

THE TRANSDISCIPLINARY VERMONT EXTENSION IPM PROGRAM ADDRESSING STAKEHOLDER PRIORITIES AND NEEDS FOR 2013-2016

Program Emphasis Area: IPM Implementation for Agronomic Crops

With over 90,000 acres planted in 2012, corn harvested for silage is the most important annual field crop grown in Vermont. Perennial forages (alfalfa, cool season grasses) are important feed crops with approximately 320,000 acres. Small grain acreage has increased recently. Surveys of stakeholders indicate silage corn pest IPM education is a critical need. Emerging arthropod and disease problems in agronomic crops addressed in the Vermont Agronomic IPM Program include Hessian fly, western bean cutworm, banded sunflower moth, Stewart's wilt in corn and northern leaf blight. Leaf rust and brown stripe are emerging diseases in forages. Established diseases (loose smut, Fusarium head blight) in wheat will also be included in educational programs. The need for weed management information is critical with an increase in cover crops and no-till. Herbicide compatibility with cover crops, weed resistance management and organic weed management practices will be a focus. Oilseed production can enhance the diversity and viability of farms in the Northeast yet pest management is a serious production obstacle. IPM goals for these key insects/diseases/weeds are to: 1) increase knowledge in pest identification, symptoms, and management; 2) collect/summarize data on the incidence/impact of these pests/diseases through scouting and monitoring; and 3) develop/update educational programs (meetings, media) and written materials (news, web articles) based on the most recent IPM monitoring data. The primary stakeholders for the Vermont Agronomic IPM Program are crop producers, dairy/livestock farmers, agriculture service providers, certified crop advisors, and federal/state agency personnel. The Vermont Agronomic IPM Program will provide stakeholders with sound, locally-derived advice for pest management decisions, reducing unnecessary uses of pesticides and increasing farmer income by reducing input costs and increasing yields. This will result in reduced potential for pest and weed resistance and human health risks.

Approach -

1. Agronomic Monitoring for Current and Emerging Pests. For each year of the project, we will do extensive monitoring for target agronomic insect pests (Hessian fly, western bean cutworm, and banded sunflower moth). Appropriate traps and lures will be disseminated to partner farms throughout the state. At least one trap for each insect pest will be located on farms in the northeast, northwest, central, and southern regions of the state (minimum of 3 sites). All the information will be gathered biweekly during the critical months for each insect to be monitored. The data will be summarized and posted on the program websites. Fusarium head blight and loose smut will be monitored on approximately 10 small grain fields on 3 farms. Approximately 25 corn fields on 10 farms will be monitored for northern corn leaf blight and Stewart's wilt. Field selection will be based on factors such as years in continuous cropping, past observed symptoms, and location. The information gathered on western bean cutworm will be added to an ongoing database established Penn State University. Fusarium head blight monitoring will be reported to the Fusarium Risk Assessment Map Tool and Commentary System hosted by Penn State University. Banded sunflower moth incidence will be reported to the National Sunflower Survey hosted by North Dakota State University. This information is useful to growers and will be used to promote the concepts of



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IPM and discuss the real, rather than perceived, risks of these insects and diseases. For forage grass diseases, we will visually rate diseases (leaf rust and brown stripe) once each spring, summer and fall on three species/variety trials that include our most important hay crop grasses grown in Vermont. The results will be summarized each year and posted on the program websites.

2. Extension Outreach Education. Information about the primary targeted arthropod pests, weeds or diseases will be written and/or updated. New factsheets will be developed on loose smut, banded sunflower moth, western bean cutworm, northern corn leaf blight, and alternative weed control strategies in sunflowers. These will be posted on the program website and also presented at annual crop, dairy/forage and pest management extension meetings. Two field days per year will be offered to highlight arthropod, weed and disease identification and scouting procedures. The field days will also demonstrate alternative weed control strategies like tine weeding and inter-seeding. A report of each season's monitoring results will be written in December of each respective year, published on the program web site and presented at winter extension meetings. The grain grower's conference, dairy and crop meetings, and the annual oilseed producer meeting will be venues for information dissemination.

Background to Approach -

Dairy production is the major agricultural industry in Vermont. Over 85% of Vermont's crop acreage is devoted to field crop production. Historically a great deal of outreach, education, and research has been conducted on managing the major economic insect pests of forage and grain crops (corn rootworms and European corn borer) However, pest complexes are beginning to change as a result of changes in weather, pesticides, and new crops grown in the area. For example, the past three years have had higher than average rainfall seasons. In addition, many farmers are starting to grow value-added crops such as wheat for local bakeries. The acres of cereal grain crops have increased ten-fold over the last five years. These new crops bring new insect pest, disease and weed challenges to the producer. As a result of changes in pest problems, there is an increased demand for more biological information on these pest species, with the ultimate goal of developing profitable, environmentally sound pest management programs. Several of the new and emerging pests of concern in Vermont are described below.

