

DIFFERENTIAL BROWSING OF *PINUS RADIATA* CUTTINGS, GRAFTS, AND SEEDLINGS

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It has been twice reported from Australia that animals browse *Pinus radiata* cuttings more than they do seedlings. Pawsey (1951) found this with sheep and rabbits in South Australia, and Fielding (1970) reported a trial in which 65% of cuttings and only 28% of seedlings were browsed, probably by wallabies, kangaroos, and rabbits. In New Zealand, Beveridge and Knowles (1971) found that sheep and cattle only slightly prefer radiata pine cuttings to seedlings, but that opossums probably have a marked preference for cuttings. On the other hand, Libby *et al.* (1972) reported that deer in California clearly preferred seedlings of radiata pine to cuttings.

THE TRIAL

The trial described here was established in Compartment 1350, Kaingaroa Forest, to compare the growth rates of seedlings with those of grafts and cuttings of the same clones. The experiment was laid out in a randomized block design with seven replications of 12 treatments (four cuttings, four grafts, four seedlots). Each plot contained five trees at 2 × 2 m spacing. The grafts and cuttings, representing four clones from 44- to 46-year-old parent trees, were planted out after 2 years in the nursery. The four 2-year-old seedling seedlots were unrelated; they were selected on the basis of availability. At time of planting, in July 1972, the cuttings were larger than the grafts, which in turn were larger than the seedlings. During the first year, however, size differences evened out considerably.

Browsing, which was attributed to rabbits and/or hares (A. Farmer, pers. comm.), was assessed in July 1973. The method was for one assessor to estimate visually the percentage foliage eaten per healthy tree. Partially eaten foliage on healthy plants was assessed as though totally eaten. Yellow or dead plants not resulting from browsing were excluded from the assessment.

RESULTS

Table 1 shows that the grafts and seedlings produced more living, healthy plants than the cuttings. Ninety-four per cent. of the healthy plants from cuttings were browsed, com-

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TABLE 1: BROWSING DAMAGE ON *PINUS RADIATA* GRAFTS, CUTTINGS, AND SEEDLINGS

Lot No.	No. of Surviving, Healthy Trees (out of 35/clone)	% Healthy Trees Damaged*	Mean % Foliage Damaged on Healthy Trees*
Grafts:			
088	35	17	1
099	34	85	26
100	35	77	20
120	35	46	6
Mean	35	56	13
Cuttings:			
088	13	100	40
099	20	90	56
100	31	97	65
120	26	88	40
Mean	22	94	50
Seedlings:			
WN68/556	35	0	0
R69/846	35	0	0
WN70/A1/2	35	0	0
R69/838	35	0	0
Mean	35	0	0

*Analysis of variance on angularly transformed data shows that differences between grafts and cuttings are significant at the 1% level.

pared with 56% of grafts and no seedlings. The percentage foliage eaten on the healthy plants followed a similar pattern, with 50% from cuttings, 13% from grafts, and none from seedlings.

No terminal buds were eaten, although foliage up to and around them had been chewed on most plants.

DISCUSSION

The use of radiata pine rooted cuttings for establishing production plantations has been advocated by Thulin and Faulds (1968). Libby *et al.* (1972) examined the advantages and disadvantages. The results of the present paper emphasize that using rooted cuttings on sites with high rabbit and/or hare populations is liable to increase establishment problems and, consequently, costs.

Seedlings of radiata pine frequently suffer hare and rabbit browsing in New Zealand. The fact that seedlings were not browsed in this trial would seem, therefore, to indicate that on a site where food is not in particularly short supply cuttings are preferred. There seems no reason to attach importance to the initial slight size difference between cuttings and seedlings (Douglas, 1973). The main difference in the three groups of plants was in their maturity (Sweet, 1973), with mature cuttings, grafts consisting of mature scions on a

juvenile plant root system, and juvenile seedlings. Mature plants would therefore seem to be preferred, with the possibility that the most palatable compound(s) was most abundant when both root and shoot systems were physiologically mature.

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