

[F. 林業機械および作業に関する研究]Thinning Operation by Wheeled Tractor

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Thinning Operation by Wheeled Tractor.

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In Japan, thinning operations have been made by human and animal power without machines.

But currently, mechanized system of thinning operation is required to be established for such reasons as the big acreage of thinning stage stands, the shortage of labours and as the results, the rapid rise of labour costs.

In this report, an experimental study is conducted about thinning operation with T-50 wheeled tractor and selective method by usual selective thinning plus line thinning.

The effects of line thinning were investigated from the view point of felling and skidding operation.

1. Experimental area.

The conditions of experimental area are as follows :

Situation : Kyushu University Forest.

Acreage : 0.53ha

Elevation : 60-80m

Tree species : HINOKI (70%), SUGI (30%)

Stand age : 36 years

Volume of stand : 202m³/ha

2. Operation spur road and landings.

Tractor operation road in experimental area was built from main forest road, 185m long, 3-4.8m width, and average slope 6°.

Landings were established at the main road near the junction of the spur road.

3. Selective method (Fig.1)

Felling the all stands in the spur road site, usual individual selection method was practised over the whole area. Then 12 extraction lines, width 1-1.5m, were established to contain more selected trees as possible as it could be.

The trees been selected individually on the thinning site and these along the lines were felled. The average intersecting angle between thinning line and spur road is 55° , and average slope 29° .

Number and volume of thinning trees are shown in table 1.

Table 1 Number and Volume

	Number	Volume	Volume per Tree
Residual	802	82.689 m ³	0.1031 m ³
Thinning	341	21.144	0.0620
spur road	62	4.000	0.0645
line	127	7.952	0.0626
selection	152	9.192	0.0605

4. Felling operation

Each trees was felled with chain-saw, top to the spur road and delimbed but leaving several branches at the top for such reasons as shortening the extraction distance, making choking operation easy and eliminating the damage to forest land and residual stands stems and roots.

Each trees along the lines was felled in parallel and trees selected individually were felled keeping voluntary angle between the spur road to make extraction easy.

Crews in felling operation are as follows.

Felling 1 assistant 1 delimbing 4

5. Skidding operation.

A cycle time in tractor skidding operation consists of the time of 9 operation factors:

- (1) travel without load.
- (2) arrange of direction.
- (3) choking.
- (4) extraction.
- (5) travel with load.
- (6) unchoking.
- (7) landing clearance.
- (8) rotation.
- (9) delay.

Crews in skidding operation are as follows:

driver	1
choker setter	2
unchoker	1

Continuous time study was practised about the logging operation.

6. Results and Consideration.

Through this experimental study, some effects of establishing lines were evident.

A. Felling operation.

Hanging trees occurred frequently in selective thinning operation are diminished exceedingly.

The moving time in felling operation is reduced, because the trees to be felled are very obvious.

Felling direction can be decided easily.

Because of the above mentioned reasons, felling time for the line thinning system was shortened to 11 sec. per tree against 19 sec. per tree for selective thinning method.

B. Skidding operation.

The places to stop the tractor are found easily.

Felled trees in selection thinning are scattered in all directions in the residual stands, so in chocking operation, the tractor must move many times to make a trip turn and as the result the tendency is observed that the cycle time is getting longer and the trip turn is getting smaller. On the contrary, in line thinning the direction of felled trees are constant, so in shot winching time big trip turn can be made. As the result, the volume skidded in unit time becomes large comparatively.

For instance, for skidding distance 100m, the skidded volume per an hour is 3.7m³ along lines against 3.2m³ with selective thinning method. Number and volume of trip turn are indicated in table 2.

Table 2 Number and Volume

	Number of Cycle	Number	Number per Cycle	Volume	Volume per Cycle
Line	12	146	12.2	7.790 m ³	0.649 m ³
Selection	19	130	6.8	8.251	0.434
Total	31	276	—	16.041	—

Conclusion

Engaging in planning and practices of the thinning operation, the author makes some problems about mechanization of thinning operation clear:

In the first planting stage, the planting rows must be decided considering the future extraction lines.

The width of the lines must be decided considering the effects of thinning over the residual stands, but it is better, if the line could be established widely as possible as it could be and set the lines in skidding net road in future clear cutting.

The pulling of winch line on the steep slope requires heavy works,

So to lighten the work, some flexible equipment must be attached to the tractor.

In conclusion, the mechanization of thinning operation must be promoted by researchers not only in the Forest Engineering but also Silviculture and Forest Management.

