86:1-5. Fresh Produce Development Company, Mount Hagen.

Rogers, A.F. and Movis, A. (1991). Recent developments in the Papua New Guinea Highlands citrus industry. In: Bala, A.A. (ed) *Proceedings of the Papua New Guinea First International Fruit Conference.* Department of Agriculture and Livestock, Port Moresby. pp 152-160.

Rose, C. J. (1982). Preliminary observations on the pandanus nut *(Pandanus julianettii* Martelli). In: Bourke, R.M. and Kesavan, V. (eds) *Proceedings of the Second Papua New Guinea Food Crops Conference.* Department of Primary Industry, Port Moresby. pp 160-167.

Sexton, L.D. (1986). *Mothers of Money, Daughters of Coffee: The Wok Meri Movement.* UMI Research Press, Ann Arbor, Michigan.

Shaw, R.D. (1990). *Kandila: Samo Ceremonialism and Interpersonal Relationships.* University of Michigan Press, Ann Arbor.

Sillitoe, P. (1983). *Roots of the Earth. Crops in the Highlands of Papua New Guinea.* New South Wales University Press, Sydney.

Smith, A.C. (1985). Flora Vitiensis Nova: A New Flora of Fiji (Spermatophytes only). Vol.3. Pacific Tropoical Botanical Gardens, Lawaii.

Strathern, A. (1976). Some notes on the cultivation of winged beans in two highlands areas of Papua New Guinea. *Science in New Guinea* 4(3):145-152.

Sumbak, J.H. (1967). Recommendations for the cultivation of Robusta coffee *(Coffea canephora)* in the Territory of Papua and New Guinea. *Papua and New Guinea Agricultural Journal* 19(3):115-124.

Swadling, P., Araho, N. and Ivuyo, B. (1991). Settlements associated with the inland Sepik-Ramu sea. *Indo-Pacific Prehistory Association Bulletin* 11:92-112.

Tarepe, T.N. (1982). Naranjilla: a new fruit for the Highlands. *Harvest* 8(4):183-185.

Tarepe, T. and Bourke, R.M. (1982). Fruit crops in the Papua New Guinea highlands. In: Bourke, R.M. and Kesavan, V. (eds) *Proceedings of the Second Papua New Guinea Food Crops Conference.* Department of Primary Industry, Port Moresby. pp 86-100.

Thomas, G.S. (1982). Review of the prospects for food processing in Papua New Guinea. In: Bourke, R.M. and Kesavan, V. (eds) *Proceedings of the Second Papua New Guinea Food Crops Conference.* Department of Primary Industry, Port Moresby. pp 408-420.

van Beek, A.G. (1987). *The Way of All Flesh: Hunting and Ideology of the Bedamuni of the Great Papuan Plateau (Papua New Guinea).* University of Leiden, Leiden.

Waddell, E. (1972). *The Mound Builders. Agricultural Practices, Environment, and Society in the Central Highlands of New Guinea.* University of Washington Press, Seattle.

Waddell, E. (1989). Observations on the 1972 frosts and subsequent relief programme among the Enga of the Western Highlands. *Mountain Research and Development* 9(3):210-223.

Wagner, R. (1967). *The Curse of Souw. Principles of Daribi Clan Definition and Alliance in New Guinea.* University of Chicago Press, Chicago.

Waiko, J. and Jiregari, K. (1982). Conservation in Papua New Guinea: custom and tradition. In: Morauta, L., Pernetta, J. and Heaney, W. (eds) Traditional Conservation in Papua New Guinea: Implications for Today. *Monograph 16.* Institute of Applied Social and Economic Research, Port Moresby. pp 21-38.

Warry, W. (1982). *Bia* and *bisnis:* the use of beer in Chuave ceremonies. In: Marshall, M. (ed) Through a Glass Darkly: Beer and Modernization in Papua New Guinea. *Monograph 18.* Institute of Applied Social and Economic Research, Port Moresby. pp 83-103.

Weightman, B. (1989). *Agriculture in Vanuatu.* British Friends of Vanuatu, Cheam, Surrey.

Weiner, J.F. (1983). *The heart of the pearl-shell. The mythological dimension of Foi sociality.* Ph. D. Thesis. The Australian National University, Canberra.

Whan, J.H., Brown, J.S., Kenny, M.K. and Merriman, P.R. (1994). Development of strategies to control coffee leaf rust in Papua New Guinea. *Papua New Guinea Coffee* 10(1):6-10.

Whiteman, J. (1965). Customs and beliefs relating to food, nutrition and health in the Chimbu area. *Tropical and Geographical Medicine* 17:301-316.

Williams, F.E. (1976). Natives of Lake Kutubu, Papua. In: Schwimmer, E. (ed) *'The Vailala Madness' and Other Essays.* C. Hurst and Company, London. pp 161-330.

Wohlt, P.B. (1978). *Ecology, agriculture and social organization: the dynamics of group composition in the Highlands of Papua New Guinea.* Ph.D. Thesis. University of Minnesota, Minneapolis.

Wood, J.W. (1980). Mechanisms of demographic equilibrium in a small human population, the Gainj of PNG. Ph.D. Thesis. University of Michigan, Ann Arbor.

Woodhouse, S. (1991). Asian fruit in Papua New Guinea. In: Bala, A.A. (ed) *Proceedings of the Papua New Guinea First International Fruit Conference.* Department of Agriculture and Livestock, Port Moresby. pp 161-168.

Yen, D.E. (1974). Arboriculture in the subsistence of Santa Cruz, Solomon Islands. *Economic Botany* 28:247-284.

APPENDIX 1. SOURCES OF INFORMATION ON PRODUCTION PATTERNS OF EXPORT CASH CROPS IN PAPUA NEW GUINEA

There is some published information available on the production patterns for a number of export cash crops. It is not presented here as it is not derived from the data sources used for the food crops. The published information sources are noted and information on the seasonal patterns are summarised. There is a reasonable amount of literature for Arabica coffee, but only a limited amount available for other export cash crops.

Arabica coffee (*Coffea arabica*)

Production of Arabica coffee is highly seasonal in the Papua New Guinea Highlands, although some production occurs throughout the year. This is well documented in six publications (Table 51) and referred to in many others. The main production season varies a little between years and between locations, but is generally in the period May to September and particularly in June, July and August.

The marked seasonality of coffee production and the heavy reliance on coffee for cash income by Highland villagers means that cash income and expenditure is also very seasonal in the Highlands. The influence of income derived from coffee production on gambling, beer sales, alcohol related disputes, sales of petrol, various foods (including rice, tinned fish, soft drinks, bread) and food consumption is examined by: Christie (1980:29, 34-38, 86-107), Hide (1981:251-263, 622-628), Warry (1982:98), Grossman (1984:196-214), Sexton (1986), Bourke (1988:107-117, 328-330), Allen and Bourke (1988) and Grossman (1991).

It is a widely held view in Papua New Guinea that villagers' devotion of time to coffee production, particularly seasonal harvesting, results in neglect of food production and consequent food shortages. This hypothesis has been examined in detail by Bourke (1988:107-117) and rejected.

Epidemics of coffee rust are seasonal in the Papua New Guinea Highlands. Rust incidence is greatest between May and July (Whan *et al.*, 1994).

Cardamom (*Elettaria cardamomum*)

Twelve months of production data from the Mysore and Malabar varieties are presented from Malasaet Village (550 m), Baining Mountains, East New Britain by DPI (1983:54). For Mysore most production was between March and July in 1982 and Malabar had a similar pattern (February to July).

Casuarina (*Casuarina oligodon*)

Casuarina is an important tree in the New Guinea highlands. It provides timber for construction and firewood; enhances soil fertility as it fixes atmospheric nitrogen; reduces soil erosion; and is the most important shade crop for coffee. In the Baliem Valley of Irian Jaya, casuarina flowers and sets seed in the drier months of July-August, with seed drop in about October-November (Askin *et al.*, 1990:217). A similar pattern has been reported in the Eastern Highlands of PNG with flowering in early August and seed maturity in November-December (Ataia, 1983).

Cocoa (*Theobroma cacao*)

National monthly cocoa production is presented for a 24-year period (1962-1985) by Jolly, Beck and Bodman (1990:103-104, 111). This shows that production is seasonal with the greatest production in the period May to July and the lowest in February to March. The pattern sometimes varies considerably between locations although it is generally consistent between years for any particular location (J. O'Donohue, pers. comm., 1993). Thus at Keravat and Vunapau Plantation in the Gazelle Peninsula, the main production flush occurs between October and December, but on the eastern side of the Peninsula it occurs earlier in the year (April to June) (J. O'Donohue, pers. comm., 1993). In

the area inland from Kandrian on the south coast of New Britain, the main production season is said by villagers to be May to September; in the Bukaua area east of Lae, the main production period is said to be October and November (Villagers, 1991); in the Angoram area on the Sepik River it is July to September (J. Risimeri, pers. comm., 1989).

The available data indicates that, in general, more cocoa is produced between May and July than in other months. However, for two locations where data are available, the main producing period is reported as October to November or December. This difference from the general pattern may be related to rainfall seasonality. In the Keravat-Vunapau area of the Gazelle Peninsula, rainfall distribution is only very weakly seasonal and the Bukaua area east of Lae receives most rainfall in May-September. The information from Kandrian, where the rainfall between May and September is extremely high, is not consistent with this hypothesis. However cocoa production is very limited in the Kandrian area because of black pod disease and the reported pattern there may be influenced by the very high rainfall, especially during the May-September period.

In a study using 17 months of production data at Keravat, Bridgland (1953) found that cocoa yield had a highly significant negative correlation with rainfall four or five months prior to harvest. However, the patterns described above, which are based on long-term recordings, are not consistent with this conclusion from Bridgland's short-term study.

Copra (*Cocos nucifera*)

Dwyer (1940:19) examined three years of copra production figures for a plantation near Madang. He considered that the peak production months were November to January with the period March to June having somewhat lower production. National level data for a nine-year period (1977 to 1985) are given by Jolly, Beck and Bodman (1990:100-101, 109). These figures do not indicate any consistent seasonal pattern, although average production was slightly higher for March and December for this particular period.

Pyrethrum (*Chrysanthemum cinerariaefolium*)

Mean monthly purchase figures of pyrethrum by DPI at Laiagam in Enga Province for a ten-year period (1970-1979) are given by Carrad (1982:152). These indicate that average production is somewhat higher between September and March and somewhat lower between April and August.

Robusta coffee (*Coffea canephora*)

According to Sumbak, there is no definite harvesting season for Robusta coffee at Keravat. However, in the Milne Bay area, the main harvest occurs between May and August with the peak in June-July (Sumbak, 1967:122).

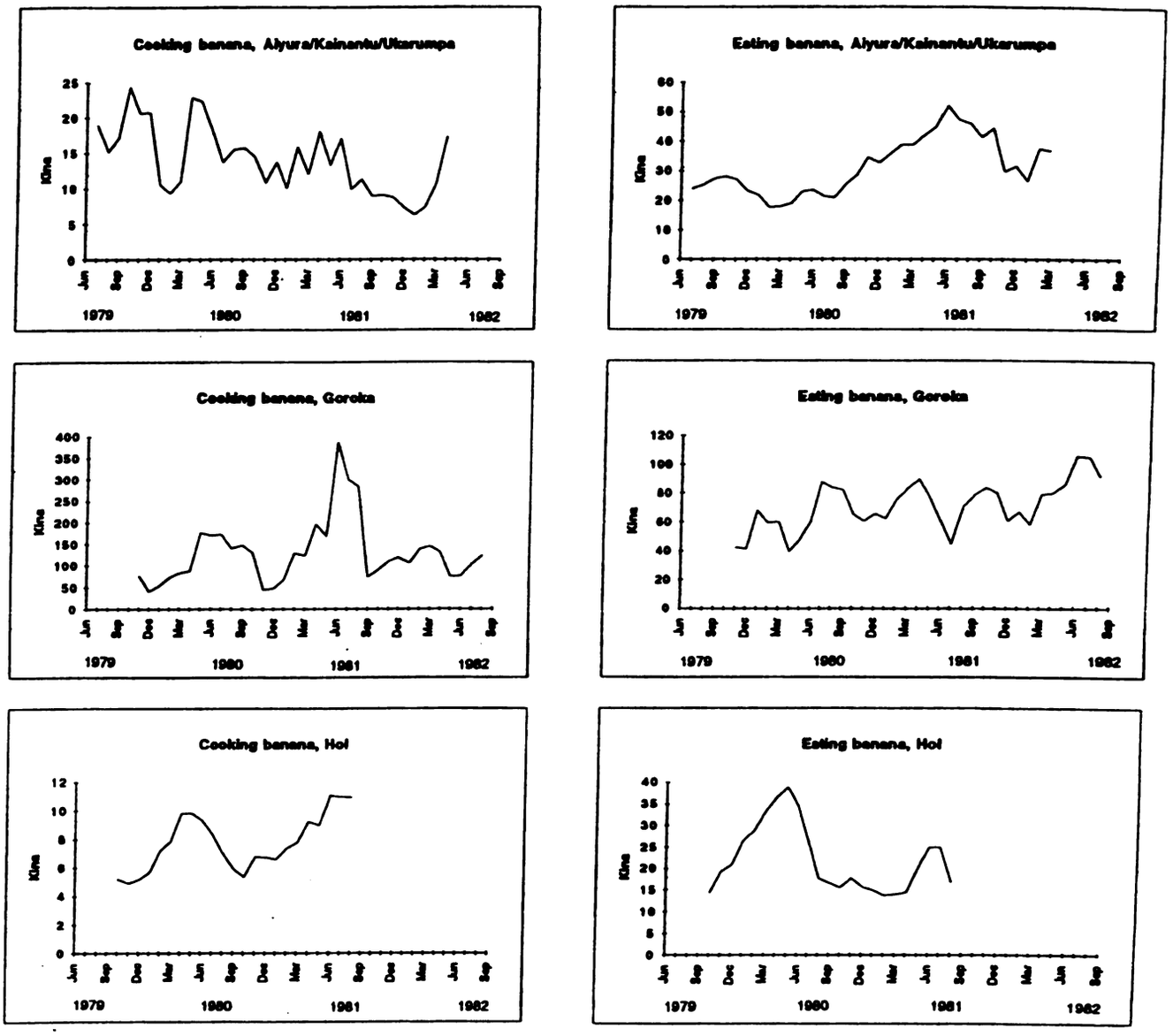


Figure 1. Value (kina/day) of cooking banana and eating banana on display at Alyura, Kainantu, Ukarumpa, Goroka and Hoi markets, June 1979 to September 1982 (three month running mean) (Source: Authors' surveys)

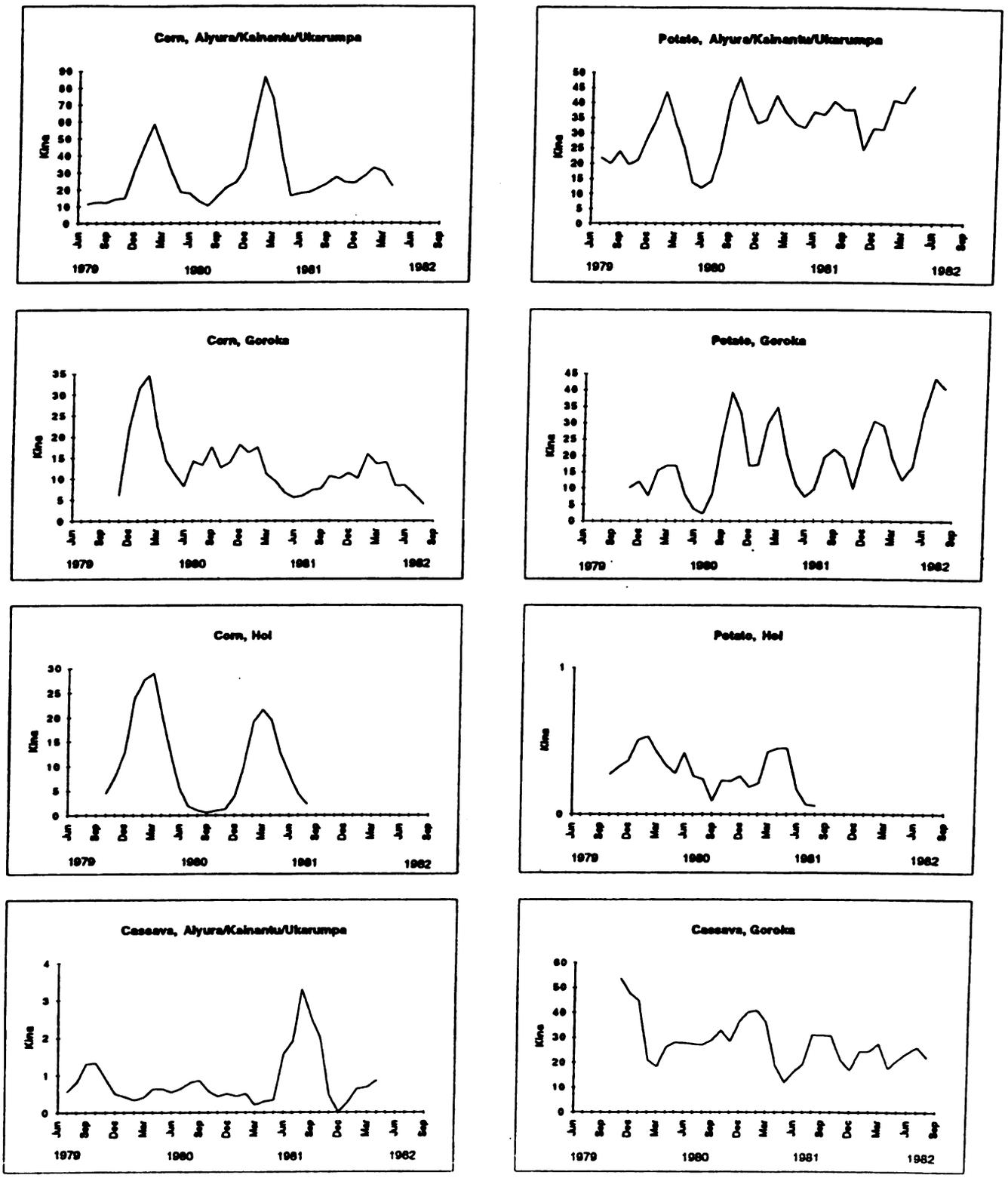


Figure 2. Value (kina/day) of corn, cassava and potato on display at Aiyura, Kainantu, Ukarumpa, Goroka and Hoi markets, June 1979 to September 1982 (three month running mean) (Source: Authors' surveys)

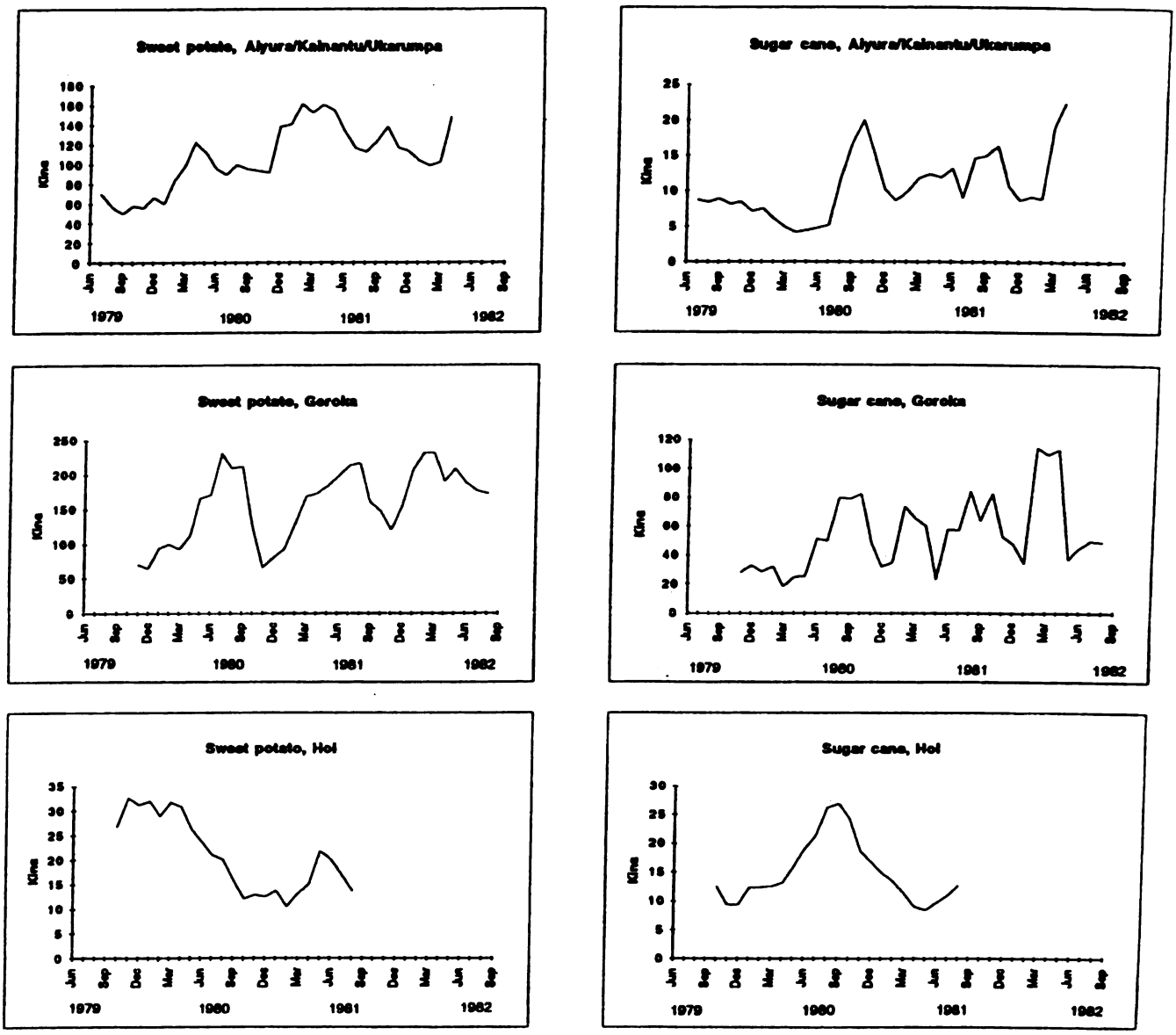


Figure 3. Value (kina/day) of sweet potato and sugar cane on display at Aiyura, Kainantu, Ukarumpa, Goroka and Hoi markets, June 1979 to September 1982 (three month running mean) (Source: Authors' surveys)

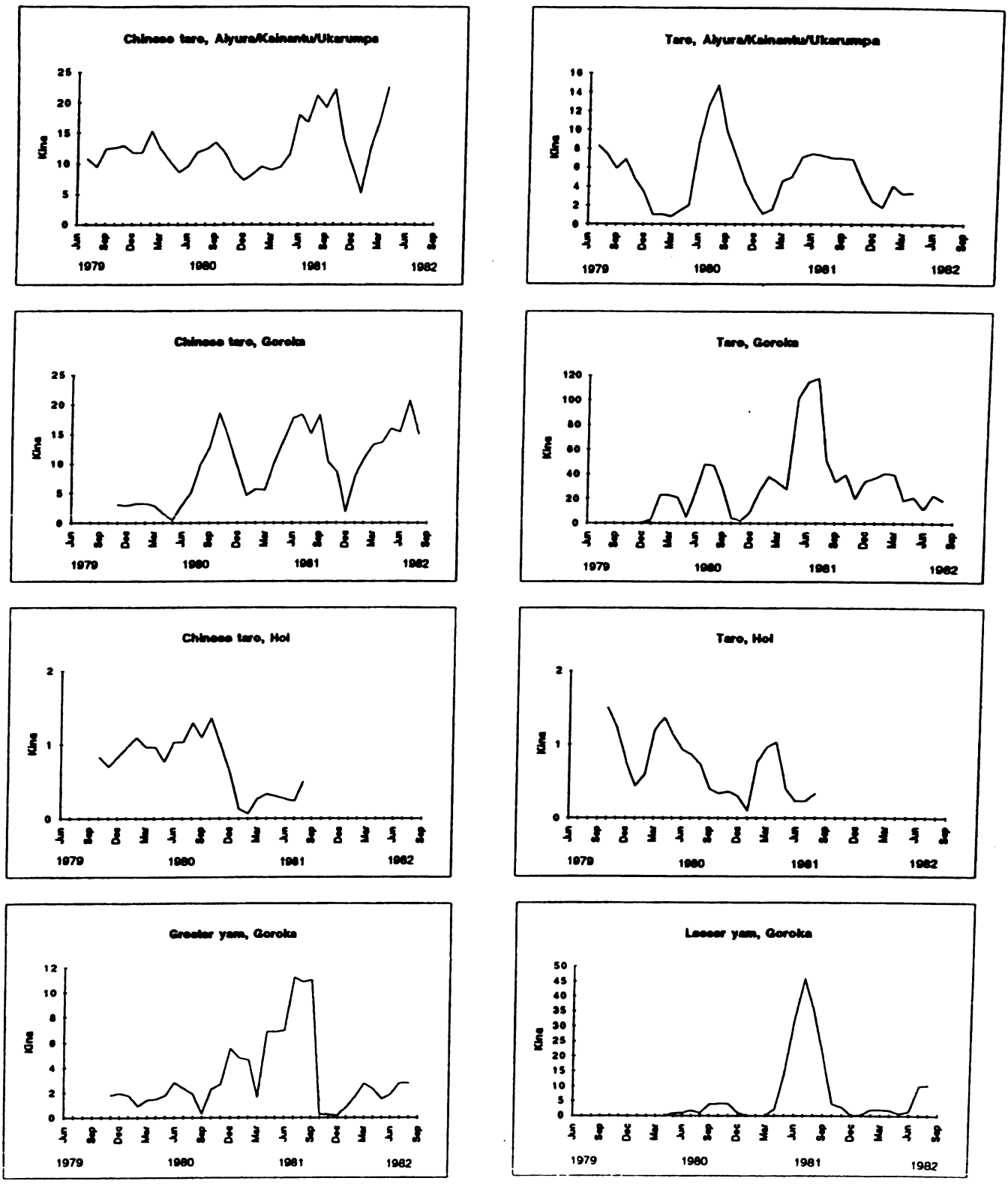


Figure 4. Value (kina/day) of Chinese taro, taro, greater yam and lesser yam on display at Aiyura, Kainantu, Ukarumpa, Goroka and Hoi markets, June 1979 to September 1982 (three month running mean) (Source: Authors' surveys)

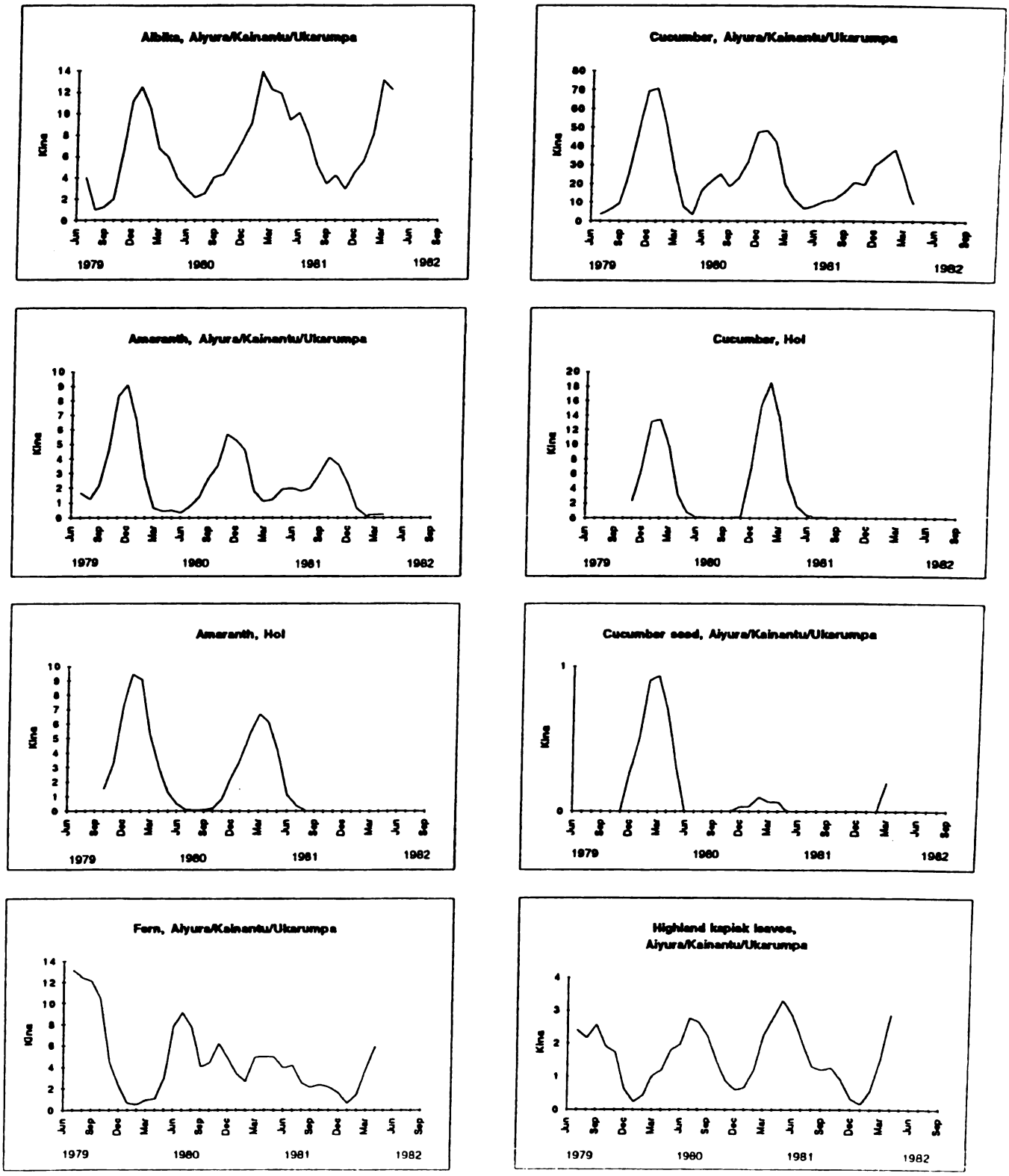


Figure 5. Value (kina/day) of aibika, amaranth, fern, cucumber, cucumber seed and highland kapiak leaves on display at Aiyura, Kainantu, Ukarumpa and Hol markets, June 1979 to May 1982 (three month running mean) (Source: Authors' surveys)

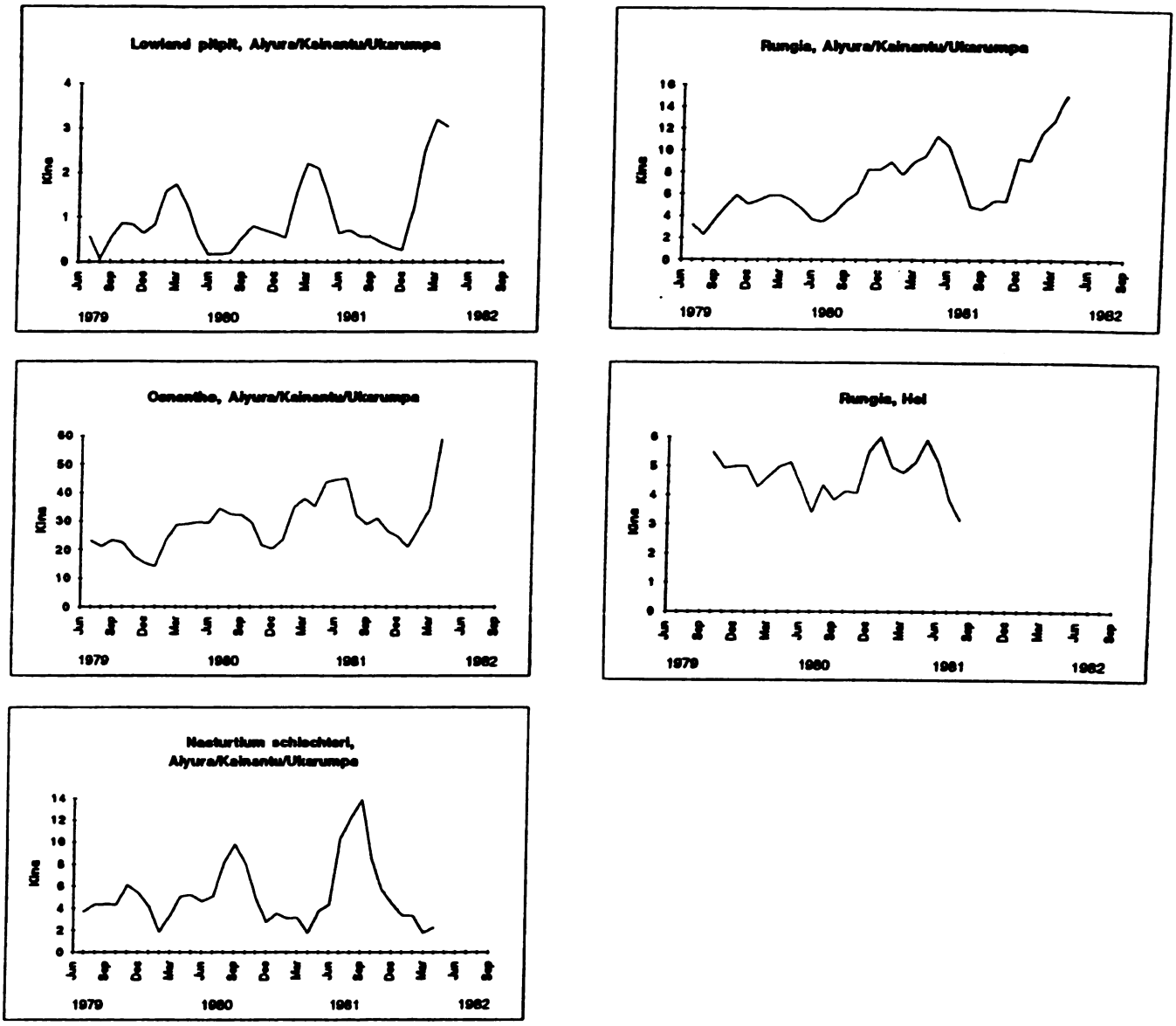


Figure 6. Value (kina/day) of lowland pitpit, oenanthe, *Nasturtium schlechteri* and rungia on display at Aiyura, Kainantu, Ukarumpa and Hoi markets, June 1979 to May 1982 (three month running mean) (Source: Authors' surveys)

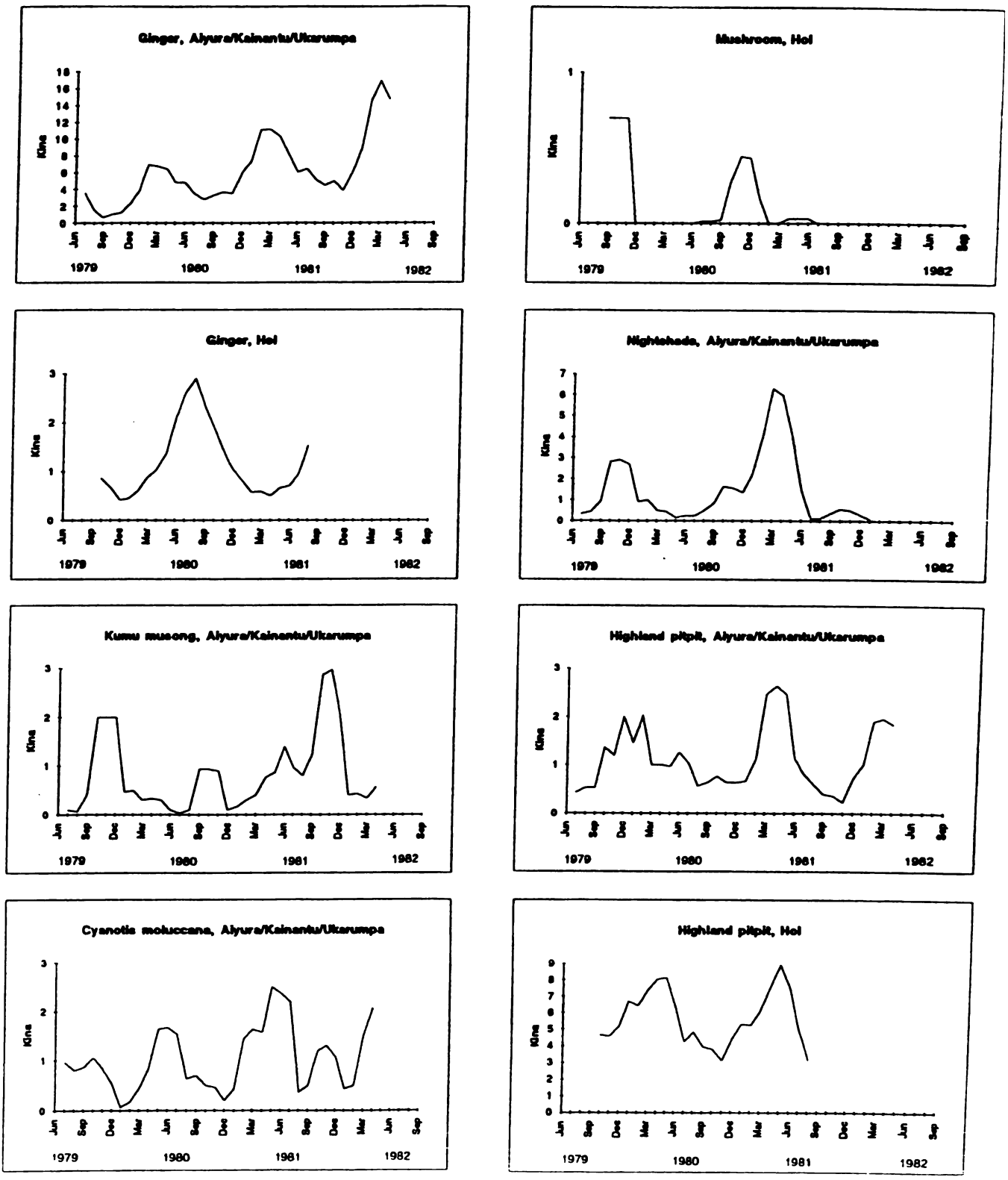


Figure 7. Value (kina/day) of ginger, kumu musong, *Cyanotis moluccana,* mushroom, nightshade and highland pitpit on display at Aiyura, Kainantu, Ukarumpa and Hoi markets, June 1979 to May 1982 (three month running mean) (Source: Authors' surveys)

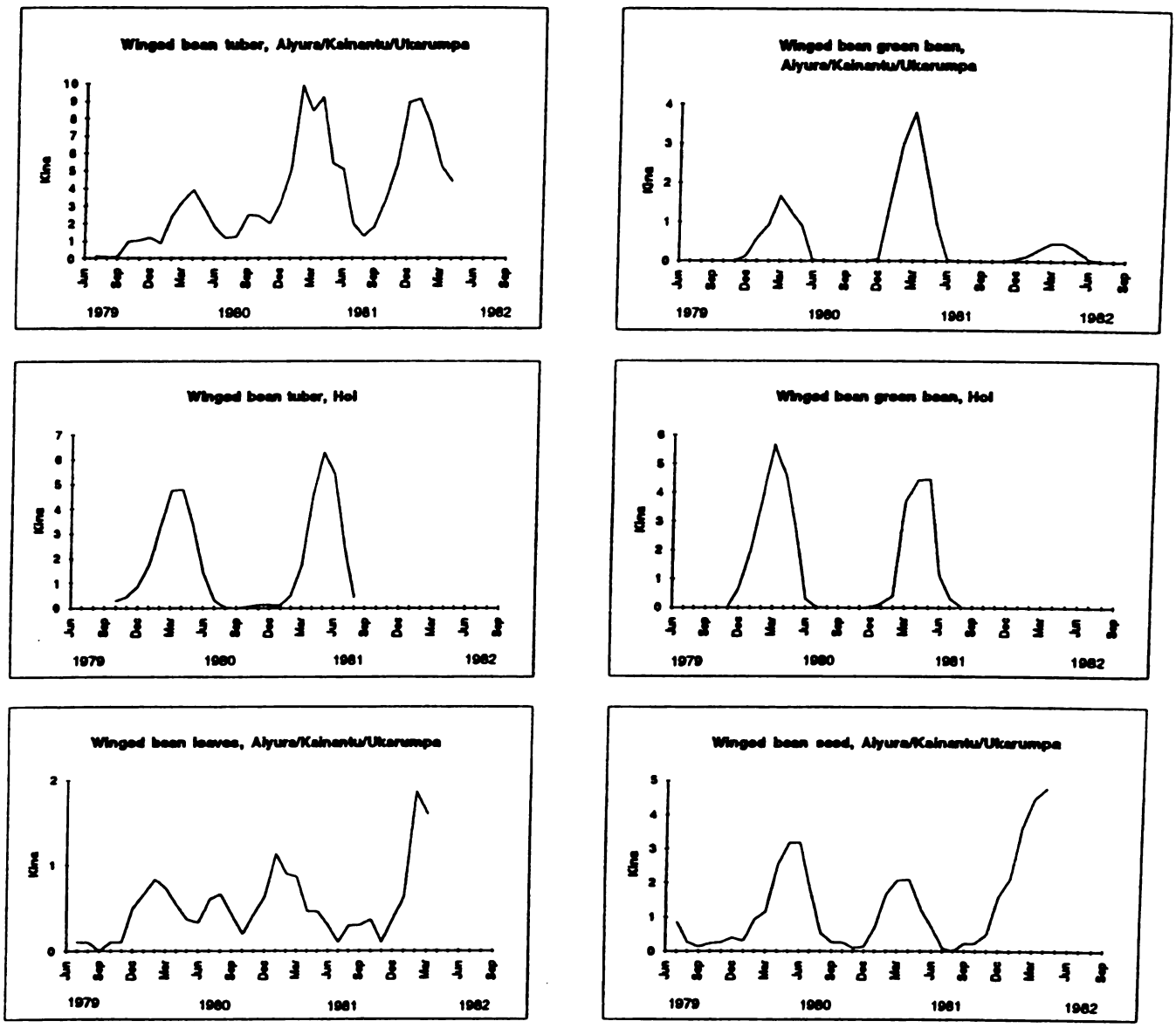


Figure 8. Value (kina/day) of winged bean tuber, leaves, green bean and seed on display at Alyura, Kainantu, Ukarumpa and Hoi markets, June 1979 to May 1982 (three month running mean) (Source: Authors' surveys)

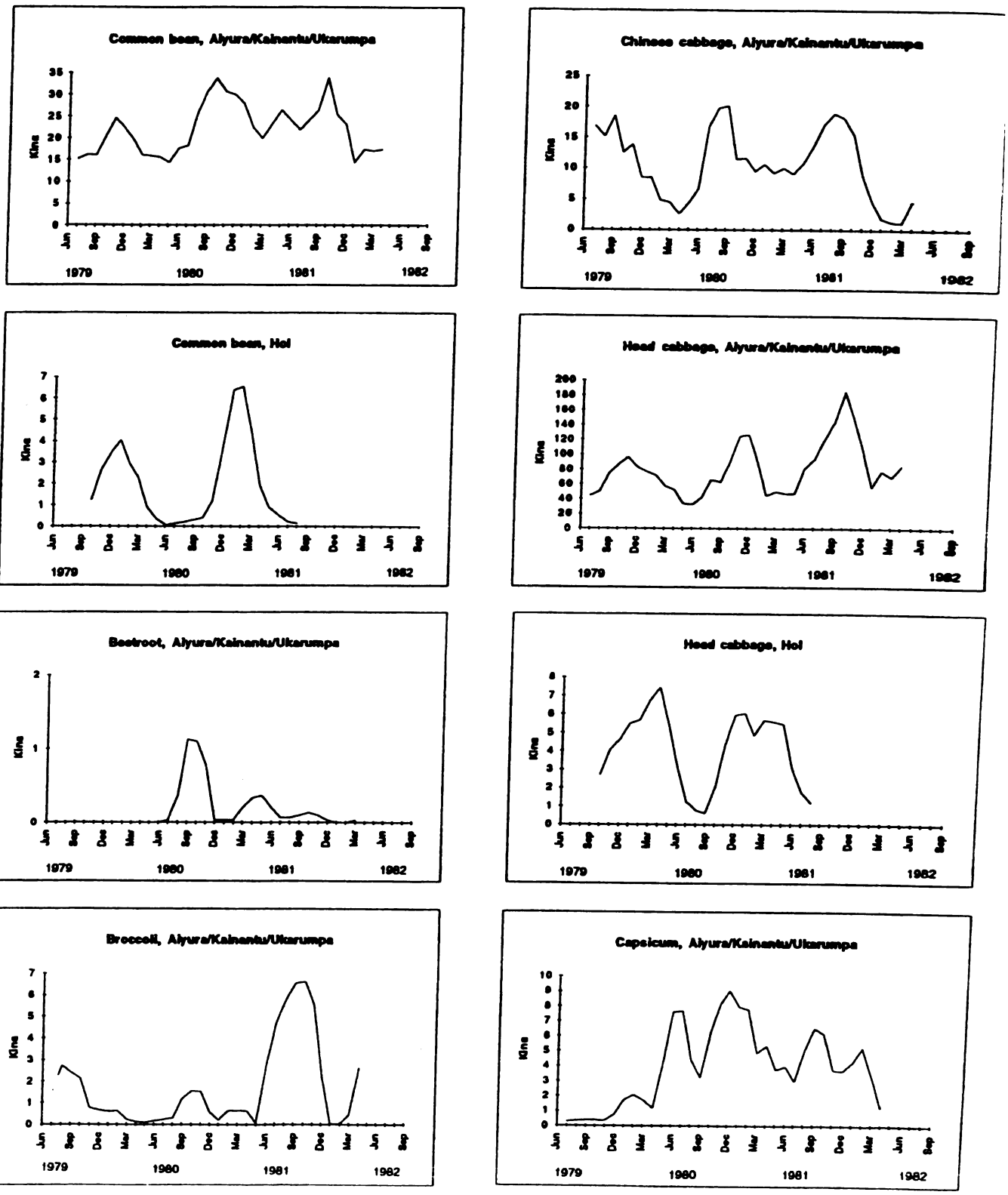


Figure 9. Value (kina/day) of common bean, beetroot, broccoli, Chinese cabbage, head cabbage and capsicum on display at Aiyura, Kainantu, Ukarumpa and Hoi markets, June 1979 to May 1982 (three month running mean) (Source: Authors' surveys)

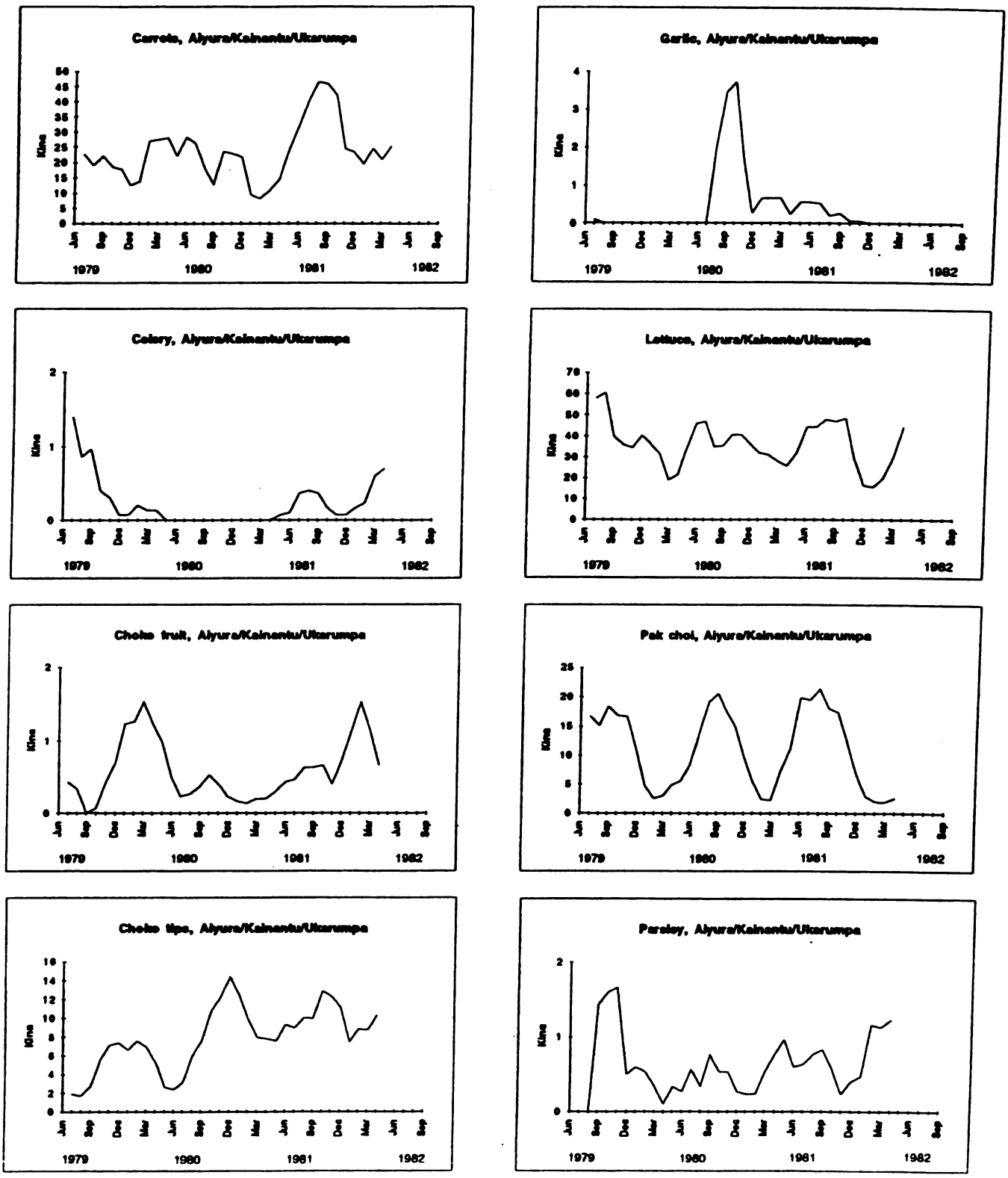


Figure 10. Value (kina/day) of carrots, celery, choko fruit, choko tips, garlic, lettuce, pak choi and parsley on display at Aiyura, Kainantu and Ukarumpa markets, June 1979 to May 1982 (three month running mean) (Source: Authors' surveys)

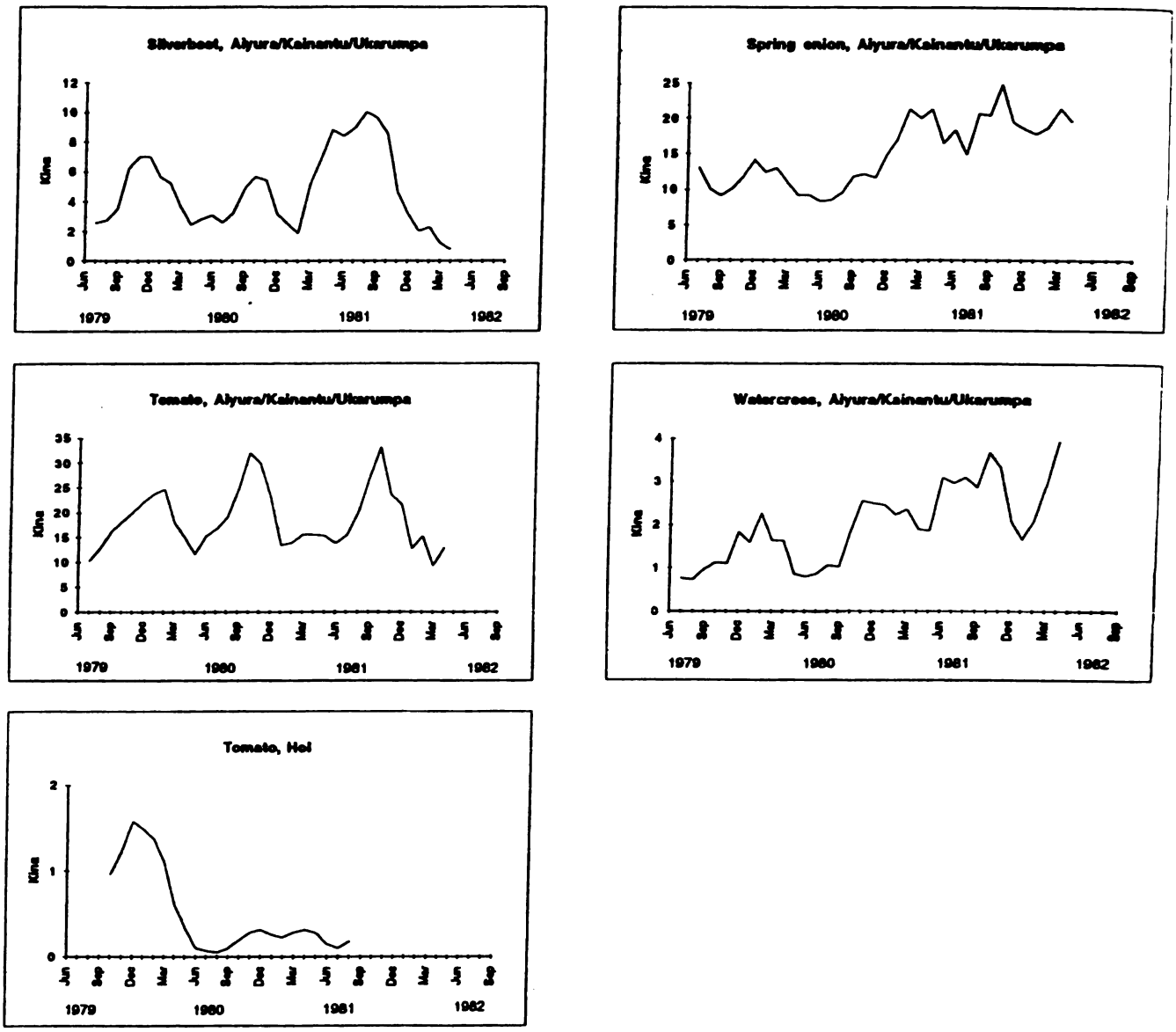


Figure 11. Value (kina/day) of silverbeet, spring onion, tomato and watercress on display at Aiyura, Kainantu, Ukarumpa and Hoi markets, June 1979 to May 1982 (three month running mean) (Source: Authors' surveys)

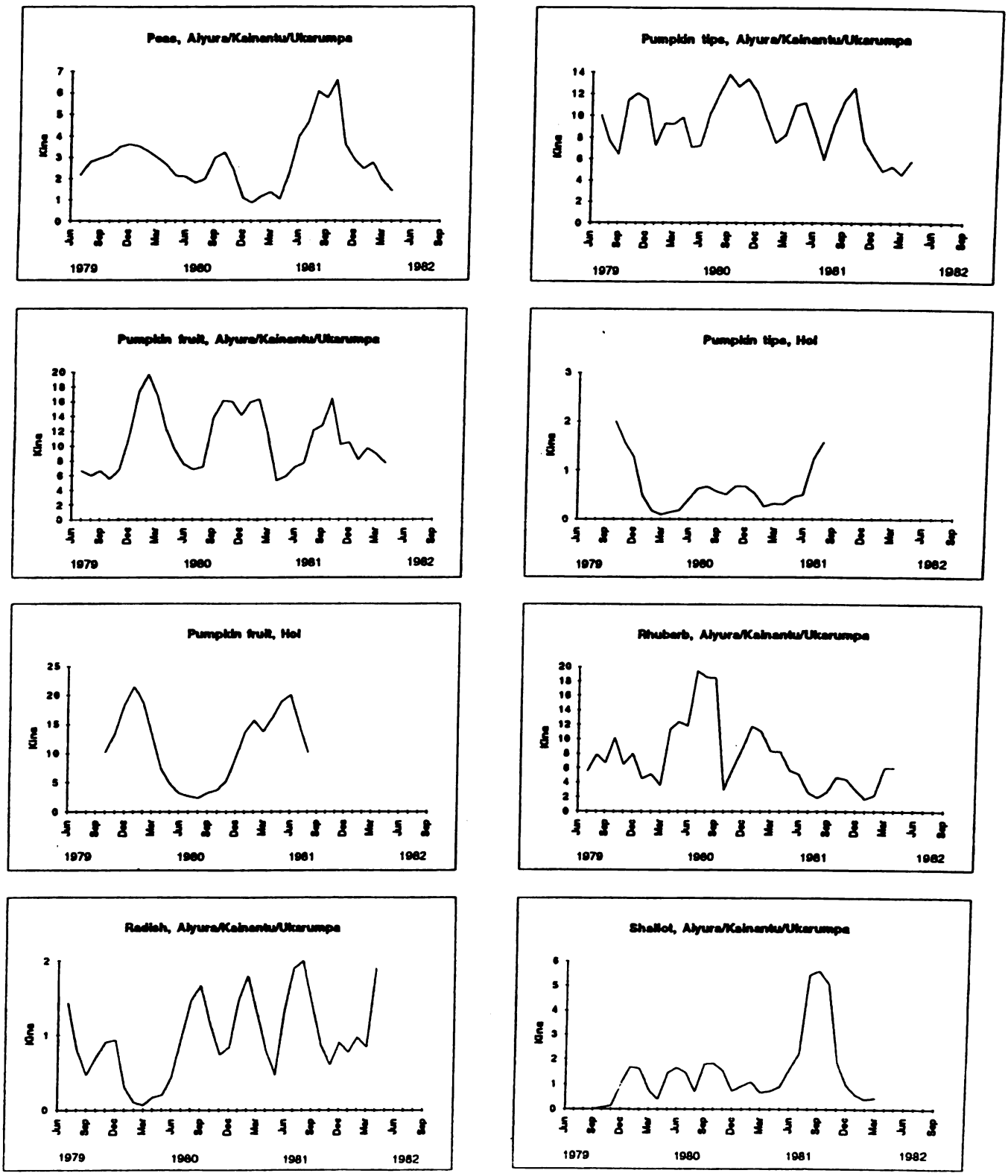


Figure 12. Value (kina/day) of peas, pumpkin fruit, pumpkin tips, radish, rhubarb and shallot on display at Aiyura, Kainantu, Ukarumpa and Hoi markets, June 1979 to May 1982 (three month running mean) (Source: Authors' surveys)

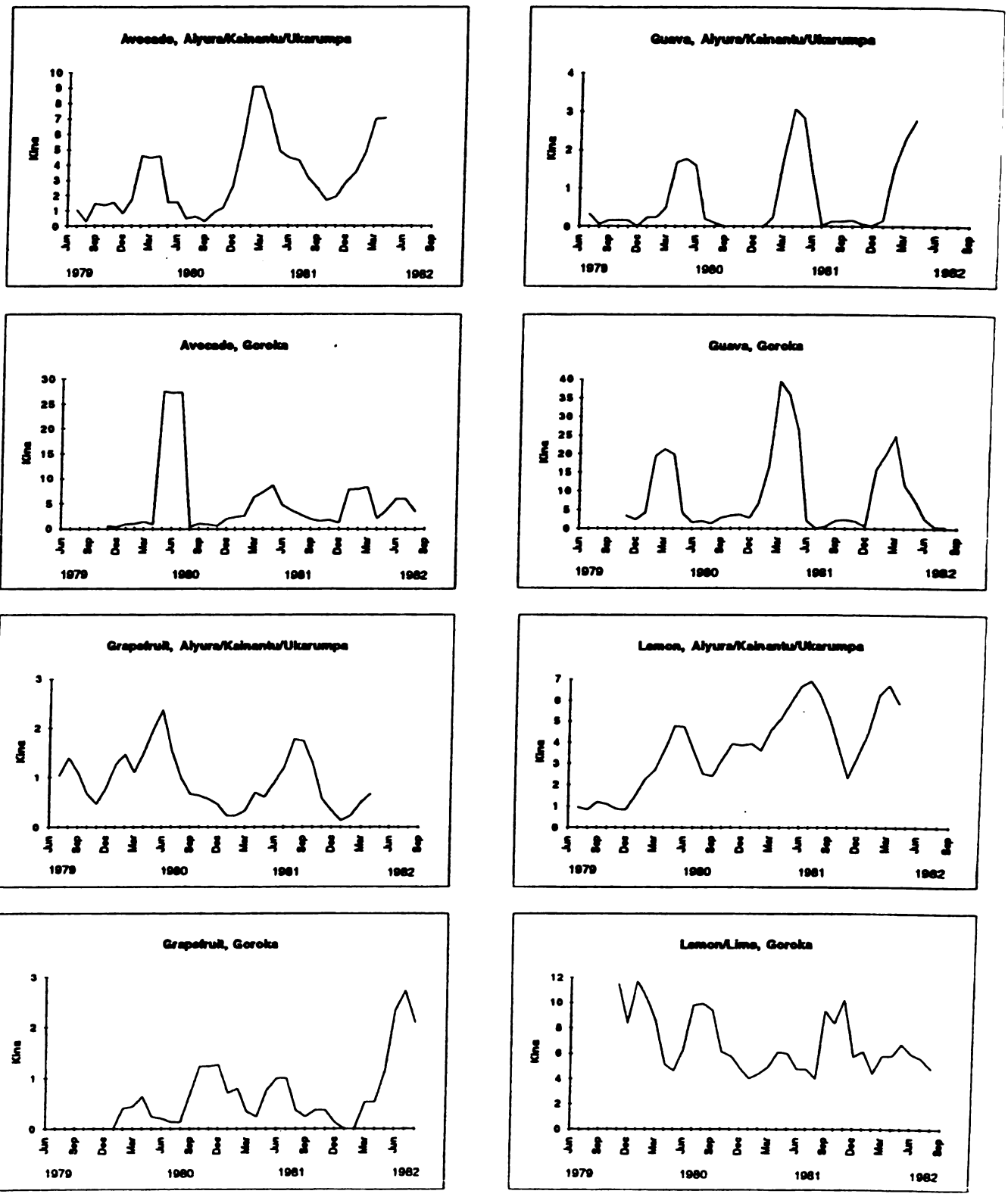


Figure 13. Value (kina/day) of avocado, grapefruit, guava and lemon on display at Aiyura, Kainantu, Ukarumpa and Goroka markets, June 1979 to September 1982 (three month running mean) (Source: Authors' surveys)

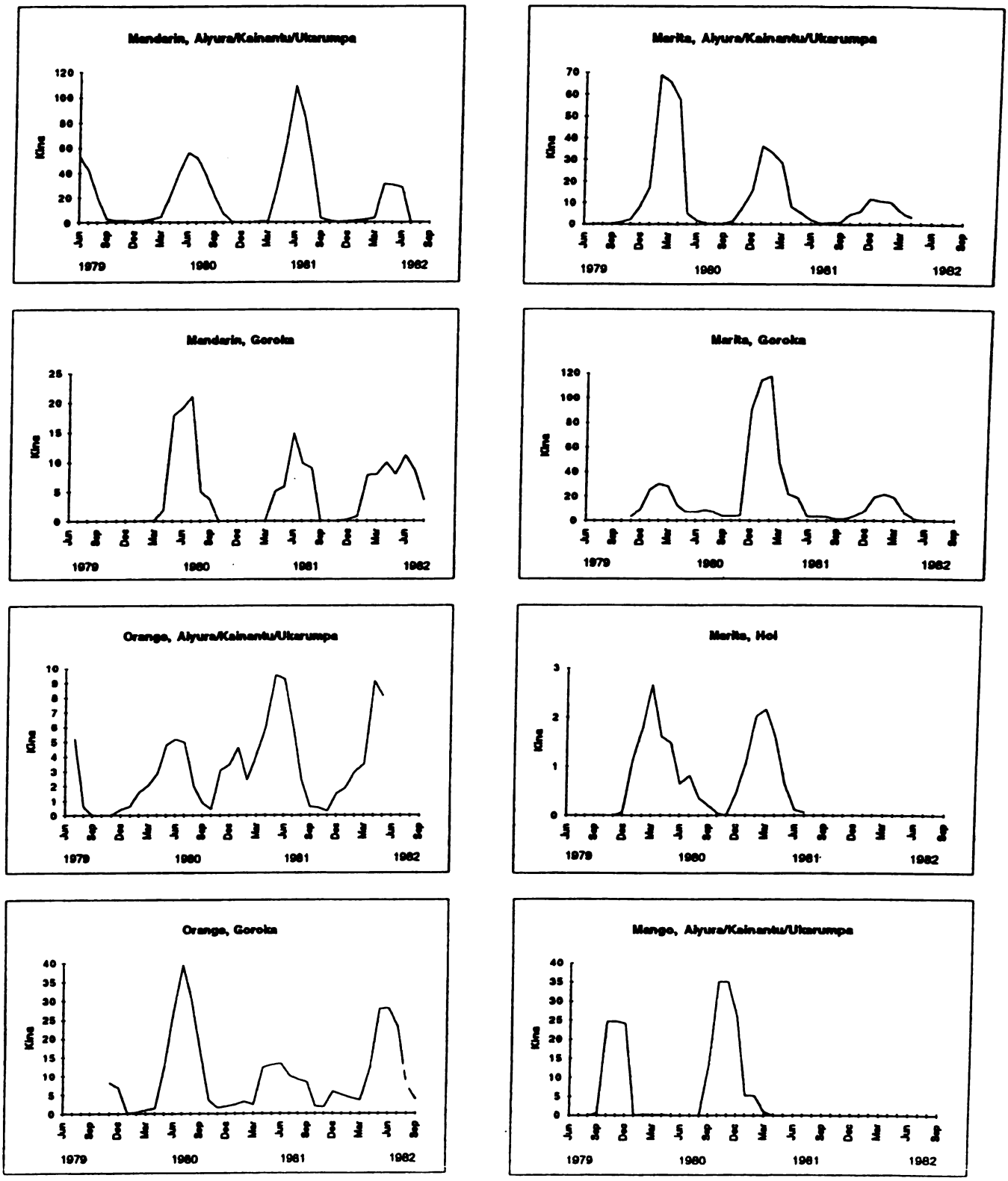


Figure 14. Value (kina/day) of mandarin, orange, marita and mango on display at Aiyura, Kainantu, Ukarumpa, Goroka and Hoi markets, June 1979 to September 1982 (three month running mean) (Source: Authors' surveys)

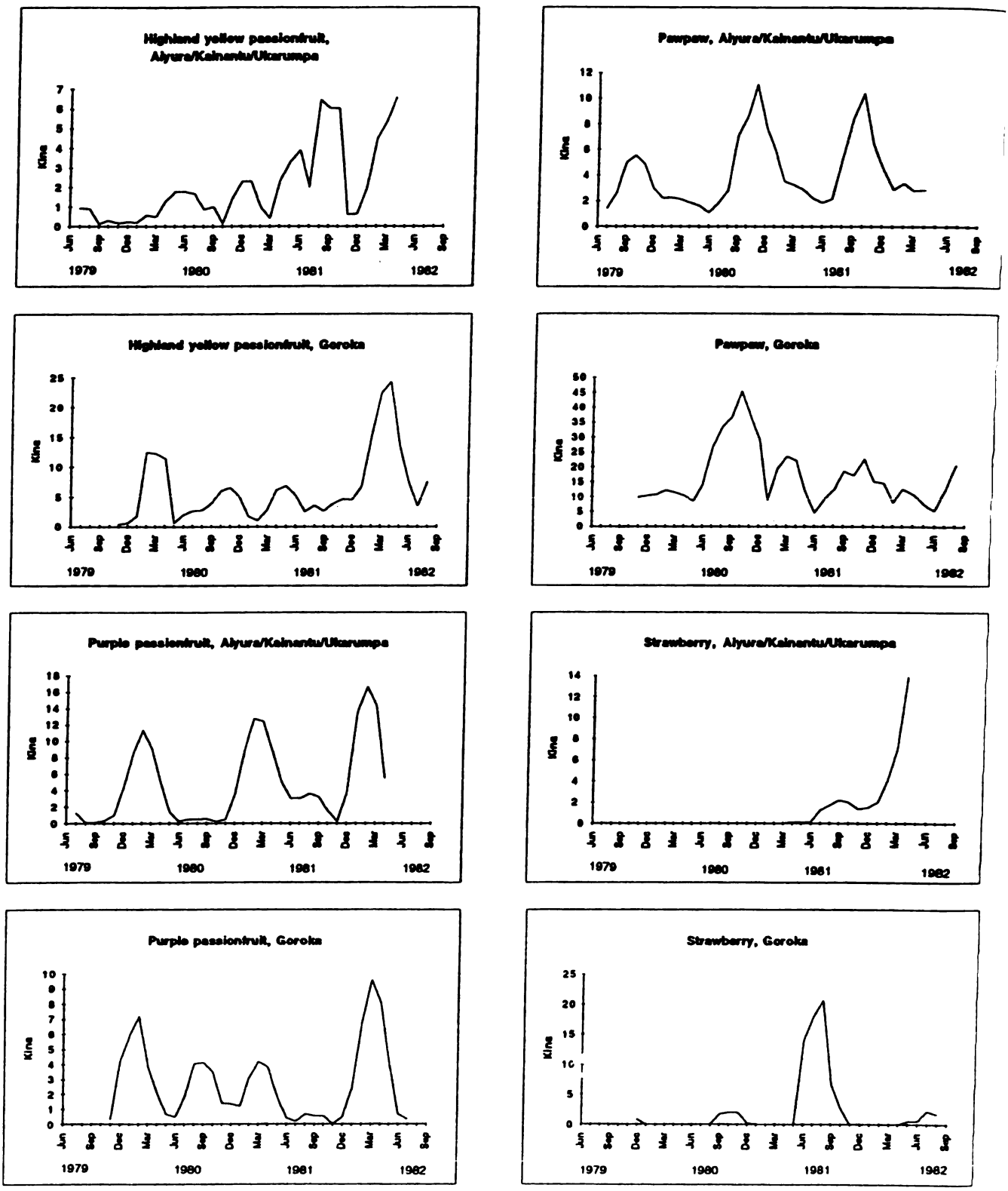


Figure 15. Value (kina/day) of highland yellow passionfruit, purple passionfruit, pawpaw and strawberry on display at Aiyura, Kainantu, Ukarumpa and Goroka markets, June 1979 to September 1982 (three month running mean) (Source: Authors' surveys)