Within the past four years, many fields have been identified to have northern corn leaf blight (NCLB), caused by the fungus *Exserohilum turcicum*. The damage from NCLB is often associated with wet seasons (Lipps and Mills 2002). A major risk factor is when no-till corn is planted into or near infested corn debris; however, spores can travel long distances by high air currents (Bergstrom 2009). One concern is that some seed company representatives are now discussing the idea of applying fungicides to protect the corn. There are hybrid differences in resistance to NCLB depending on the races of the fungi that are present. This needs to be documented and thus is part of the proposed program.

Another emerging pest of concern is the western bean cutworm (*Loxagrotis albicosta* Smith). Historically, the western bean cutworm was only a pest in the western Corn Belt. Over the past several years, this pest has become established in the Midwest and continues to move steadily from west to east. The first western bean cutworms were identified in western New York and Quebec last season. There has been no monitoring in Vermont; however presence in surrounding areas signifies a need to monitor and educate farmers. Corn growers need to be aware of the potential for this corn insect pest to make its way into Vermont. The western bean cutworm is a severe pest of corn, affecting both crop yield and quality. Unlike other cutworms, the western bean cutworm is a late-season pest of corn. It feeds primarily on corn ears, chewing and scarring kernels and predisposing the ear to fungal and mold infections.

Fusarium head blight and loose smut are currently the most important diseases facing small grain growers in the northeast, resulting in loss of yield, shriveled grain, and, most importantly, mycotoxin contamination (McMullen et al 1997). In North America, Fusarium head blight is predominantly caused by the species *Fusarium graminearum*

(sexual stage, *Gibberella zeae*). Rotation and crop residue incorporation have been shown to affect disease incidence, and it is thought that reductions in tillage have contributed to regional scab epidemics. Spores of *Gibberella zeae* are primarily transported by air currents, making it difficult to control. More than 80% of farmers in Vermont have lost a small grain crop to head blight over the last 4 years. It is important to provide farmers with up to date information on cultural strategies that will help them minimize disease risk as well as current varietal tolerance information.

University of Vermont extension has conducted preliminary research that shows that banded sunflower moth (*Cochylis hospes*) is a primary yield-limiting factor for sunflowers in the northeast. Pest management is a serious obstacle in the production of oilseed crops. In a 2012 survey of oilseed growers in the northeast, respondents indicated that one major concern was emerging insect pests. Preliminary data indicates that 60% of all sunflower fields in Vermont have banded sunflower moth pest pressure. Current research is evaluating planting dates and other avoidance strategies to reduce insect pressure. Sunflower growers also struggle with weed pressure. Herbicide control is often ineffective and farmers are looking towards mechanical or cultural strategies to reduce weed pressure. Alternative strategies such as inter-seeding with cover crops and/or tinweeding will be demonstrated on farms.

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Program Emphasis Area: IPM Implementation for Specialty Crops - Apples (including Organic Apple IPM)

Apples are an important agricultural commodity in Vermont's rural communities and working landscape. Apple orchards comprise approximately 90% of total acreage planted to fruit in Vermont (NASS 2012). The apple industry, with approximately \$20 million in annual revenue, generates jobs and supports communities and businesses across the state. Apple growers in Vermont have a critical need for IPM information, with an evolving complex of over ten disease, thirty arthropod, and diverse weed pests that require season-long management programs that integrate cultural, biological, and chemical strategies in a horticulturally and economically appropriate framework. Apple orchards also face new challenges from invasive pests such as brown marmorated stink bug and from increased incidence of diseases such as fire blight as a result of changes in weather patterns in the past decade (Berkett 2012; Northeast IPM Tree Fruit Working Group 2012). Vermont apple growers are also using new production systems requiring adaptation of IPM practices for their success. These include: adoption of high-density planting techniques; planting of reduced-spray high-value cider orchards; and transition to organic orchard management (VTFGA 2011; NASS 2012). The goal of this proposal is to provide transdisciplinary extension information to Vermont apple growers including arthropod, disease, horticulture, and weed management strategies that address IPM needs in an economic, environmental, and socially sustainable framework. The Vermont Apple IPM Program is considered a regional leader on organic orchard management practices, and will continue to provide this expertise through this proposal (Berkett and Bradshaw 2013).

