PHORMIUM RESEARCH.

NOTES ON A TALK ON 16.6.47 BY MR. W.R.BOYCE.

HISTORICAL INTRODUCTION.

As a background to the discussion of research the history of Phormium utilization was briefly recounted.

a. Period of export trade. The export of Phormium began before 1800 with trading in small quantities of hand-dressed fibre so carefully prepared by the traditional methods of the Maori that it set a high standard impossible to maintain. Using the same laborious method of extraction some large tonnages were exported with peak years in 1830 and 1855. About 1860 there was a change-over to machine extractions with the development of the percussion stripper, leading to a greatly increased output. The fluctuating fortunes of the industry from that time on were illustrated by a graph. A peak in 1873 came as a result of a world shortage of fibre, following the American Civil War: the next peak in 1890 was followed by a fall in the general trade depression of 1895, and then by a rise in the 1900's leading to an extensive development by drainage and maintenance of natural swamp areas. Trade fell off in 1910 and rose again to peaks in the war years 1914-18. A depression of trade in the early twenties brought a sharp decline in exports, followed by a temporary recovery in 1927. Another sharp decline led to the final collapse of the export trade in the thirties.

A list of publications showed how periods of activity in research and investigation were linked with times of prosperity in the export market. As phormium need not be harvested regularly there was a large element of opportunism in its utilization. This is reflected in the lack of continuity in the planning of long-term investigational work. It is interesting to note that in 1921 a special committee formed at the Second Science Congress of the N.Z.Institute recommended that a small experimental station be established. Now, 26 years later, this has almost been accomplished.

b. Period of internal utilization. Through the vicissitudes of the export era a few mills supplying a small home market have generally remained in continuous operation, some of them for periods up to 50 years, partly because for various reasons they have been able to preserve their sources of supply.

Areas producing leaf and fibre at present are Dargaville, Featherston, Martinborough, Moutoa, Blenheim, two places in Canterbury, three in Southland, three on the West Coast. These areas produce about 4,500 tons of fibre per year, compared with a potential market for 10,000 tons: to supply this demand further areas of phormium will need to be developed.

Early in the nineteen thirties a factory was started at Foxton to utilize the tow, previously largely a waste product, for the manufacture of woolpacks. To save something of the industry action had to be taken to provide an assured supply of leaf, and in 1939 the Moutoa Estate, the last remaining large area of flax in the Manawatu, was taken over as a Developmental and Research Area. Here most of the research work is now being carried out.

MOUTOA PHORMIUM DEVELOPMENTAL AREA.

The area is particularly valuable from a research point of view because it calls for management and development of both natural areas and plantations. The development work was carried out in its early stages by the Public Works Department and later by Industries and Commerce Department with Scientific and Industrial Research Department looking after the research side.

A brief description of the area was illustrated by a vegetation map and reference was made to a recent paper by Mr. Poole who carried out the original vegetation survey, one of the first projects of the kind to be undertaken in New Zealand.

a. Plantation Work. The immediate problem was to build up supplies of leaf and one of the chief tasks has been to plant up to 1000 acres of the more

easily developed land. Questions arising from this work were

1. What preparation of land was required for planting?
2. What material to plant?
3. Methods to be used in planting?
4. Management after planting?

The operations involved in draining, clearing, planting and after-management were described and shown in lantern slides.

b. Natural areas. In spite of the knowledge gained in plantation establishment experience has shown that this is practicable only under specially favourable circumstances, where the soil fertility is naturally high and drainage can lower the water table below the surface during the period of development. For this reason we must depend in many places on remaining natural areas and it is important to know what conditions are suited to the maintenance of phormium stands under cropping conditions. The problems were chiefly ecological ones, for instance the changes brought about by altering the conditions of drainage and flooding. Part of the work has been to follow these changes by means of surveys and resurveys, and permanent quadrats.

In the past, large areas of Phormium were induced by draining swampy land: in the Manawatu, extensive stop-banking and deeper drainage resulted directly or indirectly in the disappearance of many extensive flax areas. In the Wairarapa on the banks of the Ruamahunga River are two very fine stands which have been producing leaf for 50 years and are as good today as when they were first developed. Here the drainage has been improved but there is still deep flooding and silt deposition during the winter months: floods may cover the ground to a depth of 14 ft. but remain at that level for a short time only and then drain away rapidly. These conditions seem to favour phormium, enabling it to maintain itself against invaders, giving it immunity from insect attack and possibly minimizing the incidence of yellow leaf: for instance tall fescue, an aggressive weed at Moutoa, is killed out by comparatively short submergence and might be eliminated if flooding could be controlled. Other problems are insect pests, accumulation of dead leaf, control of flowering. The Wairarapa areas are noted for their sparse flowering which may be partly due to varietal effect, but more likely is caused by submergence at a time when the changes in the apical meristem preceding flowering are taking place.

