

U.S. Hop Industry Plant Protection Committee's 2006 Strategy

Strategic Approach

The U.S. Hop Industry Plant Protection Committee will continue to seek the development and implementation of economically viable integrated pest management strategies for major U.S. commercial hop growing regions, including adequate registered plant protection products for resistance management. These strategies must allow U.S. hop growers to produce a dependable supply of high quality hops for the world market, while reducing pesticide risk to the work force, environment and consumers.

Progress on 2005 Activity 1

Efficacy testing of reduced risk pesticides and biopesticides.

Field and greenhouse efficacy testing was conducted on several reduced risk and biopesticide products during the 2005 growing season. In addition to efficacy against the target pests or diseases, impacts on beneficial species were evaluated for several insecticides and fungicides.

- Insecticides (Lepidoptera species): spinosad, Bt (Xen Tari), bifenthrin, and indoxacarb were tested, with all showing good control, including medium to large sized larvae (3rd to 5th instar).
- Insecticides (garden symphylan): thiamethoxam, ethoprop (EC and granular formulations), bifenthrin, chlorpyrifos, cyfluthrin, lambda-cyhalothrin, clothianidin, fipronil, imidacloprid
- Insecticides (California prionus): imidacloprid, thiamethoxam, chlorpyrifos, ethoprop
- Insecticides (hop aphid): flonicamid, spirotetramat, and testing of aphid populations for imidacloprid resistance
- Miticides: acequinocyl, etoxazole, spirotetramat
- Fungicides – Downy Mildew: V-10161, dimethomorph, fosetyl-Al, Stylet oil, phosphoric acid, petroleum oil, famoxadone, trifloxystrobin, pyraclostrobin + boscalid, fanamidone
- Fungicides – Powdery Mildew: V-10118, trifloxystrobin, quinoxyfen, spirotetramat, myclobutanil, boscalid + pyraclostrobin, USF 2010, canola oil, potassium bicarbonate, stylet oil, sulfur, triflumizole, hop beta acids, copper. Several of these were tested in tank-mix and rotation programs to evaluate cost-effectiveness.

These activities are ongoing, to allow new products to be evaluated as they become available. As a result of these evaluations, products will be selected for registration that offer growers potential strategies for more effective pest and disease control, and

improved IPM (particularly through conservation biocontrol). As this is an ongoing activity, we do not measure success in terms of individual products. However, over time, as new products become available to growers through the registration process, they have aggressively adopted the usage of those products that offer cost-effective control of pests. Due to the fact that we pre-screen all new insecticide and miticides products for safety to beneficial populations, and eliminate those that do not fit an IPM system that relies on enhanced natural control, the new products being registered generally offer much less risk to beneficials than those products they replace. Over time this strategy will shift the entire hop pest management program to more IPM compatible products.

Results of these tests were exchanged with hop researchers in Germany, who also provided us with their 2005 test results. This allows both countries to identify promising new compounds that can potentially be pursued for concurrent registration. As Germany and the U.S. produce 60% of the world's supply of hops, international trade of hops is facilitated when growers in both countries have a similar set of pest and disease management tools available, and consistent MRLs are established in both countries.

Several research reports are being provided to document progress that is being made on these issues. These include:

- Dr. Gary Grove and Mark Nelson, Washington State University – 2005 Research Report – Fungal Diseases of Hop and Their Control
- Dr. Cynthia Ocamb, Oregon State University – 2005 Research Report - Hop Disease Management
- Dr. David James, Washington State University – 2005 Research Report on Integrated Management of Aphids and Mites on Hops, and presentation including 2005 Research Highlights
- Daniel E. Cervantes, University of Idaho – 2005 Research Report on Development of Hop Integrated Pest Management Strategies
- Dr. David Gent, USDA-ARS, Corvallis – 2005 Research Report on Biology, Epidemiology, and Management of Hop Diseases

Per-acre cost evaluation is also an ongoing activity with all potential new products. It must be taken into consideration, as it can severely limit grower adoption of these new products.

Progress on 2005 Activity 2

Support and encourage further research on Synthetic Herbivore-Induced Plant Volatiles

Research to seek a mechanism to lure beneficial arthropod species into hop yards prior to the build-up of aphid and mite populations to damaging levels was continued and expanded. Currently, growers received limited benefits from natural predators, due to the lag time between pest population development and beneficial population development. By the time adequate predators are available to bring the pest population down to manageable levels, economic damage has already occurred.

2005 research into the use of methyl salicylate and other synthetic plant volatile compounds to lure predators into hop fields prior to the build-up of economically damaging populations of pests showed great promise. Please see the attached 2005 research report and presentation by Dr. David James, Washington State University.