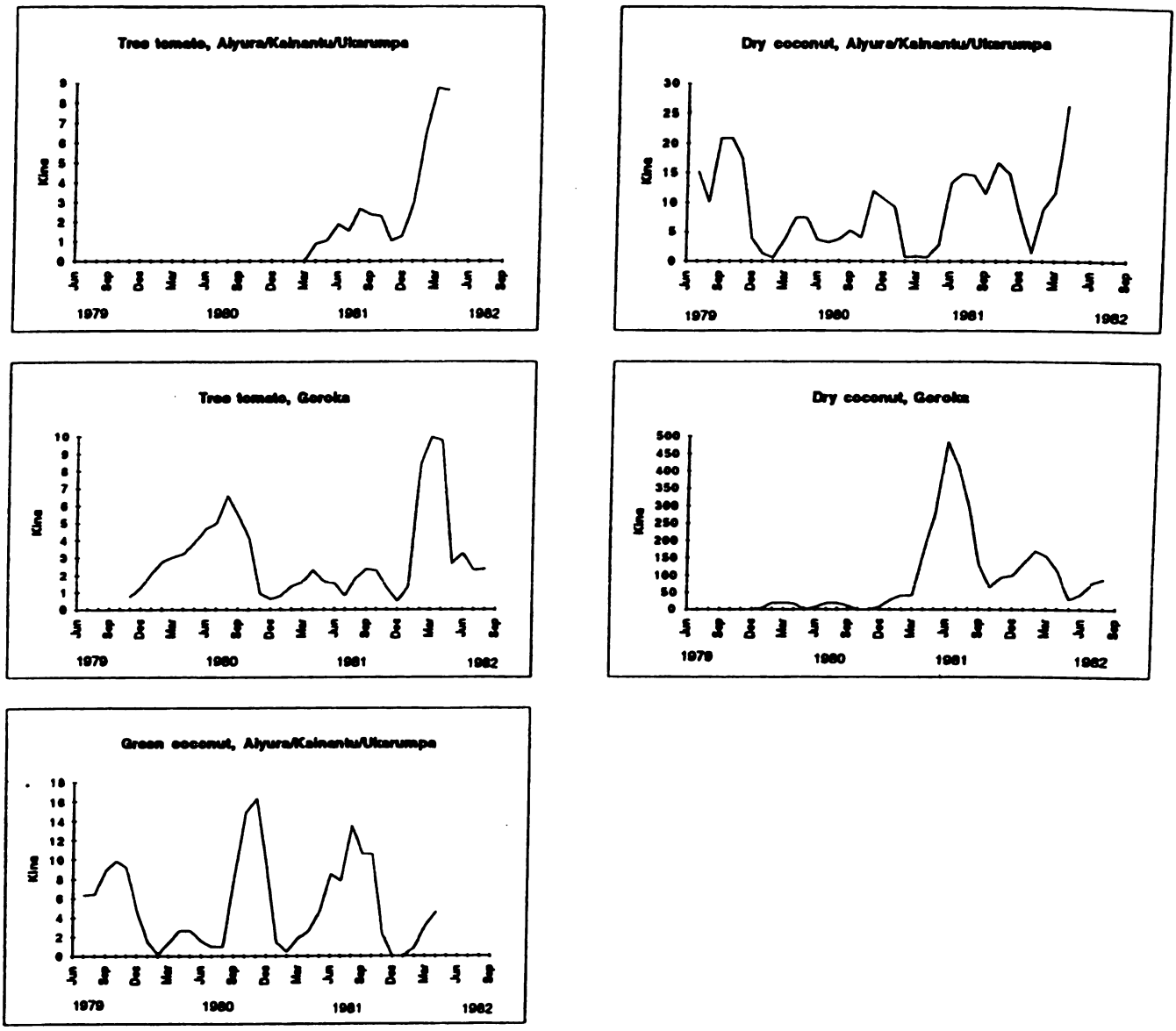


Figure 16. Value (kina/day) of tree tomato, dry coconut and green coconut on display at Alyura, Kainantu, Ukarumpa and Goroka markets, June 1979 to September 1982 (three month running mean) (Source: Authors' surveys)

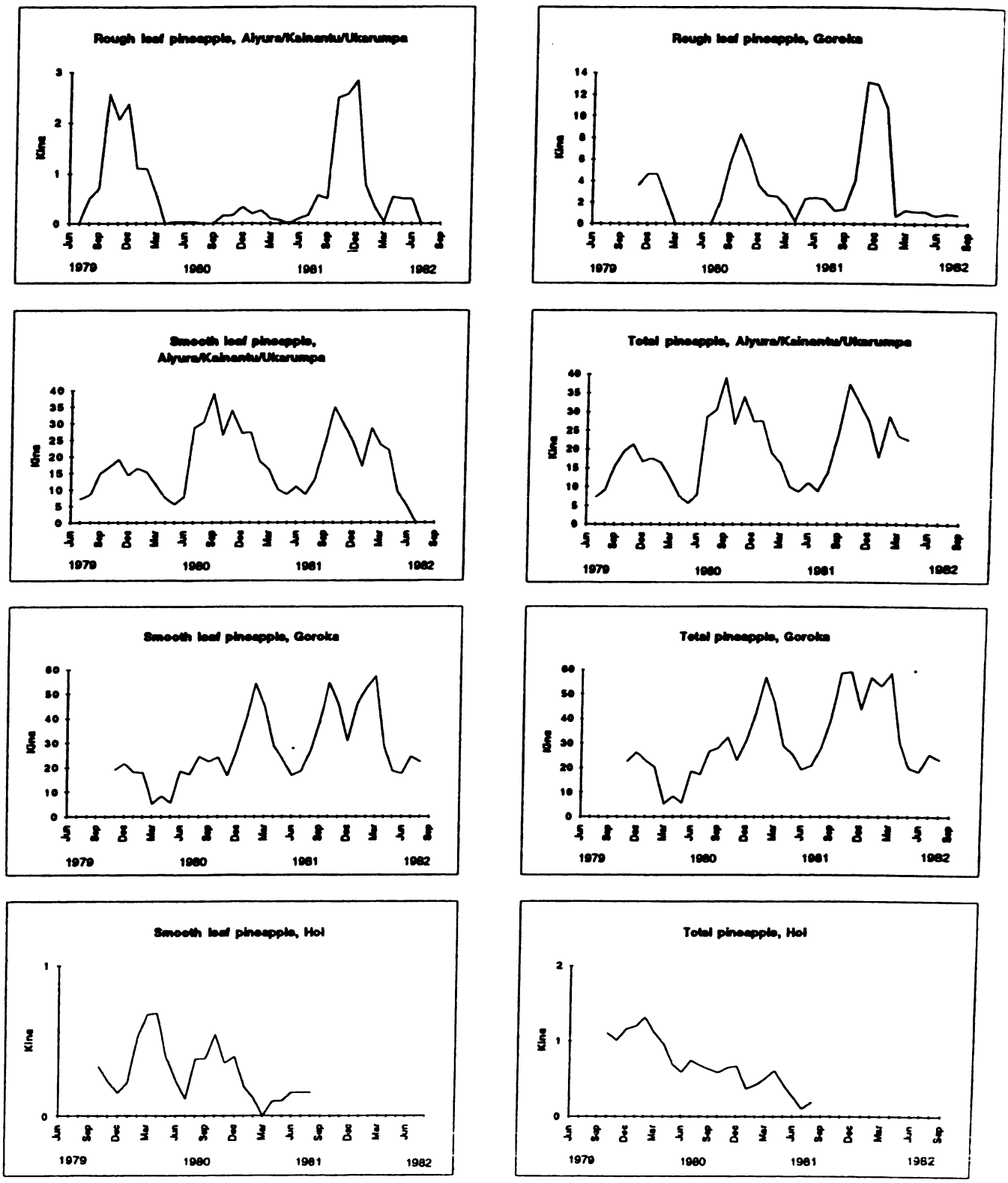


Figure 17. Value (kina/day) of smooth leaf pineapple, rough leaf pineapple and total pineapple on display at Aiyura, Kainantu, Ukarumpa, Goroka and Hoi markets, June 1979 to September 1982 (three month running mean) (Source: Authors' surveys)

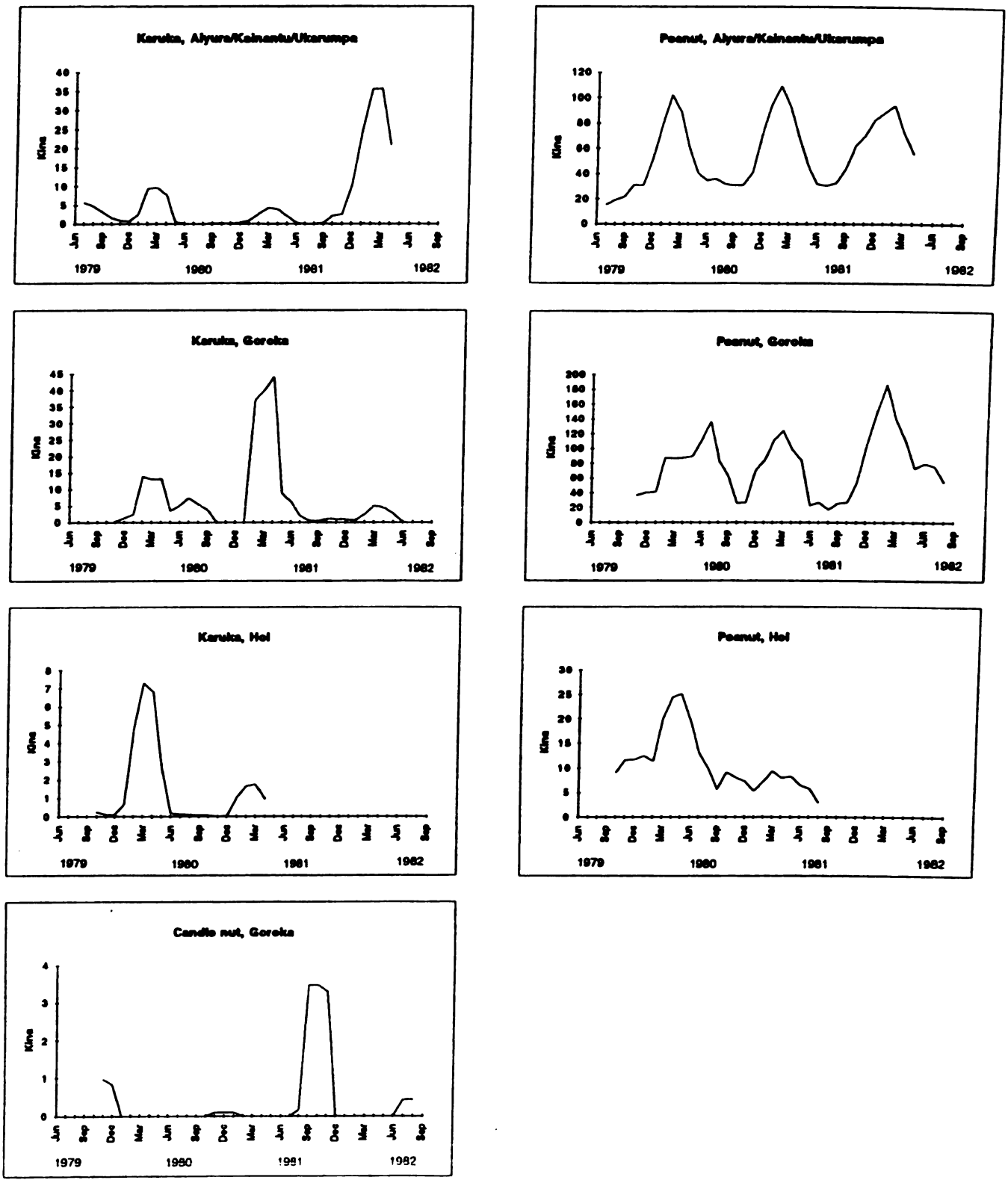


Figure 18. Value (kina/day) of karuka, candle nut and peanut on display at Aiyura, Kainantu, Ukarumpa, Goroka and Hoi markets, June 1979 to September 1982 (three month running mean) (Source: Authors' surveys)

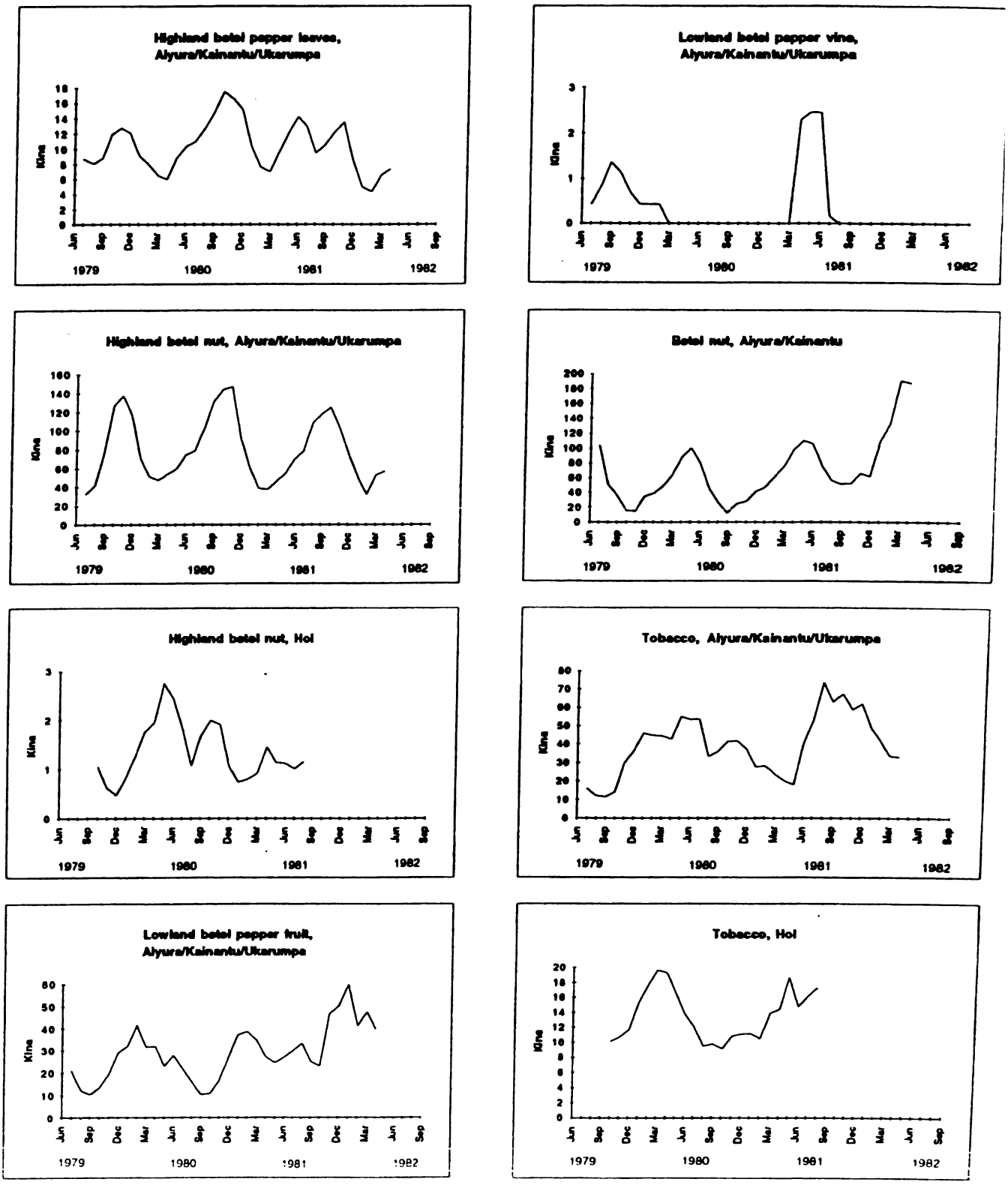


Figure 19. Value (kina/day) of highland betel pepper leaves, highland betel nut, lowland betel pepper fruit, lowland betel pepper vine, betel nut and tobacco on display at Aiyura, Kainantu, Ukarumpa and Hol markets, June 1979 to May 1982 (three month running mean) (Source: Authors' surveys)

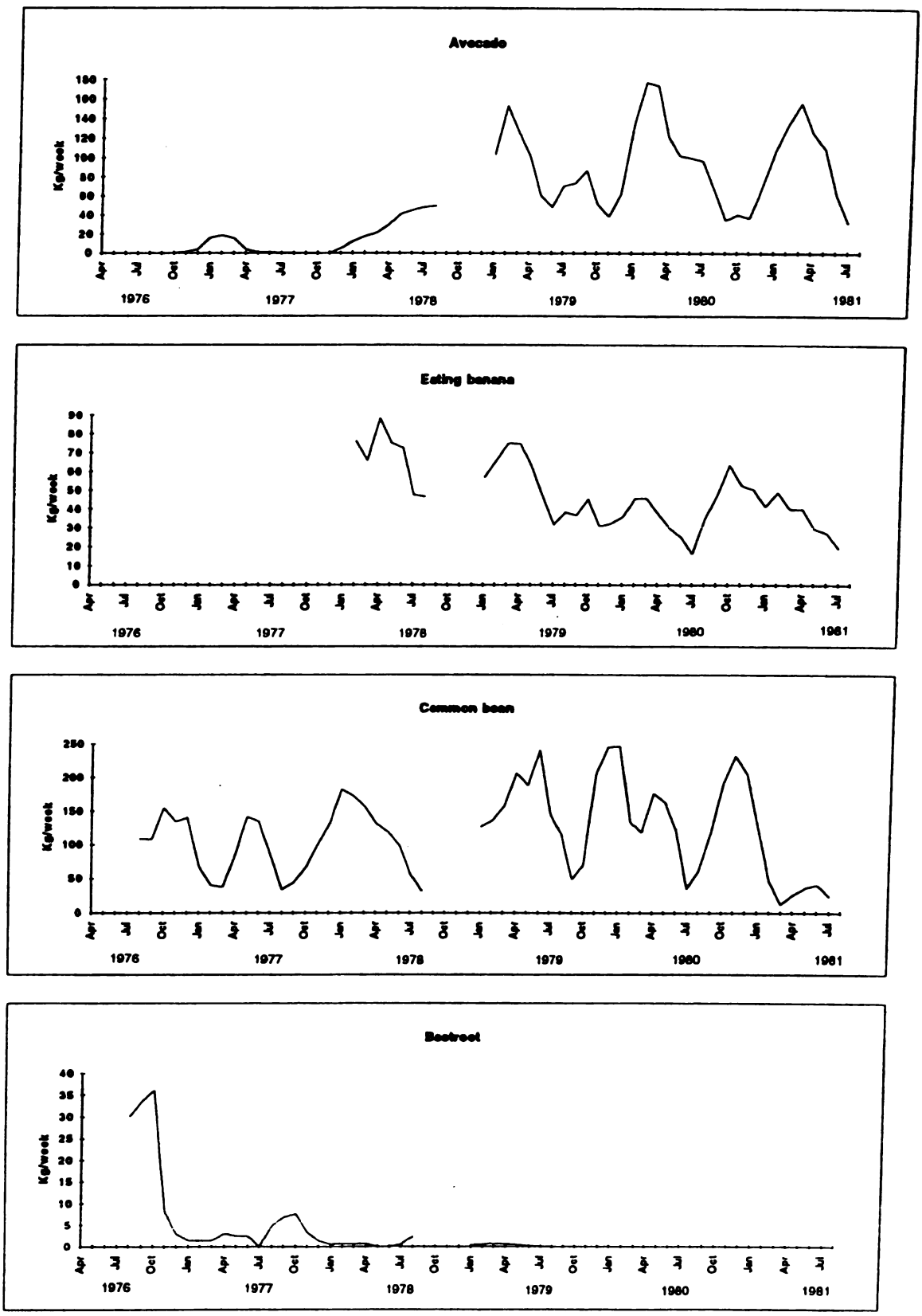


Figure 20. Monthly purchases (kg/week) of avocado, eating banana, common bean and beetroot by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (three month running mean) (Source: FMC purchase records)

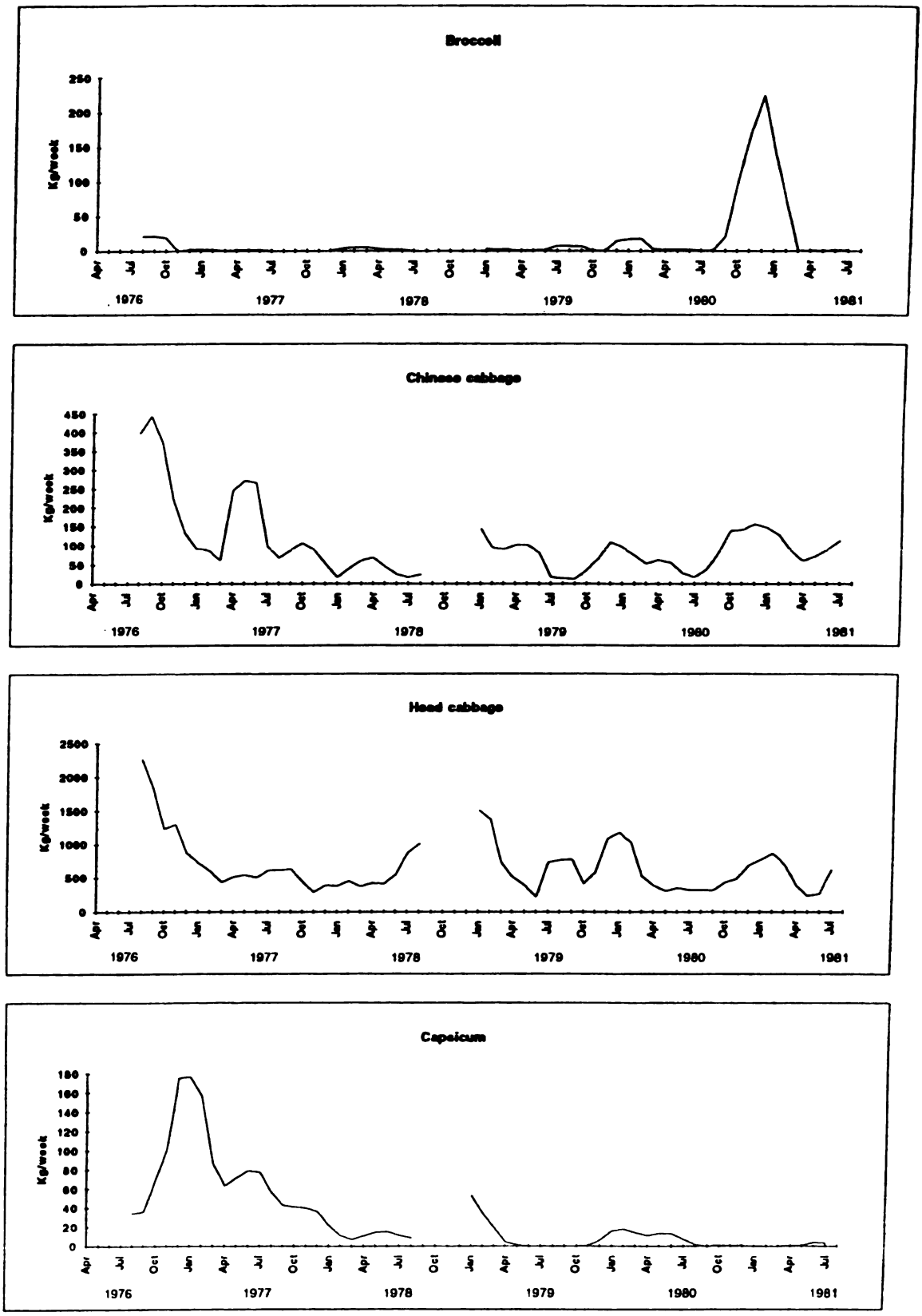


Figure 21. Monthly purchases (kg/week) of broccoli, Chinese cabbage, head cabbage and capsicum by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (three month running mean) (Source: FMC purchase records)

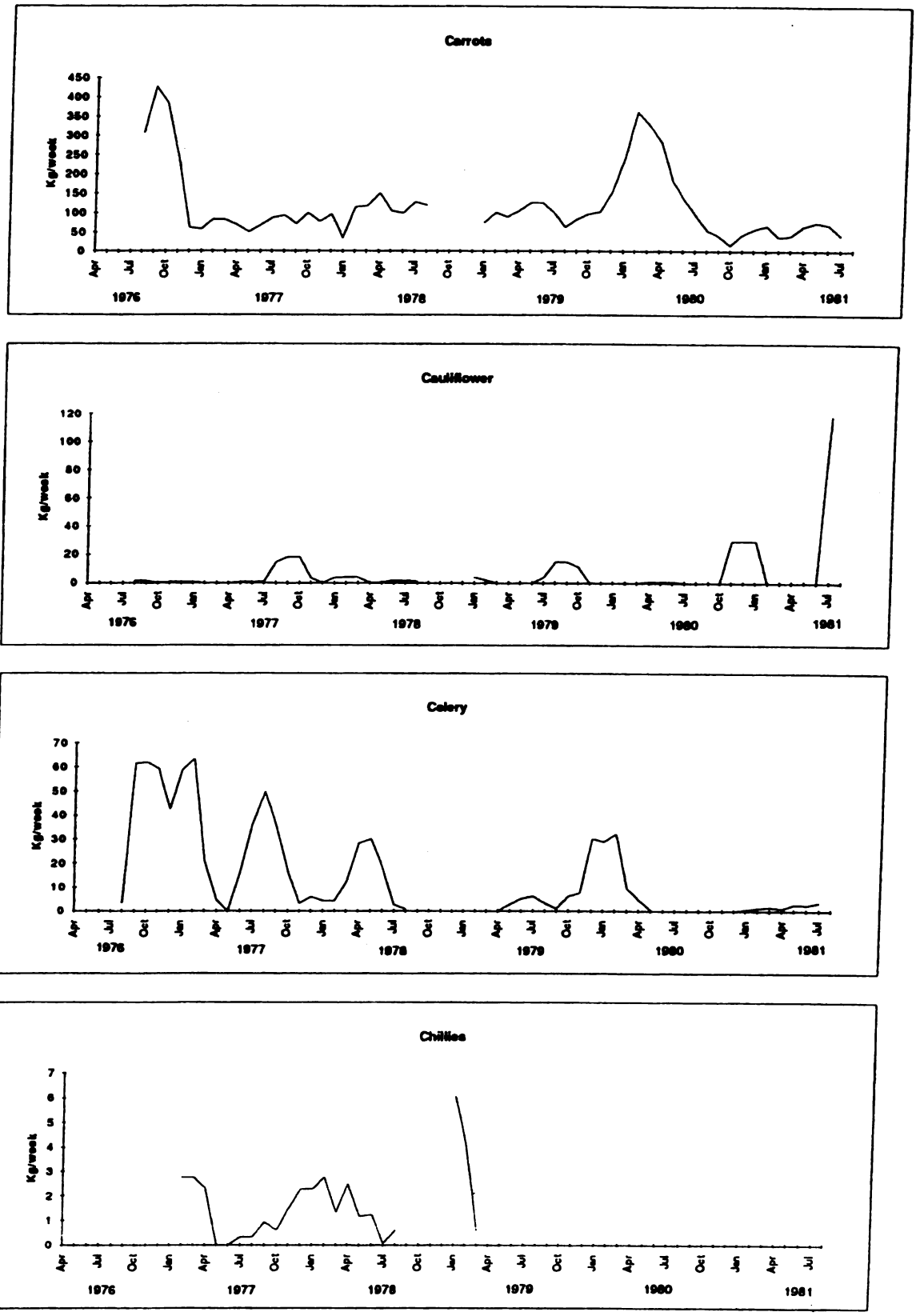


Figure 22. Monthly purchases (kg/week) of carrots, cauliflower, celery and chillies by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (three month running mean) (Source: FMC purchase records)

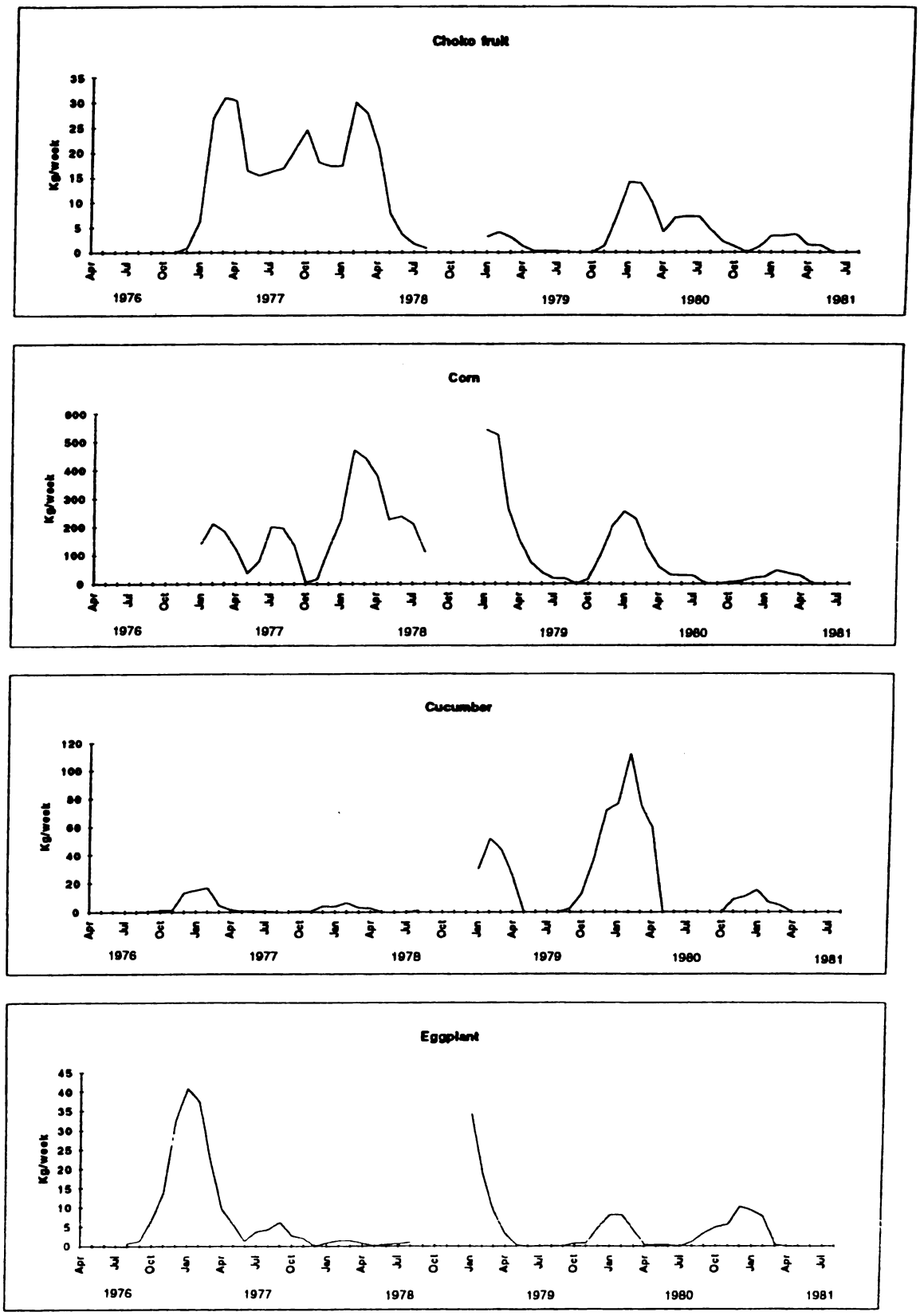


Figure 23. Monthly purchases (kg/week) of choko fruit, corn, cucumber and eggplant by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (three month running mean) (Source: FMC purchase records)

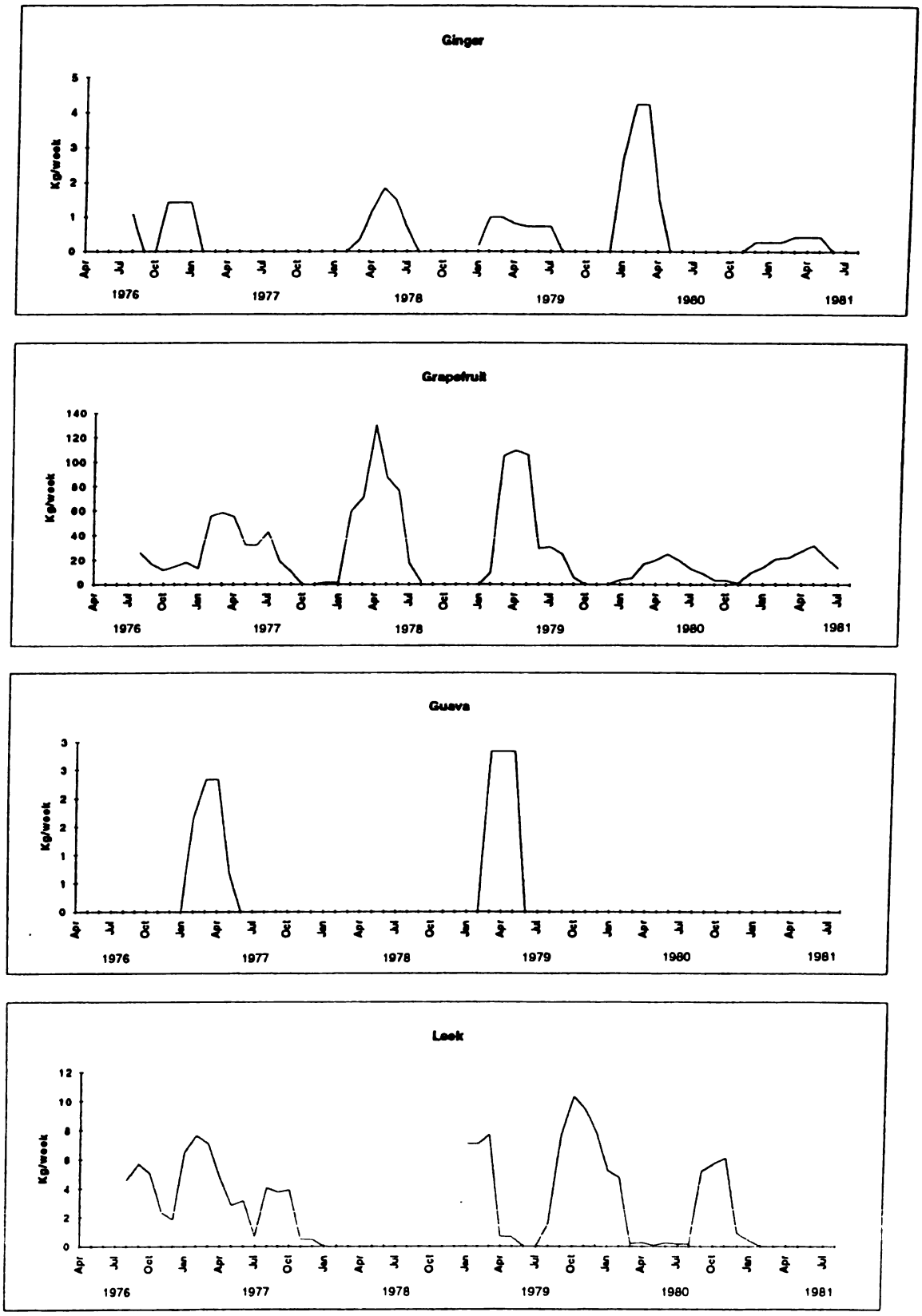


Figure 24. Monthly purchases (kg/week) of ginger, grapefruit, guava and leek by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (three month running mean) (Source: FMC purchase records)

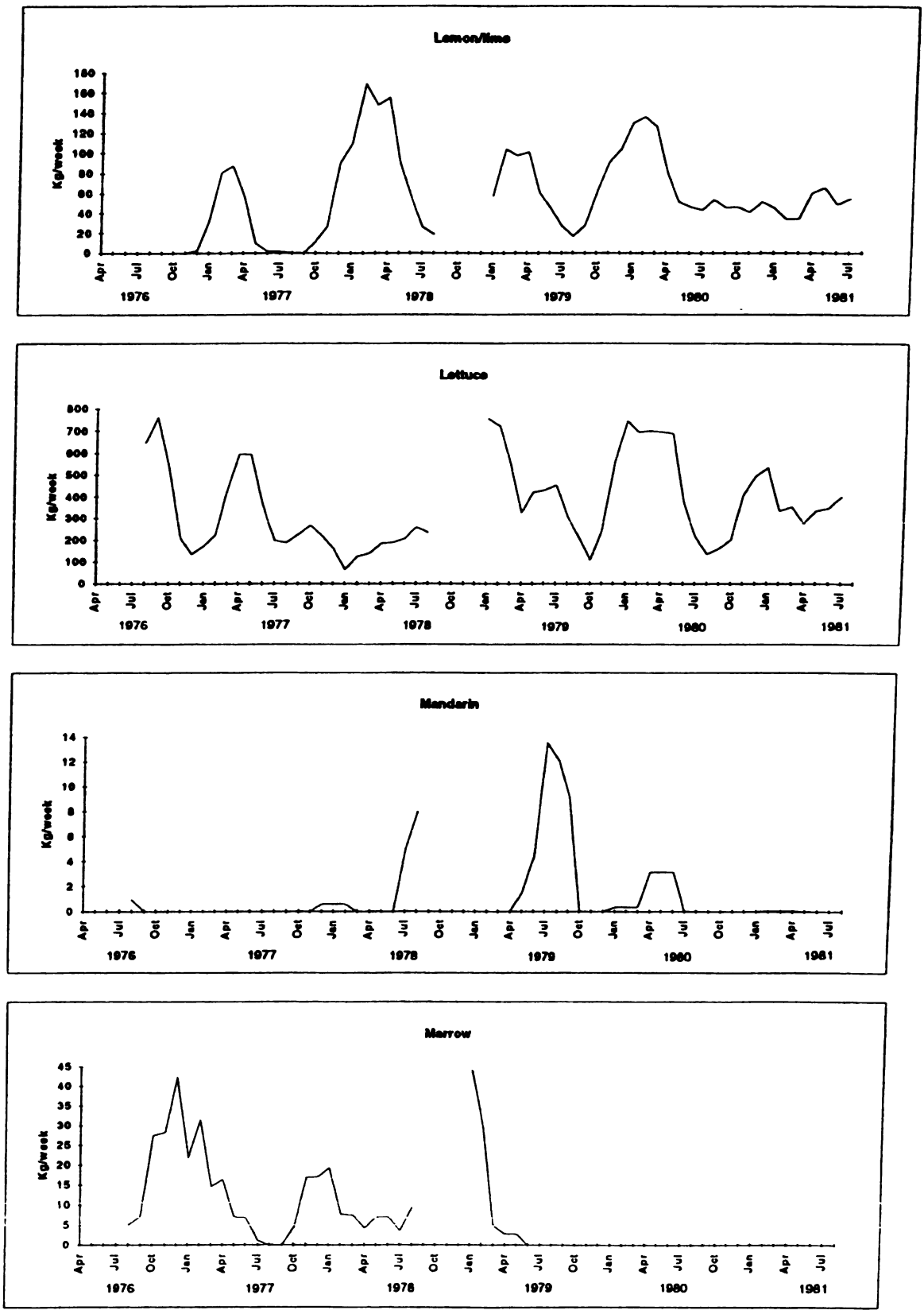


Figure 25. Monthly purchases (kg/week) of lemon/lime, lettuce, mandarin and marrow by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (three month running mean) (Source: FMC purchase records)

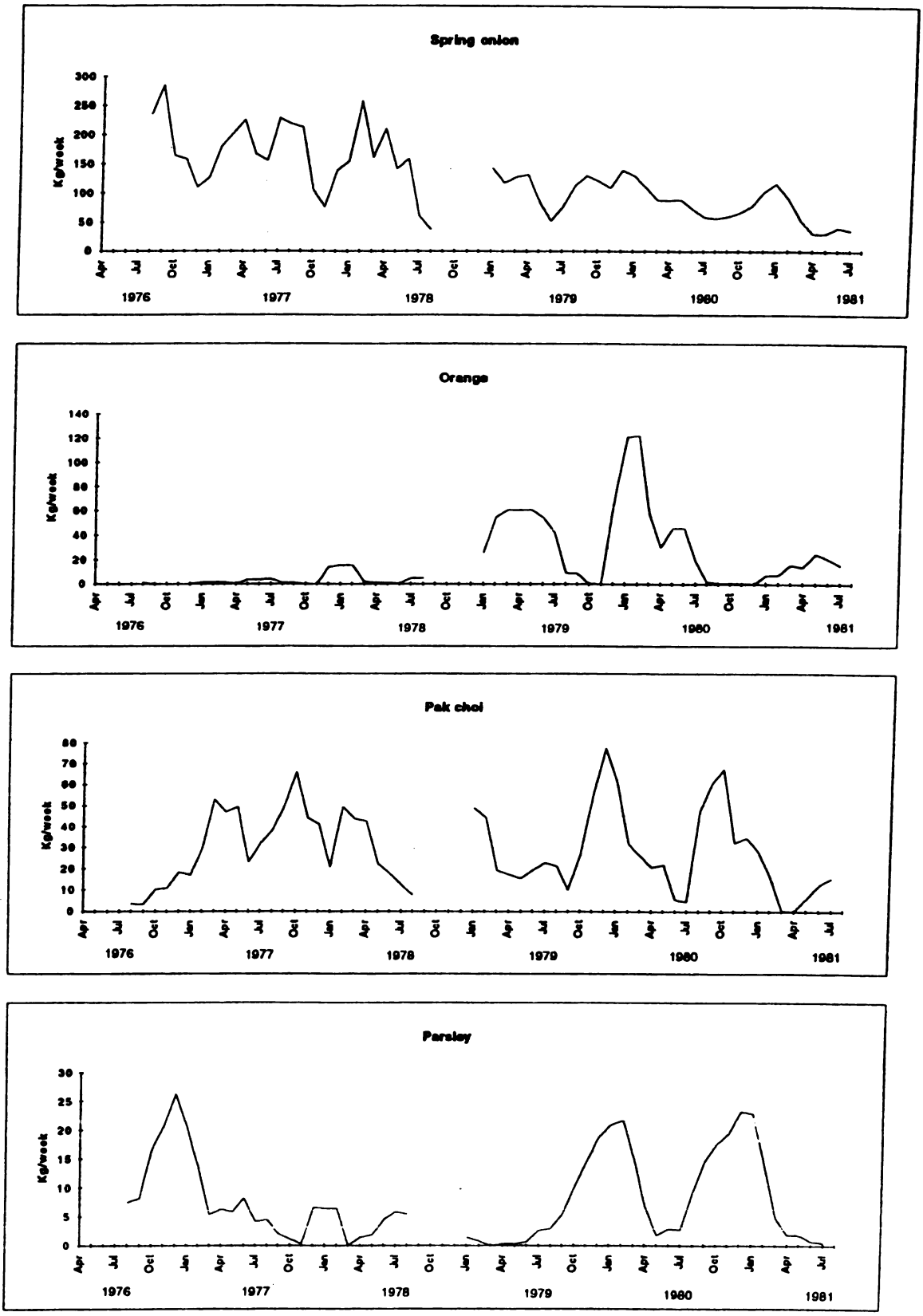


Figure 26. Monthly purchases (kg/week) of spring onion, orange, pak choi and parsley by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (three month running mean) (Source: FMC purchase records)

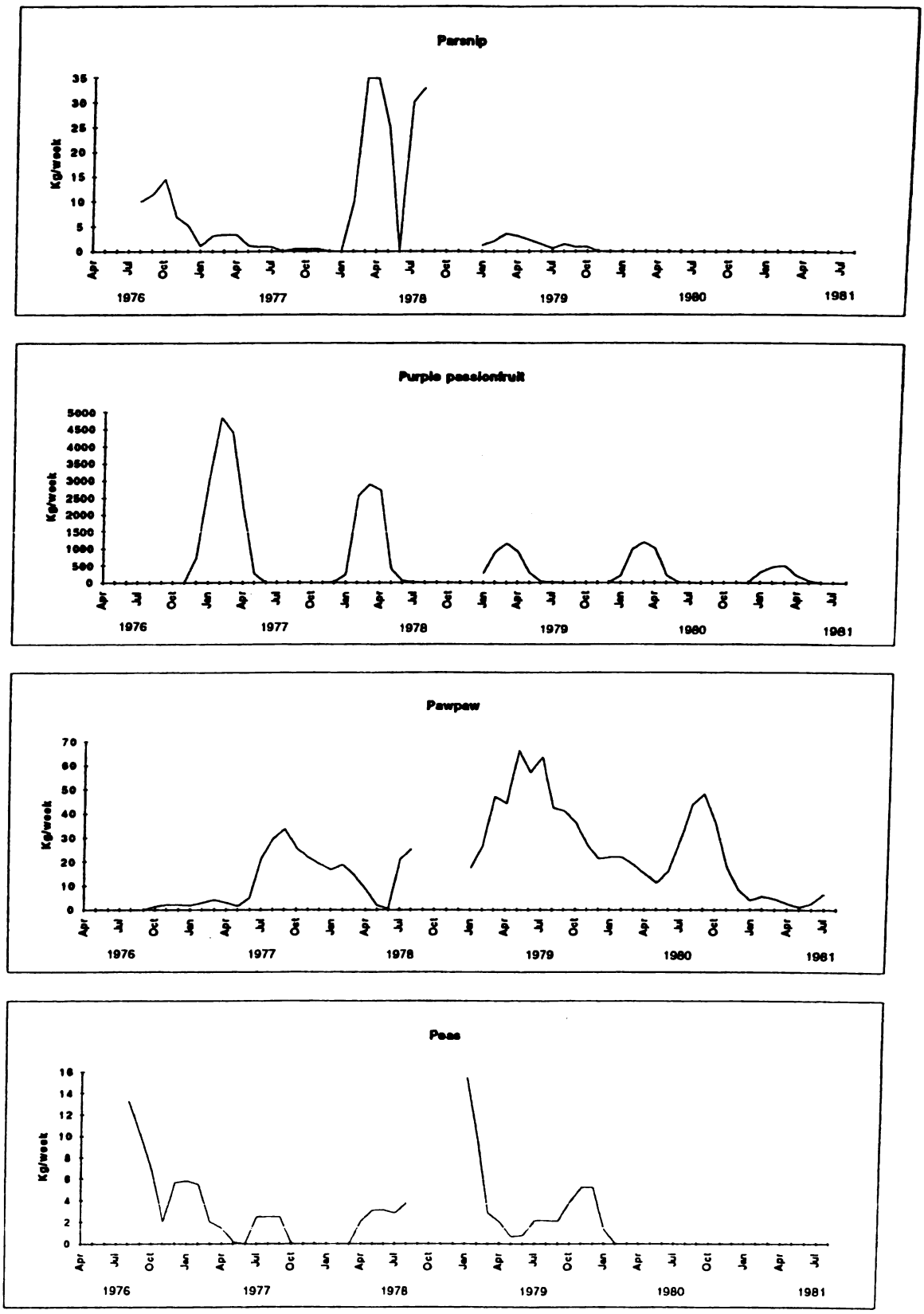


Figure 27. Monthly purchases (kg/week) of parsnip, purple passionfruit, pawpaw and peas by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (three month running mean) (Source: FMC purchase records)

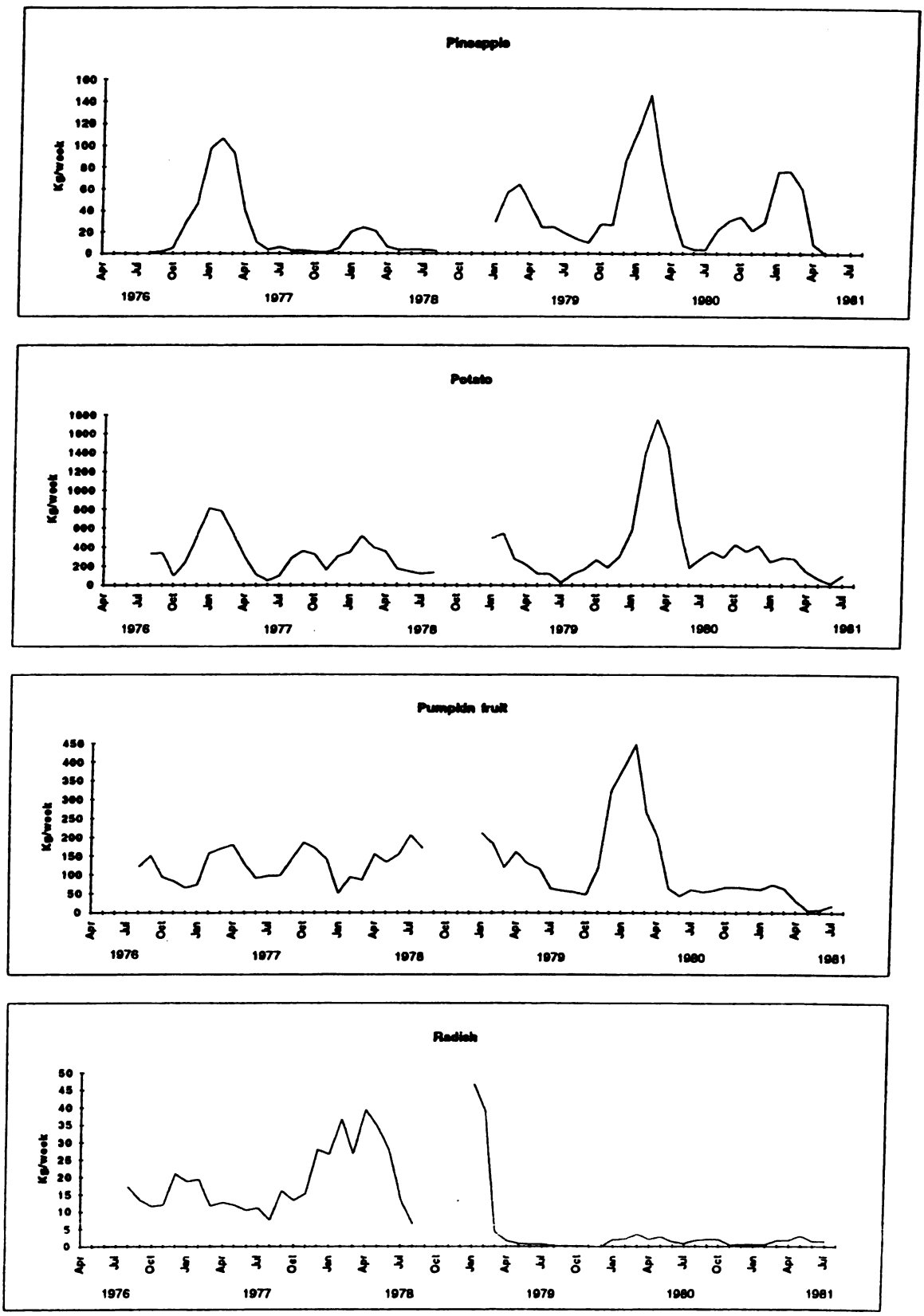


Figure 28. Monthly purchases (kg/week) of pineapple, potato, pumpkin fruit and radish by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (three month running mean) (Source: FMC purchase records)

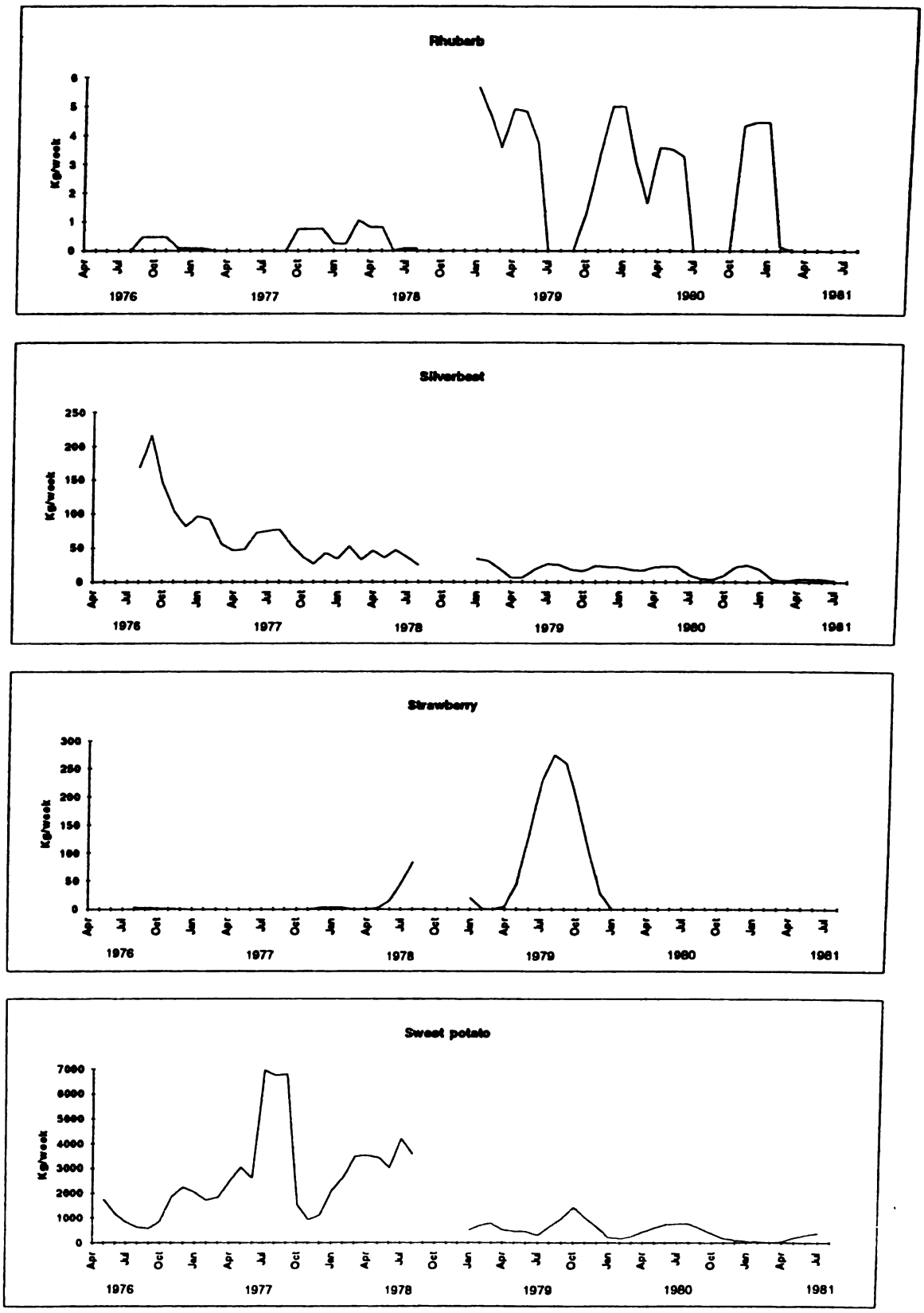


Figure 29. Monthly purchases (kg/week) of rhubarb, silverbeet, strawberry and sweet potato by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (three month running mean) (Source: FMC purchase records)

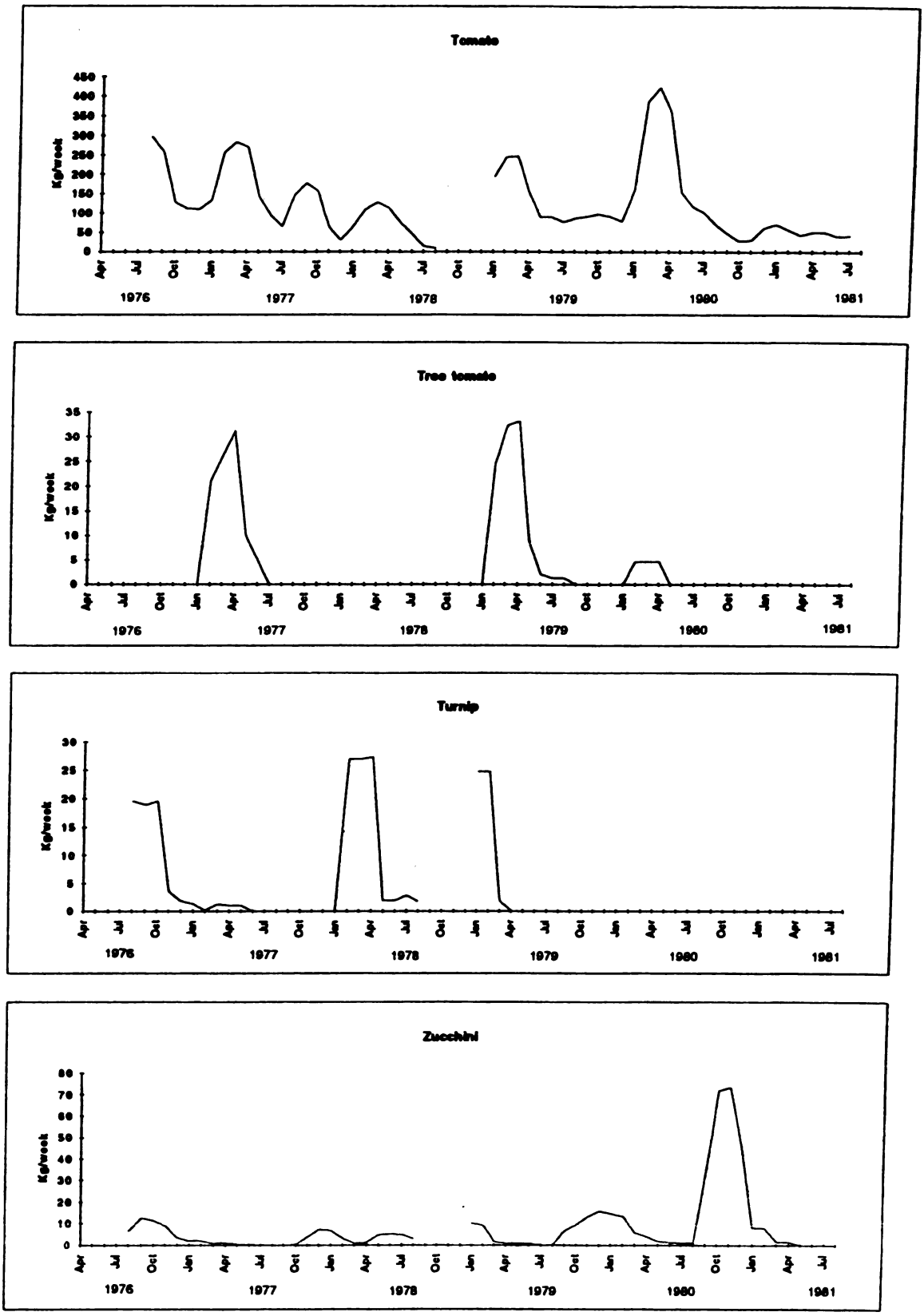


Figure 30. Monthly purchases (kg/week) of tomato, tree tomato, turnip and zucchini by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (three month running mean) (Source: FMC purchase records)

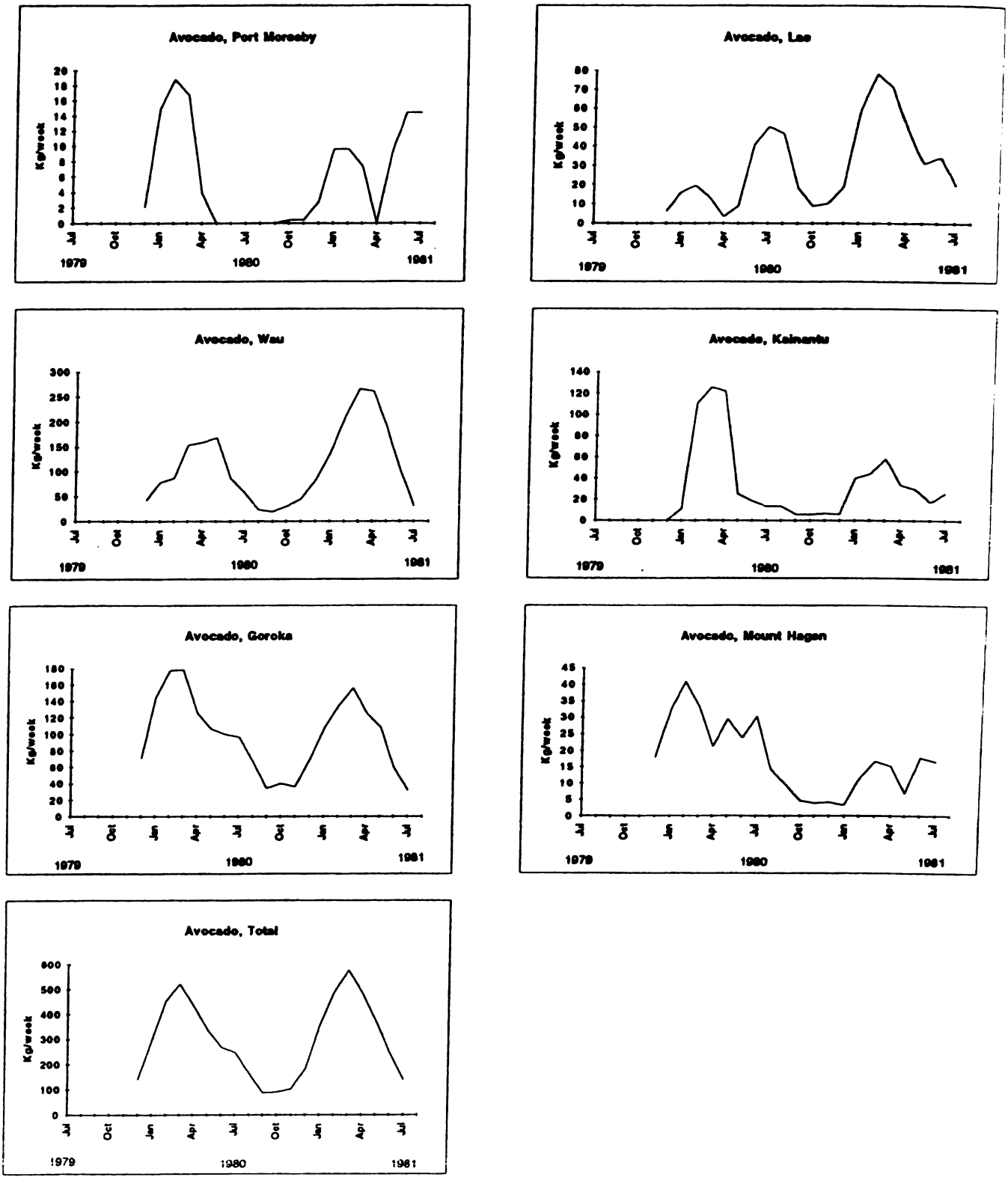


Figure 31. Monthly purchases (kg/week) of avocado by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

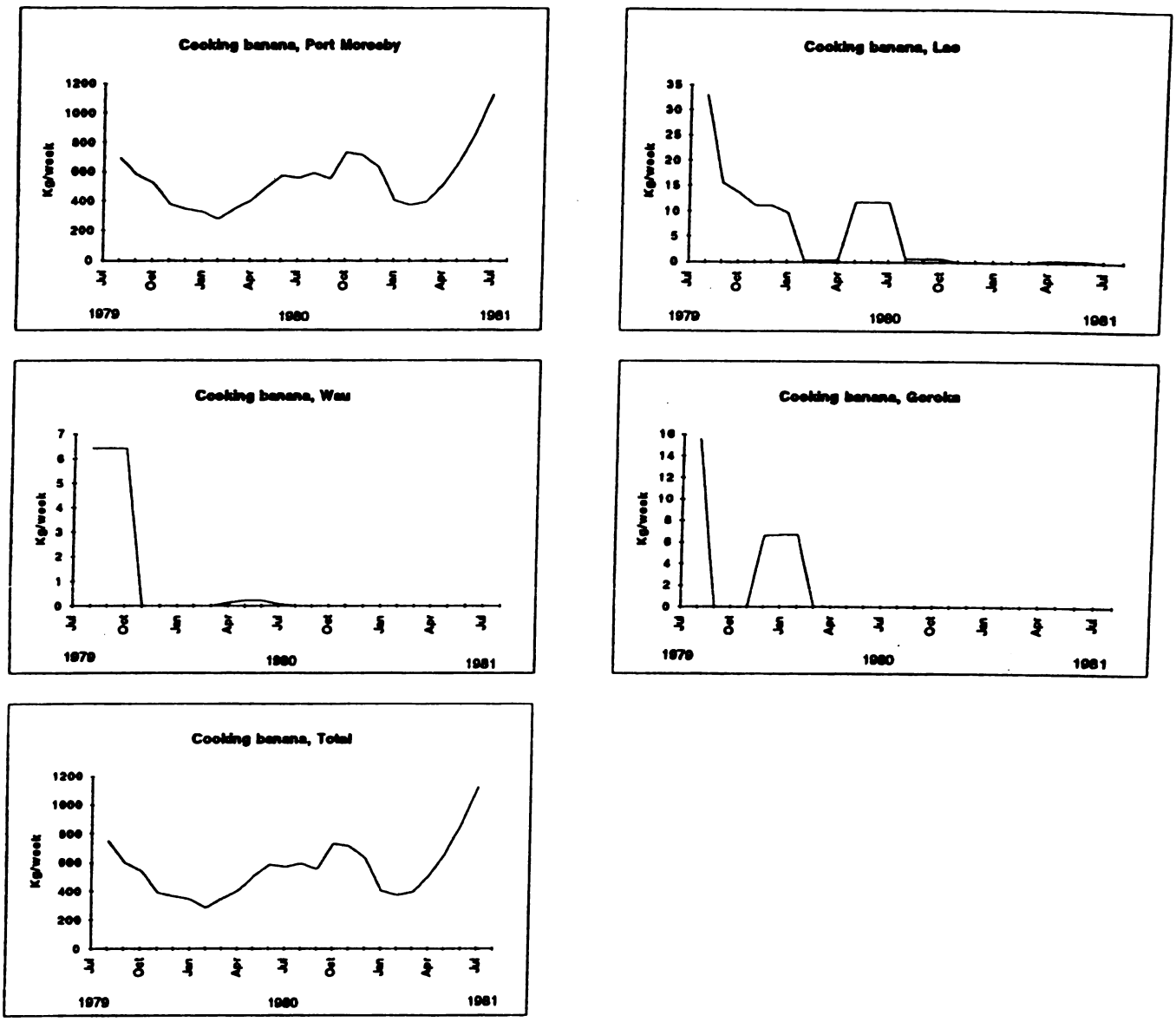


Figure 32. Monthly purchases (kg/week) of cooking banana by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

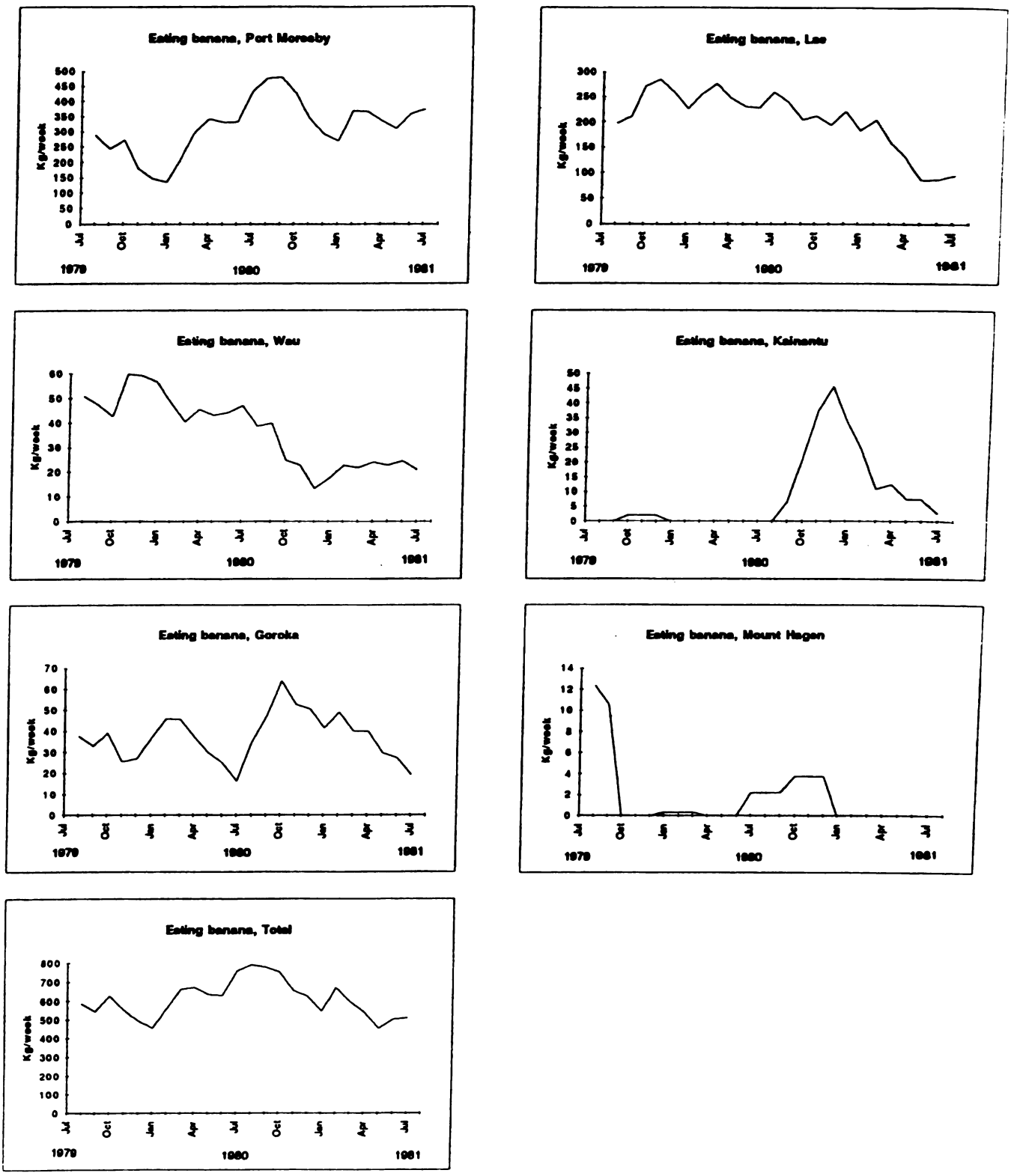


Figure 33. Monthly purchases (kg/week) of eating banana by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

