AGROFORESTRY TRIALS AT MUNDARING AND YALANBEE

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INTRODUCTION

A number of co-operative research trials between the Forests Department, the P.W.D. and C.S.I.R.O. (Land Resources Management) have been established; using considerable inputs from Divisional operations staff and the Inventory and Planning branch.

This article summarises preliminary results from this interdisciplinary research.

1. CLOVER AND CROP PRODUCTION UNDER 13-15 YEAR OLD PINUS RADIATA

13 year old P. radiata at Wellbucket were thinned to 143 and 261 $spha^{-1}$ and pruned to 6 m in May 1975. Three cultivars of subterranean clover, Daliak, Seaton Park and Woogenellup, were sown in strips between the tree rows and on a control area without trees. For two years the cultivars were reasonably pure and their individual productions of herbage and seed were measured. Chemical analyses of both green and dry herbage were performed. The strips were heavily grazed by sheep in early summer each year and this helped transfer seed to the unsown areas in the tree rows. By the third year the cultivars were fairly well mixed and all the ground surface carried pasture.

Oats and Lupins were sown on part of the experiment in 1976 and in 1977.

Trees were sampled for ring analysis, needle lengths and foliar nutrient levels, and estimates of crown cover were made.

Soil moisture measurements were made during the spring and early summer of the first two years.

The clovers established without any problems and remained healthy. They were gradually invaded by volunteer pasture species at similar rates to those which occur in agriculture. Daliak was somewhat inferior to the other cultivars and appeared to be unpalatable to the sheep when dry. This may have been related to its earlier maturity and the combination of higher fibre content, lower digestibility, lower concentrations of K, S, Mg and carbohydrates revealed by the analyses. The concentrations of P, K and S were low in the dry herbage of all cultivars but no ill effects were observed in the sheep.

By the third growing season herbage yields had fallen under the trees to 84% of the control pasture at 143 $spha^{-1}$ and to 68% at 261 $spha^{-1}$. Seed yields were higher under the trees in the first year and similar to those of the control pastures in the second year. The seeds were heavier under the trees.

Although the clovers, oats and lupins were all etiolated under the trees, this only affected the yields of clover and oats, the latter showing reduced tiller development which is often correlated with reduced yield.

The effects of pastures on tree growth rates and nutrient uptakes cannot yet be separated from those of thinning treatments but these measurements will be continued. Basal areas of individual tree crowns increased from 9 m^2 to 14 m^2 in two years.

During late spring, there was more moisture in the topsoil under the trees. This is important in seed development, pasture growth and in keeping the pastures growing longer. This may partly compensate for the reduced yields which result from shading.

2. COMBINING SHEEP GRAZING AND SOFTWOOD PRODUCTION, AT VARIOUS TREE STOCK RATES

The encouraging results of experiment 1 led to a larger experiment being established in the same locality. This had Seaton Park clover sown under 15 years old P. radiata at 70, 135 and 200 $spha^{-1}$, P. pinaster at 135 $spha^{-1}$, and on control areas from which these pines were clear felled and removed. The trees have been pruned to 6 m. Fences have been erected so that treatments can be individually grazed by sheep in June each year at rates that will fully utilise the pasture by early summer. Liveweight changes of the sheep will be measured. Trees will be measured for growth rates, changes in form and nutrient uptakes.

Other areas were also thinned and pruned but left without pasture. Half of these areas have been fertilized at the same rates as the pasture plots. This allows assessments to be made of thinning alone, thinning + fertilizing, and thinning + fertilizing + grazing of pastures, on tree growth rates etc.

The pastures were established in June 1977 and made satisfactory growth for such a dry season. Yields of clover herbage on the radiata plots ranged from 2500-4500 kg ha^{-1} and seed yields were high. These pastures were grazed until about 1000 $kg \cdot ha^{-1}$ of herbage was left. Yields of herbage were lower (1200-1500 $kg \cdot ha^{-1}$) on the less fertile and drier soils of the pinaster site and seed yields were moderate. These pastures were not grazed.

3. MANAGEMENT PROBLEMS WITH YOUNG TREES IN PASTURE AND CROP SITUATIONS

When tree seedling are planted into old pasture land it is essential to protect them from competition for light, moisture and nutrients until their roots and foliage extend beyond those of the competing plants. It is therefore necessary to spot or strip spray with weedicide for at least the first season. This leaves most of the area available for growing pastures or crops.

Grazing the pasture between young trees is risky because, once they start, stock usually eat not only the leaves but much of the stem, and permanent damage or tree deaths occur. stock usually start damaging the trees, and must be removed when the pasture is only partly utilised.

At C.S.I.R.O.'s Yalanbee Experiment Station, Bakers Hill, the palatability of several tree species in a range of pasture conditions is being investigated. The species used so far are P. radiata, P. pinaster, E. camaldulensis, E. robusta, E. maculata, E. citriodora and E. globulus.

When potted trees ranging in height from 30 to 150 cm were placed in dry pastures sheep quickly started eating them, and caused heavy losses especially if the pastures were of low quality and dominated by grass or erodium (wild geranium). In good quality pastures of clover much less damage was done, and in a highly palatable capeweed dominant pasture very few trees were eaten or damaged. The pines, E. camaldulensis and E. robusta were much more attractive to the sheep than E. citriodora or E. globulus. Fresh growth was preferred if the leaves were within reach, and sometimes bark was nibbled on trees whose leaves were not eaten.

If the land is arable, hay production and cropping between tree rows are alternatives to pasture for grazing. C.S.I.R.O. workers have investigated the effects of oat crops, on the survival and early growth rates of several tree species (P. radiata, P. pinaster, E. camaldulensis, E. robusta, E. maculata, E. citriodora and E. globulus), planted 6 m apart. In 1976 the effects of crops sown to within 45 and 90 cm of the tree rows were compared with those where no crop was sown. In 1977 the trial was repeated using only P. radiata, E. robusta, E. camaldulensis and E. wandoo. Each year both trees and crops were planted in June and the crops harvested to 20 cm by a header at the end of November.

Each year there was a tendency for the trees protected by oat crops to make better growth in early spring. Following crop removal however, survival and growth were poorer where there had been the greatest shading. In the 1976 trial, even the more distant crops affected survival and growth, probably because these crops were taller than those of 1977.