SAES-422 Multistate Research Activity Accomplishments Report **Approved**

Project No. and Title:	W1008 Biology and Management of Iris yellow spot virus (IYSV) and Thrips in Onions
Period Covered:	01-2008 to 12-2008
Date of Report:	10-Feb-2009
Annual Meeting Dates:	10-Dec-2008

W1008 Meeting Attendees – 2008

**** denotes W1008 Participant***

- *Howard Schwartz, Colorado State University, Ft. Collins, CO
- *Christy Hoepting, Cornell University, Albion, NY
- *Chris Cramer, New Mexico State University, Las Cruces, NM
- *Hanu Pappu, Washington State University, Pullman, WA
- *Stuart Reitz, USDA-ARS, Tallahassee, FL
- *Krishna S. Mohan, University of Idaho, Parma, ID
- *Dan Drost, Utah State University, Logan, UT
- *Brian Nault, Cornell University, NYSAES, Geneva, NY
- *Lynn Jensen, Oregon State University, Ontario, OR
- *Clint Shock, Oregon State, Ontario, OR
- *Ron Gitaitis, University of Georgia, Tifton, GA
- *Steve Beer, Cornell University, Ithaca, NY
- *Mike Bartolo, Colorado State University, Rocky Ford, CO
- *Kurt Volker, TKI Nova Source Yakima, WA
- Robert T. Sakata, Sakata Farms, Brighton, CO
- Kerrick Bauman, Connel, WA.
- Bill Dean River Point Farms, Irrigon, OR
- George Boyhan, University of Georgia, Statesboro, GA
- Rajagopalbabu Srinivasan, University of Georgia, Tifton, CO
- Mike Thornton, University of Idaho, Parma, ID
- Ram Sampangi, University of Idaho, Parma, ID
- Erik Feibert, Oregon State University, Ontario, OR
- Mary Ruth McDonald, University of Guelph, Guelph, ON
- Peter Rogers, Nunhems USA, Brooks, OR
- Rick Watson, Nunhems USA, Brooks, OR
- Charlie Hicks, Bayer CropScience: Livermore, CO.
- Stephen Ogden, Market Access Solutionz, Wellington, NZ
- Cynthia Hsu, Cornell University NYSAES, Geneva, NY
- Charles Boateng, Colorado State University
- Stephanie Szostek, Colorado State University
- Anitha Chitturi , University of Georgia
- Stormy Sparks, University of Georgia
- Carroll Johnson, USDA-ARS, Tifton, GA

Brief Summary of Minutes of Annual Meeting

The annual meeting of W 1008 - Onion IYSV & Thrips was held December 10, 2008, in conjunction with the National Allium Research Conference, at the Riverfront Marriott Hotel, Savannah, Georgia.

George Boyhan, chair of the organizing committee of NARC-2009 welcomed the attendees of W1008. This year's meeting was the largest for W-1008, with over 50 participants. Chris Cramer, Committee Chair, opened the meeting with introductions and thanks to George Boyhan for organizing the meeting in conjunction with the National Allium Research Conference. Chris recognized Howard Schwartz for his leadership and taking the initiative to organize the W1008. Participants were asked to update their NIMMS profiles to reflect the 3 objectives of the project plan. The committee also helps justify allocation of time and effort by experiment stations to onion research. Members were urged to invite colleagues to join the W1008 Committee, and to contact your AES Director regarding travel funds to W-1008 meetings. One of the benefits of this type of regional committee is that it raises the profile of onion thrips/IYSV problems to Congress and the USDA.

During the meeting, participants were able to give reports on their recent activities, including updates on the spread of IYSV, IPM programs for thrips and IYSV, and improvements in virus detection. Details are in the minutes.

Howard Schwartz briefly reviewed the Specialty Crops Research Initiative grant for 2009-2012, "Ensuring US Onion Sustainability Breeding and Genomics to Control Thrips and IYSV". The director for this project is Mike Havey, USDA-ARS and University of Wisconsin with project co-PDs, Foo Cheung, J. Craig Venter Institute, Chris Cramer, New Mexico State University, Hanu Pappu, Washington State University and Howard Schwartz, Colorado State University. It consists of a multi-state approach with several extension, research and outreach projects, and collaboration with onion seed companies and growers.

Election of a new Secretary – Hanu Pappu, Washington, was unanimously elected. Christy Hoepting, New York, will assume duties of Vice-chair at the next meeting. Stuart Reitz succeeds Chris Cramer as Chair of the W1008 Committee.

Participants voted that the next W1008 meeting will be held in conjunction with the National Onion Association Annual meeting in San Antonio, Texas during the first week of December in 2009. The committee will work with NOA to combine the W-1008 meeting. Because of the large number of participants at this year's meeting and the valuable exchange of information, it was decided to expand the next meeting to one full day.

The meeting was adjourned by Chris Cramer at 6:00 PM.

Minutes Attachment: Copy of Minutes.

