Smithsonian Folklife Festival

Robert Karrfalt
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Dry Branch, Georgia

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Interviewer: Jim McConnell

[Tape begins with a brief shot of the exterior of the National Tree Seed Laboratory.]

[Interior. Robert Karrfalt, seated at a table]

Robert Karrfalt (RK): I'm Bob Karrfalt. I'm director of the National Tree Seed Laboratory, which is physically located in Dry Branch, Georgia. Let me tell you about myself and a brief history of the laboratory.

I'm a forester, and I became interested in reforestation towards the end of my undergraduate studies. I became interested in genetics and tree improvement mostly because I was interested in raising trees to regenerate forests when they were harvested or damaged in other ways, and to establish forests where they'd been removed for agricultural purposes. After some graduate study I spent a short time at a Forest Service sea orchard in northern Wisconsin, and that job led me to the Tree Seed Laboratory here, where I was hired to be manager of the seed testing programs. I didn't know what a seed test was a that point, really, but I found out fairly soon and got a lot of good training, and learned a lot about seeds in the interim. Seed testing is designed to see what the quality of the seed is; to help people who raise trees that are planted out in the forest to know the seed that they're working with. Otherwise they might plant seeds that are no good and fail. But we didn't want that to happen. And nursery managers don't want that to happen. And so the Forest Service offers a service and a lot of assistance to people doing that. I worked in the seed testing program for about three or four years. Then I moved to be manager of the international seed exchange program here at the laboratory, and that program was designed to supply small quantities; by small, like five hundred to twenty-five hundred of known source of a U.S. tree. Maybe it was Loblolly pine, maybe it was Douglas fir. Mostly it was conifers. Yellow poplars were often one of interest. Trees that were used to produce fiber or [rung?] wood producers were generally what were of interest. This was to share U.S. germ plasma with other countries so they could find the best trees which could help them produce the wood and the fiber needed by their people. Following being international seed exchange manager, I became director of the laboratory in 1986, when the previous director retired. In all, I've been at the laboratory since October the 5th, 1975, which today has been almost twenty-eight full years. It's been a very exciting career.

The history of the laboratory dates back to 1951, the continuous history. The Forest Service was involved in seeds and seed testing in various ways before that, but continuous operation of the laboratory dates back probably to 1951 at the Ash Nursery in Brooklyn, Mississippi, which is in the Gulf Coastal Plain of southern Mississippi. There the Forest Service had a nursery that they established to help reforest the DeSoto National Forest. They needed to know the quality of the seed that they were working with. And when the people in that area found out what the Forest Service was doing, they wanted their seed tested also. So the Forest Service tested for their needs and for people in the agencies and companies in the local area. That need grew to the point where they said, this is not appropriate, and the Ash Seed Testing Laboratory was moved to Macon, Georgia, and there it was called the Region Eight Seed Testing Laboratory, which was the southern region, or is currently the southern region of the U.S. Forest Service. In 1955 they were testing just a few pines, and they were doing this in cooperation with the Georgia Forestry Commission, and they began charging a fee. In 1961 the work had grown to the point where, in the facilities where they had done research on seeds and they were helping people raise seeds and test seeds for the whole eastern U.S., and it seemed appropriate that the mission of the laboratory be expanded from a regional laboratory for Region Eight to the Eastern Tree Seed Laboratory. In 1972 the International Seed Exchange Program was added to the laboratory, and so we had the establishment of the three current missions of the laboratory, which is basically germ plasma conservation, germ plasma sharing with other countries; development of protocols for handling seeds, for testing seeds; and doing training for people that handle seeds in the seed testing program, evaluating the quality of the seed. In 1979 the work of the lab had continued to expand, and the mission then was that it would be a national laboratory, and we became the National Tree Seed Laboratory.

Throughout its evolution the lab had been associated with seed testing association; the Association of Official Seed Analysts, which is the United States and Canada principally; and the International Seed Testing Association. Finally, as seed testing in the associations in the last five to ten years, the international association had developed quality assurance accreditation procedures. In 2001 the laboratory became accredited by the ISTA, the International Seed Testing Association, to do all the tests prescribed in the international rules for tree and shrub seeds. This is the only laboratory that the U.S. Forest Service operates that is accredited to issue the International Seed Testing Association's seed analysis certificate. It's the only place that the Forest Service does as a seed technology center. And now in 2003, where we were principally a tree seed laboratory, we have evolved into testing many different species. The number seems to be increasing every year. The number is now well over a hundred and fifty species. So we've evolved from being principally a pine testing laboratory in its early days, to now where we're involved in shrubs and grasses and forbs— All the plants that go into making up the forest.

