SX 84302K

Cerbel Funnel Seeding

Interim Report
1985

D. Skierpen
TITLE: Central Funnel Seeding

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_________________________ (Typed)
1. Cerbel Seeding System

The Cerbel seeding system involves the use of a walking stick device to manually drive a pointed plastic funnel approximately 5 cm into the soil or duff, see appendix 1 for pictures and promotional information. The manufactured seeding gun is not operational due to the inconsistency of the seed dispersal system to dispense small seed amounts from 1-3. Renovations were made to the guns to allow manual seed dispensing through a ½" copper pipe into the seeding head and funnel. The system became operational and average productivities of 100 funnels/hour were achieved. Seed amounts from 1 to 4 were manually dispensed into the funnels from a small plastic bottle with a hole in the cap corresponding to the size of seed being used. The cerbel funnels were carried in bareroot planting bags and dispensed at 2.5 to 3 M spacing on the operational areas.

Actual experienced costs utilizing a company crew of 6 plus a foreman was 45-55¢ per funnel inclusive of overhead and survival plot establishment for the operational areas and 1.93 per funnel for the trials. Overtime rates for weekend work, 3 hour per day travel times, and a funnel cost of 8.5¢/each contributed to the relatively high cost.

Project layout for the trials was permanently marked lines (painted posts and aluminum markers) with alternate funnel and control lines. Wire flags at 1M intervals marked 50 funnels or control spots per line. Circular staked survival plots of one per hectare were used to monitor the operational areas.

2. Shortfalls and Problems

The new Cerbel seeding system requires improvement to the seed dispersal mechanism of the seeding tool with more research into funnel structure, colour and bio-degradability. The seeding tool does a good job of the basic operation of placing the funnel in the ground. Refinements are needed for a positive weather proof, single seed action mechanism. A simple, quick action bulk funnel carrier system for the field person is a necessity.

Operationally, wet weather was the worst problem causing the seeds to stick on the seeding head leaving funnels unseeded. Old or new growth especially pinegrass over 15-20 cm in height caused visual contact problems for spacing to adjacent rows. Wastage due to funnel breakage was a reasonable 2-3%.

The seeding equipment is relatively expensive at $170 per seed tool and 8.5¢ per funnel.
3. **Survey Results**

See Appendix 2 for background and history information pertaining to the areas surveyed. Appendix 3 contains the survey results and statistical data by area.

**A. Trials**

1. Control - stratified and unstratified seed

The control spots for both stratified and unstratified seed did very poorly achieving less than 20% germination and less than 27% stocked spots. First year survival dropped to less than 18% with less than 26% stocked spots. Pl1 results generally better than Se and unstratified seed is 50% less than stratified results. Surprising results were achieved on Unit B where the unstratified seed on the hand screeved control spots was lightly covered with soil. Germination was 42% with 62% stocked spots dropping to a 1st year survival of 35% with 50% stocked spots.

2. Funnels - unstratified seed

Results of the unstratified seed in the funnels although significantly better than the control spots was disappointing at 11-24% germination with 17-38% stocked funnels. Survival dropped to 4-15% with 6-24% stocked funnels. Pl1 results were similar on scarified or unscarified areas. Se results were 100% better on scarified areas. The older style cerbel funnels were frost heaved somewhat contributing to missing funnels at the October survey of 2-7% in the Pl1 areas and 11-43% in the Se areas. No signs of structural deterioration was evident in these funnels after one full year including overwinter.

3. Funnels - stratified seed

Stratified seed in the funnels had moderate germinations of 45-58% with 60-76% stocked funnels. A reasonable survival of 36-46% with 52-60% stocked funnels was recorded in October. Se results were again somewhat less than the Pl1 with a significant germination/survival drop in the unscarified Se areas. The Pl1 germinants general condition changed from good to fair over the summer. The surviving Se germinant remained stable or even slightly improved from a good condition possibly due to the fair and poor germinants dying. Funnel were not exposed to frost heaving and missing funnels in October was 0-2% in the Pl1 areas and 1-12% in the Se areas. Again no visual signs of funnel structural deterioration was evident.
B. Operational

1. Se - unstratified seed

Very poor germination of 9% with 14% stocked funnels. Survival dropped to 2% with 4% stocked funnels. Frost heaving of these older style cerbel funnels contributed to 14% missing funnels in July and 50% in October.

