He Kōrero Kōrari

Number 10 **April 2001**

Contents

Manaaki Whenua
Landcare Research

Under new management

Tēnā koutou, tēnā koutou, tēnā koutou katoa.

Welcome to the 10th issue of He Kōrero Kōrari. As reported in the last issue, I have taken over the compilation of this newsletter, so that Warwick Harris can concentrate on the important task of analysing the reams of data that have been collected on both harakeke and tī. Some folk have asked when the results of the harakeke evaluation trial will be available. It will be some time yet, because the statistical analysis required is very complex - so much so that Warwick's computer software can't actually cope with the task and we've called on Ray Webster, the biometrician for Manaaki Whenua, to help out. Once the number-crunching has been carried out, the information needs to be interpreted and written up for publication.

Although the regular six-monthly visits to measure the growth of harakeke are over, we like to look in on trial sites if we're in the area. Family events have taken Warwick throughout Aotearoa in the past six months, and he's taken the opportunity to visit the Otākou, Omaka, UNITEC and Ruamata sites. A report on these sites, along with Taumutu and Lincoln, is on page 2.

Warwick was invited to give a presentation about the weaving variety evaluation trial at the Nga Puna Waihanga hui held at Te Aute College in early December. He shares his impressions on page 4.

Just as interest in weaving continues to flourish, interest from the science community in the physical properties of harakeke is also growing. Two scientists from Industrial Research Ltd (IRL), at Lower Hutt, discuss their projects in this issue. We also talk about harakeke's role in reducing the effects of global warming!

Another feature discusses a very rare phenomenon in flax, where fans of leaves grow from the kōrari. We have such a plant growing here at Lincoln. If you have noticed an unusual looking bush like this in your area, we'd love to hear about it. Our contact details are at the back of the newsletter.

In **Tī Time**, Warwick reports on his latest observations of the tī growing in the provenance trial. In a special article, *'Why are some seedlings of tī kōuka green and*

others red-brown?", Warwick discusses the research paper that was published last year in the *New Zealand Journal of Botany.* Ross Beever gives an update on Sudden Decline. We also profile Philip Simpson's marvellous, definitive book on tī, "Dancing Leaves".

Sue Scheele

Harakeke weaving variety evaluation – site observations

Since *Newsletter No. 9* I have been able to visit several of the harakeke weaving variety evaluation sites in the course of travel independent of the evaluation. This has provided an opportunity to take notes on how the sites are being cared for, whether there has been harvesting for weaving, and what plants have flowered. These notes are recorded here in the order of the time they were made as an ongoing record of the evaluation.

Otākou Marae

Otākou Marae was visited on 18 October 2000 when I went to Invermay to record the growth of the tī. The plants were in excellent condition and the site was tidy and well cared for. There was no sign of flowering. In October 1999 *Paoa* plants had emerging kōrari that were developed to a size where they could be cut off. This suggests that few of the plants at Otakou flowered in Spring 2000.

Omaka Marae

A visit to family in Blenheim on 27 December 2000, at the time that fire swept through the dry Wither Hills above the town, provided an opportunity to visit the planting at Omaka. The airfield next to the marae was busy with helicopters and fixed-wing aircraft filling up with water to control the fire. The planting was in excellent order, the cleaning of the plants that was underway in September 2000 was completed, and all plants have responded well to the irrigation system that has been set up. All three *Paoa* plants had flowered with four kōrari on one plant and two each on the others. None of the other plants had flowered.

UNITEC

Travel to a family wedding in Auckland allowed a visit to the planting at UNITEC on 20 January 2001. This was a Saturday and I had the experience of being approached by a security guard and asked what I was up to. After I gave my identity and purpose, the security guard told me the UNITEC weavers were concerned about unauthorised people harvesting leaf from the pā harakeke. There was also concern about unauthorised harvesting of watercress from the stream next to the planting. It is good to know these resources are valued. Marked yellowing of some of the plants, notably the *Kōhunga* and *Tapamangu* in the row by the stream, raises suspicion of yellow leaf disease.

The use and care pattern of the plants at UNITEC noted a year before was reinforced by the current condition of the plants. Some had been heavily harvested, a few excessively so, and these plants were thoroughly trimmed and cleaned. With the bases of their fans perched above ground level, and having been over-harvested, the three *Paoa* plants are struggling to survive and are no longer a useful source of leaves for weaving. The surviving fans should be replanted in a separate planting and then be allowed to grow to where they can sustain an adequate supply of this popular variety. The varieties that have not been harvested or trimmed are being seriously disfigured by fungal disease and scale. These observations reinforce my opinion that a few well-cared-for harakeke plants of varieties selected to meet the needs of an active weaver or groups of weavers are an asset, whereas plantings of many varieties little-used by weavers become a burden.

