Fruit and Vegetable Disease Observations from the Plant Disease Diagnostic Laboratory, 2003

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Introduction

The UK College of Agriculture research (Kentucky Agricultural Experiment Station) and Cooperative Extension Service provide diagnosis of plant diseases and recommendations for their control through the Department of Plant Pathology. We maintain two branches of the Plant Disease Diagnostic Laboratory, one on the UK campus in Lexington, and one at the UK Research and Education Center in Princeton. Of the more than 4,000 plant specimens examined annually, approximately 10 to 15% are commercial fruit and vegetable specimens (1). Moreover, the annual number of commercial fruit and vegetable specimens diagnosed has more than doubled in recent years, but because of their complexity and diversity, the time needed to diagnose them has more than doubled. Although growers are not charged for plant disease diagnoses at UK, the estimated direct annual expenditure to support fruit and vegetable specimen diagnosis by the laboratory is $25,000, excluding UK physical plant overhead costs. During recent years, we have been able to acquire Kentucky Integrated Pest Management funds to defray some of these additional laboratory operating costs.

Materials and Methods

Diagnosing fruit and vegetable diseases involves much research into the possible causes of the diseases. Most visual diagnoses include microscopy to determine what plant parts are affected and to identify the microbe. In addition, many specimens require special tests such as moist chamber incubation, culturing, enzyme-linked immunosorbent assay (ELISA), polymerase chain reaction (PCR) assay, electron microscopy, nematode extraction, or soil pH and soluble salts tests. Diagnoses requiring consultation with UK specialists, and needing culturing, PCR and ELISA are common for commercial fruits and vegetables. The Extension plant pathology group has tested protocols for detecting, using PCR, several pathogens of interest to fruit and vegetable growers. These include the difficult-to-diagnose pathogens causing bacterial wilt, bacterial leaf spot, yellow vine decline, and Pierce's disease. The laboratory also has a role in monitoring pathogen resistance to fungicides and bactericides. These exceptional measures are efforts well spent because fruits and vegetables are high-value crops for Kentucky. Computer-based laboratory records are maintained to provide information used for conducting plant disease surveys, identifying new disease outbreaks, and formulating educational programs. New homeland security rules require reporting of all plant disease diagnoses to USDA-APHIS on a real-time basis, and our laboratories are working to meet that requirement.

The 2003 Kentucky growing season provided mostly cooler than normal temperatures and above-normal rainfall. This season produced the second wettest April-September on record and the second coolest June and July (26th coolest April-September). January temperatures were below normal but not cold enough to cause widespread cold injuries to overwintering fruit crops, although there was some injury. There were a few scattered spring frosts, which caused occasional injury and significant apple crop loss and uneven grape bloom in Central and Northern Kentucky. Fruit and vegetable diseases favored by prolonged wet weather appeared more frequently in many fields, orchards, and vineyards and with the increased disease pressure, some disease management programs that worked well in the past failed this year.

Results and Discussion

New and Emerging Fruit and Vegetable Diseases in Kentucky

- Pierce's disease of grapes caused by *Xylella fastidiosa*.
- Grape crown gall caused by *Agrobacterium tumefaciens* emerging with more vineyards planted.
- Peach fruit rot caused by a species of either *Phoma* or *Phyllosticta.*
- Cucurbit yellow vine disease caused by *Serratia marsescens.*
- Root, stem, and fruit diseases of solanaceous and cucurbit vegetables caused by *Phytophthora* spp.
- Bacterial canker of peppers caused by *Clavibacter michiganensis* subsp. *michiganensis.*
- Copper-resistant bacterial speck of tomatoes caused by *Pseudomonas syringae* pv. *tomato*.
- Bacterial fruit blotch of melons caused by *Acidovorax avenae* subsp. *citrulli*.
- Root knot nematode (*Meloidogyne* spp.) is becoming a major problem on several crops due to reduced crop rotation and use of old tobacco fields as vegetable sites.
- Virus disease incidence, especially in legume crops, could change significantly with recent introduction of the soybean aphid, a virus vector.
- Soybean rust is expected to arrive in the United States at any time, and many vegetable legumes are also hosts.

