

WINDS.

Trees in all the groves showed marked symptoms of exposure to strong winds. Indeed, exposure must be considered as one of the three major factors influencing the growth of the trees. Although shelter-belts have now been established on the groves, the stunting effects of long exposure will be difficult to correct.

Indications are that the tung tree is more readily damaged by winds than citrus trees and must be provided with even more shelter. Additional shelter-belts are required on all the groves and the fertility of the soils must be raised, since the greatest damage is always confined to the poorly nourished trees.

ESTABLISHMENT OF THE GROVES.

The most noteworthy observations on the nursery stock were—firstly, the high quality of the stock produced from early importations of American seed as compared with that brought in during the past few seasons; secondly, the high percentage germination and the vigour of the seedlings produced from Australian tung seed, and the variable percentage germination but vigorous seedlings given by New-Zealand-grown seed. The quality of the nursery stock used in the groves has not been uniform, and the rigid selection that is regarded by American growers as being so important has not been practised. The use of two-year-old, uncut, nursery stock has been most extensively adopted, but there is a lack of uniformity between the companies as to the methods of planting out the stock and of shaping the trees. Since the seed sold from the tung groves of the United States over the period 1929–34, and, to a lesser extent, right up to the present season, has been extremely variable, it must be recognized that upwards of 25 per cent. of the older trees will prove to have inherited low fruiting-capacity and will have to be replaced.

MANAGEMENT.

Most of the plantings have been made upon land of rolling topography, and sheet erosion of topsoil, and in some cases the development of gulying, has tended to influence the amount of cultivation given to the groves. As a soil-conservation measure the raising of the fertility of the soils on such planted areas to a point where the establishment of a good pasture sward would be assured is advocated. On unplanted areas the setting-out of the trees on terraced planting lines cut on the contour would be most satisfactory. Cultivation is mostly done with the rotary hoe or by manual labour.

Cover cropping has not been practised to any extent and the quantities of fertilizers applied have been far below those given to trees of the same age in the majority of American groves. Experiments to test the effectiveness of larger applications of various straight and mixed fertilizers, with and without lime, should be established on the most extensive soil types used.

SOILS.

In the main the groves which have been planted in North Auckland consist of a mosaic of soil types which are related to topography, vegetation, and previous management, but all types, with but minor exceptions, are comparable in that they are low in available plant nutrients and active calcium. The selection of these impoverished acid soils is traceable in part to the erroneous information on the requirements of the tung tree which was broadcast from unreliable sources in the United States. This information suggested that the tung tree would thrive upon the poorest of acid soils, and accordingly extensive areas of the low-producing lands of North Auckland were planted.

Not only are the soils low in nutrients, but, in addition, nearly all of them drain very slowly. The combined effects upon the trees of low nutrient supply and water-logging of the root systems have been most marked during the past three years, when the rainfall has been exceptionally heavy.

In actual practice the requirements of the tung tree have proved to be almost exactly the opposite to those which were so eagerly seized upon in the early days of the establishment of the New Zealand tung groves. The present view, which has been built upon the results obtained in the tragic years of the haphazard experiment in many countries, is that the tung tree, under suitable climatic conditions, grows and yields in proportion to the fertility and the management of the soil upon which it is grown.

The trees planted out upon the limited areas of freely draining soil types are much superior to those growing on the slow-draining impervious soils, and, given adequate shelter, can be developed into sturdy trees by raising the fertility of the soils through cover cropping with lupins or by the addition of balanced complete fertilizers. The problems to be corrected before the trees planted on the remaining soils can be expected to develop normally are extensive and the remedial measures difficult to apply.

A definite correlation between soil type and the nature of the root systems developed by the trees planted thereon was established. In addition, the incidence of "puffy bark" or swelling of the tissues outside of the wood, followed by die-back of that portion of the tree above the affected section, and of "featherlegging" (production of new growth on the main trunk below the main branches), were found to be related to the soil conditions. There was also good evidence indicating that the practice of mixing blood and bone with the soil packed round the root systems of transplanted nursery stock was partly responsible for the high losses of trees planted on the impervious clay soils through the decomposition of the soft outer tissues of the roots.

On some of the northerly slopes of several of the large groves many trees have been ring-barked by crickets.