[Scene changes to RK standing in a room, holding a notebook]

[Recording begins in mid-sentence]

RK: ... in the actual laboratory portion of the National tree Seed Laboratory. And we're going to look at how seed testing is conducted. We get the seed from seedsmen: seed sellers, seed people at the nurseries, nursery managers preparing to sell their seeds. They send us a sample of seed. It may represent thousands of pounds; it may represent only a few pounds. They identify themselves on the seed test request sheet. [Displays a page in the notebook] They tell us identifying things of the seed lot and what the species is; its identifying lot number. They give us their address. They tell us what test tests they want. We'll test the moisture content, which is important for storage; we test to see how clean the seed is, to see how much seed that we're working with versus how much trash; we test to see how many seeds there are in a pound of clean seed; whether or not they want a formal certificate on it; the kind of germination test they want on it—sometimes they want it tested by [tetrazoneum?] or excise embryo or just x-ray, or the germination test. Then we prepare a card like this, and the sample is mixed and divided, and then we begin the analysis of the seed.

[Scene changes to employee seated at a lab table with small piles of seeds]

RK: This is Blanche [Cabanas?], one of our long-term seed analysts. She's been with the program a year longer than I have. She's counting out the samples of seeds by hand now. This is [words unclear]. She's preparing it for counting out samples for doing a germination test. She's divided the samples by hand-- that's why you see four piles of seed in front of you-- and she's taking seeds from each pile. That way she gets a representative sample. We must make sure we get a good representative sample in order to estimate the mean viability of the seed lot. We don't want just the good seed or just the bad seed. We want an accurate test. So this seed has to be counted out by hand because of its size. Then she places it in the dish, and later it will be placed in the germination dish.

[Recorder stops, then starts again on same scene as above. The same employee is now using a hand-held device to count seeds.]

RK: in the last scene Blanche was counting out seeds by hand because they didn't fit our automatic counter here, or our semi-automatic counter. But now she's using the vacuum seed counter. The plate she has in her hand there will hold one hundred seeds. She's picked up almost a complete set; sometimes it's not able to get all the holes at one time. She's got one hundred seeds now and she's going to plant it in the germination dish [employee holds the counter over the dish and release the seeds into the dish]. and for those seeds that can be handled this way it's a very nice way to do it. Very evenly spaced. Quickly available. Each one is labeled... There'll be four dishes like this; one hundred seeds making up the germination test. Each one is labeled with its accession number. [Pointing to a label on the dish reading '3-100 A'] Three indicates the ear, and this would be the one hundredth test. 'Dish A'. There'll be a dish B, C, and D, making up the one hundred seeds. We have a special way we use that vacuum counter. Just touch the seeds when we turn on the vacuum, and move it just slightly, and she looks down blindly to pick up any seeds she needs to fill in the blank spaces.

[Scene changes to display a hallway]

RK: You're now looking at the hallway where the walk-in germination rooms are; the seed stratification room, where we give the seeds their artificial winter so that they'll know to germinate when we bring them in to the proper germination room; and the storage room where seed samples after we conduct their tests. They're stored there for two years in case we need to re-evaluate any of our results.

[Camera turns to show RK in one of the rooms, between metal shelves]

RK: I'm standing now in one of the germination rooms, where we conduct the germination tests. [Displays a germination dish] This is one of the larger dishes. The smaller dishes that you saw earlier are placed over here. Three tests to a shelf. We have lights to give them the light they need, either eight or sixteen hours of light. This dish contains [bald?] cypress seeds, and in it we have some seedlings that are coming up now. We evaluate the seedlings to see that it possesses all the normal structures necessary for plant growth: a good root, green color; leaves. When the seedling has all those characteristics, then we remove the seedling from the dish, pull it out, and count it. This is a nice, clean test for some high pure seed.

