

further apart. In comparison with the Austrian pine it is more light-demanding, quite as hardy when the plants have become established, and adapts itself to land that is poor and inclined to be dry. Equally good results have been obtained with this species in the Waiotapu Valley and on the exposed Kaingaroa Plains.

*Pinus austriaca* (Austrian pine) is a native of southern Europe. Height, about 75 ft.; trunk slender. The timber is light and soft, very durable, and rich in turpentine. Useful for general construction purposes. Seed is easily procured, large quantities being handled yearly by European seedsmen. Seed usually germinates well, but the trees from the seedling stage until about the twelfth year are comparatively slow-growing. In habit the Austrian pine is very compact, producing a great number of branches, and on this account is a most useful shelter-tree. Amongst the species which have been grown in quantity at the Rotorua Nursery it is the slowest grower, and on this account plantings are mostly being made pure. The species which resembles it most in regard to rate of growth, and which is perhaps the best one to mix with it, is *Pinus strobus*, but the latter species starts away quicker after planting, and overtops the Austrian pine, with the result that the leaders of the *Pinus strobus*, which are very brittle, are frequently broken off by the wind.

*Eucalypti*.—At Rotorua some forty species of this genus have been tried, with various results, and at the present time the only one that is being planted is *E. Stuartiana*. Next to this species in hardiness are *E. pauciflora*, *E. amygdalina*, and *E. globulus*. Such species as *E. marginata* (jarrah), *rostrata* (red-gum), *pilularis* (black-butt) are not hardy enough to survive through the winter frosts in this district.

In all the plantations that have been formed of eucalypti the trees have been planted 6 ft. apart in quincunx order, and in every case hilly country has been selected for the purpose. Most of this country as it comes under our hand is densely covered with fern and tutu, which has to be burned off before planting can be proceeded with. This natural growth is not done with, however, when it is burnt off, but again grows almost as strongly as before, with the result that the young trees are soon choked up. Having this heavy weed-growth to contend with, it is necessary that a species of tree that is fast-growing should be selected, and this, combined with its hardy qualities, is the principal reason why *E. Stuartiana* has been chosen to represent the Australian hardwoods in our plantations. It is easily raised from seed, and transplants well. After *E. Stuartiana* the next most satisfactory species is *E. pauciflora*, but this species is somewhat slower-growing, and in this respect entails more labour in keeping the fern-growth from choking the young trees. *E. amygdalina* is less hardy on account of its growing well into the autumn, when early frosts cut back the young growth. *E. globulus* (the common blue-gum) is perhaps the hardiest of all the eucalypti, but has been discarded by us on account of the damage done to the trees by a leaf-eating caterpillar.

*Pinus radiata* (*insignis*). This tree is too well known to require a description here. In almost every part of New Zealand it has been largely planted for shelter, and for this purpose it is admirably adapted on account of its rapid growth. In Canterbury the timber of this pine has been used for farm buildings with satisfactory results. It is also useful for making packing-cases, and experiments made in Canterbury some years ago show that butter-boxes made with it are entirely satisfactory. On account of its rapid growth, *Pinus insignis* will yield an early return in timber, and the produce would probably find a ready market in most of the dairying districts, where it should be largely grown to take the place of Kahikatea. It is not a durable timber, and makes an inferior fuel.

*Betula alba* (English or silver birch) is a native of northern and eastern Europe. The timber is used in Great Britain for firewood, charcoal for gunpowder, bobbins, herring-barrels, and other similar purposes. It is not durable in contact with the ground.

Birch has occupied but little attention in the operations of this Department, its use being confined to planting dry hill-tops, where other trees would not grow, and for shelter and ornamental effect.

*Mixed or Pure Plantations*.—A pure plantation consists of trees of one species only, while a mixed plantation may consist of two, three, or more species. A pure plantation is more easily formed and managed than a plantation consisting of several species, each of which requires different treatment; but, on the other hand, if it is intended to grow large-sized timber, many of the valuable trees cannot be grown pure, on account of their opening out at an early age and exposing the soil to the deteriorating influence of the sun and wind. This is the case with such light-demanding species as larch and oak. Pure plantations can be recommended only if it is intended to cut out the plantation at an early age for such purposes as firewood, or if there is a market for small-sized timber. Again, on most blocks of land certain portions are suitable for one species only—for instance, wet land may be planted only with alder. Light-demanding species may be planted pure, provided that when they reach a state in which they do not give sufficient protection to the soil the soil be protected by underplanting. Shade-enduring species may be planted pure, and no advantage is gained by mixing unless it be a tender species requiring the protection of a more hardy one, or a species liable to a disease which would be mitigated by mixing.

The advantages of mixed planting over pure planting may be briefly stated as follows: Mixed planting permits of a greater variety of timber being grown where the area available for planting is small. Species that, owing to their thin crowns, fail to protect the soil if planted pure can be grown to maturity if mixed with a soil-protecting species. Diseases peculiar to conifers may be mitigated if hardwoods are mixed with the conifers. Tender species that require protection when young are benefited by mixing them with a hardy species to act as nurses. Undoubtedly mixed plantations have more to recommend them than pure plantations; but in the Rotorua District it has been found a most difficult matter to get two species that will grow well in mixture. Another difficulty—and this may be said to apply to New Zealand as a whole—