

The potato is of fundamental importance in the diet and economy of the farmer in the Bolivian Andes. Usually this crop is either grown in rain-fed conditions above 4000 meters or under irrigation in the valleys where the altitude varies from 2500m to 800m. The Andean potato weevil - various species of the genus *Pemnotypus* - is the main pest at higher altitudes. The adult female lays her eggs at the base of the potato plant. The hatching larvae move through the soil and feed on the tubers formed underground. At harvesting time, the larvae leave the tubers and enter the soil forming pupae and later as adults they invade recently planted potato fields. The weevil produces one generation each year a process well synchronised with the potato crop.



Training Bolivian farmers in IPM

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The larvae cause most damage making deep, irregular tunnels in the potato tubers. Farmers report that often over 50 percent of tubers are damaged in this way and that in some cases damage runs to between 78 and 100 percent have been found. Highly toxic insecticide, often used in a dangerous and inefficient manner, is the main way these pests are controlled. Farmers have no knowledge of alternative control methods.

IPM of the Andean Potato Weevil

Building on earlier work by the International Potato Centre (CIP) in Peru (Cisneros and Gregory, 1994), the Bolivian Potato Research Programme (PROINPA) began working with IPM in Kollana, a community in the Altiplano or central highlands of Bolivia. Here, at an altitude of 3900m, the most prevalent potato pests were weevils and tuber moths. The PROINPA programme looked at existing control methods and compared them to IPM technologies so that farmers could see the advantages of the latter for themselves.

Training farmers

Farmers must understand the enemy if they are to fight it. Lack of knowledge makes control methods ineffective. The project began by providing farmers with information about the weevil. Its habits are such that many farmers are unaware of its life cycle (it walks not flies, but only walks and its habits are nocturnal) and do not know that the larva and the adult pest are different stages in the weevils development. Farmers need information on its behaviour, the length of each stage of its life cycle and the periods when the insect is most vulnerable to the various IPM strategies possible.

Training activities such as courses and field days were organised for a variety of groups including farmers, school children and extensionists from NGOs. Children were quick to learn: they were inquisitive, had a good memory and plenty of time to practice IPM components, such as manual collection. A variety of materials were used during these training sessions. PROINPA and CIP produced handouts, pamphlets, posters, slides, videos and flip charts according to local needs.

Implementing measures

Various control methods were discussed during the course of training and the farmers analysed them before deciding which were the most appropriate. IPM strategies included: **Harvesting potatoes on woolen bags** Directly after harvesting potatoes are heaped onto the bags normally used for transport. This allows the larvae that leave tubers to be caught so they cannot return to the soil and complete their cycle.

Stirring up soil in areas of concentrated infestation where potatoes were mounded in the field or where seed was selected. This left larvae and pupae exposed to light and predators. **Covering ditches with plastic in the vicinity of stores and fields.** The weevils, who are unable to fly, could not negotiate their way over the slippery plastic into the potato fields. **Ditches around the fields covered with straw** The ditch is filled with straw which creates a perfect environment for the weevils during the day making it possible to catch them easily.

Adults collected manually This is a night job because the weevils are nocturnal.

Elimination of volunteer plants

Volunteer plants may be a source of infestation. **Use of chickens** Chickens are important predators and find the weevil palatable at all stages of its development. **Directed application of insecticides and chemi-**

cal barriers. Such spot application involves the proper use of insecticides with a low toxicity. Insecticide is sprayed around the base of the plant where the adults weevils rest during the day. Chemical barriers can also be sprayed around the fields to keep weevils at bay.

Amongst the most promising components of IPM adopted by farmers in Kollana were the use of bags during harvesting; the timely and well-directed use of insecticides; covering ditches around the fields with plastic and using chickens as predators.

PROINPA and other institutions have organised weevil collection competitions to sensitise farmers to the weevil problem. Farmers who handed in the most adult weevils were given small prizes. So far eight "collection competitions" have been organised in various parts of Bolivia so far. Four have been held in La Paz and a total of 470,000 adult weevils have been collected, a figure that represents a potential population of 118,000,000 larvae. These collection competitions are most useful when run immediately prior to the time when the female weevil start to lay their eggs.

Institutional follow-up

The weevil project has stimulated interest amongst many NGOs in the central Altiplano. NGO staff have been trained in weevil control by PROINPA and this information is now being spread through several communities in other provinces.

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