

seedlings. However, some of the spruce are grown on into 3-0 plants. The beds that remain after digging operations in the spring are root pruned with a large blade that undercuts the bed. We dig our seedlings by a blade attached to a tractor that digs and lifts the entire seed bed in one operation. The seedlings are then removed to a building where they are run over a conveyor belt for grading purposes. The plants that are designated for shipping are then carefully packed by experts who have had many years experience. We have always felt that packing must be done by people that are skilled in this job and realize that even the best quality seedling is of little value to the customer if it arrives in poor condition. In conclusion, we would again like to emphasize the fact that these practices which we follow certainly may not necessarily be the best or fit your particular situation. These practices are ever changing as we put into use new and better ideas in an attempt to most economically produce the type of quality seedlings our customers desire. (Applause)

MODERATOR MEAHL: Thank you very much, Mr. Pinney. We will proceed right along with our next subject, the propagation of spruce by grafting. Our speaker is Mr. John Ravestein, Mentor, Ohio.

Mr. Ravestein presented his paper, "Our Method of Grafting Blue Spruce." (Applause)

OUR METHOD OF GRAFTING BLUE SPRUCE

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The understock used for the grafting of spruce is not grown at our nursery. Norway spruce is purchased from a reliable source as 2 to 3 year old seedlings, preferably once transplanted. You should be certain that the understock is healthy with a fibrous root system. These seedlings can vary in size from 6" to 12". We always plan to have our understock arrive in the spring in plenty of time to allow us to inspect the plants and to trim the roots in order to establish a fibrous root system. We then heel in the plants for a short time in order to induce some new root growth. They are then planted out.

We plan to have the understock grow in our nursery for two years. However, there are exceptions to this, which I will point out later.

We prefer to plant on a sandy soil which is not too rich in nutrients. The ground should be prepared as early as possible in the spring by spreading $\frac{3}{4}$ " to 1" peat over the bed and Rototilling to a depth of approximately 8". We use the peat to get a more fibrous root system, which in our estimation is necessary to make a go of it. At the time of grafting a fibrous root system is absolutely necessary to insure the survival of the understock during the process of establishing a growing graft.

We plant in rows 12 inches apart, spacing our understock $2\frac{1}{2}$ to 3" apart in the row. This spacing may sound very close to you but we

are not interested in top growth as much as we are interested in providing a good root system by the end of the year. I say one year, because at this time we dig the largest and the most suitable plants for grafting. These plants are potted in 2½" clay pots using the following mixture: (1) loam soil (not high in nutrients) (2) coarse, #9 sand, (3) peat. The plants which are left in the fields are root pruned.

The potted plants are then heeled in during the month of May, in well drained beds. No protective covering is used on the sides, although we immediately place shade over them which is not removed until about the end of June. In our climate we have found that our understock will sun-scorch if we have boards along the sides of the bed. The understock remains in the bed until some time along in the beginning of January.

After the stock has been brought in, the roots that are protruding from the pots are cut off with a knife. Also, whenever necessary an occasional branch is removed in order to give a little more room to insert the scion.

We then place the potted plants in the coolest house we have available; preferably one with a temperature of 50 to 55 degrees. If stored in temperatures warmer than 50 to 55 degrees, new root growth starts which is something we do not want at this time. We believe in keeping the understock on the cool side, since we have found, through experience our losses have been higher if a warmer storage temperature is used.

We store them until we find that new root growth has started. You have to be careful not to wait too long because once the tops start growing we think the time to graft them has past. Most of the time they are ready to graft sometime from March 1st to March 15th. This may seem late to some of you propagators, but here in Northern Ohio our winters hang on for quite sometime, even as late as the 10th of April, which occurred last year.

Our scions are obtained from trees owned by a fellow nurseryman who is located near us. These old specimen plants are of the Moerheim variety. We do not cut more scions than we can graft in forty-eight hours. There is quite a bit of controversy concerning the size of the scions that are best for grafting. We originally used small scions, and wound up with a small plant. We then changed to a large scion of reasonable size. We use the simple side graft. We tie the scion to the understock with waxed twine, not waxing the union. Our twine is waxed with light green Rose Bush Wax #410D. The grafts are not generally waxed because we believe the grafts do better without waxing.

The grafted plants are placed in the open bench at a 45 degree angle, with the union facing up. The plunging medium in the bench contains a mixture of medium fine sand, peat, and a little Styrofoam. An even temperature somewhere between 68 and 72 degrees is maintained. After they are placed in the bench we try to keep them moist, using a fine spray of water two or three times a day. If the temperature rises during the day and the ventilators of the greenhouse are opened, we place a sheet of polyethylene film over the grafted plants to make

sure that the plants are not subjected to drying. Under these conditions we know that it is sometimes very difficult to maintain an even temperature in the greenhouse, especially later in the spring.

After about three weeks, the grafted plants are taken out and approximately $\frac{1}{3}$ of the understock is removed. The plants are then replaced in the bench using the following procedure; (1) the plants are placed in the opposite direction, at a 45 degree angle, (2) the plants originally placed on the outside of the case are set in the middle of the bench, while those on the inside are placed on the outside. The plants are then kept in this position until the scions show enough new growth. At this time they are set up straight and another $\frac{1}{3}$ of the understock is removed. The remaining portion of the understock is removed some seven to ten days before placing them in outside beds. These outside beds are located on a well drained sandy loam soil. We also make sure that the bed has sufficient nutrients for plant growth. The grafts are planted 6 to 8" apart and mulched with buckwheat hulls. We have found this material to be a perfect mulch. The hulls seem to reflect the summer heat more than do other types of mulches. Double shades are then placed over the plants for two or three weeks. If we have very hot weather, burlap is also used over these shades for a few days. After two or three weeks one of the shades is removed.

Immediately after planting we place 12" boards on the west side of the bed to protect the tender grafts from drying winds. These are kept in place until the grafts are established.

From this point on the plants are more or less on their own, except for careful irrigating and spraying. We have to admit that our procedure is performed rather late in the season. However, we have had reasonable success with this method and consequently will continue to use it as long as we have satisfactory results. By satisfactory results I mean a reasonable stand.

MODERATOR MEAHL: Thank you, Mr. Ravestein, for that very practical discussion on the grafting of spruce.

Going right on with our program, we are going to take up the topic, "Propagation of Spruce by Cuttings." You will notice from your program that Mr. R. Warren Oliver, Central Experimental Farms, Ottawa, Ontario, Canada, is listed to discuss this subject. I have been informed that Dr. Stuart Nelson has assisted in the preparation of this paper and will also present it here this morning. I call upon Dr. Nelson at this time.

DR. STUART NELSON (Central Experimental Farm, Ottawa, Ontario, Canada): Thank you, Professor Meahl.

The paper presents facts that have been found through research and consequently does not supply answers to all the problems on this complicated subject.

Dr. Nelson presented the paper on "Propagation of Spruce by Cuttings." (Applause)