Evaluation of Non-Harvested Watermelon Pollenizers for Flowering Characteristics and *Fusarium oxysporum* fsp. *niveum* Susceptibility

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Seedless watermelon production requires the use of diploid pollenizer plants in order to ensure adequate pollination. This is accomplished by planting a diploid (seeded) watermelon cultivar in the field with the seedless watermelon plants. These pollenizer plants can be planted in a number of patterns including dedicated rows adjacent to the seedless rows or inter-planting them within the rows with the seedless plants. The typical ratio of pollenizer plants to the seedless plants ranges from 1:5 to 1:3 (Fiacchino and Walters, 2003; Nesmith and Duval, 2001). Regardless of the planting method or the ratio of diploid (seeded) plants to seedless plants in a given area, space must be dedicated to the pollenizer plants in order to ensure growth and development of both male flowers and harvestable fruit. Seeded watermelon can be marketed by growers, however demand for these fruit continues to decline, in proportion to seedless fruit (Lucier and Lin, 2001). Seeded fruit typically bring lower prices than the more desirable seedless fruit (ERS USDA, 2003), but the pollenizer plants require the same amount of space per plant in the production field.

Growers have recently begun to interplant cheaper open pollinated diploid cultivars within the seedless rows and eliminating the need to dedicate space for adequate seeded fruit production. The intention in this type of system is to plant the entire acreage with seedless plants at normal production spacing, and interplant pollenizer plants without regard to their production value. The fruit from these plants is not intended to be harvested by the grower to be marketed; the plants exist solely to provide pollen to the seedless cultivar. Seed companies have responded to this demand by developing cultivars of non-harvested pollinators that have unique growth habits and flowering characteristics. However, the use of these new pollenizers is relatively new and their response to field production conditions is still being evaluated. The purpose of this study was to compare male flower production over time, the total number of male flowers produced, and the susceptibility to *Fusarium oxysporum* fsp. *niveum* (FON) of several of these non-harvested pollenizer varieties in a commercial field with a history of Fusarium wilt.

Materials and Methods

Plots were established on a commercial watermelon grower's field north of Vincennes, IN. This field was planted in seeded watermelon in 2005. Each plot consisted of 10 plants spaced at 2.5 feet between plants. Between row spacing was 8 feet. In each row 7 plants were non-harvested pollinators and 3 plants of cultivar Black Diamond. Black Diamond plants were planted every 3 plants. This cultivar was used as an indicator of Fusarium wilt presence in the plots, due to its high sensitivity to the disease. Plots were laid out in a randomized complete block design with all twenty varieties appearing in each block and 6 replications per variety (Table 1). One commercial seedless variety was included as well as several common diploid cultivars. Seeds for these varieties were sown in the greenhouse on April 18, 2006 in 50 count round cell polystyrene trays filled with Jiffy Plus (Jiffy Products of America, Inc., Norwalk, OH).

The field had black plastic mulch applied prior to transplanting. Plants were transplanted to the field on May 23, 2006. Transplanting was accomplished by hand and was followed immediately by delivering 6 ounces of water into the transplant hole. Pest management was accomplished based on guidelines established in the Midwest Vegetable Production Guide 2006 (ID-56) (Egel et al, 2006).

Flower counts were made on a weekly basis on each plot. In the early season, male flowers were counted on two plants in each plot of each variety. This method was used for the first 3 counting dates, before plant vines within the row had grown together. Plants were trained between rows and vines turned back onto the plastic, to avoid varieties growing together. Beginning on the fourth week counting was accomplished by counting all male flowers in two 9 square foot areas in each plot.

Plots were rated approximately weekly for the severity of Fusarium wilt using the Horsfall-Barratt scale (Horsfall and Barratt, 1945). The Area Under the Disease Progress Curve was determined by trapezoidal integration (Shaner and Finney, 1977). Those plants that failed to recover following wilting were destructively harvested and tissue isolations were conducted to positively identify FON.

Statistical analysis of differences between cultivars was determined by ANOVA using the general linear models procedure and Fisher's least significant difference test (SAS Institute, Cary, NC).

Results and Discussion

Early season counts of male flowers showed two distinct flowering patterns (Figure 1). Two varieties, Mickey Lee and Pinnacle produced significantly more male flowers from the first to the second week of flowering than any other varieties tested. However, by the third week of counting, these varieties were not significantly different than other varieties tested.

