Watermelon Transplant Age: Influence on Fruit Yield

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Abstract. Total fruit yield of watermelon [*Citrullus lanatus* (Thunb.) Matsum. and Nakai] in Florida field tests was unaffected by transplant age (3, 4, or 5 weeks from seeding) or modular cell size (18.8, 30.7, or 60.5 cm³), but was affected by trial year. A further study revealed that early and total fruit yields at two field sites were unaffected by transplant age, ranging from 3 to 13 weeks, when grown in the same modular cell size (34 cm³), but were affected by field trial site. We conclude that transplant age or modular cell size is of little importance relative to post-transplanting conditions (site or year) in influencing watermelon fruit yield.

When growers alter planting schedules, they often ask that transplant delivery be delayed. Extension personnel, however, suggest that the "ideal" watermelon transplant age is 4 weeks (Lorenz and Maynard, 1988). When transplants are abundant, growers may reject older transplants; when they are in short supply, growers often accept all transplants regardless of plant age or condition.

Transplant age studies have produced varied results: no effect on tomato (*Lycopersicon esculentum* Mill.) fruit yield (Leskovar and Cantliffe, 1991); increased early and total tomato fruit yield (Marr and Jirak, 1990), increased early and total eggplant (*Solanum melongena* L.) yield (Harmon et al., 1991); increased early yield but no effect on total pepper (*Capsicum annuum* L.) fruit yield (Weston and Zandstra, 1988); inconsistent increases in early and total cole crop yield (Jones et al., 1991); and no effect on broccoli (*Brassica oleracea* L. Botrytis Group) head weight or diameter (Lament, 1992).

Hall (1989) obtained a higher total weight of watermelon fruit from transplants grown in 39.5-cm³ rather than in 18.8-cm³ modular cells. Weston and Zandstra (1986) reported lower early yields, but similar total yields, from tomato transplants grown in relatively small modular cells. Marsh and Paul (1988) found

cabbage transplants grown in liner cells produced heavier, but not larger, heads.

To our knowledge, no data exist on the effects of cucurbit transplant age or on the interaction of age and modular cell size. This research was conducted to determine the effects of transplant age and modular cell size on watermelon fruit yield.

Modular cell volume and transplant age. 'Charleston Grey' watermelon seeds were sown in Metro Mix 220 (Grace Sierra, Milpitas, Calif.) contained in inverted pyramid cells of expanded polystyrene flats (Todd planter flats; Speedling Corp., Plant City, Fla.). Three cell sizes were tested: 18.8 cm³ (2.5 × 2.5 × 7.6 cm deep), 30.7 cm³ (3.8 × 3.8 × 6.4 cm deep), and 65.5 cm³ (5.1 × 5.1 × 7.6 cm deep). The transplants were raised under natural light in a greenhouse set to cool at 32C and heat at 16C. The transplants (one per cell) were fertilized daily with 200 mg N/liter from 15 N-3P-12K (15-7-14; Peters Fertilizer, Fogelsville, Pa.). Transplants that were 3, 4, or 5 weeks old were transplanted on 28 Mar. 1984, 28 Mar. 1985, and 27 Mar. 1986 into Orangeburg loamy fine sand (fine-loamy, siliceous, thermic Typic Kandiodult) at the North Florida Research and Education Center in Quincy. The land had not been in watermelon production for 10 years.

Each plot contained 12 transplants 1.0 m apart in a single row down the center of a raised bed. Rows were 3 m apart. Plots had received preplant applications of dolomitic limestone at recommended rates and (in kg-ha⁻¹) 157N-70P-100K in 1984, and 134N-36P-32K in 1985 and 1986. Black polyethylene (0.032 mm) covered the nonfumigated, 90-cm-wide beds. Overhead irrigation and recommended pesticides (Maynard, 1990) were applied as needed.

The 3 (transplant age) × 3 (cell size) factorial was arranged in a randomized complete block design with four replications in each year. Fruit were harvested three times each year. Fruit <6.8 kg were excluded from determinations of total marketable fruit yield (in tonne per hectare) and mean fruit weight.

Although a year effect was apparent, neither transplant age nor modular cell volume affected total yield or mean fruit weight (Table 1). The lack of cell size influence contradicted the results of Hall's (1989) 1-year study in which 'Charleston Grey' 4-week-old transplants grown in 39.5-cm³ cells yielded more than those from 18.8-cm³ cells. Since cell size exerted no effect on fruit yield, the next series of studies examined the effects on fruit yield of a wider range of transplant age in modular cells of the same volume.

