

## FACTORS INFLUENCING SOWING RATES IN A FOREST NURSERY

by

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We in the California Division of Forestry nurseries are still rather inexperienced in the forest nursery business, so I don't feel that I am speaking as an authority in giving out these opinions on factors influencing sowing rates in a forest nursery.

We do feel, however, that this particular subject has been avoided too long and our main purpose in bringing it up was to see if we could stimulate some good

Tourney in "Seeding and Planting in the Practice of Forestry" states that the quantity of seed to sow in a given area of seed bed depends upon a number of factors, of which the more important are:

1. Species,
  2. Tree percentage,
  - 3 Length of time that seedlings remain in the seed beds.
  4. Quality of stock required.
- 50** Method of seeding.

I think that most of you, are well versed in the factors of "species," "tree percentages," "length of time that seedlings remain in the seed beds," and "methods of seeding,"

For my own enlightenment, however, I would like to bring up the subject of "tree percentages" which is number 2 in Toumey's list of factors, Frankly, this one seems to give us, in the California Division of Forestry nurseries quite a bit of trouble. When we come out with the correct density in the germination of seedlings and a proper resulting stand, I feel that it is mostly the result of luck, We go to quite a bit of trouble to run accurate germination tests on all of our seed, and then at sowing time comes the application of a rule-of-thumb figure to estimate tree percentage that, you might say, we pick out of the air. Checking at the Mt. Shasta nursery I found that in their Jeffrey and ponderosa pines, they add 5% in area and 6% in seed volume to obtain their desired amount of stock; and I must say that the results looked very good. In our nurseries this year for these two species we applied a straight 25% additional volume of seed to reach our desired density. At the present time the density looks about right, In some species, however, which we felt were rather weak in their resistance to such factors as heat and damping off, we

have applied. a 50% factor. This, in sane cases, has resulted in too great a density and in others the density has still been too light. We have some slides illustrating this wide variation which we will show in a few minutes. Perhaps after several years experience we may be able to make a correlation of our results and come up with a more sound rule-of-thumb figure. One difficulty we have experienced is low germination in some of our seed, particularly in Coast redwood. This brings out a point I just recently uncovered. Even though I used Tourney as a text book in school aid we have had one in our office for several years which we use for reference, I just ran across the information that the lower the germination percent in seeds the greater the rule-of-thumb factor that should be applied. We will have to put this to a test next spring.

Now, how about number 4 on our list of factors affecting sowing rates, "quality of stock required." In our nurseries we are raising, for the most part, 2-0 root pruned stock. We strive generally to produce 40 seedlings per square foot of seed beds or 20 per lineal foot of a drill row. This, we feel, should produce a fairly high quality tree in such species as sugar, ponderosa and Jeffrey pines, as well as Douglas fir and redwood. The Monterey pine, of which we produce about 100 Di a year, still has us guessing, We cannot decide whether it should be distributed as 2-0 root pruned or 1-03 if 2-0 whether it should be 40 or 60 per square foot. If it is to be 1-0 it could possibly be 60 per square foot without crowding. If we handle it as 2-0 at a density of 40 per square foot it becomes too large. This is just one of the problems of the quality of stock to produce.

We feel that using a light density and producing 2-0 root pruned stock in the Jeffreys ponderosa and sugar pines as well as most of our other species, has a very distinct advantage over raising dense 1-0 seedlings and then transplanting to produce 1-1 stock.

In some cases, 2-1 stock in the pines appears to have the advantage on some sites but this would be more or less a modification of the 2-0 root pruned. The Modoc National Forest in northeastern California is planting this type of stock with considerable success.

Possibly the one main advantage of raising 2-0 root pruned stock is that it should reduce culling. Culling, as we all know is an expensive process causing much wasted effort particularly in 1-1 stock. Where densities are high in 1-0 stock, which are being raised for transplanting, it appears that a high percentage of runts results in the 1-1 stock which necessitates considerable culling at the time of shipping. Also, at the time of transplanting when the trees are 1-0 it is all but impossible to cull any seedlings but the obviously deformed ones as they have not developed sufficiently to show any of their inherent characteristics. It should be possible to produce good quality 2-0 trees for considerably less cost than 1-1 transplants. We have no comparative figures at the present time, but I feel that some could be worked up which would bear out our opinions.

According to the pamphlet, "Reports of the Pacific Northwest Seeding and Planting Committee on Various Recommended Reforestation Practices and Techniques," published by the Western Forestry and Conservation Association, the size of stock can be controlled by the density of sowing. This is very true but in a seedling stand of say 100 trees per square foot where you are attempting to reduce the size of stock by dense sowing what would be the resulting quality of the seedlings? In our experience we have produced 2-0 root pruned Arizona cypress that ran about that density or perhaps a little more than that and they were, of course quite small. The call percent, however, was extremely high. The trees in the outside portions of the beds were of satisfactory quality, but those in the center were poorly developed. At the other extreme we had Douglas fir that was too thin and consequently was too large to handle easily although it appeared to have well developed top-root ration. Root pruning of course upset this balance even though

the stock had a good lateral system.

