# PLANTING TRIALS AT BALMORAL FOREST

K. W. PRIOR*

*SYNOPSIS*

*Poor soils and frequent periods of drought have caused heavy and repeated planting losses on the grassland areas at Balmoral Forest. This paper records the results of planting trials carried out with* Pinus nigra (*laricio*) *and* P. radiata. *On the dry Balmoral sites, trees planted at the bottoms of furrows or in prepared hollows have a significantly higher survival rate than trees planted on level ground.*

## INTRODUCTION

On gravelly soil at Balmoral Forest the low humidities, the periods of drought, and the frequent northwest winds have caused heavy losses to newly planted stands. Although all sites at Balmoral can be difficult, it is the grassland areas rather than areas occupied by *Leptospermum* species that have been most difficult to stock. As a result of these mortalities some 2,000 acres of grassland remain largely unstocked. Sweet vernal is the dominant grassland species. The soils throughout are light and gravelly and the terrain flat.

The purpose of this paper is to record the results of trials which have been carried out to determine if survival rates on these difficult sites can be improved.

## DESCRIPTION OF TRIALS

Three different techniques have been tested. In Trial 1 the trees were planted in ploughed furrows, in Trial 2 in the furrows formed with the tilted blade of a crawler tractor, and in Trial 3 in small hollows made with a spade.

In all three trials the furrowing, or digging of hollows, removed most of the topsoil; by exposing the gravel this created what appeared at first sight to be less rather than more favourable planting conditions. In all cases the "open root" method of planting was adopted.

*Planted in Ploughed Furrows (Trial 1)*

This trial was established on 3 August, 1954, in a grassland area on Waimakariri soils, which had previously been unsuccessfully planted four times with *P. radiata*. Furrows about 6 in. deep were formed with a plough on an area large enough to plant 42 two-year-old *P. radiata* and 36 two-year-old *P. nigra* (laricio). At the time of planting the *P. radiata* were approximately 14 in. high and the *P. nigra* (laricio) 6 in. high. The trees were planted at the bottom of the furrows; an equal number of each species was planted on an adjacent unfurrowed area as control. This trial was fenced off to exclude rabbits. Two-monthly inspections were made until 23 June, 1955, and a final inspection on 11 November, 1958.

* Forester, N.Z. Forest Service, Dunedin.

*Planted in Furrows Formed with Tractor Blade (Trial 2)*

This trial was established on 25 August, 1954, on Eyre soils on a logged area where slash prevented the use of a plough. After logging the area had been unsuccessfully planted four times with *P. radiata*. There is a sparse cover of weeds and regenerating *Leptospermum ericoides*.

Furrows about 6 to 10 in. deep were formed with the tilted blade of a crawler tractor over an area sufficient to plant 472 two-year-old *P. nigra* (laricio). Here again the trees were planted at the bottom of the furrows. A further 455 *P. nigra* (laricio) were planted on an adjacent unfurrowed area for control. The *P. nigra* (laricio) were approximately 6 in. high. This area was not fenced off from rabbits. Two-monthly inspections were made until 30 August, 1955 and a final inspection on 11 November, 1958.

*Planted in Hollows (Trial 3)*

Five plots, located on unstocked grassland distributed throughout the forest, were established on 13 September, 1954. All were on Waimakariri soils. In each plot a total of 10 one-year-old *P. radiata* and 10 three-year-old *P. nigra* (laricio) were planted in hollows 8 in. deep by 14 in. square and 90 trees of both species were planted on adjacent level ground for control. The *P. radiata* were approximately 4 in. high and the *P. nigra* (laricio) 14 in. high. The plots were not fenced off from rabbits. Two-monthly inspections were made until January, 1955, and a final inspection in November, 1958.

## RESULTS OF TRIALS

The summer of 1954–55 was not particularly dry, and with routine plantings the survival rates were generally satisfactory. In the summer of 1955–56 there was a severe drought, which killed many trees that had survived the first summer. The effects of the various treatments are shown in Tables 1 and 2. In Trials 2 and 3 a number of trees were killed by rabbits. In computing the survival percentages the numbers killed by rabbits have been subtracted from the total numbers planted so that, as far as possible, the depredations of rabbits do not influence the results.