In addition, the proceedings of the 2008 National Allium Research Conference, including presentations on IYSV and onion thrips, are available at: http://www.caes.uga.edu/commodities/fruits/vidalia/NARC08/index.html.

Accomplishments for Objectives

1. Screen onion germplasm for improved levels of tolerance to *Iris yellow spot virus* (IYSV) and thrips

Colorado – Howard Schwartz, Colorado State University, Ft. Collins, CO

In Varietal trials. 40 entries were evaluated for thrips infestation and final IYSV incidence. Varieties with blue-green waxy leaves had more thrips than varieties with green leaves (glossy coating). OLYSOS5N5 and Colorado 6 had the lowest thrips throughout the season. White Wing, Arcero and Tequila tolerated a higher number of thrips. RedBull, Granero, Oro Blanco, Vaquero were most susceptible to thrips infestations.

New Mexico – Chris Cramer, New Mexico State University, Las Cruces, NM.

In February 2008, seed of 48 onion entries was sown in a field at the Leyendecker Plant Science Research Center in Las Cruces, NM. The entries consisted on short-, intermediate-, and long-day commercial cultivars and experimental breeding lines from the New Mexico State University breeding program. Seed was sown in two equally-spaced rows on the bed top. Plots were 0.6 m in width and 5.5 m in length. In the field, there were four blocks with each entry being represented with one plot per block. On the first and last bed of the study and at the front and back borders of the study, IYSV-infected bulbs were placed to ensure IYSV inoculum in the field. On each alternate bed, IYSV-susceptible breeding lines were sown in October, 2007 to act as disease spreader rows. The field was designed such that onion thrips would acquire IYSV from the infected bulbs, live on these bulbs until scape formation, then move to autumn-sown plants, and once these plants matured then move to the winter-sown test plants. At each move, thrips would transfer IYSV to those new plants. Onion plants were grown using standard cultural practices for growing onions in southern New Mexico except that chemical sprays were not applied for controlling onion thrips levels.

Onion thrips levels were monitored throughout the growing season in the test plots and on the disease spreader rows. Samples were collected arbitrarily from IYSV-infected bulbs and plants that were being used in the spreader rows to confirm IYSV presence. Confirmation was done using ELISA and RT-PCR.

On June 6, ten randomly-selected plants per plot were rated for IYSV symptom severity on a scale of 1 to 9 where 1 indicated no IYSV lesions and 9 indicated more than 50% of leaf tissue damaged due to coalescing IYSV lesions. These same ten plants were rated on a weekly basis for 7-8 weeks. In addition, ten additional randomly-selected plants per plot were rated for IYSV symptom severity using the scale mentioned above. Each week, a new set of ten randomly-selected plants was rated per plot. Rating continued for this method for 7-8 weeks also. For both rating methods, a mean IYSV symptom severity was calculated for

each plot at each rating date. The two rating methods were compared to determine differences in symptom severity between them. On three different dates during the season, plant samples were collected from the same ten plants per plots that had been rated for IYSV symptom severity on a weekly basis. The plant samples were analyzed using ELISA to determine optical density values for each plant as a representation of IYSV titer. At the particular sampling and rating date, symptom rating and optical density value were analyzed to determine any correlation between these two factors on a per-plant, per plot, per entry, per year, and their interaction basis. With weekly severity ratings, the disease progression over time was calculated on a per-plant, per plot, and per entry basis. In addition, the change in optical density values over time was calculated on a per-plant, per plot, and per entry basis. The data collection for optical density values has not been completed for all samples so the data analysis has not been initiated. The data analysis for severity ratings has not been completed yet.

New York – Brian Nault, Cornell University, Geneva, NY.

- There was a wide range in onion thrips damage among 46 onion cultivars screened for thrips resistance in upstate New York. On a scale of 1 to 9 (1= no damage and 9= heavy damage), the range in damage was 1.2 to 6.3. In general, varieties developed for growing in the western US were most resistant to onion thrips (e.g., OLS05N5, Colorado 6, T-433, NMSU 03-52-1, Delgado, Tioga, Peso, Cometa, Vaquero, Calibra and BGS-230).

- There also was a wide range in the percentage of IYSV infected plants among the onion cultivars screened for IYSV resistance. Some cultivars had over 75% infection, whereas others were below 25%. The most resistant varieties were Vaquero, 606-1, BGS-236, Bastille, Damascus OLS05N5 and SYN-G2.

- Cultivars that supported low populations of thrips, had less thrips damage and had low levels of IYSV infection included OLS05N5 and Vaquero.

Oregon - Lynn Jensen, Clint Shock, Erik Feibert, and Monty Saunders, Oregon State University, Ontario, OR.

- Full season onion cultivars were evaluated for the severity of IYSV symptoms at two locations in the Treasure Valley area of eastern Oregon, with growing procedures relevant to commercial onion production. Ten cultivars were tested at a location with severe natural IYSV pressure and 46 cultivars were tested at a location of moderate pressure. Cultivars differed significantly in IYSV symptoms and many commercially relevant characteristics. Tissue samples were collected to relate variety IYSV symptoms with ELISA tests.