Tree Fruit Diseases

Rain and long periods of spring leaf wetness increased the occurrence of primary infections of apple scab (*Venturia inaequalis*) and promoted infections by the cedar rust fungi (*Gymnosporangium juniperi-virginianae, G. clavipes,* and *G. globosum*). Spring rains also favored apple frogeye leaf spot (*Sphaeropsis malorum*). Due to relatively cool weather during bloom, fire blight (*Erwinia amylovora*) levels were reduced but still present occasionally. Summer wetness favored apple sooty blotch (*Peltaster fructicola, Geastrumia polystigmatis, Leptodontium elatius,* and other fungi) and flyspeck (*Zygophiala jamaicensis*), all of which are enhanced by long leaf wetness periods.

Rains, especially those in late spring, favored peach scab (*Cladosporium carpophilum*) and brown rot (*Monilinia*

fructicola). Peach rusty spot (powdery mildew, *Sphaerotheca pannosa, Podosphaera clandestina, or P. tridactyla*) was also observed Peach fruit rot (*Phoma* or *Phyllosticta sp*.) was identified in the laboratory and is a new disease in at least one orchard. Cherry leaf spot (*Coccomyces hiemalis*) and plum black knot (*Apiosporina morbosum*) occurred widely.

Small Fruit Diseases

Anthracnose (*Elsinoe veneta*) was widespread on raspberry and black raspberry canes. On blackberry, systemic orange rust (*Gymnoconia nitens*) and blackberry rosette (*Cercosporella rubi*) were frequently observed. Phytophthora root rot (*Phytophthora* spp.) and Sphaerulina leaf spot (*Sphaerulina rubi*) of raspberry could be attributed to the unusually wet season.

Grape crown gall (*Agrobacterium tumefaciens*) continues to be a very serious problem for growers. Wet spring weather favored black rot (*Guignardia bidwellii*), anthracnose (*Elsinoe ampelina*), and Phomopsis cane and leaf spot (*Phomopsis viticola*). These diseases continued to build throughout the summer, particularly black rot. Grape downy mildew (*Plasmopara viticola*) and powdery mildew (*Uncinula necator*) were observed at high levels, especially late in the season. No new cases of Pierce's disease (*Xylella fastidiosa*) were found.

Wet weather favored Phytophthora root rot (*Phytophthora* spp.) of blueberries.

Strawberry foliar diseases including leaf spot (*Mycosphaerella fragariae*) and leaf blight (*Phomopsis obscurans*) were common. Botrytis and anthracnose fruit rots (*Botrytis cinerea, Colletotrichum acutatum*) were also observed.

Vegetable Diseases

In accord with a wet spring and a cool, moist summer in most of the state, infectious diseases challenged successful production of commercial vegetable crops.

Vegetable transplants. Several diseases were diagnosed from vegetable transplant production within the state, including Pythium root rot (*Pythium* sp.) of tomato, pepper, broccoli, and cantaloupe seedlings and transplants. Pythium root rot was diagnosed mainly from float system transplant operations. Cabbage damping-off (*Rhizoctonia solani*) was also observed.

Cole crops. Unusual occurrences or high levels of cole crop diseases were not found this year.

Tomatoes. Commercial tomato plantings were infected by bacterial canker (*Clavibacter michiganensis*), bacterial spot (*Xanthomonas campestris* pv. *vesicatoria*), and bacterial speck (*Pseudomonas syringae* pv. *tomato*). Pythium root rot from transplants carried over into the field and was sometimes accompanied by "wet feet." Septoria leaf spot (*Septoria lycopersici*), favored by cool, wet weather, was especially widespread this year. Early blight (*Alternaria solani*) and leaf mold (*Cladosporium fulvum*) also occurred frequently. Fruit included blossom end rot, the fruit infection stages of the fungal and bacterial leaf diseases listed above, and also gray mold (*Botrytis cinerea*). Tomato fruit also experienced other physiological disorders such as cat facing, green shoulders, and stem-end internal greening. Fusarium wilt (*Fusarium oxysporum* f.sp. *lycopersici*), and root knot nematode (*Meloidogyne* sp.) were problems in some fields. Magnesium and phosphorus deficiencies and physiological leaf roll were also observed.

