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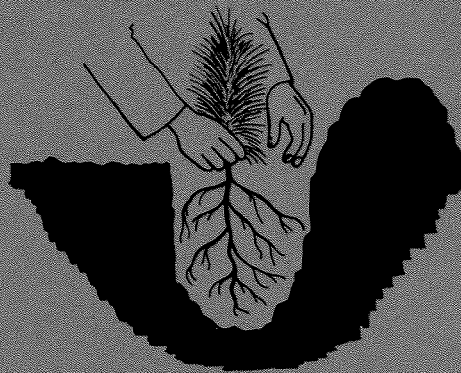
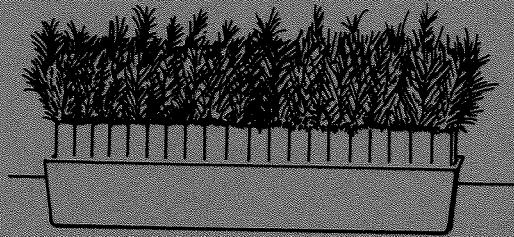
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AN ECONOMIC ANALYSIS OF REFORESTATION COSTS IN ALBERTA

by J.H. Smyth and B.W. Karaim



NORTHERN FOREST RESEARCH CENTRE
EDMONTON, ALBERTA
INFORMATION REPORT NOR-X-41

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AN ECONOMIC ANALYSIS OF REFORESTATION COSTS IN ALBERTA

by

J. H. Smyth and B. W. Karaim*

INTRODUCTION

This report represents a determined effort to describe and analyze the costs of reforestation in the Province of Alberta to an extent not previously attempted. Effort has been aimed at computing not only the total cost of each activity within the framework of the reforestation picture, but at computing the total cost of an activity by identifying and tabulating those costs which are a part of the cost structure of that activity. The costs calculated and presented in this report are those incurred by the Alberta Government.

The methodology employed to derive costs for the various activities and the handling of the analysis no doubt could be approached in a number of ways, some of which might yield better results than those described in this report. However, since this report represents a first attempt to identify the cost structure of the various activities associated with the regenerating of forest lands, it is felt that the

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methodology developed represents a rational and logical approach to the problem at the present time.

In addition to providing estimates of costs for the different systems and methods of reforestation currently practiced in Alberta, the information contained in this report can be of great value in several other areas of management and administration. For example, the cost estimates computed for the various activities can provide assistance in program-budgeting; the inefficiencies inherent in the present information systems can be improved upon to provide a better information base for decision-making as well as to provide sufficient data to allow for more meaningful comparison of costs and results of work.

The report is set up in five sections. Section One provides an overview of the reforestation program in Alberta and the possible direction it will likely take in the next few years. Section Two describes and provides a best estimate of nursery costs per unit of production for both conventional and container seedlings. Section Three describes and analyzes the costs associated with site preparation and regeneration. Section Four summarizes the expenditures incurred for each of the activities comprising the total reforestation package. Section Five contains recommendations directed toward improvement of the current information systems.

I. STATUS OF THE PROVINCIAL REFORESTATION PROGRAM IN ALBERTA

1. GENERAL

The 157,000 square miles of Crown forest lands in Alberta are divided into eleven Forests, each administered and managed separately with respect to the forest resources within its boundaries.

Approximately 58.4 million acres, or 56 per cent, of the total area within the eleven Forests are classified as productive and 41.6 million acres, or 40 per cent, are classified as non-productive forest land. The remaining four per cent is represented by water.

In total, the eleven Forests contain in excess of 59 billion cubic feet (gross) of wood material 4 inches in diameter breast height and over. Softwoods represent approximately 60 per cent of the total growing stock volume.¹

The more common coniferous tree species are white spruce, lodgepole pine, and jack pine. Less common are black spruce, balsam fir, alpine fir, and larch. Deciduous species such as aspen poplar, balsam poplar and white birch are found throughout most of Alberta.

The more common species harvested for commercial purposes are white spruce, lodgepole pine, and aspen poplar.

¹ Timber Management Branch, Alberta Forest Service.

2. REFORESTATION OF FOREST MANAGEMENT AGREEMENT AREAS

There are presently three active forest management agreements² in Alberta which include more than 10,000 square miles of publicly-owned forest land. All forest management agreements in Alberta are for a period of twenty years renewable at the expiry of the agreement provided all requirements have been met.

With respect to reforestation, each agreement states that where regrowth of young timber on any part of the cutover area remains below the standard³ prescribed by the Minister of Lands and Forests seven years after cutting, the company must, at its expense, implement a reasonable program of reforesting the unacceptable area to obtain the standard prescribed.

The agreements also provide that the Alberta Government will furnish seedlings for reforestation purposes to each company without charge, or alternatively, reimburse any company that elects to grow its own seedlings in an amount equal to the government's cost of growing the seedlings.

All three agreements call for supplemental reforestation, whereby potentially productive lands, i. e., lands inadequately stocked prior to the company's operation, are reforested on a twenty-year schedule by the government and the company in a joint program.

² The Government of Alberta has entered into agreements with three companies, namely: Northwestern Pulp and Power Limited, North Canadian Forest Industries, and Proctor and Gamble Co. of Canada Limited.

³ For more details, see: Alberta Forest Service, 1971. Regeneration Survey Manual, Timber Management Branch, Sept., 1971.

3. REFORESTATION OF TIMBER QUOTA AREAS

Effective May 1, 1966, the Government of Alberta terminated its system of competitive timber sales and established a system of timber quotas for the lumber and roundwood (post) industry.

Since implementation, the quota system has provided quota holders, or licensees, with an assured supply of timber in a particular forest area and, additionally, has resulted in the development of a timber appraisal system relating dues to timber quality.

With respect to reforestation, each quota holder may, within thirty days of being issued a license to cut timber, elect to pay the Minister a reforestation levy⁴ per thousand board feet cut or, alternatively, reforest the harvested area himself. In the event the quota holder elects to carry out his own reforestation, the Forest Management Regulations allow the Minister to supply seedlings to the quota holder at no cost provided that he supplies enough seed cones to produce the seed required to grow the equivalent number of seedlings. If he does not supply cones or seed, the quota holder must pay for the cost of the seed and the cost of growing and handling the seedlings.

In the four-year period May 1, 1966 to March 31, 1970, a total of 138,000 acres of forest land was harvested by quota holders. Quota holders opted to pay the reforestation levy on 29 per cent of

⁴ This levy is dependent upon the license being for coniferous or deciduous timber and whether or not the area harvested is classified as permanent or non-permanent forest land. For further details, see: The Forest Act, 1961. "The Forest Management Regulations, O/C 829/66, Clause 15.

the area harvested, thereby making the government responsible for the treatment of 40,000 acres. Monies collected by the Minister are spent on reforestation projects in the same management unit⁵ as that from which the assessed levy originated.

Of the 40,000 acres that the government was obligated to treat, 30,000 had actually been treated by December 31, 1970. In the same period, quota holders had treated 10,000 acres of the 98,000 acres of forest cut-over for which they retained responsibility. It is anticipated that treatment will be required on a portion of the remaining 88,000 acres.

4. REFORESTATION OF BURNED FOREST LAND

Since 1959, the Alberta Forest Service has spent considerable sums of money reforesting some of the 1.3 million acres of non-stocked, but potentially productive, land which has accumulated over the years primarily as a result of wild fires.

Past policy stipulated that preference for silvicultural treatment be given to the best or most productive sites with accessibility being the limiting factor. Future concentration will, however, be on those forest management units which show the greatest coniferous growing stock deficiency in the 0 to 20-year age-class.

As shown in Table 1, 1.3 million acres of forest land were

⁵ Each of the eleven Forests is divided into a number of management units. These units are reserved for the harvest of forest products at a level of cut which assures a perpetually sustainable and reasonably stable flow of forest products.

burned in Alberta during the period 1959-1970. A recent report⁶ pointed out that approximately 50 per cent of the forest lands burned annually will require silvicultural treatment in order to attain normal or satisfactory stocking conditions. If the 50 per cent average is applied to the total acreage of burned forest lands in this period, approximately 650,000 acres are placed in the category of requiring treatment of one form or another.

5. PROSPECTS OF REFORESTATION IN THE FUTURE

The seven-year period set by the government with respect to the reforestation of 1966 quota operations expires in 1973. Until this expiry date, it is anticipated that there will be an acceleration in the amount of reforestation work undertaken by quota holders.

The Alberta Forest Service is now planning production of five million conventional and three million container seedlings by 1975. Of the total number of container seedlings, approximately 75 per cent will be R.C.A. "peat sausages".⁷

If the 1975 production estimates are realized, a potential of 16,000 acres of forest land, based on an average of 500 seedlings per acre, could be reforested at that time.

⁶ McDougall, F.W. and L.L. Kennedy, 1971. The Status and Future of Reforestation in Alberta. Paper presented to the 53rd Annual Meeting of the Woodlands Section, C.P.P.A., 1971 (unpublished).