TABLE 1: SURVIVAL AFTER FIRST SUMMER

| | *On treated areas* | | | *On level ground* | | |
|---|---|---|---|---|---|---|
| *Species* | *Number Surviving* | *Number Planted* | *Percentage* | *Number Surviving* | *Number Planted* | *Percentage* |
| | FURROWED WITH A PLOUGH (TRIAL 1)* | | | | | |
| *P. radiata* | 38 | 42 | 90 | 23 | 42 | 55 |
| *P. nigra* (laricio) | 36 | 36 | 100 | 34 | 36 | 94 |
| | FURROWED WITH A TRACTOR BLADE (TRIAL 2)† | | | | | |
| *P. nigra* (laricio) | 456 | 462 | 99 | 356 | 421 | 84 |

* From an inspection made on 23 June, 1955.
† From an inspection made on 8 August, 1955.
No comparable inspection was made for Trial No. 3.

Although the summer of 1954–55 was a reasonably favourable one for newly planted trees, the survival rate of *P. radiata* was significantly higher on ploughed furrows than on unfurrowed ground. With *P. nigra* (laricio) for Trial 1, there was no significant difference.

The survival rate of *P. nigra* (laricio) in the furrows formed with a tractor blade was significantly higher than on unfurrowed ground.

As already stated the drought of 1955–56 was a particularly severe one and further heavy losses occurred. These losses are recorded in the data shown in Table 2.

TABLE 2: SURVIVAL AT 11 NOVEMBER, 1958

| | *On treated areas* | | | *On level ground* | | |
|---|---|---|---|---|---|---|
| *Species* | *Number Surviving* | *Number Planted* | *Percentage* | *Number Surviving* | *Number Planted* | *Percentage* |
| | FURROWED WITH A PLOUGH (TRIAL 1) | | | | | |
| *P. radiata* | 28 | 42 | 67 | 6 | 42 | 14 |
| *P. nigra* (laricio) | 10 | 36 | 28 | 3 | 36 | 8 |
| | FURROWED WITH A TRACTOR BLADE (TRIAL 2) | | | | | |
| *P. nigra* (laricio) | 342 | 459 | 75 | 74 | 419 | 16 |
| | HOLLOWS (TRIAL 3) | | | | | |
| *P. radiata* | 17 | 30 | 57 | 78 | 285 | 27 |
| *P. nigra* (laricio) | 42 | 47 | 89 | 320 | 437 | 73 |

With both species the survival rate has been significantly higher on furrowed ground and in hollows than on level ground.

Further evidence that furrowing will increase the survival rate of *P. radiata* was recorded by Bridgeman (1956). Of some 80 acres of *P. radiata* planted by a catchment board in 1955, part was on furrowed and part on unfurrowed ground. The survival on furrowed ground was 85% compared with 25% on unfurrowed ground.

## CONCLUSIONS

On certain of the hard dry sites in North Canterbury, the planting of *P. radiata* and *P. nigra* (laricio) at the bottom of furrows and in small hollows will substantially increase survival rates. This advantage is, however, claimed for only the most difficult sites; it is not recommended, even for Balmoral Forest, that furrowing be a standard practice. On sites with adequate soil moisture the effects of the treatment would be neglible and on wettish soils could be detrimental. The digging of hollows is a slow and costly job and would normally be used only for the small-scale amenity or shelterbelt plantings. Furrowing could be used for the larger programmes. Where slash prevents the use of a plough the furrows could be formed with a tractor blade.

It is considered that the furrowing or digging of pits increases the soil moisture available to the trees, provides shelter from dry winds, and eliminates competition from the roots of ground vegetation. With grassland vegetation the latter point is most important, but in Trial 2 the influence of the sparse vegetation that is present would be negligible.

## REFERENCE

Bridgeman, C. O., 1956. Furrow planting of radiata pine. *N.Z. Forest Service Newsletter*: (6) 7.

## APPENDIX — DESCRIPTION OF SOIL TYPES

*Soils of the Waimakariri Soil Set*

These soils occupy land built up of recent flood deposits, the sequence of which in any one place varies considerably. Thus pit gravels are often found to lie over sands and fine sands, the reverse of the sequence on other soils at Balmoral.

A common profile is:

6 in. dark brown sandy loams; very friable; weakly developed medium and fine granular structure; many roots; indistinct boundary.
7 in. pale yellowish brown sandy loam; friable; structureless; few roots on loose greywacke stones and sands.

*Soils of the Eyre Soil Set*

The soils are derived mainly from greywacke alluvium but vary considerably in depth and texture. Stony soils predominate but are generally associated in a complex manner with shallow and very shallow sandy soils.

A common profile is:

5 in. dark brown sandy loam; friable; moderately developed medium and fine nutty and fine granular structures; many roots; indistinct boundary.
7 in. dark yellowish brown stony sandy loam; friable; weakly developed medium nutty structure with few cast granules; many roots; indistinct boundary, on firm pale olive brown gravels and sand.

The Eyre soils to the west of the forest are greyish brown in contrast to the above dark brown soils in the east.