Peppers. Bacterial leaf spot (*Xanthomonas campestris* pv. *vesicatoria*) remains an important disease. Phytophthora stem and fruit rot (*Phytophthora capsici*) were important this wet season. Pythium root rot (*Pythium* spp.) and Rhizoctonia root rot (*Rhizoctonia solani*) were found, especially in already-infected transplants.

Cucurbits. Cucurbits are becoming more popular in Kentucky, and their diseases are increasing in economic importance. Phytophthora root rot, stem rot, leaf blight, and fruit rot (*Phytophthora capsici*) are widespread and cause losses in pumpkin, watermelon, squash, and cucumber. Anthrancnose (*Colletotrichum* spp.), gummy stem blight/black rot (*Mycosphaerella melonis*), and Cercospora leaf spot (*Cercospora melonis*) were found at serious levels in several different cucurbit fields. Pumpkin and squash powdery mildew (*Erysiphe cichoracearum*) also caused losses. Bacterial diseases of cucurbits included bacterial wilt (*Erwinia tracheiphila*) and cucurbit yellow vine decline caused by *Serratia marsescens*. However, the incidence of yellow vine decline was much lower than in the previous two years. Bacterial fruit blotch of melons (*Acidovorax avenae* subsp. *citrulli*) was confirmed for the first time in Kentucky, but it probably has been present. Foliar disease in cucurbits is often attributed to poor spraying techniques, such as poor timing, poor coverage, or use of the wrong chemicals.

Other vegetables. Bean root and stem rot (*Rhizoctonia solani*), anthracnose (*Colletotrichum lindemuthianum*) and angular leaf spot (*Phaeoisariopsis griseola*) were observed this year. Black leg (*Erwinia atroseptica*) and root knot nematode (*Meloidogyne incognita*) diseases occurred on potatoes. Asparagus was infected with leaf spot (*Cercospora asparagi*) and stem canker (*Phoma media*). Sweet corn bacterial disease outbreaks included stalk rot (*Erwinia chrysanthemi* pv. *zeae*) and holcus leaf spot (*Pseudomonas syringae*).

Growers are urged notify their county Extension agents of any observations of new outbreaks and disease trends in their fields. We want to especially monitor the new spectrum of microbes and diseases that may occur as growers change from using broad-spectrum protectant fungicides, such as Mancozeb and Chlorothalonil, to new chemicals, such as Quadris and Abound, to which pathogens are more likely to develop resistance. This risk is offset by reduced risks to human health and the environment. For example, we have noted increased bacterial diseases in tomatoes. We want to know if this is due to how we raise them, manage other diseases, or import seeds and transplants.

Because fruits and vegetables are high-value crops, the plant disease diagnostic laboratory should be a great value to commercial growers. However, many growers are not using the laboratory often enough, or they are waiting until their disease problems become well established. By then, it may be too late to do anything about them or, in some cases, to correctly diagnose the sequence of diseases that may have led to apparent crop damage. Growers need to consult frequently with their county Extension agents so that appropriate plant specimens are sent to the laboratory quickly. We are urging county Extension agents

to stress in their Extension programming the need for accurate diagnosis of diseases of high-value crops. Growers can work with their agents to ensure that Kentucky growers have the best possible information on fruit and vegetable diseases.

Literature Cited

1. Bachi, P.R., J.W. Beale, J.R. Hartman, D.E. Hershman, W.C. Nesmith, and P.C. Vincelli. 2004. Plant Diseases in Kentucky—Plant Disease Diagnostic Laboratory Summary, 2003 UK Department of Plant Pathology (in press).