The pattern of flowering in spring 2000 at UNITEC is interesting and is recorded for the varieties that flowered as: number of plants of the variety that

flowered (numbers of kōrari per plant that flowered):
Arawa 1 (1); *Ate* 3 (3, 6, 3); *Hūhiroa* 1 (10); *Kōhunga* 2 (3, 1); *Ngaro* 1 (1); *Oue* 2 (4, 4); *Parekoretawa* 1 (2); *Tāpoto* 1(5).
The normally free-flowering *Paoa* plants had no kōrari probably because they have been overharvested. The other varieties that did not flower were *Māeneene*, *Paretaniwha*, and *Tapamangu*. In total there were 43 kōrari compared to 41 for the 1999 spring flowering and 82 in 1998. The flowering of all the *Ate* plants in what was overall a poor flowering year for flax is especially interesting as Rene Orchiston recorded it as a variety with "no kōrari".

Ruamata Marae

The Ruamata Marae planting was visited on 20 January 2001, when I returned from Auckland to stay with my oldest daughter Lise and her family in Rotorua. On arriving at the marae I told people enjoying a swim on a hot day in the kura kaupapa pool of my purpose for being there.
Finding a path to the Ruamata Marae pā harakeke was difficult amongst the tangle of rapidly spreading blackberry shoots. Once amongst the plants I could see that all but a few have now reached a size where they could supply a good quantity of weaving leaf. There were only three kōrari, one each for plants of *Kōhanga*, *Paoa* and *Tapamangu*.

Just as I finished observing the plants a woman who had arrived to collect children from the pool came and challenged my presence on the site. She said she was one of the owners of the land where the harakeke are planted. She did not know the harakeke were there but was happy after I explained how the planting came to be through the participation of Emily Schuster, Hiko Hohepa and Blanche Hohepa-Kiriona. An issue that arose from our discussion is that my idea that the planting could provide a useful teaching resource for the kura kaupapa could only happen with the approval of the marae people. If this planting is not used and valued as a resource for weavers or teaching it will soon be overwhelmed with blackberry.

Taumutu

On 7 February 2001, I hitched a ride to Taumutu with Sue Scheele who was going to Southbridge for discussions with Cath Brown. The previous visit to the site was in May 2000 so there was plenty of tall grass between the plants and over the matting around them. I spent 4 hours pulling grass off the matting and from the base of the 36 measured plants and did a quick trim of dead and senescent leaves. A tired back and aching limbs after this exercise made it clear that I could not have embarked on the Harakeke Weaving Variety Evaluation as happened in spring 1995 at my present age and state of fitness. The plants at Taumutu are all healthy and, depending where they are according to the areas of deeper and moister soil, 17 are large enough to be harvestable, 14 are progressing to a useful size, and 5 remain as weak plants with few fans. None of the plants flowered in spring 2000.
The kāretu planted at Taumutu struggles to survive against smothering by twitch and other creeping grasses. Ten of the tī

Warwick busy trimming and weeding harakeke at the Lincoln evaluation site

kouka planted have grown above the smothering effect of the grass and add to the interest of the site. Several large beef cattle in the paddock next to the planting loom as a threat to the harakeke should they break the fence.

Lincoln

I look at the Lincoln harakeke frequently, especially during spring and summer when following the flowering and fruiting of the tī . I had planned to spend more time on the planting, following when plants started and stopped flowering and shed seed, but only two plants, both *Paoa*, flowered, each with a single kōrari. The flowers of these plants were first open on the week starting 20 November 2000, just a week after the beginning of flowering in 1999.

The plants at Lincoln are now large, generally healthy and able to provide a large quantity of good quality leaf for raranga and muka extraction. However, their size means that they are more difficult to care for. It is no longer possible to run the sit-on rotary mower between them as the mower blades get tied up in the fibre of the leaves. To clean one plant now would take as long as it took to clean all the plants in the early years of the evaluation. The thoughts of the effects on my body of lengthy squatting and kneeling by plants to clean them has been a real deterrent to making a start on the task! If there were weavers harvesting leaves, the task of cleaning would be much easier and there would be more reward in doing it. Luckily, we need a lot of leaves for the raranga evaluation taking place in April, so the bushes will get a thorough clean then.

Warwick Harris

Ngā Puna Waihanga hui – December 2000

An opportunity to talk about the weaving variety evaluation came with an invitation from Jacob Scott and Bana Paul to give a presentation at the national Nga Puna Waihanga hui at Te Aute College early in December 2000. This was the first national gathering of Nga Puna Waihanga for some years and the organisers were uncertain how many people would attend. The programme was a broad one covering many aspects of art, writing and film. Ata Putaranui had a leading role in organising the hui and she was efficient in arranging my travel and accommodation at Te Aute College. Staying at a boarding school brought back memories of the 11 years I spent at such an institution. I was envious of the facilities the students of Te Aute now have, even though some may still see them as spartan. I would have liked to have stayed in the house named after that famous son of Te Aute, Te Rangi Hiroa, because of his contributions to ethnobotany, but in the world of politics my stay in the house named after Apirana Ngata would have more prestige.

