CARE-PERU

FINAL EVALUATION OF THE INTEGRATED PEST MANAGEMENT FOR ANDEAN COMMUNITIES (MIPANDES) PROJECT

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Acronyms and Abbreviations

CEPAB
: Centro de Producción de Agentes de Control Biológico

CGIAR
: Consultative Group on International Agricultural Research

CIP
: International Potato Center

GIFAP
: Groupement International des Associations Nationales de Fabricants de Produits Agrochimiques

INIA
: Instituto Nacional de Investigaciones Agrarias

IPM
: Integrated pest management

MIPANDES
: Manejo Integrado de Plagas Para Comunidades Andinas

NGO
: Non-governmental organization

PRONAMACHCS
: Programa Nacional de Manejo de Cuencas Hidrográficas y Conservación de Suelos

SENASA
: Servicio Nacional de Sanidad Agraria

USAID
: U.S. Agency for International Development

FINAL EVALUATION OF THE INTEGRATED PEST MANAGEMENT FOR ANDEAN COMMUNITIES (MIPANDES) PROJECT

1.0 Executive Summary

This final evaluation of the MIPANDES Project provides key information on project accomplishments and impacts and identifies lessons learned. The objectives of the final evaluation were to: assess technical, environmental, and socio-economic project impacts; assess project achievements; identify lessons learned relative to the design, implementation, production of training materials, and extension services; and examine the future outlook of MIPANDES in relation to the spread of IPM, sustainability, new challenges, applied research, and strategic alliances.

The evaluation team was composed of an IPM specialist and team leader, two socio-economists, and an IPM advisor. The evaluation was based on literature review, field visits, personal observations, interviews with beneficiary farmers and CARE extensionists, examinations of the project's monitoring system and records, and collection and analysis of data from 479 interviews carried out by project extensionists, using a survey document generated expressly for this purpose by the evaluation team. The field portion of this evaluation took place during November 20-30, 1996. The team visited 7 CARE communities in Cajamarca and 7 in La Libertad (ANDES Project), 7 in Ancash (CHAVIN Project), and 12 in Puno (WARU WARU and MESA Projects).

In general, MIPANDES has been highly successful in achieving most of its stated aims. Its training materials and methods have proven to be remarkably effective in teaching farmers about key pest relationships previously unknown to them and in convincing them about the rationale for adopting the IPM practices espoused by the project. MIPANDES farmers have now at their disposal a menu of IPM practices that can be used to reduce populations of Andean potato weevil and potato tuber moth. MIPANDES' pesticide management training has introduced a new understanding and sensitivity regarding the risks and essential safeguards of pesticide use.

IPM practices that have been tried and proven to be cost-effective by farmers will probably be adopted permanently. A great deal of pest life cycle and IPM information has already been internalized in most project implementation areas. However, it will be essential that CARE extensionists continue to reinforce these IPM concepts to ensure truly long-lasting results among MIPANDES families. Continuing involvement in IPM will also help assure that CARE-Perú consolidates its emerging role as a center of expertise in the promotion of IPM in subsistence potato production systems.

In the opinion of most farmers interviewed, a greater proportion of uninfested or lightly-infested potatoes is being harvested for both consumption and marketing as a result of MIPANDES activities. This reduction in pest damage appears to complement the impact of CARE's diffuse light storage and potato seed distribution programs. Most farmers interviewed perceive that the MIPANDES Project did generate savings associated with decreased pesticide inputs costs.

Approximately 30% of the interviewed farmers reported annual savings equivalent to US $40 or greater, 30% of $20-39, and 40% of $19 or less. The significance of these amounts becomes apparent upon considering that the estimated annual cash income of Andean farmers is about $470 on average.

For 79% of 479 family units interviewed the adoption of IPM practices promoted by MIPANDES led to a reduction in insect pest damage. Among those farmers who were directly under the influence of MIPANDES and who experienced a reduction in pest damage, 46% considered it had decreased by 25% or less relative to the initial damage level. Another 39% of those farmers indicated that the initial damage had been reduced by 50%, while the remaining 15% experienced damage reductions of 50% or greater.

Income for farmers under MIPANDES Project areas is affected by various development actions promoted by CARE, such as supplying communities with diffuse light storehouses, small irrigation systems, and roads. There is not enough information at present to isolate the specific contributions of MIPANDES to farmers' income from other contributing factors. The reduction in the proportion of damaged potatoes, added to the reduction of damage per infested tuber, are an indication that MIPANDES is contributing to improved food availability and, in some cases, to increased income from surplus potatoes being available for sale.

Through its highly participative and attractive training programs and materials, MIPANDES has stimulated greater women and children's involvement in project activities and other community affairs. Women have shown to be especially concerned and interested about food availability and quality issues, such as degree of pesticide contamination and pest damage.

MIPANDES has actively promoted a pesticide safety program, based on guidelines developed by GIFAP as the "eight golden rules." Through this program, farmers have become aware of basic safety issues involving pesticide use. Most can explain risks associated with pesticide toxicity, the need to store pesticides in areas away from children and bury empty containers, the need to avoid spraying on windy days or against the wind, and the significance of the color codes in products' labels. Many MIPANDES farmers will now be able to add safety factors to other pesticide characteristics when making decisions regarding the purchase and use of these products.

Most farmers have learned fairly well the life cycles of both Andean potato weevil and potato tuber moth, their relationships with the potato plant; how, when, and where to find each developmental stage (eggs, larvae, pupae, adults); and the relevance of all this to IPM techniques. Farmers acknowledge that before being exposed to the MIPANDES training program they did not make the connection between the adult weevils and the larvae in the tubers, which they usually associated with hail storms, and are appreciative of their newly acquired knowledge.

Adoption of several IPM practices is taking place in virtually all community fields, and to a lesser degree in individual plots. The blend and number of IPM measures adopted varies somewhat from zone to zone. There is also evidence that some spontaneous IPM adoption is taking place in non-MIPANDES communities. The more commonly adopted practices include: night collecting of adult weevils, earthing up (aporque alto), harvesting tubers on a piece of canvas or plastic (cosecha en mantas), use of live fences, and use of repellent plants and baculovirus on

stored potatoes. The use of *Beauveria* is limited to demonstrations conducted by CARE extensionists, with a reported effectiveness of only about 10-40%.

The buildings that will house the two planned CEPABs are expected to be completed by the end of 1996. Training of future CEPAB operators has been completed, and production of biocontrol agents is expected to be underway during early 1997. CARE intends to continue supporting these centers for an undetermined period. The CEPABs constitute high risk micro-enterprises which, to ensure their sustainability, need to be provided with the appropriate support in all relevant entrepreneurial, marketing, managerial, technical, and quality assurance areas. They will require assured inoculum, quality control support, and reliable technical assistance.

The training materials are mostly of superior design, content, and quality, being held in high regard by farmers and extensionists alike. MIPANDES has thoroughly evaluated and revised the posters through an intensive participatory process involving farmers and extensionists, culminating in the set that is being used at present. MIPANDES' training aids constitute an attractive and complex blend of materials, not often available to other CARE projects or to comparable IPM projects in other countries. Their use in MIPANDES training programs has contributed to greater family involvement in project and related activities.

