BLANKING* PLANTATIONS OF RADIATA PINE

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ABSTRACT

A series of trials was laid down between 1963 and 1978 to determine the effect on the original planting of blanking small gaps (from single-tree gaps of 17 m² minimum, to gaps approximately 100 m² in extent). The earlier trials were in stands with the then conventional spacing of 2.4 × 1.8 m but the final trial, at Ashley Forest in Canterbury, was in a crop spaced at 3.6 × 1.8 m. The trials were terminated at the time of second pruning, when crop trees were about 8 m tall.

It was shown that blanking radiata pine stands in the summer or winter following planting had no measurable effect on the original crop in terms of height, d.b.h., or branch sizes where pruning was carried out on time to 1.8 and 3.7 m. In all stands, the difference in size between the blanking stock and the original crop was highly significant. Only rarely were blanking stock selected for either first or second pruning, and then only because of toppling and the inferior form of the original stocks.

Larger blanking stock (1½/0 and 2/0) was marginally better than small (1/0) stock. Delaying pruning for 1 year, even for the largest gap size, had only a minor effect on branch sizes.

It was concluded that, for the sizes of gap studied, blanking in summer or winter following original planting is of little use, except perhaps for gaps of 100 m², which would accommodate one final-crop tree, where full stocking is the aim. It is preferable to achieve full stocking in the first place by applying appropriate techniques.

INTRODUCTION

In the early days of plantation forestry in New Zealand, sound establishment techniques were carefully applied and spacing was often as close as 1.4 × 1.4 m; full stocking was generally achieved. In the planting boom years of the late 1920s and early 1930s standards fell; the quality of tree stocks, site preparation, releasing, and animal control declined, and spacing was widened

*The replacement of dead seedlings.

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to 2.4 × 1.8 m or even 2.4 × 2.4 m. Eventual stocking was often less than satisfactory.

Blanking, on a single-tree basis, was used throughout these years with the objective of achieving full stocking, usually being undertaken in the winter following planting but, if considered necessary, in the next year or two also. This may have been appropriate for slow-growing species (such as European conifers) provided there was sufficient after-care to ensure that the blanking stock survived against the lush growth of competing weeds in New Zealand. In the boom period no such care could be applied because of the large scale of operations, with the result that much of the stock used for blanking did not survive. Moreover, trees planted a year after initial planting of a fast-growing crop had little chance of reaching parity with the trees planted previously. Nevertheless, the practice persisted. By the 1960s there was growing doubt about the efficacy of blanking for stands of radiata pine. In 1963, A. K. Familton (pers. comm.) established a trial in Ngaumu Forest in the Wairarapa to determine whether blanking had any useful effect on the original crop (Valentine and Keating, 1970). A similar trial was established in Whangapoua Forest on the Coromandel Peninsula in 1964 (FRI, 1968, p. 12) where survival of initial planting was 70-80%; it was found that 77% of blanking stock died subsequently and that the survivors were not likely to achieve more than sub-dominant status.

The question was debated during FRI Symposium No. 9 (Chavasse and Weston, 1969, pp. 204-5). The consensus then was that it was best to avoid blanking (if possible) by using high-quality tree stocks, by ensuring careful handling of seedlings from the nursery to the planting spot, and by good site preparation. Nevertheless, because of the lack of precise knowledge of the effect of blanking and the fate of blanking stock, there was pressure to carry out additional research. Details of the research accordingly undertaken are given in Table 1. This programme was related to the silvicultural views of the time; for example, planting spacing was almost universally 2.4 × 1.8 m before 1970, but tended to increase thereafter.

The general objective of the series of trials was to determine if blanking had any significant effect, whether in volume or in quality, on radiata pine crops. For example: Would blanking stock be included in the crop element? Would blanking affect branch sizes of the crop element? To these trials can be added

TABLE 1: FRI RADIATA PINE BLANKING TRIALS

Year Established	*Location*	*Original Spacing (m)*	*Gap Sizes (No. of trees)**	*Age of Blanking Stocks*	*Season of Blanking*
1968 (a)	Mangatu Forest (MW)	2.4 × 1.8	1, 4 (line) 4 (square) 16 (square)	1/0 1½/0	Winter
1969 (b)	Rotoehu Forest (RW)	2.4 × 1.8	As above	1/0 2/0	Winter
1970 (c)	Rotoehu Forest (RS)	2.4 × 1.8	As above	1½/0	Summer (March)
1972 (d)	Ashley Forest (AW and AS)	3.6 × 1.8	2, 4 (line) 8 (rectangle)	1½/0	Winter and summer

