

## SEED YIELD IN A *RADIATA* PINE SEED ORCHARD FOLLOWING POLLARDING

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### ABSTRACT

Because of increasing difficulty in collecting cones from taller trees in the Tallaganda seed orchard, two blocks of trees were pollarded at about 8 m in late 1970. The 1974 seed crop from these blocks was almost twice that of other blocks in the orchard. Pollarding has not only extended the productive life of the orchard, but may also have increased its average annual production.

### INTRODUCTION

The establishment and management of the *P. radiata* seed orchard at Tallaganda, New South Wales, has been described by Fielding (1964) and Brown (1971). The orchard consists of 34 blocks, each containing a single ramet of 30 clones. Two hundred and seventy trees (238 of which survived to 1968) were planted during 1957 in blocks 1 to 15. Four hundred and forty trees were planted in 1958, 121 trees in 1959. Smaller lots in 1960 and 1961 completed the first 30 blocks. Blocks 31 to 34 were planted later. The average years of planting for blocks relevant to this study are given in Table 1.

The trees are becoming too tall to climb for cones with safety, and in recent years, a truck-mounted elevating platform has been used to assist with cone collection. The platform is capable of extension to about 18 m, and using collecting rods, cones up to 22 m above the ground may be collected. However, many of the trees in the orchard are now well above this height, and in the near future much of the cone crop will be beyond reach.

An attempt was made to alter the habit of trees in the seed orchard by top-pruning (or pollarding) at an early age (Brown, 1971). This involved cutting back the leading shoot of trees over five feet tall, in blocks 2 to 5, in 1959, 1960 (twice) and 1961. Later in each year 1961-64, the topmost shoots were cut back to just above the newly-formed female strobili. Brown (1971) found this treatment to be largely ineffective in altering the habit, and seed yield also seemed unaffected. On the other hand, van Buijtenen and Brown (1962) found that there was a severe loss of production following pollarding in *P. taeda*. They concluded that none of their pruning treatments could be safely recommended for use in seed orchards.

This study was undertaken to find out whether pollarding at a later stage in  
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development (as suggested by Eldridge, 1966 and by M. J. Harding, unpublished) could reduce the height of cone collection without drastically reducing cone yield (other than through the loss of developing cones at the time of pollarding).

#### METHODS

In November 1970, 2 of the 34 blocks in the orchard were pollarded at about 8 m and the ends of some of the remaining side branches were trimmed. The cut was located about 0.3 m above a strong whorl, and the cut surface was sloped at an angle of about 45°. In block 12 alone the cut surface was brushed with creosote and in block 13, no treatment was applied.

In October 1972, the numbers of female strobili on trees in pollarded blocks (12 and 13) and a non-pollarded block (4) were counted. The first cone collection, after pollarding, from the two blocks, was made in November 1973. During this collection, cones from the two pollarded blocks and blocks 1, 2 and 4, representing non-pollarded blocks were counted. In November 1974, again during the annual collection from the orchard, comparative counts were made of cones collected from pollarded blocks (12 and 13) and blocks 1 to 5 representing non-pollarded blocks.

#### RESULTS

Comparative tree diameters, years of establishment, numbers of strobili, cones and amounts of seed for pollarded and some non-pollarded blocks are presented in Table 1.

In 1973, there was no apparent difference in cone production between pollarded and non-pollarded blocks. But in 1974 the pollarded blocks produced very many more cones than non-pollarded blocks. Cone production in non-pollarded blocks dropped between 1973 and 1974, but in pollarded blocks it actually increased. The difference between pollarded and non-pollarded blocks is reflected in the seed production figures in 1974 and, although it seems that the count of strobili in 1972 was conservative, figures for the resulting cones collected in 1974 show the same trend to higher production in pollarded blocks.

TABLE 1—Strobili counted, cones collected and seed produced for pollarded and non-pollarded blocks of Tallaganda Seed Orchard.

Block	Planting year*	Treatment	d.b.h. (cm)		Strobili 1972	Cones 1973	Cones 1974	Seed (g) 1974
			1968	1972				
1	1957.9	none	21.8	—	—	72.1	37.0	112
2	1957.9	none	19.3	—	—	61.6	43.3	131
3	1958.1	none	18.0	—	—	—	51.4	155
4	1958.2	none	18.3	45.3	45.3	79.0	51.4	155
5	1957.9	none	19.1	—	—	—	63.3	191
12	1957.8	pollarded	20.3	77.2	77.2	76.2	90.8	299
13	1958.1	pollarded	19.1	68.8	68.8	76.5	76.9	246

\* Average planting year, obtained by summing the years of planting of each ramet in a block and dividing by the number of ramets in that block. All other results are as means per tree in each block.

There was a small difference favouring the "no-creosote" treatment in 1973, but this difference was reversed in 1974. The average year of planting shows that the pollarded and non-pollarded trees are approximately the same age, and they were also about the same diameter in 1968. It is unfortunate that cone counts were not carried out in blocks 12 and 13 before the pollarding took place. However, production in the orchard changes from year to year, and such figures might only be relevant for comparisons between blocks, rather than between years.

