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Outlook for postbloom fruit drop

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In 2017, the damage from postbloom fruit drop (PFD) was lower than the previous three years. This was mainly due to the low rainfall accumulation in late winter and early spring.

The long bloom with relatively few flowers at any one time made the decision of when to apply a fungicide particularly difficult. Bloom started in January in most locations, and there were some scattered rain events early in the year. Because of these rain events, some PFD was reported on early flowers. Then it became much drier until the end of bloom, and few new infections occurred. It is too soon to say whether the 2018 bloom season will be similar, but growers will need to remain vigilant to minimize PFD losses.

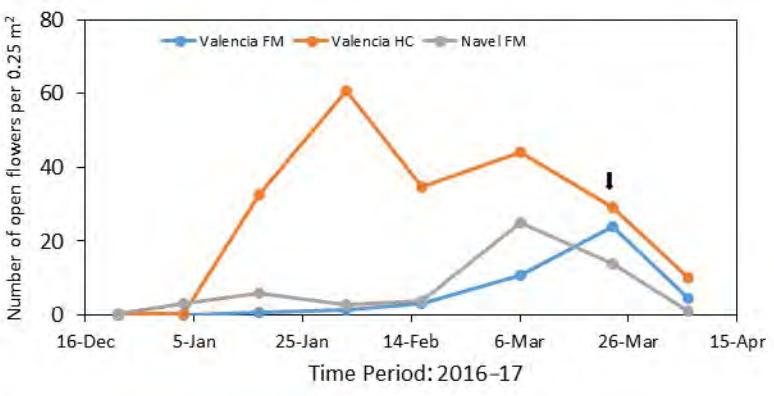

Figure 1. The black arrow indicates the time period at which gibberellin applications to the tree may be advantageous to improve fruit set without affecting the next flowering wave under normal weather conditions. Based on 2016–2017, it is expected that by mid- to late-March, flower bud induction should cease, and fruit growth and development should begin. FM = Fort Meade, HC = Haines City

SURVIVAL AND SPREAD

Postbloom fruit drop is caused by the fungus *Colletotrichum acutatum*, which is usually present in groves. Between flowering periods, the inoculum survives as dormant infection structures on leaves, buttons (persistent calyces) and twigs. When the first few flowers open, the fungal survival structures are stimulated to germinate, and a small number of spores are produced. These spores move via rain splash to open flowers where they germinate, infect and produce many more spores. The new spores then move to the next set of open flowers by subsequent rainfall events.

The fungus is highly dependent on rainfall, especially frequent rain events when flowers are present. It uses the rain to move spores and leave enough water on the flower surfaces to create optimal infection conditions. Infection usually happens within 24 hours of rain, and symptoms are visible in approximately four to five days. Flower symptoms of PFD start with difficult-to-see, water-soaked lesions on petals that turn from peach to orange-brown as they age. The fungus continues the cycle from sporulation

