

FARM SHELTER IN NEW ZEALAND.

(With particular reference to Southland-Otago),

By N. J. Dolamore, Conservator of Forests, Invercargill.PART I: NECESSITY FOR FARM PLANTATIONS:

That shelter ~~tree~~s are essential to good farming in *all* districts in New Zealand, and particularly *in the south, is a* fact which cannot be *gainsaid* although the provision of this amenity was obviously more appreciated by past generation^s than the present. One is forced to this latter conclusion by the fact that a great majority of the mature farm plantations *in this end of the South Island* are *now* either cut out or *in process of being* cut out, and it is safe to assume that less than 10 per cent of the trees removed are being replaced by young stock. In some districts this is particularly noticeable, and farms which were well provided with shelter a few years ago have been depleted of trees during the slump period, and little or no move is being made to replant. In *some* instances, not only have shelter belts been *cut* out but gorse hedges have also been removed to facilitate the *destruction* of rabbits and to reduce costs of upkeep, with the result that some holdings are *now almost* devoid of shelter of any description.

PART II: TREE SPECIES AND ESTABLISHMENT:

(a) Species: In considering this *question* it is assumed that the average farmer requires cheaply raised and *easily* established plantations primarily to shelter his homestead buildings, stock and *pastures, to a lesser extent* to provide domestic fuel and farm fencing, while in *some districts* with light soils the prevention of erosion by wind is of some importance. A great variety of exotic trees have been acclimated in New Zealand, but for practical purposes, South Island *farmers would* be well advised to select - with due regard to suitability for their own particular localities - from the twelve species which are *enumerated* hereunder in order of general value for farm forestry:

Cupressus nacrocarpa	(Macrocarpa) ;
Pinus radiata	(Insignis pine);
Pinus ponderosa	(Pondosa Pine) ;
Pinus laricio	(Corsican Pine) ;
Pinus Murrayana	(Lodgepole Pine) ;
Eucalyptus gigantea	(Red Mountain Ash);
Eucalyptus gunnii	(Cider Gum);
Eucalyptus Globulus	(Blue gum - only in the far south);
Larix decidua	(European Larch);
Pseudotsuga taxifolia	(Douglas Fir) ;
Populus fastigata	(Lombardy Poplar) ;
Pinus pinea	(Stone pine).

It is necessary to consider this list in order of suitability for various sites and climatic conditions.

Macrocarpa: This has been listed as the most valuable of all farmers' trees, more especially in view of the remarks contained in Part III (c) of this paper. Its *use* is restricted to some extent as regards *site*, however, and it makes its optimum growth in a free, well-drained soil with a rainfall in *excess* of 20 inches per *annum*. It will *withstand* severe gales, and is a most useful tree on extremely exposed situations. Its ability to withstand strong, saline wind^s is probably best illustrated on the coast line near *Orepuki*,

across the south coast of this Island. It thrives equally well inland and will stand fairly deep shade, having been used with a fair measure of success for underplanting in native forests. As a shelter tree *macrocarpa* is second to none. If planted as single trees or in groups of three or four the branches of mature trees have an enormous spread, and the most sustained rain will hardly penetrate to the ground beneath them. In shelter belts, provided the espacement is wide, the tree is comparatively long-lived, and retains its lower branches to a greater extent than any other species in common use. It has an added advantage for farm hedge purposes in that it will stand comparatively severe trimming. Grown in compact blocks at an espacement of down to 6 feet, *macrocarpa* produces a clean, straight bole with small side branches; grown on land infested with gorse or other rubbish at much wider spacing, say up to 10 feet, much the same results are achieved. The timber produced from old trees splits freely and is more durable in the ground than almost any other exotic species with the possible exception of some of the better eucalypts. *Macrocarpa* requires careful planting, and it should only be used in soils which will allow the free development of a good root system. It is not worthwhile to plant it on very dry or poor land. It is rather more difficult to transplant than most *Pinus* species and the use of boxed or trayed trees is recommended in preference to open-rooted stock. One note of warning is necessary however as it has just been discovered that the insect population so obvious in old farmyard *macrocarpa* is very largely the two-toothed longhorn *Ambeodontus tristis* which has hitherto remained undetected. This has probably served as a focus of concentration for the numbers of this insect now so troublesome in some buildings. Old and unhealthy *macrocarpa* wood should be removed from all trees and borer infested stakes and posts burned.