A key item of the hui was the launching of what has been given the tag name " Māori Mark" - effectively a trademark to identify art and traditional craft articles that are authentically Māori and produced by Māori. For my minor part in the hui I prepared a slide show of the history of the harakeke weaving variety evaluation starting from the inaugural national hui of the Aotearoa Moananui a Kiwa Weavers at Tokomaru Bay in 1983 and the Te Teko hui in 1984, and leading on to the Commonwealth Science Council Biological Diversity and Genetic Resource project on traditional uses of plants in Aotearoa and the South Pacific led by Geoff Walls, the establishment of the Rene Orchiston Harakeke Collection at Havelock North and Lincoln, the consultations leading up to the establishment of the plantings, the progress of their growth, and the current series of raranga, muka and piupiu quality assessments.

A slide show is a good way to show this history, but a slide projector,

a darkened room, and a surface to project the slides on is needed to do this. None of these items were immediately available at Te Aute. In the end a projector was found, but not being able to find an extension cord, it was only possible to show images about the size of a TV screen on the wall of the partly darkened mathematics classroom. This classroom was remote and up a hill from the centre of activity of the hui. I set up the classroom, waited until the korero about the "Maori Mark" had run well past its given time, and then waited even longer until Bana and a small party of people who were interested in the topic finally found the classroom. These folk would have preferred to have been preparing harakeke and weaving while listening to my talk, but a place to do this was not found at Te Aute.

My frustration about these arrangements was removed by the interested and warm reaction of the audience to the story of the harakeke weaving variety evaluation. While the possibility of a repeat presentation after lunch was discussed it was better for me to sit and watch the small group of weavers at the hui develop their skills of raranga with the expert guidance of Bana.

Warwick Harris

A closer look at harakeke – the IRL projects

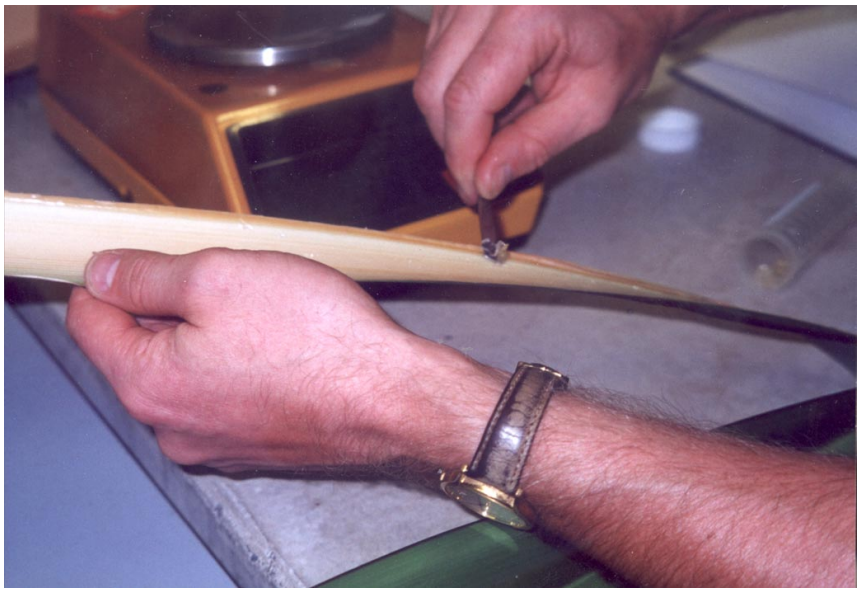
In February we had a visit from **Ian Sims**, a scientist at Industrial Research Ltd (IRL). Ian is interested in finding out more about the soluble carbohydrates and gum present in harakeke leaves and gave us this information about his research.

Soluble carbohydrates

Harakeke is now included in the family of plants called Hemerocallidaceae, and in the grouping above that, the order Asparagales. A number of other species within the Asparagales contain polysaccharides (complex carbohydrates) called fructans, which contain both sucrose and some fructose residues. These other species include onions, garlic, leeks, asparagus, cabbage trees, and agaves. Fructans play an important role in human diet. They encourage the growth of beneficial gut bacteria and inhibit the growth of harmful ones. Fructans from chicory and Jerusalem artichoke (inulins) are sold commercially as dietary supplements and are also incorporated into some processed foods (e.g., some yoghurts and icecreams). Inulins are also added to some pet foods for their beneficial health effects.

