Mr. Lanquist: Yes, the same way. It works very well. I believe that venturi cost me, when I had it made, let's see now -- $60.00 -- but they can make it much cheaper now.

Mr. Adams: You put one in each sprinkler?

Mr. Lanquist: No, we used one for all of them.

Mr. Adams: You move it along?

Mr. Lanquist: Move it along as we go.

Chairman Webster: You just measure out the amount of fertilizer you want to put on the area covered by a given sprinkler line and you run that through. When that goes through, you have an even distribution on the given area and then you let the water continue running and soak it in.

Mr. Adams: In other words, the actual concentration you put on doesn't make too much difference?

Chairman Webster: Not a particle of difference as long as it is properly watered in.

Mr. Corson: It might be of interest to this group here to know that the Special Awards Committee in Washington has just made Karl a monetary award for the work he has done in research with allyl alcohol weed control.

Mr. Lanquist: You know, I never was so surprised in my life, because you know a fellow never figures that he is going to ever get anything like that, so I was really surprised, and I sure appreciated it. I say, "Thanks, Uncle."

Chairman Webster: Thanks very much, Karl. We will have your paper recorded in the minutes with the others.

(The Chairman then introduced the next speaker, Homer Ward.)

Mr. Ward: Mike asked for a short paper, and that is what it will be. I think he set me up here just before lunch because he knew I would make it short.

THE USE OF TERRALITE IN SEED STRATIFICATION AND GERMINATION TESTS

by

Homer S. Ward

* *

Terralite is the brand name for a particular grade of Vermiculite. Vermiculite is mica that has been ground to a desired grade and expanded to by a special heat process to create sponge-like particules of mineral that are neutral, sterile, very light in weight, and is capable of rapid water absorption through capillary action. After a few rather quick tests and trials, the State Division of Forestry has adopted its use in all seed work at the Capitol State Forest Nursery.

In stratifying forest tree seed, 1 volume of seed mixed with 2 volumes of vermiculite will need no further attention, other than adding water as needed.

At the Capitol Forest Nursery the practice is to use boxes that are 12" x 12" x 18". First a 2" layer of clean vermiculte is placed in the bottom of the boxes, then filling the boxes with mixed seed and vermiculite to within 2" of the top. A 1" layer of clean vermiculite is used as a margin of safety. Enough water is added to completely saturate the entire contents before placing in the cold room. Once a week water is added by sprinkling with a garden hose fitted with a fan-shaped nozzle. It would be possible to place the boxes in a shallow tray filled with water and rely on capillary action to maintain uniform moisture content. Care should be taken to keep the seed above the water level in the trays.

Seed recovery by washing is not quite as easy with the vermiculite as it is with sand as a media, due to the flotation of some of the lighter grains of vermiculite. However, this is not too difficult to overcome.

Re-use of the vermiculite is possible and practical, if the run-off from the washer is strained through a fine screen. A 40-mesh screen was used with fair success by our nursery crew.

The use of vermiculite as a drying agent offers some excellent possibilities. One volume of washed, wet seed and one volume of dry vermiculite mixed thoroughly together and then separated will leave the seed surface dry enough for immediate sowing.

One operator used a clipper fanning mill for this purpose, but it is our opinion that the mixed material placed on a screen of hardware cloth which was agitated by hand did a much better job. A motor-driven "scalping shoe" might work out well. Even a drum type cleaner is being considered.

It was also noticed that in the process of drying seed by vermiculite that a fine "graphite like" dust adhered to the seed coat, thereby reducing the need for talc or other seed lubricants.

Seed stratified with vermiculite seemed to be more fully imbibed after 6 weeks than did seed that was stratified a like period in sand. This is due quite possibly to the fact that vermiculite is capable of holding water almost to the saturation point throughout the box by capillary action which is not possible with sand. This plus the fact that drying with vermiculite does not draw as much moisture from the seed as does air drying.

