



Implementing Ecological Approaches of Pest Management for Enhancing Sustainable Potato Production of Resource-Poor Farmers in Mountainous Regions in CIP's Target Countries of Southwest-Central Asia

International Potato Center (CIP), Lima, Peru

Country/Region:	Nepal, Bhutan, Bangladesh
German participation:	University of Hohenheim, Staatliches Museum für Naturkunde Stuttgart
Leading scientists:	Dr. Jürgen Kroschel, Dr. Marc Sporleder (CIM)
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Initial situation

Potato is an important crop for food security and cash income for many small-scale farmers in the targeted countries. However, production is severely affected by pests, especially by the potato tuber moth (PTM), *Phthorimaea operculella*, and leaf miner fly (LMF), *Liriomyza huidobrensis*. Farmers in the target countries predominately apply chemical pesticides to manage these pests. Against LMF dimethoate is used, even if it is largely useless because the fly has developed a resistance against the agent. Besides being ineffective, dimethoate is highly toxic and harmful to human health.

Against this background the project aims at establishing Integrated Pest Management (IPM) technologies. IPM in this case relies mainly on exotic parasitoids that are natural antagonists of PTM or LMF. By using IPM the project targets at increasing potato yields through pest reduction, while at the same time curbing usage of pes-

ticides, thus protecting human health and the environment. The project builds on CIP's experience in agroecology and IPM research from South America and North Africa. Nepal is priority country of the project.

Approach of the project

Capacities for IPM and research are low in the targeted countries. National research institutions are extremely weak in laboratory equipment and facilities, while funding is also limited. Therefore, the scale of PTM and LMF infestation in the countries was virtually unknown before project launch – farmers did not know LMF or perceived damages mistakenly as fungal disease.

The project envisioned a three step approach to change this situation for the better. In a first step, the amount of pest infestation, damage and control measures was studied to create the knowledge base for IPM. In a second step, an inventory of insects in potato systems was compiled, focusing on occurrence and efficacy of local natural enemies of PTM and LMF. Finally, exotic parasitoids were studied and phenology models developed to assess how the parasitoids would react to the new environment. Afterwards, parasitoids were introduced and released according to the FAO guidelines for Import and Release of Exotic Biological Control Agents. The University of Hohenheim contributed through the involvement of MSc students, the Museum für Naturkunde through its expertise in insect taxonomy, especially in the Himalaya region.

Major results achieved

Surveys on the extent of pest infestation, damage and counter measures were conducted. The surveys verified, among others, that chemical pesticides are largely ineffective against PTM and LMF. Potato tuber moth distribution was monitored year-round by farmers using pheromone trappings. During the surveys, two parasitoid species were discovered in Nepal that are promising for acting as natural local enemies of LMF. For PTM no local enemies were discovered. Therefore, three species of exotic parasitoids (*Copidosoma koehleri*, *Origilus lepidus*, *Apanteles subandinus*) were imported to Nepal from Peru, mass-reared and finally released in the Kavre District during the winter crop of 2010. In Bhutan, authorities preferred to check all pest management alternatives before importing exotic parasitoids. Moreover, several alternative control options were successfully tested with farmers to contain PTM in potato storerooms relying on *Bacillus thuringiensis* and powdered sweet flag rhizome.

In all steps local partner institutions were involved and their capacities for IPM improved: Local extension staff was trained in IPM techniques, farmers' consciousness for IPM was raised, several Nepalese students conducted MSc research within the project's parameters and the laboratory facilities of the Nepal Agricultural Research Council were improved so that local mass-rearing of exotic parasitoids is possible now. Additionally, it is planned to introduce IPM training courses to the curriculum of the Nepalese farmer's field school network. For the future, the project will be continued and scaled-up to Pakistan and India under auspices of the Austrian Development Agency, thus guaranteeing

continuous involvement in Integrated Pest Management in the region for the improvement of living conditions of poor potato farmers.

Expected impact

The better understanding of potato agroecosystems and the developed bio-control options will contribute to modify the current pest management practices in the targeted potato-production systems. The livelihood of resource-poor potato farmers, who are the primary beneficiaries, should improve through higher potato yields and tuber quality, and less intoxications from chemical pesticides. Potato consumers will benefit through reduced pesticide residues as well.

Intermediate users of the project results are researchers from national partner institutions and members of other governmental or non-governmental organizations, which are involved in potato production. The knowledge generated is intended to be transferred to a wide range of stakeholders. The project will increase the awareness of farmers and extension workers of hazardous pesticides and the benefits of IPM.

Collaborating institutions

National Potato Research Program, Nepal; Nepal Agricultural Research Council, Nepal; NARC's Entomology Division, Khumaltar, Katmandu, Nepal; Department of Entomology, Institute of Agriculture and Animal Science, Tribhuvan University, Rampur, Chitwan, Nepal; CIP-Bhutan Potato Development Program, Bhutan; Tuber Crops Research Institute, Bangladesh

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