Insignis Pine: This tree is so widely known that comparatively brief mention will suffice here. It provides good shelter more quickly than any other species and is extremely tolerant as regards site, and formerly thrived in nearly all situations from sea level up to 2,500 feet altitude in the south, and with rainfall varying from 15 to 115 inches per annum.

However, as a result of recent trouble with fungoid diseases and attacks by boring insects in plantations unsuitably situated the range of sites considered desirable has been somewhat reduced. An essential condition with this and all other coniferous trees is that the land shall be well drained. An extremely common cause of trouble in plantations, especially in Southland, is lack of drainage, and thousands of trees ranging up to 60 or 80 feet in height are lost annually owing to poor drainage or a rise in the water level due to blocked drains. In the South Island, *insignis* pine should not be planted above 1,500 feet altitude, and unless in particularly favourable situations its use where the average rainfall is below 20 inches cannot be recommended.

As the farmer's future objective should be rather to produce shelter than saw log timber, an espacement of 12 feet to 16 feet is recommended. Even wider spacing may be advisable where several rows of trees are planted for a shelter belt. The resultant stand will be more windfirm and will give better low shelter.

Provided that grass, bracken or other rank growth may be kept in check, the use of seedling planting stock is recommended with this species, or failing that small trees with well developed roots are preferable. The use of trees more than two years old is definitely not advised.

Using the term in a forestry sense, *insignis* pine is a short rotation tree. Under favourable conditions it will reach maturity in 40-45 years and in many cases after attaining the age

of 60 years the trees are unsafe and instances of damage to stock, implements and buildings by falling trees have not been uncommon.

Corsican Pine, Pongosa pine, and Lodgepole pine: These are suitable for drier situations and will survive on poor soils than species already dealt with. They are not affected by frost and thrive in Central Otago at an altitude of 2,600 feet. Of the three, Lodgepole pine grows most rapidly, produces the heaviest foliage, and has the most attractive appearance. For farm plantations the spacing of these should be from 10 to 12 feet, and planting stock should be three years old.

Owing to recent developments in America, the seed, particularly of *Pinus ponderosa*, is extremely hard to secure. This is due very largely to the Roosevelt Forestry Expansion Programme using C.C.C. and similar types of relief labour. Practically all supplies collected in U.S. are now required in that country, the only stocks available for despatch to New Zealand are their surplus (if any). Canadian sources of supply have practically dried up owing to the fact that the Canadian Government has retrenched, and closed its seed station in British Columbia. Corsican pine, true to type, is almost equally difficult to procure. Supplies of Lodgepole pine suitable for farmers' purposes may be collected in New Zealand, and will probably be available during the next few years.

Red Mountain Ash: A hardy frost-resistant eucalypt of erect habit and handsome appearance which carries a heavy growth of foliage and gives excellent shelter if planted at wide spacing. It makes very rapid growth and for this reason it is one of the few trees which may be mixed with insignis pine for shelter belts. Red mountain ash timber is straight, splits freely, but is not durable in the ground. In Victoria where the timber is used extensively for house building, trees as young as 40 years of age are converted to saw timber for this purpose.

The germination of seed of this species is rather poor and the trees should be planted in fairly good soil. As with all other eucalypts, the seedlings are planted out into permanent locations at about 10 months old.

Cider Gum: This is the most frost-resistant eucalypt of value for farm shelter purposes. It is reputed to be the only one which has withstood the heaviest frosts experienced in Central Otago. It may be used in mixture with the slower growing pines already mentioned and also with larch. The wood is not of great value save as fuel.

Blue Gum: This, the most common species of eucalypt, can only be recommended with confidence in the south where it has continued to grow unaffected by blight. On poor scrub and weed-infested land, blue gum is often a distinct asset as it regenerates freely and successive crops of pole timber for pit props, etc., can be cut at comparatively frequent intervals. It is tolerant as regards site and soil conditions and on rather poor, hard clay land where growth is slow it produces very durable post timber. As fuel the wood is fairly satisfactory.

