

during the winter months. We use electric cables to maintain a bottom heat of 70 degrees Fahrenheit and we use a well-drained, coarse sand. We re-use our sand year after year and treat it with mercury prior to placing the cuttings. With all of our cuttings, we dip the bases in a 1:10 dilution of Jiffy Grow for 5 seconds.

In the chart below are the results of 2 years of rooting cuttings. With the Koster spruce and Moerheim spruce we got a very poor percentage of rooting. From our selected Colorado blue spruce, our percentage rootings varied from 2% to 90% with an average of approximately 50%. It may be that we got better rooting on the Colorado spruce because they were grown on our own soil, whereas the Koster spruce and Moerheim spruce were grown on a different nursery with different soil conditions and a different fertilizing program.

Cuttings were taken from January 20 to March 11th and rooted cuttings were dug from June 30th to August 1st and placed in 4" pots in our plastic covered greenhouse for 18 months. They were then put into the open field at 4' x 4' spacing.

	Date Placed	Date Dug	No Placed	No Rooted
Koster Spruce	2/22/66	6/30/66	770	127
Koster Spruce	1/27/67	8/10/67	690	29
Moerheim Spruce	1/26/67	8/10/67	115	21
Selected Blue Spruce	3/11/66	7/1/66	1,635	834
Selected Blue Spruce	1/20/67	8/10/67	6,746	3,478

WALTER KRAUSE: Thank you, Duane. Our next speaker is Ralph Shugert and we are anxious to hear Ralph speak to us on the subject of "Seedling Propagation".

SEEDLING PROPAGATION

RALPH SHUGERT
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Prior to presenting this paper, I would ask your indulgence for a moment, and extend the deep appreciation of myself, and my wife Shirley, for all of the courtesies extended to us during our visit in Fresno. Last December the Eastern Region had their 17th annual meeting in Mobile, Alabama, and the southern hospitality was outstanding. . . certainly the western hospitality during your 9th annual meeting is also heartwarming, and very pleasing. My fervent thanks to all of you.

In discussing such a wide embracing topic as the sexual propagation of woody plants, I have decided to make some general observations, and explain some of the techniques that are employed at Plumfield Nurseries, Fremont, Nebraska. In glancing over our shoulder through the Proceedings of past meetings of the Society, there have been many words pertinent to seedling propagation. One of the very finest reviews of this topic was a paper presented at last year's Eastern Region meeting by Dr. Steve O'Rourke. I quote from his paper: "Propagation by seed has been a matter of concern to members of the International Plant Propagator's Society since its organization in 1951. The sixteen volumes of the Proceedings, 1951 to 1966, contain 27 articles on seeds and seedage. Some of these papers are broadly basic and comprehensive, some quite narrowly specific, while others treat of practical measures to insure economic stands of seedlings. All of the articles, however, have contributed to a broader knowledge and fuller understanding of seed problems and how to overcome them." Now, let us examine specifics, and explore various aspects of seedling plant propagation.

Our technique of growing seedlings, in Nebraska, does not differ much today from previous years. We have been drilling the majority of seed, in either beds or rows. I have a definite affinity for this method over the broadcasting procedures, because of the better control of seed density, and the ease of weeding. I dare say that anyone who has weeded seed beds knows the weeding time is reduced in drilled rows as against broadcast. All of our bed seeding is accomplished with a Planet Junior drill. We are using four of the six drills, giving us a seven inch spacing between rows one and two, and rows three and four. This leaves a fourteen inch spacing between rows two and three. We feel we are better off giving up some valuable bed area for a more efficient row spacing in ultimately producing a uniform seedling. At the present bed spacing each row receives light on at least one side, during the early growth and development of the seedling.

