

Northeastern IPM Center – IPM Partnership Grants – 2010 – Proposal Project Description

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Project Title: Providing Northeast Growers Added Weaponry to Integrate into their Arsenal against Eggplant Pests

Project Type: Minigrant

Eggplant is grown throughout the Northeast and is an important fresh market specialty crop for organic and conventional growers. Unlike short season crops which have volatile seasonal values, eggplant provides farmers constant capital throughout the growing season. The Colorado potato beetle, a major potato pest of solanaceous crops is known for its ability to defoliate eggplant. It occurs in high enough numbers each year to completely defoliate an eggplant crop. Conventional and organic growers mostly rely on broad spectrum, selective pesticides, or OMRI listed products respectively, to help manage CPB. Yet, the CPB has a notable ability to develop resistance to a wide array of chemicals with some insecticides failing within one year of use. Thus, indiscriminate insecticide use does not always adequately control this pest. Other prominent eggplant pests are flea beetles and similar to the CPB, eggplant producers normally use chemicals as a single management approach for this pest. Conversely, organic producers have a limited selection of OMRI approved products for use against eggplant insect pests and these products are costly. Thus, the development of low cost management tactics that can be used as part of a comprehensive IPM program thus reducing the amount of chemical sprays is desirable for all eggplant growers. Consequently, certain behavioral aspects of CPB and flea beetles make them vulnerable to cultural control methods. Therefore, these “weak links” in their life cycle should be exploited to reduce growers’ sole dependence on chemical input.

The CPB is well adapted to agricultural systems which make suppressing it a difficult task. There is much research devoted to managing CPB in potato fields; and although CPB is a prominent eggplant pest, limited research has been conducted relative to eggplant. Similarly, research on flea beetle control in eggplant is lacking and those studies devoted to developing flea beetle management strategies focused on synthetic insecticide use. However, organic eggplant is growing rapidly throughout the Northeast and synthetic chemical use is not an option. Flea beetle adults emerge from overwintering in March and when eggplant is transplanted in May, adult flea beetles migrate to young plants. Their feeding cause extensive shot-hole damage and despite eggplant’s high growth rate, large populations can retard growth, reduce yield, and kill young plants. The yield potential of eggplant is greatly influenced during its early growth cycle. Thus, early pest levels can be a primary determinant of final yield. As such, the development of production practices that improve early eggplant vigor can accordingly, reduce the impact of flea beetle injury and the amount of insecticidal sprays. Growers with CPB problems are advised to practice crop rotation. However, many eggplant producers especially resource challenged and socially disadvantaged farmers which make up a large percentage of growers have limited land and “long distant crop rotation is not practical. Further, the CPB employ “bet-hedging” reproductive strategies, distributing its offspring in space (within and between fields) and time (within and between years), minimizing risk of tragic loss from insecticides or crop rotations

The use of cultural control to manage insects in eggplant has lacked research awareness. However, there are certain behavioral aspects of the CPB that opens it to this method. For example, CPB use visual and olfactory cues to locate host plants. Adults are attracted to volatiles produced from plants and in particular plants that CPB have fed on. Colorado potato beetle is capable of moving by flight and walking. However, their dispersal starts at the moment of beetle eclosion and newly emerged beetles walk after emerging from the soil. Further, summer generation adults need to feed 5-10 d before their flight muscles are fully developed. Thus, after completing soil pupation, they must walk over the ground surface to reach their host plant. As such, this behavior is the “weak link” in the CPB seasonal life cycle. Therefore, an overall

successful management strategy for CPB may be partially hinged upon our ability to form a physical and chemical barrier between its location of emergent and the eggplant crop.

Although CPB are capable of long flights, early-season movement is mostly by walking. A winter wheat cover crop has been shown to form a physical barrier to CPB searching for host plants during the spring. Further, it was found that buffers of winter wheat and hay significantly retarded CPB infestation and reduced early season defoliation. Similar findings were reported when straw mulch barriers were used. Other researchers suggested that a winter rye and clover planting impeded the movement of walking CPB. During that study, it was also found that potato fields “hidden” by a rye-clover cover crop was discovered by smaller numbers of CPB after an extended time period following releases compared to potato fields without these vegetational barriers. Thus, nonhost plants surrounding eggplant fields may help isolate the crop and extend immigrating CPB arrival time thus reducing early season colonization and defoliation.