2. Study the biology and epidemiology of IYSV and thrips, and impacts of chemical, cultural and biological tactics that can reduce their impacts upon onions.

Colorado – Howard Schwartz, Colorado State University, Ft. Collins, CO

- In a spatial and temporal distribution of thrips and IYSV study, areas that had higher thrips also tended to have higher IYSV. IYSV is present in all production areas of Colorado. The effect of thrips and IYSV on yield was inconsistent. Relationships between thrips, IYSV and edaphic properties appear to be weak. A poster on this study was presented at the NARC (see presentations at national meetings: Schwartz et al. #17).

- Results from Actigard trials were summarized. In general, Actigard applied pre-bulb can reduce the incidence of IYSV. In a commercial field with moderate pressure, IYSV was reduced 4 to 17%, and jumbo yield was increased 11 to 54% by most of the Actigard treatments.

- The role of onion transplants in the movement of thrips and IYSV was studied. Thrips were recovered in 56 to 100% the sources examined from Arizona (Phoenix), Texas (southern) and California (Sacramento Valley). Incidence of IYSV in these transplants varied from 0 to 56% (up to 5% of plants within a source). Transplants could serve as potential source of thrips and IYSV. Volunteer onions continue to test positive for IYSV from 2004 to 2008 and may serve as a green bridge for IYSV between seasons.

- Studies on the localization of IYSV in onion were conducted. Results showed a great degree of variability for the presence of IYSV in different parts (leaf, neck, bulb, basal plate, and root) showing uneven distribution of the virus within the infected plant.

- Bulb-borne infection of IYSV: Bulbs were collected from field-grown, symptomatic plants (19-24 weeks) after bolting. All the foliage was removed, and bulbs were planted in a greenhouse. The resulting plants were positive for IYSV. This suggests possible IYSV transmission through bulb. Discussion followed on how to ensure that the harvested bulbs were completely free of viruliferous thrips before they were planted in the greenhouse.

- Studies to identify weed hosts continued in 2008. Several weeds were found positive for IYSV using ELISA and RT-PCR. Weeds found to be positive for IYSV were used as source plants for onion thrips for acquisition. These thrips were able to transmit IYSV to onion. Studies to test if thrips could transmit IYSV from infected onion to weeds are in progress.

Idaho – Krishna Mohan, Ram Sampangi, Mike thornton, University of Idaho, Parma, ID

- Several weeds growing in and around onion fields in the Treasure Valley were sampled and tested for IYSV. Many of them were positive by ELISA but could not be verified by RT PCR. Hanu Pappu, Washington State University is working to resolve the discrepancies between ELISA and RT PCR results for IYSV. These discrepencies have occurred in numerous weed surveys. Ram will repeat ELISA testing using kits from different commercial sources to determine if there is a difference in the results of testing weeds.

- Seasonal dynamics of thrips populations were studied in onion fields in the Treasure Valley. A poster was presented at the NARC (see presentations at national meetings #16).
- Insecticidal treatments including fipronil and Cruiser were evaluated for thrips control and their effect on final IYSV incidence in the Treasure Valley growing region. Carbamate insecticides like Carzol and Lannate were evaluated for potential plant health benefits on onion. It appeared that carbamate insecticides had no effect on plant health. This project was presented at the NARC (see presentations at national meetings #24)

New York – Brian Nault, Cornell University, Geneva, NY

- Volunteer onion plants growing in onion fields and cull piles, as well as selected weed species are sources of IYSV in NY. These sources are known hosts for both IYSV and onion thrips. Among these sources, weeds may contribute the most to annual spread of this disease because their densities far outnumber densities of volunteer onions in the onion-cropping system. However, more research is needed to examine this hypothesis. Monitoring temporal and spatial relationships between IYSV, weed hosts, onion thrips and the onion crop is critical to identify which onion fields are at highest risk for IYSV and to be able to target IYSV management strategies accordingly.

- Onion plants imported from AZ for transplanting in NY tested negative for IYSV, and therefore transplants are not likely a source in NY. Imported bulbs discarded into cull piles during repackaging could be a source, but may not be a major one. We learned this summer that many imported bulbs do not sprout even when provided conditions to do so; perhaps these bulbs were treated with a sprout inhibitor prior to harvest. If imported bulbs never produce foliage to support another generation of thrips, IYSV cannot be transferred from those bulbs to nearby onion fields. Additionally, cull piles are small, geographically isolated areas and many are located great distances from onion fields.

- Early in the season (through June), onion thrips densities in transplanted onion fields were significantly higher than densities in direct-seeded onion fields.

- We were able to detect IYSV much earlier in 2008, and more of the fields in 2008 had higher IYSV prevalence levels prior to harvest compared with 2007. When direct-seeded fields had higher levels of IYSV than their transplanted counterparts, the difference was much greater than when transplanted fields had higher levels of IYSV than their direct-seeded counterparts. This suggests that, contrary to what we original hypothesized, the direct-seeded fields may be more at risk to IYSV than transplanted fields even though transplanted fields had significantly higher populations of thrips early in the season.

