

Grafted Watermelon Performance in Kentucky

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Introduction

Although not often observed in the U.S., grafting of vegetables is relatively common in much of Asia and parts of Europe. In some Asian countries such as South Korea, more than 80% of melons are grafted (Lee and Oda, 2003). Although labor intensive, grafting allows farmers in these countries to overcome many soilborne pathogens such as *Verticillium* wilt, *Fusarium* wilt and nematodes, without the use of large amounts of synthetic pesticides. In addition to disease resistance, grafting of vigorous rootstocks to traditional vegetable cultivars often increases yield, and water and nutrient uptake. Recently, the practice of grafting watermelons has increased in popularity in the southeast United States. Growers in South Carolina are successfully using disease resistant cucurbit rootstocks to double crop watermelons. While labor intensive, the practice has been shown to be economically viable for growers who wish to double crop melons on the same land in one year. This study was undertaken to determine the performance of grafted melons in Kentucky.

Materials and Methods

The watermelon ‘Sugar Baby’ was used as the scion for grafting and two rootstocks. ‘Shintosa Camel,’ an interspecific hybrid squash, and ‘Macis,’ a *Lagenaria* (gourd), were used as rootstocks. Both rootstocks were made available from Nunhems Seeds. The watermelon ‘Sugar Baby’ was seeded into 128 cell trays on 24 April, 2008. The two rootstocks were seeded approximately one week later into 128 cell trays. The grafts between the ‘Sugar Baby’ scion and ‘Shintosa Camel’ rootstock were performed on 5 May, while the ‘Sugar Baby’ to ‘Macis’ grafts were performed on 19 May, and ‘Sugar Baby’ self-grafts were performed on 20 May. Grafts were performed as follows: the rootstock and scion stems were cut at 45° angles, put together, and held in place using commercially available plastic grafting clips (Johnny’s Seeds). Immediately after grafting, plants were placed on a mist bench and covered with plastic and heavy black shade cloth. This was done to keep the humidity high, without having water sitting on the plants. Shade cloth was used to prevent heat stress on the grafted plants. After ten days, plants were removed from the mist environment and placed in a greenhouse.

Plants were transplanted to the field on 13 June; transplants were placed on black plastic mulch with drip irrigation. The study was arranged as a randomized complete block design with four replications of seven plants for each treatment with the exception of the self-grafted treatment. Due to a lack of plant materials, the self grafted treatments consisted of four replications of five plants each. Plants were spaced 24 inches apart in row, and rows were on 6-foot centers. Weed control was accomplished by broadcasting annual ryegrass at the rate of 100 lbs per acre with a mixture of 50 lbs per acre of sorghum sudangrass prior to laying plastic. The grass mixture was then sprayed post-transplant with Gramoxone Max 3L at the rate of 2 pt per acre with a shielded spray; an additional application of 2 pt per acre of Strategy 2.1 E was applied three weeks after transplanting. Pre-plant fertilizer was applied at the rate of 500 lbs of 10-20-20 per acre; the remaining required nitrogen was applied on a weekly basis through drip irrigation at the rate of 32 lbs an acre per week in the form of calcium nitrate. The plants were watered by an automated

system that watered once a day; the plot was watered at the rate of 1 acre inch of irrigation water per week, per acre. Capture 2 EC and Endosulfan 3 EC were used in rotation on a weekly basis from transplant until a week before projected harvest for control of insects. Capture 2 EC was used at the rate of 4 fl oz per acre, while Endosulfan 3 EC was used at the 2 pt per acre rate. Once vines began to run plants were sprayed with fungicides on a weekly rotation of 11 fl oz per acre of Quadris, 2 pts per acre of Chlorothalonil, and/or 2 lbs per acre of Mancozeb. Melons were first harvested 21 August, and a second harvest was needed on 29 August. Harvest was determined by a dead tendril at the point where the fruit attaches to the vine, along with a yellow ground spot. At harvest, fruit was counted, weighed, external measurements were taken, and the internal sugars were measured both near the rind and near the center of the fruit.