*Controls consisted of unblanked gaps of the same sizes and, in the case of the 16-tree group, of a fully stocked stand.
(a) Chavasse and Bowles, 1975
(b) Chavasse and Bowles, 1977a
(c) Chavasse and Bowles, 1977b
(d) Balneaves, 1979

the Ngaumu trial Wn 109 (Valentine and Keating, 1970) as corroborative evidence; this is coded NW (see Table 1).

METHOD

In the Ngaumu trial circular 0.04 ha plots were laid out 1 year after initial planting in a stand where mortality ranged from 13 to 24% and stocking from 1878 to 2520 stems/ha. Half the plots were left unblanked and the other half were blanked, on a single tree basis, using 1/0 stock. There was no weed problem on this site and mortality of blanking stock was only 5%. Assessments were continued for 7 years with measurements of heights, d.b.h. of pruned trees, and maximum diameter of branches.

In the Mangatu, Rotoehu, and Ashley trials the gaps were created in either the winter or the summer after planting by removing trees in the plots to be blanked and replacing them with blanking stock. Regular releasing was undertaken throughout the period of assessment during which measurements of height and stem and branch diameters were recorded. All data were subjected to analysis of variance.

Trees were selected for pruning on the basis of dominance and stem form; this was complicated in both the Mangatu and Ashley trials because of toppling. First pruning height was approximately 1.8 m and second pruning height about 3.7 m.

RESULTS

Height Growth

Height measurements were undertaken in winter with the exception of the last four measurements at Ngaumu and the last at Ashley. These summer measurements have been adjusted to winter heights by interpolation in order to compare them with the other trials. Between blanked and unblanked plots there was no difference in mean heights of original trees. Mean heights are shown in Table 2.

TABLE 2: MEAN HEIGHTS (m) OF ORIGINAL AND BLANKED TREES

		Year from Original Planting						
Trial	*Stock*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
NW	Original	0.5	1.0	1.8	2.8	4.2	6.0	8.0
MW		0.5	1.5	2.9	4.5	6.2	8.3	—
RW		0.5	1.5	3.2	5.2	7.2	—	—
RS		0.5	1.4	3.0	4.4	6.6	—	—
A		0.5	0.9	1.5	2.5	3.6	5.1	6.8
NW	Bl. 1/0*	0.2	0.3	0.8	1.5	2.6	4.0	5.6
MW	Bl. 1/0	0.3	0.8	1.9	3.2	4.8	6.6	—
MW	Bl. 1½/0	0.4	1.0	2.1	3.6	5.2	6.9	—
RW	Bl. 1/0	0.2	0.9	2.0	3.4	5.1	—	—
RW	Bl. 2/0	0.4	1.1	2.3	3.5	5.8	—	—
RS	Bl. 1½/0	0.4	1.1	2.4	3.6	5.6	—	—
AW	Bl. 1½/0	0.3	0.5	1.1	1.7	2.8	4.1	6.2
AS	Bl. 1½/0	0.5	0.6	1.0	1.7	2.9	4.5	6.4
Means	Original	0.5	1.3	2.5	3.9	5.6	6.5	7.4
	Blanking	0.3	0.8	1.7	2.8	4.3	5.2	6.2
Diff.		0.2	0.5	0.8	1.1	1.3	1.3	1.2

*Blanked with 1/0 stock, etc.

1. *Comparison of annual height growth of original and blanking stock*: In order to compare the height growth of the original and blanking stock, the graphs for blanking stock in Fig. 1 should be displaced by 1 year. Similarly, in Table 2 the growth of the blanking stock between years 2 and 3 is compared with the growth of the original stock between years 1 and 2, and so on.