- In general, direct-seeded fields are harvested later than transplanted fields. This could affect IYSV levels by allowing the virus more time to spread within the field, and by concentrating infected thrips migrating out of harvested fields into the remaining fields that were still standing. In fact, our results suggest that later season adult thrips behavior may be more important in the epidemiology of IYSV in New York onions than early season thrips populations.

- Insecticides that provided the best protection against onion thrips included Radiant SC, Movento 240 SC and Carzol SP. Section 18s for Movento and Carzol for thrips control in onion have been submitted to New York State DEC and EPA for the 2009 season.

- Several insecticide application sequence approaches were evaluated and the best approaches were those that included two consecutive applications of the products mentioned above. However, more research is needed to identify the best sequence of these products during the season.

- Timing insecticide sprays for thrips control using action thresholds reduced the number of applications relative to a calendar-based spray program. Yet, the efficacy of the product had a dramatic impact on the number of applications made (i.e., most effective products were sprayed fewer times relative to less effective products).

- Brian Nault submitted a package to the New York State Department of Environmental Conservation that led to a **Specific Emergency Exemption (FIFRA Section 18)** for the use of formetanate hydocloride (Carzol SP) on onion for onion thrips control. The Crisis Exemption request was granted by NYSDEC from May- September 2008.

- Brian Nault wrote a letter of support that led to the New York Department of Environmental Conservation granting a **FIFRA Section 24(c), Special Local Needs Label**, for the use of Radiant SC on onion for onion thrips control in New York. (Valid through 12/31/2008).

Utah – Dan Drost, Utah State University

- A statewide IYSV survey was conducted where fields were scouted every 2-3 weeks and samples collected. Symptomless plants tested positive for IYSV via ELISA tests in July, but symptoms did not show up until August.

- A weed survey was conducted in collaboration with Hanu Pappu, Washington State University. Two new weed species were identified as hosts of IYSV including a type of salt bush, Atraplex, and a Foxtail, which is the first detection of IYSV in a grass species. This stresses the importance of keeping voucher specimens of weed hosts. A major effort is underway to investigate reduced nitrogen applications in combination with crop rotations and use of composts and other additives that increase the biological activity of the soil to reduce onion thrips and IYSV.

- In Utah, some growers have adopted a rotation which includes 5 years of alfalfa, 1 year of field corn and 1 year of wheat before planting onions. Ninety units of nitrogen are used per year. In this system, the grower went from using 10 insecticide sprays per season to 1 in 5 years to control thrips. Onions look paler green and yield about 10% less, but the savings in fertility and insecticide inputs more than make up for the lower

yield, economically. In another project, trap crops including buck wheat and carrots are being investigated to reduce onion thrips populations.

Washington – Lindsay du Toit, Tim Waters and Hanu Pappu Washington State University

- A sentinel plot of five onion cultivars that were each treated or not treated with insecticides was monitored in 2008. Thrips counts and yield were assessed, but iris yellow spot did not develop in that trial. These sentinel plots were isolated from any onion seed crops, and in one of the few sections of the Columbia Basin (central Basin) in which IYS has not become a problem for onion production (one of the few sections in which seed crops aren't grown). Interesting preliminary data suggest that certain foliar insecticide treatments may exacerbate powdery mildew on onion plants.

- Severe iris yellow spot was found in at least 3 onion seed crops in the northern Columbia Basin in 2008. One field had >90% lodging 3 weeks prior to harvest. IYSV is definitely still causing significant problems in onion seed production in the northern Columbia Basin of Washington.

- New records of IYSV confirmed by Hanu Pappu include Mason Valley in Nevada, and new regions in Northern California. New hosts include garlic, spiny sowthistle and foxtail.

- Work to develop a procedure for mechanical transmission of IYSV into onion is underway, which would be useful for screening for resistance. Some progress has been made, but high efficiency is lacking. The NSs antibody is useful in quickly identifying IYSV transmitters among thrips, as not all thrips carrying the virus can transmit it. Then, it can be determined when most of the viriliferous thrips are entering or present in the field.

- Western blots are being investigated for improved accuracy of identifying IYSV in weeds, as there continues to be discrepancy between ELISA strongly testing positive and PCR testing negative in weeds.

3. Transfer information on progress dealing with IYSV and thrips biology and IPM strategies to the onion industry and other interested parties

New York – Brian Nault, Cornell University, Geneva, NY

- Several meetings were held in 2008 to inform NY's onion industry about results from this project: the Annual Winter New York Onion Industry Council Meeting in Ithaca in January, the Empire State Fruit and Vegetable EXPO in Syracuse in February, the Annual Summer New York Onion Industry Council Meeting in Elba in July and the Elba Muck Onion Meeting in Elba in August. Additionally, an annual workshop was held in Ithaca that included a session to update Cornell Cooperative Extension Educators about

results from this project. Please see the list of presentations to grower groups for additional information.