Statistics were performed using SAS statistical software. Data was tested for normality, and transformed if necessary. Results were considered significantly different if $P < 0.5$.

Results and Discussion

Grafted plants using the commercially available rootstock ‘Shintosa Camel’ had greater yields than the other treatments (Table 1). Although the self-grafted plants yielded fewer fruit per acre than the other treatments, there was no significant difference among the treatments with regard to fruit number per acre. Average fruit weight was highest in all of the grafted treatments. While plants grafted to the commercial rootstocks had slightly higher average fruit weights than the self-grafted plants, they were not significantly different. This suggests that the act of simply grafting the ‘Sugar Baby’ melons increased fruit yield, regardless of the rootstock used. Soluble solids (sugars) were also significantly higher in all the grafted treatments when compared to the non-grafted control plants. Although the vigor of the commercially available rootstock seedlings were greater than the ‘Sugar Baby’ seedlings, it seems as if the act of grafting the plant may have had more of an effect on traits such as fruit size and sugar content than the actual rootstock that was used. However, it should be noted that during the grafting process the ‘Sugar Baby’ plants grafted to the commercial rootstocks had a much higher percentage of success (90%, data not shown) than those ‘Sugar Baby’ seedlings that were self-grafted (50% success rate). Nonetheless, those plants grafted to the ‘Shintosa Camel’ rootstock did yield significantly more per acre than the other treatments. The higher yield of this treatment was likely a combination of rootstock vigor and the act of grafting, which seems to promote larger fruit. Similar results have been reported elsewhere (Cohen et al., 2005; Lee and Oda, 2003).

The hot, dry weather encountered during this growing season resulted in large numbers of spider mites. To determine if there was an effect of the treatments on mite damage, ratings were taken on 13 and 20 August. Interestingly, while the non-grafted control plants were severely infested with spider mites (Table 2), spider mite levels were relatively low on the grafted treatments. This suggests that regardless of rootstock used, the act of grafting made those plants either more resistant to spider mites or simply less attractive. It is plausible that the act of grafting the ‘Sugar Baby’ melons may have initiated a stress response in those plants.

The results from this trial suggest that grafting may be used to increase fruit yield and quality in some melons. However, more research is necessary to determine if grafting is economically feasible for Kentucky farmers.

Literature Cited

Cohen, R., Y. Burger, C. Horev, A. Porat, and M. Edelstein. 2005. Performance of Galia-type melons grafted on to *Curcubita* rootstock in *Monosporascus cannonballus*-infested and non-infested soils. *Ann. Appl. Biol.* 146:381-387.

Lee, J.M., and M. Oda. 2003. Grafting of herbaceous vegetable and ornamental crops. *Hort. Rev.* 28:61-125.

Table 1. Performance of grafted melons in 2008.

Treatment	Yield (cwt/A) ¹		Avg. No (Melons/A)		Avg Fruit Wt (lb)		Avg. Length (in)		Avg. Width (in)		Sugars (close to rind) (%)		Sugars (interior) (%)	
Non grafted	434	b*	8,571	a	5.4	b	20.5	b	20.0	b	7.9	b	8.7	b
Self Graft	488	b	6,960	a	6.7	a	21.7	a	22.4	a	8.3	ab	9.1	ab
Macis Rootstock	542	b	8,572	a	7.3	a	22.8	a	22.2	a	8.8	a	9.4	a
Shintosa Camel Rootstock	654	a	8,614	a	7.6	a	23.0	a	22.2	a	8.4	a	9.1	ab

*Treatments followed by different letters are statistically different with $P < 0.05$.

¹cwt/A= 100 pound units/acre.

Table 2. Spider mite damage on grafted melons in 2008.

Treatment	Mite Damage Ratings 13 Aug. (1-5) ¹		Mite Damage Ratings 20 Aug. (1-5)	
Non grafted	4.0	a*	5.0	a
Self Graft	1.5	b	2.0	c
Macis Rootstock	1.0	b	2.25	bc
Shintosa Camel Rootstock	1.5	b	2.75	b

* Treatments followed by different letters are statistically different with $P < 0.05$.

¹1=little or no visible infestation, 5=severe infestation.