Progress on 2005 Activity 3

Educational meetings and field days

The annual U.S. Hop Convention was held in January, in conjunction with Hop Research Council. The event featured individual research presentations and panel presentation / discussion formats on disease and pest management and IPM. This forum allowed all public researchers, growers, and other plant protection professionals to present current information and participate in an interactive discussion with growers. Research field days were held in Washington during June and Oregon during July, providing local growers with an opportunity to view these activities first hand. A group of brewery representatives toured and received briefings on Washington pest and disease research during early September. This provided an excellent opportunity to demonstrate the industry's efforts to reduce pesticide use and improve environmental stewardship to end-users of the product.

Progress on 2005 Activity 5

Coordination of hop entomology, pathology, weed science, and genetics programs to develop cost-effective IPM strategies for U.S. commercial hop producing areas and new hop varieties with genetic resistance to certain pests and diseases.

Our team of scientists continued to develop economically viable integrated pest and disease control strategies. They coordinate their efforts to the extent possible, to seek control options for important hop pests and diseases (most have only part-time responsibility for hops, so must balance this work with responsibilities in other cropping systems). While each scientist is concentrating on a different area of research, their efforts are complementary and collaborative. The research team includes 2 mycologists, 1 virologist, 2 entomologists, 2 geneticists/plant breeders, and 1 weed scientist. In addition, private consultants assist in this effort, particularly in efficacy testing of promising new plant protection tools. These activities are ongoing.

During 2004 we were successful in maintaining enhanced funding for UDSA-ARS hop research, which has allowed the establishment of a full-time hop pathology program. The new scientist, Dr. David Gent, started in this position in December 2004. This program replaced a part-time effort that had been underway for the previous 7 years. At the hop industry's request, ARS expanded the responsibility of this position to include the development of systems approaches to hop production. Dr. Gent truly "hit the ground

running” in 2005, embarking on several collaborative research projects with other members of the hop research team.

One of these projects was done in collaboration with Dr. David James, and evaluated the effects of fungicides on populations of pest and beneficial insects and mites on hops (see 2005 research reports by David James and David Gent for complete discussion and results). This study confirmed the fact that sulfur use causes an increase in mite populations.

Activities for the Coming Year

Activity 1

Field efficacy testing of reduced risk pesticides and biopesticides (ongoing activity).

How does this activity reduce pesticide risk?

Efforts to identify new products that offer improved efficacy, reduced risk to workers and the environment, improved safety to beneficial organisms, and reduced cost are ongoing. These products may allow growers to more effectively control pests and diseases at reduced cost, through the preservation of natural enemies and by maximizing the synergistic effect of various tank mixes and rotational programs. They will also enhance current programs by slowing or preventing the development of resistance, thereby allowing growers to continue to use the lowest possible rates and infrequent applications for acceptable season-long plant protection programs.

How will you measure the risk reduction gained from this activity?

Products for testing in 2006 have been identified (list attached). This will include early-stage testing of new products that have not previously been evaluated, and continuing evaluation of promising compounds that have been screened in the past 1-2 years (compared to registered products as standard treatments). In addition, these activities are coordinated with German hop researchers. We are often able to utilize their testing results in lieu of preliminary screening to select compounds for further evaluation, saving one to two years of testing, and moving safer products into the registration pipeline more rapidly.

Coordinating our testing program with the German hop industry also allows tolerance and registration activities to proceed concurrently, improving international harmonization of pesticide standards. It is desirable for German or EU MRLs to be in place before U.S. growers widely adopt the usage of new products, due to the high percentage of the crop that is exported to Europe.

Activity 2

Support and encourage further research on Synthetic Herbivore-Induced Plant Volatiles (new activity for 2004).

A mechanism to lure beneficial arthropod species into hop yards prior to the build-up of aphid and mite populations to damaging levels is needed. Currently, growers are unable to benefit substantially from natural predators, due to the lag time between pest population development and beneficial population development. By the time adequate predators are available to bring the pest population down to manageable levels, economic damage has already occurred.

Research conducted in 2003-2005 on the use of methyl salicylate and other synthetic plant volatile compounds to lure predators into hop fields prior to the build-up of economically damaging populations of pests is showing great promise. Additional resources will be devoted to this project in 2006, to further investigate its potential for commercial application. Please see the attached 2005 research report by Dr. David James, Washington State University, and presentation featuring highlights of this and other research.

How does this activity reduce pesticide risk?

The ability to manipulate beneficial arthropod populations, to increase levels prior to pest damage to the crop, has the potential to substantially reduce the use of miticides and aphicides in the future. Reducing the amount of pesticides necessary to control these major pests would result in substantial risk reduction.

How will you measure the risk reduction gained from this activity?

This research is still preliminary, and will require substantial additional work to determine whether the approach is viable from a biological standpoint. Test plots will continue to be placed in commercial hop fields during 2006, which will allow economic viability to be evaluated. Economic viability must be established before risk reduction potential can be evaluated. Assuming this research culminates in the deployment of commercially viable systems to enhance conservation biocontrol, the reduction in pesticide use can be measured through grower pesticide use surveys, communications crop consultants, and information from pesticide manufacturers and distributors. Risk reduction would be directly related to decreases in pesticide use. In addition, growers would be more likely to select predator-friendly pesticide options when treatment thresholds are reached, which would further contribute to risk reduction.

