# GROWING INTRODUCED VEGETABLES IN THE LOWLANDS

## 3. THE GREEN VEGETABLES

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### INTRODUCTION

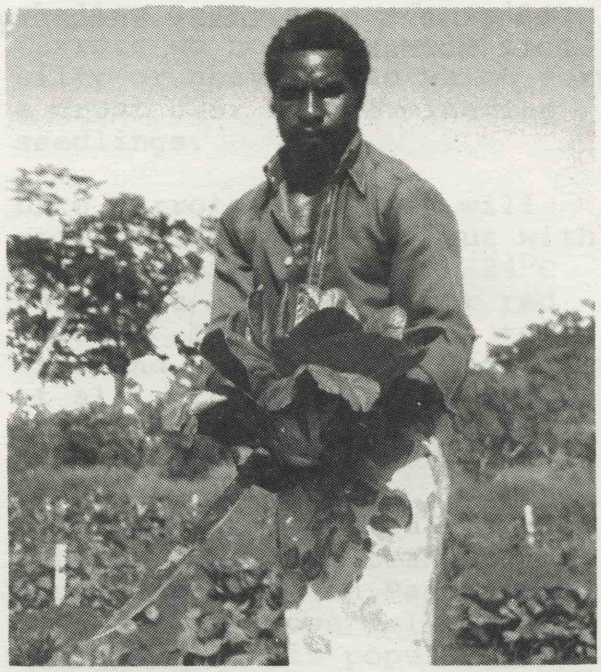
In the first article in this series of four papers, we discussed the lowland environment (climate) in Papua New Guinea. In this article, we discuss the green vegetables. The other vegetables were discussed in the second article.

Green vegetables are a popular and important part of the main meal each day for many people. The green vegetables used in temperate countries are different from those traditionally grown or gathered in Papua New Guinea.

In temperate countries the most important green vegetables are members of the cabbage family. English cabbage, Chinese cabbage, Pak choi and Brussels sprouts are used for their leaves. Cauliflower and broccoli are grown for the white or green heads, or curds. Other green vegetables used cooked, include silverbeet, spinach and New Zealand spinach. Two important salad vegetables are lettuce and celery.

### CABBAGE FAMILY

The dark green leaves and thick white stems of Pak choi are a more popular vegetable in the tropics than in temperate climates. Pak choi grows quickly and well in the lowlands.



*Pak choi*

English and Chinese cabbage are grown for the large firm heads with tightly packed leaves. They are important market vegetables because they store and can be transported well.

Chinese cabbage is more popular in Japan and China than Europe, but it is becoming better known in other temperate countries. Both these types of cabbage grow best where the average

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*Chinese cabbage growing beside a traditional green - water kaukau or kangkong*

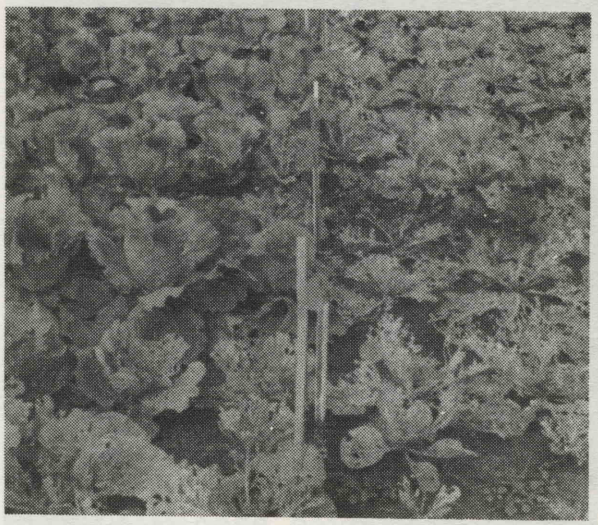
daily temperature is 15-20°C. Where the mean daily temperature is above 24°C, Chinese cabbage forms soft heads. Tying a string around the head of Chinese cabbage will make it form a firm head. Better still, varieties have been bred in Japan and Taiwan which form good firm heads in the tropical lowlands.

If the average daily temperature is above 24°C, English cabbage does not grow. However heat tolerant varieties have been bred in Japan and Taiwan which will grow well in the lowlands of Papua New Guinea. Above 700 m heat tolerant varieties are not needed.

At the higher temperatures in the lowlands, there are two other problems with cabbage. Chinese cabbage often becomes infected with bacterial soft rot, which causes the plant to die a few days before it is ready for harvest. However there are now some varieties which are resistant to this disease. For more information about bacterial soft rot, see Plant Pathology Note, No. 18 (Harvest Volume 8, No. 3, pp. 141-144, 1982).

