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AUTOMATIC WATERING OF POTTED PLANTS

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The usual surface method of watering potted plants is a time-consuming operation that adds greatly to the cost of production. To save labor, several methods have been devised to water potted plants automatically: (1) automatic injection, (2) constant water level, and (3) copper tube.

Automatic Injections

The automatic-injection method has already been described in Cornell University Agricultural Experiment Station Bulletin 793 and in New York State Flower Growers Bulletin 7. Potted plants are placed on gravel in a water-tight bench (figure 1) and water is injected into the bench to submerge the pots from one-half to one-third at the time of watering. The water remains in the bench until the surface of the soil becomes moist. Then the surplus water is drained to a tank for re-pumping or is drained to the sewer. The plants dry uniformly and all are thoroughly watered at the same time when the driest plants require watering.

All types of potted plants in all sizes of pots have been grown successfully by this method with great savings in labor.

Constant Water Level

To further simplify the watering of potted plants, the constant-water-level method was devised. This method makes use of the principle of capillary movement, the water moving in all directions in the pores of the soil, sand, and pots.

Potted plants are placed on a layer of sand or plunged in sand, in a water-tight bench, with a constant water level 1 inch below the bottom of the pot (figures 2 and 3). Water moves from the water table in the bottom of the bench through the sand, through the walls of the pot, and through the soil in the pot as shown in figure 4. If the pot is plunged in sand, water will also move from the sand directly through the wall of the pot into the soil. As water is taken out of the soil by plant roots, more water moves in by capillarity.

FILLING THE BENCH

The first requirement of the constant-water-level method is a water-tight bench that is level lengthwise. Shallow V or flat-bottom benches are satisfactory. Several types are illustrated in New York State Flower Growers Bulletin 7. Place a water conductor of half-tile, angle iron, or an inverted V of metal or wood, lengthwise in the middle of the bench. Spread pea gravel on the bottom of the bench to a depth of 1 inch at the edge of the bench. Level the surface of the gravel by injecting water and leveling the gravel with the surface of the water. Place the sand on the gravel to the depth desired and level it.

WATER TABLE

The water level is maintained at the junction of the gravel and the sand by a float valve attached to the regular water line, as shown in figure 5. The poultry type of float valve is designed for low pressures and has given some trouble when used with high pressures in greenhouses.

It is best to maintain the water table about 1 inch below the base of the pots. If the water touches the pots, the soil remains so wet that oxygen is excluded and anaerobic conditions result; the roots are killed and growth is unsatisfactory. Root systems of two large geranium plants from 4-inch pots, grown with the water table touching the pot, are shown in figure 6. The roots in the lower half of the pot on the left and right are dead and black. The soil was grayish black and smelled of hydrogen sulfide gas produced by anaerobic soil organisms. The soil in the upper half of the pot is farther from the water and therefore is less moist; the white roots of the plant in the center indicate that conditions were suitable for good growth.

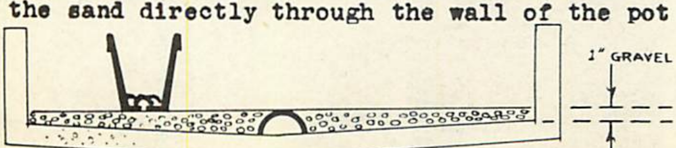

Figure 1. Bottom of bench leveled with gravel for automatic watering by the injection method.

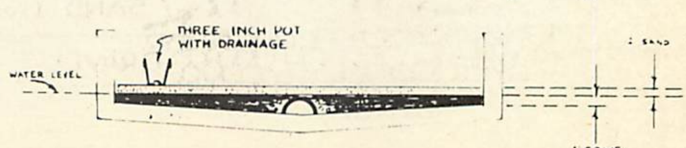

Figure 2. Bench with pot on sand for automatic watering by the constant water-level method.

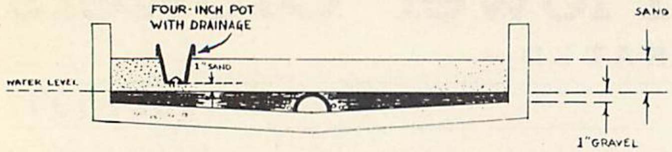

Figure 3. Bench with pot plunged in sand for automatic watering by the constant water-level method.

If the soil remains too wet, the water table may be lowered slightly; the soil will then be drier.

PLUNGING THE POTS

How far the pots should be plunged in the sand varies under different conditions. The amount of water required by the plant and the rate of supply to the plant by capillarity depend on: (1) size of plant, (2) time of year, (3) type of soil, (4) type of pot, (5) type of sand under pot, (6) size of pot, and (7) depth of plunging.

1. Size of plant. Large plants require more water than small plants.

2. Time of year. During the summer when light intensity and temperatures are greater than in winter, transpiration (evaporation of water from the leaves) is greater; therefore, plants require more water in summer than in winter. Similarly, plants grown under shade require less water than plants growing in full sunlight. Water movement by capillarity is slow. Under conditions of rapid drying water may be removed from the soil so fast that capillarity may be broken and thorough watering of the pot will be necessary to re-establish capillarity.

3. Type of soil. Water tends to move by capillarity more rapidly in sandy soils than in heavier clay soils.

4. Type of pot. The pots as sold by different manufacturers vary in hardness and porosity. Water probably moves in and through the walls of some pots more rapidly than through others.

5. Type of sand under pots. Some sands carry water by capillarity more readily than others; a medium fine sand is satisfactory. Other materials, such as Vermiculite, may be as good as or better than sand.

6. Size of pot. Soil increases in dryness in proportion to the distance from the water table; the farther from the table, the dryer the soil. The surface of the soil in a 2 1/4-inch pot would be about 3 1/2 inches from the water level if the base of the pot were 1 inch above the water. The surface of the soil in a 6-inch pot would be about 6 inches above the water and therefore would tend to be drier than the surface soil in a 2 1/4-inch pot.

7. Depth of plunging. When a pot is pressed lightly into the sand, water moves through the bottom of the pot and to some extent up through the walls of the pot into the soil (figure 4). Also, there is exposed a large area of the pot from which water can evaporate to the atmosphere,

In a pot plunged to the rim in sand, water moves up rapidly in the sand and then through the walls of the pot as well as through the bottom to wet the soil and supply water to the plant roots in greater volume than a pot set on the surface of the sand. Likewise, evaporation from the surface of the pot is eliminated.