⁷ A 1" x 3" extruded peat cylinder (sausage) developed by the Research Council of Alberta.

TABLE 1. STATISTICS OF DEPLETION AND REFORESTATION IN ALBERTA, 1959-1970

Fiscal Year	Depletion			Silvicultural Treatment			Seedlings Planted		
	Cutover ¹	Burned ² 000's acres	Total	Scarifi- cation	Seeded 000's acres	Planted ³	Conven- tional	Container 000's	Total
1959-60	42	73	115	2.6	.1	.070	35	-	35
1960-61	31	17	48	6.0	1.1	.048	24	-	24
1961-62	34	182	216	10.0	3.5	.250	125	-	125
1962-63	37	4	41	10.7	7.9	.346	173	-	173
1963-64	47	17	64	9.0	8.2	.522	261	-	261
1964-65	41	13	54	10.5	6.8	.650	325	-	325
1965-66	41	54	95	18.5	11.1	1.402	701	-	701
1966-67	43	52	95	17.9	13.0	1.752	876	-	876
1967-68	37	16	53	27.9	20.3	1.968	745	289	984
1968-69	42	834	876	17.3	9.1	3.294	524	1,123	1,647
1969-70	<u>50</u>	<u>68</u>	<u>118</u>	<u>12.1</u>	<u>10.4</u>	<u>2.680</u>	<u>667</u>	<u>673</u>	<u>1,340</u>
TOTALS	445	1,330	1,775	142.5	91.5	13.0	4,456	2,035	6,491

¹ McDougall, F.W. and L.L. Kennedy, 1971. The Status and Future of Reforestation in Alberta (unpublished).

² Alberta Department of Lands and Forests. Annual Reports. Figures in table include productive and non-productive acreage burned on Crown land only.

³ Calculations based on an average of 500 seedlings planted per acre.

II. FOREST TREE NURSERY PRODUCTION

The Provincial Tree Nursery at Oliver is responsible for the production of deciduous and conifer seedlings for the shelterbelt program in the agricultural zone of the Province and for the production of conventional and container 3-0 conifer seedlings for reforestation purposes on Crown land. The major and minor species grown for forestry purposes are white spruce and lodgepole pine, respectively. The nursery is administered and operated by the Alberta Department of Agriculture.

With information provided by the Department of Agriculture, this section of the study provides current realistic costs of production for both conventional and container forestry stock. To derive these costs, the Provincial Tree Nursery was assumed to be a privately-owned commercial tree nursery operating within the free enterprise economy producing shelterbelt and forestry seedlings as the one, and only, cash crop. Under this assumption, land taxes and depreciation of capital assets could be included as part of the costs of production. For several reasons, records for overhead expenditures⁸ were inadequate or found to be non-existent for the fiscal years analyzed. "Guestimates" of these expenditures for the forestry program were not attempted and, therefore, not included as part of total production costs.

The methodology employed in the allocation of expenditures among different segments of the forestry program is discussed briefly in

⁸ Includes expenditures on items such as fuel, electricity and water.

appropriate sections which follow. It is the writer's opinion that the methodology devised represents a reasonable approach to analyzing seedling production costs under the constraints imposed by the information available.

1. NURSERY ACCOUNTING SYSTEM

The Provincial Tree Nursery accounting system was designed to record most expenditures incurred by the farm shelterbelt and forestry programs. It includes expenditures directly incurred by the production of seedlings and those associated with general nursery administration and operation. With respect to the forestry program, the following are kept as separate bookkeeping entries for purposes of recording direct production costs: seed extraction, forestry containers, 1-0 conifer seedlings, 2-0 conifer seedlings, and 3-0 conifer seedlings.

Major entries of the nursery accounting system, under which individual costs associated with that activity are posted, are tabulated in Appendix 1.

2. SEED EXTRACTION COSTS

The cost of seed is a necessary expenditure frequently omitted or not identified as a separate component in production cost studies of nursery stock. To avoid repeating such error in this report, the first step taken in this phase of the study was to estimate a cost per pound for spruce and pine seed. An estimated cost per pound for each of these species based on nursery accounting records for 1968-69 and 1970-71 is

shown in Table 2. These average costs will be employed in calculations when deemed necessary throughout the remainder of the report. A more detailed breakdown of the input determinants used to calculate the average costs is tabulated in Appendix 2.

Direct extraction costs include outlays for items such as wages, salaries, unemployment insurance, repair and maintenance of equipment, and stationery. Administration costs include salaries and wages of Alberta Department of Agriculture administrative personnel only. When interviewed, administrative personnel at the Provincial Tree Nursery estimated approximately five (5) per cent of employee time was spent providing services such as supervision, typing and record-keeping during the period the extraction plant was in operation. This percentage of total time allocated to the extraction plant and its operation was used to estimate a reasonable administrative cost. Depreciation allowances⁹ for the seed extraction plant, plant equipment, and seed storage plants were based on the Department of Agriculture's valuation (1970) of the assets. The combined depreciation allowances for the two fiscal years averaged \$1.41 per pound of seed.

The average cost per pound of seed in storage does not include costs incurred by the transportation of cones from the field depot to the nursery or overhead expenditures of the seed extraction and seed storage plants. The exclusion of overhead costs accounts for the direct extraction

⁹ Appendix 3 tabulates the capital cost allowances of buildings and equipment used in the production of bare-root and container stock.

TABLE 2. AVERAGE COST PER POUND OF SPRUCE AND PINE SEED¹

Provincial Tree Nursery, Oliver, Alberta

Cost Components	Fiscal Year		Arithmetic
	1968-69	1970-71	Average
	dollars per pound		
Direct Extraction Cost	1.64	.92	1.22
Administration	.02	.02	.02
Depreciation: Seed Extraction Plant	.71	.52	.60
Plant Equipment	.75	.55	.64
Cold Storage Plants ²	<u>.17</u>	<u>.17</u>	<u>.17</u>
Sub-total	3.29	2.18	2.65
Cost of Cones per Pound Seed:			
Spruce	3.75	3.75	3.75
Pine	11.00	11.00	11.00
Total Cost of Seed (in storage):			
Spruce ³	7.04	5.93	<u>6.40</u>
Pine ³	14.29	13.18	<u>13.65</u>

¹ See Appendix 2 for detailed breakdown of cost determinants.

² Estimated approximately 20,000 pounds of spruce and pine seed in storage during two fiscal years.

³ Cost per pound of seed does not include cost of transporting cones from field depot to nursery or overhead expenditures of seed extraction and cold storage plants.

Source: Horticulture Branch, Alberta Department of Agriculture.

costs for both spruce and pine seed being equal, although it is recognized that pine cones are subject to "pre-cleaning" and "scorching" prior to entering the kiln for drying. Consequently, the additional steps necessary for the removal of seed from pine cones does result in a relatively higher extraction cost than that indicated in Table 2.

In January, 1972, an inventory of stored seed revealed 24,000 and 6,000 pounds of spruce and pine, respectively. If one accepts the average values calculated per pound of seed, total value of seed in storage currently amounts to \$209,900.

3. PRODUCTION COSTS: CONVENTIONAL FORESTRY STOCK

A. Methodology

To provide a reasonable estimate of the cost to produce conventional, or bare-root, forestry stock, expenditures recorded for the three fiscal years 1968-69, 1969-70, and 1970-71 were utilized. A breakdown of the direct¹⁰ and indirect¹¹ costs associated with the production of the three age-classes of forestry stock is tabulated in Table 3. To avoid discussing in detail the methodology developed to allocate the indirect costs of production, it is suffice to mention that annual costs were prorated among the three age-classes of forestry stock based on a calculated percentage

¹⁰ Costs related directly with production of seedlings and recorded in the nursery accounting system as 1-0, 2-0, and 3-0 conifer seedlings, respectively.

¹¹ Classified for purposes of this report as administration, maintenance, machinery maintenance, grounds and roads, irrigation and miscellaneous. These expenditures reflect costs incurred by the nursery as a single operating unit.

of direct forestry production costs to total direct nursery production costs.

Administration, miscellaneous and maintenance¹² expenditures, noted as indirect costs, were prorated among the three age-classes in a similar manner as described above; but, because of the nature of these costs, it was necessary to carry the allocation procedure one step further. It was recognized that a portion of these costs was absorbed by the production of container seedlings and, accordingly, were apportioned to both the container and conventional components of the forestry program.

It is recognized that periodic visits are made to the nursery by Edmonton-based personnel of the Alberta Department of Agriculture and Alberta Forest Service for varied business reasons. For the three fiscal years under consideration, a rough approximation of the total time spent by personnel of these two agencies on nursery business was "guestimated". The equivalent dollar value of this time was estimated and posted to "salaries" under the bookkeeping entry "Nursery Administration". Consequently, total forestry production costs for each age-class in each fiscal year includes this additional administrative input not otherwise accounted for in the nursery accounts.

Adjustments to 1-0 seedling production costs incurred by fall sowing were required. Since fall inventory counts identify the preceding

¹² "Maintenance" is not a bookkeeping entry in the nursery accounting system. Major upkeep of the nursery is the responsibility of the Alberta Department of Public Works. Monies expended annually on the nursery by this Department were obtained from the Public Accounts of the Province of Alberta (annual).