In male flower counts taken on June 27, 2006, SP-1 had significantly more flowers than other varieties (Figure 2). On the July 13, 2006 count, variety 6148 had significantly higher numbers of male flowers than any other variety. This was followed by SP-1 and 6132, which were not significantly different from each other. Sidekick and 6146 were significantly higher than the remaining 15 varieties. It should be noted that while we did not plant seedless watermelon varieties in the field and measure yield, July 11, 2006 would roughly translate to the first female flowering date for plants in a seedless watermelon variety trial carried out in a nearby field. These differences can be clearly seen in Figure 3.

When the last five male flower counting dates are averaged together, three distinct flowering groups emerge (Figure 4). Both SP-1 and 5WDL 6148, while not significantly different from each other, produced significantly more male flowers than other varieties.

The next group 5WDL 6132, SideKick, and 5WDL 6146 were not significantly different from each other, but produced significantly more male flowers than the remaining 15 varieties. The remaining group all performed similarly in terms of male flower production. They were not significantly different from one another and did produce significantly less male flowers than varieties in the first two groups.

The relatively warm weather that occurred in the latter part of May was correlated with a lower incidence of Fusarium wilt in southwestern Indiana in 2006. These conditions may have also lead to a lower incidence and severity of Fusarium wilt in this experiment that was field planted May 23, 2006. Few significant differences in Fusarium wilt were observed in the field experiment. Based upon this data, only Pinnacle, A&C 9825 and possibly NUN 6017 are sufficiently susceptible to interfere with pollination in a field with a history of FON wilt. Black Diamond is not used as a pollinator and was included in this study as a variety susceptible to Fusarium wilt.

Table 1: List of non-harvested pollenizers used in this trial. Inclusion or exclusion of a variety in this list should not be considered an endorsement or reproach of any particular variety.

Variety	Company
Pinnacle	Southwestern Seeds
SW 4806 (seedless)	Seedway
Jenny	Nunhems
Companion	Seminis
NUN 6017	Nunhems
Side Kick	Harris Moran
5WDL 6148	Syngetna
SP-1	Syngenta
5WDL 6146	Syngenta
5WDL 6132	Syngenta
Charleston Gray	n/a
Calhoun Gray	n/a
Dixie Lee	Willhite
All Sweet	Willhite
Black Diamond	Willhite
Sangria	Syngenta
Mickey Lee	Willhite
Royal Sweet	Willhite
Crimson Sweet	Syngenta
A&C 9825	Abbott & Cobb

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Figure 1: Early season counts of male flowers. All male flowers from each of two plants were counted for each plot. Note on the June 13, 2006 counting that both Mickey Lee and Pinnacle had significantly more male flowers than other varieties and measured by Fisher's LSD (α=0.05).