The base-line diagnosis, carried out during early 1994, did not provide information on socio-economic and political factors in Perú which influenced the economy of subsistence farmers. Factors such as the elimination of agricultural credit, end of the US Dollar subsidy, and devaluation of the national currency, have affected farmers' ability to procure agrochemical inputs. Other weaknesses of this diagnosis include: scarcity of quantitative data on crop pest damage, lack of information on pest control costs, and scarcity of information on family income and monetary losses due to pest damage, all of which adversely affect its usefulness for evaluation purposes.

MIPANDES' monitoring system was designed to follow up and record the changes, elicited by the project, in the way that farmers deal with potato pest problems. The methodology of the monitoring system is sound. Each variable was to be recorded at different times in the crop life cycle, as well as during the storage of tubers, in order to measure the partial (additive effects of each IPM practice) and total (cumulative effects of the IPM practices) changes that would take place. There were some initial problems with the implementation of the monitoring process which affected the usefulness of the data collected.

The contributions of CIP have not only been invaluable but essential for the conception and implementation of MIPANDES. The availability of its ready-for-transfer IPM technology made it possible for the project to readily fill a major crop protection gap in the project areas. CIP also developed the prototype training materials which were later validated and modified by CARE. The opportunity to receive training at CIP was highly valued by CARE extensionists, who consider it a prestigious and stimulating experience which provided them with the knowledge and confidence to function as IPM practitioners. Conversely, MIPANDES has provided CIP the opportunity to be involved in IPM implementation throughout a vast Andean area, contributing to enhancing the cost-effectiveness of CIP's long-term investments in potato IPM research.

Recommendations regarding the future role for CARE in IPM implementation, CARE-CIP strategic alliance, training materials, training for extensionists, monitoring system, and the kind

of support and CARE involvement needed by two planned CEPABs are summarized in section 6.0. Some of the more significant ones are listed below.

- CARE should have the opportunity to consolidate its IPM experiences by continuing to implement current project strategies and activities for another 2-3 years. CARE should ensure the sustainability of this project by further intensifying IPM in its present target areas. It is desirable that CARE pursues this intensification process, while it continues to explore ways to further extend its IPM technology to a wider population.

- During the intensification stage, CARE should systematize the MIPANDES experience, lessons learned, training and extension materials, monitoring system, group management, and interactions with farmers to further optimize the chances of adoption at the diffusion stage.

- CARE is now in a position to collaborate with and provide guidance to local NGOs and public sector institutions having both extension capabilities and interest in transferring IPM technology. CARE should employ its newly acquired IPM capability in providing training and guidance to governmental and non-governmental institutions interested in implementing similar IPM activities.

- CARE should make an effort to maintain its strategic alliance with CIP in order to continue implementing joint activities as opportunities are identified to further help improve subsistence-level potato production in Perú. The agreement could be fine-tuned to better conform to the interests and needs of the respective institutions. If such alliance is no longer possible, CARE should consider establishing a partnership with a research institution, such as INIA, or a suitable university.

- CARE should consider modifying its training materials for use at the grade school level and offering them for distribution to rural school centers. If CARE opts for this approach, its impact will need to be monitored and evaluated.

- MIPANDES' base line diagnosis and monitoring system are essential tools for documenting achievements and providing discipline and guidance to project activities. These elements need to be strengthened in any future MIPANDES actions, ensuring that the extension staff is made aware of their aims and applications and revising them on a regular basis until they become practical and useful tools.

- CARE extensionists who continue to be engaged in IPM activities should receive pertinent additional training. A three day workshop in selected IPM topics, once a year, and occasional field visits by IPM specialists would provide the added knowledge and stimulus needed by extensionist to continue performing adequately in this area.

The following recommendations apply to the support needed by the two CEPABs:

- CARE needs to continue providing technical assistance and support to the CEPABs, at least for one full year after these become operational. To the extent possible, these micro-enterprises should remain initially under CARE management and be turned over to the communities by the end of the first year of operation.

- CARE needs to invest in all required product and process registrations required by Peruvian law, as outlined in section 5.2.1.4 of the evaluation report. A qualified specialist should be contracted to design an attractive packaging for these products, and funds need to be assigned for their marketing. The CEPABs will need working capital, and its workers need to be compensated with a suitable salary.

- It will be highly desirable that CIP continues to support future MIPANDES activities to further refine the use of *Beauveria* in rural communities, to provide quality assurance support and inoculum to the two planned CEPABs and to continue to offer guidance and technical assistance to CEPAB personnel and CARE extensionist in all aspects of the production process of both biocontrol agents.

- A few CARE extensionists need to be trained in all aspects of the production and use of the microbiological agents to provide timely guidance to CEPABs when so required, since personnel from qualified laboratories such as CIP's may not be readily available to help solve unexpected problems that may arise during routine operations.

- Training and technical assistance for CEPABs should include both production techniques and micro-enterprise management, including organization, legal requirements, administration, and commercialization.

- The CEPABs need to have adequate quality assurance provided by a qualified laboratory, as well a reliable supply of inoculum.

- The use of *Beauveria* for control of Andean potato weevil larvae under rural community conditions needs refining, particularly with regard to dosage and humidity requirements, before its use becomes more widespread.

2.0 Introduction

The potato, *Solanum tuberosum*, ranks as one of the most important food crops for subsistence farmers throughout the Peruvian Andes, where annual yields average 2-7 tons/ha. In spite of having been grown locally for thousands of years, present farming practices are not effective in addressing severe losses caused by a complex of insect pests and diseases. Chief among these are the Andean potato weevil, *Premnotrypes* spp. (three closely-related species) and the potato tuber moths, *Phthorimaea operculella* and *Symmetrischema plaesiosema*. Without adequate protection, the potato weevil and tuber moth, together, often cause crop damage in excess of 50%, with infestations sometimes approaching the 100% level. Depending on the severity of the attack, potatoes damaged by the weevil retain some value, and can still be used for human consumption, to manufacture chuño (freeze-dried potatoes), or as pig feed for the most severely damaged tubers. Damage by potato tuber moth is considered far more severe, as tubers infested with this insect acquire a bitter taste that renders them unacceptable for human consumption. In general, the weevil is the dominant field insect pest, whereas the potato tuber moth is detrimental to stored potatoes. With the exception of the higher and colder regions in the Puno department, the potato tuber moth is a major storage pest in most MIPANDES Project areas. However, this insect is present in those project areas in the Puno department which are immediate to the Titicaca lake, where this immense water body has a

warming effect on the ambient temperature. In addition to insect pests and diseases, frost, hail, and drought often inflict severe damage to the potato crop in project areas.

Other insects, such as *Epitrix* sp. and thrips, may some times cause some damage to the potato foliage. During wet years, the potato late blight, *Phytophthora infestans*, causes losses that, in the view of farmers, often matches or exceeds those inflicted by the Andean potato weevil.

