CROP PROTECTION PROGRAMME

Integrated Management of Major Insect Pests of Potatoes in Hillside Systems in the Cochabamba Region of Bolivia (IPM of Potato Pests in Bolivia)

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FINAL TECHNICAL REPORT

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Executive Summary

Andean potato is the principal staple food for Bolivians and also a major cash crop, grown nationally by 400,000 small-farm families. Most potato farmers are poor, and yields are low due to a complex of biotic factors, particularly insect pests. The most important of these are potato tuber moths (PTMs) and Andean potato weevils (APWs) which each cause losses of up to 500 US$/ha/year and farmers have been using increasing amounts of pesticides in attempts to improve potato productivity.

The previous project aimed to develop improved methods for control of the two main pests of potatoes in Bolivia and other countries in the Andean Region, potato tubermoths (PTM) and Andean potato weevils (APW). The Purpose of this project was to develop strategies to reduce the impact of pests and stabilise yields and cultivation practices of crops in Hillsides systems, for the benefit of poor people. The project aimed to contribute to this Purpose by ensuring that PROINPA and other organisations in the Region have both the materials and expertise required to continue development and adaptation of the outputs of the previous project for use by farmers, particularly traps for APW and IPM training material for schoolchildren.

Further optimisation of the traps for APW was carried out and trials are in progress in five farmers' fields. Materials for teaching schoolchildren about IPM of potato pests have been developed and evaluated with 15 rural school teachers in 4 basic education schools. An international training course was held to promote the outputs of the project. This was attended by 15 representatives from NARS in the main potato-producing countries in the Region, i.e. Peru, Bolivia, Ecuador, Colombia and Venezuela.

Traps for APW will be made more widely available through a new project funded by the World Bank Development Market Place. IPM training material for schoolchildren will be disseminated by PROINPA.

Background

Andean potato is the principal staple food for Bolivians and also a major cash crop, grown nationally by 400,000 small-farm families. A similar situation exists in other countries in South America. Most potato farmers are poor, and yields are low due to a complex of biotic factors, particularly insect pests. The most important of these are potato tuber moths (PTMs) and Andean potato weevils (APWs) which each cause losses of up to 500 US$/ha/year and farmers have been using increasing amounts of pesticides resulting in both abuse and overuse in a vain attempt to improve potato productivity.

The previous project (IPM of potato pests in Bolivia; R8044, September 2001 – August 2004) aimed to develop improved methods for control of the two main pests of potatoes in Bolivia and other countries in the Andean Region, potato tubermoths (PTM), *Phthorimaea operculella* and *Symmetrischema tangolias,* and Andean potato weevils (APW), *Premnotrypes* spp. and *Rhigopsidius piercei (*previously *tucumanus)*.

PROINPA worked with NRI and CIP to investigate the possibilities of using pheromones and/or host-plant attractants in management of APWs. No evidence for production of pheromones could be found, even though many related species produce sex and/or aggregation pheromones. However, attraction of both species of weevil to volatiles from potato leaves was observed. Two components of potato leaf volatiles where detected which elicited electroantennogram (EAG) responses from the weevils, and these were identified. The synthetic compounds were evaluated in laboratory bioassays at PROINPA and CIP and field trapping tests in Bolivia and showed behavioural activity. In the field, locally-produced

pitfall traps were developed and these were baited with blends of the active chemicals. Traps baited with the chemicals caught as many *P. latithorax* weevils as those baited with potato leaves and unbaited traps caught few weevils.

The project also carried out a base-line survey of farmers' perceptions of pests and diseases of potatoes in three communities. Training days were carried out in these communities on the different IPM components with emphasis on biological control of APW and PTM and on the rational use of pesticides. The courses were conducted largely in the local quechua language and were attended by men, women and children. Work was also started on education of children in rural schools in IPM of potato pests using specially designed textbooks. Children and women are often responsible for potato cultivation and the schools provide an untapped opportunity for introducing large numbers of children to the concepts of IPM at an early age and facilitate a way to reach and be more convincing with parents.

During the project a PROINPA scientist received training in identification of pheromones and molecular techniques for identification of entomopathogenic viruses at NRI. PROINPA held a course on "Pest Diagnosis" for scientists and technicians in Bolivia and neighbouring countries.

Project Purpose

The Purpose of the project was to develop strategies to reduce the impact of pests and stabilise yields and cultivation practices of crops in Hillsides systems, for the benefit of poor people. The project aimed to contribute to this Purpose by ensuring that PROINPA and other organisations in the Region have both the materials and expertise required to continue development and adaptation of the outputs of the previous project for use by farmers.

Activities were carried out to optimise the weevil traps and ensure they are available for uptake by users. The curriculum material on IPM of potato pests developed during the previous project was finalised and evaluated with the children. Outputs of the project were disseminated NARs in the Region by means of a workshop held at CIP in Lima, Peru, for representatives from Colombia, Ecuador, Peru and Venezuela as well as Bolivia national potato/crop protection programmes.