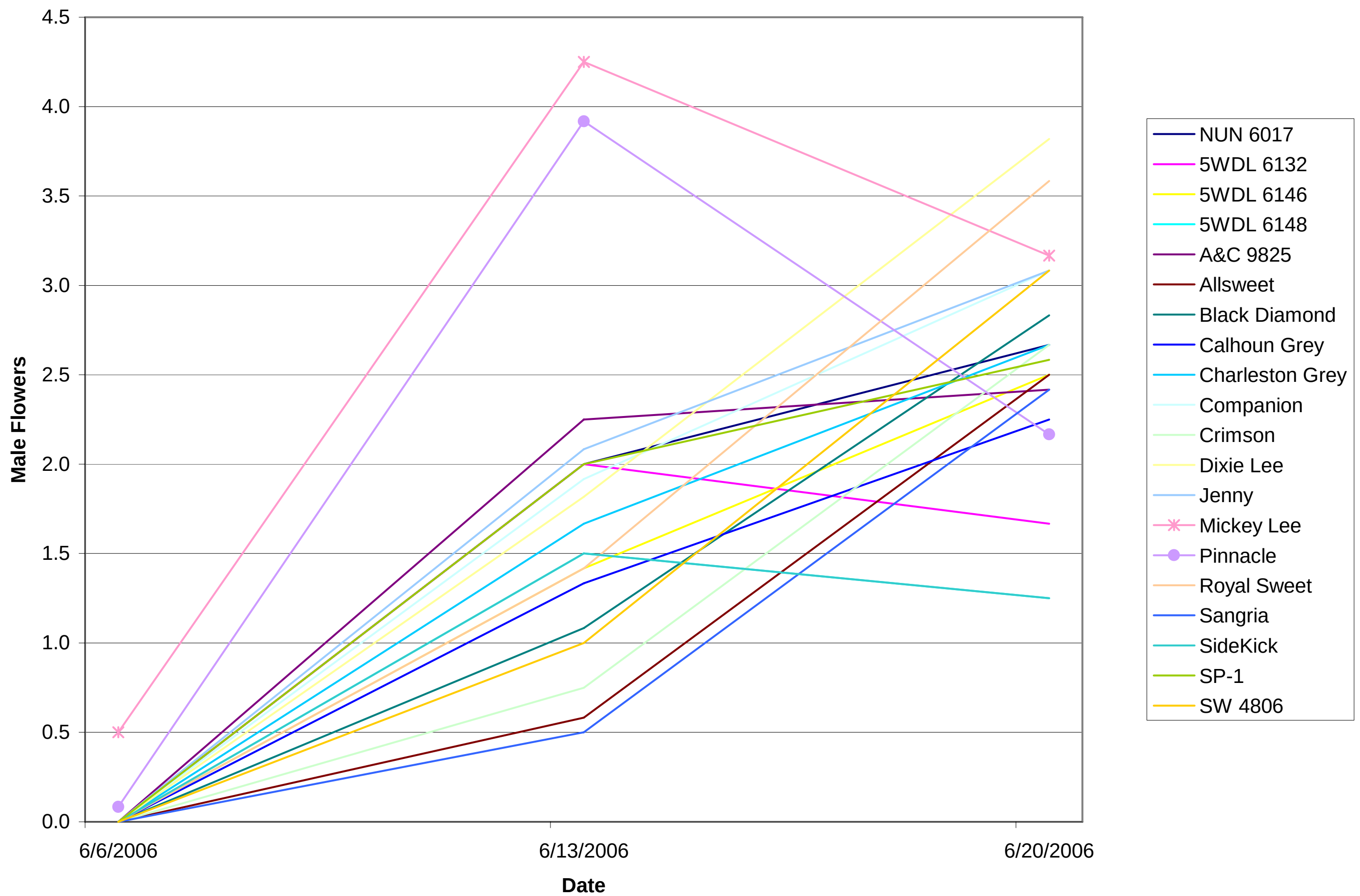

Figure 2: Male flower counts from June 27 to August 1, 2006 were taken on two 9 square foot areas in each plot. During the week of 6-27-2006, SP-1 had significantly more flowers than other varieties. On the July 13, 2006 count, variety 6148 had significantly higher numbers of male flowers than any other variety.