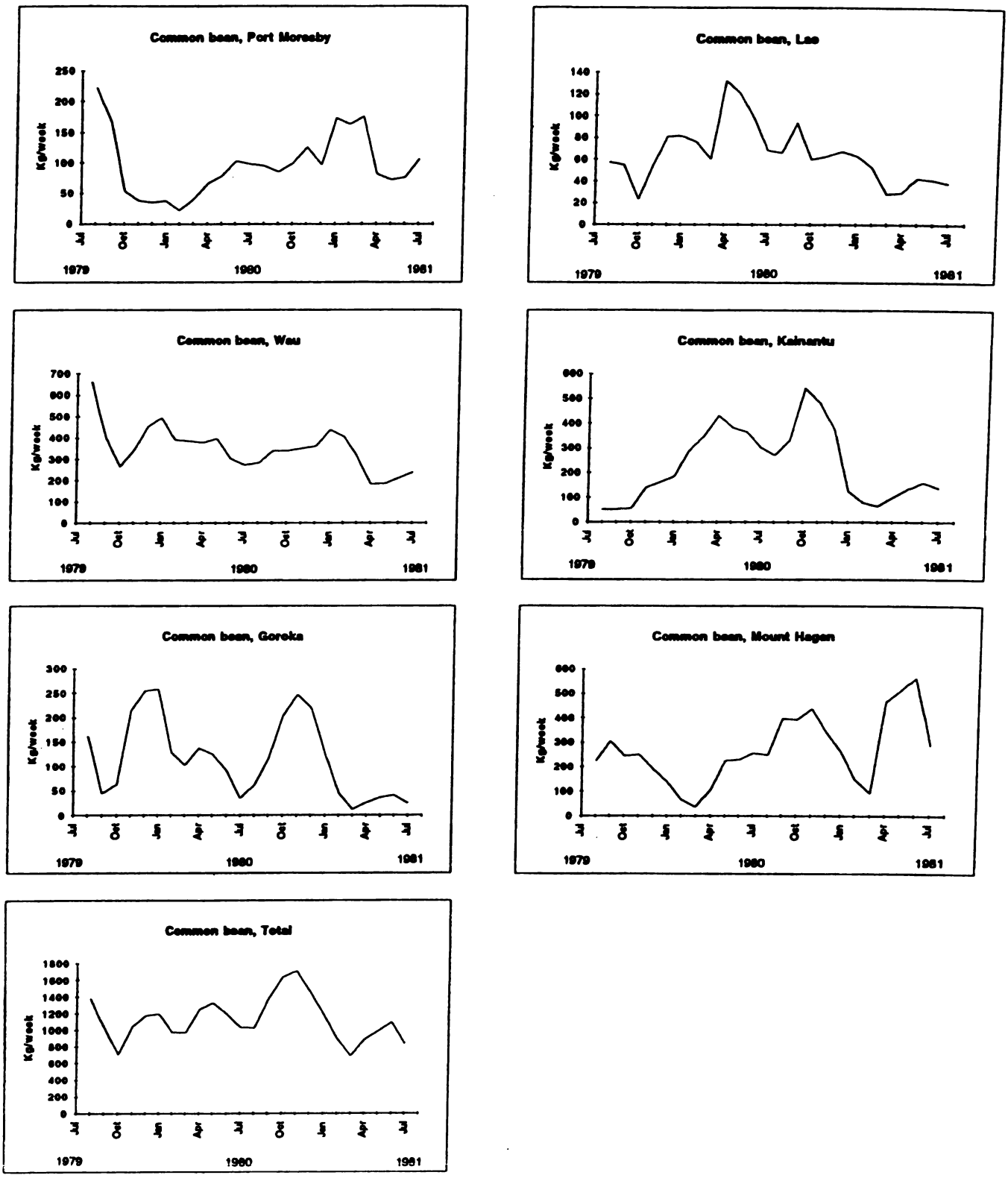


Figure 34. Monthly purchases (kg/week) of common bean by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

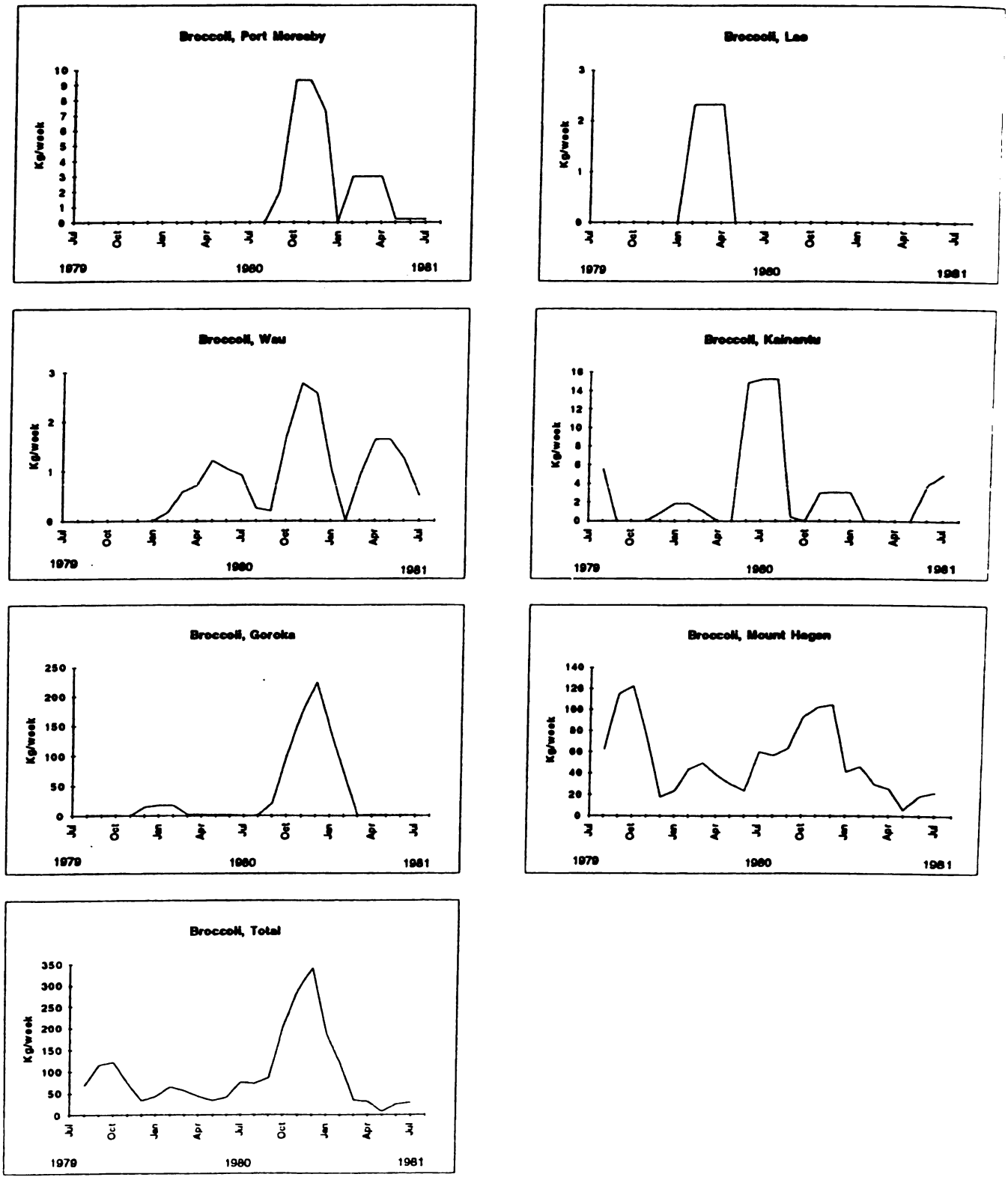


Figure 35. Monthly purchases (kg/week) of broccoli by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

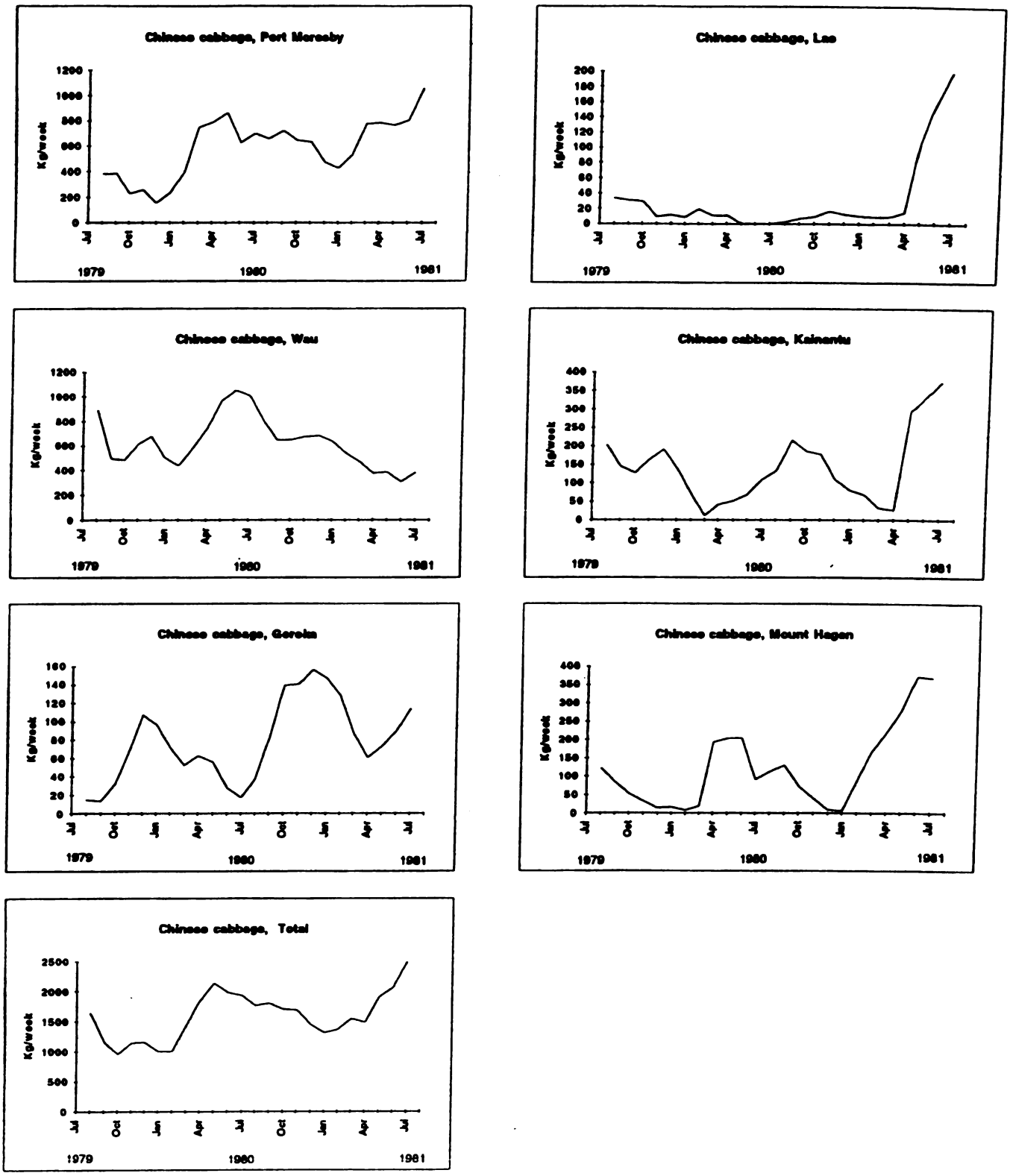


Figure 36. Monthly purchases (kg/week) of Chinese cabbage by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

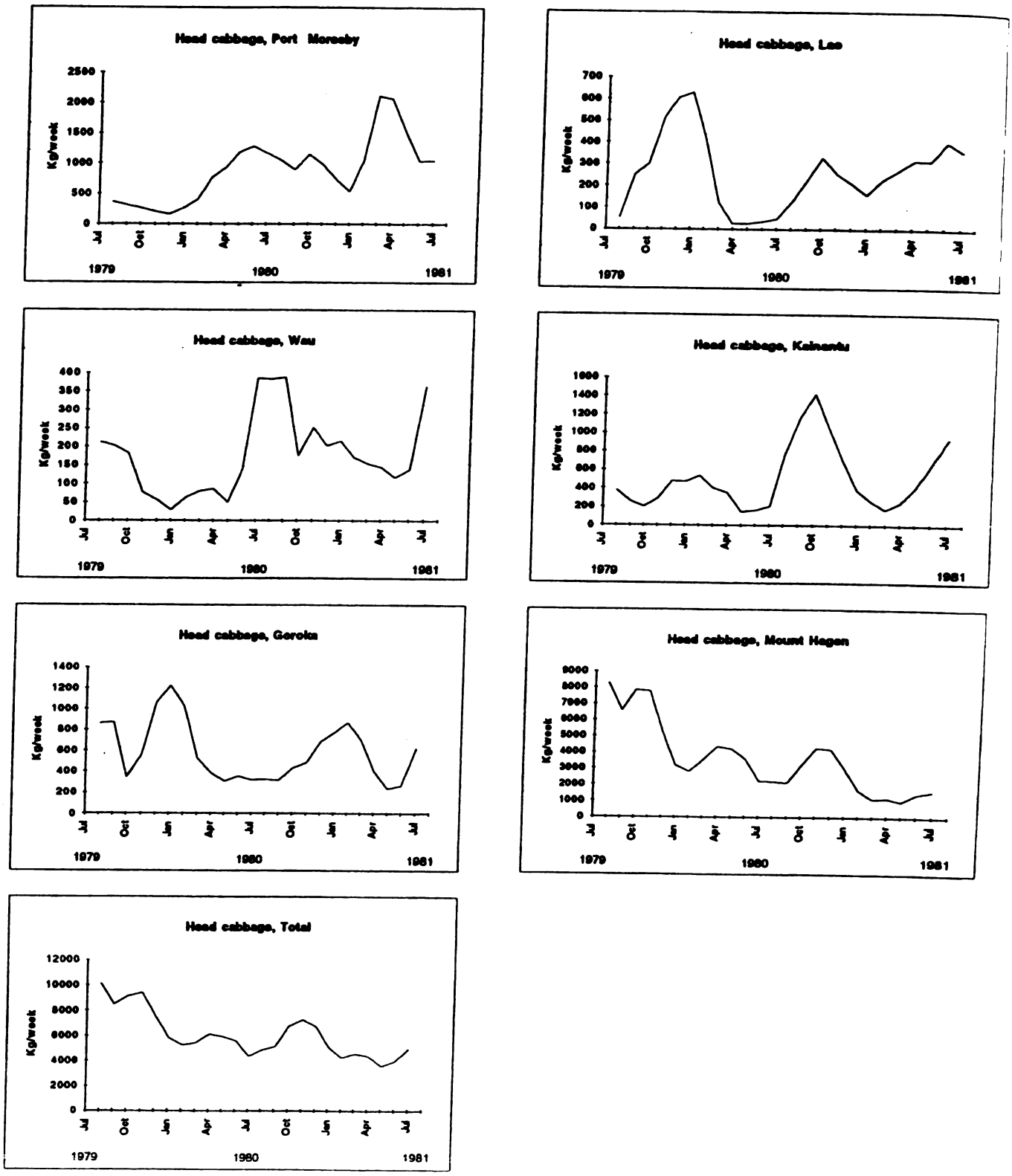


Figure 37. Monthly purchases (kg/week) of head cabbage by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

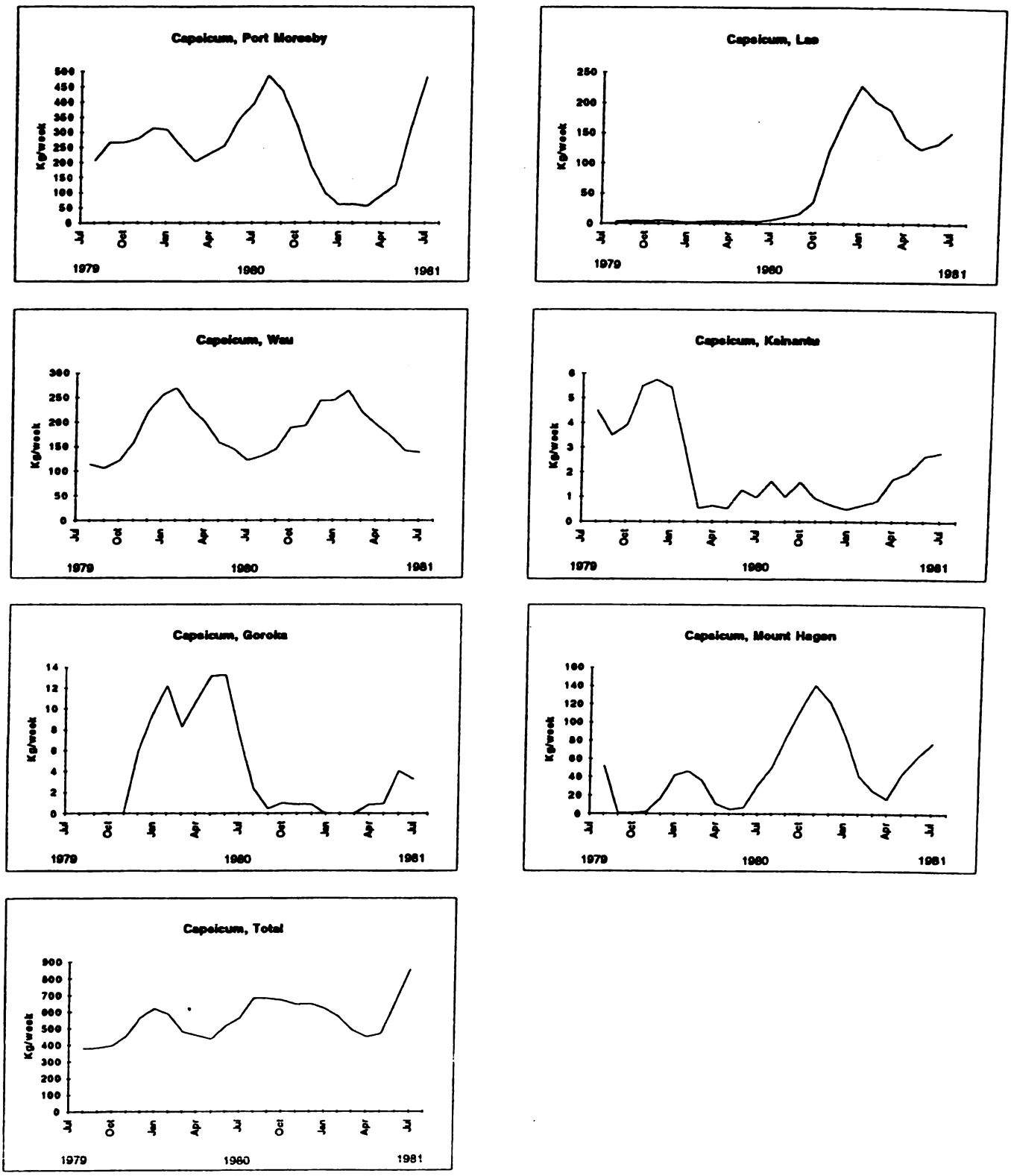


Figure 38. Monthly purchases (kg/week) of capsicum by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

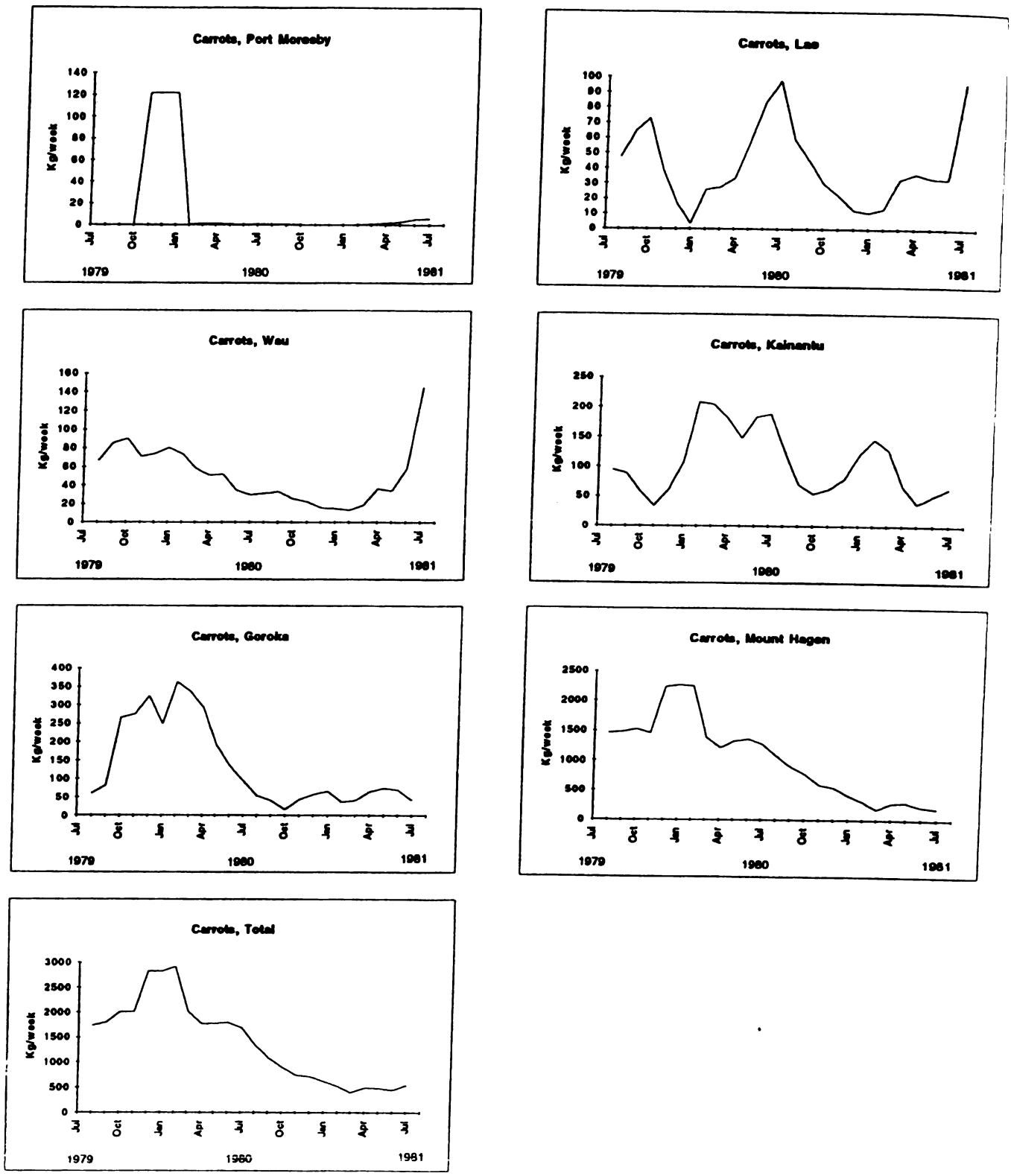


Figure 39. Monthly purchases (kg/week) of carrots by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

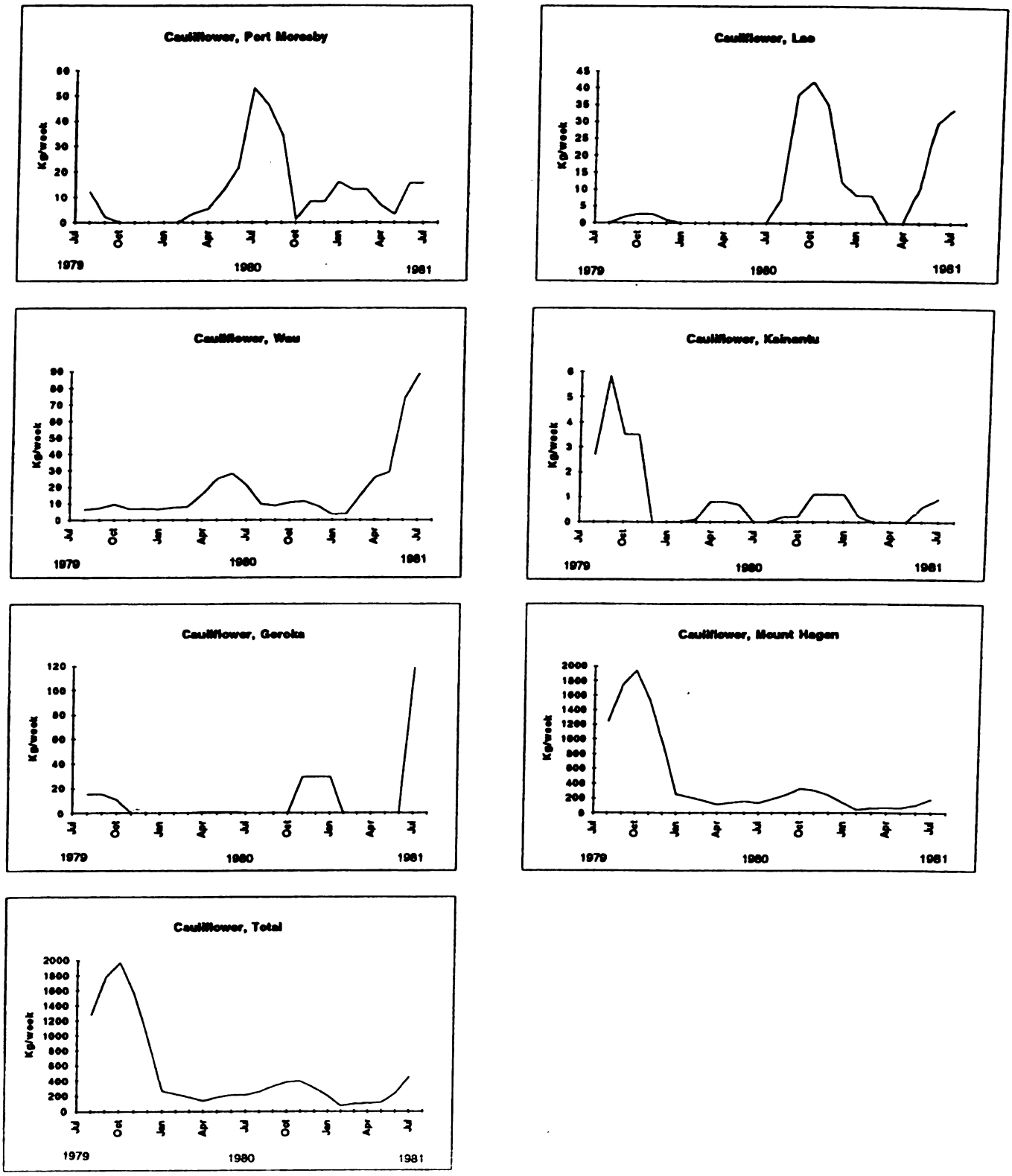


Figure 40. Monthly purchases (kg/week) of cauliflower by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

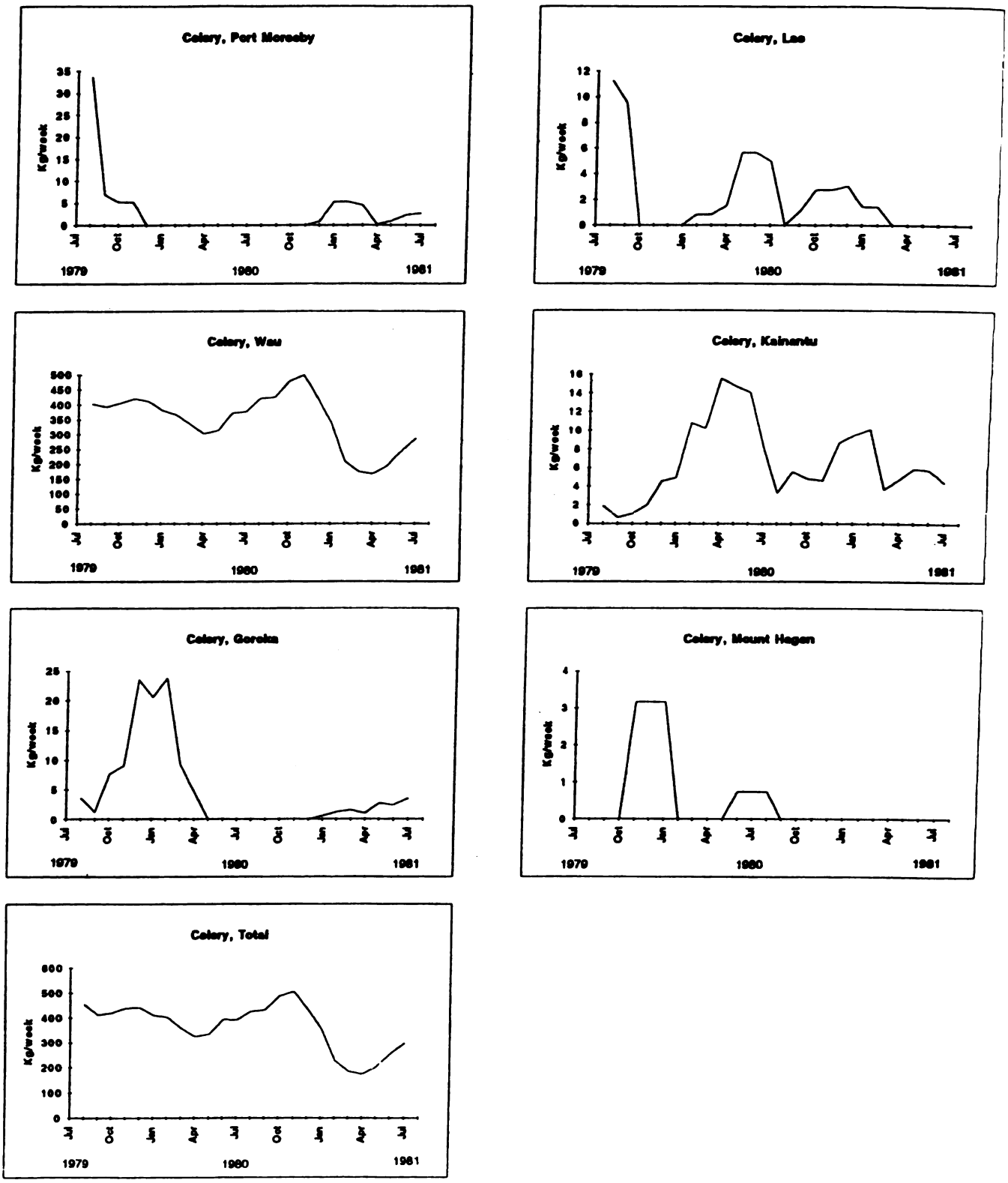


Figure 41. Monthly purchases (kg/week) of celery by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

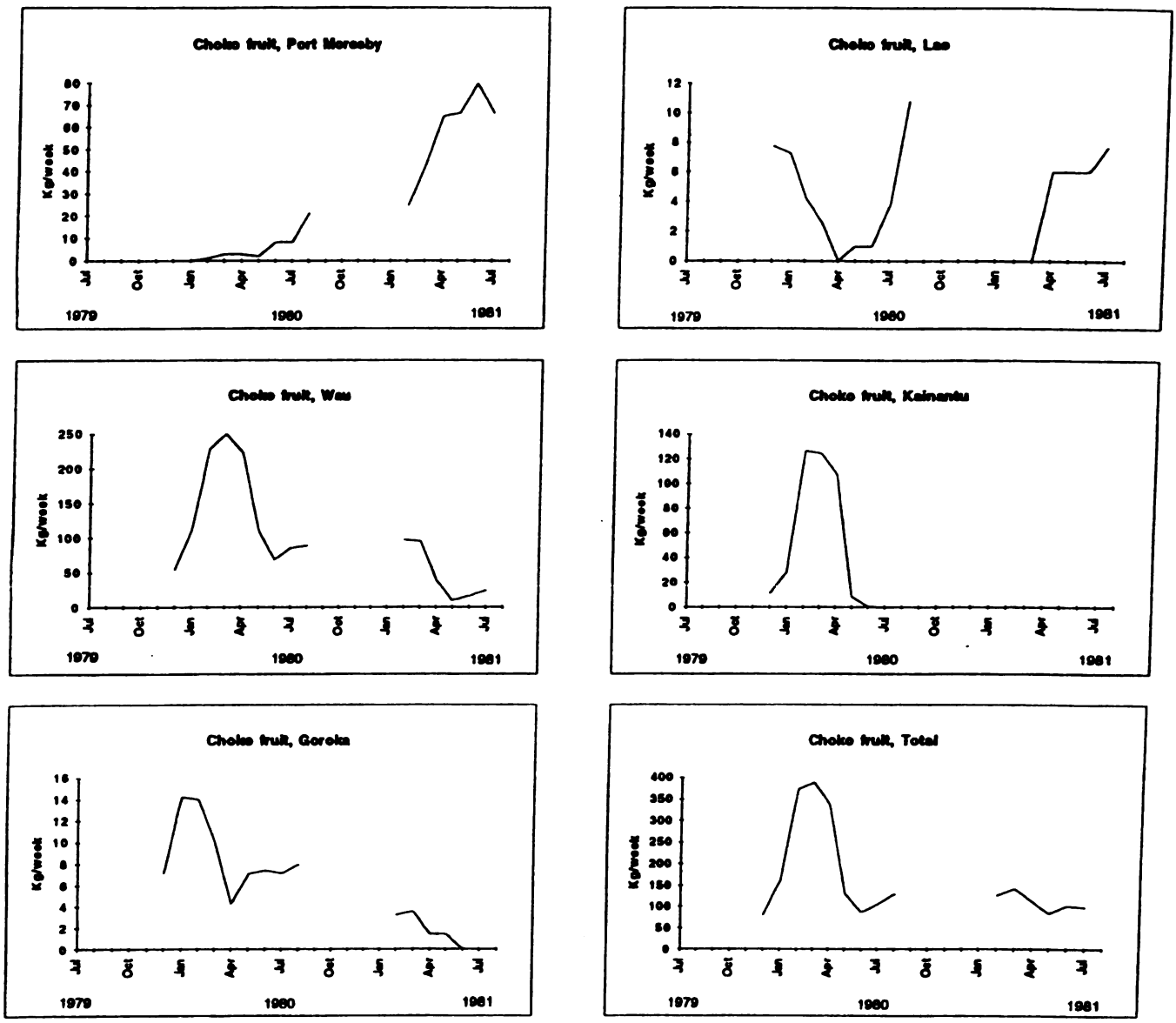


Figure 42. Monthly purchases (kg/week) of choko fruit by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

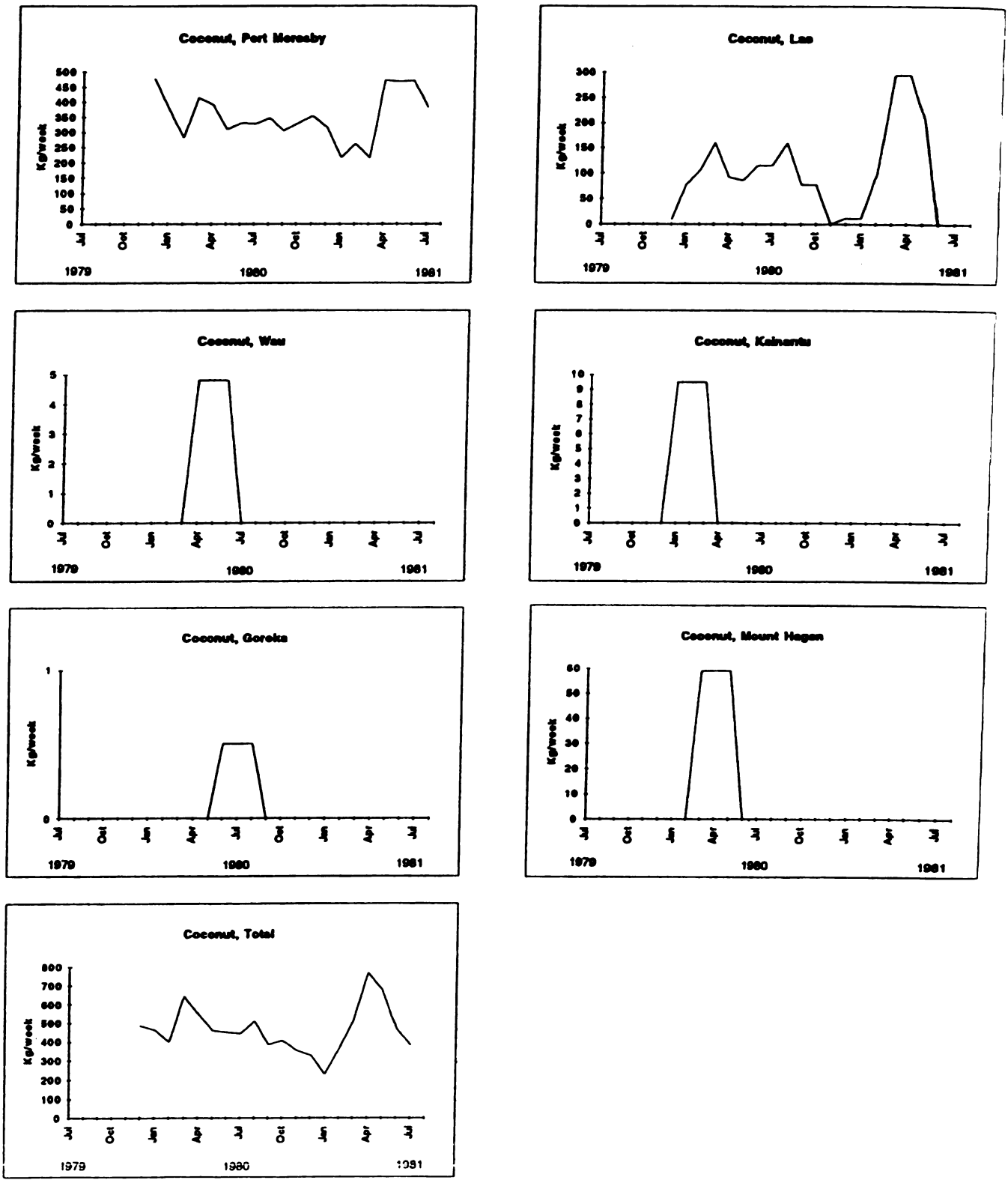


Figure 43. Monthly purchases (kg/week) of coconut by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

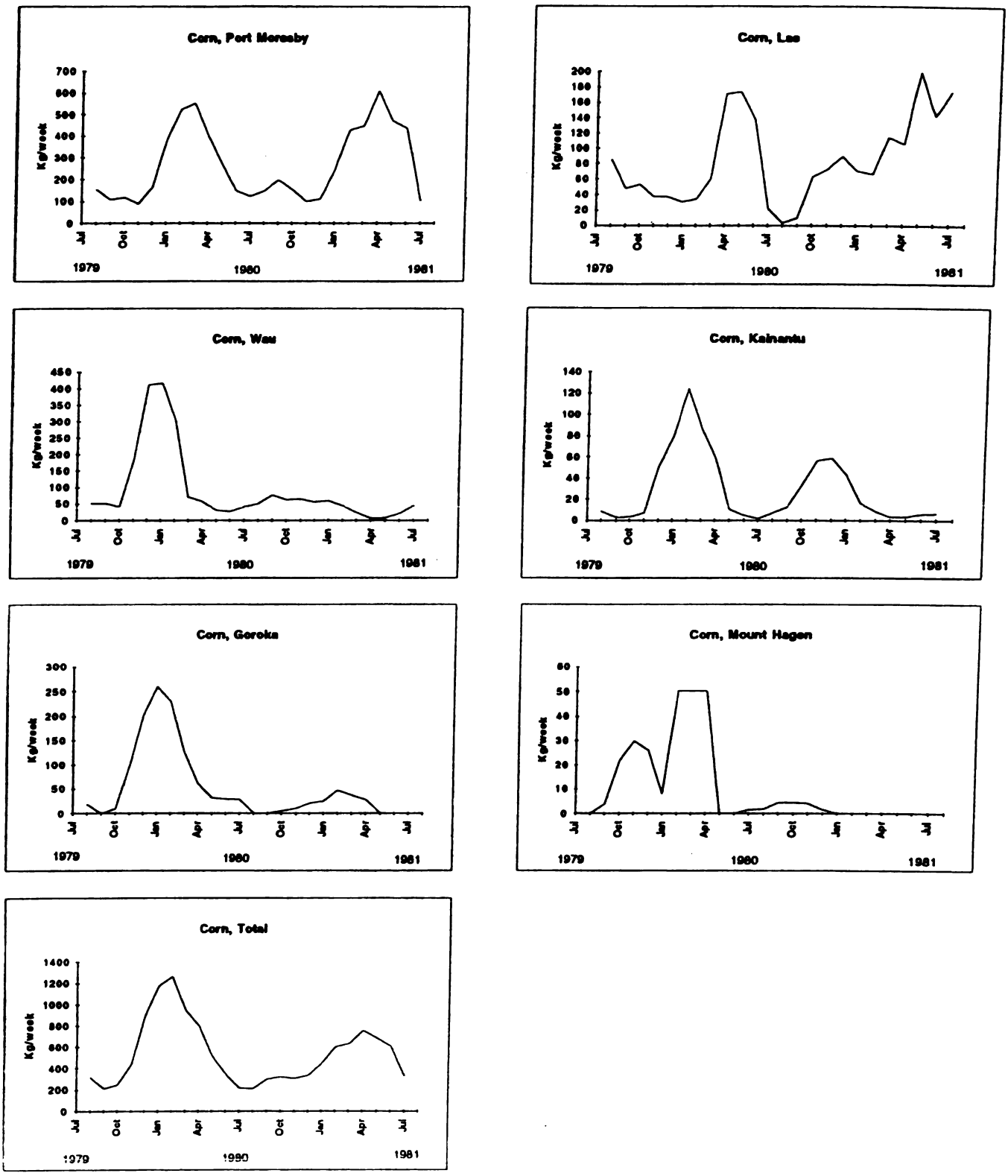


Figure 44. Monthly purchases (kg/week) of corn by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

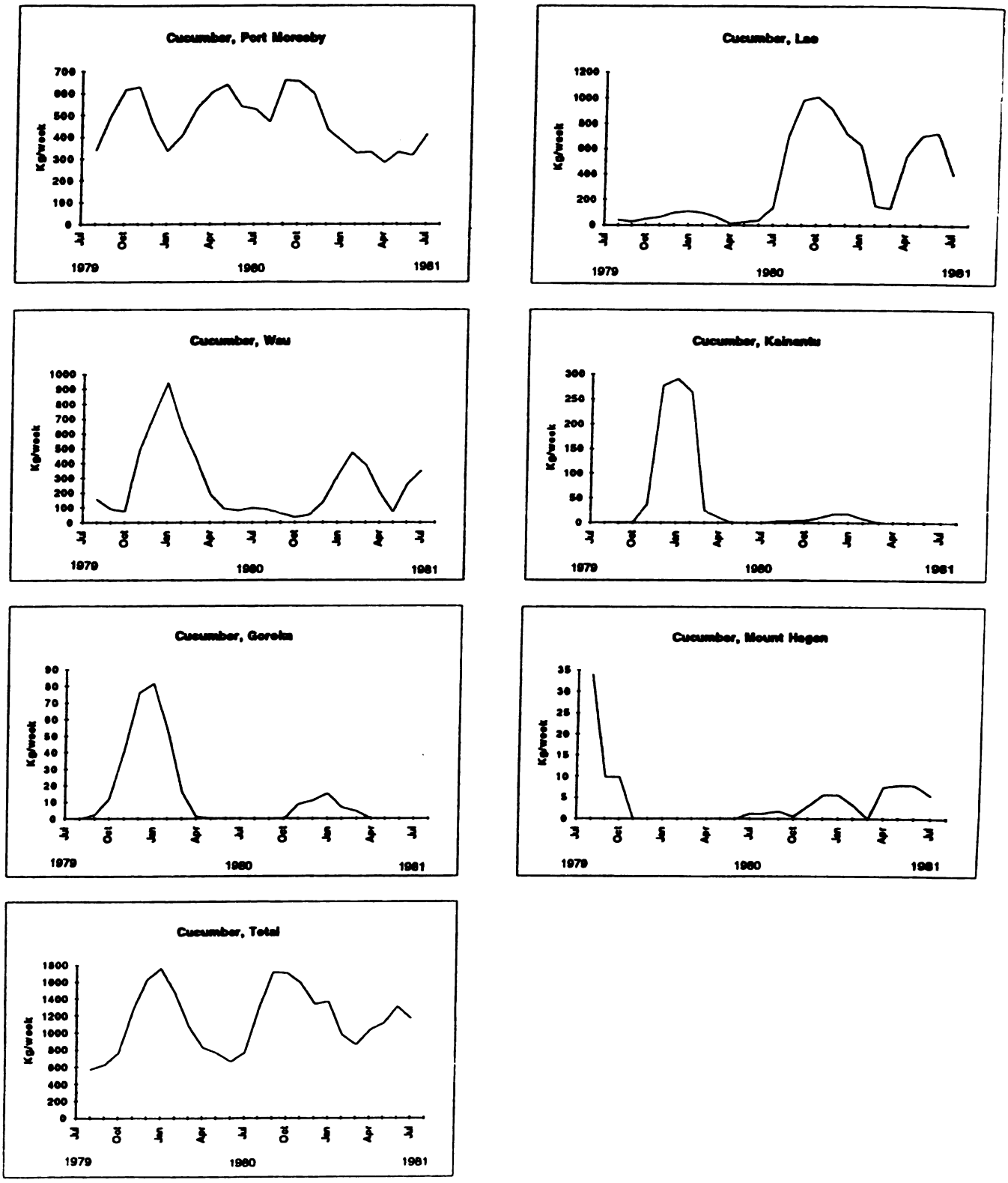


Figure 45. Monthly purchases (kg/week) of cucumber by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

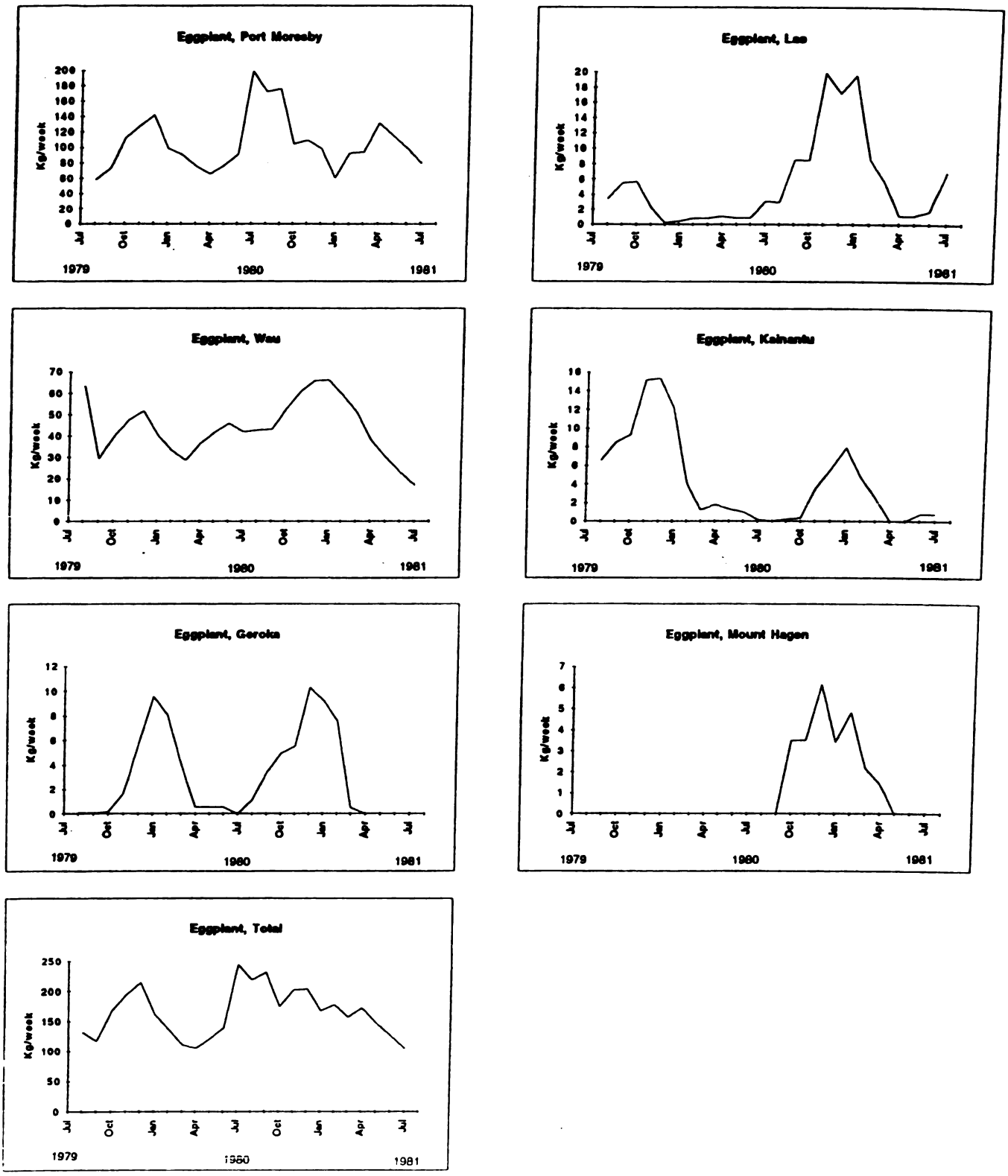


Figure 46. Monthly purchases (kg/week) of eggplant by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

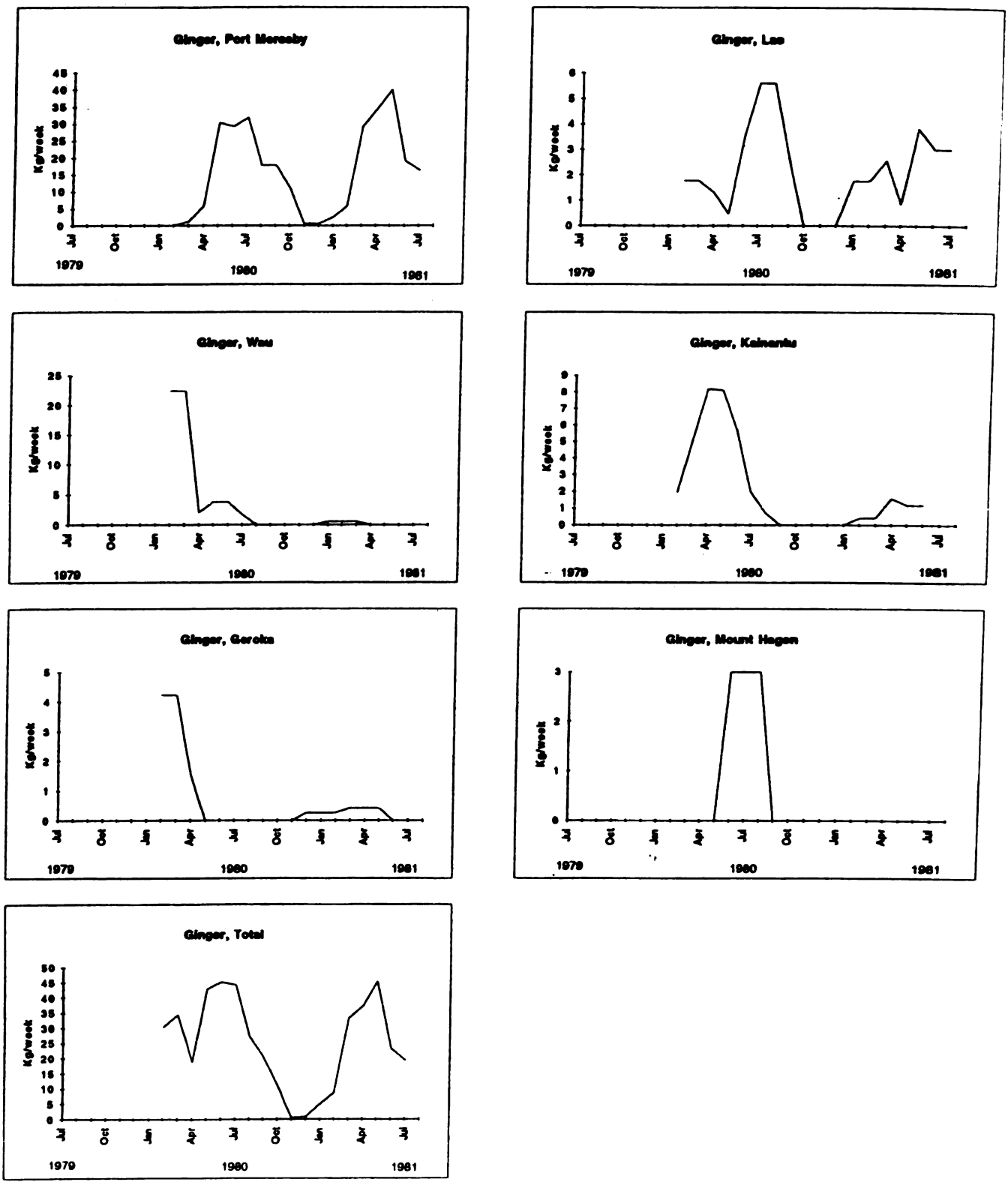


Figure 47. Monthly purchases (kg/week) of ginger by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

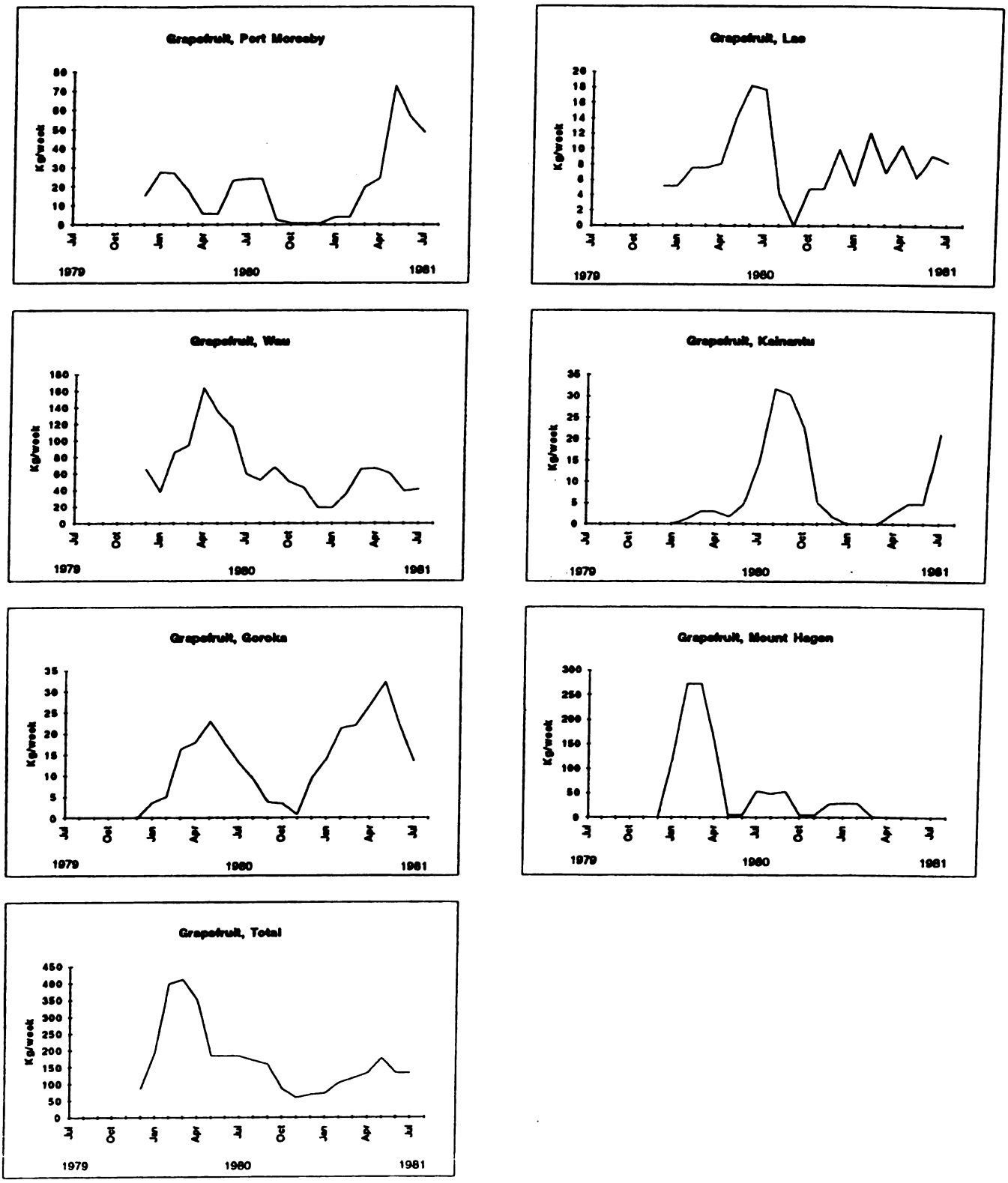


Figure 48. Monthly purchases (kg/week) of grapefruit by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

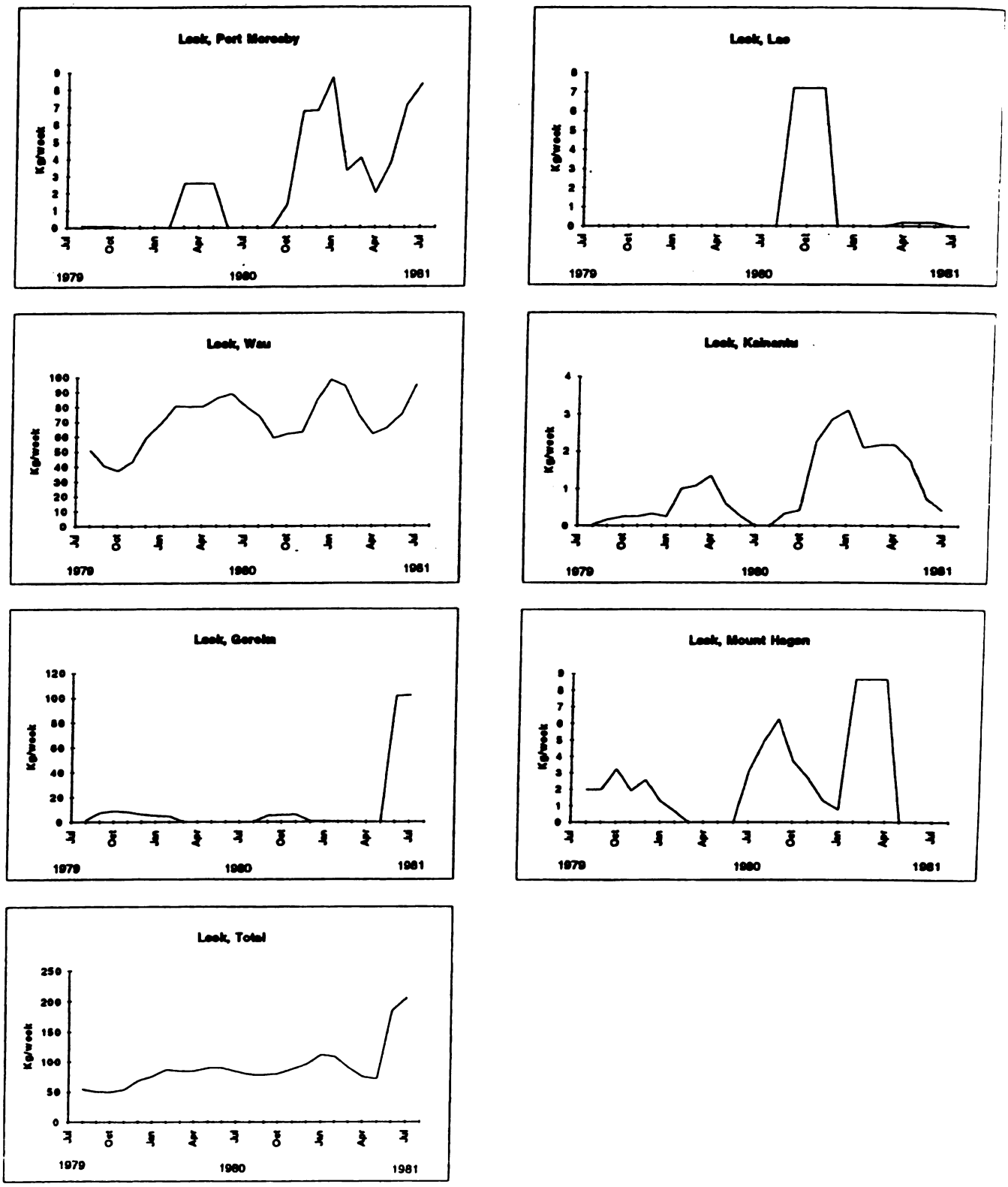


Figure 49. Monthly purchases (kg/week) of leek by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

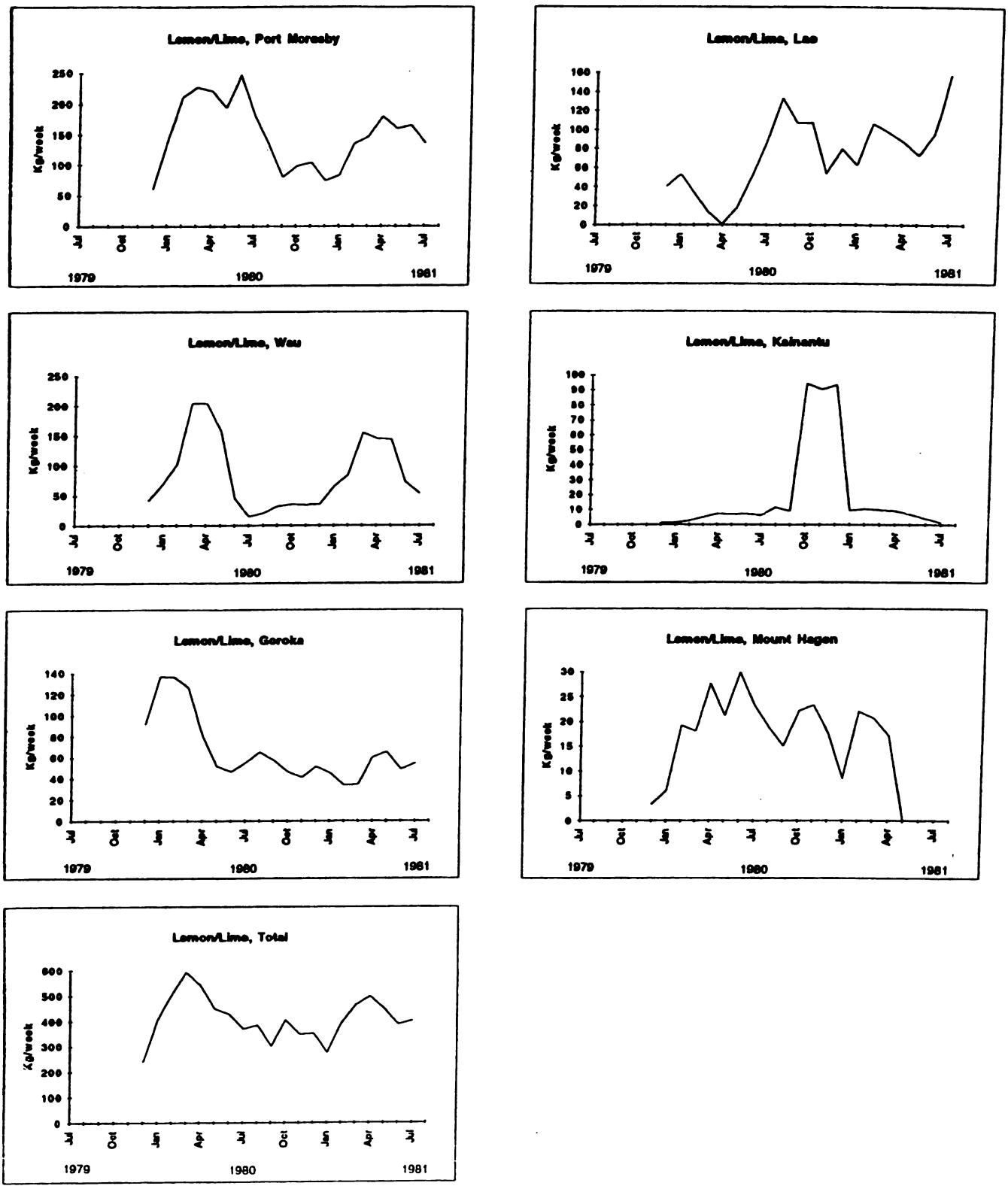


Figure 50. Monthly purchases (kg/week) of lemon/lime by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

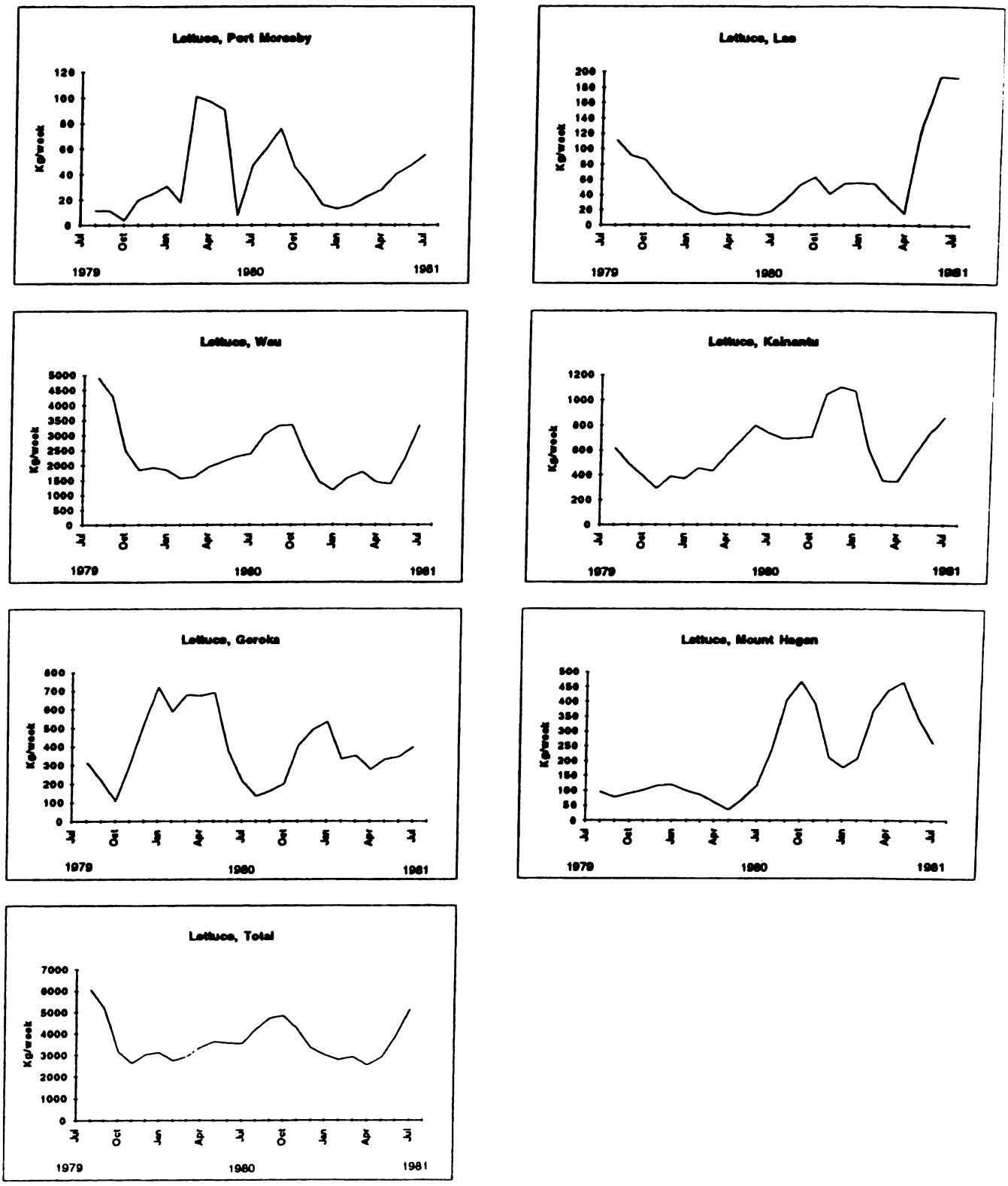


Figure 51. Monthly purchases (kg/week) of lettuce by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

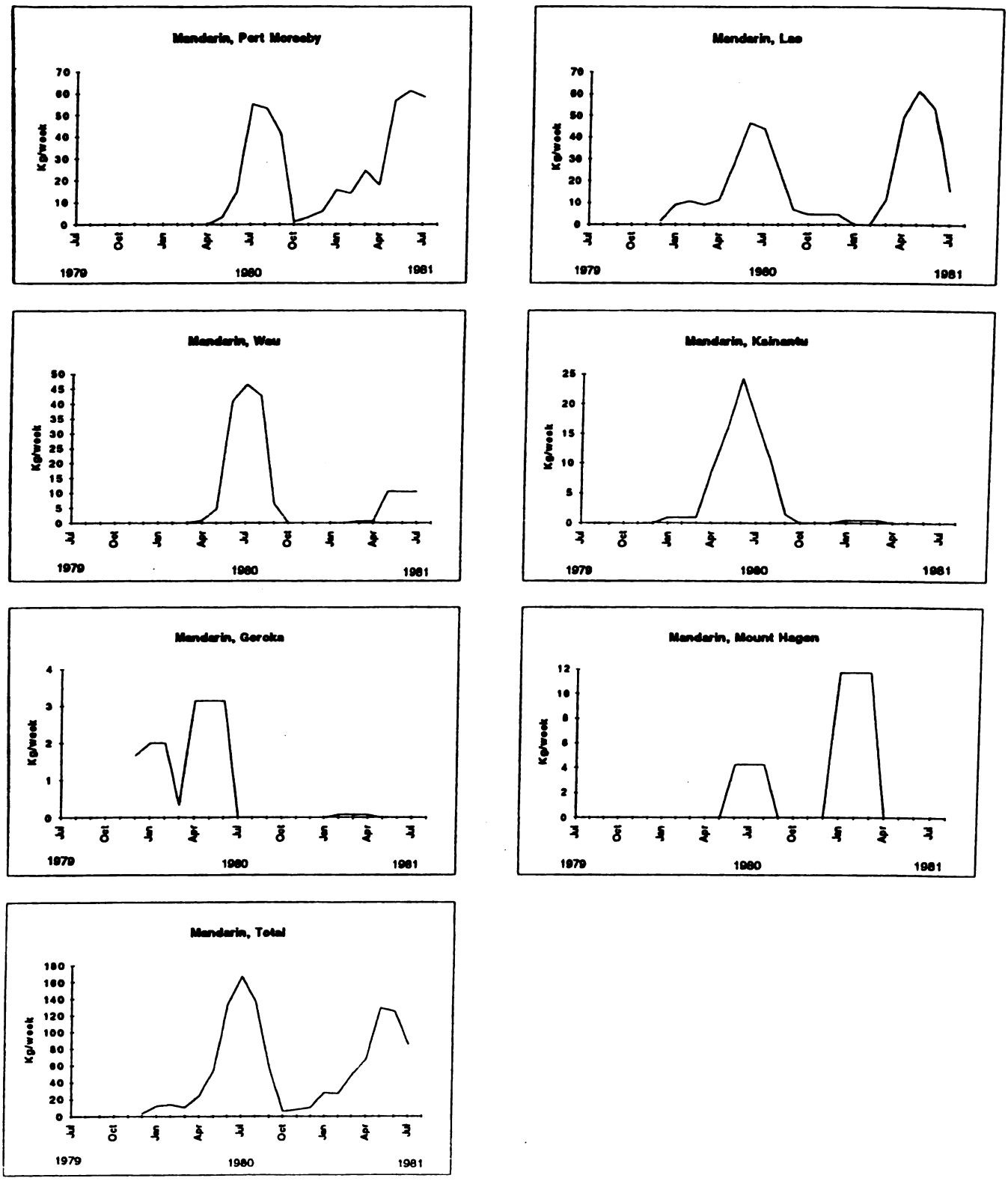


Figure 52. Monthly purchases (kg/week) of mandarin by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

