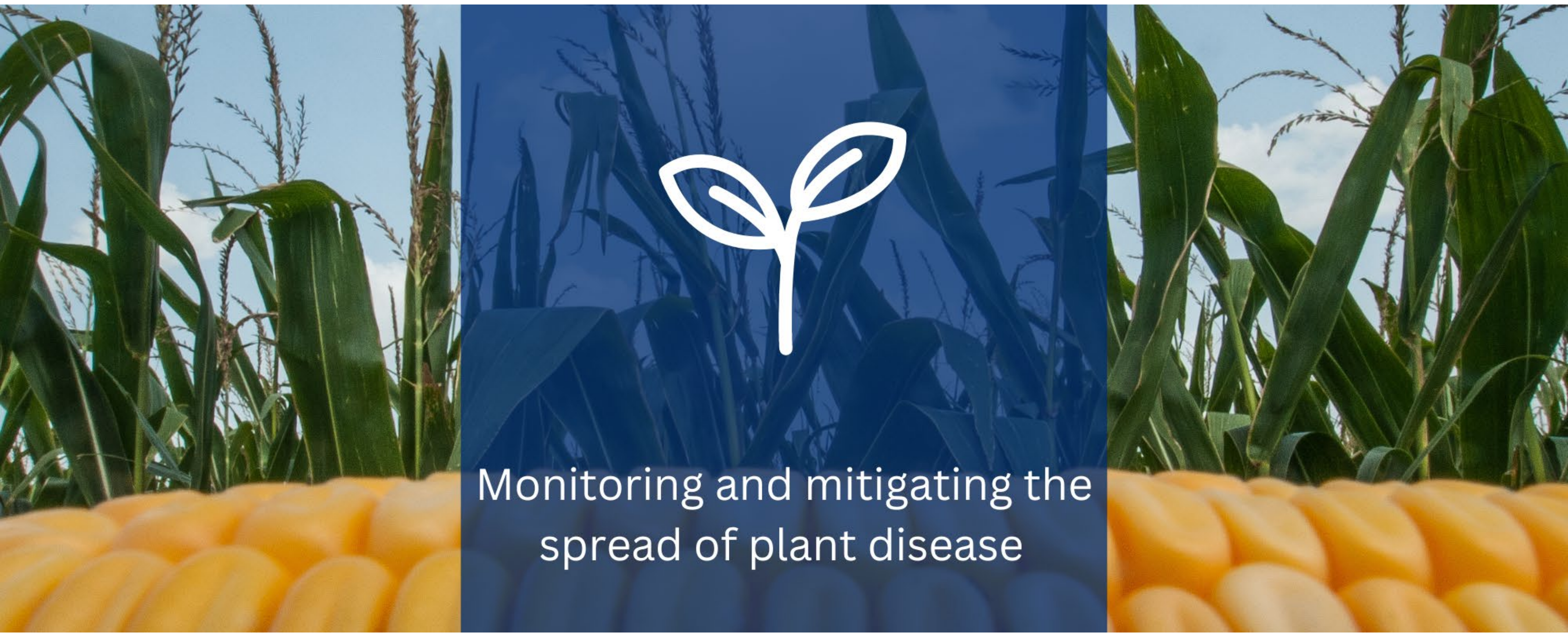
Agricultural Research Service
U.S. DEPARTMENT OF AGRICULTURE

# How ARS Does It:
# Prioritizing Animal, Human, Plant, and Environmental Health

ARS is committed to controlling plant diseases to ensure food security and an adequate supply of food and non-food crops for feed, fiber, and energy. In 2019, USDA estimated that plant diseases cost the U.S. agricultural industry $43 billion. This includes losses from crop yield, quality, and marketability. The most common plant diseases in the United States are caused by fungi, bacteria, and viruses.




Plant diseases can be spread in a number of ways, including wind, water, insects, and animals. Effective control of plant diseases requires an understanding of the biology of disease-causing agents. The following accomplishments in 2022 highlight ARS successes in identifying and halting the spread of plant diseases.

***Genes involved in plant defense in resistant durum wheat.*** The plant disease Fusarium head blight (FHB) is an important constraint to profitable durum wheat production in the upper U.S. Midwest and durum cultivars currently lack consistently high levels of FHB resistance. To identify new genes for disease resistance, ARS researchers in St. Paul, Minnesota, studied differences in the genes expressed by FHB-susceptible lines and a newly developed M4 line that has moderately high FHB resistance. During infection, the resistant M4 line activated many categories of genes associated with an active plant disease defense response. These genes are being further characterized to better define the mechanism of resistance and assist in breeding better cultivars. These new native sources of FHB resistance in durum wheat with the gene markers will be a great boon to the effort in breeding for resistant cultivars and the growers in the U.S. Upper Great Plains region. (NP 303)

***Machine learning approaches identify root microbial community members associated with Prunus replant disease.*** Prunus replant disease (PRD), affecting more than 10,000 replanted almond orchards every year, is a serious but poorly understood soilborne disease complex that suppresses tree development, efficient water and nutrient use, and crop yield. Integrated PRD management requires a better understanding of factors that drive its occurrence. Machine learning approaches focusing exclusively on root microbial populations resulted in identifying 26 bacteria, 2 oomycetes, and 2 fungi as top predictors of PRD induction. *Streptomyces scabiei*, *Steroidobacter denitrificans*, *Streptomyces bolbili*, and *Pythium mamillatum* were relatively abundant (5-43 percent) among the top predictors. The findings will guide future targeted testing of microbial taxa for PRD induction and suppression in roots. (NP 303)

***New diagnostic method to detect a spinach pathogen in leaves.*** Downy mildew disease of spinach, caused by the plant pathogen *Peronospora effusa*, is the major disease constraint on spinach in the United States and worldwide. ARS researchers in Salinas, California, led the effort to develop a species-specific detection system that can be used in the field. The DNA-based system can be deployed from a pickup truck, detecting the pathogen within 3 to 4 hours. This new early detection technology will help growers target fungicide applications more effectively prior to symptom development and help prevent downy mildew epidemics. Since nearly 45 percent of U.S. spinach is organic, the technology is especially helpful to organic growers who can choose to harvest organic crops earlier and avoid symptom development that renders their product unmarketable. Results are published in the peer-reviewed journal Plant Disease. (NP 303)

***Fusarium strains and climate change factors have different influences on mycotoxin contamination of cereal crops.*** Fusarium fungi are devastating pathogens that infect cereal crops. They cause billions of dollars in annual yield losses and poison grains with mycotoxins, making them unsafe to eat. Climate change is predicted to increase the frequency and severity of Fusarium disease and mycotoxin contamination of cereal grains. However, it has been unclear how rising atmospheric carbon dioxide and temperature will specifically impact Fusarium graminearum ear rot of corn and head blight of wheat. ARS researchers in Peoria, Illinois, showed that both economically important crops were more susceptible to mycotoxin contamination when grown at elevated carbon dioxide, but warmer temperatures reduced mycotoxin contamination. Additionally, the effects of carbon dioxide and temperature were dependent on the F. graminearum strain, and, under combined stress conditions, a strain that produced the highest mycotoxin levels in corn produced the lowest levels in wheat. This study provides valuable information needed by producers (farmers) and regulatory agencies to determine the risk of Fusarium disease outbreaks and mycotoxin contamination in the future. (NP 108)

Learn more about
National Program 303

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National Program 108