Vermont IPM Extension Implementation Program 2021-2024

Priority Area: IPM Implementation in Agronomic Crops

VT farmers are developing new business models to meet the increasing demands for local agricultural products including addition of 5 flour mills, 8 malt houses, 15 hemp processors, 3 tortilleria, 40 distilleries, 120 microbreweries, hundreds of artisan bakeries, and dozens of businesses using locally grown corn, cereal grains, beans, oilseeds, hemp, and hops. The need for locally grown organic and non-GMO grains has continued to increase and although New England boasts vibrant organic dairy and vegetable sectors, it lags behind other regions for local grain production. Organic grain (corn, cereal, oilseed, legumes) acreage has increased in New England from 800 in 2008 to 6,500 acres in 2016. The number of VT farms growing dry beans and soybeans more than doubled between 2012 and 2016. Pest management is a serious obstacle in corn, cereal grains, dry beans, and oilseed crops production. In the last five years, organic farmers throughout the northeast have experienced reduced yields and quality due to intense disease and weed pressure related to increased rain events and erratic climate fluctuations. In 2018, farmers reported 30% yield and quality loss due to cereal foliar and head diseases. In 2019, grain samples submitted to the UVM Cereal Grain testing lab indicated 28% of samples are above the 1% DON (vomitoxin) threshold for human consumption. IPM strategies to manage Fusarium head blight as well as other grain diseases in organic systems is critical. We continue to find high incidence of loose smut in cereal grain fields as a result of infested seed lots. Testing farmers' seed lots with new rapid PCR tests will be essential to keep this disease from further damaging organic grain production. In a 2018 survey of organic grain growers in the northeast, 88% said they were interested in receiving more education about weed, disease insect ID and management to grow a successful crop. Managing diseases and pests is a challenge for soybean and dry bean growers. Seedborne pathogens provide a source of destructive diseases and limiting these pathogens before sowing can reduce common root rots and foliar, pod and seed diseases. Soybeans for local tempeh and soymilk markets must be free of staining and in a 2018 grain survey 87% of farmers reported weeds and disease often kept them from meeting these high value markets. All farmers reported being concerned about emerging pests (soybean cyst nematode, stem borers, midges, sudden death syndrome) reported in other bean growing regions.There are over 350 acres of hops in the northeast. At our 2019 Hop Conference, 56% of growers indicated more information on disease and arthropod pest management would help them increase yield. In 2020, 300 farmers registered to plant 2000 acres of hemp. As the acreage of hemp increases throughout the northeast and growing practices are established, the impacts on crop loss due to improper disease and pest management are becoming more evident. The need for scientifically-based research and education is critical so farmers can succeed with this new crop. The majority of hemp and hop growers are identified as "beginning farmers" with little to no experience in pest management. This has led to growers applying broad-spectrum pesticides without consideration of economic thresholds, beneficial arthropods, pollinators and other environmental risks. In this project we will identify the disease and pests that challenge northeast growers. Farmers will learn to ID pests in their fields, learn if their seed sources are disease free and learn the best agronomic practices to minimize pest damage. Our goal is to help farmers design robust crop systems that successfully address pest challenges to produce a diversity of food and feed grains while minimizing impacts on the environment.

USDA United States Department of Agriculture National Institute of Food and Agriculture

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Priority Area: IPM Implementation in Agronomic Crops

Approach -

1. Field Days and Winter Conferences. Three Field Days (50 farmers/event) and 2 Winter Conferences (150 farmers/event) will highlight grain, beans, hemp and hops pest management trials, IPM scouting strategies and pest ID tools. Conferences will be live-streamed on our website.

2. Hop and Hemp Disease Survey. In 2022 and 2023, 20 northeast hop and hemp farms will be surveyed for cone and flower diseases prior to harvest. Photos and information from surveying will be used to produce Diagnostic Cards and other outreach materials for growers.

3. Seed Quality Testing. 25 farmers will be offered annual seed quality testing for grains and beans over three years. Results with information on how to reduce pathogens in seed lots will be sent to the grower to promote certified seed use or cleaning of seed when disease is present.