Several researchers have examined mechanisms involved in CPB dispersal and orientation. Studies have shown that blending their host plant with nonhost plants blocks the release of upwind responses. The fact that nonhost plants can impede CPB colonization into a crop by behaving as a physical and chemical barrier implies the use of nonhost plant to help manage CPB needs research attention. On the basis of information obtained from a literature review and corroborating findings of a preliminary trial, cover crops may offer an economical and environmentally sound approach to CPB management. I anticipate a significant decrease in the colonization and population growth of CPB on eggplant planted into crimson clover (CC) and that natural enemies will egress from the senescing CC on to neighboring eggplants resulting in greater CPB mortality compared with monoculture eggplant. A further belief is that eggplant will grow more rapidly in the senescing CC and thus the impact of flea beetle injury will be less compared to no CC plots. The main goal of the planned project is to introduce a new weapon (e.g., CC) into the IPM arsenal for eggplant. Although eggplant will be used as the cash crop during this project, the strategic approach investigated is pertinent to other cropping systems such as tomatoes where CPB and flea beetles can be problematic. Specific objectives include to: i) determine how CC impact numbers of predatory and pest arthropods in eggplant, ii) quantify the effect of CC on CPB egg predation, iii) quantify the impact of CC on eggplant productivity and marketable yields, and iv) deliver a more integrated, sustainable, and economically viable option to growers and educators for the suppression of eggplant pests.

A large replicated field trial will be carried out to examine and demonstrate the ability of CC to reduce CPB populations and eggplant injury from flea beetles. Crimson clover will be planted in the fall and during spring; eggplant will be planted into the senescing CC. The experiment will be arranged in a split-plot randomized complete block design with four replications. Main plot factors will be eggplant planted into CC or eggplant monoculture. Subplots will consist of biopesticide (BP) or no BP sprays. The use of BP sprays will allow quantification of how well the CC suppresses insect pests compared to biopesticides that presently show great efficacy against all prominent eggplant insect pests. Various plant growth parameter and developmental stages will be recorded as an indicator of plant productivity. Eggplant leaf nitrogen status also will be monitored. Yield data will be recorded from each subplot treatment and compared among treatments and with yields in conventional and organic producers’ eggplant fields. Several channels will be used to disseminate and promote the exchange of information obtained from the

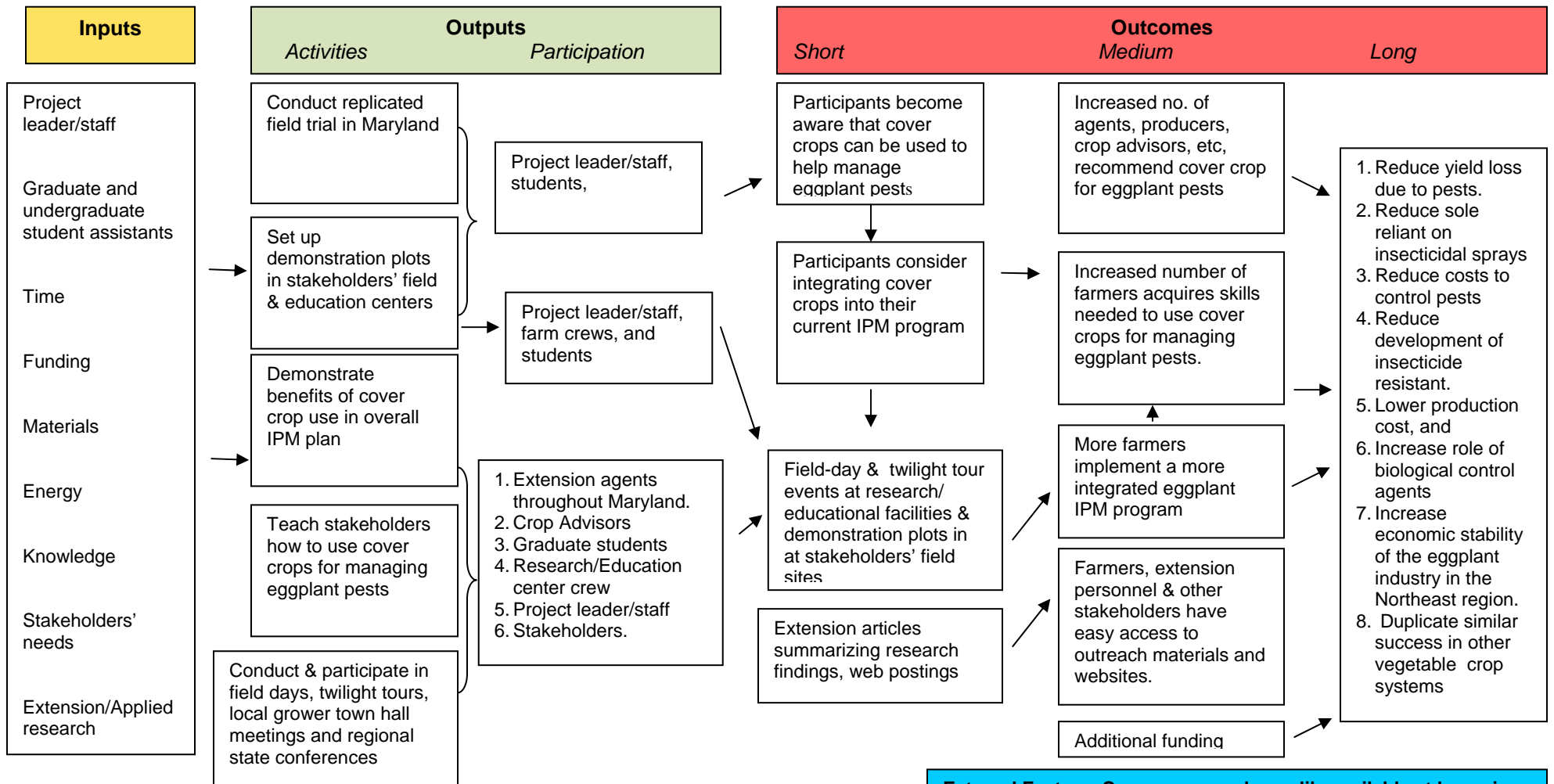
project to stakeholders. Among these channels will be the establishment of hands-on demonstration plots, presentations at town hall meetings, twilight tours, growers' meetings, and local fruit and vegetable conferences, and creation of publication brochures, newsletters, and postings on the University of Maryland IPM website. Extension pamphlets that detail information about CC and how to properly use it for managing eggplant pests will be published and distributed through county extension offices and web site clippings. These pamphlets will provide information to educators, growers, and other Northeast community members.