Approach -

Extension Outreach Education. Websites for standard apple IPM and organic apple IPM will be enhanced each year based on stakeholder input and will include time-sensitive articles and a blog of orchard observations during the growing season to encourage practices that promote IPM. At least 12 newsletters, blog posts, and/or fact-sheets containing time- and crop-sensitive IPM information including arthropod, disease, and weed management as well as horticultural, food safety, risk management, and orchard economics issues will be published each season. Outputs will be directed to existing listserves that presently have 353 subscribers, as well as social media outlets to increase the reach of the program. Fifty current and prospective apple growers will attend workshops at demonstration orchard sites annually to learn hands-on IPM strategies that can be applied to their farms. At least ten growers annually will receive one-on-one consultation on IPM implementation on their farms to improve crop protection and economic and environmental sustainability. Outreach communications will integrate site- and region-specific weather and pest models provided by the Vermont sites of Cornell University's Network for Environmental and Weather Applications (NEWA) to provide timely information to growers. (Carroll 2013.) In response to stakeholder input collected at a recent strategic planning session for the Vermont apple industry attended by growers, research and extension personnel, Vermont Agency of Agriculture staff, and non-government support partners, an interactive, two-way electronic mailing list will be established and moderated by program staff to fa-



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Facilitate communication and cooperation between growers and service providers to identify emerging pests and coordinate timely, effective, and appropriate management strategies.

The Vermont Apple IPM Program is committed to increasing IPM implementation in commercial orchards across the state by delivering an integrated extension program that addresses priorities identified by growers, IPM advisors, and other industry service providers. These stakeholders actively provide input through regular evaluation surveys and are an integral part in the development of the Vermont Apple IPM Program which includes standard and organic IPM components. IPM demonstration orchards will be used for specific workshops and tours during the growing season in each year in collaboration with the Vermont Tree Fruit Growers Association, the Northeast Organic Farmers Association of Vermont (NOFA-VT), and other stakeholders. Growers will be provided with one-on-one consultations when necessary to provide specific information applicable to unique farm operations. Program personnel will contribute to annual revisions of the New England Tree Fruit Management Guide and with planning and presentations at regional grower meetings such as the Vermont Tree Fruit Growers Annual Meeting and New England Fruit and Vegetable Meetings. Program priorities are also tailored to address needs identified in evaluations from the Northeast IPM Tree Fruit Working Group (Northeast IPM Tree Fruit Working Group 2012).

Background to Approach -

The Vermont Apple IPM Program delivers up-to-date, scientifically based IPM information to stakeholders in order to increase adoption of IPM practices in orchards that encourage environmental, economic, and health benefits. IPM information will be generated from on-farm monitoring, implementation of a statewide network of weather monitoring equipment, and collaboration with apple growers and regional IPM practitioners, including the Northeast IPM Center Brown Marmorated Stinkbug and Tree Fruit Working Groups (<http://www.northeastipm.org/working-groups>), to coordinate IPM strategies, reduce effort duplication, and to adapt strategies to local farm situations. Program personnel have active orchard management experience in addition to academic and research credentials that contribute to the development of unique, applied program output that highlights horticultural, economic, and environmental sustainability.

Apple IPM will be demonstrated at the University of Vermont Horticulture Research and Education Center in South Burlington, VT. Standard and certified-organic IPM demonstration orchards of various ages (planted between 1983 and 2011) represent a diverse range of production systems from traditional freestanding semi-dwarf trees (200 trees/acre) to trellised high-density orchards (1210 trees/acre) which growers are adopting in the region and which are well-suited for demonstration of IPM practices relevant to Vermont apple growers. (VTFGA 2011).

Stakeholders participating in each component of the Vermont Apple IPM Program will be asked to evaluate the program and provide input into its future directions. Each year, surveys will be constructed to identify changes in IPM knowledge and practices; to determine how these changes have impacted economic costs and environmental and health risks and to identify emerging and most important pests that affect their crop in a given season. Apple growers indicate that past information provided by the Vermont Apple IPM Program has resulted in; a reduction in pesticide applications on their farm (83%); and cost savings to their business (68%) (Bradshaw and Berkett 2012). Surveys of growers who utilize IPM information from the Network for Environmental and Weather Applications (NEWA) indicate an average savings of \$19,500 in spray costs and reduction in crop loss of \$264,000 annually (Carroll et al. 2007).

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Program Emphasis Area: IPM Implementation for Specialty Crops - Cold Climate Grapes

The cold climate grape industry is rapidly expanding in Vermont and offers significant value-added and agri-tourism economic opportunities. Pest management is critical in grape production, with an evolving pest complex including over twenty arthropod, more than ten disease, and multiple weed pests that must be managed season-long every year with a combination of cultural, biological, and chemical methods. There is a continued increase in new growers in Vermont who are starting vineyards with limited or no background in agriculture, and it is imperative to not only continue the Vermont Cold Climate Grape IPM Program but to also expand transdisciplinary educational outreach and training demonstrations so that these growers will start, from the beginning of their operation, to make vineyard pest management decisions that minimize environmental, health and economic risks. Established growers have also identified pests of increasing concern, including anthracnose, brown marmorated stinkbug, and spotted wing drosophila, as their vineyards mature (Carisse and Morissette-Thomas, 2013, Lee et al., 2011). Timely and regionally-appropriate IPM information will allow these growers to manage these and other pests while maintaining economic, environmental, and social sustainability. The Vermont Cold Climate Grape IPM Program is the acknowledged resource in northern New England for IPM information. The goal of this proposal is to increase IPM implementation in commercial vineyards across the state by continuing to deliver an integrated extension program that addresses the priorities identified by growers, IPM advisors, and other industry service providers.

