Title: Research Trial to compare potentially effective pruning tools that are currently available around the world.

OIC: S.D. McConnell

Location: Stave Lake (in progress), and one or more of the following areas: Whistler Interpretative Forest, Duncan area, and/or Vancouver watershed area.

Region/District: Vancouver/Chilliwack Forest District (in progress)
Squamish Forest District, Duncan Forest District, Vancouver Regional District.

Objective: To compare pruning tools that exhibit potentially beneficial attributes to the forest industry. The tools to be examined will be chosen from a worldwide selection. If improvements are possible and potentially profitable to any one or more of the tools tested these modifications will be carried out and the prototype included in the trials.

Progress: Working plan is complete but subject to modifications.

Next Scheduled Assessment/Treatment: 1st Trial was established on Sept. 23rd, 1991 and more will be established in September, October, and November.

Report Distribution: Library - Silviculture Branch, Victoria, B.C.
Library - Chilliwack Forest District
Library - All other Districts that trials are carried out in.
Working Plan for Pruning Tool Comparison Trials

Title: Research Trial to compare potentially effective pruning tools that are currently available around the world.

Objective:

Determine:
- manual or manual-motorized¹
- best manual tool for 1st lift
- best manual tool for 2nd lift
- best manual-motorized tool for 1st lift
- best manual-motorized tool for 2nd lift
- best combination of manual and/or manual-motorized tools for more than one lift
- best overall tool for 1st lift
- best overall tool for 2nd lift

Assessment Parameters:
- quality and productivity (costs included)
- what are the properties that ascertain its capabilities and incapacities?
- are improvements possible?

*Using this data, answer the question, "is there potential to construct a manual-motorized tool that improves on the current best manual and manual-motorized tool in the 1st and/or 2nd lifts"?

If the answer is "yes" then consider constructing that tool.

Procedure/Layout:

1.0- choose study area that meets the following criteria
- terrain suitable to research (i.e. relatively flat good access throughout site, homogeneity in stand composition is prevalent)
- site requires pruning

¹ Large mechanized pruning machines have been omitted from this study as in our opinion these tools do not seem conducive to working in the rough terrain of British Columbia.
1.1 - some of the study area will be divided into 1/4 hectare units for tool tryout (i.e. tools that are potentially inefficient, ineffective and/or damaging will not be used in trials but will be experimented with to examine potentially beneficial attributes)

**Tool Comparison and Hectare Breakdown**

**1st Lift - Manual**
- Snap Cut 208 pole saw = 2 hectare
- 924 handsaw = 2 hectare
- New Zealand handsaw = 2 hectare
- New Zealand lopping shear = 2 hectare
- Jack Sherley's lopping shear = 1/4 hectare
- Corona handsaw = 1/4 hectare
- Snap Cut handsaw = 1/4 hectare

**1st Lift - Motorized**
- circular-saw head (Power Pruner) = 1/4 hectare
- reciprocating-saw head (RAU) = 1/4 hectare
- prototype & contingency = 0.5 hectares
- total 1st lift hectare = 14.25 hectares

**2nd Lift - Manual**
- handsaw & ladder = 2 hectares
- Snap Cut polesaw = 2 hectares
- Corona 1414 polesaw = 1/4 hectare
- Sandvik polesaw = 1/4 hectare
- lopping shear & ladder = 1/4 hectare

**2nd Lift - Motorized**
- Power Pruner (circular-saw head) = 1/2 hectare
- RAU Power Pruner = 1/2 hectare
- Highcutter = 1/2 hectare
- Prototype & contingency = 0.5 hectares
- total 2nd lift hectare = 11.25 hectares

2 - a four man crew is divided into 2 two man crews
- each crew is assigned a unit and tool
- pruning commences
2.0 - select tools
   - based on literature and observations, that are relevant to objective
2.1 - eliminate tools obviously ineffective, inefficient, and/or excessively damaging\(^2\) to a tree
2.2 - test for biological efficacy/productivity on unit blocks of the study area

**Expected Tool Type Breakdown (after eliminations)**

**1ST LIFT**

*Manual -1st Lift*
- 1 handsaw
- 1 lopping shear
- 1 polesaw

**2ND LIFT**

*Manual -2nd Lift*
- 1 polesaw
- handsaw with ladder
- lopping shear with ladder

*Motorized -2nd Lift*
- 1 manual-motorized pruner
- prototype

**Experimental Design:**

1 - the study area will be divided into smaller, approximately, 2 hectare units to be used for trials
   - one unit will be pruned by two workers using the same tool
   - these units will be well marked out in the field and later placed onto a well defined map

\(^2\) The definition of excessive damage should be open to deliberation throughout the study.
3 - Monitor workers

3.1 - Productivity

Measurements will be of the form:
- time taken to prune unit
- amount pruned on a given day (i.e. given day will consistently be near end of trial period)
- trees per hour on a given day (i.e. on a given day as above) with each tool measured twice (i.e. one hour in morning, one hour in evening)
- the hour will be divided between the 2 workers using the tool in question

3.2 - Ergonomics

Ergonomics will be looked at subjectively (i.e. interview workers as to the general physical effects experienced, and to the degree, while using and after using each tool)

4 - Survey pruned areas

Survey Procedure

The survey procedure is based on a method used by Herring and Pollack (1985).