[Scene of RK in a different room.]

RK: This is where we make x-rays of seeds. What we're looking for in x-ray is to look at the internal structures of the seed to see if an insect or a fungus has maybe damaged the seed, or if it was damaged in the handling of it; might have a crack in it. We can also look to see if it developed properly, 'cause we can't the seed to germinate and grow if there's no embryo in it, and we can see that in the x-ray. The way x-ray is made, we use an x-ray paper, and I'll show that in more detail in a moment. It's in an x-ray cassette, because we have to protect it from the light. We've counted out a set number of seeds, usually two hundred, four hundred for some other tests. This is longleaf pine. I've spread it out so that the seeds don't touch each other. Otherwise the images will be superimposed, just like taking a photograph in a group. If somebody's standing behind somebody else, you won't see them. So we'll spread this out here nicely. Then we'll place it in our x-ray cabinet. We'll lay it in the center here. Close the door, set our time, and what voltage we want for the proper seed, and push the button. It's as easy to operate as most microwave ovens, and probably safer because it's shielded from any radiation. Very safe piece of equipment. Our final product then, looks like this. [Holds up an x-ray image] This is a beech seed from the beech tree. And the nice bright white ones are those which are filled and well-developed. These are the ones we would expect to give us a seedling. There are a few that are just the shadow of the seed coat; those of course would not germinate. There's nothing there to grow. No embryo. Each one of these, of course, is numbered with an accession number that we assign to the seed lot when it arrives at the laboratory. And that's pretty much how we do x-ray.

[Scene changes to RK seated at a small workstation]

RK: In this place we do what is called [tetrazolium?] testing, or excised embryo testing. These procedures are developed to circumvent the problem of dormancy in testing liability of seeds. When we germinate a seed we've got to make it germinate. In order to do that, sometimes cold treatment, moist cold treatment where it's given a simulated winter works. In a lot of cases we have what's called deep and variable dormancy in native plants, and it's not easy to get them to germinate, or we can't get them to germinate on a schedule that's practical for plant production. So we use tests that shorten the time frame considerably. In the [tetrazolium?] test is where we cut the seed open, pour a chemical solution on it of [tetrazoleium?] chloride, which reacts with enzymes in the respiration process, and if the seed is alive and it's respiring, then these enzymes will react with the chemical and change it from a clear solution to a pink or magenta color, which will stain the living tissues. It's a very nice procedure. It takes a good bit of skill and practice to learn to do it correctly. The equipment is relatively simple: a forceps to hold the seed and a good sharp, single edge razor blade. And a binocular microscope when you need to look closely at the embryo. And a lot of these seeds are small and you need the [envelope]. And sometimes a dissecting needle to help lift and move the seed around and feel how the seed tissue is—is it nice and firm and alive? So the analyst would come here and cut with a razor blade, take a look under the microscope. The excised embryo is similar, but in that case we must be very careful to remove the embryo from the seed without damaging it. And we plant it much the same way as we do for germination. Removed from the seed, embryos will often germinate. There are inhibitory things, either physical or chemical, that prevent the embryo from germinating in the seed. Take it out, excise it that is, and plant it in one of the germination rooms like we looked at earlier, and they will grow freely. I think that pretty well wraps it up.

[Scene changes to show RK in another lab room next to a machine on a table.]

RK: This machine will be the first machine we're going to look at in a series of things used for what we call seed conditioning. How we take raw seed that's been collected in the field and put it in shape where it can be stored efficiently, where we can clean up the empties from it or insect damage or disease damaged seeds, and get a high quality seed which will give us an efficient and high quality seedling. Let me take it apart first to show how it operates. We'll remove the discharge gate here; remove the top portion. And now we see the working parts of the machine. This screen or cylinder, the company calls a shell. It's made of square wire. It's slightly elliptical in its shape. There are two brushes that spin inside this shell, and they are just so that so they just touch the shell at its close radius and just release the seed at the wide radius. That lets the seed turn over so that it can be cleaned on different sides. We'll put it back together now and show what it does to the seed. We'll attach our vacuum line here so that we don't have dust blowing everywhere. Got to turn on the vacuum. Cut. [Laughs] I haven't turned on the vacuum cleaner.