Again, since I am no authority on this subject, we will show our few slides and invite discussion.

DISCUSSION:

MR. CORSON: One thing I want to ask. You spoke of calling the safety factor of 25 to 50%. Do you mean you were over sowing that amount in the same space?

MR. ADAMS: **Yes.**

MR. CORSON: when we apply our safety factor we do it to the amount of space. If there is any integrity in the germination of your seed you shouldn't sow more seed in a given amount of space.

MR. SCHUBERT: Was it stratified seed? Did you get stratification in your seed bed?

MR. ADAMS: I sowed stratified seed.

MR. SCHUBERT: On running germination test on a batch of seed you can, Within the same can, have quite a variance in germination Percent from one spot in the can to the other if you mix the can up or get a representative sample of the can. If you don't mix it up sometimes **it is** high and then again low.

MR. ADAMS: We try to stratify the same length of time.

MR. SCHUBERT The Woody Plant Book gives a formula (see page 49, Woody Plant Seed Manual). Generally that should come out pretty close. It is suggested that you add to that a "fudge" factor.

MR. ADAMS: That is right.

MR. SCHUBERT: You don't have to add another to it. When you add sawdust to heavy grade soil does this bring about a nitrogen deficiency in the soil?

MR. ADAMS: We took care of that by heavy applications of ammonium sulphate.

MR. LANQUIST: Any questions on 1-0 root stock?

MR. CORSON: 1-1 stock is giving the best all around results. 2-0 will do equally as well as 1-1 on all around stock but if you want a plant that will go to any one of several planting sites 1-1 is better to use than 2-0.

QUESTION: Have you any cost figures?

CORSON: 2-0 cost about half as much as 1-1.

QUESTION: What about survival?

MR. CORSON: 1-1 and 2-0 along side each other on severe site will have difference of 40%. On best sites will run about the same. We'll have to select stock to fit the site which we should ultimately come to. We have got to stay now on some type of stock that will be universally good on all **sites.**

MR. LANQUIST: I don't believe that we can say that Ronnie is supposed to sow for 80 per square foot in the Davis Nursery but Ronnie probably knows that he can sow for 40 per square foot because **he is** the only one who could know. It all depends on the experience of the nurseryman in that location and other conditions combined. You have other factors : what type of stock are we supposed to *grow*; but at the same time we have to consider the soil fertility and the conditions of the nursery. Some factors won't show up the first year but **will** the second year or they won't show up in a dense stand. But **we** would know **if** the stand was a little thinner. Can we have more comments on that?

MR. SCHUBERT: I don't know about the genetic factor but sowing density would be governed by type of stock you want to raise which in turn is governed by the species. Monterey pine will want to grow at 40 per square foot because it is a rapid grower. Depends a lot upon particular conditions in the nursery. We have done very little work on determining seedling densities. I can't say anything based on facts and figures. Maybe we should do some work **on** that and determine **same** density for each particular nursery. You can do that at your *own* nursery. **All** you have **to** do is put in series of plots with known number of seedlings. Space **them** in evenly. Carry them all the way out into the field to see if it does actually make any difference. Chances are spindly seedlings will not make it in the field. You have to **do it** at your own nursery. My personal opinion is that each and every nursery should do that. Determine seedling density for all species you are going to grow all age classes. Often the nurseryman does not have time to devote Do it on a small basis first and if it proves successful then try it over the entire nursery. It was mentioned using ammonium sulphate. It may be a remedy but it could be a water factor, too.

MR. CORSON: I conducted a **test** on seed bed density on 1-1 stock. Started with the seed and sowed at various densities in the seed bed and then transplanted into the field. Result of tests was that a density of anywhere from 80 **to** 100 seedlings per square foot was not too great. From the actual standpoint of cost per survived tree in the field 80 trees **to** the square foot density was the best.

MR. ADAMS: Did you try any lesser densities?

MR. CORSON: 100, 80, 60,40. Ponderosa.

MR. CRAIG: Where Karl has attractive young ladies doing the work for him will you **tell** them what help you have.

MR. ADAMS: Two of the nurseries are located at prison camps and one is at a youth camp.

MR. WOODBRIDGE METCALF: I tried to interest Forest Genetics to avoid competition in the beds by putting the seedlings in the beds with the same spacing. The plantations or arboretums was planted at 15-foot spacing. The seedlings were classified as vigorous, normal and weak. There is one vigorous one 40 feet tall and a weak one only 4 feet tall.

MR. WYCKOFF: You will find a lot of variation within the individuals in the various rows on the point of vigor. On the stock grown at Placerville it does not necessarily indicate that that seed will show when taken to some other environment.

Some discussion of the genetic factor the variable is undoubtedly there. It will take a lot of work to segregate it out.

Many foresters consider it standard practice to take their seeds from certain trees. The results are beginning to show. Move first from broad seed zone and tie seed sources down by narrow areas. The next step is go into the tree selection for seed. Those are all things that can be done without any degree of help from tree geneticists. That will keep the foresters busy for a long time

The meeting recessed at 12 o'clock and reconvened at 1 p.m..