impact of pesticides on parasitoid survival. Percent parasitism is greatly affected by the presence or absence of a single parasitoid or leafminer when the total of these 2 groups is low. Thus, no % parasitism is presented in Table 2 when numbers of adult leafminers and parasitoids were less than 5. For this reason, no data are presented for % parasitism of leafminers from plots treated with Dursban at the 4x rate, Vydate when applied alone and applied in combination with Ambush and for Ambush alone.

Eight days after the 6th pesticide application, the highest numbers of mines were found when UC 55248 had been applied. The lowest density of mines occurred in plants treated with Mavrik 2 EC at the 2x and 4x rates, Penncap-M, Vydate, Vydate with Ambush or Ambush alone.

Just as UC 55248 resulted in the largest numbers of mines per chrysanthemum leaf, treatments of this compound resulted in the greatest numbers of adult leafminers developing from leaf samples held in the laboratory. Significantly more leafminer adults developed from leaves treated with UC 55248 at the 1x and 2x rates than developed from leaves to which no pesticides had been applied. The smallest numbers of adult leafminers developed from leaves taken from plots on which Dursban, Mavrik 2 EC or 20 WP, Vendex, Altosid at the 2.5x rate, Penncap-M, Vydate, Vydate with Ambush or Ambush alone were used. However, there was no significant difference between numbers of leafminer adults from plants treated with these pesticides and numbers of adults from plants treated with water alone.

Leafminer increase in response to pesticide use has been documented (1, 2) but the increase has usually been attributed to pesticidal induced reductions of regulating parasitoids. However, not only did UC 55248 result in the greatest numbers of leafminers, but it also was among the group that had the highest % parasitism of leafminers. Thus, it is unlikely that the observed effect of UC 55248 on leafminer can be attributed to the removal of leafminer parasitoids by the chemical.

The lowest rates of leafminer parasitism occurred in chrysanthemums treated with Dursban at the 1x and 2x rates, Mavrik 2 EC at the 2x rate and Penncap-M. The use of these treatments in chrysanthemums, when attempting to establish biological regulation of leafminers, could thus be unwise.

Phytotoxicity. One week after the 6th application of experimental pesticides, plants from only 2 treatments showed phytotoxicity symptoms. Vydate alone and Vydate in combination with Ambush resulted in small necrotic spots on the tips of leaves as was observed in the spring experiment. Charcoal residues from the Altosid treatments accumulated on leaves and in open flowers where this pesticide was used. Overhead watering in commercial operations might eliminate similar accumulations. No phytotoxic effects of any pesticides were found on flowers.

The apparent effects of an experimental treatment on mobile arthropods in small plots, as used in these experiments, sometimes may appear different from effects that would occur if the pesticide were applied throughout a pompon facility. When a pesticide with a short period of effectiveness is applied on small areas, target pests from outside the treated area may immigrate after the pesticide's effectiveness has diminished. Since the proportion of immigrating insects to insects present at the time of application in a large treated area would be much smaller than the proportion in a small treated area, the apparent effectiveness of pesticides applied on the larger area would be greater. Thus, some pesticides evaluated in these experiments may provide better control in commercial use than these data would indicate when considered without other information.

These data have demonstrated the responses to certain pesticides of populations of several arthropods important to chrysanthemum production. With these and other similar data, a chrysanthemum grower may insure the most effective use of pesticides and may be able to avoid pest increases caused by the disruption of natural control organisms.

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A RAPID AND SIMPLE METHOD FOR DETERMINING EVAPOTRANSPIRATION REQUIREMENTS FOR POTTED ORNAMENTAL CROPS[1]

C. D. Stanley and B. K. Harbaugh
University of Florida, IFAS,
Agricultural Research & Education Center,
5007—60th Street East,
Bradenton, FL 33508-9324

Additional index words. *Begonia* x *heimalis* Fotsch., water use prediction, capillary mat.

Abstract. **A method was developed for determining and estimating future water use for potted ornamental plants utilizing a capillary mat system, specifically measured plant parameters, a sensitive balance and a *recording* evaporimeter. Regression analysis was performed on data collected from the experiment's test plant, Rieger elation begonia (Begonia x heimalis Fotsch.), to develop predicting models. The final model included plant foliage height (cm), plant flower height (cm), and evaporative demand (mm) as independent variables to estimate water use. The coefficient of determination (r^2) value for the model was 0.92, alluding to large accountability for the variation by the parameters used in the model. The method used was evaluated as being very effective at generating reliable data in a short period of time.**

[1]Florida Agricultural Experiment Stations Journal Series No. 3418.

The importance of being able to measure water use by crops is well documented (4). This ability, when carried out quickly and efficiently can greatly aid in irrigation management (2). If the ability to estimate past water use and predict future requirements, then water applications may be made to replenish only that which has been used, thus wasting very little water.

