

(2) Hybrids: Crosses were made between several varieties in December, 1927, and January, 1928. The crossing was done in Mr. A. Seifert's nursery at Shannon. The parents were chosen for particular excellence in one or more respects. The following were crossed (Mr. Seifert's number for each variety is used here):—

SS: An upright plant with leaves which strip excellently, yielding fibre of good colour and great strength; a good disease-resistant plant. The height is not sufficient to produce a good crop.

13 K: A tall-growing variety of high cropping-capacity and good general qualities, but slightly lacking in strength.

21 H: An exceedingly-rigid-leaved variety, yielding fibre of particularly good colour, but lacking in strength.

37 A: A very heavy cropping variety of good general quality.

The variety SS was crossed with each of the others, so that seed of the following hybrids was secured: SS $\times$ 13 K, SS $\times$ 21 H, SS $\times$ 37 A. The hybrids SS $\times$ 21 H, and SS $\times$ 37 A have grown quite satisfactorily, but it is too early yet to say whether or not they will have the desired combinations of characters. The cross 13 K $\times$ SS has produced seedlings which in habit of growth and colour are intermediate to seedlings of the parent varieties. The most noticeable feature is, however, the vigorous growth of these seedlings as compared with seedlings of the parents. The accompanying photographs (figs. 1 and 2) illustrate this point. This hybrid vigour is, of course, well known in both animal and plant crosses. It seems feasible to use this vigour in commercial phormium-plantations in order to hasten maturity and increase the yield per acre. Before large numbers of hybrids can be provided it will, however, be necessary to develop methods of crossing on a large scale. This work is to be prosecuted vigorously in the next flowering season. It must be remembered that hybrid vigour is important from the point of view of disease (*e.g.*, yellow leaf). As a rule, hybrid vigour means also resistance to disease.

(d) *Collection of Varieties in Past Year.*—A total of 220 strains has now been collected. For convenience these are referred to as varieties. There is no doubt that the majority will be distinct from one another. The centres from which fairly large collections of varieties have been obtained are as follows: Martinborough, 37; Wellington (Palliser Bay), 7; Waverley (Taranaki), 8; Blenheim, 18; South Westland, 12. Many other varieties have been obtained from North Auckland-Kaingaroa, Whangaroa, Bay of Islands, Waikato, Bay of Plenty, and other localities in both Islands. Wherever time and opportunity allowed, the collection has included five fans and also seed of each variety. Exact written notes have been made to enable the precise bush to be found again. In most cases photographs have been taken to illustrate the locality and the characteristics of the variety. Obviously, seed could not be taken from all varieties, because seed was ripe only towards the end of the time spent in the field. Seed was, however, collected and sown pod by pod from more than one hundred of the varieties collected this year. This seed is already growing. The fans collected in this way have mostly been planted on the 20-acre plot set aside for phormium-cultivation. Seed-capsules of each variety are being kept wherever possible. These capsules, or "pods," are valuable features in distinguishing varieties otherwise very similar in appearance. Photographs and capsules of each strain will be filed permanently for reference purposes.

(e) *Experimental Area of Uniform Plants.*—It was considered most desirable that an area of about 1 acre should be planted with plants of one variety for experimental purposes. No variety is yet known which produces seedlings of sufficient uniformity for this purpose, so that planting by fans was necessary. The problem of securing enough fans (about one thousand) of one variety was expected to be very difficult. Fortunately, the required number was obtained from Maori plantations of a very good variety. These plants are now set out on the 20-acre experimental area. The variety concerned is a hybrid of the same nature as the cross SS $\times$ 13 K mentioned above. The growth is most vigorous, and the fibre of excellent quality. Seedlings of this hybrid naturally show a "breaking-up" of the hybrid strain, so that propagation by fans is necessary. A careful genetical analysis of this hybrid will be made to find if it can readily be increased by seed on a commercial scale. The acre of this hybrid now planted will, in any case, be available for increase by fans if such a course proves desirable.

(f) *Yellow-leaf Disease: Mr. Meadows's appointment.*—In February of this year Mr. L. Meadows, of Canterbury College, was appointed to this College by arrangement with the Scientific and Industrial Research Department. Mr. Meadows was appointed chiefly in view of the urgent necessity for some work on yellow-leaf disease. The attack on the yellow-leaf problem is being made in general along the following lines:—

(1) Field observations of its occurrence on various soil-types and under different conditions of soil moisture, &c.

(2) Root excavations of diseased and healthy plants to determine if the disease can be correlated with any features noted in this way. Mr. Meadows has done extensive work on the excavations and careful mapping of root-systems. The results as yet cast no light on yellow-leaf disease, but represent a distinct gain in our knowledge of the root-system of the plant.

(3) The selection and breeding of resistant strains of phormium is regarded as the policy which will ultimately be the most successful. As noted under section (c) hybrid vigour frequently renders plants immune to disease. Selection of resistant strains is being given particular attention. A question which must be answered is to what extent seedling plants inherit resistance from the resistant parent. An area of land very susceptible to the disease will be needed at some time in order to answer such questions.

(4) Manurial trials are to be undertaken as soon as trial areas can be arranged. Mr. T. Rigg, of the Cawthron Institute, has given many helpful suggestions for work along these lines.