<u>Final Report</u> (03/12/08): IYS Risk Index to Predict Virus and Thrips

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Funding ($58,716) was authorized by the WRIPM Center on 2 February 2005 to Colorado State University researchers (Drs. H. F. Schwartz, W. S. Cranshaw and R. Khosla) to initiate field studies in 2005 and 2006 in Colorado in areas with a history of *Iris Yellow Spot Virus* (IYSV).

The overall goal was to develop multi-faceted management strategies that will reduce grower reliance upon high-risk pesticides, while at the same time improve productivity, profitability, sustainability and food safety for onions grown in diverse cropping system in the western U.S. and elsewhere. We investigated cultural practice effects upon thrips and tospovirus management in the western U.S., and will develop a Risk Index Model for future validation in the western U.S. The specific objectives of this study were to:

I. Determine the relationship of Iris yellow spot to soil properties, plant stress, and management practices.
II. Develop an Iris yellow spot Risk Index for validation by growers and crop consultants to identify and avoid high risk situations in different cropping systems.

Combined data sets (years) are still being evaluated for publication as we develop an Iris Yellow Spot Risk Index for validation by onion growers and crop consultants in Colorado and other western onion-growing states where these pests continue to be priority threats to the crop. These final analyses and the proposed Risk Index will be included in our Final Report that was submitted March 12, 2008.

Overview:

Iris yellow spot virus (IYSV) and its thrips vector are yield limiting pests of onion in the western U.S. This project investigated the relationship of iris yellow spot (IYS) to thrips populations, soil properties, plant stress, and grower management practices in Colorado onion fields. Results show that spatial autocorrelation of iris yellow spot is limited and that secondary spread of the virus occurred randomly within fields. In general, spatial autocorrelation varied by study site. The incidence of iris yellow spot was significantly autocorrelated at three of six selected study sites during 2005 and 2006. At one site that had significant autocorrelation at the first sampling date, autocorrelation was greater at the second and third sampling dates, indicating localized secondary spread within the field. Early season thrips populations were autocorrelated at most study sites, and subsequent thrips populations were significantly autocorrelated, however, later-season populations were randomly distributed. These results suggest that thrips are entering onion fields at a specific point (e.g., field margins and/or other crops) and then migrating randomly to adjacent healthy plants as infested plants become more stressed and damaged. Significant spatial cross-correlation was found between thrips density and the incidence of iris yellow spot at two study sites. These results could contribute to the

development of an IYS Risk Index to predict potential risk from iris yellow spot and its thrips vector; with primary index components that could include cultivar susceptibility, prior disease history, stage of crop growth, proximity to other potential sources of thrips and virus, high temperature stress, drought stress, and other crop stresses. Future validation of such a model could provide an efficient and uniform vehicle to disseminate critical and time-sensitive information related to IPM strategies that could be employed to address current and future outbreaks of onion thrips and iris yellow spot in Colorado and elsewhere.

In general, significant spatial dependency varied by study site. Early season thrips counts were spatially dependent at most study sites (4 of 6 during 2005 and 2006). Subsequent thrips counts (i.e., 2 and 3) exhibited significant spatial dependency in 3 of 6 sites. Later season thrips poplations were randomly distributed. These results suggest that thrips enter onion fields at a specific point (e.g., field margins or from other crops) and then migrating more randomly to adjacent plants as populations increase.

The incidence of IYS was spatially autocorrelated in three of the six study sites during 2005 and 2006. One trend was clear with the IYSV data: of the sites that exhibited spatial dependency, the second and third sampling dates exhibited stronger spatial auto correlation. The first sampling date was significant at only one study site. Significant spatial cross-correlation was found between thrips count and IYSV incidence at two study sites. These results suggest that areas that have high thrips populations may tend to have greater incidence of IYS as compared to areas with lower thrips populations.

Knowledge gained in this study could be used, in part, to create an iris yellow spot risk index, similar to the tomato spotted wilt risk index for peanut, for future testing and validation by researchers and use by growers, crop consultants, and other interested stakeholders to determine the relative risk of an IYS epidemic in a given field or production region. The IYS risk index could identify high risk situations and direct growers to avoid cultural practices that may lead to serious yield losses. A risk index could also emphasize and promote an integrated IYS management system that can be tailored to each grower's production and marketing needs and resources. We propose that an Onion IYSV Risk Index could be based upon pest and crop history, environmental patterns (e.g., high temperature, low moisture) and forecasts, production stresses (e.g., nutritional deficiencies and excesses, soil compaction), stage of plant development (e.g., vegetative to bulb stages of growth), pest population thresholds, and cultivar susceptibility to one or both pests. Validation of the model could then provide an efficient and uniform vehicle to disseminate critical and time-sensitive information related to IPM strategies that could be employed to address current and future IYS outbreaks in Colorado and elsewhere.

BULB ONION Risk Assessment – *Iris Yellow Spot Virus* (*IYSV*) **Tospovirus – Transmitted by Onion Thrips** **Colorado State University - Integrated Pest Management Program**			
Disease Risk Category**			**Risk Estimate:**
Forecasted Weekly Rainfall, Dew, Humidity: Bulbing to Early Cropping			
Above Normal: 0	Normal*: 1 {e.g.,1/4"}	Below Normal: 2	
Forecasted Average Daily High Temperature: Bulbing to Early Cropping			
Above Normal: 2	Normal*: 1 {e.g.,86°F}	Below Normal: 0	
Onion Field Adjacent to Other Sources of Thrips			
Small Grain, Alfalfa, Onion: 2	Other Vegetables, Corn, Fallow: 1		
Onion Rotation < 3 yrs, Volunteer Onions or Culls < 1 mile (2 km) away			
Yes: 2	No: 1		
Soil Stress(es): Compaction, Low Fertility, High pH or Salinity, Other			
Severe: 2	Moderate: 1	Minimal: 0	
Weed Population in and Around the Onion Field			
High: 2	Average: 1	Low: 0	
Type of Irrigation System			
Furrow: 3	Drip: 2	Sprinkler: 1	
Type of Onion Production System			
Seed: 2	Transplant/Set: 1		
No. of Thrips/plant (prebulb to 4 weeks postbulb)			
Low (< 25/pl): 1	Moderate (26-50): 3	High (> 50): 5	
Varietal Reaction to IYSV and/or Thrips			
Susceptible: 3	Unknown: 2	Tolerant: 1	
Initial IYSV Lesions on Few to Many Plants in Field or Nearby Fields			
2-4 Wks Pre-Bulb: 5	2 Wks Pre/Post-Bulb: 3	2-4 Wks Post-Bulb: 1	
		Disease Risk Estimate TOTAL:	
ENVIRONMENTAL THRESHOLDS (weekly) for Disease Forecast: * Temperature: Define normal for your region = e.g, average daily high temperature of 86°F (30°C) * Moisture: Define normal for your region = 0.25 inches (0.6 cm) of rainfall per week ** Insert Value of 2 for missing information for a specific Disease Risk Category			

If the total ***IYSV* Risk Value** is 15 or greater, consider treatment with a rotational program that includes conventional insecticides and/or biopesticides to reduce thrips pressure and virus transmission.

Note: As with any pesticide, always read and follow instructions and precautions. Refer to the Onion Growth Stage Chart, and incorporate other Integrated Pest Management approaches such as crop rotation, sanitation (of culls, volunteers, weeds), certified seed/clean transplants, plant resistance or tolerance to thrips and/or *IYSV*, tillage, straw mulch, adequate irrigation and fertility, and timely scouting.

[Model Proposed for Testing and Validation by Drs. H. F. Schwartz and D. H. Gent, Colorado State University - 12/2007]