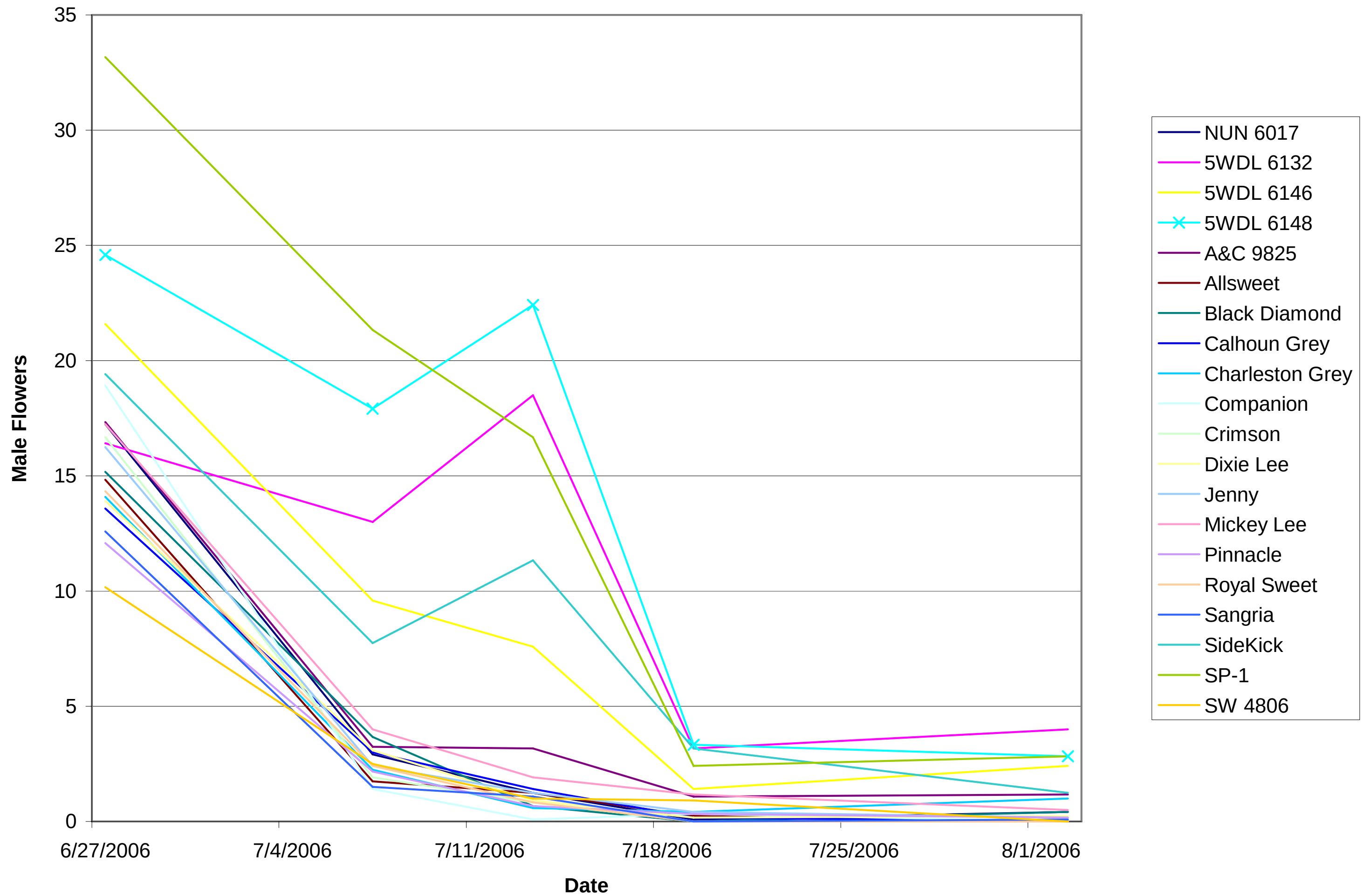

Figure 3: Male flower counts from 51 days after transplanting (7-13-2006). This date closely approximates initial female flowering for the seedless watermelon variety trial conducted in a nearby field.

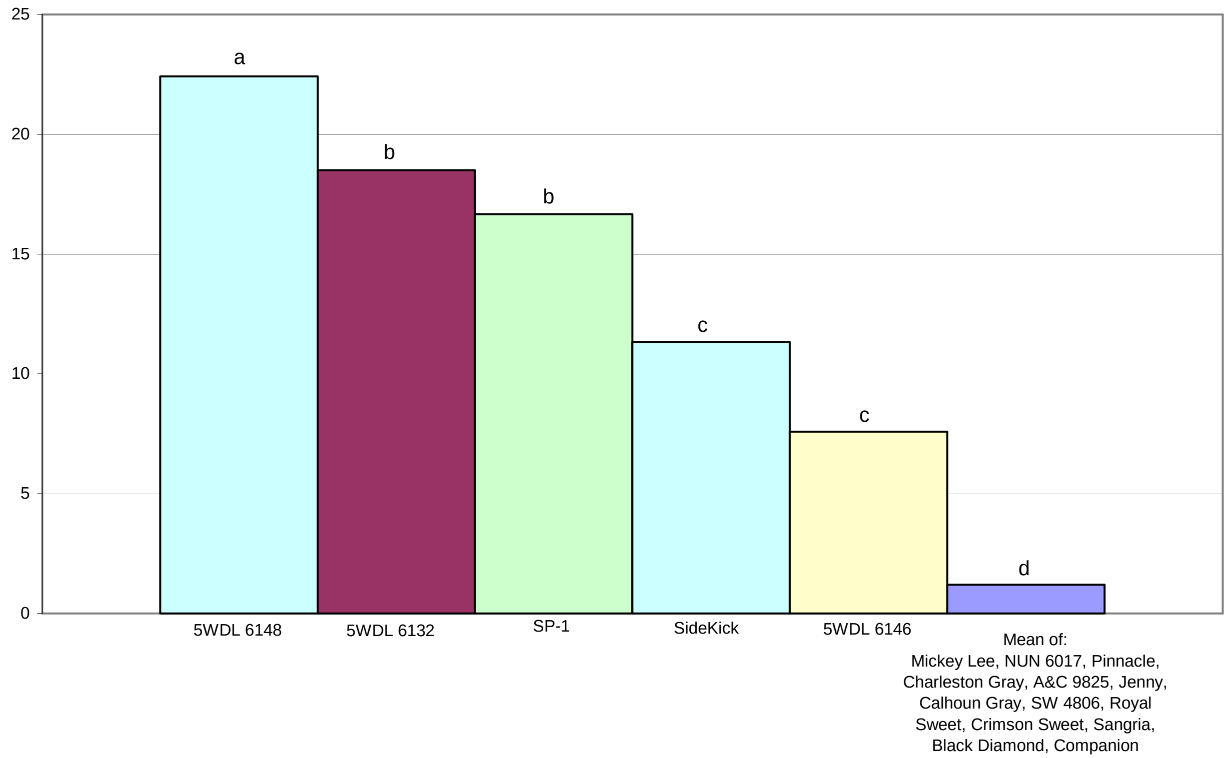

Figure 4: Overall mean of male flower counts for the last 5 dates counted. Flower counts were made over two 9 foot square areas in each plot.

