ALTERNATIVE STRATEGIES FOR MANAGING THE COLORADO POTATO BEETLE

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The Colorado potato beetle (CPB) is the most important defoliating pest of potatoes worldwide. It is present in the major potato growing areas of Washington, Idaho, and Oregon and is primarily controlled by insecticides. These insecticides may become ineffective or unavailable due to the development of resistance and/or environmental concerns including food safety and groundwater contamination. The lack of alternative strategies could have a chaotic effect on potato production, thus, there is a need to develop and integrate improved alternative control methodologies for insect pests attacking potatoes.

Insecticide resistance is a serious and recurring problem in control of CPB in potato production areas in the eastern half of the U.S. However, through appropriate planning and research, we should be able to avoid resistance in the Northwest. At present, in the Northwest, CPB populations are effectively suppressed by insecticides; often by ones that are routinely applied for control of GPA. In the future we will need to use an integrated approach to manage both of these pests. A number of possible control approaches are available and research is in progress on some of them.

Both chemical and biological insecticides are available and more are being developed. Chemical insecticides will continue to be used and hopefully used only when needed, thus extending their lifetime as the number of replacement materials is likely to be limited. One biological insecticide, Bacillus thuringiensis (B.t.) is currently available and is being used on a limited basis against CPB in Eastern U.S. and Europe. Several companies sell this biological insecticide which is only effective against the larval stages. Timing and coverage are critical in using B.t. as it has limited persistence and larvae must feed on it to be killed.

A number of beneficial agents have the potential of contributing to the control of CPB but they are usually eliminated by the routine application of chemical pesticides. Limited research effort is being devoted to beneficial fungi and nematodes and more is needed so they can be developed and incorporated into an integrated management system. Research on beneficial parasites needs to be increased to assess opportunities for the introduction of exotic species and to develop techniques to manipulate and enhance the effectiveness of native parasite species.

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A number of species of predators that attack CPB are often found in unsprayed potatoes; these include: lady beetles, ground beetles, lacewings, spiders, assassin bugs and stinkbugs. We have been conducting research on the use of stinkbug predators for several years and have developed procedures to produce them in the laboratory for use in inoculative release programs in early season. Two species have been evaluated and we found Perillus bioculatus to be the best candidate for field use; in controlled field tests they reduced CPB populations by 65%. Current effort is continuing on integrating inoculative release of this predator with applications of B.t.

Host plant resistance has the potential of serving as an effective first line of defense against CPB. This is true for both traditionally produced and genetically engineered resistant plants. Single genes such as the endotoxin gene of B.t. have been transferred into potato plants, thus the plants are able to produce the toxin and kill CPB larvae. This past season we conducted field evaluations of genetically transformed B.t.-Russet Burbank potatoes with plantlets produced by Monsanto Co.; similar evalulations were done in Oregon and Wisconsin. Fifty transgenic lines were evaluated in replicated tests against non-transformed and insecticide treated potatoes. Forty-nine of the fifty transgenic lines had 0% defoliation while the non-transgenic lines were completely defoliated and insecticide treated had about 10% defoliation. Plants grown from transgenic plantlets yielded over 2½ times as many potatoes as those from non-transgenic plantlets. Resistance can be anticipated if the use of high expression B.t. transgenic potatoes is widespread, thus making this new and novel strategy useless. A prudent approach may be to incorporate an intermediate or even a low level of B.t. in conjunction with other suppressive management strategies making use of plant resistance as one component of the system. We are conducting research on integrating low expression B.t. plants with inoculative releases of the stinkbug predator.

A number of cultural techniques offer potential as part of an overall program to reduce CPB populations. Several different vacuum systems have been developed to remove CPB adults from potato fields. We tested one last season that had been developed for strawberry insects. The Ag-Vac unit removed about 80% of the beetles in one pass. Propane flamers are being used in eastern U.S. to kill adult CPB when the potato plants are 4-8 inches tall. Twenty of these units were in use in New York state last year and a single pass kills 80-90% of the beetles. Overwintering CPB adults emerge from the soil (in or near last year's potato fields) in early spring about the time potato plants emerge and the adults usually walk about seeking potato plants, thus rotation and location of potato fields can be very important. If beetles fail to find potato plants in adjacent areas they take flight and are dispersed over a wide area. The use of strategically located strip-plantings of potatoes might be used to collect the spring emerging adults so they could be eliminated by spraying, vacuuming or flaming. The trap strips of potatoes could be planted at the edge of the overwintering site (last year's potatoes) or at the edge of the current season potato field.

Management of CPB in the future will most likely involve integrated strategies. These programs will be more knowledge intensive and suppressing CPB will be only one portion of the total crop management system.