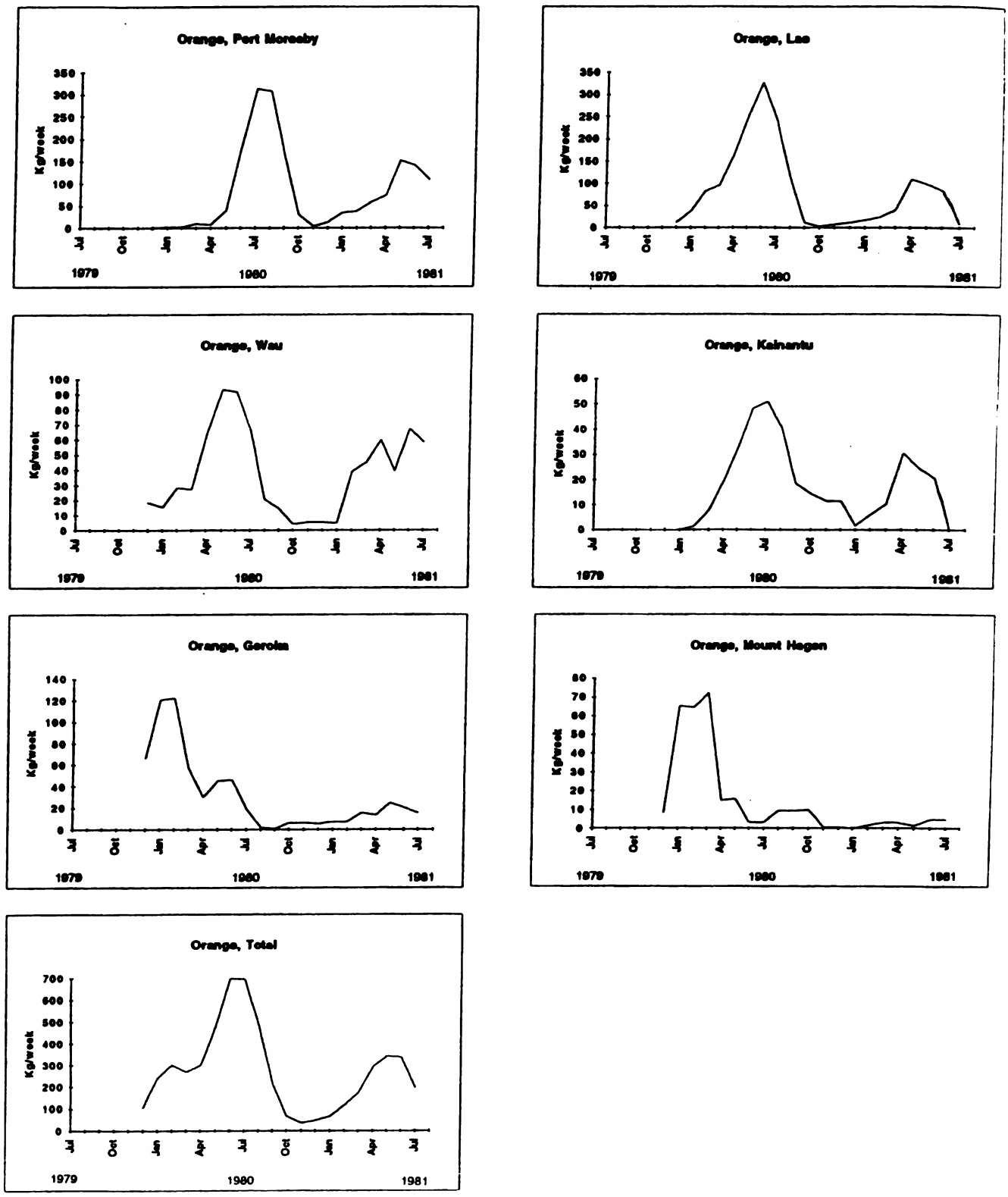


Figure 53. Monthly purchases (kg/week) of orange by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

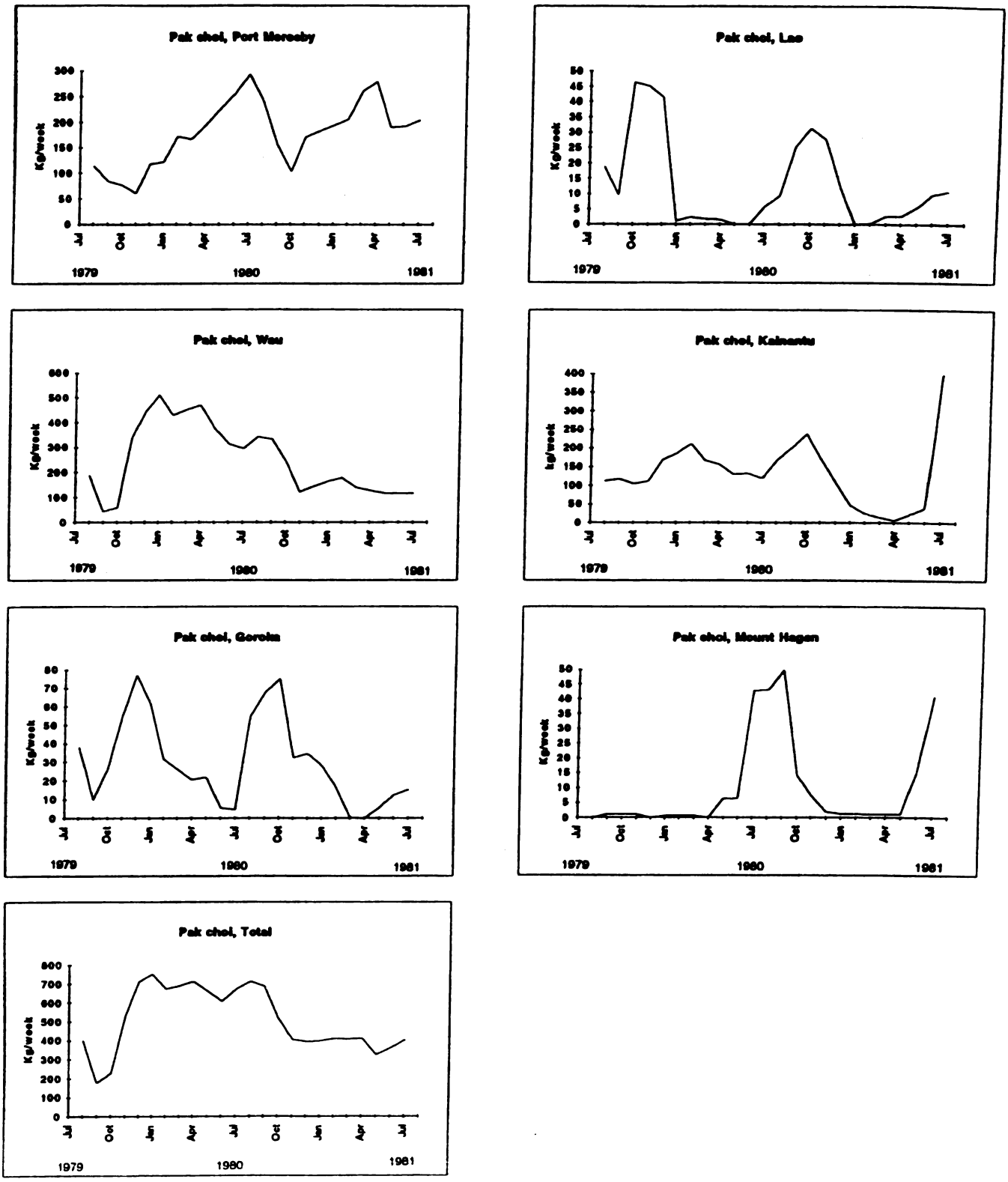


Figure 54. Monthly purchases (kg/week) of pak choi by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

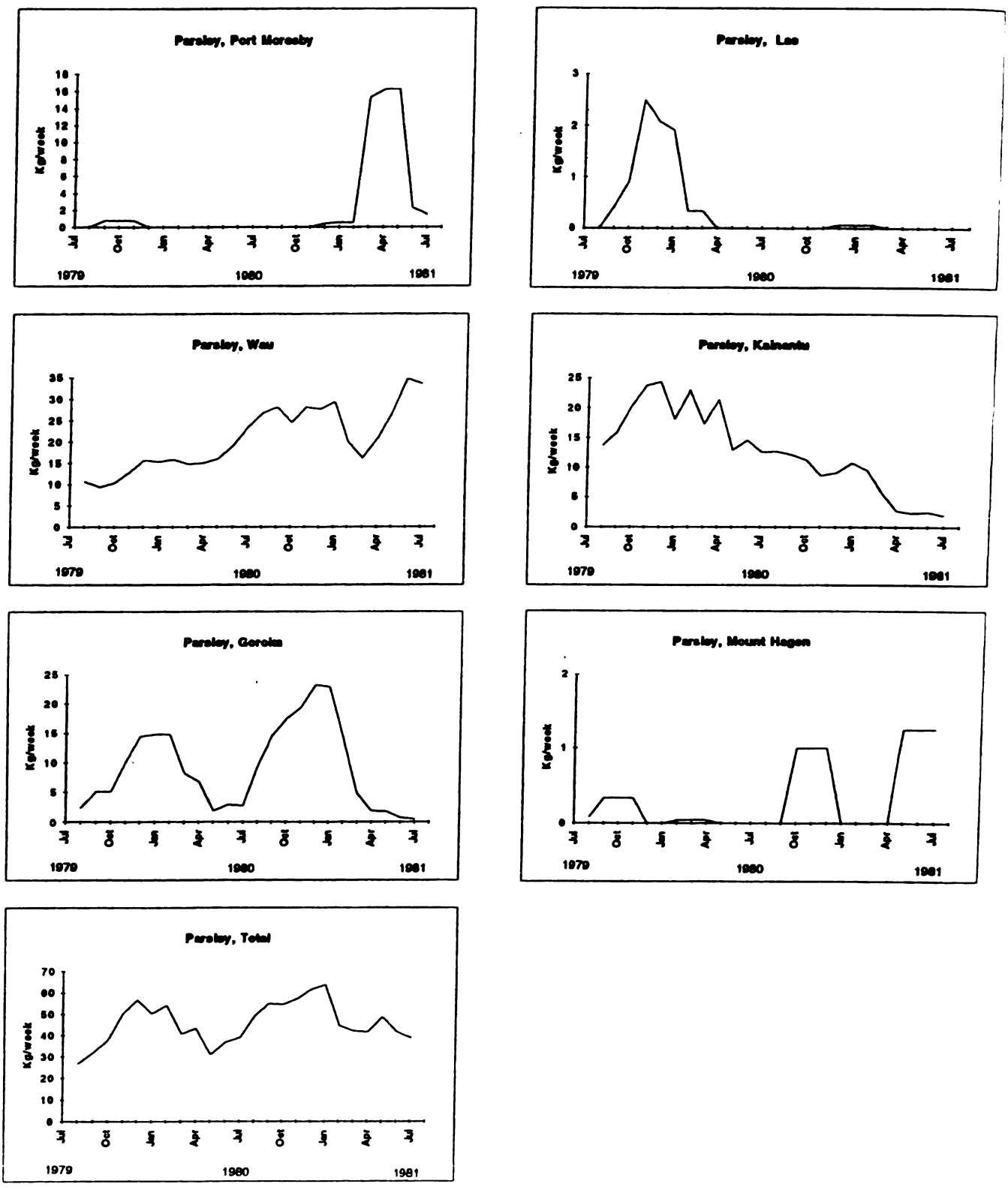


Figure 55. Monthly purchases (kg/week) of parsley by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

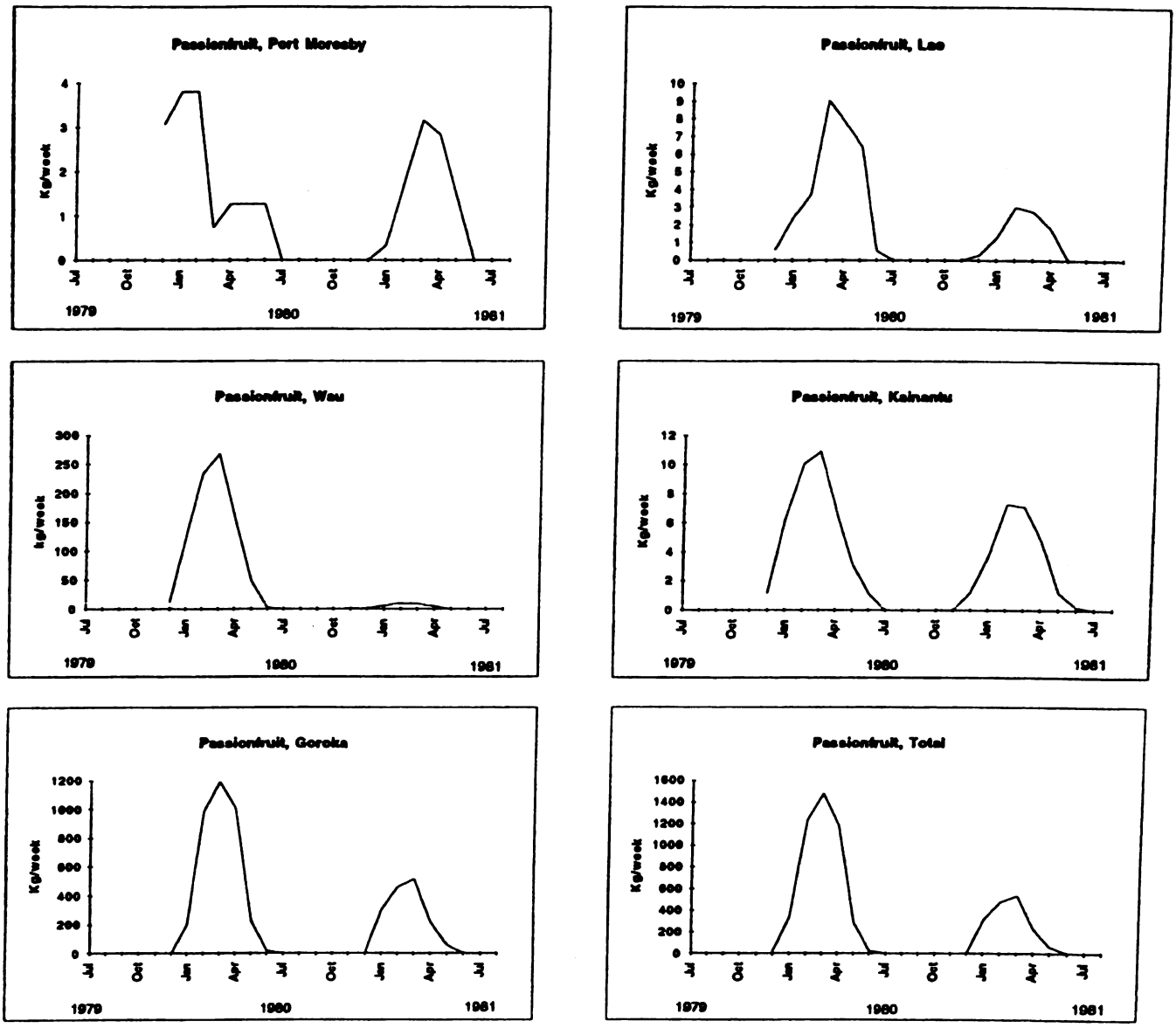


Figure 56. Monthly purchases (kg/week) of purple passionfruit by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

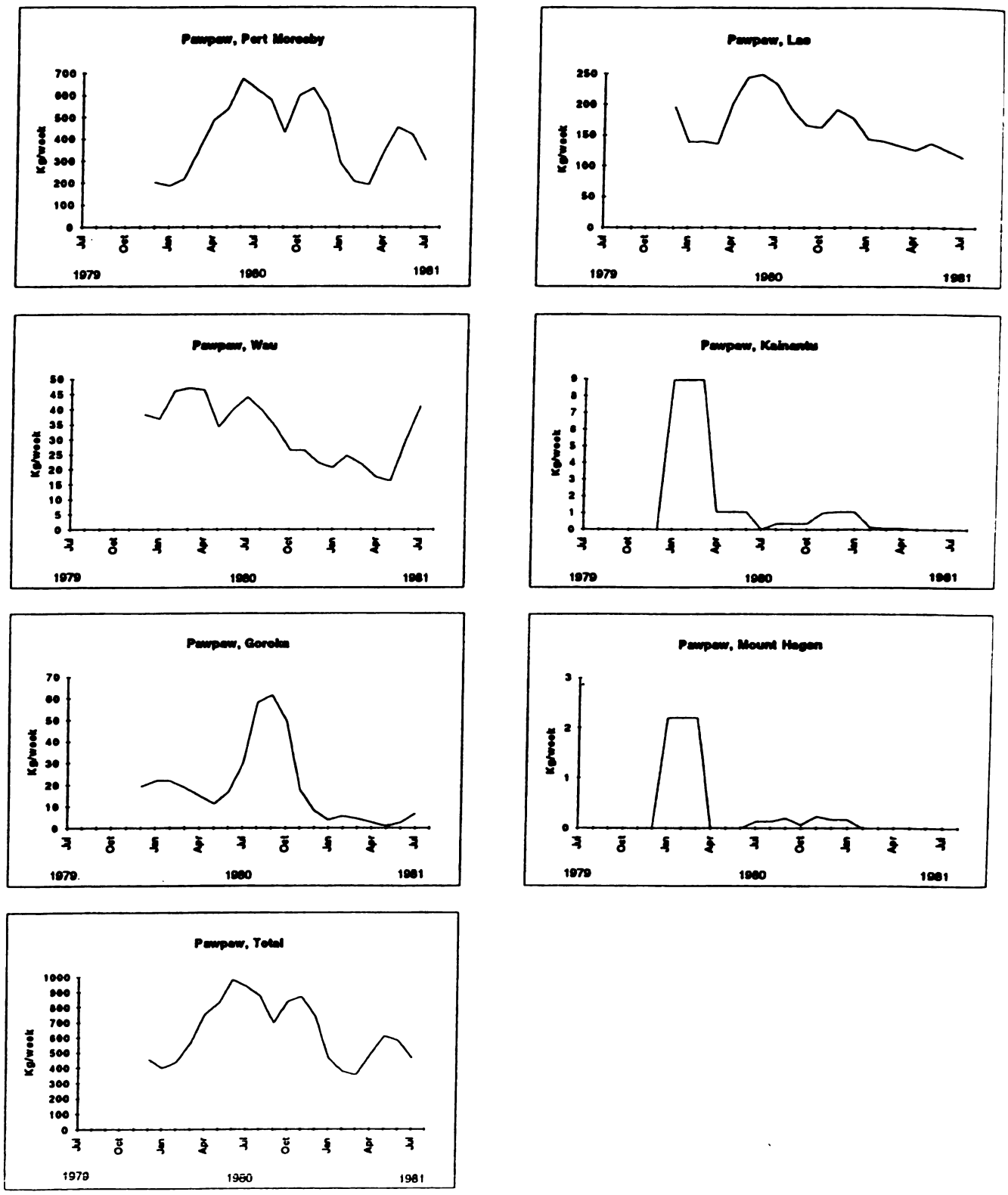


Figure 57. Monthly purchases (kg/week) of pawpaw by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

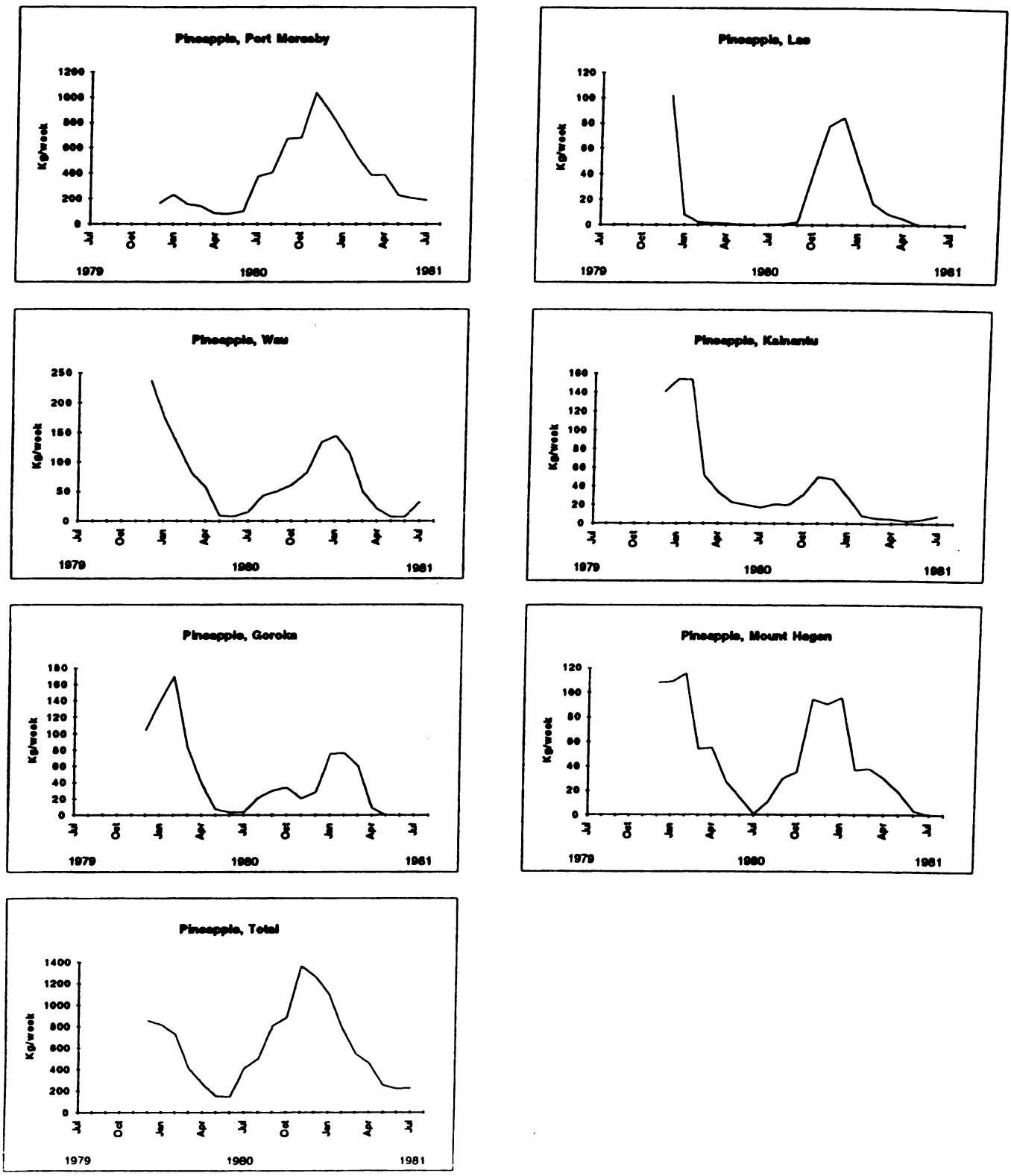


Figure 58. Monthly purchases (kg/week) of pineapple by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

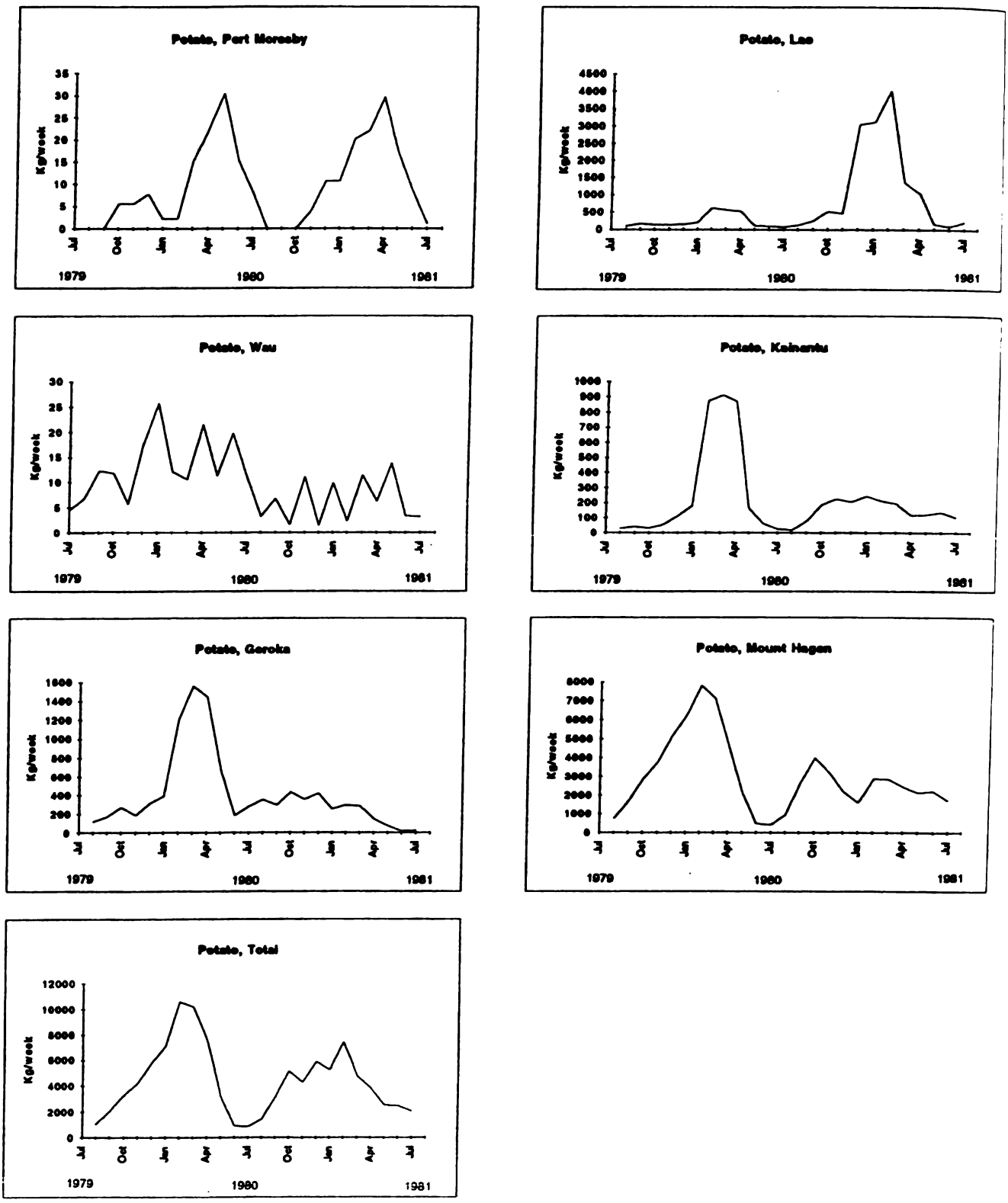


Figure 59. Monthly purchases (kg/week) of potato by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

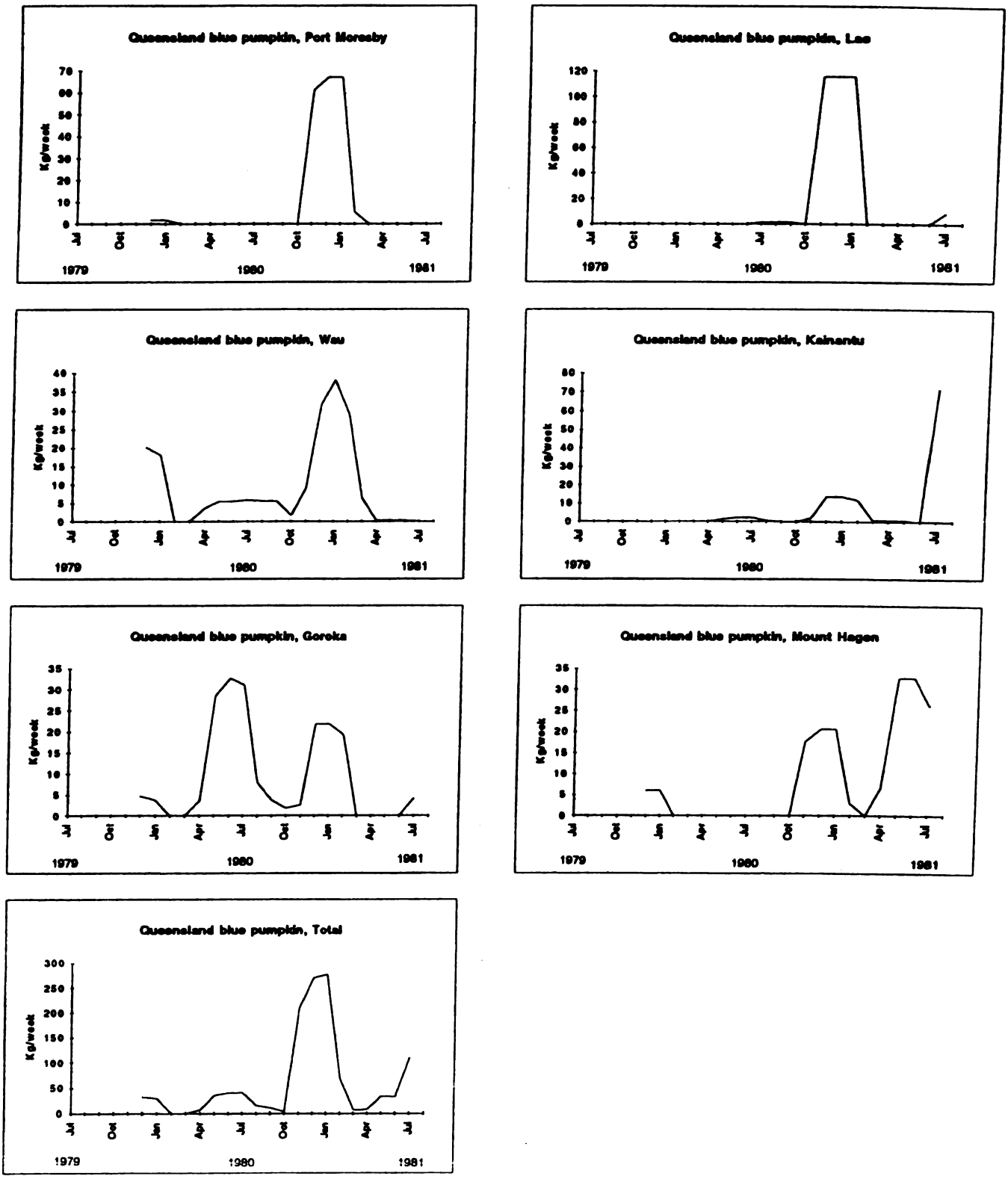


Figure 60. Monthly purchases (kg/week) of Queensland blue pumpkin by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

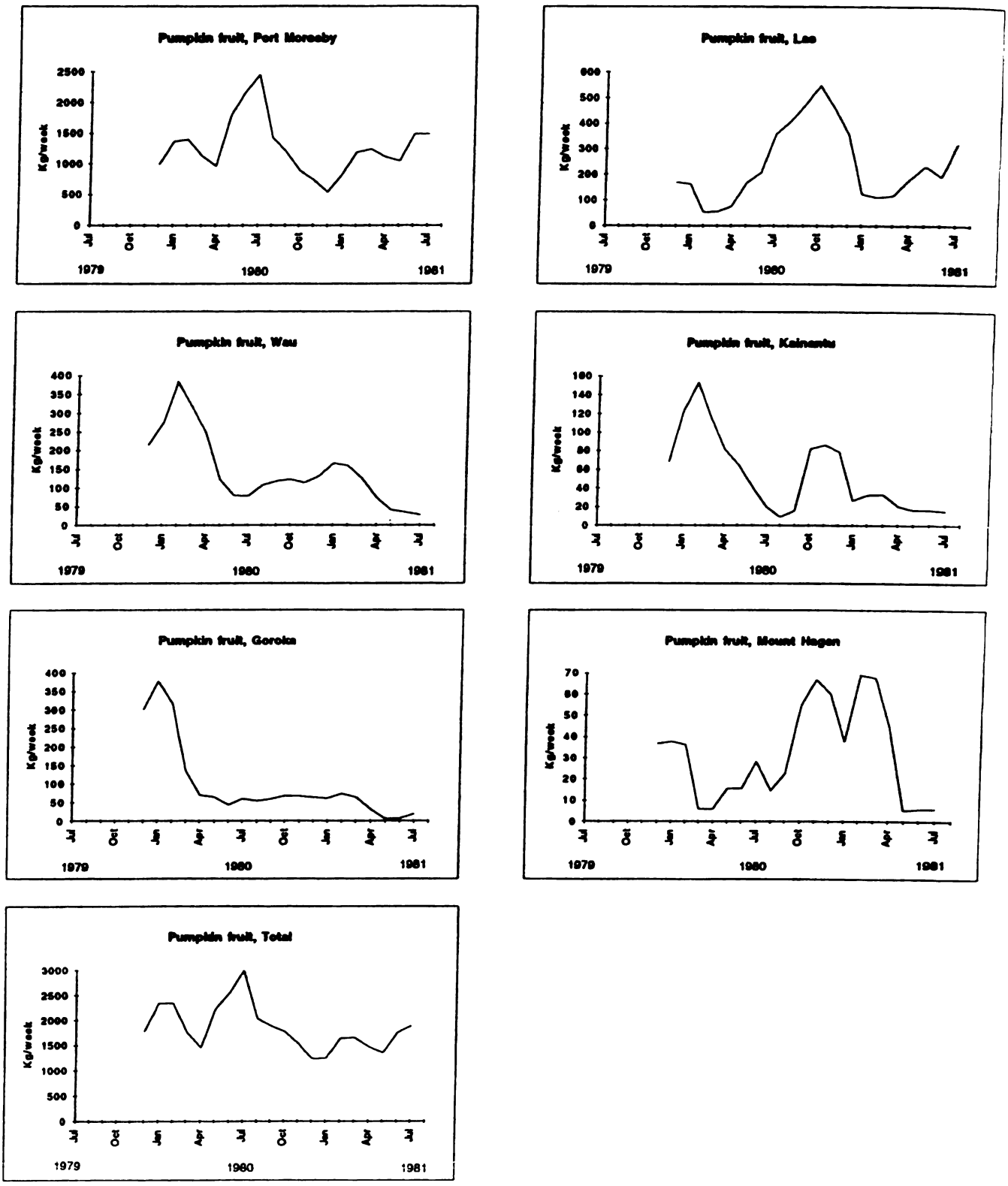


Figure 61. Monthly purchases (kg/week) of pumpkin fruit by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase figures)

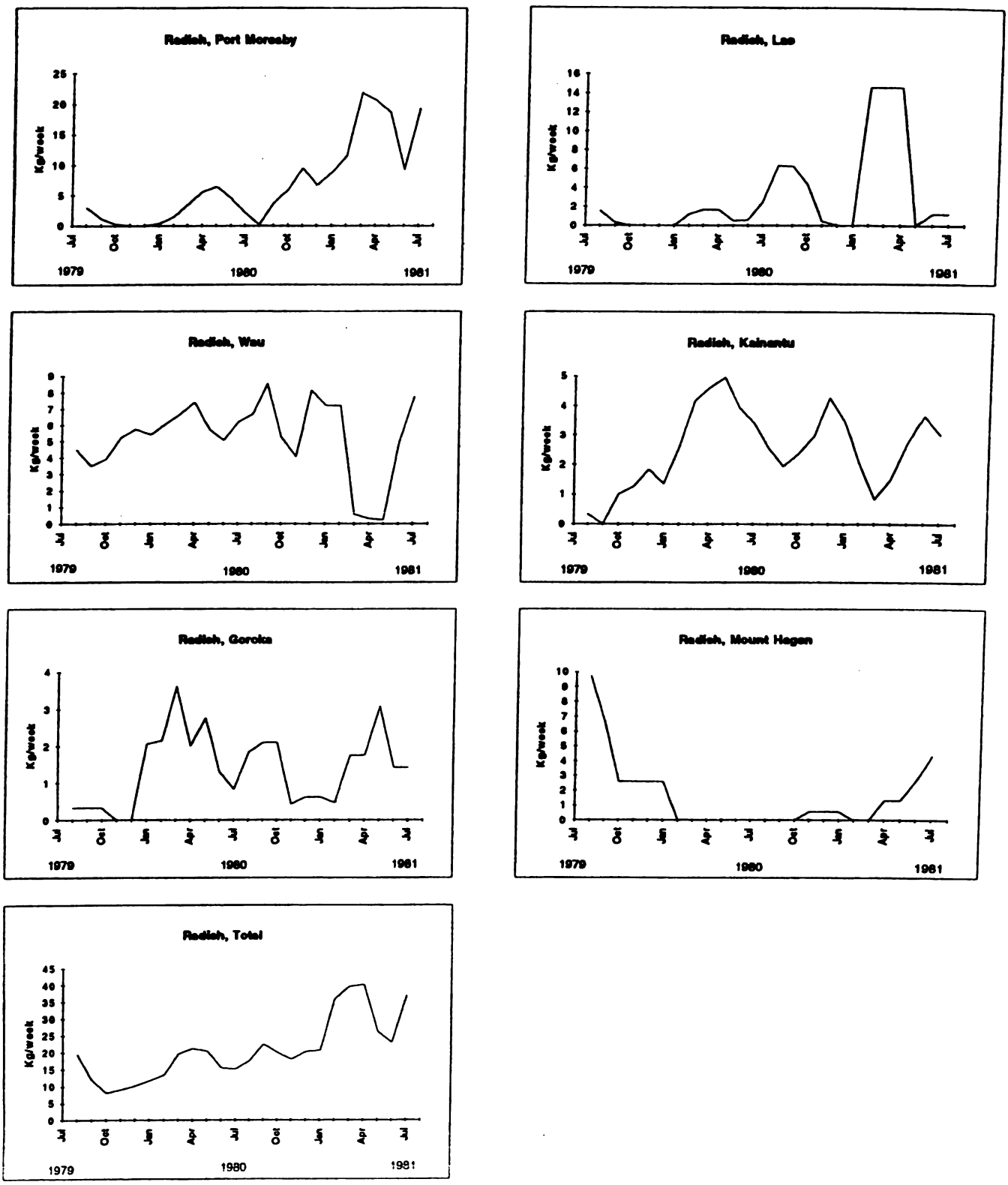


Figure 62. Monthly purchases (kg/week) of radish by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

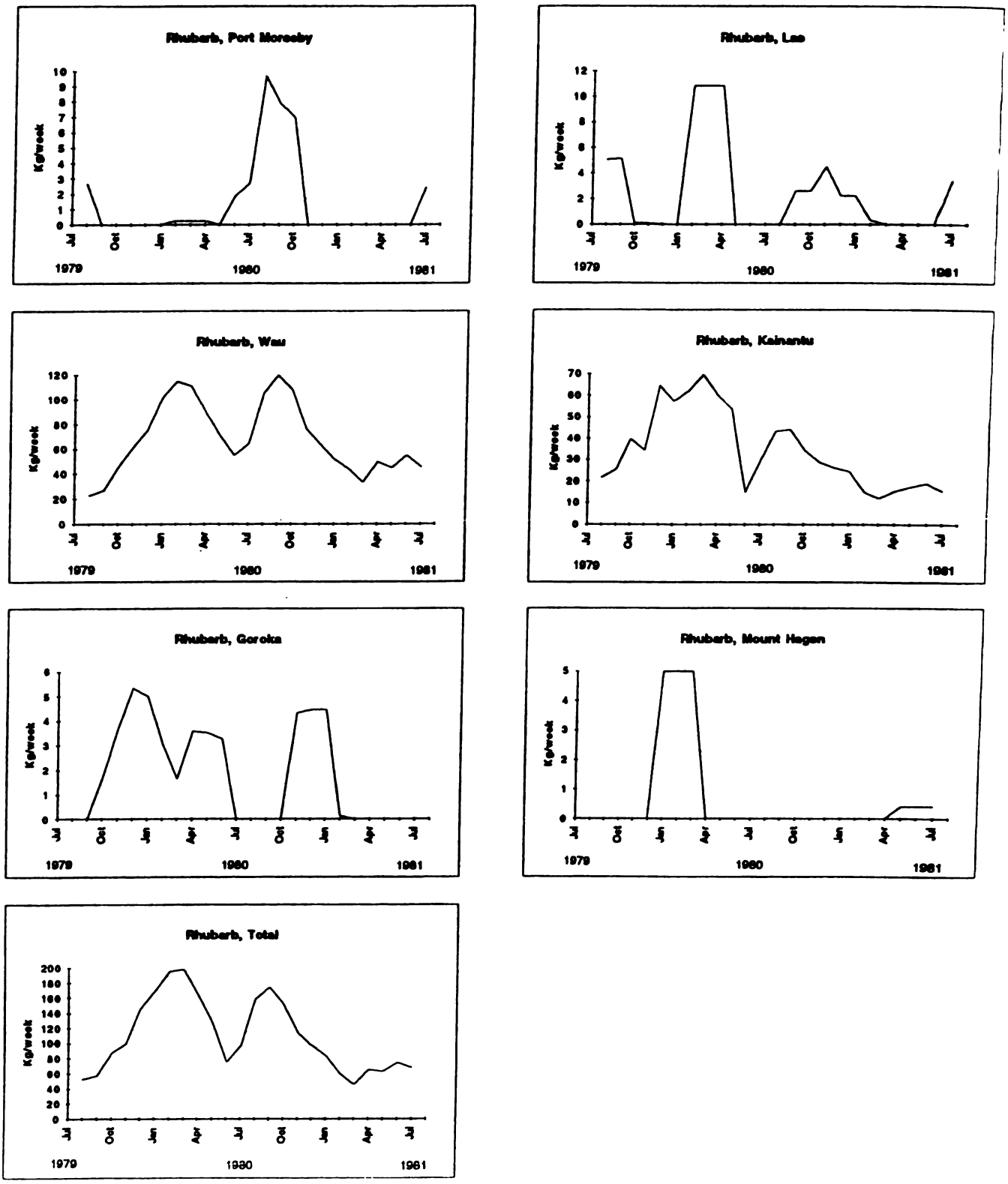


Figure 63. Monthly purchases (kg/week) of rhubarb by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

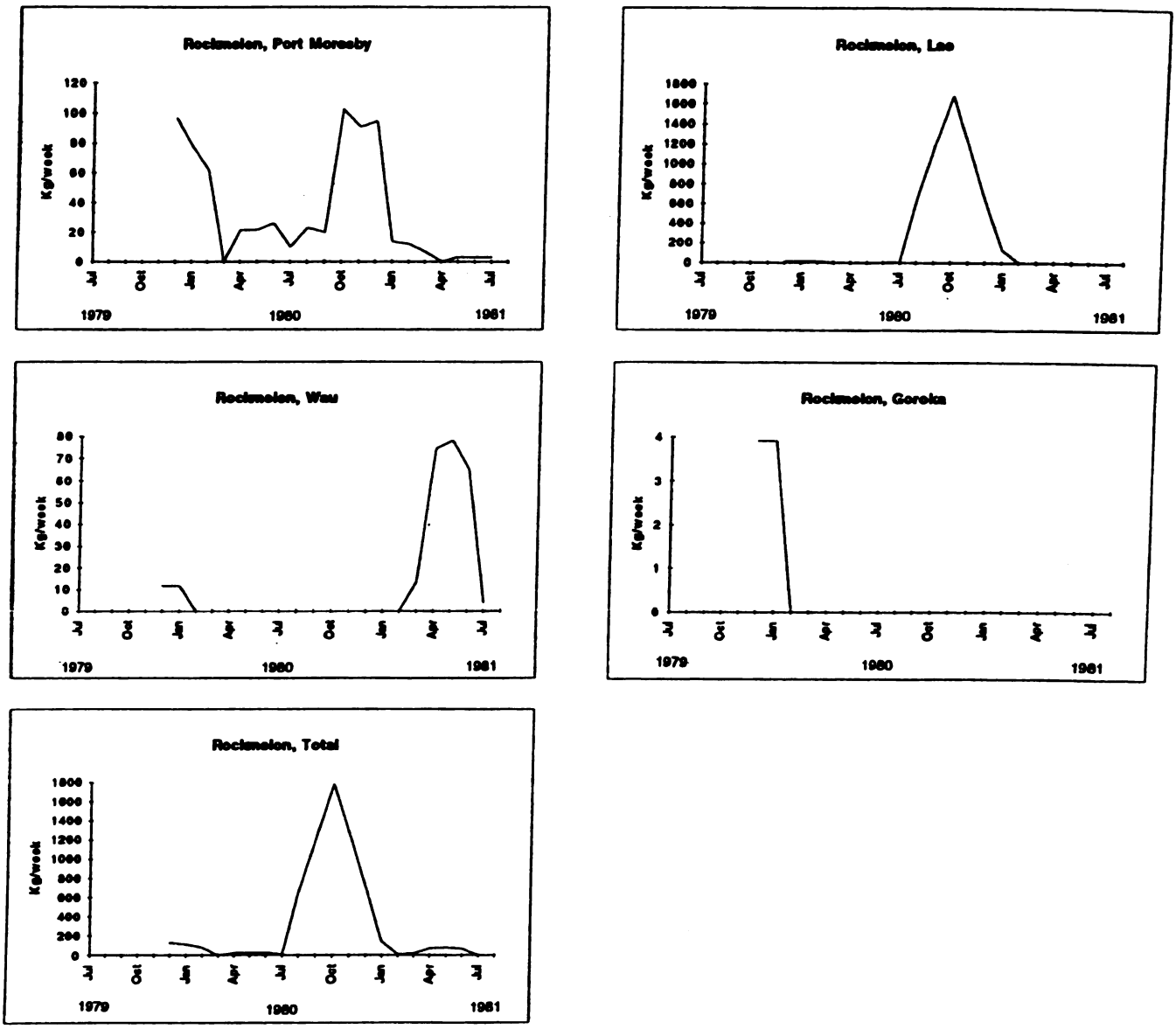


Figure 64. Monthly purchases (kg/week) of rockmelon by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

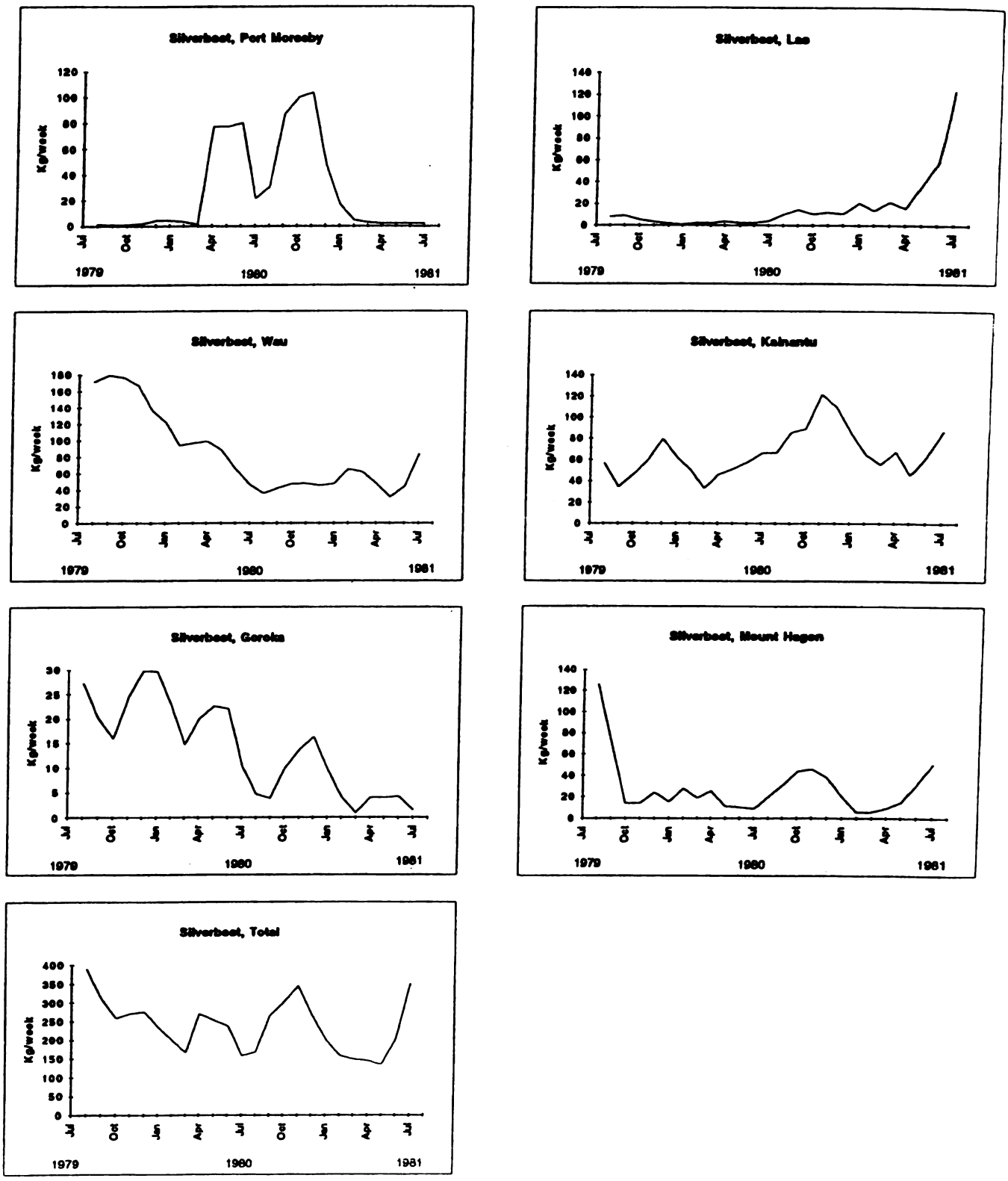


Figure 65. Monthly purchases (kg/week) of silverbeet by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

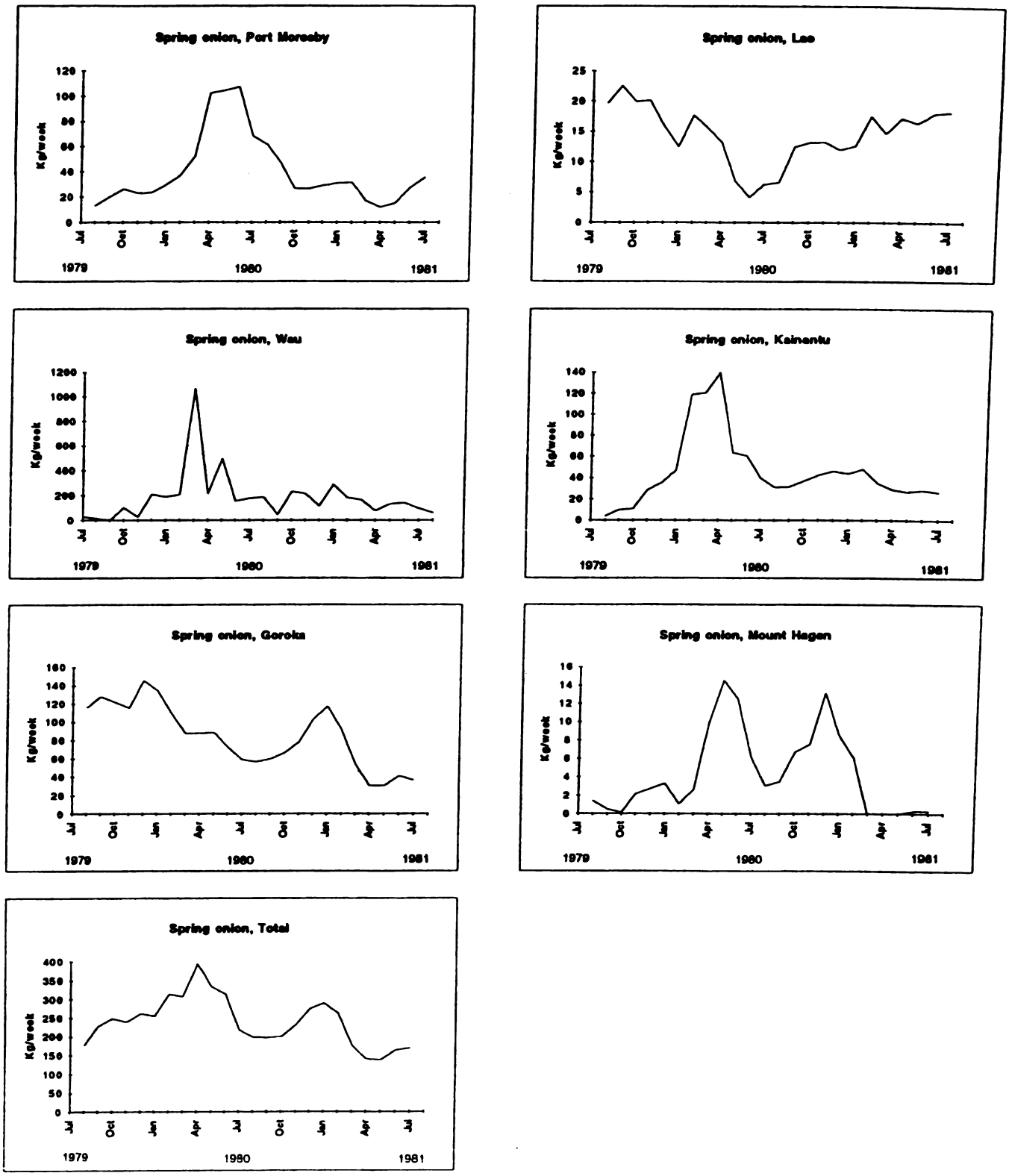


Figure 66. Monthly purchases (kg/week) of spring onion by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

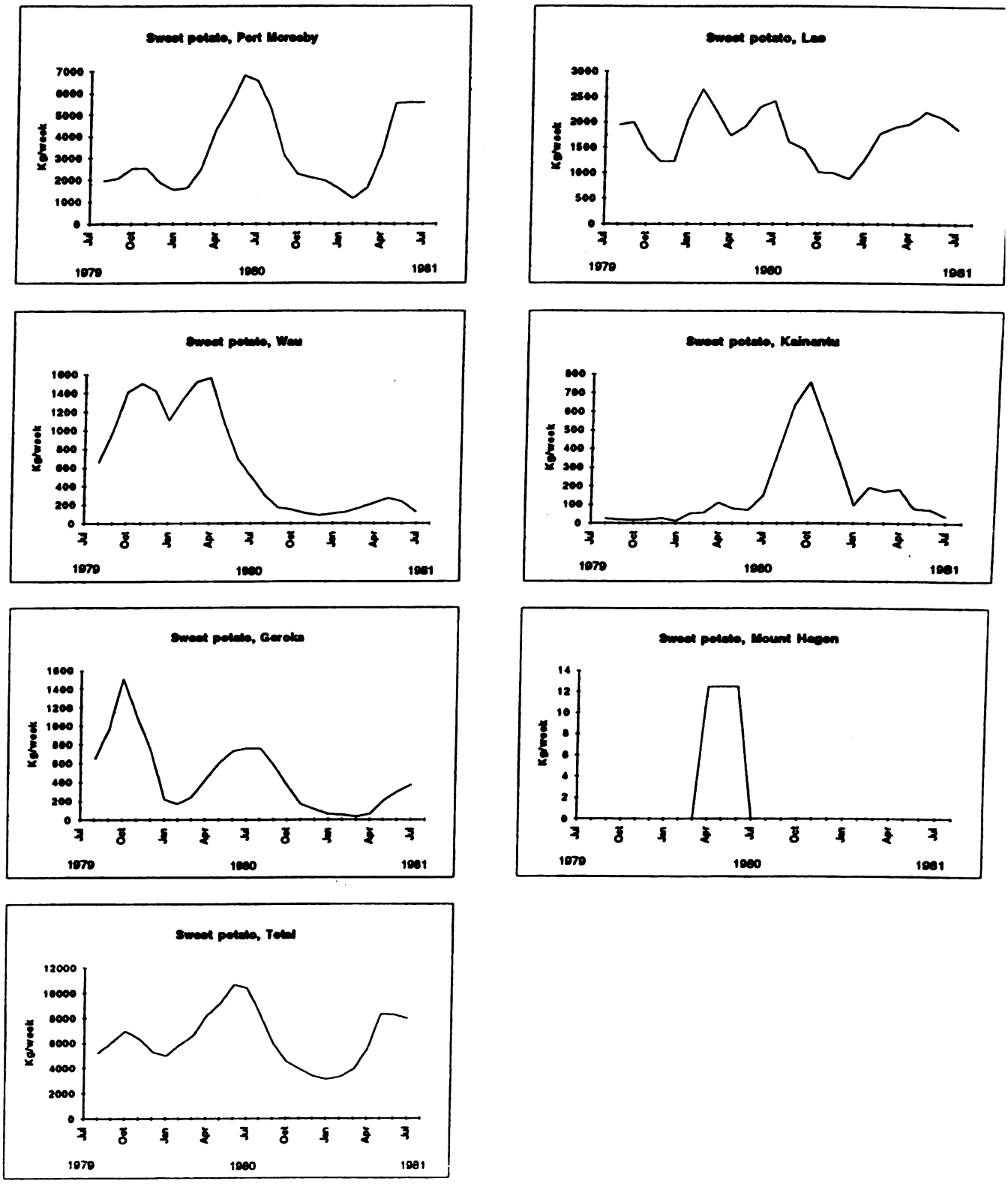


Figure 67. Monthly purchases (kg/week) of sweet potato by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

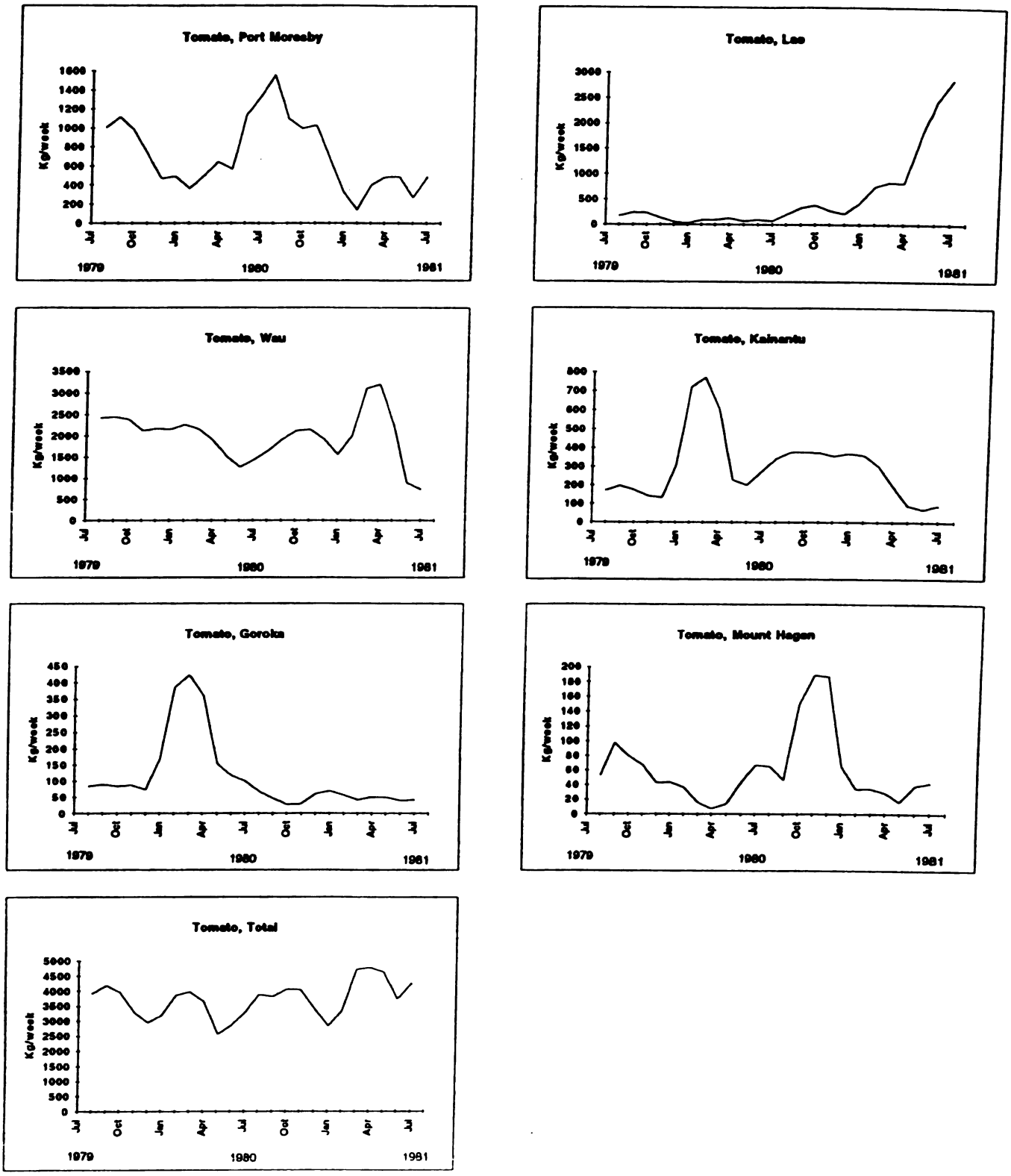


Figure 68. Monthly purchases (kg/week) of tomato by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

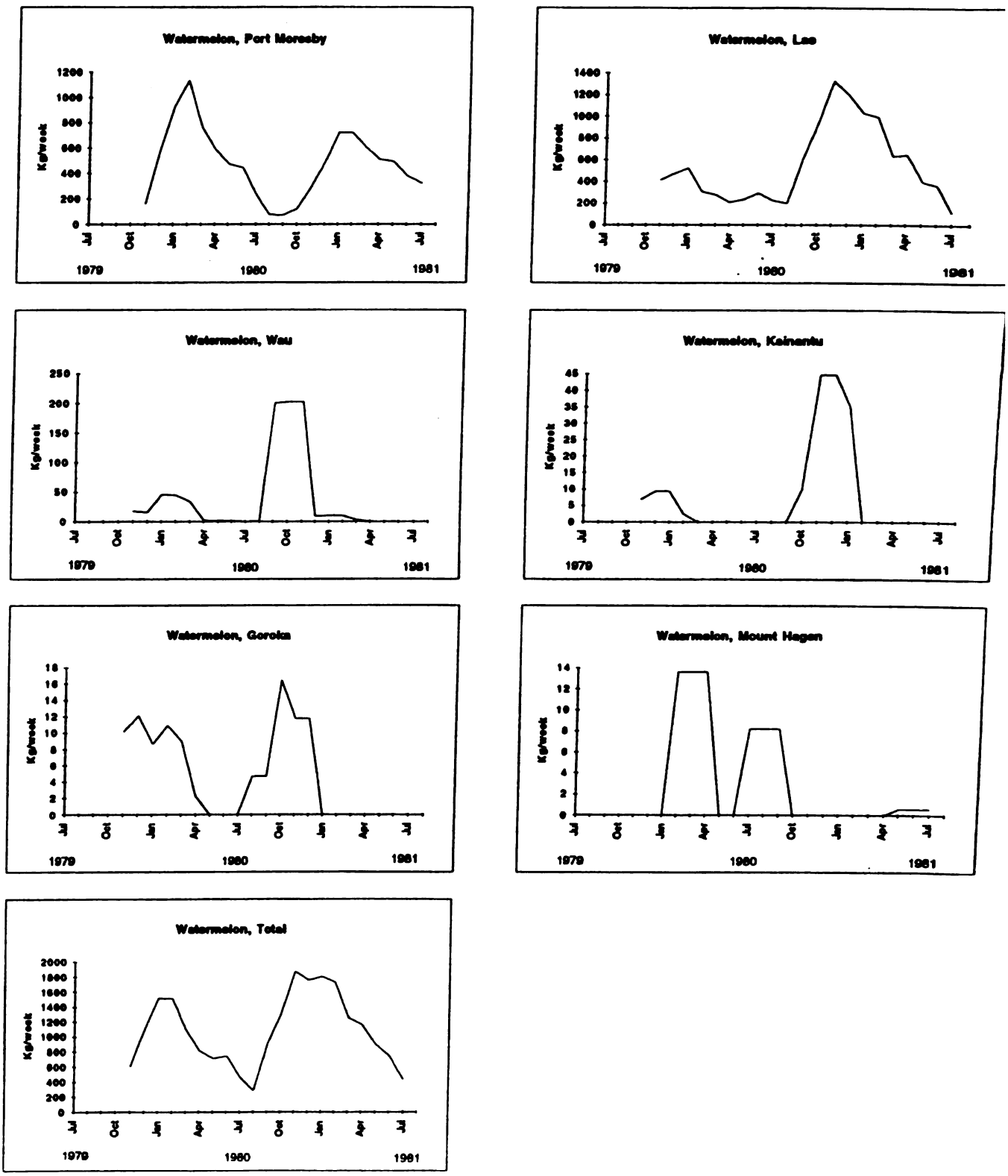


Figure 69. Monthly purchases (kg/week) of watermelon by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

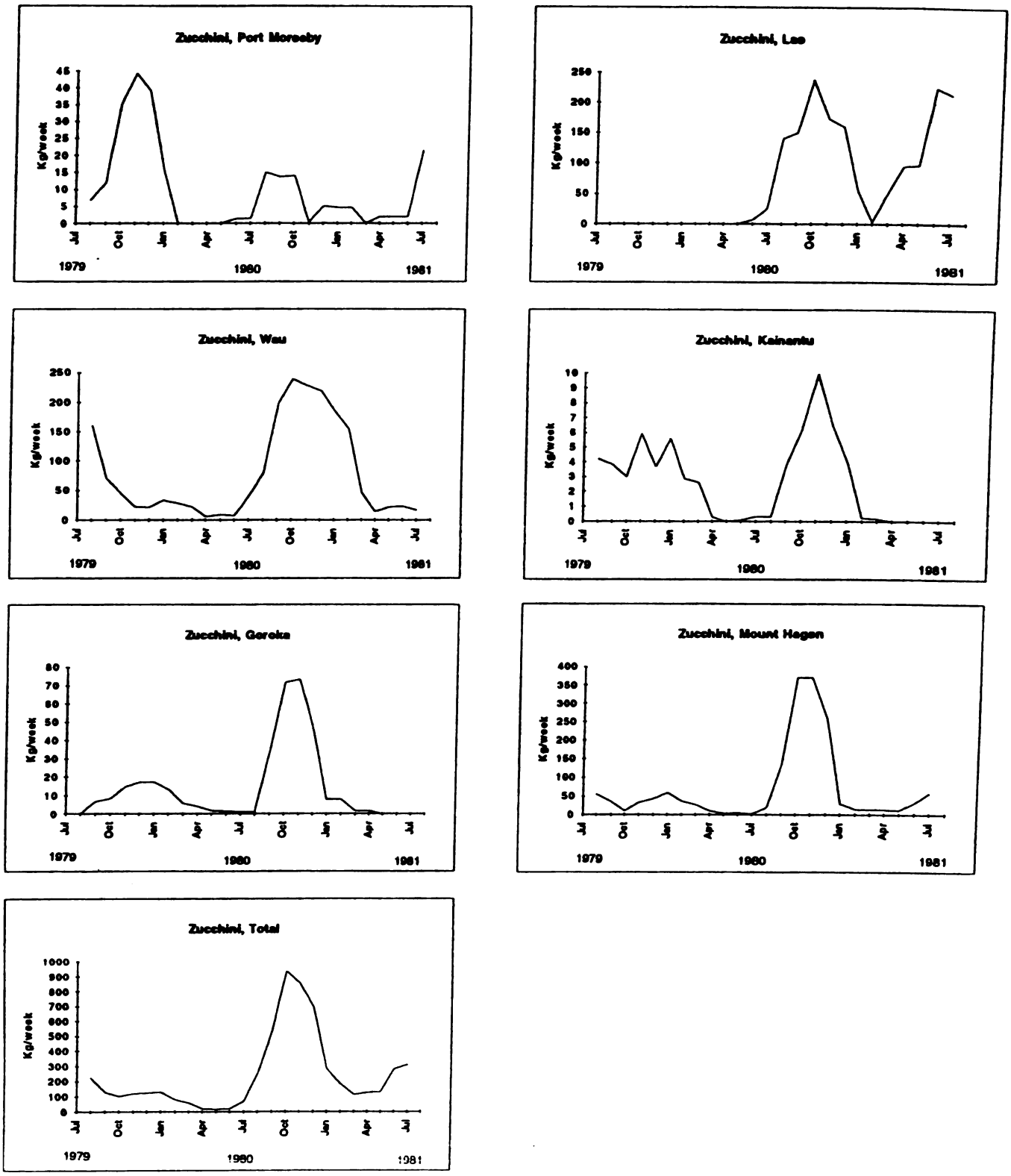


Figure 70. Monthly purchases (kg/week) of zucchini by the Food Marketing Corporation for six buying centres and total purchases, July 1979 to August 1981 (three month running mean) (Source: FMC purchase records)