CARE-Perú has been working in the Peruvian Andes since the mid 1980s to help alleviate some of the problems affecting poor families whose subsistence is entirely dependent on agriculture. In September, 1993, CARE-Perú began implementing its Integrated Pest Management for Andean Communities (MIPANDES) Project, in collaboration with the International Potato Center (CIP) and with the financial support of USAID-Perú. MIPANDES aimed to teach farmers how to reduce damage caused by the Andean potato weevil and the potato tuber moth, in order to help increase the amount and quality of potato harvested. The IPM technology promoted by MIPANDES was based on research and validation work conducted by CIP over 15 years, which led to the formulation of a set of IPM recommendations, which are being offered to farmers in menu form, rather than as a set of recommendations to be rigidly applied. This unique project thus combined the proven technical capacity of CIP, a major international research center in the CGIAR system, and the infrastructure, local presence, and substantial extension capacity of a major NGO such as CARE.

The project targeted for assistance 3,500 rural families in 117 Andean communities distributed in four departments. MIPANDES was not conceived as an isolated project, but was rather designed as a set of activities to be implemented by four ongoing host CARE projects: ANDES in the departments of Cajamarca and La Libertad, CHAVIN in department of Ancash, and WARU WARU and MESA in the department of Puno. Thus, MIPANDES extensionists were in effect ANDES, CHAVIN, WARU WARU, and MESA project extensionists.

3.0 Purpose and Methodology of the Evaluation

The purpose of the MIPANDES Project evaluation is to provide key information on project accomplishments and impacts and to identify lessons learned that may help to improve future similar projects. The objectives of the final evaluation are to: a) assess technical, environmental, and socio-economic project impacts; b) assess project achievements relative to intermediate and final project objectives; c) identify lessons learned relative to the design, implementation, production of training materials, and extension services; and d) examine the future outlook of MIPANDES in relation to the mass diffusion of IPM, sustainability, new challenges, applied research, and strategic alliances.

The evaluation team was composed of four individuals: an IPM specialist and team leader, two socio-economists, and an IPM advisor. The evaluation was based on literature review, field visits, personal observations, group interviews with beneficiary farmers and CARE extensionists, examinations of the project's monitoring system and records, and collection and analysis of data from 479 individual interviews carried out by project extensionists. The individual interviews utilized a survey document generated expressly for this purpose by the socio-economist members of the evaluation team.

The field portion of this evaluation took place during November 20-30, 1996. During this period, the team visited 7 CARE communities in Cajamarca and 7 in La Libertad (ANDES Project), 7 in Ancash (CHAVIN Project), and 12 in Puno (WARU WARU and MESA Projects).

4.0 Relationship of MIPANDES to CARE's Program Principles

The evaluation team found that the aims of the MIPANDES Project are fully compatible with CARE's Program Principles:

Addressing significant problems: MIPANDES was designed to provide immediate and long-term answers to food and economic losses chronically experienced by Andean rural families practicing subsistence agriculture. MIPANDES directly addressed income generation and food security concerns, while indirectly responding to environmental and health issues associated with pesticide misuse.

Working with poor people: MIPANDES decidedly worked with some of the poorer of Andean families which depend entirely on agriculture for their existence. In these project areas, crops are each year subject to the ravages of insect pests and diseases, as well as to potentially destructive hail, frost, and drought.

Participation: MIPANDES was designed as a participatory project, where beneficiary farmers have been actively involved in all aspects of project activities, ranging from validation of training materials to the various training, extension, and field day activities. MIPANDES' menu of pest management practices was designed to foster farmers' decision making abilities by encouraging them to elect on their own which particular IPM practices to adopt.

Adaptability: MIPANDES has the potential to become a model that may be replicated in other regions, not only with comparable pest management projects, but also in other development areas, where well-defined needs, available technology, and comparable conditions for the establishment of strategic alliances may exist.

Sustainability: With the right level of support, most MIPANDES activities will prove to be sustainable to some extent. IPM practices that have been tried and proven to be cost-effective by farmers will probably be adopted indefinitely. A great deal of pest life cycle and IPM information has already internalized to a great extent in most project implementation areas. However, it will be essential that CARE extensionists continue to reinforce IPM concepts introduced during the life of the project, beyond its planned three years, to ensure truly long-lasting results among MIPANDES families. Continuing involvement in IPM will also help assure that CARE-Perú consolidates its emerging role as a center of expertise in the promotion of IPM in subsistence potato production systems. Key MIPANDES activities should be extended for at least two more years to consolidate gains attained during its first three years and to systematize project experiences in preparation for meeting related new challenges.

Fundamental change: Project activities fostered farmer empowerment by introducing new knowledge pertaining to previously unsuspected key crop-pest relationships, by offering the opportunity to experiment with particular blends of IPM practices, and by encouraging greater opportunity in the decision making process involving crop management and enhanced capacity

for organization and income-generation. Women and children, in particular, became active participants in project activities.

5.0 Findings and Conclusions

5.1 Impacts and Results

Because of its very success, the adoption of project-promoted IPM practices have begun to spill over to adjacent communities outside MIPANDES' influence. At least some of IPM practices are being spontaneously adopted, in various degrees, in non-MIPANDES communities. In many cases, families assisted under CARE host projects, but not directly under MIPANDES, also received some form of IPM training. The absence of CARE-assisted communities which were not exposed to IPM technologies hindered attempts to reliably compare project impact on its target communities with other CARE communities never exposed to IPM.

5.1.1 Food security and income

In the opinion of most farmers interviewed by the evaluation team, a greater proportion of healthy (uninfested or lightly-infested) potatoes is being harvested for both consumption and marketing as a result of MIPANDES activities. This reduction in pest damage appears to complement the impact of CARE's diffuse light storage and potato seed distribution programs.

5.1.1.1 Pest control savings

Most interviewed farmers (98% of those directly assisted by MIPANDES and 88% of those indirectly receiving such assistance) perceive that the MIPANDES Project did generate savings associated with decreased pesticide inputs costs. It is mainly those farmers who have been trained in IPM practices who tend to note and quantify such savings. For farmer families who discontinued chemical control of the Andean potato weevil and tuber moth as a result of the project's training program, their actual savings vary according to different spraying frequencies and doses applied before the project started. As such, 30% of the interviewed farmers reported annual savings of US $40 or greater, 30% of $ 20-39, and 40% of them experienced savings of $19 or less. The significance of these amounts becomes apparent upon considering that the estimated annual cash income of Andean farmers is about $470 on average.

5.1.1.2 Reduction in tuber damage

The vast majority (79%) of 479 family units interviewed, irrespective of whether they were directly involved with MIPANDES or not, stated that the IPM practices introduced by the project had led to a reduction in insect pest damage. The proportion of farmers that felt that pest damage had decreased varied with the region as follows: 63% in Ancash, 78% in Cajamarca, 66% in Puno, and 98% in La Libertad. Among those farmers who were directly under the influence of MIPANDES and who experienced a reduction in pest damage, 46% considered it had decreased by 25% or less relative to the initial damage level. Another 39% of those farmers indicated that the initial damage had been reduced by 50%, while the remaining 15% experienced damage reductions of

50% or greater. A greater proportion (92%) of family units that participated in MIPANDES' formal IPM training program felt that pest damage had definitely decreased, whereas only 71% of family units that were informally exposed to IPM training acknowledged that pest damage had been reduced.