Ian and his group have been looking at the accumulation of carbohydrates, especially fructans, in harakeke leaves. The natural levels of water-soluble

Ian Sims, IRL. Ian scrapes gum from the leaves (see over) and places it in a test tube for later analysis



carbohydrates are highly variable, depending on season and climatic conditions. Leaves cut from the plant and illuminated continue to synthesise carbohydrate through photosynthesis, but cannot export that new carbohydrate to the rest of the plant. It is hoped that this carbohydrate is stored in the leaves as fructan. The team know that the fructans extracted from harakeke leaves are structurally distinct from chicory and Jerusalem artichoke. It is possible then that the harakeke fructans may have an even more beneficial effect on bacteria in the intestinal tract than the latter plants.

Harakeke gum

Many of us already use the gum that exudes from the base of harakeke leaves to heal cuts and sores on our hands (useful in the garden), and for applying to eczema.

Ian is starting a project to examine the structure and physical properties of the gum. He is also interested to know if there is much variation in yield, and while he was here at Lincoln, Ian collected gum from one fan of five different harakeke varieties: *Kōhunga*, *Tāpoto*, *Ngaro*, *Whahariki* and *Awahou*. *Kōhunga* and *Tāpoto* produced the most gum and Awahou the least. The gums of *Whahariki* and *Tāpoto* were more viscous (thick and sticky). There hasn't been any published research into the physical properties of harakeke gum since the 1950s, so it is timely that IRL are interested in adding to our knowledge about this special substance.

Why does fibre from different harakeke vary in its properties?

Tony Davidson at IRL is looking at the plant cells of harakeke. He is interested in Helical Crystals ("helical" means shaped like a spiral or spring), which occur in the micro fibres in the walls of the cells. Tony is testing the idea that differences in the way these cellulose crystals are oriented account for the different properties of harakeke fibre, such as strength, lustre, hardness and colour. Tony will examine leaves of about 10 varieties and test crystallite orientation by X-ray diffraction, and cell shapes and wall thickness by optical microscopy. Tony expects that differences in cellulose crystallite orientation will be responsible for some of the differences in fibre properties.

Sue Scheele

Harakeke – helping combat the effects of global warming!

Another recent request for access to the plants at Lincoln was made by Larry Burrows, an ecologist at Manaaki Whenua, Lincoln. He is interested in plants that can grow and accumulate biomass as a means of fixing carbon to reduce the effect of atmospheric CO_2 on global warming. Growing harakeke and also tī kōuka for this purpose would have the added value of providing food

and habitat for native species as well as plantings that are in harmony with New Zealand's natural landscape. Larry would like to know how much biomass can be accumulated by stands of harakeke and tī kōuka. The answer to this question is not all that simple. Although Sue and I were able to give Larry leads to relevant information, there are no existing measurements that specifically answer his question. We may be able to lead him to plants of harakeke and tī kōuka that can be dug up, weighed, and used along with information about the growth and yields of the species grown as commercial crops to provide good estimates of potential carbon accumulation.

Warwick Harris

A most unusual flax

"What's wrong with that flax?" ... "That flax looks seriously weird"... are some comments heard from folk who notice the unusual whaririki (*Phormium cookianum*) that grows near the entrance to the Herbarium at Manaaki Whenua, Lincoln.

The whaririki is a tall, robust bush with coarse, drooping leaves. The peculiar features are the kōrari. At the joints on the scape or stem where you would expect the branchlets to emerge that carry the flowers and seed capsules, clusters of new leaf fans appear. Fans growing lower down the scape have tended to brown off and die, but at the top end of the kōrari, the clusters of leaves are much thicker. Some of the kōrari have become so heavy with the amount of vegetative growth they carry that they lie flat on the ground. The leaves on these secondary fans vary from 10 cm to 100 cm in length. Several of the fans, while still attached to the scape, have developed short aerial roots. I suspect that if the kōrari were not lying over a concrete path, these fans would take root in the ground.

The whaririki outside the Herbarium, Manaaki Whenua, Lincoln. Fans of leaves (vivipars) spring from the kōrari

This kōrari is weighed down by the large vivipars that have grown at its tip

Some of the fans have moved into a flowering phase. These unusual growths have within months produced their own little kōrari, about 30 cm long, with a few yellow-green flowers, followed by long skinny twisted capsules. (Normally flax grown from seed takes at least 6 years to mature).

This unusual condition is called vivipary and it is rare among New Zealand plants. Mangroves provide the best example of true vivipary, where the seed continues to develop while still attached to the mother plant, growing to a considerable size before dispersal. Some terrestrial plants, such as grasses and rushes, can also produce plantlets (bulbils) on their flowering stems that are capable of independent growth. Botanists have suggested that this kind of "vegetative switching" – most common in arctic, alpine and arid regions – has evolved in response to a short growing season and a lack of suitable sites for seeds to germinate.

