SECTION 6
ENGINEERING, ECONOMICS, STRUCTURES AND INNOVATIONS

Dr. Robert E. McNeil, Section Chairman
Dr. Win Dunwell, Moderator

Nursery Crop Information Delivery Using CD-ROM Technology - An Update

R.A. Baumgardner and David M. Price
South Carolina

Two CD-ROM discs containing a great wealth of information pertaining to the nursery crop industry are now available. "The National CD-ROM Sampler: An Extension Reference Library" contains over 75 major collections and handbooks representing 15,000 documents that equal 50,000 pages of information. This information pertains to all areas of agriculture and much of the material deals with Horticulture documented from many different areas of the U.S. The disc was developed through a cooperative agreement by: National Agricultural Library; Extension Service, USDA; Virginia Cooperative Extension Service; Minnesota Extension Service. It is available from Interactive Design & Development, Virginia Tech, Plaza 1, Building D, Blacksburg, VA 24061-0524.

The second disc titled "IFAS CD-ROM DISC 3" is being used at the University of Florida and also contains much helpful data related to nursery crops, etc. in Florida. Several Cooperative Extension Service handbooks and manuals dealing with Florida lawns, weeds, plant selection, etc. are included on this disc. A special feature of this disc is a collection of high resolution digitized plant images that complement several different plant databases. This disc is routinely updated and "IFAS DISC 4" will be released soon and available for purchase. Although designed for Florida, much of the information is generic and equally applicable to other states in the Southeast.

It is suggested that to take full advantage of graphic, audio, printouts, and text search and retrieval speed, that these discs be run with a CD-ROM player attached to an AT- class computer, a super VGA monitor, audio amplifier and speakers, and laserjet printer.

Container Media Moisture Determination with an Electronic Sensor

Juan I. Valiente and Tom H. Yeager
Florida

Nature of Work: The interest given to irrigation efficiency and water use has increased due to economic and environmental reasons. Water conservation strategies have forced growers to implement water savings programs. A current trend to improve the efficiency of irrigation systems is through the use of electronic control systems. Electronic control systems can only be implemented through the use of interfaces and sensors. The cost of computer hardware and conversion equipment is no longer the major limiting factor opposing the development of automatic irrigation systems. Improved sensors probably hold the key of how widely electronics will be used in agriculture. In the ornamental industry the main problems limiting the use of sensors are the interaction of electronic sensors with salt concentrations and loss of contact between sensor and the media. A salt insensitive sensor must be used to avoid changes in calibration due to the application of fertilizer.

Capacitance-based sensors are not as sensitive as resistive type sensors to parameters other than moisture (1). They rely on the fact that water has a much higher dielectric constant (insulating value) than air or dry materials (water 80, dry soil 5). Hence, changes in water content of a porous media are reflected in changes in the dielectric constant of the media. Nevertheless, the relationship between the capacitance probe readout and water content is not linear and is influenced by the type of soil. The purpose of this study was to compare a capacitance sensor response to fertilized and nonfertilized nursery media.

The sensor used in this study was the Aquametrics soil-moisture sensor (7764 Arjons Drive, San Diego, CA 92126-4365). Sensors were connected to a frequency counter according to the specifications provided by the manufacturer. The system used to extract the water from the media consisted of 6" diameter PVC cylinders with porous plates at their bottom. The vacuum system used consisted of a vacuum pump, valves, manometer, water traps, and tygon tubing.

Previous to the experiment, a 2 pine bark-1 Canadian peat-1 sand medium by volume was saturated with water and saline solution (100 ppm nitrogen with NH_4NO_3). Porous plates were saturated by applying a suction greater than the porous plate's bubbling pressure in one end with water in the other. Two PVC cylinders received the salt solution and one cylinder water. Saturated media (6" deep) was placed in the PVC cylinders along with two sensors and ground connectors. Extraction of water from the media was done by applying increments in soil moisture tension with the vacuum system. With each increment, there was a release of water from the bottom of the container followed by water relocation within the container. Water was collected into Erlenmeyer flasks that functioned as water traps. Readings of the sensors were taken after the system reached equilibrium.

Differences in soil moisture content were estimated gravimetrically by weighing each cylinder separately, and volumetrically by measuring the volume of water collected in the water traps.