In all trials the pattern of height growth of the blanking stock was different from that of the original trees, but this pattern was not consistent, presumably owing to site differences. At Ngaumu the annual height growth of the blanking stock was at first the same as that of the original stock; thereafter the height growth

of the blanking stock was slightly in excess of that of the original trees. In the Mangatu trial the initial growth of the blanking stock was faster than that of the original trees, but after 2 years the growth rates were the same. In the Rotoehu trials the initial increment of the blanking stock was faster than that of the original trees but from the second year it was less. In the Ashley trial the initial increment of the blanking stock was less than that of the original stock but it gradually increased so that by the sixth year from planting the blanking stock was growing faster than the original stock; this could have been the result of shelter provided by the original stock in this windy locality.

2. *Height growth from the time of initial planting*: In all except the Ashley trials, the difference in height between the blanking and the original stock increased annually. In other words, the blanking stock fell further and further behind the height of the original stock so that the likelihood of the blanking stock being included in the final crop became increasingly remote. At Ashley, however, the difference in height between blanked and original stock diminished. This could be the result of shelter but may also be related to the wider initial spacing in this trial. The North Island pattern is illustrated in Fig. 1, taken from the RW trial.

3. *Height growth of the original stock*: In all trials there was no difference, throughout the trial periods, in the height of the original stock, irrespective of gap size and whether the gap was blanked or not. Blanking therefore had no effect on height growth of the original stock.

4. *Height growth of blanking stock in relation to gap size*: There was no significant difference between the mean heights of blanking stock, irrespective of gap size.

5. *Effect of age of blanking stock*: In the MW and RW trials 1½/0 and 2/0 blanking stock grew faster than the smaller 1/0 stock; differences were significant at the 5% level only in the RW trial, but not elsewhere.

6. *Effect of season of planting*: There were no significant differences between summer and winter blanking at Rotoehu (although these are not strictly comparable because the trials were not contemporaneous). At Ashley the summer blanking stock grew slightly faster than the winter stock. This is not of practical significance as in most years it would be very difficult to establish trees in summer in Canterbury because of drought.

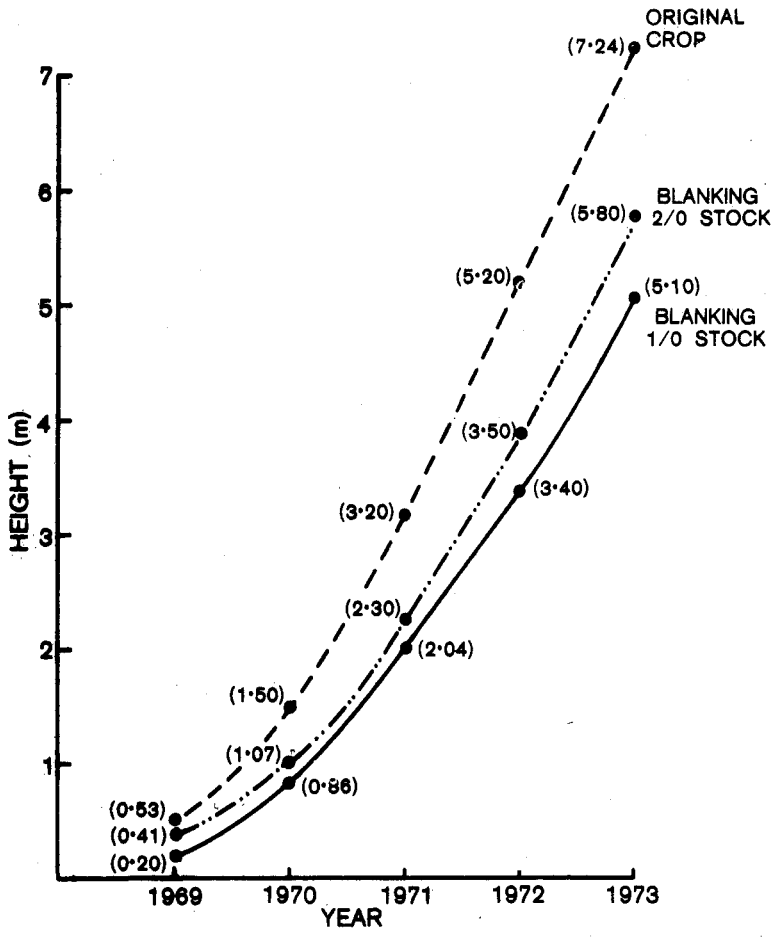

FIG. 1: *Mean height of original crop trees and of 1/0 and 2/0 blanked trees, by years (Trial RW)*

Diameters

In the Ngaumu trial the trees selected for first pruning (6 years after the original planting) had a mean d.b.h. of 7.8 cm. Those selected for a second pruning 18 months later (mainly trees that had already been selected for the first lift) had a mean d.b.h. of 12.7 cm. Trees removed in thinning at the time of the second lift had a mean d.b.h. of 11.2 cm (original stock) and 7.1 cm (blanking stock) — a highly significant difference.