5.1.1.3 Increase in farmers' earnings

Income for farmers under MIPANDES Project areas is being affected by a host of development actions promoted by CARE, such as agronomic-related assistance and supplying communities with infrastructure such as diffuse light storehouses, small irrigation systems, and roads. Isolating the effects of MIPANDES from these other factors presents a daunting challenge.

In the case of families for which pest control savings were equivalent to US $19 or less per planting season and for which crop damage reductions average 30% of the initial pest damage, the minimum contribution of MIPANDES would amount to about US $33.00 per planting season (Annex 2). In addition, there are indications that as the proportion of damaged tubers decreases there is a corresponding increase in tuber quality (i.e. the severity of weevil-inflicted damage in infested tubers is also decreasing), which logically results in farmers obtaining better prices for their crops in the market.

5.1.1.4 Food security

The reduction in the proportion of damaged potatoes, added to the reduction of damage per infested tuber, are an indication that MIPANDES is contributing to improved food availability and, in some cases, to increased income from surplus potatoes which are now available for sale. The food security concept itself refers to the capacity of a family unit to produce sufficient food crops to satisfy its food needs or, conversely, to generate crop surplus that can be sold to generate extra income, which in turn can be used to purchase the required food items. In this regard, increasing family income is only one aspect of the food security strategy. Another aspect is given by a greater food availability, potatoes in this case, both in greater amounts and in better quality. As pest damage is reduced, there is a greater availability of healthy potatoes, which translates to a modest improvement in the supply of food for families participating in MIPANDES. In addition, farmer's pest control savings, however small, will probably further contribute to the procurement of food items.

5.1.2 Women and children

In the opinion of most CARE extensionists interviewed, through its highly participative and novel training programs, MIPANDES has contributed to stimulate greater involvement of women and children in community affairs, including crop production activities. Women and children often have become actively involved in project activities. Women have shown to be especially concerned and interested about food quality issues, including pesticide residues and degree of pest damage. Both women and children have become enthusiastically involved in night weevil collecting activities and weevil collection contests, frequently won by children. The teaching process focussing on pests' life cycle and the various IPM practices available and relying on

multiple and attractive training materials and exercises has provided a catalyst for the entire family unit to work together in IPM activities.

Women have participated in the operative units, often as head of households, mainly after losing their husbands to abandonment or death. Their average participation is about 29%, ranging from 11% to 58% of the total membership. Women have proven to be knowledgeable of risks associated with pesticide use and clearly understand the meaning of the color codes in these products' labels. Women tend to be especially aware of the improvement in food (potato) availability and quality resulting from MIPANDES' actions, relative to the achieved reduction in pest damage and pesticide contamination. A few young women have been selected by their own communities in Ancash and Puno to participate in the operation of the CEPABs due to their superior understanding of pest life cycle and IPM practices. These women have received training in the production of biocontrol agents and the management of CEPABs.

5.1.3 Health and environmental impacts

The use of pesticides in project areas ranges from low to moderate. Although insecticide applications seldom exceed two per season, when conditions are favorable to the spread of late blight, farmers may apply fungicides as often as eight times per season. The current absence of governmental subsidies for agricultural inputs and the unavailability of agricultural credit have resulted in a significant reduction in the procurement of agrochemicals by subsistence farmers.

MIPANDES has actively promoted a pesticide safety program, which was based on basic pesticide management guidelines developed by GIFAP as the "eight golden rules." Through this program, farmers have become aware of basic safety issues involving pesticide use. Most can explain risks associated with pesticide toxicity in general, the need to store pesticides in areas away from children and bury empty containers, the need to avoid spraying on windy days or against the wind, and the significance of the color codes in products' labels. It can be stated that as a result of MIPANDES, many farmers will now be able to add safety factors to other pesticide characteristics when making decisions regarding the purchase and use of these products.

Many of the older farmers in the project areas have witnessed higher levels of pesticide use and intoxication cases in the past, when the fields they now own belonged first to large estates and subsequently became part of production cooperatives.

5.1.4 Transfer of IPM technology

Adoption of several IPM practices is taking place in virtually all community fields, and to a lesser degree in individual plots. The blend and number of IPM measures adopted varies somewhat from zone to zone. Farmers are guided by CARE extensionists through the use of printed training materials, oral presentations, field demonstrations and exercises, and the use of videos.

Farmers have learned the life cycles of both the weevil and potato tuber moth, their relationships with the potato plant, and how, when, and where to find each developmental stage (eggs, larvae, pupae, adults). The thoroughness of this knowledge varies with each individual farmer, and for many it will require frequent reinforcement until this knowledge is thoroughly internalized.

The practices which are more commonly adopted include: night collecting of adult weevils, earthing up (aporque alto), harvesting tubers on a piece of canvas or plastic (cosecha en mantas) to force weevil larva out, the use of live fences, and the use of repellent plants and baculovirus to protect stored potatoes against the potato tuber moth (the latter mainly in the departments of Cajamarca and La Libertad). Also adopted, to a lesser extent, are: soil tillage after harvest, destruction of volunteer potato plants, and the use of trap ditches around potato fields.

Manual weevil removal has become such a popular activity that most farmers have learned to recognize the hours of the night when the weevils are more likely to be active and the relationships between ambient temperature and weevil activity.

Two limitations to the effectiveness of this practice are plot size and plot distance from the farmers' habitation. As plot size increases, the effectiveness of night collecting activities in the removal of weevil populations decreases, as a single family unit cannot keep up with the infestations. In such cases, farmers may rely on a limited insecticide application to complement the weevil collecting practice. Similarly, as a potato field's distance from a farmer's house increases, the cost-effectiveness of this practice decreases, as families are reluctant to travel great distances, often in hilly terrain and under cold and rainy weather for a night collecting session.

The use of live fences is rather more common in the Cajamarca and La Libertad project sites. Barley, oats, and tarwi (*Lupinus* sp.) were commonly selected for the live fences. Although technically not an IPM menu item, the waru waru -- once filled with water -- apparently becomes a formidable barrier for migrating weevils. As a result, weevils are hardly a problem in the waru waru plots of Puno.

The use of *Beauveria* thus far is limited to demonstration exercises conducted under the oversight of CARE extensionists. The fungus is being applied at the rate of 2 kg of formulated product per each square meter assigned to tuber storage, usually in a corner of the farmer's house. It is reported by farmers that its effectiveness is no more than 10-40%, which would allow for a great deal of weevil survival. This technique needs refining, particularly with regard to dosage and humidity requirements, before its use becomes more widespread.

Although MIPANDES farmers commonly express that neighbors tend at first to deride the practice of IPM activities, a great deal of spontaneous IPM adoption appears to be taking place on non-MIPANDES communities, at the own initiative of non-MIPANDES farmers. In some cases, CARE extensionists have taken on their own to extend IPM training to non-MIPANDES communities.