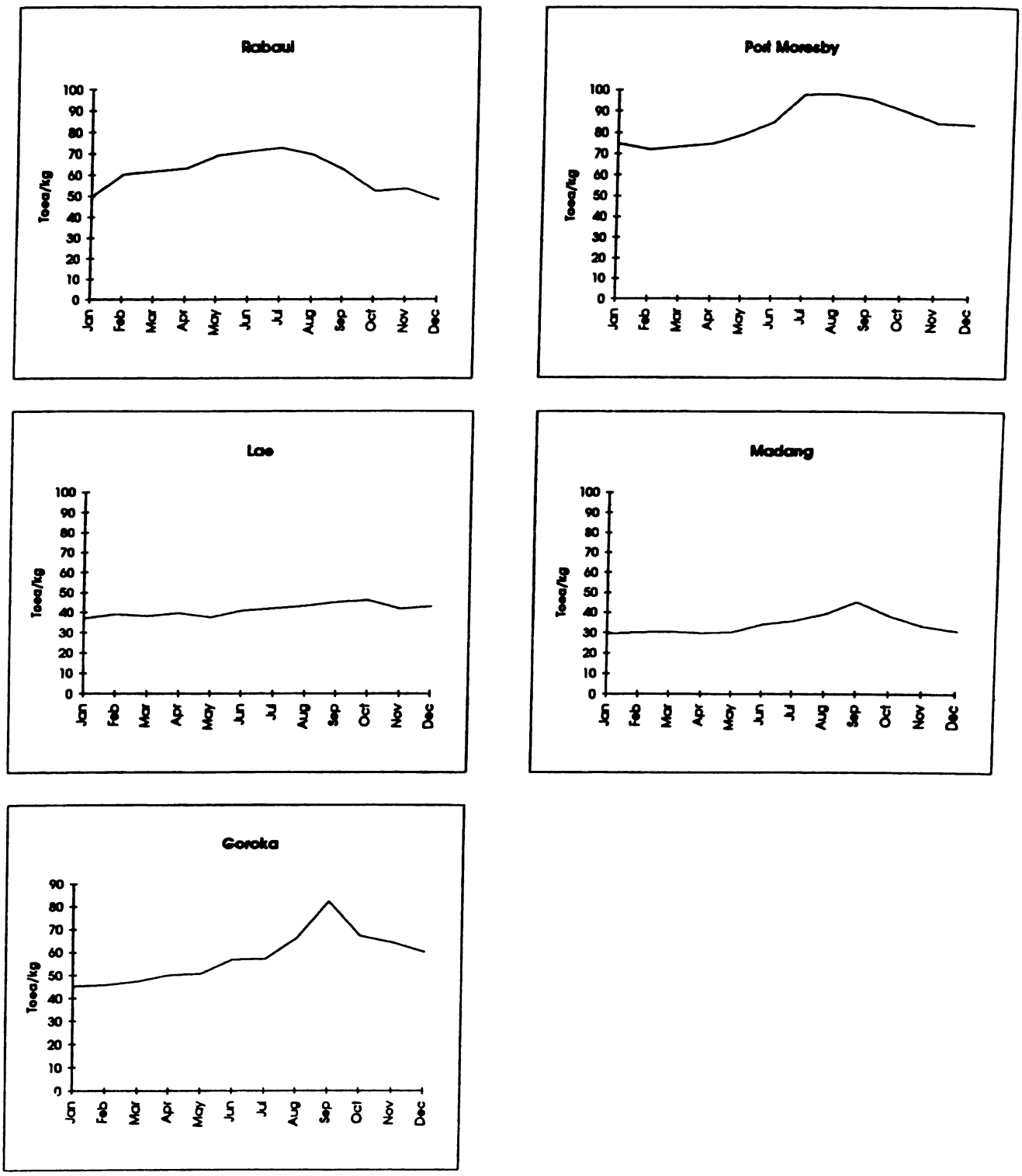


Figure 71. Mean monthly price (toea/kg) for aibika at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

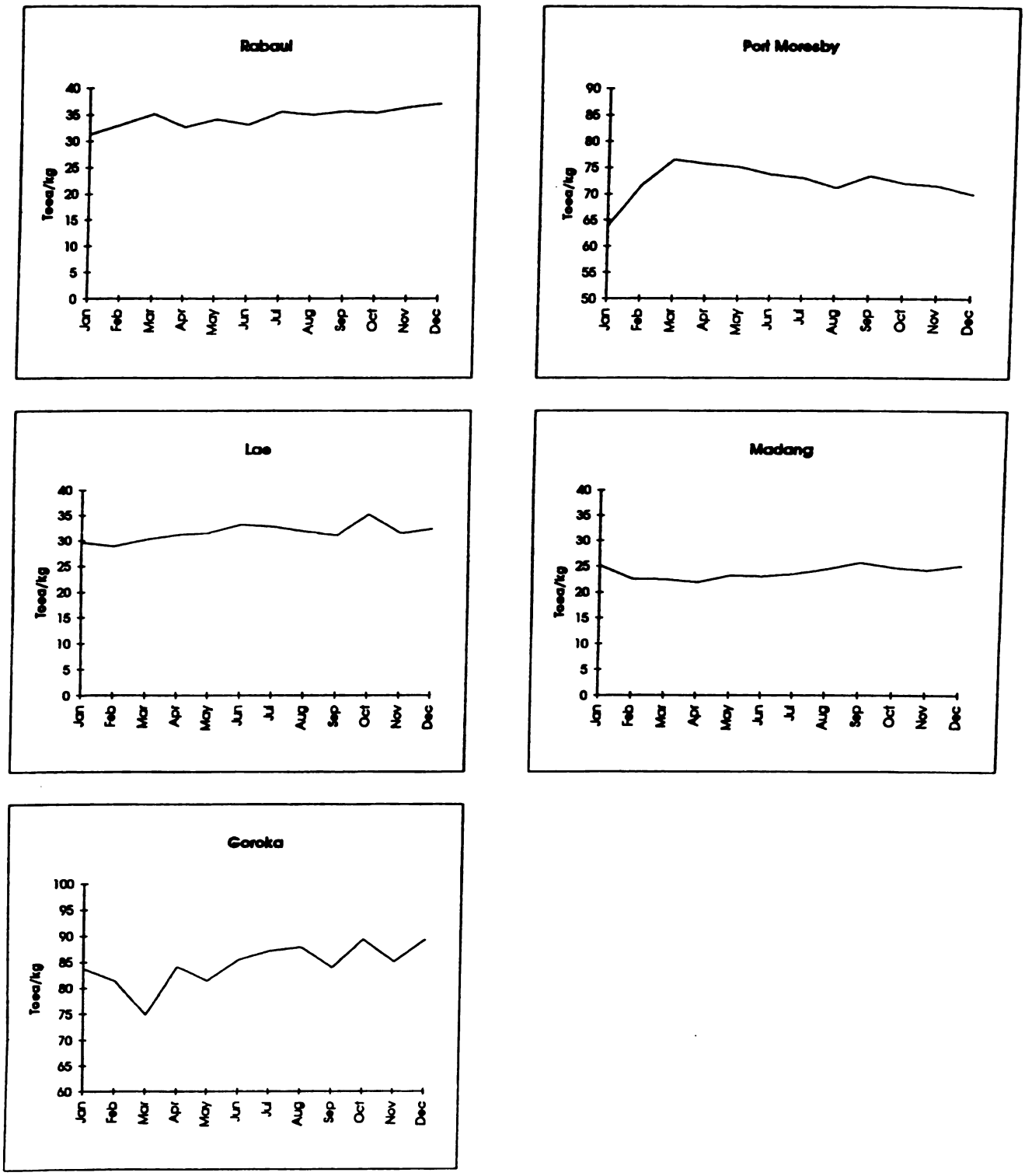


Figure 72. Mean monthly price (toea/kg) for cooking banana at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

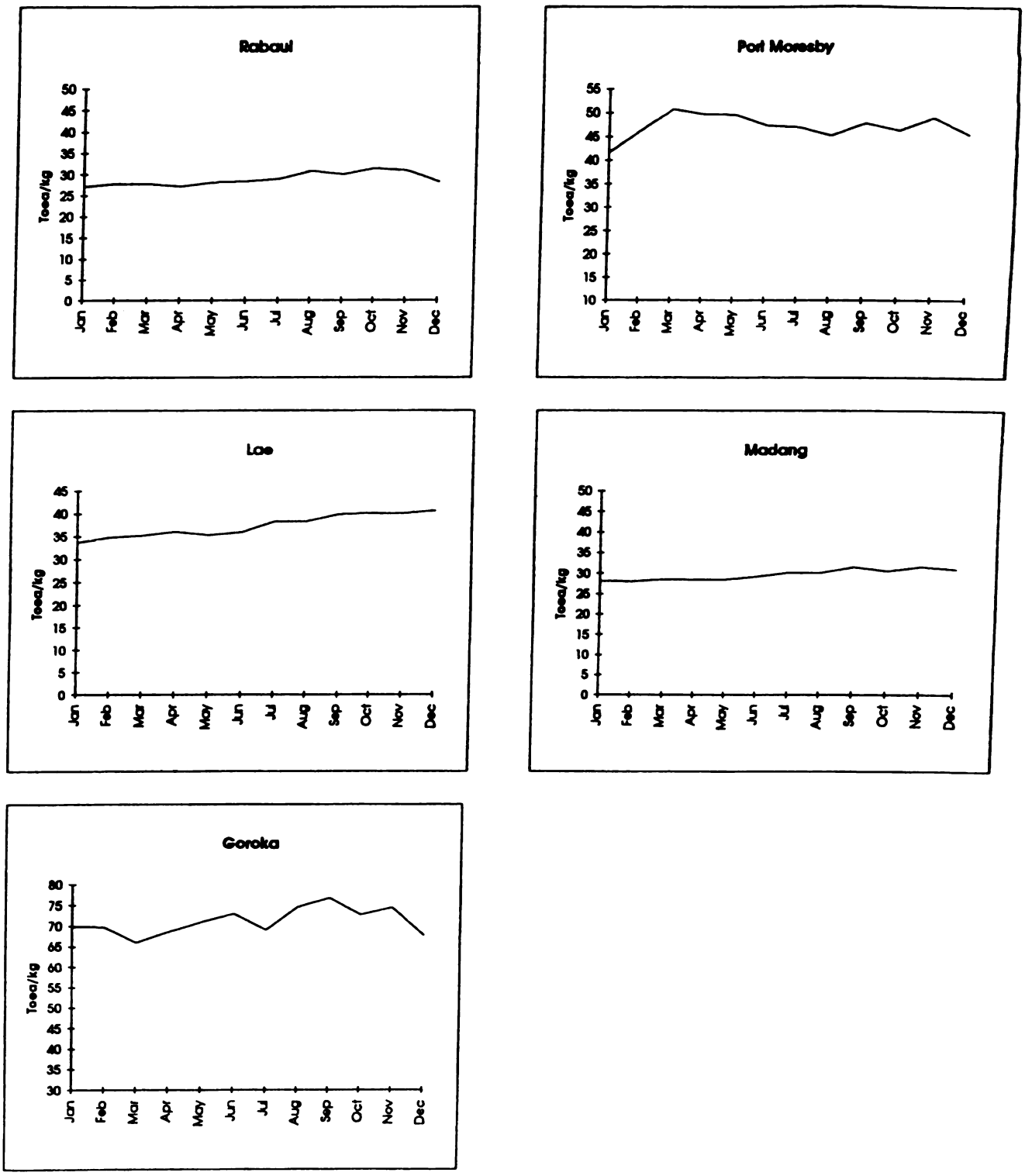


Figure 73. Mean monthly price (toea/kg) for eating banana at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

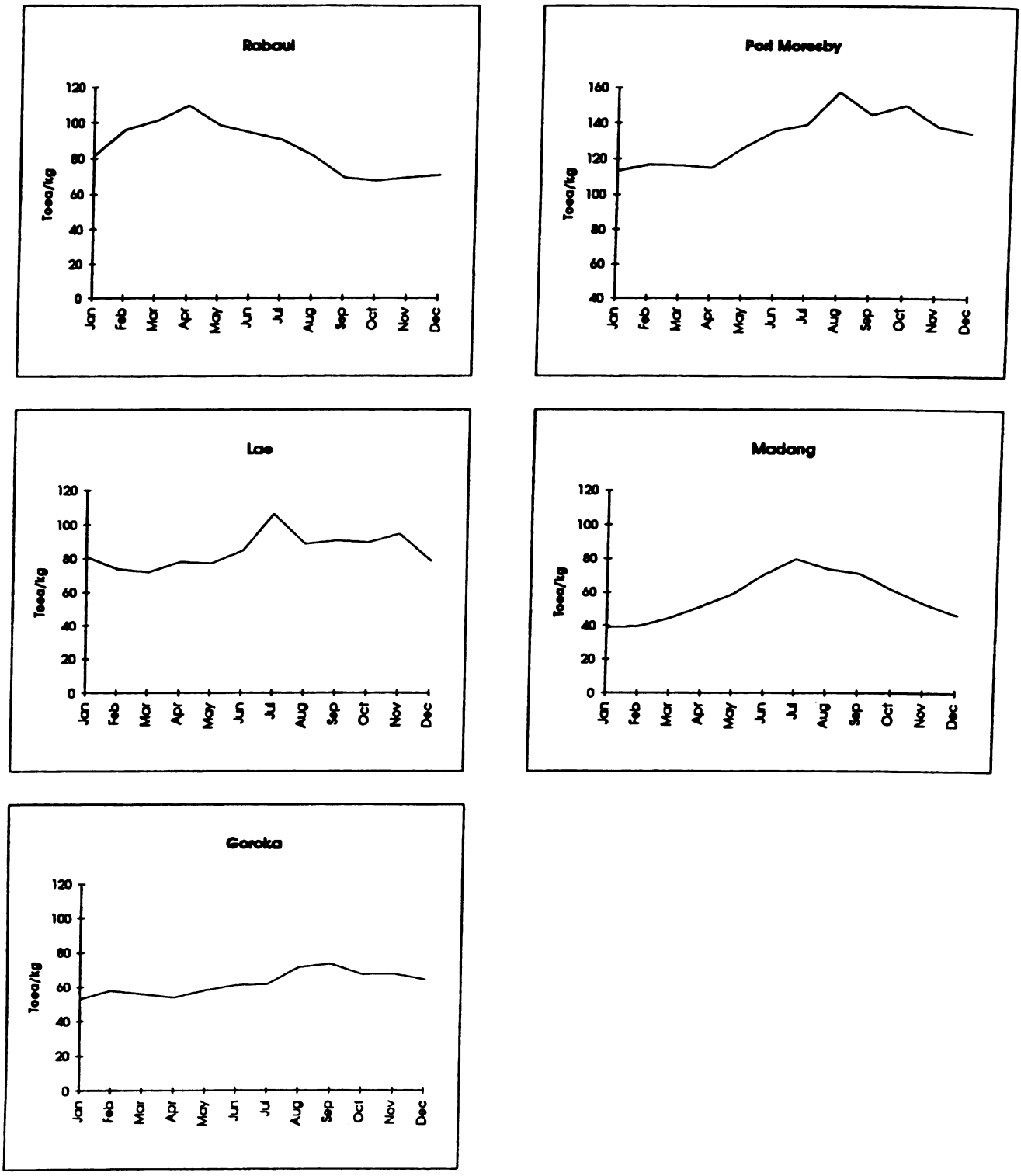


Figure 74. Mean monthly price (toea/kg) for common bean at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

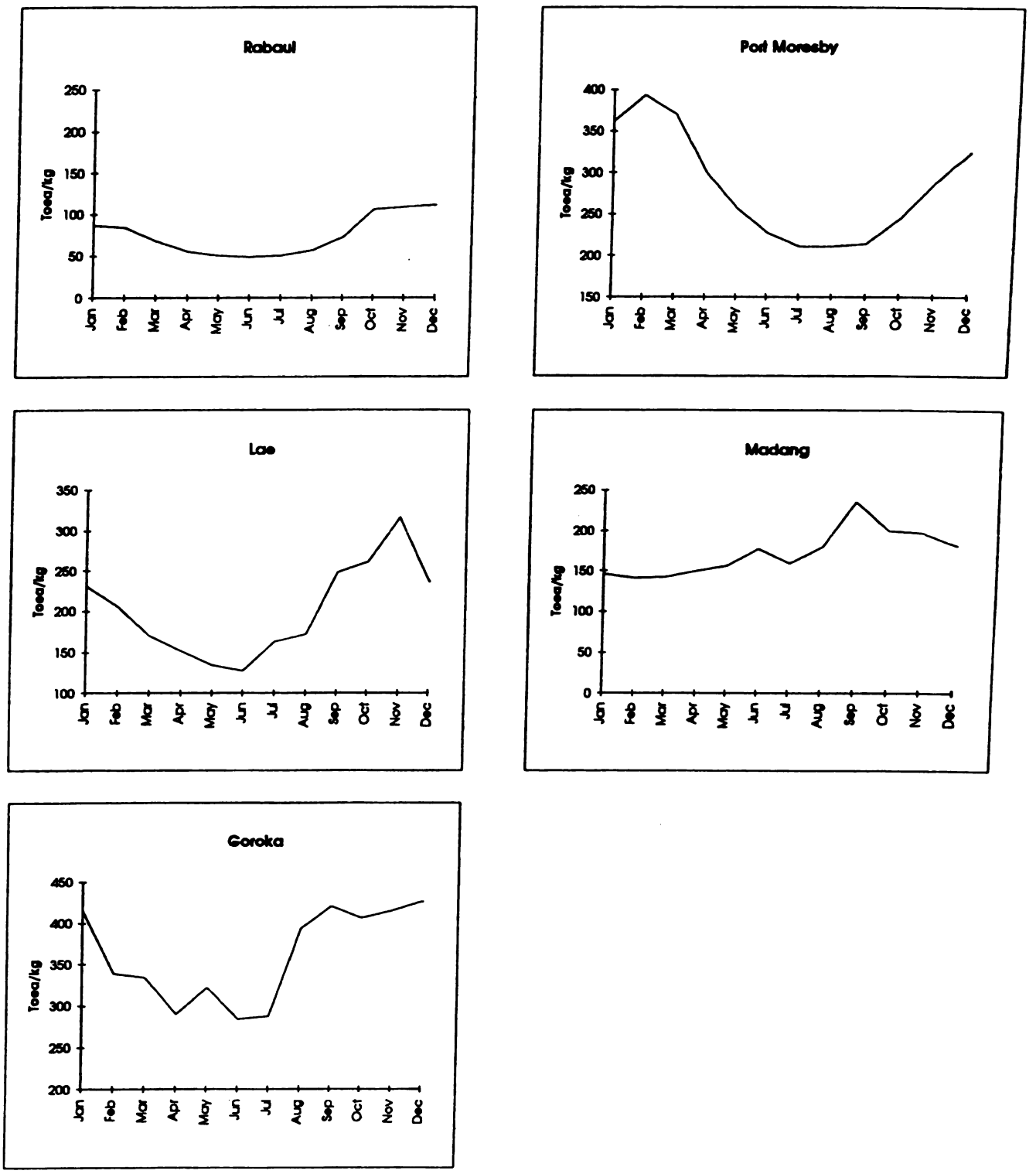


Figure 75. Mean monthly price (toea/kg) for betel nut at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

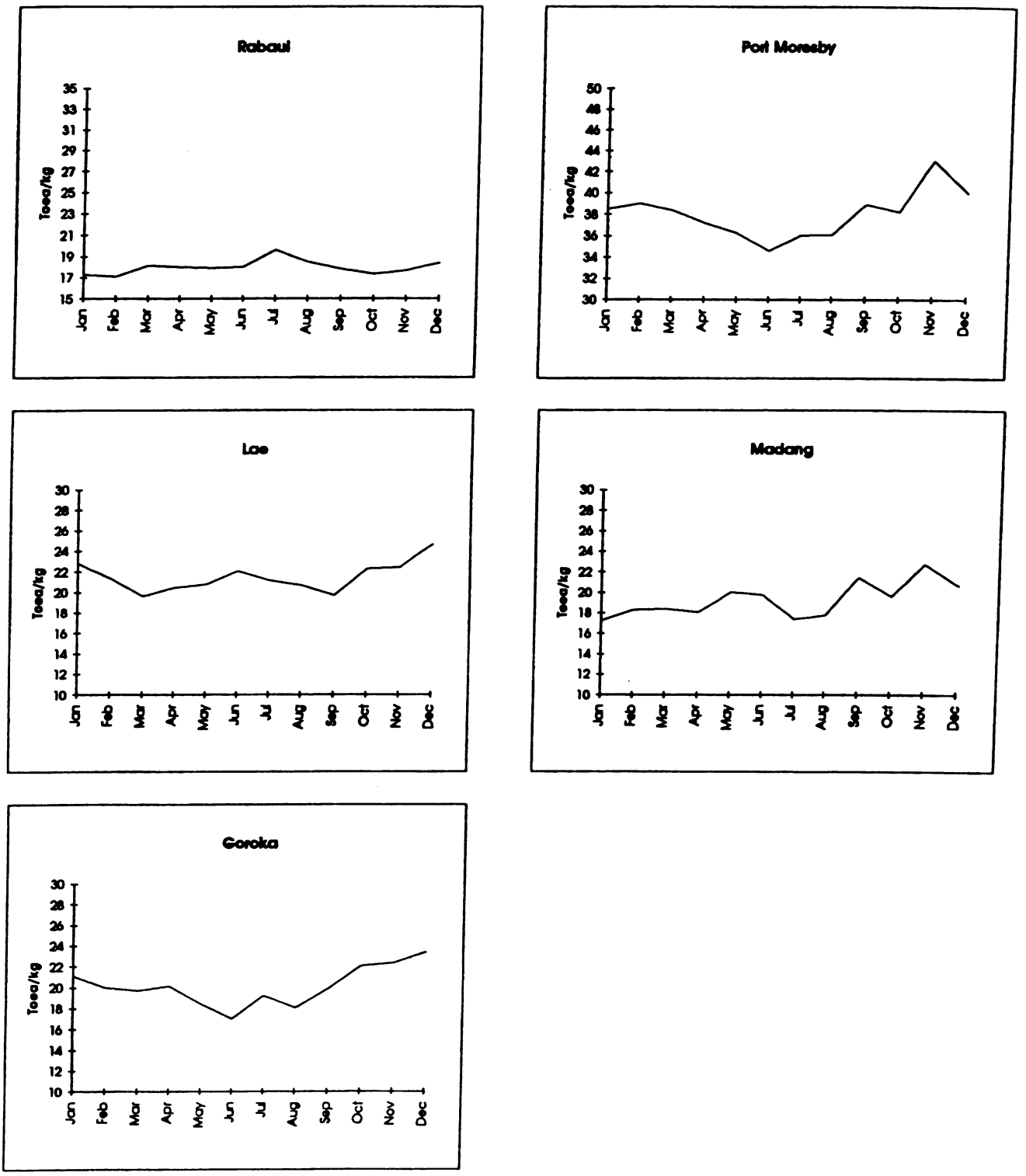


Figure 76. Mean monthly price (toea/kg) for cassava at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

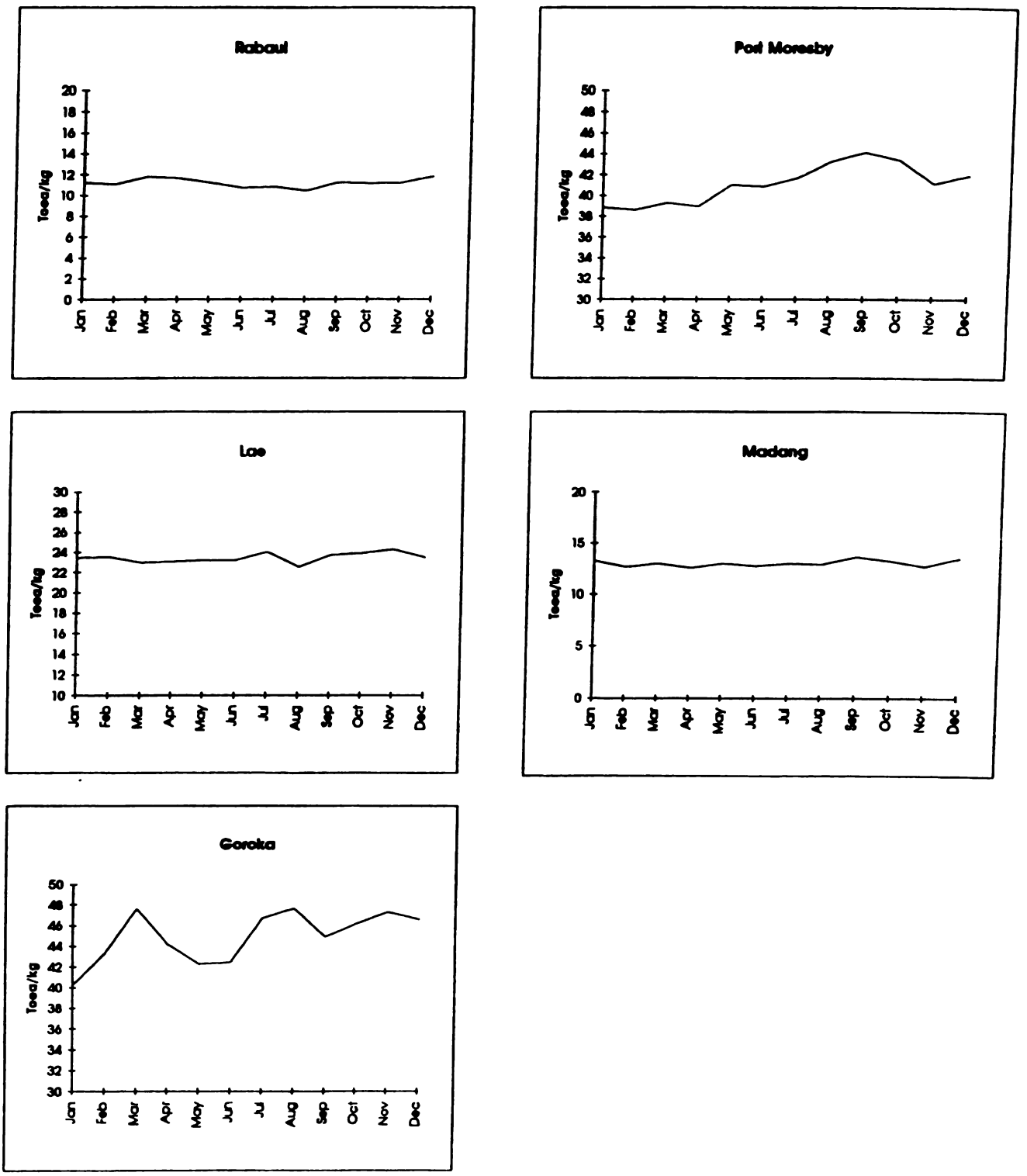


Figure 77. Mean monthly price (toea/kg) for coconut at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

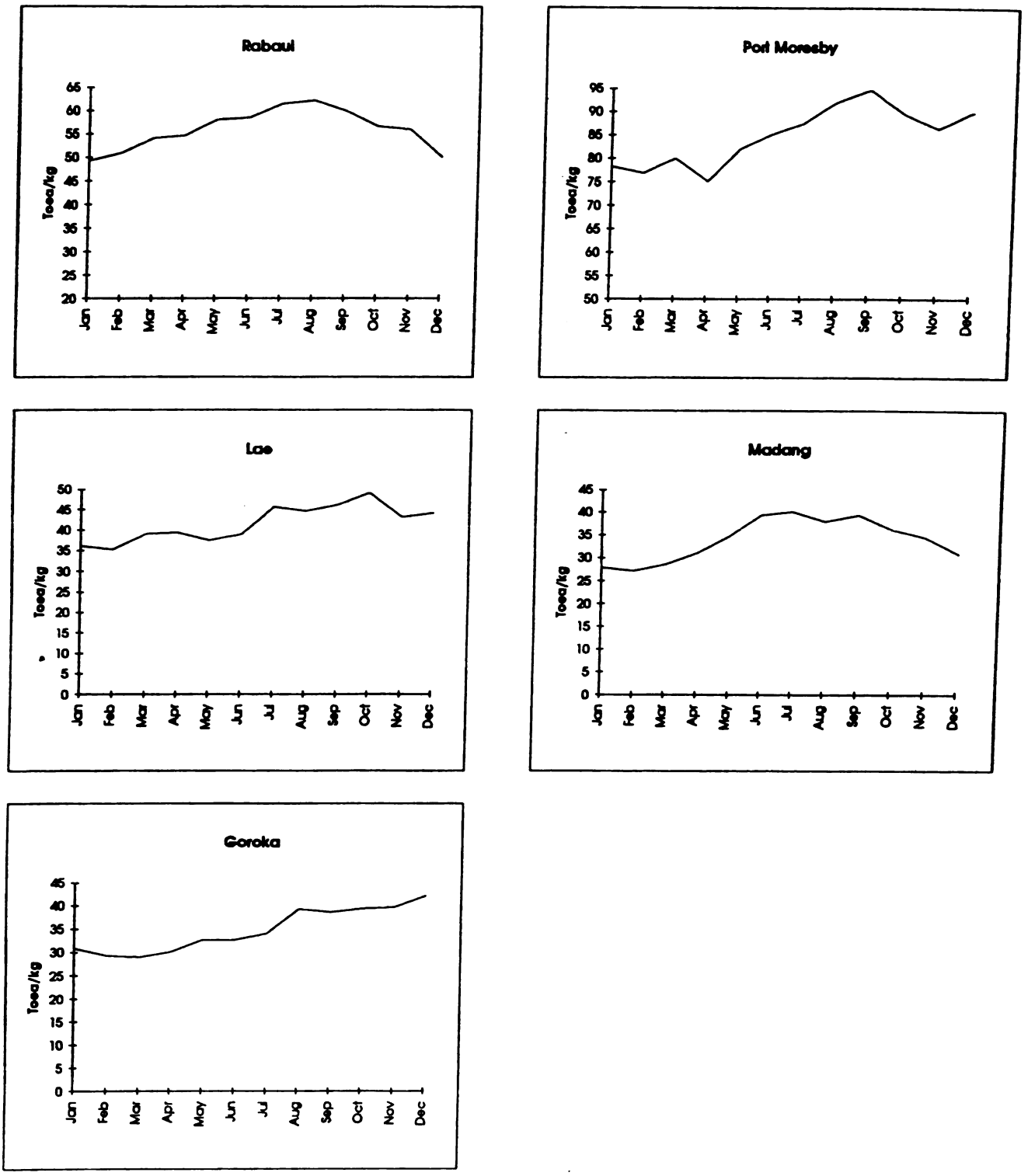


Figure 78. Mean monthly price (toea/kg) for corn at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

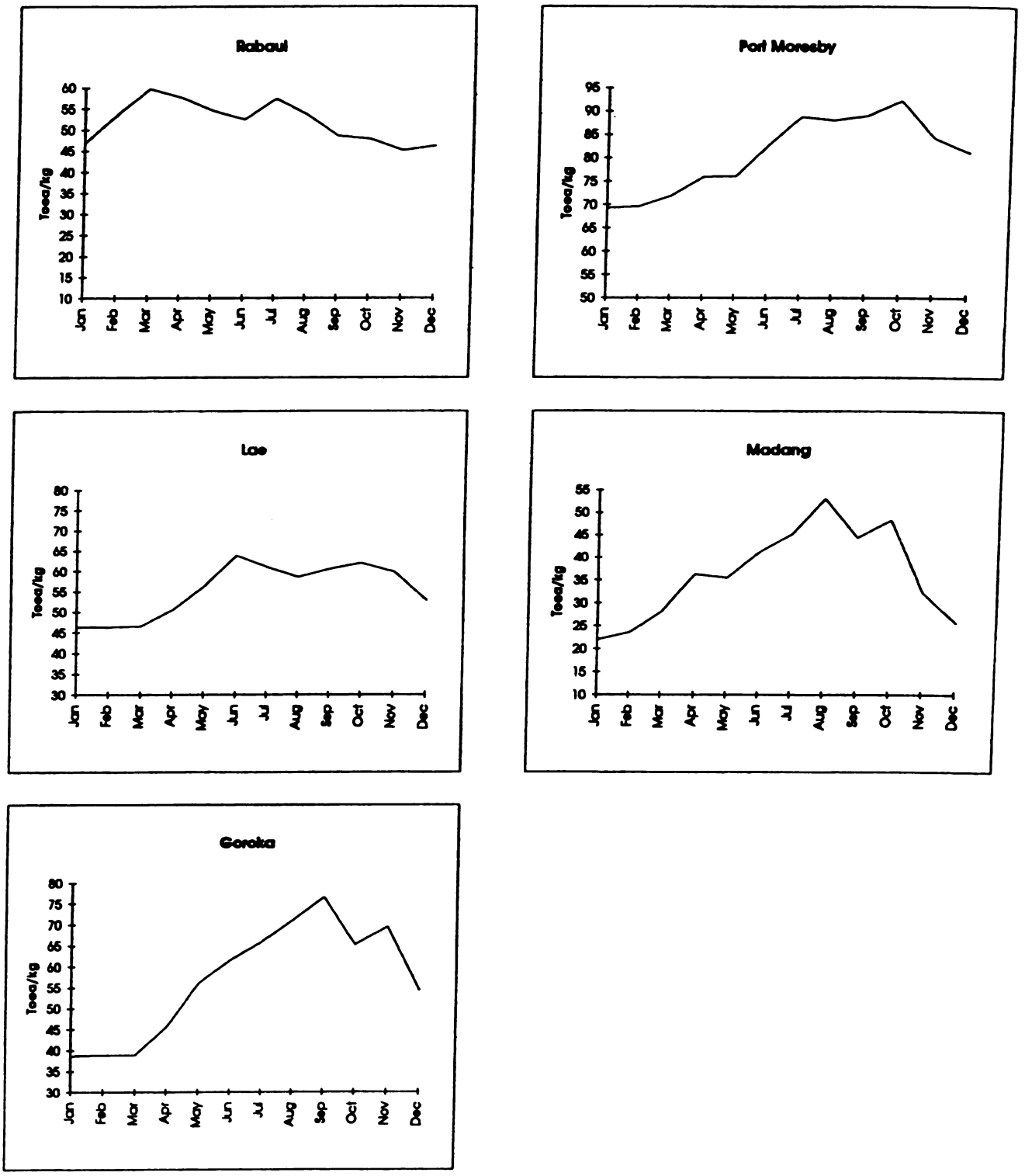


Figure 79. Mean monthly price (toea/kg) for cucumber at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

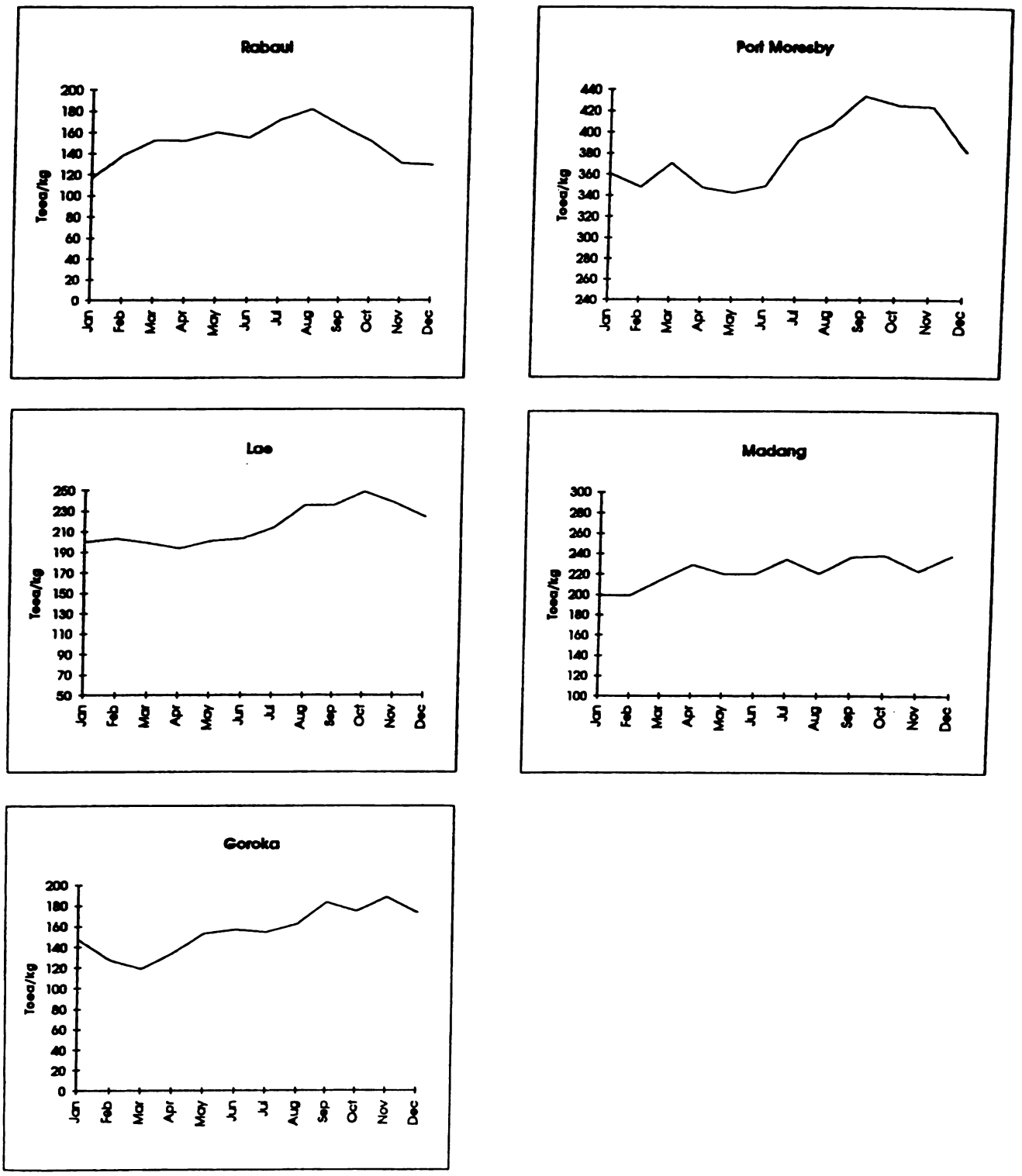


Figure 80. Mean monthly price (toea/kg) for peanuts at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

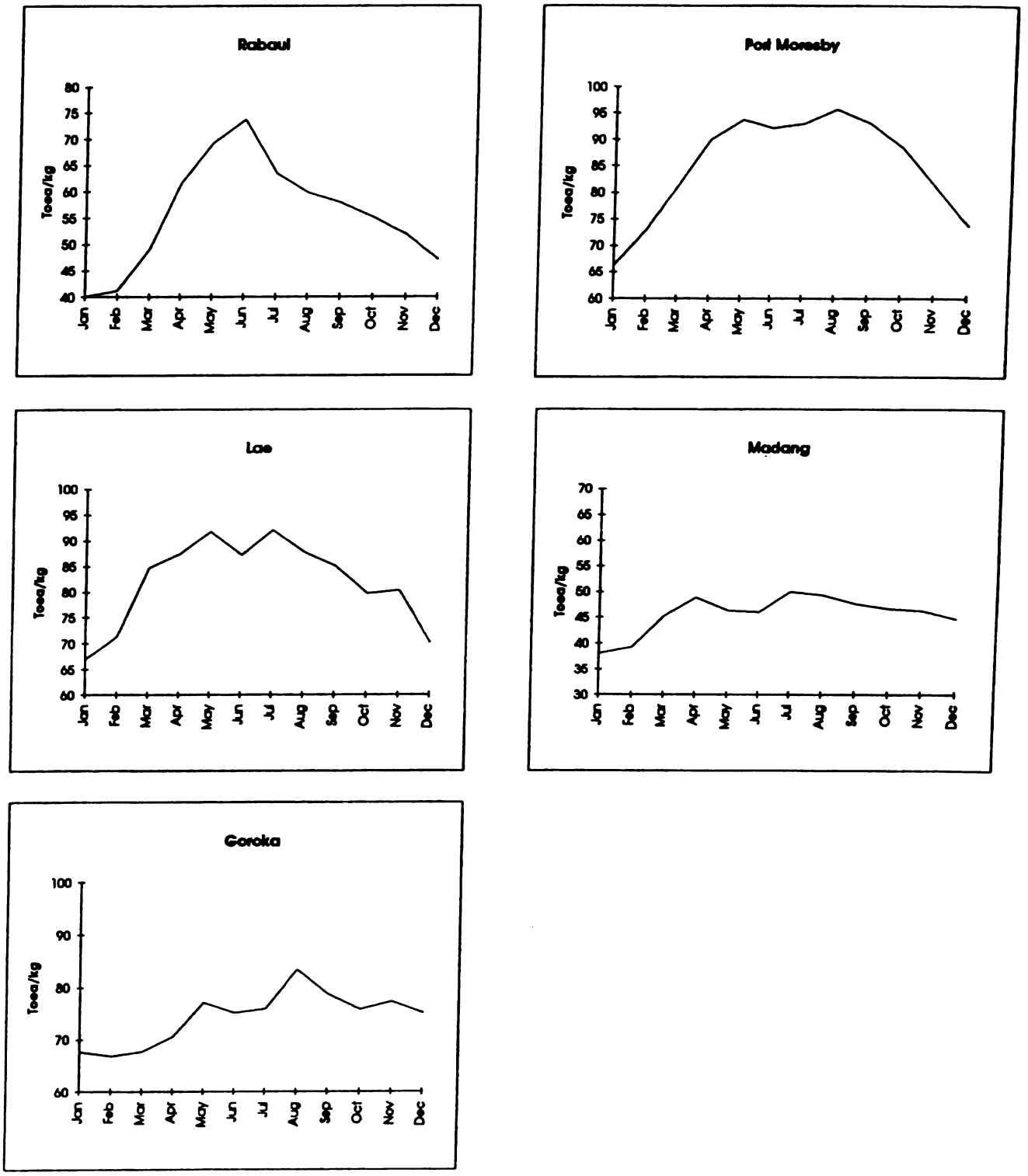


Figure 81. Mean monthly price (toea/kg) for pineapple at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

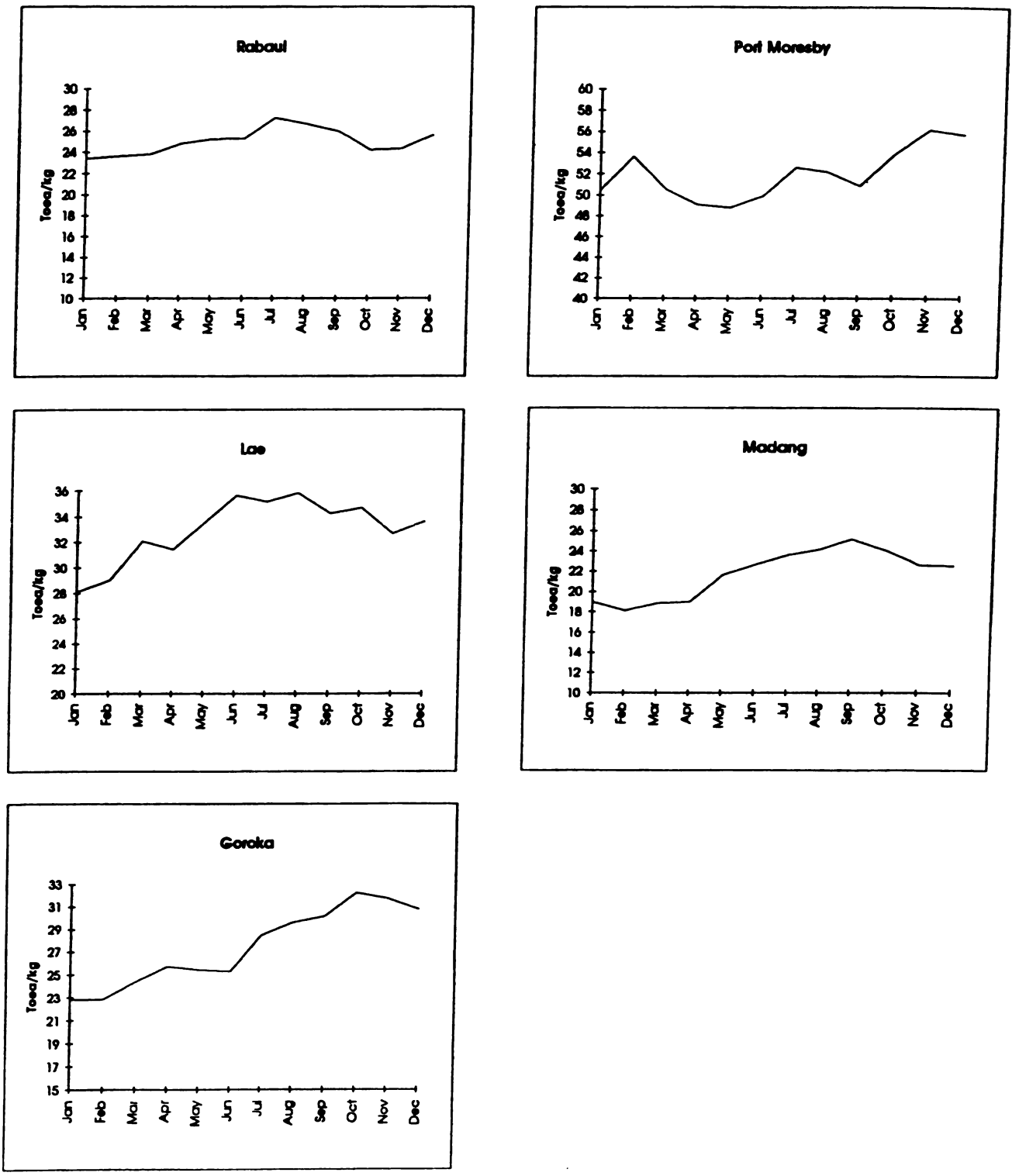


Figure 82. Mean monthly price (toea/kg) for pumpkin fruit at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

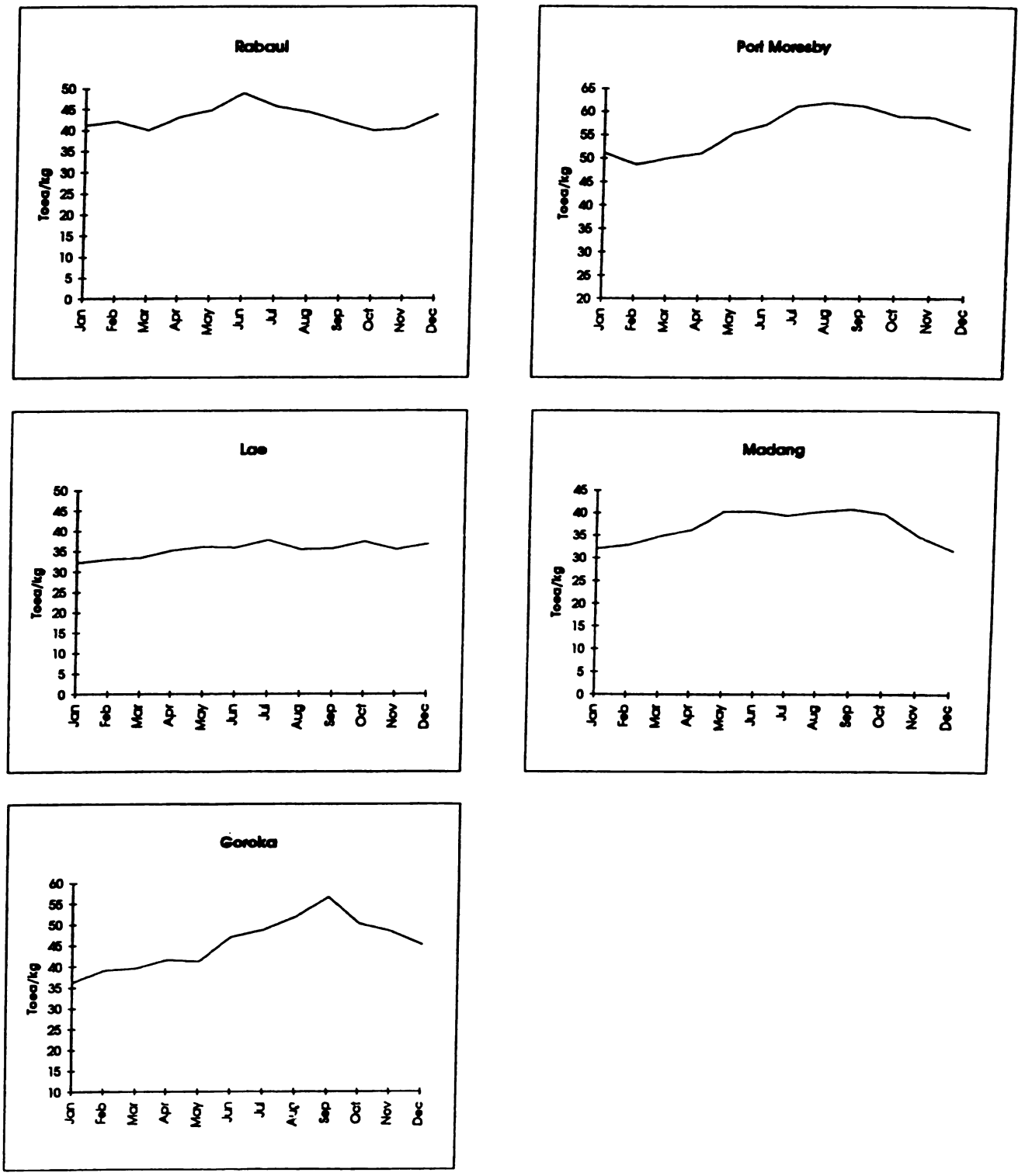


Figure 83. Mean monthly price (toea/kg) for pumpkin tips at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

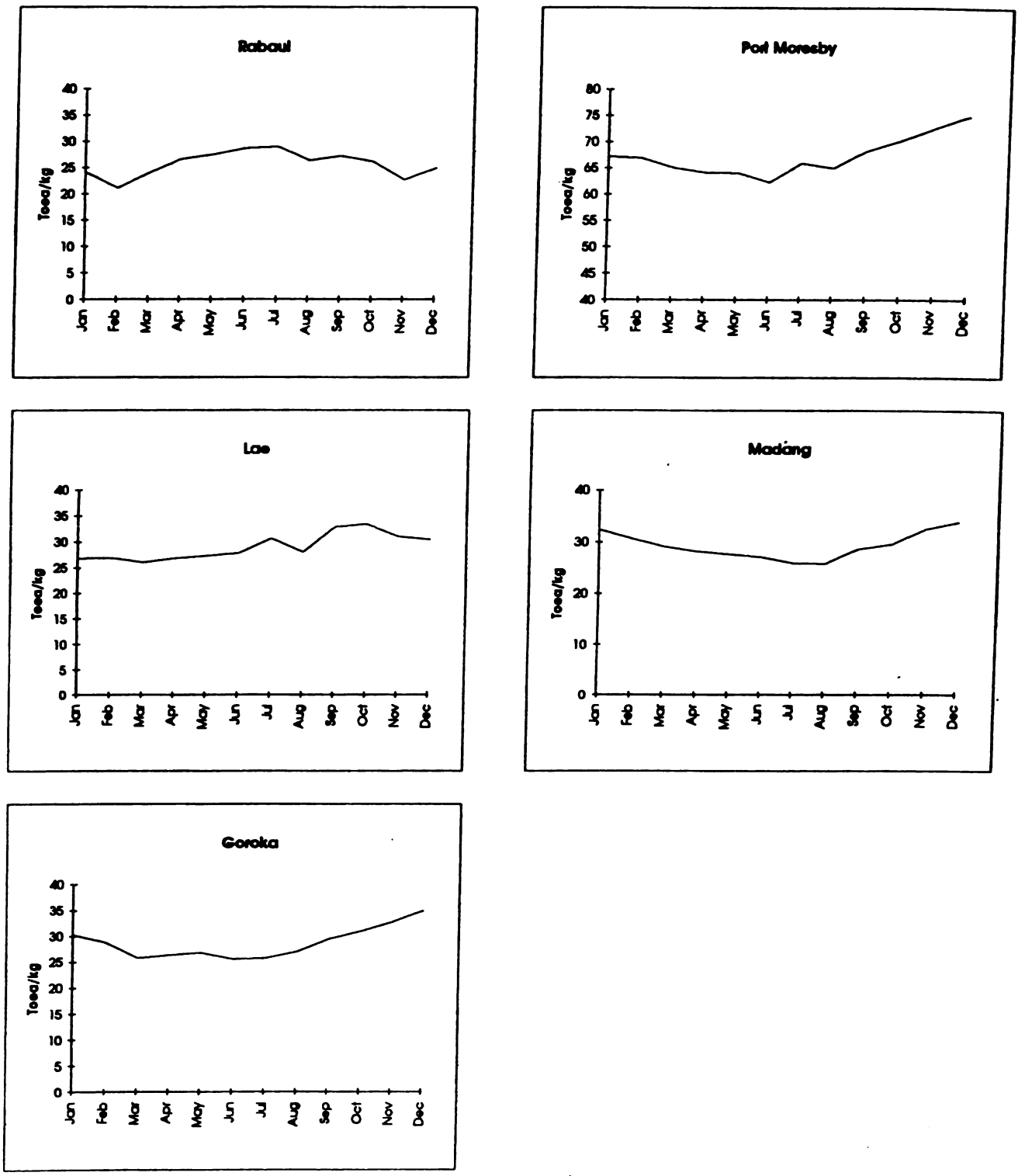


Figure 84. Mean monthly price (toea/kg) for sweet potato at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

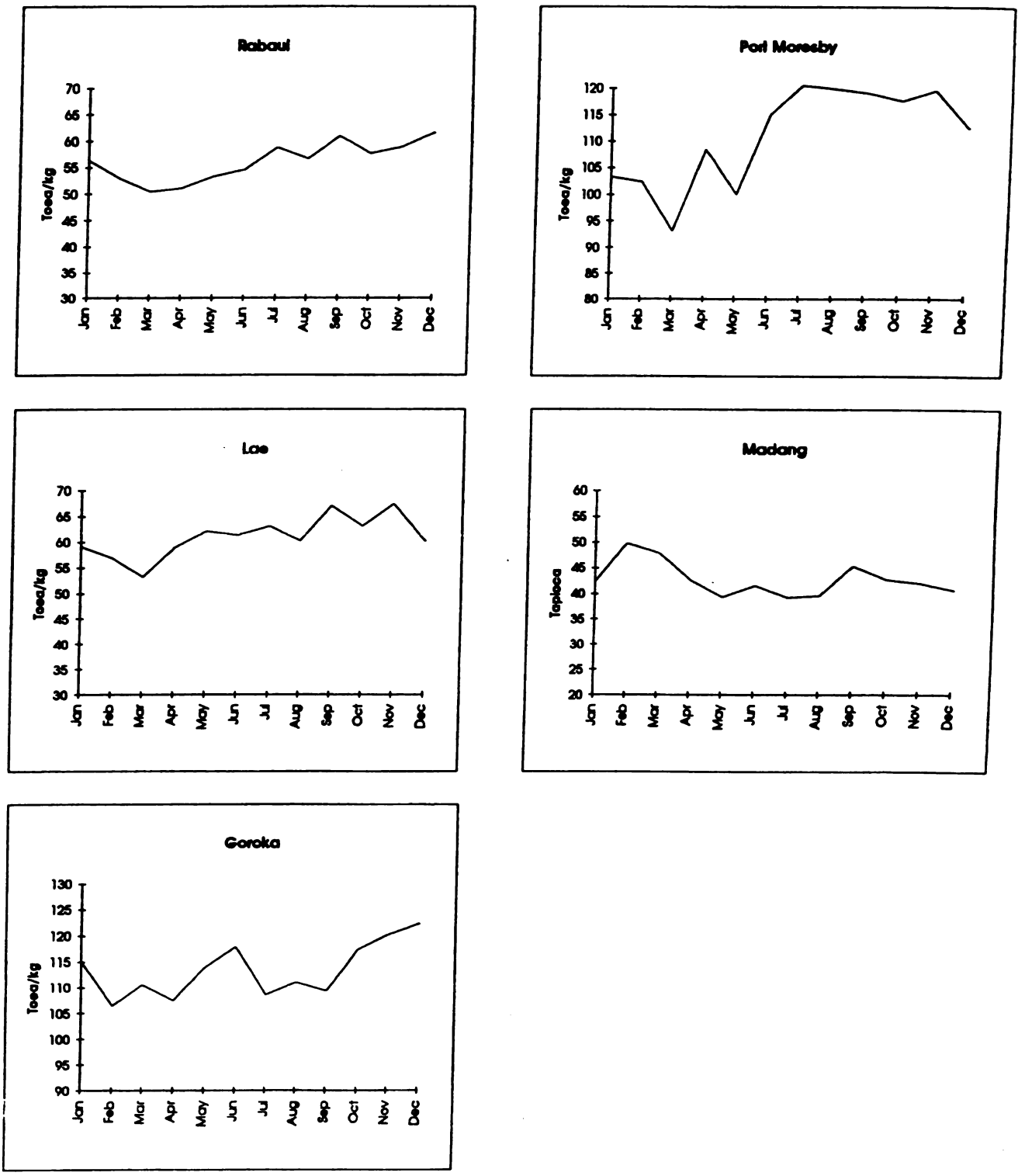


Figure 85. Mean monthly price (toea/kg) for taro at Rabaul, Port Moresby, Lae, Madang and Goroka markets, January 1971 to December 1992, in constant 1991 prices (Source: National Statistics Office)

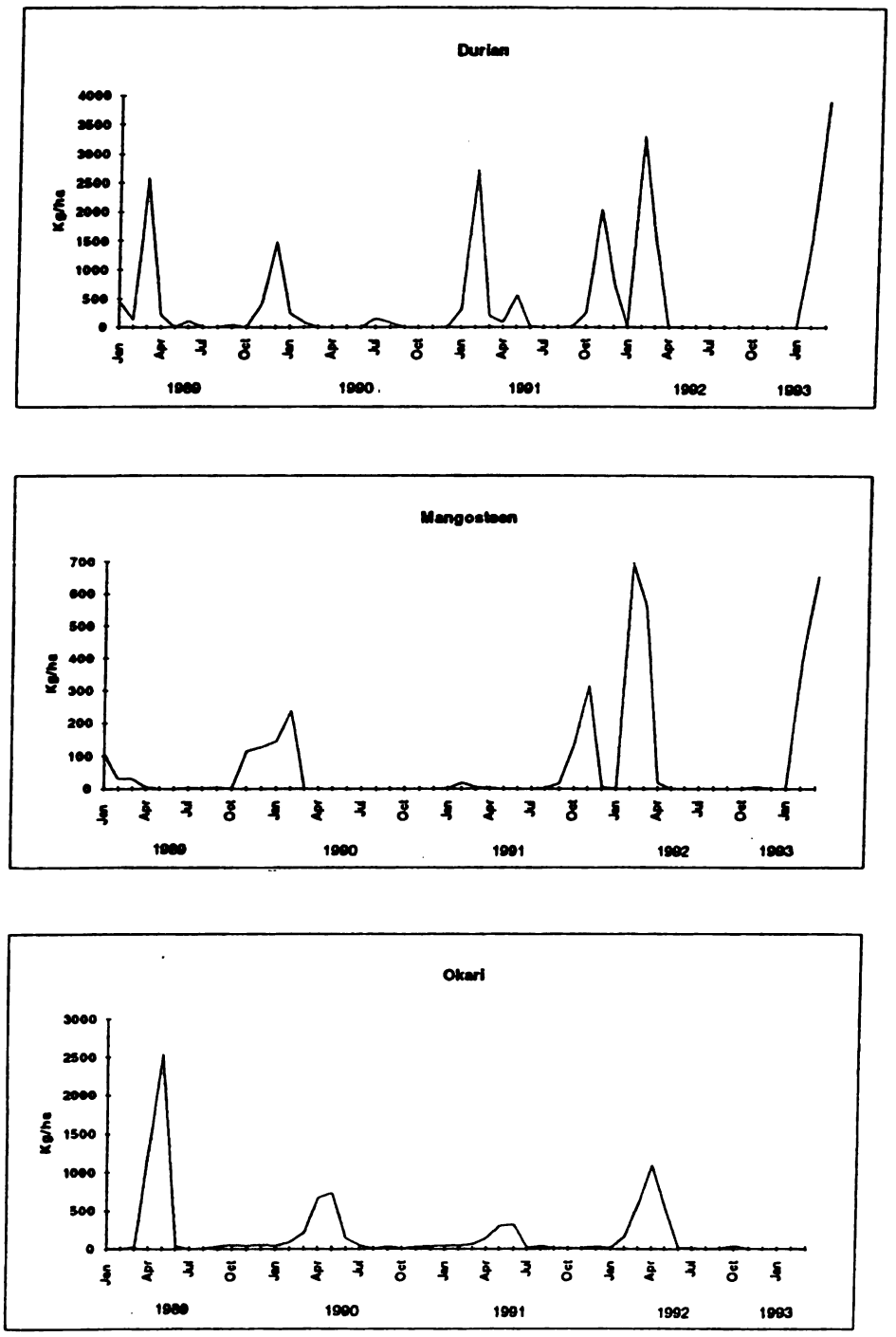
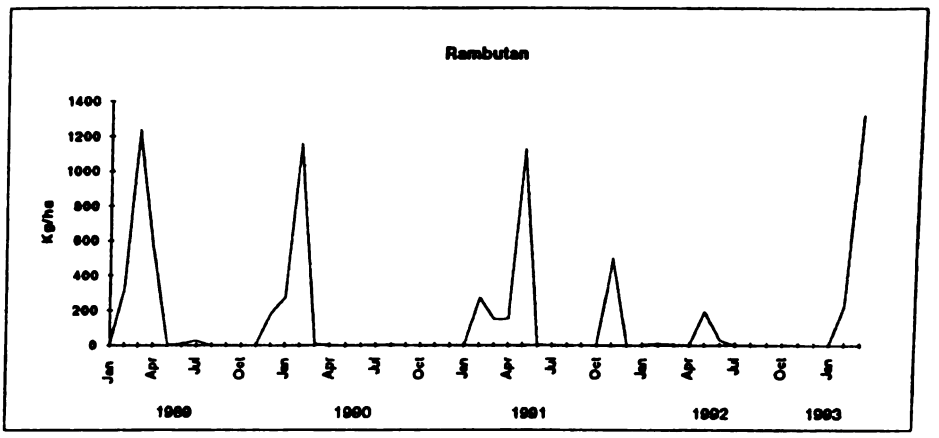
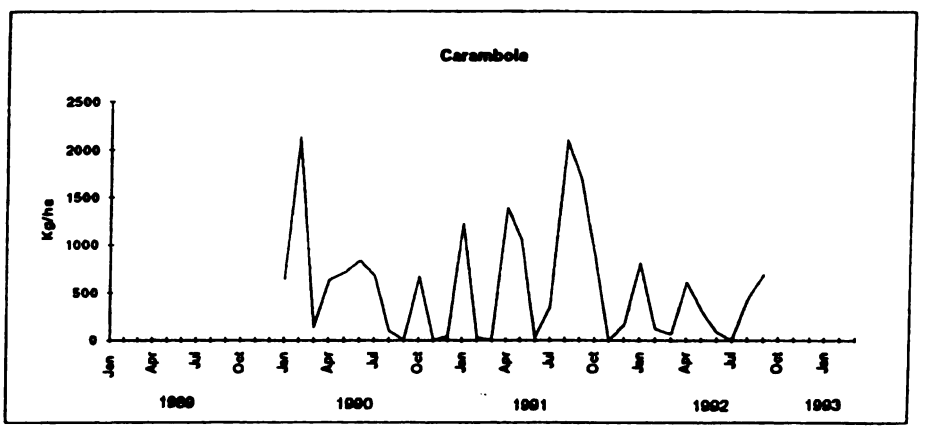


Figure 86. Production (kg/ha) of durian, mangosteen and okari at LAES Keravat, January 1989 to March 1993 (Source: S. Woodhouse)





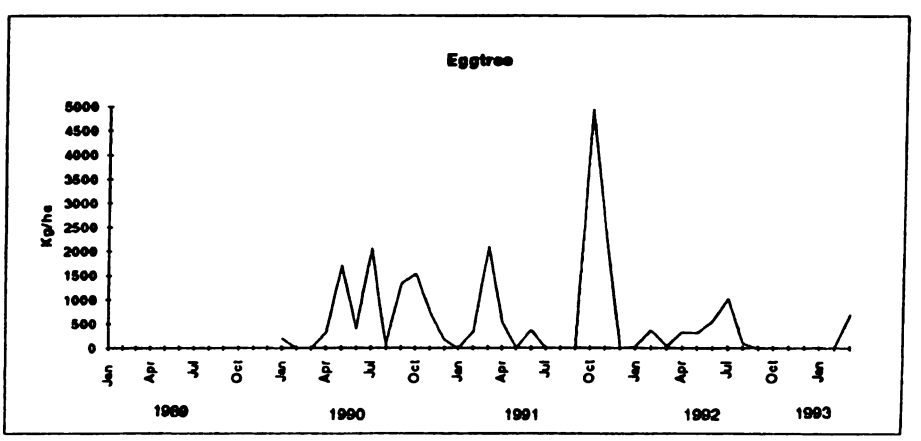


Figure 87. Production (kg/ha) of rambutan, carambola and eggtree at LAES Keravat, January 1989/1990 to March 1993 (Source: S. Woodhouse)

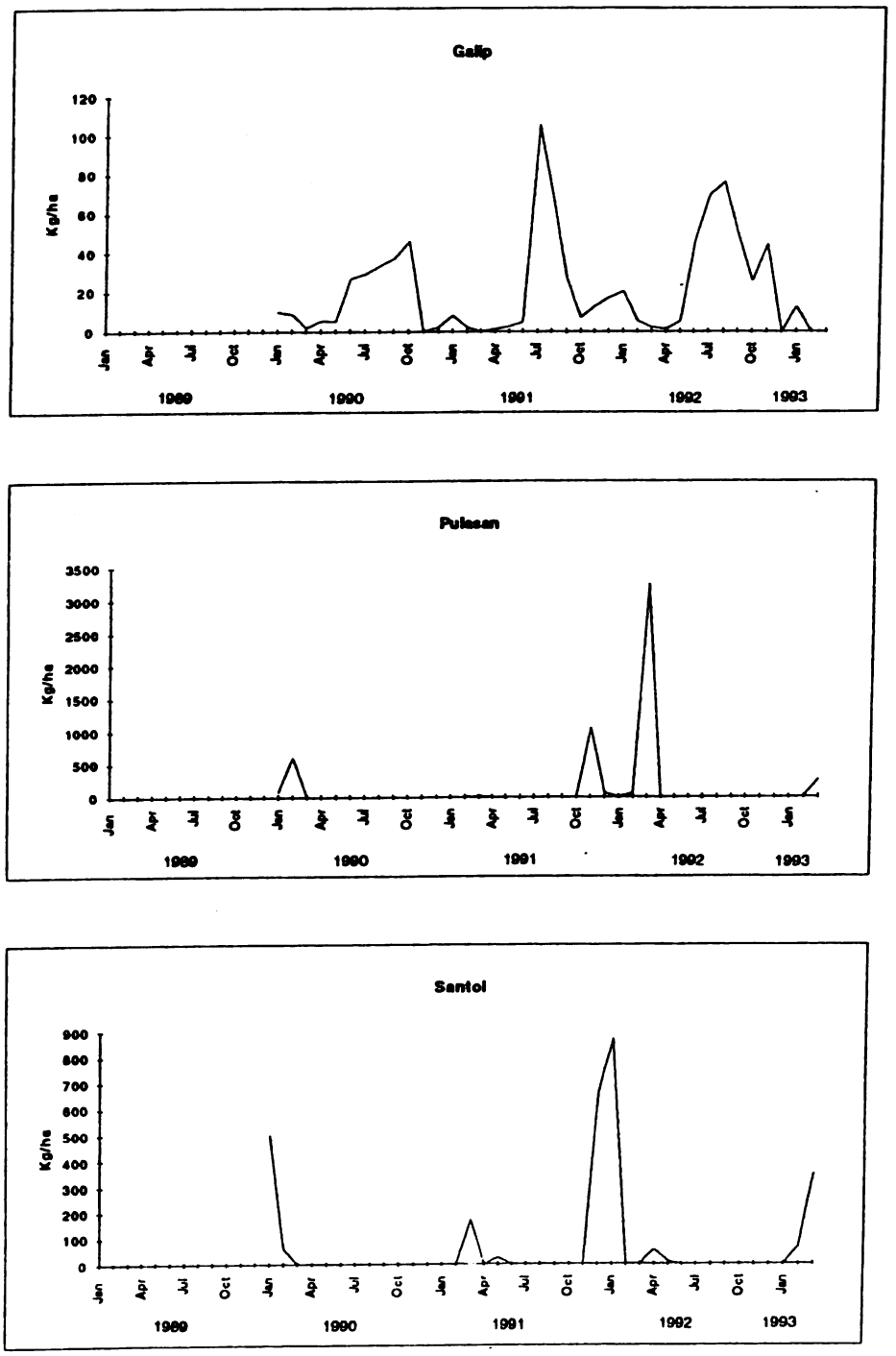
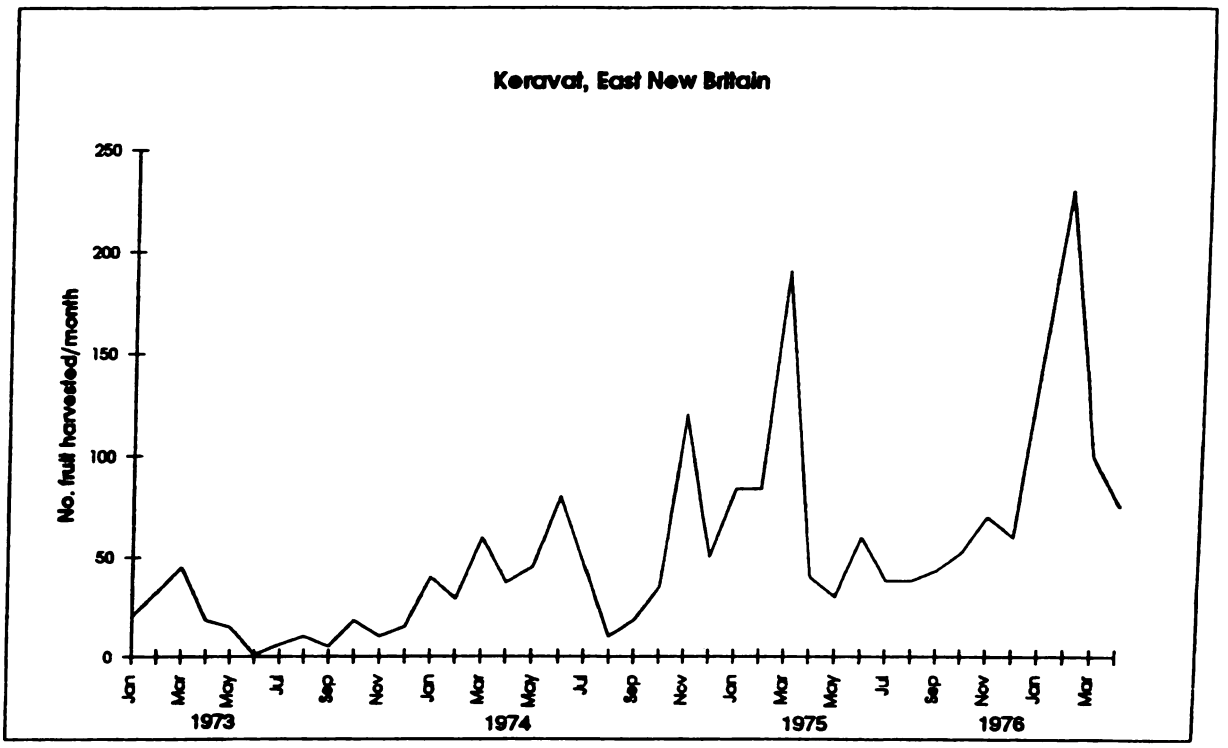


Figure 88. Production (kg/ha) of galip, pulasan and santol at LAES Keravat, January 1990 to March 1993 (Source: S. Woodhouse)