Douglas Fir: The use of this tree should be limited to comparatively sheltered sites on good soil and with a rainfall of at least 20 inches per annum but preferably much more. As it grows fairly rapidly and attains a great height if the main leader is not damaged by wind, it is unsuitable for planting in a mixed stand with Corsican pine, Larch, etc.

Larch: A deciduous tree of erect growth and comparatively little value for shelter, but its presence enhances the appearance

of plantations and it thrives well if mixed with the slower growing conifers already described.

Heartwood of larch upwards of 35 years old, is fairly durable in the ground and may be used as posts, poles, etc. As firewood it burns freely, but is not of great value.

Lombardy Poplar: This is a most hardy tree of this species established in New Zealand, is frost-resistant and thrives in dry situations. It should preferably be raised from small cuttings placed in a nursery in September and planted out 10-11 months later. The timber has been used successfully for the production of fruit cases; and dray and cart floors,

Stone Pine: This tree has been little used but is recommended in dry districts. It is frost resistant, has a very wide spreading habit, and is suitable for shelter for stock, implements, etc. The use of a few trees in a group spaced, say, 25 feet to 30 feet apart, is suggested. It should be noted that this tree is difficult to transplant and very susceptible to frost in nursery and early stages of growth.

(b) Establishment. Soil sites have been briefly dealt with under the heading of species, and a few definite rules may be laid down in connection with the establishment of shelter belts. The first essential is that they must be securely fenced and the total exclusion of rabbits and hares is imperative. No hard and fast rule may be stated for the direction of farm shelter belts as this must vary with the configuration of the country and the direction of prevailing winds. Generally speaking, however, and more particularly in Southland, it is desirable that the belts should run approximately north anti. south in order that paddocks should not be unduly shaded by the trees.

In establishing plantations adjacent to homesteads, farmers very frequently use tall growing species too close to dwellings. This practice is due to the desire to secure early shelter from winds, but the ultimate effect is undue shading of the buildings, blocked spoutings through needle fall and interference with drains by tree root systems, and, finally the danger of damage by falling trees as species such as *Pinus radiata* definitely become over-nature within the ordinary life of well-built farm homesteads.

Where difficulty is experienced in securing planting stock farmers might without much trouble undertake to raise their own trees from seed, and bulletins dealing with the establishment of small nurseries for this purpose may be obtained from any office of the State Forest Service.

Methods of planting vary to some extent according to the class of soil, climatic conditions, and type of trees to be used. Generally speaking, in the establishment of small plantations the site should be selected, fenced, cleared of any very rank growth, and the ground should be pitted in the autumn by lifting a spit of soil where each tree is to be planted, breaking it up and leaving it to be replaced when the tree is finally planted, usually late in the winter. In placing the trees it is necessary that the roots should be spread and not bunched together. The ground round young trees should be thoroughly firmed after planting. Where rank grass is present: a certain amount of clearing will be necessary the following year and possibly for two years. The same may apply on sites infested with gorse, weeds, manuka or other rank growth. In the vicinity of homesteads many farmers will desire, for aesthetic reasons, to use a mixture of trees and possibly include a greater variety than have been mentioned in this paper. This is, of course, a matter of choice, but the inclusion of more species has been

purposely avoided as the object is rather to produce a paper dealing with the establishment of farm shelter plantations from a purely practical point of view.

Referring to the drier part of Central Otago, in particular, it is desired to stress that this cannot be regarded as a forest district, in that it has never supported indigenous forests, and it is not economically practicable to undertake the establishment of exotic plantations of any magnitude in a district with so low a rainfall. The few species which are those proved best by practical trials extending over a great many years, but their rate of growth is definitely slower than in more favourable situations where winter climatic conditions are less severe and the rainfall heavier.

Warning should be issued against planting near telegraph and power lines and particularly near aerodromes. A recent case in this connection occurred in Hastings where the removal of trees on properties round an aerodrome was necessary because they caused wind currents. In view of the certain development of air transport, this aspect may become of very great importance in the future and it is possible that the planting of trees on properties near air-ports may be absolutely prohibited. It is a point which should be kept in mind by those who desire to establish plantations of tall growing trees,

PART III: FARM TIMBER UTILISATION:

(a) Fuel: Throughout the greater part of Otago and Southland with the exception of comparatively sparsely settled parts of Central Otago, the production of firewood from farm plantations is not assumed to be of great importance owing to the fact that coal and supplies of secondary indigenous woods have been comparatively cheap while the provinces are also well served with electricity.