Experiments under Crops (page 4) show that plants in 3-inch pots or smaller can be watered automatically by pressing the pots about 1/4 inch into sand. The soil was composted silt loam and the water table was 1 inch below the pot. Plants in 4-inch pots or larger must be plunged in sand to the rim, especially 5- or 6-inch pots.

Reports from several growers indicate that under their conditions they have been able to water plants automatically by the constant-water-level method with plants in 5-inch pots set on sand. Other growers have found it necessary to plunge the pots. This difference in results probably is due to some

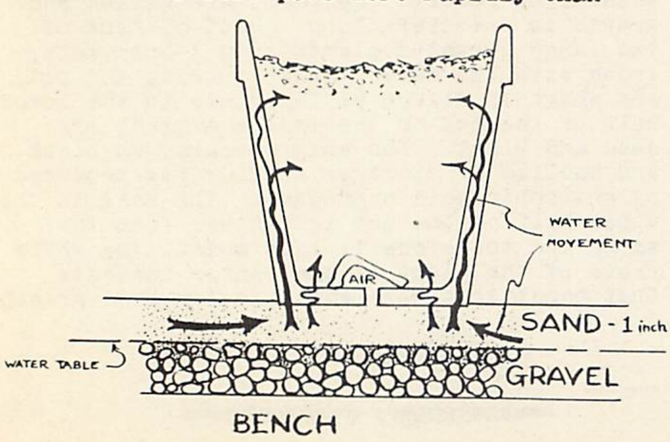

Figure 4. Movement of water by capillarity from the water table to soil in pot.

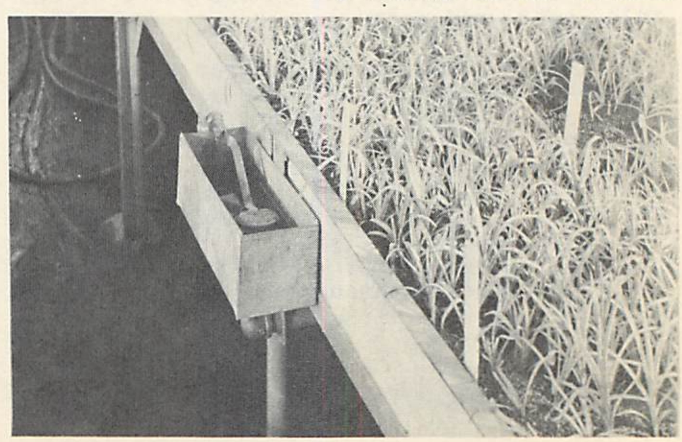

Figure 5. Tank and float valve to maintain constant water level in a water-tight bench.

Figure 6. Root injury (left and right) to geraniums from lack of oxygen.
Left and right: plants grown with water touching the pot. Center: plant grown with water table 1 inch below the pot.

of the conditions previously listed, especially type of soil and type of pot.

The ideal arrangement would be to press the pots about 1/4 inch into the sand to get good contact and to maintain the constant water table 1 inch below the pots. Growers interested in automatic watering should try this arrangement first. If the plants do not get enough water, the pots should be plunged. When plunging the pots, enough water should be injected to flood the sand. The sand becomes "soupy" and easy to move as the pots are put in place.

After the plants are set in an automatically watered bench, the soil should be surface-watered to establish capillarity; then the water table is adjusted.

The surface of the soil of automatically watered plants sometimes appears quite dry even though the rest of the soil ball may be moist. This happens when the supply of water by capillarity is not enough to keep the surface soil moist in addition to filling the moisture requirements of the plant. Remove a few plants from the pots and examine them to see whether or not the entire root ball is moist.

If for any reason the soil becomes dry and capillarity is lost, the pots should be surface-watered heavily or the water table raised, as in the injection system, until the surface soil is moist. The excess water is then drained and the automatic constant water level re-established.

DRAINAGE IN POTS

To get maximum contact of soil and pot for greatest capillary movement of water, drainage may be omitted except for a piece of crock over the drain hole.

A half inch of sand in the bottom of the pot would aid in capillary movement of water for automatic watering and would aid in drainage when the plant is later surface watered by the customer.

FERTILIZATION

Automatically watered pot plants may be fertilized in the same way as surface-watered plants. It is easiest to apply the fertilizers in solution. Dry fertilizers can be applied to the soil and watered in with a surface watering, allowing the excess water to drain from the bench and then re-establishing the constant water level.

Because less fertilizer is leached when pots are automatically watered than when surface-watered, less frequent applications of fertilizer are required.

ROOT DEVELOPMENT

The root development of automatically watered pot plants is as good or better than that of surface-watered plants (figures 9, 12, 17, and table 1).

It was expected that automatically watered plants might root through the drain hole into the sand, but surface-watered geranium plants standing on gravel had more roots through the bottom of the pot than did automatically watered plants. Roots extending through the bottom of the pots are shown in figure 7.

None of the other plants grown by the automatic method rooted very much through the drain hole, and generally less than for surface-watered pots.

If the soil in the upper part of the pot is not moist enough, roots will be concentrated in the lower part of the pot, as shown in figure 12. They will extend through the drain hole where the moisture supply is more satisfactory. Plants with a good moisture supply throughout the entire soil ball do not extend their roots through the drain hole

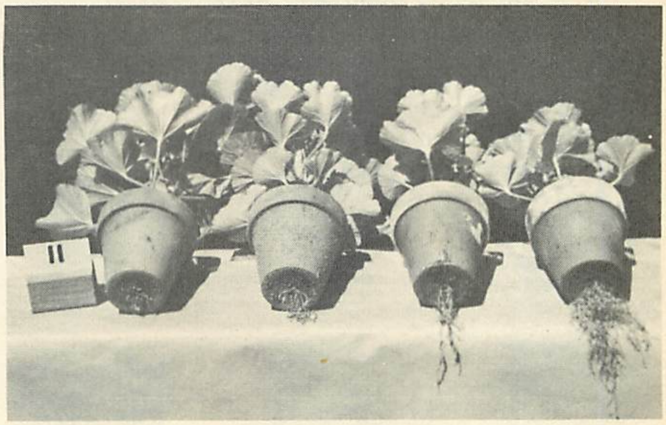

Figure 7. Effect of moisture on root growth through drain hole.
These geranium plants were potted on March 25 and photographed on May 22.
Two plants on left: plunged to rim; water table 1 inch below pot.
Two plants on right: surface watered, standing on gravel.