TABLE 3: MEAN D.B.H. (cm) OF ORIGINAL AND BLANKING STOCK (MW, RW, RS, A)

Trial	Years since Original Planting	Fully Stocked Stand	Unblanked Stand (originals)	Blanked Stand		
				Originals	Bl. 1/0	Bl. 1½/0 & 2/0
MW	6	15.2	16.0	15.6	11.0	12.2
RW	4	13.1	13.8	13.5	7.5	8.4
RS	4	10.8	10.5	10.3		6.1
AW	5	8.8	10.0	9.5		6.5
AS	5	8.8	10.0	9.5		6.7
AW	7	12.4	13.1	13.0		10.5
AS	7	12.4	13.1	13.0		10.6

In no trial was there any significant difference between mean d.b.h. of the fully stocked stand, the originals in the unblanked plots, and the originals in the blanked plots. In other words, blanking had no effect on the d.b.h. of the original stocks. Nor had size of gaps any significant effect on d.b.h. of original stocks. There were also no significant differences between d.b.h. of 1/0 and 1½/0 (or 2/0) blanking stock or between summer and winter blanking at Ashley. On the other hand, there was in all trials a highly significant difference between d.b.h. of the original stock and that of the blanking stock.

Bulk ($D^2 H \times 10^{-n}$) Index

Bulk often gives a clearer measure of growth differences than either height or diameter on their own. The bulk figures given in Table 4 are based on mean d.b.h. and mean height at the end of the trials.

There were no significant differences, in any of the trials, between bulk of trees in the fully stocked stand and the originals in the unblanked and the blanked plots, nor any detectable

TABLE 4: BULK ($D^2H \times 10^{-2}$) OF ORIGINAL AND BLANKED TREES

Trial	Years since Original Planting	Fully Stocked Stand	Unblanked Stand (originals)	Blanked Stand		
				Originals	Bl. 1/0	Bl. 1½/0 & 2/0
NW	7	—	150	150	30	
MW	6	187	197	191	76	95
RW	4	169	145	156	35	47
RS	4	133	134	130		45
AW	7	116	134	127		79
AS	7	116	134	127		82

differences related to gap size. There was also no significant difference between bulk of 1/0 and 1½/0 (or 2/0) blanking stocks, although the latter were larger. The difference between originals and blanking stock was highly significant in all cases.

Selection for Pruning

Two selections were made — for first pruning to 1.8 when selected crop trees were 5 to 6 m tall, and for second pruning to 3.7 m when selected crop trees were about 8 m tall (slightly later, in both cases, at Ngaumu). Selection at Ngaumu was approximately 1000 stems/ha. Original selection at Mangatu was about 800 stems/ha and, for second pruning, 500 stems/ha. At Rotoehu and Ashley only trees which might form part of the final crop were pruned; these were dominants with good stem form where possible but where toppling had occurred stem form took precedence. Details are given in Tables 5 and 6, showing blanked plots only.

TABLE 5: DETAILS OF TREES SELECTED FOR FIRST PRUNING (TO 1.8 m)

Trial	Mean d.b.h. (cm)	Mean Height (m)	Number Selected		Percentage	
			Originals	Blanking	Originals	Blanking
NW	7.8	7.3	130	5	96	4
MW	9.3	5.2	76	2(a)	97	3
RW	11.5	6.1	96	—	100	—
RS	10.5	5.3	47	2(b)	96	4
A	9.5	5.5	63	9(c)	88	12

(a) At Mangatu, 1 year after original measurements 43% of trees had toppled. These were propped up by substantial turves, but 14% had again toppled by the following year, plus an additional 25%. These trees (390 in all) were tied back to heavy stakes but this was insufficient and many toppled again or died. About one-third of the original trial had to be discarded for this reason. At time of first pruning, selection was restricted but even so only two blanking stock were selected because this stock was in general already well behind originals.