#### DISCUSSION

There seems to be a small difference between the two pollarded blocks; block 12 produced more cones in 1974 than did block 13, and the difference was fairly consistent over all clones. It is not possible to be certain whether the difference is related to creosoting of the cut surfaces or not; at least the creosote was not associated with reduced cone production.

Pollarding at an early age did not show any clear benefits in *P. radiata* at Tallaganda (Brown, 1971), or in *P. taeda* (van Buijtenen and Brown, 1962). Pollarding in these cases took place while the trees were still small, which might explain the lack of a positive response. The present work is the first account of the effect of pollarding on *P. radiata* at a fairly late stage in the development of the trees.

The 1973 total crop for Tallaganda was the largest ever (172.8 kg), even though a further 8 of the 34 blocks had been pollarded in 1972 and as a consequence produced very little seed. The 1973 yield was 46 kg/ha compared with 21.9 kg/ha in 1972 and 30.7 kg/ha in 1974. The yield in 1974 was less than the 1973 crop in all except the pollarded blocks. Apart from the loss in 1971 and 1972, the pollarding does not appear to have led to a reduction in annual yield at Tallaganda, unlike the pruning treatments applied to *P. taeda* described by van Buijtenen and Brown (1962).

Matthews (1963) and Kozłowski (1971) have made extensive reviews of flowering and the exogenous (mainly temperature, light, water and nutrient supply) and endogenous (promoting and inhibiting growth substances) factors affecting both initiation of flowers and strobili and their later development. Pollarding as such is neither mentioned nor can its effects with respect to initiation be assessed from the information they present. Any extreme treatment which seriously impairs the tree's health and vigour can be expected to reduce the tree's fruit production. The present pollarding was evidently not extreme.

It was expected that the pollarding treatment would reduce yield somewhat, with production gradually increasing to approximately its former level over a number of years (Eldridge, 1966). It was surprising, therefore, to see that not only was production in pollarded blocks similar to other blocks in 1973, but it considerably exceeded that of unpollarded blocks in 1974. It is not possible at this stage to be certain whether there has been extra strobilus initiation as a result of pollarding, but production figures over the next few years should clarify the position.

The cone production figures for 1973 imply that the numbers of female strobili produced in 1971 were the same on both pollarded and non-pollarded blocks. Table 1 shows that pollarded and non-pollarded blocks are of about the same age and size. Blocks 1 to 5 are on one side of the orchard and occupy the first five rows of trees (blocks are rectangular, 6 × 5 tree blocks). Blocks 12 and 13 occupy part of tree rows

11 to 15 inclusive and are physically quite close to blocks 1 to 5. Blocks 2 to 5 have been pruned periodically from 1959 to 1964 but this does not seem to have affected production which is similar to block 1 (unpruned). There is no evidence that the pollarded blocks (with the same clone content) are systematically different from blocks 1 to 5 except for the pollarding treatment.

In vigorous unpollarded *P. radiata* the upper crown dominates the lower crown by correlative inhibition (Cremer 1973) which largely or entirely prevents the development of female strobili in the lower crown. Pollarding removes the inhibition together with the upper crown and allows the development of dominating shoots and female strobili on branches which otherwise would have remained subordinate and virtually free of female flowers (Fig. 1). Pollarding was carried out in November 1970. Fig. 1 shows that a response in terms of female strobilus production occurred within the following one to three months, i.e. during the period when female primordia are initiated in New Zealand (Bollman 1974). This led to cone harvests in 1973 which were comparable in size on pollarded and intact trees (Table 1). Pollarding a few weeks or months later in the season would probably be too late to allow female primordia to arise, and this would have prevented the formation of the 1973 cone crop. But pollarding a few weeks or months earlier might have boosted the 1973 crop, as was apparently the case with the 1974 crop.

Collection from the pollarded blocks at Tallaganda is considerably easier than from the non-pollarded blocks. In the next year or so, an increasing proportion of the cones will be out of reach in non-pollarded blocks. The pollarded treatment should increase the productive life of the orchard by up to five years.



FIG. 1—Branch array, showing newly developed female strobili, nine months after removal (November, 1970) of upper crown.

## CONCLUSIONS

1. There was a drop in seed yield from 1973 to 1974 in non-pollarded blocks, which did not occur in pollarded blocks.
2. Seed yield was the same in 1973 from both pollarded and non-pollarded blocks suggesting that the pollarding treatment in 1970 had an immediate effect on the sites of strobilus initiation in 1970-1971.
3. Collection of cones from pollarded blocks is much easier than from non-pollarded blocks. In the next year or so, collection will be impracticable from the tallest trees in Tallaganda.
4. Pollarding at 8 m (or thereabouts) at age 12-14 years when trees are about 25 m high would prolong the productive life of a radiata pine seed orchard.

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