MANAGING INSECTICIDE RESISTANCE IN ONION THRIPS

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Management of onion thrips continues to be a high pest priority for Wisconsin onion growers. In 2006 the hot and dry conditions experienced in mid-summer led to increased populations that were very difficult to control in some areas. Furthermore, many of the earlier registered products for control of onion thrips are loosing control efficacy. Onion thrips insensitivity to λ -cyhalothrin (Warrior®) is suspected in Wisconsin similar to that which has been proposed in Ontario, Canada (Allen et al., 2005) and in New York populations using a thrips insecticide bioassay system (TIBS) (Shelton et al., 2003). Local insensitivity to Lannate® may also be occurring with increasing leaf damage following foliar applications and only 'fair' control of thrips populations. As a result, onion thrips management should be a top priority along with the potential for onion thrips to spread Iris yellow spot virus (IYSV) (Gent et al., 2004). An improved understanding of the ecology and management of onion thrips on a broad scale is essential to develop methods of control for this pest and to develop effective resistance management plans.

Onion growers in Wisconsin currently have a very limited range of insecticidal products available. Since the enactment of the Food Quality Protection Act (FQPA) in 1996, regulatory actions continue to threaten the long-term availability of the older, higher-risk compounds. FQPA is currently focused on the organophosphates and carbamates which effectively represent nearly half of the registered materials for onion thrips control. Furthermore, pending reviews may expand to include the synthetic pyrethroids as well. This will ultimately lead to a very narrow spectrum of available control options at a time when the chemical industry often foregoes seeking registrations of new materials on minor crops. Onion growers do, however, have some control over how rapidly insensitivity and resistance develops to the remaining arsenal of compounds and chemistries by developing well conceived, resistance management plans.

Recently registered for use in 2006, SpinTor® 2 SC is a new Naturalyte class of insecticide containing metabolic, fermentation products of the fungus, *Saccharopolyspora spinosa*, and appears to provide good thrips control as a population suppressive compound (Fig. 1). Product coverage and early season applications at thresholds were crucial for adequate control of onion thrips using this product. In 2006, New York, Michigan and Colorado were granted a crisis exemption for the use of Carzol® SP as a foliar insecticide treatment to manage onion thrips. In Oregon and Idaho, a Section 18 was granted for the same use. Unregistered, pending materials for thrips control also show some promise for control of onion thrips. Both abamectin (Agrimek® 0.15 EC) and spinetoram (Radiant® 2SC) performed remarkably well when compared to control efficacies of the two most currently used materials, λ-cyhalothrin and methomyl.

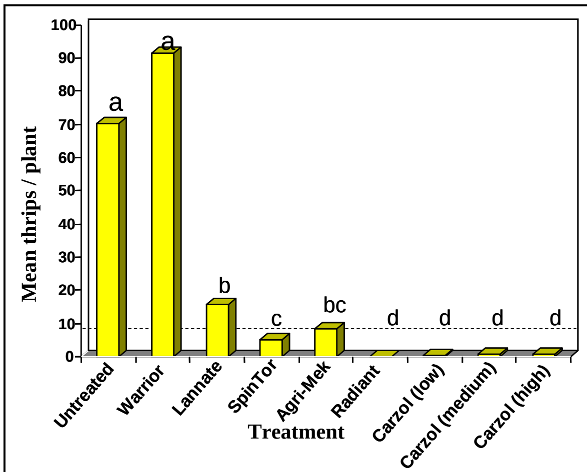

Figure 1. Season average onion thrips control using foliar-applied insecticides, Potter, NY, 2006 (B.A. Nault, Cornell University)

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Resistance management programs for onion thrips control are now under development in other onion producing regions of the US. In New York, the TIBS was recently implemented to survey thrips populations in commercial fields to the two most widely used classes of insecticides, λ-cyhalothrin and methomyl (Shelton et al., 2005). Assays performed in 2003 demonstrated significant variability in the spatial and temporal patterns of susceptibility to λ-cyhalothrin whereas field rates of methomyl still provided sufficient control. In 2005, a year in which onion thrips densities were much higher than in previous years, producers were unable to control populations of onion thrips in specific field locations and attributed this lack of control to developing resistance. Bioassays (TIBS) performed in 2005 did not, however, result in dissimilar levels of response to either λ-cyhalothrin or methomyl among test populations and resulted in surprisingly similar levels of control. The authors suggested that variation in thrips control may have been due, in part, to other factors including localized high populations, poor spray coverage, application intervals, and different onion varieties.