The condition is very rarely seen in flax. In 1882, the Rev. Philip Walsh gave a talk about "a very remarkable abnormal growth" he found on a harakeke bush on the banks of Papatiki stream (north of Urenui in northern Taranaki). The harakeke was growing in a large patch of "ordinary flax". Walsh described the vivipars growing on one of the kōrari. He was struck by the fact that the stalk was still green though it was August, when ordinary kōrari are dead and dry.

In 1896, William Williams, the Bishop of Waiapu, was walking at Blackhead Beach (Hawke's Bay), when he noticed a whaririki bush in seed, with the capsules surrounded by dry leafy material. He planted a few of the seeds and recorded what happened with one of the resulting plants. In 1900, the only kōrari produced grew one or two abortive flowers, and clusters of leaves about 30 cm long where normally flowers would grow. In 1901, the plant produced four kōrari a little over 1 m in length, with leaf clusters at the end of the scapes up to 60 cm long. In 1902, the four kōrari produced were over 2 m tall and produced flowers and seeds in the normal way. However the seeds did not start to ripen until early May, and by the end of June (when Bishop Williams wrote his paper) there were still unripe capsules on the bush. During the summer, the upper ends of the korari began to be clothed in leaves. The growths on the korari of the previous season (1901) were still green and fresh and one had produced a scape about 45 cm long, "which bore a few flowers and ripened seed". Bishop Williams recorded that, since then, other flowers had been produced in August and September.

This unseasonal growth pattern is typical of a viviparous flax. Two well-known New Zealand botanists, H. H. Allan and Lucy Cranwell, carried out some breeding work on

Some vivipars have produced flowers on the secondary kōrari

Long, twisted seed capsules have developed on some vivipars

plants that were almost certainly descended from the plant cultivated by Bishop Williams. They found that although the appearance and flowering of the secondary kōrari was commonest in early December (like the Herbarium flax), "they matured in August, September, May and June, as well, often with abnormal flowers". New primary kōrari developed in January and February. Flowers, both normal and abnormal, appeared on the lower part of the scape, and vivipars (fans of leaves) on the upper part.

We're trying to find out whether the Herbarium plant is descended from Bishop William's plant. H.H. Allan was the first director of Botany Division, DSIR, and it may have come from his collection.

Meanwhile, I've gathered seed from the Herbarium whararikiand if it germinates, I'll grow a few plants on to see whether they are also viviparous. I'll also plant out some of the vivipars that have developed aerial roots. Allan and Cranwell's observations showed that the viviparous habit is inherited and that environmental conditions have only a secondary influence. That view is supported in a review of vivipary in flowering plants undertaken by Elmqvist and Cox in 1996.

Peter Johnson, based at Manaaki Whenua, Dunedin, is also growing some youngsters that he found perched on old kōrari on a whararikigrowing on the south side of Coromandel Harbour.

It is a pity that the Herbarium whararikiis not a high-quality weaving harakeke – vivipars are clones of the parent plant and planting them could provide a quick means of building up stock!

Sue Scheele

Tī time

The event most warranting a tī party in recent times has been the launching of Philip Simpson's book

Warwick observing fruit ripening on tī

"Dancing Leaves. The story of New Zealand's cabbage tree, tī kouka" in December 2000. The book is remarkable for the breadth of its coverage of all aspects of tī kōuka and is lavishly illustrated. In the thoroughness of his coverage Philip provides information about the tī provenance evaluation, and as a likely extension of the evaluation, a section of the book gives beautiful images of articles made from tī that he sought out from museum collections and the few contemporary users of tī fibre. Sue Scheele profiles the book as a special item for this Newsletter.

In a way I have come to be "dancing with cabbage trees" in a weekly ritual at Lincoln. This dance has the steps of moving between the rows of trees with an aluminium ladder over my shoulder, stopping at flowering trees, climbing the ladder, observing the state of flowering and progress of fruit ripening, climbing down the ladder and recording the observations, and then waltzing on to the next flowering tree to repeat the steps.

In 1998, 36, and in 1999,111 tī kōuka trees flowered at Lincoln. The flowers and fruits of most of these could be observed at eye level without a ladder. This year most of the inflorescences of the 44 trees have to be viewed from a ladder, some from the precarious highest steps. Another way of getting up to them will have to be worked out in order to follow the flowering and fruiting and measure inflorescence and fruit dimensions next year.

The smaller number of flowering trees in spring 2000 than in 1999 is surprising both because Bob Brockie's observations of the patterns of cabbage tree flowering predicted that 2000 should be a good flowering year and more of the trees should have reached the maturity required for first flowering. When I visited the Invermay planting on 18 October 2000 only one tree with an inflorescence was found although Bruce Smallfield tells me a few more developed later.