Oregon/Idaho - Lynn Jensen, Clint Shock, Erik Feibert, and Monty Saunders, Oregon State University, Ontario, OR.

- Information pertinent to IYSV and thrips biology was transferred to growers, other onion industry parties, and the public through numerous meetings, field days, publications, and the internet.

Impacts

Oregon/Idaho

- Due to better knowledge of the transmission of IYSV, less of the Idaho-Oregon onion bulb production area combines summer bulb production with over-wintering and seed production crops. Growers are also practicing more vigilance in destroying onion culls. Since many growers are planting over-wintering fields further from summer production fields and destroying more culls, these actions help break the natural green bridge keeping IYSV pressure high from one production year to the next. Overall, there has been less IYSV expression in the Treasure Valley of Idaho-Oregon in 2007 and 2008 than in 2005 and 2006.

Publications

1. Gent, D. H., and Schwartz, H. F. 2008. Iris yellow spot. pp. 80-83. *In,* Compendium of Onion and Garlic Diseases, 2nd Ed. APS Press, St. Paul, MN.

2. Hoepting, C.A., J. Allen, K. Vanderkooi, M. Hovius, H.R. Pappu, and M.R. McDonald. 2008. First Report of *Iris yellow spot virus* on Onion in Canada. *Plant Disease* 92:318.

3. Hsu, C., C. Hoepting, A. Shelton and B. Nault. 2008. Seasonal prevalence of *Iris yellow spot virus* in transplanted and direct-seeded onion fields, pp. 60-66. *In* Program and Proceedings of the 2008 National Allium Research Conference, Savannah, GA.

4. Huchette, O., C. Bellamy, R. Filomenko, B. Pouleau, S. Seddas, and H.R. Pappu, 2008. Iris yellow spot virus in Shallot and Onion in France. Plant Health Progress. doi:10.1094/PHP-2008-0610-01-BR.

5. Larentzaki, E., J. Plate, B. A. Nault and A. M. Shelton. 2008. Impact of straw mulch on populations of onion thrips (Thysanoptera: Thripidae) in onion. J. Econ. Entomol. 101(4): 1317-1324.

6. Larentzaki, E., A. M. Shelton, and J. Plate. 2008. Effect of kaolin particle film on Thrips tabaci (Thysanoptera: Thripidae), oviposition, feeding and development on onions: A lab and field case study. Crop Protection 27: 727-734.

7. Nault, B. A., M. Fuchs, C. Hsu, E. Smith and A. Shelton. 2008. Potential sources of IYSV, relationship between IYSV and onion thrips, and thrips control in New York, 9-12. *In*: Proceedings of the 2008 Wisconsin Muck Crops Research Update. March 4, 2008. Portage, WI. University of Wisconsin Extension and Wisconsin Muck Growers Association.

8. Nault, B. A., and M. L. Hessney. 2008. Onion thrips control in onion, 2007. Arthropod Management Tests. 33: E20.

9. Nault, B., A., C. Hsu, E. Smith, A. Shelton, M. Fuchs, C. Hoepting and A. DiTommaso. 2008. Identifying sources of IYSV in New York's cropping system, pp. 67-72. *In* Program and Proceedings of the 2008 National Allium Research Conference, Savannah, GA.

10. Nault, B. A. and A. M. Shelton. 2008. Insecticide efficacy and timing of sprays for onion thrips control, pp. 52-56. *In*: Proceedings of the 2008 Empire State Fruit and Vegetable Expo. February 12-14, 2008. Syracuse, NY. Cornell Cooperative Extension and New York State Vegetable Growers Association.

11. Nault, B. A. and A. M. Shelton. 2008. Update: Insecticides and sequences of applications for onion thrips control. Cornell University Cooperative Extension Vegetable Program. Veg Edge 4(7): 6-9.

12. Nault, B. A. and A. M. Shelton. 2008. Insecticides and sequences of applications for onion thrips control in onion fields. Cornell University Cooperative Extension of Orange County. Muck and Mineral. June 2008. pp. 1-3.

13. Nault, B. A. and A. M. Shelton. 2008. Insecticides and timing for onion thrips control. Cornell University Cooperative Extension Vegetable Program. Veg Edge 4(6): 12-14.

14. Pappu, H.R., and M.E. Matheron. 2008. Characterization of *Iris yellow spot virus* from onion in Arizona. *Plant Health Progress*. doi:10.1094/PHP-2008-0711-01-BR.

15. Pappu, H.R., I.M. Rosales, and K.L. Druffel. 2008. Serological and molecular assays for rapid and sensitive detection of Iris yellow spot virus (Genus Tospovirus, Family Bunyaviridae) infection of bulb and seed onion crops. Plant Disease 92:588-594. (cover page of the issue).

16. Shock, C.C., E.B.G. Feibert, L.B. Jensen, S.K. Mohan, and L.D. Saunders. 2008. Onion variety response to iris yellow spot virus. HortTechnology. 18:539-544.

