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TRICKLE IRRIGATION FOR ESTABLISHING ROOTED CUTTINGS FOR CUT FLOWER CHRYSANTHEMUM PRODUCTION[1]

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Abstract. **A study was conducted to determine if trickle irrigation could be utilized to effectively establish** Chrysanthemum **X** morifolium **Ramat. 'Manatee Yellow Iceberg' rooted cuttings used for cut flower production. The effects and interactions of irrigation system, plastic mulch, and antitranspirant treatment were evaluated for 2 seasons of replicated studies. Data collected included plant top and root dry weights and leaf area for the 1983 fall season and plant top dry weight and leaf area for the 1984 spring season. Results showed significant differences among irrigation systems with trickle irrigation being as effective or better than the other systems in establishing the transplants in either season of testing. No significant effect of the antitranspirant treatment was detected. The use of plastic mulch had a detrimental effect on transplant establishment in the fall season and no effect in the spring. Results indicate that a properly designed and managed trickle irrigation system may be used as an alternative to overhead irrigation for establishment of chrysanthemum rooted cuttings.**

Recent concern over the potential for more restrictions on the use of Florida's water resources for agricultural purposes because of periodic droughts, salt water intrusion into wells, and increasing competition from non-agricultural water users (1, 7, 8) has prompted some chrysanthemum cut-flower growers to consider alternative irrigation systems for crop production. Presently, overhead sprinkler systems are used most often (7) because of past economics (5) and experience, low maintenance requirements, and usefulness for other crop management activities other than strictly as irrigation for plant growth (6, 7). These activities include water use in land preparation, frost and freeze protection, and establishment of cuttings transplanted into production beds.

One alternative irrigation system under consideration is trickle irrigation. Recent work (2, 3) has documented that water savings of up to 76% over the more commonly used overhead sprinkler system can be realized with proper use of a trickle system with no effect on reducing crop quality or yield. Other potential benefits besides water savings include energy savings, improved fertilization control, insect pest control (4), the nonwetting of plant foliage (reducing disease potential), and the compatibility of scheduling other management operations with irrigation (i.e., pesticide application). In addition to these, most water management districts in Florida are now exempting restrictions on water use during water shortage periods for growers using trickle irrigation systems.

The usefulness of trickle irrigation for management activities other than providing water for growth has not been fully investigated for crop production under Florida conditions. One such activity, establishing transplanted chrysanthemum cuttings, can use large quantities of water when overhead sprinkler irrigation is used. This system provides water for growth, keeping foliage cool, and increasing relative humidity to avoid additional stress other than transplant shock on the transplants. In order to determine whether trickle irrigation could be substituted for overhead sprinkler irrigation, a study was initiated to compare cutting growth during a normal establishment period using 3 irrigation systems. In addition, alternative cultural factors (the use of mulching and/or an antitranspirant) were investigated to determine effects and interactions with irrigation systems on cutting growth.

Materials and Methods

Studies were conducted during the 1983 fall season and 1984 spring season. In order to control water application treatments, the experimental plots were placed in a sawtooth greenhouse structure with a fiberglass roof and open sides overlying an EauGallie fine sand (Alfic Haplaquod). Elimination of the water table effect was controlled by using lines of perforated polyethylene drainage tubing buried 61 cm from the soil surface.

Experimental design was a split-split plot with 4 replications with irrigation system as the main plot, mulch as the subplot, and anti-transpirant as the sub-subplot. An experimental unit of 6 plants across the bed per sub-subplot was used. The design and treatments were the same for both seasons of experimentation. Irrigation system treatments used in the studies were microsprinkler (Microjet), fogger (Reed Irrigation Systems), and trickle (Chapin Twin-Wal, 10-cm emitter spacing) systems. These particular overhead systems were chosen because of the high level of control for water application on small plots and the unique water emitting characteristics of the systems. The microsprinkler system emitted larger droplets than the fogger system and at a faster application rate. The fogger system with its finer droplet size, required a longer application time. The difference between these systems regarding the amount of time that the foliage was wet (during and after application) and the amount of evaporation that occurred during application could possibly affect transplant establishment. The trickle irrigation system utilized 3 lines of tubing spaced 15 cm from each other. Transplants were planted 7.6 cm away from the tubing. Since the trickle system did not wet the foliage at all, the importance of foliage wetness could be investigated. The mulch treatment was a white opaque plastic covering installed on one-half of each main plot. A foliage antitranspirant dip treatment (Vaporguard) was used on chrysanthemum transplants in one-half of each subplot at the recommended concentration.