Approach -

Extension Outreach Education. The Vermont Cold Climate Grape IPM website will be enhanced each year based on stakeholder input and will include time-sensitive articles and a blog of vineyard observations during the growing season which will encourage biological, cultural, and chemical practices that promote IPM in the vineyard. At least 12 newsletters, blog posts, and/or factsheets containing time- and crop-sensitive IPM information including arthropod, disease, and weed management as well as horticultural, risk management, and economic issues will be published each season. Outputs will be directed to the existing program listserves that presently have over 200 subscribers as well as social media outlets to increase the reach of the program. Fifty current or prospective grape growers will attend workshops at demonstration vineyard sites annually to learn hands-on IPM strategies that can be applied to their farms. At least ten growers annually will receive one-on-one consultation on IPM implementation on their farms to improve crop protection and economic and environmental sustainability. Outreach communications will integrate site and region-specific weather and pest models provided by the Vermont sites of Cornell University's Network for Environmental and Weather Applications (NEWA) with on-site observations to provide timely information to growers (Carroll 2013). Currently there are 200 stakeholders (growers, state and federal agency personnel, extension personnel, and industry reps.) from Vermont and beyond that receive Cold Climate Grape IPM information from the program. The IPM demonstration vineyard at the University of Vermont Horticul-



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ture Research and Education Center will be used for specific workshops and tours during the growing season in each year in collaboration with the Vermont Grape and Wine Council and other stakeholders. Growers will be provided with one-on-one consultations when necessary to provide specific information applicable to unique farm operations. Program personnel will contribute to regional grower meetings such as the Vermont Grape and Wine Council and New England Fruit and Vegetable Meetings. Program personnel participate in many collaborative ventures that exist in the region such as: the Northern Grapes Project, a multidisciplinary USDA SCRI research and outreach project with collaborators in 12 states that focuses on integrated practices for commercial vineyards in cold climates; NE1020 Multi-state Evaluation of Wine grape Cultivars and Clones, which coordinates grape cultivar evaluation across similar climates in 24 U.S. states; and joint grower meetings with New England and New York grape growers and IPM practitioners.

Background to Approach -

The Vermont Cold Climate Grape IPM Program provides up-to-date, scientifically-based IPM information to stakeholders in order to increase adoption of IPM practices that encourage environmental, economic, and health benefits to growers and the public. IPM information will be generated from on-farm monitoring, implementation of a statewide network of weather monitoring equipment, and collaboration with grape growers and regional IPM practitioners, including the Northeast IPM Center Brown Marmorated Stinkbug and Spotted Wing Drosophila Working Groups (<http://www.northeastipm.org/working-groups>), to coordinate IPM strategies, reduce effort duplication, and to adapt strategies to local farm situations. Program personnel have active vineyard management experience in addition to academic and research credentials that contribute to the development of unique, applied program output that highlights horticultural, economic, and environmental sustainability. Cold climate grape IPM practices will be demonstrated at the University of Vermont Horticulture Research and Education Center in South Burlington, VT, where a demonstration vineyard was established in 2007 and contains 16 cultivars of interest to Vermont and other cold-climate growers. In the previous season, growers received on-on-one IPM consultations from program personnel; a field day attended by 32 stakeholders was held at the demonstration vineyard; 15 issues of the Grape IPM Update were disseminated to the 200 stakeholders on the program listserv and downloaded approximately 800 times from the program website.

Stakeholders participating in each component of the Vermont Cold Climate IPM Program will be asked to evaluate the program and provide input into its future directions. Each year, surveys will be constructed to identify changes in IPM knowledge and practices; to determine how these changes have impacted economic costs and environmental and health risks and to identify emerging and most important arthropod, disease, and weed pests that affect their crop in a given season. In surveys conducted in 2011, 95% of grape growers reported practicing IPM on their farms, and one hundred percent of respondents reported that they found the information provided by the Vermont Cold Climate Grape IPM Program useful, with 83% reporting the information Highly Useful. Eighty-seven percent of the growers indicated they would adopt one new IPM practice, and 70% said they would reduce pesticide use due to the Vermont Cold Climate Grape IPM Program (Berkett and Bradshaw, 2012).