TABLE 3. BREAKDOWN OF COSTS ASSOCIATED WITH THE PRODUCTION OF
CONVENTIONAL FORESTRY STOCK, 1968-1971

Provincial Tree Nursery, Oliver, Alberta

Expenditure	Fiscal Year								
	1968-69			1969-70			1970-71		
	1-0	2-0	3-0	1-0	2-0	3-0	1-0	2-0	3-0
	<u>Cost of production in dollars</u>								
Direct Production Costs	10,171	2,698	3,503	6,155	5,006	5,140	6,634	2,348	8,566
Indirect Production Costs									
Administration	11,522	2,933	3,981	5,734	4,672	4,672	5,926	2,116	7,619
Miscellaneous	2,077	529	717	1,526	1,243	1,243	3,120	1,114	4,012
Maintenance ¹	2,898	738	1,001	1,834	1,494	1,494	2,009	718	2,583
Machinery Maintenance	1,162	300	412	197	161	161	732	250	944
Grounds and Roads	310	80	110	132	108	108	160	55	206
Irrigation	308	80	109	530	432	432	127	43	164
Seed Cost ²	974	-	-	206	-	-	868	-	-
Depreciation ³ : Buildings	-	-	-	-	-	-	-	-	2,500
Equipment	1,742	1,742	2,282	1,742	1,742	2,282	1,742	1,742	2,282
Property Taxes	64	64	64	64	64	64	64	64	64
TOTALS	31,228	9,164	12,179	18,120	14,922	15,596	21,382	8,450	28,940
No. Seedlings (thousands) ⁴	2,692	1,904	539	386	1,884	1,619	1,874	270	1,602
Cost/thousand	11.60	4.81	22.60	46.94	7.92	9.63	11.41	31.30	18.06

¹ Source: Public Accounts of the Province of Alberta (annual) .

² Number of pounds of spruce and pine seed sown obtained from Provincial Tree Nursery sowing schedules.

³ See Appendix 3.

⁴ See Table 4.

fall and spring seedlings as 1-0 stock, it was necessary to transfer and combine fall sowing costs with those of the following spring. As a result, this procedure allowed total production costs of 1-0 stock to be equated to the inventory counts. Table 4 tabulates total spruce and pine seedlings inventoried since 1968.

TABLE 4. CONVENTIONAL SEEDLING INVENTORY¹
Provincial Tree Nursery, Oliver, Alberta

Year ²	Age-Class			Total
	1-0	2-0	3-0	
	000's seedlings			
1968	2,692	1,904	539	5,135
1969	386	1,884	1,619	3,889
1970	1,874	270	1,602	3,746
1971	2,452	1,593	230	4,275

¹ The inventory consists of approximately 65 per cent white spruce and 35 per cent lodgepole pine.

² Inventory taken in fall of year indicated.

Source: Provincial Tree Nursery, Oliver.

B. Capital Cost Allowances

The capital cost allowances (depreciation) on buildings and equipment were calculated from the information tabulated in Appendix 3. Prior to 1970, 3-0 seedlings were sorted, graded and packed for distribution in older type buildings having no value for depreciation purposes. As a result, no depreciation allowances for these buildings were recorded for 3-0 stock in the two fiscal years 1968-69 and 1969-70. These buildings were removed to allow for the construction of the new packing shed in 1970.

C. Property Tax

The Provincial Tree Nursery comprises approximately 480 acres, or 3/4 section. Of this total, about 60 acres are apportioned to the forestry program. Currently, 50 acres are in production and the remaining acreage is lying fallow.

The Alberta Department of Municipal Affairs has assessed the land value of the nursery at \$21,410 (1971).¹³ The millage rate (1971) for the municipality in which the nursery is located (M.D. Sturgeon) is 72 mills, or \$72 per thousand of assessed valuation. Assuming that the assessed valuation and mill rates have been constant since fiscal 1968, total land tax is calculated to be \$1,542 or \$3.21 per acre. Allowing equal distribution of 20 acres of productive and fallow land to each age-class of forestry stock, annual taxes amounted to \$64.20 per age-class.

¹³ Section 25, clause 12 and 13 of the Municipal Taxation Act (1967) exempts farm buildings and growing crops from assessment. Since the growing of trees is recognized as a crop, these two clauses are equally applicable to a commercial nursery.

D. Discussion

The total cost of conventional 3-0 forestry stock "at the nursery gate" in the spring of 1971 amounted to \$37.58/M seedlings.¹⁴ This cost is considerably higher than those reported elsewhere.¹⁵ Detailed production cost analysis has not been attempted in preceding years; therefore, a comparison of current 3-0 costs with previous costs cannot be made at this time.

The variation in the cost per thousand seedlings for the same age-class in each of the fiscal years is evident in Table 3. Several factors may suggest reasons for these differences. Firstly, rise and fall of production costs may stem directly from inadequate planning of the annual budget by management personnel. An improved budgeting and programming system for the nursery and the allocation of predetermined monies to each of the nursery activities should result in keeping annual costs to a minimum.

¹⁴ Year	<u>68-69</u>		<u>69-70</u>		<u>70-71</u>		
Age-Class	1-0		2-0		3-0		
Cost/M	\$11.60	+	\$7.92	+	\$18.06	=	\$37.58

¹⁵ See: Anonymous, 1970. Provincial Legislation and Policies on Reforestation: A Survey, Forestry Chronicle, Vol. 46, No. 6, December, 1970.

McDougall, F.W. and L.L. Kennedy, 1971. The Status and Future of Reforestation in Alberta. Paper presented to the 53rd Annual Meeting of the Woodlands Section, C.P.P.A., 1971 (unpublished).

Secondly, the differences noted in annual costs may result from inefficiency in nursery production techniques resulting in unnecessary high costs. For example, in the three fiscal years analyzed mortality, or loss of seedlings, in the seedbeds amounted to 40 per cent, or 1,090 M seedlings.¹⁶ Inefficiency is one element of nursery operations which can be corrected and controlled.

Thirdly, it is conceivable that errors are made unintentionally when costs incurred by a particular production activity are not posted correctly to the appropriate bookkeeping entry. In order to have an efficient and reliable accounting system, costs should be identified and adequately described on the basic expense documents at the nursery. This intermediate but extremely important step should eliminate the problem of posting costs incorrectly.

If not already observed, it should be noted that 3-0 forestry stock which will be available for distribution in the spring of 1972 has, according to the schedule of costs, already amounted in two years to \$78.24/M seedlings.¹⁷

¹⁶ From Table 4, inventory counts recorded 2,692 M 1-0 seedlings in 1968. In 1970, inventory figures for these same seedlings (now 3-0 stock) showed that only 1,602M seedlings remained in the seedbeds.

¹⁷ $\text{Cost/M} = (46.94 + 31.30) = \78.24 . The number of seedlings being produced during the 3-year period strongly influences the cost per thousand.

4. PRODUCTION COSTS: CONTAINER FORESTRY STOCK

A. Methodology

In 1971, three types of containers accounted for most of the 1,304,306 spruce and pine seedlings propagated for shipment in the fall of 1971 and spring of 1972. Of the total number of containers, there were approximately 520,336 BC/CFS Styrobloc plugs, 486,690 Spencer-Lemaire plugs, 188,416 R.C.A. "peat sausages"¹⁸ and 108,864 paper pots. Because of experimentation with containers and seedlings prior to 1970, only 1971 production was considered for analysis.

Table 5 provides a detailed breakdown of production costs for seedlings reared in three different types of containers. Administration, miscellaneous and maintenance costs which were apportioned on a percentage basis between the conventional and container components of the forestry program are included. Difficulties were encountered in estimating overhead expenditures associated with container production and, therefore, are omitted from the analysis. Similarly, difficulties were encountered in "guestimating" the cost of the trays in which the Spencer-Lemaire plug and R.C.A. peat sausage seedlings sit. These costs are likewise omitted from the analysis.

Since it was not possible to observe all stages of production for each type of container, a number of assumptions were made which could be applied to all three containers for costing purposes. They are as follows:

¹⁸ The Research Council of Alberta has developed a 1" x 3" extruded peat cylinder (sausage) which is currently supplied to the nursery at a cost of \$10.00/M.

TABLE 5. PRODUCTION COSTS RELATING TO CONTAINER TYPES, 1971

Provincial Tree Nursery, Oliver, Alberta

<u>Cost Components</u>	<u>Cost per Seedling in Cents</u>		
	<u>BC/CFS Styro- block plug</u>	<u>Spencer- Lemaire plug</u>	<u>R.C.A. sausage</u>
Container ¹	.700	.366	1.000
Peat	.056 ²	.056 ²	Included in the
Grit ³	.004	.004	.004 above cost
Fertilizer ⁴	.040	.040	.040
Seed: ⁵ spruce	.005	.005	.005
pine	.016	.016	.016
Labour: (a) filling container ⁶	.238	.238	Included in cost of container
(b) seeding container ⁷	.087	.087	
(c) maintenance ⁸	.989	.989	
Administration	.383	.383	.383
Miscellaneous	.222	.222	.222
Maintenance	.143	.143	.143
Capital Cost Allowance ⁹	.054	.054	.054
TOTAL COSTS: Spruce seedling	2.921	2.587	2.927
Pine seedling	2.932	2.598	2.938

¹ For a detailed description of each type of container selected for production cost analyses, see Appendix 4.

