HELICOPTER CONE HARVESTING— IS IT PRACTICAL?

By William A. Baron[1]

Abstract. An aerial cone rake was used by the Vermont State Tree Nursery and the Georgia-Pacific Nursery to efficiently harvest large quantities of balsam fir *(Abies balsamea)* cones. During the same collection period a crew was employed to collect balsam fir cones by hand. Cost and production records were maintained for both efforts.

Introduction

Cone crop surveys taken during the summer of 1984 indicated an abundance of cones on many northeastern softwood species. Of particular interest was the tremendous cone crop on balsam fir *(Abies balsamea).*

Both the Vermont State Tree Nursery and the Georgia-Pacific Nursery[2] sought to exploit the 1984 balsam fir cone crop. Several seasons of marginal balsam fir cone production resulted in a short supply of seed at both nurseries. Large quantities of stand specific seed were required for immediate sowing. In addition, enough seed had to be collected to maintain an adequate inventory between natural seed year cycles.

The requirement for collecting large quantities of seed was further complicated by the very nature of balsam fir seed dispersal. Balsam fir, in Vermont, is typically collected during a two week period in mid-August. Collection prior to mid-August often results in the harvesting of immature seed. After late August, balsam fir cones shatter and the seed is rapidly dispersed.

A. Helicopter/Aerial Cone Rake Collection— Independently, both the Vermont State Tree Nursery Manager and the Georgia-Pacific Nursery Manager began exploring the possibility of using an aerial cone rake[3]. Originally, the rake was developed for collecting cones from western firs and spruces. Dr. Helmut Fandrich of Fandrich Cone Harvesters Ltd. noted the potential for a cooperative effort between Vermont and Georgia-Pacific. Vermont had a well equipped seed extractory and no helicopter. Georgia-Pacific had a helicopter, with a highly skilled pilot, and no seed extractory. A mutually beneficial agreement was developed with little hesitation.

   Vermont provided logistical/ground support and seed processing/storage. Georgia-Pacific provided the helicopter, helicopter support crew, and ground transportation for the cone rake. The cone rake leasing cost was shared by both parties. Harvested seed was divided equally.

   Four sites were selected for the collection effort. Two of the sites were in Maine and two were in Vermont. Criteria for site selection included the quantity and quality of seed, the availability of a nearby helicopter staging area, and the selection of stands exhibiting at least phenotypically superior Christmas tree characteristics.

   The aerial operation began on August 15, 1984 and concluded on August 23, 1984. Detailed cost and production records were maintained (Table 1).

B. Collection By Hand— In an effort to secure additional seed in a very specific locale, the Vermont State Tree Nursery employed a crew to hand collect balsam fir cones. The col-

[1] Nursery Forester, Vermont State Tree Nursery, 111 West Street, Essec Junction, VT 05452
[2] Georgia-Pacific Nursery, Bill Sayward, Manager, Woodland, Maine 04694-0999
[3] Fandrich Cone Harvesters Ltd., 2461 Sunny side Place, Clearbrook, British Columbia, Canada V2T 4C4

lection area consisted primarily of 20 to 30 foot balsam fir trees with abundant cone crops. Collection techniques included ladders and a limited amount of felling. Detailed cost and production records were maintained (Table 1).

Methods and Materials

A. Helicopter/Aerial Cone Rake Collection—A typical collection day began early in the morning with the ground crews driving to and setting up the staging area. Plastic tarps were laid on the ground and weighted down.

Upon its arrival, the helicopter was hitched to the cone rake. The helicopter lifted the rake off the transport trailer and proceeded to the adjacent balsam fir stand. The pilot searched out trees appearing phenotypically superior and bearing an abundance of cones. Once located, the pilot lowered the cone rake over the tree top (6 to 10 feet) and began raising and lowering the rake in an effort to remove numerous cones and small branches.

