Water Loss From Carnations

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On any given day, the water lost by carnations may vary from less than 0.1 to more than 1.2 qt/ft^2/day for short periods. Measurements at the highest rate were obtained in October from carnations planted on July 7, 1967. The accompanying figure shows the relationship between net radiation and water loss, and vapor pressure gradient and water loss.[1] Vapor pressure gradient between the leaf and air was used instead of relative humidity since a plant can still loose water even if the air is at 100% relative humidity. Relative humidity for an air temperature of 70 F is given above the vapor pressure gradient at the bottom of the graph. If the amount of water in the air remains the same, an increase in air temperature will decrease the relative humidity, and a decrease in air temperature will increase humidity.

The plants were grown in Idealite and we assume that water was freely available to the root system. Water loss was determined largely by the conditions of sunlight and relative humidity within the greenhouse. A closer relationship between water loss and vapor pressure gradient than with water loss and net radiation was evident. The relative dryness of the air sometimes caused a higher rate of evaporation than would be expected on the basis of the amount of sunlight available to the plants.

More recent information suggests, that with carnations growing in Idealite, and with a constant nutrient solution, the stress that the carnation is subjected to is directly related to water loss. Provided the plant temperature is the same as the air temperature, control of relative humidity will directly influence stress, and is easier to control than the amount of sunlight. Increasing humidity without regard to plant

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[1]See last page for footnote.

temperature, however, may cause excessive plant temperature without actually reducing evaporation, or result in condensation of water on the plant should it be cooler. But, it appears that we should reduce excessively low humidity conditions that often occur when fans are operating without water in the pads. This condition exists most of the time in spring and fall in Colorado.

Vapor Pressure Gradient and Relative Humidity

Water in the greenhouse is constantly undergoing changes of state, from a liquid to a vapor and back to a liquid. If some liquid is enclosed in a box, evaporation will eventually come to equilibrium with condensation. The water vapor in the air above the liquid will exert a measurable pressure, depending upon temperature, and the relative humidity is 100%. At freezing the vapor pressure is about 5 millibars of 0.075 psi. At 212 F the vapor pressure is 14.7 psi, and at 400 F, the vapor pressure is about 174.2 psi. Relative humidity is the ratio between actual vapor pressure and vapor pressure at saturation at a particular temperature. At 68 F, and a relative humidity of about 65%, the actual vapor pressure is about 14.7 mb or 0.22 psi. At 100% humidity, and 68 F, the vapor pressure would be about 0.34 psi, and 0.22 divided by 0.34 is approximately equal to 65%. As temperature increases, the amount of water air can hold increases. If, however, the amount remains constant, relative humidity will decrease. These relationships are the reasons why expressing the factor in terms of vapor pressure differences between leaf and air is technically correct and more accurate than relative humidity alone. If temperature of the leaf is higher than the surrounding air, and both the air inside the leaf and outside are at 100% relative humidity, the leaf will still loose water since the vapor pressure inside the leaf will be higher.

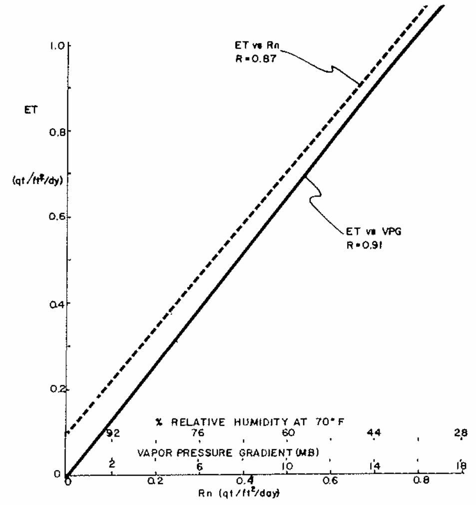

Figure 1. Relationship between et radiation (R) and water loss (ET), and vapor pressure gradient (VPG) and water loss from carnations. The vapor pressure gradient is the difference between vapor pressure of water inside the plant leaf and vapor pressure of water outside the leaf. The percent relative humidity was calculated, assuming that the plant temperature was the same as the air temperature of 70 F.

Riley, J. J. 1968. Physiological response of plants to salinity and humidity. Plant Physiology (Supplement) 43:S-34.

Red kidney beans were grown in solution cultures to which sodium chloride had been added to increase salinity. Essentially, those plants grown in saline solutions at high humidity grew better than plants in equally saline solutions subjected to low humidities.

Note: Initial data from work at CSU indicates that stress in the carnation, grown in inert media, is directly related to the rate of water loss which is in turn directly related to humidity. Research is now underway to study the interaction between salinity and stress. However, it is logical to assume, that where the irrigation water is high in total soluble solts, the humidity in the greenhouse should be kept at a fairly high level without letting water remain on the plants overnight. JJR

Recent and Good

The following are abstracts of papers presented at the 65th Annual Meeting of the American Society for Horticultural Science at University of California, Davis, August 18-21, 1968.

