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MODERATOR DUGAN: Just to show you the progress that our Society has made, a few years ago the next subject nearly caused a riot. Nobody dared bring it up on the floor. Here it is as part of the printed program. Dr. Reisch is going to speak to us on the use of Anti-dessicants in the establishment of liners.

THE USE OF ANTI-DESICCANTS IN ESTABLISHING LINERS

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Transpiration, or water loss from various plant parts, is a natural process which can, under certain conditions, result in damage to or death of plants. Rapidly transpiring plants often lose water to the extent that leaf cells lose turgor and wilting results. If water loss exceeds absorption beyond the extent of recovery, death from dehydration will eventually occur. Even a moderate loss of turgidity causes premature closure of stomates which interfers with photosynthesis and other metabolic processes. Water loss can become very critical when roots are damaged or removed as in bare-root transplanting, and are not sufficient to compensate for the water lost in transpiration.

The objective of this study was to determine the feasibility of using specific anti-desiccants in reducing water loss and increasing survival of transplanted bare-root plants.

Emerson and Hildreth (2), in 1933, found that corn oil and sulfonated linseed oil reduced transpiration of Austrian Pine seedlings. Thornton (6), in the same year, reported better resuls in transplanting bare-root evergreens when the root systems were treated with paraffin emulsions. In 1935 Chadwick (1) reported that emulsified paraffin and vegetable wax reduced transpiration, and as a result, transplanting of woody plants may be aided. In 1937, Miller et al (5) found that paraffin aided survival of summer transplanted maples, elms, lilacs, and conifer seedlings.

In recent years the anti-desiccants appearing on the market have primarily consisted of latex, plastics, and various types of resins. As with the waxes, paraffins, and oils, much research has centered around increasing survival of transplanted plants.

Working with a vinyl latex, Jones and Richey (4) reduced desiccation during the first two days after setting out tomato plants. Gartner, O'Rourke, and Hammer (3), tested a vinyl latex on transplanting a wide variety of ornamental plants and reported the following: 1) both bare-root and balled and burlapped conifers responded favorably in June and July; 2) survival of most deciduous trees under study was improved; 3) the cessation of growth which normally takes place in most transplanted plants, was often prolonged as a result of treatment.

The complete research project related to winter protection, transplanting, and transpiration rates and this paper covers the latter two aspects.

Transplanting

The materials used in this study were FOLI-GARD and RUTEX, acrylic copolymers formulated by the U.B.S. Chemical Company, Cambridge, Mass., and WILT-PRUF, a vinyl latex formulated by Nursery Specialty Products, Inc., New York, New York. These anti-desiccants were diluted according to the manufacturers instructions and applied with a small hand pump sprayer.

Cotoneaster divaricata was selected as the test plant for the transplanting phase since it has an open, sparse root system which leads to some transplanting difficulty.

The plants were transplanted from nursery rows at the Berryhill Nursery Co., Springfield, Ohio to The Ohio State University nursery at the following times, either bare-root or balled and burlapped, as indicated.

1962

October — bare-root, 24-30 inches in height
November — bare-root, 24-30 inches in height

1963

*June — bare-root, 15-18 inches in height
July — balled and burlapped, 18-24 inches in height

August — balled and burlapped, 24-30 inches in height
October — bare-root, 30-36 inches in height
October — balled and burlapped, 30-36 inches in height
* Winter injury caused reduction in plant height

The Foli-Gard and Wilt-Pruf treatments were applied to both leaf surfaces before digging and the Rutex applied to the roots (where indicated) immediately after digging. Each treatment date included 90 bare-root or 45 balled and burlapped plants. Each anti-desiccant treatment was applied to groups of three plants and replicated five times. Bare-root treatments were as follows:

1. Foli-Gard on foliage
2. Wilt-Pruf on foliage
3. Rutex on roots
4. Foli-Gard on foliage and Rutex on roots
5. Wilt-Pruf on foliage and Rutex on roots
6. Untreated

Since the plants moved balled and burlapped were without exposed roots, only treatments 1, 2, and 6 were used.

Results

Survival varied with both time and treatment and the following observations were made on results from the various transplanting dates.

October 18, 1962 — *Bare-root*

As indicated in Table 1, Foli-Gard and Foli-Gard plus Rutex reduced the extent of branch die-back and the number of branches with dieback.

Those plants treated with Wilt-Pruf and Wilt-Pruf plus Rutex had more dieback than the untreated plants. This could be due to the fact that leaves on these plants remained attached from 7 to 10 days longer which could have resulted in greater water loss.

Table 1. The effect of anti-desiccants on *Cotoneaster divaricata,* 24 to 30 inches in height, transplanted bare-root Oct. 18, 1962.
A. Measurements of the average dieback per plant and the number of branches with dieback on July 31, 1963.