Exploration of novel management approaches is warranted in order to devise a more comprehensive management plan with an emphasis on insecticide resistance management. An initial approach is the use of cultural practices to reduce the attractiveness and likelihood that onion plants will be colonized by thrips. Ongoing research trials in Colorado have indicated that onion test plots with straw mulch(es) may reduce thrips colonization and total populations with observed reductions in thrips populations of up to 65%. Furthermore, mulches on onions have been shown to decrease IYSV incidence by up to 60%. Additional studies have also shown that onions produced on mulches have higher marketable size and weight compared to onions grown on bare soil, thus increasing the growers' net return. Intercropping of various plant species has also been investigated to compare reductions in colonization rates of onion thrips and overall reductions in yield (Trdan et al., 2005). Moreover, reflective mulches have been evaluated as an additional means of reducing the apparency of plants and extending the interval over which thrips colonize the susceptible crop, although this approach has been met with very little success. Another novel development of disease and insect control is the utilization of aqueous formulations of particle films. Particle film is based on kaolin and its coating serves as a physical barrier repelling arthropods and/or suppressing infestations by making the plant visually or tactually unrecognizable as a host. Ongoing research in New York reports that these materials hamper insect movement, feeding and other physical activities. Such technology has effectively suppressed plant diseases and several plant-feeding insect pests, without affecting plant growth and marketability.

Current guidelines for onion thrips on onions which was originally developed in Michigan is an action threshold of 3 thrips per green leaf. The effectiveness of this decision tool may have been useful for onion growers in Michigan at the time of its development, but may be inadequate for the conditions and currently registered materials in Wisconsin. Specifically, this guideline was developed at a time prior to the onset of any known insensitivity. Moreover, the relative effectiveness of a currently labeled insecticide must be considered when recommending a specific threshold. Conversely, some currently registered materials with apparent resistance, or lower toxicity, may require a lower action threshold to reduce populations below an economic threshold. Other compounds with greater efficacy may be applied at a higher, adjusted threshold and thus each insecticide may require a different threshold, but present guidelines do not consider this.

A comprehensive, insecticide resistance management approach for long-term control of onion thrips will undoubtedly be multi-tactic and should include, where possible, all available technologies to a) reduce the attractiveness of onion plants, b) delay the arrival of the dispersing populations infestation, c) correctly time pest control applications with appropriate equipment, and d) use effective remedial measures to lower population densities. To accomplish this, growers and pest control practitioners must be aware to avoid the consecutive use of insecticidal products with similar modes of action, or EPA numbered group, against onion thrips. Further, avoid using tank mixes of different insecticidal groups as this approach has been demonstrated to be effective only when there is no known resistance to either chemistry and if both materials have similar residual activity. Also, strict adherence to sampling plans and field scouting will improve the timing of required applications at appropriate thresholds. As is often the case in early season thrips colonization of fields, treat only the infested portions of fields where thresholds have been exceeded (spot spray), which is often adjacent to fallow field margins where thrips overwintering success is greatest. Achieving good spray coverage is also a critical component of an effective onion thrips resistance management plan. This is often achieved with higher spray volumes and the addition of non-ionic surfactants. It has also been well documented that natural mortality factors, including biological control, can greatly impact thrips populations. As such, the use of selective insecticide chemistries (e.g., SpinTor® 2 SC), which have less adverse effects on non-target organisms, should be used where possible. Finally, agricultural producers and pest managers need to remember that many factors can undermine insecticide efficacy and these factors may be independent of insecticide resistance. It is imperative to make an effort to understand the cause(s) of a perceived efficacy problem as a first step to resolving such an issue. It is very important to seek information from the product supplier, the crop consultant, and an appropriate extension specialist to determine why an issue arose and develop a plan to avoid any future problem. This area of pest management seems extremely important and relevant to the needs of the onion industry especially in light of the potential invasion of IYSV.

References

Allen, J.K.M., C.D. Scott-Dupree, J.H. Tolman, and C.R. Harris. 2005. Resistance of Thrips tabaci to pyrethroid and organophosphorus insecticides in Ontario, Canada. Pest Mgmt. Sci. 61:809-815.

Gent, D.H., H.R. Schwartz, and R. Khosla. 2004. Distribution and incidence of IYSV in Colorado and its relation to onion plant production and yield. Plant Dis. 88:446-452.

Shelton, A.M., B.A. Nault, J. Plate, and J.Z. Zhao. 2003. Regional and temporal variation in susceptibility to lambda-cyhalothrin in onion thrips in onion fields in New York. J. Econ. Entomol. 96:1843-1848.

Shelton, A.M., J.Z. Zhao, B.A. Nault, J. Plate, F.R. Musser, and E. Larentzaki. 2006. Patterns of insecticide resistance in onion thrips (Thysanoptera: Thripidae) in onion fields in New York. J. Econ. Entomol. 99:1798-1804.

Trdan, S., D. Znicdarcic, N. Valic, L. Rozman, and M. Vidrih. 2006. Intercropping against onion thrips, *Thrips tabaci* Lindeman (Thysanoptera : Thripidae) in onion production: on the suitability of orchard grass, lacy phacelia, and buckwheat as alternatives for white clover. J. Plant Dis. Prot. 113:24-30.