In some simple tests at our nursery, Douglas fir seed, stratified 6 weeks, increased their dry weight by 87%, in drying the seed suitable for machine sowing. Aired drying removed 27% of the WET weight as compared with 14% removed by drying with vermiculite.

One very important advantage of drying with vermiculite is the fact that it can be done indoors regardless of outside weather. In some of our early spring aerial seeding projects, timing may well be the key to success.

In summing up the advantages of using vermiculite, I have listed the following factors:

The material is clean and sterile.

Very light and easy to handle.

Needs no preliminary screening or handling.

Economical (cheaper to buy than to process raw materials).

Available in any quantity up to carload lots.

Its use very materially cuts down on time and labor.

(On request only)
Terra-lite Division
Vermiculite-Northwest, Inc.
1318 N. Maple St., Spokane, Wash. (Office and Factory)
2303 N. Harding Ave., Portland 12, Ore. (Office and Factory)
5035 First Ave., Seattle 4, Wash. (Office)

$2.00 per 4-bu. bag, F.O.B. Portland.

Mr. Engstrom: Do you use the finest grade of terralite?

Mr. Ward: No, Number Four fine.

Mr. Brown: Homer, did you have much loss when you recovered it after you dried it?

Mr. Ward: In the drying we could make 100% recovery, or practically so. It left the seed in very fine condition for drill sowing. As far as the dust sticking to the seed, that was very slight.

Mr. Adams: We have been using that Vermiculite with very good success. We removed the seed from the vermiculite with our fanning mill. We spread it out on tarps and let it dry a little bit, and then put it through the fanning mill.

Mr. Ward: Well, the fanning mill, I think, would be quite successful.

Mr. Adams: It is not too good for recovery though, because we don't get all the seed out, and then you have impure vermiculite.

Mr. Ward: The washing of the seed, I think, is the best method of separation.

Mr. Lanquist: How much does it cost?

Mr. Ward: $2.00 for a 4-bushel bag.

Mr. Lanquist: How much does that 4-bushel bag weigh? It takes 15½ pounds, you say?

Mr. Ward: Yes, that would be about a cubic foot. It is actually, I think, about 14 pounds per bushel.

Chairman Webster: We found a definite advantage in using terralite for stratification and drying seed in connection with direct seeding. When you have a large volume of seed and want it right now. It is difficult to surface dry the seed after it has come out of the stratification. It is not a simple job as you fellows know. We can take seed out of stratification, wash it out with water in just a matter of minutes, if you have a proper set-up to do it, and then take that soaking wet seed and mix it, one volume of wet seed to one volume of dry terralite. This is agitated and in a matter of about two minutes you have surface dried your seed, to the extent that it will run through hoppers of a helicopter or a seed drill. This is a very definite advantage. If you let your seed set very long after surface drying, the moisture will start to come out again, but it is a simple matter to repeat the drying process.

Mr. Rindt: How do you dry the terralite for recovery?

Mr. Ward: On tarps.

Mr. Rindt: Spread it out in the sunlight?

Mr. Ward: Have them sloped off.

Chairman Webster: But you can't be in the wind or you will lose it as fast as it dries; it will blow away.

Mr. Bamford: Don't you find that after using it several times your grain started to collapse -- every time you handle it you press it a little bit, and those grains aren't very strong; the structure isn't very strong.

Mr. Ward: That is something we will have to work on a little while longer. We have only used it one season.

Chairman Webster: You can afford to throw it away, however, if you only use it once, it would still be economical.

Mr. Allen: Mr. Chairman, you might be interested in some experiments we have been doing the last couple of years on naked stratification. So far, we haven't got it into the pilot stage. We have just handled the seed for germination work. What we do is soak the seed, primarily Douglas-fir, for 24 hours, and then surface dry it which, of course, is a problem in large quantities, and then stratify it in bottles or containers which can have a loose top, which doesn't allow too much evaporation. The results we have had so far are very promising. We have had excellent germination after two weeks, almost comparable to six weeks with sand or with vermiculite, or other stratifying media. The other thing that might interest you -- that is just a possibility -- we have only worked with quarter pounds so far.