Transplant age and site. 'Crimson Sweet' watermelon seeds were sown biweekly into Heco Plug Mix (Southern Importers, Greensboro, N. C.) contained in 34-cm³ hemispherical (5 cm in diameter) cells to achieve transplants that were 3, 5, 7, 9, 11, or 13 weeks old at transplant time. The transplants were raised in a commercial greenhouse (Johnny Johnson's Greenhouses, Immokalee, Fla.) under natural light and temperature regimes (November to February temperature range: 23-26C days and 10-15C nights), and they received 200 mg N/liter from 20N4P-17K (Peter's 20-10-20) daily.

The transplants were planted on 9 Feb. 1990 at Immokalee and Fort Myers in Immokalee fine sand (sandy, siliceous, hypothermic, Arenic Haplaquod). At Immokalee, 56N-67P-78K was broadcast at 1120 kg-ha⁻¹. Beds were fumigated with 98 methyl bromide : 2 trichloronitromethane (chloropicrin) (v/v) at 201 kg-ha⁻¹; we simultaneously applied

Table 1. Influence of year, transplant age, and transplant cell volume on weight of 'Charleston Grey' watermelon.

Factor	Total fruit yield (t-ha ⁻¹)	Mean fruit wt (kg/fruit)
Year		
1984	41.6b [*]	8.3 c
1985	67.8 a	11.2 a
1986	41.9b	9.6 b
Transplant age (weeks)		
3	49.8	9.7
4	49.7	9.6
5	51.7	9.9
Cell volume (cm ³)		
18.8	49.5	9.8
30.7	49.7	9.7
65.5	52.0	9.7
F test significance		
Year (Yr)	**	**
Transplant age (Ta)	NS	NS
Cell volume (Cv)	NS	NS
Yr × Ta	NS	NS
Yr × Cv	NS	NS
Ta × Cv	NS	NS
Yr × Ta × Cv	NS	NS

^{*}Mean separation within columns at *P* 0.05 according to Duncan's multiple range test.

^{**}Nonsignificant or significant at *P* ≤ 0.01, respectively.

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Table 2. Early and total fruit yields of 'Crimson Sweet' watermelon as influenced by transplant age and site.

Transplant age (wks)	Early yield		Total yield	
	(t·ha ⁻¹)	(no. fruit/ha) 1000s	(t·ha ⁻¹)	(no. fruit/ha) 1000s
Fort Myers				
3	39.5	3.96	73.1	7.23
5	45.4	4.75	79.3	7.80
7	35.6	3.39	78.9	7.91
9	42.4	4.29	69.2	7.23
11	25.7	2.71	54.6	5.76
13	41.6	3.96	75.1	7.35
Immokalee				
3	87.1	8.90	124.1	13.3
5	94.3	9.40	126.3	13.5
7	84.4	8.54	114.9	12.6
9	86.9	8.97	122.9	13.7
11	81.7	8.82	116.4	13.1
13	84.6	8.68	116.6	12.5
F test significance				
Site (S)	*	*	*	*
Transplant age (Ta)	NS	NS	NS	NS
S × Ta	NS	NS	NS	NS

NS, Nonsignificant or significant at $P \leq 0.05$, respectively.

153N-0P-201K at 806 kg·ha⁻¹ in two narrow bands on the top of the bed 25 cm to either side of the bed center. The beds were then sealed with 0.032-mm-thick black polyethylene plastic. The raised beds (20 cm high × 91 cm wide on 3.7-m centers) were irrigated by subsurface seepage.

At the Fort Myers site, a 10-year-old bahiagrass (*Paspalum notatum* Flugge.) pasture prepared several months in advance by repeated disking, received (in kg·ha⁻¹) 112N-45P-90K. The 61-cm-high × 122-cm-wide beds were neither fumigated nor covered with plastic mulch, but received subsurface seepage irrigation.

The design was a randomized complete block consisting of eight blocks, with four blocks at each site. Each plot was a 6.4-m-long bed containing a single row of seven transplants 91 cm apart. Plants that did not survive transplanting were replaced within 10 days with appropriately aged plants. Pesticides were applied as needed, according to the Florida Cooperative Extension Pest Control Program (Maynard, 1990).