4. Extension Outreach Education. Conference proceedings and meeting videos will be posted to our website. Two IPM Briefs will be published/year and posted on the UVM Extension crop and hops blogs with scouting information, identification and IPM strategies for a broad range of crops. A Hemp IPM guide will be created and posted online by 2023 including pest ID, lifecycle and management tools. Hemp Pest Diagnostic Cards will be produced as quick grower reference guides. New innovative outreach techniques will be launched and will include the following educational tools: goScout Action Survey- growers will be able to take photos and send a survey form by phone to our team to help with pest ID during scouting. The goScout tool will help identify emerging pest issues in crop fields. Results of the survey will help focus an IPM Hour where critical pest information identified by the farmers is discussed to improve scouting and management. A monthly IPM Hour will be held during the growing season and will include current issues and picture sharing, IPM strategies with time for Q & A and discussion. A Virtual Reality (VR) environment will be developed for hemp growers as aides for arthropod/disease ID. Immersive VR is a 3D, computer-generated environment where participants use specialized headsets (aka optical head-mounted display, Oculus Rift) to explore and manipulate virtual objects. In 2019, our team released the first VR Scouting Tool geared towards hops (https://www.uvm.edu/sites/default/files/media/VRScoutHopsUserManual.pdf). We will use this platform to create VR Scout Hemp, transporting growers into a virtual hemp field where they identify beneficial and pest arthropods and diseases seen in the northeast. This unique tool allows growers to practice scouting year-round, better preparing them for the field season.

Vermont IPM Extension Implementation Program 2021-2024

Priority Area: IPM Implementation in Specialty Crops: Tree Fruit & Grapes

Apples and grapes are important components of Vermont's specialty crops industries, with total value over $25 million annually (USDA NASS, 2020). Vermont apple and grape growers have a critical need for IPM information, with a complex of over 25 major disease, 40 arthropod, and diverse weed pests that require season-long IPM programs. Vermont orchardists are well-versed in IPM implementation however, important shortcomings remain. Web-based decision support systems (DSS), mainly the Cornell University Network for Environmental and Weather Applications (NEWA) platform are often used by growers to implement IPM on their farms. For scouted and monitored pests, growers recently rated their comfort for using trap-based IPM to guide management as "neutral" for most pests, and noted continued unease integrating monitoring and DSS into their IPM programs. Prior work by this team helped to develop low-input vineyard IPM programs based on disease models that relied on cultivar resistance and synthetic pesticides. Recently, the greatest growth in grape production in Vermont is among growers who adopt a 'naturalistic' management philosophy which eschew synthetic chemicals and use strategies from organic/biodynamic systems. There is little research-based support available to assist these producers with crop and pest management. The VT Fruit IPM Program is considered a regional leader on organic management practices in orchards and can easily apply that lens to viticulture research and Extension, which we propose to address in this project. Two students, next generation scientists, will participate in scouting and grower education.

Approach -

1. Orchard Scouting Network. Six farms will participate in orchard pest monitoring training. Results will be communicated to growers to guide pest management decisions. Growers will complete monitoring and submit data to program personnel. Fruit will be assessed at harvest for pest-related damage and defects.

2. Evaluation of 'natural' grape production. Vineyards managed under 'natural' production practices for pest and disease damage, crop yield, and juice quality will be evaluated. This will include surveying growers in Vermont and surrounding areas to determine extent of 'natural' management, define common practices, determine baseline pest incidence/severity in 'natural' vineyards, and evaluation of common pest intervention practices. At least two vineyards will be evaluated yearly for incidence of disease and pest damage and will be monitored in each year of the project to evaluate trends in pest populations within the region.

3. Extension Outreach Education. IPM information, including pollinator protection practices, for apple and grape growers will be distributed via website and listserv (400 subscribers), at farm visits and workshops. Outreach communications will integrate site- and region-specific weather and pest models based on NEWA information to provide timely information to growers.

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Priority Area: IPM Implementation in Specialty Crops: Ornamentals/ Vegetables in Greenhouse, High Tunnel, and Nursery

High tunnel specialty crop production is often a critical component of small diversified farms. There are at least 700 vegetable high tunnels in Vermont, which at an average size of 24'x 96' grow 1.6 million ft2 of crops: floriculture/bedding plants are worth $15 million in sales and vegetables over $5.2 million. High tunnels and greenhouses have historically relied on insecticides and encouraging adoption of IPM is key to protect pollinators and beneficial arthropods. The UVM Greenhouse/High Tunnel IPM program addresses growers' needs while improving environmental sustainability and profitability of these industries in ME, NH and VT. Annual Tri-State Greenhouse IPM Workshops (150 growers/yr.) and IPM First (40 sites/10 yr.), an individualized grower IPM training program, are long-running cornerstones of the program. The Tri-State Workshops include IPM presentations with a hands-on training format. As a result, 89% of past attendees have: increased biocontrols; use of plant-mediated IPM systems; decreased pesticides and improved scouting, yet only 55% reported using Clinics to ID their pests or diseases. One third of the IPM First growers reduced chemical pesticides as a result of the program and adopted new IPM strategies: biological controls; plant-mediated IPM systems; bio-pesticides; use of scouting tools and inspection of plant shipments.