² Calculated on the basis that each cavity can hold 2.5 cu. in. of peat which costs \$.39/cu. ft.

³ Total cost for 27 bags used was \$45.90. This cost was spread over 1,304,306 containers.

⁴ Estimate provided by the Canadian Forestry Service, Edmonton.

⁵ Based on an estimate of 4½ lbs. of pine seed used at \$13.65/lb and 7 ¾ lbs. of spruce seed at \$6.40/lb.

⁶ Interview revealed that three labourers at \$2.50/hr. could fill 25,200 Spencer-Lemaire cavities in one day.

⁷ Interview revealed that three labourers at \$2.50/hr. could seed 68,400 Spencer-Lemaire cavities in one day.

⁸ One technician for summer (\$2,500) plus two man-years of labour at \$2.50/hr. equals \$12,900. This cost was spread over total production of 1,304,306 containers.

⁹ See Appendix 3.

1. It was assumed that labourers took the same amount of time to fill a BC/CFS Styroblock and Spencer-Lemaire cavity with peat mixture.
2. It was assumed that labourers took the same amount of time to seed a BC/CFS Styroblock, Spencer-Lemaire, and R.C.A. peat sausage container.
3. It was assumed that all containers required the same amount of maintenance.¹⁹
4. It was assumed that each container produced one seedling.

B. Capital Cost Allowances

The greenhouse and equipment used to rear container stock have a current appraised value of \$7,000 (Appendix 3). Based on 1971 production estimates, annual depreciation of assets in 1971 amounted to .054¢ per seedling.

C. Discussion

Under the assumptions noted above, the cost of production per thousand spruce and pine seedlings at the Provincial Tree Nursery in 1971, inclusive of administration and depreciation, was as follows:

¹⁹ Includes weeding, thinning, watering, fertilizing, and loading trays for shipment.

	<u>Spruce</u>	<u>\$/M</u>	<u>Pine</u>
BC/CFS Styroblock plug	29.21		29.32
Spencer-Lemaire plug	25.87		25.98
R.C.A. peat sausage	29.27		29.38

Excluding the price of the container, the cost of producing the BC/CFS Styroblock and Spencer-Lemaire plug seedlings was the same. These costs amounted to \$22.21 and \$22.32/M for spruce and pine seedlings, respectively.

As with conventional forestry stock, analysis of container production costs has not been carried out extensively in preceding years. Consequently, a comparison of current with past costs cannot be made at this point in time.

Despite innovations such as the vibrating table and pneumatic mechanical seeder, the process of filling, seeding and applying grit still remains labour intensive. Perhaps if the nursery adopted only one container type for mass production, mechanization would play a more important role and production costs would be reduced significantly.

III. SITE PREPARATION AND REGENERATION

The 157,000 square miles of provincial forest land in Alberta are administered by the Alberta Forest Service of the Department of Lands and Forests. One responsibility of this agency is to regenerate burned forest lands and inadequately stocked cutover lands on which quota holders have elected to pay the reforestation levy. Reforestation on forest management agreement areas is the responsibility of the operating company.²⁰

Two components of the total reforestation picture are described in this section - site preparation and regeneration. Current costs of site preparation for clearcut, partial cut and burned forest lands prior to natural or artificial regeneration are described. Similarly, current costs of artificially reforesting non-stocked or inadequately stocked forest lands by methods presently employed in the Province are described.

1. INFORMATION SYSTEM AND METHODOLOGY

The Alberta Forest Service has devised a relatively simple system for recording various types of data for areas treated in some fashion for purposes of bringing about an acceptable level of stocking. Briefly, the system consists of the following steps: (1) field reports

²⁰ See Section I for further detail of provincial and industry responsibilities in reforestation.

are prepared tabulating pertinent information for each reforestation project; (2) completed reports are dispatched to Edmonton where the information is transferred to "needle-sort" cards (see Appendices 5 and 6) and; (3) completed cards are filed by Forest and activity year for future reference. The needle-sort cards were the primary source of information for this section of the report.

Expenditures recorded for site preparation and regeneration activity for the three-year period 1969, 1970, and 1971 were employed to calculate costs. It was thought that the three-year period would reflect a significantly better estimate of current, or 1971, costs.²¹

Originally, the intention was to classify and analyze the data by Forest. This procedure was abandoned because of the inadequate number of projects in any one Forest. The alternative was to aggregate the data for the eleven Forests and calculate weighted averages for each of the expenditures associated with site preparation and regeneration activity.

2. SITE PREPARATION

Much of the acreage requiring treatment in Alberta is scarified using D6, D7 or equivalent crawler tractors equipped with conventional or specialized blades. In the past few years, V-blades have become popular

²¹ At the time data were being researched for this report (July-August, 1971), only a percentage of 1971 site preparation and planting projects completed to that time had field report data transferred to the needle-sort cards. Consequently, it was necessary to utilize data from the previous two years.

and are being used more frequently. It is reported that this type of blade allows for better mineral soil exposure and continuous non-stop scarification with minimum "back-up time". On some sites scarification is attained with D8, D9 or equivalent crawler tractors utilizing drags constructed from old crawler tractor pads.

Total cost of preparing a forest site for regeneration purposes was calculated for three different types of disturbed areas, i.e., clearcut, partial cut and burned forest land. A weighted average for each of the major costs - machine cost, regeneration survey, preliminary plans, project administration, and travel - associated with site preparation was calculated. These costs are tabulated in Table 6.

The machine cost per acre employing crawler tractors with blades or utilizing tractor pads as drags was \$15.67, \$14.59, and \$12.59 on clearcut, partial cut and burned forest land, respectively. The machine costs are, however, more representative of crawler tractors with blades since there were only a few projects which recorded the use of tractor pads as drags in the period analyzed. On any one project factors such as experience of machine operator, the power unit used, type of scarifier, weather, site conditions, and topography play a significant role on costs per acre and may cause some deviation from the average costs calculated above.

It was found that data for the remaining cost items - regeneration survey, preliminary planning, administration, and travel - were absent from many of the records researched. Since "guestimates"

TABLE 6. WEIGHTED AVERAGE COST PER ACRE FOR SITE PREPARATION ON
THREE KINDS OF DISTURBED FOREST AREAS IN ALBERTA, 1971¹

Expenditure	Area Treated		
	Clearcut	Partial Cut	Burn
	\$/acre		
Machine cost ²	15.67	14.59	12.59
Regeneration Survey	.59	.59	.59
Preliminary Plans	.48	.48	.48
Project Administration	.55	.55	.55
Travel	<u>.40</u>	<u>.40</u>	<u>.40</u>
TOTAL COST	17.69	16.61	14.61

¹ An insufficient number of site preparation projects in 1971 for each type of disturbed area necessitated employing data for the three-year period 1969-71. It is felt, however, that the costs shown are a reasonable estimate of the cost/acre in 1971.

² The average cost was obtained by combining data for all models of crawler tractors used for site preparation in the period analyzed. The cost/acre includes rental of machine, insurance, depreciation, fuel, transport to and from planting area, etc.

for these expenditures for individual projects could not be attempted without additional information, it was assumed that costs for each of these should not differ significantly from one type of area treated to another. Consequently, the data which were available were aggregated and weighted costs per acre determined. As shown in Table 6, the average costs are as follows: regeneration survey - \$.59; preliminary plans - \$.48; project administration - \$.55 and; travel - \$.40.

In the period analyzed, the greater proportion of site preparation activity occurred in the Clearwater-Rocky and Slave Lake Forests. Total costs for treatment are therefore more representative of these two Forests than of others in the Province.

It should be noted as a concluding remark that many of the records researched for site preparation data were an aggregation of a number of projects which differed in either size or type of area treated rather than being an account of a separate and identifiable project. Although such combined data were utilized for purposes of this report, it was felt, due to the manner in which the data were used, that the costs per acre would not differ significantly from the costs per acre that would have been calculated had all records been for individual projects. However, it should be pointed out that if such data were to be employed for other purposes, e.g. to determine the relationship between cost per acre and size of area treated, the practice of summing costs and acreages for several projects would undoubtedly lead to misleading conclusions concerning total treatment costs.

3. REGENERATION

A. Conventional and Container Planting Stock

In Alberta, conventional seedling stock is planted using planting bars and hoes or by planting machines. The use of mechanical equipment is limited primarily by the topography and condition of the site. The standard practice is to plant at the rate of five hundred 3-0 seedlings per acre.

As in the past, container seedling stock continues to be planted by hand using a dibble to prepare the planting hole. The Alberta Forest Service anticipates considerable expansion of the container program in the future.