THE PHORMIUM PLANT: HABIT, GROWTH, LEAF PRODUCTION.

Phormium is a perennial monocotyledonous plant with a short underground rhizome from which erect shoots or fans are given off. The life of a fan is indefinite but normally after 4-6 years it flowers and dies back and is succeeded by fans rising at a higher level and emerging between the leaf bases of the older fans. The rate of growth of individual fans varies with the time of year, rising to a maximum in December.

Starting from a single fan or seedling a clump of fans is first produced, which then extends outwards to form a bush 2-3 ft. in diameter. As the centre of the bush dies out a circle of fans is left, which eventually breaks up into clumps of a few fans each, giving in a "natural" swamp area a more or less random distribution of a clump of fans. In dominant phormium stands the number of fans per acre is remarkably constant varying about 22,000. An acre of ground, once in four years, will produce up to 40 tons of leaf: if there are 22400 fans each one produces 4 lb. of leaf. The number of leaves varies about 6-8 per fan. If a stand is mature leaves from 7-9 ft. in length make up about 75% of the weight. Good practice confines cutting to ten months of the year as flax cut in March and April is liable to severe frost damage.

TAXONOMY.

In fibre characters P. tenax and P. colensoi differ greatly, though each species shows great variability within itself. A collection of many varieties of tenax has been assembled. Hybrids occur naturally as the species cross quite easily and give a highly fertile F1 generation. Studies of the progeny of artificial crosses should assist in the study of wild hybrids.

SELECTION, BREEDING, AND GENETICS.

Earlier workers have collected tenax plants outstanding for strength, coarseness, colour, stripping quality and content of fibre. Many of these have been multiplied vegetatively until now we have plantations up to 100 acres of one clonal variety. Many of our best varieties were selected originally by the Maoris. From the best of these clonal varieties large numbers of seedlings have also been raised to fulfil the planting programme. To produce finer types of fibre several crosses have been made between varieties of tenax and colensoi and one of these has already given promising results in preliminary tests.

DISEASES.

Yellow leaf, the most serious disease, was dealt with in some detail. A concerted effort is being made at present to find its cause and cure, both still unknown. The course of the disease appears to be -

1. Appearance of lesions in the roots followed by breakdown and rotting of the rhizome.

2. Rotting spreads fairly rapidly and results in yellowing on the leaves, the first sign usually noticed. Sometimes the rot spreads so rapidly that the leaves roll and collapse without preliminary yellowing.

3. When the rhizome rot spreads above ground the fans can easily be knocked out and the plant soon dies.

The disease appears in most P. tenax areas of the North Is. and has been reported from the South: it appears in many different soil types and seems to be independent of most variables so far observed. It occurs sporadically in plantations and natural areas. There is a tendency for a group of plants in a plantation row to go off together, while beside them in the row or adjoining rows plants continue to grow vigorously. No certain case of recovery has been observed in spite of transplanting and manurial treatment. No success has attended efforts to transmit the disease by planting healthy and diseased fans together, by core injection, by contact of cut surfaces, and by planting healthy fans in positions occupied by diseased ones. Many isolations from diseased plants have failed to reveal any fungus or bacterium likely to be a primary pathogen. The possibility of virus disease has not been overlooked and the question of trace element disease is being fully investigated.

The talk showed that there is still much to be learned about phormium, one of our first known and most familiar plants, the fibre from which has been of commercial value for 150 years, and at times one of our most important exports.

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MIRAMAR GULLY.

The August excursion, attended by about twenty people, was an afternoon trip to the gully beyond the Miramar tram terminus. The vegetation has changed much since Buchanan wrote of it in (Trans. N.Z.I. vol. 5, 1872) but the remnant of native scrub has escaped burning over a considerable number of years and now shows a fair range of species, about sixty being noted.

Species characteristic of the exposed coastal rocks here grow more luxuriantly, for example Phormium colensoi, Hymenanthera crassifolia, Olearia solandra, Macropiper excelsa, Poa anceps, Aciphylla squarrosa, and especially Coprosma propinqua, which in the broader of the two valleys forms considerable thickets of shoulder-high, twiggy bushes. Hybrids between this species and C. robusta are abundant: C. lucida is also present, and C. rhamnoides was covered with translucent ruby-red berries. Pittosporum tenuifolium that had been planted freely in the grassy floor of one valley was not seen growing naturally.

Conspicuous exotics were broom, the yellow-flowered daisy bush Osteospermum moniliferum (bush tick berry), Pinus radiata, and Berberis darwinii, the last-named a garden escape that is becoming naturalized rather freely in a number of places about Wellington.