I was fascinated reading the proceedings of your last years meeting, and in particular the papers by Dr. Haddock, Dr. Allen and Jack Doty. In reading Mr. Doty's paper I admire his aggressive herbicide program pertaining to seed beds. I am pleased that he is getting good control with Atrazine and Simazine, with no so called "build-up". I wouldn't have the courage to use those two materials in Nebraska on seed beds or seed rows. I would definitely agree with Jack Doty that herbicides are necessary today in reducing seedling weeding costs, which of course is the highest facet of seedling production costs. The seedling herbicide program at the Plumfield Nurseries, consists of two materials — calcium cyanamid and Dacthal. There aren't too many nurseries using calcium cyanamid today, but we are very pleased with the results. We are applying this material at eighty pounds per one thousand

square feet of bed space. It is extremely important that this material is incorporated into the soil to receive the maximum weed control. To accomplish this we use two applications at one-half rate, harrowing the material into the beds twice. After the beds are treated we then water them lightly, and wait sixty days prior to seeding. We have all the beds treated by August 5th, in order to start seeding the first week in October. For the small amount of spring bed seeding that we do, the beds that were treated in early August are absolutely weed free the middle of April. Now, to combat the wind-blown grass and weed which in past years created horrendous labor costs, we are using three applications of Dacthal during the growing season. The control has been excellent, with just a few of our Nebraska broad blade weeds not being controlled. We are using Dacthal at the rate of twelve (12) pounds per acre. At this point I would like to give a word of caution; it is very important to have true leaves formed on the seedlings prior to application, rather than cotyledons only. The one and only seedling damage I have had using Dacthal was with *Rosa rugosa*, because the seedlings had not yet formed true leaves. The result was mortality.

Another interesting herbicide treatment we tested this past year was the seeding into Treflan treated soil. Strangely enough, when I contacted the manufacturer of this product, they had absolutely no research information on the results of seeding woody ornamentals into Treflan. We measured an exact acre, and applied 1.3 pints of Treflan on August 29, 1967, and the spring seeding terminated on May 20, 1968. Accompanying this paper is a table showing variety, date sown and general observations which will be printed in next year's Proceedings. To give a brief summary we used 19 different species, most of them seeded at one row to the test block. They were not irrigated or cultivated, and all weeding costs were carefully tabulated. At the close of the twelve month period after treatment, there was a total of forty-one man hours of weeding for the acre. It is my guess that if I had cultivated that test acre this year, there would have been no more than twelve to fifteen hours of weeding. Now as to the effect on germination, I feel that this material did effect the stands of *Lonicera tatarica*, *Lonicera maackl f. podocarpa* and *Rosa multiflora*. To enlarge this test we have treated three and eight tenths acres on September 3, 1968, and our fall seeding in this plot will be completed in October. It is my hope that if germination is not retarded, we can seed into Treflan treated seed rows, and follow with two or three spring and summer applications of Dacthal to hopefully close a season with ten man hours of hand labor (weeding) per acre, per growing season. Our labor dollar saving per year, on seed rows weeding would be substantial.

As has been mentioned by perhaps every nurseryman who is discussing seedling propagation, the concern about seed

collection is very apparent. It is sad that the era of the private seed collector is disappearing. To off-set this change, the only answer for the seedling grower today is quite simply to plant their own seed rows. Any of us who have collected seed knows that it is not an inexpensive venture, but in the final analysis the cost of the seed itself is really an inconsequential cost of a seedling crop. Seed rows can be maintained quite economically, and the assurance of having your own source of seed is extremely gratifying. In discussing seed, it is our intent at Plumfield Nurseries to have a full years supply of seed on hand in the seed cooler at all times. We rarely reach one-hundred percent seed supply on the ninety-five species that we seed annually, but we come very close. This same seed cooler room also holds our seed stratification boxes. The paper presented last year at this meeting by Dr. George Allen covered all facets of stratification in a very complete and capable manner. We are using cold stratification with sand as the media. *Cotoneaster*, *Juniper*, *Prunus*, *Tilia* and *Viburnum* are some of the genera that are stratified prior to planting. We also differ from most commercial nurseries in that we use the hot water treatment, rather than acid, for *Cercis*, *Gleditsia* and *Robinia*. Although it takes a bit longer to hot water treat as against acid, I still prefer the former to the latter to modify seed coats which are impermeable to water.

