

*The
Connecticut
Agricultural
Experiment
Station,
New Haven*



*Bulletin 1033
March 2010*

**Personal-Sized
Watermelon
Trials 2008-2010**

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SUMMARY

In 2008-2010, eleven cultivars of personal-sized (3-7 pound) seedless watermelons and one seeded pollinator variety were grown on a sandy terrace soil (Windsor, CT) and a loamy upland soil (Mt. Carmel, CT). Average total estimated yield of personal-sized watermelons of all cultivars was 10,504 fruit/acre (A) at Windsor compared to 9,737 fruit/A at Mt. Carmel. At Windsor, the average number of fruit/plant was 4.6 with an average of 47% of the fruit in the 3-7 pound range. At Mt. Carmel, the average number of fruit/plant was 3.9 with 56% of the fruit in the 3-7 pound range. The average total estimated yield of watermelons greater than 7 pounds was 42.9 T/A at Windsor compared to 24.7 T/A at Mt. Carmel. Size distribution, fruit characteristics, Brix (percent soluble solids), and rind thickness were also evaluated. The cultivars Mielhart and Bravo had the greatest yields of personal-sized watermelons, while Mini Yellow, Big Tasty, and Snack Pack had the greatest yields of watermelons greater than 7 pounds. Mielhart, Bravo, Fantasy, Leopard, Wonder, and Vanessa produced a large percentage of melons in the 3-7 pound personal-sized watermelon range. Big Tasty, Mini Yellow, and Snack Pack had significantly thicker rinds, averaging 0.49 of an inch. The varieties producing the thinnest rinds were Bravo, Mielhart, Vanessa, and Valdoria, averaging 0.35 of an inch. Bravo, Mini Yellow, Valdoria, and Wonder had sugar content equal to or greater than 11%. Management strategies are presented to maximize yield by cultivar selection and management.

INTRODUCTION

History. The culture of watermelon has been traced back thousands of years. Ancient hieroglyphics revealed that it was grown in Egypt, as well as lands around the Mediterranean and east as far as India (Robinson and Decker-Walters, 1997). Its culture subsequently spread to the warmer parts of Russia, Asia Minor, the Near East, and the Middle East. It appears to have reached China about a thousand years ago. The long history of the watermelon from North Africa to middle-Asia led to the view that it was of Asiatic origin, although it has never been found growing wild in Asia. In 1850, David Livingston, the great missionary-explorer, settled the question of its origin where he found large tracts in central Africa covered with wild watermelons. Bitter and sweet melons occur side-by-side in the wild, but to the eye, they are indistinguishable. Local natives

had to puncture each fruit and taste its juice before using it for food or drink.

In the early 1600's, traders brought watermelon to the Americas, where it was first cultivated in Massachusetts in 1629. Native Americans in Florida were reported to be growing watermelons by the mid-1600's. Father Marquette, French explorer of the Mississippi, reported them being grown along the Mississippi River in 1673.

Uses. In America, watermelons are mostly used as a dessert, eaten fresh and cold. The rind is sometimes made into preserves, but the seeds are used in this country only for planting. In southern Russia, beer is made from watermelon juice or the sugary juice may be reduced to heavy syrup like molasses. In Iraq, Egypt, and elsewhere in Africa, the flesh of the melon is used as a food staple and animal feed. In semi-desert districts, watermelon is an important source of water during dry periods; even today there are districts in Africa where it is cultivated solely for that purpose. In many parts of Asia, the seeds are often roasted and eaten, with or without salting. Asians also preserve watermelon by salting (brining) large pieces or halves in barrels.

Production of seedless watermelon seeds. Standard seeded watermelon varieties may contain as many as 1,000 seeds in each fruit. Some consumers find the seeds scattered throughout the flesh annoying. This led to the development of hybrid seedless watermelons over 40-years ago. Recently improved varieties, aggressive marketing, and increased consumer demand created a rapidly expanding market for seedless watermelons. A question often asked about growing seedless watermelons is: "How does one obtain seeds of a seedless watermelon?" The key is knowledge of the genetic makeup of the watermelon fruit. The number of chromosomes in a normal watermelon plant is doubled by the use of the chemical colchicine. According to the American Heritage Dictionary, colchicine is a poisonous, pale-yellow alkaloid, $C_{22}H_{25}NO_6$, obtained from the autumn crocus and used in plant breeding to induce chromosome doubling and in medicine to treat gout. Doubling the chromosomes in a normal (diploid) watermelon produces a tetraploid plant (one having 4 sets of chromosomes). The tetraploid plant is then bred back, or pollinated, by a diploid or normal plant, producing a sterile triploid plant that produces melons that contain no seeds. The tetraploid seed parent produces only 5-10% as many seeds as a

normal diploid plant, resulting in a seed cost 10 to 100 times more than that of standard, open-pollinated varieties and 5 to 10 times that of hybrid diploid watermelon varieties.

The triploid seed has a thicker seed coat than standard diploid watermelon seed. Because of this and the expense of the seed, most triploid melons are started as transplants. Germination of the triploid seed is not as high (60-80%) as the standard cultivars (90-95%), even under the best of conditions. This should be considered when ordering seeds and planning production.

Watermelon plants bear both male and female flowers (monoecious). Only female flowers set fruit. Hybrid triploid watermelon plants do not produce sufficient viable pollen to induce fruit set and development. Therefore, pollen from a normal diploid seeded watermelon variety must be provided. Approximately one-third of the plants in the field should be pollinators. Planting pollinators in the guard rows and then every third row in the field provide optimum coverage. Alternatively, pollinators can be planted as every third plant within each row. Pollinators produce small (<3 lb) seeded fruit. Honey bees are the principal insects that pollinate watermelons.