Approach -

1. Tri-State IPM Workshops. Annual events will include presentations on IPM topics, IPM Factsheets and promotion of Plant Diagnostic clinics since half of the attendees had never used this service. Growers will connect through the GreenGrower listserv for Northern New England.

2. IPM First will offer individual grower instruction and IPM Factsheets on key pests.

3. Extension Outreach Education. IPM factsheets (5) will be developed for listservs, workshops and educational events. Presentations (3) at workshops will be given related to factsheet content. Distribute IPM information in newsletters, on our website and through listserv for growers.

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Priority Area: IPM Implementation in Communities

Consumers are quick to resort to over-the-counter pesticides when dealing with unknown pests in their lawns, landscapes, and gardens. The gardening public often rely 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. As a result of COVID-19 the number of new gardeners in Vermont has expanded rapidly, making access to current IPM information even more critical. The effective statewide UVM Master Gardener (MG) program will be used to deliver IPM information to 100-200 students/year through a 16-week online eXtension course. According to 2020 evaluations, 43% of the students did not know what IPM was before the class and after the course, 100% planned to adopt a new IPM practice. In 2019, MG students from the 2018 Course were surveyed to measure medium outcomes to see if they had adopted an IPM practice since the course: 96% of the 2018 students had adopted a new IPM practice as a result of the training.In addition to the course, the MG program also delivers IPM information through the toll-free MG Helpline, websites, emails, MG outreach activities, and advanced training webinars. The Helpline typically receives over 1,600 calls and emails with the ability to upload photos and questions. Although the MG Helpline accepted no home garden physical samples last year due to COVID-19, the Helpline volunteers and the PDC typically handle about 150 home garden samples. According to our 2019 Helpline Client Survey, 70% of the Helpline inquiries related directly to pest ID and basic IPM principles. In our 2019 year-end client survey: 43% said they used a new IPM practice; 25% reduced pesticide use as a result of the diagnosis and recommendations. The UVM PDC will provide diagnostic support for the MG Helpline.The 366 MG volunteers are active forming connections in the state and promoting IPM at schools, Ag fairs, farmers markets, community gardens, prisons, libraries, hospitals, condo associations and garden centers. In 2019, over 12,290 hours were logged by the volunteers in IPM outreach, and since the program's inception (1991) they have logged 254,075 volunteer hours. The UVM MG program receives no funding from Extension. The requested VT EIP funds are critical to allow this vital IPM outreach and education program to continue and expand the IPM message to an important and diverse community of stakeholders that include underserved populations including non-English speakers, gardeners, seniors, and women.

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Priority Area: IPM Implementation in Communities

Approach -

1. Master Gardener Course. 16-week online eXtension course (~200 students) will be offered annually. Several lectures introduce and incorporate IPM: Entomology, Vegetable Crops, Plant Diseases and Pesticides 101; Native and Pollinator Plants and Caring for Woody Trees and Shrubs.

2. Master Gardener Helpline. A popular statewide service staffed with trained volunteers to answer phone and email questions on insect, weed, and disease problems and IPM strategies.

3. Advanced Training Webinars with factsheets. The MG program, with the UVM PDC, will offer 3 advanced training webinars/year with factsheets on emerging insect, weed, and disease problems and IPM strategies for management. Webinars and factsheets will be archived on the website and so they will be available for future Helpline training and for the general public.

Priority Area: IPM for Pollinator Health

In the US, managed honeybees provide $15 billion in pollination services, however, managed hives have decreased from 6 million in the 1940s to a current estimate of about 2.5 million (Bartuska 2019). Loss of habitat, along with pesticides and parasites, are primary stressors responsible for the decline of native pollinators (Goulson et al. 2015). The 2017 Vermont Pollinator Protection Committee (Vermont's Pollinator Protection Committee Report) agreed that pesticides should not be used prophylactically but only when justified through an IPM program and recommended education be provided to growers and licensed pesticide applicators in the area of pollinator protection. The Vermont Pollinator Committee identified providing habitat to pollinators and education and outreach about pollinator health and protection, especially as it related to chemical insecticide applications, as Priority areas.To date there has been little education or outreach to the row-crop farming community related to protecting pollinators in agronomic crops. Research conducted regionally showed neonicotinoid seed treatments in corn and soybean are not justified in about 95% of the field crop acreage, which represents 500,000 ha of fields (corn, soybean, cereals) (Labrie et al. 2020). IPM strategies based on pest densities and risk factors represent a more sustainable solution for protecting field crops and for preserving environmental and human health. Little is known about bee communities in northern New England apple orchards (Dibble et al. 2018) or the effect of providing habitats in combination with artificial nesting devices to attract and sustain wild native pollinators. Surveys showed over 69% of the 2020 Tri-State Greenhouse IPM Workshop attendees rated protection of pollinators and other beneficial arthropods in greenhouse, nursery and landscape settings as a high priority and 88% said they would be willing to create habitat plantings to help attract pollinators and beneficial arthropods. The attendees also indicated they would be interested in providing education to customers on the importance of protecting pollinators. Encouraging home gardeners to establish flower habitat plantings to provide food, shelter and nesting sites for pollinators and other beneficial arthropods will enhance pollinator populations. Artificial nesting sites (nest boxes/ bee houses) can attract and increase the abundance of important native pollinator species. Public awareness and education about the value of pollinator protection through IPM is key to getting the public involved. Pesticide applicators in VT do not currently receive pollinator IPM education to become certified and recertification education does not consistently include pesticide risks to pollinators or IPM practices to protect pollinators. Providing this content is critical to protect our pollinators.

