VEGETATIVE REGROWTH OF BEILSCHMIEDIA TAWA AFTER SELECTIVE LOGGING AT PUREORA AND ROTOEHU

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ABSTRACT

Vegetative regrowth was assessed on stumps of **Beilschmiedia tawa** (A. Cunn.) Kirk (tawa) which had been felled in two early selective logging trials in the central North Island. Live coppice occurred on 53% of stumps 21 years after logging at Pureora (an average of nearly six shoots per stump) but on only 10% of stumps at Rotoehu 23 years after logging (an average of four shoots per stump). Deer browsing has been observed on new tawa coppice; thus formerly high animal populations in Rotoehu may have contributed to its scarcity there. Assumed mean height-growth rates of 8–12 cm/year are similar to those of seedlings growing under good light conditions. Vegetative vigour is maintained, even enhanced, in larger (and on average, older) trees, and coppice is more likely to develop when subsidiary stems are left on stumps at logging. The value of post-logging coppice shoots as a potential source of future canopy trees, however, may be limited by the presence of well-developed natural regeneration in most tawa-dominant forests.

INTRODUCTION

Coppice shoots from smashed saplings and small trees often constitute a large proportion of new tawa regeneration after logging (Knowles & Beveridge 1982) and coppicing is the usual means by which stagnant seedlings and saplings persist in heavy shade after dieback and death of the original stem. New coppice shoots commonly develop on freshly cut stumps but little is known about factors affecting their development and longevity. Under a selection management system, coppice regeneration might be a potential source of future merchantable trees, or at least help maintain the tawa component in the canopy.

Development of new vegetative shoots was assessed 21–23 years after felling of trees for sawlogs in two older central North Island logging trials, and analysed in relation to a variety of stump and site characteristics. A distinction was made between coppice shoots arising from the base of the stem (from adventitious or from dormant buds) and root suckers (adventitious shoots arising from roots (Smith 1962)). In this study root suckers were found arising only from large superficial roots, close to the stump.

METHOD

Study Areas

The selectively logged areas examined were:

(a) 1959 selective tawa logging trial, Cpt 101, Rotoehu State Forest. One-third of the volume of merchantable tawa was removed from 20 ha of rimu-rata/tawa-kohekohe-kamahi* forest on hilly terrain, logged previously for podocarps and mangeao. Tree selection aimed at leaving healthier trees and avoiding patches of regeneration of merchantable species. Healthy subsidiary stems were left on the stumps from which sawlogs were removed (Usmar 1959).

(b) 1961 selective logging trial, Pouakani Block, Pureora State Forest. One-third of the merchantable podocarp and tawa volume was removed from two 15-ha blocks of rimu-matai/tawa forest on undulating terrain; in one block it was removed mostly from the centres of podocarp groups, and in the other from the margins. Most of the tawa felled were associated with podocarps. Over-all tree selection aimed at leaving a stable residual stand by removing a proportion of defective or unstable trees (Forest Research Institute 1975).

Data Collection

Height and mortality of coppice shoots and root suckers were recorded on 49 stumps at Rotoehu and 40 at Pureora, along with the following variables:

(1) Stump diameter;

(2) Position with respect to upper hardwood canopy;

(3) Topographic position;

(4) Overstorey vegetation (principal species, general height);

(5) Soundness (to nearest 20%);

(6) Subsidiary stems left after felling (survival and diameter at breast height).

Vegetative growth on stems attached to cut stumps was not included in the study.

Data Analysis

Because there were important physical and biotic differences between study areas, data for Rotoehu and Pureora were analysed separately. For Rotoehu data, Pearson's 2 × 2 contingency table was used to assess the relationship between presence of live residual stems and of vegetative growth, and t-test was used for the effect of diameter on presence of vegetative growth.

For Pureora data, correlation coefficients between frequency, abundance, and mean height of shoots, and stump and site variables were tested for significance. T-tests were

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* rimu (*Dacrydium cupressinum* Lamb.); rata (*Metrosideros robusta* A. Cunn.); kohekohe (*Dysoxylum spectabile* (Forst. f.) Hook. f.); kamahi (*Weinmannia racemosa* L. f.); mangeao (*Litsea calicaris* (A. Cunn.) Kirk); matai (*Podocarpus spicatus* Mirb.).

used to assess the effect of diameter on presence of vegetative growth, and the effect of position in forest on abundance of coppice shoots.