17. Ward, L.I., Z. Perez-Egusquiza, J.D. Fletcher, F.M. Ochoa Corona, J.Z. Tang, L.W.Liefting, E.J. Martin, B.D. Quinn, H.R. Pappu and G.R.G. Clover. 2008. First Report of Iris yellow

spot virus on Allium cepa in New Zealand. New Disease Reports http://www.bspp.org.uk/ndr/july2008/2008-43.asp British Society for Plant Pathology.

18. Waters, T. D., and D. B. Walsh. Thrips control on dry bulb onions in Washington State, 2007. Arthropod Management Tests. 33: E3

Presentations

Research Reports: Abstracts and Papers at International Professional Meetings

1. Pappu, H.R. and C.C. Shock, 2008. Progress toward understanding and managing *Iris yellow spot tospovirus* epidemics in onion bulb and seed crops. The 3rd Conference of the International Working Group on Legume and Vegetable Viruses (IWGLVV), 20-23 August 2008, Ljubljana, Slovenia.

Research Reports: Abstracts and Papers at National Professional Meetings

1. Bag, S., K.L. Druffel, and H.R. Pappu. 2008. Genome Characterization and genetic Diversity of Iris yellow spot virus. National Allium Research Conference, Savannah, GA. December 11-13, 2008.

2. Buhrig, W. and M. Thornton. Strategies to Improve Early Season Thrips Control and Suppress Iris Yellow Spot Virus in Onions. 2008 National Allium Research Conference, December 10-13, Savannah, Georgia.

3. Diaz-Montano, J., A. M. Shelton, B. A. Nault and M. Fuchs. 2008. Screening for resistance and impact onion thrips (*Thrips tabaci* Lindeman) and *Iris yellow spot virus* on onion growth. Eastern Branch - Entomological Society of America Annual Meeting, Syracuse, NY.

4. Diaz-Montano, J., A. M. Shelton, B. A. Nault and M. Fuchs. 2008. Screening for resistance and yield losses caused by onion thrips (*Thrips tabaci* Lindeman) and Iris yellow spot virus on onions. Entomological Society of America Annual Meeting, Reno, NV.

5. Drost, D., J. Reeve, K. Evans, L. Andreasen, and D. Alston. Cultural Management of Onion Thrips And Iris Yellow Spot Virus. 2008 National Allium Research Conference, December 10-13, Savannah, Georgia.

6. Feibert, E.B.G.,C.C. Shock, and L.D. Saunders. 2008. Irrigation intensity, irrigation frequency, and emitter flow rate for drip-irrigated onion. 2008 National Allium Research Conference, December 10-13, Savannah, Georgia.

7. Gitaitis, R. Detection and Distribution of Iris Yellow Spot Virus in Spiny Sowthistle in Georgia. 2008 National Allium Research Conference, December 10-13, Savannah, Georgia.

8. Hsu, C. L., C. Hoepting, A. M. Shelton and B. A. Nault. 2008. Tracking the spread of *Iris yellow spot virus* (IYSV) in onion fields. Entomological Society of America Annual Meeting, Reno, NV.

9. Hsu, C., C. Hoepting, A. Shelton and B. Nault. 2008. Seasonal prevalence of *Iris yellow spot virus* in transplanted and direct-seeded onion fields. 2008 National Allium Research Conference, Savannah, GA.

10. Hsu, C., D. Shah, M. Fuchs, A. Shelton and B. Nault. 2008. Differences in thrips pressure and prevalence of *Iris yellow spot virus* (*Tospovirus*) in transplant and direct-seeded onions. Eastern Branch - Entomological Society of America Annual Meeting, Syracuse, NY.

11. Jensen, L.B., and C.C. Shock. Oregon progress on the biology and management of Iris yellow spot virus (IYSV) and thrips in onions. Annual meeting of the W1008 working group. December 10, Savannah, Georgia.

12. Jensen, L.B., C.C. Shock, and L.D. Saunders. 2008. Managing insecticides for maximum efficacy against thrips in dry bulb onion in the Oregon / Idaho production region. 2008 National Allium Research Conference, December 10-13, Savannah, Georgia

13. Nault, B., A., C. Hsu, E. Smith, A. Shelton, M. Fuchs, C. Hoepting and A. DiTommaso. 2008. Identifying sources of IYSV in New York's cropping system. 2008 National Allium Research Conference, Savannah, GA.

14. Nault, B., A. Shelton, M. Fuchs, C. Hsu, E. Smith, and M. Hessney. IYSV epidemiology, thrips ecology and management in New York. W-1008 Onion IYSV and Thrips Annual Meeting. Denver, CO.

15. Nault, B. A., A. Shelton, M. Fuchs, A. Taylor, C. Hsu, E. Smith, P. Jentsch, M. Hessney and H. Grimsland. 2008. Summary of research on onion maggot, onion thrips and *Iris yellow spot virus* in New York. New York Onion Industry Council Winter Meeting, Ithaca, NY. January 22, 2008. Speaker, 15 minutes. Attendees: 30. Onion growers, CCE educators and Cornell faculty.