Activity 3

Study the biology and ecology of mites, aphids, hop loopers, and California prionus (new activity).

How does this activity reduce pesticide risk?

While researchers have done work in these areas for many years, the importance of more targeted studies has become evident. Growers are beginning to accept the fact that there are no “silver bullet” pesticides for many of the chronic pests that plague hops, including those listed in 3a (above). A quarter century ago growers were able to rely on products like cyhexatin, disulfoton, and carbofuran to control these pests, and the hope for replacements with similar levels of activity against the pest persisted. However, we are now seeing a real shift in grower attitudes about pest control, whether due to a new generation taking over the decision-making activities for these operations, or finally acknowledging that the days of “silver bullets” are probably past. When growers become more accepting of alternative management systems, exciting new avenues become available to our researchers. That research must be based on a more complete understanding of the biology and ecology of those species.

An example is the study of groundcover vegetation and insectary plants to enhance IPM in hops, by encouraging beneficial insect populations, which were started in 2005 by Dr. David James (see attached research report and presentation). Another example is the work being done by Dan Cervantes at the University of Idaho on California prionus, to evaluate the potential for development of a pheromone-based control program. This area of study will continue to offer new avenues to pursue non-pesticide alternatives to enhance IPM programs in hops. The result will be reduced pesticide use, which will also result in reduced risk.

How will you measure the risk reduction gained from this activity?

As this activity is very research and discovery based, specific risk reduction will be difficult to measure. However, over time this work should result in new cultural practices and management activities that will allow growers to reduce costs and improve control of various pests, while reducing conventional pesticide usage. This is likely to be a slow shift, and will involve changing time-honored traditions and attitudes among growers. While specific risk reduction from any one practice that results from this research may be difficult to quantify, the long-term benefit of risk reduction can be evaluated based on trends of the type and quantity of pesticides that are being applied in the future.

Activity 4

Educational meetings and field days (ongoing activity).

Sessions will be held periodically, to provide growers and field consultants with emerging research results, techniques to improve scouting and pest/disease control, more reliable treatment thresholds, identification of beneficial organisms, and an understanding of the interaction of various control efforts on other organisms (including beneficials). As research efforts yield promising results on alternative cultural practices, plant protection products, and improved management of important pest and disease organisms, meetings and field days will be utilized to inform, demonstrate and educate growers regarding

these developments. One workshop was held in Oregon during February 2005. Tentatively scheduled activities include Workshops and Field Days in July and August.

How does this activity reduce pesticide risk?

Timely transfer of research results to growers will allow more rapid implementation of practices that will enhance the control of important pest and disease species, while improving the profitability of the industry.

Improving identification of pest/disease organisms and beneficial organisms, and a better understanding of treatment thresholds for each pest complex and control regimen, will allow growers to improve timing of applications and will likely result in overall use reduction.

How will you measure the risk reduction gained from this activity?

Over time, this reduction will be reflected in the periodic surveys of pesticide application records. In the short term field day attendance will be recorded, allowing us to estimate the percentage of hop growers and consultants who service this industry have been contacted by these outreach efforts.

Activity 5

Coordination of hop entomology, pathology, weed science, and genetics programs to develop cost-effective IPM strategies for U.S. commercial hop producing areas and new hop varieties with genetic resistance to certain pests and diseases.

In addition, international communication and collaborative research efforts among hop researchers worldwide are encouraged. This may allow meaningful results to be generated more rapidly, making improved pest and disease control strategies available to hop growers worldwide.

How does this activity reduce pesticide risk?

The deployment of successful, cost-effective IPM programs and hop production systems to growers will eventually allow substantial reduction in the use of pesticides, resulting in economic savings to the hop industry and a reduction in pesticide risk. By expanding this effort internationally, we benefit from the work of hop scientists in other regions, which allows our research efforts to progress more rapidly. Our researchers have substantially improved their collaboration on projects, to better evaluate the effects of one program on others (for example, the effects of fungicide applications for disease control on insect and mite populations – see attached research reports from Drs. David Gent and David James).

How will you measure the risk reduction gained from this activity?

Effective and economic IPM strategies will take several years to develop and implement. Over time, as growers begin to implement stages of these programs, a reduction in use and/or risk should be quantifiable in the periodic surveys of pesticide application records. Coordination of research activities will be facilitated by a minimum of two meetings per year between researchers in different disciplines. The USHIPPC will serve in an oversight capacity to facilitate this interaction, to assist researchers in developing goals and objectives that meet the needs of the industry, and coordinate research funding.

The globalization of this effort should also result in reduced pesticide use and risk in many countries that currently export hops to the U.S.