2. Se - stratified seed

A moderate to poor germination of 30-48% with 26-37% stocked funnels. Survival dropped to 14-36% with 12-26% stocked funnels. Areas were considered predominantly unscarified due to revegetation over a 3 year period. Surviving germinants remained in a stable fair to good condition. Cattle trampling on areas contributed to the 6-37% missing funnels.

3. Pli - stratified seed

Good germination at 71-77% with 65-69% stocked funnels. Survival dropped significantly to 24-36% with 24-41% stocked funnels as a result of germinant desiccation. Areas were predominantly unscarified due to revegetation. Only 2-6% missing funnels were recorded in October.

4. Fdi - stratified seed

Good germination at 76% with 73% stocked funnels resulting in a survival of 52% with 50% stocked funnels. The Fdi germinant remained stable at a good condition and the best average germinant height of 40MM. The area was considered equal as to scarified/ unscarified ground. Better germinant survival was evident on North aspects. Missing funnels increased from 4-14%.

5. Cerkon cones - Pli stratified seed

Moderate germination of 46% with 47% stocked cones dropped to a survival of 12% with 16% stocked cones. The cones are easily dislocated and even with dirt placed on the cone rim there were 42% missing in 2 months and 63% by October.

C. Summation

The control spots as anticipated did poorly in germination/survival for both stratified and unstratified seed. The surprise and potential sleeper requiring follow up is the unstratified seed placed on scarified ground and lightly covered with dirt. Germination/survival percents were equal to stratified seed in the funnels without the 8.5¢
C. Summation (con't)

Cost of the funnel. Stratified seed in the funnels had moderate germination/survival in the trials with Pli results generally better than the Se. Pli results remained similar on scarified or unscarified areas whereas Se results dropped significantly on unscarified areas. Frost heaving was evident and must be given consideration especially in the Se areas.

On the operational areas the Se unstratified seed did very poorly in germination/survival possibly due in part to frost heaving and 50% missing funnels. Se stratified seed had moderate to poor germination/survival somewhat less than recorded on the trials. The wider range of micro-sites sampled on the operational areas plus a problem with cattle trampling and missing funnels on some areas may account for the differences in the Se stratified seed results. The Pli stratified seed had very encouraging germination with a disappointing fall down in survival as a result of germiant desiccation. The Fdi stratified seed did best overall with good germination, survival, growth and condition. No structural deterioration of the funnel was visible even after one full year of weathering on the fall/R3 funnels.

The small sample of Cerkon cones had moderate germination and survival, however the dislocation of 64% of the cones in the first year is unacceptable for operational applications.
4. **Potential**

Survey results did clearly show the ability of the "Cerbel" funnels to significantly improve germination of stratified and unstratified seed under natural field conditions. Stratified seed responded very encouragingly to germination in the funnels for all 3 species. Further research into funnel structure, colour and bio-degradability is necessary to maintain initial germination percents through the summer into fall survival.

The Cerbel seeding tool requires improvements, however simple changes make the seeding method operational and comparable to bareroot productivities and costs. The room for improvement should allow significant gains to be possible in productivities and resulting cost reductions. Considering savings in nursery costs and possible lack of scarification required for some species (Pli), the benefit/cost relationship is very favourable for seeding over planting on site specific dry belt areas. The potential of this or similar seeding systems to reduce the regeneration delay, provide a natural seedling unhindered with nursery associated growth development problems and at a cost competitive with any planting must be pursued.

Continuation of our seeding program in 1985 will consist of stratified seed placed on mechanical scarified rows resulting from our 1984 site treatment. A light coverage of dirt will be raked over the seeds to try and duplicate the surprise results recorded on Unit B of the trials. Funnels with stratified seed will be seeded in equal numbers on similar scarified rows for comparison. Our 1983/84 seeding projects will be monitored in the fall to continue observations of survival, growth and funnel deterioration.

The seeding potential and benefits are "real". The challenge is for research and improvement to seeding methods and products utilizing operational field results as a guidance system to recognize the potential.
APPENDIX 1

Information and Pictures of Cerbel Seeding Method
Two direct seeding methods used in Scandinavia

This is a presentation of two seeding methods which have attracted much attention during the seventies as an alternative and complement to the traditional forest regeneration.

