IPM CRSProgress

Improved Practices Yield Stud Spuds in Ecuador

Traditional methods of potato farming in Ecuador involve high use of toxic insecticides. New practices developed as a result of IPM CRSP research have reduced the use of these pesticides while at the same time improving yields, all at a lower cost. IPM CRSP research shows that the most effective way of disseminating new practices is a combination of methods: farmer field schools, field days, pamphlets, and radio messages.

Agricultural development is essential for improved well-being in rural Ecuador. As much as 40 percent of the population relies on agriculture as its primary source of income, and agricultural exports account for a significant proportion of foreign exchange revenue. In the highlands, potatoes are a major staple, and more than 90,000 producers grow them on about 60,000 hectares of land. Potato production is associated with heavy use of chemical inputs such as pesticides and fertilizers.

Concerns have emerged about the sustainability of Ecuador's potato production as rising input costs have created a price squeeze. Public health officials are increasingly concerned about the consequences of pesticide overuse. These concerns include short and long-term health problems, water and soil contamination, buildup of resistance in pest populations, and destruction of beneficial insects.

Unprotected Spraying

Most pesticides are applied in liquid form using backpack sprayers, and not all farmers utilize protective equipment while spraying. Pesticides also imply a significant economic cost for producers. Pesticide expenditures typically comprise between 12 percent and 20 percent of production costs.

Producers need alternative pest management approaches that are feasible, economically sustainable, and effective. Integrated Pest Management (IPM) can help lower production costs, reduce exposure to pesticides, and improve long-term sustainability of the agricultural system.

The national agricultural research institution in Ecuador (INIAP), supported in part by the IPM Collaborative Research Support Program (IPM CRSP) funded by USAID, has developed technologies to manage potato pests.

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IPM Solutions

Three main pests significantly impact potato production in Ecuador. They are, in order of economic significance, late blight (*Phytophthora infestans*), the Andean potato weevil (*Premnotrypes vorax*), and the Central American tuber moth (*Tecia solanivora*). Studies in the 1990s in northern Ecuador reported that nearly 100 percent of farmers were affected by late blight, 80 percent by Andean Weevil and 6 percent by tuber moth. The IPM CRSP conducted original research to develop strategies for effective management of these three pests.

Late blight is a fungal disease that attacks potatoes around the world. Yield losses depend on the virulence of the fungal strain and whether farmers have the resources to use available fungicides. Studies on lower virulence strains estimate losses at 15 to 30 percent of the crop. Without chemical intervention, more lethal strains put farmers at great risk of losing much of their crop.

The prime means of control for late blight is fungicide applications. Farmers in Carchi, Ecuador spray their fields between one and 11 times during a crop cycle, with most farmers spraying six times. Farmers spray as a preventive strategy because late blight is difficult to control once the disease has become established. IPM CRSP recommendations include: (1) use of resistant varieties[1], (2) improved field sanitation, (3) implementation of crop rotations, (4) monitoring to determine need for spray applications, and (5) alternating different types of fungicides to prevent the buildup of resistance.

Potatoes in storage

Pheromone trap in a potato field

The Andean weevil can also cause significant damage without proper management. Crop damage of up to 80 percent has been measured in infested fields in Ecuador. Farmers typically use three strategies against the Andean weevil: (1) insecticides to target the larval stage of the insect, namely carbofuran and methamidofos (which are restricted in the United States because of high toxicity), (2) crop rotations, and (3) use of undamaged seed.

The IPM CRSP recommends the use of traps to monitor and target adult populations. Traps consist of foliage from potato plants baited with the pesticide acephate at a relatively low toxicity level. If populations reach a specific threshold, farmers are advised to spray at the base of plants since adult weevils tend to remain at soil level. This IPM CRSP recommendation is simple to implement and leads to less costly but more effective control of the pest. At harvest, the IPM CRSP recommends that all tubers should be completely removed from the field. Farmers are advised to wait 30 days before replanting.

The tuber moth is not yet a big problem for farmers in Ecuador; however, it has an affinity for temperate valleys like those found in Carchi. It can cause damage to pre-harvested tubers as well as stored potatoes. In either case, current methods of control use highly toxic insecticides such as carbofuran and carbosulfan.

In the field, IPM techniques include: (1) pheromone

[1] Varieties were developed through a series of CIP (International Potato Center)-sponsored and IPM CRSP research including breeding and consumer acceptance surveys. Other recommendations were also developed through IPM CRSP research.

traps to monitor and track adult populations and (2) spraying low doses of profenofos when populations reach a specified threshold. In storage, farmers are advised to use baculovirus to kill insects and keep the harvested potatoes covered. Other recommendations include: (1) earlier planting and harvests that avoid the dry season (tuber moths prefer dry weather to slip between cracks in the soil), (2) hilling up of soil around plants, (3) crop rotations, and (4) disinfecting seed with low-toxicity pesticides such as carbaryl and malathion.

IPM vs. Conventional Technologies: Is IPM Profitable?

In field trials, a cost-benefit analysis was used to compare conventional methods to IPM techniques. In all cases, input costs were significantly lower on IPM plots. Yields were higher in two out of three cases, and in the third case, yields were the same. Taking into account costs and benefits, net profits were higher in all trials, with estimates showing that the net benefit of adopting IPM is between $600 and $800 per hectare.

Thus, IPM is a cost-effective choice for potato farmers and requires no additional capital. Extra labor only appears to be necessary at harvest time. Inputs such as pesticides and fertilizers are used less in IPM plots and offset the increase in costs from purchased seeds.

IPM traps in a potato field

Ecuadorian potato farmers

Dissemination of IPM

The IPM CRSP explored alternate means of disseminating technology because of the absence of public support for agricultural extension in Ecuador. Several training and dissemination methods were used, including training of trainers, Farmer Field Schools (FFSs), field days, and written methods. Well over 5,000 farmers in Carchi have been trained through FFSs, field days, and short workshops.

Because of the relative complexity of the IPM method, studies have found that a complementary mix of dissemination methods is most effective. The use of these methods has been shown to lead to widespread adoption of IPM. Estimates show that more than 50 percent of farmers in the region are using at least four out of 17 of the recommended IPM practices. While FFSs are most effective at improving the knowledge of participants about pest management principles, they are also very expensive and best used in combination with other less costly methods. Field school participants are, however, most likely to share their experiences with others.

About 70 percent of field school participants adopted more than half of the recommended techniques compared to only 53 percent of people who attended field days and 36 percent who heard of IPM through pamphlets. A lot of information about IPM is spread through word of mouth, which leads to moderate levels of IPM adoption. Farmer field school participants actively spread

information to non-participants. The average field school participant speaks to 11 other farmers about IPM, and many of these farmers end up adopting one or more IPM techniques. Farmers who are exposed to IPM through means other than field schools are less likely to spread information about IPM to their neighbors.

However, field schools are costly to administer, and evidence shows that a combination of field schools with alternative dissemination methods, such as field days, pamphlets, and radio messages, is the most cost-effective means of spreading IPM information in the highlands of Ecuador.

Information in this article comes from a 2005 agricultural economics master's thesis written by Maria Mauceri.

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