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Program Emphasis Area: IPM Implementation for Specialty Crops - Greenhouse

Vermont, (USDA 2008b). Ornamentals are grown with minimal tolerance for pests and diseases, making this industry one of the heaviest pesticide users. The goal of the Vermont Greenhouse IPM Program is to enhance environmental sustainability and profitability of the greenhouse ornamentals industry in New Hampshire, Maine and Vermont by increasing growers' use of IPM practices. The Tri-State Greenhouse IPM Advisory Group was established to link the greenhouse ornamentals industry of the three states and to develop Tri-State Greenhouse IPM workshops in each state to address grower IPM needs. From 2009-2013, over 600 people have been reached through these workshops. Evaluations show adoption of biocontrol has increased from 28-70% since 1998, and 58-70% from 2009 to 2013. Recent grower surveys identified and prioritized site visits as an important way to increase IPM adoption. Through the Vermont Greenhouse IPM Program, individualized objective-based learning plans were established with over 40 growers, targeting their specific needs. Each year new growers are added to increase grower adoption of advanced IPM tactics that reduce pesticide use in New England. The two-pronged Vermont Greenhouse IPM Program addresses grower needs through individualized training and the Tri-State Greenhouse IPM workshops. It is expected that participating growers will continue to increase their adoption of IPM, including use of biological control, while decreasing pesticide use, which will be documented with on-going evaluations.

Approach -

1. Individualized Greenhouse IPM Training Program. To achieve broader IPM adoption, programs tailored to individual operations are essential, which is the central principle for the Vermont Greenhouse IPM Program. Vermont commercial greenhouse growers producing bedding plants will be selected to take part in the program. The Vermont Greenhouse IPM Program will work with 4 greenhouse operations per year. Each operation usually receives support for 2-4 years, depending on their needs and situation. Each year some of the growers will be phased out and new ones will be added, totaling 10-12 different operations over the 3 years of the project. Each operation involves 2-3 people, resulting in approximately 30-35 different individuals for the one-on-one program. The Senior/Key Person will meet with each grower/owner and staff people to obtain baseline data on past and current arthropod pests and diseases and IPM tactics used, from which an objective-based IPM Action Plan will be devised, including scouting protocols, data recording systems and advanced IPM tactics. Program staff will visit each operation once or twice per month during the growing season (Jan.–Jun.) to assist with implementing and refining the Plan. The Senior/Key Person will recruit grower participants, develop the IPM Action Plan, maintain general project oversight, summarize results and prepare reports. In response to grower requests, various novel educational tools will be devised that are short and to the point, with more pictures and fewer words. A series of 2-3 "Pictionars" will be prepared on key IPM subjects, such as identification of arthropod pests and beneficials. These will support the hands-on training and serve as permanent references. Several 15-minute "Webinettes" on IPM will be produced that growers can view when they have a spare few minutes. All of these educational materials will be put on



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the Vermont Greenhouse IPM Program website. At the end of each season, grower meetings will be held to gather input on program success, and determine aspects of the IPM Action Plan growers intend to adopt in the future. A summary of grower evaluations will be prepared, and will direct program improvement. Results from grower evaluations and information on pesticide use will provide direct evidence of the program's impact.

2. Tri-State Greenhouse IPM Workshops. Workshops for ~ 55 attendees will be held annually each January in Maine, New Hampshire and Vermont (total of ~160 growers/year). Attendees represent a range of skill levels. Some have come to the workshops for many years, and new topics must be offered to retain their interest. Others are new to the industry and need background information to fully comprehend the more advanced workshop content. New strategies will be developed to integrate beginning and advanced growers, such as offering short tutorials on basic subjects (e.g., arthropod pest and disease identification, water and soil testing, etc.) during the lunch break. In addition, prior to the workshop, registrants will receive a list of suggested webinars to view that prepare them for the workshop. The Vermont Greenhouse IPM Program will coordinate the project, working closely with other extension and state agricultural department personnel from cooperating states, all of whom have agreed to participate in the project. These cooperators will act as state contacts, assisting with workshop logistics and publicity. They will serve as workshop presenters and facilitators. The Vermont Greenhouse IPM Program will be responsible for workshop mailings, registration and compiling information packets; will coordinate out-of-state invited speakers who will take part in the workshops; and will summarize the results of the exit evaluations.

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Program Emphasis Area: IPM Implementation for Specialty Crops - Landscape

The landscape industry represents a diverse array of agricultural activities associated with lawn and landscape plant care and property management. This proposal specifically targets the segment of this industry linked with managing plants in golf courses, public parks, greenspaces, and private properties. State departments of agriculture in Maine, New Hampshire and Vermont lack specific information on how many landscape businesses exist in their states, the revenues generated from them, or the acreages they manage. The landscape industry has received limited support from extension and state agriculture departments. Landscapers attend the annual Tri-State Greenhouse IPM workshops yet find the information not well matched to their needs. The goal of the Vermont Landscape IPM Program is to provide education to this underserved agricultural population in the three states and encourage their adoption of IPM. This is a new initiative for the region. This IPM program will enhance the environmental sustainability and profitability of the landscape industry in northern New England by increasing landscapers' knowledge of pests and IPM practices that minimize management costs and reduce pesticide use. This IPM program is the initial step to expand IPM support services to this underserved agricultural population in the years ahead.