{Camera is turned off.]

[Camera is turned on with vacuum cleaner running. RK is displaying a tub.]

RK: The seed we have in this tub is called winter fat. It looks a lot like some kind of insulation you'd put in your attic. But these are really the fruits. They're called hairy utricles if anybody really wants to know. But I'm going to put them in the machine, and it'll extract the seed from the fruits.

[Places the tub next to the machine.]

Well, it will if I plug it in.

[Camera stops. Starts again.]

RK: We'll now take the winter fat and put it through the brush machine to show how it extracts it.

[Places seed in the top of the machine]

This knob here adjusts the discharge gate, determining how long the seed will stay in the machine. [Displays the tub into which seed has been discharged.]

Much of the trash went up the vacuum shoot. Some fell through. Some fell through into this pan [Camera focuses on a pan next to the machine] Well, I'm going to need to do it a little more than that.

[Displays the pan] How about this. It looks a little bit like it did before. However, we have the seed shelled out from the fruits. Does that show up all right on my hand? [Camera focuses on the seeds in close-up] These are the seeds. And there are some sticks and so forth that we will bring over there and clean and screen later. But this is the actual seed. Much easier to work with. This particular machine is portable. We've sent it to Pennsylvania, Missouri, Louisiana, North Carolina. It's traveled around a good bit for demonstration and training purposes. It even went to upstate New York. By motor freight, and sometimes we carry it just in a Ryder truck. One thing to add to this machine. It was very important in production of hardwood seedlings and native plants in that we had a lot of difficult seeds like this that needed to be extracted from their fruits, needed to be pulled apart from the clusters they were in, taken out of pods, so that we could work with them. This machine was very efficient for that, and that was very important as we increased the number of species that we worked with, as the nurseries began to work with a lot of different species.

[Scene changes to RK standing in another part of the lab, with screens stored on shelves on the wall.]

RK: What we're going to do next with the winter fat is a screening to remove large particles from the seed. And in front of me here is a large collection, about a hundred and forty different sizes of screens; hand screens. They come in many different materials. [Corrects himself] Or several different materials, many [emphasis] different sizes. This is woven wire. The one in my left hand here is a little similar to window screen, a little bit bigger than that; and this [indicates screen is his right hand] is very fine screening here, much like a tea sieve. {Displays two other screens] The next kind of screen I have is a slotted screen or oblong hole. Here's one in my left hand which is a very large screen; and here's one [displays screen in his right hand] and here's one that's got slots that are much thinner. [Displays two other screens] Probably one of the most commonly used ones are round-hole screens. The one on my left of course is a big size, and the one on my right is a smaller one. The one on my right is probably the one that will work well for our winter fat, at least as a starter, to scalp off the large materials that are in the seed.

[Scene of RK in another indoor location]

RK: here's the screen we selected, based on experience and looking at the size seed and the size trash. We could have tested several, but we'll just give this one a quick try. [Displays a tub containing seeds] Here's the seed and trash that came out of the machine. We'll just pour it all on top of the screen, tap it and shake it to get the seed where it'll vibrate down through the screen, reach the screen. Work it with our hand a little bit. This is the most accurate way of screening because you can present the seed on the screen in so many different angles and directions. And that's what really needed to get an effective screening, so that chance alone doesn't determine whether or not it gets through. Provide a lot of opportunities for the seeds to work their way down. And we'll inspect it visually here to make sure we don't have trapped seed. Trashy, chaffy, flushed seed like this is hard to flow sometimes, and it's necessary. Now this material would actually probably be run on the brush machine a second time because I see a lot of fruits which weren't completely opened up. But if we look at the tray here, now we have a lot of fine trash, and a lot of seeds caught I that fine trash. Probably our next step will be to put this seed through a blower, which will remove this light material and leave the seeds behind.

[Scene of RK next to another piece of equipment]

RK: We all here? We're all here. This is a column blower. It's a batch machine used to separate seeds from trash by air. The weight of the seed in the moving air column is different from the trash can be blown up and collected in these side trays. This over here is a gauge which tells us how much air pressure we're using. We're going to take this winter fat that we had from the other step of screening, brush machine and screening, where it still has a lot of light trash in it. And we'll put it in this machine and I believe we'll be able to blow that light material away. I have to remove the top first.