The other problem is an insect pest called diamond-back moth. The young larvae of this moth eat the leaves of all the cabbage family. This insect occurs in the highlands too, but at warmer temperatures it grows more quickly. Unfortunately no varieties of English or Chinese cabbage are resistant to this insect. Because new larvae grow so quickly, spraying the plants with an insecticide does not always give good control of the insect.

We have found that it is better to grow one crop of the cabbage family, then remove and compost, bury or burn all the old plants before sowing seed for a new crop. The new crop should be planted on different ground. These practices help prevent insects and diseases building up to very high numbers in the garden. (See Entomology Bulletin No. 8 in HARVEST Volume 8, No. 1, pp. 26-28 for more details).



*Cabbage. On the left, sprayed to control diamond-back moth caterpillars. On the right, unsprayed*

The Brussels sprout plant first grows a leafy stalk up to 1 m tall. Later on, the sprouts, which are like baby cabbages, grow at the base of each leaf up the stem. The Brussels sprout plant grows well at higher temperatures, but for good firm sprouts to develop, the temperature must drop below 8°C every night. So this crop cannot be grown in the lowlands, or even in most parts of the highlands.

Cauliflower and broccoli start growing like cabbage. First the young plants only grow leaves. When they get to a certain age, the growing tip changes from producing leaves to producing the young head or curd. After that stage no more leaves are formed.

There are two main groups of cauliflower varieties. The largest group is the temperate types. Normally, these will only grow curds when the maximum daily temperature is below 20-25°C, and about 17°C is best. If the temperature is higher than this, they keep growing more leaves and do not produce a curd. The other group is the tropical cauliflowers. These originally came from India. This type will form curds when the average temperature is as high as 28-30°C. This is the type to grow on the lowlands.

*Cauliflower*

Many of the temperate varieties of cauliflower produce curds which are well covered by leaves until the curd is ready to cut. This keeps the curd white. The tropical cauliflowers have open leaves which do not cover the curd while it is growing. So when the curd is ready to harvest it has been yellowed by the sun. The curd of these cauliflowers can be kept white if the leaves are tied over the curd, once it starts growing.

Broccoli is easier to grow on the lowlands than cauliflower. Almost all varieties of broccoli will form heads at the temperature in the lowlands. But some varieties give better results than others.

All the members of the cabbage family grow well on soils that would be too heavy for some other vegetables.

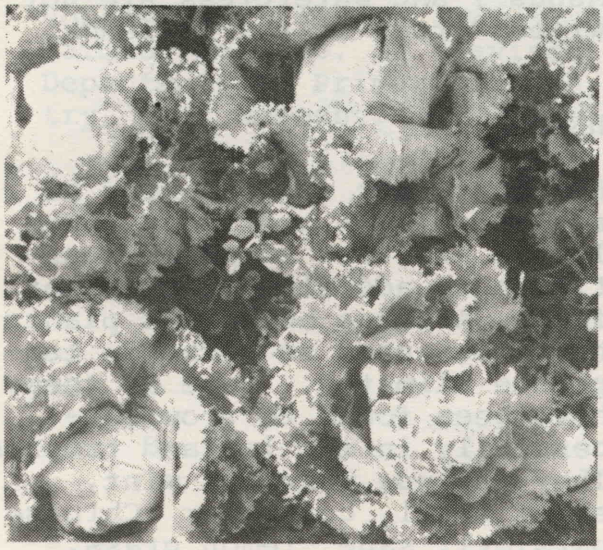
## SALAD VEGETABLES

There are two temperature problems to be overcome before lettuce can be grown in the lowlands. Soil temperatures of 15-22°C are best for the germination of lettuce seed. When the soil temperature is above 25°C many varieties of lettuce do not germinate well, and above 29°C they do not germinate at all. High temperatures stop the seed from taking up water to start germination. This can easily be overcome by slightly wetting the seed and placing it in a fridge or an airconditioned room for two days before it is sown.

The other temperature problem with lettuce occurs during growth. Lettuce grows better where the maximum daily temperatures are below 24°C. At higher daily temperatures lettuce still grows but many varieties grow a seedstalk instead of forming a firm head. This

is called bolting.

Good, although small, lettuces can be grown in the lowlands, if they are watered regularly (every 2 days when there is no rain), and a variety which does not bolt to seed quickly is used. Better size lettuces are grown above an latitude of 700 m in Papua New Guinea.



