shown to confer additional benefits to the scion in the form of improved tolerance to edaphic and other abiotic stresses; however, the mechanisms behind the enhanced stress tolerance are not well understood. Specific traits within root system morphology (RSM), in both field crops and vegetables, have been shown to improve growth under abiotic stress conditions. A greenhouse study was conducted November 2015– January 2016 to compare the RSM of 17 commercially available tomato rootstocks and one commercial field variety ('Florida-47'). Plants were grown in containers filled with a mixture of Turface® and pool filter sand (2:1 v/v) and harvested at 2-, 3-, or 4-weeks after emergence. The study was laid out in a RCBD with four blocks and fully factorial (18 cultigens 3 harvest dates) arrangement. At harvest, roots were carefully cleaned and then stained with 0.5 $g \cdot L^{-1}$ neutral red dye for 24 h. Following staining, roots were scanned and analyzed with WinRhizo. Data collected included total root length (TRL), average root diameter, specific root length (SRL), and relative diameter class. No significant cultigen harvest interaction was found. The main effect of cultigen was significant ($P \leq 0.05$) for all response variables and the main effect of harvest was only significant ($P \leq 0.01$) for TRL. 'Shield RZ', 'RST-106', and 'TD-2' had the longest TRL throughout whereas 'Beaufort', 'Kaiser', and 'RST-105' had the shortest. 'BHN-1088' had the thickest average root diameter, which was 32% thicker than the thinnest, observed in 'Beaufort'. SRL in 'Beaufort' was 60% larger than 'BHN-1088'. This study demonstrated that, in the non-grafted state, differences exist in RSM of tomato rootstocks grown and that, grown in a solid porous media, these differences can be quantified quickly and accurately using WinRhizo software. This method has the potential to help serve as a screen to further characterize rootstock quality and selection for growers.

8:30–8:45 AM

Effect of Fertilizer Source and Grafting on Tomato Growth, Leaf Nitrogen, and Fruit Yield in High Tunnels

Fairuz Buajaila*
Washington State University, NWREC, Mount Vernon, WA

Jeremy Cowan
Washington State University, Spokane, WA

Lynne Carpenter-Boggs
Washington State University, Pullman, WA

Debra A. Inglis
Washington State University, Mount Vernon, WA

Ed Scheenstra
Washington State University, NWREC, Mount Vernon, WA

Carol Miles
Washington State University, NWREC, Mount Vernon, WA

This study investigates fertilizer source and the use of grafted plants for season extension and fruit yield of tomato grown in high tunnels in northwest Washington in 2015. An integrated fertilizer [poultry manure (2242 $kg \cdot ha^{-1}$) plus 90 $kg \cdot ha^{-1}$ urea (46–0–0)] was compared with commercial chemical fertilizer [monoammonium phosphate (11-52-0), potassium sulfate (0-0-50), and urea (46–0–0)] applied at 112 N, 168 P_2O_5, and 56 K_2O $kg \cdot ha^{-1}$, and plant growth and fruit yield were measured. Additionally, grafting was tested to see if it affects leaf petiole nitrogen, early marketable yield, and season extension. Grafting treatments were 'Panzer' tomato grafted on 'Estamino', 'Maxifort', 'DRO138TX', and non-grafted 'Panzer' (control). Plant height and number of leaves were measured at transplanting and every 3 weeks thereafter. Height was greater for plants grown with commercial fertilizer than with integrated fertility on 21 May and 11 June, but there was no effect due to grafting with the three rootstocks. Plants grown with commercial fertilizer had more leaves than plants grown with integrated fertility on 30 Apr., 21 May, and 11 June, but there was no difference among the three rootstocks. Plants were pruned once per week from 30 Apr. to 24 Aug., and pruning biomass was greater with commercial fertilizer than for the integrated fertility treatment early in the season (4 and 11 June), and due to rootstocks later in the season (21 July, 10 and 24 Aug.). Nitrate-N was measured in both leaf tissue and fresh petiole sap of fifth or sixth youngest fully mature leaf (from the plant top) at 5, 7, 9, and 11 weeks after transplanting. There was no effect of fertilizer source on nitrate-N of either leaf tissue or fresh petiole sap; however, plants grafted on 'Estamino' had significantly more nitrate-N in fresh petiole sap on 1 June. Fruit were harvested once a week at 75% red stage, and harvest did not occur significantly earlier or later in the high tunnel due to the use of grafted plants. Marketable fruit number was greater for non-grafted plants on 21 July, for plants grafted with 'Estamino' on 14 Sept., and with the integrated fertility treatment on 28 Sept. Total mean marketable fruit weight was 6.3 kg per plant and did not differ due to fertilizer source or rootstock. Fertility management with 100% mineral fertilizer or an integrated fertility treatment can have equal fruit yield, and grafting did not affect harvest window or yield.