Chairman Webster: What is your temperature?

Mr. Allen: Of stratification?

Chairman Webster: That's right.

Mr. Allen: Approximately 32° F. Another possibility that might be of interest is the storage of stratified seed after it has been stratified. You are worried about the time of seeding. We have had two different experiments run on that. One of the students a couple of years ago did some very elementary preliminary work, and we have a boy now working on the problem, who is writing his Master's thesis this year, and he has found that we can store stratified seed which has been surface dried naked without any medium at all in sealers with a loose top for approximately six weeks without any loss of germination. Now that, I think, is a possible lead to follow up, because we may stratify our seed for, let's say direct seeding, either in the nursery or out in the open cutover, and yet the weather conditions at the time when that seed comes out may not be satisfactory. We may have to wait for two weeks or three weeks before we can actually sow, so I think the preliminary results we have had so far would suggest that if we properly surface dry, we can store that seed at 32° almost indefinitely, as long, certainly, as we would want to store it. We have had that replicated; it is not just one trial, but that has been tried now, I think, in three separate experiments. We have had about the same results, and that is all with Douglas-fir. We haven't tried it with hemlock or any other species. Douglas-fir being a large seed, I don't think aeration is a particular problem in storing the seed. With very fine seed, you might have a heating effect, of course, particularly in large quantities.

Mr. McDaniel: I might state that our Research Department has been experimenting with granulated pumice dust or pummi, and they have shown marvelous results and they put it in 5-gallon buckets about one to one volume seed and pummi dust granulated, which is smaller than the seed. They get that from the little fanning mill, clipping mill, probably like Frosty uses. Then we use inverted pans underneath and set the buckets in these pans of water, being sure there is a layer of pummi granulation above the water, of course, and then the seed is put on top and then there is a percolation right straight through, and it requires practically no watering whatsoever. Upon removing these vessels, they merely screen it out and it is separated from the seed.

While I am on my feet, I might give you fellows one of these experiences that I ran into, like our Swede over here. Our 2-0 stock today has the most marvelous germination we have ever had in Douglas-fir. We made our first sowing of two and a half 350-foot areas and were run out by rain. We had a lot of washed seed left on hand. I merely put it in buckets in this 34° room and it stayed there. I watched it carefully, took it out every day, a small quantity of it, and let it dry a little bit, and it just firmed right up. It went for three weeks before we could sow the remainder of our area, which is an area of about seven million Douglas-firs, and upon sowing, we got practically an instant germination, within about 7 to 8 days. Every seed seemed to have germinated at once. Another thing, our research department did was to soak Douglas-fir seed for 7 days under water at 35°, Yellow pine, Ponderosa pine for around 9 to 10 days, and they got just as good results on taking that wet seed out. I think possibly by our next meeting, you fellows might try some of that and get away from this seed stratification on soaking seed in water in a cold room in small quantities and seeing the results, because it certainly simplifies it immediately and then use the vermiculite in drying the seed. I think there might be something to this

Mr. McDaniel (cont'd): water soaking and not stratification, but of course, it needs experimental work, and I think our research department is going to carry that on.

Mr. Lanquist: You know the Lake States Experiment Station has tried that soaking of seed, and like Mac said, it is very successful, and it is something worthwhile working on. Now they soak the seed, but what they did, they forgot to change the water, so that is something that is probably just as important as soaking it, because if you are going to do it, what you want to do is put the seed into a stream of running water over a screen or something so the water is aerated all the way through, and it only takes about 5 to 10 days or so, and you have the same thing as if you stratified your seed.

Chairman Webster: How often does the water have to be changed if you are just doing it in containers?

Mr. Lanquist: Well, I can't remember, but it should be changed every day, I think they said, or every other day.

