THE CORNWALLIS PINES

by I.A.E. Atkinson

Many readers, when passing along the road to Huia, will have noticed the yellowish foliage and stunted appearance of some of the pine plantations at Cornwallis. Both these trees and the adjacent healthy stands were planted in 1922; the contrast today is remarkable and presents a puzzling problem.

These stunted trees have been planted in a gumland scrub community where manuka and wiwi grass(Schoenus tendo) are the only abundant plants. Annual ring counts show the manuka to be 35 to 40 years of age. Yet most plants are little more than 5-8 feet high. Occasional spindly kauri, tanekaha and rewarewa are present but these, like the Pinus radiata and manuka, are growing extremely slowly.

Stunted pines only occur on flat and gently sloping sites. On steep slopes the pines are apparently healthy. This relationship of stunted vegetation to site is a good indication that something is wrong with the soil.

This, in fact, is the case, since these inferior soils are waterlogged for the greater part of the year. The pines have "wet feet". Soils supporting healthy pines are comparatively well drained. However, this is by no means a complete explanation since in small gullies and depressions, where waterlogging is more acute, the pines actually increase in size and vigour.

We may divide soil characteristics into three groups: chemical, physical and biological. In the chemical group we deal with the various plant foods such as nitrate and phosphate. Structural properties of the soil which affect water supply and soil aeration comprise the physical group. Soil biology is concerned with the various soil inhabiting organisms such as earthworms and the infinite millions of minute bacteria and soil fungi which affect plants in numerous ways. Though we try to separate these groups of soil characteristics in our own minds, we must always remember that in reality they all interact together in their effects on plants.

It is possible to show, by growing seedling pines in pots subjected to various nutrient treatments, that, even though all the Cornwallis soils are extremely low in available plant food, the factors responsible for the stunted growth are primarily physical characteristics of the soil. Due partly to the waterlogging already mentioned, aeration in the inferior soils is very poor. Adequate aeration is essential for the absorption of soil nutrients and in a soil which is already low in plant foods, any reduction in aeration will result in starvation for the plant. This, essentially, is the trouble at Cornwallis although other factors are also involved.

An indication of what these factors are may be obtained by examining the root system of the stunted trees. It is only

shallowly developed with few roots penetrating the heavy clay subsoil. Thus in summertime, when the topsoil dries out, the pine is unable to replenish its water supplies from the deeper moist levels and an acute water shortage develops.

Another significant feature of the root system is the absence of mycorrhizal roots. These are short lateral roots growing in association with a fungus which ramifies through and envelopes the root tissue. Such roots are known to be more effective in the absorption of nutrients. They can be found in the surface soil layers of any healthy pine stand and their absence from the stunted pines, perhaps again due to inadequate aeration, still further reduces the ability of these trees to absorb nutrients.

What possibilities are there for improving the growth of the stunted pines? With existing knowledge it appears that little can be done. Any method of increasing subsoil drainage such as giant discing would improve pine growth but such an undertaking would almost certainly be uneconomic.

Many more questions could be asked about Cornwallis, though not easily answered. Enough has been said to show that we have here a very interesting example of the complex interrelationships existing between soil and vegetation.

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