Anti-desiccant	Average die-back per plant in inches	Average number of branches with dieback
Foli-Gard + Rutex	93.8	14.1
Foli-Gard	96.4	15.8
Rutex	181.9	23.6
Untreated	184.9	21.6
Wilt-Pruf	217.0	18.1
Wilt-Pruf + Rutex	220.0	31.2

B. Observations of the general condition of the same plants on June 28, 1964

Anti-desiccant	Condition*			
	Good	Fair	Poor	Dead
Foli-Gard	15	0	0	0
Foli-Gard + Rutex	13	1	0	1
Rutex	10	1	0	4
Untreated	10	0	1	4
Wilt-Pruf + Rutex	10	3	0	2
Wilt-Pruf	8	1	0	6

*The values indicate the relative condition of the plants as follows..
Good — Over 40" in height, vigorous appearance
Fair — 25-40" in height, not as vigorous
Poor — Less than 25" in height, weak in appearance

November 19, 1962 — *Bare-root transplanting*

There was no advantage in the use of anti-desiccants. Rutex alone and Rutex with the other materials caused increased die-back. Eighteen months after treatment all plants appeared to be of equal good quality.

June 7, 1963 — *Bare-root transplanting*

All leaves turned brown after transplanting and plants had considerable dieback; however, on the basis of regrowth. Foli-Gard was superior to other treatments, whereas plants treated with Wilt-Pruf plus Rutex were in poorer condition than the untreated plants. This pattern was still evident 12 months later.

August 28, 1963 — *Bare-root transplanting*

All leaves turned brown and dropped and all plants died to near ground level regardless of treatment. Regrowth the following June, 1964 was approximatetly 50 percent better on all treated plants (excepting Rutex alone) than on those untreated.

October 10, 1963 — *Bare-root transplanting*

All anti-desiccant treatments were beneficial in this planting. Rutex alone was again the least effective.

July 16, 1963 — *Balled and burlapped transplanting*

The plants treated with anti-desiccants were of equal quality to those untreated.

August 28, 1963 — *Balled and burlapped transplanting*

The use of Foli-Gard resulted in plants of superior quality; however, survival was good in both treated and untreated plots.

October 10, 1963 — *Balled and Burlapped transplanting*

Both anti-desiccant treatments were superior to no treatment as indicated in Table 2, below.

Table 2. The effect of anti-desiccants on Cotoneaster divaricata, 30-36 inches in height transplanted balled and burlapped October 10, 1963 Observations of the general condition of the plants were recorded June 28, 1964.

Anti-desiccant	Condition*		
	Good	Fair	Dead
Wilt-Pruf	15	0	0
Foli-Gard	14	0	1
Untreated	5	1	9

*The condition of the plants was judged as follows: Good — Complet eleaf coverage to branch tips Fair — Partial leaf coverage with some die-back of branches

In summary, the success of transplanting Cotoneaster divaricata decreased in the following order.

Bare-root transplanting without anti-desiccants with plant in a leafless condition

Balled and burlapped transplanting with anti-desiccants

Bare-root transplanting with anti-desiccants in autumn, with leaves on the plants

Foli-Gard was more effective than Wilt-Pruf in increasing transplanting survival and there was no advantage with the use of Rutex on the roots.

II. *Effect of Anti-Desiccants on Transpiration*

Plants of *Weigela 'Vaniceck'* and *Euonymus fortunei 'Coloratus'* were used in laboratory research designed to study the effects of Rutex and Foli-Gard on transpiration rate.

The plants were grown in solution and the rate of transpiration measured by use of a potometer, under the following conditions and combination of conditions.

Temperature — 90°F, 70°F, 40°F

Wind Velocity — 0, 5, 13 M.P.H

Foli-Gard and Wilt-Pruf Applications —

Upper, lower, both leaf surfaces

Light intensity and humidity were maintained at constant levels.

Results

1. Foli-Gard reduced water vapor loss an average of 35 percent whereas Wilt-Pruf reduced it an average of 24 percent.
2. Transpiration was reduced 10 percent when anti-desiccants were applied to the upper side of the leaf and by 30 to 40 percent when applied to the lower surface.
3. An increase in wind velocity over the leaf surface from 0 to 13 m.p.h. had no effect on the transpiration rate when Foli-Gard was used, however, the rate increased with increased velocity on plants treated with Wilt-Pruf. Two possible reasons explaining the reduced effectiveness of Wilt-Pruf are that it tended to form droplets resulting in uneven coverage and became brittle and cracked when the leaves moved in the air stream.

4. Anti-desiccant treatment decreased transpiration to a relatively constant level all 3 temperatures.

III. *Effect of Guard Cell Movement on Anti-desiccant Film*

The natural opening and closing of stomates, affects the rate of transpiration and this study was under taken to determine the effect of guard cell movement on anti-desiccant film. *Tradescantia fluminensis variegata* was selected as the test plant since the leaves have few and large stomates which can be readily observed with a microscope.

To obtain an impression of the stomates, a combination of silicone rubber and a catalyst was applied to the leaf, allowed to dry, and then peeled off. An impression was made from this with cellulose acetate and acetone which, upon drying, was clear and could be viewed under a microscope.