RESULTS AND DISCUSSION

Vegetative growth occurred much more commonly and in greater abundance in the Pureora study area than in Rotoehu (Table 1). Root suckers arising around the stump on large superficial roots were far scarcer than coppice shoots in both areas, occurring on only 6% of stumps at Pureora and 2% at Rotoehu. Callusing of stumps was not observed.

TABLE 1—Development of coppice shoots on felled tawa at Rotoehu and Pureora

	Pureora	Rotoehu
Sample size (No. stumps)	40	49
Mean soundness of stumps (%)	67	39
(standard error)	(5)	(4)
Stumps with coppice shoots (%)	53	10
(standard error)	(8)	(4)
Mean number of shoots per stump	5.8	4
(standard error)	(0.9)	(1.6)
Live shoots (%)	70	95
(standard error)	(7)	(3)
Mean height of shoots (m)	2.6	1.9
(standard error)	(0.2)	(0.3)

Mean height of coppice was comparable in both localities, with individual shoots up to 6 m at Pureora and 4 m at Rotoehu. Dead shoots accounted for a significant proportion of coppice at Pureora, although they occurred only on stumps also bearing live shoots.

Nearly half of the stumps examined at Rotoehu had live residual stems up to 50 cm d.b.h. left on the stump at felling. These are presumed to be of vegetative origin, and so development of vegetative shoots on standing stems must have been common in the past. The scarcity of new vegetative growth after the 1959 logging at Rotoehu and its comparative abundance at Pureora may partly reflect the high deer population in Rotoehu in the years immediately after logging, and their relative scarcity at the same time at Pureora (McKelvey 1963). Deer browsing has been observed on new tawa coppice in forest near the Pureora study area.

The Rotoehu data suggest that post-logging vegetative growth is more likely to occur where subsidiary stems are left on stumps at felling, and on larger trees, and data from Pureora suggest that shoots tend to have greater vigour on larger trees (Table 2). The latter contrasts with the general observations of Smith (1962) that vigour of sprouting from stumps declines rapidly with increasing age and diameter, ordinarily ending before the trees become effective seed-bearers. In common with many other species (Smith 1962), however, tawa sprouts satisfactorily during the period of most rapid growth (usually from large pole-size onward).

TABLE 2—Factors affecting development of coppice shoots

	Pureora	Rotoehu
Mean diameter of stumps (cm)		
(a) with coppice	58.3	70.8
(b) without coppice	56.7	55.9*
Percentage of stumps with coppice		
(a) with residual stems	N.A.	100
(b) without residual stems	N.A.	0**
Mean number of shoots per stump		
(a) within high forest	19.5	N.A.
(b) outside high forest	2.0**	N.A.
Correlation coefficient between mean height of shoots and –		
(a) stump diameter	0.31*	N.A.
(b) height of overtopping podocarp regeneration where present	0.91*	N.A.

N.A. Not applicable

* Significant at $p = 0.05$

** Significant at $p = 0.01$

The abundance of coppice shoots on stumps under high forest at Pureora (Table 2) may reflect frost damage to shoots in more open situations. In general, coppice shoots are particularly subject to damage from frost (Troup 1952) and frost is an established cause of death of tawa foliage, buds, and young shoots in autumn and early winter (MacKenzie & Gadgil 1973). The correlation between mean shoot height and that of overtopping podocarp regeneration (mostly miro (*Podocarpus ferrugineus* D. Don)) where present, suggests that "drawing up" by overhead light can occur under a low overstorey. Otherwise relationships between tawa vegetative regrowth and other vegetation were unclear.

It is likely that most vegetative regrowth develops soon after tree felling. On this assumption, mean and maximum height growth rates of coppice shoots (0.08 (0.17) m/year for Rotoehu and 0.12 (0.29) m/year for Pureora) are similar to those recorded for new shoots on smaller cut stems over the first three growing seasons in Whakarewarewa State Forest (R. J. Cameron, unpubl. data) and for seedlings in small canopy gaps (Knowles & Beveridge 1982). However, they are generally higher than growth rates of seedlings in the usual range of light conditions met within high forest (Knowles & Beveridge 1982).