[Remove top, puts seeds in the bottom, replaces the top.]

Turn on the blower, and gradually introduce air by opening this gate at the top. And we're getting light materials getting blown up and down the side. [Taps the column] Now this material is hanging together a little bit because it's trashy, so we're going to have to tap it just a little bit to get it to break loose from itself. And I still just see light trash. We've got another side gate here we can open and draw seed off a little bit quicker. Some more tapping. Okay, it looks like we're doing pretty good now. The seed is not clumping up any longer. We'll keep watching here that we're just blowing off light trash and not getting seeds coming over. I'm keeping my eye on the gauge a little bit to help me judge how much I'm dropping the pressure.

[Vacuum runs for a few seconds]

RK: I'm going to shut this off temporarily to remove the trash that's in here. Beginning to overload this machine just a little bit.

[Removes trash]

I'll check our material here. Looks like we're getting it pretty clean now. All we've got is big sticks left down there, which probably aren't going to come off too well with air. I'll make a quick inspection here to make sure I haven't lifted seeds. I just see like trash there. Okay, so we'll turn the air back on and finish polishing this off.

[Turns vacuum on again. It runs for several minutes without commentary]

RK: I'll turn it off and make one more inspection. [Turns vacuum off] I believe I have largely larger sticks now and clean seed. [Looks for seeds among trash] There are a few seeds here but they look kind of on the shriveled side. Much smaller than what remains, so they're probably underdeveloped. So here's our final product, which I'll pour into this dish here to get a better look at it. And here it is. Seeds; and now we have long sticks, which we could pick out by hand if we had just a few seeds, but we have a machine or tool that'll help us do this almost in a tenth of a time it'll take to hand pick it. We're going to go to that machine. That machine's called a [indent cylinder].

[Scene changes to another location]

RK: The final step in cleaning this winter fat seed is going to be to take these stems out of it. That doesn't look very complicated; you could pick it out with your fingers, but there's a device called the [indent cylinder]. And this is half of a shell. [Displays it] There's another one that goes around so you have a cylinder that rotates the sees like this. [Displays the movement using the half-cylinder] And what'' going to happen here is the seed'' going to settle into these indents, these dents in this piece of metal. They're going to be like the person who's riding in a boat that sits down. The sticks are going to be like the person who's riding in a boat that stands up. They're going to lose their balance and fall overboard. So as this turns there'll be man overboard, and it's going to be the long sticks. We're going to pour these seeds onto the shell [Does so], and we're going to roll this thing back and forth a little bit [Does so], tap it. The seeds are getting trapped in the shell, and the sticks are running off to the side. So now my sticks are over here. [Points to the pan that the sticks have fallen into] They're here and here and here. We did have a little spill but that shouldn't have occurred. Some of the pockets were overloaded. And we'll put our sticks over here. We'll make another quick little clean there. [Puts the sticks back on the cylinder; shakes cylinder over the tray.] Maybe help it by hand just a tad. So now we have our sticks here in this tray, which we'll transfer to our little [wet one?]. And we've taken our seeds from what looked like insulation, to clean, pure, flowable seed. We can effectively store this now because we've reduced the volume tremendously, and we can plant it easily, quite likely by machine. Those allow us to control bed density, giving the plants all the proper spacing they need to grow, and doing it cost effectively so that we can afford the cost of reforestation and re-vegetating the communities, plant communities, that this plant is part of.

[Scene changes to RK in another part of the lab]

RK: The device we're going to look at here is an aid to doing purity testing, and purity testing is very important for several reasons. I have an [assembled?] sample of seed here. It could possibly have been one that came in from a nursery, although it's got extra trash in it for demonstration purpsoes. Make it easy to see things. Purity testing is important because it tells how much is good seed in a pound of seed; and trash gets in this, so you want to know how much, when you buy a pound of seed you want to know how much seed you're actualy buying. It's also very important for determining things like the number of weed seeds that might be in a sample. We all hear about invasive weeds which are pretty important, and this seed analysis is very important to see if any of those seeds may by chance have gotten into our sample, because we don't want to put a difficult weed in our nursery, and we don't want to, if we were sowing these seeds directly in the forest, we wouldn't want to introduce a difficult weed that will cause us problems down the road. What goes on here then is that we pour the seed into this funnel. There's this one feeder here, a laboratory feeder, which pushes the seed down here, and it's a narrow through. It comes down one that's wider. Because when you do the purity [c.d.?] you spread the seeds out and look at all the particles; the seeds, and the trash pieces, and what other seeds might be there. And that, believe it or not, takes a while to scatter by hand. This machine—we'll bring it down here—will scatter it automatically for you so the seed analysts can focus on picking out the trash and doing the analysis, rather than scattering seeds. So we'll just go through it here quickly to show you how it works.