Deux méthodes d'ensemencement terrestre utilisées dans les pays scandinaves

Voici la présentation de deux méthodes d'ensemencement direct qui ont attiré l'attention durant les années 70. C'est une alternative ou un complément à l'amélioration des forêts.
CERBEL®
FUNNEL SEEDING

Scarification is not necessary. Six seeds of spruce or pine are sown directly into the humus layer, in plastic funnel shelters, CERBEL. It is not necessary that the point of the funnel reaches the mineral soil.

The plastic shelter is a protection against vermin, e.g. insects, field mice and birds.

The plastic material in the shelter is influenced by sunlight and microorganisms and is gradually decomposed into carbon dioxide and water.

The temperature and the humidity in the minigreenhouse are favourable for germination as well as for growth.

Funnel seeding gives growing plants in the most different surroundings, also on high altitudes.

The fertility of the soil is of little importance for the result, but on the other hand there are negative effects of shading site vegetation. On moist sites the seeding must be done on dry heaps and the spacing decreased.

In order to get a fully satisfactory result from funnel seeding we recommend that you put out min. 3800 funnel's per hectare.

It is important for growth and survival that the funnels are placed on small raisings of the ground.

CERBEL®
ENSEMENCEMENT AVEC "METHODE DE L'ENTONNOIRE"

Le scarification n'est pas nécessaire. Six (6) semences d'épinettes ou de pins peuvent être déposées directement dans l'humus à l'intérieur de l'entonnoir en plastique "CERBEL". Il n'est pas nécessaire que le bout de l'entonnoir touche le sol minéral.

L'entonnoir "CERBEL" est aussi une protection contre la vermine, les insectes, les souris et les oiseaux.

Le matériel plastique est aussi influencé par la lumière et les micro-organismes, ce qui a pour effet de se décomposer graduellement.

L'ensemencement donne une bonne croissance des plants sur la plupart des sols. Pour avoir de bons résultats, nous recommandons de mettre en terre min. 3800 CERBEL à l'hectare. De plus, pour ce genre d'appareil, il est préférable d'utiliser l'épinette.

Il est important pour la croissance et la survie des plants de ne pas placer l'entonnoir "CERBEL" dans une dépression de terrain.
CERKON®
CONSEEDING
On bare mineral soil exposed by scarification, seeds from pine or spruce are protected by semitransparent plastic cones, Cerkon.

The mini-greenhouse created by the plastic cone offers temperature and humidity conditions which are very favourable for the germination of the seeds. The plastic cones serve also as protection against vermin, e.g. insects, field mice and birds. Further, the cone reduces the risk of freezing. 80–90% of the cones usually have germinants during the first fall.

The plastic material in the cone is influenced by sunlight and microorganisms and is gradually decomposed into carbon dioxide and water.

Cone seeding is cheaper than planting and simple to perform. You need seeds, cones and seeding appliance. The site must be scarified before you start the seeding. The most convenient seeding period is from April to the first half of July. In order to obtain a fully satisfactory result from cone seeding we recommend that you put out 2400 cones per hectare, on ground suitable for cone seeding. Be careful to place the cone correctly on the ground. See description below.

CERKON®
ENSEEMECENT AVEC MINI-SERRES
Utilisée sur des sites scariés, la semence de pins ou d’épinettes est protégée par un cône de plastique semi-transparent, "LE CERKON".

La mini-serre, créée par le cône de plastique, offre des conditions de température et d’humidité favorable à la germination des semences.

Le cône sert aussi à la protection contre les insectes ou autres prédateurs. De plus, le cône réduit considérablement les risques de gel. Les résidus de germination sont de l’ordre de 80 à 90% durant la première saison.

Le matériau plastique des cônes est influencé par la lumière et les micro-organismes, ce qui a pour effet de décomposer graduellement le cône.

L’ensemenement par cônes est moins dispendieux que la plantation et aussi plus facile à réaliser. Le site doit être scarifié au préalable. Les meilleurs temps pour réaliser un ensemencement sont les mois de avril et de juin.

Il est recommandé pour obtenir un "Stocking" plus important d’utiliser 2400 cônes à l’hectare.

Il est important de placer le cône correctement sur le sol et nous vous recommandons la méthode suivante.
CERKON® and CERBEL® systems for seeding have been developed at the University of Umeå, Sweden, Dept. of Forest Science, in cooperation with AB Cerbo in Trollhättan.

Les systèmes CERKON® et CERBEL® ont été développés à l'Université d'Umeå, Suède, Dept. de recherche scientifique des forêts., en collaboration avec AB CERBO, Trollhättan.
CERBO DIRECT SEEDING EQUIPMENT

As a supplier of silvicultural tools and equipment we are always on the look out for new and innovative products. Rarely however do we encounter anything whose future excites us as much as does the "CERBO" line of direct seeding products.

