Production of disease-free onion bare root transplant seedlings

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The first recommendation in an Integrated Pest Management strategy for controlling the neck rot disease of onion, caused by *Botrytis allii*, is to start with clean seed and transplant seedlings. In New York, major outbreaks of Botrytis neck rot of up to 80% loss in some varieties have occurred in association with the increase in growing onions from imported bare root transplants from Arizona over the last 6-7 years, especially during the very wet growing seasons of 2000 and 2004. A study conducted by Hoepting *et al.* in 2005 and 2006 revealed that 78% of 56 imported bare root onion transplant seedling samples (variety by grower) had some level of *B. allii* infection prior to their being transplanted into the ground in New York. Infection per sample (variety by grower) ranged from 1 to 66% of the individual transplant seedlings. Comparatively, no *B. allii* was detected in plug transplants or in seedlings of similar age and size as transplant seedlings that were direct seeded in local onion fields. These results confirmed that bare root transplant seedlings produced in Arizona are not produced free of the neck rot pathogen and serve as an important source of inoculum for this potentially devastating disease.

The objectives of this project are i) to elucidate why onion transplant production in Arizona is conducive to transplant seedlings being infected with *B. allii*, and ii) to develop control strategies so that these transplants can be produced free of *B. allii*. This project will be a collaborative effort among an Extension Vegetable Specialist (the project director), a Plant Pathologist and a Seed Scientist from Cornell University, an Extension Plant Pathologist from the University of Arizona, an onion transplant producer in Arizona, and Bejo Seed Company. It will include trials in Arizona on a commercial onion transplant farm and in New York at a research farm.

Research results from this project will be used to develop IPM guidelines for managing Botrytis neck rot in onions. New York ranks sixth in the nation for onion production with a five year average value of $45.7 million. Approximately 15% of the 13 000 acres of onions grown in New York are now being grown from transplants, the majority of which are imported bare roots from Arizona. In addition, several small scale fresh market growers in the Northeast produce onions from imported bare root transplants and have also suffered losses due to *B. allii*. Growing onions from clean transplants has the potential to save the onion industry in the northeast thousands of dollars. This project is complimentary to other projects conducted by Hoepting et al. including an investigation of the economic feasibility of growing onions from locally grown plug transplants, an evaluation of fungicides for controlling the secondary spread of *B. allii* during the growing season, and impact of harvest and curing processes on incidence of neck rot in storage.

It is well documented that *B. allii* can be seed and soil borne. One difference among bare root transplants grown in Arizona, plug transplants and direct seeded onions is that the former is often produced from raw or minimally treated seed (i.e. thiram), while the latter two are typically grown from treated seed. Recently, laboratory studies conducted by Dr. Lorbeer at Cornell University have shown that onion seedlings are extremely susceptible to *B. allii* just as the tip of the cotyledon emerges from the seed coat. Thus, seed treatments could effectively prevent germinating onion seedlings from becoming infected with *B. allii* during transplant production.

We will conduct trials in Arizona and New York to elucidate whether *B. allii* is introduced to onion seedlings via seed and/or soil and whether seed treatments can prevent infections from occurring. Two seed lots of the same variety, one with 35% *B. allii* infection and the other with none have been obtained from Bejo Seeds. Seed treatments, thiram (188 mg a.i./100 g of seed) and tebuconazole (250 mg a.i./100 g of seed), applied by Cornell Seed Scientist, Alan Taylor, will be evaluated in each seed lot. Tebuconazole has shown efficacy against *B. allii* in laboratory studies and is currently in the IR-4 system for registration as a seed treatment for onion smut control in onions. An untreated control is included in both infested and clean lots for a total of 6 treatments. Two thousand

seeds per treatment were seeded (in January) and grown at the Sunbelt transplant farm in Arizona using commercial-scale production techniques. Transplants will be harvested by Mary Olson, Extension Plant Pathologist, University of Arizona, in early May. Each treatment will produce approximately 20 bundles of 100 plants. They will be shipped to New York for analysis by Hoepting, Klotzbach and Lorbeer using a bioassay technique adapted from du Toit et al. 2004, which was initially used by this group to identify *B. allii* in transplant seedlings. In New York, a replicated trial with each of the treatments will be conducted at the New York Crop Research Facility. The trial will consist of a randomized complete block design with 4 replications with 500 seeds per replicate. Onions will be planted using a push seeder at a rate of 90 seeds per foot and 19 inch row spacing to represent transplant production conditions. Similarly, the trial will be irrigated to induce uniform emergence, which is common practice in Arizona. Plants will be harvested (about 5 bundles of 100 plants per replicate) when they are about 3 months old at the end of July when they are about the same age as transplant seedlings grown in Arizona, and assayed for *B. allii* as described above.

The typical practice of mowing transplants prior to harvesting may be spreading *B. allii* from plant to plant. To evaluate the effects of mowing and fungicide treatment applied at mowing on *B. allii* infection of transplant seedlings, trials will be conducted in Arizona and New York. In Arizona, at the Sunbelt farm, Olson will collect samples of approximately 10 bundles of 100 plants prior to mowing and after mowing for 5-10 varieties destined for Elba, NY. In addition, she will apply two treatments, Rovral (1.5 pt/A) and Pristine (18.5 fl oz/A), immediately after mowing, as these fungicides have proven efficacy against *B. allii*. The same amount of plants will be collected from each of these treatments, all of which will be shipped to NY where they will be analyzed by Hoepting et al. for *B. allii* as previously described. In New York, the same treatments will be evaluated in a replicated trial with clean and infested seed, which will be conducted in the same manner as the seed treatment study. Treatments will include: 1) clean seed - not mowed, 2) clean seed - mowed, 3) clean seed – mowed + Rovral, 4) clean seed – mowed + Pristine, 5) infested seed – not mowed, 6) infested seed – mowed, 7) infested seed – mowed + Rovral, 8) infested seed – mowed + Pristine.

Results from this study and IPM guidelines for managing Botrytis neck rot in onions will be shared with onion growers in the northeast via presentations at grower meetings, newsletter articles, upgraded recommendations in the Cornell and other Vegetable Guidelines. Results will also be published in American Phytopathological Society Pest Management Research Reports.