THE EFFECT OF TOP PRUNING AND SUBSEQUENT INTENSIVE CROWN
MANAGEMENT ON CONIFEROUS CONE PRODUCTION: 1. INTERIOR SPRUCE

C. HEWSON AND M. ALBRICHT
1986

INTRODUCTION

Pruning coniferous seed orchard ramets to enhance cone production has been studied for many years (Werner, 1975). Results have been both encouraging and discouraging - in some cases cone production has equalled or exceeded control trees (Philipson, 1985) and (Nienstadt, 1981), yet in other instances cone production was reduced (Werner, 1975). In all cases, pruning was conducted on "mature" (cone producing) ramets and results were published within five years of treatment.

Few, if any studies have been conducted to illustrate the long term effects of top pruning and crown management of immature coniferous ramets on subsequent cone production, even though the practice has been conducted for many years in fruit orchards. This trial will be ongoing for at least ten years. It will include top pruning in the first year and subsequent annual branch pruning and spreading if deemed necessary.
A brief discussion of crown management techniques follow:

1. Top Pruning

The amount of top removed determines the form or framework of the ramet. Swales, J.E. (1978) has described three forms of tree as a result of top pruning:

   a. central leader - the main leader is retained as the dominant growth on the tree.
   b. modified central leader - the central leader is removed back to an uppermost lateral branch.
   c. open center - the leader is completely removed and a whorl\(^{1}\) of three to six branches is allowed to develop.

The open center form of pruning is not recommended for fruit trees due to the large crowns formed and large land areas required to produce a given quantity of fruit.

---

\(^{1}\) The term "whorl" is technically incorrect as all branches originate from lateral auxiliary vegetative buds (Ross, S.D. and R.C. Currell, 1985). However the term is used in this text to refer to the larger nodal branches clustered in the distal portion of stem internode.
Current trends are to establish hedgerows of orchard trees pruned around the central leader to maintain small, compact crowns (Swale, J.E., 1978) or plant large numbers of orchard trees grafted onto dwarf rootstock. This latter technique has produced two to four times the yield of fruit per acre when compared to production on standard sized trees (Tukey, H.B., 1979). Unfortunately, dwarfed coniferous rootstocks are not available and studies to establish hedgerow orchards for seed production have not been initiated. As this trial is an attempt to develop large crown areas to utilize space available, while at the same time reduce total height at maturity, ramets will be pruned to form open center trees.

2. Branch Pruning

Depending on the time of year, branch pruning can be used either to increase or decrease crown density. Branch pruning during the dormant season, i.e. late August to early March promotes flushing of latent and lateral buds on deciduous trees (Anon, 1957) and (Swales, J.E., 1978).
Pruning to increase crown density on spruce, pine and fir species should be done only on new growth and shortly after growth has commenced in the spring (Anon, 1977). Research on shearing Christmas trees confirms that pruning must be done no later than mid June in order to obtain the greatest number and the greatest length of new shoots (Brown, J.H., 1985). Pruning prior to bud burst resulted in significant branch mortality and overall reduced growth.

Branch pruning midway through the active growing season or later reduces subsequent branch development both in coniferous and deciduous trees (Swales, J.E., 1978) and (Brown, J.H., 1985). If crowns of the treated ramets become too dense and hinder light penetration summer pruning may be advocated.

3. Branch Spreading

No literature is available to the author on branch spreading in coniferous trees although Werner, M. (1975) makes brief reference to bending South African pine stems and branches to increase cone production. Branch spreading is anticipated to
to be extremely important on these young coniferous ramets as lateral branches tend to compete for dominance when the leader is removed. In addition, branch spreading should increase crown area and improve light penetration. Swales, J.E. (1978) describes several techniques used to spread branches. Some or all of these techniques will be used in this trial.

4. Scoring

Scoring, similar to pruning, may be used to promote or reduce crown growth on fruit trees (Swales, J.E., 1978). Latent buds can be stimulated to grow by using a sharp knife during the dormant season to cut through the bark situated just beyond the bud. Scoring branches during the growing season will check growth. Scoring may be used to a limited extent to determine the effect of this technique on coniferous trees.
5. Other techniques

Other methods of crown management have been employed in both fruit and seed orchards to produce better crops. These include:

a. applying chemicals to the foliage, including fertilizers, auxins, hormones and other products (Anon, 1986).

b. girdling main stems or branches by removing portions of the bark and cambium.

c. spraying pesticides.

None of these treatments will be included in this study except when required for protection. Any chemical treatment will be applied equally to all ramets in this study.

OBJECTIVE

To determine the effect of top pruning and ten years of subsequent intensive crown management on cone production of interior spruce ramets.
MATERIALS AND METHODS

Sixty-eight ramets consisting of two ramets from each of thirty-four clones will be selected from a plantation consisting of approximately 180 ramets. The pairs will be selected for similar height, growth form, previous flower crop (if any) and age. Clones selected will vary in age from four to six years and will originate from parent trees selected through out the interior of British Columbia. Initial measurements will be limited to height and crown diameter.

Each ramet will have at least three, preferably four or more, main branches growing from one whorl. One ramet from each pair will be selected for top pruning. The most suitable whorl, regardless of age or position will be marked for retention. All branches and whorls above this point will be removed during late June, during the active growing season. The ramet will be top pruned at a slight angle approximately thirty centimetres above the selected whorl and will be used to support the spreader sticks. This stem will be removed at a later date. The height from the ground to the top whorl will be recorded.
Each year top pruned ramets will be examined in early spring, immediately after vegetative bud burst, and in mid summer, just prior to cessation of active growth. During spring examination, branches will be spread using spreader wires or sticks. This procedure will be continued until crown diameters utilize the space available. Bud pruning, branch pruning, and/or scoring may be deemed necessary during spring to promote vegetative growth. Dead and dying branches will be removed.

During mid summer examination, additional pruning may be undertaken to increase light penetration through the crown. Spreader sticks will be resecured if loose.

Both treated ramets and controls will be fertilized, irrigated and monitored for insects and disease following current orchard prescriptions. During the first three years, the number of male and female flower buds will be recorded, then removed, to ensure maximum crown development on each ramet. Commencing year four, flower counts will be continued and all female flowers will be pollinated. Each fall the total number of cones per ramet and filled seed per cone will be recorded. In addition, cone and seed size, total number of seed per cone, and germination studies may be evaluated to determine if crown management affects these parameters.
COSTS AND RESPONSIBILITIES

All operational activities will be undertaken by the Silviculture Branch in liaison with Research Branch. Estimated time and material costs for the period June, 1986 to December, 1987 are:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Man Days</th>
<th>Materials ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer 1986-Selection, measuring top pruning</td>
<td>2</td>
<td>$10.00</td>
</tr>
<tr>
<td>Spring 1987-Crown management, flower counts and removal</td>
<td>2</td>
<td>$25.00</td>
</tr>
<tr>
<td>Summer 1987-Crown management</td>
<td>.5</td>
<td></td>
</tr>
<tr>
<td>Fall 1987-Data Summary, Interim report.</td>
<td>1.5</td>
<td>$35.00</td>
</tr>
</tbody>
</table>

6     $35.00
REFERENCES


