

# Leaf Fall and Flowering of Nikau

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THE number of scars that girdle the stems of nikau invites some sort of correlation with age of the palm, just as age of many woody plants is indicated by the number of concentric rings in the cross-section of the trunk. The large number of rings on nikau growing in relatively young vegetation caused me to question the accuracy of the one-ring—one-year assumption so widely held. To this end 38 nikau palms growing in pasture near a forest margin in the Kahuterawa valley, Palmerston North, were kept under observation for seven years, and details of number of leaves shed each year were recorded. As leaf shedding and flowering were intimately associated there was also an opportunity to study flowering and the fate of flowers.

## LEAF FALL

Nikau, like most of the other 2,000 or more palms, bears its leaves in a terminal cluster. In each cluster the lowest, and thus the oldest, encloses in its dilated sheath the leaf bases of about 13 expanded leaves above it (Fig. a). The leaves are shed in sequence up the stem, each leaving an annular scar marking its point of attachment. The rhachis or shaft of every leaf lies in a definite position relative to other leaves (Fig. b). If a string is passed from the base of the shaft of the lowest leaf to the second leaf by the shortest distance, then over the third and so on, the string forms a spiral. At the ninth leaf the string would have passed around the tree exactly three times. Shafts of successive leaves lie  $135^\circ$  apart. The leaves of some nikaus, like the one illustrated (Fig. a), spiral upwards in an anticlockwise direction (right-handed) while about an equal number of trees have leaves which turn in the opposite direction. The right-handed and left-handed phenomenon is known also in coconut palms which are reported to have a predominance of right-handed individuals, these being more productive than their left-handed counterparts. The direction of spiralling is governed by the side of the cotyledon on which the second leaf develops, and is not controlled genetically.

Of the 785 leaves which were shed by 38 trees in seven years 88% fell between the months of December and May inclusive. Individual trees showed considerable variation in output of leaves. A few shed five leaves in one year while others lost only one leaf in two years. There was no tendency for a high loss one year to be offset by a low loss the next. Trees growing on similar sites often behaved very differently but those on dry, windy sites tended to have thinner stems and a slower turnover of leaves. Over the seven-year period the 38 trees averaged a leaf fall of 2.95 leaves a

year. Differences from year to year were quite marked.

Year (Nov.-Nov.)	Leaves shed/ tree	Inflorescences/ tree	Normal Inflorescences %
1959	3.22	2.21	73
1960	2.36	1.44	34
1961	3.36	2.34	74
1962	2.81	2.10	58
1963	2.97	2.10	67
1964	2.89	2.18	90
1965	2.10	1.26	70

Leaf fall and flowering of nikau. (Averages for 38 trees).

Age calculation of nikau is complicated further by the age of the tree when the first scar is formed. Miss M. M. Johnson in *Bull. Wellington Bot. Soc.* No. 16 noted that a cultivated plant in her garden reached 20 years of age before the first ring scar formed. Four leaves were shed in that flowering season.

It is clear that the one-ring—one-year assumption has no basis, and further that there is no way of calculating age accurately from the number of rings.

#### FLOWERING

The inflorescence (called a spadix because of its fleshy axis) develops in the leaf axil below the base of the shaft and is exposed when the leaf is shed. When released from its constricted space the inflorescence bursts through the double-layered, boat-shaped spathe which envelops it, and the spathe falls to the ground. Usually this expansion occurs within a few days of leaf fall. The stout axis of the inflorescence (Fig. a) has about 40 branches, some of the basal ones being divided again into four or five branchlets. Each finger-like branch (Fig. c) bears numerous pink flowers in groups of three, one female with a larger male on either side of it, except on the terminal two or three inches of each branch which bears pairs of male flowers only. Male flowers (Fig. d) open almost immediately they are exposed by the splitting spathe. About three days after the spathe has fallen all male flowers are open and swarms of insects (mostly flies) are attracted to the stigmatic fluid of the sterile pistil. By the seventh day most of the male flowers have fallen and it is not until about the fourteenth day that the stigmas of the female flowers appear (Fig. e). Again clouds of insects appear, apparently to feed on the exudate on the ovary just below the stigmas. By this time the ovary has developed to a remarkable extent, the fruits having attained more than one-third of their ultimate length. In less than a year from flowering the fruits change from green to red and are shed or eaten by pigeons. Seeds voided by a pigeon had a germination percentage of 86 in the one sample tested.