Each irrigation system was designed and tested to apply 0.6 cm of water daily at a frequency of 6 irrigation times per day without interference from adjacent systems. Application periods for the fogger and trickle systems were approximately 2.5 times longer than for the microsprinkler system. Fertilization was applied preplant using Osmocote slow-release fertilizer (14-14-14) at a rate of 510 kg N/bedded ha. 'Manatee Yellow Iceberg' rooted chrysanthemum cuttings were transplanted into raised bed plots 0.9 m wide and 3.7 m long at a planting density of 1 plant/0.84 m^2 (transplants were spaced 15 cm apart across the bed and 15 cm apart down the bed). Planting dates were September 19, 1983 for the fall season and May 9, 1984 for the spring

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season. Two sampling dates (September 29 and October 6, 1983) were used for Fall 1983 and data collected included top dry weight, root dry weight, and leaf area. One sampling date (May 21, 1984) was used for Spring 1984 in which top dry weight and leaf area data were collected.

Results and Discussion

Table 1 shows the statistical significance of the effects of the various treatments and their interactions on leaf area, top dry weight, and root dry weight. Irrigation system effect was significant ($P < 0.05$) in the 1983 fall season for leaf area, top dry weight, and root dry weight for the September 29 sampling date (10 days after planting) and for top dry weight ($P < 0.05$) for the October 6 sampling date (17 days after planting). During the 1984 spring season, response to irrigation system treatment (at 12 days after planting) was significant with top dry weight and leaf area ($P < 0.05$). The effect of the mulch treatment on response was significant for all measured parameters in the 1983 fall season but not significant for data collected in the 1984 spring season. No irrigation system-mulch treatment interaction was detected for any measured parameter on any sampling date. This result was not expected because of the different emitting characteristics of the irrigation systems. The trickle system delivers water below the soil surface and was expected to benefit the most from mulching. The overhead systems by their nature, were expected to be less effective with mulching since the only water reaching the soil had to come through the plant holes in the plastic. The interaction between irrigation system and mulching may have been eliminated by the fact that the plots were adequately moist when the study began. The interaction of the 2 factors on plant growth probably would have become more significant for plants grown beyond the length of this transplant study. Since treatments in the study included periodically wetted plant foliage (with overhead systems) and foliage that never was wetted (with the trickle system), it was expected that the anti-transpirant would have been effective in at least one of the situations, but this was not the case. No significant effect of the antitranspirant or any of its interactions on the measured parameters were detected. This indicated a possible lack of effectiveness for reduction of transpiration on the part of the antitranspirant used due either to the product itself or to the inability to detect differences because of the short duration of this study. In either case, the use of antitranspirants for rooted cutting establishment appears to be inappropriate with any of the irrigation systems used in the study.

Table 2 shows mean separation of top dry weight and leaf area data among irrigation system main plot treatments for both seasons of data collection. Significant separation of irrigation system treatments occurred for top dry weight in all sampling dates. Significant differences occurred for leaf area data among irrigation systems except for the October 6, 1983 sampling date. Although the above mentioned significant mean separations for irrigation system did occur, no clear advantage was seen for any 1 system even between sampling dates within the fall season. For example, the fogger system provided a more advantageous growing environment for transplants 10 days from planting for top dry weight as measured on the September 29 sampling date, but when sampled 7 days later, the trickle system plots were not significantly different. Results from the fall season were not always consistent with those from the spring season. The fogger system, as effective as the trickle system in the fall season, was significantly less effective for top dry weight compared to the trickle system in the spring season. Similar results were seen for leaf area data collected over the 2 seasons where no irrigation system seemed to hold a consistent advantage over another. The use of plastic mulch as a main effect was significantly detrimental to transplant establishment for the fall season, but showed no significant effect in the spring season (Table 2).

