CONTAINER FIELD PERFORMANCE IN THE ROCKIES AND PLAINS 1/

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Abstract.--Experimental planting of container stock has been occuring on a regular basis for the past six years on the Northern Plains and for five years in the Rocky Mountains.

Results to date indicate that survival normally will be equal to or better than survival of bare root plantings.

Changes in container designs and improved greenhouse techniques have influenced field success.

INTRODUCTION

The Plains and the Rockies - those regions through the middle of this country that are typified by cattle grazing on open ranges, fields of high value cereal grains and an abundance of scenic mountain peaks, valleys and lakes. But the tree too is important in these areas; whether it be as wind breaks or shelterbelts, for commercial wood products, aesthetics or site stabilization.

During 1973, more than 50,000 acres were planted in these regions. With this annual investment in the land, it's imperative that the best survival and growth technically possible be achieved. It's to this end that work in containerized forestation proceeded.

THE PLAINS

Work on the Plains was initiated in the later 1960's and today includes outplantings from greenhouse facilities in North Dakota and Colorado. Species outplanted to date include ponderosa pine, blue spruce, Scotch pine, Siberian larch, and Douglas-fir.

While greenhouse treatments of the various species have been improved and refined, most of the initial outplantings show significant gains in both survival and incremental height growth.

Using the work of Tinus in the Dakotas, table 1 illustrates the range of performance that may occur in Plain's plantings.3/

Table 1.--Field survival in the Plains after one growing season.

	Ponderosa pine		Blue spruce		Scotch pine		Siberian larch		Douglas-fir	
Year	Container	Bare root	Container	Bare root	Container	Bare root	Container	Bare root	Container	Bare root
	%	%	%	%	%	%	%	%	%	%
1968	96	5								
1969	60	7	25	6						
1970	95	88								
1972	93	89	73	92	93	90				
1973	71	57	94	12	96	82	93	8	91	50

1/Paper presented at North American Containerized Forest Tree Seedling Symposium, Denver, Colorado, August 26-29, 1974.

2/Silviculturist, U.S. Plywood division of Champion International Corp., Bonner, Montana.

3/Tinus, Richard W. 1974. Unpublished data.

These trees were planted between April 25 and June 1 which is the normal spring planting period.

For some plantations both one and two year survival data has been collected (table 2).4/

Table 2.--Comparative field survival of Plains plantings after one and two growing seasons.

Species	Year 1		Year 2	
	Container	Bare root	Container	Bare root
	%	%	%	%
Ponderosa pine	93	89	77	76
Ponderosa pine	71	57	44	17
Blue spruce	94	12	84	0

In assessing incremental height differences, first year analysis indicates growth of the container stock varying from 80% of the growth of the bare root seedlings on one extreme, to a high of 680% difference for the same comparison.

Average first year growth over the six years of ponderosa pine planting has been 3.3 cm for the container grown trees and 2.4 cm for the bare root trees.

Second year results also show the height growth of the container stock as ranging from slightly less than the bare root seedlings to significantly higher growth responses.

THE MOUNTAINS

Field trials with containerized stock have been established on a regular basis in the Rockies since early 1969. The greatest percentage of these plantings are located in Montana and Idaho, with the bulk of the work having been conducted by U.S. Plywood (formerly Anaconda Forest Products), The University of Idaho, St. Regis Paper Company and the U.S. Forest Service.

A wide variety of container systems, planting sites and planting periods have been tried.

The first trials used container rather than containerless systems. The field plantings of ponderosa pine established by U.S. Plywood on a site in Northwestern Montana illustrate the effects of container size and planting season on field survival (table 3).

Table 3.--39½ mile plantation survival.

Month planted	Container type	Growing season 1	2	4	5
		%	%	%	%
August	5/8" Conwed1/	43	35		28
	1" Conwed1/	72	55		39
	2" Conwed1/	90	78		60
	Jiffy - 72/	56	53		50
	Bare root	0	0		0
November	5/8" Conwed1/	61		38	
	1" Conwed1/	77		53	
	2" Conwed1/	77		74	
	Bare root	43		8	
June	1" Conwed1/	99		76	
	2" Conwed1/	94		91	
	Styro - 23/	87		73	
	Bare root	70		56	

1/5/8"x 6" plastic mesh container manufactured by Conwed Corporation, 770 29th Ave. S.E., Minneapolis, Minn. The other sizes are also 6" long with diameters of 1" and 2" respectively.
2/Manufactured by Jiffy-Pot, Ltd., Grorud, Norway.
3/2 cu. in. styrofoam plug-mold manufactured by Beaver Plastics, Ltd., 12806 63rd Street, Edmonton, Alberta, Canada.

The prime planting period for ponderosa pine in Western Montana is between April 1 and June 1. Summer planting of bare root stock is both a biologic and economic impossibility, while fall planting is normally not recommended.5/

The four and five year data indicates a significant increase in survival may be realized by the use of any of the container types. The data also indicates that while the spring planting period remains the optimum season for ponderosa pine reforestation, it is possible to plant during the fall and summer with a proportionately lower degree of success.

The various systems tried indicate that field survival of greenhouse grown stock is greatly influenced by the soil volume of the container: the larger the container, the higher the survival.

4/Tinus, Richard W. 1974. Unpublished data.