5.2 Project status: expected outputs and implementation process

5.2.1 Project outputs

5.2.1.1 Knowledge of pest life cycle and pest-crop interactions

Pest life cycle training was mostly completed during the first year of project implementation. Farmers' understanding of pest biology and crop-pest relationships ranges from rather superficial to quite detailed. At the very least, most farmers have acquired a working knowledge of the pests' life cycles and are now aware of these processes and their relationship to the application of IPM control techniques. Farmers acknowledge that before being exposed to the MIPANDES training program they did not make the connection between the adult weevils and the presence of larvae in the tubers, which they usually somehow associated with hail storms. It is evident that farmers are appreciative that the project has filled this knowledge gap for them. Farmers seem to be very much aware that it took a great deal of work by CARE extensionists, through the use of videos, pictorial literature, and live field demonstrations, to convince them that larvae and weevils were really two developmental stages of the same species and that the adults could be found feeding on the potato plant at nigh and hidden in the soil in the daytime, mainly unnoticed.

Although farmers were comparatively more familiar with the potato tuber moth life cycle (i.e. it is possible to relate the presence of moths and ensuing tuber infestations in stored potatoes, whereas the link of the Andean potato weevils to their larvae in buried tubers is far less apparent), MIPANDES training activities were instrumental in organizing and consolidating this knowledge in a way that made it clear and acceptable.

5.2.1.2 Safe pesticide use

During its three years of implementation, MIPANDES has provided extensive training to beneficiary farmers on sound pesticide use practices, based on GIFAP's eight "golden rules," which cover various aspects of the safe handling, application, storage, and disposal of pesticides and empty containers. At the time of this evaluation, MIPANDES farmers appear to have not only memorized but also internalized the rules, being able to explain in their own words the various aspects of safe and appropriate pesticide use, including the meaning of color codes, which refer to relative toxicity in product labels.

Although the IPM practices promoted by MIPANDES rely predominantly on nonchemical measures, these do not actually exclude pesticide use. Indeed, insecticides are being applied selectively along the borders of MIPANDES potato fields. In addition, manual night collection of weevils appears to be effective only in small fields. It has been expressed by some farmers that the limit of this practice's effectiveness is about half a hectare. In potato fields larger than that, collecting may not proceed fast enough to suitably clear the fields of weevils, and a limited insecticide application may be necessary as a complementary measure.

5.2.1.3 IPM practices

One of the general features observed by the evaluation team in all MIPANDES communities visited, and in some non-MIPANDES ones as well, was the degree of understanding and adoption of at least some of the practices included in the MIPANDES IPM menu. Usually, there were three to five practices adopted by most farmers. These included: night collecting of weevils by the entire family to reduce populations of the adults before these can breed and lay eggs; earthing-up (aporque alto) to widen the soil barrier that exists between the burrowing Andean potato weevil and potato tuber moth larvae and the growing tubers; harvesting potatoes on a piece of canvas or plastic (cosecha en mantas) to force weevil larva out of infested tubers and destroy them or feed them to chickens; soil tillage to expose buried larvae and pupae to natural enemies and the elements; destruction of volunteer potato plants to destroy one of the sources of weevil infestations; use of baculovirus and repellent plants to protect stored potatoes against the potato tuber moth, mainly in community storage sheds reserved for seed potato; and to a lesser extent, the use of live fences and ditches around potato fields.

5.2.1.4 Centers for the production of biocontrol agents (CEPABs)

As initially conceived, MIPANDES included support for the establishment of eight rural CEPABs that would produce formulated products of a baculovirus for use on the control of the potato tuber moth, *P. operculella*, and the fungus *Beauveria brongniartii*, for control of potato weevil larvae. In early 1995, CARE with USAID approval reduced the number of planned CEPABs from eight to two, one to be located in Collahuasi, Ancash and the other in Chancachi, Puno, without reducing the annual production targets of formulated virus and fungi.

As designed, the CEPAB constitutes a high risk micro-enterprise which, to be sustainable, needs to be provided with the appropriate support in all relevant entrepreneurial, marketing, managerial, technical, and quality assurance areas. So far, the two planned CEPABs are being provided with training for local personnel, infrastructure, equipment, and part of the operating materials. They do not have as yet assured inoculum, quality control support, or the provision of reliable long-term technical assistance. Furthermore, the demand for these microbiological products is not entirely defined.

In addition, there is no registered patent for neither the production process nor for the pathogenic strains, and although there is an established entrepreneurial capacity for implementing a CEPAB in Ancash (ECOMUSA, a community venture), such capacity does not yet exist in Puno. These gaps preclude any kind of registration of the production and commercialization process of the microbiological agents and introduce an element of doubt regarding the sustainability of these micro-enterprises.

In order for the two biocontrol products to be legally marketed in Perú, the following conditions need to be first satisfied: 1) The biocontrol agents must have registered patents. 2) Each CEPAB must have its own Registro Unico del Contribuyente (RUC) and any other legal requirement for their normal operation. 3) Each of the biological products must have a brand registration filed with INDECOPI. 4) Each must also comply

with all legal provisions required by SENASA, including: a) registration of production and packaging, b) registration of the distributor, c) registration of the experimental product, and d) registration of the formulated biological product. It is also required that an individual be registered as the professional in charge of the entire registration process.

In addition, the following recommendations should be considered by CARE as part of its commitment to continue supporting the two CEPABs:

CARE will need to continue providing technical assistance and support to the CEPABs, at least for one full year after they become operational. To the extent possible, these micro-enterprises should remain under CARE management during the first year of operation, before being turned over to the communities.

A few CARE extensionists need to be trained in all aspects of the production and use of the microbiological agents to provide timely guidance to CEPABs when so required, since personnel from qualified laboratories such as CIP's may not be readily available to help solve unexpected problems that may arise during routine operations.

Training and technical assistance should include both production techniques and micro-enterprise management, including organization, legal requirements, administration, and commercialization.

The CEPABs will need working capital, and its workers need to be compensated with a suitable salary.

By virtue of having to function under rural conditions, the CEPABs will need to have adequate quality assurance provided by a qualified laboratory, as well a reliable supply of inoculum.

CARE, with USAID support, needs to invest in all required product and process registrations required by Peruvian law. A qualified specialist should be contracted to design an attractive packaging for these products. It is also advisable to assign funds for their marketing.

5.2.2 Training materials and validation

To achieve its aim of teaching farmers to recognize and manage the two main potato insect pests, MIPANDES designed a rather unique set of farmer-oriented training materials, including videos, brochures, posters, insect display cases, and slide sets. These materials are in general of superior design, content, and quality. Through an extensive participatory process involving farmers and extensionists, MIPANDES has consistently evaluated these materials, revising them in several occasions and culminating in the set that is being used at present. MIPANDES' training aids are rather unique in that they constitute an unusually attractive and informative set of training tools, not usually available to other CARE projects nor to comparable IPM projects implemented in other countries. The timely use of these materials was facilitated by MIPANDES' access to its own audio-visual equipment.

