Pomegranates in Florida: current status and future possibilities

By Achala Nepal KC and Gary E. Vallad



Look for the launch of Vegetable and Specialty Crops News, a brand new magazine from AgNet Media in 2017. It will include features like this on pomegranates, blueberries, peaches, vegetables and more. Watch for developments online at www.vscnews.com. he pomegranate originated in Iran and has been cultivated throughout the Mediterranean and northern India since ancient times. Although first introduced by Spanish settlers in the late 1700s, pomegranate production in California has expanded to approximately 25,000 acres valued at more than \$117 million in 2014. Pomegranates are primarily grown as a fruit crop and marketed for fresh fruit, arils and juice. However, pomegranate is also used as an ornamental tree or shrub in landscaping.

The pomegranate fruit is popular for its nutritional content and health benefits. It is rich in essential vitamins and minerals and is a powerful antioxidant. Pomegranate is touted for its potential anti-cancer and immune-supporting effects and its ability to lower cholesterol and other cardiac risk factors.

INCREASING INTEREST

There is increasing interest in commercial pomegranate production in Florida and Georgia. However, pomegranate is best adapted to regions with cool winters and hot summers, preferring a semi-arid over a tropical climate. Most cultivars are fairly cold hardy, tolerating temperatures down to 7° F, though some cultivars can be severely injured below 12° F. Pomegranate is also heat and drought tolerant, but performs best when temperatures are above 85° F for at least 120 days and supplemental irrigation is provided during tree establishment and fruit development.

Although Florida's humid, subtropical climate is quite different from California's, several growers have successfully grown pomegranates for up to six years in Florida. The approximately 200 acres under cultivation remain mostly experimental, with groves scattered from central to northern Florida.

DISEASE RESEARCH

Unfortunately, Florida's subtropical climate is also favorable for several diseases, which have severely limited production. Losses to fruit rot, stem blight and dieback, and leaf and fruit spots are typically observed throughout the season. Our research efforts have focused on surveying the primary diseases occurring on pomegranates in Florida and the causal pathogens involved to further research disease management. We relied on symptomatic tissues collected during surveys of pomegranate groves and from samples received from pomegranate growers. Causal organisms were cultured from diseased tissues and identified based on culture morphology and DNA sequencing of conserved genes.

Several pathogens were identified, including two fungal pathogens (Neofusicoccum parvum and Lasiodiplodia sp.) belonging to the Botryosphaeriaceae family that were isolated from fruits and stems; two Colletotrichum species that were isolated from leaves and fruits; and a fruit rot-causing pathogen (Pilidiella granati) was also isolated from fruits. Another fungus belonging to the order Diaporthales was also frequently isolated from leaves, stems and fruits. Additional laboratory and greenhouse tests confirmed that these six pathogens are very aggressive on pomegranate fruits and leaves, causing foliar spotting and blighting, and fruit rot.

Additional research is underway to develop an integrated disease management program. Research includes studies to monitor the presence of each pathogen in groves throughout the pomegranate growing season and to identify cultural and effective fungicidal compounds for disease management. Effective management requires an understanding of pathogen biology. The diseases caused by most of these



Symptoms of pomegranate diseases: A) anthracnose, caused by *Colletotrichum* sp., on the calyx of a developing fruit; B) anthracnose and fruit spots caused by a *Colletotrichum* and *Cercospora*-like pathogen; C) leaf spots caused by a *Cercospora*-like pathogen and D) *Pilidiella granati*; E) stem dieback caused by Diaporthales and *Colletotrichum* sp.; F) fruit mummification typical of *Pilidiella granati* at the end of the growing season.

pathogens are known to be polycyclic, whereby the pathogens are capable of several infection cycles per growing season. In addition, most of these pathogens are known to survive on infected plant materials (stems, leaves and fruits) and remain dormant until conditions are favorable to reinitiate disease. Based on field observations and controlled tests, most of the pomegranate cultivars evaluated to date are susceptible to these pathogens. frequent precipitation events help to splash and disperse the spores of these pathogens to neighboring branches and trees, resulting in an exponential increase in disease incidence.

We have already gathered evidence that these pathogens are present in apparently healthy buds at the beginning of the season. During the 2015 growing season, flower buds were collected from late January through March from three different locations

Lowering pathogen levels through field sanitation will help enhance fungicide performance and may even help lower the risk of developing fungicide resistance in pathogen populations.