Several methods for measuring and predicting evapotranspiration have been developed. Most of the methods have been developed for agronomic field crops. Some methods include water balance methods such as soil water depletion (5) and lysimetry (3). Micrometeorological methods include energy balance equations and empirical methods. Many micrometeorological methods include direct measurements of evapotranspiration by use of lysimeters and then comparing these measurements to concurrent meteorological measurements and developing relationships that are useful in predicting future or estimating past water use.

Because of the special nature of container-grown ornamental plants and the large numbers of plant species that are of potential importance, only limited work has been done on water use estimation for these ornamental crops. Some research (1) has been conducted for several woody and foliage plant species in which methods of estimating water use on a monthly basis were evaluated.

If water use estimates are to be used for practical purposes, then daily water use prediction methods are required. Because of the artificial growing conditions that exist for ornamental potted plants, none of the existing formulas utilizing meteorological parameters really apply to this situation. Methods for estimating water use requirements for ornamental plants must be developed under the actual conditions that the plants are growing and must be specific for plant species and stage of growth.

The objective of this experiment was to develop and evaluate a rapid and simple method of determining water use by ornamental plants and to use these determinations in developing equations to estimate water use based on plant species, plant characteristics and evaporative demand.

Materials and Methods

This study was conducted at the Agricultural Research and Education Center at Bradenton from Mar-May 1981 in a glass greenhouse structure. The method to measure water use was designed utilizing a capillary mat system. Vattex® mat material was used with a twin-wall trickle tubing setup acting as the water supplier to the mat. The mat was watered thoroughly by applying trickle irrigation 3 times/day which kept the mat constantly moist. One plant species (Rieger elation begonia [*Begonia* x *heimalis* Fotsch.]) was chosen as the test plant for evaluation of the system.

'Schwabenland Red' Rieger begonia plants (5 cm tall) were transplanted to standard plastic 15 cm pots. The potting medium was a volume mix of Canadian peat, horticultural grade vermiculite, builder's sand, and perlite in a 5.3:3:1 ratio, respectively. The mix was amended with 3kg/m^3 Osmocote® 14-6.1-11.6 (N-P-K), 6 kg/m^3 dolomite, 3 kg/m^3 hydrated lime and 1.1 kg/m^3 Perk (a minor element mixture). The adjusted pH of the soil mix was 6.5. The plants were placed on the capillary mat and grown for one week prior to the initiation of the study. For each week following this period of time, one set of plants was removed from the mat daily, plant characteristic measurements were made (plant height, plant width, and flower height) and the pot weighed on a sensitive balance (0.1 g). The plants were then placed on a bench spaced on 40 cm centers without an irrigation system for a 24-hr. period. Then the plants were reweighed and placed back on the capillary mat. Each pot was watered manually to reestablish capillary action in the pot. Another set of plants was removed and underwent the same process, thus using the four sets of six replicates for a normal 5-day week. Each plant was allowed to grow on the capillary mat for a 1-week period prior to removal for water use determinations. Evaporative demand was estimated by using a Belfort Evaporation Recorder, Model 6075. This instrument estimated water evaporation from a 250 cm^2 pan on a 24-hr. cycle. The instrument proved to be convenient because of its size and ease of operation.

The data collected were used in a stepwise multiple regression analysis to develop predicting methods for water use. The postulated regression model was:

$$\text{WATER} = f(\text{LFHT, LFWTH, FLHT, EVAP}) \quad [1]$$

where

WATER = total water use (ml),
LFHT = height of plant foliage (cm),
LFWTH = width of plant foliage (cm),
FLHT = height of tallest flower (cm),
EVAP = estimated atmospheric evaporative demand (mm).

Results and Discussion

Observation of the data revealed a large range in total water use due to days of differing evaporative demand and the plants changing in size as the study progressed. The stepwise multiple regression model development for each independent variable included in the postulated model [1] and the respective coefficients of determinations (r^2) are shown in Table 1. In this procedure, each time in independent variable was added to the analysis, significance of that variable was tested and the improvement of the r^2 value was evaluated. The model including LFHT, FLHT, and EVAP as independent variables was found to have the least number of statistically significant independent variables. LFWH was not included because it did not contribute significantly to the model. The model generated was

$$\text{WATER} = -94.3913 + 8.5800\ \text{LFHT} - 1.2418\ \text{FLHT} = 28.8183\ \text{EVAP}. \quad [2]$$

Table 1. Progression of model development for Rieger Begonia.

Independent variables to predict water[z]	Coefficient of determination (r^2)
FLHT	0.21
LFWTH	0.50
EVAP	0.56
LFHT	0.73
FLHT, LFWTH	0.54
FLHT, EVAP	0.65
LFHT, LFWTH	0.78
LFWTH, EVAP	0.80
LFHT, FLHT	0.80
LFHT, EVAP	0.88
LFHT, FLHT, LFWTH	0.82
FLHT, LFWTH, EVAP	0.82
LFHT, LFWTH, EVAP	0.90
LFHT, FLHT, EVAP	0.92
LFHT, FLHT, LFWH, EVAP	0.92

[z]WATER, FLHT, LFWTH, EVAP and LFHT represent water use, flower height, plant foliage width, evaporative demand, and plant foliage height, respectively.