16. Sampangi, R.K., S.K. Mohan, C.C. Shock,and E.B.G. Feibert. 2008. Abundance and population dynamics of onion thrips and incidence of iris yellow spot virus in Treasure Valley region of Idaho and Oregon. 2008 National Allium Research Conference, December 10-13, Savannah, Georgia

17. Schwartz, H., S. Fichtner, D. Gent, R. Khosla, D. Inman, W. Cranshaw, M. Camper, and L. Mahaffey. P-14 Spatial and Temporal Distribution of Thrips and IYSV of Onion in Colorado. 2008 National Allium Research Conference, December 10-13, Savannah, Georgia.

18. Schwartz, H., D. Gent, S. Fichtner, W. Cranshaw, L. Mahaffey, M. Camper, K. Otto, and M. McMillan. Management of Onion Thrips and IYSV with Straw Mulch and Biopesticides. 2008 National Allium Research Conference, December 10-13, Savannah, Georgia.

19. Schwartz, H. F., K. Otto, S. Szostek, C. Boateng, W. S. Cranshaw, M. A. Camper, and L. Mahaffey. Thrips And IYSV Sources in Colorado Onion Production Systems. 2008 National Allium Research Conference, December 10-13, Savannah, Georgia.

20. Shock, C.C. 2008, E.B.G Feibert, L.B. Jensen, S.K. Mohan, R.K. Sampangi, H. Pappu, and L.D. Saunders. 2008. Onion variety response to iris yellow spot virus. 2008. National Allium Research Conference, December 10-13, Savannah, Georgia.

21. Shock, C.C.,E.B.G. Feibert, and L.D. Saunders. 2008. Irrigation scheduling for drip-irrigated onion. 2008 National Allium Research Conference, December 10-13, Savannah, Georgia.

22. Smith, E., A. DiTommaso, M. Fuchs, A. M. Shelton and B. A. Nault. 2008. Identifying weed hosts for onion thrips (*Thrips tabaci*) and implications for Iris yellow spot virus management in onion. Entomological Society of America Annual Meeting, Reno, NV. *(Note: Awarded second place in Student Competition for the President's Prize in the Section Plant-Insect Ecosystems: Tri-trophic Interactions).*

23. Smith, E., C. Hsu, M. Fuchs, A. Shelton, C. Hoepting and B. Nault. 2008. Assessing possible sources of onion-thrips transmitted *Iris yellow spot virus* in New York onion fields. Eastern Branch - Entomological Society of America Annual Meeting, Syracuse, NY.

24. Thornton, M. and W. Buhrig. Impact of Carbamate Insecticides on Thrips Populations and Iris Yellow Spot Virus Incidence in Onions. 2008 National Allium Research Conference, December 10-13, Savannah, Georgia.

25. Volker, K. Impact of Surround Wp Crop Protectant for Management of Thrips Infestation and Overall Plant Health. 2008 National Allium Research Conference, December 10-13, Savannah, Georgia.

Reports at Grower meetings and field days:

1. Diaz, John M., A. Shelton and B. Nault. 2008. Onion resistance to onion thrips and IYSV. Empire State Fruit and Vegetable Expo, Syracuse, NY. February 13, 2008. Cornell Cooperative Extension and New York State Vegetable Growers Association. Co-author, 10 minutes. Attendees: 80. Onion growers, vegetable industry representatives, crop consultants, CCE educators and Cornell faculty.

2. Feibert, E.B.G., and C.C. Shock. 2008. Cultural practice options to reduce IYSV risks. OSU Malheur Experiment Station Onion Variety Day, Ontario, OR, August 26, 2008.

3. Fuchs, M., C. Hsu, A. Shelton and B. Nault. 2008. Regional survey results and field incidence of IYSV. Empire State Fruit and Vegetable Expo, Syracuse, NY. February 13, 2008. Cornell Cooperative Extension and New York State Vegetable Growers Association. Co-author, 20 minutes. Attendees: 80. Onion growers, vegetable industry representatives, crop consultants, CCE educators and Cornell faculty.

4. Hoepting, C.A. 2008. Iris yellow spot virus on onions in New York State. 57th Annual Muck Vegetable Growers Conference, Bradford, Ontario, Canada, March 26-27, 2008. 70 attendees.

5. Hoepting, C.A. 2008. Onion thrips management strategies. Fall Vegetable Workshop, Granby, NY, November 19, 2008. 15 attendees.

6. Hoepting, C.A. and B.A. Nault. 2008. Advances in the control of onion thrips – a report from New York. 57th Annual Muck Vegetable Growers Conference, Bradford, Ontario, Canada, March 26-27, 2008. 70 attendees.

7. Jensen, L. 2008. Onion ag issues. Treasure Valley Ag Show, Ontario, OR, January 19.

8. Jensen, L. 2008. Thrips control in onions. Idaho/Malheur County Onion Growers Annual Meeting, Ontario, OR, February 5.