Personal-sized watermelons. Four types of watermelons are available in supermarkets. Traditional seeded watermelons have been a major part of the market for many years and weigh 18-35 pounds. Large seedless watermelons have been available since 1988 and usually weigh 15-25 pounds. Icebox-size melons, seeded and seedless, generally weighing 7-12 pounds each, have been available for about 10 years. Personal-sized seedless watermelons, weighing 3-7 pounds, were first marketed in 2003 and are now the fastest growing part of the watermelon category (Ohlemeier, 2006). They offer an attractive alternative for small families or for consumers that have limited refrigerator space. They are just the right size for a single-meal serving without the storage and bulk issues associated with traditional seedless watermelon. Besides its smaller size, personal-sized watermelons generally have a thinner rind, which reduces waste and yields more edible flesh. The thin rind, however, makes long distance shipping difficult. Thus, personal-sized watermelons are an ideal crop for Connecticut's local farmers' markets and roadside stands. It has been reported that watermelon growers in the South have resisted growing personal-sized watermelons because of changes in cultural requirements and the need for

different harvesting equipment which makes them less profitable.

Researchers have found that concentrations of lycopene (an antioxidant), vitamin C, and beta-carotene are especially high in personal-sized watermelons (Womack, 2006). Watermelon contains 8-10 milligrams of lycopene/cup (fresh weight) compared to 4 milligrams in a medium size tomato (Womack, 2006). Personal-sized watermelons average 9-20 milligrams of lycopene/cup (The Grower, 2005) with the cultivar Extazy averaging the greatest amounts (Maynard, 2008). Lycopene has been linked to the possible prevention of cancer and heart disease (Womack, 2006). Watermelon is listed by the American Heart Association as one of the best foods for cardiovascular health (Womack, 2006)

Since 2003, cultivar trials of personal-sized watermelon have been conducted in California, Florida, North Carolina, South Carolina, and Oklahoma. Because of an expanding market and willingness of consumers to pay a premium price (\$4.99 per fruit) for these melons, personal-sized watermelons were added to our New Crops Program in 2005. It is important that trials be conducted locally because differences in climate and soils may alter the growth and quality of the fruit, and affect cultivar choices and management decisions, such as use of plastic mulch. Based on early trials conducted during the period 2005 to 2007, personal-sized seedless watermelons can be grown successfully in Connecticut with little special treatment (Maynard, 2008).

In this bulletin, I report yield and quality of 11 personal-sized watermelon cultivars grown during 2008-2010 at our research farms in Windsor and in the Mt. Carmel section of Hamden. Characteristics of each cultivar are discussed as well as management and cultural techniques.

METHODS AND MATERIALS

Sites and soils. Trials of personal-sized watermelons were conducted for three years at the Valley Laboratory, Windsor, on Merrimac sandy loam (Entic Haplorthod), an inland sandy terrace soil with somewhat limited moisture holding capacity (Shearin and Hill, 1962); and at Lockwood Farm, Mt. Carmel, on Cheshire fine sandy loam (Typic Dystrochrept), a coastal loamy upland soil with moderate moisture-holding capacity (Reynolds, 1979).

Cultivars. Five cultivars were grown in 2008. These included Mielhart, Mini Yellow, Valdoria, Vanessa, and Wonder. The nine cultivars evaluated in 2009

were: Big Tasty, Bravo, Extazy, Fantasy, Leopard, Mielhart, Snack Pack, Vanessa, and Wonder. The seven cultivars evaluated in 2010 were: Bravo, Extazy, Fantasy, Leopard, Mielhart, Vanessa, and Wonder. The pollinator cultivar for all years was Side Kick. Rind characteristics of each cultivar and seed sources are described in Table 1.

Culture. The personal-sized watermelon cultivars and the pollinator cultivar were seeded on April 22-28. The seedlings were grown in Promix BX (Premier, Red Hill PA) in 3x3x3-inch Jiffystrips and placed in a greenhouse maintained at 75°-90° F. After germination, plants were thinned to one per pot. Seedlings were moved to a cold frame for hardening before transplanting in the field. Water-soluble 20-20-20 fertilizer (one tbs/gal) was added to the seedlings before they were transplanted in mid-June, 3-feet apart in 45-foot rows. Each row was divided in half, forming two replications. The cultivars in each replication were randomly selected. The pollinating plants were planted between the second and third plant (1.5 ft. between), between the fifth and sixth plant of each cultivar, and an additional one placed between each replication. Thus, each 45 foot row contained 7 plants each of two cultivars plus 5 pollinators interspaced along the row. Earlier studies had shown that, for most of the cultivars, there was a greater percentage of personal-sized (3-7 pounds) watermelons from plots mulched with black plastic, compared to unmulched plots (Maynard, 2008). Therefore, all rows in these trials were mulched with 1.25 mil black plastic (3 ft. wide). Plants were removed from all plots at the end of the growing season and the land fallowed over winter.

Fertilization. The soils were fertilized at a rate of 1000 lb./A 10-10-10 before planting. In mid-July, the strips between the black plastic were sidedressed with 240 lb/A calcium nitrate. Total application of nitrogen during the growing season was 140 lb/A. Soil pH was about 6.5 at each site, thus, lime was not required.

Weed control. At Windsor, weeds were controlled by the herbicide Strategy (3 pt/A) sprayed in the aisles after planting. At Lockwood Farm, weeds were controlled mechanically by rototilling before vines completely carpeted the aisles.

Insect and disease control. Insects and diseases were controlled by Maneb (mancozeb), Quadris (azoxystrobin), Asana (esfenvalerate), Dithane, and Bravo (chlorothalnil) applied per labeled directions as needed throughout the growing season. For details, see Appendix 1.

Irrigation. The crops at both sites were irrigated with overhead sprinklers as needed to provide the plants with 1-inch of water weekly.