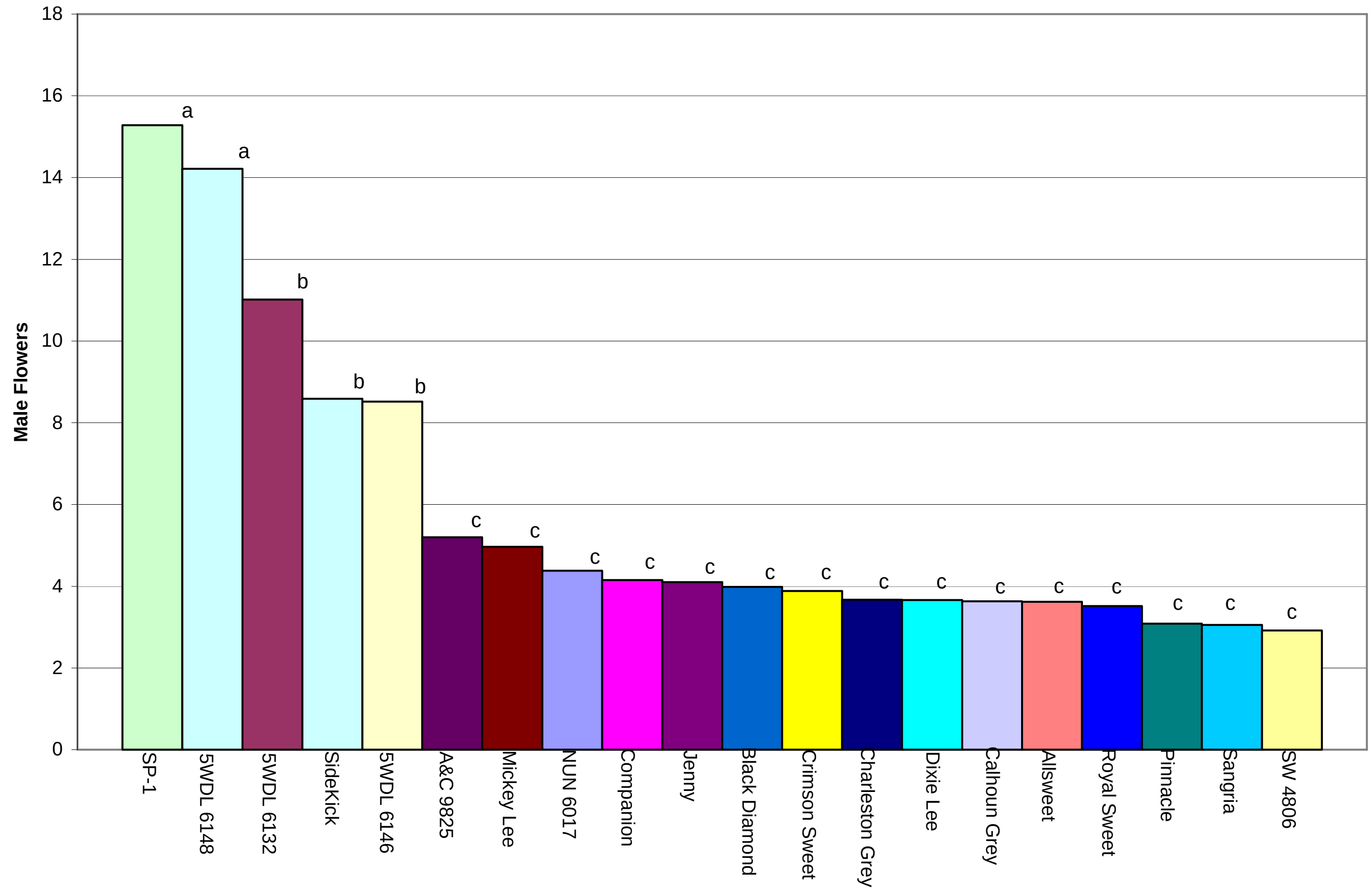

Figure 5: Area under the disease progress curve for each variety. A higher number on this scale indicates a greater sensitivity to FON wilt caused by *Fusarium oxysporum* fsp. *niveum*. Trial was planted in a field with a know history of Fusarium wilt.