For both programs, regular labour, minimum security crews and contract crews have been utilized for planting projects. For the conventional seedling program, the trend is toward contract planting with the objective of minimizing costs. It is fully expected that the three sources of labour noted above will continue to be used in the container program.

Methodology similar to that to compute site preparation costs was used to compute major costs associated with establishing conventional and container planting stock. A weighted average for all Forests combined was calculated for each program. Insufficient data, however, prevented a comparison of planting costs to be made between clearcut, partial cut and burned areas as described for site preparation. The alternative was to compare costs on the basis of planting on scarified and non-scarified sites. Table 7 shows individual and total costs per acre for establishing

conventional and container planting stock on the two types of sites described.

From Table 7, note that the first two cost items - regeneration survey and preliminary plans - have identical costs per acre for each method of planting on both the scarified and non-scarified sites. Costs are identical due to the inadequate number of observed values for each of these two items. To obtain an estimate for each of these, it was necessary to combine all observed values from the two programs and calculate a weighted average cost. It was assumed that there should not be any significant difference in cost with respect to conducting a regeneration survey or preparing preliminary plans for a scarified or non-scarified site.

It is recognized that travel costs, e.g., transport of planting crews to and from a project, are highly variable. However, a weighted average for each method of planting on the two sites was thought desirable and, therefore, included in the schedule.

Table 7 provides a best estimate of planting costs for 1971 on the basis of 500 seedlings per acre. The per acre estimates show that container planting by hand on non-scarified sites was the least expensive of the five methods. Total cost per acre was \$16. Conventional or bare-root, stock hand planted on non-scarified sites was the most expensive. Total cost per acre was estimated at \$26.50.

Analysis of planting costs to the extent carried out in this report has not been previously attempted in Alberta. Consequently, there are no past estimates against which present costs can be compared. However,

TABLE 7. WEIGHTED AVERAGE COST PER ACRE FOR COMMON PLANTING METHODS IN ALBERTA, 1971¹

Planting Method	Expenditures					Total Cost per acre	Average Number Trees per acre ²	Cost per tree	Best Estimate of cost/acre (1971) 500 trees/acre
	Regeneration Survey	Preliminary Plans	Project Administration	Travel	Machine and/or Labour				
	\$	\$	\$	\$	\$	\$		\$	\$
<u>Scarified Area</u>									
Conventional Stock Machine Planted	.59 ³	.78	1.68	1.63	10.42	15.10	371	.041	20.50
Conventional Stock Hand Planted	.59 ³	.78	2.59	.77	12.64	17.37	458	.038	19.00
Container Stock Hand Planted	.59 ³	.78	2.39	1.01	12.35	17.12	431	.040	20.00
<u>Non-Scarified Area</u>									
Conventional Stock Hand Planted	.59	.78	2.90	1.23	12.81	18.31	348	.053	26.50
Container Stock Hand Planted	.59	.78	3.64	1.35	20.19	26.55	821	.032	16.00

¹ An insufficient number of projects in 1971 for each of the planting methods necessitated employing data for the three-year period 1969-71. It is felt, however, that the costs shown are a reasonable estimate of cost/acre in 1971.

² Average number of trees planted per acre calculated from the projects analyzed for each planting method.

³ In many cases, planting on scarified areas is not implemented immediately, but at some later date. Prior to the time planting on previously scarified sites is anticipated, a regeneration survey is usually conducted. Hence, the inclusion of this cost. However, in cases where planting is carried out immediately after scarification, this cost can be excluded.

Source: Timber Management Branch, Alberta Forest Service.

discussion with individuals well acquainted with the provincial reforestation programs indicated the planting costs (Table 7) were "what was expected" and "reasonable". Container stock hand planted on scarified areas was the only method of planting whose cost per acre was suspect. The cost calculated, \$20 per acre, was viewed as being somewhat too high.

All conditions being equal, it is fairly well known in Alberta that regenerating an acre of scarified forest land with conventional stock is relatively more expensive than with container stock. Estimates shown in Table 7 do not suggest this situation. Table 7 also suggests that the cost per acre for establishing container stock on non-scarified areas is less expensive than on scarified areas. This is known to be, in fact, not the case at all. The reason or reasons for the high cost appearing as it has for container stock hand planted on scarified sites (\$20) cannot be explained without further investigation of each individual planting record and, possibly, interviews with field staff. There is, no doubt, a combination of factors responsible, e.g., low productivity per labourer, aggregation of cost data for several planting projects, recording data incorrectly, inexperienced planting crews, and site conditions. Because of the doubt raised concerning its credibility as a reasonable estimate of planting costs, caution should be taken in extending its use beyond this report.

B. Seeding

Seed can be either scattered uniformly over the entire area (broadcast seeding) or applied in small quantities to those particular

micro-sites where germination is likely to be successful (spot seeding).

Because of the limited number of needle-sort cards, i.e., individual projects, from which data were available for this system of regeneration, the estimates provided below for aerial and hand broadcast seeding should be accepted as a first approximation only. The two methods of seeding described in this report are discussed for no other purpose than to provide "ball park" estimates for comparative purposes with other previously described methods of regeneration.

(i) Aerial Broadcast Seeding

Aerial broadcast seeding is still in the experimental stages in Alberta. Data for aerial seeding were taken from recent projects, two of which occurred in 1969, five in 1970, and one in 1971.

The average cost of seeding on previously scarified sites at the rate of 5.3 oz. of spruce seed per acre amounted to \$3.65 per acre. This cost includes helicopter ferrying time to and from the project site, operator, seeding time, aviation fuel, labour for block layout and flagging, and cost of spruce seed estimated at \$6.40 per pound.

(ii) Hand Broadcast Seeding

From the five needle-sort cards researched for cost data in the three-year period 1969-71, analysis of the data generated the following costs per acre: labour - \$1.09; supervision - \$.25 and; seed - \$1.02.²² Total cost amounted to \$2.36. Project size ranged from 28 acres to 258

²² Application was at the rate of .16 pounds, or 2.6 oz. per acre. At \$6.40/pound for spruce seed, cost per acre amounted to \$1.02.

acres. Excluded from the above due to insufficient data are recognized project costs such as regeneration survey, preliminary planning and travel.

One should not infer from the amount of information obtained that hand seeding is not common practice in Alberta. On the contrary, over 100,000 acres of forest land have been seeded since 1959. The reason for not obtaining more cost data results from a back-log of field reports from which data must be transferred to the needle-sort cards. At the time seeding records were being researched for this report, the task of transferring data to the permanent filing system was just beginning.

IV. SUMMARY

The objective of this report was to analyze and describe the cost of stand establishment in Alberta to an extent not previously attempted. Estimates of costs associated with seedling production, site preparation, and regeneration - components of the total reforestation picture - were computed for the various methods of reforestation currently practiced in the Province. The costs calculated for each of the components represent a best estimate for 1971 based on the data available. Summary statements suggesting the best method of reforestation based solely on costs calculated were not attempted or given any consideration.

Production costs for both conventional and container planting stock were described. Conventional, or bare-root, 3-0 spruce and pine stock leaving the "nursery gate" in the spring of 1971 were valued at \$37.58/M seedlings. Three types of containers, BC/CFS Styroblock plug, Spencer-Lemaire plug and the R.C.A. peat sausage, currently used in Alberta were selected for comparison of production costs. For both spruce and pine, production per thousand seedlings utilizing the R.C.A. peat sausage was the most expensive; the Spencer-Lemaire plug the least expensive. Production costs were for 1971.

