HANDLING OF LARGE NURSERY STOCK

by

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The increasing demand for large planting stock in the Pacific Northwest has created special problems, both for the nurseryman and the planter. Conventional means of lifting, packaging, transporting and planting, as used for 2-0 seedlings, cannot do the job for large transplant stock. At least not economically. This means other methods and techniques must be devised and experiments conducted in order to find better and less costly ways of handling and planting large stock.

This paper will present a few ideas and, we hope, stimulate some interest in the problems that occur with the production and planting of big trees.

Why Large Stock?

State ownership in Washington is in the lower elevations - the dynamic better growing sites which grow everything, A certain portion of the state acreage due to poor practices in the past, has resulted in non-production of commercial species, and in order to convert these acres to production one of the tools we are using is large planting stock. This has increased the demand for bigger nursery stock, This demand for bigger trees has raised the production cf transplant stock at the Webster Nursery from about 500 thousand in 1959 to better than 3 million in 1965, Future trends indicate that this will reach almost 6 million by 1970.

Transplant stock is not cheap, it's expensive to produce in the nursery and plant in the field, Table I shows the cost of the various age classes produced in the Webster Nursery during the 1965-66 season. Generally transplants cost from two to four times as much as 2-0 stock depending on age. The cost of planting is also shown in Table I. The average cost of the planted transplant tree runs from 2.6 cents to 10.7 cents more than the planted 2-0. The question may be asked; does the additional cost of transplant stock really warrant its use? We will attempt to answer this later in the paper.

What Is Large Stock?

At this stage we should probably define what we mean by large stock. We have used the term transplant and have shown the various age classes produced

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at the Webster Nursery, but have not defined what size of tree we are talking about. Table II shows the various transplant classes produced at the Webster Nursery and sizes of the stock. These measurements were taken over a number of years but generally reflect the average size tree the nursery must handle and the field must plant. These transplants produce tall - bushy trees with thick stems which are difficult to sort, tie and package.

Because the nursery also does some fall sowing, of which a large amount is transplanted as 1-0's, this causes further problems in warehousing and record keeping.

Nursery Handling Techniques

Since the Webster Nursery was and generally still is geared to the production of c-0 stock, the handing of transplant stock presents a particular problem. In the past it was generally absorbed into the 2-0 processing with some inconvenience. As the production of transplant stock increased, attempts were made to increase the efficiency of handling these larger trees. A specific tying table has been designed which utilizes a 30'' belt and is used for tying transplants. Also a high silhouette 2010 John Deere tractor is now used for lifting transplants. A six row transplanter has been developed which utilizes 6 standard Holland seedling transplanters with modified shoes. These developments have helped in the production of transplant stock, but we still have problem areas and one in particular is the packaging of large stock. Past practices have been to use open end bales and multi-walled bags, such as used in 2-0 bailing, but with fewer trees per bale depending on age class. This has generally resulted in large awkward bales, less efficiency in baling, and reduced seedling storage.

During the last few years the staff at the Webster Nursery have investigated the use of containers especially selected for large stock. These involve cardboard boxes, large multi-walled bags, cardboard-veneer boxes, and wire-bound crates. The costs, number of trees, container sizes, and field reaction are summarized in Table III. Unhappily we cannot report a great success. Generally the bags proved to be the best as far as handling and storage was concerned. The four and five feet bags were better suited for the older age classes of transplants, but still were limited in the number of trees they `could hold.

The cardboard boxes held some promise at first, but trials conducted during the 1965-66 season showed them to be impractical. These boxes did not store well on pallets. They picked up moisture and became soft in storage. Also they require much more room in our cold storage facilities. The boxes were bulky to handle in the field and the top layer of trees had a tendency to dry out. When water was added the boxes became soft and could not be reused. Since they cost 58 cents a piece they had to be reused two to three times in order to be economical. Actually very few returned in useable shape.

Two other boxes were investigated. One was a knock-down cardboard veneer box and the other a wire-bound crate. The knock-down box cost $2.00 - S3.00 each and since they offered no distinct advantage over the cardboard box they were only given a cursory examination. The wire bound crate presented problems with trees drying out, so no attempt was made to field test it.