Results and Discussion: Data given in Figure 1 indicate a similar response with or without 100 ppm nitrogen, even though the magnitude of response differs. As media moisture content initially decreased, frequency readings increased until about 0.2 bar. Previous studies by Harvis (2) and Richards (3) recommend irrigation of ornamental plants when tension levels reach 0.2 and 0.3 bars, respectively, to avoid water stress. A media tension of 0.2 bar in our study corresponded to about 35.9% gravimetric moisture.

Significance to Industry: This study indicates that the response of a capacitance sensor is similar for a media that received 100 ppm nitrogen solution or water; however, the magnitude of response varied with media moisture content. At media moisture tensions of less than 0.2 bar, which is common in soilless media, sensor response varied less than at higher tensions, yet these preliminary observations indicate that fertilization could affect sensor calibration.

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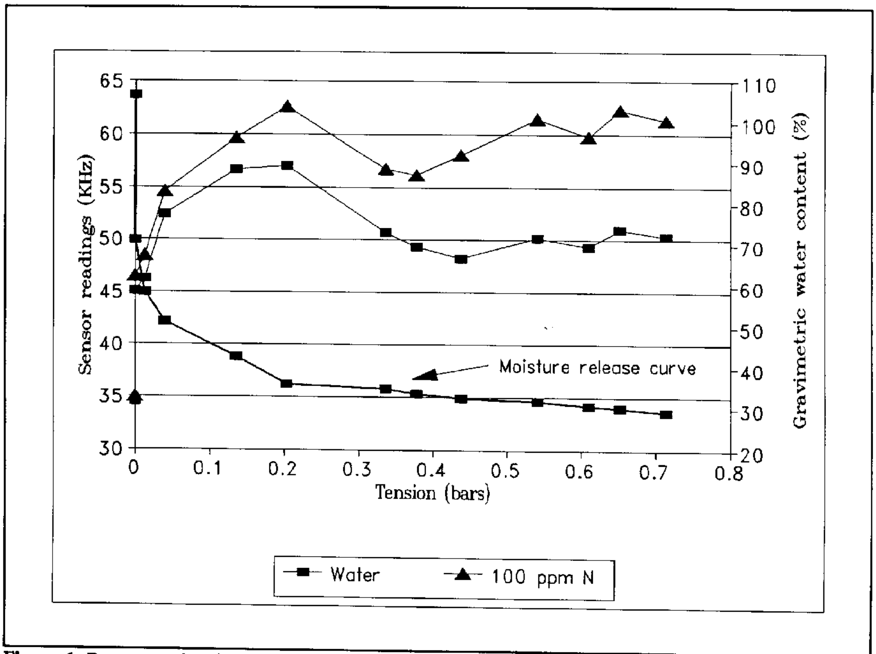

Figure 1. Response of moisture sensors in a 2 pine bark - 1 Canadian peat - 1 sand medium (by volume) initially saturated with water or 100 ppm nitrogen (NH_4NO_3) solution.

Recycling Newspapers as Capillary Irrigation Mats

Kenneth C. Sanderson
Alabama

Nature of Work: Contamination of groundwater with nitrogen and other chemicals become one of the major issues facing ornamental growers (2). A popular irrigation method in the 1970's, capillary mat irrigation, (CMI) may conserve water and reduce possible run-off while trapping chemicals (1,3,4,5,6). Capillary mats are easy to set up and maintain (3) and their costs are low (6). Other advantages of CMI are minimal wetting of foliage, high water vapor pressure around the plant, flexibility of spacing, different pot size and less labor (5). Disadvantages of CMI are excessive water supplied (3,5), ineffective water supplied at low humidities (5), root rot (1,6), algae on mats (1,3) insect infestations in mats (1,3) and high soluble salts (1). Various materials have been used as mats: sand (3,5), felt carpeting natural and synthetic fibers (4,6) and newspaper (1). The purpose of the current research was to compare a newspaper mat with a synthetic fiber mat and overhead-hose irrigation on the growth of potted chrysanthemum in four different media.

