Colorado Flower Growers Association

IN COOPERATION WITH COLORADO A & M COLLEGE

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Irrigation of Greenhouse Crops

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As Paul Burgevin so deftly puts it in his current Handbook of Chrysanthemum and Carnation Production, hand watering with a hose is not the best method of watering greenhouse crops but it is often the most enjoyable one. The labor involved in manual irrigation amounts to from 6 to 8 per cent of the cost of production on most crops. An unnoticed reduction in income may also result from poorer quality due to insufficient water or compaction of the soil, and leaching of the nutrients or high soluble salt accumulations due to poor watering habits.

Several watering methods have been advanced over the years. Sub-irrigation, constant water level and others have been tried and found lacking by some commercial growers. Sprinkler systems employing the Ohio State, Skinner and other nozzles have found widespread use on roses and have been used to some extent for watering other crops. The cost incurred through the use of these systems is usually less than the cost of hose watering per year. Ease of operation and freedom from faults which cannot be readily corrected are essential requisites of a satisfactory system. Nozzles which continually clog give uneven distribution of water which eventually forces the grower to resume hand watering.

Two watering systems have stood the test of time at Colorado A & M.

Roses

Sprinklers using the Hopper self-cleaning nozzle arranged similar to the Ohio State system have been in continuous use on roses for five years. The water passes through this nozzle in a spiral, hitting a washer at the outlet. The spinning action of the washer gives a self-cleaning action. An end nozzle on a line occasionally becomes plugged. This is corrected by replacement with a clean one, a small supply of which are kept at hand. Once these nozzles have been removed from the pipe, they are easily put back without a wrench. Water supplied through a tee at the mid-point of a one-inch galvanized pipeline will have sufficient head to supply 40 to 45 nozzles (120 to 135 ft. of pipe) with no appreciable unevenness in water distribution. However, the number of systems which can be turned on simultaneously will depend upon the pump capacity or pressure head at the water main.

This system is readily adapted to crops that will tolerate overhead sprinkling. One grower has used them successfully on young tomato plants for spring sales. Another grower is using a large version of the same nozzle for overhead watering of chrysanthemums during the early stages of the crop. This nozzle may be obtained in sizes which throw circular sprays of from 3 ft. to over 20 ft. in diameter. The distribution of water is remarkably uniform.

For Carnation and Miscellaneous Crops

The Braun system of irrigating carnations has been under test at Colorado A & M since October 1954. It has been in use on a large scale in the Dan R. Braun Greenhouses, Denver, over this same period. This system consists of 180-degree flat spray nozzles 32 inches apart in a flexible plastic pipeline which forms a closed loop around the outside of the bench. The nozzles are arranged as shown in the accompanying diagram to give optimum coverage. An extra nozzle may be necessary at one or both ends of the bench.

Flexible plastic pipe is laid around the bench just inside the side-walls and attached to the water supply by a tee. The pipe should be left on the bench two or three days to straighten out. One quarter inch holes 32 inches apart are then drilled in place. The brass nozzles can be screwed or forced into the pipe without tapping. Gates flexible plastic pipe 75P with an inside diameter of 0.824 and OD of 1.012 has been used on installations to date. Connection of the plastic pipe to 3/4-inch galvanized nipples is facilitated by heating the plastic and stretching it over the nipple.

This flexible plastic pipe with nozzles has been through a regular steam sterilization without apparent detrimental effects. How many steamings it would stand is open to question. The pipe should not be handled or crushed while it is hot. Since plastic pipe has a high expansion rate, provisions should be made to allow it to expand over the ends of benches. Considerable looping of the pipe is noted on a hot day, however this has not presented a problem. As soon as water is turned on the pipe assumes the position it had when drilled. The ease of installation, low cost, and low friction losses make plastic pipe ideal for greenhouse irrigation. Nozzles do not need to be in perfect alignment to do a fine job of watering.

Galvanized pipe is being used instead of plastic by some growers. The higher initial and installation costs should be weighed against the advantages of a permanent system, negligible expansion, and the known ability of pipe to withstand repeated steaming.

Notes on the Braun System and costs presented by Dana Cable of Park-Elitch Company at the recent Colorado Short Course:

Nozzles were adjusted with the first watering so those closest to the source of water were tighter, those at the opposite end most open. They have remained adjusted.