Harvest. Watermelons were harvested in late September after they were determined to be ripe. Some experience is required to harvest watermelons when they are fully mature. Harvest timing is critical because watermelons cease to ripen after they have been removed from the vine. The following indicators denote full maturity: (1) light green, curly tendrils on the stem near the point of attachment of the melon usually turn brown and dry; (2) the surface color of the fruit becomes dull; (3) the skin becomes resistant to penetration by the thumbnail and is rough to the touch; and (4) the ground spot (where it lies on the soil) turns from light green to a pale yellow. Each fruit was weighed. The few fruits weighing less than 2 pounds were unmarketable and, thus, excluded in the analysis. The rind thickness was measured on ten random samples from each replication and the results averaged after statistical analysis.

Percent soluble solids. Percent soluble solids measures percent total sugars. The Brix meter (Palette Digital Refractometer, Atago USA, Bellevue, Washington), a standard tool, allows rapid measurement in the field. Samples were obtained from the center of 10 randomly sampled fruit, the juice expressed, and its Brix measured. The Brix readings for each cultivar were averaged after statistical analysis.

Statistical Analysis. A three-factor (location, year, cultivar) analysis of variance (ANOVA) was used to compare both percent personal sized watermelon and percent of watermelons that were greater than 7 pounds. All values were arcsine transformed to stabilize the variance (Neter and Wasserman 1974). Tukey's HSD test was used to test for significant differences at $p < 0.05$.

RESULTS AND DISCUSSION

Size Distribution. Size is one of the most critical criteria for personal-sized watermelons. Personal-sized watermelons (3-7 lb) are usually sold by the melon with the current market price averaging \$4.99/melon. Those exceeding 7 pounds are usually sold by weight (typically 0.49/lb). With these prices, watermelons weighing between 7 and 10 pounds would sell at a lower price than personal-sized watermelons. Thus, unless the goal of the grower is to strive for large watermelons, it is to the grower's advantage to have a large percentage of melons in the 3-7 pound (personal-sized) range.

Percent personal sized watermelons did not vary between years ($F_{2,66} = 0.921$, $P = 0.403$), but did differ by location ($F_{1,66} = 8.947$, $P = 0.004$) and cultivar ($F_{10,66} = 19.121$, $P < 0.001$). Averaging all cultivars in all years, there was a greater percentage of watermelons in the personal-sized range at Mt. Carmel (56%) compared to Windsor (46%) (Table 2). The greatest yearly difference between sites was in 2009 when 54% of the harvested watermelons at Mt. Carmel were personal-sized compared to 41% at Windsor (Tables 3-5). The greatest percentage of personal-sized watermelons (61%) occurred at Mt. Carmel in 2010. In all three years, there were a greater percentage of watermelons smaller than 3 pounds at Mt. Carmel.

Windsor had a significantly greater percentage of watermelons greater than 7 pounds (51% compared to 34% at Mt. Carmel) ($F_{1,66} = 23.661$, $P < 0.001$) (Table 6). The greatest yearly difference was in 2009 when 57% of the harvested watermelons at Windsor were greater than 7 pounds compared to 34% at Mt. Carmel (Tables 3-5). Percent greater than 7 pounds also varied by cultivar ($F_{10,66} = 15.965$, $P < 0.001$).

In 2008, 54% of the watermelons at Mt. Carmel were personal-sized compared to 46% at Windsor (Table 3). The cultivar Mielhart produced at least 80% in the personal-sized range at both sites followed by Wonder, averaging 62%. Fifty-two percent of Windsor's watermelons were greater than 7 pounds compared to 43% at Mt. Carmel. The cultivars Mini Yellow (80%) and Valdoria (67%) had the greatest percentage of watermelons exceeding 7 pounds at both sites.

In 2009, 54% of the watermelons at Mt. Carmel were personal-sized compared to 41% at Windsor (Table 4). The cultivar Mielhart produced the greatest percentage in the personal-sized range at Mt. Carmel (89%), while Bravo had the greatest percentage at Windsor (79%). Cultivars also producing large percentage of personal-sized watermelons were Bravo, Leopard, and Vanessa at Mt. Carmel and Extazy, Fantasy, Leopard, Vanessa, and Wonder at Windsor. Fifty-seven percent of Windsor's watermelons were greater than 7 pounds compared to 34% at Mt. Carmel. Both Big Tasty and Snack Pack had over 90% of their watermelons exceeding 7 pounds.

In 2010, 61% of the watermelons at Mt. Carmel were personal-sized compared to 54% at Windsor (Table 5). The cultivar Mielhart produced the greatest percentage in the personal-sized range at Mt. Carmel

(73%), while Fantasy, Leopard, and Bravo also had strong percentages. Bravo had the greatest percentage at Windsor (75%). Forty-two percent of Windsor's watermelons exceeded 7 pounds compared to 25% at Mt. Carmel. Extazy had the greatest percentage in this size range at Windsor (60%), while, at Mt. Carmel, Wonder, Extazy, Fantasy, and Leopard had the greatest percentage (31% average).

Averaging all years and both sites, Mielhart produced the greatest percentage in the personal-sized range (74%) and was significantly greater than Extazy, Fantasy, Valdoria, Mini Yellow, Big Tasty, and Snack Pack (Table 2). Bravo (71%) was significantly greater than Valdoria, Mini Yellow, Big Tasty, and Snack Pack. Snack Pack (2%) and Big Tasty (6%) had the smallest percentage in the personal-sized category.

