

# A COMPARISON OF TWO METHODS OF PRUNING 8 TO 14 FEET

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## INTRODUCTION AND OBJECTIVES

Two approaches to pruning *Pinus radiata* to 14 ft have been considered suitable for use in Kaingaroa Forest. They are the conventional curved blade mounted on a pole or, alternatively, the use of a short wooden ladder together with a short saw. Work study officers have analysed both systems and recommended the adoption of the ladder and saw technique because of its speed, reduced costs, and improved precision of the pruning operation.

## STAND DETAILS

To compare pruning times derived from the pole and saw and the ladder and saw methods, adjoining areas in Compartment 93 were set up. Compartment 93 is a stand of naturally regenerated *P. radiata* clearfelled in 1956-7 and supplemented in 1959. The stand was thinned to 600 s.p.a. and pruned to 8 ft over the period 1964-5-6. The ground conditions in the area were composed of very heavy slash but little vegetation, with slopes up to 5°.

One-hundred-and-forty trees were selected and graded in Compartment 93 by work study personnel. This involved the climbing of all trees and the counting and measuring of all branches. The trees were ringed with silver paint at 8 ft and 14 ft to remove any confusion in the mind of the ladder pruner. To give a better comparison with pole pruning times, a further 87 trees were similarly graded for later timing with the curved blade and pole. All data were recorded on field sheets and the trees numbered for later identification.

To reduce unnecessary variables, all branches below 8 ft were removed prior to the trial.

## THE ALTERNATIVE METHODS OF PRUNING

The method selected for the ladder pruning is made up of three phases:

- (1) *Prune*: this phase started when cutting of branches commenced, and concluded when the last branch fell.
- (2) *Descend and walk*: this commenced after the pruning was completed, and by implication contains the work element of picking up the ladder.

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- (3) *Set*: this element commenced as the operator swung his ladder up in order to set it against the selected stem and concluded when the operator started to prune. It contains the work element of ascending the ladder.

There is no selection element allowed at this stage as the trees were positively identified for the pruner.

The operator is expected to cut branches as he ascends the ladder and cut the maximum number of branches before repositioning. A six-week training period allowed the pruner to use either the right or left hand with far greater dexterity than would have been the case had a new man been under study. Ambidexterity is a prime requirement if the operation is to be done with speed and precision.

The pole pruner selected to prune the 87 trees had no special training period but was considered experienced, competent and work-hardened to the operation. A standard 9ft 6in. duralumin pole with the standard "Orsa" saw blade was used to carry out the operation. Pole pruning is broken into two phases:

- (1) *Prune*: the phase commences when the operator swings up his saw to cut the first branch and concludes when the last branch falls.
- (2) *Walk*: this element commences when the last branch falls and the operator moves off to the next tree and concludes as the operator swings up his saw to prune. Where marking is not done it will also contain the process of selecting the next tree.

The pruner is expected to restrict movement to a minimum in this operation and cut the maximum number of branches from each position.

The ladders were of timber construction, secured together with coach bolts. The ladders under study were 7ft 11 in. in height and weighed 18.5 lb. The height of the ladders is a little low and should be a minimum of 8 ft 6 in. A wooden platform on top of the ladder provides a stand for the operator. The platform has a concave recess to fit the bole of the tree and increase ladder stability.

The saw is similar to the conventional meat saw; it has a heavy steel frame with a meat saw type handle. The heavy construction of the frame allows considerable tension, via a hexagonal nut, to be applied to the "jack" saw blade incorporated in the tool. This reduces blade breakage.

## THE TIME STUDY

### (1) *Ladder Pruning*

A run of 30 trees per operator was rated and timed by the work study officer. While one operator was under study, the other was pruning outside the plot. This method of timing cuts down excessive rest periods and allows the operator to develop a smooth pattern of work. Pruning times are presented in Table 1 and Fig. 1.

TABLE 1: PRUNING BY LADDER AND SAW

Grade	No. of trees	Actual time (min)	Smoothed time (min)
1	5	0.38	0.44
2	45	0.57	0.58
3	40	0.81	0.70
4	30	0.89	0.84
5	12	0.98	0.98
6	3	1.07	1.12