However, when I visited the Mount Albert and UNITEC plantings on 20 January 2001, I counted 30 flowering trees, which was many more than had flowered there in earlier years. Some of the trees had ripe fruit, 3 weeks earlier than fruit first ripened at Lincoln. The trees at Auckland are now taking off in their growth after lagging behind the trees at Lincoln and Invermay for several years. This is because of the delay in their planting in the field and also the effect of matting at Lincoln and Invermay reducing competition from grass and weeds around the plants. Thus the Auckland trees have taken longer to reach the size/maturity needed for first flowering and are out of step with the trees at other sites

Warwick waltzing with a full-skirted tī

in regard to whatever natural stimulus determines years of prolific tī kōuka flowering. Ross Beever has been making crosses between a selection of the flowering trees at Mount Albert Research Centre as a precursor to genetic studies using molecular marker techniques.

Late in 2000 I put a concerted effort into recording the characteristics of the leaves and their arrangement on the tī kōuka at Lincoln. This included the size, shape, thickness and colour of the leaves and whether leaves are curved and floppy or stiff and erect. Preliminary analysis of this data had revealed very interesting differences between the populations for all these characters, many of which are linked to the latitude of population origin. The trees are at an interesting stage in regard to the form of their skirts of dead leaves, most of which cover the full length of the trunk below the green tuft. Some skirts are curvaceous and others are straight and slim. There are even some bare-topped beauties from particular localities (populations) where trees have begun to shed their dead leaves on the upper part of the trunk while older dead leaves remain attached on the lower part of the trunk. Perhaps this is why "dancing with cabbage trees" is fascinating.

Together Ross Beever, Stephanie Parkes and I made another year's record in spring 2000 of the height and trunk growth of the trees at Auckland, Lincoln and Invermay. Meanwhile, Ray Webster, Manaaki Whenua biometrician located at Lincoln, has been doing complex analyses of the growth data from the earlier years. This is producing results that tell us much more about differences in the growth rates and seasonal patterns of growth of tī kōuka from different regions of New Zealand.

By bringing tī kouka from different places and growing them together under uniform garden conditions we are in a sense allowing them to tell the story of their differences. Our task can be seen to be to translate their language and record their story. A second chapter in this translated story was published in the period of this Newsletter. A summary of this paper is given in the item "Why are some seedlings of tī kouka green and others red-brown? ".

Warwick Harris

Why are some seedlings of tī kouka green and others red-brown?

Warwick Harris & Ross Beever 2000: Genotypic variation of seedlings of wild populations of *Cordyline australis* (Lomandraceae) in New Zealand. *New Zealand Journal of Botany* 38: 595–606.

First, it may help understanding of the paper to explain the meaning of some of the words in its title. "Genotypic variation" relates to differences between individuals of a species that can be seen to be caused by different states of genes (alleles) inherited by those individuals. Straightforward examples of genotypic differences are blue and brown eyes for humans and red and white flowers for many species of flowering plants. These are examples of characters that are not readily altered by the environment in which the individual who inherits them develops and grows.

However, expression of many genes is modified by the environment. For example, plants have the genetic potential to develop to a specified size. If the environment in which they develop does not have enough water or mineral nutrients for their requirements, their mature size will be less than their potential size.

"Phenotypic variation" relates to differences between individuals of a species that result from environmental modification of the expression of the genes the individuals inherited. The first step in the tī kōuka provenance

evaluation was to go to wild stands and observe trees to determine if their characteristics differed between stands. The differences observed were called phenotypic because the effects of the genes possessed by the plants and the environmental effects on the form of the trees could not be separated. Consequently, the title of the paper that described differences between the wild stands of tī kouka was "Phenotypic variation of leaves and stems of wild stands of *Cordyline australis* (Lomandraceae)".

The classic way to separate the genetic and environmental influences on the characteristics of plants within a species is to raise them from seed and grow them in the same environment. Thus we gathered seed from wild stands of tī kouka at widely separated sites in New Zealand, sowed all the seed at the same date, and then have allowed the resulting plants to grow to maturity in uniform garden environments. We have grown the plants in three different garden environments (Auckland, Lincoln and Invermay) to see if the genetic differences between the populations of plants from the different wild sites are expressed differently in those gardens.

These days DNA fingerprints can directly distinguish genetic differences between individuals. But these techniques do not indicate how chemically defined genetic differences are expressed as characters, especially complex characters subject to environmental modification.

Cordyline australis is the binomial scientific name of the plant known to Māori as tī kouka (and several other names) and cabbage tree is the common English name. At other times and in other places it has been given different English names such as Palm Lily and Torquay Palm. Once the taxonomic relationships of a species is fully understood, it has only the one scientific name consisting of a generic name and a specific name, but it can still be known by several different common names. Philip Simpson in "Dancing Leaves" gives the complex history of the derivation of the scientific name of tī kouka.