Materials and Methods: A flat, greenhouse bench was measured into treatment plots to allow random assignment with two replications of these irrigation methods: overhead hose, synthetic fiber mat and 10 sheets of newspaper mat. A 2 mil black polyethylene sheet was placed under the mat treatments which were automatically irrigated by a solenoid valve controlled by a 24-hr timeclock (operation 9 AM to 4 PM daily). A mist system was modified to deliver the water to the mats. Four rooted cuttings of chrysanthemum Dendranthema x grandiflorum (Ramat.) Kitamura 'Dare' were planted on Dec 21 into 15 cm (6-inch) plastic pots containing these media: Bactolite (Michigan Peat Co., Houston, TX), Fafard No. 2 (Fafard Inc., Anderson, SC), ProGrow PX-2 (ProGrow Inc., Suffolk, VA) and 2 sphagnum peat moss:1 vermiculite:l perlite. Standard commercial procedures for growing potted chrysanthemums were used (8). Plants received the appropriate photoperiod for vegetative growth (Dec. 21-Jan. 2) and for flowering (Jan. 2-flowering). Every two weeks, plants were fertilized with 20-10-20 (20.0N-4.4P-16.6K), Peter's Peatlite (W.R. Grace & Co., Fogelville, PA), liquid fertilizer at the rate of 2.2 per liter (2 lb per 100 gal). When one-third of the flowers on a pot were open, the plant height and area (diameter measured in two directions and multiplied), and flowers per plant were recorded. Plants were also rated for quality on a 1 (poor, unsalable) to 5 (excellent, salable) index.

Results and Discussion: No statistical differences in plant height occurred with irrigation or media treatments (Tables 1 and 2). Plants irrigated with overhead-hose and the fiber mat produced larger plant areas than newspaper irrigated mats (Table 1). Number of flowers per pot and plant quality rating did not differ with irrigation method. Hannings et al. (4) reported increased plant height and flower number with mat irrigation. While Bactolite media appeared to hold the most water and 2 sphagnum peat moss:l vermiculite: 1 perlite held the least water, no differences occurred in the height, area, flower number and rating of the plants grown in the four media.

Significance to Industry: This work indicates that 10 sheets of newspaper can be used as a capillary irrigation mat to successfully grow plants. Comparable plant height and area, flowers per plant and plant quality were obtained with overhead-hose, synthetic fiber mat and newspaper mat. Media did not seem to influence mat irrigation or the growth of the potted chrysanthemums used in this study.

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Table 1. Growth of potted chrysanthemum irrigated by three methods.

	Growth Parameters			
Irrigation Method	Height (cm)[z]	Area (cm^2)[y]	Flowers Per Pot[x]	Rating[w]
Overhead-hose	27a[x]	937b	60a	4.0a
Fiber mat	29a	1139a	68a	3.8a
Newspaper mat	29a	918b	61a	4.4a

[z] English conversion: 2.5 cm = 1 inch.

[y] Area:width of plant measured in 2 directions and multiplied for cm2.

[x] Flowers per pot: each pot contained 4 pinched plants. Divide by 4 to obtain flowers per plant.

[w] Mean separation in columns by Duncan's multiple range test, means followed by same letter are not significantly different at 5% level.

[v] Plant quality rating: 0 = dead; 1 = very poor, unsalable; 2 = poor, some salable; 3 = average, salable; 4 = above average, good plant, salable; 5 = excellent plant, salable.

Table 2. Growth of potted chrysanthemums grown in four media under various irrigation methods.

	Growth Parameters			
Media	Height (cm)[z]	Area (cm2)[y]	Flowers Per Pot[x]	Rating[w]
Bactolite	28a[v]	1092a	68a	4.2a
Fafard #2	28a	1114a	68a	4.2a
Pro-Grow PX2	29a	940a	64a	4.5a
2 Peat:l Vermiculite: l Perlite	27a	842a	54a	3.3a

[z] English conversion: 2.5 cm = 1 inch.

[y] Area:width of plant measured in 2 directions and multiplied for cm2.

[x] Flowers per pot: each pot contained 4 pinched plants. Divide by 4 to obtain flowers per plant.

[w] Mean separation in columns by Duncan's multiple range test, means followed by same letter are not significantly different at 5% level.

[v] Plant quality rating: 0 = dead; 1 = very poor, unsalable; 2 = poor, some salable; 3 = average, salable; 4 = above average, good plant, salable; 5 = excellent plant, salable.