[Pours the seeds and trash into the funnel]

We use these forceps—usually a very fine-tipped one—it'll get hold of fine pieces of trash like this little guy here.

[Camera focuses on close-up of seeds coming out into the narrow funnel]

And down here I see another seed. In fact I see several other seeds. {Picks them out with forceps] If we have a lot of trash we have to stop and... [Continues picking] Big seed; a piece of needle. And so forth, on down through the whole sample, till we've run it all out. And we've saved a considerable amount of time. Half to a third of the time than if we had to scatter it by hand. Little things, when you're doing tedious work, can add up to a big amount.

[Scene changes to RK in a different part of the lab.]

RK: What we have here is a specific gravity table. It's often used to finish seed, to do special things with seed after you've really cleaned it up and it looks pretty good. It's good for digging heavy objects out of seeds, like stones or metal that's fallen in. It's hard to imagine how that might get there, but in the processing of collecting of seeds things happen. That's the best way to say it. It's also very good to do very fine seperations of density between seeds to get insect damaged seeds out or seeds that aren't quite formed right. We've been able to really get high germinations from this machine with many different species that were not possible with anything else. What we're going to demonstrate here is just how it operates, and we're going to take some stones out of this pine seed. The table will be shaking; the seed will be doing a nice little dance across this table, or we call it a deck. We control... There's air blows up through the stack and gets the seed to float a little bit, and heavier objects stay in contact with the deck, and they get pushed up the hill by the shake. So contrary to what you think, that heavier things would maybe be on the bottom, heavier things are going to go up the hill in this way, and the lighter things will come down the hill. So I'm going to turn that one. You won't hear me talking 'cause it's going to make some noise, and we'll just be running it briefly. The seeds are going to pour down here, and I'll bring the machine up to get these stones out, and they're all going to come up here and [we'll call it the rock pile].

[Turns the machine on. Camera shows the stones coming out.]

RK: I ran the air in there a little bit to slide the seeds off of the stones, and you can see up here we had quite a collection of stones. Some of these stones, like this one, look a lot like this seed. The stone is in my left hand, and the seed is in my right hand here. [Drops seed] Whoops. Let me lay them side by side. The stone is here; the seed is there. You have to look carefully to make the distinction with your eye. The machine makes the distinction very quickly. This machine is made by several different companies in different sizes. This one is [predictably] set up on a dolly with wheels. We can pick it up with a forklift and take it wherever we want to. It's also a widely traveled machine. It's gone to workshops throughout the eastern U.S.

[Scene changes to RK in another part of the lab, next to a piece of machinery.]

RK: We'll just take a look at a couple other little things here. We're not going to demonstrate them because of the time limitation. We've already shown most of the principals, but there are some other variations of how to clean seeds. This machine here is called an aspirator. It's different from the blower in that instead of pushing air up it pulls it up. It aspirates rather than blows it up. There's a fan here that draws air up through this column and down into a cyclone area, and material will collect here. Heavier materials fall on down. And you can adjust how much vacuum you're drawing by adjusting this air gate. This machine here is called an incline draper. It separates things on the ability of the seeds to roll. This belt goes this way, pulling material uphill that will lay flat on the belt. Things that are round, or really slippery, will continue on down the belt and fall off here, and we feed the seed off of this little feeder right here. We can adjust the tilt of this machine as well as the speed of the belt, and that gives us a wide range of adjustments in which to separate seeds.

[RK is shown in front of a different machine.]