This model had an overall r^2 of 0.92 which indicated that 92% of the variation was accounted for by the independent variables included in the model and, thus, the independent variables in the model adequately described the water use of the plants. Actual vs estimated values of data included in the model are shown in Fig. 1.

The purpose of the capillary mat system was to provide

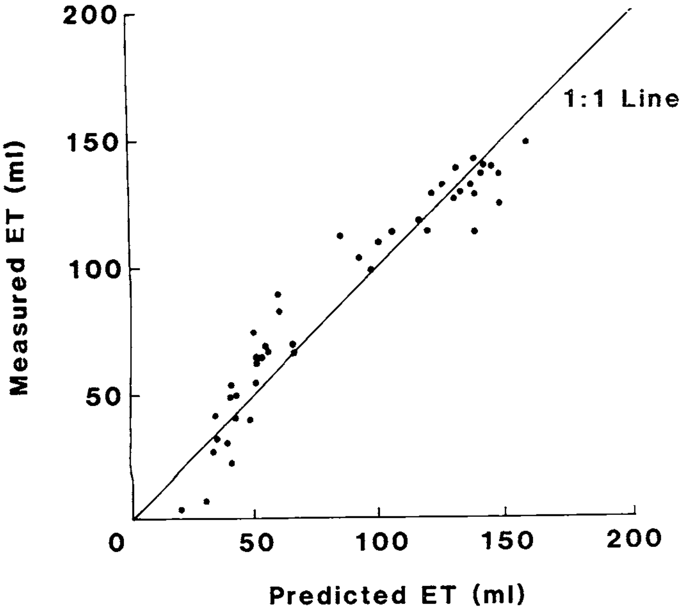

Fig. 1. Measured evapotranspiration (ET) values versus ET values predicted from Eq [2].

optimum soil mix-water conditions to the plants just prior to removal. It was also assumed that enough water was held in the pot to protect against water stress development for the test plant in the 24-hr period that it was removed from the mat. If stress should develop, then visible signs of wilt or increased variation of the data and decreased r^2 values in the models would have occurred. Since this did not occur, it was assumed that no stress developed.

The main advantages of the method are the ease of operation and rapid generation of reliable data. This method will be used to screen several plant species of ornamental crops to categorize them according to water use with relation to size and growing environment. It is hoped that by defining water needs, more efficient irrigation of potted ornamental crops will result.

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TRANSPIRATION IN GROWTH RETARDANT TREATED POINSETTIA, BEAN AND TOMATO[1]

J. E. BARRETT AND T. A. NELL[2]
University of Florida, IFAS,
Ornamental Horticulture Department,
Gainesville, FL 32611

Additional index words. ancymidol, chlormequat, daminozide.

Abstract. **Three weeks after treatment, drenches of chlormequat at 495 mg/15 cm pot and ancymidol at 0.5 mg/pot on poinsettia** (Euphorbia pulcherrima **Wild. cv. Annette Hegg) reduced whole plant transpiration by 12 and 24 percent, respectively. At the same time, foliar sprays of daminozide at 2400 ppm and drenches of chlormequat at 619 mg/pot on bean** (Phaseolus vulgaris **L. cv. Harvester) reduced transpiration by 26 and 23 percent, respectively. These chemicals also reduced stem elongation, stem dry weight, total shoot dry weight, and leaf area. Leaf dry weight was not greatly affected. While reducing total plant water use, the chemicals did not alter transpiration rate as measured by water loss per unit leaf area or unit shoot dry weight. Transpiration in tomato** (Lycopersicon esculentum **Mill. cv. Walters) treated with chlormequat as a foliar spray was reduced during the 24 hours following treatment, but was not affected by chlormequat drench or ancymidol in either spray or drench form.**

The group of growth regulating compounds termed growth retardants have many effects on plants. Treated plants normally have stems with a larger diameter and shorter internodes and leaves which are smaller and darker green (2). These effects are due to reduced cell division (11, 15) and cells in the stems having reduced length and greater radial expansion (5, 13). In leaves the cells are smaller and more compact with less intercellular space (5, 14).

Plants treated with these compounds often display increased resistance to environmental stresses caused by low temperature, air pollution, or drought (2). Transpirational water loss is reduced in treated plants (1, 6, 7, 9, 10). These studies were initiated to determine the effects of various growth retardants on water use in bean, poinsettia and tomato.

Materials and Methods

Beans and poinsettias were grown in 15 cm plastic pots using a peat:sand:perlite (1:1:1) medium. Tomatoes were grown in 10 cm pots in the same medium. Poinsettias were obtained as rooted cuttings from commercial sources, held under noninductive photoperiods throughout the studies, and treated three weeks after potting. Beans were direct seeded and treated when the primary leaves were fully

[1]Florida Agricultural Experiment Station Journal Series No. 3442.
[2]The authors gratefully acknowledge the support provided by Paul Ecke Poinsettias, American Cyanamid Company, Eli Lilly and Company, and Uniroyal, Inc.