TABLE I. Nursery Costs and Planting Costs for Various Age Classes of Douglas-Fir Stock Produced at the Webster Nursery, 1965-66 Season 1/

Age Class	Total Acres Planted	Total Trees Planted	Average Trees/Ac.	Cost/M Nursery Stock	Average 2/ Cost/Ac.	Ave. Cost Per Planted Tree
2-0	1263	426,600	338	$11.00	$21.13	6.2¢
3-0	5	2,275	455	15.60	26.64	5.8
2-1	733	256,500	350	28.00	30.91	8.8
2-2	59	11,520	195	45.00	32.99	16.9
1-1 3/	995	413,245	415	26.00	37.70	9.1

1/ The costs are for Dept. of Natural Resources planting crews excluding inmate labor.

2/ Costs include planting stock, labor, supervision and transportation.

3/ Large percentage of stock auger planted.

TABLE II. Size Comparison for Various
Douglas-Fir Transplant Age Classes
Produced at the Webster Forest Nursery

Age Class	Sowing Date	Average Total Height cm.	Average Stem Diameter mm	Average Root Titration Value ml	Average Oven Dry Weight Tops gm.	Average Oven Dry Weight Roots gm.	Average Oven Dry Weight Whole Plant gm.	Top Root Ratio
1-1	Fall Sown	40.5	7.77	40.1	12.27	5.81	17.83	2.13
1-1	Spring Sown	30.5	5.84	33.6	5.83	3.35	9.15	1.80
1-2	Fall Sown	72.9	10.71	160.5	35.72	10.36	46.08	3.40
1-2	Spring Sown	73.0	10.42	113.1	31.08	8.60	39.68	3.63
2-1	Spring Sown	33.5	6.99	55.1	8.55	4.69	13.24	1.84
2-2	Spring Sown	63.9	13.77	143.6	33.4	14.7	58.1	2.27
2-3	Spring Sown	106.9	12.64	184.4	69.4	16.6	86.0	4.18
1-3	Fall Sown	83.6	11.73	172.6	41.3	12.8	64.1	3.23

TABLE III. Various Experimental Containers For Packaging Douglas-fir Transplant Stock.

Container	Size	Number of Transplants					Cost Per Unit	Field Reaction
		2-2	1-2	2-1	1-1	2-3		
Box 1/ - Cardboard water proof adhesive, waxed Inside	28x16x14	-	-	300	500	-	$0.584	Fair to poor, bulky, hard to handle & store, outside became soft in cold storage.
	28x14x12	-	-	250	450	-	-	
	30x14x12	-	-	250	450	-	-	
Bags 2/ - Kraft poly-lined	24x11½x30	-	-	250	400	-	$0.148	Good to fair, holds up in adverse weather, easy to store and handle.
	24x11½x48	100	100	-	-	-	0.231	
	24x11½x60	-	-	-	-	25	0.278	
Crate - Wirebound	50x14x18	200	200	-	-	-	$0.104	Not sent to field.
Cardboard - Veneer box - Break down box	30x18x14	250	250	350	500	-	$2.00-3.00	Not sent to field.

1/ Box tried with and without peat - trees stored better when peat was used.

2/ Bags tried with and without peat - trees stored better when peat was used.

TABLE IV. Growth and Survival of Various Age Class Studies of Douglas-Fir in Western Washington.

Study	Location	Age Class	Number Trees Planted	Average Ht. Cm.	Percent Survival	Remarks
EP-4	Capitol Forest	2-0	600	52.5	46.0	5th Year Survival Count.
		2-1	600	67.5	84.0	
		2-2	600	86.0	88.0	
EP-1	Larch Mtn.	2-0	700	129.0	71.7	5th Year Survival Count. Scarified Ground.
		2-1	700	148.5	77.8	
		2-2	700	164.2	78.5	
N.R.P. #36	Capitol Forest	2-0	300	49.0	70.9	5th Year Survival Count.
		3-0	300	52.0	64.3	
		2-1	300	55.0	76.7	
		2-2	300	59.0	92.2	

TABLE V. Comparison of Various Ages of Douglas-Fir Planting Stock for Three Methods of Planting.