Many growers in the Northeast use cover crops as part of their standard production practice. Growers in Delaware and Maryland are given cost share funds to grow cover crops during the off season. New Jersey Environmental Quality Incentives Program pays farmers to plant cover crops for erosion control. In other Northeast states, cover crops are being used to reduce erosion and sedimentation. Cover crops are usually planted in the fall and killed just prior to planting the cash crop. Farmers are mostly unaware that these cover crops may aid pest suppression. For example, CC inhibits weed seed germination through allelopathy. CC grown during the winter fallow period reduced weed biomass from 54 to 99% and 22 to 46%, respectively, at spring crop planting. Others found that CC residues reduced density of several weed species and that soils where CC was grown contained higher organic matter than bare-ground soils. Thus, in addition to using CC to help manage insect pests, it can be used to suppress weeds and add a significant amount of N to eggplant crops, each of which will contribute to increasing eggplant vigor. Thus, a feasible practice for farmers growing eggplant and/or tomatoes is to use CC as their winter cover crop. The fact that CC will start to senesce prior to spring crop planting, indicates growers will not have to use chemicals or mechanical inputs to suppress the CC.

This project is needed to obtain information that will be utilized to educate stakeholders on practical IPM strategies for growing eggplant. As a result, I expect i) growers to acquire skills needed to use cover crops to increase farm sustainability while lowering production costs, ii) to increase the role of biological control agents in eggplant fields, and iii) growers' enthusiasm, awareness, and confidence in adopting non-chemical IPM tactics to boost profits and environmental quality will be increased. Although the proposed project targets all stakeholders, underrepresented groups such as organic producers, resource challenged growers, and those seeking more sustainable options will especially gain. The ultimate goal is to lower production cost, and subsequently increase marketable yields so that growers can sustain greater economical viability from their farm operations. Cost savings will vary with farm size, and levels of overwintering insect populations, and other environmental factors. We anticipate educating hundreds of farmers and other stakeholders throughout the Northeast and a 20% adoption rate by farmers impacted by CPB and/or flea beetles during the initial 2 years following the project resulting in thousands of dollars in increased profits. If northeast eggplant growers are not given more options, they will continue to experience problems with insecticide resistance and use their own guesswork with regards to management solutions. Cover crops have shown great potential for use as a barrier to CPB colonization and if properly manage cover crops can be used to increase early season plant vigor and minimize losses from flea beetle injury. As such, cover cropping can be an important addition to the current IPM arsenal for managing eggplant pests. This project will allow the investigation of an IPM friendly option that is adaptable by a wide array of eggplant producers. Thus, in the absent of funding, information on a practical pest management option may not be further evaluated and disseminated to Northeast stakeholders.

Logic Model

Title: Providing Northeast Growers Added Weaponry to Integrate into their Arsenal against Eggplant Pests. **Priority:** Stakeholders' needs.
Situation: Eggplant is grown throughout the Northeast and is an important fresh market specialty crop for organic and conventional growers. Most growers rely solely on pesticides to manage eggplant pests. This can be partly credited to the fact that cultural control tactics has lacked research awareness in eggplant. This project is needed to obtain and disseminate information to stakeholders on a more practical IPM strategy for eggplant pests.



Assumptions: Farmers recognize the significance of eggplant pests; Some positive benefits of cover crop use known.

External Factors: Cover crop seeds readily available at low price. Local agencies such as Dept of Agri., NRCS promote cover crop use on farms; EPA encourage reduce synthetic pesticides use

Evaluation: Cannot be concluded within the time frame of this project but appropriate methods including Turning Technologies, LLC (i.e., Interactive software) will be used at outreach events during and beyond the term of this project to help assess changes in attitudes and adoption levels.