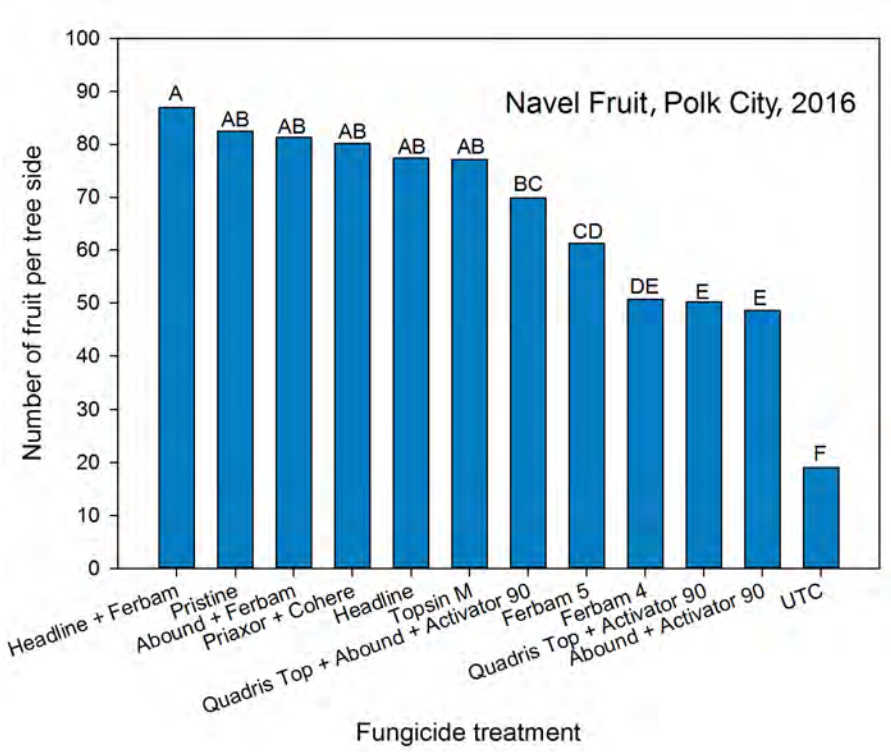

Figure 2. The average number of fruit per tree side for each of 11 fungicide treatments compared with an untreated control (UTC) in the 2016 postbloom fruit drop trial conducted in a navel block in Polk City, Florida. Fungicide treatments with the same letter are not significantly different in fruit numbers at the 95 percent confidence level. Applications were made on March 16 and 22, 2016.

to symptoms for as long as susceptible flowers are available.

While windblown rain is the main means of disease spread, human activity contributes to long-distance spread through equipment movement. Workers with petals on their person can spread disease, especially if work occurs in wet canopies. Locations that have extended blooms, multiple bloom cycles or off-season bloom cycles have more problems than locations where bloom is restricted to a short period.

At the end of bloom, the fungus causes young fruitlets to abscise, leaving the buttons. Fruit in a cluster with late flowers can also abscise if those flowers become infected. The fungal population will shrink at the end of bloom, but *C. acutatum* will survive on the tree until more flowers appear and the conditions are right.

EFFECTS OF WEATHER

At the time of writing this in mid-November 2017, weak La Niña conditions, warmer temperatures and

lower than average rainfall have been experienced (https://www.climate.gov/enso). The chance of La Niña conditions remaining until sometime between February and April of 2018 was between 65 and 75 percent. Normally in La Niña years, there are enough chill hours to initiate flower development, but the warming temperatures cause multiple small waves of bloom as seen last year.

However, storm damage from Hurricane Irma also will likely influence flower development. If trees were defoliated and/or sustained root damage, they may not have the resources to produce many flowers. The effect of hurricane damage on trees weakened by huanglongbing (HLB) has not been observed before, so we are not entirely sure what the outcome will be, but the best guess is that a weak flowering response is likely.

This means that it is uncertain whether PFD will be a major problem in spring 2018. Rainfall is lower than average in La Niña years, but that does not mean no rain. If there are several wetting events at key times during bloom, PFD could be problematic. Since we are likely to have a reduced number of flowers for 2018, it is important for growers to be prepared to manage PFD.

In 2016–2017, we monitored one navel site and two Valencia sites in Central Florida for flowering patterns. We observed open flowers in navel as early as mid-January and three major flowering waves. However, in Valencia at both sites, a trickle bloom was observed that reached its peak in March. Overall, low average temperatures during the winter and warm temperatures during the early spring resulted in accelerated flower bud induction and prolonged bloom. In addition, stress induced by HLB and drought conditions can add to a prolonged bloom.

Hurricane Irma brought high-velocity winds throughout the Florida citrus-production region, resulting in excessive leaf and fruit loss in many places. Hurricane-induced stress can result in off-season flowering, which already can be seen at many

locations. In addition, leaf loss in September due to the hurricane may result in more vegetative growth at the expense of flower buds. As defoliation followed by warm temperatures in the fall can be conducive for vegetative growth, reproductive growth can be compromised due to fewer available carbohydrates as well as fewer buds left for flower bud induction.

GIBBERELLIN APPLICATION

In 2017–2018, efforts should be made to reduce tree stress to minimize prolonged bloom. Care should be taken to improve fruit set in spring. If significantly fewer flowers than usual are observed by mid-March and a smaller crop is projected, a gibberellin (GA) spray at time of fruit set may improve it. GA application can have two advantages: improving flower to fruit set and reducing fruitlet abscission. GA application can help in fruit set when applied at time of bloom to fruitlet stage.

Product	Rate/Acre
Control	—
Quadris Top + Activator 90	15.4 fl. oz. + 0.25% v/v
Quadris Top + Abound + Activator 90	15.4 fl. oz. + 3.2 fl. oz. + 0.25% v/v
Abound + Activator 90	15.5 fl. oz. + 0.25% v/v
Abound + Ferbam	15.5 fl. oz. + 6 lb.
Headline	15 fl. oz.
Headline + Ferbam	15 fl. oz. + 6 lb.
Pristine	18.5 oz.
Priaxor + Cohere	6 fl oz. + 16 fl. oz.
Topsin M	2 lbs.
Ferbam	4 lbs.
Ferbam	5 lbs.

Table 1. Treatments and rate per acre used in the 2016 Polk City, Florida, postbloom fruit drop trial on navel oranges. All applications were made with 125 gallons of water per tree rate.