5/Hite, Wayne A. 1971. Unpublished data.

Another outplanting in Montana illustrates other problems which may befall reforestation attempts (table 4).

Table 4.--West Fork Gold Creek survival.

Species	Container type	Growing season 1	2
		%	%
Ponderosa pine	Tinus1/	93	78
Siberian larch	Tinus1/	90	73
Western larch 79	Tinus1/	89	81
Western larch 80	Tinus1/	53	33
Ponderosa pine	5/8" Conwed2/	52	38
Ponderosa pine	Bare root	57	49

1/2"x 2"x 8" book planter manufactured by Spencer-Lemaire Industries Limited, 9160 Jasper Ave., Edmonton, Alberta, Canada.
2/5/8"x 6" plastic mesh container manufactured by Conwed Corporation, 770 29th Ave. S.E., Minneapolis, Minn.

The two poor appearing containerized lots have easily explainable problems. Western larch lot #80 is off site. This seed was collected over 100 miles and 900 feet lower in elevation from the plantation site, whereas western larch lot #79 was collected on the edge of the experimental area.

The ponderosa pine lot grown in the 5/8"x 6" Conwed tube was not conditioned properly prior to outplanting with subsequent heavy mortality during a series of late spring and early summer frosts.

A third example, from State of Idaho lands in the Idaho panhandle region, shows no significant survival difference among the container systems, only a highly significant difference in first year survival between the container grown and bare root ponderosa pine (table 5).6/

To date, no incremental height data has been collected on any of the outplantings in the Northern Rockies.

CONCLUSIONS

While not all of the field performance to date indicate significantly superior results to the conventional bare root planting, there appears to be about an average 20% overall gain in survival through the use of containerized stock.

6/Weadick, Mark. 1974. Unpublished data.

Table 5.--Lodgepole block first season survival.

Container type	Survival
	%
Hillson1/	89
Styro - 22/	98
Styro - 82/	98
U. of I.3/	88
Bare root	60

1/Manufactured by Spencer-Lemaire Industries Limited, 9160 Jasper Ave., Edmonton, Alberta, Canada.
2/2 and 8 cu. in. styrofoam plug-mold manufactured by Beaver Plastics, Ltd., 12806 63rd Street, Edmonton, Canada.
3/Developed by Univ. of Idaho, Moscow, Id

The variable results, especially in the mountainous region, suggests that on some planting sites, bare root stock is a viable management alternative based on expected field survival and growth. The decision on which method to use must then be based on factors other than biological.

As some examples show, increased knowledge of physiological tree needs should improve both survival and growth through better container design, greenhouse care based on individual specie requirements, and adjusted planting procedures.

Question: What is the average cost per live tree at the end of one growing season? What costs are included?

Hite: On one harsh site we presently have 65 percent survival; the cost per surviving 1,000 seedlings is $189.60. Typically, we judge success of our plantations on a cost-per-surviving-seedling basis. The trends show that the bigger the container, the better the survival. However, cost per surviving 1,000 seedlings is minimum with mid-size containers, even though survival is slightly less than for the largest size. Therefore, except for some very special conditions, we don't use the large-size containers.

Question: To what do you attribute the large differences in survival between container and bare-root seedlings planted in the spring of 1974? Were the bare-root plants in good condition at time of planting and were they properly planted?

Hite: On one area planted in northern Idaho, survival for container seedlings was between 88 and 98 percent, for bare-root only 60 percent. Bare-root seedlings were lifted and replanted within 3 days. I can't say they were planted properly, but they were planted typically.

All the sites in Montana were planted by one crew of four women who did a good job. They didn't know which seedlings were containerized and which ones were bare-root when they put them in the ground. That might sound strange, but when the tree improvement project was initiated, we had decided that all the stock would be grown bare-root in the nursery. Some lots germinated poorly and we didn't have enough seedlings for our ten outplantings. So we took more seed from the half sibling families and grew additional seedlings overwinter in the greenhouse. The next spring we transplanted the container stock into the bare-root nursery and grew everything for one more year.

When container transplants were outplanted, their root mass was fairly intact even after a year in the bare-root nursery bed and had lots of active root ends ready to grow. They not only survived well, but a lot of them doubled in height. The bare-root stock didn't survive well; many didn't even break bud. Perhaps the poor performance of bare-root stock was due to poor shoot-root balance. We did not permit root pruning or top pruning, because we wanted to measure their normal height growth. This winter we're going to grow catch-up stock again in the greenhouse. We are going to containerization now in the hopes of salvaging something from our 2 million dollar cooperative tree improvement program.

Question: Have you examined root egress from the Conwed container? Can you speculate how it will look after 3 to 5 years in the field?

Hite: We were concerned that roots would grow through the mesh but be strangled by it if they could not break it. So we grew seedlings in a growth chamber to a size equivalent to 3 years growth in the field. At this point, the growth chamber malfunctioned and cooked the trees. They were dug up, and their roots were found to be penetrating the mesh, but callousing on each side of it. The container was not being split. We reran the experiment and reached a tree size equivalent to 5 years in the field before the growth chamber malfunctioned again and froze the trees. Callouses on each side of the mesh were found as before, but they were larger, and some splitting of the container was beginning to occur. There was no significant difference in height, diameter, or dry weight between seedlings grown in the container and those grown without the container.