Approach -

1. Landscaper Survey. The first critical step when initiating an outreach program to promote IPM adoption is to collect baseline data on pest and disease issues, current management practices and knowledge level, pesticide use and extent of IPM adoption by the target audience. In Year 1, a survey of landscapers in Maine, New Hampshire and Vermont will be conducted. This survey will provide key information on what landscapers need to adopt IPM and essential data on how many landscape operations exist in the tri-state region, how many acres they cover, and what pesticides are used. This will enable extension and state departments of agriculture to develop effective educational programs to meet their needs and begin to advance IPM adoption. A survey tool will be developed by the Vermont Landscape IPM Program. It will be reviewed by state agricultural personnel from each state, all of whom have agreed to cooperate on the project. A database of names and addresses of landscape businesses in the three states will be collected with assistance from state agriculture personnel and private grower associations, such as the Vermont Greenworks (VT Professional Nursery & Landscape Assoc.). Multiple methods will be used to distribute the survey, including email lists, web based systems (e.g., Survey Monkey), and distribution at workshops and conferences. The cooperators will serve as state contacts, assisting with publicizing and disseminating the survey. Survey results will be compiled, from which a summary will be prepared for immediate access to the cooperators and industry leaders and will be used in developing the IPM outreach program. Articles reporting survey results will be prepared for trade magazines and refereed journals.



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2. Regional IPM Workshops for Landscapers. Workshops will be held in years 2 and 3 of the project in Vermont and Maine to reach landscapers over a large geographical area in northern New England. These workshops will be limited to 25-35 registrants to encourage audience participation. This has been found to be an effective format for the Tri-State Greenhouse IPM workshops. Sessions with larger groups tend to be less interactive, which reduces attendee learning. The program will be developed by the cooperators based on needs identified in the survey. They will assist with workshop logistics and publicity, and serve as workshop presenters and facilitators. The Vermont Landscape IPM Program will be responsible for workshop mailings, registration and compiling information packets and will coordinate out-of-state invited speakers who will take part in the workshops, and summarize the results of the exit evaluations.

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Program Emphasis Area: IPM Implementation in Communities

The goal of the Vermont Communities IPM Program is to educate home gardeners about the basics of IPM in order to increase adoption of science-based, sustainable IPM approaches for management of insects, weeds and diseases to reduce environmental and health risks. The very effective statewide Vermont Master Gardener (MG) program will be utilized to deliver IPM information through the MG course, toll-free Helpline, blogs, website, emails, MG outreach activities, and webinars. Stakeholders include hospitals, schools, agricultural fairs, community gardens, farmers markets, libraries, prisons, and garden centers. Each MG volunteer has visibility in diverse communities and amplifies the message of using IPM strategies to many more people than could be reached without this established and well-respected program. The MG Helpline is a popular resource for gardeners for current insect, weed and disease information. In 2012, 90% of the Helpline inquiries related directly to IPM basic principles. With an exponential increase in email requests for arthropod pest, weed and disease information, the Vermont MG program will expand the program and the time/salary requested for the MG Outreach Professional. This will facilitate development of a template for the MG website to enable gardeners to submit questions, upload photos and receive a personalized message from a Master Gardener. This will also allow for development of a new webinar series for MG volunteers for 5 training in advanced IPM concepts and emerging insect, weed and disease problems. The requested EIPM funds will allow this vital IPM outreach and education program to continue and to expand the IPM message to an important and diverse community of stakeholders. The specific goal of the Vermont Communities IPM Program is for 85% of the participants (e.g., Helpline users, MG community outreach, new email template/expanded website users) to increase their knowledge of IPM when managing disease, weed and arthropod pest problems and to adopt one practice that leads to reduced pesticide use.

Approach -

1. Master Gardener Course. Approximately 200 adults enroll in the Master Gardener course each year. One lecture out of the 13 week course will be dedicated to basic IPM topics and delivered on various aspects of IPM and will include aspects of plant disease, entomology, soil health and stewardship, sustainable landscapes, and the safe and judicious use of pesticides.

2. Master Gardener Helpline. Approximately 24 MG volunteers will staff the state-wide toll free Master Gardener Helpline. This extremely popular program uses IPM strategies to answer consumer's arthropod pest, weed and disease questions throughout the year. The Helpline receives almost 2,000 calls and emails each year. In past surveys, the Helpline calls have proven to be an effective method for increasing IPM awareness and use of IPM strategies by the caller. The Helpline volunteers are familiar with IPM and need information on advanced IPM topics to stay interested and current. The MG Outreach Professional will ensure advanced IPM training is provided to volunteers.



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3. **Master Gardener outreach.** There are currently 900 active Master Gardeners in Vermont who volunteer in a variety of vetted, science-based outreach programs all with a strong educational component based on IPM principles. These Master Gardener volunteers are active in the state forming connections and linkages with schools, agricultural fairs, farmers markets, community gardens, prisons, libraries, hospitals, condo associations and garden centers. They will educate Vermonters about garden and landscape pest identification and management using IPM strategies. Over 14,000 hours were logged by the volunteers in IPM outreach in 2012. The Senior/Key Person and MG Outreach Professional will ensure that Master Gardeners receive the advanced IPM education they need to continue to meet the needs in these stakeholder communities.