Latin is used for scientific names and for tī kouka the interpretation is instructive. *Cordyline* comes from the Greek word *kordyle*, meaning club. This relates to the underground stems or rhizomes characteristic of the genus. The specific name *australis* is Latin for south. It relates to the geographical distribution of the species from the perspective of Northern Hemisphere botanical explorers. Sadly these days the name leads many overseas gardeners to believe it is an Australian species.

Lastly in regard to the title of the paper is the plant family name Lomandraceae. This name is included in a title to help botanists place a species and genus that they do not know into a higher order of grouping of plants with related features that they may be familiar with. Taxonomists have had difficulty in deciding which family *Cordyline* belongs to. Once it was included in the lily family and still some say tī kouka is the largest lily in the world. For some time it was placed in the Agave family but application of DNA-related techniques has placed it in Lomandraceae. This means that rengarenga (*Arthropodium cirratum*) is the closest relative to tī amongst New Zealand native plants. Harakeke was once included together with tī in the family Agavaceae, but recently it has been placed in the Hemerocallidaceae family.

Whew! All this explanation required for a few words in a title. What about the content of the paper itself?

When the tī seedlings first emerged after sowing, those of some populations were all red-brown, others all green, and others a mixture of these colours. This was unexpected. As the seedlings grew the red-brown colouration disappeared at different rates for different populations. It was also noted that there was a difference

between the incidence of red-brown pigmentation at the base of the seedlings and on their leaves. There were also differences between populations in the size and shape of their leaves.

The differences between the populations were related to their latitude of origin. Red-brown seedlings became more common the further south the population. Is there a reason for this?

The explanation favoured in the paper is that the red-brown colour acts as a sun-screen to reduce the damaging effects of high light on frozen plant tissue. This damaging effect of light is seen when leaves of frosted plants die on the side of the plant that receives the morning sun whereas leaves on the shaded side remain undamaged.

Tī kōuka needs open well-lit ground for its seed to germinate and establish. These open situations are exposed to ground frosts, and the severity of frosts is greater in more southern locations. As the seedlings grow their leaves are raised above the ground frost level, and other plants growing around them also provide frost protection. Consequently the value of a built-in sunscreen to reduce light damage of frozen tissue becomes less as the seedlings become older, and so the red-brown colour disappears.

Warwick Harris

Sudden Decline update

In He Kōrero Kōrari No. 6 (January 1999) we reported on recent progress in finding the cause of cabbage tree sudden decline. We described work showing that a specialised bacterium (a phytoplasma) is involved and showed an electron micrograph of the organism. Scientific detective work of this nature is sometimes slow and painstaking. In this case the research team led by myself and Richard Forster (HortResearch) has been involved on the project for over 12 years. One of the "quality checks" in science is the publication of research findings in scientific journals. Before papers are accepted by such journals they are subject to rigorous peer review by specialists in the field. The paper describing the breakthrough in understanding Sudden Decline has just been accepted by the leading international journal Plant Disease. It is called "Association of '*Candidatus Phytoplasma australiense*' with Sudden Decline of cabbage tree in New Zealand" with authors molecular biologist Mark Andersen, plant pathologist Ross Beever, electron microscopist Paul Sutherland, and molecular biologist Richard Forster.

More research is needed, especially to identify the insect that transmits the phytoplasma from plant to plant. Such knowledge will underpin methods to control the phytoplasma long term. In the short term all can contribute to ensuring we do not lose tī from the landscape by protecting wetland corners and stream margins from grazing stock, and planting tī in gardens and restoration sites.

Ross Beever

Dancing Leaves – The story of New Zealand's cabbage tree, tī kōuka.
by Philip Simpson
Canterbury University Press, Christchurch. 2000

Reviewed by Sue Scheele

Philip Simpson's Dancing Leaves is a celebration of a tree that has a place in the heart of every New Zealander — the cabbage tree or tī kōuka. It is a splendid book in

every way — immensely readable, beautifully illustrated and full of absorbing detail on all aspects of tī kouka. We find out about the cabbage tree's structure and growth, its close relations in the genus *Cordyline*, and its place in the natural landscape. There's a section on Sudden Decline, on growing cabbage trees in gardens and as a landscape feature both here and overseas. Two marvellous chapters explore the depiction of cabbage trees in art, poetry and design.

Of special significance to our readers are the chapters of the book devoted to Te ao Maori o te tī – the Maori world of the cabbage tree. Philip presents the whakapapa of tī, as told to him by Hohepa Delamere, Te Whanau a Apanui. I was struck by the parallels with the scientific understanding of the biology of tī. As Philip says, "The whakapapa presented here is intended to add meaning to the scientific material already presented. The two world views enrich each other and together tell a story that is appropriate for, and accessible to, a greater number of people in Aotearoa New Zealand."