Three cultivars, Mielhart, Vanessa, and Wonder were grown all three years at both sites. Percent personal sized watermelons of these cultivars differed between years ($F_{2,28} = 41.558$, $P < 0.001$), location ($F_{1,28} = 12.265$, $P = 0.002$), and cultivar ($F_{2,28} = 7.660$, $P = 0.002$). When averaging those three cultivars, the percentage of personal-sized watermelons varied from 52% to 64% at Windsor and 60% to 76% at Mt. Carmel. The year 2008 had a significantly greater percentage of personal sized watermelons than 2009 ($P < 0.001$) and 2010 ($P < 0.001$). Mielhart had a significantly greater percentage than either Wonder ($P = 0.005$) and Vanessa ($P = 0.007$). Vanessa was also grown in earlier trials during 2005-2007 (Maynard 2008). The average percentage of personal-sized watermelons of those earlier trials was 75%, compared to 58% for these trials. Watermelons were harvested some two weeks earlier in the 2005-2007 trials, which may have contributed to a greater percentage weighing 3-7 pounds, but they were not necessarily fully ripe.

Some cultivars were described as personal-sized, but were considerably larger, averaging over 17 lbs. These included Snack Pack and Big Tasty, which had significantly greater percentages of watermelons greater than 7 pounds than the other cultivars (Table 6). Snack Pack and Big Tasty both had at least 92% exceeding 7 pounds at both sites, while Mini Yellow had at least 74% exceeding 7 pounds at both sites.

Yields. Unlike larger watermelons, personal-sized watermelons are sold by the melon, not by the pound. Therefore, estimated yields were measured in number of fruit per acre. In 2008, the average total yield of all cultivars was 14,637 fruit/A at Mt. Carmel compared to 13,743 fruit/A at Windsor, a 7% difference (Table

7). Because the average number of fruit per plant was virtually the same at both sites (6.0 vs. 5.9), the larger average yield at Mt. Carmel was due to a greater percentage of the fruit weighing from 3-7 pounds (54% vs. 46%).

In 2008, at both sites, Mielhart had the greatest yield of personal-sized watermelons exceeding all other cultivars by at least 107% in Windsor and 42% at Mt. Carmel (Table 7). Wonder had the second greatest yields at both sites.

In Connecticut, virtually all watermelons are sold at roadside stands and farmers markets, and are not shipped long distances. Therefore, oversized watermelons (>7 lbs), even though not classified as “personal-sized”, could still be sold as a seedless watermelon. Overall quality does not diminish as the size increases. At both sites, Mini Yellow produced the greatest number of fruit exceeding 7 pounds and the greatest number of tons/A (Table 7). Weight is an important consideration as these oversized watermelons would be sold by the pound.

In 2009, the average total yield of personal-sized watermelons was 7,951 fruit/A at Windsor compared to 7,298 fruit/A at Mt. Carmel, a 9% difference (Table 8). Windsor had a greater number of fruit/plant (3.6 vs. 2.8) and Mt. Carmel had a greater percentage in the personal-sized range, 54% and 41%, respectively. Considering oversized (> 7 lbs) watermelons, plants at Windsor averaged double the yield in T/A compared to Mt. Carmel, 40.4 and 20.0, respectively.

At Windsor, in 2009, Bravo produced the greatest number of personal-sized fruit/A (17,550) while Vanessa, Mielhart, and Leopard also had yields exceeding 12,000 fruit/A (Table 8). Although Mielhart produced the greatest number of oversized (> 7 lbs.) watermelons, Snack Pack had the greatest T/A of the oversized watermelons. Snack Pack had fewer watermelons, but the average weight of each watermelon was greater. Big Tasty, Extazy, Fantasy, and Vanessa had the second greatest yields in T/A of oversized watermelons.

At Mt. Carmel, in 2009, Bravo again had the greatest number of personal-sized fruit/A (14,009), while Mielhart also produced over 10,000 watermelons/A. Big Tasty and Snack Pack had both the greatest numbers and the greatest yields in T/A of oversized watermelons.

In 2010, the average total yield of personal-sized watermelons was 11,474 fruit/A at Windsor,

compared to 9,373 fruit/A at Mt. Carmel, a 22% difference (Table 9). Windsor had a greater number of fruit/plant (4.8 vs. 3.5) and Mt. Carmel had a greater percentage in the personal-sized range (61 vs. 54%). Considering oversized (> 7 lbs) watermelons, plants at Windsor averaged more than double the yield in T/A, compared to Mt. Carmel, 37.9 and 17.0, respectively.

At Windsor, in 2010, Bravo and Mielhart produced the greatest number of personal-sized watermelons/A (19,275 and 16,705, respectively), while Fantasy, and Leopard yielded over 10,000 watermelons/A (Table 9). Extazy, Fantasy, and Mielhart produced the greatest numbers of oversized (> 7 lbs) watermelons and had the greatest yields (T/A).

At Mt. Carmel, in 2010, Bravo again had the greatest number of personal-sized watermelons per acre (13,721), while Mielhart and Fantasy also produced over 10,000 watermelons per acre (Table 9). Fantasy, Bravo, and Wonder had both the greatest numbers and the greatest yields in T/A of oversized watermelons.

The average personal-sized yields of the three cultivars (Mielhart, Vanessa, and Wonder) grown in all three years were 20,180 fruit/acre in 2008, compared to 9,463 fruit/acre in 2009 and 9,469 fruit/acre in 2010. Yields of watermelons greater than 7 pounds averaged 36.2 T/A in 2008, compared to 21.2 T/A in 2009 and 24.2 T/A in 2010. The greater yields of both types of watermelons in 2008 were due, in part, to a greater number of fruit/plant at both sites, which indicated that more flowers were pollinated. In 2009, there were 24 days with measurable rain between June 15 and July 31 (when pollination was occurring) compared to 16 days in 2008 (Table 10). Since pollinating insects are less active on rainy days, the greater number of rainy days in 2009 could be the reason fewer flowers were pollinated; hence, a smaller number of fruit/plant. In 2010, it was hot and dry during the same time period. For 32 days, temperatures exceeded 85°F compared to 17 days in 2008. Very hot temperatures lead to less activity of pollinating insects, which could be the reason why fewer flowers were pollinated. It appears that optimum weather conditions for pollination occurred in 2008, which resulted in unusually high watermelon yields.