Mr. McDaniel: I don't think this fellow changed the water for 7 days, but he kept it in this chilled room.

Mr. Isaac: There is a recent reference that says you get better results if you do not change the water.

(The meeting then adjourned for lunch.)

The meeting resumed at 1:30 P.M. when the Chairman introduced the next speaker, Mr. James Augenstein.

Mr. Augenstein: Now that reading reminded me of nurserymen trying to figure up costs. It seems we have a lot on seed at this meeting, and I was glad to see it. In fact, when Mike wrote and wondered what we should have, that is one thing I was hoping we would have, and I finally got stuck with a little of it.

Cost is the main thing, as you fellows know, around a nursery. We all talk about costs, but we don't do much about seed. We have been stumbling along in the dark. The research has been helping us out during the last few years. I know in Region 1, all we knew was what we studied out ourselves about collection and extraction of seed and storing of seed. We did have a little help up at the experimental station with regards to storing of seed. I remember back some years ago Philip Wakeley, from the Southern Forest Experiment Station, I think it was 1937, came out with a bulletin. I think he started his work along in the early 30's, probably one of the first to do much for us on seed. Unfortunately, it was way down south, his work was all of the southern pine types, which is quite different from our northwest types, and we didn't think much of it. In fact, the bulletin didn't have too much in it, I felt, that was of any benefit to us. Probably for themselves it was all right, but this last winter I had a sad awakening when I received a bulletin published by him. It was Occasional Paper No. 123 on Storing Southern Pine Seed, published in September 1951, on some

Mr. Augenstein: (cont'd) of the things that he found out. Now apparently these experiments he started years ago he has been carrying through, and I feel that he is quite an authority on it now, at least he should be, and some of the things in that bulletin, if you fellows haven't seen it, are worth reading. It was little simple things that were wrecking our seed, and for the past several years we have really taken a beating on seed. This past winter, I think, was the worst beating I have taken. I collected around 3000 bushels of cones, Ponderosa and White pine, mostly Ponderosa, and I think about 110 pounds of it was from the Bitter Root area and 700 pounds north of us, on Kootenay, gave a one percent germination test. Yet when we collected the cones, they looked good, seeds looked good, and what went wrong, we don't know. The cones collected between those two gave pretty fair germination percent, so we feel it is something in the way that seed was collected, the type of Fall we had, or something. When I got this bulletin, I think it bears out some of the things that might have happened there, and I was hoping we would get a chance to report on it, which I have.

COLLECTION, EXTRACTION, STORAGE, AND HANDLING
OF FOREST TREE SEEDS
by
James W. Augenstein

* *

A continuous supply of good seed is the backbone of a planting program. Without seed we could not raise trees. Therefore, it is essential that tree seeds be collected and handled properly in order to attain the highest viability during the entire storage period.

The seed crop on conifers is very erratic. Up to the present time there is no method for determining when a tree will bear cones. Thus, when the seed supply is low, seed must be collected whenever it is available until sufficient seed is in storage.

According to recent experiments by Philip C. Wakely of the Southern Forest Experiment Station, it is important to handle the cones properly from the time they are collected until the seed is extracted, cleaned and stored if good, viable seed is to be expected. Much of the following information in this report was taken from Mr. Wakely's Occasional Paper No. 123 on "Storing Southern Pine Seed," published in September 1951. It is true that southern pine seed differs in character from the conifer seed in the Northwest. However, it shows the importance of proper handling of all seed.

Collection and Storage of Cones

There are various methods for determining when the seed is mature. One of the most reliable methods is the specific gravity test. When a cone will float in S.A.E. 20 motor oil or in a mixture of 1 part of kerosene to 4 parts of raw linseed oil, it is mature. This method is not accurate if the cones are wormy or if the cones have been picked for several hours. The cones should be tested as soon as picked. Another method is to test the hardness of the endosperm. If the endosperm is solid, it is normally mature. The longer a cone can be left on the tree without losing the seed before picking, the better the seed will store.