Specified Source(s) of Funding: the Libyan government

8:45–9:00 AM

Grafting, Irrigation, and Fertilization Effects on Tomato Plant Growth and Fruit Yield and Quality

Bizhen Hu*
The Ohio State University, Wooster, OH

Jennifer Moyseenko
The Ohio State University-OARDC, Wooster, OH

Matthew Kleinhenz
The Ohio State University-OARDC, Wooster, OH

The use of grafted vegetable plants is expanding in the United States, partly because of reports that they withstand biotic and abiotic stresses more effectively than standard, ungrafted seedlings. However, it is still unclear whether this capacity extends across sites, growing conditions, and rootstock-scion combinations. Our objective was to test the effects of irrigation and fertilization regimes and grafting on tomato growth, and

An asterisk (*) following a name indicates the presenting author.

fruit yield and quality in conventionally managed field plots. Studies were conducted in 4 years as a split-plot design with irrigation (2012) or fertilization management (2013–15) as the main plot and grafting as the subplot. Two irrigation treatments (standard, 50% of standard) were tested in 2012. Two fertilization treatments (pre-plant fertilization only, pre-plant fertilization plus standard fertigation) were tested in 2013 and 2014; and, four fertilization treatments (no pre-plant fertilization, pre-plant fertilization only, pre-plant fertilization plus standard fertigation, pre-plant fertilization with 150% of standard fertigation) were employed in 2015. Two commercial rootstocks ('Maxifort' and 'Emperador') and one experimental line ('320') were used in 2012 to 2014. Three commercial rootstocks ('Maxifort', 'Estamino' and 'Supernatural') were included in 2015. 'BHN589' was used as the scion and ungrafted control each year. Ripe fruits were harvested weekly 7, 7, 5, and 4 times in 2012, 2013, 2014, and 2015, respectively. Total and marketable fruit weight and number were measured, and average marketable fruit weight and marketable yield percentage were calculated. A subset of fruits was analyzed for fruit quality including Brix, pH, and titratable acidity (TA). In 2013 and 2014, plant growth was also monitored. Above-ground vegetative biomass, leaf area and N content, and truss number were greater in grafted than ungrafted plants in 2013, but the opposite was true in 2014. Regardless, yield trends were consistent across all years, with grafted plants having greater total seasonal yield than ungrafted plants. Neither irrigation nor fertilization management affected yield in 2012 and 2013, but fertilization affected yield in 2014 and 2015. The °Brix was higher in fruits from ungrafted versus grafted plants across all years. Fruit pH and TA were greater at the higher fertilization rate in 2014 and 2015. The grafting-irrigation/fertilization interaction was not significant for most variables. We conclude that plant performance is influenced by grafting combinations and fertilization regimes. Grafted plants have a higher yield potential than ungrafted ones under both high and low rates of irrigation/fertilization.

Specified Source(s) of Funding: USDA-SCRI

9:00–9:15 AM

Grafted Seedless Watermelon Production with Different Planting Densities

Qianru Liu*
University of Florida, Gainesville, FL

Xin Zhao
University of Florida, Gainesville, FL

Zack Black
University of Florida, Gainesville, FL

Jeffrey Brecht
University of Florida/IFAS, Gainesville, FL

Charles Sims
University of Florida, Gainesville, FL

Grafting watermelon with hybrid squash rootstocks can provide resistance to certain soil-borne diseases and improve plant vigor, thus leading to enhanced fruit yield. Given the yield improvement of grafted plants, the potential of reducing grafted plant population to increase cost effectiveness was explored. This study was designed to assess rootstock effects on yield and fruit quality of seedless watermelon grown with different in-row planting densities. The field trial was carried out in Fall 2015 in Citra, FL., with seedless watermelon (*Citrullus lanatus*) 'Melody' grafted onto interspecific squash (*Cucurbita maxima* x *C. moschata*) hybrid rootstock 'Super Shintosa'. Grafted and non-grafted 'Melody' were planted using in-row spacings of 0.76, 1.07, 1.37, and 1.68 m, with a constant between-row spacing of 2.44 m, resulting in populations ranging from 2444 to 5378 plants/ha. The experiment was arranged in a split-plot design with four replications, with planting densities as the whole plot treatments and grafting as the subplot factor. Marketable and unmarketable fruit weight and number were recorded for two harvests. At the first harvest, six fully ripe fruit from grafted and non-grafted plants in the 0.76 and 1.68 m treatments were sampled and stored overnight at 12 °C before fruit quality assessment. Instrumental measurements included flesh firmness, total soluble solids, titratable acidity, pH, flesh color, and lycopene content. Overall acceptability, flavor, and firmness were evaluated by consumer sensory analysis using a 1–9 hedonic scale, while sweetness, firmness, and juiciness were scored using a 1-5 "just about right" scale. At the second harvest, all the fruit were cut for evaluation of hollow heart. After the final harvest, plant roots were scored for root-knot nematode galling using a 0–10 rating scale. Grafting and in-row spacing showed significant effects on fruit yield. Despite higher root-knot nematode galling ratings in grafted plants, across all in-row spacings, grafting significantly improved marketable fruit number and average fruit weight on both per-plant and per-acre bases. With respect to in-row spacing, both marketable fruit number and weight per plant were highest at 1.68 m spacing while they were highest on a per-acre basis at 1.07 m spacing. At the first harvest, fruit quality analysis showed some differences in lycopene (non-grafted 'Melody' watermelon at 0.76 m spacing had the highest value) and lightness of fresh color (non-grafted 'Melody' watermelon at 1.68 m spacing had the lowest value). Interestingly, grafting significantly reduced hollow heart incidence at the second harvest.

Specified Source(s) of Funding: FDACS

9:15–9:30 AM

Grafting Watermelon to Control Verticillium Wilt Caused By *Verticillium dahliae* in Washington

Sahar Dabiran*
Washington State University, Mount Vernon, WA

Verticillium wilt, caused by the soilborne fungus *Verticillium dahliae*, is a significant disease affecting watermelon production in Washington State. In 2015, a field study was conducted at three locations in Washington to investigate the Verticillium wilt reactions, and fruit yield and quality of watermelon cv. TriX Palomar non-grafted (control) and grafted with rootstocks Super Shintosa, Tetsukabuto and Just grown with black and clear