IYSV FLARES UP IN NEW YORK IN 2013: SHOULD ONION GROWERS BE CONCERNED?

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Iris yellow spot virus (IYSV) can cause devastating losses to onion crops around the world. Lesions may form on leaves of infected plants that cause foliage to die prematurely **(Fig 1)**, resulting in an onion crop with smaller bulbs. Since IYSV was first discovered in New York onion fields in 2006, infected onion plants can be found in most onion fields every year. Yet, devastating losses attributed to IYSV have been rare. In 2013, there was a severe epidemic of IYSV in two nearby fields in western New York that caused nearly 100% infection and substantial economic loss. These fields were transplanted with onions imported from Arizona and located approximately 10 miles from the Elba muck onion-growing region. *Were these rare cases, or should onion growers be concerned about IYSV getting worse in the future*? Although severe IYSV epidemics may not become more common in the future, there is no method to prevent IYSV from infecting onion crops, nor is there a cure for saving onion plants once they become infected. This article provides an overview of what we know about the epidemiology of IYSV in New York onion fields and some suggestions how to mitigate its prevalence and impact on bulb yield.

Fig. 1. Onion plants, cv. 'Ovation', infected with IYSV on a farm in western New York in 2013.

What is the impact of IYSV on bulb yield? Onion plants were pulled at the end of the season from multiple fields that had been either direct seeded or transplanted in the Elba Muck**.** Onion bulb weights from plants that tested positive for IYSV were compared with those that were not infected. Onions that tested positive for IYSV were significantly smaller than those without IYSV (7.6 to 26.3% lower weights) **(Fig. 2)**. Many of these infected plants lacked IYSV symptoms, suggesting that IYSV may impact bulb yields in many cases without ever knowing they are infected.

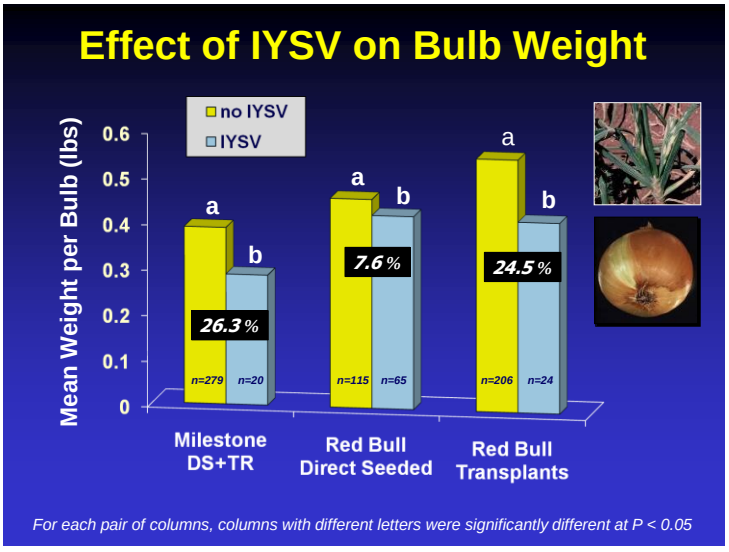

Fig. 2. Impact of IYSV on bulb yield in New York in 2009.

How do plants become infected with IYSV? IYSV is not seed transmitted, nor does it persist in the soil like many other plant pathogens. IYSV must have a living host to survive and an insect vector to spread it from plant to plant. Onion thrips is the major vector of IYSV in New York and throughout the world. Only onion thrips larvae (immatures) can acquire IYSV as they feed on infected plants. Both larvae and adults can transmit IYSV; adults can infect multiple plants during their lifetime.

What are sources of IYSV in New York? Identifying where IYSV comes from is an important step for developing strategies to avoid epidemics or to manage them. Previous research at Cornell has shown that IYSV may be imported annually into New York via infected onion transplants initially grown in the southwestern US and via bulbs imported from the western US. IYSV also likely has been established in New York for some time and persists between seasons through volunteer onions and a number of non-annual weed species. Currently, the source(s) of IYSV that is most important for initiating epidemics is not known. Below is a summary of what has been discovered about these sources in New York since 2006, and speculation about which sources may be most important in the spread of IYSV in onion fields.

Imported onion transplants. Over 9,000 onion transplants imported from Arizona **(Fig. 3)** have been tested for IYSV and a very small percentage tested positive (0.04%). Based on this percentage and typical onion transplanting densities in New York, the average number of IYSV-infected transplants per acre was estimated to be 112. These imported onion plants also may be infested with onion thrips. Taken together, imported transplants could be a significant source of IYSV in New York onion fields in some years.

Fig. 3. Onion transplants imported into New York from Arizona.

