Colorado Flower Growers Association

IN COOPERATION WITH COLORADO A & M COLLEGE

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Basic Methods of Irrigating Greenhouse Carnations

by Jorge Caparas

Within the last ten years growers have shown considerable interest in time and labor saving watering systems. Hand watering methods are probably still the most widely used, but the high cost of watering incurred through their use and the growing awareness among growers of their undesirable effects on soil structure are forcing more and more growers to consider mechanical means of watering.

The development and adaptation of a number of watering systems to greenhouse use can be attributed to Post and his associates at Cornell University. Automatic watering by means of wicks, injection, constant level, and surface tube methods represent the more notable results of their work. Flat spray systems of bench irrigation were brought to the attention of flower growers by Laurie and his associates at Ohio State University about the same time. Several sprinkler systems which have been developed recently were the results of efforts by enterprising growers and self-employed individuals. There is no doubt that satisfactory greenhouse irrigation systems are evolving.

This study was undertaken to evaluate the relative merits of these various watering systems. Consideration of all the systems in a study extensive enough to obtain fairly reliable results would have involved considerable expense and effort. Fortunately, the mode of water application employed in all greenhouse watering systems and the manner in which excess irrigation water is treated permit the classification of these systems under one of the following basic methods:

1. Surface application of water in free draining benches,

2. Subirrigation of benches with watertight sides and bottoms,

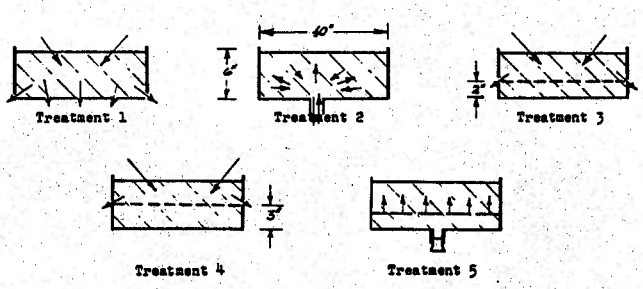
3. Surface application of water on benches capable of storing two inches of free water,

4. Surface application of water on benches capable of storing three inches of free water, and

5. Maintaining free water in watertight benches at a depth of two inches by means of suitable valve and float mechanisms.

Accordingly this investigation was confined to the evaluation of the relative merits of these five basic methods of irrigation, shown diagrammatically in Fig. 1. Each irrigation treatment was replicated four times.

Fig. 1. Schematic diagram of irrigation treatments.



Treatment 1 -- Surface-watered, free draining.
Treatment 2 -- Subirrigated; drainage permitted after soil becomes saturated.
Treatment 3 -- Surface watered; provision made for 2 inches free water storage.
Treatment 4 -- Surface watered; provision made for 3 inches free water storage.
Treatment 5 -- Free water kept at a constant depth of 2 inches by means of a valve and float mechanism. Drainage permitted only when soil is leached.

Vinyl plastic was utilized as an impervious membrane bench lining and a valve and float mechanism was employed to maintain the water level in each of the plots of treatment 5.

Rooted cuttings of White Sim carnations were planted on June 15, 1954. With the exception of the irrigation treatments, all the cultural practices observed in commercial ranges were followed.

Heavy production began on October 3, 1954 and continued until March 13, 1955. The flowers were cut three times a week and were graded on the basis of weight and stem length. The quality index, used as the criterion of quality, was derived by averaging all grades.

A mercury tensiometer was installed in each of the test plots except those in which a constant water level was maintained, and the plots were watered when the tensiometers registered readings of nine to ten inches of mercury. Records were kept on the number of irrigations required during the period June 15, 1954 to April 17, 1955.

Seven keeping trials were conducted during the winter of 1955. Five to seven flowers from each treatment were used per test. The keeping solution used was tap water with 100 ppm chlorine added. The cut carnations were placed in a constant temperature room at 66° F and the mean useful life determined for each sample.

The salt toxicity in the soil was evaluated by measuring the conductances of three 1:5 extracts prepared from soil samples obtained from each plot at approximately three-month intervals.

