

Summary of USWBSI Biocontrol Workshop held August 1, 2007 in San Diego, California at the Town and Country Hotel

The short term aim of the MGMT RA is to provide a commercially viable control method or decision support system that would result in a reduction of DON in grain by at least 50%.

Attendees included biological control researchers Bergstrom, Bleakley, Boehm, Paul, Schisler and Yuen (and research team member Jochum). Avila-Adame of Marrone Organic Innovations also attended the meeting. The MGMT RAC of the USWBSI was represented by Neate, Draper, and Kirk and also Bergstrom who had a dual role. The biological control researchers expressed disappointment that no EC members attended the workshop.

Neate summarized recent organizational changes undergone by the USWBSI including the recent combining of the CBCC RAC with the EEDF RAC to form the MGMT RAC as well as the creation of the BAR and HWW collaborative research areas. Areas described included the move toward more integrated/collaborative research, the increased goal and outcome focus, and the greater emphasis on accountability and performance measurement of the USWBSI as a whole.

Procedures followed in evaluating research proposals submitted to the USWBSI were reviewed. The way the PRP moves from the USWBSI headquarters to the RAC and the EC and the communications between the groups was described so that the group knew how decisions are made about an individual project.

The range of criteria used in evaluating the proposals within CBCC was also described, as well as some comments.

Comments

- All proposals compete with all others - no allocation is reserved for an area
- MGMT exists to find a solution to a problem, not just to distribute money
- Money available is limited compared to number of grants and amount requested
- Ideally collaboration doesn't mean just replicating a trial in a different state.

Criteria (unordered)

- Is the proposal within an identified priority area
- Applicants history of success in past projects
- Chances of success of this project
- Potential effectiveness of proposed method compared to other existing/proposed methods
- Practical viability - it has to fit current or predicted future farming systems
- Economic viability – it has to be cost effective
- Time frame to a useable product/method
- Resource amount requested compared to comparable applications

Schisler presented information on the use of biological control products in field agriculture, the environmental advantages of such products, the continuing growth of the organic food market to 3% of the entire food market and the role biocontrol products will play in the organic food market including organically grown wheat products. From figures compiled by Schisler he calculated a reduction in funding of biocontrol research over the past 3 years by the USWBSI from 29% of the CBCC RAC funding in 2005 to 13% of the CBCC RAC in 2007. From 2005 to 2007, funding specifically for fungicide work went from 72% to 51% of the CBCC funding as the diversity of projects supported changed to include investigation of a wider range of management methods that included the integration of fungicides with other management techniques, as well as movement of the cultural control area from another RAC into CBCC. The perceived “variability” of biocontrol was also addressed and data indicating the variability and lack of effectiveness of Folicur in reducing DON over the course of nationwide uniform field trials from 1999-2006 was presented (Paul et al, 2007, Phytopathology).

Research Summaries:

Presentations were made by representatives of all the biological control research groups at the meeting

Schisler: Data from the means of all the 2001 field trials, the 2001 Fayetteville trial, the 2002 winter wheat trial, 2004 Peoria trial and the 2002 and 2005 Wooster trials was presented which showed significant reductions in some trials of FHB severity or DON by *Cryptococcus* sp and trends in other trials. The 2001 uniform trials gave an average of 30% reduction in DON. The findings of several years of research in fermentation, formulation, and population dynamics were also discussed. It was clear that these organisms are well studied and much is known about how to grow them under semi-commercial conditions as well as factors involved in their survival pre and post field application. A commercial partner is now being negotiated with Marrone Organic Innovations.

Bergstrom: The origin and patent for Trigocor 1448 a strain of *Bacillus subtilis*, was discussed, as well as it's antagonism/antibiosis toward a wide range of plant pathogens. Invitro data indicated significant inhibition of *F graminearum* spores, and later slides showed the production of antibiotic metabolites produced by the bacterium. No specific data or statistics were presented for greenhouse studies, but a summary statement indicated large percentage reductions in disease and DON compared to the untreated control plants. Field data from two trials in Brazil showed that in combination with Folicur, Trigocor 1448 resulted in significant reductions in both disease severity and DON and a statement was made that good results had been also obtained in other locations. Data was presented which challenged the general belief that FHB on wheat was largely initiated at flowering and not during grain fill and ripening. This has significant implications for the length of time that a wheat head has to be protected protected, and BCA's may be useful in this extended protection.

Yuen: The biocontrol agent investigated by this group is *Lysobacter enzymogenes* C3. The University of Nebraska and PI are not actively pursuing patent protection

commercialization of this BCA because use of the organism as a biocontrol agent was widely published. They are interested in identifying industry partners to develop new, patentable products involving the organism. The BCA is consistently effective in the greenhouse and its mechanism has been shown to be associated with both induced resistance and antibiotics/enzymes. Effectiveness can be cultivar specific and good floret coverage is required. The group has also actively collaborated on research in other biological control systems, eg. other BCA's both live and killed, combinations of BCA's, DON degrading organisms, application factors influencing BCA survival and effectiveness and BCA application to residue.

Bleakley: the group of biocontrol agents investigated by this group are tentatively *Bacillus amyloliquefaciens*. After application of either supernatant or whole cells in five field trials in SD, MO and OH in different years the BCA reduced at least one disease component comparably to Folicur. The BCA's have been shown to be effective against tan spot disease as well as FHB. Progress has been made on optimizing culture conditions required by the BCA. Specific lipopeptide antibiotics were shown to be involved in mechanism of action and are dependant on culture medium and additives. Using selective isolation techniques they demonstrated that the bacteria persists/grows on the host.

Researcher identified future needs:

Schisler: Need for further fermentation work and formulation development. Support will be needed for spray application technology work and inclusion in uniform trials.

Bergstrom: Integrate BCA with best fungicide/resistance/rotation , microbial ecology studies of bacterium and Fusarium populations on floral structures.

Yuen: Fungicide integration with BCA and host resistance, effectiveness in control of late infections, application to crop residues

Bleakley: Integrate application of BCA with use of fungicide and spray additives; presence of lipopeptides and their genes on plant after BCA application; population studies of BCAs. Mechanistic and epidemiological and plant-pathogen-BCA interaction studies.

Increasing Success in Funding Support from MGMT:

Most but not necessarily all of the following was discussed in the meeting, or in subsequent communications. To increase chances of success, proposals should consider the following areas that are not specific to biocontrol research,

- It should be clear in the introduction, and in the choice of research being proposed, how, and how effectively, the proposed research would deliver control of FHB and DON according the aims of the MGMT RAC as stated above
- For the specific control measure being tested, data should be provided that demonstrates effectiveness and consistency of control of FHB and DON over as many

years as possible. To overcome the perception of a lack of effectiveness or consistency, all individual trial data of effect on disease and DON should be presented.

- Collaborations would ideally be developed that would increase the speed to a commercial product or increased effectiveness of a product. It was clear that the different groups were at different stages of the commercialization process and had different skills that were complementary.
- New or speculative areas of research should provide supporting preliminary research results.

Specific areas that may be competitive depending on funding availability and other competing applications,

- Timing of fungicide application is currently limited by residue on harvested grain. Testing of a BCA for control outside of the window of application of a fungicide
- Integration of the best BCA with the best current fungicide/cultivar/rotation trials to demonstrate IPM use
- Demonstration of combinations of BCA's or BCA and fungicide to give increased control compared to fungicide alone
- Mechanisms of action of specific BCA's if those are likely to significantly increase the effectiveness of those BCA's, or if it provides generic information that will lead to increased effectiveness of a range of commercializable BCA's