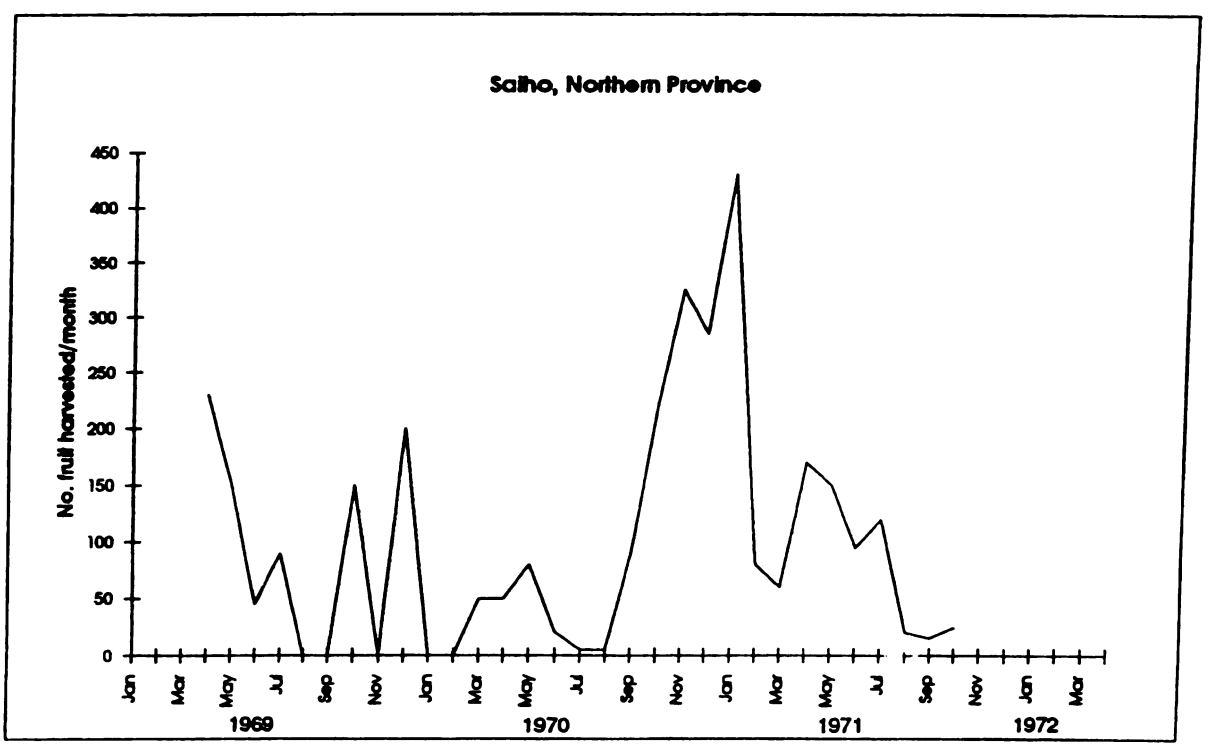


Figure 89. Pineapple production (fruit/month) at Saiho, Northern Province (April 1969 to October 1971) and Keravat, East New Britain (January 1973 to April 1976) (Source: Bourke, 1976a)

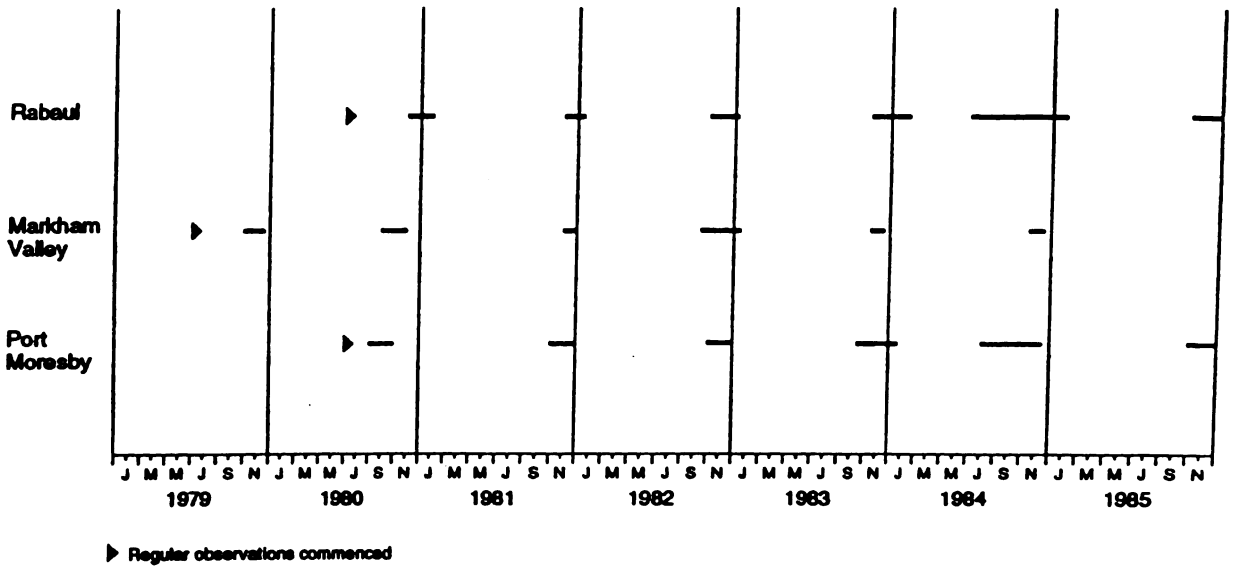
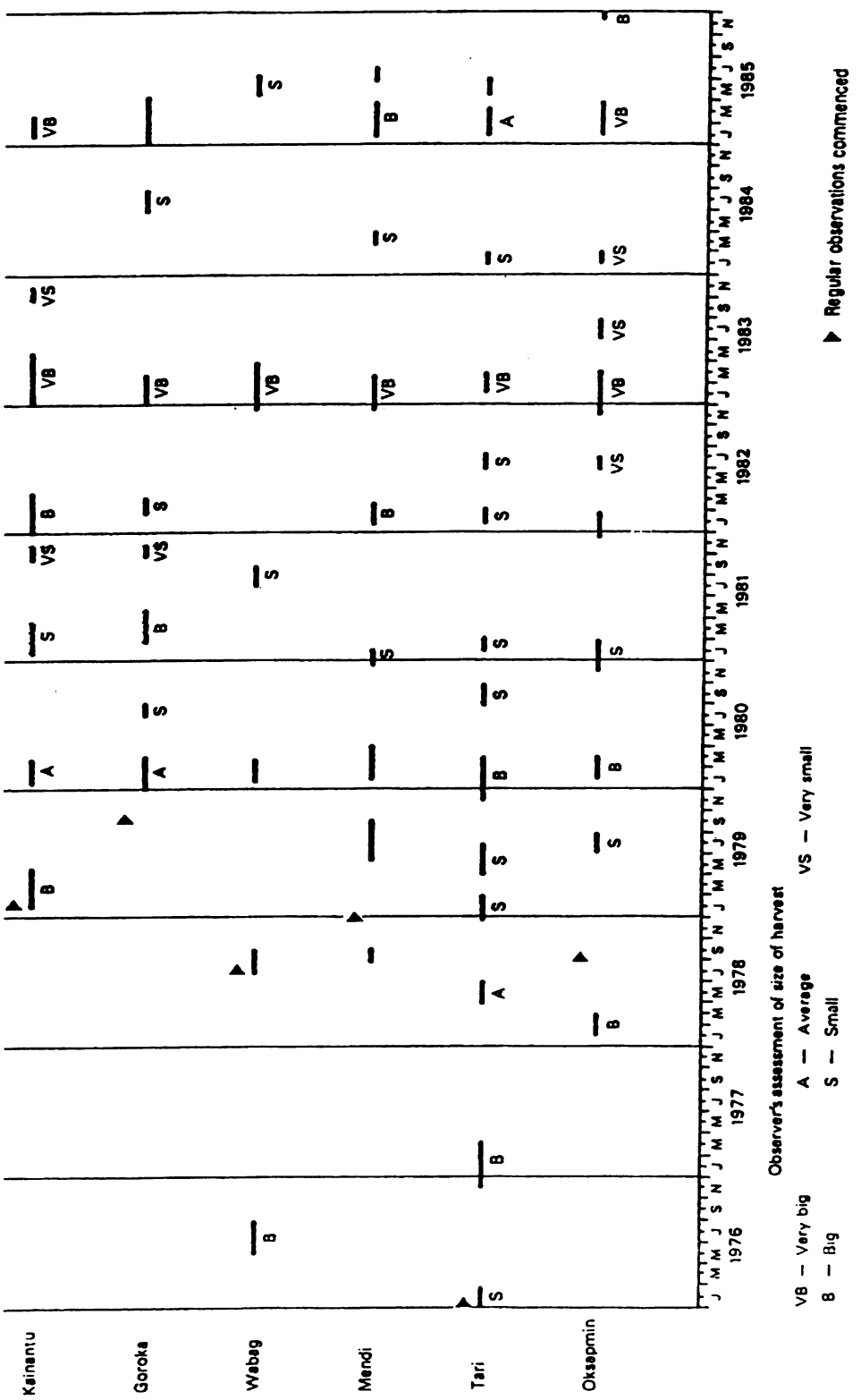


Figure 90. Harvesting periods of introduced mango at Rabaul, Markham Valley and Port Moresby, 1979 to 1985 (Source: Network of observers)

Figure 91. Harvesting periods of karuku nut pandanus at six highland locations, 1976 to 1985 (Source: Bourke 1988: 125)



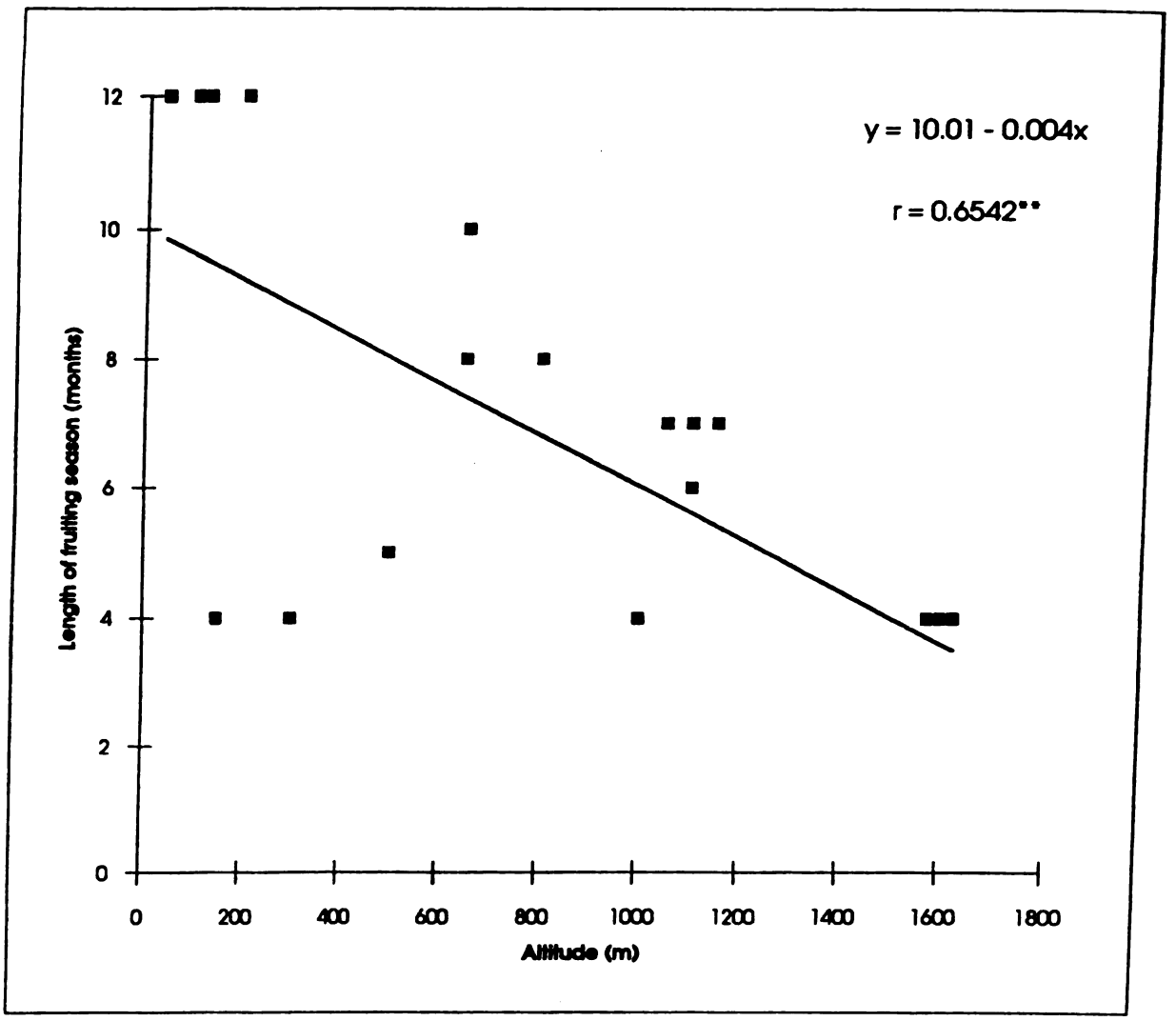
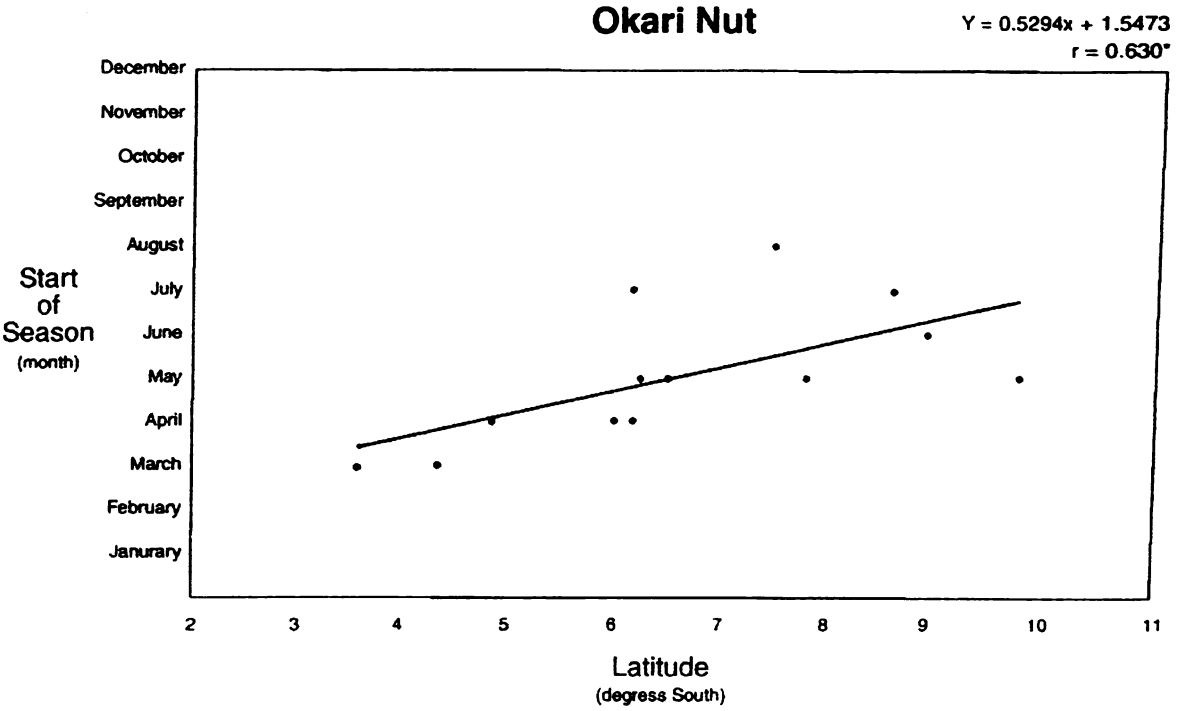


Figure 92. Length of fruiting season of marita pandanus at various locations versus altitude

Figure 93. Start of the harvesting season (month) of galip and okari nuts at various locations versus latitude



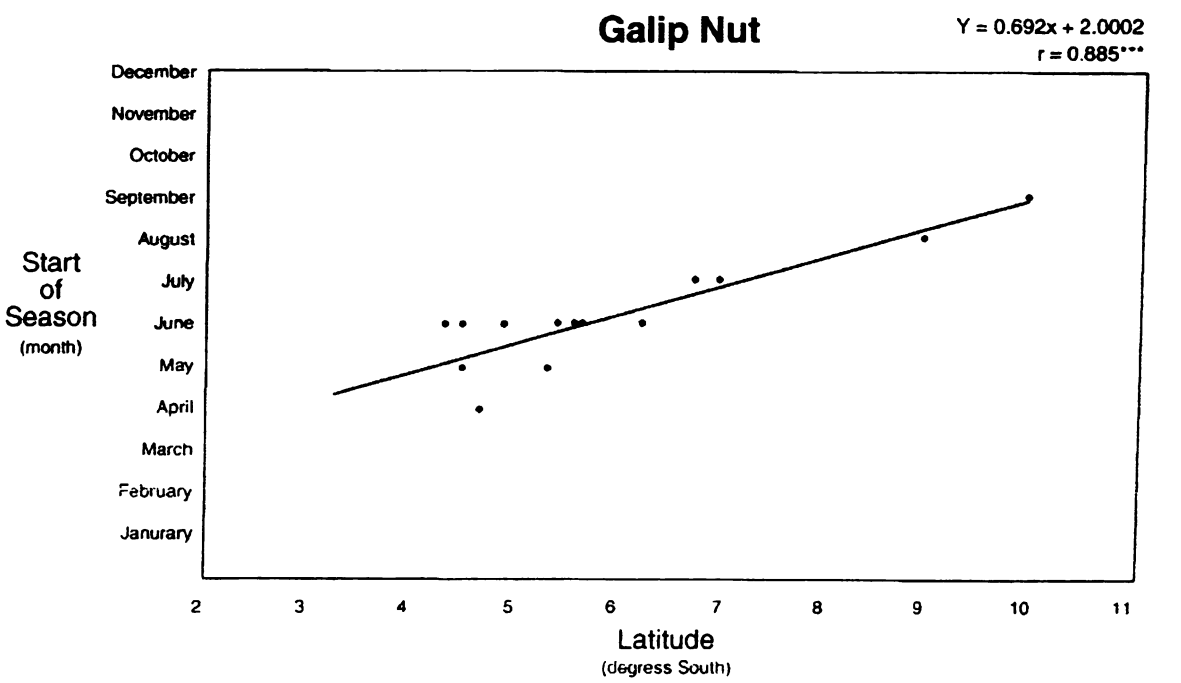


Table 1a. Details of data sources

Data source	Location	Period (years)	Number of commodities	Type of data
Market survey	Aiyura, Kainantu, Ukarumpa EHP	3	84	Fortnightly counts of value of produce on display
Market survey	Goroka	3	33	Fortnightly counts of value of produce on display
Market survey	Hol, Nembi Plateau SHP	2	36	Weekly counts of value of produce on display
FMC purchase figures	Goroka	5	45	Quantity purchased per week
FMC purchase figures	Port Moresby, Lae Wau, Kainantu, Goroka, Mt Hagen	2	40	Quantity purchased per week
CPI market survey	Rabaul, Port Moresby, Lae Madang, Goroka	22	15	Weekly records of price per kg
Experimental recordings	Keravat, ENB (and Saiho, Oro Province)	3/4	10	Weekly weight of fruit or nuts produced
Observer network	Rabaul, Markham Valley, Port Moresby	6	1	Start/finish of mango harvest season
Observer network	Kainantu, Goroka Wabag, Mendi, Tari Oksapmin	10	1	Start/finish of karuka nut harvest season
Villagers' statements and literature	Numerous locations	-	74	Statements by villagers and observations by long-term residents

Table lb. Survey details for five highland markets

Market	Main survey period[1]	Frequency of survey[2]	Survey time[3]	Supervisor
Kainantu[4]	Jun 79-May 82	FN	10 am-noon Fri	R. M. Bourke
Aiyura	Feb 79-May 82	FN	3-4 pm Fri	R. M. Bourke
Ukarumpa	Jun 79-May 82	FN	6-7 am Fri	R. M. Bourke
Goroka	Oct 79-Sep 82	FN	10 am-noon Sat	T. N. Tarepe
Hol, Nembi	Sep 79-Sep 81	W	9-10 am Sat	E. D'Souza

Notes:

1. Some surveys were conducted for up to three months before the main survey period whilst techniques were being tested. Certain data were collected regularly for several years after the main survey period.

2. The fortnightly surveys (FN) were done on the Friday or the Saturday of the Government pay week as turnover is much higher on these days than any other during the fortnightly business cycle. There is not a fortnightly cycle in Hol market and hence the survey was done weekly (W).

3. Surveys were timed for the period when most sellers were in position but buying had not started or had not peaked. The actual time of the survey depended on weather conditions. Following wet mornings, market activities and the surveys were delayed.

4. Separate surveys were also conducted in 1981-1982 of Kainantu, Aiyura and Ukarumpa markets to calculate total annual sales, the influence of the fortnightly business cycle on market sales and mean earnings per seller (Bourke and Nema, 1985).

Table 2. Physical environment of market supply areas and other locations

Location[1]	Mean annual rainfall (mm)	Number of dry months[2]	Drier months[3]	Altitude range (m)
Rabaul, ENB	2000	2	May-Oct	0-400
Keravat, ENB	2800	0	Jun-Aug	20-50
Popondetta/Saiho, Oro Prov	2500	2	Jun-Oct	100
Port Moresby[4]	1000	7	May-Nov	0-500
Lae, Morobe Prov[4]	4600	0	Jan-Feb	0-1000
Bulolo, Morobe Prov	1500	3	May-Oct	600-800
Wau, Morobe Prov	1800	2	May-Oct	800-1200
Markham Valley, Morobe Prov	1400	5	Apr-Sep	100-400
Kainantu, EHP	2000	3	May-Oct	1200-2000
Aiyura/Ukarumpa, EHP	2200	1	May-Oct	1600-1800
Madang	3500	0	Jul-Sep	0-200
Goroka, EHP	1900	3	May-Oct	1400-2200
Mt Hagen, WHP[4]	2600	0	Jun-Aug	1500-2400
Mendi, SHP	2800	0	Jun	1600-2200
Wapenamanda, Enga Prov	2500	0	Jun-Jul	1800
Wabag, Enga Prov	3000	0	Jun-Jul	2000-2700
Taluma, Enga Prov	2400	2	Jun-Aug	2600
Laiagam, Enga Prov	2200	2	Jun-Aug	2200
Nembi Plateau, SHP	3000	0	Jun-Jul	1600-2000
Kandep, Enga Prov	2200	0	Jun-Aug	2500-3000
Tari, SHP	2700	0	Jun-Jul	1600-2500
Oksapmin, Sandaun Prov	2900	0	Jun	1500-2200

Notes:

1. Locations included are those for which longitudinal data are available.

2. The number of months where the mean monthly rainfall is less than 100 mm.

3. Months in which rainfall is significantly less than in other months. Note that monthly rainfall may still be high (>100 mm/month) in the "drier months".

4. Produce sold in Port Moresby, Lae and Mt Hagen markets is drawn from a wide range of environments and the total range of environments is greater than indicated here. Produce in Lae comes from all major environments in PNG, including the seasonally dry lowlands, humid lowlands, intermediate altitude zone, highland, high altitude and very high altitude zones.

Table 3. Value (kina/day) of starchy foods on display at Aiyura, Kainantu, Ukarumpa, Goroka and Hoi markets, June 1979 to September 1982 (Source: Authors' surveys)

		Cooking banana *Musa* ave			Eating banana *Musa* ave			Cassava *Manihot esculenta*			Corn *Zea mays*		Potato *Solanum tuberosum*		
MONTH	YEAR	Aiy/Ktu/Uka	Goroka	Hoi	Aiy/Ktu/Uka	Goroka	Hoi	Aiy/Ktu/Uka	Goroka	Aiy/Ktu/Uka	Goroka	Hoi	Aiy/Ktu/Uka	Goroka	Hoi
Jun	1979	36			25			1		9			21		
Jul	1979	8			24			0		11			19		
Aug	1979	19			24			1		15			35		
Sep	1979	24		5	28		11	2		12		5	15		0
Oct	1979	14	141	6	30	39	16	2	37	10	1	4	22	2	0
Nov	1979	35	45	4	26	28	16	1	22	21	9	4	22	22	0
Dec	1979	13	45	4	25	66	25	0	103	14	9	15	20	6	0
Jan	1980	14	31	7	19	36	21	1	19	69	49	19	44	8	0
Feb	1980	5	86	6	22	106	34	0	12	64	37	36	42	9	1
Mar	1980	9	103	9	13	34	32	0	31	54	18	27	45	28	0
Apr	1980	19	66	9	20	36	35	1	12	15	12	23	14	13	0
May	1980	40	100	11	25	45	43	1	36	22	13	11	16	9	1
Jun	1980	8	372	8	24	60	30	0	37	18	8	3	11	2	0
Jul	1980	7	40	8	21	76	21	1	11	14	4	2	8	0	1
Aug	1980	27	106	8	16	127	19	1	34	8	31	1	23	4	0
Sep	1980	13	273	5	23	48	13	1	36	10	6	1	40	21	0
Oct	1980	8	63	4	35	72	18	1	16	31	17	0	58	51	0
Nov	1980	23	54	7	28	77	16	1	46	24	16	2	47	46	0
Dec	1980	2	17	9	41	33	20	0	23	19	19	2	13	1	0
Jan	1981	17	72	4	29	87	12	1	46	56	29	8	40	3	0
Feb	1981	12	113	6	37	66	13	0	56	109	19	21	51	47	0
Mar	1981	19	293	12	50	73	16	0	25	95	14	28	37	46	0
Apr	1981	5	53	6	29	116	13	0	26	17	19	16	22	18	1
May	1981	30	333	11	47	86	15	1	6	13	5	14	39	5	0
Jun	1981	5	120	11	50	35	33	0	5	19	6	8	34	11	0
Jul	1981	16	703	12	50	61	27	4	38	22	6	3	38	6	0
Aug	1981	8	76	10	33	39	15	2	15	15	6	2	36	12	0
Sep	1981	9	75	11	55	112	9	5	40	26	9	1	47	40	0
Oct	1981	9	70		36	86		1	38	30	7		30	14	
Nov	1981	9	125		42	84		0	14	27	15		36	4	
Dec	1981	8	135		11	101		0	11	16	7		7	11	
Jan	1982	5	88		42	27		0	26	28	12		51	51	
Feb	1982	5	83		27	73		1	37	38	11		35	30	
Mar	1982	12	235		45	75		1	11	31	25		37	7	
Apr	1982	15	120		40	80		0	35	23	4		49	21	
May	1982	25	30			76		1	7	14	13		52	10	
Jun	1982		66			92			21		8			19	
Jul	1982		121			150			44		5			69	
Aug	1982		120			74			14		7			44	
Sep	1982		128			53			8		1			9	

		Sweet potato *Ipomoea batatas*			Sugar cane *Saccharum officinarum*			Chinese taro *Xanthosoma sagittifolium*			Taro *Colocasia esculenta*			Greater yam *Dioscorea alata*	Lesser yam *Dioscorea esculenta*
MONTH	YEAR	Aiy/Ktu/Uka	Goroka	Hoi	Aiy/Ktu/Uka	Goroka	Hoi	Aiy/Ktu/Uka	Goroka	Hoi	Aiy/Ktu/Uka	Goroka	Hoi	Goroka	Aiy/Ktu/Uka
Jun	1979	66			7			10			10				
Jul	1979	66			9			10			11				
Aug	1979	56			11			13			5				
Sep	1979	49		25	6		20	9		1	7		2	1	
Oct	1979	46	103	28	10	43	16	10	2	1	7	0	2	0	0
Nov	1979	66	36	28	9	26	8	13	3	0	8	0	2	2	0
Dec	1979	49	72	43	7	15	10	7	4	1	6	0	1	3	0
Jan	1980	76	84	23	7	57	10	15	1	1	2	1	0	1	0
Feb	1980	66	124	30	10	13	17	14	4	1	0	9	1	1	0
Mar	1980	114	92	34	2	25	10	10	5	1	0	58	1	1	0
Apr	1980	121	82	32	3	16	10	6	0	1	2	1	2	2	0
May	1980	134	161	27	7	33	19	8	0	1	2	4	1	2	0
Jun	1980	83	256	20	3	27	19	12	1	1	2	11	1	2	3
Jul	1980	71	77	24	4	85	19	9	6	2	21	62	1	5	0
Aug	1980	114	359	19	8	29	26	15	7	1	14	72	1	0	3
Sep	1980	114	193	17	23	116	33	13	15	1	9	7	0	1	0
Oct	1980	56	82	11	19	92	22	13	17	1	7	7	0	0	9
Nov	1980	106	99	6	18	40	18	9	24	2	6	0	1	6	3
Dec	1980	106	15	20	6	14	16	5	2	0	1	0	0	2	0
Jan	1981	200	120	10	4	42	16	6	2	0	1	29	0	9	0
Feb	1981	114	135	12	14	48	13	12	10	0	2	47	0	4	0
Mar	1981	171	128	16	12	132	12	6	5	0	2	39	2	1	0
Apr	1981	172	244	18	16	17	9	6	1	1	9	14	1	0	0
May	1981	140	147	17	15	33	6	14	25	0	4	30	0	19	6
Jun	1981	153	161	36	10	20	16	15	16	0	6	259	0	1	36
Jul	1981	110	288	13	14	120	13	26	12	1	11	55	0	0	54
Aug	1981	88	192	8	3	31	9	10	27	0	3	39	0	32	48
Sep	1981	141	171	20	27	102	16	28	6	1	6	59	1	0	3
Oct	1981	142	118		15	59		20	22		11	2		1	6
Nov	1981	133	150		6	88		19	3		3	58		0	0
Dec	1981	77	92		10	12		3	1		0	0		0	0
Jan	1982	131	218		9	43		7	2		5	45		1	0
Feb	1982	104	309		9	49		6	21		1	66		2	1
Mar	1982	61	167		9	252		25	10		7	11		3	5
Apr	1982	142	220		39	29		19	9		2	42		4	0
May	1982	243	184		19	60		24	22		1	3		1	0
Jun	1982		222			23			18			19		0	2
Jul	1982		157			51			7			13		5	2
Aug	1982		151			76			38			37		4	26
Sep	1982		211			20			1			5		0	2

Table 4. Value (kina/day) of traditional vegetables on display at Aiyura, Kainantu, Ukarumpa and Hoi markets, June 1979 to May 1982 (Source: Authors' surveys)

		Aibika *Abelmoschus manihot*		Amaranth *Amaranthus spp.*		Cucumber *Cucumis sativus*		Cucumber seed *Cucumis sativus*	Ferns	Bottle gourd *Lagenaria siceraria*
MONTH	YEAR	Aiy/Kts/Ukr	Hoi	Aiy/Kts/Ukr	Hoi	Aiy/Kts/Ukr	Hoi	Aiy/Kts/Ukr	Aiy/Kts/Ukr	Aiy/Kts/Ukr
Jun	1979	16		2		1		0	22	0
Jul	1979	1		2		7		0	8	0
Aug	1979	1		2		3		0	10	1
Sep	1979	0	0	0	1	8		0	20	0
Oct	1979	2	0	5	2	17	0	0	7	1
Nov	1979	4	0	0	1	53	0	0	5	1
Dec	1979	14	0	12	7	75	6	0	2	1
Jan	1980	16	0	7	14	80	13	1	0	1
Feb	1980	8	0	1	8	58	20	1	0	0
Mar	1980	7	1	0	5	19	7	1	1	0
Apr	1980	5	0	1	2	4	2	1	1	0
May	1980	5	0	1	1	0	0	0	1	0
Jun	1980	2	0	0	0	6	0	0	7	0
Jul	1980	2	1	0	0	43	0	0	16	0
Aug	1980	3	1	2	0	15	0	0	5	2
Sep	1980	3	1	2	0	17	0	0	3	0
Oct	1980	7	0	4	0	23	0	0	5	0
Nov	1980	3	0	4	0	28	0	0	6	0
Dec	1980	7	0	0	2	43	1	0	8	0
Jan	1981	12	0	3	5	71	18	0	1	1
Feb	1981	9	1	2	4	31	26	0	1	0
Mar	1981	21	0	0	7	25	11	0	6	0
Apr	1981	7	0	1	0	3	4	0	8	0
May	1981	6	0	3	2	7	1	0	2	0
Jun	1981	14	0	3	1	10	0	0	6	0
Jul	1981	9	2	1	0	7	0	0	4	0
Aug	1981	2	0	2	0	15	0	0	2	0
Sep	1981	5	0	3	0	13	0	0	1	1
Oct	1981	4		4		18		0	3	0
Nov	1981	4		5		32		0	3	0
Dec	1981	1		2		9		0	0	0
Jan	1982	8		0		49		0	2	0
Feb	1982	7		0		44		0	0	1
Mar	1982	9		0		21		0	3	0
Apr	1982	23		0		6		1	0	1
May	1982	5		0		0			7	1

		Ginger *Zingiber officinale*		Highland laplak leaves *Ficus dammaropsis*	Kumu musong *Ficus copiosa*		*Cyanotis moluccana*	Mushroom	Nightshade *Solanum nodiflorum*	Highland pitpit *Setaria palmifolia*	
MONTH	YEAR	Aiy/Kts/Ukr	Hoi	Aiy/Kts/Ukr	Aiy/Kts/Ukr	Hoi	Aiy/Kts/Ukr	Hoi	Aiy/Kts/Ukr	Aiy/Kts/Ukr	Hoi
Jun	1979	7		1	0		1		0	1	
Jul	1979	4		2	0		1		1	1	
Aug	1979	1		4	0		1	0	0	0	
Sep	1979	1	1	1	0	1	1	0	0	1	6
Oct	1979	1	1	4	1	1	1	2	2	1	5
Nov	1979	2	1	2	5	0	2	0	6	3	3
Dec	1979	1	0	0	0	0	0	0	1	0	6
Jan	1980	4	0	0	1	0	0	0	2	3	7
Feb	1980	0	1	0	0	0	0	0	0	1	8
Mar	1980	11	1	1	0	0	0	0	1	2	5
Apr	1980	4	1	2	1	0	1	0	0	0	9
May	1980	5	1	1	0	0	1	0	0	1	10
Jun	1980	0	2	3	0	0	3	0	0	2	5
Jul	1980	4	3	3	0	0	1	0	1	1	4
Aug	1980	1	3	3	0	1	1	0	0	0	3
Sep	1980	4	2	2	0	1	0	0	1	1	7
Oct	1980	5	2	1	3	0	1	0	2	1	2
Nov	1980	3	2	1	0	1	0	1	3	1	3
Dec	1980	3	1	0	0	1	0	1	1	0	5
Jan	1981	12	1	0	0	0	0	0	1	1	5
Feb	1981	7	1	1	0	0	1	0	5	1	5
Mar	1981	15	0	2	1	0	3	0	6	2	5
Apr	1981	12	1	4	0	0	1	0	8	5	8
May	1981	4	1	3	1	0	1	0	4	1	10
Jun	1981	8	1	4	1	0	0	0	0	1	9
Jul	1981	6	1	2	2	0	1	0	0	1	4
Aug	1981	5	1	0	0	0	0	0	0	0	2
Sep	1981	4	2	1	0	0	0	0	0	0	3
Oct	1981	4		2	3		1		1	1	
Nov	1981	7		1	5		2		1	0	
Dec	1981	1		0	1		1		0	0	
Jan	1982	10		0	1		0		0	2	
Feb	1982	15		0	0		1		0	1	
Mar	1982	18		1	1		1			3	
Apr	1982	17		3	0		3			2	
May	1982	9		4	1		2			1	

Table 5. Value (kina/day) of traditional vegetables on display at Aiyura, Kainantu, Ukarumpa, Goroka and Hoi markets, June 1979 to September 1982 (Source: Authors' surveys)

		Oenanthe *Oenanthe javanica*		Lowland pitpit *Saccharum edule*	*Nasturtium schiechteri*	Rungia *Rungia klossii*		*Trichosanthes pulleana*
MONTH	YEAR	Aiy/Kta/Uka	Hoi	Aiy/Kta/Uka	Aiy/Kta/Uka	Aiy/Kta/Uka	Hoi	Goroka
Jun	1979	27		2	1	4		
Jul	1979	16		0	4	4		
Aug	1979	26		0	0	1		
Sep	1979	21	0	0	3	2	7	
Oct	1979	23	0	2	4	8	5	
Nov	1979	23	0	1	0	5	4	
Dec	1979	7	0	0	0	5	6	0
Jan	1980	10	0	1	2	6	5	0
Feb	1980	20	0	2	2	6	4	1
Mar	1980	24	0	2	2	6	4	0
Apr	1980	32	0	1	6	6	6	0
May	1980	21	0	0	7	4	5	1
Jun	1980	36	0	0	2	4	4	1
Jul	1980	31	0	0	4	3	4	0
Aug	1980	36	1	0	9	4	3	0
Sep	1980	36	1	0	11	6	7	0
Oct	1980	36	1	1	9	6	2	0
Nov	1980	28	0	1	3	6	4	0
Dec	1980	0	0	0	2	13	7	0
Jan	1981	27	0	1	3	6	6	0
Feb	1981	37	0	1	6	8	5	2
Mar	1981	40	0	3	1	9	4	0
Apr	1981	36	0	3	3	10	6	0
May	1981	29	0	0	2	10	6	0
Jun	1981	65	0	1	7	15	6	0
Jul	1981	39	0	1	5	7	3	1
Aug	1981	30	0	1	20	2	2	0
Sep	1981	26	1	1	13	6	4	0
Oct	1981	30		1	9	6		0
Nov	1981	37		0	3	5		0
Dec	1981	13		0	4	6		0
Jan	1982	24		0	6	18		0
Feb	1982	26		3	0	4		0
Mar	1982	32		4	4	13		0
Apr	1982	45		2	1	21		0
May	1982	99		3	2	11		0
Jun	1982							0
Jul	1982							0
Aug	1982							3
Sep	1982							0

		Winged bean tuber *Psophocarpus tetragonolobus*		Winged bean green bean *Psophocarpus tetragonolobus*		Winged bean leaves *Psophocarpus tetragonolobus*	Winged bean seed *Psophocarpus tetragonolobus*
MONTH	YEAR	Aiy/Kta/Uka	Hoi	Aiy/Kta/Uka	Hoi	Aiy/Kta/Uka	Aiy/Kta/Uka
Jun	1979	0		0		0	2
Jul	1979	0		0		0	0
Aug	1979	0		0		0	0
Sep	1979	0	0	0		0	0
Oct	1979	0	0	0	0	0	0
Nov	1979	3	1	0	0	0	0
Dec	1979	0	1	0	0	0	1
Jan	1980	1	2	0	2	1	0
Feb	1980	2	3	1	4	1	0
Mar	1980	5	5	1	5	1	2
Apr	1980	3	6	3	8	1	1
May	1980	4	3	0	1	0	4
Jun	1980	2	1	0	0	0	4
Jul	1980	0	0	0	0	1	1
Aug	1980	2	0	0	0	1	0
Sep	1980	2	0	0	0	0	1
Oct	1980	4	0	0	0	0	0
Nov	1980	2	0	0	0	0	0
Dec	1980	1	0	0	0	1	0
Jan	1981	7	0	0	0	1	0
Feb	1981	7	0	4	0	2	2
Mar	1981	15	1	4	1	0	3
Apr	1981	3	4	3	10	1	2
May	1981	10	8	0	3	1	2
Jun	1981	4	6	0	1	0	0
Jul	1981	2	1	0	0	0	0
Aug	1981	0	0	0	0	0	0
Sep	1981	2	0	0	0	1	0
Oct	1981	4		0		0	1
Nov	1981	5		0		0	0
Dec	1981	8		0		0	1
Jan	1982	15		0		1	4
Feb	1982	5		0		1	2
Mar	1982	3		1		4	5
Apr	1982	8		1		0	7
May	1982	3		0			2

Table 6. Value (kina/day) of introduced vegetables on display at Alyura, Kainantu, Ukarumpa and Hoi markets, June 1979 to May 1982 (Source: Authors' surveys)

		Common bean *Phaseolus vulgaris*		Beetroot *Beta vulgaris*	Broccoli *Brassica oleracea var. botrytis*	Chinese cabbage *Brassica pekinensis*	Head cabbage *Brassica oleracea var. capitata*		Capsicum *Capsicum annuum var. grossum*
MONTH	YEAR	Aiy/Kau/Uke	Hoi	Aiy/Kau/Uke	Aiy/Kau/Uke	Aiy/Kau/Uke	Aiy/Kau/Uke	Hoi	Aiy/Kau/Uke
Jun	1979	12		0	1	13	44		0
Jul	1979	21		0	3	12	51		1
Aug	1979	12		0	1	25	38		0
Sep	1979	15	1	0	4	8	62	3	0
Oct	1979	21	1	0	2	22	124	3	1
Nov	1979	25	2	0	1	7	74	2	0
Dec	1979	28	5	0	0	12	92	7	0
Jan	1980	14	3	0	1	6	83	5	2
Feb	1980	17	4	0	0	7	55	4	3
Mar	1980	17	2	0	0	1	78	8	1
Apr	1980	13	1	0	0	5	38	8	1
May	1980	18	0	0	0	2	40	8	2
Jun	1980	13	0	0	0	7	23	2	10
Jul	1980	23	0	0	0	11	34	1	11
Aug	1980	18	0	0	0	32	70	1	2
Sep	1980	36	0	1	1	16	94	0	1
Oct	1980	38	0	2	3	12	25	1	7
Nov	1980	27	1	0	1	6	150	5	11
Dec	1980	27	3	0	0	16	190	7	6
Jan	1981	36	8	0	0	6	31	6	10
Feb	1981	22	9	0	0	10	43	5	8
Mar	1981	16	3	0	2	12	88	4	6
Apr	1981	28	1	1	0	8	48	8	1
May	1981	31	1	0	0	7	36	5	9
Jun	1981	20	0	0	0	17	58	3	1
Jul	1981	21	0	0	8	17	140	1	2
Aug	1981	25	0	0	6	17	74	1	6
Sep	1981	27	0	0	3	23	130	2	7
Oct	1981	26		0	10	15	218		6
Nov	1981	47		0	6	8	190		5
Dec	1981	2		0	0	2	27		0
Jan	1982	21		0	0	4	93		6
Feb	1982	20		0	0	0	48		7
Mar	1982	11		0	0	0	82		3
Apr	1982	20		0	1	3	88		1
May	1982	21			7	11	85		0

		Carrots *Daucus carota*	Celery *Apium graveolens var. dulce*	Choko fruit *Sechium edule*	Choko tips *Sechium edule*	Garlic *Allium sativum*	Lettuce *Lactuca sativa*	Pak choi *Brassica chinensis*	Parsley *Petroselinum crispum*
MONTH	YEAR	Aiy/Kau/Uke	Aiy/Kau/Uke	Aiy/Kau/Uke	Aiy/Kau/Uke	Aiy/Kau/Uke	Aiy/Kau/Uke	Aiy/Kau/Uke	Aiy/Kau/Uke
Jun	1979	27	2	0	2	0	41	13	0
Jul	1979	17	1	1	3	0	90	12	0
Aug	1979	24	2	0	1	0	44	25	0
Sep	1979	16	0	0	2	0	48	8	0
Oct	1979	26	1	0	5	0	28	22	4
Nov	1979	13	0	0	10	0	32	21	1
Dec	1979	14	0	1	7	0	44	8	0
Jan	1980	11	0	1	6	0	45	5	1
Feb	1980	16	0	2	7	0	16	1	1
Mar	1980	53	0	1	10	0	29	1	0
Apr	1980	12	0	2	4	0	9	7	0
May	1980	19	0	1	2	0	27	7	0
Jun	1980	35	0	0	2	0	68	3	1
Jul	1980	31	0	0	3	0	43	15	0
Aug	1980	13	0	0	4	0	30	24	1
Sep	1980	11	0	1	10	6	32	19	0
Oct	1980	14	0	1	8	4	45	19	1
Nov	1980	45	0	1	14	1	46	14	0
Dec	1980	9	0	0	15	0	32	11	0
Jan	1981	11	0	0	15	0	31	4	1
Feb	1981	8	0	0	8	2	33	2	0
Mar	1981	5	0	0	7	0	30	2	0
Apr	1981	20	0	0	9	0	21	3	1
May	1981	19	0	0	8	1	26	17	1
Jun	1981	35	0	0	6	1	49	13	1
Jul	1981	43	0	1	14	0	58	30	0
Aug	1981	43	1	1	7	1	26	18	1
Sep	1981	54	0	1	10	0	60	19	1
Oct	1981	41	0	1	14	0	55	20	1
Nov	1981	31	0	1	15	0	31	14	0
Dec	1981	1	0	0	8	0	1	3	0
Jan	1982	38	0	2	10	0	18	4	1
Feb	1982	20	1	2	4	0	28	2	0
Mar	1982	17	0	1	12	0	14	0	2
Apr	1982	26	1	0	10	0	47	3	1
May	1982	33	1	0	9	0	72	4	1

Table 7. Value (kina/day) of introduced vegetables on display at Alyura, Kainantu, Ukarumpa and Hoi markets, June 1979 to May 1982 (Source: Authors' surveys)

		Peas	Pumpkin fruit		Pumpkin tips		Radish	Rhubarb	Shallot
		Pisum sativum	*Cucurbita moschata*		*Cucurbita moschata*		*Raphanus sativus*	*Rheum rhaponticum*	*Allium cepa* var. *aggregatum*
MONTH	YEAR	Aiy/Kta/Uka	Aiy/Kta/Uka	Hoi	Aiy/Kta/Uka	Hoi	Aiy/Kta/Uka	Aiy/Kta/Uka	Aiy/Kta/Uka
Jun	1979	1	6		14		2	5	0
Jul	1979	2	2		13		1	8	0
Aug	1979	4	11		3		1	2	0
Sep	1979	3	4	9	7	2	0	12	0
Oct	1979	2	5	9	10	1	0	6	0
Nov	1979	4	8	13	16	2	2	13	0
Dec	1979	4	6	19	9	1	1	1	0
Jan	1980	3	18	24	8	0	0	10	3
Feb	1980	4	26	21	5	0	0	2	2
Mar	1980	4	15	11	15	0	0	3	0
Apr	1980	2	10	7	8	0	0	6	0
May	1980	3	12	4	7	0	0	25	1
Jun	1980	2	7	3	6	0	0	8	3
Jul	1980	2	4	2	8	1	1	4	1
Aug	1980	2	10	3	16	1	2	46	1
Sep	1980	3	8	2	12	0	2	4	1
Oct	1980	5	24	5	14	1	1	4	4
Nov	1980	3	17	4	13	1	0	2	1
Dec	1980	0	7	7	14	1	1	13	0
Jan	1981	1	18	17	10	1	2	12	2
Feb	1981	2	22	17	6	0	2	11	1
Mar	1981	1	9	13	7	0	2	11	1
Apr	1981	1	4	10	12	1	0	4	0
May	1981	1	3	25	14	0	1	10	2
Jun	1981	5	10	22	8	1	1	3	1
Jul	1981	6	8	14	5	1	3	2	2
Aug	1981	3	5	9	5	2	2	3	3
Sep	1981	0	24	8	16	2	1	1	11
Oct	1981	5	10		11		1	4	3
Nov	1981	5	16		9		1	8	2
Dec	1981	0	5		3		0	0	1
Jan	1982	3	11		7		2	0	0
Feb	1982	4	9		5		0	5	1
Mar	1982	1	10		4		1	2	1
Apr	1982	1	8		5		2	11	0
May	1982	3	5		8		4	5	

		Silverbeet	Spring onion		Tomato		Watercress	
		Beta vulgaris	*Allium cepa* var. *cepa*		*Lycopersicon esculentum*		*Nasturtium officinale*	
MONTH	YEAR	Aiy/Kta/Uka	Aiy/Kta/Uka	Hoi	Aiy/Kta/Uka	Hoi	Aiy/Kta/Uka	Hoi
Jun	1979	1	12		8		1	
Jul	1979	4	9		11		1	
Aug	1979	2	18		12		1	
Sep	1979	2	3	0	16	0	1	0
Oct	1979	6	6	0	20	1	1	0
Nov	1979	11	21	0	19	2	1	0
Dec	1979	4	9	0	21	1	1	0
Jan	1980	9	13	0	27	2	3	0
Feb	1980	7	16	1	23	2	1	0
Mar	1980	3	19	1	24	1	3	0
Apr	1980	2	7	0	7	1	2	0
May	1980	3	19	1	14	0	1	0
Jun	1980	4	10	0	14	0	0	0
Jul	1980	2	5	0	18	0	1	0
Aug	1980	1	11	0	18	0	1	0
Sep	1980	0	13	0	21	0	1	0
Oct	1980	7	11	1	35	0	1	0
Nov	1980	4	12	0	46	0	3	1
Dec	1980	5	12	0	15	0	3	1
Jan	1981	1	21	0	13	0	1	1
Feb	1981	2	18	0	12	0	3	1
Mar	1981	3	24	0	16	0	2	1
Apr	1981	10	17	0	19	0	1	0
May	1981	7	22	0	12	0	2	0
Jun	1981	9	19	0	16	0	2	0
Jul	1981	9	23	0	14	0	5	0
Aug	1981	9	12	0	17	0	2	0
Sep	1981	12	27	0	30	0	3	0
Oct	1981	8	22		34		4	
Nov	1981	5	25		35		4	
Dec	1981	1	11		2		2	
Jan	1982	4	19		29		1	
Feb	1982	2	23		8		3	
Mar	1982	1	14		9		3	
Apr	1982	1	27		10		3	
May	1982	1	17		19		6	

Table 8. Value (kina/day) of fruit on display at Aiyura, Kainantu, Ukarumpa, Goroka and Hoi markets, June 1979 to September 1982 (Source: Authors' surveys)

		Highland yellow passionfruit *Passiflora ligularis*		Purple passionfruit *Passiflora edulis f. edulis*		Pawpaw *Carica papaya*			Tree tomato *Cyphomandra betacea*		Black raspberry *Rubus laciocarpus*
MONTH	YEAR	Aiy/Ktu/Uka	Goroka	Aiy/Ktu/Uka	Goroka	Aiy/Ktu/Uka	Goroka	Hoi	Aiy/Ktu/Uka	Goroka	Aiy/Ktu/Uka
Jun	1979	1		4		1			0		0
Jul	1979	2		0		1			0		0
Aug	1979	0		0		3			0		0
Sep	1979	0		0		4			0		0
Oct	1979	0	0	0	0	8	13	1	0	0	0
Nov	1979	1	1	1	1	4	8	0	0	0	0
Dec	1979	0	0	2	0	2	9	0	0	1	0
Jan	1980	0	1	10	12	3	15	0	0	2	0
Feb	1980	0	4	13	6	2	8	1	0	3	0
Mar	1980	1	32	11	4	2	13	0	0	4	0
Apr	1980	0	0	3	2	2	13	0	0	3	0
May	1980	3	2	1	0	1	5	0	0	3	0
Jun	1980	3	0	0	0	2	7	0	0	5	0
Jul	1980	0	4	0	1	0	30	0	0	5	0
Aug	1980	3	4	1	4	4	43	1	0	4	0
Sep	1980	0	0	1	7	4	28	2	0	10	0
Oct	1980	0	8	0	1	13	39	1	0	2	0
Nov	1980	0	10	0	2	8	70	2	0	1	0
Dec	1980	4	2	1	1	12	2	1	0	1	0
Jan	1981	3	3	9	1	4	18	1	0	1	0
Feb	1981	0	0	16	2	3	9	1	0	1	0
Mar	1981	0	0	13	6	5	34	1	0	2	0
Apr	1981	1	8	8	5	3	28	0	0	1	0
May	1981	6	11	5	1	1	4	0	3	3	6
Jun	1981	3	2	2	0	3	4	1	0	0	4
Jul	1981	3	3	2	0	2	6	0	3	1	6
Aug	1981	0	2	5	0	2	17	1	2	1	2
Sep	1981	16	5	4	2	12	14	1	4	3	3
Oct	1981	2	0	1	0	11	25		2	3	4
Nov	1981	6	6	0	0	6	13		1	1	11
Dec	1981	0	7	0	0	1	30		0	0	0
Jan	1982	2	0	11	2	5	2		2	0	6
Feb	1982	4	13	30	6	3	11		7	4	3
Mar	1982	8	33	9	13	2	10		10	22	5
Apr	1982	5	21	5	10	3	16		9	5	5
May	1982	8	19	3	1	3	6		6	3	10
Jun	1982		1		1		1			0	
Jul	1982		3		0		9			7	
Aug	1982		6		0		27			0	
Sep	1982		14				27			0	

		Rough leaf pineapple *Ananas comosus*			Smooth leaf pineapple *Ananas comosus*			Total pineapple *Ananas comosus*		
MONTH	YEAR	Aiy/Ktu/Uka	Goroka	Hoi	Aiy/Ktu/Uka	Goroka	Hoi	Aiy/Ktu/Uka	Goroka	Hoi
Jun	1979	0			5			5		
Jul	1979	0			9			9		
Aug	1979	0			8			8		
Sep	1979	2		1	9		0	11		1
Oct	1979	1	4	0	27	31	0	28	35	1
Nov	1979	6	0	1	15	16	0	20	16	1
Dec	1979	0	7	1	16	11	0	16	18	1
Jan	1980	2	7	1	12	39	0	14	46	1
Feb	1980	2	0	1	21	5	0	23	5	1
Mar	1980	0	0	1	13	10	1	13	10	1
Apr	1980	0	0	0	1	1	1	1	1	1
May	1980	0	0	0	9	15	0	9	15	1
Jun	1980	0	0	0	7	2	0	7	2	1
Jul	1980	0	0	0	8	40	0	8	40	0
Aug	1980	0	0	1	71	11	0	71	11	1
Sep	1980	0	6	0	12	24	1	12	30	0
Oct	1980	0	11	0	34	33	0	34	44	0
Nov	1980	1	8	1	33	16	1	34	24	1
Dec	1980	0	0	0	35	1	0	35	1	1
Jan	1981	1	3	0	13	66	0	14	69	0
Feb	1981	0	5	0	34	52	0	34	57	0
Mar	1981	0	0	0	9	45	0	9	45	1
Apr	1981	0	0	0	6	37	0	6	37	1
May	1981	0	1	0	16	4	0	16	5	0
Jun	1981	0	6	0	5	29	0	5	35	0
Jul	1981	0	1	0	13	17	0	13	18	0
Aug	1981	0	0	0	9	10	0	9	10	0
Sep	1981	1	3	0	19	54	0	20	57	0
Oct	1981	0	1		44	52		44	52	
Nov	1981	6	8		43	58		49	66	
Dec	1981	1	31		3	28		5	58	
Jan	1982	1	0		28	8		28	8	
Feb	1982	0	1		21	105		21	106	
Mar	1982	0	1		38	47		38	47	
Apr	1982	0	2		13	20		13	22	
May	1982	2	1		16	19		17	20	
Jun	1982		1			17			17	
Jul	1982		1			17			18	
Aug	1982		2			40			42	
Sep	1982		0			10			10	

Table 9. Value (kina/day) of fruit on display at Alyura, Kainantu, Ukarumpa, Goroka and Hoi markets, June 1979 to September 1982 (Source: Authors' surveys)

		Avocado		Grapefruit		Guava		Lemon*		Lime	Mandarin	
		Persea americana		*Citrus paradisi*		*Psidium guajava*		*Citrus limon*		*Citrus aurantifolia*	*Citrus reticulata*	
MONTH	YEAR	Aiy/Kta/Uka	Goroka	Aiy/Kta/Uka	Goroka	Aiy/Kta/Uka	Goroka	Aiy/Kta/Uka	Goroka	Aiy/Kta/Uka	Aiy/Kta/Uka	Goroka
Jun	1979	3		0		1		1		0	67	
Jul	1979	0		1		0		0		0	53	
Aug	1979	0		2		0		2		0	6	
Sep	1979	0		1		0		1		0	1	
Oct	1979	4	1	0	0	1	0	1	10	0	2	0
Nov	1979	0	0	1	0	0	1	1	6	1	2	0
Dec	1979	1	1	1	0	0	3	0	11	0	1	0
Jan	1980	2	0	1	0	0	3	1	0	2	1	0
Feb	1980	3	2	2	0	1	7	3	16	1	3	0
Mar	1980	0	2	1	1	0	49	3	7	0	4	0
Apr	1980	1	1	0	0	1	8	2	3	0	7	0
May	1980	3	0	3	1	4	3	0	0	1	54	0
Jun	1980	0	82	3	0	0	2	0	5	0	60	48
Jul	1980	1	0	1	0	0	0	2	8	0	54	4
Aug	1980	0	0	1	0	0	4	3	16	0	41	11
Sep	1980	1	1	1	0	0	0	3	5	0	21	0
Oct	1980	0	2	0	2	0	5	2	7	0	2	0
Nov	1980	2	0	1	2	0	5	5	0	0	0	0
Dec	1980	2	0	1	0	0	1	5	4	0	0	0
Jan	1981	5	6	0	2	0	2	2	4	0	0	0
Feb	1981	10	1	0	0	0	17	5	4	0	0	0
Mar	1981	13	1	1	0	1	30	4	5	0	2	0
Apr	1981	5	17	0	0	5	72	4	5	0	1	0
May	1981	4	4	1	0	4	6	7	8	0	81	15
Jun	1981	6	5	0	2	0	0	6	5	0	113	3
Jul	1981	3	5	1	1	0	0	7	1	0	133	27
Aug	1981	4	1	2	0	0	0	8	8	0	7	0
Sep	1981	3	2	2	0	0	1	4	3	0	4	0
Oct	1981	1	3	1	1	0	5	3	16	0	1	0
Nov	1981	1	0	1	0	0	1	4	5	0	1	0
Dec	1981	3	3	0	0	0	0	0	9	0	0	0
Jan	1982	4	1	0	0	0	1	7	4	0	2	1
Feb	1982	3	20	0	0	1	46	7	6		3	1
Mar	1982	7	3	0	0	4	12	5	3		2	21
Apr	1982	11	2	1	2	2	17	8	8		6	1
May	1982	3	1	1	0	2	8	4	8		65	7
Jun	1982		8		2		1		6			15
Jul	1982		9		5		1		6			11
Aug	1982		1		1		0		5			0
Sep	1982		0		0		1		4			0

* Lemons and limes were not recorded separately at Goroka market.

		Mango*		Marita			Orange		Banana passionfruit		Strawberry	
		Mangifera indica		*Pandanus conoideus*			*Citrus sinensis*		*Passiflora mollissima*		*Fragaria* sp.	
MONTH	YEAR	Aiy/Kta/Uka	Goroka	Aiy/Kta/Uka	Goroka	Hoi	Aiy/Kta/Uka	Goroka	Aiy/Kta/Uka	Goroka	Aiy/Kta/Uka	Goroka
Jun	1979	0		1			14		0		0	
Jul	1979	0		0			2		0		0	
Aug	1979	0		0			0		0		0	
Sep	1979	0		0		0	0		0		0	
Oct	1979	2	0	1	0	0	0	4	0	0	0	
Nov	1979	72	110	2	2	0	0	20	0	1	0	3
Dec	1979	0	0	4	0	0	0	1	0	0	0	0
Jan	1980	0	0	19	17	0	1	0	0	1	0	0
Feb	1980	0	0	29	50	3	1	0	0	0	0	0
Mar	1980	1	0	158	22	2	3	1	0	1	0	0
Apr	1980	0	0	10	10	3	3	2	0	1	0	0
May	1980	0	0	5	3	0	3	1	0	0	0	0
Jun	1980	0	0	1	7	2	0	35	0	0	0	0
Jul	1980	0	0	0	11	0	4	45	0	1	0	0
Aug	1980	0	0	0	0	1	2	39	0	2	0	0
Sep	1980	0	0	0	2	0	0	7	0	2	0	0
Oct	1980	36	0	0	1	0	0	3	0	1	0	5
Nov	1980	66	0	4	0	0	1	1	0	2	0	1
Dec	1980	0	0	19	2	0	0	1	0	0	0	0
Jan	1981	13	0	23	261	1	1	4	0	0	0	0
Feb	1981	3	0	67	60	2	5	3	0	0	0	0
Mar	1981	0	0	10	12	3	1	3	0	0	0	0
Apr	1981	0	0	0	52	2	7	2	0	0	0	0
May	1981	0	0	0	1	0	10	32	0	0	4	0
Jun	1981	0	0	1	2	0	12	5	0	0	1	0
Jul	1981	0	0	0	7	0	0	2	0	0	0	42
Aug	1981	0	0	0	1	0	1	23	0	0	3	12
Sep	1981	0	0	2	2		1	3	0	0	2	8
Oct	1981	0	0	0	2		0	0	0	0	2	0
Nov	1981	0	0	12	2		1	3	0	0	3	0
Dec	1981	0	0	6	10		0	2	0	0	0	0
Jan	1982	0	0	18	12		4	12	0	0	2	0
Feb	1982	0	0	9	36		2	1	0	0	4	0
Mar	1982	0	0	5	18		3	0	0	0	6	0
Apr	1982	0	0	5	3		6	10	0	0	11	0
May	1982	0	0	1	0		19	26		1	24	0
Jun	1982		0		1			47		0		2
Jul	1982		0		0			11		0		0
Aug	1982		0		0			12		0		5
Sep	1982		0		0			0		0		0

* Mangoes are grown in the Markham valley and transported to the highlands for sale.

Table 10. Value (kina/day) of nuts on display at Aiyura, Kainantu, Ukarumpa, Goroka and Hoi markets, June 1979 to September 1982 (Source: Authors' surveys)

		Dry coconut *		Green coconut *	Sprouted coconut *	Candle nut	Karuka			Peanuts		
		Cocos nucifera		*Cocos nucifera*	*Cocos nucifera*	*Aleurites moluccana*	*Pandanus julianettii*			*Arachis hypogaea*		
MONTH	YEAR	Aiy/Kta/Uka	Goroka	Aiy/Kta/Uka	Aiy/Kta/Uka	Goroka	Aiy/Kta/Uka	Goroka	Hoi	Aiy/Kta/Uka	Goroka	Hoi
Jun	1979	29		0	0		5			21		
Jul	1979	10		0	0		6			18		
Aug	1979	7		7	0		6			8		
Sep	1979	13		0	0		3		1	32		10
Oct	1979	42	0	13	0	0	1	0	0	26	5	0
Nov	1979	8	0	10	0	3	1	1	0	36	77	0
Dec	1979	3	0	4	0	0	0	0	0	30	28	17
Jan	1980	1	0	0	0	0	1	3	0	96	17	0
Feb	1980	0	8	1	0	0	6	4	2	117	77	11
Mar	1980	0	50	0	0	0	21	35	13	99	169	14
Apr	1980	11	0	4	0	0	2	0	7	51	14	35
May	1980	11	0	4	0	0	0	5	0	32	80	24
Jun	1980	0	0	0	0	0	0	0	0	36	174	16
Jul	1980	0	19	0	0	0	0	5	0	34	79	19
Aug	1980	10	34	3	0	0	0	11	0	36	157	5
Sep	1980	2	0	0	0	0	0	0	0	25	14	7
Oct	1980	4	0	22	0	0	0	0	0	30	19	5
Nov	1980	6	0	23	3	0	0	0	0	37	45	15
Dec	1980	26	0	4	0	0	0	0	0	56	17	3
Jan	1981	0	24	0	0	0	1	0	0	121	152	3
Feb	1981	2	66	0	0	0	2	0	3	107	84	0
Mar	1981	0	40	1	0	0	5	111	2	96	89	0
Apr	1981	1	20	4	0	0	0	0	0	76	190	10
May	1981	1	430	2	0	0	1	12	1	34	0	5
Jun	1981	0	367	7	1	0	0	5	0	28	56	10
Jul	1981	33	620	16	2	0	0	2	0	33	0	4
Aug	1981	0	219	0	0	0	0	0	0	31	19	3
Sep	1981	0	53	25	0	1	0	0	0	35	26	2
Oct	1981	23	120	7	0	10	0	1		66	31	
Nov	1981	21	22	0	0	0	0	2		87	24	
Dec	1981	0	143	0	0	0	1	0		58	103	
Jan	1982	1	132	0	0	0	23	0		103	185	
Feb	1982	3	132	0	0	0	50	1		105	150	
Mar	1982	22	240	3	0	0	34	6		75	217	
Apr	1982	0	87	7	0	0	24	8		40	40	
May	1982	47	0	5	0	0	5	0		51	72	
Jun	1982		0			0		0			66	
Jul	1982		125			0		0			69	
Aug	1982		168			1		0			66	
Sep	1982		31			0		0			34	

* Dry coconut, green coconut and sprouted coconut are grown in the lowlands and transported to the highlands for sale.

Table 11. Value (kina/day) of narcotics on display at Aiyura, Kainantu, Ukarumpa and Hoi markets, June 1979 to May 1982 (Source: Authors' surveys)

MONTH	YEAR	Highland betel pepper fruit *Piper gibbilimbum* Aiy/Kta/Uka	Highland betel pepper leaves *Piper gibbilimbum* Aiy/Kta/Uka	Hoi	Highland betel nut *Areca macrocalyx* Aiy/Kta/Uka	Hoi	Lowland betel pepper fruit* *Piper betle* Aiy/Kta/Uka
Jun	1979	0	8		21		30
Jul	1979	0	9		20		17
Aug	1979	0	9		40		16
Sep	1979	3	6	1	48	1	4
Oct	1979	1	11	1	137	1	11
Nov	1979	1	19	0	196	1	25
Dec	1979	3	9	0	86	0	23
Jan	1980	1	9	0	74	0	40
Feb	1980	0	10	1	59	2	33
Mar	1980	0	5	1	21	1	51
Apr	1980	0	5	1	62	2	11
May	1980	0	8	1	79	2	34
Jun	1980	0	14	1	38	4	24
Jul	1980	0	9	0	107	1	25
Aug	1980	0	10	1	83	1	16
Sep	1980	0	19	1	106	2	7
Oct	1980	0	19	2	162	3	8
Nov	1980	0	18	1	132	2	18
Dec	1980	0	16	0	116	1	25
Jan	1981	0	11	0	31	0	39
Feb	1981	1	4	1	36	1	47
Mar	1981	0	7	0	49	1	29
Apr	1981	0	9	0	28	1	28
May	1981	0	12	1	62	2	25
Jun	1981	0	15	0	76	1	21
Jul	1981	0	16	0	72	1	34
Aug	1981	0	8	0	88	2	34
Sep	1981	0	5	1	165	1	32
Oct	1981	0	18		161		19
Nov	1981	0	13		110		28
Dec	1981	0	9		96		102
Jan	1982	0	4		20		20
Feb	1982		3		34		57
Mar	1982		7		42		46
Apr	1982		10		83		39
May	1982		5		46		33

MONTH	YEAR	Lowland betel pepper vine* *Piper betle* Aiy/Kta/Uka	Betel nut* *Areca catechu* Aiy/Kta/Uka	Tobacco *Nicotiana tabacum* Aiy/Kta/Uka	Hoi
Jun	1979	0	107	17	
Jul	1979	1	58	19	
Aug	1979	1	68	12	
Sep	1979	1	6	5	13
Oct	1979	2	14	18	9
Nov	1979	0	26	20	8
Dec	1979	0	4	52	15
Jan	1980	1	74	37	12
Feb	1980	0	30	49	10
Mar	1980	0	33	48	22
Apr	1980	0	110	36	18
May	1980	0	114	44	18
Jun	1980	0	99	85	14
Jul	1980	0	58	31	9
Aug	1980	0	19	44	13
Sep	1980	0	12	24	6
Oct	1980	0	14	49	19
Nov	1980	0	47	61	11
Dec	1980	0	23	25	11
Jan	1981	0	54	26	11
Feb	1981	0	66	32	11
Mar	1981	0	67	27	9
Apr	1981	0	95	12	21
May	1981	7	132	21	13
Jun	1981	1	104	21	22
Jul	1981	0	83	79	10
Aug	1981	0	49	59	17
Sep	1981	0	46	83	25
Oct	1981	0	69	47	
Nov	1981	0	41	73	
Dec	1981	0	87	57	
Jan	1982	0	57	57	
Feb	1982		186	33	
Mar	1982		157	35	
Apr	1982		232	33	
May	1982		176	31	

* Lowland betel pepper fruit and vine, and lowland betel nut are grown in the lowlands and transported to the highlands for sale.