*Small heads of Minetto lettuce growing at Laloki*

Celery is not suitable for growing in the lowlands. Like lettuce, the seed will germinate if it is wetted and put in a cool place. But celery will not grow when the average temperature is above 24°C. 15-20°C is ideal. Celery can be grown above an altitude of 900 m in Papua New Guinea. However there is a closely related vegetable called Chinese celery which does grow well in the lowlands. Because the stems are thinner and tougher to eat, it cannot be used raw in salads, but cooked it has the same flavour as celery.

OTHER GREEN VEGETABLES

Silverbeet or Swiss chard can be grown in the lowlands. It grows best between 18 and 27°C. Because lowland temperatures are near the higher end of this range, silverbeet is best grown during the cooler season.

Spinach and New Zealand spinach cannot be grown in the lowlands. Spinach grows best where average temperatures are from 10 to 20°C, but it will grow at higher temperatures. However, in short days, the higher the average temperature, the quicker spinach bolts to seed. In Papua New Guinea, spinach can be grown above an altitude of 1000 m.

Asparagus is a perennial vegetable. In temperate climates the young stalks start growing from the roots in early spring. They are harvested for three months. Then the plant is left to grow leaves and store up food in the roots for next year. Over winter, the leaves die and the plants remain dormant. In the tropics, asparagus keeps growing all year.

*Asparagus at Ilimo Farm. The new stalks ready for cutting can be seen at the base of the mature fronds.*

The Taiwanese have developed a method for growing asparagus under tropical conditions. The seedlings are grown in a nursery then they are transplanted

into the field, and left to grow for about 6 months. Then a trellis is made down the row and three or four fronds from each plant are tied up to it. The leaves on these fronds make the food to keep the plant growing. All the other fronds are cut out. As the new stalks grow, they are harvested for market. When the mature fronds start to die, young stalks are left to grow to replace them. Harvesting continues all year round, but regular applications of fertilizer and irrigation during dry periods are needed to keep the crop growing. In Taiwan, asparagus grown like this has been harvested for 15 years.

Some other introduced green vegetables are okra, basella, talinum and watercress. All these grow in the lowlands although watercress does better at high altitudes.

*Basella growing behind cabbage at Laloki*

Okra is an important vegetable in other tropical countries, but it is not grown widely in Papua New Guinea. There are two types of basella (Ceylon spinach), green and red leaf. This crop grows very well in the lowlands and is not usually damaged by diseases or insects. It is becoming popular in institution gardens. Talinum ('Kumu Manus') and watercress are not widely grown in the lowlands.

## HERBS

Herbs are not usually used as a vegetable on their own. The leaves are used in small quantities to add flavour to other food. A large number of plants have been used as herbs in temperate climates. Some of these have been found to grow successfully in the lowland tropics. They include parsley, mint, sweet basil, coriander (Chinese parsley), sage, lemon grass, Chinese mustard and sorrel.

## VARIETY RECOMMENDATIONS

Trials on many of these crops have been carried out at Laloki during the last 10 years. From these trials good varieties for growing in the dry Papuan lowlands have been found. Trials in other lowland areas of Papua New Guinea have shown that these varieties also grow well elsewhere. In the fourth article in this series, the recommended varieties are listed for each crop.

## FURTHER READING

Blackburn, K.J. (1976). Observations on the selection and management of introduced vegetable varieties under Port Moresby dry season conditions. In *1975 Papua New Guinea Food*

*Crops Conference Proceedings*. K. Willson and R.M. Bourke (Eds). Department of Primary Industry, Port Moresby. pp. 163-186, 381-384.

Bourke, R.M. *et al*. (1983). *Leafy Vegetables*. Farming Note No. 27. Department of Primary Industry, Port Moresby.

Bull, P.B., Blackburn, K.J. and Voight, A.E. (1983). *Vegetables*. Farming Note No. 10 (Revised). Department of Primary Industry, Port Moresby.

Kemp, C. (1976). Trial work with introduced vegetables in West New Britain. In *1975 Papua New Guinea Food Crops Conference Proceedings*. K. Willson and R.M. Bourke (Eds). Department of Primary Industry, Port Moresby. pp. 187-204.

Thistleton, B.M. (1982). Control of diamond-back moth in brassicas. Entomology Bulletin No. 8 (Revised). *Harvest* 8 (1):26-28.

Tomlinson, D. (1982). Bacterial soft rot of vegetables. Plant Pathology Note, No. 18. *Harvest* 8 (3): 141-143.