Treatment	Age Class	Number Trees Planted	Average Ht. Cm.	Percent Survival	Remarks
Hand Planting	2-0	364	57.5	72.5	1st Year Survival.
	2-1	375	70.0	86.4	
	2-2	379	89.2	92.9	
Auger Planting 1/	2-0	364	55.0	77.2	
	2-1	371	71.8	84.4	
	2-2	374	96.8	91.2	
Hand Planting	2-0	96	19.3	75.0	1st Year Survival. 50% of 2-0 stock browsed; 6% of 2-3 stock browsed.
Auger Planted 2/	2-3	96	137.3	75.0	
	2-3	102	122.4	86.3	

1/ Auger was Clinton "Little Beaver" Back Pack Auger.

2/ Hydraulic auger mounted on AC-HD7.

Although the trials to date have not been real encouraging the nursery staff is continuing to investigate packaging techniques. They also are looking at other approaches to the handling of large stock. The adaption of the Lanquist seedling harvester 1/ to lift and package transplants in the bed is now being investigated by our Nurseryman, Homer Ward. Also the use of transplant inventory counts to eliminate the physical counting of stock is being looked at. These and other techniques, we hope, will allow the Webster Nursery to more conveniently and economically handle large stock.

Planting and Survival of Large Stock-

Trials conducted by the Department of Natural Resources have shown definite advantages in using large transplant stock in the type of conditions we now encounter on our planting sites. Transplant stock survives better and is better able to overcome competition from invading brush and withstand animal damage than seedling stock. The results of several of these trials are summarized in Table TV. Generally transplant stock has shown from 20 to 40% higher survival than 2-0 or 3-0 seedlings, Also the larger stock has maintained its initial growth advantage after five years.

The larger initial investment in planting transplant stock ($9-16/Ac.) is balanced by the higher survival. On a cost per surviving tree, the investments are almost the same however, many areas planted with 2-0 stock will require the additional cost of spot planting.

One tool that has become increasingly more important in planting transplant stock is the power auger. Our department has tried both the Clinton "Little Beaver" back Pack Auger and the McCullock 35-A Auger and from the standpoint of ease of handling the McCulloch is much preferred of the two. A large, hydraulic auger, 12" in diameter, mounted on a cat has also been tried. This was designed for planting 2-3 stock which averages about 4-5' tall. Trials to compare survival of auger vs hand planting have shown no real advantage in increased survival with the auger (Table V), but production has been more consistent and larger transplant stock is easier to plant with the auger.

A typical auger crew consists of 5 men as follows:

(a) 2 - Augermen (one scalps and one drills holes - change off periodically).
(b) 1 - Planter (carries and places trees in holes).
(c) 1 - Tamper (carries shovel and actually plants the trees).
(d) 1 - Logistics Man (hustles trees, gas for the auger, etc.).

This type of crew will plant around 400-500 trees per man day.

Future of Large Stock

There is no question that large stock is becoming more important as a reforestation tool, As noted before the Webster Nursery anticipates a production

1/ Lanquist, K. B. 1954. Seedling Harvester. Tree Planters' Notes 16:5-6.

of 6 million transplants by 1970. This will be the maximum the nursery can handle with its present acreage. Between now and then the Nursery staff must work on developing better and more economical. means of handling the stock. New harvesting and packaging systems that will eliminate one or more costly steps should be devised. Larger storage areas for packaged stock will need to be designed and possibly mobile work shelters will be needed in the nursery field,

In the field the need for a continuous flow of stock from the nursery must be maintained. Workable tree delivery programs will need to be established. Portable tree storage units may have to be erected at the planting site.. The use of small, compact planting crews using augers needs to be considered in planting large stock.

This presents a challenge not only to the Webster Nursery, but to all nurseries now getting started in transplant programs.

DISCUSSION

Q: You have tried this various size stock now from 2 1/2 feet to 5 feet, have you come to a conclusion as to what size stock you would like to have as a standard class for regular production?

A: This is a little difficult to say, because we not only produce stock for our state lands but a number of private owners. As far as our department is concerned, we will probably be using 1-1, 2-2 and 2-1. Cost of stock at the nursery is $26.00, S45.00 and $28.00 respectively. Cost of planting 2-1, S30.91; 2-2, $32.99; 1-i, S37.70.

Q: Why do you consider transplant stock in the operation of producing large trees as against seedling stock, such as 3-0:

A: No field studies with 3-0 yet, only with transplants. I have forms which show the rates of survival. They have spent time and effort to moving toward using transplants instead of 3-0,

Q: Has there been any concern about the root ratios of transplants?

A: Old concepts of proper top root ratio have been discarded. Large transplants are way out of balance, but survival is the measure.