Days to maturity were calculated from the transplanting date to the date of first significant harvest. The average maturity of all the cultivars tested was 87 days compared to the average maturity listed in the seed catalogs (83 days).

Rind thickness. Rind thicknesses ranged between 0.3-0.5 inches (Table 11). The cultivars that produced the thickest rinds were Big Tasty, Mini Yellow, and Snack Pack averaging 0.49 of an inch. These were also the cultivars that produced the greatest percentage of watermelons over 7 pounds. The varieties producing the thinnest rinds were Bravo, Mielhart, Vanessa, and Valdoria, averaging 0.35 inches. As most of the watermelons grown in Connecticut will not be shipped long distances, a thicker rind is unnecessary. A thinner rind that provides more edible flesh and less waste would be especially appealing for customers of roadside stands and farmers markets.

Sweetness. Bravo, Mini Yellow, Valdoria, and Wonder had Brix values equal to or greater than 11% (Table 11). The lowest sugar concentrations (average of 9.4%) were two of the cultivars that had thicker rinds and high percentages of larger watermelons (Big Tasty and Snack Pack).

There is a slight year-to-year variability in sugar concentrations. Some cultivars are more variable than others. When comparing the average Brix of each cultivars that were planted all three years, the average values for Mielhart varied from 10.6 to 11.0, Vanessa from 10.2 to 11.4, and Wonder from 10.8 to 11.2. Excessive water in the days before harvest can lower sugar concentration in the fruit. Maturity can also affect the total soluble sugars. Mielhart and Wonder have more consistent sugar concentrations relative to Vanessa.

MANAGEMENT STRATEGIES

Selection of cultivars. Many personal-sized watermelon varieties can be grown successfully in Connecticut. Eight of eleven varieties evaluated produced abundant marketable personal-sized watermelons. The remaining three varieties produced abundant marketable medium-sized (> 7 lbs) watermelons. There are several fruit characteristics to consider when choosing a variety. First is the color and the appearance of the fruit. This cosmetic characteristic has little effect on taste. However, harvesting is much easier if the color of the seedless cultivar is different than the color of the seeded pollinating variety. Size is another factor to consider. According to seed catalogs, all cultivars tested were classified as personal-sized in the 3-7 pound range. However, some produced a greater percentage of fruit in the 3-7 pound range. Other noteworthy characteristics to consider include sweetness of the fruit, seedlessness, and seed germination. Lastly, the total yield is an important consideration, especially

for commercial enterprises. Varieties with large yields at both sites demonstrated their usefulness throughout Connecticut.

Among the named seedless cultivars, Bravo, Leopard, and Mielhart had rind characteristics (striped) similar to the pollinator cultivar, Side Kick, which still could be distinguished from the others because of its small size. Mini Yellow, Valdoria, and Vanessa (all dark green with no stripes) were easily distinguished from the pollinator cultivar. Only Valdoria contained a few seeds. In 2009, germination was poor in the greenhouse for Leopard and Vanessa; however, in other years when these varieties were planted, germination was acceptable. The varieties producing the thinnest rinds were Bravo, Mielhart, Vanessa, and Valdoria, while Bravo, Mini Yellow, Valdoria, and Wonder had the greatest sugar concentrations.

Taking all factors into consideration including yields, it appears that Mielhart, Bravo, and Vanessa, provided abundant marketable personal-sized watermelons. Of these three cultivars, Bravo was the sweetest. If farmers are interested in growing cultivars that have acceptable yields for both personal-sized and larger watermelons, these three cultivars also provided abundant larger (>7 lbs) marketable watermelons. In addition, Fantasy had the greatest yields (T/A) in 2010 with these larger watermelons and had the third greatest yields of personal-sized watermelons.

When considering the potential gross income/A of each cultivar, Mielhart averaged \$115,586/A over three years (Tables 5-7) compared to \$80,968 for Vanessa and \$78,549 for Wonder. Bravo averaged \$97,266 over the two years that it was grown with all other cultivars averaging lower numbers. Thus, a grower who chooses to include Mielhart will average at least \$18,000 more per acre compared any of the other cultivars.

The cultivar, Sidekick provided an excellent supply of pollen throughout the growing season and its distinctive fruit made harvesting easier.

Mulches. Watermelon prefers warm soil temperatures. Plastic mulches raise the soil temperature an average 6-12°F, whereas organic mulches such as compost, leaves, or grass clippings lower the soil temperature 10-18°F (Hill et al., 1982). Thus, plastic mulches are preferable to organic mulches for watermelon crops. Black plastic is preferable to clear plastic because weeds cannot germinate and grow under black plastic. Clear plastic

creates a mini-greenhouse and favors weed growth. In this study, plastic mulch was applied by hand in the first year and in subsequent years by a tractor-drawn plastic layer.

Earlier trials with amended and unamended soils found that the warming effect of black plastic mulch compared to unamended soil is more evident early in the season (Maynard, 2008). The warmed soil beneath the plastic mulch encouraged early plant growth and plants growing in plots amended with plastic mulch grew larger during the early flowering season. A greater number of flowers was produced, compared to plants growing in unamended plots. At both sites, in all years, yields from plots amended with plastic mulch had greater average yields than the unamended plots (Maynard, 2008). This was due to a greater number of fruit/plant.

Black plastic mulch also provides good weed control. Young watermelon plants cannot compete with weeds early in the growing season. Weed control contributes to larger plant size early in the season. Unfortunately, black plastic mulch may create water stress if the plastic is laid in dry soil. Plastic laid after a rain or irrigation alleviates this potential problem. Holes can be punched in the plastic after a rain to drain puddles on the plastic and to allow water to penetrate the underlying soil.

