

SURVIVAL OF PENNSYLVANIA STATE NURSERY SEEDLINGS, 1971-81

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Since 1950, I have been associated with the forest tree nursery business. There have been a great many changes in nursery techniques and operations from the early 50's to the present. During this time frame, there has been a continuing trend in the nurseries to mechanize more and more operations, and to introduce more chemicals into nursery practices. Major portions of the meetings of this group have, for the past 30 years or so, been devoted to mechanization and chemical usage. I feel that this was an important part of the growth of our business. The mechanization and use of chemicals were greatly needed to reduce ever increasing costs, and to improve propagation techniques; and ultimately, they made it possible for us to become more concerned with seedling quality and care.

During the last 35 years that I have been a part of the forest tree nursery business, I have noticed a very marked improvement in the quality of forest tree seedling and transplant stock. I'm sure that all of you, regardless of how long you have been in the business, have also made observations of the continuing improvement of stock quality. Unfortunately, while we as nurserymen were concentrating so hard on improving the stock that we were growing, we often were not checking on how the stock was doing after it was planted in the field. I'm sure that we all did spot check plantings now and then, but we really didn't conduct any extensive survival studies. Of course there were many reasons why we felt that we couldn't get involved in this type of study. Survival checks are time consuming, and most of us didn't have personnel or funds to conduct them. Often, we felt that these studies were the responsibility of field personnel or university people. Also, when we should be checking field planting procedures during the planting season, we were extremely busy with shipping operations. Well, regardless what our reasons were, most of the time we just weren't following through on seedling and transplant stock performance in the field.

Now, in the past few years at nurserymen's meetings, I believe we've all heard more references and talks about nursery stock performance after it leaves the nursery. We've also heard more about better communications with those people planning for and/or planting nursery stock. This has been a very encouraging sign for me because we, as nurserymen, should be aware of how our stock, that we have babied in the nursery, performs after it leaves our care.

Until I became involved in several surveys of outplantings in the state of Pennsylvania, I assumed that stock survival in the field was probably 70 percent or better for most planting. Boy, was I in for a shock!

I'd like to go into some of the details leading up to the surveys in Pennsylvania because I think that they may be important to this discussion.

The checks of outplantings in Pennsylvania were only conducted on stock produced by the state forest tree nurseries. This approach was used because: (1) we were mainly interested in the results of our tree seedling program, and (2) we had excellent records on the numbers of seedlings sent out from the nurseries, the species composition of each order, and the location of the planting sites. This information about numbers of seedlings, species and site would not have been available to us for the majority of commercial plantings.

Initially, questions about seedling performance were raised within a committee established in the Bureau of Forestry to investigate the premise that hardwood seedling establishment was extremely poor. When the committee, of which I was a member, began to search, information was about nil. However, everyone seemed to be convinced that conifer plantings were exhibiting very good survival. Then, the question was asked on what basis this observation was made. It came as quite a surprise to those of us on the committee that we really had no extensive or reliable surveys of conifer outplantings to support such a supposition after shipping more than 690 million seedlings from our state tree nurseries.

When this information was made available to our state forester, he assigned a management section chief, a forest pathologist and myself to the task of evaluating the plantings in one of our twenty forest districts.

The three of us started work on the outplanting survey in the Harrisburg main office of the Bureau of Forestry. It was decided that plantings from one to ten years of age were to be checked for survival. This time frame was selected because it was assumed that causes for planting failures could possibly be determined for the first ten years after planting, but would be extremely difficult to establish for plantings older than ten years. The sites to be checked were selected at random from nursery orders and applications, and from plantation reports in the main office files. The sites were then pared down to get a balanced representation of the various species, plantation ages and quantities planted. All of the sites selected in this district were on state forest land. After the sites had been selected, the district forester was asked to locate the sites prior to the arrival of the survey team. The team then spent one week in the district evaluating the plantings.

When we arrived in the district, the district forester was asked for his estimate of planting success. He told us that planting survival was probably about 75 percent. After the first day in the field we found that the success of plantings was much lower than his estimate.

The district forester would not believe the team's report, and he accompanied us in the field for the next day and one half. Before going with us he said our sampling technique must be poor, the right plantations weren't being checked, etc., etc. After he had been evaluating the plantings with us for 1 1/2 days, he had to admit that the team's survey methods were good and that planting success in the district was, indeed, very dismal. I'm pointing out this episode with the district forester only to show that many times field personnel, instead of making scientifically based checks of planting survival, rely instead on visual observations made as they drive around their districts. Of course, in doing this, one always sees the successful plantations, and very seldom see the failures.