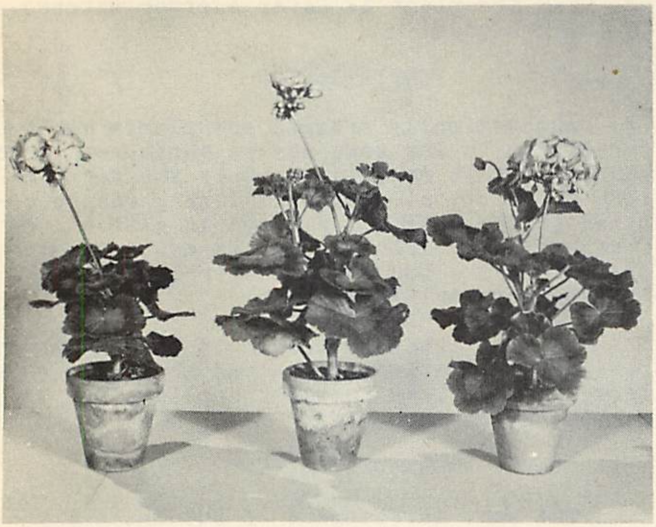

Figure 8. Geranium plants watered by each method, photographed 6 weeks after potting. Left- surface; center, injection; right, constant water level, plunged to rim with water 1 inch below pot.

because the water content of the soil in the pot is satisfactory.

QUALITY OF PLANTS

The quality of the plants was the same whether grown by surface watering, injection watering, or constant water level. The only difference noted so far was that the geranium plants grown by surface watering during November, December, and January tended to be a little more compact than the automatically watered plants.

Automatically watered plants flowered at the same time as those which were surface watered. After being removed to home conditions, plants grown by one method of watering were as good as any other.

CROPS GROWN BY CONSTANT WATER LEVEL

Since April 1946 poinsettias, geraniums,

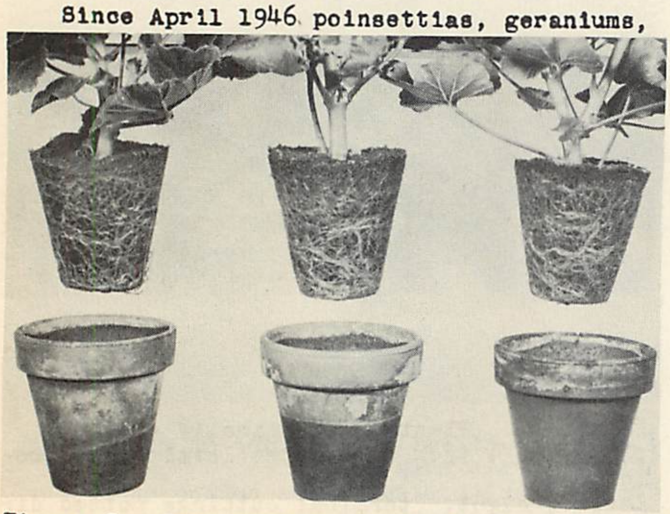

Figure 9. Root system of plants shown in figure 8.
Left, surface watered; center, injection watered; right, constant water level, plunged to rim with water 1 inch below pot.

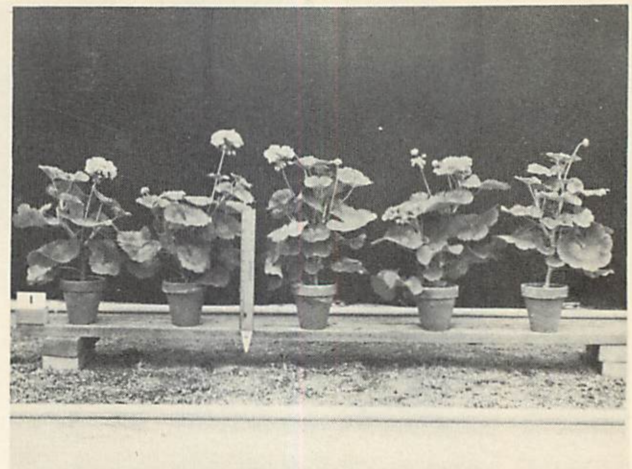

Figure 10. Effect of watering on geraniums grown at 50°F.
Left to right: surface-watered; injection watered; constant water level (three to right): plunged 1 inch with water 1 inch below pot; plunged to rim with water 1 inch below pot; plunged to rim with water touching pot. These plants were potted on November 14, 1946 and photographed on February 20, 1947.

cyclamen, cinerarias, lilies, narcissi, Saintpaulias, azaleas, and hydrangeas have been grown successfully by the automatic constant-water-level method.

Geraniums

Experiment 1.

The first automatic watering of potted plants by constant level was started in early April 1946. Cuttings of the variety Mme. Landry, rooted in constant water level Vermiculite, were potted in 4-inch pots on April 2. The pots were plunged to the rim in sand with the water level 1 inch below the pot. About 50 per cent of the plants were in flower, as in figure 8, six weeks later on May 15 and 90 per cent were in flower on June 2.

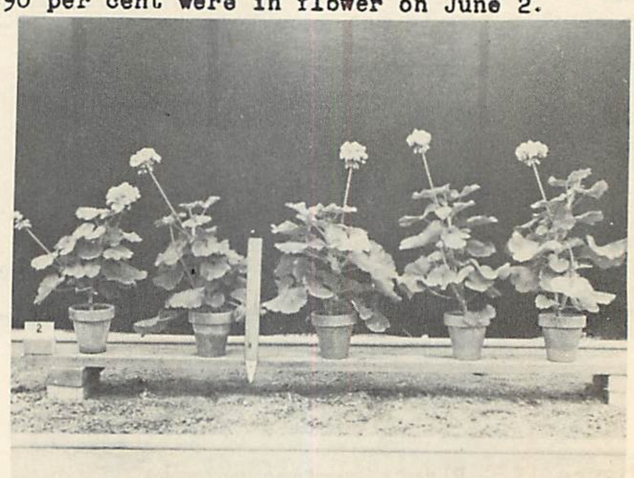

Figure 11. Effect of watering on geraniums grown at 60°F.
Left to right: surface-watered; injection watered; constant level (three to right): plunged 1 inch; plunged 2 inches; plunged to rim. Water table 1 inch below all pots.