(b) Two trees selected on form since there were insufficient trees of good form in the originals: both were within the 16-tree plot. Their heights were comparable to the mean of the selected trees but their diameters were 20% less.

(c) There was considerable toppling in the Ashley trial, making it impossible to select sufficient trees from the original stock (which was, as noted, at a lower stocking — 1500 stems/ha — than the other trials). Nine blanking stock were selected for first pruning. Mean d.b.h. of these was 7.5 cm (range 6.3—9.2) and mean height was 4.9 m (range 3.5—6.1) — well behind the mean for the selected originals.

TABLE 6: DETAILS OF TREES SELECTED FOR SECOND PRUNING (TO 3.7 m)

Trial	Mean d.b.h. (cm)	Mean Height (m)	Number Selected		Percentage	
			Originals	Blanking	Originals	Blanking
NW	12.7	9.5	44	1	98	2
MW	15.6	8.1	48	2(a)	96	4
RW	13.7	8.0	96	—	100	—
RS	12.9	7.6	48	2(b)	96	4
A	13.1	8.0	63	9(c)	88	12

(a) The two trees selected for first pruning were discarded, but two further trees, from the 16-tree blanking square, were selected for second pruning. These were both some 1 m shorter and had d.b.h. some 2 cm less than the mean of selected originals.

(b) The two blanked trees selected for first pruning were again included in second pruning. Heights were again comparable with originals, but diameters were 2 cm less. Both were in the 16-tree blanking square.

(c) The nine trees selected for first pruning were again included for second pruning. Mean d.b.h. was then 11.3 cm (range 9.5—13.5) and mean height was 7.6 m (range 6.5—8.5). Again, selection was because there were no alternatives.

Where toppling occurred (Mangatu and Ashley) there were insufficient trees of good form of the original stocking, and it was therefore necessary to select blanking stock for both the first and second prunings. It should be noted that in the MW, RW, and RS trials the gap of 16 trees was 12 × 9 m in size so that, at a final-crop stocking of 200 stems/ha (mean distance between trees about 7 m) there should be one final-crop tree in this gap. In the Ashley trials the largest gap was comparable (8 trees) at 11 × 9 m, so again there should probably also be one final-crop tree in a gap of this size. However, the blanking stock selected for first and second pruning was smaller, in both height and d.b.h., than the mean of the selected original stock, and may therefore not be included in the final crop.

Maximum Branch Diameters

1. *First pruning lift*: In the Ngaumu trial the mean diameter of the four largest branches (trees were pruned to 2.1 m height) was 2.54 cm in the blanked plots and 2.51 cm in the unblanked plots.

In the other trials branches were segregated into "IN" (that is, branches growing into gaps, whether blanked or not) and "OUT" (that is, growing away from gaps and into the original stand). Details are given in Table 7.

TALE 7: MEAN MAXIMUM BRANCH SIZES (cm) AND NUMBER OF WHORLS GROWING INTO GAPS (IN) AND INTO THE ORIGINAL STAND (OUT) — FIRST PRUNING LIFT: PRUNED TREES

Trial	*Treatment*	*Mean No. of Whorls with Largest Branch Growing*		*Mean Max. Branch Diameters (cm)*	
		IN	*OUT*	*IN*	*OUT*
MW	Fully stocked stand	2.5	2.3	2.2	2.9
	Blanked plots	2.1	2.4	2.8	2.9
	Unblanked plots	2.5	2.2	3.2	3.3
RW	Fully stocked stand	2.8	2.7	3.5	4.0
	Blanked plots	2.6	2.6	3.1	3.1
	Unblanked plots	2.9	2.2	3.1	2.6
RS	Fully stocked stand	2.4	2.5	2.3	2.7
	Blanked plots	2.7	2.4	2.5	2.7
	Unblanked plots	2.4	2.2	2.4	2.5
A	Fully stocked stand	2.3	2.7	2.9	2.9
	Blanked plots	2.5	2.4	2.8	2.8
	Unblanked plots	2.5	2.2	3.4	3.7

The trees chosen for pruning were, in each trial, generally uniform in height and d.b.h., but number of whorls and the diameter of the largest branch in each whorl varied rather widely. No statistically significant differences could be found, in any trial between:

— branches recorded IN or OUT:
— different gap sizes;
— branches in the fully stocked stand, the unblanked, and the blanked plots;
— summer and winter blanking at Ashley Forest.