(b) Fencing, Timbers: These have so far been produced almost exclusively from indigenous forests, but owing to the difficulty of access and exhaustion of supplies the position as regards the future demands serious consideration. Where farmers have grown suitable exotic timber such as macrocarpa or durable eucalypts, these will be very valuable, but reliance must be placed largely upon the remaining indigenous forest timbers and upon exotic softwood posts which have been subjected to preservative treatment. The State has during the past twelve years used or sold quantities of both posts and poles which have been creosoted, and three steam-operated plants are now in course of preparation for work on a large scale in this direction. It is anticipated that the production will within two years be sufficiently large to overcome the shortage which is seriously threatened in many districts. The preliminary work carried out in this connection has demonstrated that posts can be treated and marketed at prices which compare favourably with those of posts produced from our indigenous forests, while the experience already acquired in New Zealand and other countries where creosoted wood has been in regular use for many years supplies the necessary guarantee of durability. The creosoting of fencing material may, of course, be quite successfully carried out by farmers whose plantations contain suitable softwoods, but generally speaking it will be safer to rely upon the product of the larger plants where all timber is subject to uniform treatment;

(c) Saw Logs: During the last seven or eight years the sale of plantation timber for saw logs has steadily increased and many farmers have derived considerable benefit from royalties received for plantations established by an earlier generation. While it is impossible to secure accurate data, it is reasonable to assume that the royalty paid by sawmillers for the 27½ million board feet of

exotic timber produced according to the Government Statistician's figures for New Zealand during 1934-35, amounted to roughly £22,000, and of this the greater part was from farm plantations. These figures have been greatly exceeded since and may easily have increased by 50 per cent. for 1936-37. As far as the two southern provinces are concerned, the end of this supply is in sight, and the next two years will see a great decrease in the sawn timber output.

It is quite apparent, however, that the demand for saw logs from this source will not continue indefinitely; With the approaching maturity of large areas of state plantations throughout the Dominion, local body plantations in some districts and also plantations of private forestry companies in the North Island, a change will take place in the present generally wasteful and uneconomical methods of manufacture. The trend will be towards larger and more economically operated centralized permanent sawmills and factories producing timber and box shooks of higher quality than that now generally marketed.

In view of the foregoing, the present is an opportune time to sound a note of warning to those who may contemplate the establishment of large shelter plantations of short-lived trees with a view to the ultimate production of saw timber; and farmers are recommended to plant only such species and areas as may be regarded as useful within the limits of properties on which they are grown. It is highly probable that plantations carrying from a few hundred thousand to perhaps a million feet of timber of the rather indifferent quality now so keenly sought after in many districts will not find a ready sale.

DISCUSSION.

W. R. CHRISTIE. (Te Houka, Balclutha):

broughtup the following points: --

What age should shelter trees be when planted?
Mr. Dolamore advises nothing older than 2 years, and prefers seedlings. At this age, however, they are subject to the attack of hares and rabbits. Few farmers can afford to erect a rabbit-proof fence.

What is the correct method of planting a tree? Some people say they should be planted in the middle of a hole, with the roots spread evenly out on all sides, but against that there is the argument that in exposed positions it is preferable to plant to the side of the hole away from the prevailing wind.

In planting trees on the high ridges, most plantations of Pinus are placed too close to the area requiring to be sheltered. No mention was made of the danger of the uprooting of Pinus on shallow gravelly soils, due to the root system being more or less shallow and confined to the surface,

With regard to Macrocarpa, it is suggested that before planting the land should be cultivated by taking a crop of potatoes or turnips off. It is also advisable to water or puddle the trees in.

Larch should not be planted below a 300 ft. level.
Blue gum should not be planted on ridgy country.
Might not Pinus radiata be used for the purpose of eradicating gorse and briar? It has been ascertained from the authorities that this can be done at from £2/10/- to £3/10/- per acre.

No mention was made of Cupressus Lawsoniana.