Photoperiod on Chrysanthemum

The effect of long photoperiods on flower development of Chrysanthemum morifolium. Ben-Jaacov, J. and R. W. Langhans, Cornell Univ., Ithaca, N.Y.

Application of long days to chrysanthemum plants, after initial flower induction by short days, was discussed. The effect of the long day treatment is dependent on the time of its application, with regard to the development stage of the flower bud. Early (before florets induction is completed) application of long days causes an increase in the number of florets initiated. Late (after florets induction is completed) application of long days causes the elongation of the florets. This elongation is caused by increased cell division. Ed. Note - This knowledge has application to the practice of interrupted lighting. The response varies somewhat with varieties and possibly with the climate in which the varieties are grown.

Photoperiod on Flower inition and Development in Carnation

Effect of photoperiod on flower initiation, development, leaf formation, and stem elongation of Dianthus caryophyllus. Cheng, Le-Hong, and R. W. Langhans, Cornell Univ., Ithaca, N.Y. Histological sections were made of carnation apexes to study the changes that occurred during flower initiation and development. Increasing the photoperiod hastened flower initiation, but slowed development. Stem elongation and leaf formation studies were made on plants grown under various photoperiods. The longer the photoperiod, during the vegetative state, the greater the stem elongation rate. Photoperiod, however, had no effect on the rate of leaf formation. Photoperiod, also had no effect on stem elongation rate after flower initiation. The rate of stem elongation was very fast after flower initiation.

Lighting Young Carnations

Effect of supplemental light on flowering response of carnation in the greenhouse. Elstrodt, C. J., and J. B. Shanks, Univ. of Maryland, College Park, Maryland. A 2-year study was conducted on 2 varieties of carnation. Plantings were made June 1, July 1, and Aug. 1, and pinched 3 weeks later. Natural photoperiods were compared with 3 incandescent light interruptions of the dark period. Results indicate that additional light produced earlier flowering, more uniform development, and fewer nodes on flowering shoots.

Temperature and Photoperiod on Carnation

Flower initiation of carnations as effected by temperature and photoperiod following pinching. Shanks, J. B., and C. J. Elstrodt, University of Maryland, College Park, Md. Two varieties of carnation received 4 combinations of 55 and 65F temperatures and 8 and 24 hour photoperiods for 2 or 4 weeks before or at weekly intervals following pinching. Node counts indicated that earlier flowering was promoted by long days during the fourth through sixth weeks following pinching. Temperature had no primary effect.

Abscisic Acid on Ornamental Plants

Responses of some ornamental plants to synthetic abscisic acid. Cathey, H. M., USDA Agric. Res. Service, Beltsville, Maryland. Weekly applications of RS-abscisic acid (ABA) to carnation plants grown on long days delayed the flowering as much as those grown on 8-hr days. Plants grown on 8-hr days and treated with ABA initiated and developed flowers 10 to 12 weeks later than those grown on 8 hr days. When ABA treatments were discontinued the plants resumed immediately their normal growth characteristics. ABA applications every other day delayed the flowering of petunia while cornflower was nonresponsive to all dosages tested. The flowering of short-day plants, chrysanthemum and marigold, was unaffected by daily applications of ABA. ABA suppressed the growth of the long-day plants Japanese maple and dogwood grown on long days. The plants formed resting meristems similar to those observed on plants grown on 8-hr days. ABA was not active in promoting leaf abscision of any of the species tested.

Photosynthate Contribution of Growing Rose Shoots

Kohl, H. C. and D. E. Smith, Univ. of Calif., Davis. Using C as a tracer, it was learned that shoots of greenhouse roses are parasitic until very late in their life history. Ed. Note - Only about the last 6 to 8 days the rose is on the plant does it contribute toward the food storage in the plant below the point of rose removal.

A New Growth Substance

The response of several flower crops to foliar sprays of an ethylene producing compound. Shanks, J. B., University of Maryland, College Park. An experimental compound from Amchem Products, Inc. (Amchem 66-329) was reported by Leopold (BioScience 17:22) to produce ethylene in plants when applied as a foliar spray. Applications were made at intervals during the 1967 growing season to hydrangeas, gardenias, and azaleas, and to certain other crops as poinsettias, carnations, chrysanthemums, and snapdragons at more specific stages of growth. A typical effect on all plants has been dwarfing or retarding of growth and in mature plants of promoting leaf abscision. Hydrangeas defoliated in October were dwarfed in growth in the greenhouse following cold storage. Lateral branching was induced in azaleas, particularly when used in conjunction with suboptimal concentrations of fatty acid esters for chemical pinching. Delayed flower formation was noted in chrysanthemums, hydrangeas, and azaleas. Snapdragon was emasculated by an application immediately prior to flowering.

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