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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Heavy Pruning Reduces Growth of Southwestern Ponderosa Pine

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In 1948, a study to evaluate four intensities of pruning on ponderosa pine was established on the Fort Valley Experimental Forest, Arizona. This study was superimposed on an older thinning study established in 1934 in a 20-year-old stand.

STUDY-PLOT TREATMENTS

The pruning study was installed on four plots that had been given a "crop tree" thinning in 1934; average spacing between crop trees was 8 by 8 feet. Thinning on the four plots was as follows: (A) control, no thinning; (B) no release of dominant trees, other crop trees given light release; (C) all trees within 2 to 3 feet of crop trees were removed; (D) all trees other than crop trees were removed with the exception of very small saplings.

Sixteen trees were pruned to each of four intensity levels on each of the four thinning plots in 1948 as follows: (1) control, only dead branches removed; (2) 20 percent of live crown removed; (3) 40 percent of live crown removed; (4) 60 percent of live crown removed. Tree heights, and diameters at breast height and at 9 feet were measured at the time of pruning (1948), in 1953 and 1958 (table 1).

RESULTS

Removal of 60 percent of the live crown reduced diameter growth at breast height and at 9 feet on all plots. There were no significant differences in diameter growth among the other three pruning intensities (table 2). Diameter growth at breast height was significantly greater on thinned plots than on the unthinned plot.

Pruning intensity did not affect height growth materially. Height growth, however, did vary significantly with thinning; trees on the unthinned plot grew less than those on the thinned plots.

DISCUSSION

Results of this study parallel other findings on the pruning of ponderosa pine. Pearson² stated that crown length equal to 30 percent of total tree height is adequate to provide up to 2 inches of diameter growth per decade in young ponderosa pine. Hallin³ found that one-half the live crown of ponderosa and Jeffrey pines in California can be removed provided four-tenths of the total tree height is left in live crown. In this study, diameter

Table 1. --Average diameter and height of crop trees prior to pruning in 1948

Plot	Trees per acre, 1958	Percent of live crown removed				Average
		0	20	40	60	
DIAMETER BREAST HEIGHT (INCHES)						
A	5,576	3.3	3.4	3.2	3.5	3.4
B	3,729	4.4	4.8	4.9	4.7	4.7
C	3,851	3.9	3.6	4.3	3.8	3.9
D	1,612	5.4	4.7	4.9	5.0	5.0
Average	3,692	4.2	4.1	4.3	4.2	4.2
HEIGHT OF CROP TREES (FEET)						
A	5,576	16.2	16.2	15.6	16.1	16.0
B	3,729	19.8	21.0	22.0	20.8	20.9
C	3,851	16.6	16.5	18.5	17.4	17.2
D	1,612	21.9	21.2	19.8	20.9	21.0
Average	3,692	18.6	18.7	19.0	18.8	18.8

growth was not reduced by pruning if 31 percent or more of the tree height was left in live crown.

The pruning study might have been more meaningful if trees had been pruned to leave specified percentages of tree height in live crown. Average percentages of tree height in live crown did vary with intensity of pruning (table 3). For each combination of thinning and pruning, however, there was a wide variation in percentage of residual crown.

SUMMARY

In 1948, 64 crop trees on each of four thinning plots were selected and assigned one of four pruning treatments as follows: control; 20 percent of live crown removed; 40 percent of live crown removed; 60 percent of live crown removed. Diameters at breast height and at 9 feet and tree height were measured in 1948, 1953, and 1958.

The results agree generally with other findings on the pruning of ponderosa pine. Forty percent of the live crown can be removed without significantly affecting diameter growth if at least 31 percent of total tree height is left in live crown. Height growth was not materially reduced by the degrees of pruning tested.

Diameter and height growth were significantly greater on thinned plots than on the unthinned plot.

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²Pearson, G. A. *Management of ponderosa pine in the Southwest*. U.S. Dept. Agr. Agr. Mono. 6, 218 pp., illus. 1950.

³Hallin, William E. *Pruning ponderosa and Jeffrey pine*. U.S. Forest Serv. Calif. Forest and Range Expt. Sta. Res. Note 115, 4pp. 1956.

Table 2. --Average increase in diameter and height by thinning treatment and pruning intensity, 1949-58

Plot	Trees per acre, 1958	Percent of live crown removed				Thinning level averages
		0	20	40	60	
<u>Number</u>						
INCREASE IN D. B. H. (INCHES)						
A	5,576	0.59	0.74	0.50	0.37	0.55
B	3,729	.86	.75	.72	.49	.70
C	3,851	.80	.70	.83	.47	.70
D	1,612	1.01	.82	.83	.59	.81
Average	3,692	.82	.75	.72	.48	.69
INCREASE IN DIAMETER AT 9 FEET (INCHES)						
A	5,576	.86	.99	.80	.62	.82
B	3,729	1.04	.92	.82	.63	.85
C	3,851	1.13	1.05	1.06	.75	1.00
D	1,612	1.27	1.03	1.04	.73	1.02
Average	3,692	1.08	1.00	.93	.68	.92
INCREASE IN HEIGHT (FEET)						
A	5,576	5.72	5.97	5.72	5.45	5.72
B	3,729	7.77	7.06	7.59	7.70	7.53
C	3,851	7.13	6.62	6.84	6.16	6.69
D	1,612	8.22	7.94	7.47	7.54	7.79
Average	3,692	7.21	6.90	6.90	6.71	6.93

Table 3. --Average percentage of total tree height in live crown immediately after pruning

Plot	Trees per acre, 1958	Percent of live crown removed			
		0	20	40	60
<u>Number</u>		<u>Percent</u>			
A	5,576	46	39	28	19
B	3,729	46	39	30	21
C	3,851	52	41	31	21
D	1,612	56	40	34	23
Average	3,692	50	40	31	21