We are pleased therefore to announce that Forestworld Supplies Ltd. has been granted the "CERBO" line distributorship for B.C. and Alberta by their Canadian agent K.B.M. Ltd.

The CERBO direct seeding systems are becoming a vital component in your progression to an expanded, effective reforestation program.

Some of the benefits you can expect from using CERBO Direct Seeding systems:

1) Direct seeding does best on dry harsh sites where survival of other stock types would be poor.

2) Greatly reduced operational logistics. With 4000 cones per box, and no cold storage considerations, field operations are greatly simplified.

3) Although care must be taken when handling seeds during operations there are not the difficulties or dangers in seeding mortality and vigour that are inherent in normal stock handling.

4) All seedlings that result from direct seeding programs are of course naturally rooted.

5) There is a longer than normal period each year when direct seeding operations can be carried out.

6) Lower than normal per hectare planting costs.

7) Simplified checking procedures.

8) No limit or cutbacks to your planting programs because of nursery limitations.

Direct seeding has a long successful history in Scandinavia and accounts for 21% of the artificial regeneration program in Finland. In B.C. there have been many successful trials, and small operational projects for a number of years and now for the '83 season there will be a large operational project.

Give us a call! Let us answer your questions.
APPENDIX 2

History Information of Areas Surveyed
Appendix 2 - History Information of Areas Surveyed.

The following information gives a brief history of the areas involved in our seeding program.

A. Trials

1. Unit A
   - CP 512 BLK 6, S.W. of Savona.
   - IDFb1 1Va, elev. 1296 M.
   - P1 532 M logged 1982 (fall)
   - Seedlot 3218 P1i, 86% germination.
   - 400 funnels & control, unstratified seed (fall/83)
   - 400 funnels & control, stratified seed (spring/84)
   - 90% unscarified ground.

2. Unit B
   - CP 512 BLK 6, S.W. of Savona.
   - IDFb1 1Va, elev. 1296 M.
   - P1 532 M logged 1982 (fall)
   - Seedlot 3218 P1i, 86% germination.
   - 400 funnels & control, unstratified seed (fall/83)
   - 400 funnels & control, stratified seed (spring/84)
   - 100% of funnel and control spots were hand screefed to mineral soil.
   - control spots with fall unstratified seed received a light coverage of soil.

3. Unit C
   - CP 512 BLK 6, S.W. of Savona.
   - IDFb1 Vb, elev 1311 M.
   - S 831 M logged 1982 (fall)
   - D-7 brush blade scarification (fall/83)
   - Seedlot 4269 Se, 89% germination.
   - 400 funnels & control, unstratified seed (fall/83)
   - 400 funnels & control, stratified seed (spring/84)
   - approximately 50/50 as to scarified/unscarified ground.

4. Unit D
   - CP 512 BLK 6, S.W. of Savona.
   - IDFb1 1Va, elev 1311 M.
   - P1 532 M logged 1982 (fall)
   - medium chain drag scarification (fall/83)
   - Seedlot 3218 P1i, 86% germination.
   - 200 funnels & control, unstratified seed (fall/83)
   - 200 funnels & control, stratified seed (spring/84)
   - 84% of samples placed in scarified chain drag trenches.
5. Unit E

- CP 122 BLK 8, Crater Creek (West Hat Creek Valley)
  - IDFb1 Vb, Elev 1350 M
  - FS 530 M + F Vets logged 1979 (winter)
  - D-6 brush blade scarification (fall/80)
  - planted seedlot 3303 Se PSB 211 1+0 (spring/81)
  - surveyed 48% survival in 1983.
  - seedlot 4269 Se, 89% germination.
  - 400 funnels & control, unstratified seed (fall/83)
  - 400 funnels & control, stratified seed (spring/84)
  - 74% of area sufficiently revegetated to be considered unscarified.