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Priority Area: IPM for Pollinator Health

Approach -

1. Agronomy Pollinator Education. Pollinator protection and importance will be highlighted at each winter conference through at least 1 presentation by an area expert. Two Pollinator Protection Briefs will be published per year and posted on the UVM Extension crop "What's Cropping Up" blog with strategies for a broad range of crops. A Protecting Pollinators in Field Crops Bulletin will be created and posted online in 2022. A Pollinator Protection Webinar Series will be hosted in 2023. Topics will include the importance of pollinators around us, how pesticides impact pollinators, practices to minimize non-target impacts of pesticides, and information on reading EPA Bee Advisory Label. We will work with 10 growers/year to develop a Pest Assessment Plan (PAP) similar to those required in Ontario, Canada. The PAP will focus on a soil pest assessment to determine if a farm/field has soil pest levels that would warrant the use of neonicotinoid seed treatments.

2. Greenhouse/High Tunnel Pollinator Plantings. Habitat plantings will be established at 3 IPM First sites yearly. Bee nesting boxes at each site will be surveyed 4 times/season for colonization. Educational signs and brochures will be produced for the public. Growers will be encouraged to offer pollinator-friendly supplies (seed mixes/bee boxes) for sale at each retail location. One yearly on-site educational event for the public will be held to increase awareness of beneficial insect ID and importance of habitats for pollinators and beneficials. Attendees will receive ID factsheets/hand lenses and be added to an email list for further pollinator education.

3. Master Gardener Pollinator Education. Two annual on-line presentations (habitat hedges and creating nest boxes for native bees) with factsheets will be offered to the home garden and MG audience, posted on the MG website and distributed at outreach events.

4. Pesticide Education Pollinator IPM Training. Pollinator protection IPM education will be delivered to current and prospective pesticide applicators through annual UVM Extension PSEP meetings and through the Pesticide Applicator Newsletter. This will ensure VT pesticide applicators understand the risk of pesticides to pollinators and IPM practices to protect pollinators.

Priority Area: IPM Support for Pest Diagnostic Facilities

The UVM Plant Diagnostic Clinic (PDC) addresses several regional 2018 NEERA-1604 extension priorities in addition to priorities set at a northeast Small Fruit and Vegetable working group meeeting in 2018 (https://www.northeastipm.org/neipm/assets/File/Priorities/Priorities-VegetableIPMWG-2018.pdf) where 67% of the attendees rated pest/disease ID and management as the top priority in vegetable crop extension education and pest management education in high tunnels as the second most important priority. The PDC serves as the overarching resource providing diagnostic support for all the stakeholders and Priority areas in the VT EIP. Vermont stakeholders need access to timely, accurate and cost-effective diagnostics to make informed management decisions based on IPM strategies. The most recent PDC survey results showed 91% of stakeholders who submitted a pest, weed or disease sample used IPM strategies to manage their pest as a result of the diagnosis. Commercial growers (84%) indicated they reduced pesticides due to the information received from the PDC and saved an average of $~1,400 as a result of decreased pesticide use. New growers unfamiliar with pests and IPM are steadily increasing, especially in industrial hemp and other specialty crops. These growers often have limited backgrounds in agriculture and it is essential to have an impartial facility to identify pests in a wide range of crops and provide IPM information that minimizes environmental, health and economic risks. The PDC samples often drive the IPM topics presented in newsletters, on TV and in workshops throughout the northeast. The MG Helpline, home gardeners and consumers represent expanding audiences requiring diagnostic and IPM information on current and emerging problems to avoid unnecessary pesticide use. The PDC provides diagnostic backup for the hundreds of calls and samples/photos the Helpline volunteers receive each season. The PDC represents Vermont's interests in the National Plant Diagnostic Network (NPDN) and receives no operating funding other NPDN funds. All PDC samples are uploaded to the NPDN National Repository to track emerging pest problems..