Table 12. Monthly purchases (kg/week) of avocado, eating banana, common bean, beetroot, broccoli, Chinese cabbage, head cabbage, capsicum and carrots by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (Source: FMC purchase records)

MONTH	YEAR	Avocado *Persea americana*	Eating banana *Musa sp.*	Common bean *Phaseolus vulgaris*	Beetroot *Beta vulgaris*	Broccoli *Brassica oleracea var. botrytis*	Chinese cabbage *Brassica pekinensis*	Head cabbage *Brassica oleracea var. capitata*	Capsicum *Capsicum annuum var. grossum*	Carrots *Daucus carota*
Apr	1976	8		46	38	2	377	2804	28	122
May	1976	5		152	0	0	63	883	18	185
Jun	1976	missing data								
Jul	1976	0		38	5	0	274	3518	31	217
Aug	1976	0		112	0	6	367	2687	30	238
Sep	1976	0		176	66	58	552	583	42	466
Oct	1976	0		38	15	0	413	2220	36	578
Nov	1976	0		251	7	0	152	888	128	107
Dec	1976	3		114	2	0	93	785	138	39
Jan	1977	8		56	0	5	155	946	260	36
Feb	1977	37		35	3	0	27	448	133	87
Mar	1977	10		32	2	0	85	424	79	119
Apr	1977	0		46	0	0	73	425	48	32
May	1977	1		171	8	3	578	894	62	54
Jun	1977	1		208	0	0	166	522	105	65
Jul	1977	0		24	0	0	55	298	71	84
Aug	1977	0		22	0	0	73	1023	57	112
Sep	1977	0		57	15	0	74	513	42	88
Oct	1977	0		55	6	0	118	360	30	16
Nov	1977	0		88	2	0	127	445	52	199
Dec	1977	0		156	2	0	22	52	36	15
Jan	1978	15	87	150	0	0	0	661	19	75
Feb	1978	22	87	238	0	11	22	367	7	17
Mar	1978	16	98	127	2	4	91	278	7	253
Apr	1978	26	35	101	0	0	69	443	8	84
May	1978	47	135	164	0	5	44	551	16	115
Jun	1978	49	57	91	0	0	22	239	18	114
Jul	1978	36	27	42	0	0	19	853	9	68
Aug	1978	57	59	34	2	0	20	1528	5	203
Sep	1978	53	54	19	5	0	44	971	11	87
Oct	1978	missing data								
Nov	1978	missing data								
Dec	1978	45	44	142	0	3	161	1142	65	46
Jan	1979	147	57	53	0	0	105	2598	50	114
Feb	1979	117	70	186	1	5	167	792	44	62
Mar	1979	197	70	169	1	0	13	713	9	129
Apr	1979	63	66	116	1	0	90	658	4	81
May	1979	44	69	334	1	0	201	175	0	107
Jun	1979	74	34	113	0	2	16	347	0	189
Jul	1979	28	36	272	0	2	25	134	0	66
Aug	1979	109	24	49	0	17	11	1726	0	29
Sep	1979	84	53	24	0	1	5	445	0	74
Oct	1979	68	33	74	0	0	22	190	0	149
Nov	1979	3	50	112	0	0	81	633	0	71
Dec	1979	44	16	428	0	0	102	950	2	89
Jan	1980	138	37	193	0	44	146	1963	16	300
Feb	1980	221	61	117	0	8	46	813	28	342
Mar	1980	174	39	90	0	1	35	500	8	448
Apr	1980	128	36	149	0	0	84	158	6	196
May	1980	92	37	289	0	8	89	496	16	211
Jun	1980	116	17	51	0	0	14	255	16	147
Jul	1980	121	22	20	0	0	0	311	5	51
Aug	1980	53	11	35	0	0	36	387	1	66
Sep	1980	25	72	120	0	3	74	271	1	26
Oct	1980	25	58	185	0	59	134	278	0	10
Nov	1980	71	61	257	0	245	210	746	3	11
Dec	1980	14	39	255	0	216	79	429	0	109
Jan	1981	126	51	102	0	212	181	888	0	52
Feb	1981	184	34	17	0	0	181	1003	0	40
Mar	1981	95	62	19	0	0	21	717	0	19
Apr	1981	190	24	1	0	2	58	384	0	63
May	1981	90	34	57	0	0	102	109	2	112
Jun	1981	47	31	52	0	0	58	215	0	51
Jul	1981	44	17	15	0	4	110	464	10	47
Aug	1981	5	10	7	0	0	173	1193	0	29

Table 13. Monthly purchases (kg/week) of cauliflower, celery, chillies, choko fruit, corn, cucumber, eggplant, ginger, grapefruit and guava by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (Source: FMC purchase records)

MONTH	YEAR	Cauliflower *Brassica oleracea* var. *botrytis*	Celery *Apium graveolens* var. *dulce*	Chillies *Capsicum frutescens*	Choko fruit *Sechium edule*	Corn *Zea mays*	Cucumber *Cucumis sativus*	Eggplant *Solanum melongena*	Ginger *Zingiber officinale*	Grapefruit *Citrus paradisi*	Guava *Psidium guajava*
Apr	1976	10	10		0		0	0	2	165	20
May	1976	5	0		16		7	0	2	15	0
Jun	1976	missing data									
Jul	1976	0	2		0		0	1	3	35	0
Aug	1976	5	0		0		0	0	0	38	0
Sep	1976	0	8		0		0	2	0	4	0
Oct	1976	0	177		0		1	2	0	6	0
Nov	1976	1	1		0		2	17	0	25	0
Dec	1976	2	0		0	57	0	23	4	13	0
Jan	1977	0	127	0	3	138	38	59	0	17	0
Feb	1977	0	50	1	16	228	8	41	0	9	0
Mar	1977	0	14	7	62	272	6	12	0	141	5
Apr	1977	0	0	0	15	55	0	13	0	25	2
May	1977	0	0	0	14	39	0	4	0	0	0
Jun	1977	2	0	0	21	16	2	0	0	71	0
Jul	1977	0	49	0	12	183	0	0	0	26	0
Aug	1977	0	61	1	16	406	0	11	0	32	0
Sep	1977	44	49	0	23	0	0	2	0	0	0
Oct	1977	11	5	2	23	0	0	6	0	0	0
Nov	1977	0	5	0	28	14	2	0	0	0	0
Dec	1977	0	0	3	3	33	0	0	0	0	0
Jan	1978	0	13	4	21	329	10	0	0	5	0
Feb	1978	11	0	0	28	325	1	3	0	0	0
Mar	1978	1	0	4	41	763	8	2	0	175	0
Apr	1978	0	37	0	14	236	0	0	1	39	0
May	1978	0	48	4	7	135	0	1	3	178	0
Jun	1978	2	5	0	3	306	0	0	2	46	0
Jul	1978	3	0	0	1	269	0	1	0	7	0
Aug	1978	0	3	0	1	58	0	1	0	0	0
Sep	1978	0	0	2	0	3	4	1	0	0	0
Oct	1978	missing data									
Nov	1978	missing data									
Dec	1978	5	0	0	1	301	9	55	0	0	0
Jan	1979	0	0	11	3	953	25	30	0	0	0
Feb	1979	0	0	2	5	370	57	18	1	0	0
Mar	1979	0	0	0	4	244	74	8	2	28	0
Apr	1979	0	0	0	0	162	0	1	0	288	8
May	1979	0	0		0	63	0	0	0	13	0
Jun	1979	0	8		1	0	0	0	2	17	0
Jul	1979	0	7		0	56	0	0	0	59	0
Aug	1979	11	3		0	0	0	0	0	17	0
Sep	1979	33	0		0	0	0	0	0	0	0
Oct	1979	0	0		0	0	7	0	0	0	0
Nov	1979	0	18		0	50	30	2	0	0	0
Dec	1979	0	4		4	248	73	0	0	0	0
Jan	1980	0	69		18	316	112	12	0	0	0
Feb	1980	0	14		21	202	45	12	8	12	0
Mar	1980	0	14		3	169	180	0	5	4	0
Apr	1980	0	0		6	11	0	0	0	34	0
May	1980	3	0		3	3	0	1	0	21	0
Jun	1980	0	0		12	83	1	0	0	19	0
Jul	1980	0	0		7	2	0	0	0	19	0
Aug	1980	0	0		3	0	0	0	0	1	0
Sep	1980	0	0		4	0	0	3	0	6	0
Oct	1980	0	0		0	1	0	7	0	2	0
Nov	1980	0	0		0	15	0	5	0	0	0
Dec	1980	88	0		0	15	26	5	0	0	0
Jan	1981	0	0		3	33	7	21	1	29	0
Feb	1981	0	2		7	27	13	2	0	14	0
Mar	1981	0	2		0	82	0	0	0	22	0
Apr	1981	0	1		4	3	0	0	1	31	0
May	1981	0	0		0	0	0	0	0	29	0
Jun	1981	0	7		0	0	0	0	0	37	0
Jul	1981	0	0		0	0	0	0	0	0	0
Aug	1981	354	3		0	0	0	0	0	3	0

Table 14. Monthly purchases (kg/week) of kohlrabi, leek, lemon/lime, lettuce, mandarin, marrow, orange, pak choi and parsley by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (Source: FMC purchase records)

		Kohlrabi	Leek	Lemon/lime	Lettuce	Mandarin	Marrow	Orange	Pak choi	Parsley
		Brassica oleracea	*Allium ampeloprasum*	*Citrus limon*	*Lactuca sativa*	*Citrus reticulata*	*Cucurbita sp.*	*Citrus sinensis*	*Brassica chinensis*	*Petroselinum crispum*
MONTH	YEAR	var. *gongylodes*	var. *porrum*	*C. aurantifolia*						
Apr	1976	0	0	0	3385	0	11	0	0	44
May	1976	7	33	0	376	0	0	10	0	8
Jun	1976	missing data								
Jul	1976	43	0	0	103	3	2	4	3	7
Aug	1976	0	4	0	700	0	13	0	7	5
Sep	1976	39	10	0	1044	0	0	0	0	11
Oct	1976	47	3	0	450	0	8	0	2	9
Nov	1976	12	2	0	94	0	74	0	20	30
Dec	1976	13	2	0	85	0	3	0	2	23
Jan	1977	37	2	7	220	0	51	0	25	25
Feb	1977	38	16	90	206	0	12	4	24	13
Mar	1977	8	0	146	242	0	32	0	38	3
Apr	1977	2	0	26	840	0	0	0	90	1
May	1977	1	9	0	703	0	17	1	0	16
Jun	1977	3	0	4	235	0	4	10	46	2
Jul	1977	0	1	1	158	0	0	0	17	8
Aug	1977	0	1	0	188	0	0	4	32	3
Sep	1977	2	10	0	200	0	0	0	65	3
Oct	1977	1	0	0	271	0	0	0	51	0
Nov	1977	0	2	35	324	0	14	0	81	1
Dec	1977	0	0	45	64	0	37	0	0	0
Jan	1978	0	0	191	100	2	1	43	42	19
Feb	1978	0	0	94	29	0	21	4	21	0
Mar	1978	3	0	223	244	0	2	0	86	0
Apr	1978	0	0	126	144	0	0	2	24	0
May	1978	0	0	117	165	0	11	2	17	4
Jun	1978	0	0	29	254	0	11	0	25	1
Jul	1978	0	0	26	198	0	0	0	11	8
Aug	1978	0	0	25	328	15	0	14	1	8
Sep	1978	0	0	0	178	0	26	0	11	0
Oct	1978	missing data								
Nov	1978	missing data								
Dec	1978	0	0	28	428	0	44	12	38	2
Jan	1979	0	0	88	862	0	62	1	97	3
Feb	1979	2	21	57	972	0	7	64	14	0
Mar	1979	0	0	168	331	0	0	99	23	0
Apr	1979	0	2	69	345	0	8	19	22	0
May	1979	0	0	68	301	0	0	63	8	1
Jun	1979	2	0	45	613	4	0	100	17	0
Jul	1979	0	0	23	373	0	0	0	34	1
Aug	1979	0	0	13	372	27	0	26	18	7
Sep	1979	0	5	18	179	0	0	1	12	1
Oct	1979	0	19	57	76	0	0	0	0	8
Nov	1979	0	0	115	69	0	0	0	68	22
Dec	1979	0	2	102	504	0	0	0	87	14
Jan	1980	0	14	97	1064	0	0	200	67	21
Feb	1980	0	0	102	637	1	0	163	21	28
Mar	1980	0	1	120	442	0	0	4	7	16
Apr	1980	0	0	87	1020	0	0	0	51	1
May	1980	0	0	56	623	0	0	81	4	3
Jun	1980	0	0	32	423	0	0	51	11	1
Jul	1980	0	1	52	84	0	0	8	2	4
Aug	1980	0	0	47	136	0	0	0	1	3
Sep	1980	0	0	63	181	0	0	0	140	21
Oct	1980	0	16	28	166	0	0	2	41	20
Nov	1980	0	2	49	254	0	0	0	22	12
Dec	1980	0	1	47	799	0	0	0	35	27
Jan	1981	0	0	59	424	0	0	0	48	31
Feb	1981	1	0	30	377	0	0	22	2	11
Mar	1981	0	0	14	196	0	0	0	0	1
Apr	1981	0	0	59	486	0	0	25	0	3
May	1981	0	0	106	147	0	0	16	0	2
Jun	1981	0	0	29	364	0	0	34	17	1
Jul	1981	305	0	0	525	0	0	12	20	0
Aug	1981	2	0	125	306	0	0	0	0	1

Table 15. Monthly purchases (kg/week) of parsnip, purple passionfruit, pawpaw, peas, pineapple, potato, pumpkin fruit, radish and rhubarb by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (Source: FMC purchase records)

		Parsnip	Passionfruit	Pawpaw	Peas	Pineapple	Potato	Pumpkin fruit	Radish	Rhubarb
		Pastinaca sativa	*Passiflora edulis f. edulis*	*Carica papaya*	*Pisum sativum*	*Ananas comosus*	*Solanum tuberosum*	*Cucurbita moschata*	*Raphanus sativus*	*Rheum x hybridum*
MONTH	YEAR									
Apr	1976	0	0	0	0	8	115	286	48	1
May	1976	0	0	0	19	0	83	46	26	0
Jun	1976	missing data								
Jul	1976	1	0	0	0	3	24	61	12	0
Aug	1976	3	0	0	11	0	725	243	28	0
Sep	1976	20	0	0	19	0	242	61	11	0
Oct	1976	5	0	0	0	5	45	149	1	1
Nov	1976	13	0	4	1	11	0	75	23	0
Dec	1976	3	0	2	5	68	670	27	13	0
Jan	1977	0	2188	0	11	62	695	97	28	0
Feb	1977	0	6868	3	2	163	885	96	16	0
Mar	1977	0	5484	6	4	85	587	279	15	0
Apr	1977	1	796	4	1	22	233	135	5	0
May	1977	0	4	0	0	0	92	126	19	0
Jun	1977	3	0	1	0	10	12	122	13	0
Jul	1977	0	0	14	0	0	46	24	0	0
Aug	1977	0	0	49	8	8	234	145	21	0
Sep	1977	0	0	28	0	0	500	124	2	0
Oct	1977	1	0	26	0	0	272	155	26	0
Nov	1977	0	0	25	0	4	126	278	12	2
Dec	1977	0	0	15	0	0	85	74	8	0
Jan	1978	0	54	17	0	10	685	70	64	0
Feb	1978	0	697	18	0	50	291	18	8	1
Mar	1978	30	6900	21	0	12	622	202	38	0
Apr	1978	74	1663	4	0	0	306	46	34	2
May	1978	0	167	1	6	6	144	218	46	0
Jun	1978	0	18	1	3	4	73	136	23	0
Jul	1978	0	0	0	0	1	215	108	14	0
Aug	1978	90	0	62	6	6	73	375	4	0
Sep	1978	0	0	14	6	2	115	30	2	0
Oct	1978	missing data								
Nov	1978	missing data								
Dec	1978	0	0	20	21	6	157	252	28	3
Jan	1979	0	0	3	21	6	823	260	105	7
Feb	1979	4	629	30	5	77	506	114	8	7
Mar	1979	2	1857	48	4	87	362	165	5	0
Apr	1979	5	799	64	0	29	17	84	1	3
May	1979	3	101	21	2	19	321	235	0	11
Jun	1979	0	4	114	0	25	14	71	2	0
Jul	1979	2	10	37	0	30	29	43	0	0
Aug	1979	0	1	40	6	0	33	77	0	0
Sep	1979	3	1	51	0	10	284	56	1	0
Oct	1979	0	0	32	0	19	186	33	0	0
Nov	1979	0	0	25	12	52	335	53	0	4
Dec	1979	0	0	24	4	16	36	267	0	6
Jan	1980	0	0	15	0	198	563	647	0	5
Feb	1980	0	607	27	0	134	1142	231	6	4
Mar	1980	0	2347	24	0	106	2482	466	0	0
Apr	1980	0	621	6	0	12	1645	162	4	1
May	1980	0	54	15	0	0	221	33	1	10
Jun	1980	0	1	13	0	10	146	60	3	0
Jul	1980	0	0	20	0	0	192	38	0	0
Aug	1980	0	0	54	0	0	511	85	0	0
Sep	1980	0	0	58	0	64	365	41	5	0
Oct	1980	0	0	32	0	27	5	51	1	0
Nov	1980	0	2	19	0	13	934	113	0	0
Dec	1980	0	0	2	0	25	127	40	1	13
Jan	1981	0	3	4	0	49	203	40	1	0
Feb	1981	0	910	6	0	154	420	103	0	0
Mar	1981	0	471	7	0	27	256	78	0	0
Apr	1981	0	171	1	0	0	172	11	5	0
May	1981	0	10	0	0	0	12	4	0	0
Jun	1981	0	0	2	0	0	37	3	4	0
Jul	1981	0	0	6	0	0	12	15	0	0
Aug	1981	0	0	12	0	0	274	38	0	0

Table 16. Monthly purchases (kg/week) of silverbeet, spring onion, strawberry, sweet potato, tomato, tree tomato, turnip and zucchini by the Food Marketing Corporation at Goroka, April 1976 to August 1981 (Source: FMC purchase records)

MONTH	YEAR	Silverbeet *Beta vulgaris*	Spring onion *Allium cepa* var. *cepa*	Strawberry *Fragaria sp.*	Sweet potato *Ipomoea batatas*	Tomato *Lycopersicon esculentum*	Tree tomato *Cyphomandra betacea*	Turnip *Brassica rapa*	Zucchini *Curcurbita pepo* var. *medullosa*
Apr	1976	41	471	8	2482	491	8	0	3
May	1976	14	136	0	1674	225	0	8	
Jun	1976	missing data			1042				
Jul	1976	61	86	4	761	237	0	7	1
Aug	1976	267	465	5	691	550	0	0	10
Sep	1976	176	153	1	430	107	0	52	10
Oct	1976	206	235	2	605	118	0	5	19
Nov	1976	53	103	2	1564	159	0	2	6
Dec	1976	52	138	1	3331	57	0	4	2
Jan	1977	137	89	0	1833	112	0	0	3
Feb	1977	100	154	0	945	231	0	1	1
Mar	1977	38	297	0	2348	428	64	0	2
Apr	1977	28	158	0	2177	160	15	3	0
May	1977	73	225	0	2892	192	15	0	1
Jun	1977	42	120	0	4080	46	0	0	0
Jul	1977	100	121	0	815	45	0	0	0
Aug	1977	82	445	0	15045	102	0	0	0
Sep	1977	40	90	0	3475	291	0	0	0
Oct	1977	32	105	0	938	137	0	0	0
Nov	1977	31	123	0	157	41	0	0	1
Dec	1977	15	0	0	1668	13	0	0	11
Jan	1978	82	293	0	1491	34	0	0	10
Feb	1978	5	172	0	3141	143	0	0	0
Mar	1978	72	310	0	3288	150	0	81	0
Apr	1978	21		0	4036	96	0	0	3
May	1978	45	322	1	3218	98	0	1	1
Jun	1978	40	103	6	3029	33	0	5	11
Jul	1978	55	53	38	2774	5	0	0	4
Aug	1978	15	28	94	6811	3	0	4	0
Sep	1978	4	32	118	1145	20	0	1	5
Oct	1978	missing data							
Nov	1978	missing data							
Dec	1978	21	284	56	23	108	0	0	3
Jan	1979	38	70	4	117	99	0	88	23
Feb	1979	43	77	0	1355	374	0	6	5
Mar	1979	12	206	0	652	261	74	0	0
Apr	1979	4	101	0	377	105	24	0	0
May	1979	4	88	15	506	100	3	0	3
Jun	1979	13	83	118	462	82	0	0	0
Jul	1979	38	6	263	326	104	4	0	0
Aug	1979	27	160	299	61	61	0	0	0
Sep	1979	10	173	260	1557	93	0	0	1
Oct	1979	17	56	219	1277	120	0	0	19
Nov	1979	21	132	84	1452	79	0	0	9
Dec	1979	33	136	0	293	75	0	0	11
Jan	1980	13	147	0	196	79	0	0	27
Feb	1980	20	104	0	158	328	0	0	6
Mar	1980	20	78	0	149	756	14	0	7
Apr	1980	9	83	0	406	187	0	0	4
May	1980	36	164	0	727	138	0	0	1
Jun	1980	23	79	0	680	137	0	0	0
Jul	1980	8	35	0	777	77	0	0	3
Aug	1980	1	62	0	810	88	0	0	0
Sep	1980	5	72	0	696	42	0	0	0
Oct	1980	5	45	0	229	10	0	0	102
Nov	1980	20	83	0	167	30	0	0	114
Dec	1980	42	108	0	107	49	0	0	5
Jan	1981	13	117	0	63	104	0	0	19
Feb	1981	0	126	0	21	57	0	0	0
Mar	1981	0	31	0	81	10	0	0	5
Apr	1981	3	4	0	0	60	0	0	0
May	1981	9	56	0	108	84	0	0	0
Jun	1981	0	31	0	496	8	0	0	0
Jul	1981	4	36	0	289	29	0	0	0
Aug	1981	1	43	0	323	88	0	0	1

Table 17. Monthly purchases (kg/week) of avocado, cooking banana, eating banana, common bean, broccoli and chinese cabbage by the Food Marketing Corporation for six buying centres, July 1979 to August 1981 (Source: FMC purchase records)

Avocado
Persea americana

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	0	0	26	12	48	1	88
Aug	1979	0	32	0	21	127	0	179
Sep	1979	missing data						
Oct	1979	missing data						
Nov	1979	0	0	0	0	0	0	0
Dec	1979	0	0	60	0	76	0	136
Jan	1980	0	19	69	3	138	54	283
Feb	1980	30	30	106	31	221	43	466
Mar	1980	12	11	88	298	174	26	608
Apr	1980	0	0	270	49	141	31	490
May	1980	0	0	121	19	62	7	210
Jun	1980	0	27	116	7	110	51	316
Jul	1980	0	80	22	29	121	14	281
Aug	1980	0	29	36	4	53	27	149
Sep	1980	0	16	14	8	25	2	65
Oct	1980	0	10	10	0	25	0	50
Nov	1980	1	2	67	4	71	12	155
Dec	1980	0	19	60	11	14	0	103
Jan	1981	7	35	125	4	126	1	297
Feb	1981	22	123	230	100	184	9	674
Mar	1981	0	77	276	22	95	25	496
Apr	1981	0	14	290	47	190	16	556
May	1981	0	56	217	31	90	4	399
Jun	1981	27	24	60	12	47	0	169
Jul	1981	16	23	32	9	44	50	174
Aug	1981	0	12	0	50	5	0	73
	Total	130	650	2292	787	2192	372	6423

Cooking banana
Musa aaa

MONTH	YEAR	Port Moresby	Lae	Wau	Goroka	Total
Jul	1979	705	52	0	47	804
Aug	1979	566	10	0	0	576
Sep	1979	804	37	19	0	860
Oct	1979	373	0	0	0	373
Nov	1979	302	4	0	0	306
Dec	1979	378	29	0	0	407
Jan	1980	260	0	0	20	280
Feb	1980	332	0	0	0	332
Mar	1980	227	1	0	0	228
Apr	1980	466	0	0	0	466
May	1980	489	0	0	0	489
Jun	1980	497	35	0	0	532
Jul	1980	731	0	0	0	731
Aug	1980	448	0	0	0	448
Sep	1980	901	2	0	0	903
Oct	1980	612	0	0	0	612
Nov	1980	983	0	0	0	983
Dec	1980	548	0	0	0	548
Jan	1981	361	0	0	0	361
Feb	1981	314	0	0	0	314
Mar	1981	454	0	0	0	454
Apr	1981	421	0	0	0	421
May	1981	647	1	0	0	648
Jun	1981	910	0	0	0	910
Jul	1981	1056	0	0	0	1056
Aug	1981	1411	0	0	0	1411
	Total	15034	171	20	67	15291

Eating banana
Musa aaa

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	300	218	67	0	47	0	632
Aug	1979	144	167	60	0	13	32	434
Sep	1979	360	167	20	0	53	0	625
Oct	1979	224	250	57	0	39	0	572
Nov	1979	235	367	45	0	32	0	684
Dec	1979	77	220	76	0	12	0	385
Jan	1980	120	184	55	0	37	0	496
Feb	1980	100	265	37	0	61	1	564
Mar	1980	300	317	51	0	30	0	718
Apr	1980	300	246	33	0	36	0	764
May	1980	327	178	53	0	37	0	595
Jun	1980	270	266	44	0	17	0	604
Jul	1980	303	237	36	0	22	0	668
Aug	1980	630	274	62	0	11	7	983
Sep	1980	400	207	19	0	72	0	784
Oct	1980	493	131	30	19	58	0	851
Nov	1980	474	297	17	46	61	11	906
Dec	1980	151	154	13	48	36	0	403
Jan	1981	240	211	11	44	51	0	556
Feb	1981	400	184	20	11	34	0	666
Mar	1981	448	217	20	19	62	0	774
Apr	1981	240	70	8	3	24	0	361
May	1981	317	95	36	15	34	0	497
Jun	1981	371	85	25	4	31	0	515
Jul	1981	305	81	13	3	17	0	499
Aug	1981	395	117	25	0	10	0	517
	Total	8295	5266	964	217	942	58	15712

Common bean
Phaseolus vulgaris

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	193	48	952	60	426	121	1800
Aug	1979	361	101	700	62	36	355	1623
Sep	1979	114	23	318	31	24	200	710
Oct	1979	26	46	170	64	74	361	734
Nov	1979	23	7	306	66	93	173	668
Dec	1979	67	117	558	268	460	220	1730
Jan	1980	17	118	494	130	193	178	1132
Feb	1980	31	10	420	137	101	16	724
Mar	1980	10	100	246	601	66	7	1064
Apr	1980	70	72	478	305	110	89	1132
May	1980	111	225	406	300	295	226	1563
Jun	1980	54	65	304	453	51	364	1291
Jul	1980	144	3	197	253	20	101	717
Aug	1980	95	137	316	204	35	306	1095
Sep	1980	47	58	332	358	129	339	1263
Oct	1980	114	85	300	430	185	546	1736
Nov	1980	130	37	317	831	302	293	1918
Dec	1980	126	67	305	105	255	471	1466
Jan	1981	20	90	308	113	102	258	996
Feb	1981	308	24	550	80	17	60	1060
Mar	1981	95	34	207	47	10	128	580
Apr	1981	65	27	112	60	1	84	366
May	1981	87	27	171	107	57	1172	1701
Jun	1981	66	74	271	140	52	276	888
Jul	1981	76	23	101	146	15	240	691
Aug	1981	179	18	253	118	7	348	924
	Total	2710	1648	8482	5766	3063	6940	29621

Broccoli
Brassica oleracea var. botrytis

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	0	0	0	17	0	42	59
Aug	1979	0	0	0	0	0	0	0
Sep	1979	0	0	0	0	1	146	147
Oct	1979	0	0	0	0	0	199	199
Nov	1979	0	0	0	0	0	23	23
Dec	1979	0	0	0	0	0	0	0
Jan	1980	0	0	0	3	44	30	77
Feb	1980	0	0	0	3	8	41	52
Mar	1980	0	7	1	0	1	60	69
Apr	1980	0	0	1	0	0	48	50
May	1980	0	0	0	0	6	7	13
Jun	1980	0	0	2	0	0	35	37
Jul	1980	0	0	1	45	0	28	74
Aug	1980	0	0	0	1	0	117	118
Sep	1980	0	0	0	0	3	24	27
Oct	1980	0	0	1	0	59	48	113
Nov	1980	22	0	5	0	245	208	477
Dec	1980	0	0	3	9	216	52	280
Jan	1981	0	0	0	0	212	56	269
Feb	1981	0	0	0	0	0	17	17
Mar	1981	9	0	0	0	0	67	76
Apr	1981	0	0	3	0	2	6	10
May	1981	0	0	2	0	0	4	6
Jun	1981	1	0	0	0	0	6	7
Jul	1981	0	0	2	12	4	46	62
Aug	1981	0	0	0	3	0	14	18
	Total	38	7	20	92	799	1322	2277

Chinese cabbage
Brassica pekinensis

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	447	25	1517	280	25	175	2469
Aug	1979	581	14	831	236	14	98	1775
Sep	1979	110	62	320	91	5	93	680
Oct	1979	468	16	341	195	22	64	1016
Nov	1979	111	10	796	184	70	0	1171
Dec	1979	193	1	708	203	111	34	1250
Jan	1980	157	25	528	185	141	8	1045
Feb	1980	357	0	278	27	38	8	709
Mar	1980	664	33	506	2	35	8	1248
Apr	1980	1227	0	960	8	84	43	2321
May	1980	473	0	749	115	69	529	1935
Jun	1980	890	0	1195	32	14	39	2170
Jul	1980	524	0	1214	90	0	44	1841
Aug	1980	692	0	817	236	38	192	1775
Sep	1980	759	8	818	103	74	108	1865
Oct	1980	715	12	706	310	134	84	1974
Nov	1980	483	7	617	145	210	21	1462
Dec	1980	731	31	703	79	79	8	1629
Jan	1981	227	1	726	106	181	0	1241
Feb	1981	329	0	483	57	181	12	1062
Mar	1981	1041	27	414	43	21	251	1797
Apr	1981	862	0	518	0	58	240	1778
May	1981	356	17	196	37	102	171	879
Jun	1981	863	303	446	845	58	431	3086
Jul	1981	1078	154	282	116	110	516	2256
Aug	1981	1113	138	419	158	173	158	2160
	Total	15650	885	16667	3763	2048	3342	42372

Table 18. Monthly purchases (kg/week) of head cabbage, capsicum, carrots, cauliflower, celery and choko fruit by the Food Marketing Corporation for six buying centres, July 1979 to August 1981 (Source: FMC purchase records)

Head cabbage
Brassica oleracea var. capitata

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	841	21	112	436	134	15100	16405
Aug	1979	200	83	153	453	2004	5313	8274
Sep	1979	200	54	369	235	445	4345	5744
Oct	1979	368	614	83	89	160	10095	11408
Nov	1979	119	233	94	277	417	9128	10268
Dec	1979	121	601	53	484	1005	4085	6530
Jan	1980	221	804	22	665	1003	2550	6066
Feb	1980	431	363	10	290	813	2944	4862
Mar	1980	546	36	156	677	500	2906	4815
Apr	1980	1291	28	79	267	158	4737	6559
May	1980	940	9	25	113	498	5413	6998
Jun	1980	1336	37	46	58	255	2462	4193
Jul	1980	1560	53	344	300	311	2900	5468
Aug	1980	586	59	707	255	367	1264	3331
Sep	1980	967	270	39	1759	271	2366	5662
Oct	1980	1007	362	360	1463	278	2721	6301
Nov	1980	1334	364	129	1016	749	4632	8220
Dec	1980	491	45	268	633	429	5432	7298
Jan	1981	366	218	210	411	866	2527	4622
Feb	1981	753	213	166	106	1003	1007	3253
Mar	1981	1905	255	134	283	717	1450	4834
Apr	1981	3610	342	159	123	364	868	5565
May	1981	666	353	140	335	169	1219	2782
Jun	1981	372	243	48	755	215	832	2466
Jul	1981	2131	666	227	810	464	2213	6553
Aug	1981	618	220	618	1161	1163	1796	5812
	Total	22905	6502	5007	13563	15637	100411	164284

Capsicum
Capsicum annuum var. grossum

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	113	2	112	10	0	156	393
Aug	1979	245	5	164	1	0	0	355
Sep	1979	264	2	126	3	0	0	396
Oct	1979	291	4	89	7	0	4	395
Nov	1979	244	5	151	2	0	0	402
Dec	1979	310	5	236	8	0	4	564
Jan	1980	389	0	275	8	18	46	736
Feb	1980	227	0	250	1	11	76	565
Mar	1980	142	8	283	0	8	18	460
Apr	1980	230	4	152	0	6	16	416
May	1980	311	0	170	1	18	0	501
Jun	1980	217	8	154	0	16	0	394
Jul	1980	504	0	114	3	6	20	646
Aug	1980	490	10	100	0	1	75	646
Sep	1980	498	21	179	2	1	57	757
Oct	1980	355	15	154	1	0	118	643
Nov	1980	140	71	232	2	3	165	612
Dec	1980	73	278	191	0	0	138	680
Jan	1981	91	196	307	0	0	63	657
Feb	1981	15	212	235	2	0	63	527
Mar	1981	81	201	250	1	0	0	533
Apr	1981	69	153	175	1	0	13	410
May	1981	124	74	191	4	2	36	491
Jun	1981	183	146	183	1	0	81	594
Jul	1981	651	177	82	3	10	66	990
Aug	1981	612	132	152	5	0	84	986
	Total	6847	1720	4610	64	86	1290	14656

Carrots
Daucus carota

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	0	20	52	90	86	1467	1665
Aug	1979	0	21	46	134	23	1410	1633
Sep	1979	0	102	102	93	74	1517	1887
Oct	1979	0	71	100	42	149	1512	1882
Nov	1979	0	46	90	38	574	1553	2271
Dec	1979	366	3	44	23	103	1325	1863
Jan	1980	0	4	116	124	300	3624	4370
Feb	1980	0	4	79	177	342	1649	2251
Mar	1980	2	79	24	325	449	1268	2137
Apr	1980	2	9	72	112	221	1249	1664
May	1980	0	22	57	106	219	1124	1521
Jun	1980	0	143	27	225	147	1622	2163
Jul	1980	0	86	21	219	51	1336	1713
Aug	1980	2	63	42	122	86	861	1197
Sep	1980	0	28	31	42	26	1008	1135
Oct	1980	0	44	27	48	19	811	950
Nov	1980	0	18	18	74	11	501	623
Dec	1980	0	4	22	67	109	476	677
Jan	1981	0	15	7	99	52	675	848
Feb	1981	0	14	17	199	40	90	360
Mar	1981	0	12	17	143	19	177	367
Apr	1981	2	74	22	46	63	265	471
May	1981	3	25	71	17	112	407	634
Jun	1981	3	3	9	51	51	227	344
Jul	1981	0	72	87	87	47	44	355
Aug	1981	4	218	330	54	29	313	948
	Total	393	1185	1520	2727	3379	26729	35933

Cauliflower
Brassica oleracea var. botrytis

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	30	0	0	1	0	498	529
Aug	1979	6	0	7	7	14	1736	1769
Sep	1979	0	0	13	0	33	1483	1529
Oct	1979	0	5	2	11	0	2016	2034
Nov	1979	0	3	14	0	0	2335	2352
Dec	1979	0	0	4	0	0	243	247
Jan	1980	0	0	3	0	0	215	218
Feb	1980	0	0	12	0	0	304	317
Mar	1980	0	0	8	0	0	116	125
Apr	1980	10	0	4	0	0	91	105
May	1980	6	0	35	2	3	134	180
Jun	1980	22	0	30	0	0	210	267
Jul	1980	36	0	14	0	0	142	194
Aug	1980	100	0	13	0	0	56	169
Sep	1980	1	21	2	0	0	366	390
Oct	1980	2	93	11	1	0	307	413
Nov	1980	1	12	10	0	0	316	348
Dec	1980	22	0	4	3	89	303	420
Jan	1981	2	24	2	1	8	107	136
Feb	1981	25	0	4	0	0	16	45
Mar	1981	13	0	5	0	0	10	28
Apr	1981	2	0	37	0	0	174	213
May	1981	6	0	36	0	0	26	68
Jun	1981	2	31	14	0	0	10	57
Jul	1981	39	59	171	2	0	292	563
Aug	1981	6	12	81	1	356	257	713
	Total	332	259	552	28	494	11761	13427

Celery
Apium graveolens var. dulce

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	96	5	448	4	7	0	562
Aug	1979	5	29	456	2	4	0	496
Sep	1979	0	0	310	0	0	0	310
Oct	1979	16	0	420	0	0	0	436
Nov	1979	0	0	490	3	23	0	515
Dec	1979	0	0	353	3	4	10	369
Jan	1980	0	0	393	8	44	0	445
Feb	1980	0	0	398	4	14	0	417
Mar	1980	0	3	310	21	14	0	347
Apr	1980	0	0	301	6	0	0	307
May	1980	0	2	299	20	0	0	321
Jun	1980	0	15	343	19	0	0	376
Jul	1980	0	0	479	4	0	2	485
Aug	1980	0	0	312	2	0	0	314
Sep	1980	0	0	476	3	0	0	479
Oct	1980	0	3	488	11	0	0	502
Nov	1980	0	5	476	0	0	0	481
Dec	1980	0	0	533	3	0	0	535
Jan	1981	2	4	258	23	0	0	286
Feb	1981	14	0	229	3	2	0	248
Mar	1981	0	0	147	5	2	0	154
Apr	1981	0	0	148	4	1	0	153
May	1981	1	0	208	6	0	0	214
Jun	1981	2	0	221	8	7	0	238
Jul	1981	4	0	305	4	0	0	313
Aug	1981	2	0	333	2	3	0	340
	Total	141	66	9123	166	125	12	9632

Choko fruit
Sechium edule

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Total
Jul	1979	28	30	47	5	0	111
Aug	1979	47	12	114	4	0	177
Sep	1979	missing data					
Oct	1979	missing data					
Nov	1979	0	0	26	0	0	35
Dec	1979	0	0	26	1	4	40
Jan	1980	0	5	113	32	18	168
Feb	1980	0	8	190	53	21	280
Mar	1980	3	0	373	295	3	674
Apr	1980	6	0	178	25	6	215
May	1980	0	0	119	1	4	123
Jun	1980	0	3	36	1	12	51
Jul	1980	24	0	52	0	7	83
Aug	1980	0	8	170	0	3	182
Sep	1980	40	24	45	0	14	123
Oct	1980	missing data					
Nov	1980	missing data					
Dec	1980	missing data					
Jan	1981	0	0	16	2	3	22
Feb	1981	0	0	173	0	7	179
Mar	1981	74	0	103	0	0	177
Apr	1981	56	0	11	0	4	71
May	1981	65	18	6	0	0	89
Jun	1981	78	0	12	0	0	90
Jul	1981	96	0	32	0	0	128
Aug	1981	25	23	29	0	0	77
	Total	542	150	1077	418	105	3091

Table 19. Monthly purchases (kg/week) of coconut, corn, cucumber, eggplant, ginger and grapefruit by the Food Marketing Corporation for six buying centres, July 1979 to August 1981 (Source: FMC purchase records)

Coconut
Cocos nucifera

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	1711	154	43	2	0	0	1900
Aug	1979	360	130	0	0	0	0	490
Sep	1979	missing data						
Oct	1979	missing data						
Nov	1979	646	0	0	0	0	0	646
Dec	1979	806	28	0	0	0	0	834
Jan	1980	178	0	0	0	0	0	178
Feb	1980	346	203	0	28	0	0	578
Mar	1980	325	115	0	0	0	0	440
Apr	1980	575	163	0	0	0	177	915
May	1980	274	0	14	0	0	0	288
Jun	1980	85	95	0	0	0	0	180
Jul	1980	637	250	0	0	2	0	889
Aug	1980	263	0	0	0	0	0	263
Sep	1980	147	230	0	0	0	0	377
Oct	1980	511	0	0	0	0	0	511
Nov	1980	336	0	0	0	0	0	336
Dec	1980	219	0	0	0	0	0	219
Jan	1981	398	35	0	0	0	0	433
Feb	1981	34	0	0	0	0	0	34
Mar	1981	360	260	0	0	0	0	618
Apr	1981	254	625	0	0	0	0	879
May	1981	806	0	0	0	0	0	806
Jun	1981	344	0	0	0	0	0	344
Jul	1981	294	0	0	0	0	0	294
Aug	1981	542	0	0	0	0	0	542
	Total	10210	2267	57	30	2	177	12760

Corn
Zea mays

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	189	144	48	18	56	0	455
Aug	1979	115	24	89	7	0	0	235
Sep	1979	162	87	16	1	0	0	266
Oct	1979	42	34	47	1	0	12	136
Nov	1979	151	39	59	8	29	54	339
Dec	1979	72	49	446	12	263	24	856
Jan	1980	277	32	727	133	316	0	1485
Feb	1980	796	18	75	92	202	0	1185
Mar	1980	495	50	111	147	169	151	1122
Apr	1980	368	111	25	20	11	0	535
May	1980	342	351	38	9	3	0	743
Jun	1980	84	58	29	2	83	0	256
Jul	1980	9	3	16	3	2	0	34
Aug	1980	267	5	80	0	0	5	356
Sep	1980	167	2	57	19	0	1	246
Oct	1980	162	22	93	19	1	8	305
Nov	1980	138	165	39	63	15	5	422
Dec	1980	9	31	63	67	15	0	185
Jan	1981	107	72	68	26	33	0	302
Feb	1981	536	160	53	16	27	0	740
Mar	1981	548	20	16	6	82	0	673
Apr	1981	262	215	4	3	3	0	486
May	1981	1023	81	3	0	0	0	1107
Jun	1981	129	302	18	7	0	0	455
Jul	1981	160	45	41	11	0	0	257
Aug	1981	23	179	75	2	0	0	277
	Total	6719	2235	2336	711	1366	259	13626

Cucumber
Cucumis sativus

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	294	46	247	0	0	72	649
Aug	1979	344	60	180	1	0	0	584
Sep	1979	382	23	37	1	0	30	482
Oct	1979	750	4	48	0	7	0	808
Nov	1979	712	120	144	1	29	0	1005
Dec	1979	428	69	1296	112	88	0	1992
Jan	1980	222	102	755	720	112	0	1909
Feb	1980	300	100	905	41	45	0	1411
Mar	1980	648	28	366	32	4	0	1078
Apr	1980	502	7	143	1	0	0	743
May	1980	561	1	69	0	0	0	651
Jun	1980	750	70	70	0	1	0	891
Jul	1980	292	46	106	0	0	0	443
Aug	1980	545	307	115	0	0	4	971
Sep	1980	575	1750	45	10	0	0	2380
Oct	1980	662	887	24	2	0	2	1778
Nov	1980	531	383	36	1	0	0	951
Dec	1980	488	1460	80	28	28	7	2021
Jan	1981	367	320	290	25	7	10	1024
Feb	1981	300	98	500	2	13	0	1040
Mar	1981	248	32	564	0	0	0	843
Apr	1981	377	272	29	0	0	0	678
May	1981	224	1310	0	0	0	23	1574
Jun	1981	368	524	100	0	0	1	1000
Jul	1981	330	334	560	1	0	0	1263
Aug	1981	515	327	292	0	0	15	1149
	Total	12007	8799	7066	977	331	163	29383

Eggplant
Solanum melongena

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	34	0	136	3	0	0	173
Aug	1979	71	0	29	8	0	0	108
Sep	1979	69	16	28	9	0	0	114
Oct	1979	80	6	34	9	0	0	129
Nov	1979	188	1	61	10	1	0	260
Dec	1979	117	0	49	26	5	0	197
Jan	1980	121	0	46	10	12	0	188
Feb	1980	59	1	27	1	12	0	100
Mar	1980	94	1	27	2	0	0	124
Apr	1980	75	0	32	1	0	0	108
May	1980	27	2	50	2	2	0	84
Jun	1980	128	1	43	1	0	0	172
Jul	1980	118	0	45	0	0	0	163
Aug	1980	351	0	36	0	0	0	388
Sep	1980	48	0	46	0	3	0	97
Oct	1980	139	17	46	1	7	0	209
Nov	1980	135	0	67	1	5	11	220
Dec	1980	63	34	69	10	5	0	181
Jan	1981	98	0	82	7	21	6	204
Feb	1981	22	16	66	6	2	2	117
Mar	1981	150	1	46	0	0	4	212
Apr	1981	103	0	38	0	0	0	141
May	1981	133	2	28	0	0	0	163
Jun	1981	111	1	24	0	0	0	136
Jul	1981	54	2	16	2	0	0	76
Aug	1981	74	16	9	0	0	0	101
	Total	2900	130	1164	108	74	25	4171

Ginger
Zingiber officinale

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	27	0	3	6	0	0	36
Aug	1979	22	0	10	2	0	0	34
Sep	1979	0	0	0	0	0	0	0
Oct	1979	missing data						
Nov	1979	missing data						
Dec	1979	missing data						
Jan	1980	0	0	0	1	0	0	1
Feb	1980	0	3	67	1	8	0	79
Mar	1980	0	3	0	4	5	0	11
Apr	1980	3	0	0	10	0	0	13
May	1980	14	1	6	11	0	0	33
Jun	1980	74	0	5	4	0	0	83
Jul	1980	0	9	0	2	0	9	20
Aug	1980	22	8	0	0	0	0	30
Sep	1980	32	0	0	0	0	0	32
Oct	1980	0	0	0	0	0	0	0
Nov	1980	2	0	0	0	0	0	2
Dec	1980	0	0	0	0	0	0	0
Jan	1981	0	0	0	0	1	0	1
Feb	1981	7	5	2	0	0	0	14
Mar	1981	10	0	0	1	0	0	11
Apr	1981	71	3	0	0	1	0	75
May	1981	23	0	0	4	0	0	26
Jun	1981	26	9	0	0	0	0	35
Jul	1981	8	0	0	0	0	0	8
Aug	1981	15	0	0		0	0	15
	Total	355	40	93	45	15	9	558

Grapefruit
Citrus paradisi

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	21	3	13	4	59	0	99
Aug	1979	33	0	8	8	10	0	59
Sep	1979	missing data						
Oct	1979	missing data						
Nov	1979	0	0	130	0	0	0	130
Dec	1979	1	18	3	0	0	0	19
Jan	1980	39	0	64	0	0	0	103
Feb	1980	42	0	49	0	11	358	460
Mar	1980	0	23	148	4	4	456	635
Apr	1980	12	0	90	5	34	0	141
May	1980	5	2	250	0	15	0	276
Jun	1980	0	41	55	0	19	15	130
Jul	1980	65	13	37	14	19	0	147
Aug	1980	8	0	89	29	1	146	273
Sep	1980	0	0	32	52	8	0	92
Oct	1980	0	0	85	10	2	14	111
Nov	1980	2	14	35	5	0	0	56
Dec	1980	0	0	11	0	0	0	11
Jan	1981	0	18	12	0	29	82	139
Feb	1981	12	0	34	0	14	7	66
Mar	1981	0	21	63	0	22	0	106
Apr	1981	48	0	101	0	31	0	179
May	1981	25	11	38	8	29	0	110
Jun	1981	146	8	44	7	37	0	242
Jul	1981	0	9	37	0	0	0	46
Aug	1981	0	8	43	57	3	0	111
	Total	465	182	1473	202	346	1080	3747

Table 20. Monthly purchases (kg/week) of leek, lemon/lime, lettuce, mandarin, orange and pak choi by the Food Marketing Corporation for six buying centres, July 1979 to August 1981 (Source: FMC purchase records)

Leek
Allium ampeloprasum var. porrum

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	0	0	63	0	0	0	63
Aug	1979	0	0	65	0	0	0	65
Sep	1979	0	0	25	0	5	6	36
Oct	1979	0	0	33	1	19	0	52
Nov	1979	0	0	55	0	4	4	63
Dec	1979	0	0	43	0	2	2	47
Jan	1980	0	0	81	1	14	2	98
Feb	1980	0	0	83	0	0	0	83
Mar	1980	0	0	78	2	1	0	81
Apr	1980	0	0	80	1	0	0	89
May	1980	0	0	83	1	0	0	84
Jun	1980	0	0	96	0	0	0	96
Jul	1980	0	0	88	0	1	0	89
Aug	1980	0	0	57	0	0	0	57
Sep	1980	0	0	78	0	0	0	81
Oct	1980	0	22	44	1	16	4	87
Nov	1980	4	0	66	0	2	2	73
Dec	1980	16	0	78	0	1	2	105
Jan	1981	0	0	106	3	0	0	111
Feb	1981	10	0	108	1	1	0	120
Mar	1981	0	0	67	3	0	26	95
Apr	1981	3	0	48	3	0	0	55
May	1981	4	1	66	1	0	0	75
Jun	1981	5	0	79	1	0	0	85
Jul	1981	13	0	77	0	305	0	395
Aug	1981	7	0	129	0	2	0	138
	Total	69	22	1879	24	379	63	2427

Lemon/Lime
Citrus limon/Citrus aurantifolia

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	66	67	58	10	23	5	257
Aug	1979	296	62	89	0	12	5	462
Sep	1979	missing data						
Oct	1979	missing data						
Nov	1979	16	0	36	0	57	0	109
Dec	1979	37	60	49	0	123	0	266
Jan	1980	131	60	41	4	97	10	342
Feb	1980	256	39	119	0	192	8	614
Mar	1980	249	0	148	4	129	40	580
Apr	1980	179	0	344	11	67	7	607
May	1980	237	1	121	8	56	37	459
Jun	1980	166	52	8	2	32	20	280
Jul	1980	337	103	7	12	52	33	543
Aug	1980	39	112	30	5	81	17	284
Sep	1980	25	185	26	19	63	7	324
Oct	1980	177	24	40	4	28	21	293
Nov	1980	95	114	41	262	49	36	598
Dec	1980	48	24	23	6	47	11	152
Jan	1981	87	100	44	13	59	4	307
Feb	1981	124	63	129	19	39	11	367
Mar	1981	192	158	81	19	14	52	503
Apr	1981	123	73	255	11	59	0	522
May	1981	225	31	100	7	106	0	470
Jun	1981	191	113	77	3	29	0	353
Jul	1981	141	141	48	2	9	0	336
Aug	1981	217	42	9	125	0	526	
	Total	3600	1857	1949	401	1539	324	9669

Lettuce
Lactuca sativa

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	0	147	3483	552	373	119	4674
Aug	1979	22	82	6025	677	388	82	8135
Sep	1979	12	126	4312	626	179	106	5363
Oct	1979	0	87	1650	166	76	62	2044
Nov	1979	0	46	1468	364	63	101	2001
Dec	1979	60	63	2364	318	774	144	3723
Jan	1980	15	17	1944	458	750	106	3289
Feb	1980	18	18	1252	330	637	107	2364
Mar	1980	21	27	1484	572	375	85	2564
Apr	1980	264	3	2130	390	1020	66	3873
May	1980	6	17	2190	738	623	33	3606
Jun	1980	1	21	2063	903	423	7	3418
Jul	1980	18	9	2651	758	84	176	3684
Aug	1980	124	34	2463	556	136	174	3487
Sep	1980	43	69	3966	761	181	360	5409
Oct	1980	61	59	3495	781	166	681	5242
Nov	1980	33	63	2566	586	254	363	3858
Dec	1980	3	2	879	1775	799	136	3593
Jan	1981	11	166	911	960	424	138	2545
Feb	1981	25	64	1666	486	377	257	2906
Mar	1981	16	0	2065	371	196	233	2906
Apr	1981	33	36	1566	213	486	622	2966
May	1981	46	8	650	476	147	462	1777
Jun	1981	48	353	1916	957	364	316	3954
Jul	1981	53	221	4066	766	525	258	5893
Aug	1981	66	4	4618	881	306	206	5474
	Total	985	1639	64253	16451	10126	5360	98835

Mandarin
Citrus reticulata

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	11	8	3	21	0	0	50
Aug	1979	14	10	0	0	0	0	24
Sep	1979	missing data						
Oct	1979	missing data						
Nov	1979	0	0	0	0	0	0	0
Dec	1979	0	0	0	0	0	0	0
Jan	1980	0	5	0	0	5	0	10
Feb	1980	0	22	0	3	1	0	26
Mar	1980	0	5	0	0	0	0	5
Apr	1980	0	0	0	0	0	0	0
May	1980	0	29	3	26	0	0	67
Jun	1980	10	55	12	21	0	0	97
Jul	1980	35	50	100	26	0	13	238
Aug	1980	121	21	19	4	0	0	165
Sep	1980	4	0	0	0	0	0	4
Oct	1980	0	0	0	0	0	0	0
Nov	1980	0	14	0	0	0	0	14
Dec	1980	10	0	0	0	0	0	10
Jan	1981	8	0	0	0	0	0	8
Feb	1981	30	0	0	2	0	35	67
Mar	1981	5	0	0	0	0	0	6
Apr	1981	39	35	2	0	0	0	75
May	1981	10	113	0	0	0	0	123
Jun	1981	122	37	30	0	0	0	189
Jul	1981	52	10	1	0	0	0	63
Aug	1981	2	0	0	0	0	0	2
	Total	471	418	178	102	24	48	1242

Orange
Citrus sinensis

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	0	102	22	8	4	0	185
Aug	1979	0	24	16	2	26	0	67
Sep	1979	missing data						
Oct	1979	missing data						
Nov	1979	0	1	22	0	0	0	23
Dec	1979	0	0	7	0	0	8	15
Jan	1980	0	35	27	0	200	16	278
Feb	1980	6	77	13	0	163	172	430
Mar	1980	0	136	46	5	4	6	198
Apr	1980	22	73	24	19	6	38	182
May	1980	0	284	122	35	81	0	521
Jun	1980	98	397	134	45	51	9	733
Jul	1980	452	300	20	68	8	0	843
Aug	1980	392	33	43	43	0	0	511
Sep	1980	61	0	0	13	0	28	122
Oct	1980	11	2	1	0	2	0	15
Nov	1980	0	5	12	31	17	2	66
Dec	1980	0	15	4	4	0	0	23
Jan	1981	38	14	1	0	0	0	53
Feb	1981	65	21	10	1	22	0	119
Mar	1981	12	35	108	18	0	5	177
Apr	1981	101	64	18	13	25	4	225
May	1981	106	232	55	62	18	0	473
Jun	1981	248	0	46	0	34	0	328
Jul	1981	88	18	101	0	12	14	213
Aug	1981	12	4	29	0	0	0	45
	Total	1713	1932	877	362	667	303	5854

Pak choi
Brassica chinensis

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	138	40	462	63	83	0	786
Aug	1979	114	12	66	109	18	0	269
Sep	1979	90	5	15	104	12	0	145
Oct	1979	50	13	32	81	0	4	113
Nov	1979	92	122	129	129	67	0	432
Dec	1979	41	1	852	126	97	0	1051
Jan	1980	223	2	349	254	67	0	852
Feb	1980	103	1	333	180	21	2	554
Mar	1980	192	5	603	201	7	0	810
Apr	1980	206	0	418	121	51	0	702
May	1980	187	0	380	147	4	0	628
Jun	1980	284	0	313	123	11	19	852
Jul	1980	298	0	236	126	2	0	543
Aug	1980	298	17	342	108	1	109	816
Sep	1980	125	11	451	270	163	20	779
Oct	1980	44	48	208	227	41	20	466
Nov	1980	142	38	80	215	22	2	310
Dec	1980	325	0	78	71	35	0	438
Jan	1981	81	0	277	35	48	4	429
Feb	1981	177	0	140	35	2	0	321
Mar	1981	358	0	121	4	0	0	479
Apr	1981	247	8	163	2	0	3	421
May	1981	233	0	102	13	0	0	336
Jun	1981	92	8	92	48	17	0	217
Jul	1981	253	21	159	56	20	46	525
Aug	1981	287	3	101	1087	9	78	467
	Total	4656	351	6530	3907	794	305	13340

Table 21. Monthly purchases (kg/week) of parsley, passionfruit, pawpaw, pineapple, potato and pumpkin fruit by the Food Marketing Corporation for six buying centres, July 1979 to August 1981 (Source: FMC purchase records)

Parsley
Petroselinum sativum

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	0	0	13	18	0	0	31
Aug	1979	0	0	13	16	0	0	29
Sep	1979	0	0	7	14	1	0	21
Oct	1979	2	1	0	25	0	1	46
Nov	1979	0	2	16	23	6	0	47
Dec	1979	0	5	14	24	16	0	58
Jan	1980	0	0	18	26	21	0	65
Feb	1980	0	1	15	4	7	0	27
Mar	1980	0	0	15	30	16	0	70
Apr	1980	0	0	15	9	1	0	25
May	1980	0	0	15	16	3	0	35
Jun	1980	0	0	18	13	1	0	33
Jul	1980	0	0	24	14	4	0	42
Aug	1980	0	0	20	16	3	0	42
Sep	1980	0	0	20	14	21	0	63
Oct	1980	0	0	20	13	20	0	60
Nov	1980	0	0	16	8	12	3	40
Dec	1980	0	0	30	6	27	0	71
Jan	1981	1	0	20	14	31	0	73
Feb	1981	1	0	23	13	11	0	47
Mar	1981	0	0	11	2	1	0	13
Apr	1981	40	0	15	3	3	0	66
May	1981	3	0	37	4	2	0	46
Jun	1981	0	0	29	1	1	4	34
Jul	1981	4	0	30	3	0	0	45
Aug	1981	1	0	35	2	1	0	37
	Total	57	9	543	326	222	8	1165

Passionfruit
Passiflora edulis f. edulis

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Total
Jul	1979	missing data					
Aug	1979	0	0	0	0	1	1
Sep	1979	missing data					
Oct	1979	missing data					
Nov	1979	0	0	0	0	0	0
Dec	1979	0	0	0	0	0	0
Jan	1980	9	2	38	4	0	52
Feb	1980	2	5	336	16	907	966
Mar	1980	0	4	327	11	2347	2688
Apr	1980	0	18	140	8	621	785
May	1980	4	2	7	4	54	70
Jun	1980	0	0	0	0	1	1
Jul	1980	0	0	0	0	0	0
Aug	1980	0	0	0	0	0	0
Sep	1980	0	0	0	0	0	0
Oct	1980	0	0	0	0	0	0
Nov	1980	0	0	0	0	2	2
Dec	1980	0	0	3	0	0	3
Jan	1981	1	0	2	4	3	8
Feb	1981	1	3	13	8	910	935
Mar	1981	4	5	15	11	471	506
Apr	1981	4	0	0	3	171	178
May	1981	0	0	0	1	10	10
Jun	1981	0	0	0	0	0	0
Jul	1981	0	0	0	0	0	0
Aug	1981	0	0	0	0	0	0
	Total	25	40	882	65	5196	6208

Pawpaw
Carica papaya

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	391	305	29	0	37	9	791
Aug	1979	386	190	56	0	44	1	630
Sep	1979	missing data						
Oct	1979	missing data						
Nov	1979	190	256	46	0	19	0	486
Dec	1979	224	197	46	0	24	0	395
Jan	1980	224	223	26	0	15	0	488
Feb	1980	117	86	44	27	27	7	307
Mar	1980	314	110	66	0	24	0	516
Apr	1980	618	210	29	0	6	0	864
May	1980	527	266	42	3	15	0	875
Jun	1980	470	230	31	0	13	0	747
Jul	1980	1004	226	47	0	22	0	1329
Aug	1980	383	241	54	0	54	0	733
Sep	1980	332	111	16	1	90	0	550
Oct	1980	582	148	29	0	32	0	790
Nov	1980	665	229	32	0	19	0	1164
Dec	1980	430	201	16	3	2	1	656
Jan	1981	276	104	17	0	4	0	404
Feb	1981	170	125	27	0	0	0	327
Mar	1981	176	190	30	0	7	0	403
Apr	1981	237	83	8	0	1	0	329
May	1981	666	102	14	0	0	0	723
Jun	1981	522	223	26	0	2	0	773
Jul	1981	140	50	48	0	6	0	244
Aug	1981	248	68	49	0	12	0	377
	Total	9303	4167	831	34	488	8	14861

Pineapple
Ananas comosus

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	1	2	9	43	30	0	84
Aug	1979	0	0	57	28	1	5	92
Sep	1979	missing data						
Oct	1979	missing data						
Nov	1979	0	282	259	52	30	38	661
Dec	1979	267	19	287	39	13	62	687
Jan	1980	220	4	164	332	270	225	1215
Feb	1980	200	1	72	92	134	48	547
Mar	1980	46	2	158	37	100	82	423
Apr	1980	100	1	24	27	12	41	271
May	1980	47	0	0	37	0	43	127
Jun	1980	35	0	2	4	10	0	51
Jul	1980	221	0	22	18	0	0	263
Aug	1980	671	0	24	20	0	1	926
Sep	1980	110	2	84	14	84	33	316
Oct	1980	1027	5	44	17	27	55	1174
Nov	1980	886	114	57	62	13	19	1158
Dec	1980	1100	114	147	72	23	211	1765
Jan	1981	551	25	198	9	49	42	875
Feb	1981	300	11	68	5	154	35	682
Mar	1981	658	16	59	12	27	34	804
Apr	1981	107	0	0	0	0	46	153
May	1981	395	0	5	3	0	10	413
Jun	1981	178	0	17	5	0	0	200
Jul	1981	39	0	1	5	0	0	45
Aug	1981	346	0	78	15	0	0	439
	Total	7981	586	1648	951	982	1022	13369

Potato
Solanum tuberosum

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	0	32	18	5	29	257	340
Aug	1979	0	188	27	64	39	1183	1482
Sep	1979	0	93	58	21	284	843	1291
Oct	1979	0	241	48	46	186	2986	3467
Nov	1979	17	70	23	31	336	4725	5202
Dec	1979	0	111	71	92	34	3676	3985
Jan	1980	7	256	169	214	563	7063	8225
Feb	1980	0	247	91	246	576	7966	9126
Mar	1980	0	1356	43	2167	2462	8374	14421
Apr	1980	46	78	66	330	1625	4935	7106
May	1980	22	132	57	112	221	659	1203
Jun	1980	25	97	80	52	146	802	1202
Jul	1980	0	64	45	20	102	16	337
Aug	1980	0	70	16	8	511	451	1056
Sep	1980	0	237	28	25	365	2313	2968
Oct	1980	0	426	8	262	5	4926	5588
Nov	1980	0	904	45	333	934	4740	6956
Dec	1980	12	46	0	140	127	9	340
Jan	1981	20	8181	50	147	203	1778	10379
Feb	1981	0	1110	0	445	420	2977	4961
Mar	1981	40	2748	46	46	256	3850	6987
Apr	1981	26	236	25	84	172	1705	2258
May	1981	22	158	70	210	12	1790	2262
Jun	1981	3	82	13	60	37	2886	3081
Jul	1981	0	55	13	141	12	1941	2162
Aug	1981	0	534	32	105	27	297	994
	Total	239	17712	1071	5348	9789	73179	107338

Pumpkin fruit
Cucurbita moschata

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	856	290	190	2	36		1384
Aug	1979	96	165	466	0	50	23	800
Sep	1979	missing data						
Oct	1979	missing data						
Nov	1979	58	47	120	0	0	0	222
Dec	1979	1520	328	136	10	255	10	2267
Jan	1980	1400	132	388	196	647	91	2860
Feb	1980	1174	20	300	164	231	4	1898
Mar	1980	1622	0	466	160	76	14	2277
Apr	1980	594	130	188	80	102	0	1103
May	1980	683	88	87	84	33	4	980
Jun	1980	4000	272	92	52	60	42	4907
Jul	1980	1728	261	60	9	36	0	2096
Aug	1980	1534	543	82	0	95	43	2297
Sep	1980	1042	418	180	18	41	1	1699
Oct	1980	1012	461	91	30	51	25	1670
Nov	1980	827	766	98	196	113	138	1842
Dec	1980	572	146	152	30	40	36	977
Jan	1981	415	153	145	7	40	4	764
Feb	1981	1482	78	196	43	103	71	1977
Mar	1981	1678	98	133	48	78	133	2168
Apr	1981	556	173	42	10	11	0	791
May	1981	1095	277	45	4	4	0	1426
Jun	1981	1490	248	35	36	3	16	1826
Jul	1981	1887	50	25	10	15	2	1988
Aug	1981	1096	688	23	0	36	0	1826
	Total	28307	5836	3741	1120	2149	668	41821

Table 22. Monthly purchases (kg/week) of Queensland blue pumpkin, radish, rhubarb, rockmelon, silverbeet and spring onion by the Food Marketing Corporation for six buying centres, July 1979 to August 1981 (Source: FMC purchase records)

Pumpkin fruit (Queensland blue) *Cucurbita moschata*

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979							
Aug	1979	0	0	51	0	13	0	64
Sep	1979	missing data						
Oct	1979	missing data						
Nov	1979	0	0	0	0	3	0	3
Dec	1979	5	0	54	0	11	19	89
Jan	1980	0	0	0	0	0	0	0
Feb	1980	0	0	0	0	0	0	0
Mar	1980	0	0	0	0	0	0	0
Apr	1980	0	0	0	0	0	0	0
May	1980	0	0	11	0	11	0	21
Jun	1980	0	0	0	5	75	0	85
Jul	1980	0	0	0	2	13	0	15
Aug	1980	0	4	12	0	6	0	22
Sep	1980	0	0	5	0	0	0	11
Oct	1980	0	0	0	0	0	0	0
Nov	1980	0	0	0	0	0	0	0
Dec	1980	184	347	27	0	0	53	625
Jan	1981	17	0	66	35	56	0	187
Feb	1981	0	0	19	0	0	0	19
Mar	1981	0	0	0	0	0	0	0
Apr	1981	0	0	0	2	0	0	2
May	1981	0	0	1	0	0	20	21
Jun	1981	0	0	0	0	0	79	79
Jul	1981	0	0	0	0	0	0	0
Aug	1981	0	25	0	215	13	0	253
	Total	207	377	266	264	215	176	1501

Radish *Raphanus sativus*

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	6	4	5	1	0	0	24
Aug	1979	3	1	8	0	0	12	24
Sep	1979	1	0	1	0	1	8	11
Oct	1979	0	0	2	0	0	0	2
Nov	1979	0	0	9	3	0	0	12
Dec	1979	0	0	5	1	0	8	14
Jan	1980	0	0	3	2	0	0	5
Feb	1980	1	0	8	2	0	0	17
Mar	1980	3	4	7	5	0	0	19
Apr	1980	6	2	5	6	4	0	23
May	1980	7	0	10	3	1	0	22
Jun	1980	6	0	2	6	3	0	16
Jul	1980	1	2	3	3	0	0	8
Aug	1980	0	6	14	1	0	0	21
Sep	1980	0	12	4	3	6	0	24
Oct	1980	11	1	8	2	1	0	23
Nov	1980	7	0	4	3	0	0	13
Dec	1980	11	0	0	5	1	2	18
Jan	1981	3	0	20	6	1	0	30
Feb	1981	13	0	1	0	0	0	14
Mar	1981	10	44	0	1	0	0	64
Apr	1981	34	0	1	2	5	0	42
May	1981	9	0	0	2	0	4	16
Jun	1981	13	0	0	4	4	0	21
Jul	1981	5	4	15	5	0	4	32
Aug	1981	40	0	0	0	0	0	57
	Total	198	77	143	63	33	58	570

Rhubarb *Rheum rhapontieum*

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	0	0	41	0	0	0	57
Aug	1979	0	15	0	16	0	0	37
Sep	1979	0	0	21	42	0	0	63
Oct	1979	0	0	53	19	0	0	72
Nov	1979	0	0	63	58	5	0	126
Dec	1979	0	0	69	26	6	0	101
Jan	1980	0	0	96	109	5	0	210
Feb	1980	0	0	141	36	4	15	196
Mar	1980	1	33	107	41	0	0	181
Apr	1980	0	0	85	132	1	0	217
May	1980	0	0	80	7	10	0	97
Jun	1980	0	0	49	21	0	0	70
Jul	1980	0	0	37	16	0	0	58
Aug	1980	3	0	100	51	0	0	162
Sep	1980	21	0	170	63	0	0	254
Oct	1980	0	0	81	16	0	0	107
Nov	1980	0	0	72	22	0	0	94
Dec	1980	0	0	78	46	13	0	141
Jan	1981	0	1	44	11	0	0	56
Feb	1981	0	0	36	17	0	0	53
Mar	1981	0	0	53	17	0	0	68
Apr	1981	0	0	11	3	0	0	14
May	1981	0	0	85	26	0	0	112
Jun	1981	0	0	36	23	0	1	62
Jul	1981	0	0	42	8	0	0	50
Aug	1981	7	10	56	15	0	0	91
	Total	45	73	1718	850	44	16	2747

Rockmelon *Cucumis melo*

MONTH	YEAR	Port Moresby	Lae	Wau	Goroka	Total
Jul	1979	0	0	0	0	0
Aug	1979	0	0	0	0	0
Sep	1979	missing data				
Oct	1979	missing data				
Nov	1979	56	0	0	0	56
Dec	1979	47	0	35	12	94
Jan	1980	186	54	0	0	241
Feb	1980	0	0	0	0	0
Mar	1980	0	0	0	0	0
Apr	1980	0	0	0	0	0
May	1980	65	3	0	0	68
Jun	1980	0	0	0	0	0
Jul	1980	14	0	0	0	14
Aug	1980	16	12	0	0	28
Sep	1980	40	1065	0	0	1065
Oct	1980	4	1653	0	0	1657
Nov	1980	264	1435	0	0	1699
Dec	1980	5	301	0	0	305
Jan	1981	16	0	0	0	16
Feb	1981	20	0	0	0	20
Mar	1981	0	0	0	0	0
Apr	1981	0	0	40	0	40
May	1981	0	0	183	0	183
Jun	1981	9	0	11	0	20
Jul	1981	0	0	0	0	0
Aug	1981	0	0	0	0	0
	Total	740	5504	270	12	6525

Silverbeet *Beta vulgaris*

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	2	3	150	94	39	171	466
Aug	1979	3	16	145	46	33	193	435
Sep	1979	0	6	210	32	19	14	271
Oct	1979	0	5	183	26	17	2	233
Nov	1979	3	4	137	81	21	26	272
Dec	1979	2	0	181	73	35	15	306
Jan	1980	7	0	93	85	34	32	250
Feb	1980	4	2	82	30	20	0	148
Mar	1980	0	4	97	36	15	51	202
Apr	1980	0	0	102	33	9	5	149
May	1980	232	7	99	69	36	20	463
Jun	1980	0	0	64	52	23	8	147
Jul	1980	9	0	34	52	7	2	104
Aug	1980	55	12	42	95	1	15	221
Sep	1980	28	16	33	53	6	43	179
Oct	1980	170	13	51	109	5	35	392
Nov	1980	95	0	59	105	20	53	331
Dec	1980	38	23	34	152	17	50	313
Jan	1981	11	8	45	73	13	10	159
Feb	1981	3	31	65	32	0	0	131
Mar	1981	0	1	67	91	0	7	166
Apr	1981	6	33	35	44	3	11	131
May	1981	0	13	22	67	9	9	120
Jun	1981	1	63	38	28	0	25	152
Jul	1981	5	96	74	97	4	58	333
Aug	1981	1	213	142	139	1	69	564
	Total	681	568	2319	1766	376	926	6657

Spring onion *Allium cepa var. cepa*

MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	11	20	0	8	21	3	62
Aug	1979	10	27	13	4	155	1	209
Sep	1979	10	12	59	0	179	1	262
Oct	1979	32	28	70	25	56	0	211
Nov	1979	30	19	81	7	137	0	273
Dec	1979	7	13	0	53	153	7	232
Jan	1980	33	16	36	47	147	2	281
Feb	1980	46	9	49	41	104	2	253
Mar	1980	31	29	3	267	78	0	407
Apr	1980	78	10	33	53	83	6	263
May	1980	199	1	86	89	103	23	512
Jun	1980	37	10	47	39	79	14	224
Jul	1980	87	2	38	44	35	0	206
Aug	1980	81	9	30	37	62	4	223
Sep	1980	17	11	51	12	72	5	167
Oct	1980	42	19	49	46	45	1	203
Nov	1980	20	10	50	54	83	14	230
Dec	1980	17	11	91	29	108	7	262
Jan	1981	51	15	73	58	117	18	332
Feb	1981	25	12	65	46	126	0	273
Mar	1981	19	26	66	41	31	0	182
Apr	1981	7	7	34	20	4	0	71
May	1981	10	19	55	26	56	0	167
Jun	1981	29	23	56	35	31	0	173
Jul	1981	44	12	35	24	36	1	152
Aug	1981	34	20	63	21	43	0	181
	Total	1014	386	1231	1134	2134	109	6008

Table 23. Monthly purchases (kg/week) of sweet potato, tomato, watermelon and zucchini by the Food Marketing Corporation for six buying centres, July 1979 to August 1981 (Source: FMC purchase records)