The training materials are held in high regard by farmers and extensionists alike, having generated a significant demand by farmers and rural schools in and outside MIPANDES Project sites for additional posters and brochures, which due to budget constraints were printed and distributed in limited numbers. In a way, such demand has contributed to the absence of "control" communities, totally unaffected by MIPANDES' messages, which could have been used to accurately measure project impact.

In addition to being highly useful as training tools, the attractive qualities of MIPANDES' training materials and pest biology themes had also the unintended effect of eliciting in participating communities a great deal of interest in the overall project from the start. Their use has contributed to the participation and integration of the entire family, both during their evaluation process, as well as during the various training sessions and field days.

The video was found to be especially attractive and highly motivational to farmers. It is recommended that in future IPM training programs, the videos be used first to stimulate interest and serve as an introductory feature for the other training materials and programs. In terms of attractiveness to families, the video ranked first, followed by brochures, posters, and field practices. Some farmers remarked that brochures and posters were essential to reinforce their newly acquired knowledge, as these can be reviewed as often as necessary. It was further expressed that without the printed materials, their single exposure to the videos would have been eventually forgotten.

Part of the acceptance of MIPANDES' training materials and activities was probably due to the involvement of beneficiary families in the lengthy validation of posters. This process offered the opportunity to families to actively offer comments and suggestions regarding poster content and design, causing farmers to become identified with such materials.

Although useful for its initial purposes, the IPM training guidelines used by CIP to train MIPANDES extensionists are still rather limited in content and applicability. To facilitate their use in training other extensionist, such as the ALTURA Project field staff, CARE should consider developing these guidelines into a more systematic and comprehensive IPM training manual addressing mid-level technical and extension staff.

5.2.3 Soundness of project design

There are several valuable and novel characteristics in the design of MIPANDES:

a) It was based on a strategic alliance between two highly complementary and successful institutions, one of which, CIP, brings into the partnership its well-established and prestigious research capacity and the other, CARE, contributes its significant extension network service and close working relationship with client farmers;

b) MIPANDES was not designed as an isolated project, but rather was superimposed on four established host projects, each with its own set of extensionists and client families;

c) It was designed to addresses two major pest problems, recognized as such by farmers, affecting one of the most important Andean food crops;

d) It was based on proven nonchemical IPM techniques, which do not exclude pesticide use, developed and validated over the past 15 years by CIP and, thus, readily available for transfer;

e) It offers IPM technology to farmers in the form of new knowledge regarding pest biology and a menu of pest management options that can be used by them on a selective basis; and

f) New information was presented to farmers in a definite sequence, beginning with the biology and life cycle of key pests during the first year of the project and continuing with IPM practices during the second and third years.

On the down side, there has been a tendency to over-emphasize the importance of CEPABs in the overall performance of the project, especially considering that the production and use of targeted biocontrol agents have not been fully worked out at the rural micro-entrepreneurial level. The project did not address some of the other local pests, such as the potato late blight *Phytophthora infestans* (a fungal disease), nematodes, and minor insect pests, such as *Epitrix* spp. *P. infestans* is a major disease that causes damage to potatoes at a scale often comparable to or exceeding that of the Andean potato weevil.

On the other hand, unlike the weevil, at present there are no readily available nonchemical IPM techniques for late blight management that could be offered in menu form to farmers. Nematodes may also be devastating to potatoes when present in the soil. However their distribution is rather patchy, and the only available nonchemical control practices rely mainly on long-term crop rotation. Nematicide applications are effective but quite expensive and considerably hazardous to applicators.

5.2.3.1 Base-line diagnosis

The base-line diagnosis was carried out during January and February, 1994, as the implementation of MIPANDES was beginning in a few communities. This study did not provide information on socio-economic and political factors in Perú which have significantly influenced the economy of subsistence farmers. For instance, the elimination of agricultural credit, the end of the US Dollar subsidy, and the devaluation of the national currency that took place around this time reduced the ability of the poorer farmers to continue procuring agrochemical inputs, including pesticides.

The base-line diagnosis was intended to support the evaluation of project impacts. Relatively few projects are designed with such a data base, and the existence of one represents an asset in the design of MIPANDES. However, there are built-in impediments that prevent this information from being useful for evaluation purposes. These include: a) lack of statistical analysis that allows for evaluation of the samples; b) overabundance of frequency data and scarcity of quantitative data on crop pest damage; c) incomplete information on pest control costs; and d) scarcity of information on family income and monetary losses due to pest damage.

5.2.3.2 Monitoring system

The variables considered in the base-line study were used to set up a monitoring system for the project. MIPANDES' monitoring system was designed to follow up and register

various changes expected to occur in the way that farmers deal with potato pest problems as a result of project interventions. For instance, changes were anticipated in: a) the identification of the two main pests and in the knowledge of their basic biology; b) understanding and adoption of IPM practices; c) the relative abundance of pest populations; d) the degree of damage inflicted by pests to the potato plant and tuber; and e) the farmers' production costs and income.

The methodology of the monitoring system was straight-forward. Each variable was to be recorded at different times during the crop' life cycle, as well as during the storage of tubers, in order to measure the partial (additive effects of each IPM practice) and total (cumulative effects of the IPM practices) changes that would take place.

However, the monitoring process ran initially into a few difficulties. First, its implementation was delayed until the second year, entirely missing the first planting season. Consequently, extensionists had to go back and collect data from the missing first year. Extensionists and regional representatives were not made aware from the very beginning about its significance or shown, until 1.5 years into the life of the project, how to collect the required data and fill the forms, and why. Thus, the monitoring process was initially seen by those involved as a rather sterile and time-consuming exercise. Also, sampling standards, especially those applying to harvested and stored potatoes, were not well defined from the start, resulting in extensionists applying their own sampling criteria and rendering these data useless for comparison purposes. In addition, no absolute control plots were included in the monitoring process, thus missing the opportunity of comparing results achieved in communities practicing IPM vs. communities not so engaged.

5.2.4 Changes undergone by project during its implementation

The MIPANDES Project experienced relatively few changes during its three years of implementation. During April - September, 1994, the project's logframe was modified to conform with USAID guidelines. During October 94 - March 1995, the targeted 20% reduction in crop losses due to pest damage was itself reduced to 10%. The most significant change experienced by the project during its implementation was the reduction, during this last period, in the number of planned community-managed biocontrol production centers (CEPABs) from the eight originally planned to two, while maintaining the original annual production of biocontrol agents unchanged. This change was precipitated by a Ministry of Agriculture decision to finance a network of SENASA-supported biocontrol production centers, similarly targeting the production of commercial formulations of baculovirus and *Beauveria*, which promised to become a formidable competition for the incipient MIPANDES' CEPABs. As it turned out, the anticipated mass production of biocontrol agent by the SENASA and associated centers is still to materialize. However, in view of the concerns raised by this evaluation team regarding the various requirements that need to be satisfied before the long-term sustainability of the two CEPABs is assured, the decision to limit their number to only two was, in the end, an appropriate one.