Approximately 6 to 12 trees could be raked before the pilot was required to return to the staging area. At the staging area, the pilot lowered the rake onto the plastic tarp. The helicopter ground crew released the wire basket from the rake. The pilot raised the rake allowing the cones and branches to fall onto the plastic. Another quick setdown for re-attaching basket to rake and the pilot was departing for another load. The entire unloading procedure took 30 to 60 seconds. Average time per load was 11 minutes. However, load time varied from 6 minutes to 20 minutes depending on collection conditions. The pilot operated for three average loads and then landed for a rest period and helicopter refueling.

Between load drops, the ground crew moved in and began harvesting the cones. The sheer volume of cones and small branches made it impossible for the ground crew to stay ahead of the aerial cone rake. By day's end, several rack trucks were required to remove all cones and branches. This material was transported to the seed extractory and processed at a later time.

The pilot averaged 2.5 hours of actual raking time per day. Safety was of primary importance.

The workday was long, often starting at 4:30 a.m. and ending at 10:00 p.m.

B. Collection by Hand—The crews left early in the morning and drove to the collection area. The daily procedure consisted of setting extension ladders into 20' to 30' balsam fir trees and picking the cones by hand. Occasionally, a tree was felled and the cones were harvested from the top. At the conclusion of the work day the crews would return the cones to the seed extractory.

Results

A. Helicopter/Aerial Cone Rake Collection-1,372 pounds of balsam fir seed were collected in 12.08 flying hours. The seed cost $13,332.00 to collect, transport, process, and store. Cost per pound of clean seed averaged $9.75 (Table 1).

B. Collection by Hand-233 pounds of balsam fir seed were collected over a two week period in mid-August. The seed cost $4,069.00 to collect, transport, process, and store. Cost per pound of clean seed averaged $17.46 (Table 1).

Summary

The aerial cone rake efficiently harvested large quantities of balsam fir seed. The associated overhead was offset by the large volume of harvested seed. The resulting cost per pound was approximately one-half the cost of hand harvested seed.

Key variables to consider:

1. Cone crop must be of high quality and large quantity.
2. The weather must cooperate. Clear days, no wind, and low humidity are ideal.
3. The helicopter pilot must be highly skilled and be familiar with the operation of suspended loads at low altitude.
4. The collection site must be road accessible and provide for an adequate staging area.
5. Permanent and temporary labor must be hard working and dedicated. The days are long and the work is difficult.

TABLE 1

BALSAM FIR CONE COLLECTION

COSTS	HELICOPTER	vs.	HAND COLLECTION
I) Collection			
a) Permanent Labor	$ 877.00		$1,516.00
b) Overhead and Benefits	272.00		470.00
c) Temporary Labor	500.00		825.00
d) Temporary F.I.C.A.	34.00		55.00
TOTAL	$1,683.00		$2,866.00
II) Transportation			
a) Truck Mileage	$ 353.00		$ 205.00
b) Labor included in collection costs			
III) Extraction			
a) Permanent Labor	$ 960.00		$ 267.00
b) Overhead and Benefits	298.00		83.00
c) Temporary Labor	1,334.00		513.00
d) Temporary F.I.C.A.	90.00		34.00
TOTAL	$2,682.00		$ 897.00
IV) Seed Storage			
a) Permanent Labor	$ 101.00		$ 39.00
b) Overhead and Benefits	31.00		12.00
TOTAL	$ 132.00		$ 51.00
V) Miscellaneous			
a) Helicopter Rental	$4,832.00		$ - - - -
b) Cone Rake Lease	3,600.00		- - - -
c) Hand Cleaner, Gloves, etc.	50.00		50.00
TOTAL	$8,482.00		$ 50.00
GRAND TOTAL	$13,332.00		$4,069.00

CLEAN SEED COST/lb.

Helicopter	$13,332.00 Total Cost / 1,367 lbs. seed =	$ 9.75/lb.
Hand Collection	$ 4,069.00 Total Cost / 233 lbs. seed =	$17.46/lb.