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EFFECT OF INTERMITTENT IRRIGATION AND ANTITRANSPIRANTS ON ESTABLISHING STRAWBERRY TRANSPLANTS ON MULCH[1]

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Abstract. **Trials were conducted for three seasons using continuous or intermittent overhead sprinkler irrigation during daytime to establish strawberry transplants in the fruiting field. In addition to continuous irrigation, a thirty minute interval was used the first season, and a fifteen minute interval was added in the second and third seasons. Antitranspirants were included as treatments during the first two seasons. The cultivar 'Florida Belle' was used in all trials. Breeding lines 69-712 and 71-729 and cultivars 'Tioga' and 'Tioga Special' were used during various seasons.**

Generally, the leaf surface of plants given fifteen or thirty minute intermittent irrigation remained moist between irrigations. However, with dry and windy conditions leaf surfaces were dry for as long as ten minutes with the use of the thirty minute interval.

Overall, the use of antitranspirants did not enhance plant survival, leaf retention, fruit size, nor seasonal yield. The use of intermittent irrigation did not reduce leaf retention, plant survival, fruit size, nor seasonal yields compared to continuous irrigation. The results indicate that as long as the plant can be kept moist and the mulch is moist or cool (about 21C) during the period of establishing transplants any irrigation time interval could probably be used without reducing yields. The use of intermittent irrigation saved more than one-half the irrigation water applied to the continuously irrigated treatment.

Overhead sprinkler irrigation is provided to reduce leaf moisture stress on newly transplanted strawberries set in the fruiting field (4). The poorly developed root system and the excessive transpiration caused by the high ambient air temperature place a severe moisture stress on the plant. If sprinkler irrigation is not provided the leaves wilt and contact the hot black polyethylene mulch. The leaves then become desiccated and necrotic, and this results in defoliated plants which produce lower and later yields (1). Even if leaves are not lost because of moisture stress, a leaf water deficit increases respiration and decreases photosynthesis (2, 3) and thus slows the plant's growth. In addition large volumes of water are used to establish plants, and water for this purpose may not be available in the future.

Some greenhouse crops are established and grown with intermittent overhead irrigation while anti-transpirants have reduced water loss when applied to the foliage (5, 7).

This study was initiated to develop methods to conserve water and the energy required to pump the water during the period of establishing strawberry transplants. Methods used were intermittent overhead sprinkler irrigation and the application of antitranspirants to plant foliage before transplanting.

Materials and Methods

Field experiments were conducted during three seasons. During the first two seasons the antitranspirants Vapor Gard at concentrations of 2.5 and 5%, and Folicote at concentrations of 5 and 10% and a control (H_2O) were used. Plant foliage was immersed in the antitranspirant solutions, drained, and the plants set in black polyethylene mulched beds. In addition to continuous overhead sprinkler irrigation, a thirty minute interval was used the first season, and a fifteen minute interval was added in the second and third seasons to establish plants. The irrigation interval alternated with an equal interval of no irrigation. Irrigation was usually provided from 9 a.m. to 5 p.m. These irrigation treatments were applied only during the period that transplants were being established. This period was from date of transplanting to 14 days later. After this period, all treatments were irrigated alike as needed with overhead sprinkler irrigation. Because of the good internal drainage of the soil no surface run-off of water occurred during the establishing period. The cultivar 'Florida Belle' was used all three seasons. In addition, breeding line 69-712 was used the first season, the cultivar 'Tioga' during the second season, and breeding line 71-729 and cultivar 'Tioga Special' were used the third season. Foliage was not removed from transplants before transplanting, except for dead or diseased leaves. Standard cultural procedures were used (6) with fruit harvested twice weekly for four months. Plants were evaluated periodically and moisture application was monitored. Maximum air temperatures during the first 20 days of October (when transplants were established) varied between 23 and 34C.

The statistical design was a split-split-plot with irrigation frequency as main plots, cultivars as sub-plots and antitranspirants as sub-sub-plots. There were five replicates the first two seasons and four replicates the last season.

Results and Discussion

The use of antitranspirants had little effect on plant condition or survival at time overhead irrigation was discontinued for establishing transplants (Table 1). The only yield effect of antitranspirants was on the January yield in 1973-74 (Table 2). The January yields would reflect any delay in fruiting that may have been caused by treatments. Little yield variation occurred during the remainder of the season, and seasonal yields were not significantly affected either year by antitranspirants. Fruit size was also not affected by antitranspirants.