Plant spacing. Size is critical for classification of watermelons in the 3-7 pound range for personal-sized watermelons. For all the cultivars, there were some melons that were either too large or too small. Normally, fruit size can be controlled by closer plant spacing within the row to produce smaller fruit. However, studies of personal-sized watermelons have shown that fruit size appears to be unaffected by plant spacings (Katz, 2005). It appears that, at least for personal-sized watermelons, genetics plays the dominant role in determining fruit size. In this study, plants were spaced 3 feet apart within the row. This spacing might be reduced to 18 inches to increase the number of plants per acre.

Pollinator placement. To produce seedless watermelons, one third of the field should be planted with a pollinator cultivar. This can be achieved in two ways: every third row or every third plant within the row. In this study, the pollinator was planted between the second and third plant and between the fifth and sixth plant in each cultivar with an additional pollinator planted between the two replications. Having the entire third row planted with a pollinator cultivar facilitates planting, especially if mechanical planters are used. Harvesting is also

easier, especially if the seedless fruit and fruit from the pollinator vary little in size and color. However, if space is a consideration, in-row planting of the pollinator is preferred; then every row is productive.

Harvest. For roadside and farmers' markets sales, only mature fruit should be harvested. Immature fruit will not ripen off the vine and Brix levels will not increase. Watermelons should be cut from the vine rather than pulled, leaving about an inch of stem. Ripeness can be judged by a withering tendril adjacent to the stem attachment to the vine. The color of the ground patch (uncolored area where the fruit lies on the ground) also changes from white to yellow. With experience, ripeness can be detected by sound. A mature fruit has a hollow tone if rapped with your knuckle compared to a high pitched tone in immature fruit. Another indicator of maturity includes increased "waxiness" of the rind. Overripe fruit may split when subjected to rapid changes in soil moisture following rains. If heavy rain is forecast, ripe fruits should be picked to prevent cracking.

CONCLUSIONS

Personal-sized seedless watermelons can be grown successfully in Connecticut with little special treatment. Eight of eleven cultivars evaluated produced excellent quality fruit and yields at both sites. Black plastic mulch increased yields by increasing the number of fruit per plant. Informed choices of seedless cultivars and pollinator cultivars can make harvesting easier. For the homeowner, personal-sized watermelons provide a sweet healthy dessert without sacrificing valuable space in the refrigerator. For the commercial grower, personal-sized watermelons offer special market opportunities, especially for those who grow for roadside stands and farmers' markets.

ACKNOWLEDGEMENT

I would like to thank Hazara Seed Company for donating seeds of Bravo, Extazy, Fantasy, Leopard, Mielhart, and Wonder for the 2009 and 2010 trials.

REFERENCES

- Hill, D.E., L. Hankin, and G.R. Stephens 1982. Mulches: Their effect on fruit set, timing, and yields of vegetables. Connecticut Agricultural Experiment Station Bulletin 805. 15 pp.
- Katz, M. 2005. Smaller may be better. *The Grower*. May pp.29-30.
- Maynard, A.A. 2008. Personal-sized watermelon trials 2005-2007. Connecticut Agricultural Experiment Station Bulletin 1014. 16 pp.

- Neter, J, and Wasserman, W. 1974. Applied Linear Statistical Models. Richard D. Irwin, Inc. Homewood, Illinois. pp. 842.
- Ohlemeier, D. 2006. Growers take it personal as minimelons catch on. *The Packer*. Vol. CXIII, No. 17.
- Reynolds, C.A. 1979. Soil Survey of New Haven County, Connecticut. United States Department of Agriculture, Soil Conservation Service. 197 pp.
- Robinson, R.W. and D.S. Decker-Walters. 1997. Cucurbits. *Crop Production Science in Horticulture* No. 6. CAB International, Wallingford, UK. pp. 84-86.
- Shearin, A.E. and D.E. Hill. 1962. Soil Survey of Hartford County, Connecticut. United States Department of Agriculture, Soil Conservation Service. 126 pp.
- The Grower, 2005. Mini-melons pack big nutritional punch. Vol. 38(3):38-39.
- Womack, R. 2006. Watermelons of a different color. *Growing*. Vol. 4(2):16-19.

Table 1. Fruit characteristics of cultivars in 2008-2010 personal-sized watermelon trials

Cultivar	Year Planted	Rind Characteristics	Supplier
Big Tasty	2009	Light green, no stripes	Burbee
Bravo	2009-10	Light green, dark stripes	Hazara
Extazy	2009-10	Dark green, mottled striping	Hazara
Fantasy	2009-10	Dark green, mottled striping	Hazara
Leopard	2009-10	Light green, dark stripes	Hazara
Mielhart	2008-10	Light green, dark stripes	Hazara
Mini Yellow	2008	Dark green, no stripes	Rupp
Snack Pack	2009	Light green, no stripes	Burbee
Valdoria	2008	Dark green, no stripes, lightly seeded	Siegers
Vanessa	2008-10	Very dark green, no stripes	Holmes
Wonder	2008-10	Dark green, mottled striping	Hazara
Sidekick (pollinator)	2008-10	Light green, wide dark stripes	Holmes

Table 2. Mean percentages for watermelons between 3 and 7 lbs

Cultivar	Mt. Carmel	Windsor	Average
Mielhart	81%	66%	74% a
Bravo	65%	78%	71% ab
Leopard	63%	58%	61% abc
Wonder	60%	51%	55% abc
Vanessa	58%	53%	55% abc
Extazy	59%	38%	49% bc
Fantasy	62%	33%	48% bcd
Valdoria	41%	25%	33% cde
Mini Yellow	23%	13%	18% def
Big Tasty	9%	7%	8% ef
Snack Pack	0%	3%	2% f
Average	56%	46%	51%

Means followed by the same letter are not significantly different by Tukey's HSD test at the five percent level.