A GA application should be timed appropriately (Figure 1, page 14), as an early-spring application can reduce flowering. In order to ensure the next wave of flowering is not affected by GA application, it is suggested to apply GA when no more major waves of flowering are expected. Follow the label! GA application may not be helpful if the fruit set is already optimal, as heavy fruit set does not always translate to high yield.

PRIORITIZING PFD MANAGEMENT

Flowers are likely to be scarce this year, so growers need to develop a PFD management plan to avoid

many flowers from being affected. Preparation of groves should be underway. Foremost, remove severely declined, economically unproductive trees; they cost more to protect than is profitable. Prioritize groves for protection using cultivar susceptibility (e.g., Valencia and navel) and potential yield as criteria. If a block is not capable of producing enough fruit to cover the cost of fungicide application, it should be low priority. Prioritized grove blocks should be scouted regularly on foot for infected flowers.

If the first indication of PFD is the current year's buttons, then it is too late for management. It is important to know whether there is inoculum present from last year and when trees begin to flower. If inoculum (buttons are a good indicator) is present, plan for PFD management.

Foremost, remove severely declined, economically unproductive trees; they cost more to protect than is profitable.

If you are considering fungicide applications for PFD, timing is critical. It is more complicated than before because many trees with HLB have several waves of bud development and flowers, and because of the hurricane damage. Therefore, target applications toward the most profitable waves of flowers. The optimal timing for the first application is around 10 percent bloom if you are judging by the phenological stage. If further applications are needed, full bloom and then 90 percent open bloom would be good targets. However, the best way to time applications is by the use of the PFD-Fungicide Application Decision (FAD) system (http://pfd.ifas.ufl.edu). Timing is highly specific to the grove situation, including overall flowering stage and local weather conditions, which the model will help pinpoint. Remember that a spray application without an effective fungicide is enough to trigger an infection event.

FUNGICIDE RESEARCH RESULTS

Once a decision to apply a fungicide is made, the question then becomes what fungicides to use. Trials in 2017 were inconclusive because of low infection levels, but an economic analysis was undertaken with data from 2016 when there was more disease pressure. The goal was to estimate which treatment gave the best profit, which is not always the same as best yield. This is because there are large differences in the prices among fungicides.

The fungicides and application rates are presented in Table 1 (page 18). The trial took place in a navel grove in

Treatment	Average number of fruit per tree	Boxes per tree	Revenue per tree ($)	Cost per tree ($)	Profit per tree ($)	Chemical efficacy ranking by yield	Chemical efficacy ranking by profit
Headline + Ferbam	150	0.55	9.52	1.33	8.18	1	3
Abound + Ferbam	148	0.54	9.38	1.17	8.20	2	2
Pristine	143	0.53	9.08	1.27	7.81	3	5
Topsin M	141	0.52	8.97	0.67	8.30	4	1
Priaxor + Cohere	136	0.50	8.62	0.80	7.83	5	4
Headline	128	0.47	8.10	0.88	7.22	6	6
Quadris Top + Abound + Activator 90	125	0.46	7.91	0.92	6.99	7	7
Ferbam 5 lb.	109	0.40	6.92	0.77	6.15	8	8
Abound + Activator 90	88	0.32	5.55	0.73	4.83	9	10
Ferbam 4 lb.	87	0.32	5.54	0.69	4.85	10	9
Quadris Top + Activator 90	84	0.31	5.31	0.86	4.46	11	11
Untreated Control	32	0.12	2.04	0.00	2.04	12	12

Table 2. Revenue, cost and profit per tree and chemical efficacy ranking from 2016 postbloom fruit drop trial on navels in Polk City, Florida.

Polk City. Applications were based on the recommendations of the PFD-FAD system. The results are presented in Figure 2 (page 16) and Table 2, and the fungicides are listed in order of highest to lowest yield.

It is important to note that navel prices were relatively high during the 2016–17 season. Thus, it may not be profitable to apply expensive products to lower-priced fruit. The chemical prices used for the analysis were based on retail prices and were collected during March and April of 2017. All analyses were on a per-tree basis, and only costs of materials and applications for PFD were taken into account.

The fungicide yielding the greatest profit per tree was Topsin M, even though it had the fourth highest yield (but costs half as much as Headline +

Ferbam). Unfortunately, Topsin M is not registered for use in citrus because of residue risks. The two standard strobilurin and Ferbam combinations recommended were ranked 1 and 2 for yield. Abound + Ferbam ranked second for profitability and Headline + Ferbam was a close third. These two combinations are good choices because they are effective and have some strobilurin resistance management included. Adding Ferbam to either strobilurin treatment increased the profitability of the treatments. Making a decision on what products to use should involve both product efficacy and cost-benefit analysis.

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