

New developments in managing downy mildew, black rot, and Alternaria leaf spot in cole crops

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Black rot, *Alternaria* and downy mildew are all serious diseases of cabbage in New York. Downy mildew of cole crops, caused by the water mold *Hyaloperonospora brassicae*, is a disease that can infect a plant at any stage of growth. It is most common on seedlings in early spring in both the greenhouse and field, and later in the season, on mature plants when the weather is cool and wet with extended dew periods. Black rot, caused by the bacterium *Xanthomonas campestris* pv. *campestris* (Xcc) is a significant disease of cabbage, and other crucifer crops world-wide and is an annual problem for the cabbage industry in New York. *Alternaria* leaf spot, caused by the fungus *Alternaria brassicicola*, also appears annually and is most common in the fall.

We were able to test several products for efficacy against downy mildew during the 2015 season. Cabbage transplants were moved to the field in July, and the experiment was conducted later in the season as downy mildew appears most commonly in the fall. Applications of control products began on September 1 and continued on a seven day schedule. Products included were Champ 30 WG (77% copper hydroxide), Bravo Weather Stik (chlorothalonil), Cabrio (pyraclostrobin), Phostrol (phosphorus acid, at two rates) and Presidio (fluopicolide). A non-treated control was also included. All treatments worked better than the untreated control, (Figure 1) and no phytotoxicity was observed with any of the treatments.

Recent black rot work in our lab has focused on improving upon our strategy of comparing genomic fingerprints of Xcc isolates using gel electrophoresis banding patterns. Using a genotyping system called multi-locus sequence typing (MLST), we compared the DNA sequence of 8 genes in each of 154 isolates collected in NY over the last decade. We have completed this work, and found two major groups of Xcc in NY, and a third group that included the leaf spotting pathogen *Xanthomonas campestris* pv. *raphani* (very closely related but can't move in the veins of the plant). We were then able to compare the DNA sequences of the 154 isolates from NY to 18 isolates from around the world. We found that the isolates from around the world were intermixed with those from NY, indicating that strains are being globally distributed.

Over the past two years, we have been studying *Alternaria brassicicola*, the fungus that causes *Alternaria* leaf spot. We now know that isolates from NY are very diverse. In fact, 44 of 49 isolates tested were unique. This is important to better understand how the pathogen is overwintering in NY, and to ensure that we test a diverse set of isolates for pathogenicity and fungicide resistance assays. We also tested the 49 isolates for resistance to the fungicide Quadris (azoxystrobin). While there was some variability in how sensitive pathogen isolates were, they were all found to be sensitive based on conidial growth assays in the lab and on DNA sequence of a gene known to be responsible for resistance.

Figure 1. Control of cabbage downy mildew using different control products. The results shown are the area under the disease progress curve (AUDPC = amount of disease over time)