Time of flowering closely parallels time of leaf fall. For these records flowering was regarded as the period of blooming of the male flowers and the figures are averages for the seven-year period. Six per cent of inflorescences flowered in December, 20% in January, 33% in February, 35% in March and only 5% in April. A few inflorescences appeared in November, May and June.

Although there is potentially one inflorescence with 4000—5000 fruits for every leaf shed, only 65% of the 785 leaves falling exposed a spathe. This percentage would be a little higher if it included the undeveloped inflorescences which fell soon after emergence and escaped notice. Of the normal inflorescences only two-thirds produced ripe fruits. Year-to-year variations of the proportions of inflorescences reaching maturity were considerable, ranging from 34% to 90% (see table). There are several apparent causes of the losses.

- Occasionally a leaf fell while the inflorescence was still undeveloped. Usually it soon dropped off or, if the spathe opened, survived for a while then withered.
- Less often the leaf clung too long and the constricted inflorescence decayed before release. Rarely the sheath split below the shaft and the inflorescence emerged before the leaf fell. Coincidence of leaf fall and optimum stage for flower emergence was not perfect. Inflorescences develop gradually over a period of two or more years and the state of maturity seems to govern leaf fall to a major degree, but ill-timed shedding sometimes occurs because of wind damage, restriction by surrounding plants or the tenacity of the leaves.
- Many inflorescences were damaged by opossums chewing through the fleshy base soon after the spathes sloughed off.
- The caterpillars of *Doxophyrtis hydrocosma* destroyed a number of maturing fruits and probably were responsible for the germination failure of 14% of the seeds in pigeon droppings.
- Because of the protandry of the species there are times after the male flowers have been shed when the inflorescence is entirely female and no local pollen is available. However, there is circumstantial evidence to suggest that this does not always occur. The first line of evidence comes from Miss M. M. Johnson (pers. comm.) who observed successful fruit set on a single isolated inflorescence separated by several miles from the nearest nikau. Further support for the contention is contained in a little-known paper by V. Ostinelli published in 1921 in *Bull. Soc. Tosc. Art.* 46 which reports a limited fruit set in isolated inflorescences on some occasions. Varying degrees of protandry may have been responsible for the poor fruit set and absence of fruiting.
- In some climates season of flowering may have some influence.

Ostinelli attributed the variable success of fruiting to season. He observed that flowers appearing in the hot, dry summer months in Sicily did not produce fruits while those in the cooler, moist autumn did, though only a small number of fruits were formed. It is interesting to note that in New Zealand the peak of flowering is at the end of summer. Too few out-of-season flowering records are available to demonstrate the influence of season on fruit set but it is noteworthy that inflorescences appearing as late as July and as early as November set fruit normally. It may be significant that the failures are least around the time of peak flowering. Fifty-three per cent of December flowers failed to mature, 34% in January, 21% in February, 31% in March and 46% in April.

My impression is that opossums caused most losses but ill-timed appearance of spathes resulted in very appreciable mortality. *Doxophyrtis* took toll of seeds but did not cause total failure of an inflorescence. The efficiency of pollination and influence of climatic factors remain to be determined. It should be noted that the figures presented here are from trees grown in the open. Those grown in the shade of a forest canopy are much less successful in producing fruits.

### Notes on Growth of Young Nikau Plants

As in a number of other palms, nikau seedlings have a mechanism by which the growing point is pushed deeper into the soil during the first few years of life. This is illustrated in the accompanying drawing by Mr A. E. Esler. The seed germinates at or near the soil surface, as shown in (a), and initially the seedling grows at this level (b, c), but after a few years the "stem" elongates downward (d) and the growing point is forced down well below the soil surface (e). There the growing point remains for a number of years, with the stem portion shown in (e) dying and rotting away. Eventually the true stem grows upwards to form a trunk, and the growing point is raised above the soil surface.

I collected four young nikau seedlings at about stage (b) from the wild in 1955 and grew them in pots for several years until they had developed slightly beyond stage (e). They were then planted out in a gully in fairly deep shade. Now at least 15 years old, they are bearing six to seven leaves with the largest leaf 6 ft 3 in long (leaf stalk plus midrib), and it will be some years yet before any will be big enough to start forming a trunk. In all four plants each young leaf develops to the right of the preceding one, the angle between the leaves being 120° to 180°, average 150°. Over the last three years the plants have produced slightly more than one leaf a year on the average. The appearance of young leaves is not governed by season, though growth is probably slower in the winter.

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