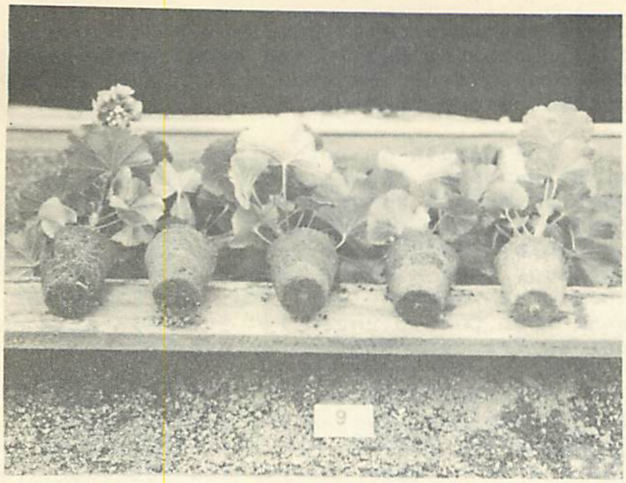

Figure 12. Root systems of plants shown in figure 11.
Left to Right: surface-watered; injection watered; constant water level (three to right); plunged 1 inch; plunged 2 inches; plunged to rim. Water table 1 inch below all pots.

The surface-watered and injection-watered plants flowered as early as the automatically watered plants. The root systems were good in all three methods (figure 9) of watering.

Experiment 2.

Cuttings of Mme. Landry rooted in Vermiculite were potted directly into a composted silt loam in 4-inch pots on November 14. Plants were grown by surface watering and by the injection method. To study the effects of depth of plunging and height of pots above the water table, other plants were grown by the constant-water-level system with 3 depths of plunging of the pots in sand: 1 inch, 2 inches, and up to the rim. For each depth of plunging, plants were grown with the water table 2 inches below the pot, 1 inch below the pot, and touching the base of the pot. Geraniums were grown in each of these 11 treatments in a night temperature of 50° and 60°F.

Figure 13. Plants surface-watered
Left to right: terminal cuttings potted direct on February 28; terminal cuttings rooted and potted on March 25; leaf-bud cuttings potted direct on February 10; leaf-bud cuttings rooted and potted on March 14. Photographed on May 22.

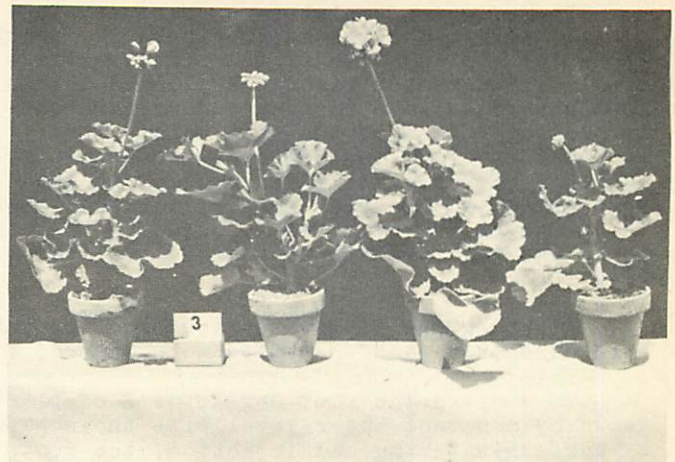

Figure 14. Plants automatically watered, plunged to rim with water level 1 inch below pots.
Left to right: terminal cuttings potted direct on February 28; terminal cuttings rooted and potted on March 25; leaf-bud cuttings potted direct on February 10; leaf bud cuttings rooted and potted on March 14. Photographed on May 22.

All of the plants grown in the 60°F. house were in full flower or with buds showing color by January 20, or 9 weeks after potting. Those in the 50°F. house were in similar condition by February 12, or 13 weeks after potting. Representative plants are shown in figures 10 and 11. There was no difference in size of plants in the various treatments.

Plants in pots plunged 1 or 2 inches with the water table 1 inch below, and all treatments with the water table 2 inches below the pot, required surface watering on January 11 and 25. Plants in the pots plunged to the rim with the water table 1 inch below the pot required no surface watering.

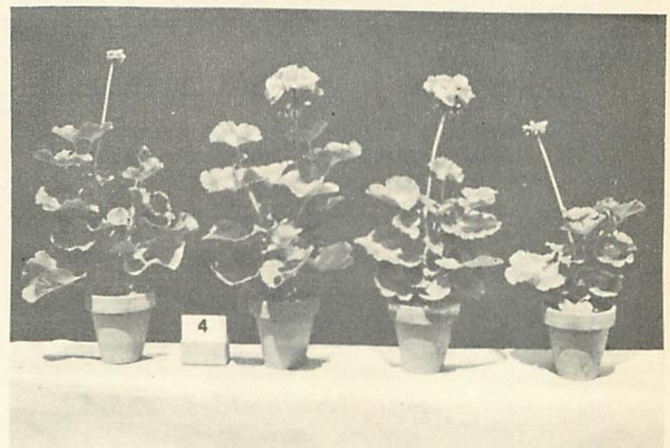

Figure 15. Plants automatically watered, plunged 1/4 inch with water level 1 inch below pots.
Left to right: terminal cuttings potted direct on February 28; terminal cuttings rooted and potted on March 25; leaf-bud cuttings potted direct on February 10; leaf-bud cuttings rooted and potted on March 14. Photographed on May 22.

The effect of moisture on root development is well demonstrated in figure 12, which shows the root systems of the plants in figure 11. The center plant was plunged 1 inch in the sand and the roots are concentrated in the lower inch of the root ball. The fourth plant from the left was plunged 2 inches; the roots are more abundant in the lower than in the upper half of the soil ball. The plant on the right was plunged to the rim; roots are well distributed throughout the soil.

Plants grown with water touching the pot were chlorotic, and the roots were injured.

To compare the root development of plants grown by constant-water-level with those grown by surface-watering and injection, the root systems of six geraniums from each treatment were carefully washed and dried in an oven. The tops also were dried and weighed. There was little difference in weight of the root systems (table 1). Those of the automatically watered plants were slightly larger.