In another chapter, Philip describes his hīkoi from Cape Reinga to the far south, to see tī kouka's place in the Māori environment. It is easy to be disheartened by the number of important tī that have disappeared from the landscape, though their stories remain. Then we are reminded of the ability of tī to revive itself. Philip was taken to see a tī, purportedly the largest in New Zealand, growing near Turangi. There were fears it had died of Sudden Decline. As Philip and the kaumatua, Rakato te Rangiita, approached they were concerned to see dead branches. Then they saw a vigorous green branch emerging from the decaying remains of three large trunks, which Philip was able to confirm had collapsed naturally, and not of Sudden Decline. The sacred tree was regrowing.

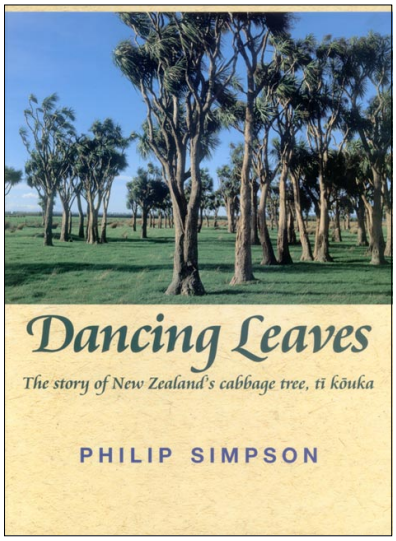
The number of Maori names for different types of tī, parts of the plant and the products made from them, reflect the importance of tī to Maori and there is substantial information on nga mahi tī (uses of cabbage trees). Of special interest to weavers is the section on use of cabbage trees for fibre, including wonderful photos of cloaks, kete, sandals and ropes. They provide inspiration for a hui we are planning together with Te Rōpū Raranga/Whatu o Aotearoa to explore the weaving possibilities of different types of tī kouka leaves.

In the epilogue to Dancing Leaves, Philip Simpson calls for us all to not only protect tī already in the landscape, but to restore those places where tī can regenerate, associated with the species they evolved with. The single most important thing to do is to protect riparian land – riverbanks, the margins of swamps and lakes, and the coastal strip. (A message

Philip Simpson checks tī for viable seed

reinforced by Ross Beever in his update on Sudden Decline). To restore the ecological health of tī is to restore its mauri.

Dancing Leaves should be available from your local bookseller. It can also be purchased from Manaaki Whenua Press, PO Box 40, Lincoln 8152. The cost is $59.95, including postage and packing.



Matauranga Māori

In the epilogue to Dancing Leaves, Philip Simpson considers how matauranga Māori, if widely shared, could enrich us all and provide a way forward in a bicultural society. His words reflect the kaupapa of our partnership with Māori in this programme, in which we seek to increase our mutual understanding of plant taonga.

Philip writes:
"A very important aspect of writing this book has been contact with the Māori world. Personal contacts, visits to important places and trees, access to museum collections and a review of the written record have revealed a deep and abiding regard for tī kōuka. Weaving materials, medicines and food continue to be harvested and oral traditions passed on. But there is a problem because landscapes that were once gathering places may no longer be accessible; memorial trees and the names they inspired are continually being lost, and elders may take their traditional knowledge with them when they die. Artefacts are scattered, the story is fragmented, There is a need for research on the identity of fibres so that items in museums can be correctly identified and appreciated. There is a great need for Māori scholars to assemble the knowledge that remains and take the story far beyond what I have been able to do here. The whakapapa, or genealogy, presented in this book is the story as told by one tohunga (expert) only. There will be other versions. But the importance is not so much the detail but that the whakapapa exists at all. It provides a view in matauranga Māori, the traditional world view. It can be compared with the scientific world view, the points of similarity reflecting the need for clear communication about an important resource, regardless of culture. Together with the scientific stories, matauranga Māori provides a way forward in a bicultural society. I think that together the Māori and Pākehā stories are today more valuable than either one on its own."

What's next?

In April, Kahu Te Kanawa, Margaret Murray and Edna Pahewa will get together again at Ngati Moki Marae, Taumutu and begin the evaluation of the rest of the harakeke in the Rene Orchiston Collection. For comparison, we will measure the same characteristics as last time. Up north, at about the same time, Erenora Puketapu-Hetet and Tina Wirihana will make some standard kete from the 12 harakeke varieties in the evaluation trial, so we can assess aspects such as colour and shrinkage. Nau mai, piki mai ki runga i tenei waka hoe ai!

What we're particularly excited about is the prospect in autumn 2002 for a hui on working with cabbage tree leaves and fibre. Watch this space!

Stop Press

He Korero Korari is now available on the Internet

Go to **www.landcare.cri.nz**
Under **information** click on
newsletters/He Korero Korari

-See the photographs in colour!

A golden kete made from the yellow-green leaves of *Paoa*

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