Table 1. Condition of transplants at end of establishment period as related to antitranspirants.[z]

Treatment	Concn %	% Surviving live plants 1974	1975	No. dead leaves/plot 1975
Vapor Gard	2	95	99	6.6
Vapor Gard	5	96	99	6.7
Folicote	5	98	99	5.9
Folicote	10	99	99	6.8
H_2O		95	99	7.2

[z]No significant differences because of treatment.

Irrigation frequency had no significant effect on plant survival and number dead leaves/plant at end of establishment period (Table 3) nor on average fruit size for season (not presented).

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Table 2. Effects of antitranspirants on January and seasonal yields for first two seasons.

Treatment	Concn %	Yields (lbs/acre) 1973-74 January	1973-74 Seasonal	1974-75 January	1974-75 Seasonal
Vapor Gard	2	3876 b[z]	20026 a	5176 a	25084 a
Vapor Gard	5	3767 b	19128 a	4503 a	24295 a
Folicote	5	4950 a	21795 a	4616 a	23901 a
Folicote	10	4412 ab	20798 a	4471 a	22861 a
H_2O		3805 b	19363 a	4713 a	23237 a

[z]Mean separation among averages in a column by Duncan's multiple range test, 5% level.

Table 3. Effect of irrigation frequency on number of dead leaves and plant survival at end of establishment period.[z]

Irrigation frequency	% Plant survival 1974	% Plant survival 1975	% Plant survival 1976	Dead leaves/plot 1975	Dead leaves/plot 1976
			Florida Belle		
Continuous	99	99	100	5.9	23
1/2 hour	100	99	100	6.2	32
1/4 hour		99	92	4.4	31
	69-712	Tioga	71-729	Tioga	71-729
Continuous	91	99	100	6.6	19
1/2 hour	96	99	88	9.9	22
1/4 hour		99	86	6.9	14
				Tioga Special	
Continuous			98		16
1/2 hour			97		17
1/4 hour			98		14

[z]No significant differences in percentage plant survival or dead leaves per plot because of irrigation frequency.

Irrigation frequency did not significantly affect yields the first two seasons (Table 4). There were some significant differences the third season but these were not consistent among all cultivars or lines used. For the third season yields did not appear to be related to plant condition or survival at end of establishment period. The amount of water applied by irrigation was measured during the third season, and the continuous irrigation treatment received more than twice (71 mm daily) the amount of water during the period of establishing the transplants as compared to either of the other two irrigation treatments (28 mm daily). The plots were checked frequently in the third season during the establishment period. The plant foliage and polyethylene mulch became dry between irrigations with the thirty minute interval. This occurred under low humidity and fairly brisk wind conditions. Foliage and mulch were dry for as long as ten minutes under these dry conditions. The temperature of the mulch during this ten minute interval remained cool (27C) relative to that mulch not receiving irrigation (50C). The temperature of the mulch with continuous overhead sprinkler irrigation was near that of our irrigation water, about 20C.

Table 4. Effect of irrigation frequency on yield (lbs/acre) for each of 3 seasons.

Irrigation frequency	1973-74 January	1973-74 Seasonal	1974-75 January	1974-75 Seasonal	1975-76 January	1975-76 Seasonal
			Florida Belle			
Continuous	4747 a[z]	20235 a	4246 a	22435 a	3323 a	23285 a
1/2 hour	5001 a	22447 a	4881 a	24560 a	2786 a	25788 a
1/4 hour			5172 a	22640 a	1301 b	21310 a
	69-712		Tioga		71-729	
Continuous	3305 a	18830 a	3798 b	21995 a	2894 a	17295 b
1/2 hour	3590 a	19375 a	5063 a	26972 a	3683 a	22995 a
1/4 hour			5020 a	24683 a	1984 b	20263 ab
					Tioga Special	
Continuous					1116 b	16468 b
1/2 hour					1951 a	19660 ab
1/4 hour					1719 a	22007 a

[z]Mean separation among averages in columns within a cultivar by Duncan's multiple range test, 5% level.

From the data of these experiments it would appear that intermittent overhead irrigation can be used to reduce water and energy consumption without adversely affecting transplants or yields. The time interval between irrigations or the length of the irrigation period should be such that foliage remains moist and mulch remains cool or moist during the day-time stress period. This should prevent excessive leaf loss which could delay and reduce fruit yields.

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