Experiment 3.

Geraniums of the variety Mme. Landry were propagated in February and March and grown with different depths of plunging. With each watering method leaf-bud cuttings were made and potted directly in a silt loam in 4-inch pots on February 14, 1947; at the same time leaf-bud cuttings were stuck in Vermiculite and potted on March 14. Terminal cuttings likewise were potted directly without rooting on February 28; terminal cuttings also were stuck in Vermiculite and potted on March 25.

The plants in all treatments grew well (figures 13, 14 and 15). By May 16, nine weeks after potting rooted cuttings, 90 per cent of the plants from terminal cuttings were in flower and in good salable condition; 85 per cent of the plants from leaf-bud cuttings potted directly without rooting were in full flower by May 20 and were better than the plants from leaf-bud cuttings which were rooted before potting.

The plants in pots plunged to the rim with the water table 1 inch below the pot were given one surface watering on May 4. The plants in pots plunged 1/4 inch with the water table 1 inch below required spot waterings at least once a week. Plants in a soil mixture of 2 parts of silt loam and 1 part of sand with pots plunged 1/4 inch likewise required frequent spot waterings.

With the type of soil and pot used in this experiment during the spring months, plunging the pots to the rim with the water table 1 inch below the pot was necessary for satisfactory automatic watering by constant level.

Cinerarias

Seed of Cremer's and Siter's strains were sown on September 24, 1946, potted in 2-inch pots on October 31, and later shifted to 6-inch pots. Those of Siter's strain were in flower about February 20. Cremer's strain was in flower two weeks later. The quality of all plants was good, except those with water touching the bottom of the pot. These plants were light yellow in color and showed evidence of nitrogen deficiency as a result of root injury. Representative plants are shown in figure 16.

Poinsettias

Rooted cuttings in 2 1/4-inch pots.

Cuttings of the variety Mrs. Paul Ecke rooted with constant water level in Vermiculite were potted on September 17 in 2 1/4-inch pots in a composted silt loam and watered by the methods given in table 2. After the

TABLE 1. Dry Weight of Tops and Root Systems in Grams

Plant number	Surface watering		Injection watering		Constant water level plunged to rim; water 1 inch below pot	
	Tops	Roots	Tops	Roots	Tops	Roots
1	12.4	2.6	10.1	4.2	12.6	3.9
2	10.4	3.5	11.6	3.5	13.6	3.2
3	13.2	3.5	10.0	3.7	12.6	4.1
4	12.2	3.6	11.3	4.1	12.5	3.1
5	11.0	3.2	10.6	3.6	13.4	3.5
6	12.8	2.8	10.0	3.7	12.9	4.6
Average	12.0	3.2	10.6	3.8	12.9	3.7

plants were set in the bench, they were immediately surface watered; no additional surface watering was necessary for plants watered automatically by the constant water level. The root systems were examined, graded, and photographed on October 7. Representative plants are shown in figures 17 and 18.

All of the watering treatments were good except when the water was only 1/2 inch below the pot (table 2); the soil of these pots was too wet for good root growth. Because of the inconvenience of plunging pots in sand, setting the pots on sand with the water table 1 inch below the pots is recommended.

The plants with good root systems were panned in 6-inch pots on October 8 and all were then watered automatically by plunging the pots to the rim with a constant water table 1 inch below the pot. None of these plants required surface watering. All were in good salable condition for Christmas. Representative plants were photographed on December 10 and are shown in figure 18.

Another lot of cuttings stuck in Vermiculite on October 4, was potted in 2 1/4-inch pots on November 7 and watered by the methods given in table 3. The root systems were graded on December 8 (table 3). Both root development and growth with all of the watering treatments were good except when the water touched the bottom of the pot.

Plants in 6-inch pans.

To study the effect of depth of plunging and distance between the bottom of the pot and the water table on the efficiency of watering and on the type of growth, poinsettia cuttings were stuck in Vermiculite on August 16 and on September 18. A month later the rooted cuttings were panned direct from Vermiculite and watered as indicated in figures 19 and 20. All plants were grown at 60°F. N. T.

The effect of size of plants on the water requirement was demonstrated. Surface- and injection-watered plants were watered daily. Plants in pots plunged to the rim and half plunged with the constant water table 1 inch below the pot were watered automatically until early December when those of the August propagation required surface watering once a

Figure 16. Cineraria plants watered by each method.
Left to right: surface-watered; injection watered; constant water level (three to right): plunged 1/2 inch with water level 1 inch below pot; plunged to rim with water level 1 inch below pot; plunged to rim with water touching pot. Photographed on February 20.

week to re-establish capillarity. Plants of the September propagation in these two treatments did not require surface watering. Apparently the larger plants of the earlier propagation had a greater water requirement than did the smaller plants of the September propagation, and under these conditions water could not move fast enough by capillarity to supply the large plants.

Plants of both propagations in pots half plunged with the water table 2 inches below or with the pots on the sand with the water table 1 inch below were not satisfactorily watered automatically and required occasional surface waterings.

The only difference in height of plants as a result of the watering treatments was that the plants setting on sand tended to be somewhat shorter than the surface-watered plants and those in the other automatically watered treatments.

The effect of time of propagation on size of plants is well illustrated in figure 21. The first plant was propagated on October

TABLE 2. Condition of Root Systems, October 7, 1946

Watering Method	Number of Plants		
	Good	Fair	Poor
Surface	11	1	0
Injection	11	1	0
Plunged to rim; water 1 inch below pot	12	0	0
Setting on sand; water 1 inch below pot	12	0	0
Plunged to rim; water 1/2 inch below pot	8	1	3
Plunged 2 inches;water 1/2 inch below pot	8	2	2