Four plots will be established in each unit along a transect that runs through all units of the entire block. The plot will begin at a predetermined distance on the transect. One side will be of a fixed length (20m) while the other side will be of a variable length. Twenty pruned trees are required in a plot, therefore the variable plot length is dependent on density. All trees in the plot will be labelled (numbered) from one to twenty as they are encountered at a perpendicular distance to the variable boundary. The four corner trees of the plot will be labelled as such with one of the corners consistently being labelled with the plot number.
EXAMPLE

TRANSECT

\[ \begin{array}{c|cccc}
  & 1 & 2 & 3 & 4 \\
\hline
 5 & 6 & 7 & 8 & 9 \\
 10 & 11 & 12 & 13 & 14 \\
 15 & 16 & 17 & 18 & 19 \\
 20 & 21 & 22 & 23 & 24 \\
\end{array} \]

VARIABLE

All trees in the plot will be examined for damage to the cambium layer on the stem and branch collar and this will be recorded for each tree as present or not present. Every 5th tree (i.e. 5th, 10th, 15th and 20th) will be more intensively examined. All stumps will be measured and results tallied in 0.5 cm classes and each cut will be classified as to its surface texture (e.g. smooth refers to a surface configuration of less than 1 mm in variability, rough- 1 mm to 3 mm, or jagged- >3 mm) for these four selected trees. The diameter of the stumps will also be measured and the total number of stumps per tree will be recorded.

These 4 selected trees per plot will have their heights, diameters at breast height, and ages recorded as well.

5 - Evaluate data and compile in report format
- data analysis will utilize T-tests
Conclusions:

The results of this study will be discussed in a formal report that will be made available to the Ministry of Forests, Silviculture/Research Branch in Victoria, B.C.

The Ministry will also receive a detailed map of the study area showing which tools were used in which units and where the plots are located. This information should be useful in looking at longer term effects.

All Districts that trials are carried out in will receive this report with the aforementioned map as well.

References cited

PRUNING TOOL EVALUATION SUMMARY FORM

Date___________________
Contract opening # and unit_____________________
Trial Unit No.___________
Tool_____________________
Tool cost_________________
Tool supplier's name and address_____________________
Unit size____ha.
No. of workers___________
Names of workers___________________

Tool description ________________________________

STAND DESCRIPTION

Species =______
sph =______
Species =______
sph =______
Species =______
sph =______
Species =______
sph =______
Total sph =______
Mean height of crop trees =______
Range of height of crop trees =______
Mean dbh of crop trees =______
Range of dbh of crop trees =______
Mean age of crop trees =______
Range of age of crop trees =______
Mean no. of limbs to be removed =______
Mean diameter size of limbs to be removed =______
Range of diameter size of limbs to be removed =______

SITE DESCRIPTION

Average slope % =______
Topography =______
Slash class (low-high) =______
Brush class (low-extreme) =______

CLIMATE DESCRIPTION

Total no. of hot days (>24 C) =______
Total no. of rainy days =______
PRODUCTIVITY

Trees per hour = ______
Time interval of day ______ a.m.-____ a.m. climate______
Trees per hour = ______
Time interval of day ______ p.m.-____ p.m. climate______
Mean trees per hour = ______
Standard error of the mean = ______

Area pruned on day ______ of trial period = ______ ha. climate______
Time taken to prune entire unit = ______ hrs.

QUALITY

Total no. of trees with damage to bole ______
Total no. of scars to bole ______
Percent damage to bole caused by ______ = ______%  
Percent damage to bole caused by ______ = ______%

Total no. of trees with damage to stem collar ______
Total no. of scars to stem collar ______
Percent damage to stem collar caused by ______ = ______%  
Percent damage to stem collar caused by ______ = ______%

Total no. of stubs: 0cm ______
>0cm-0.5cm ______
>0.5cm-1.0cm ______

Total no. of cuts: smooth(<1mm) ______
rough(1mm-3mm) ______
jagged(>3mm) ______

Comments

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
ERGONOMICS
Worker's name
General mental attitude over trial period: good fair bad
General physical condition over trial period: good fair bad
Most physically stressed parts of body:
How worker found tool to be for breakdown and/or maintenance time:
approx. time spent per day
approx. time spent during trial period
Did worker like the tool? yes no
Worker's name
General mental attitude over trial period: good fair bad
General physical condition over trial period: good fair bad
Most physically stressed parts of body:
How worker found tool to be for breakdown and/or maintenance time:
approx. time spent per day
approx. time spent during trial period
Did worker like the tool? yes no
Comments:


TOTAL P.11