RK: Okay. Here's another machine. This separates on a different characteristic: surface texture. It's called the vibratory separator. It's nine inches square, and that's all the bigger it can be made or it won't work properly. It sits on a vibratory feeder motor. It can be adjusted this way or that way for various amounts of gravity pull. There are different kinds of decks that can be put on here of different texture. We have used in it forestry to remove pitch from white pines and from larch. Larch in particular gets a lot of pitch in it. And what happens is, the seeds are slippery and they will slide down the hill, where pitch is tacky and it remains in contact, and it gets pushed up the hill by the vibration. And it slides off the little deck, similar to the gravity table machine that we saw earlier. And we can adjust how much seed we put on here, how much this vibrates, and how it's tilted in the different directions. Plus we have little cut-off gates here where we can make the separations again.

[RK is shown seated at a table]

RK: Okay. We've gone through a number of technical things here at the laboratory; how the seed testing is done. Seen a lot of equipment, several pieces of equipment that are used to clean seeds up; and why we're doing it. Then a large part of what we do there is what's called technology transfer. We do training and troubleshooting, both nationally and internationally, for seed workers and nursery managers. We hold workshops on... A general seed testing workshop. We do workshops on the [tetrazolium?] test And the x-ray. We do quite a few workshops on seed conditioning. The machinery we demonstrated was portable; we can load that into a truck and take it off different places. Other places we go, seed plants are well-equipped and we can just go and use their equipment. We have workshops where we talk about buying and selling seeds; the factors that are involved there. Usually those kind of topics are worked into the other workshops on seed testing or seed conditioning. Another aspect of our laboratory is working with seed testing associations mentioned earlier. The Association of Official Seed Analysts and the International Seed Testing Association. A lot of that work. A lot of that work revolves around developing rules for seed testing. [Holds up a book] This is the rule book for the International Seed Testing Association, 2003. It's a loose-leaf notebook, so that when there's changes made people can just add in the changes. But everything is prescribed on how to do the work. A lot of details have to be learned when you get to it, but... Other kinds of books we've contributed to: this is a handbook on how to do [tetrazolium?] testing. Lab personnel contributed significantly to it. It shows how to cut a seed, how to [pare?] for the testing; and then shows how the stain pattern would be. And our seed analysts have produced several chapters for this book, for the shrubs and trees. Here's yet another one that we did with the Association of Official Seed Analysts on seedling evaluation. What is a normal seedling that we talked about at the germination test. This book helps you evaluate that.

Going back a little bit to technology transfer, a major publication that we've been involved in is this book here, called Seeds of *Woody Plants in the United States*. It was published in 1974 and it's just undergone a major revision and it's now gone on to the final stages of publication. As you can see, most of the copies around are badly worn. [Laughs] It's been used a lot by many people. Translated into quite a few foreign languages. The lab had a major role in redoing the illustrations in this book for the new edition. The staff also helped revise the write-ups on the different genera and in the introductory chapters. We also host a web site and maintain a web site on the raft material. Because it is such a large volume publication procedures took quite a while, and in order to get the information out and the new information out we established a web site, so as new information was written we posted it to the web site. When the final book is done it will be put up on the web site in all its glory.

Also on our web site, we have unique ways now of—unique as compared to the past—of reaching our customers. We have seed test request forms there that they can download and fill out to send in with their seeds, so they no longer have to wait on us to fax them or mail them a form. There are instructions on how to submit the test, which kinds of tests to request. Our contact information is there so that we can easily be found. In all of our current work, when we go to a meeting, give a paper, we bring home our Power Point presentations and post it to our web site. So if people missed the meeting or want to go back over something again that they saw, it's there for them to work with. And any of our publications, current publications, we put up there, as opposed to people writing, asking for the publication where we used to have to mail it out, now we just send them to the web site. We also generate a few compact discs that we can distribute to the public.

So the laboratory has gone through quite an evolution over the last fifty years. Beginning principally as a pine testing laboratory for reforestation in the southeast; taking on a broader range of species, broader and broader; working into non-woody plants even now, because their characteristics and similar in germination, the problems of handling them are similar, we could add a lot of experience to that effort to move into restoration of plant communities with non-tree species. And we reach our customers in a different sort of way. And the future, who knows where that may take us, but we're ready to go; to continue to work in the United States and throughout the world to keep the forests alive and diversified.

END OF INTERVIEW