The climate in Florida (temperatures of 80° F to 90° F and humidity of 70 percent to 90 percent) and frequent precipitation are optimum for the pathogen(s) during the pomegranate cropping season, providing favorable conditions for rapid disease development. The in Florida, two in Georgia and one in South Carolina. The buds were divided into six stages from early stage bud to fruit initials, surface sterilized, and incubated in plastic chambers. In addition, some of the flower buds were plated onto artificial media to force germination of overwintering spores. All six pathogens were recovered from every flowering stage, indicating that these pathogens are already present at the early stages of fruit development.

Similarly, three pomegranate orchards in Central Florida were monitored for disease symptoms every other week from late January through late August 2015. Initial disease symptoms appeared as spotting of the calyx of fruits in early May caused by Colletotrichum sp. These symptoms spread to leaves, stems and other parts of fruits causing spots, blight-like symptoms and defoliation. Other symptoms, such as fruit spots, leaf spots, leaf blight, shoot blight and fruit mummification, became more prevalent toward the mid to late pomegranate season, and were caused by a combination of several pathogens.

FUNGICIDE FINDINGS

Pathogens were also tested for their sensitivity to several fungicides in laboratory assays. The fungicides Cuprofix, Endura, Folicur, Topsin, Cabrio, Penncozeb and Scala were evaluated for their ability to reduce the growth of *Neofusicoccum parvum*, *Lasiodiplodia* sp. and *Colletotrichum* sp. in culture. All pathogens were highly sensitive to Cabrio, Folicur and Topsin, but only moderately sensitive



Fungicide field trial showing A) the treated trees in the front row vs. untreated trees in back rows and B) fungicide-treated fruits at the end of the growing season.

to Penncozeb. The fungicides Cuprofix, Scala and Endura failed to restrict the growth of the tested fungi.

Five fungicides (Cabrio, Penncozeb, Scala, Switch and Luna Experience) were also tested for their effectiveness under field conditions at several grower sites. Three fungicides (Cabrio, Luna Experience and Penncozeb) were effective against foliar and fruit diseases under field conditions when applied every two to three weeks. Although promising, additional research is necessary to further the timing and frequency of fungicide applications, as well as to identify favorable fungicide rotations. None of the tested fungicides are currently registered for use on pomegranates. However, three fungicides are being tested to establish residue tolerances.

RESISTANCE AND SANITATION

The use of resistant varieties is by far the most economical and sustainable means for managing any disease. Currently, there are more than 100 pomegranate cultivars that are being tested for various traits in Florida, including resistance to the *Colletotrichum* sp. and the two pathogens of the Botryosphaeriaceae. In addition, more than 2,000 breeding lines have been developed that will be screened for disease resistance and other traits of economic importance.

Pomegranate is a potential alternative crop for growers in Florida and nearby states. Disease appears to be the greatest impediment to commercial production. Therefore, the adoption of disease-management practices will be critical.

Field sanitation will likely be an integral part of any disease management strategy, since many of the identified pathogens are known to survive in plant residues in other cropping systems. Sanitation efforts will help reduce local levels of the pathogen within the pomegranate orchard, which can help delay disease development. Even as research progresses, eventually leading to pomegranate varieties with improved levels of resistance and fungicide recommendations, lowering pathogen levels through field sanitation will help enhance fungicide performance and may even help lower the risk of developing fungicide resistance in pathogen populations.

Although our knowledge about some of these pathogens is limited, it is clear from other crops that growers will benefit from implementing sanitation practices to minimize the presence of the pathogen in the field for the upcoming season. This can be achieved best by clearing leaf litter, fruit and diseased stems from orchards. Especially during the late fall when many trees go dormant and lose their leaves, it is important to clear leaf debris from around trees that may be harboring the pathogen from the previous season.

This is also an ideal time to inspect trees for diseased branches. We recovered *Neofusicoccum parvum* and *Lasiodiplodia* sp. from most of the pedicels (part of branch attached to fruit) sampled during our surveys. So, pruning diseased branches and pedicels should help minimize carryover of the pathogen. All the infected leaves, stems and fruits should be removed from the orchard to a safe distance and burnt or disposed of as permitted by local ordinances.

Similarly, equipment that comes into contact with diseased tissues should be cleaned of debris. Hand tools used for pruning can be sanitized using a 75-percent alcohol, 10-percent sodium hypochlorite solution (Regular Clorox® bleach), quaternary ammonium or other approved disinfectant. Growers are encouraged to refer to the article "Disinfection of Horticultural Tools" at edis.ifas.ufl. edu/ep380 for additional information.

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