Liquid fertilizers through the line cause some green corrosion but no nozzle stoppage has been noted after six months.

Benches up to 150 feet long are watered from a tee connection at one end. Note: This requires a good pressure head at the main.

Water supply comes from 2-inch main through 1-inch valve reduced to 3/4-inch as it leaves the tee (see diagram).

This system does not require high pressures but it does require an adequate head of water for the length of bench to be watered. More than enough water to satisfy all nozzle openings must be available through the valve.

The initial watering required 20 minutes to soak a bench. Soil has loosened and opened so benches will now drip water in 5 to 7 minutes. Costs for 100-foot bench:

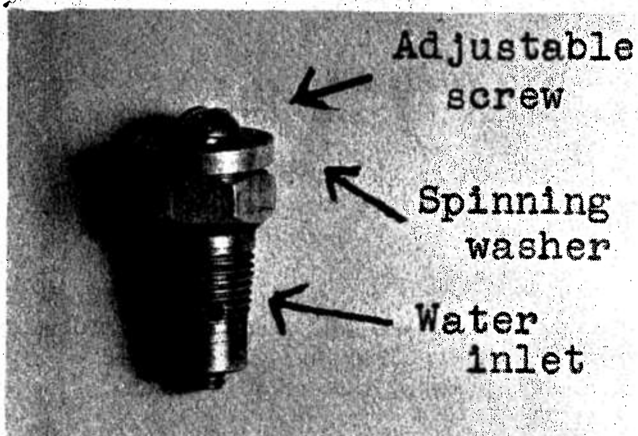
74 nozzles at 18¢	15.32
208 ft. plastic pipe at 11¢	22.88
Valve and galvanized piping including header system	6.00
Labor	9.00
	$ 53.20

Greco Watering System

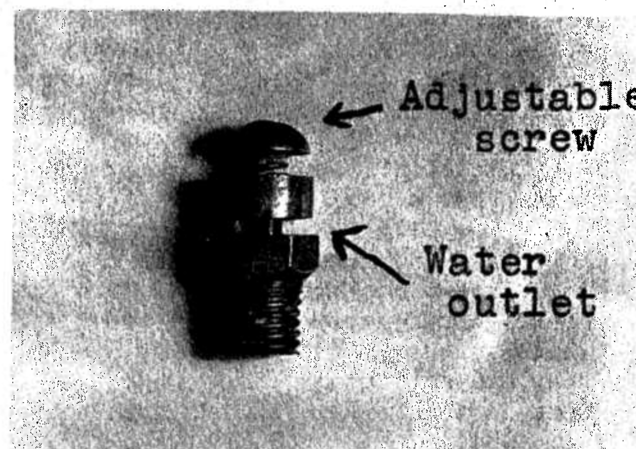
The Greco system applies water through relatively large plastic soaker tubes. It is inexpensive to install and depends largely upon capillary movement for distribution of water. While we have not tested this method as thoroughly as others, we know that it can be made to work satisfactorily. The tubes are available with holes 4 or 8 inches apart, in clear or black plastic. Black plastic with holes at 4-inch spacings seems to be the most satisfactory.

Notes on this system presented at the recent Colorado Short Course by William Leonard, Cherry Creek Greenhouses, Denver:

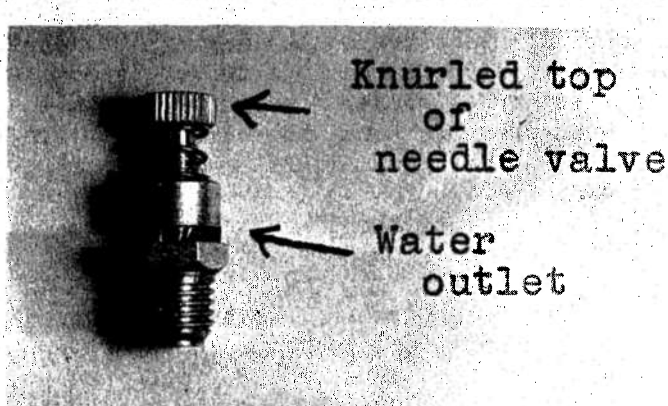
Greco watering is very satisfactory when combined with liquid feeding. Not satisfactory when fertilizer applied dry. Not good if suspended material in the irrigation water.