Table 1. Statistical significance of the effects of irrigation method, mulch, and antitranspirant treatments on leaf area, top dry weight, and root dry weight for chrysanthemum transplants grown during Fall 1983 and Spring 1984.

	Fall 1983						Spring 1984	
	Leaf area		Top dry wt.		Root dry wt.		Leaf area	Top dry wt.
	Sampling date							
	9-29-83	10-6-83	9-29-83	10-6-83	9-29-83	10-6-83	5-21-84	5-21-84
Irrigation (I)	*z	ns	*	*	*	ns	*	*
Mulch (M)	**	**	**	**	*	*	ns	ns
I * M	ns	ns	ns	ns	ns	ns	ns	ns
Antitranspirant (A)	ns	ns	ns	ns	ns	ns	ns	ns
I * A	ns	ns	ns	ns	ns	ns	ns	ns
M * A	ns	ns	ns	ns	ns	ns	ns	ns
I * M * A	ns	ns	ns	ns	ns	ns	ns	ns

z** and * represent statistical significance at the 1% and 5% levels, respectively.

Table 2. Mean separation of top dry weight and leaf area measurements among irrigation methods and between mulch treatments for chrysanthemum transplants grown during Fall 1983 and Spring 1984.

	Top dry wt (g/transplant)			Leaf area (cm^2/transplant)		
	Sampling date					
Treatment	9-29-83	10-6-83	5-21-84	9-29-83	10-6-83	5-21-84
Microsprinkler	4.97 bz	7.88 b	7.25 b	685.4 b	1796.5y	1644.2 ab
Fogger	6.44 a	8.87 ab	6.47 c	851.4 a	2164.7	1488.1 b
Trickle	4.70 b	9.80 a	7.95 a	699.6 b	2167.2	1830.6 a
Mulch	4.85 b	7.86 b	7.38y	666.5 b	1775.0 b	1725.4y
No Mulch	5.90 a	9.83 a	7.07	824.3 a	2310.3 a	1587.0

zMean separation within columns by Duncan's multiple range test, 5% level.
yNo significant difference detected among means within column.

Since the primary objective of this study was to determine whether trickle irrigation could adequately establish chrysanthemum rooted cuttings compared to overhead methods and not to determine the best system for this purpose, we conclude that it appears that trickle irrigation can be used to perform this function. Regardless of season, trickle irrigation eventually was equal to or better than the other irrigation systems for the measured parameters. This seems to indicate that the need to keep plant foliage cool by wetting in order to establish transplants is not as important as expected.

These tests were conducted during periods of peak evaporative demand for typical seasons, so it is expected that trickle irrigation would perform as well during other less demanding times of the season. It should be stressed that a properly designed and managed trickle system is required in order to be effective for the sandy soils on which chrysanthemum production often occurs. Until testing under field conditions can be accomplished, caution should be exercised for total reliance on trickle irrigation for the establishment of chrysanthemum rooted cuttings. However, it does appear that if trickle is used in conjunction with overhead irrigation, less use of overhead and more of trickle irrigation could accomplish the same goal with substantial savings of water.