Imported onion bulbs. Some bulbs imported into New York for repackaging have the potential to end up in cull piles. If these bulbs are infected with IYSV and produce foliage, they could be become a source for IYSV. Onion thrips could colonize and reproduce on these plants and the subsequent generation could spread the virus to nearby onion fields. Based on a survey of 12 cull piles across New York State over two years, half were infected with IYSV. The average number of plants infected per cull pile averaged 8% (range of 2 to 16 plants per cull pile). While some cull piles are located in proximity to onion fields, the incidence of IYSV near these cull piles is not greater than the incidence far from cull piles. Imported bulbs are not likely a significant source of IYSV.

Volunteer onion plants from onion fields. IYSV could bridge seasons in New York through volunteer onion plants. One out of every five fields with volunteer onion plants has tested positive for IYSV. The average percentage of volunteers testing positive in these fields ranged from 1 to 8 per acre. Volunteers could be an important source of IYSV provided that onion thrips can complete a generation on them before field laborers remove them from fields. However, volunteer onions are frequently removed from most fields before onion thrips can complete a generation, reducing the threat that volunteers are a perennial and important source of IYSV in most situations in New York.

Non-annual weed species. Perennial weeds such as dandelion and common burdock tested positive for IYSV and are reproductive hosts for onion thrips. Therefore, IYSV could survive over winter in these weed species and onion thrips could colonize and reproduce on them in the spring, acquire IYSV, and then spread the virus into nearby onion fields. Although these weed species are relatively common near onion fields, the percentages of these plants infected with IYSV are estimated to be low (0.1 to 0.4%). Based on these levels of infection and population densities of dandelion and common burdock, we estimate that there are approximately 5 to 25 weed plants per acre of habitat bordering onion fields that are infected with IYSV. Thus, these weed species could be an important source in some years and locations.

How does IYSV spread within onion fields? Levels of IYSV in onion fields are usually low until early August **(Fig. 4)**, and plants infected with IYSV are often asymptomatic during this period. IYSV can increase rapidly during the second half of August, sometimes reaching 100%. Adult thrips densities near the end of the season are positively correlated with final IYSV levels. Thus, the rapid increase in IYSV incidence late in August is likely due, in part, to virulilferous adults migrating from maturing or harvested onion fields into adjacent onion fields that are not harvested. Additionally, there is typically a greater incidence of IYSV-infected onions along field edges than field centers early in the epidemic.

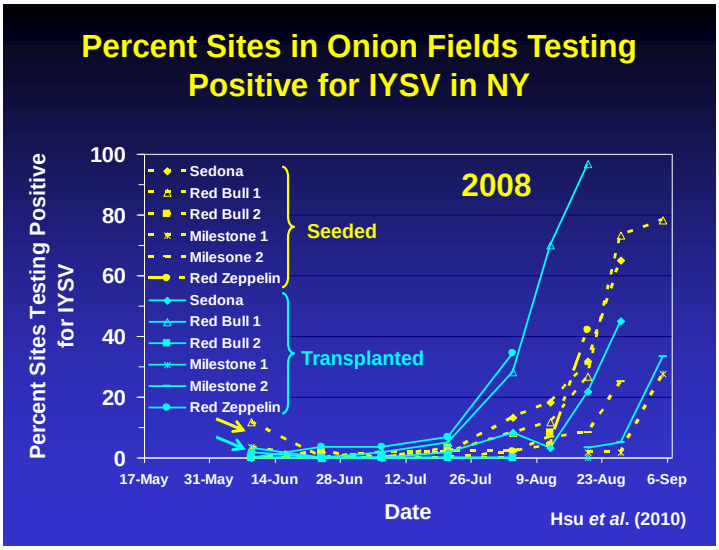

Fig. 4. Progression of IYSV epidemics in transplanted and direct-seeded New York onion fields.

How can IYSV be managed? Studies have shown that levels of IYSV in onion fields are correlated with onion thrips populations. Therefore, effective management of onion thrips should result in effective IYSV management. Management strategies for onion thrips and IYSV are described below.

Host plant resistance. Onion cultivars that have a high level of resistance to thrips and IYSV do not exist, but there are some cultivars that have either partial resistance or tolerance to thrips and IYSV. Foliage of these cultivars tend to have a yellow-green, glossy to semi-glossy appearance **(Fig. 5)**. Onion thrips do not colonize these