However, in the MW and A trials the largest branches in the unblanked plots were larger than those in the blanked plots; in both cases there were branches which would be sufficiently large to downgrade sawn timber to No. 2 framing, but in both cases the OUT branches were slightly larger than the IN branches.

2. *Second pruning lift*: In the Ngaumu trial the mean diameter of the four largest branches in the second lift (2.1 to 4.3 m) was 3.45 cm in the blanked plots and 3.20 in the unblanked.

Branches in the other trials were recorded in the same manner as for the first pruning lift; details are shown in Table 8.

As with first pruning, the selected trees in each trial were generally uniform in height and d.b.h., and number of whorls

TABLE 8: MEAN MAXIMUM BRANCH SIZES (cm) AND NUMBER OF WHORLS GROWING INTO GAPS (IN) AND INTO THE ORIGINAL STAND (OUT) — SECOND PRUNING LIFT: PRUNED TREES

Trial	Treatment	Mean No. of Whorls with Largest Branch Growing IN	Mean No. of Whorls with Largest Branch Growing OUT	Mean Max. Branch Diameters (cm) IN	Mean Max. Branch Diameters (cm) OUT
MW	Fully stocked stand	2.0	1.5	3.5	3.4
	Blanked plots	1.7	1.7	3.6	3.6
	Unblanked plots	1.8	1.6	3.8	3.9
RW	Fully stocked stand	1.5	1.3	4.2	2.9
	Blanked plots	1.7	1.8	3.1	3.4
	Unblanked plots	1.9	1.4	3.4	3.2
RS	Fully stocked stand	1.7	2.0	3.7	3.6
	Blanked plots	1.9	1.7	3.6	3.8
	Unblanked plots	1.7	2.0	3.7	3.6
A	Fully stocked stand	1.5	1.4	3.8	3.8
	Blanked plots	1.7	1.0	3.6	3.7
	Unblanked plots	1.8	0.8	4.5	4.6

and diameter of the largest branch in each whorl tended to vary fairly widely. Again, no significant differences could be found in any trial between branches recorded as IN or OUT, different gap sizes, branches in the fully stocked stand, the unblanked, and the blanked plots, summer and winter blanking at Ashley Forest. And again, in all cases, trees had branches of such a diameter that they would downgrade sawn timber to No. 2 framing.

The branches in the unblanked plots at Ashley, although not significantly different from those in the fully stocked stand and the blanked plots, were substantially larger. This may be the effect of the wider spacing in this trial and provides some circumstantial evidence that blanking may be useful at this lower stocking. The effect could, however, be related to the site.

3. *Effect of delayed pruning*: In all but the Ngaumu trial, pruning was undertaken, for both lifts, strictly on time. In the RW trial a further selection of 52 trees was made 1 year after second pruning to determine if lack of blanking would lead to greater maximum branch diameters if pruning were delayed. Selected trees were dominants which might have been expected to benefit from the fact that nearby trees had been pruned. No significant differences were found between trees in the fully stocked stands, the blanked, and the unblanked plots, nor could any differences be attributed to gap sizes.

In the RS trial the four largest unpruned trees of the original crop were selected in each plot and the two largest branches in each whorl (IN and OUT) were measured in the ground-to-2.4 m portion of the stems, ignoring minor whorls below 0.5 m. There were wide differences in branch sizes but again no significant differences between branch sizes in different treatments could be detected. However, maximum branch sizes in the unblanked plots (especially square of four trees and square of 16 trees) were marginally larger than in the fully stocked stand and the unblanked plots. The difference would have no practical importance.

Total Branch Basal Area

The total branch basal area gives a measure of the pruning effort required. Accordingly the diameters of all branches were recorded for a sample of pruned trees to determine whether blanking had had any effect on this.

1. *First pruning*: Details are given in Table 9.