Results

Neither Wilt-Pruf or Foli-Gard caused guard cells to close nor did they prevent them from closing.

The anti-desiccant film was affected by the movement of the guard cells in the following manner.

FOLI-GARD

Time after treatment

1 day — Slight cracking in stomatal aperture of some stomates

3 days — Definite opening in stomatal aperture of many stomates

7 days — Same as 3 days with no additional cracking.

WILT-PRUF

1 day — Pronounced cracking of stomatal apera-

3 days — Cracking evident around many guard cells, and some pieces of film missing

7 days — Areas of film missing, considerable cracking evident.

Summary:

Anti-desiccants will improve survival of deciduous plants when moved in full leaf either bare-root or balled and burlapped. In this study no advantage was found with use of anti-desiccants when plants were transplanted in a leafless state.

In laboratory studies Foli-Gard reduced the rate of transpiration to a greater degree than Wilt-Pruf which is probably the reason that Foli-Gard was more effective than Wilt-Pruf in increasing the survival of transplanted Cotoneaster divaricata. This supposition was further substantiated by other research which indicated that Foli-Gard formed a continuous film over the leaf surface for a longer period of time than Wilt-Pruf.

Although not a panacea for transplanting deciduous plants in full leaf, the use of anti-desiccants will aid in re-establishment and improved survival even though the period of effectiveness may exist for only a few days.

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MODERATOR DUGAN: We are now ready for the question period.

ROLAND DEWILDE: I would like ask Dr. Pridham why he stored the elm cuttings in the refrigerator before sticking them?

DR. PRIDHAM: The reason was that we were taking cuttings from over a hundred trees and it was easier to gather and store them and then stick the whole lot in one operation. We kept the cuttings at 35° F. in polyethylene bags for about a month's time. However, I do believe that we did get some benefit from hardening the cuttings during storage and this is procedure used in England by Jobling.

DR. HESS: I would like to ask Mr. Heit if he has used tetrazolium chloride test to determine seed viability and if he would recommend it as a test for ornamental seeds?

MR. HEIT: Yes we have used it in emergency situations but from our experience a normal germination test is more reliable. This is because with weakened or damaged seed you might get false results. However, I know some laboratories, some foresters, and some nurserymen are using it with fairly good results. It is a difficult test to evaluate unless you have had a lot of experience.

PETER VERMEULEN: Dr. Heit, have you had any experience of seed from witchs' brooms?

DR. HEIT: No.

JOHN RAVENSTEIN: I want to ask Henry Homer Chase if the root system on his magnolia develop only on one side or is it all around the stem? Why do you make the cut only on one side?

HENRY H. CHASE: Yes, after transplanting that root system is going to surround the entire stem. It is quick and easy to make the cut only on one side.

JOHN RAVENSTEIN: You said that you cut the plants off in November. In the dormant season you have a plant completely cut off?

HENRY H. CHASE: Yes, there is nothing there except the adventitious buds which will come next spring to produce the forty-five to fifty stems we use.

RALPH SHUGART: I would like to ask Mr. Heit what seed bed density he used for pine?

MR. HEIT: This depends upon how long you are going to leave the seedlings in the bed. If you transplant them after the first year, you can grow up to 100 per square foot. If you are going to grow 2 year seedlings, we cut it down to fifty to sixty per square foot. If you are going to grow three year seedlings, cut the number down to 30 or 40 per square foot.

MR. LOWENFELS: I don't want to start another argument here, but on this anti-desiccant business, Dr. Snyder gave a talk to the Holly Society and between these two talks I don't know whether to use them or not because Dr. Snyder says the materials wore off.

DR. REISCH: It does wear off in about three to seven days.

MR. LOWENFELS: So what is the benefit of using it in the field if it is going to wear off?

DR. REISCH: That's a good question.

WILLIAM FLEMER *III*: I would like to ask Dr. Pridham if he found clonal differences in rooting the different elm cuttings or did they all root relatively uniformly?

DR. PRIDHAM: I think that everybody who plays with elms, runs into a few trees that don't want to root. However, we did get at least twenty percent rooting of all the varieties we took this past summer.

MODERATOR DUGAN: Our next subject is the no tillage method of propagation and production which is just about as controversial as you can get. Many of us had the pleasure of seeing this operation last December and we know that the plants do grow. Today we will have the opportunity to hear how it is done. Hugh Steavenson.

MULCH CULTURE OR "NO-TILLAGE" METHOD OF PROPAGATION AND PRODUCTION

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Forrest Keeling Nursery
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Those of you who have visited our nursery in Northeast Misouri know we are situated in quite hilly terrain overlooking the Mississippi River bottoms. Our primary production over the years has been seedlings, but in the past decade or so our production has included material as large as specimen (caliper) shade trees and container stock. We grow a long list of tree and shrub seedlings as well as a variety of evergreens and other stock; so my comments on mulch or "no-tillage" culture are not restricted to just a few items.