5.2.5 Role of women and children

Although no specific targets for women and children are specified in the project's logframe, their participation in MIPANDES activities has been notable and constitutes one of the main achievements of this project. In most communities, the family as a unit has actively participated in the evaluation of training materials; in the various training sessions, field days, and weevil collection contests; and in the adoption of several IPM practices. Many women appear to have become outspoken regarding IPM, pesticide safety, and food quality and safety issues. Exposure to MIPANDES' training sessions appears to have provided some women with the opportunity to openly voice opinions and express themselves in public.

5.2.6 Role of CIP

The contributions of CIP have not only been invaluable but absolutely essential for the conception, design, and successful implementation of the MIPANDES Project. It was CIP's research and validation work since the early 1980s, in collaboration with INIA, which provided the basis for the IPM technology that was promoted by MIPANDES. This work led to the first successful application of IPM measures against the Andean potato weevil in Chincheros, Cuzco in the early 1990s. The availability of this ready-for-transfer technology made it possible for the project to readily fill a major crop protection gap in the project areas. CIP also developed the prototype training materials which were later validated and modified by CARE.

The opportunity to receive training at CIP was highly valued by CARE extensionists, who consider it a prestigious and stimulating experience that helped to strengthen not only their technical knowledge but also their confidence in their ability to function as IPM practitioners. Likewise, the field visits by CIP professionals was also highly appreciated by CARE extensionists. In some occasions, CIP professionals have actually joined CARE extensionists in teaching and demonstrating to farmers aspects of pest biology and IPM practices.

Conversely, MIPANDES has provided CIP the opportunity to become involved in IPM implementation throughout a vast Andean area, contributing to enhancing the cost-effectiveness of CIP's long-term investments in potato IPM research. In addition to its partnership with CARE, CIP has also entered into agreements with various governmental and non-governmental organizations in Perú for the purpose of promoting the spread of this same IPM technology.

CIP contributions to future MIPANDES activities will still be needed for further refining the use of *Beauveria*, within an IPM context, in rural communities; to provide quality assurance support and inoculum to the two planned CEPABs; and to continue to offer guidance and technical assistance to CEPAB personnel and CARE extensionist in all aspects of the production process of both biocontrol agents.

5.2.7 Progress in the establishment of the CEPABs

In early 1995, CARE requested to USAID that the number of planned CEPABs be reduced from eight to two, on the basis of unanticipated competition expected to come from similar planned SENASA operations. USAID acceded to this request. One of the two remaining CEPABs was to be located in Ancash and the other in Puno. At the time of this evaluation, none of the two planned CEPABs was yet fully operational. The physical infrastructures are still being

constructed, under the oversight of civil engineers, and are expected to be completed by the end of the year. Training of future CEPAB operators has been completed, however, and production of biocontrol agents is expected to be underway during early 1997. CARE intends to continue supporting these centers for an undetermined period. Such support should include designing a suitable production and marketing strategy for the biocontrol products. Additional recommendations for CEPAB support are provided in section 5.2.1 4.

5.2.8 Technical expertise in the CEPABs

Although those community members who have been selected and trained to carry out all aspects of CEPAB operation have not actually been able to apply their training as yet, they seem to be knowledgeable of the production process for *Beauveria* and Baculovirus formulations. Performing optimally under actual CEPAB operation conditions will be the final test of their training.

The sustainability of the CEPABs will depend on the timely incorporation of several essential elements needed for their successful operation. Among these are the provision of monitoring and technical assistance by CIP or an equally competent institution; the establishment of a quality assurance system for the biocontrol agents to be produced, ensuring that the biocontrol agents are patented and duly registered as such with SENASA; the provision of operational funding until the CEPABs are able to make a profit and stand on their own, the need to meet all the legal requirements needed to function as independent micro-enterprises, and continuing technical assistance and oversight by CARE in management and marketing.

5.3 Lessons Learned

5.3.1 Problem definition and IPM menu

MIPANDES was clearly designed to help Andean families to resolve a major crop protection problem in the most direct way possible and using tools already available. In this regard, the potato was identified as the most important crop grown by Andean subsistence farmers, and the Andean potato weevil and potato tuber moth as two of the most important potato pests. CIP's past work with potatoes in the Andes had partially focussed on the management of the potato weevil and potato tuber moth, both of which are responsible for severe damage to the potato crop on a regular basis, and thus constitute a major impediment to increasing crop yields.

The IPM technology developed by CIP lent itself to be patterned and presented to farmers in the form of a menu of IPM practices that allowed them to select at will those best suited to their needs, thus contributing to fostering empowerment and decision making capabilities. Furthermore, it had been established that, in the case of the Andean potato weevil, farmers did not really made the connection between the adult and larva stages, thus missing the opportunity to begin controlling this pest at the adult stage, before it had mated and laid eggs. Providing this information to farmers, by itself, represented a significant improvement in their ability to deal with this insect.

The other major pest problem in the area, the potato late blight *P. infestans*, can be as damaging, but unlike the weevil and tuber moth, this disease is not as easily managed, certainly not through a combination of nonchemical practices. Weather induced problems, such as frost,

drought, hail can be at least as damaging as the combined effects of some of these pests, but unlike the latter, there is very little that can be done at this time to attenuate their effect.

5.3.2 Suitability of IPM practices relative to their acceptance and adoption

Experience acquired with the promotion of IPM in developing nations since the 1970s shows that, to be accepted and adopted by farmers, IPM practices need to be practical, effective, not too time consuming, and easily blended into the farmer's regular crop management routine. Most IPM practices offered by MIPANDES, in menu form, have indeed some of these characteristics, and although virtually all require the investment of farmers' time and effort, many have readily been adopted. What is important in this case is that farmers perceive the time and effort trade-off as definitely beneficial, i.e. as leading to a significant reduction in crop damage. As long as farmers continue perceiving definite benefits, they will continue to adopt IPM practices. Likewise, individual practices are not adopted when these prove to be unpractical, such as planting live fences when plots are so small that live fences would take space reserved for potatoes or digging trenches around potato fields in areas with high slopes and/or heavy soils.

5.3.3 Training and extension methodology

The training materials and highly interactive training methods, as a whole, have represented a major achievement in the promotion of IPM under MIPANDES and have led to significant gains beyond those expected from the actual contents of the materials alone. The colorful and attractive design of these materials and their availability have elicited a favorable response in beneficiary families and have contributed to stimulating their interest in learning and experimenting. The videos, in particular, have had the unintended effect of encouraging the participation of the entire family in the training programs. The weevil collecting contests have further stimulated interest in the learning process. Training extensionists at the onset of the project has facilitated, in turn, the training of farmers. The existence of the diffuse light warehouses promoted by CARE has also facilitated the demonstration and adoption of some IPM practices for stored potatoes.