While this discussion is relative to Farm afforestation, Mr. Christie considers that the day is fast coming when much of the grassland might be profitably converted to growing trees.

MR. DOLAMORE replied as follows:-

Macrocarpa should be planted in the middle of the hole. It is not a tree that blows over very readily. In the case of Pinus, this should be planted to the side of the hole away from the prevailing wind. In grass land a square piece of turf should be cut out of the ground to facilitate planting,

I agree that Larch should not be planted below the 300 ft. level as a general rule.

Cupressus Lawsoniana is an extremely valuable tree, but it is more difficult to handle than macrocarpa. In the seedling and nursery stages it is delicate, but as a tree it will be just as valuable as macrocarpa.

Pinus radiata can be very successfully used for the suppression of gorse and other similar rubbish, but if you do this on a large scale you are establishing what becomes a commercial

plantation, When it reaches maturity in **30** years' time, what **is** going to be its value in competition with the large State Forest and **other** plantations? I cannot recommend the large scale planting of that species merely to suppress areas of gorse and briar, **if** you also went to plant it for profit, It is rather an expensive way of getting rid of the gorse.

RADIATA SEEDLINGS v. 3-yr.-old stock: Among State Forest areas established with seedling and two to three-year stock we have **never** had to carry on anything like the amount of blanking if seedlings are used. We find that the seedling **stock** is best. You **must**, however, keep out the hares and rabbits.

UPROOTING OF OLD PINES: This is probably caused by the trees being planted too close together and not subsequently thinned, A **whole block** of pines was blown down in a gale at Clydevale. The roots were 'not properly established and **the trees have** not become windfirm.

MR. STUART spoke of the importance of Flax in the Orepuki District. He mentioned that an area which was **cut** out twelve months ago **is** now giving' shelter again,

MR. HURST asked how close you could plant to aerodromes, power line & telegraph poles; and boundary fences,

MR. DOLAMORE replied that it depended **upon** the type of tree. With regard to aerodromes, it is possible that **before** long the planting of trees on adjoining properties will be **out** of the question.

MR. FOUGERE said - "The legal position with regard to boundary fences is that the consent of the adjoining owner should be obtained before planting."

He further asked whether, in consideration of the fact that the Cork Oak does exceedingly **well** in Otago, it might not be **profitable** to grow it extensively,

MR. DOLAMORE -

The value of Cork Oak grown on a commercial scale in New Zealand would be negligible, It is usually grown in much warmer climates than Otago and Southland - such, for instance, as Spain and Portugal, and **the** bark crop is harvested by cheap peasant **labour**.

MR. OSBORNE, asked if the question of the **possibilities** of the Lombardy Poplar timber being used for Butter boxes had been gone into* It was one of the few timbers that had no aroma, and was an extremely useful type for the manufacture of **various farm** implements.

With regard to shelter belts being planted north and south, in Canterbury this is wrong, They should be in the opposite directions. In Canterbury the prevailing practice has been to plant to break the N. W. wind. This also is wrong, The wind that does the damage **in** that district is the S. W. gale. If the shelter belt is planted east and west, it gives shelter from the S. W. wind in the spring, and from the N. W. in the summer.

MR. DOLAMORE - We do not generally recommend the planting of Lombardy poplar for butter boxes. Certain varieties of poplar are suitable for food containers such as butter boxes, grow more rapidly and produce cleaner timber than Lombardy-

DIRECTION OF FARM SHELTER BELTS. This must be governed to a great extent by the **configuration** of the **country** and the direction of the prevailing winds. In Southland, north and south, is essential to **avoid** undue shading.

MR. MCGREGOR -

In my **experience**, Mr. Dolamore's **contention** that the shelter belt should run north and south is right as it **applies** to Southland. It breaks the cold westerly or south-westerly winds, and you get great benefit from the shelter on this line,

In connection with the Lombardy poplar, we have in view the use of **this** tree to correct erosion on the hill country where the bush and scrub have been destroyed, and the **gravel** is coming down on to the good land. In **Kaikoura** rows of poplars were planted as close as possible across a river bed where they held a bank 12 feet high. In a similar manner, if planted on bare hills, they will hold back gravel and shingle **from** invading the flat **country**.