Immediate beneficiaries of the project outputs will be the NARS in these countries, but ultimate beneficiaries will be small-holders who depend upon potatoes for food security and as a source of income.

Research Activities & Outputs

1. Traps for Andean potato weevils available.

1.1. Laboratory bioassay work at PROINPA and CIP to evaluate attractants

Laboratory bioassays at PROINPA confirmed that (*Z*)-3-hexenol is attractive to *P. latithorax* at low doses. At 5µg it is attractive to males and females, but not as attractive as a potato leaf. At 1 µg it is as attractive as a leaf for males but not for females. A synthetic blend of some of the sesquiterpenes found in volatiles from potato leaves was not attractive at any dose. In bioassays at CIP on *P. suturicallus*, (*Z*)-3-hexenol was not attractive to either sex at the doses tested. Large-scale collections of potato leaf volatiles have been made at NRI and analysed by GC-MS. Analyses by GC-EAG failed to show any additional olfactory stimulants in the volatiles, but preparations were very noisy and it is planned to repeat this work.

1.2. Trapping work by PROINPA in farmers' fields to optimise further blends and dispensers.

Field trapping trials carried out in farmers' fields showed that traps baited with leaves or a blend of (*Z*)-3-hexenol and (*E*)-2-hexenal caught significantly more weevils than unbaited traps. Addition of the blend of synthetic sesquiterpenes (above) reduced catches.

A new model trap was designed by using local and recyclable material. This trap is easily made and its cost is less than an American dollar (U$). In laboratory evaluations these traps were very efficient and no escape of captured adult weevils occurred, as was observed with other trap models where 50 % of weevils were able to escape. These traps, blends and dispensers are being evaluated under field conditions.

Trapping trials are in progress in five farmers' fields.

1.3 Training of PROINPA staff

A member of PROINPA staff previously given training in aspects of pheromone technology at NRI. During this extension NRI supplied materials for making lures at PROINPA and details of how to source these were provided.

2. Educational material for rural schools completed and validated.

2.1 Training of male and female adult farmers.

This activity was carried out in 4 different rural communities and a total of 185 female and male adults participated ands were trained on different IPM components with emphasis on life cycle and biological control of APW and PTM and, on the rational use of pesticides.

2.2 Development and dissemination of materials for education of children in rural schools.

Two workshops have been carried out with 15 rural school teachers in 4 basic education schools in Tiraque, In the first one, teachers were trained on the themes described of the prepared books, and the training material was evaluated in the second one. The group of teachers have validated both teacher and pupils training material (See attachment on workshop with teachers). In this activity all necessary material for students was given to trained teachers as well as some posters, drawings, photographs related to different sections of the provided teaching material. Based on the results obtained, and reviews by PROINPA and CIP partners, the training material has been improved and is ready for final printed version.

3. Local organisations in the Andean Region have materials and expertise required to continue development and adaptation of improved methods for control of Andean potato weevils and potato tubermoths into an Integrated Pest Management Strategy .

An international training course "Development and Application of Ecological Approaches in Integrated Pest Management in Potato Production" was held at CIP, Lima, Peru, during 20-24 June 2005. It was attended by 15 representatives from NARS in Peru, Bolivia, Ecuador, Colombia and Venezuela. Lectures and practical tutorials were given by project staff from PROINPA,, NRI and CIP, and two other international experts from USA and New Zealand.
During the workshop, results obtained in the IPM of Potato Pests in Bolivia project were shared with all participants and the development of a international working group was discussed.

Contribution of Outputs to developmental impact

Benefits to poor people

Andean potato is the principal staple food for Bolivians and also a major cash crop, grown nationally by 400,000 small-farm families. In a previous project new technologies have been developed for control of Andean potato weevil (APW) and potato tuber moth (PTM), two of the major constraints to growing potatoes in the Region. In this project pheromone traps are being trialled in five farmers' fields. Materials for teaching schoolchildren about IPM of potato pests have been developed and evaluated with 15 rural school teachers in 4 basic education schools.

Potential for wider impact

An international training course was held to promote the outputs of the project. This was attended by 15 representatives from NARS in the main potato-producing countries in the Region, i.e. Peru, Bolivia, Ecuador, Colombia and Venezuela.

Future work

A project submitted by PROINPA and NRI to develop the pheromone traps for APW further has been approved for funding by the World Bank Development Market Place (2005-2008).

Further development and dissemination of materials for teaching schoolchildren about IPM of potato pests will be carried out by PROINPA.

Biometricians Signature

I confirm that the biometric issues have been adequately addressed in the Final Technical Report:

Signature: N/A
Name (typed): N/A
Position:
Date:

Bioassay and trapping experiments have been carried out as previously and analysed by methods established previously.