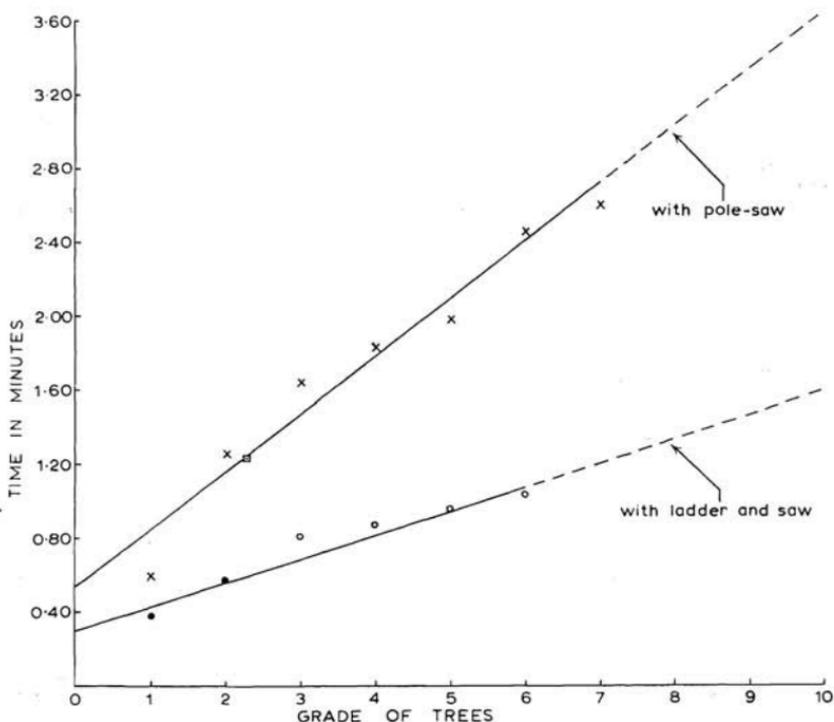


FIG. 1: Pruning time per tree of specified grade from 8 to 14 ft.

Examination shows that a straight line fits the information as well as any other line.

The descend and walk element, timed over 131 occasions, was  $0.33 \pm 0.03$  minutes at the 95% confidence level. Setting up the ladder over 133 occasions gave an elemental time of  $0.12 \pm 0.04$  minutes at the 95% confidence level. The results of the analysis of both these elemental times are satisfactory.

## (2) Pole Pruning

For the collection of data in the pole pruning operation, the total number of trees (87) was pruned in two runs, one of 50 trees and the other of 37 trees. The results of this study are contained in Table 2 and Fig. 1. The times are expressed at the 95% confidence level.

TABLE 2: PRUNING BY POLE AND ORSA BLADE

Grade	No. of trees	Actual time (min)	Smoothed time (min)
1	28	0.60 ± 0.09	0.83
2	28	1.26 ± 0.14	1.14
3	14	1.64 ± 0.30	1.46
4	11	1.83 ± 0.29	1.78
5	3	1.99	2.10
6	2	2.46	2.42
7	1	2.60	2.74

An examination of the figure will show that a straight line fits the data as well as any other. The data are weak in the higher grades and the times are substantially below the standard times currently being used in the 8 to 14 ft pruning lift.

TABLE 3: PRUNING 8 TO 14 FT

Grade	Pole pruning times (min)	Ladder pruning times (min)	Differences (min)
1	1.16	0.89	-0.27
2	1.47	1.03	-0.44
3	1.79	1.15	-0.64
4	2.11	1.29	-0.82
5	2.43	1.43	-1.00

## COMPARISON OF EFFICIENCY AND COST

Table 3 shows a comparison of times derived from the two pruning methods. To give a better picture, the descend and walk and set times have been added to the ladder and saw times. A time of 0.33 min per occasion for walk time has been added to the pole times to give parity.

An examination of the data shows that gains are to be made by adopting the ladder and saw technique to carry out the specified pruning lift. The increased differences in time as the grades increase is noteworthy.

Based on the two sets of standards gathered in Compartment 93, and the adoption of an average grade of 2.50 for the compartment, pruning costs may be compared as follows:

	<i>Ladder and saw</i>	<i>Pole pruning</i>
Trees per day at target ....	364	247
Cost per acre at 180 s.p.a.	\$4.97	\$7.32
Basis of Cost:	\$	
Wage rate (FH II) ....	7.1672	
Bonus at 100% ....	2.6664	
Locality allowance ....	0.2000	
Cost per 8 hr day ....	<u>10.0336</u>	

The times for walking have been taken from the study area and do not contain time for selecting trees in either operation. The cost structure does not presume to be full but, as each operation has been treated similarly, the comparison is a fair one.

The indications are that the cost of pruning 8 to 14 ft in Kaingaroa Forest can be reduced by 30 to 40% if the ladder and saw are adopted as the standard pruning method.

## DISCUSSION

As already indicated, the 8 to 14 ft pruning operation can be speeded up through using short ladders and saws. Why is this so? It is considered that the following factors have a bearing on the superiority of the technique.

- (1) The "Jack" saw blade is a particularly good cutting instrument, manufactured from high grade steel; it keeps its edge well, requires very little set because of its narrow gauge, and it cuts wood on the forward and back stroke.
- (2) The positioning of the wrist and cutting tool above the branch to be cut is mechanically superior to an activation of the cutting edge through a pole from 9 ft 6 in. away.
- (3) The ladder allows the pruner to climb away from many of the factors which inhibit pole pruning — *e.g.*, slope, slash and vegetation.
- (4) Excessive movement during the pruning operation is prohibited by the pruner's position on top of the ladder.
- (5) The ladder method forces a simple but effective approach to the operation. There is no room for time-consuming additions to the work method, such as excessive movement and repositioning.
- (6) The technique allows the pruner to develop an aggressive attitude to the job. Aggressiveness in pole pruning invariably leads to blade jamming and excessive expenditure of time and energy.

There are, however, disadvantages, the prime one being the safety of the pruner. There is an element of danger in standing on a ladder 8 ft from the ground while vigorously cutting branches, but there has been no recorded injury to operators. The possibility of the pruner cutting his arm or hand is present, but is no more significant than many other factors in other forest operations.

### CONCLUSIONS

The ladder and saw technique for pruning to 14 ft is superior to the conventional pole and "Orsa" saw blade method.

Costs can be substantially reduced using this method.

The ladder and saw method of pruning is more suited to pruning the more vigorous and heavily branched tree types now being selected.

There are elements of danger in the operation which should not be overlooked because of its appeal in other respects.

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