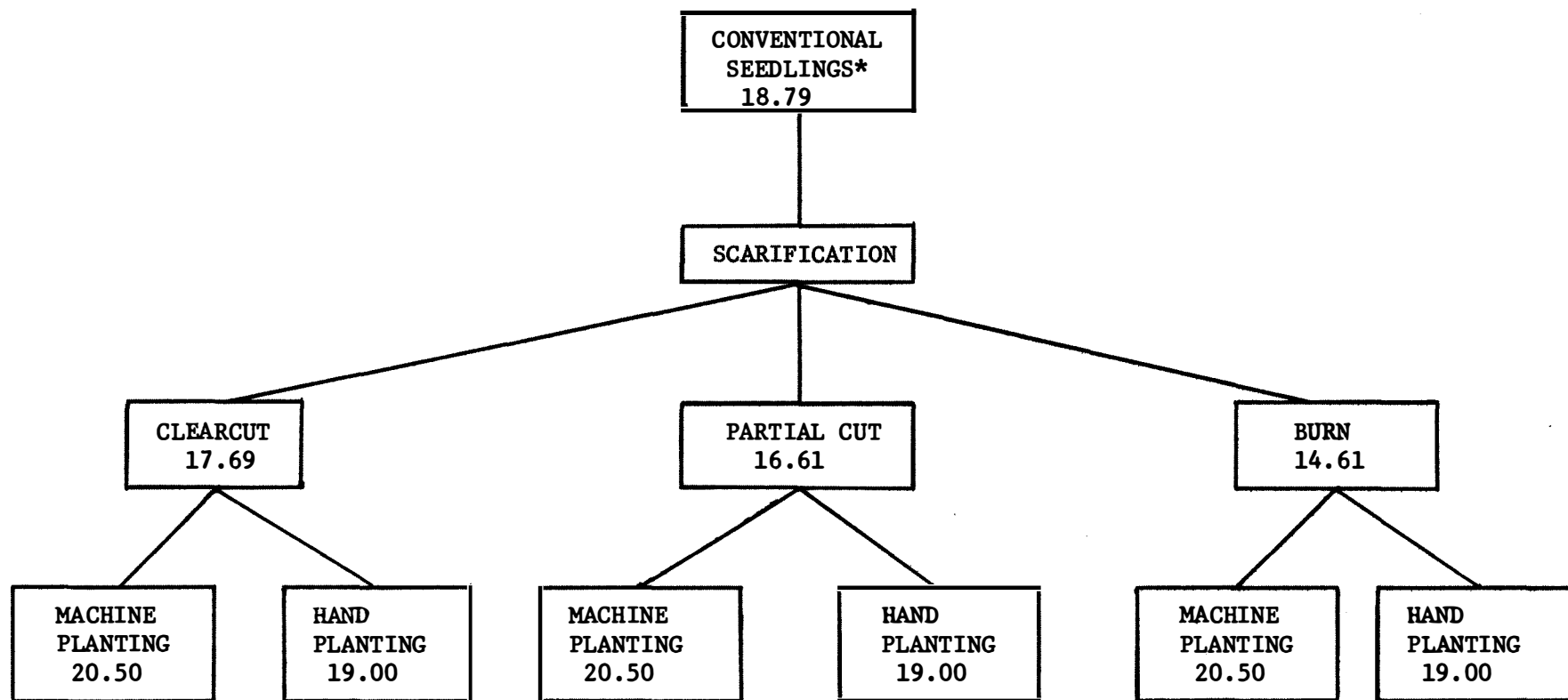
Total cost of site preparation on clearcut, partial cut, and burned forest lands was described. Costs ranged from \$14.61 to \$17.69 per acre for burned and clearcut areas, respectively.

Similarly, cost of regeneration by different systems and

methods currently practiced in Alberta was described and compared. Costs were considered for regeneration on scarified and non-scarified sites. Aerial and hand broadcast seeding costs, although described as "ball park" estimates or first approximations, were considered only for comparative purposes with other methods of regeneration.

To provide a complete picture of reforestation costs in Alberta for 1971, Figures 1-4 summarize the cost structure for the different systems and methods of reforestation described in this report. Total establishment costs are shown.

FIGURE 1. STAND ESTABLISHMENT COSTS PER ACRE FOR CONVENTIONAL SEEDLINGS ON SCARIFIED SITES
IN ALBERTA, 1971

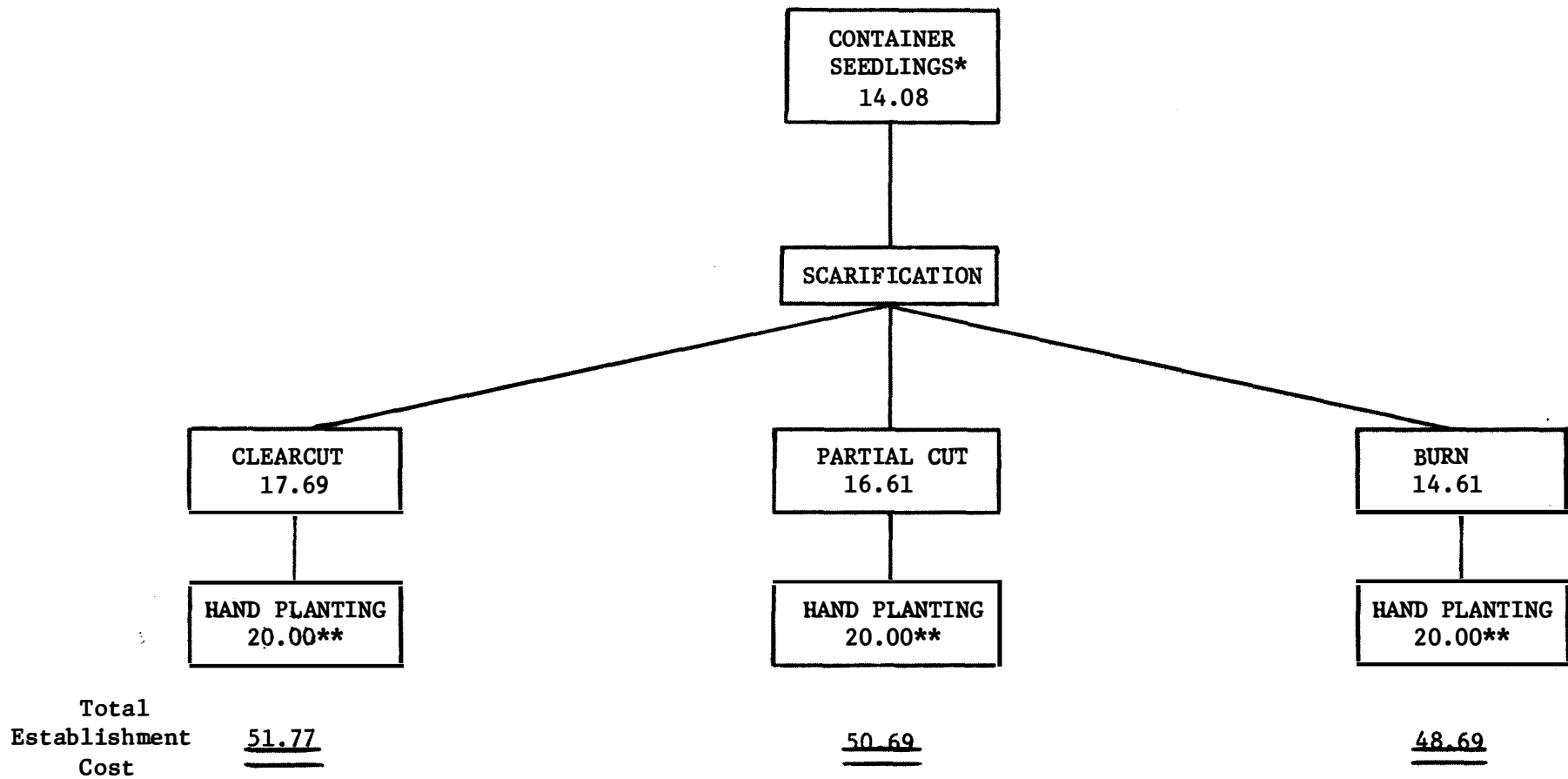


Total						
Establishment	<u>56.98</u>	<u>55.48</u>	<u>55.90</u>	<u>54.40</u>	<u>53.90</u>	<u>52.40</u>
Cost						

* @ 500 seedlings per acre.