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Priority Area: IPM Support for Pest Diagnostic Facilities

Approach -

1. Diagnostics. The PDC will provide stakeholders with rapid and accurate diagnosis and current IPM recommendations that consider pollinator health. Approximately 600 samples and several hundred emails/photos are submitted annually from commercial growers, MG Helpline volunteers, gardeners and consumers. Since the recent evaluation of the Tri-State IPM workshop for greenhouse growers indicated half the participants had never used a Diagnostic clinic, we will focus efforts on reaching this clientele. We will expand diagnostic and outreach efforts to a new audience of 20 "New Farms for New Americans" farmers (small market gardeners from Africa/Asia) who have requested assistance with pest ID and IPM. Two UVM students will accompany farm visits to encourage the next generation of IPM specialists.

2. Northeast Small Fruit and Vegetable IPM Working Group. UVM will invite 25 IPM educators to meet in 2022 to discuss current/emerging pests and IPM strategies. We will update the education/research priorities from 2018 and share results on the NE IPM center website.

3. Extension Outreach Education. We will present IPM information in 10 workshops/yr. addressing current/emerging insect, weed and diseases using IPM tactics in commercial crops in Vermont and region. The PDC will offer 2 workshops on pests and diseases in addition to scheduled field visits with the 'New Farms for New American' farmers. Presentations promoting Diagnostic services for the Tri-State IPM meeting will be coordinated with partnering states. The PDC will contribute a column to the bi-weekly VT veg and berry listserv (450 VT and northeast growers) on current insect/disease problems with IPM information and will provide VT information for UMass Veg Notes (2,120 northeast growers) on a weekly basis. The PDC will provide three "Across the Fence" TV programs on insect, weed and disease outbreaks and IPM strategies (20,000 regional viewers) and will contribute to websites, webinars, press releases, articles and newsletters in other Priority areas.

4. Program Support for IPM Communities. The PDC will work with the MG Program to provide lectures for the MG Course; provide three Advanced Training webinars with IPM factsheets, and contribute IPM information for MG websites, articles and newsletters for the home gardener and consumer. The PDC will provide diagnostic backup for Helpline. (Please see evaluation of these outputs under the IPM Implementation in Communities).

Vermont IPM Extension Implementation Program 2021-2024

Priority Area: IPM Education for Pesticide Applicators

Vermonters who use Restricted Use pesticides or pesticides in the course of their work are required to pass a CORE exam and the appropriate category exams to become certified. Once certified, recertification credits are earned annually though approved educational opportunities to maintain certification. The initial certification process is often the first place an applicator is introduced to IPM concepts. Recertification educational opportunities are crucial to meet the need for in-depth IPM education for pesticide applicators and are especially critical to address rapidly changing IPM information with the pressure of climate change, current and emerging pests, pollinator protection, loss of pesticide chemistries, and introduction of new crops. The UVM Pesticide Safety Education Program (PSEP) works closely with Vermont Agency of Agriculture, Food & Markets (VAAFM) to provide training and education resources for current (~1200 certified applicators) and prospective applicators through meetings, online courses, newsletters, and outreach. UVM PSEP relies on minimal grant and Extension funding and nominal workshop fees to fund the program. Lack of funding impacts the stability and vigor of pesticide education programming in the state and erodes initiatives to develop new programs that provide critical IPM information for applicators.

Approach -

1. Online Education for Pesticide Applicators with factsheets. Two annual Initial Certification trainings will be offered to potential applicators to introduce and review IPM concepts in the pesticide manual. Two category-specific trainings will be offered annually to provide IPM education to certified applicators on current/emerging pests, IPM strategies and pesticide selection to avoid non-target organisms, etc.

2. Pesticide Applicator Report newsletter. Two issues/year will be produced for applicators with emphasis on IPM topics, current/emerging pests and non-target effects of pesticides. Newsletter will include quizzes on IPM content that can be submitted for recertification credit.

3. IPM and Pesticide Basics. This eXtension online course with factsheets will be developed for advanced training of MG volunteers and be available to the public on the MG website.

4. Extension Outreach Education. The PSEP website will provide IPM education for current and prospective pesticide applicators and will promote training opportunities, the newsletter, online IPM courses and current IPM topics. Presentations on IPM and pesticide safety education topics will be provided at regional meetings and to UVM enrolled student courses.

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