CONCLUSIONS

The vegetative regrowth (chiefly coppice shoots) which frequently develops after tawa trees are felled, can persist for at least two decades and over this period growth rates often exceed those of seedlings under similar conditions. Unlike many species, the ability of tawa to coppice after felling is maintained, even enhanced, with increasing diameter and, on average, age (Ogden & West 1982).

On several stumps at Pureora, individual coppice shoots were separated from the decaying parent stump by callus formation, had developed their own root systems (presumably of adventitious origin), and were functioning independently of the parent stump or other coppice shoots (Fig. 1). This mechanism would appear to allow develop-

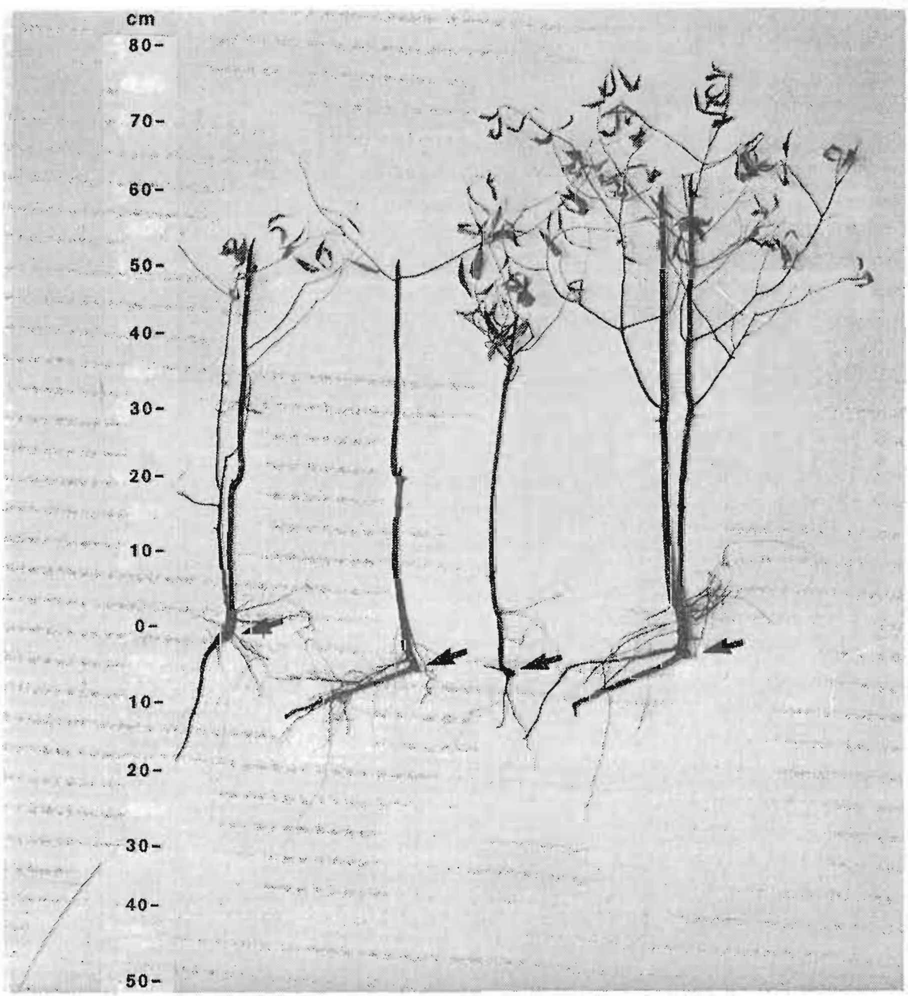

FIG. 1—Coppice shoots from a cut tawa stump at Pureora 21 years after felling, showing separation from parent stump by callus formation (see arrows) and development of individual root systems (upper stems removed).

ment to continue indefinitely. In natural forest, vegetative regeneration (chiefly from basal coppice shoots) is a means by which senescent tawa trees prolong their existence after the onset of crown deterioration.

There seems no reason, therefore, why the vegetative regrowth arising from cut stumps after logging cannot continue development. In most tawa-dominant forests, however, it is likely to be of value only as a long-term supplement to the natural regeneration usually present in advanced stages.

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