4. **Master Gardener website.** This website serves as a site for consumers and gardeners to access current and emerging insect and disease information on a timely basis. This is an impactful forum used to deliver information on problems important to consumers including spotted wing drosophila, impatiens downy mildew, late blight, etc.

5. **The Master Gardener blog** (6,000 hits in the last year). The blog will be continued and will provide current insect, weed and disease IPM information to sectors of the gardening community using this type of social media. The MG Outreach Professional will oversee the blog and will provide timely IPM information through this increasing popular method of communication among our volunteers.

6. **IPM Webinars.** The MG Outreach Professional will develop and design a pilot webinar series on advanced IPM topics for training for our Master Gardeners, with the future goal of offering the resource to the gardening public.

7. **Evaluation of effectiveness/impacts.** Stakeholders participating in each component of the Master Gardener program will be asked to evaluate the program and provide input into its future directions. Each year, surveys for Helpline, the MG course, the advanced IPM webinars and email templates user will be constructed to identify changes in knowledge and adoption of IPM practices and to determine how these changes have impacted environmental and health risks.

Background to Approach -

Consumers are often quick to resort to over-the-counter pesticides when dealing with unknown pests in their lawns, landscapes, and gardens. The gardening public often relies on information from potentially untrained 'big box' store or garden center staff when making pest management choices. As a result, pesticides are used by consumers incorrectly or unnecessarily. A significant challenge is educating the diverse group of consumers and communities on IPM and providing information that will enhance adoption of a science-based, integrated approach to managing pests. A main focus of this area of emphasis is to provide home gardeners and communities the basics of IPM, including correct and timely arthropod pest, weed and disease identification, pest life cycles and IPM strategies and tools, including non-pesticide alternatives. This will be accomplished by using the very effective Vermont Master Gardener program to educate and disseminate IPM information to this diverse communities of stakeholders through the Master Gardener course, the toll free state-wide Helpline, numerous community outreach programs, the Master Gardener website, IPM webinars, MG blog and new email template for replying to consumers linking IPM information housed on the MG website.

THE TRANSDISCIPLINARY VERMONT EXTENSION IPM PROGRAM ADDRESSING STAKEHOLDER PRIORITIES AND NEEDS FOR 2013-2016

Program Emphasis Area: Area: Support for Pest Diagnostic Facilities

Vermont agriculture is becoming more diverse, with fewer dairy farms and a rapidly growing horticulture industry. The number of new crop producers unfamiliar with IPM is rapidly increasing. These new stakeholders often have limited background in agriculture and it is imperative to have a pest diagnostic facility in the state that can identify arthropod, weed and disease pests in a wide range of crops, and provide current IPM information for pest management decisions that minimize environmental, health and economic risks. Vermont's population centers are also increasing in size. The gardening public represents another expanding audience requiring diagnostic and IPM information on current and emerging pests to limit unnecessary pesticide use. The UVM Plant Diagnostic Clinic will serve as an overarching resource for all the stakeholders in the different Vermont EIPM Program Emphasis Areas. The stakeholders in these areas (and additional stakeholders) need access to timely, accurate and cost-effective diagnostics to make informed management decisions based on IPM strategies. Several new insect pests, weeds and diseases (spotted wing drosophila, impatiens downy mildew, emerald ash borer, brown marmorated stink bug, boxwood blight, and western bean cutworm) are emerging and require identification and management to minimize losses and the unnecessary use of pesticides. Current IPM management strategies for established arthropod pests, weeds and diseases must be adapted due to the effects of climate change. The goals of the UVM Plant Diagnostic Clinic are 1) to make new stakeholders aware of this diagnostic resource 2) to provide new and established stakeholders with the critical first step in IPM; accurate, timely and cost-effective insect, weed and disease diagnosis 3) to use the information gained from submitted samples (and other insect, weed and disease issues as appropriate) to provide IPM information to benefit growers and gardeners who may also be faced with the same problem. IPM information will be provided through one-on-one education, grower websites, newsletters, TV programs, Vermont Master Gardener, workshops and factsheets. In the 2010-2013 VT EIPM Program, vegetable and berry growers were specifically targeted to increase their use of the UVM Plant Diagnostic Clinic. Growers who sent in samples were surveyed; 97% reported timely, accurate and cost effective diagnostics helped them with their pest management decisions. Growers (87%) reported they chose IPM practices as a result of the diagnosis. This proposal expands the scope of UVM Plant Diagnostic Clinic services to target new stakeholders to provide pest identification and IPM expertise to meet increasing demands for IPM information. Impacts of the program will be evaluated after each growing season. The specific goals are to increase the number of stakeholders using the UVM Plant Diagnostic Clinic by 30% and for 85% of the users or participants to increase their knowledge of IPM practices and to adopt at least one IPM practice.