Fruit were harvested 27 Apr. and 4, 15, and 25 May at Immokalee, and 3 and 17 May at Fort Myers. Fort Myers plots were only harvested twice due to cooperator harvesting error. We determined fresh weight and number of marketable fruit per hectare for early (first harvest only at Fort Myers, first two harvests at Immokalee) and total harvests.

The dry weight, leaf area, height, and number of nodes of transplants increased with increasing transplant age (data not shown). These results were in agreement with other observations for increasing transplant age

(Leskovar and Cantliffe, 1991; Marsh and Paul, 1988; Weston and Zandstra, 1986). The percentage of plant death following transplanting was similar for all transplant ages.

Early and total fruit yields were influenced by site but not by transplant age or its interaction with site (Table 2). The higher yields at Immokalee than at Fort Myers maybe attributed to the black plastic mulch covering the beds at Immokalee. The tendency for spring-planted plasticulture (mulch) watermelons to produce higher yields than watermelons grown on bare ground has been observed (Bhella, 1988). A delay of several weeks occurred before irrigation was properly implemented at Fort Myers. Although modest rainfall supported growth, this factor also may have contributed to the lower early yield at Fort Myers than at Immokalee, as we noticed an overall reduction in crop vigor. The higher early and total yields at Immokalee were the result of more fruit produced (Table 2), not heavier fruit.

The original 11-week-old transplants failed before transplanting were replaced with transplants obtained from another commercial source. These replacement plants were grown in smaller cells (25 cm³), nutrient deficient, and flowering. They tended to produce lower yields than the original transplants at Fort Myers, but not at Immokalee.

Despite differences in transplant size at setting, transplant age had no effect on early or total yield (Table 2). While differences in both early and total yield resulting from transplant age differences in various crops have been reported (Harmon et al., 1991; Marr and Jirak, 1990), others have documented no age effect

on yield (Lament, 1992; Leskovar and Cantliffe, 1991). It seems that watermelon transplants physiologically synchronize fruit set and development in spite of chronological age. This synchronization may be heightened by Florida growing conditions, which are generally favorable. Weston and Zandstra (1988) showed that solanaceous transplants produced near the study site were more productive than those shipped long distances. Further work is required to test the interactive effects of watermelon transplant age with shipping distance or shipping conditions on field performance.

Our results indicated that watermelon transplants produced similar yields regardless of cell volume or transplant age. Yields, however, were affected by year and site. Thus, even with varied cultural practices or environments, watermelon transplants up to 13 weeks old have yields similar to 4-week-old plants, which had been considered the ideal age for planting.

Literature Cited

- Bhella, H.S. 1988. Effect of trickle irrigation and black mulch on growth, yield and mineral composition of watermelon. *HortScience* 23:123-125.
- Hall, M.R. 1989. Cell size of seedling containers influences early vine growth and yield of transplanted watermelon. *HortScience* 24:771-773.
- Harmon, R., L.A. Weston, and R.T. Jones. 1991. Effect of root cell size and transplant age on Yield of transplanted eggplant. *HortScience* 26:689. (Abstr.)
- Jones, R. T., L.A. Weston, and R. Harmon. 1991. Effect of root cell size and transplant age on cole crop yields. *HortScience* 26:688. (Abstr.)
- Lamont, W.J. 1992. Transplant age has little effect on broccoli head weight and diameter. *HortScience* 27:848.
- Leskovar, D.I. and D.J. Cantliffe. 1991. Growth and yield of tomato plants in response to age of transplants. *J. Amer. Soc. Hort. Sci.* 116:416-420.
- Lorenz, O.A. and D.N. Maynard (eds.). 1988. Knott's handbook for vegetable growers. 3rd ed. Wiley, New York.
- Marr, C.W. and M. Jirak. 1990. Holding tomato transplants in plug trays. *HortScience* 25:173-176.
- Marsh, D.B. and K.B. Paul. 1988. Influence of container type and cell size on cabbage transplant development and field performance. *HortScience* 23:310-311.
- Maynard, D. (ed.). 1990. Watermelon production guide for Florida. Univ. Florida, Coop. Ext. Bul. SP113.
- Weston, L.A. and B. Zandstra. 1986. Effect of root container size and location of production on growth and yield of tomato transplants. *J. Amer. Soc. Hort. Sci.* 111:498-501.
- Weston, L.A. and B. Zandstra. 1988. Effect of flat cell size, transplant age, and production site on growth and yield of pepper transplants. *HortScience* 23:709-711.