Table 3. Percent size distribution of watermelons in 2008 (rows may not add up to 100% because of rounding)

Cultivar	<3 lbs	Personal-sized (3-7 lbs)	>7 lbs
<u>Windsor</u>			
Mielhart	4	82	14
Mini Yellow	2	13	86
Valdoria	0	25	75
Vanessa	3	53	43
Wonder	1	57	41
<u>Mt. Carmel</u>			
Mielhart	9	80	11
Mini Yellow	1	23	76
Valdoria	0	41	59
Vanessa	2	57	40
Wonder	2	67	30

Table 4. Percent size distribution of watermelons in 2009 (rows may not add up to 100% because of rounding)

Cultivar	<3 lbs	Personal-sized (3-7 lbs)	>7 lbs
<u>Windsor</u>			
Big Tasty	0	5	95
Bravo	6	79	15
Extazy	0	45	55
Fantasy	0	15	85
Leopard	4	65	31
Mielhart	1	55	45
Snack Pack	0	4	96
Vanessa	3	57	40
Wonder	9	44	47
<u>Mt. Carmel</u>			
Big Tasty	0	8	92
Bravo	19	67	13
Extazy	7	60	33
Fantasy	12	62	26
Leopard	25	60	5
Mielhart	6	89	6
Snack Pack	4	0	96
Vanessa	17	72	11
Wonder	17	67	17

Table 5. Percent size distribution of watermelons in 2010 (rows may not add up to 100% because of rounding)

Cultivar	<3 lbs	Personal-sized (3-7 lbs)	>7 lbs
<u>Windsor</u>			
Bravo	6	75	19
Extazy	5	35	60
Fantasy	1	49	49
Leopard	5	56	39
Mielhart	2	59	38
Vanessa	9	50	41
Wonder	2	54	45
<u>Mt. Carmel</u>			
Bravo	13	63	24
Extazy	15	58	28
Fantasy	4	63	33
Leopard	8	65	27
Mielhart	10	73	17
Vanessa	31	59	9
Wonder	17	48	36

Table 6. Mean percentages for watermelons between over 7 lbs

Cultivar	Mt. Carmel	Windsor	Average
Mielhart	11%	31%	21% a
Bravo	19%	16%	18% a
Leopard	22%	37%	30% ab
Wonder	29%	45%	37% ab
Vanessa	21%	42%	31% ab
Extazy	29%	59%	44% ab
Fantasy	30%	66%	48% bc
Valdoria	59%	75%	67% bcd
Mini Yellow	75%	86%	81% cde
Big Tasty	91%	93%	92% de
Snack Pack	96%	97%	96% e
Average	34%	51%	43%

Means followed by the same letter are not significantly different by Tukey's HSD test at the five percent level.

Table 7. Yields of watermelons in 2008

Cultivar	Avg Fruit/plant no.	% pers.sized 3-7 lbs	est. yield no./A*	% oversized >7 lbs	est yield no./A*	est yield (>7 lb) T/A**	gross income/A dollars***
<u>Windsor</u>							
Mielhart	8.9	82	31,790	14	5,428	21.6	179,800
Mini Yellow	4.5	13	2,548	86	16,858	83.0	94,055
Valdora	4.5	25	4,900	75	14,702	69.0	92,071
Vanessa	6.1	53	14,083	43	11,426	47.3	116,628
Wonder	6.2	57	15,394	41	11,073	51.3	127,090
<u>Mt. Carmel</u>							
Mielhart	7.6	80	26,484	11	3,642	15.3	147,149
Mini Yellow	4.9	25	5,336	74	15,795	76.1	101,205
Valdora	4.5	41	8,037	59	11,565	46.5	85,675
Vanessa	5.9	57	14,649	40	10,280	44.6	116,807
Wonder	6.4	67	18,679	30	8,364	37.0	129,468

*Estimated Yield no/A = number plants/A (4,356) X number fruit/plant X % fruit 3-7 lbs

**Estimated Yield T/A = number plants/A (4,356) X number fruit/plant X % fruit >7 lbs X avg. weight of >7 lb fruit

*** Assuming \$4.99/fruit for personal-sized and \$0.49/lb for >7 lb fruit

Table 8. Yields of watermelons in 2009

Cultivar	Avg Fruit/plant no.	% pers.sized 3-7 lbs	est. yield no./A*	% oversized >7 lbs	est yield no./A*	est yield (>7 lbs) T/A**	gross income/A dollars***
<u>Windsor</u>							
Big Tasty	1.6	5	348	95	6,621	57.6	58,185
Bravo	5.1	79	17,550	15	3,332	13.8	101,098
Extazy	3.5	45	6,861	55	8,385	42.3	75,690
Fantasy	2.4	15	1,568	85	8,886	43.2	50,160
Leopard	4.3	65	12,175	31	5,807	23.2	83,489
Mielhart	5.8	55	13,896	45	11,369	43.9	112,363
Snack Pack	2.0	4	348	96	8,364	71.8	72,101
Vanessa	5.8	57	14,401	40	10,106	45.1	116,059
Wonder	2.3	44	4,408	47	4,709	22.7	44,242
<u>Mt. Carmel</u>							
Big Tasty	1.8	8	627	92	7,214	58.6	60,557
Bravo	4.8	67	14,009	13	2,719	11.0	80,685
Extazy	3.3	60	8,625	33	4,744	20.6	63,227
Fantasy	3.6	62	9,723	26	4,077	16.8	64,982
Leopard	3.3	60	8,625	15	2,156	9.1	51,957
Mielhart	2.6	89	10,080	6	680	2.8	53,043
Snack Pack	1.6	0	0	96	6,691	48.8	47,824
Vanessa	2.6	72	8,154	11	1,246	5.6	46,176
Wonder	2.0	67	5,837	17	1,481	7.0	35,987

