# Greenhouse Cropping and Container Washing[1]

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This paper describes a mechanized tray and tube washer for cleaning reusable tree seedling containers. A brief summary of a two crop system for Northern latitudes is included as an example of how the system is used in an actual operation.

My main purpose here today is to describe a container washing system which I think has great potential to lower the cost of cleaning reusable tree seedling containers. This system also should help reduce the spread of disease from one container crop to the next.

Before I get into the specifics of the washer, I would like to describe our cropping system as an actual example of the use and re-use of containers.

The greenhouse complex of the Coeur d' Alene Nursery is on what is known as a two crop system. This means two crops are grown and shipped to the field for planting each year. In our case that involves planting approximately 2 1/2 million cells for each crop and shipping about 2 1/4 million trees. Since we are growing primarily in Ray-Leach pine cells[3], we are dealing with 12,500 trays per crop. It should be noted that we like to talk in terms of trays, but keep in mind that a tray consists of 200 individual cells. Being in excess of 47 degrees North latitude we want a system that makes maximum utilization of the long summer days and at the same time allows us to shut down our crop as the days get shorter and correspondingly cooler. When this factor is considered along with the field's requirements for a specific stock size, and some experimentation over the last few years, we were able to come up with our starting dates for our two crops. A general run down of our growing scheme would be as follows: The first crop is sown the lst of March. This crop is grown in the greenhouse until the middle of June, at which time it is moisture stressed, to stop height growth, and moved to a shade house covered with 47 per cent shade cloth. Once in the shade house, the stock continues to add caliper and root development until it is shipped to the field for fall planting. The fall planting, in the field, starts with late summer rains and ends when snowfall closes the planting sites. The season for fall planting typically runs from early September to early November.

In mid June, when the March sown crop was moved to the shade house, we start the second crop. Our actual target date for sowing is July 1. The July weather can be quite unpredictable. One day it may be in excess of 100 degrees, and the next day it could be in the 70's. The reason for bringing up this point is to mention the use of shadecloth on the greenhouse during germination of the July sown crop. The shadecloth remains in place until thinning and consolidation of the crop is completed. Thinning would normally be complete about the first week of August.

As long as the weather cooperates, in the form of bright sunny days, the crop will have obtained necessary height growth by mid to late October. At this point, the crop is stressed and the cyclic lighting is shut off to stop height growth. In the meantime, the weather has turned too cold to move the succulent crop outside to hardenoff naturally and develop the necessary caliper and root growth. By manipulating temperature and nutrient regimes, the stock is hardened-off in the greenhouse and held inside until the middle of February. By February the stock is full acclimatized

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[3]Tradenames are used only for specificity and convenience of the reader. No endorsement to the exclusion of equally suitable products is implied or intended.

and is moved outside to make room for the March 1st sowing. The crop that is moved to the shade house in February is shipped to the field for spring planting which runs from April to the middle of June. This is a brief summary of how our cropping system works.

Because of the many variables involved, especially the unpredictable planting weather, we have found it best to maintain somewhere between 2 1/2 to 3 full sets of containers for each greenhouse. This number of containers allows us to have one set in the greenhouse, one set in the shade house, and almost one complete set in the field at any given time.

Now this is where we have to air our dirty laundry. As I mentioned earlier we use primarily Ray-Leach pine cells '
This means we have approximately 25,000 dirty trays per year which must be cleaned prior to reuse. For the most part the dirty containers from one crop are returned with the shipment of the most recent crop. For example, containers shipped to the field in the spring are returned on the same truck which delivers a fall shipment. These containers would then be recleaned and used for the July 1st sowing.

Our old system consisted of knocking the remaining media from the cells, filling in blanks where cells were missing, and soaking the trays and cells in a stock tank containing a water and chlorox solution. This was a rather time consuming process, when you figure that it took four people working full time four weeks to wash 5,340 trays. This averages out to only 8.3 trays cleaned per person per hour. With this in mind, we set out to develop a mechanized system of washing the dirty trays. Working with our mechanic, Ralph Purcell, we came up with an idea for an open mesh conveyor moving through an enclosed chamber containing three series of high pressure jets. The last set of jets is fed by a steam cleaner, to provide high temperature water mixed with steam to sterilize the trays and cells.

We have found, using this system, three workers can wash 1,500 trays per day. So, in about eight days, we can wash enough containers for an entire sowing. This is quite a time savings over the old system. Now this does not describe the complete picture. There is still a need for some pre-clean of cell filled with media, or anything else they may contain when they are returned from the field. For the most part, four additional people can do the pre-cleaning to keep the other people supplied on the container washer. As the quality of the crops increase, the need for pre-cleaning decreases because there are fewer plugs containing media from stripped out trees. If you include both the pre-cleaning, washing, and stacking, it works out to 26.8 trays cleaned and stored per person per hour. This means we are able to complete the cleaning
job in about 1/3 of the time it took previously to the use of the washer.

Now let's talk dollars and cents. The cost to fabricate and build the container washer was less than $4,000. Based on the cost of the washer and prevailing labor cost, each Nursery will have to decide on the economics for their individual situation.
In the case of our operation, we are realizing an actual savings of $0.61 for each container washed. Based on 25,000 trays, this amounts to a gross savings of $15,250 per year.

At this point, I would like to show you a few slides and explain some specifics on how this unit works:

Slide 1.--The trays are brought to the cleaning machine on a wagon. At this point the trays have been pre-cleaned (i.e., media, etc. removed). Note the steam cleaner and the large storage tank. The water storage tank was found to be necessary because we were pumping about 15 gallons of water per minute at 100 PSI through the first two series of fourteen 8,008 tee-jets. As it turned out, a single garden hose could not supply the necessary water, so an interim storage tank fed by two hoses was used. You might also note the water flowing away from the washer. We decided at the very early stages of design, that it would be too difficult and expensive to look at a filtration system to enable us to reuse the water.

Slide 2.--In the foreground you can see the dirty trays being fed into the washer. In the background you might notice two stacks of containers. The rear stack (outside the doorway) are broken trays which will be stored separately for later repair. We have found that a mixture of acetone and formaldehyde works as a very effective glue on damaged trays.

Slide 3.--Here we are demonstrating that the washer will take super cells as well as pine cells. The machine is equipped with adjustable siderails so
different widths of containers may also

be fed through this washer. This slide also shows the wire mesh conveyor belt which was used so water could be sprayed at the trays from all four sides.

Slide 4.--The motor for the high pressure pump is located between the front legs. The electrical and plumbing for this side of the washer should be noted.

Slide 5.--Here you can see the clear containers coming off the back side of the washer. Note the steam being released from inside the washer. Also note the slit rubber strip located on this end of the enclosure. This helps trap the steam inside thereby allowing a higher temperature to be maintained. You can also see the plumbing on the other side of the unit along with the pressure gauge to check for water flow.

Slide 6.--As the trays come off of the washer they are stacked onto pallets to be placed in storage until the next sowing.

Slide 7.--This is a shot into one of our cone sheds now serving double duty as interim container storage.

Missoula Equipment Development Center has been very helpful by drawing blueprints and assembling a parts list for the components use in the container washer. These prints will be available from the Coeur d'Alene Nursery within a few weeks.