9. Jensen, L. 2008. Thrips identification and control. Fertilizer Field Representative Workshop. Oregon State University, Ontario, OR, May 22, 2008.

10. Jensen, L. 2008. Insecticides for thrips control in onions. OSU Malheur Experiment Station Field Day, Ontario, OR, July 9, 2008.

11. Jensen, L. 2008. Movento for thrips control in onions. Bayer Tour. Ontario, OR, August 11, 2008.

12. Jensen, L. 2008. Controlling onion thrips. Treasure Valley Field Tour. Ontario, OR, August 15, 2008.

13. Jensen, L. 2008. Strategies for thrips control in onions. Pacific Northwest Vegetable Association Annual Meeting. Kennewick, WA, November 19, 2008.

14. Nault, B. 2008. Onion insect management. Elba Muck Onion Twilight Meeting, Elba, NY. August 5, 2008. Cornell Cooperative Extension Vegetable Program. Speaker, 15 minutes. Attendees: 40. Onion growers, vegetable industry representatives and crop consultants.

15. Nault, B. A. 2008. Getting the upper hand on onion thrips and IYSV. Wisconsin Muck Farmers Association Annual Meeting. Portage, WI. March 4, 2008. Speaker, 45 min. presentation.

16. Nault, B., C. Hsu, E. Smith and J. Diaz-Montano. 2008. Onion thrips and IYSV research update and demonstration. New York State Onion Industry Council Summer Tour and Meeting, Elba, NY. Cornell Cooperative Extension. Co-speaker, 20 minutes. Attendees: 60. Onion growers, vegetable industry representatives, crop consultants, CCE educators and Cornell faculty.

17. Nault, B., and A. Shelton. 2008. Thrips control using insecticides: What and when to apply? Empire State Fruit and Vegetable Expo, Syracuse, NY. February 13, 2008. Cornell Cooperative Extension and New York State Vegetable Growers Association. Speaker, 20 minutes. Attendees: 80. Onion growers, vegetable industry representatives, crop consultants, CCE educators and Cornell faculty.

18. Shock, C.C. 2008. Perspectives on onion irrigation scheduling and drip irrigation. Stress on onion and its impact on ISYV development. 48th annual meeting of the Malheur County and Eastern Idaho Onion Growers Annual Meeting, Four Rivers Cultural Center, Ontario, February 5, 2008.

19. Shock, C.C. 2008. Onion variety performance. 48th annual meeting of the Malheur County and Eastern Idaho Onion Growers Annual Meeting, Four Rivers Cultural Center, Ontario, February 5, 2008.

20. Shock, C.C. 2008. Perspectives on onion irrigation scheduling and drip irrigation. Drip Irrigation Conference, Clearwater Supply. February 6, 2008.

21. Shock, C.C. 2008. Soil moisture requirements for onions. Pacific Northwest Vegetable Association Annual Conference and Trade Show, Three Rivers Convention Center, Kennewick, WA, November 19-20.

22. Shock, C.C. and E.B.G. Feibert. 2008. Irrigation, fertilization, and cultivar to manage IYSV. OSU Malheur Experiment Station Field Day, Ontario, OR, July 9, 2008.

23. Waters, T.D. and du Toit, L. WSU Onion Field Day, Othello, WA, August 28, 2008.

24. Waters. T.D. 2009 Annual Conference and Trade Show of the Pacific Northwest Vegetable Association, Kennewick, WA, November, 19 2008.

Internet Resources

1. Jensen, L.B. 2008. Insecticide efficacy trial for thrips control in dry bulb onions – 2007. Oregon State University Agricultural Experiment Station, Special Report 1087:52-56. http://www.cropinfo.net/AnnualReports/2007/InsecticideEfficacyTrialThripsBulbOnions2007.html

2. Jensen, L.B., C.C. Shock, and L.D. Saunders. 2008. Managing Carzol® for Maximum Efficacy Against Thrips – 2007. Oregon State University Agricultural Experiment Station, Special Report 1087:57-73. http://www.cropinfo.net/AnnualReports/2007/ManagingCarzol2007.html.

3. Schwartz, H. F. 2008. Web site dedicated to information and resources on thrips and IYSV. http://www.alliumnet.com/index.htm

4. Shock, C.C., E.B.G. Feibert, L.D. Saunders, L. Jensen, K. Mohan, and H. Pappu. 2008. 2007 Onion variety trials. Oregon State University Agricultural Experiment Station, Special Report 1087:17-25. http://www.cropinfo.net/AnnualReports/2007/OnionVarietyTrials2007.html

5. Shock, C.C., E.B.G. Feibert, L.D. Saunders, L.B. Jensen, and K. Mohan. 2008. Management of onion cultural practices as a means to control the expression of iris yellow spot virus. Oregon State University Agricultural Experiment Station, Special Report 1087:34-51. http://www.cropinfo.net/AnnualReports/2007/IrisYellowSpotVirusOnion2007.html.