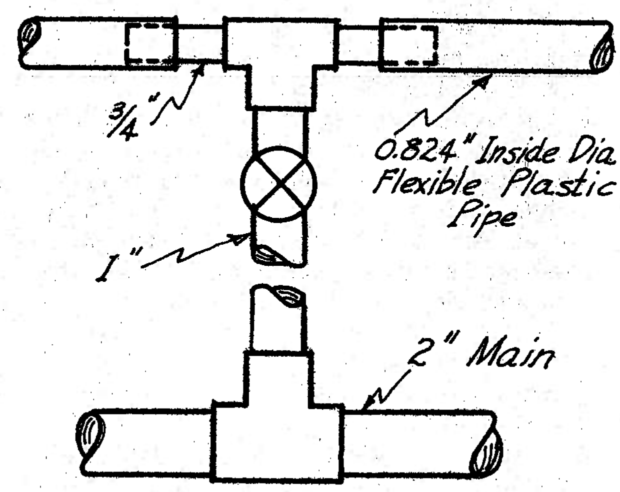
Hopper full-circle nozzle



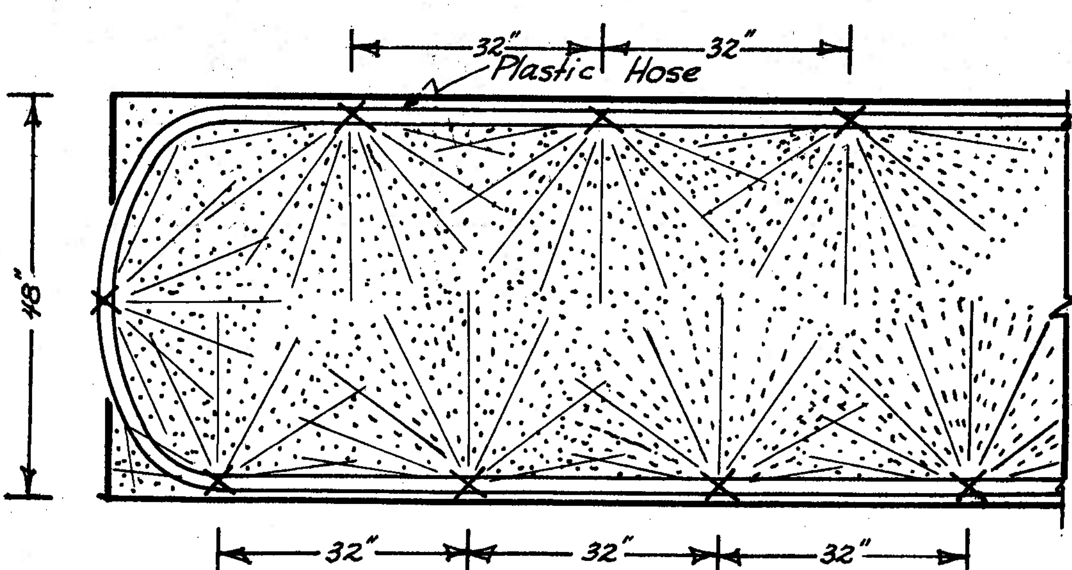
180 degree Hopper Nozzle



180 degree Mogensen Nozzle



SUGGESTED
HEADER ARRANGEMENT



DAN BRAUN SYSTEM
180° Nozzles Staggered for Better Coverage

Occasional plugging of holes is corrected on the bench by 1) raising pressure in tubes, 2) opening ends of tubes and flushing them out. About twice yearly hoses are taken off bench and cleaned.

Growth of algae plugs holes in clear hose. Not a problem in black hose.

Watering time 10 to 20 minutes. With this system they have watered about once weekly during winter, 3 to 4 times each 2 weeks in summer. The thorough soaking they are able to get with Greco hose reduces the frequency of irrigation.

Watering is not even at time of application but capillarity distributes moisture throughout the soil. An occasional hole may be plugged without harming plants.

It is possible to irrigate the entire range of 125 000 square feet in one day.

More thorough watering with this system has improved the quality of their carnations.