Approach -

1. Pest/Disease Diagnosis. The Vermont Pest Diagnostic IPM Program will provide new (and established) stakeholders with rapid, accurate and cost effective arthropod, weed and disease diagnosis through the University of Vermont (UVM) Plant Diagnostic Clinic. Clients will include those from commercial growers (agronomic, apple, grape, greenhouse, landscape, nursery, vegetable, berry, etc.), Vermont Master Gardeners and the gardening pub-



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lic. Depending on the experience of the client, IPM information given after the diagnosis may be basic or very advanced. Users of the UVM Plant Diagnostic Clinic will be contacted and surveyed at the end of the season to assess and evaluate IPM impacts.

2. On-site farm visits, email, and phone consultations. Several means of communication will be used to educate commercial growers (agronomic, apple, grape, greenhouse, landscape, nursery, vegetable, berry, etc.) on insect, weed and disease identification and management. Using IPM strategies is a priority of the Vermont Pest Diagnostic IPM Program. To assess impacts of the program, growers that were visited or had submitted pest identification and management inquiries during the growing season will be surveyed.

3. Presentations/Workshops/Twilight Meetings. Presentations addressing current and emerging pest and disease problems using basic and advanced IPM tactics will be made at least 2 annual commercial grower association meetings; Vermont Vegetable and Berry Growers Association meeting, Vermont Tree Fruit Growers Association meeting, the GreenWorks Meeting of the Vermont Nursery and Landscape Association, Vermont field and forages meetings, Vermont grape grower meetings, Vermont grain growers meetings and annual organic association meetings (Northeast Organic Farmers Association of Vermont) during the winter. Presentations will also be made for Vermont Master Gardeners and the gardening public audiences to include insect, weed, and disease diagnostics and IPM. Meetings will incorporate stakeholder evaluations and request input for future program direction. The results will be evaluated, compiled and reported.

4. Newsletters/Publications/Press Releases. Articles will be written on insect, weed and disease outbreaks, identification and IPM management strategies and practices for commercial growers (agronomic, apple, grape, greenhouse, landscape, nursery, vegetable, berry, etc.), Vermont Master Gardeners and the gardening public. Insect, weed and disease updates will be provided through listserves, websites, newsletters, and the Vermont Agency of Agriculture's newsletter (<http://www.vermontagriculture.com/Agriview>) when appropriate. Vermont growers who are certified pesticide applicators will receive IPM information through the bi-annual Pesticide Applicator Report (<http://pss.uvm.edu/peps>). This newsletter, co-authored with the Vermont Agency of Agriculture, addresses IPM issues, new pesticide chemistries, and other pest identification and management strategies for a very diverse audience of growers/applicators. Press releases will be generated and distributed throughout the state through the Vermont Pest Diagnostic IPM Program which will address current outbreaks of diseases or insect pests as needed.

5. Television. One 20 minute program will be presented each year on Across the Fence (the longest running daily farm and home television program in the country reaching over 20,000 viewers in VT, NY and Canada) based on new and emerging pests and diseases in VT and the region. This will be geared mainly to the home gardening audience.

6. Evaluation of effectiveness/impacts. Stakeholders participating in each component of the Vermont Pest Diagnostic IPM Program will be asked to evaluate the program and provide input into its future directions. Each year, surveys will be constructed to identify changes in knowledge and practices and to determine how these changes have impacted environmental and health risks.

Background to Approach -

The UVM Plant Diagnostic Clinic is the main diagnostic facility available to commercial growers (agronomic, apple, grape, greenhouse, landscape, nursery, vegetable, berry, etc.), Vermont Master Gardeners and the gardening public

in Vermont and is the only Vermont diagnostic facility participating in the National Plant Diagnostic Network (NPDN) (<https://www.npdn.org>). All samples submitted to the UVM Plant Diagnostic Clinic are logged and uploaded to the NPDN National Repository (<https://npdn.ceris.purdue.edu>) so emerging insect, weed and disease problems can be nationally tracked. The Senior/Key Person attends all NPDN meetings and trainings and participates in exercises designed to facilitate reaction to new insect and disease issues of national importance. The Senior/Key Person also participates and contributes to regional IPM pest management publications.

Without the UVM Plant Diagnostic Clinic's positive identification of arthropod pests, weeds or diseases, yield losses may be significant and pesticides may be used incorrectly or unnecessarily by commercial growers (agronomic, apple, grape, greenhouse, landscape, nursery, vegetable, berry, etc.) and the gardening public. Access to cost effective, timely and accurate diagnosis of plant problems along with current pest management strategies using IPM can save time, money and reduce environmental and health risks. Educating and providing impactful IPM programs to diverse groups of stakeholders, those who's livelihood and income relies on growing and harvesting healthy agricultural crops and those who's enjoyment and pleasure comes from growing healthy gardens and landscapes, is critical. Each group needs timely, accurate and cost effective insect, weed and disease identification and IPM management strategies to reduce environmental and health risks.