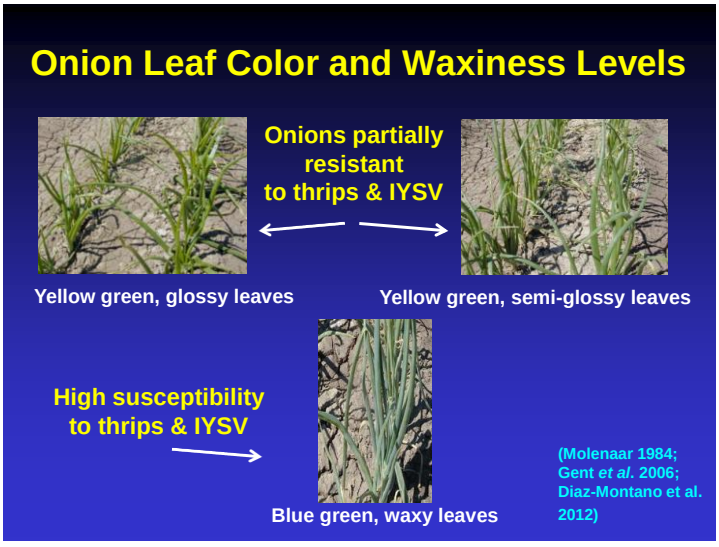

Fig. 5. Onion leaf color and waxiness are associated with susceptibility to thrips and IYSV.

cultivars as quickly or reproduce on them as successfully as cultivars that have a blue-green, waxy appearance. Many of the partially resistant and tolerant cultivars are best adapted to short-day growing conditions and do well in the western US. Research is needed to identify if any of these cultivars also may grow well in New York.

Cultural control tactics. Harvesting onions early should reduce the period thrips infest the crop and the incidence of IYSV. Planting onions early and selecting early maturing cultivars will facilitate an early harvest. Onion thrips adults tend to move from maturing or harvested onion fields into nearby unharvested fields **(Fig. 5)**. Typically, migrating thrips will infest several neighboring fields adjacent to one that has matured or been harvested **(Fig. 5a)**. Planting fields of similar maturity together should direct and localize thrips movement and IYSV spread to fewer fields **(Fig. 5b)**.

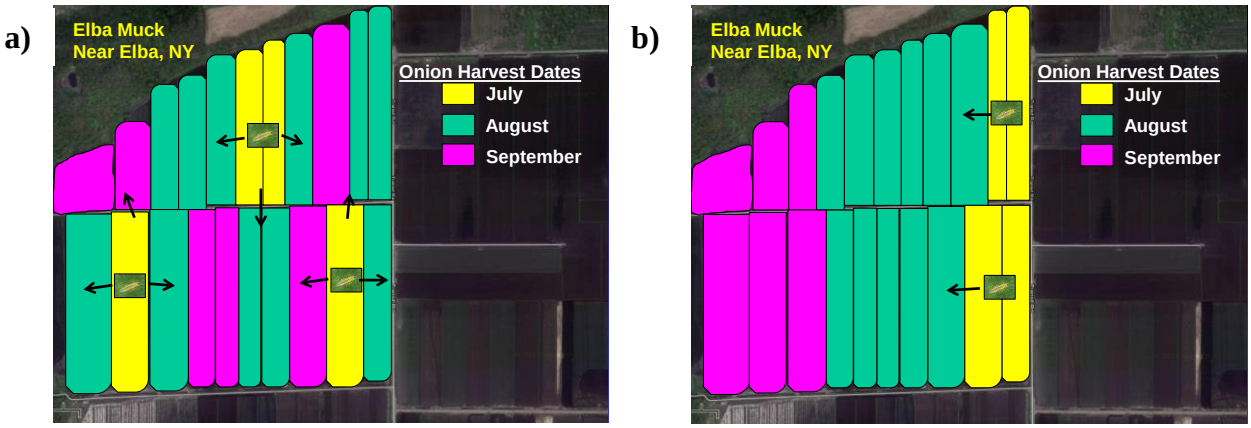

Fig. 5. **a)** Common situation in which onion fields of varying maturity will be planted. **b)** Proposed planting arrangement that would direct and localize thrips movement and IYSV spread to fewer fields.

Another cultural control tactic that helps manage thrips involves reducing levels of nitrogen applied to the crop at planting. Previous research shows that reducing the level of nitrogen from 125 lbs/acre to approximately 95 lbs/acre will reduce thrips densities without reducing marketable yield. Other potential benefits include lower fertilizer costs, lower levels of excess nitrogen in the environment and bacterial rot in storage. Past studies also have suggested that the impact of IYSV on reducing bulb size can be minimized if environmental stresses like drought and excessive soil moisture can be avoided.

Chemical control. The most common and effective strategy for managing onion thrips is to use insecticides. A number of highly efficacious products are available and strategies in which to use them over the course of the growing season have been identified and recommended in Cornell University's Integrated Crop and Pest Management Guidelines for Commercial Vegetable Production http://veg-guidelines.cce.cornell.edu/.

Summary. Management of IYSV and onion thrips is not mutually exclusive. Moreover, reliance on a single management strategy like insecticide use may not be sustainable in the long term. Efforts are needed to evaluate combinations of management tactics with the goal of identifying an integrative management program that is highly effective against onion thrips and IYSV, practical, economical and environmentally sustainable.