After the survey was completed in the district, the team reported to the state forester that:

- (1) Of 57,500 hardwood seedlings planted on the sites checked, survival was 0 percent.
- (2) Of 103,600 conifer seedlings planted on the sites checked, survival was 59 percent.

Upon receiving this information from the survey team, the state forester requested that we evaluate the plantings in two more districts. The same techniques for selecting sites to be evaluated were used for these two districts as were used for the first district surveyed.

In the three districts a total of 154,600 seedlings planted on private land, and 514,830 seedlings planted on state land were checked for survival. Forty-two plantings on private land and 57 plantings on state land (a total of 98 plantings) were examined in the three districts. Although these plantings were a small number of the total plantings in the districts, because of the random selection method used, and the similarity of survival characteristics between districts, the sampling was considered representative of forest planting conditions for all the plantings within the districts surveyed, and for plantations throughout the state.

It should be noted here that the survey team did not evaluate plantings on strip mine sites. The survival on these sites was checked in a more extensive survey under Project 20. Amy Griffith will cover these evaluations next on the program.

The results of the evaluations made in the three forest districts were quite disconcerting. The survival percentages were:

	Hardwoods	Conifers	Total
Total private	35	27	27
Total state	1	30	24

The evaluation team surmised that the better survival of hardwoods on private lands could be attributed to more care for smaller plantings.

It should be pointed out, as you can see, that survival of conifer seedlings on both state and private lands was very low, and the results are quite similar in values. Maybe I'm naive, but prior to the surveys, I would have guessed that survival of seedlings on state lands (under the administration of foresters) might have been considerably better than survival on private lands.

The survey team had hoped, at the outset of their work, to determine survival rates for individual species. This, they found, was impossible to do for a number of reasons:

- (1) There weren't enough seedlings checked for each species to be statistically significant.
- (2) Often a species reported as planted on a site actually was not there. Many times another species would be on the site.
- (3) Acreages of plantations were often unknown or erroneous.
- (4) Many areas were replanted several times over a period of years.

The reasons for planting failures were quite numerous, and varied somewhat in the three districts that were surveyed. However, there were some causes of failures that were observed in all districts (on state and private lands) even though they were of varying importance in each of the districts. These reasons or causes of planting failures were:

- (1) Deer browsing, especially in the two northern Pennsylvania districts, and to a lesser extent in the one southern district checked.
- (2) Planting in excessively heavy underbrush. The bulk of this type of vegetation consisted of ferns, laurel, blueberries, and various grasses. This excess vegetation not only created adverse competition for light, moisture and nutrients, but also, in some cases, had some allelopathic effects on planting stock.
- (3) Losses due to forest fires.
- (4) Insect attacks (oak leaf roller, gypsy moth, aphids, etc.)
- (5) Improper planting techniques.
- (6) Improper handling of stock by planters.

Many of these reasons for failure of planting stock after it left the nurseries can be remedied, but we first have to communicate with the planters. Show them that we have a product that we are proud of, and if it is handled correctly and planted on the proper site with good site preparation, the planting material will survive well.

Now that I have convinced all the nurserymen here that we are the guys with the "white hats", and all the people that do the planting are the "badies", let me say that it ain't necessarily so!

It seems that over the last twenty years or so, we have definitely improved stock quality with the more obvious and visual things such as mechanization of operations, and the use of chemicals to control weeds, insects and diseases. As I attended these meetings, I felt pretty good about our progress toward better stock quality. At least I did until I listened to Dr. Kormanik's presentation at the Iowa meeting last year. When he seemed to be pointing out that perhaps we should be discarding large numbers of seedlings of some species because they didn't show good lateral root development, which probably indicated poor survival changes in the field, his remarks really made me sit up and take notice! And I think that this points out what this meeting is all about.

There are so many things that we don't know about seedling and transplant performance, and these things encompass so many fields of knowledge. Look at the program for this meeting. How varied are the subjects, and how different the fields of interest of the speakers! We still have a long way to go in the nurseries to produce stock that will survive well in the field. Just think of what we here in Pennsylvania have to do if we want to reach a 75 percent field survival for our stock. We have to get help from people in all fields of investigation to upgrade our nursery stock, and we have to convince planters that they have to change some of their methods of stock care and planting techniques.

Let's continue to improve the quality of our stock with all the help that we can get from our learned colleagues, and then let's really get our oar into how our stock is used in the field.