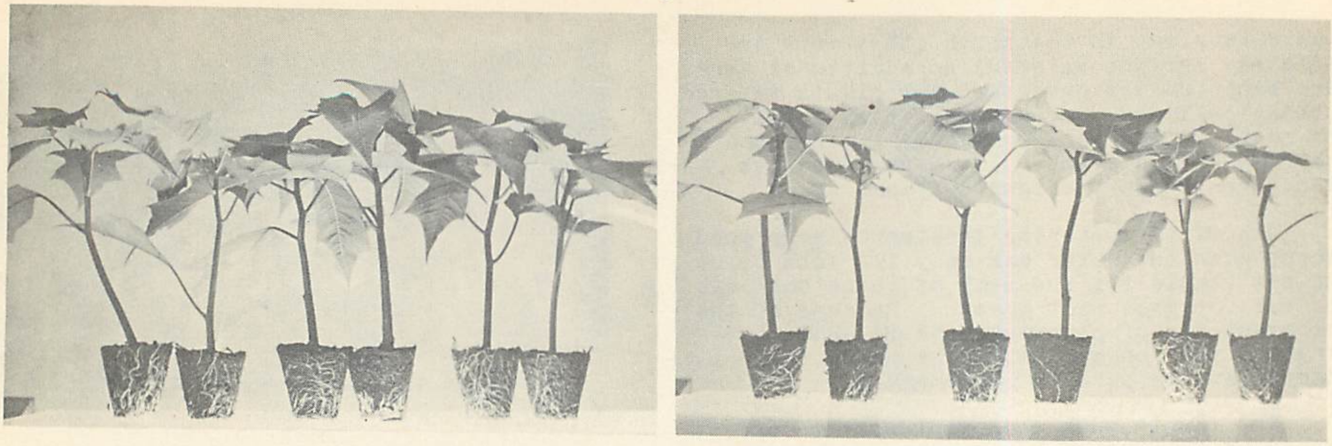

Figure 17. Poinsettia plants (good and fair) by each method.
Left to right: surface watered; injection watered; constant water level, plunged to rim with water level 1 inch below pot; half plunged, water level 1/2 inch below pot; set on sand with water level 1 inch below; plunged to rim with water level 1/2 inch below pot. The cuttings were potted on September 17 and photographed on October 7.

4, potted in 2 1/4-inch pots on November 7, and panned on December 4. The cuttings for the second plant from the left were stuck on September 18, and panned direct on October 18. The third plant from the left was propagated on August 16, potted in 2 1/4-inch pots on September 17 and panned on October 8. The tallest plant was from cuttings taken on August 16 and panned direct on September 17. All of the plants were grown with the pots plunged to the rim, with the constant water table 1 inch below the pot. The size of plant can be reduced by late propagation if good, vigorous cuttings are used. It is not, however, recommended that poinsettia cuttings be taken later than September 15.

SUMMARY

1. Put the water conductor and the gravel in the bottom of a water-tight bench. Level the gravel in water.

2. Put 1 inch of sand on the gravel, level the sand in water.

3. Place the potted plants on the sand, pressing the pots lightly into the sand to get good contact between sand and pot.

4. Give the plants a good surface watering to establish capillarity.

5. Establish a constant water level 1 inch below the bottom of the pot.

6. If the soil remains too wet causing exclusion of oxygen, lower the water table.

7. If the plants are not watered automatically, add more sand and plunge the pots.

8. Do not allow the water table to come in contact with the pot.

9. Automatically watered plants are as good as surface watered plants.

10. Automatic watering of pot plants saves labor.

Copper Tube Method

Because the constant water level and injection methods require a water-tight bench, some growers may wish to use an adaptation of the copper-tube method of watering described in New York State Flower Growers Bulletin No. 17. The bottom of the bench should be covered with roofing paper, Vermiculite, peat moss, gravel, or some other material to prevent the sand from sifting through the cracks. Pots are set on sand or plunged in sand the same as in the constant water level arrange-

cont. on page 12

TABLE 3. Condition of Poinsettia Root Systems, December 8, 1946

Watering Method	Number of Plants Good	Fair	Poor
Surface	34	8	0
Injection	35	7	0
Plunged to rim; water 1 inch below pot	39	3	0
Half plunged; water 1 inch below pot	36	6	0
Setting on sand, water 1 inch below pot	35	7	0
Plunged to rim; water touching pot	30	3	9

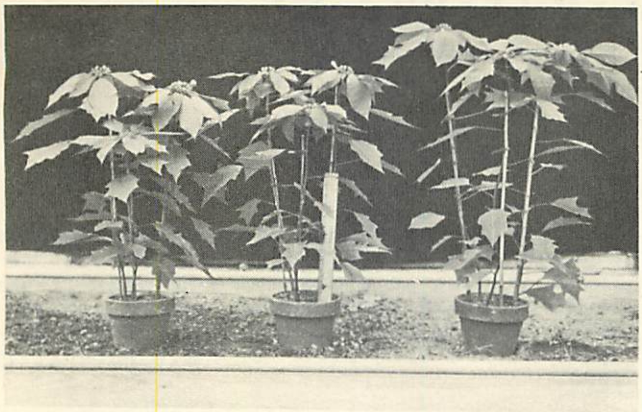


Figure 18. Poinsettia plants grown by automatic watering.
These plants were propagated on August 16, planted in 2 1/4-inch pots on September 17, and shifted to 6-inch pots on October 8. Photographed on December 10.


Figure 19. Poinsettia plants watered by seven methods.
Left to right: surface-watered; injection watered; constant level, plunged to rim with water level 1 inch below pot; plunged to rim with water level 1 inch below pot; plunged 2 inches with water level 2 inches below pot; plunged 2 inches with water level 1 inch below pot; set on sand with water level 1 inch below.
These plants were propagated on August 16 and panned on September 17. Photographed on December 10.

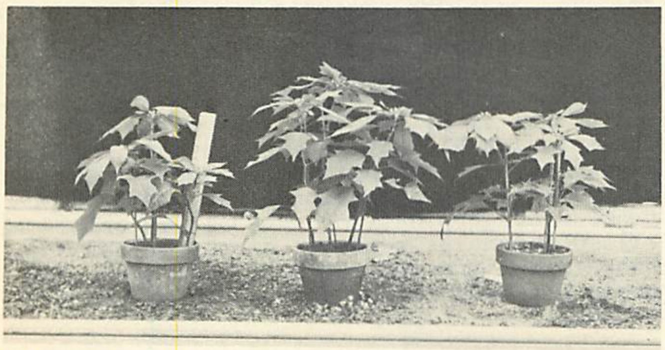


Figure 20. Poinsettia plants watered by seven methods.
Left to right: surface-watered; injection watered; constant level, plunged to rim with water 1 inch below pot; plunged to rim with water level 1 inch below pot; plunged 2 inches with water level 2 inches below pot; plunged 2 inches with water level 1 inch below pot; set on sand with water level 1 inch below.
The plants were propagated on September 18 and panned on October 18. Photographed on December 10.