Literature Cited

1. Duerr, A. D. and J. T. Trommer. 1981. Estimated water use in the Southwest Florida Water Management District and adjacent areas, 1980. U. S. Geological Survey Open-File Rpt. 81-1060.
2. Harbaugh, B. K., C. D. Stanley, and J. F. Price. 1982. Trickle irrigation rates and chrysanthemum cut flower production. HortScience 17:598-599.
3. Harbaugh, B. K., C. D. Stanley, and J. F. Price. 1985. Influence of trickle irrigation rates on chrysanthemum cut flower production. J. Amer. Soc. Hort. Sci. 110: (in press).
4. Price, J. F., B. K. Harbaugh, and C. D. Stanley. 1982. Response of mites and leafminers to trickle irrigation rates in spray chrysanthemum production. HortScience 17:895-896.
5. Stanley, C. D., J. W. Prevatt, S. P. Kovach, and B. K. Harbaugh. 1983. An economic analysis of two irrigation systems for field production of cut-flower chrysanthemums. Proc. Soil Crop Sci. Soc., Fla. 42:149-153.
6. Stanley, C. D., B. K. Harbaugh, and J. W. Prevatt. 1983. The advantages and disadvantages of trickle irrigation for cut-flower chrysanthemum production. Bradenton Agr. Res. Education Center Res. Rpt. BRA1983-4.
7. Tefertiller, K. R. 1983. Florida agriculture in the '80s: Ornamental Horticulture. Univ. Florida, Inst. Food Agr. Sci., Gainesville, FL. p. 13-34.
8. Tefertiller, K. R. 1983. Florida agriculture in the '80s: Special issues. Univ. Florida, Inst. Food Agr. Sci., Gainesville, FL. p. 167-209.

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RELATIVE PERFORMANCE OF SLUDGE COMPOST POTTING MEDIUM FOR CULTURE OF SEA OATS[1]

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Abstract. **Plant growth for sea oats (**Uniola paniculata, **L) grown in screened and unscreened sewage sludge compost was assessed by comparing plants grown in these 2 materials, combined with beach sand, with plants grown in 2 commercially available potting mixes which were used as standards. Fifteen individuals each of** U. paniculata **were grown for 4 months in 25-cm diameter containers in mixtures of beach sand and screened compost of 0:1, 1:3, 1:1, and 3:1 (v:v) and unscreened compost in the same ratios for a total of 10 different potting mix combinations, including the 2 standards. Growth was evaluated by means of a size index in which plant height and spread were summed. At the end of the growing period, plants in 3 potting mixes: Metromix 300, a 3 beach sand: 1 screened compost mix and a 1 beach sand: 1 screened compost mix exhibited significantly faster growth than those in the other 7, in terms of both size index and number of culms.**

Protection of the upland portions of sandy shorelines can be accomplished through the creation of barrier dunes and the stabilization of existing dunes (6). Barriers of vegetation are often planted to provide this protection. One of the most commonly used dune stabilization plants in the southeastern United States is sea oats (*Uniola paniculata* L.). Sea oats are a hardy native grass that can survive rapid sand accumulation, occasional flooding, salt spray, sandblasts, wind and water erosion, wide temperature fluctuations, drought, and low soil nutrients (6). Due to its ability to trap large volumes of sand, sea oats were one of the first Florida plants to be protected by law (9).

Although sea oats are the most important and widespread grass on Florida's coastal dunes (2), they are difficult to propagate from seed. The few nurseries that raise sea oats collect seed from the wild, with state permission, and through a separation process sort viable from nonviable seeds, which may make up 60% or more of the total harvest (O. Bundy, personal communication). Seedlings are raised in flats and are commonly sold as liners averaging 25-28 cm in height. For dune stabilization, staggered, parallel rows of sea oats are planted along the seaward face of the dune. Depending upon postplanting maintenance, mortality in liner sized plants can range from 40 to 50% (O. Bundy and T. Johnson, personal communications).

Grasses and woody ornamentals have been successfully grown in mixtures containing sewage sludge compost (4, 5). Sludge composting is the thermophilic decomposition of organic constituents into a relatively stable humus-like material (7). The organic matter in compost is particularly beneficial as a soil conditioner because it has been stabilized, decomposes slowly, and remains effective for a longer time than organic matter in uncomposted wastes. Compost can improve the physical properties of sandy soils through increased water content retention, enhanced aggregation, and increased microbial populations.

[1]Mention of any product or trade name is for identification purposes only and does not constitute an endorsement.