Analyses indicate that boron deficiency is also responsible for the occurrence of corky-pit in Central Otago. Soil samples from Auckland and Hawke's Bay from orchards reputedly free of corky-pit showed a much higher boron content than soils from Nelson.

7. Manurial Trials.

Manurial trials have been conducted (1) at the research orchard, Appleby, (2) in the Cawthron Institute orchards, and (3) in private orchards throughout the fruitgrowing districts. These orchards are selected by the Horticulture Division of the Department of Agriculture.

The report of the trials at the research orchard appear in a previous section of this report.

Cawthron Institute.

The manurial trials include fertilizer trials on Jonathans at Upper Moutere, Cox's Orange at Waimea West, and Sturmer and Dougherty apples at the Annesbrook orchard of the Institute.

The experimental treatment has been continued over a period of twelve years at Upper Moutere, seven years at Waimea West, and approximately fifteen years at Annesbrook. The results are here briefly summarized.

Upper Moutere.—The experiment was laid down in 1923, and for the first five years the quantities of manures applied were comparatively small, and differences due to manurial treatment were slow in making an appearance. From 1928 onwards the quantities of manure were increased and differences at once became marked. Over the six-year period 1930–35 a "complete" manure has given an average increase of two hundred cases of fruit per season over the "no-manure" plots, or an increase of 77 per cent. Sulphate of ammonia alone at the rate of 3 lb. per tree has increased yields only 26 per cent., and does not approach the increase secured by a "complete" fertilizer, while the fruit is small, liable to cracking and much russeting. In conjunction with phosphate and potash, dried blood has not proved quite so effective as sulphate of ammonia, when equal quantities are used.

Comparing the effects of 1 lb. and 4 lb. of muriate of potash in a "complete" fertilizer, it is interesting to note that four seasons elapsed before a specific difference could be detected in the trees and in fruit-yield as a result of the increased potash manuring. The trees receiving the heavier dressing of potash are now superior in both appearance and yield. An application of 24 lb. of muriate of potash per tree in 1934 was followed by a marked improvement in growth and an apparent improvement in yield of fruit.

The highest colour of fruit at export shipping date was associated with the blocks receiving dried blood or "no manure." The blocks receiving 3 lb. of sulphate of ammonia per tree, whether given in association with minerals or alone, were backward in colour. The data suggest that a high supply of nitrogen in the tree retards colour and adversely affects the bloom of the fruit.

The blocks receiving "no manure," or nitrogen alone, gave the highest percentage of small fruit, while the blocks receiving a "complete" fertilizer gave the best export size of apples. The block receiving 4 lb. of muriate of potash with nitrogen and phosphate was outstanding for the large percentage of big-size fruit produced. Russeting was most severe on the "no manure" and "nitrogen only" blocks.

Waimea West.—This experiment on Cox's was commenced in 1928, and is situated on a poor hill-slope which shows good response to nitrogenous fertilizing, and was designed to test the influence of different rates of ammonium sulphate with phosphate and potash. The use of 3 lb. of ammonium sulphate per tree has given during the course of seven seasons about 350 lb. of fruit per tree more than from trees treated with 1 lb. Cool-storage tests have shown a greater amount of internal breakdown in the case of fruit from the plots receiving the heavier dressings.

The same type of experiment carried out on deeper soil located on the flat of the Moutere Hills showed no advantage with the heavier dressing of nitrogen in comparison with the 1 lb. dressing.

Annesbrook Orchard.—On the untreated rows die-back in Dougherty trees is very pronounced, and a reduction in yield of fruit and size of tree has become very noticeable. Superphosphate alone and superphosphate plus potash have given considerable benefit, although the best result has been secured with the complete manure. The good results secured by the use of super and potash without nitrogen on the Annesbrook experiment is probably due to the fact that the soil is comparatively well supplied with organic matter and had at the commencement a much higher nitrogen status than the Moutere Hills soil.

General.—Chemical analyses show that, while there has been a large accumulation of phosphate in the top 6 in. of soil, the phosphate has penetrated below the 12 in. depth, and there does not appear to be any question that small quantities, at any rate, of the phosphatic manures applied are actually reaching the rooting-zone of the trees. Wherever comparatively heavy dressings of potash have been given similar results are recorded.

Plots which have received annual dressings of ammonium sulphate show a marked increase in soil acidity. Concurrently on all manured plots there has been a great improvement in the nitrogen status of the soil in comparison with untreated soils. This is no doubt partly due to the use of blue lupins for ploughing in, but also is possibly connected with the use of ammonium sulphate and the retention of ammonia compounds in the soil due to slow nitrification under the acid soil conditions which prevail in many Moutere Hills orchards.

Co-operative Trials.

Seventy-five co-operative trials arranged through the Horticulture Division and treated in the various fruitgrowing districts of the Dominion have been continued. The trials have included treatment with NPK and lime alone and in association with various groupings. Though yield records have been taken in some cases, most of the trials have been assessed by general observations of visual response.