PAPERS REVIEWED

LILY PRODUCTION FROM SCALES INCREASED BY GROWTH SUBSTANCES
McClellan, W.D. and Stuart, Neil W., pg. 14 and 48, Flor. Ex. and Hort. Trade World, May 24, 1947.

Arasan or Fermate as a fungicide on lily scales during propagation is recommended. Inclusion of very small amounts (0,02%) of the chemical growth-promoting substance, napthalenacetic acid, with the fungicide resulted in the production of more bulblets than when the scales were treated with the fungicide alone or were untreated. Similar results were obtained by treating the scales with talc containing small amounts of some of the growth substances.

Lily scales are treated with the fungicides by shaking them with a small amount of the full-strength dry powder in a sack or keg. No injury has been observed. The scales should not be incubated or stored in a closed chamber following treatment due to toxic volatile products that are formed.

Bulbs treated with fungicides, growth substances and combinations did not show the benefits attained by treatment of scales.

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SURFACE PIPE IRRIGATION
Hasek, Raymond, Ohio Florists Association Bulletin #212, May, 1947; Roses, Inc. Bulletin #114, May, 1947; Canadian Florist, pg. 7, May 20, 1947; Flor. Review, pg. 31, May 22, 1947, and Flor. Exchange and Hort. Trade World, pg. 19, May 24, 1947.

A 3/4 or 1" pipe with Ohio State special nozzles inserted at 12-to 15-inch intervals is laid on the soil midway between the sides and extending the entire length of the bench.

The water from these nozzles is ejected in a fine fan-shaped spray so there is a minimum of washing where the water strikes the soil.

By overlapping the spray from each nozzle, an entire bench up to 5 feet in width can be thoroughly watered.

With a water pressure of 75 pounds, a 100-foot bench is watered in approximately 10 minutes.

Fifty feet of pipe from a water inlet is the most efficient length without serious reduction in the water spread from the nozzles because of reduced water pressure.

The method can be used on either sloping or level benches, and no surface sand layer is necessary for water dissemination. The system is easily removed during replanting operations and easily installed in benches containing growing plants. Little or no compaction of the soil results. Labor is saved. Plant stems and foliage do not cause serious interference with the spread of water; at no time does the water reach heights of over 3 to 4 inches above the soil surface.

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CUT FLOWER STORAGE TEMPERATURE SUMMARY
Whiteman, T. M. Florists Review, pg. 31, June 19, 1947.

One of the chief factors affecting the storage life of cut flowers is temperature. The objective in storing freshly cut flowers is to maintain the original quality so that, after removal from storage, both buds and open flowers will live out their natural life span.

The storage temperatures most desirable for various kinds of flowers lie between 33 and 50 degrees F. Of the 50 flowers tested, a storage temperature of 40 degrees is recommended for 58% of the kinds, 33-35 degrees for 36% of them, and 50 degrees for 6%.

The best storage temperature for mixed flowers is 40 degrees F. Cut flowers for which 45-50 degrees is recommended, when stored at a much lower temperature, may not keep well after removal from storage.

Generally flowers stored at temperatures lower than the optimum will have a shorter life when later used for home decoration.

The length of time that the blooms are to be stored should be considered. With a temperature of 45 to 50 degrees, a week or ten days is too long for the satisfactory keeping of many kinds of flowers, if the longest "afterlife" is sought. A table listing the recommended temperature and approximate length of storage period for about 50 kinds of flowers is given.

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CHEMICAL WEED CONTROL
Krone, Paul R., Flor. Review, pg. 31 and 32. May 8, 1947,

Preliminary results with weed control by using chemical weed killers look promising, particularly for gladiolus growers and possibly for tulip and daffodil producers.

Dow contact herbicide kills all plants that it strikes and was used just before the gladiolus shoots emerged from the soil. Complete kill of all weed foliage was obtained. The material did not injure the soil nor the gladioli which had not yet emerged, but it did not kill weed seeds nor the weeds in the process of germination. Whether it completely killed perennial weeds or merely burned them back to the ground was not determined. Few weeds appeared in the sprayed block until midsummer.

Dow selective weed killer in some instances gave excellent weed control while at other times it was not entirely satisfactory. On some plots no injury to gladiolus foliage was apparent but on others leaves were severely burned. If the spray is applied so it does not hit the tops of the gladiolus foliage, the injury is reduced to a minimum. The selective weed killer was more effective on small weeds (less than 3 inches tall) than on large ones.

Sulphuric acid in 0.5% solution gave erratic results.

Solvisol and Stanisol killed outright a large percentage of gladioli and severely burned the rest.

2, 4-D may have real possibilities as a soil treatment. Although 2, 4-D spray injures gladiolus foliage, no noticeable injury during the first year's growth was produced when used as a soil treatment three or more weeks before planting.

Definite retardation of growth was evident during the early season on plots where the soil was treated with 10 and 20 pounds of 2, 4-D per acre immediately after planting; flowers were normal but the average corm size was decreased.

Corms planted three weeks or more after the application of 2, 4-D grew at the same rate and flowered at the same time as corms grown on untreated soil.

Adequate weed control was obtained on soils receiving the 10-and 20-pound treatments 3 weeks before planting.

Although the soil treatment looks promising, it will not be recommended until corms produced under these conditions have been grown on for a second year. In some instances with other plants, the effects of 2, 4-D have been carried over in the plant with more injury the second year than in the year in which it was applied.

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CONTROLLING PLANT DISEASES PAYS OFF IN FLOWER PRODUCTION

Dimock, A. W. Flor. Rev. pp. 29,30, May 29, 1947 and Flor. Ex. and Hort. Trade World, pp. 17, 36, 53.

The importance of disease-free planting stock, of preventing or avoiding rather than attempting to cure plant diseases, should be emphasized.

This practice results in an actual saving of planting stock, a tremendous saving in the cost of control measures, and a saving of labor by reduction of the roguing, replanting, spraying and culling operations. Disease prevention and control also pay off in the assurance of top quality and top prices.