FIGURE 2. STAND ESTABLISHMENT COSTS PER ACRE FOR CONTAINER SEEDLINGS ON SCARIFIED SITES

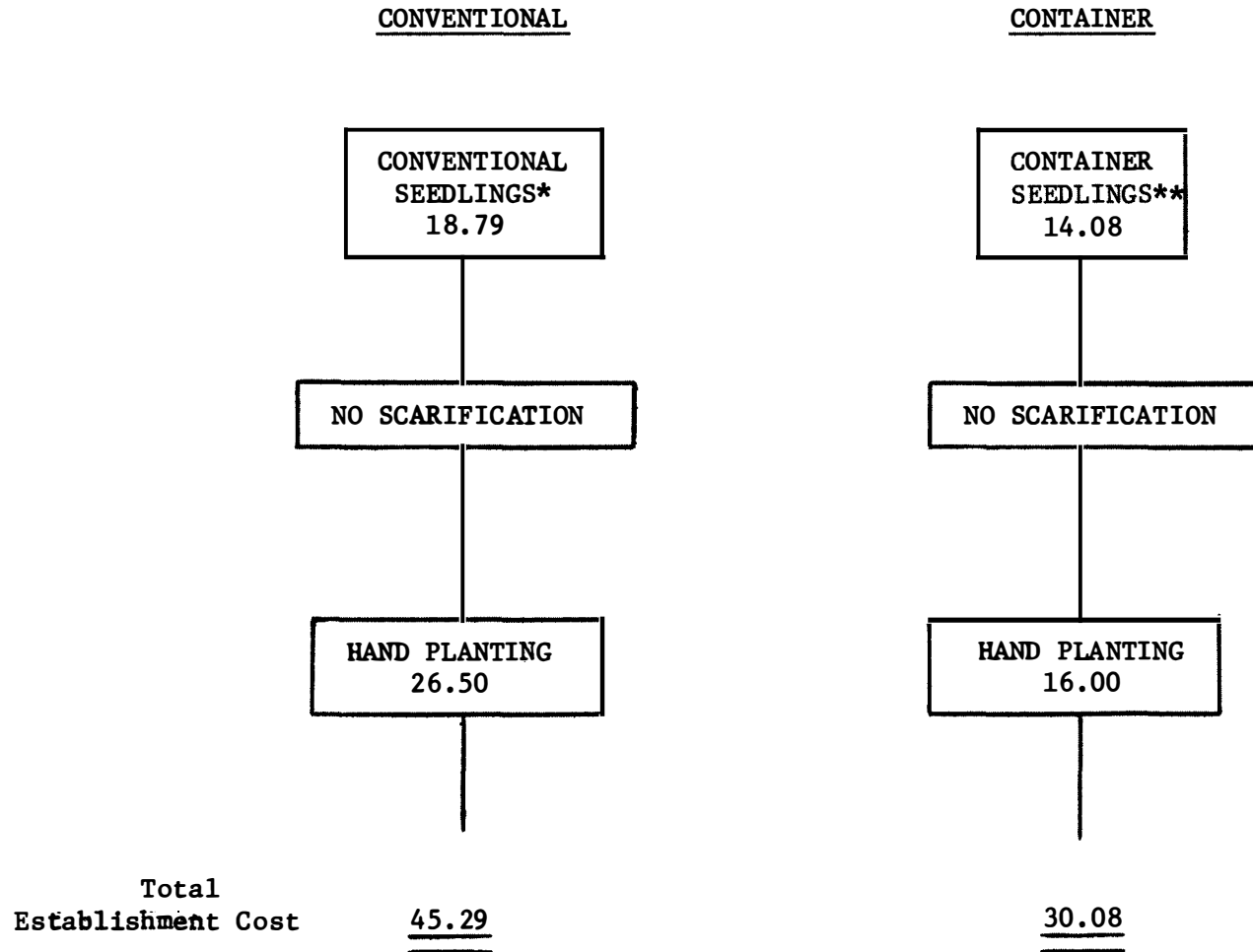
IN ALBERTA, 1971



* @ 500 seedlings per acre. The cost, \$14.08, represents the arithmetic average of the six cost figures shown on page 23.

** This cost is suspected of being too high, see page 32.

FIGURE 3. STAND ESTABLISHMENT COSTS PER ACRE FOR CONVENTIONAL AND CONTAINER SEEDLINGS
ON NON-SCARIFIED SITES IN ALBERTA, 1971

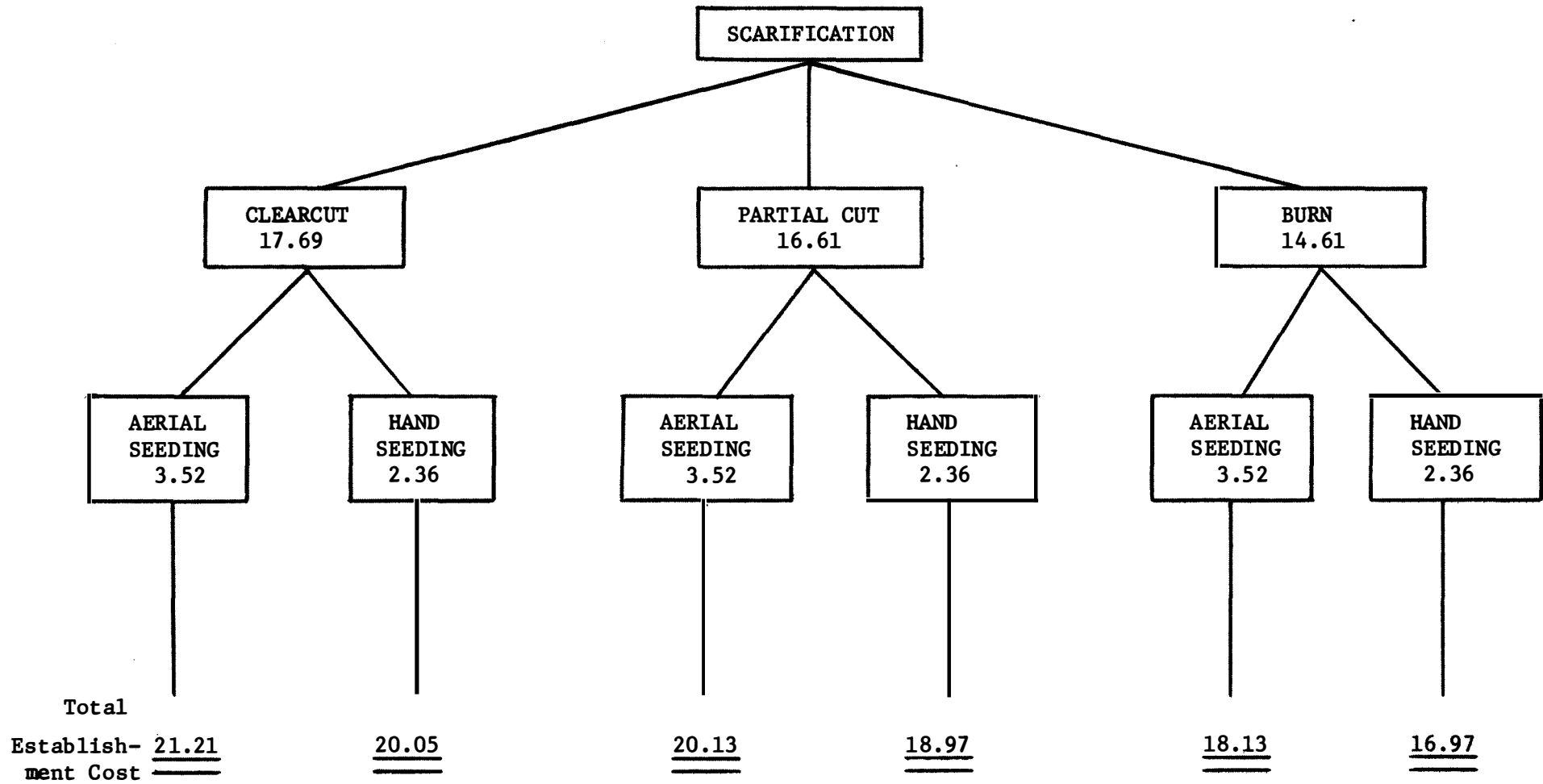


* @ 500 seedlings per acre

** @ 500 seedlings per acre. The cost, \$14.08, represents the arithmetic average of the six cost figures shown on page 23.

FIGURE 4. STAND ESTABLISHMENT COSTS PER ACRE FOR SEEDING ON SCARIFIED SITES

IN ALBERTA, 1971



V. RECOMMENDATIONS

PROVINCIAL TREE NURSERY

Because of the difficulties encountered in managing and recording costs of a two-fold nursery operation such as the Provincial Tree Nursery, the following recommendations are suggested for the purpose of permitting more accurate production costs to be recorded for the Forestry program. They are in no order of importance.

1. Overhead expenses, e.g., fuel, water, electricity, incurred by both the conventional and container seedling programs should be recorded and maintained separately.
2. To calculate an annual depreciation rate for the extraction plant, storage plant and plant equipment per pound of seed, up-to-date records of seed in storage should be maintained.
3. Expenditures incurred by fall sowing operations should be recorded separately and combined with the following spring sowing costs. This procedure will allow fall inventory counts for 1-0 stock to be equated to production costs.
4. Expenditures incurred by spring lifting, grading and packing of 3-0 stock should be recorded and maintained as a separate production operation.
5. An accurate account of the amount of seed sown, by species, for conventional and container production should be recorded.
6. Since there are a number of production runs per year for container stock, records of production and costs should be kept separately for

each of these runs.

7. All invoices should be recorded and coded to the appropriate activity at the nursery.
8. Time spent by nursery personnel on different activities in the Forestry program should be recorded and coded daily at the nursery.

To ensure that the above recommendations are carried out as efficiently as possible for proper record-keeping, it may be necessary to allocate an employee full-time to this administrative function.

ALBERTA FOREST SERVICE

9. There appears to be very little consistency in the method of preparing field reports for site preparation and planting projects. Many reports are written sometime after the projects have been completed. It is at this point in time that the individual responsible for preparing the report must recall a great deal of information from memory. In view of this, it is recommended that a uniform system for recording field data be set up for all Forests whereby essential information is recorded at the time the project is being carried on. This procedure will eliminate many of the errors inherent in recalling facts from memory. Secondly, a format should be designed for use in all Forests in order to provide consistency in reporting project data to Edmonton.
10. Each project undertaken should be identified and recorded as a separate activity, regardless of size. The present practice of aggregating the cost data for a group of projects should be discontinued.

11. Each project recorded on a needle-sort card should have the corresponding field report readily available in Edmonton for cross-reference.
12. In many instances needle-sort cards identifying site preparation projects fail to indicate whether or not planting followed. As a result, difficulty is encountered in correlating the activities which may have occurred on any one forest site. It is recommended that steps be taken to initiate a system whereby needle-sort cards describing either site preparation or planting make reference to those needle-sort cards recording any additional activity that may have occurred on that site.