TABLE 9: MEAN TOTAL BRANCH BASAL AREA (cm^2) PER WHORL: FIRST PRUNING

Trial	*Fully Stocked Stand*	*Blanked Plots*	*Unblanked Plots*
MW	*(22) 22	(136) 27	(96) 27
RW	(24) 25	(105) 18	(201) 18
RS	(31) 10	(93) 13	(106) 14
A	(41) 24	(219) 24	(53) 32

*Figures in parentheses are numbers of whorls measured.

There was considerable variation within each sample. No statistically significant differences in relation to treatments could be demonstrated, although (especially in the Ashley trial) basal areas in the unblanked plots tended to be relatively large.

2. *Second pruning*: Details are given in Table 10.

TABLE 10: MEAN TOTAL BRANCH BASAL AREA (cm^2) PER WHORL: SECOND PRUNING

Trial	*Fully Stocked Stand*	*Blanked Plots*	*Unblanked Plots*
MW	*(13) 29	(107) 37	(48) 50
RW	(16) 27	(156) 23	(81) 25
RS	(21) 26	(93) 29	(92) 33
A	(26) 27	(116) 34	(40) 43

*Figures in parentheses are numbers of whorls measured.

Again there was considerable variation within each sample. No statistically significant differences in relation to treatments could be demonstrated. However, apart from trial RW, figures for the unblanked plots (especially in the Ashley and Mangatu trials) were larger than for the fully stocked stand or the blanked plots. The inference is that blanking may have had some effect on branch sizes in the second pruning lift.

CONCLUSIONS

The general objective of this series of trials was to determine if blanking had any significant effect on the volume or quality of radiata pine crops for gaps up to about 100 m^2 in area. In terms of current thinking on radiata pine silviculture, a gap of this size would accommodate one final-crop tree at 200 stems/ha. The trials were established in the context of silvicultural thinking at the time — that is, initial spacing of 2.4 × 1.8 m for Mangatu and Rotoehu and 3.6 × 1.8 m for the Ashley trial. Studies were continued only up to the time of the second pruning lift (to 3.7 m) when selected trees were about 8 m tall.

Within these constraints the series of trials has indicated that blanking radiata pine in the summer or winter following planting has had no measurable effect on the original crop in terms of height, d.b.h., or branch sizes where pruning was carried out on time in two lifts to 1.8 and 3.7 m. In all cases, at the end of each trial the difference in size between the blanking stock and the original crop was highly significant, with an indication that the blanking stock would fall even further behind in later years. Only in rare instances were blanking stock selected for either first or second pruning, and then only because of toppling and the inferior form of the original stocks.

There was some indication that, at the wider spacings employed at Ashley, blanking may have had a marginal effect on total branch basal area; in the unblanked plots this tended to be relatively large.

There was evidence that larger tree stocks used for blanking (1½/0 and 2/0) were marginally superior to smaller (1/0) seedlings. However, releasing was regularly undertaken in these trials. In normal operations this is unlikely to be the case, so that blanking stock would have even less chance of surviving or growing.

Delaying pruning for 1 year, even for the largest gap size, had only a marginal effect on branch sizes, of no practical importance

(although the knotty core size is likely to have increased; this was not measured).

DISCUSSION

Although it is possible to plant radiata pine through the year in carefully conducted trials (Moberly, 1970), this is unlikely to be possible on an operational scale, so summer blanking would not normally be favoured. However, it has been observed in a large number of establishment trials that trees which are going to die (or to die back) can mainly be recognised during the first 2 months after planting. The indication is, therefore, that for radiata pine (and, by inference, for other fast-growing conifers) blanking could be undertaken immediately following completion of the winter planting programme, provided tree stocks are specially prepared for this by suitable conditioning regimes, that large vigorous stocks are used, and that handling and planting are undertaken with care to protect seedlings from debilitating influences. However, it is clear that there is little point in blanking small gaps, but it may be prudent to blank gaps of 100 m^2 or larger if full stocking is the aim, and also to avoid the production of reaction wood in trees bordering such gaps.

The alternative to blanking is to ensure that the original planting is 100% successful, which is much to be preferred. This can be achieved on all but the most difficult sites, by using only high-quality vigorous tree stocks, by good site preparation measures, and by careful handling and planting of stock. The wider the initial spacing, the more important these become.

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