The perplexities and unknowns in seedling production have been with us since primitive man began sowing seed for his food. The phrases such as "delayed germination", "internal dormancy", "double dormant", "secondary dormancy", are confusing and, to say the least, incomprehensible. The experience and practical knowledge of the members of our Society, as recorded in our Proceedings, are providing (and shall continue to do so) valuable information for all of us presently engaged in seedling propagation.

Challenges confront all of us every day, and this is certainly so in the case of the sexual propagation of plants. I made the statement in Newport, Rhode Island, during the 16th annual meeting of the Eastern Region, that nothing gives me a greater exhilaration than to observe seedlings germinating in the spring. I still believe and feel this very strongly. Another new growing year is approaching and "God's in his Heaven, all's right with the world".

WALTER KRAUSE: Thank you very much Ralph. We will have an opportunity to have questions after our next speaker. Our next speaker is Mr. Ralph Pinkus of Dallas, Texas, who will be speaking to us on "Integrating Propagation and Sales".

HERBICIDE TEST PLOT
Plumfield Nurseries
Fremont, Nebraska

Row #	Variety	Seed Source	Crop Year	Date Sown
1	<i>Prunus americana</i>	Edwards	1967	10/2/67
2	<i>Corylus americana</i>	Smith	1966	10/3/67
3	<i>Elaeagnus angustifolia</i>	Moran	1966	10/4/67
4	<i>Prunus tomentosa</i>	Plumfield	1965	10/5/67
5	<i>Prunus besseyi</i>	Plumfield	1965	10/5/67
6	<i>Lonicera tatarica</i>	Moran	1965	10/10/67
7	<i>Prunus spinosa</i>	Plumfield	1965	10/11/67
8	<i>Prunus serotina</i>	Plumfield	1965	10/11/67
9	<i>Lonicera maackii</i> f. <i>podocarpa</i>	Plumfield	1965	10/12/67
10	<i>Prunus hortulana</i>	Hopperton	1967	10/17/67
11	<i>Quercus palustris</i>	Johnson	1967	10/17/67
12	<i>Juglans nigra</i>	local	1967	12/4 /67
13	<i>Fraxinus Pennsylvania</i> var <i>lanceolata</i>	local	1967	12/4 /67
14	<i>Prunus Armeniaca</i> 'Ansu'	Schumaker	1967	12/4 /67
15	<i>Rosa multiflora</i>	Sanwa	1966	4/25/68
16	<i>Caragana arborescens</i>	Fey	1966	4/25/68
17-18	<i>Ulmus americana</i>	local	1965	5/23/68
19-20	<i>Ulmus pumila</i>	Garland	1965	5/23/68
21-22	<i>Gleditsia triacanthos</i> f. <i>inermis</i>	Edwards	1967	6/5 /68

DATA: Test plot treated measured 435 ft. by 100 ft. Rows were seeded four foot on center.

Material used was Treflan, 1.3 pints in fifty (50) gallons of water. Application date was August 31, 1967.

The plot was maintained by one person during the year, with *no* cultivation or irrigation during the growing season.

Total weeding time for the plot was forty-one (41) man hours, from May 1, 1967 to October 1, 1967.

OBSERVATIONS:

There was a poor seed stand in row #7 (*Lonicera maackii* f. *podocarpa*), and row #6 (*Lonicera tatarica*). The first comparison with the check rows took place on May 23, 1968 and it was apparent that germination was retarded. On June 15, 1968, row #15 (*Rosa multiflora*) was checked against the field rows and it too showed germination retardation. All other rows, except those noted above, showed good germination and equal to the check rows in adjacent fields.

If this block had been cultivated, I believe that twelve (12) to fifteen (15) hours of weeding for the growing season would have kept the plot weed free. Strangely enough several rows had the same height and caliper as the check rows which were cultivated and irrigated during the growing season.