*Estimated Yield no/A = number plants/A (4,356) X number fruit/plant X % fruit 3-7 lbs

**Estimated Yield T/A = number plants/A (4,356) X number fruit/plant X % fruit >7 lbs X avg. weight of >7 lb fruit

***Assuming \$4.99/fruit for personal-sized and \$0.49/lb for >7 lb fruit

Table 9. Yields of watermelons in 2010

Cultivar	Avg Fruit/plant no.	% pers.sized 3-7 lbs	est. yield no./A*	% oversized >7 lbs	est yield no./A*	est yield (>7 lbs) T/A**	gross income/A dollars***
<u>Windsor</u>							
Bravo	5.9	75	19,275	19	4,883	19.9	115,684
Extazy	4.3	35	6,556	60	11,238	49.9	81,616
Fantasy	5.1	49	10,886	49	10,886	56.3	109,495
Leopard	4.4	56	10,733	39	7,475	31.9	84,820
Mielhart	6.5	59	16,705	38	10,759	48.5	130,888
Vanessa	3.1	50	6,752	41	5,536	23.7	56,918
Wonder	4.0	54	9,409	45	7,841	35.2	81,447
<u>Mt. Carmel</u>							
Bravo	5.0	63	13,721	24	5,227	23.6	91,596
Extazy	2.9	58	7,327	28	3,537	16.4	52,634
Fantasy	3.9	63	10,703	33	5,606	24.5	77,418
Leopard	3.5	65	9,910	27	4,116	16.6	65,719
Mielhart	3.7	73	11,766	17	2,740	11.8	70,276
Vanessa	2.3	59	5,911	9	902	3.8	33,220
Wonder	3.0	48	6,273	36	4,704	22.2	53,058

*Estimated Yield no/A = number plants/A (4,356) X number fruit/plant X % fruit 3-7 lbs

**Estimated Yield T/A = number plants/A (4,356) X number fruit/plant X % fruit >7 lbs X avg. weight of >7 lb fruit

*** Assuming \$4.99/fruit for personal-sized and \$0.49/lb for >7 lb fruit

Table 10. Rainfall and temperature readings taken at Mt. Carmel in 2008, 2009, 2010 (June 15-July 31)

Year	Avg. Max. Temp. (°F)	Avg. Min. Temp. (°F)	#days> 85°F	Rainfall (avg. 7.27") (in)	#rainy days
2008	82.0	63.9	17	7.87	16
2009	77.8	60.7	2	14.26	24
2010	86.0	65.2	32	7.31	11

Table 11. Mean values for rind thicknesses and Brix

Cultivar	Rind thickness (inches)	Brix (%)
Big Tasty	0.50a	9.2d
Bravo	0.36b	11.6a
Extazy	0.46a	10.7c
Fantasy	0.42b	10.4c
Leopard	0.40b	10.9bc
Mielhart	0.36b	10.8bc
Mini Yellow	0.49a	11.5a
Snack Pack	0.48a	9.6d
Valdoria	0.38b	11.2ab
Vanessa	0.31c	10.9bc
Wonder	0.44b	11.0b

Means followed by the same letter within each column are not significantly different by Tukey's HSD test at the five percent level.

Appendix 1. Spray records**Windsor***2008:*

Weed control: 6/13/08 Strategy @ 3.5 pts/Ac = 114ml (between plastic rows only)

- 6/24/08 Dithane M-45 @ 2lb/Ac = 24g
 Quadris @ 15.4 oz/Ac = 12ml
 Asana XL @ 9.6 oz/Ac = 8 ml
 In 2 gal H₂O, solo TG-3
- 7/18/08 Dithane M-45 @ 3lb/Ac = 94g
 Bravo Ultrex @ 2lb/Ac = 63g
 Asana XL @ 9.6 oz/Ac = 19 ml
 In 3 gal H₂O, Mist blower

2009:

Weed Control: 6/10/09 Strategy @ 3 pts/Ac = 48 ml (between plastic rows only)

- 6/24/09 Maneb 80W @ 2lb/Ac = 20g
 Quadris @ 15.4oz/Ac = 10 ml
 In 2 gal H₂O, solo TG-3
- 7/13/09 Maneb 80W @ 2lb/Ac = 28g
 Bravo Ultrex @ 1.8lb/Ac
 Asana XL @ 9.6 oz/Ac = 9 ml
 In 3 gal Solo TG-3
- 8/6/09 Aliette WDG @ 4lb/Ac = 105 g
 Quadris @ 15.4oz/Ac = 26 ml
 In 6 gal Spartan

2010:

Weed Control: 6/11/10 Strategy @ 3 pts/Ac = 39ml (between plastic rows only)

- 7/16/10 Quadris @ 15.4 oz/Ac = 26 ml
 Dithane M-45 @ 2lb/Ac = 52 g
 In 3 gal Mist blower

Mt. Carmel*2008:*

7/10/08 Ridomil- Bravo applied with a standard spray gun at the rate of 2 lbs./ acre.

2009:

- 7/9/09 Gramaxone applied with a backpack sprayer at a rate of 2 oz./ gallon.
 8/17/09 Pristine applied with a standard spray gun at the rate of 15 oz./ acre.

2010:

- 7/28/10 Gramaxone applied with a backpack sprayer at a rate of 2 oz./ gallon.
 8/25/10 Champ(2) applied with a standard spray gun at a rate of 21 oz./ acre.
 8/25/10 Flint applied with a standard spray gun at a rate of 4 oz./ acre.
 * Champ and Flint applied as a tank mixture.

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