How may we assure ourselves of disease-free planting stock? Familiarize yourselves with the diseases which may affect the crops you grow. Use disease-resistant varieties wherever possible, such as gladiolus varieties resistant to fusarium yellows, mums resistant to verticillium wilt and strains of asters highly resistant to fusarium diseases.

Buy new planting stock and seeds from reputable firms with a good record for supplying high-quality, disease-free material. Insist on the maximum possible freedom from diseases.

Mosaic and streak, virus diseases of carnations, can be controlled by careful and complete roguing of the cuttings and young plants, coupled with year-around indoor culture. Mother blocks of healthy plants should be established for the production of cuttings.

Bacterial wilt or root rot of carnations kills roots and causes discoloration of the conducting tissues, and yellowing and wilting of the foliage; wilt can be controlled by ruthlessly roguing out all diseased or suspected plants during the growing season and by taking cuttings only from healthy plants. In taking cuttings, they should be broken out, not cut out or pinched out with the finger nails, since this may spread bacteria from the diseased to the healthy cuttings. Place the base of cuttings in a 1:1000 solution of potassium permanganate (1 ounce to 7 1/2 gallons) for ten minutes before sticking in sterilized propagating media. Grow the plants in sterilized soil.

Alternaria blight may be transmitted on carnation cuttings and will build up rapidly in field-grown plants unless thoroughly and repeatedly sprayed. Dip cuttings briefly in a Fermate suspension (2 level tablespoons per gallon) before sticking in the sand and spray the cuttings and young plants several times with the same preparation. Inside culture is advocated. Field-grown plants should be sprayed with Bordeaux mixture, Fermate or Zerlate, plus a good spreader such as DuPont Spreader-Sticker, Penetrol, and Tergitol Penetrant No. 7.

Rhizoctonia foot-rot of stocks can be easily prevented by growing plants, from seed flats on to the growing bench, in sterilized soil. Bacterial blight of stocks may be seed-borne; soak the seed in water at 127-131 degrees F. for 10 minutes and plant in new or sterilized soil.

Black mold disease of roses is generally carried on the understock. As a precaution, thoroughly clean all grafting cases and spray them with 1:50 formaldehyde solution. Treat the understock by immersing in potassium permanganate solution (6 ounces to 10 gallons) for 1 hour, or in formaldehyde (four ounces to 10 gallons) for 2 hours, before any of the grafting operations are carried on.

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Anaerobic Conditions

A grower using the constant water-level method of watering bench crops recently reported trouble when he used water which was being pumped from a swampy area. This water contained a large amount of organic matter; in the bottom of the bench anaerobic organisms "worked" on the organic matter with toxic conditions resulting. A change to a new source of water relatively free of organic matter eliminated the trouble.

Welcome New Members

ACTIVE

Monroe
Mabel W. Sartoris, Webster Floral Co., Webster

Oneida
Kalvin J. Whitton, Hilltop Greenhouses, Caroline & Ney Ave., Utica

ASSOCIATE

California
Kawai Nursery, R.D., Box 1688, Richmond
Woodside Nurseries, 1567 Valota Road, Redwood City

Colorado
Junglewood, Inc., Mt. Morrison

Connecticut
Andrew D. Woodbury, Box No. P.M.B. 5728, Danbury

Illinois
F. C. Schaefer, Schaefer Greenhouses, Box #588, Aurora

Kentucky
J. M. Merritt, 1010 Columbia Bldg., Louisville

Michigan
F. J. Buthker, Muskegon Floral Co., 1411 Pine St., Muskegon

New Jersey
H. W. Ridgway, Innis Speiden Co., Mickleton
Oscar Strauss, Park Ridge Nur. & Ghs., 105 Rivervale Rd., Park Ridge

New York
Northeastern Soil Testing Service, 71 Lenox Rd., Rockville Centre

Pennsylvania
Buennings, Florist, 1900 Lehigh St., Easton
Raymond K. Burkhart, R.D.#5, Lancaster
Kroninger Bros., 119 S. Madison St., Allentown
George E. Perry, Henry A. Dreer, Inc., 1306 Spring Garden St., Philadelphia

Denmark
Oluf Kristensen, Handelsgartneri & Froavl, NY Kastrupgaard, Kastrup

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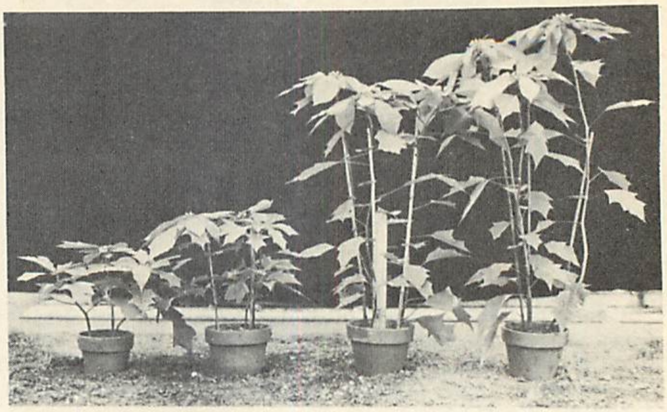

Figure 21. Effect of time of propagation on size of plants grown at 60° night temperatures. Left to right: Propagated on October 4, potted in 2 1/4-inch pots on November 7, panned on December 4; propagated on September 18, panned direct on October 18; propagated on August 16, potted in 2 1/4-inch pots on September 17, panned on October 8; propagated on August 16, panned direct on September 17.

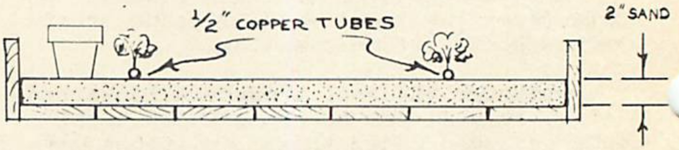

Figure 22. A non-water-tight bench for the copper-tube watering of potted plants.

cont. from pg.8-Automatic Watering

ment but the sand is moistened by use of two lines of copper tube as shown in figure 22. Water is applied until the sand is thoroughly saturated. The frequency of application should be determined by the individual grower under his own conditions. In most greenhouses the water can be turned on at least once each day and allowed to run until drip starts through the bench. During periods of high evaporation, it may be necessary to allow the water to run two or three times each day.

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Appreciation is expressed to Fred Horton and his assistants for their help in conducting these experiments.

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Acting editor,

John G Seeley