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Appendix 1. ACCOUNTING ENTRIES

Provincial Tree Nursery, Oliver, Alberta

<u>Appropriation Vote</u>	<u>Code</u>	<u>Entry</u>
1126	A	Nursery Administration
1126	B	Shelterbelts, Conifers
1126	C	Shelterbelts, Deciduous
1126	D	Seed Extraction
1126	E	Forestry Containers
1126	F	Large Trees and Shrubs for Landscaping
1126	G	1-0 Conifer Seedlings
1126	H	2-0 Conifer Seedlings
1126	J	3-0 Conifer Seedlings
1126	K	Forestry Transplants
1126	L	Miscellaneous, General
1126	M	Horticulture Administration
1126	N	Tree Distribution
1126	P	Machinery Maintenance
1126	Q	Grounds and Roads
1126	R	Irrigation

Source: Horticulture Branch, Alberta Department of Agriculture.

Appendix 2. INPUT DETERMINANTS FOR AVERAGE COST PER POUND OF SPRUCE AND PINE SEED

Provincial Tree Nursery, Oliver, Alberta

Item	Fiscal Year		Arithmetic Average
	1968-69	1970-71	
<u>Basic Information</u>			
Total Pounds Spruce Seed Extracted ¹	7,348	10,450	8,899
Total Pounds Pine Seed Extracted ¹	<u>1,159</u>	<u>1,147</u>	<u>1,153</u>
TOTAL	8,507	11,597	10,052
Average Weight of Spruce Seed/Bushel Cones ²	1 lb.	1 lb.	1 lb.
Average Weight of Pine Seed/Bushel Cones ²	4 oz.	4 oz.	4 oz.
Cost of Cones/Pound Seed ³ : Spruce	\$3.75	\$3.75	\$3.75
Pine	\$11.00	\$11.00	\$11.00
<u>Cost Information</u>			
		Dollars	
Direct Extraction Costs ⁴	13,955	10,650	12,302
Administration Costs ⁵	173	222	198
Depreciation: Seed Extraction Plant ⁶	6,000	6,000	6,000
Plant Equipment ⁶	<u>6,400</u>	<u>6,400</u>	<u>6,400</u>
TOTAL COSTS	26,528	23,272	24,900
Cost Per Pound Spruce Seed ⁷	6.87	5.76	6.23
Cost Per Pound Pine Seed ⁷	14.10	13.01	13.48
Depreciation: Cold Storage Plant ⁸	.17/lb.	.17/lb.	.17/lb.

¹ Alberta Tree Seed Registers, Provincial Tree Nursery, Oliver.

² McDougall, F.W. & L.L. Kennedy, 1971. The Status and Future of Reforestation in Alberta.

³ Premium prices paid by Alberta Forest Service are \$2.75 and \$3.75 per bushel for pine and spruce cones, respectively.

⁴ Includes monies expended on freight, clothing, repairs, salaries, wages, etc.

⁵ Includes salaries and wages of personnel of Department of Agriculture having some responsibility in administration of nursery.

⁶ See Appendix 3.

⁷ Cost per pound of seed prior to storage. Does not include transportation cost of cones or overhead expenditures of seed extraction plant, e.g. fuel, electricity.

⁸ Based on an estimated 20,000 pounds of seed in storage during the two fiscal years analyzed. Addition of the depreciation allowance to the preceding spruce and pine values provides a per pound "in storage" value.

Appendix 3. CAPITAL COST ALLOWANCE OF ASSETS EMPLOYED IN THE PRODUCTION
OF FOREST TREE SEEDLINGS

- Provincial Tree Nursery, Oliver -

Building/Equipment	Value ¹	Capital Cost Allowance ²			Comments
		% per annum	Annual Allowance Credited to Forestry Operations		
	\$		Amount \$	\$	
Extraction plant	120,000 (1967)	5	6000	6000	
Extraction plant equip.	32,000 (1967)	20	6400	6400	- includes machinery, laboratory equipment and cone trays.
Packing shed	100,000 (1970)	5	5000	2500	- utilized 50% by forestry program primarily to pack 3-0 stock.
Conveyor belt	1,200 (1967)	20	240	240	- used exclusively for packing 3-0 stock.
Conveyor belt	1,500 (1970)	20	300	300	- used edclusively for packing 3-0 stock.
Tractors, fork lift, wagons, etc.	35,000 (1968)	15	5250	2625	- equipment used approximately 50% of time on forestry program.
Rototillers, lawnmowers,etc.	3,000 (1968)	20	600	300	- equipment used approximately 50% of time on forestry program.
Seeders, root pruner, planters, etc.	20,000 (1968)	10	2000	1800	- equipment estimated to be used 90% of time on forestry program.
Cold storage buildings & equip.	75,000 (1962)	5	3750	3375	- first constructed in 1962; enlarged in 1969. Appraised at \$75,000 in 1970. This value used to depreciate asset beginning fiscal 1968. Utilized 90% by forestry program for storage of seed.
Irrigation pump	5,000 (1968)	10	500	250	- no estimate of purchase date for pump or irrigation equipment which is constantly being added to. For purposes of this report, the current estimated (1970) value will be used to depreciate asset beginning fiscal 1968.
Irrigation equipment	5,000 (1968)	10	500	250	
Greenhouse & Equip.	7,000 (1970)	10	700	700	- used exclusively for container seedling production.

¹ Appraised value of asset(s) 1970. Alberta Department of Agriculture.

² Schedule B - Income Tax Act, 1968.

() approximate year of establishment or purchase.

Appendix 4

PLANT CONTAINERS EMPLOYED IN ALBERTA

The BC/CFS styroblock is relatively new and was developed in 1970 by the Research Development Group of the Pacific Forest Research Centre, Canadian Forestry Service, in co-operation with the Reforestation Division of the B.C. Forest Service. The styroblock is a non-reusable rectangular block, 20 by 14 inches (51 by 36 cm), manufactured of foam polystyrene with tapered, rounded cavities in which seedlings are grown. The styroblock in use in Alberta has 192 cavities, each 4.5 inches (11.4 cm) in depth by 1 inch (2.5 cm) in diameter at the top and rounded to a 0.37-inch hole (0.94 cm) in the bottom. The styroblock has been developed for protecting and shaping seedlings for ease of handling and planting. Seedlings are removed prior to planting and the molded mixture of root and soil which is withdrawn from the cavity is referred to as a styroplug. At the time of costing production for the study, one styroblock (192 cavities) retailed at \$1.35 which amounted to .700 cents per cavity.

The Spencer-Lemaire fold-up plug tray similarly utilizes the concept of growing a seedling in a container and removing it prior to planting. The container was developed by Spencer-Lemaire Industries of Edmonton in co-operation with Northwestern Pulp and Power Limited, of Hinton, Alberta, and is a folding plastic container. When folded, each sheet forms six rectangular cavities 1 inch (2.5 cm) by 0.75 inch (1.9 cm) at the top by 4 inches (10.2 cm) in depth. The cavities have corrugated walls which help to induce roots to grow downward and prevent spiralling. At the time

of costing production for the study, 1000 fold-up plug trays (6000 cavities) retailed at \$22.00 or .366 cents per cavity.

The R.C.A. peat sausage is also a plug seedling concept developed by the Research Council of Alberta (R.C.A.). In their process a thin-walled tubular polyethylene casing is filled by extruding a moist peat into a cylindrical casing through a die. A long cylindrical length of medium encased in its thin plastic wall is produced and this length is cut into shorter sections, usually between 2 and 7 inches (5.1 and 17.8 cm). In the field, it is intended that the container wall film will be slit integrally with the planting operation. At the time of costing production for the study, 1000 R.C.A. peat sausages cost \$10.00, exclusive of trays to hold plugs.

Source: Cayford, J.H., 1972. Container Planting Systems in Canada.
Forestry Chronicle, Volume 48, Number 5, October, 1972.

see also: Waldron, R.M. (Ed.) 1972. Proceedings of a Workshop on
Container Planting in Canada. Canada Department of the
Environment, Canadian Forestry Service, Dir. Prog.
Co-ord., Inf. Rep. DPC-X-2, 168 pp.

COST SUMMARY							MAP 1" = 1 Mile									
PROJECT ITEM	HRS.	RATE	T.C.	C/M	C/A	C/T										
Regeneration Survey																
Preliminary Plans																
Project Administration																
Access, travel																
Camp, food																
Supp., parts																
Site Prep																
type																
"																
Planting																
hand																
mach., transport																
type																
Plots																
Stock Value																
TOTAL PROJECT																
FINAL COST (5th.yr.)																
% LOSS x TC & TC =																
REMARKS:																

INFORMATION "NEEDLE-SORT" CARD FOR
 SITE PREPARATION AND REGENERATION DATA (BACK)

Smyth, J.H. and B.W. Karaim

1972. An economic analysis of reforestation in Alberta.

Information Report NOR-X-41; 51 p.; Northern Forest Research Centre, Canadian Forestry Service, Environment Canada, Edmonton, Alberta.

Smyth, J.H. and B.W. Karaim

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