B. Operational

1. CP 122 BLK 8

- Crater Creek (West Hat Creek Valley)
  - IDFb1 Vb, Elev 1350 M, 11 ha.
  - FS 530 M + F Vets logged 1979 (winter)
  - D-6 brush blade scarification (fall/80)
  - planted seedlot 3303 Se PSB 211 1+0 (spring/81)
  - surveyed 48% survival in 1983.
  - seedlot 4269 Se, 89% germination.
  - 50 funnels, unstratified seed (fall/83)
  - 60% unscarified ground.
  - seedlot 3215 Pli, 87% germination.
  - 42 funnels, stratified seed covering 5 ha. (spring/84)
  - 67% unscarified ground.
  - seedlot 4269 Se, 89% germination.
  - 33 funnels, stratified seed covering 3 ha. (spring/84)
  - 73% unscarified ground.
  - seedlot 3538 Fdi, 92% germination.
  - 44 funnels, stratified seed covering 3 ha. (spring/84)
  - 54% scarified ground.
  - 10,000 funnels seeded inclusive all species.

2. CP 123 BLK 14

- Colley Creek (West Hat Creek Valley)
  - IDFb1 V1, Elev 1370 M, 6 ha.
  - PIS 531 M & F Vets logged in 1979 (winter)
  - D-6 brush blade scarification (fall/80)
  - planted seedlot 3303 Se PSB 211 1+0 (spring/81)
  - plantation stocking very sparse over 6 hectares due to wet ground conditions at time of planting.
  - seedlot 4269 Se, 89% germination.
  - 57 funnels, stratified seed covering 6 ha. (spring/84)
  - predominantly unscarified ground due to revegetation.
  - 7,500 funnels seeded.
3. CP 216 BLK 3
- Anderson Creek (West Hat Creek Valley)
- IDFb1 V1, Elev 1463 M, 5 ha.
- PIFS 531 M logged in 1976 (winter)
- minor spot burning (fall/80)
- planted seedlot 3303 Se PSB 211 1+0 (spring/81)
- very poor plantation survival.
- Seedlot 4044 Se, 92% germination.
- 43 funnels, stratified seed covering 5 ha. (spring/84)
- 67% unscarified ground.
- 5,100 funnels seeded.

4. CP 512 BLK 4
- Indian Gardens Creek, S.W. of Savona
- IDFb1 Vb&V1, Elev 1189, 6 ha.
- F(S) 530 M logged in 1983 (winter)
- seedlot 4325 Se, 85% germination.
- 39 funnels, stratified seed covering 6 ha. (spring/84)
- 67% unscarified ground.
- 4,500 funnels seeded.

5. CP 8 Sav Fire
- Loon Lake
- IDFb1 Id, Elev 1128 M, 16 ha.
- F(P1) 832 P burnt by wildfire in 1971.
- seedlot 3218 Pl, 86% germination.
- 100 funnels, stratified seed covering 16 ha. (spring/84)
- 84% unscarified ground.
- 20,000 funnels seeded.
APPENDIX 3

Statistical Survey Results by Area
### Operational Areas - Unstratified & Stratified Seed

<table>
<thead>
<tr>
<th>AREA DESCRIPTION</th>
<th>BIO GEO CLASS</th>
<th>AREA</th>
<th>SEED TYPE</th>
<th>SAMPLE SIZE FUNNELS (SPOTS)</th>
<th>SURVEY NUMBER</th>
<th>% GERMINANTS G M P</th>
<th>AVE. HT (MM)</th>
<th>% GERMINATION OR SURVIVAL</th>
<th>% STOCKED FUNNELS (SPOTS)</th>
<th>% SCARIFY GROUND</th>
<th>% UNSCARIFY GROUND</th>
<th>% FUNNEL CONDITION G M P MISSING</th>
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<td>Se-Unstrat</td>
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<td>27</td>
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<td>14</td>
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<td>42 1 25 18</td>
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<td>25</td>
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<td>19</td>
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<td>10 11 16 63</td>
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# EVANS PRODUCTS - SAVONA DIVISION
## DIRECT SEEDING SURVEY INFORMATION
### UNITS A-F (TRIALS) UNSTRATIFIED SEED

<table>
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<th>AREA DESCRIPTION</th>
<th>BIO GEO CLASS</th>
<th>H./.</th>
<th>SEED TYPE</th>
<th>SAMPLE SIZE</th>
<th>FUNNELS /SPOTS</th>
<th>SURVEY NUMBER</th>
<th>% GERMINANTS</th>
<th>AVE. GT (MM)</th>
<th>% GERMINATION OR SURVIVAL</th>
<th>% STOCKED FUNNELS /SPOTS</th>
<th>SCARIF GROUND</th>
<th>UNSCAR GROUND</th>
<th>FUNNEL CONDITION</th>
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