This system was installed at a cost of approximately $3500 and, when combined with liquid feeding, has facilitated a decrease in employees from 29 to 16.

Ed. note: The Greco system can be installed for approximately 18 to 20 cents per lineal foot of bench.

Miscellaneous Soaker Hoses

Plastic soaker hoses of several designs have been tested at Colorado A & M during the past year. Most of these hoses have had common faults. Many soaker hoses will appear to distribute water satisfactorily when they are new, however subsequent plugging of the outlet holes or uneven distribution of water due to head loss limits their use in greenhouse irrigation.

Soaker type hoses work best under low pressure. They must be relatively large in diameter to reduce friction losses and to carry adequate water for benches 100 to 150 feet in length. The wall thickness of most plastic hoses is greater than that actually needed. As a result, much higher pressures are required to force water out of the holes. Whenever high pressures are applied the friction losses become proportionately greater, and the unevenness of water distribution becomes more evident. After watering carnations two or three months with a soaker hose which has this uneven pressure head, the plants near the water source become light colored from too much moisture, while those at the opposite end of the line are hard from inadequate soil moisture.

The Gates Rubber Company has cooperated with us in developmental work and in basic investigations of the greenhouse irrigation problem. We hope to incorporate the knowledge gained in an inexpensive soaker hose which will correct the faults of those available at this time.

General Points on Sprinkler Irrigation

1. A much better moisture-air relationship is maintained as the soil is not packed. This permits the soil to be kept wetter without danger of waterlogging.

2. All watering systems depend to some extent upon capillary movement of water for thorough wetting of the soil. Water moves best laterally through moist soil.

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Hopper nozzles are manufactured by Harold Hopper, 1660 Hoyt St., Denver. Mogensen nozzles are made by R. H. Mogensen, 6025 Mountview Blvd., Denver.

Insurance Against Flashing of Sulphur Generators

The volatilization of sulphur by means of small home made generators has proved an excellent means of controlling mildew on greenhouse roses. Quite a few rose growers over the country are now using these inexpensive generators. All agree that mildew disappears for good shortly after the generators are put in use.

The tin can and electric bulb generator was first described by Dr. J. L. Forsberg in 1952. Slight modifications were suggested by your editor in Roses, Inc. Bul.202. We found that 40-watt electric bulbs were much safer to use as a heat source, since the flash point of sulfur is near the temperature obtained from a 60-watt bulb.

During the past three months two generator fires have occurred with 40-watt bulbs. To learn more about this problem we consulted our physicists and electrical engineering staff at Colorado A & M. Two possible causes of these fires were indicated. First, the electrical current is variable. Although rated at 115 volts, it may vary from around 105 to as high as 125 volts in Fort Collins. Similar current variations are common in most localities. Secondly, there is a good possibility that occasional 40-watt bulbs may be nearer 60 watts. It is too much to expect that all 40-watt bulbs are exactly as rated.

The heat given off by an electric bulb changes with the amount of current and the time it burns. Since we burn bulbs continuously in volatilizing sulphur we can disregard time. The formula may be written as follows:

$$\text{Heat (calories)} = .24 \ \frac{(\text{voltage})^2}{\text{resistance}} \times \text{time}$$

The resistance in a hot electric bulb changes so little that we can also disregard this or say that it remains constant. Therefore we have a simple problem in which the heat changes directly with the square of the current voltage. A hypothetical example could be

$$\text{Heat} = .24 \ (115 \text{ volts})^2 = 3174$$

If the line voltage increases to 125 we would get

$$\text{Heat} = .24 \ (125 \text{ volts})^2 = 3750,$$

an increase in heat of 576 or 18 per cent. A bulb which burns 40 watts could stand this surge in current, but a faulty bulb burning 50 or 55 watts might flash the sulphur.

We should be able to eliminate these chance fires by passing the current which feeds the generators through constant voltage transformers. Constant voltage transformers are available which provide output regulation of 115 volts ± 1% even when input variations occur up to ±15%. The total wattage of all bulbs on the line gives the size of transformer required. An additional precaution would be the testing of all bulbs used in sulphur generators and discarding those which vary from 40 watts by more than 10%.

Your editor,

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FIRST CLASS