Results

No evidence was found to show that the five basic methods of irrigation differed significantly in their influence on production and grade of carnations (Table 1). The reduced production from plots watered by the constant level method was not great enough to be significant, when analyzed statistically.

Fig. 2. Relative availability of water. (winter)

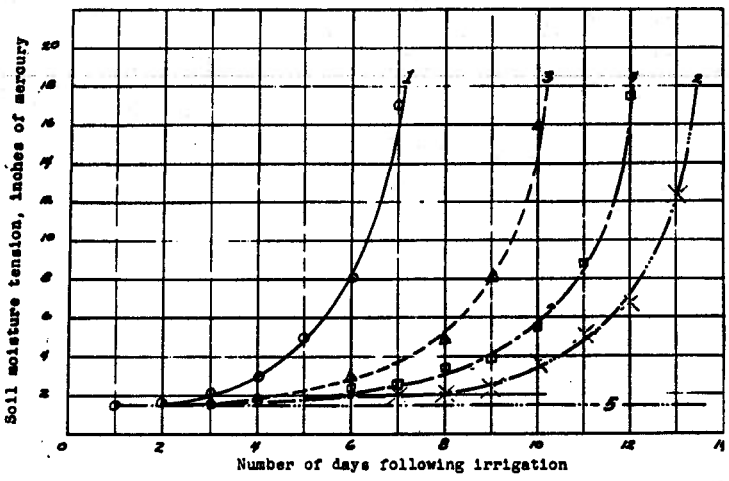
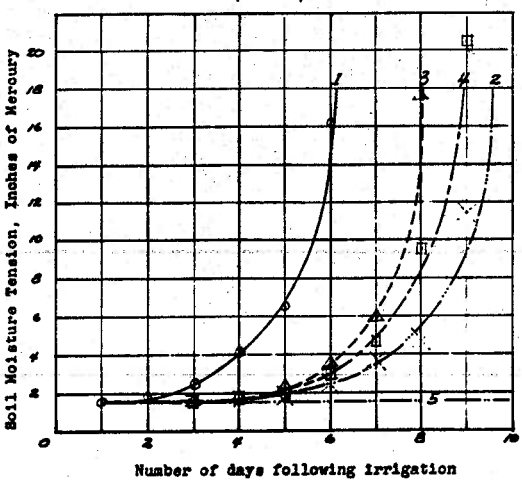


Fig. 3. Relative availability of water. (summer)



The irrigation treatments definitely affected irrigation frequency. Free draining plots required the greatest number of water applications and subirrigated plots the least. Free water supplied temporarily in the soil prolonged the time interval between irrigations by three to five days (Figs. 2 and 3).

Continuous light and temperature records were kept during the time of this investigation. Significant negative correlations between light intensity one day previous to harvest and sugar content were obtained for both the period beginning February 16 and the period beginning June 7. This means that the higher the total light intensity, the lower was the sugar content in flower stems cut the following morning. No correlation was found between sugar content and the sum of light two or three days previous to harvest. The authors feel that light intensity measurements give very good indirect measurements of plant temperatures. On bright days the plant temperature may get so high that less sugar is assimilated.

A highly significant negative correlation was obtained for the period beginning June 7 between the temperature one day previous to harvest and the sugar content of flower stems at harvest. Flowers cut on mornings following hot days had less sugars. There was no correlation between sugar and preharvest temperature for the February 16 period, probably because temperatures were much cooler. Neither was there a correlation between sugar and the sum of temperatures two or three days previous to harvest.

Since sugars play such an important part in the life of cut carnations, we must reevaluate all of our cultural and handling practices in light of their effects on sugar assimilation and use. Quite a lot is known about the general phases of carbohydrate manufacture and use by plants. Much specific information is needed if we are to outline the optimum conditions for sugar assimilation by various plants.

Literature cited

1. Johnson, Gestur. 1955. Unpublished data. Colorado A & M College.

2. Partridge, S. M. 1948. Filter paper partition chromatography of sugars. Biochemistry Journal. 42: 238-248.