		Sweet potato *Ipomoea batatas*							Tomato *Lycopersicon esculentum*						
MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	2625	1941	348	29	326	0	5469	870	84	2192	142	105	3	3376
Aug	1979	666	2166	385	48	66	0	3548	699	136	2169	183	56	96	3350
Sep	1979	2132	1723	1230	0	1557	0	6641	1450	330	2912	186	93	60	5032
Oct	1979	3202	2109	1359	10	1277	0	7955	1200	254	2242	223	120	137	4175
Nov	1979	2267	657	1641	44	1709	0	6317	306	111	2032	115	43	42	2648
Dec	1979	2185	889	1502	4	293	0	4872	675	41	2106	91	101	24	3037
Jan	1980	1172	2133	1118	34	196	0	4651	423	11	2382	194	79	63	3151
Feb	1980	1266	3234	696	0	150	0	5376	376	13	1977	636	328	44	3377
Mar	1980	2466	2901	2188	121	149	0	7539	285	243	2446	1329	756	5	5063
Apr	1980	3771	816	1675	47	466	0	6716	841	27	2098	346	187	0	3466
May	1980	6652	1782	822	167	727	38	10187	805	111	1206	149	138	16	2429
Jun	1980	5066	3145	706	23	594	0	10534	55	59	1314	190	137	25	1780
Jul	1980	7866	1956	553	24	777	0	11201	2554	121	1258	265	77	87	4363
Aug	1980	5847	2147	254	385	810	0	9454	1375	31	1753	388	86	90	3706
Sep	1980	2136	713	126	739	690	0	4405	737	449	1948	394	42	29	3590
Oct	1980	1428	1543	125	766	229	0	4094	1181	521	2655	367	10	31	4165
Nov	1980	3201	774	196	781	167	0	5159	1072	186	2374	375	30	386	4436
Dec	1980	1646	668	11	163	167	0	2536	836	136	2026	378	49	139	3558
Jan	1981	1623	1195	51	106	63	0	2438	98	324	1367	317	104	24	2233
Feb	1981	2141	1801	246	76	21	0	4376	66	831	1301	418	57	35	2762
Mar	1981	271	2226	64	366	81	0	3041	271	1662	3333	346	10	45	5666
Apr	1981	2511	1562	196	36	0	0	4337	876	584	4476	136	60	26	6371
May	1981	6556	2067	394	114	106	0	9241	366	771	1585	90	84	16	2962
Jun	1981	7556	2975	216	84	496	0	11331	282	3745	586	42	8	8	4675
Jul	1981	2656	1225	66	21	286	0	4176	220	2756	516	76	29	91	3690
Aug	1981	6666	1376	56	3	323	0	8365	966	2965	1137	151	89	28	4426
	Total	86241	45843	16255	4154	11717	38	163947	18816	15002	50666	7516	2660	1557	96757

		Watermelon *Citrullus lanatus*							Zucchini *Cucurbita pepo var. medullosa*						
MONTH	YEAR	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total	Port Moresby	Lae	Wau	Kainantu	Goroka	Mt Hagen	Total
Jul	1979	0	10	1	0	0	0	11	0	0	206	8	0	58	356
Aug	1979	missing data							0	0	103	4	0	86	193
Sep	1979	missing data							21	0	89	0	1	22	132
Oct	1979	21	89	39	0	0	0	148	16	0	23	8	20	0	65
Nov	1979	146	473	9	0	31	0	659	70	0	23	1	5	10	110
Dec	1979	321	671	7	21	0	0	1019	47	0	21	9	20	90	188
Jan	1980	1276	274	32	8	6	0	1596	0	0	22	1	27	29	79
Feb	1980	1186	631	100	0	20	0	1931	0	0	57	7	6	60	130
Mar	1980	949	8	3	0	7	41	1007	0	1	5	1	7	21	35
Apr	1980	199	189	0	0	0	0	349	0	0	5	0	4	0	9
May	1980	663	415	4	0	0	0	1083	0	0	7	0	1	11	19
Jun	1980	666	92	0	0	0	0	696	0	0	14	0	0	3	17
Jul	1980	82	367	1	0	0	0	450	4	18	1	0	3	0	26
Aug	1980	14	210	0	0	0	25	249	0	54	104	1	0	3	162
Sep	1980	126	18	2	0	14	0	162	41	347	132	0	0	54	574
Oct	1980	76	1661	566	0	0	0	2270	0	49	366	11	102	340	867
Nov	1980	166	1206	0	30	35	0	1440	1	316	229	0	114	706	1376
Dec	1980	629	1172	0	105	0	0	1906	0	154	96	11	5	54	323
Jan	1981	676	1266	22	0	0	0	1967	14	0	329	0	19	16	366
Feb	1981	667	721	19	0	0	0	1567	0	0	126	1	0	17	143
Mar	1981	622	1055	0	0	0	0	1677	0	0	0	0	5	11	24
Apr	1981	336	132	0	0	0	0	468	0	154	3	0	0	16	173
May	1981	579	754	0	0	0	0	1333	0	131	31	0	0	16	184
Jun	1981	565	315	0	0	0	2	881	0	4	31	0	0	4	39
Jul	1981	0	21	0	0	0	0	21	0	536	8	0	0	73	620
Aug	1981	400	0	0	0	0	0	400	65	96	11	0	1	98	271
	Total	10461	11632	833	183	112	67	23288	284	1871	2125	70	338	1810	6498

Table 24. Mean monthly price (toea/kg) and standard deviation for aibika, cooking banana, eating banana and common bean at five urban markets, January 1971 to December 1992, in constant 1991 prices

Aibika	*Abelmoschus manihot*									
	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	49.5	14.6	74.9	13.5	36.8	6.8	29.4	5.1	45.2	7.2
Feb	60.2	18.2	71.9	9.5	38.9	6.6	30.0	6.6	45.8	7.2
Mar	61.6	16.4	73.4	10.3	38.0	5.8	30.3	6.2	47.2	8.4
Apr	63.2	20.0	74.8	10.3	39.5	6.4	29.6	5.8	50.1	10.3
May	69.1	18.8	78.9	10.7	37.5	6.5	30.1	5.5	50.7	11.0
Jun	71.1	18.0	84.7	14.1	40.8	7.8	33.7	7.3	56.9	15.0
Jul	72.8	20.7	97.6	17.5	41.8	8.1	35.4	8.5	57.0	17.5
Aug	69.4	18.8	97.9	24.3	43.0	10.3	38.9	10.1	66.2	28.9
Sep	62.5	16.4	95.5	19.2	44.8	7.3	45.3	18.3	82.4	36.1
Oct	52.2	8.5	90.1	17.9	45.8	8.0	38.0	12.2	67.1	32.6
Nov	53.3	13.9	84.2	15.0	41.7	6.5	33.1	6.3	64.3	34.1
Dec	48.2	10.4	83.4	16.8	42.8	8.1	30.9	6.0	60.3	43.5

Cooking banana	*Musa cvs*									
	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	31.2	8.6	63.8	11.7	29.6	6.0	25.1	5.1	83.8	28.7
Feb	33.1	11.6	71.6	17.2	28.8	5.1	22.5	3.2	81.4	21.3
Mar	35.1	12.0	76.4	18.9	30.2	5.0	22.5	2.8	74.9	18.7
Apr	32.6	12.5	75.7	19.7	31.1	5.0	21.8	2.1	84.1	31.2
May	34.2	11.1	75.1	18.3	31.4	5.3	23.2	2.3	81.3	23.7
Jun	33.1	11.5	73.7	13.3	33.1	6.4	22.9	3.2	85.4	33.7
Jul	35.5	13.9	73.0	15.5	32.7	6.5	23.4	3.3	87.1	32.2
Aug	35.0	11.2	71.1	12.4	31.7	6.3	24.4	4.9	87.8	23.4
Sep	35.7	14.1	73.4	13.7	31.0	5.2	25.6	6.6	83.9	24.8
Oct	35.3	14.7	71.9	12.4	35.2	5.9	24.7	6.2	89.4	27.7
Nov	36.4	15.4	71.5	12.8	31.4	4.9	24.2	4.1	85.0	24.7
Dec	37.1	12.6	69.9	12.6	32.2	3.2	25.1	4.9	89.3	31.0

Eating banana	*Musa cvs*									
	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	27.1	4.1	41.6	8.1	33.6	7.1	28.2	4.2	69.8	18.5
Feb	27.8	4.8	46.2	11.0	34.8	8.5	28.1	6.5	69.7	18.7
Mar	27.7	6.5	50.7	13.7	35.3	5.6	28.5	4.9	65.9	15.5
Apr	27.2	4.5	49.6	9.9	36.0	7.2	28.5	5.2	68.5	21.6
May	28.2	5.4	49.5	10.3	35.3	6.2	28.5	3.9	70.9	18.7
Jun	28.4	5.7	47.3	8.5	35.9	8.4	29.2	5.2	72.9	18.8
Jul	29.0	6.6	47.1	7.3	38.3	9.0	30.1	5.4	69.0	18.2
Aug	30.9	7.5	45.3	9.0	38.3	6.6	30.1	5.2	74.5	13.9
Sep	30.1	5.8	47.8	8.5	39.9	7.3	31.5	7.2	76.6	15.6
Oct	31.4	7.3	46.3	10.5	40.1	8.0	30.6	6.4	72.7	15.1
Nov	31.0	5.2	49.1	11.0	40.1	7.0	31.6	3.4	74.4	17.3
Dec	28.2	4.2	45.6	11.3	40.6	6.6	31.0	4.7	67.8	13.4

Common bean	*Phaseolus vulgaris*									
	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	81.1	23.2	113.3	20.1	81.1	22.8	38.8	6.2	52.8	12.4
Feb	96.1	31.9	116.5	19.5	73.8	17.8	39.5	7.3	57.5	13.7
Mar	101.3	34.1	116.3	17.3	72.1	16.3	44.4	10.1	55.6	11.7
Apr	109.6	30.2	114.8	22.5	78.1	20.5	51.4	6.6	53.8	9.8
May	98.8	28.1	126.1	22.3	77.3	22.6	58.9	15.2	57.9	13.4
Jun	94.5	22.9	135.7	29.5	84.8	23.6	70.6	23.5	61.1	14.5
Jul	90.4	25.7	139.0	39.8	106.4	38.0	79.8	20.5	61.7	17.8
Aug	81.3	17.7	157.5	35.2	88.7	28.9	73.7	16.9	71.6	26.4
Sep	69.1	20.2	144.6	48.0	90.8	21.0	71.1	21.8	73.3	23.6
Oct	67.6	21.6	150.0	40.8	89.5	32.8	61.3	14.1	67.1	18.7
Nov	69.5	20.9	138.2	41.6	94.8	25.6	52.9	12.1	67.5	26.5
Dec	71.0	14.8	134.3	26.1	78.5	15.6	46.2	7.3	64.1	36.0

Source: Weekly prices recorded for the consumer price index for the National Statistics Office

Table 25. Mean monthly price (toea/kg) and standard deviation for betel nut, cassava, coconut and corn at five urban markets, January 1971 to December 1992, in constant 1991 prices

Betel nut ***Areca catechu***

	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	86.1	40.4	361.9	241.6	230.7	107.6	145.9	42.6	416.3	139.6
Feb	83.7	38.1	393.1	264.2	205.3	93.2	140.4	46.5	338.4	108.7
Mar	67.6	22.3	370.3	117.3	169.9	90.4	141.7	55.2	333.8	107.6
Apr	54.8	15.6	300.1	85.8	151.3	47.0	149.7	62.4	290.0	113.8
May	50.3	8.7	256.8	70.6	134.5	53.0	155.8	60.2	322.0	106.3
Jun	48.8	8.9	227.5	60.7	127.2	44.7	177.2	81.6	284.1	87.5
Jul	50.2	9.8	210.4	63.2	162.8	70.4	158.8	71.1	287.6	111.8
Aug	56.7	15.8	210.5	79.7	171.7	84.1	179.5	82.5	393.2	144.5
Sep	72.0	21.3	213.5	78.6	247.7	143.3	236.0	169.5	420.2	121.9
Oct	105.6	39.5	244.4	117.0	261.0	122.8	199.7	79.4	406.5	99.1
Nov	108.6	46.0	288.3	147.2	316.4	143.1	197.3	70.6	415.0	141.0
Dec	111.1	42.2	324.3	195.1	235.4	91.9	181.7	52.0	426.0	172.0

Cassava ***Manihot esculenta***

	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	17.3	3.6	38.5	9.1	22.8	5.9	17.2	3.0	21.1	7.2
Feb	17.1	3.7	39.0	7.4	21.4	5.3	18.3	3.3	20.0	5.1
Mar	18.1	5.3	38.3	6.9	19.6	3.5	18.4	6.8	19.7	6.3
Apr	18.0	4.5	37.2	5.9	20.4	4.0	18.0	4.5	20.1	6.1
May	17.9	3.9	36.2	6.8	20.8	4.7	20.0	4.3	18.4	4.9
Jun	18.0	3.6	34.6	7.5	22.0	8.7	19.8	3.7	17.0	3.3
Jul	19.6	6.2	36.0	8.1	21.1	6.6	17.4	4.7	19.2	4.7
Aug	18.5	5.6	36.1	7.3	20.7	3.7	17.7	5.0	18.0	3.5
Sep	17.8	3.7	38.9	8.2	19.7	4.2	21.4	7.4	19.9	5.1
Oct	17.3	3.8	38.2	7.4	22.3	5.4	19.6	8.0	22.0	11.9
Nov	17.7	3.7	43.1	11.6	22.4	5.9	22.7	7.0	22.4	11.1
Dec	18.4	4.8	40.0	11.2	24.7	6.8	20.7	2.4	23.4	13.3

Coconut ***Cocos nucifera***

	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	11.2	3.7	38.8	8.1	23.4	4.9	13.3	4.0	40.2	7.3
Feb	11.1	2.5	38.6	7.7	23.5	3.4	12.6	2.9	43.3	4.6
Mar	11.8	4.5	39.3	9.7	22.9	3.5	13.0	3.2	47.6	8.4
Apr	11.6	3.2	38.9	7.3	23.0	4.4	12.6	2.7	44.2	10.6
May	11.2	2.4	41.0	9.6	23.2	5.0	13.0	3.1	42.3	7.8
Jun	10.8	2.4	40.9	8.4	23.2	4.5	12.7	3.2	42.5	11.6
Jul	10.8	2.9	41.7	9.4	24.1	4.7	13.0	3.6	46.7	5.2
Aug	10.5	2.6	43.2	11.2	22.5	5.0	12.9	3.8	47.6	7.6
Sep	11.3	2.9	44.1	10.4	23.7	5.2	13.6	6.2	44.9	8.7
Oct	11.2	2.7	43.4	8.5	23.9	4.1	13.2	4.1	46.2	9.4
Nov	11.2	2.4	41.1	8.2	24.3	3.5	12.7	2.7	47.3	7.9
Dec	11.8	2.6	41.9	8.1	23.5	4.6	13.5	2.9	46.6	13.7

Corn ***Zea mays***

	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	49.2	15.0	78.2	14.1	36.0	8.7	27.9	8.8	30.9	5.5
Feb	51.0	12.5	76.9	10.8	35.2	6.4	27.1	5.4	29.2	6.8
Mar	54.1	15.7	80.0	11.0	39.0	6.2	28.5	6.5	29.0	6.7
Apr	54.7	12.8	75.1	7.1	39.3	8.7	31.0	7.3	30.1	6.6
May	58.1	15.8	81.9	11.8	37.5	5.0	34.8	6.5	32.6	6.6
Jun	58.5	17.6	85.1	9.6	38.9	5.4	39.3	13.0	32.7	4.7
Jul	61.4	13.7	87.4	11.0	45.6	14.7	40.1	8.8	34.1	4.0
Aug	62.3	13.6	92.0	12.6	44.5	6.7	38.0	6.5	39.2	7.1
Sep	59.8	10.6	94.6	14.4	46.1	10.3	39.4	8.9	38.6	7.6
Oct	56.6	11.4	89.5	12.0	49.0	11.1	36.1	10.3	39.4	7.9
Nov	55.9	9.3	86.4	12.7	43.2	7.6	34.4	7.6	39.7	10.6
Dec	50.1	10.6	89.9	18.3	44.1	7.0	30.9	8.7	42.1	21.4

Source: Weekly prices recorded for the consumer price index for the National Statistics Office

Table 26. Mean monthly price (toea/kg) and standard deviation for cucumber, peanuts, pineapple and pumpkin fruit at five urban markets, January 1971 to December 1992, in constant 1991 prices

Cucumber ***Cucumis sativus***

	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	46.7	11.5	69.3	10.7	46.4	11.1	21.9	6.7	38.6	4.2
Feb	53.7	14.8	69.6	10.6	46.3	8.7	23.5	5.3	38.9	8.0
Mar	59.8	17.8	71.8	7.9	46.6	8.3	28.0	6.6	38.9	8.3
Apr	57.8	16.5	75.9	11.0	50.5	12.5	36.3	9.3	45.5	13.2
May	54.5	14.1	76.0	8.9	56.2	11.3	35.4	5.8	56.0	15.4
Jun	52.4	10.7	82.7	10.1	63.8	12.2	41.2	7.0	61.5	21.8
Jul	57.4	16.5	88.8	19.8	61.0	13.5	45.1	12.1	65.9	24.6
Aug	53.6	12.3	88.0	16.5	58.5	8.7	53.1	9.5	71.0	32.2
Sep	48.5	9.9	89.0	17.5	60.4	8.9	44.4	6.0	76.5	26.4
Oct	47.8	10.8	92.3	18.5	62.0	11.2	48.3	12.0	65.2	24.1
Nov	45.2	14.3	84.3	14.4	59.8	8.2	32.1	5.4	69.4	23.1
Dec	46.1	15.4	81.1	10.1	52.8	13.5	25.6	7.4	54.2	18.5

Peanuts ***Arachis hypogaea***

	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	116.3	21.8	360.7	30.1	199.7	48.4	199.3	42.8	147.8	38.8
Feb	138.6	40.5	347.7	43.2	202.8	36.5	199.1	50.9	127.2	30.5
Mar	152.8	42.9	370.2	59.7	198.9	53.2	214.5	42.7	118.6	24.7
Apr	152.0	45.6	347.2	58.0	193.4	48.3	229.0	47.2	134.0	42.9
May	159.8	42.4	342.3	54.2	200.5	47.7	220.2	52.3	152.7	40.7
Jun	154.7	41.1	348.6	53.3	203.0	47.3	220.1	46.4	156.7	43.6
Jul	171.7	38.2	392.3	42.7	213.7	55.6	234.3	54.1	154.2	35.5
Aug	181.8	41.7	406.1	36.3	235.4	57.3	220.6	57.1	162.3	49.2
Sep	166.0	51.2	434.1	54.0	235.6	61.6	236.8	75.3	183.2	40.6
Oct	151.7	48.8	424.9	63.1	248.5	71.2	237.9	61.8	174.5	44.9
Nov	131.1	29.0	423.4	56.5	237.9	59.7	222.8	64.7	187.9	45.2
Dec	129.5	25.2	381.0	32.6	224.0	67.0	238.0	49.2	173.4	38.9

Pineapple ***Ananas comosus***

	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	40.0	12.9	66.2	12.0	67.0	9.8	38.1	7.5	67.6	9.0
Feb	41.2	12.6	73.0	17.5	71.4	9.5	39.3	8.6	66.7	11.3
Mar	49.1	19.5	81.2	11.3	84.7	16.7	45.2	7.4	67.6	11.0
Apr	61.6	21.1	90.0	13.5	87.5	17.6	48.8	12.2	70.5	13.6
May	69.3	29.0	93.7	19.1	91.8	13.4	46.3	15.3	77.1	12.9
Jun	73.7	32.2	92.1	15.1	87.2	15.0	46.0	5.7	75.2	11.4
Jul	63.4	24.8	93.0	17.2	92.0	16.8	50.0	9.9	75.9	11.7
Aug	59.7	22.7	95.6	20.0	87.8	19.4	49.3	10.2	83.3	21.9
Sep	57.9	25.6	93.1	18.9	85.0	18.1	47.6	10.2	78.8	10.3
Oct	55.1	17.5	88.5	14.2	79.6	16.8	46.7	7.1	75.9	11.5
Nov	51.9	18.3	81.1	13.0	80.3	11.9	46.3	9.3	77.3	11.6
Dec	47.1	16.0	73.8	13.1	70.2	11.4	44.6	8.8	75.2	12.5

Pumpkin fruit ***Cucurbita moschata***

	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	23.4	4.7	50.4	7.7	28.1	4.7	19.0	3.1	22.9	6.4
Feb	23.6	4.7	53.6	8.2	29.0	3.7	18.1	3.4	22.8	5.3
Mar	23.8	5.3	50.5	5.8	32.1	6.8	18.9	5.4	24.4	7.1
Apr	24.8	4.4	49.1	5.7	31.5	9.8	19.0	3.8	25.7	7.0
May	25.2	6.2	48.8	6.2	33.6	11.5	21.6	5.8	25.4	5.8
Jun	25.3	4.1	49.9	6.4	35.6	15.8	22.7	4.3	25.2	5.4
Jul	27.2	6.4	52.6	7.6	35.1	15.4	23.6	4.6	28.4	8.7
Aug	26.7	5.6	52.2	8.3	35.8	13.1	24.2	7.0	29.6	10.7
Sep	26.0	2.9	50.9	7.5	34.3	13.8	25.2	6.1	30.2	8.5
Oct	24.2	2.7	53.9	7.2	34.7	12.4	24.0	6.4	32.2	12.2
Nov	24.3	2.5	56.2	8.3	32.7	5.5	22.6	2.9	31.7	9.0
Dec	25.6	6.1	55.7	9.8	33.6	6.3	22.5	3.8	30.8	11.0

Source: Weekly prices recorded for the consumer price index for the National Statistics Office

Table 27. Mean monthly price (toea/kg) and standard deviation for pumpkin tips, sweet potato and taro at five urban markets, January 1971 to December 1992, in constant 1991 prices

Pumpkin tips ***Cucurbita moschata***

	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	41.1	6.3	51.2	9.0	32.2	6.6	32.0	8.3	36.1	4.6
Feb	42.1	5.7	48.6	7.6	32.9	6.2	32.9	6.5	39.1	8.1
Mar	40.0	5.9	50.0	9.5	33.3	6.5	34.8	7.7	39.6	7.4
Apr	43.0	9.5	50.9	8.4	35.1	6.4	36.2	7.4	41.5	7.9
May	44.6	7.8	55.3	10.3	36.0	5.9	40.3	8.0	41.2	5.1
Jun	48.8	9.5	57.1	9.1	35.8	7.7	40.3	10.5	47.0	9.0
Jul	45.6	10.9	61.1	10.5	37.7	8.0	39.4	9.4	48.7	11.5
Aug	44.2	8.2	61.9	13.2	35.4	6.6	40.2	9.2	51.9	15.6
Sep	42.0	7.0	61.1	17.1	35.5	7.5	40.8	8.2	56.6	19.5
Oct	39.9	7.3	58.9	17.5	37.4	14.0	39.7	11.0	50.1	16.8
Nov	40.3	5.9	58.7	14.3	35.3	4.7	34.8	8.5	48.4	26.6
Dec	43.6	6.3	56.2	10.3	36.8	9.9	31.6	7.3	45.3	30.7

Sweet potato ***Ipomoea batatas***

	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	24.1	10.6	67.1	15.3	26.8	8.0	32.4	11.0	30.2	10.5
Feb	21.1	3.6	66.8	16.0	26.9	6.9	30.6	7.9	28.9	8.9
Mar	24.0	7.0	65.0	17.7	26.0	7.1	29.1	5.0	25.7	6.1
Apr	26.6	9.0	64.1	16.1	26.8	7.8	28.2	5.6	26.3	6.1
May	27.4	7.6	64.1	15.5	27.2	9.7	27.6	4.4	26.7	7.3
Jun	28.7	6.1	62.2	12.4	27.8	10.5	27.1	4.9	25.6	5.0
Jul	28.9	5.5	65.9	11.9	30.6	10.4	25.9	4.3	25.7	6.2
Aug	26.3	4.8	65.0	11.0	28.0	8.9	25.8	3.8	27.0	6.8
Sep	27.1	5.3	68.3	13.1	32.8	9.4	28.7	6.9	29.4	9.7
Oct	26.1	7.1	70.2	11.6	33.4	8.8	29.6	6.7	30.9	12.8
Nov	22.6	6.4	72.6	13.8	31.0	8.7	32.5	8.1	32.7	13.3
Dec	24.9	6.1	74.9	17.3	30.5	9.2	33.8	8.6	34.9	16.3

Taro ***Colocasia esculenta***

	Rabaul		Port Moresby		Lae		Madang		Goroka	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Jan	56.3	19.2	103.3	23.2	59.1	19.2	42.3	11.5	115.1	41.0
Feb	52.9	11.4	102.3	25.1	56.9	20.1	49.8	13.2	106.5	34.5
Mar	50.4	9.4	93.1	20.1	53.2	17.8	47.9	10.3	110.5	36.3
Apr	51.1	14.5	108.4	24.4	58.9	18.8	42.6	10.2	107.5	38.2
May	53.3	11.4	100.0	18.6	62.2	22.0	39.3	8.3	113.8	37.4
Jun	54.6	12.5	115.1	23.5	61.4	23.1	41.5	9.5	117.9	44.3
Jul	58.8	11.5	120.6	29.1	63.1	20.1	39.2	7.4	108.6	44.5
Aug	56.6	13.7	119.9	26.5	60.3	20.9	39.5	8.5	111.0	45.0
Sep	60.9	15.2	119.1	24.6	67.1	18.9	45.4	10.9	109.3	41.0
Oct	57.7	13.1	117.6	26.3	63.0	20.3	42.7	7.2	117.3	40.2
Nov	58.9	9.9	119.7	25.6	67.5	20.1	42.1	10.2	120.2	41.4
Dec	61.6	16.0	112.5	26.8	60.2	22.1	40.7	7.7	122.3	41.2

Source: Weekly prices recorded for the consumer price index for the National Statistics Office

Table 28. Production (kg/ha) of durian, mangosteen, okari and rambutan at LAES Keravat, January 1989 to March 1993 (Source: S. Woodhouse)

		Durian *Durio zibethinus*			Mangosteen *Garcinia mangostana*				Okari *Terminalia kaembachii*		Rambutan *Nephelium lappaceum*
Series*		00	10	40	00	10	20**	40	00	10	20***
Year planted		1952	1963	1974	1963	1960	1973	1952	1963	1952	1973
Number of trees		1	5	7	10	18	135	2	10	22	32
MONTH	YEAR										
Jan	1989	6023	0	0	205	805	6	0	8	3	0
Feb	1989	352	258	0	8	256	2	0	0	0	326
Mar	1989	1362	6206	148	8	243	4	0	0	37	1235
Apr	1989	0	385	115	0	41	0	0	186	1788	556
May	1989	0	0	0	0	0	0	0	583	3434	1
Jun	1989	1403	0	0	0	0	0	0	54	28	0
Jul	1989	0	0	0	0	23	0	0	0	0	28
Aug	1989	0	0	0	0	12	0	0	15	1	0
Sep	1989	520	0	0	0	32	0	0	18	41	0
Oct	1989	0	0	0	0	3	0	0	138	17	0
Nov	1989	2490	64	328	174	722	31	0	22	53	0
Dec	1989	444	21	2683	237	811	10	1388	36	61	178
Jan	1990	1787	147	105	143	281	130	149	84	26	273
Feb	1990	404	0	102	162	651	178	945	15	116	1162
Mar	1990	0	0	0	0	0	0	0	13	304	10
Apr	1990	0	0	0	0	0	0	0	40	952	0
May	1990	0	0	0	0	0	0	0	8	1070	0
Jun	1990	0	0	0	0	0	0	0	101	151	0
Jul	1990	1735	0	41	0	0	0	0	101	25	2
Aug	1990	716	0	50	0	0	0	0	13	1	5
Sep	1990	0	0	0	0	0	0	0	31	33	0
Oct	1990	0	0	0	0	0	0	0	11	10	0
Nov	1990	0	0	0	0	0	0	0	5	38	0
Dec	1990	0	0	0	0	0	0	0	0	51	0
Jan	1991	2238	365	0	0	0	1	0	90	34	0
Feb	1991	8109	3712	1234	24	65	13	0	9	58	272
Mar	1991	447	0	304	16	9	3	0	68	58	148
Apr	1991	0	211	0	0	7	0	0	79	183	151
May	1991	451	1260	88	0	0	0	0	62	467	1127
Jun	1991	0	7	0	0	0	0	0	76	424	3
Jul	1991	0	0	0	0	0	0	0	25	8	0
Aug	1991	0	0	0	0	0	2	0	103	10	0
Sep	1991	0	21	0	4	30	8	465	30	6	0
Oct	1991	1560	170	119	33	96	137	816	2	11	0
Nov	1991	519	855	3087	213	709	215	4066	21	14	500
Dec	1991	0	0	1362	0	0	0	406	85	7	0
Jan	1992	0	0	0	0	1	0	0	14	4	0
Feb	1992	4642	7822	11	767	938	652	1108	8	217	10
Mar	1992	215	1664	1462	800	1036	446	2760	13	853	1
Apr	1992	0	0	0	10	0	21	0	138	1515	0
May	1992	0	17	0	0	0	0	0	116	735	192
Jun	1992	0	0	0	0	0	0	0	14	8	27
Jul	1992	0	0	0	0	0	0	0	20	8	0
Aug	1992	0	0	0	0	0	0	0	13	0	0
Sep	1992	0	0	0	0	0	0	0	29	0	0
Oct	1992	0	0	0	0	0	0	0	99	6	0
Nov	1992	0	0	0	5	0	3	310	21	4	0
Dec	1992	0	0	0	0	0	0	0	0	0	0
Jan	1993	0	0	0	1	0	0	0	28	0	0
Feb	1993	3550	2279	895	258	336	410	863	51	0	226
Mar	1993	367	2531	5369	1800	1152	462	3473	18	0	1320

* Locations at the LAES, Keravat are:

00 series	Near clubhouse
10 series	Block 403
20 series	Experimental plantings (various locations)
40 series	Arboretum

** The 20 series of mangosteen commenced production only in 1987 and yields are still increasing. These trees are fertilized regularly.

*** These trees are fertilized regularly.

Table 29. Production (kg/ha) of carambola, eggtree, galip, pulasan and santol at LAES Keravat, January 1990 to March 1993 (Source: S. Woodhouse)

		Carambola	Eggtree	Galip		Pulasan	Santol
		Averrhoa carambola	*Garcinia xanthochymus*	*Canarium indicum*		*Nephelium mutabile*	*Sandoricum koetjape*
Series		40	00	00	10	00	40
Year planted		1983	1988 (?)	1982	1983	1973	1983
Number of trees		3	5	3	8	10	3
MONTH	YEAR						
Jan	1990	645	198	36	0	77	503
Feb	1990	2135	0	32	0	804	60
Mar	1990	130	0	7	0	0	0
Apr	1990	635	315	20	0	0	0
May	1990	714	1707	10	0	0	0
Jun	1990	537	300	10	33	0	0
Jul	1990	677	2073	11	36	0	0
Aug	1990	100	66	37	32	0	0
Sep	1990	0	1335	22	43	0	0
Oct	1990	675	1536	14	56	0	0
Nov	1990	0	724	0	0	0	0
Dec	1990	45	173	0	3	0	0
Jan	1991	1233	0	0	0	0	0
Feb	1991	32	344	5	1	0	0
Mar	1991	0	2003	0	0	11	173
Apr	1991	1303	529	2	1	0	0
May	1991	1053	0	4	2	0	26
Jun	1991	25	372	15	1	0	0
Jul	1991	360	0	54	125	0	0
Aug	1991	2104	0	10	58	0	0
Sep	1991	1662	0	64	13	0	0
Oct	1991	800	4034	18	3	0	0
Nov	1991	0	2391	47	0	1070	0
Dec	1991	100	0	63	0	65	663
Jan	1992	817	34	75	0	0	870
Feb	1992	110	376	10	0	60	0
Mar	1992	63	44	0	3	3250	0
Apr	1992	615	328	5	0	0	55
May	1992	312	366	6	4	0	12
Jun	1992	60	560	15	57	0	0
Jul	1992	0	1028	2	95	0	0
Aug	1992	420	102	25	93	0	0
Sep	1992	607	0	7	65	0	0
Oct	1992		0	21	27	0	0
Nov	1992		0	115	18	0	0
Dec	1992		0	0	0	0	0
Jan	1993		13	46	0	0	0
Feb	1993		0	0	0	0	65
Mar	1993		600	0	0	264	350

* Locations at the LAES, Keravat are:

00 series	Near clubhouse
10 series	Block 403
20 series	Experimental plantings (various locations)
40 series	Arboretum

Table 30. Harvesting periods of introduced mango *(Mangifera indica)* at Rabaul, Markham Valley and Port Moresby, 1979 to 1985

1. Rabaul area, ENB

Regular observations: late 1980 to early 1986

Method of observation: Casual observations in local markets and fruit trees in the Rabaul area

Observers: A. Leng and R. M. Bourke (1980 to 1983); L. Kurika and T. Sitapai (1983 to 1986)

Harvesting period: December 1980 to January 1981; December 1981 to mid-January 1982; November 1982 to early January 1983 (good season); mid-November 1983 to mid-February 1984 (average season); July 1984 to January 1985 (extended season); November 1985 to December 1985 (average season).

2. Markham Valley, Morobe Province

Regular observations: late 1979 to early 1985

Method of observation: Casual observations in food markets in the Markham Valley and a formal regular survey in Kainantu market

Observers: R. M. Bourke and K. Nema

Harvesting period: November 1979 to mid-December 1979; October 1980 to November 1980; December 1981 (poor season); mid-October 1982 to mid-January 1983 (good season); mid-November 1983 to mid-December 1983 (average season); mid-November 1984 to mid-December 1984.

3. Port Moresby-Laloki area, Central Province

Regular observations: late 1980 to early 1986

Method of observation: Casual observations in local markets and fruit trees in the Port Moresby and Laloki areas

Observers: G. King with additional observations by A. Rogers and G. Gorogo

Harvesting period: September 1980 to October 1980; November 1981 to December 1981; November 1982 to December 1982; mid-October 1983 to mid-January 1984 (good season); August 1984 to mid-December 1984 (extended season); November 1985 to December 1985 (good season).

Table 31. Harvesting periods of karuka nut pandanus *(Pandanus julianettii)* at six highland locations, 1976 to 1985[1]

1. Kainantu, EHP

Regular observations commenced: February 1979

Method of observation: Fortnightly count of value of nuts offered for sale in Kainantu market

Observers: R. M. Bourke and K. Nema (assisted by W. Akus, C. Tumana and A. Nigel)

Harvesting period: February-May 1979; February-March 1980; March-April 1981; November 1981; January-April 1982; January-May 1983; November 1983; February to May 1985. See Table 10 for market counts for the period 1979 to 1982. The surveys continued until the end of 1985 and the additional data are given in Bourke (1988:335). Note that market surveys include both recently harvested and stored nuts and thus tends to overestimate the length of the harvesting season. Karuka pandanus were in season in the nearby Okapa area in January- February 1978 (Jeffries, 1978:129fn), and were probably also bearing in the Kainantu area at about the same time.

2. Goroka, EHP

Regular observations commenced: October 1979

Method of observation: Fortnightly counts of value of nuts offered for sale in Goroka market until September 1982, and then casual observations of market and village production

Observers: T. Tarepe (1979 to 1985) and B. Carrad (1983, 1984)

Harvesting periods: January-March 1980; August 1980; March-May 1981; November 1981; March-April 1982; January-March 1983 (very big); July-August 1984 (small); January-mid May 1985 (see Table 10)

3. Wabag, Enga Province

Regular observations commenced: August 1978

Method of observation: Casual observations of sales in Wabag market and village production in Middle Lai Valley

Observers: M. Meggitt (1976), B. Carrad (1978 to 1980), E. Paugari (1981, 1982), L. Baldwin (1983), P. Wohlt (1984, 1985)

Harvesting periods: June-July 1976 (big); August-September 1978; February-March 1980 (some in December 1979 and January 1980 also); August-September 1981 (small); December 1982-April 1983 (very big); June-mid July 1985 (small)

4. Mendi, SHP

Regular observations commenced: January 1979

Method of observation: Casual observation of sales in Mendi market and village production in Mendi Valley

Observers: J. Tompkins (1979, 1980), R. M. Bourke (1978 to 1981), M. Anders (1981 to 1983), R. Crittenden (1984, 1985), C. Floyd (1984)

Harvesting periods: September 1978; June-September 1979; February-May 1980; December 1980-January 1981 (small); February-March 1982 (big); mid-December 1982-March 1983 (very big); April 1984 (small); mid-February-April 1985 (big); June-July 1985. (Sillitoe (1983:108) gives data on bearing seasons for the Wage Valley near Nipa in 1977 and 1978)

5. Tari, SHP

Regular observations commenced: January 1976

Method of observation: Regular observations of village production in North Tari Basin (1976 to 1980) (Rose, 1982); Casual observations in Tari market and village production in Tari Basin (1981 to 1985)

Observers: C. Rose (1976 to 1980), E. D'Souza (1981 to 1985)

Harvesting periods: January-February 1976 (small); December 1976-March 1977 (big); May- July 1978 (average); January-February 1979 (small); May-July 1979 (small); December 1979- March 1980 (big); September-October 1980 (small); February 1981 (small); February-March 1982 (small); July-August 1982 (small); February-March 1983 (very big); February-March 1984 (small); February-mid-March 1985 (average); June-July 1985

6. Oksapmin, Sandaun Province

Regular observations commenced: September 1978

Method of observation: Casual and systematic observations of village production (Cape, 1981:156)

Observers: N. Cape (1978 to 1980), J. Darby (1981 to 1984), I. Davis (1984, 1985), J. O'Sullivan (1985, 1986)

Harvesting periods: February-March 1978 (big); July-August 1979 (small); February-March 1980 (big); December 1980-February 1981 (small); mid-December 1981-March 1982; June 1982 (very small); December 1982-March 1983 (very big); July-August 1983 (very small); February 1984 (very small); February-April 1985 (very big); June 1985; mid-December 1985-April 1986 (big)

Note:

[1.] These data are for the cultivated species only *(Pandanus julianettii)*. They were originally presented in Bourke (1988:333-338). Recordings ceased at all locations during 1986. The quality of the data varies because of the number of observers and the unavoidable subjectivity of assessment of crop size. The most consistent methods were used at Kainantu and Tari. Based on comments provided by observers, crop size has been classed as: very big, big, average, small and very small.

Table 32: Harvesting periods of kuruka nut pandanus (*Pandanus julianettii)* noted in patrol reports, Southern Highlands, 1949 to 1971[1]

Period	Location	Source
Jun-Jul 1955	Tari	Tari 8 of 1954/55
Aug-Sep 1957	Koroba	Koroba 1 of 1957/58
Jan-Mar 1958	Koroba	Koroba 5,6,8 of 1957/58
Jan-Feb 1958	Erave, Kagua, Nembi	Erave 5 of 1957/58 Nipa, Tari[2]
Mar-Apr 1960	Tari	Tari 5 of 1959/60
Feb-Mar 1961	Ialibu	Ialibu 8 of 1960/61
May-Jun 1961	Margarima	Nipa 5 of 1960/61
Feb 1962	Tari	Kutubu 4 of 1961/62
Jan 1963	Lake Kopiago	Kopiago 5 of 1962/63
Jan-Feb 1964	Tari	Tari 15 of 1963/64
Feb 1965	Nipa Basin	Nipa 7 of 1964/65
Nov 1965-Mar 1966	Upper Mendi	Mendi 3,7 of 1965/66
Dec 1965-Feb 1966	Ialibu	Ialibu 5 of 1965/66
Early 1966	Tari	Tari 2 of 1965/66
Jan 1966	Margarima	Nipa 6 of 1965/66
Feb 1968	Ialibu	Ialibu 10,14 of 1967/68
Mar 1968	Nipa Basin	Nipa 15 of 1967/68
Feb 1970	Ialibu	Ialibu 14 of 1969/70
Feb-Mar 1970	Upper Mendi	Mendi 17 of 1969/70

Notes:

1. The source is incidental comments made in patrol reports. The data under "source" is the unique patrol report number. This is not a systematic source of information on pandanus harvests, as are market surveys. Data from Bourke (1988:337).

2. Reported as the "best season for many years".

Table 33. Harvesting periods of wild karuka nut pandanus *(Pandanus brosimos)*, Iumbisa Village, Kandep area, Enga (1972-1975, 1983-1986) and Tari Basin (1983-1986)

1. Iumbisa Village, Kandep area, Enga Province

Regular observations: April 1972 to April 1975; January 1983 to December 1986

Method of observation: Systematic observation of village production by P. Wohlt. The observations for the period 1972 to 1975 were published in Wohlt (1978:126-127)

Harvesting periods: January-February 1973 (large): January-February 1975 (large): January-February 1983 (average); April-beginning May 1984 (small); August 1984 (very small); June-mid-July 1985 (large); February 1986.

2. Fringe of Tari Basin, Southern Highlands

Regular observations: 1983 to 1986

Method of observation: Casual observations on migration by villagers to high altitude locations (Tari Gap) to harvest nuts by E. D'Souza.

Harvesting periods January 1983-early March 1983 (large); early June-early July 1985.

Table 34a. Reported main harvesting season of breadfruit *(Artocarpus altilis)* at various locations

Location	Approximate altitude (m)	Harvest season	Source
Wogeo (Vokeo)[1] Is, ESP	0-100	May-Jun	Hogbin (1938-39:128)
Gazelle Pen, ENB	0-100	Feb-Mar	Aburu (1982:108)
Eastern Baining Mts	0-400	Sep-Nov	Villagers, Jun 1995
Gazelle Pen, ENB			
Inland Pomio	200-600	Jan-Mar	Villagers, Jun 1995
New Britain			
Karkar Is	0-200	Jun-Aug	Villagers, Jul 1991
Madang Prov			
Unea (Bali) Island WNB	0-50	Jul-Aug Nov-Jan	Villagers, Jul 1995
Hoskins area, WNB	0-100	Aug-Sep	Villagers, Jul 1995
Kandrian area, WNB	0-100	Dec-Mar	Hide (1985:18)
Kandrian area, WNB	0-100	Aug-Oct	Villagers, May 1993
South Bougainville	0-100	May-Jun	Oliver (1955:28, 37)
Kiriwina Is, MBP	0-10	Apr-May	Malinowski (1935:50, 314)
Islands[2], MBP	0-100	Nov-Feb	Villagers, Feb 1994
Cape Vogel, MBP	0-50	Oct-Feb	Mogina (2002:65)
Dogura area MBP	0-100	Nov-Feb	Kahn (1986:46, 49, 164)
Milne Bay area MBP	0-100	Oct-Mar	Cheung (1980:14)

Notes:

1. Hogbin notes that breadfruit bears at irregular intervals and the periods for the harvest cannot be accurately forecast; but the main crop was gathered during 3 or 4 weeks in May-June in his period of fieldwork.

2. Villagers were asked at 15 locations on the following islands: Normanby, Fergusson, Goodenough, Kiriwina, Iwa, Gawa and Ianaba. The most common response was the November to February period, but most other months were mentioned by at least one respondent.

Table 34b. Reported main harvesting season of breadnut *(Artocarpus camansi)* at various locations

Location	Approximate altitude (m)	Harvest season	Source
Dreikikir area, ESP	100-300	May-Jul	Obrist van Eeuwijk (1992:190)
Maprik area, ESP	100-300	Aug-Feb	Lea (1964:124)
Gogol Valley Madang Prov	0-100	Aug-Sep	Villagers, Jul 1991
Ningerum area Western Prov	50-100	Sep-Nov	R. Walsch (pers. comm., 1979)
Wasu area, Huon Pen, Morobe Prov	0-100	Jul-Sep	Villagers, Oct 1991
Mogulu area, Nomad Dist, Western Prov	100-400	May-Aug	van Beek (1987:23)
Mogulu area, Nomad Dist, Western Prov	100-400	Sep-Dec	Villagers, May 1992 (reported to B. J. Allen)
Bukaua area Morobe Prov	0-100	Jan-Mar	Villagers, Oct 1991
Obo (Fly/Strickland R junction) Western Prov	50	Nov-Feb	Villagers, May 1992
Lakekamu R Gulf Prov	0-100	Jan-Apr	Villagers, May 1992
Ioma area Oro Prov	0-100	Dec-May	Waiko and Jiregari (1982:25)
Cape Vogel, MBP	0-100	Sep-Nov	J. Mogina (pers. comm, 2002)
Mt Bosavi, SHP	200-400	Nov-Feb	Freund (1977:294)
Imonda area, Sandaun Prov	300	Apr-May	Gell (1975:161)
Anguganak area Sandaun Prov	400-600	Apr-Oct	Lewis (1975:54)
Swanson Valley Gulf Prov	600-700	Nov-Dec	R. Speece (pers. comm., 1980)
Ivori Valley Gulf Prov	600-1000	Jun	Bonnemère (1992:44)
Simbai Valley	700-900	Sep-Oct	Clarke (1971:183)
Tagui V, Simbai area, Madang Prov	800-1800	Jun-Aug	Wood (1980:39)
Karimui Plateau Simbu Prov	1000-1200	Sep-Oct	Wagner (1967: 11)
Karimui Plateau Simbu Prov	1000-1200	Sep-Oct	Hide *et al.* (1984:213)
Mt Sisa, SHP	1100	Apr-Jul	Kelly (1977 :45)

Table 35. Reported main harvesting season of lowland pitpit *(Saccharum edule)* at various locations

Location	Approximate altitude (m)	Harvest season	Source
Maclay Coast Madang Prov	0-100	Jan-Feb	Miklouho-Maclay (1885:34)
Ulamona area[1] WNB	0-100	Apr	Villagers, Jul 1995
Hoskins area[1] WNB	0-100	Dec-Feb	Villagers, Jul 1995
Pomio area, ENB	0-100	Mar-Apr	Villagers, Jun 1995
Gloucester District, WNB[2]	0-100	Mar-Apr	Villagers, May 1993
Tinputz area Bougainville	0-100	Mar-Apr	Villagers, Sep 2002
Uvol area, ENB	0-100	Mar-Apr	Villagers, Jun 1995
Buin, South Bougainville	0-200	Mar-May	K. Billy (pers. comm., 1996)
Strickland R Western Prov	100	Dec-Mar	P. Dwyer and M. Minnegal (pers. comm., 1993)
Nomad R Western Prov	100	Feb-May	Shaw (1990:39-41)
Popondetta area Oro Prov[3]	100	Mar	Crocombe and Hogbin (1963:6)
Islands[4], MBP	0-100	Mar-May	Villagers, Feb 1994
Dogura area, MBP	0-100	Feb-May	Kahn (1986:46, 50, 166)
Milne Bay area MBP	0-100	Feb-Apr	Cheung (1980:14)
Baining Mts ENB	200-400	Dec-Apr	Fajans (1985:73)
Eastern Baining Mts Gazelle Pen, ENB	0-400	Jan-Feb	Villagers, Jun 1995
Anguganak area Sandaun Prov	400-600	Jan-Dec	Lewis (1975:54)
Swanson Valley Gulf Prov	600-700	Dec-Feb	R. Speece (pers. comm., 1980)
Lake Kutubu, SHP	700	Jan-Mar	Williams (1976:166)
Karimui Plateau Simbu Prov	1000-1200	Nov-Apr	Hide *et al.* (1984:213)
Mt Sisa, SHP	1100	Dec-May	P. Dwyer (pers. comm., 1993)

Notes:

[1] In the Hoskins and Ulamona areas of West New Britain, villagers stated that the traditional varieties of pitpit bear in about December to February, but recently introduced types bear in an irregular and non-seasonal manner.

[2] Based on statements by villagers at four locations between Kilenge and the Aria River.

[3] Crocombe and Hogbin note that the *pasiro* cultivar of edible *pitpit* ripens in about March.

[4] Villagers were asked at seven locations on the following islands: Basilaki, Normanby, Fergusson and Goodenough. The most common response was the March to May period, and the range was December to July.

Table 36. Reported main harvesting season of tulip *(Gnetum gnemon)* leaves and fruit at various locations

Location	Approximate altitude (m)	Harvest season	Source
Young leaves			
Eastern Baining Mts Gazelle Pen, ENB	0-400	Jun-Jul	Villagers, Jun 1995
Imonda area, Sandaun Prov	300	Nov-Apr	Gell (1975:161)
Anguganak area[1] Sandaun Prov	400-600	Nov-Dec	Lewis (1975:54)
Lake Kutubu, SHP	700	Nov-Dec	Villagers, Nov 1990
Pindiu area Morobe Prov	800-1000	Oct-Dec	Villagers, Oct 1991
Fruit			
Oriomo Plateau Western Prov	0-50	Dec-Feb	Ohtsuka (1983:90)
Anguganak area Sandaun Prov	400-600	Dec-Feb	Lewis (1975:54)

Note:

[1] Lewis indicates that leaves are available all year, but are most abundant in November–December.

Table 37. Reported main harvesting season of Malay apple *(Syzygium malaccense[1])* at various locations

Location[2]	Harvest season	Source
Gazelle Peninsula, ENB	Nov-Jan	Aburu (1982:109)
Gazelle Peninsula, ENB	Dec-Feb	Villagers, Jun 1995
Eastern Baining Mts, ENB	May-Jun	Villagers, Jun 1995
Gazelle Peninsula, ENB	Dec-Jan	
Keravat, ENB	Dec-Feb	Aburu (1982:118)
Keravat, ENB	Jun-Aug	S. Woodhouse (pers. comm., 1993)
Talasea area, WNB	Jul Jan	Villagers, Jul 1995
Inland Pomio, ENB	Jan-Mar	Villagers, Jun 1995
Kandrian and Gloucester[3] areas, WNB	May-Jun	Villagers, May 1993
"Coastal"[4]	Sep-Dec	Kesavan and Kambuou (1991:21)
Kiriwina Islands[5], MBP	Sep-Oct	Malinowski (1935:50, 311)
Islands[6], MBP	Oct-Jan	Villagers, Feb 1994

Notes:

1. Some records may also be for *Syzygium megacarpa*.

2. All locations are at low altitudes (0-200 m).

3. Villagers were asked at six locations in Kandrian and Gloucester Districts. The most commonly stated period was May to June, and the range was April to October. Malay apple was fruiting at the time of fieldwork (May, 1993).

4. Observations are from Morobe and Sandaun Provinces (R. Kambuou, pers. comm., 1994).

5. The Kiriwinan name "mokakana" for Malay apple was used by Malinowski.

6. Villagers were asked at four locations on Kiriwina, Kitava and Iwa Islands. The most common response was in the October to January period, and the range was September to February.

Table 38. Reported main harvesting season of introduced mango *(Mangifera indica)* at various locations

Location	Approximate altitude (m)	Harvest season	Source
Inland Pomio area ENB	200-600	Jan-Feb	Villagers, Jun 1995
Unea (Bali) Island WNB	0-50	Dec-Jan	Villagers, Jul 1995
Gloucester area, WNB	0-100	Sep-Dec	Villagers, May 1993
Kandrian area WNB	0-100	Nov-Jan	Hide (1985:18)
Kandrian area WNB	0-100	Nov-Dec Apr[1]	Villagers, Feb 1990
Kandrian area[2] WNB	0-100	Dec-Feb May-Jun	Villagers, May 1993
Sialum area Morobe Prov	0-100	Oct-Jan	Villagers, Oct 1991
Finschhafen area Morobe Prov	0-100	Jan-Feb	Villagers, Oct 1991
Bukaua area Morobe Prov	0-100	Oct-Dec	Villagers, Oct 1991
Obo (Fly/Strickland R junction), Western Prov	50-100	Nov-Jan	Villagers, May 1992
Lakekamu R Gulf Prov	0-100	Oct-Nov	Villagers, May 1992
Islands[3] MBP	0-100	Nov-Dec	Villagers, Feb 1994
Dogura area, MBP	0-100	Oct-Jan	Kahn (1986:46,50,165)
Milne Bay area, MBP	0-100	Nov-Jan	Cheung (1980:13-14)
Dreikikir area, ESP	100-300	Dec-Jan	Obrist van Eeuwijk (1992:190)
Anguganak area Sandaun Prov	400-600	Oct-Nov	Lewis (1975:54)
Bulolo area Morobe Prov	600-700	Oct-Nov	J. Simpson (pers. comm., 1979)

Notes:

1. There is less fruit in this second season than in the main earlier one.

2. Statements recorded in four villages in the Kandrian area in May 1993 were somewhat conflicting. Mangoes were maturing on both the south and north coast of New Britain at the time of fieldwork and this late season possibly contributed to the conflicting statements.

3. Villagers were asked at 14 locations on the following islands: Normanby, Dobu, Fergusson, Goodenough, Kiriwina, Kitava, Iwa, Gawa and Ianaba.

Table 39. Reported main harvesting season of marita pandanus *(Pandanus conoideus)* at various locations

Location	Approximate altitude (m)	Harvest season	Source
Oriomo Plateau Western Prov	40	Jan-Dec	Ohtsuka (1983:101)
Kiunga area Western Prov	100	Jan-Dec	Villagers, May 1992
Strickland R Western Prov	100	Sep-Dec	P. Dwyer and M. Minnegal (pers. comm., 1993)
Ningerum area Western Prov	100-150	Jan-Dec	R. Walsh (pers. comm., 1979)
Dreikikir area, ESP	100-300	Jan-Dec	Obrist van Eeuwijk (1992:108, 190)
Mt Bosavi, SHP	200-400	Nov-Feb	Freund (1977:294)
Anguganak area Sandaun Prov	400-600	Sep-Jan	Lewis (1975:54)
Upper Karawari R ESP	400-900	May-Dec	Dornstreich (1973:221, 316)
Swanson Valley Gulf Prov	600- 700	Oct-Jul	R. Speece (pers.comm., 1980)
Ivori Valley Gulf Prov	600-1500	Sep-Apr	Bonnemère (1992:41)
Lake Kutubu, SHP	700	Nov-	Williams (1976:166)
Lake Kutubu, SHP	700	Dec-	Weiner (1983:26)
Hindenberg Ra Western Prov	700-1300	Dec-Mar	Hyndman (1979:120)
Mt Sisa, SHP	800	Sep-Apr	Kelly (1977:32)
Pindiu area Morobe Prov	800-1000	Oct-	Villagers, Oct 1991
Simbai V Madang Prov	900-1500	Aug-	Rappaport (1968:174-176)
Karimui Plateau Simbu Prov	1000-1200	Nov-Apr	Hide *et al.* (1984:213)
Karimui Plateau Simbu Prov	1000-1200	Nov-Apr	Wagner (1967:11)
Mt Sisa, SHP	1100	Oct-Apr	Dwyer (1985)
Simbai V Madang Prov	1150	Sep-Mar	Buchbinder (1973:107)
Tagui V, Simbai area, Madang Prov	800-1800	Feb-Apr	Wood (1980:39).
Goroka area EHP	1450-1700	Jan-Apr	T. Tarepe (pers.comm., 1982)
Sinasina area Simbu Prov	1500-1700	Jan-Apr	Hide (1981:402)
Nembi Plateau SHP	1500-1700	Jan-Apr	Bourke (1988:129)
Kainantu area EHP	1550-1700	Jan-Apr	Bourke (1988:129)

Table 40. Reported main harvesting season of purple passionfruit *(Passiflora edulis f. edulis)* at various locations

Location[1]	Harvest season	Source
Goroka area	Dec-May	Charles (1972:893)
Goroka area	Feb-Apr[2]	Thomas (1982:413)
Mt Hagen area	Jan-Jun	Charles (1972:893)
Highlands	Jan-Apr	Densley (1978:30)
Highlands	Dec-Apr	Nitsche (1971:57)
Highlands	Jan-Apr	Tarepe and Bourke (1982:93)

Notes:

1. All locations are at between 1400 and 2300 m altitude.

2. Thomas states that a minor second crop occurs around October.

Table 41. Reported main harvesting season of pineapple *(Ananas comosus)* at various locations

Location[1]	Harvest season	Source
Keravat, ENB	Oct-Mar Mar-Jun[2]	Bourke (1976b)
Umboi Island Morobe Prov	Oct-Dec Jun-Jul[2]	Villagers, Oct 1991
Kandrian area, WNB	Nov-Jan Apr[2]	Villagers, Feb 1990
Sattleberg area Huon Peninsula Morobe Prov	Nov-Jan	Villagers, Oct 1991
Obo (Fly/Strickland R junction), Western Prov	Sep-Jan	Villagers, May 1992
Islands[3], MBP	Oct-Jan	Villagers, Feb 1994
Dogura area, MBP	Aug-Dec	Kahn (1986:46, 168)

Notes:

1. All locations are at low altitudes (0-200 m), except the Sattleberg area (800-1000 m).

2. There is less fruit produced in this second season than in the main earlier one.

3. Villagers were asked at six locations on the following islands; Normanby, Dobu, Fergusson, Goodenough and Iwa. At four locations, responses were within the period October to January, but at two locations villagers claimed that production was not seasonal.

Table 42. Reported main harvesting season of taun *(Pometia pinnata)* at various locations

Location	Approximate altitude (m)	Harvest season	Source
Manus Is	0-100	Nov-Dec	W. Rooney (pers. comm., 1980)
Manus Is	0-100	Nov-Dec	R. Croyden (pers. comm., 1981)
Lumi Sandaun Prov	500-700	Jan-Mar	Villagers, May 1982
Anguganak area Sandaun Prov	400-600	Sep-Nov	Lewis (1975:54)
Dreikikir, ESP	100-300	Aug-Oct	Obrist van Eeuwijk (1992:108, 190)
Dreikikir, ESP	200-400	Nov-Feb	Allen (1989b:283)
Prince Alexander and Torricelli Mts ESP and Sandaun	200-600	Nov-Mar	Swadling *et al.* (1991:102)
Maprik, ESP	100-300	Jan-Apr	Lea (1964:124)
Namatanai area New Ireland	0-100	Jan-Feb	R. Croyden (pers. comm.,1983)
Baining Mts, ENB	400-500	Dec-Jan	Villagers, Jun 1995
Unea (Bali) Island WNB	0-50	Nov-Dec	Villagers, Jul 1995
Coastal Pomio, ENB	0-100	Nov-Dec	Villagers, Jun 1995
Inland Pomio, ENB	200-600	Jan-Feb	Villagers, Jun 1995
Inland Kandrian, WNB	200-400	Nov-Dec	Villagers, Jun 1995
Kandrian, WNB	0-100	Dec-Jan	Villagers, May 1993
Santa Cruz Solomon Islands	0-100	Dec-Jan	Yen (1974:266)
Vanuatu	0-400	Dec-Jan	A. Walter (pers. comm., 1994)

Table 43. Reported main harvesting season of watermelon *(Citrullus lanatus)* at various locations

Location[1]	Harvest season	Source
Ulamona area, WNB	Nov-Dec	Villagers, Jul 1995
Pomio area, ENB	Jan-Feb	V. Engelberg, pers. comm., 1995
Mamusi Plateau, WNB	Oct-Dec	S. Marogo, pers. comm., 1995
Markham and Ramu Valleys	Nov-Jan	Tarepe and Bourke (1982:89)
Obo (Fly/Strickland R junction) Western Prov	Dec-Jan	Villagers, May 1992
Kiriwina, Kitava and Iwa Islands, MBP	Nov-Jan	Villagers, Feb 1994
Dogura area, MBP	Aug-Mar	Kahn (1986:46, 168)

Note:

[1] All locations are at low altitudes (0-300 m).

Table 44. Reported main harvesting season of *Castanopsis acuminatissima* nut at various locations

Location	Approximate altitude (m)	Harvest season	Source
Strickland R Western Prov	100	Dec-Feb	P. Dwyer and M. Minnegal (pers. comm., 1993)
Nakanai Range, ENB	800-900	Sep-Oct	Panoff (1972:73)
Tauri V, Gulf Prov	1000-1100	Jul-Aug	Villagers, Aug 1980
Karimui Plateau Simbu Prov	1000-1200	Sep-Oct	Hide *et al.* (1984:213)
Kagua area, SHP	1600-1800	Dec-Mar	Villagers, Nov 1990
Lai V, SHP	1700-2000	Nov-Dec	Villagers, Nov 1990
Nembi Plateau, SHP	1700-2000	ca Dec	Villagers, Sep 1979

Table 45. Reported main harvesting season of sea almond[1] *(Terminalia catappa)* at various locations

Location[2]	Harvest season	Source
Watom Island, ENB	Apr-May	Villagers, Jun 1995
Karkar Is, Madang Prov	Nov-Dec	Villagers, Jul 1991
Marind-Anim area South coast, Irian Jaya	Feb	Luyken and Luyken-Koning (1955:333)
Islands[3], MBP	Dec-Feb	Villagers, Feb 1994
Dogura area, MBP	Feb-May	Kahn (1986:49-50, 164)

Notes:

1. Known as *talis* in Papua New Guinea Tok Pisin. Also known as Java almond.

2. All locations are at low altitudes (0-100 m).

3. Villagers were asked at 16 locations on the following islands: Normanby, Dobu, Fergusson, Goodenough, Kiriwina, Kitava, Iwa, Gawa and Ianaba. The most common period was December to February, and the range of responses covered November to March. At two locations, villagers claimed that a second season occurs in June and July.

Table 46. Reported main harvesting season of galip nut (*Canarium indicum*) at various locations in Papua New Guinea, Solomon Islands, Australia, Vanuatu and Fiji

Location[1]	Harvesting season	Source
Wogeo (Vokeo) Island, ESP	Apr-Jun	Hogbin (1938-39:131)
Tanga Is New Ireland Prov	Jul-Aug	Bell (1948:247)
Anguganak area Sandaun Prov	Aug-Oct	Lewis (1975:54)
Dreikikir area, ESP	Nov Feb-Mar	Obrist van Eeuwijk (1992:190)
Keravat, ENB	Aug-Nov Apr-Jun	Aburu (1982:120)
Eastern Baining Mts Gazelle Peninsula, ENB	Jun-Aug	Villagers, Jun 1995
Karkar Island Madang Prov	Apr-Jun	Villagers, Jul 1991
Unea (Bali) Island, WNB	Jun-Aug	Villagers, Jul 1995
Hoskins area, WNB	Jun-Jul	Villagers, Jun 1995
Pomio area, ENB	Jun-Aug	Villagers, Jun 1995
Umboi Island Morobe Prov	Jun-Aug	Villagers, Oct 1991
Maclay coast Madang Prov	May-Jul	Miklouho-Maclay(1885:349)
Kandrian and Gloucester Districts, WNB[2]	May-Aug	Villagers, May 1993
Inland Kandrian, WNB	Jun-Jul	Villagers, Jun 1995
South Bougainville Bougainville Prov	Jul-Sep	Oliver (1949:57) Oliver (1955:28, 37)
Western Prov Solomon Islands	Jul-Oct	Evans (1991:56-57)
New Georgia Solomon Islands	Jun-Jul	Hviding and Bayliss-Smith (2000:99)
Other provinces Solomon Islands	Aug-Dec	Evans (1991:56-57)
Normanby and Dobu Islands, MBP	Sep-Nov	Villagers, Feb 1994
Innisfail, Australia	Aug-Sep	B. Evans (pers. comm., 1994)
Vanuatu[3]	Oct-Dec	A. Walter (pers. comm., 1994)
Fiji	Sep-Jan	Smith (1985:473)

Notes:

1. All locations are at low altitudes (0-300 m), except Anguganak (400-600 m).

2. Based on interviews in eight villages on the north and south coast of New Britain.

3. A second season is reported in March-July in Vanuatu (A. Walter, pers. comm., 1994).

Table 47. Reported main harvesting season of okari nut *(Terminalia kaernbachii)* at various locations

Location	Approximate altitude (m)	Harvest season	Source
Wewak area, ESP	0-100	Mar-May	Villagers, May 1982
Keravat, ENB	0-100	Mar-May	Aburu (1982:121)
Aria V, Gloucester area, WNB	0-100	Apr-Jun	Villagers, May 1993
Strickland V, Nomad Dist, Western Prov	100	Apr-Jun	P. Dwyer and M. Minnegal (pers. comm., 1993)
Kiunga area Western Prov	50-100	Apr-Jun	Villagers, May 1992
Mogulu area, Nomad Dist, Western Prov	100-400	May-Aug	van Beek (1987:23)
Mogulu area, Nomad Dist, Western Prov	100-400	May-Jul	Villagers, May 1992 (reported to B. J. Allen)
Putei area Tauri V, Gulf Prov	50-100	May-Jun	Villagers, May 1992
Bereina area Central Prov	0-100	Jul-Sep	Villagers, Aug 1984
Solomon Islands	0-100	Jun-Sep	Evans (1991:56)
Mt Dayman, MBP	300-800	May-Jul	Brass (1956:98)
Swanson V Gulf Prov	600- 700	Aug-Sep	Villagers, Aug 1980
Mt Sisa, SHP[1]	800	Jul-Sep	Kelly (1977:45)
Karimui Plateau Simbu Prov	1000-1200	May-Aug	Hide *et al.* (1984:213)

Note:

[1] Kelly (1977:45) gives the season for Tahitian chestnut as July to September, but this is almost certainly a misidentification for okari, as Tahitian (Polynesian) chestnut does not grow at this altitude.

Table 48. Reported main harvesting season of Polynesian chestnut[1] (*Inocarpus fagifer*) at various locations

Location[2]	Harvest season	Source
Watom Island, ENB	Jul-Aug	Villagers, Jun 1995
Gazelle Peninsula, ENB	Dec-Jan	Villagers, Jun 1995
Keravat, ENB	Jan-May	Aburu (1982:120)
Eastern Baining Mts Gazelle Peninsula, ENB	May-Jun	Villagers, Jun 1995
Nissan Island Bougainville Prov	Jun-Jul	S. Woodhouse (pers. comm., 1994)
Karkar Is, Madang Prov	Jun-Jul	Villagers, Jul 1991
Unea (Bali) Island, WNB	Dec-Feb	Villagers, Jul 1995
Pomio area, ENB	Sept-Oct	Panoff (1972:73)
Pomio area, ENB[3]	Jun-Jul	Villagers, Jun 1995
Gloucester District, WNB	Nov-Feb	Villagers, May 1993
Kandrian area, WNB	Apr-May	Villagers, Feb 1990
Islands[4], MBP	Nov-Feb	Villagers, Feb 1994
Dogura area, MBP	Oct-Dec	Kahn (1986:49-50,164)
Milne Bay area, MBP	Oct-Jan	Cheung (1980:14)
Cape Vogel, MBP	Sept-Nov	J. Mogina (pers. comm., 2002)

Notes:

1. Known as *aila* in Papua New Guinea Tok Pisin.

2. All locations are at low altitudes (0-200 m).

3. At Buka Village east of Pomio, villagers reported the main harvest as being June-July, but in certain years an extended season occurs from April to September.

4. Villagers were asked at 15 locations on the following islands: Normanby, Dobu, Fergusson, Goodenough, Kiriwina, Kitava, Gawa and Ianaba. The most common response was in the November to February period, and the range was October to March.

Table 49. Reported main harvesting season of sis *(Pangium edule)* at various locations

Location	Approximate altitude (m)	Harvest season	Source
New Ireland	0-100	Jan-Feb Jul-Aug	Peekel (1984:384)
Inland Pomio, ENB	200-600	Jun-Jul	Villagers, Jun 1995
Kandrian, WNB	0-100	May-Jun	Villagers, May 1993
Upper Karawari V ESP	200	Aug-Sep	M. Dornstreich (in Morren 1979:5)
Islands[1], MBP	0-100	Dec-Feb	Villagers, Feb 1994
Managalas Plateau Oro Prov	600-1000	Jun-Aug	Villagers, March 1982
Ivori V, Gulf Prov	600-1000	May-Aug	Bonnemère (1992:274)
Kaintiba area Gulf Prov	700	May-Aug	Villagers, Aug 1980
Paiela, Enga Prov	600-1000	Jun-Jul	F. Robinson (pers. comm., 1999)
Lake Kopiago, SHP	800-1000	Jun-Jul	N. Haley (pers. comm., 1998)
Nankina V, Huon Pen, Madang Prov	800-1000	Jul-Aug	Villagers, Nov 1991 (reported to M. Levett)
Karimui Plateau Simbu Prov	1000-1100	May-Aug	Hide *et al.* (1984:213)
Karimui Plateau Simbu Prov	1000-1100	May-Jul	Wagner (1967:11)

Note:

1. Villagers were asked at seven locations on the following islands: Normanby, Dobu, Fergusson, Kiriwina and Kitava. The most common response was in the December to February period, and the range was September to February.

Table 50. Reported main harvesting season of betel nut *(Areca catechu)* at various locations

Location[1]	Nuts most abundant	Source
Watom Island, ENB	Jun-Jul	Villagers, Jun 1995
Unea (Bali) Island, WNB	Apr-Jun	Villagers, Jul 1995
Tinputz area Bougainville	Mar-Oct	D. Tokapip (pers. comm., 1996)
Kandrian area, WNB	Feb-Aug	Villagers, Feb 1990
Nomad River Western Prov	Jun-Aug	Shaw (1990:39)
Tauri V, Gulf Prov	Jun-Dec	Villagers, May 1992
Murua area Gulf Prov	Jun-Jul	Villagers, May 1992
Islands[2], MBP	May-Jul	Villagers, Feb 1994

Notes:

1. All locations are at low altitudes (0-200 m).

2. Villagers were asked at 11 locations on the following islands: Dobu, Fergusson, Goodenough, Kiriwina, Keileuna, Kitava, Iwa and Ianaba. The most common response was in the May to July period, and the range was April to August.

Table 51. Published monthly production data for Arabica coffee

Location	Number of years	Period	Type of data	Source
Enga Prov	10	1969-1978	Mean monthly production	Carrad (1982:152)
Simbu Prov	4	1971-1974	Mean monthly production	Howlett *et al.* (1976:221, 231)
Kainantu area	2	1976-1977	Monthly production	Grossman (1984:199)
Kainantu area	7	1978-1984	Monthly production	Bourke (1988: 108-110, 328-329)
CRI, Aiyura, (13 experimental plots) and 2 plantations, WHP (6 blocks)	3	1987-1990	Monthly production	Harding (1991a: 14-16, 82-89)
Kainantu area (14 village plots)	3	1987-1990	Monthly production	Harding (1991b: 9, 57-61)

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compiled by Suzanne Ridley, Australian Writers Services

This book describes the production patterns of 180 economic crops in Papua New Guinea, that is, the seasonality of production (or the lack of it) and year-to-year variation. It is based on extensive field recordings of availability of food and cash crops. The data sources are long-term market surveys; purchase figures for a government-run fresh food wholesaler; interviews with villagers; observations of village agriculture; experiments on research stations; and literature reviews. The data runs are between 1 and 22 years long, with most 3 to 5 years.

Thus the book is based on solid empirical evidence with exceptionally long data runs. For each crop, the producing pattern is described in terms of continuity of supply, seasonality and variation within the seasonal pattern. The information comes from all major environments in PNG which is unusual for such a diverse nation.

Where sufficient data are available for a crop, it is analysed to examine the relationship between the production patterns for that crop and environmental factors, such as temperature, day length and rainfall. The social contribution to the patterns observed are also noted, in particular, the influence of the local agricultural system.

Because the data sets are so extensive, the book will form a benchmark for future studies on crop production and the impact of climate change on crop production in the Pacific. The information provided here is basic for agricultural development in Papua New Guinea, and elsewhere in the Pacific.

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