Although teaching pests biology before IPM practices was used as a successful MIPANDES training strategy, in future MIPANDES-related activities, pest biology and IPM training should be undertaken simultaneously to help accelerate the process of IPM adoption. During MIPANDES' first phase, it was first necessary to train CARE extensionist in the basics of IPM and its application to potato production in the Andes. At that time, most of them had little previous exposure to IPM programs. Now, even though their experience is still limited to a single crop-pest system, many CARE extensionists are experienced IPM practitioners as well, and should be able to continue acting in this capacity indefinitely, as long as they continue to receive additional IPM training on a regular basis. A three day workshop in selected IPM topics, once a year, and occasional field visits by IPM specialists should provide the additional knowledge and stimulus needed by CARE extensionist engaged in IPM activities to continue performing adequately in this area.

5.3.4 Advantages and disadvantages of integrating MIPANDES with other CARE projects

By addressing key crop protection problems, perceived as critical by beneficiary families and extensionists alike, MIPANDES has filled an important gap in the implementation of its host projects, complementing CARE's interventions which address crop production household livelihood security, and community organization issues. This is but one major advantage of integrating MIPANDES with existing host projects. Without the benefit of existing, well-established host projects, an IPM project conceived in isolation would have required considerably more funding and still would be hard pressed to drive its messages across. Through its previous investments in the project area CARE became familiar with its people and their needs, its geography, and agricultural problems. MIPANDES offered practical solutions to a major cause of potato yield losses and training materials and methods that were perceived as alluring by most farmers. With a well established client farmer population, extension network, and complementary programs, MIPANDES fitted naturally as another essential element in all CARE host projects, and under this arrangement was considerably less costly to implement.

The disadvantages of designing MIPANDES as an organized set of new activities that rested on existing CARE projects are few and relatively unimportant when compared to the advantages of so doing. CARE extensionists, already fully engaged in other project activities, had to assume a new role and undertake new responsibilities, which added to their work load. Among the MIPANDES activities, the monitoring process was seen by extensionists as particularly frustrating, at first. On the other hand, the unexpected interest generated by MIPANDES' subjects was so high that it may have actually led to less attention being paid, proportionally, to other CARE project activities for a while.

5.3.5 Advantages and disadvantages of the CARE-CIP partnership

The advantage of the CARE-CIP strategic alliance vastly overshadow the disadvantages inherent to such partnerships. Both institutions brought into the partnership their complementary strengths, which under MIPANDES were channelled towards a common aim. The result was a project that neither institution would have been able to fully implement by itself, since in each case there would have been a major element missing: extension capabilities in the case of CIP and technical expertise, in the case of CARE. By bringing IPM technology to over 3,500 Andean families, MIPANDES has contributed to the cost-effectiveness of CIP's long-term IPM research activities.

The few disadvantages are somewhat predictable and are associated mainly with CIP's limited capacity to become too involved with work in any one country. As a major international research center in the CGIAR system, CIP has well defined research objectives and world-wide commitments. Although Perú is the host country where CIP's headquarters are located, this center is not expected to devote more than a proportional portion of its efforts to national projects, as CIP staff must respond to requests for assistance and be engaged in research activities in many countries. Its very nature precludes CIP from being on call to provide unlimited assistance to a project such as MIPANDES. Similarly, at this point, and after over 15 years of potato IPM research, it is unclear to what extent is CIP prepared to further pursue this line of work, especially if

CIP perceives such work as approaching the point of diminishing returns for the invested effort.

An informal CARE-CIP partnership continues even after MIPANDES has ended. CARE should make an effort to maintain this strategic alliance with CIP in order to continue implementing joint activities as opportunities are identified to further help improve subsistence-level potato production in Perú. The agreement could be fine-tuned to better conform to the interests and needs of the respective institutions.

5.3.6 Relevant criteria for training extensionists in IPM

To be effective as bearers of IPM technology, extensionists must be first thoroughly convinced that IPM indeed works and that it is not a fad but technology based on several decades of intense research and implementation carried out in both industrialized and developing countries. Workers trained in green revolution-style approaches may have trouble understanding and accepting basic IPM principles, and may require additional training. It is highly desirable that IPM training is extended beyond the specific crop-pest relationships that apply to MIPANDES and should combine broad IPM principles, as well as practical, field-oriented pest identification and management knowledge relevant to the dominant cropping systems in the areas where extensionists are located. The extensionists should be able to provide technical assistance in crop protection and help farmers to solve the more common pest problems affecting not only potatoes but other major crops grown. Initial training should last a minimum of 2-3 weeks, and most of it should be conducted in the field, during the various stages of the growing season. Further training will enhance the prestige of extensionist and their ability to continue additional knowledge and problem-solving tools to host communities.

5.3.7 Appropriateness of including pesticide management training in an IPM program and the relative importance of biocontrol in a nonchemical IPM menu

5.3.7.1 Pesticide management and IPM

To begin with, pesticide use (chemical control) is one of the tactics available to the IPM approach. Chemical control may or may not be included in a given program, depending on a wide range of circumstances. Under subsistence agriculture, for instance, pesticides are seldom used. However, CARE's beneficiary farmers regularly need to apply fungicides for the control the late blight, *P. infestans*, sometimes as much as eight applications per season. Some of the more common fungicides being used in project areas include: Ridomil® (metalaxyl), Dithane® (mancozeb), Antracol® (propineb). Manzate® and Polyram® (dithiocarbamates), and Cupravit® (copper oxychloride). They also apply insecticides, but far less often, no more than two or three applications per season. Often, farmers attempt to save money by applying them in less-than recommended doses, thus neutralizing the effectiveness of the application.

An IPM program may draw from a variety of pest control techniques, as necessary. However, IPM does not require predetermined numbers or combinations of techniques, nor is the inclusion of any one technique required for IPM implementation. Thus, an IPM program may or may not require chemical control actions. Often, the IPM strategy

maximizes the effectiveness of traditional and introduced nonchemical control techniques, in the least ecologically-disruptive manner One common denominator to most mature IPM programs is the protection and encouragement of naturally-occurring biocontrol agents (natural enemies), such as by carefully adjusting the chemical control component.

On the other hand, when dealing with crops which are already being treated with pesticides, IPM should aim first at reducing the number of pesticide applications through the introduction of appropriate action thresholds, while promoting rational pesticide management practices and shifting to less toxic and more selective products and nonchemical control methods. Either way, an IPM program should emphasize preventive measures and interfere as little as possible with the crop production process.

As long as farmers are already applying pesticides, it is not only convenient but essential to include rational pesticide management training in an IPM program such as MIPANDES. Without such training, farmers would have to rely exclusively on pesticide vendors and each other for information on all aspects of pesticide use, including safety practices. Public sector extensionists seldom reach these remote communities.

It has been established that in the past, MIPANDES farmers have used some of the more toxic insecticides in the market, such as aldrin, Furadan® (carbofuran), Folidol® (methyl parathion), metasystox, Tamaron® (methamidophos), and BHC. Some farmers affirm to have witnessed or experienced, in the past, mild cases of organophosphate-carbamate intoxication. In MIPANDES communities, less toxic products, such as Sevin® (carbaryl), Belmark® (fenvalerate), Alsystin® (triflumuron), Orthene® (acephate), Oncol® (benfuracarb), Force® (tefluthrin), Decis® (deltamethrin), Ambush® (permethrin), and Ripcord® (cypermethrin), are having limited use in project fields at present. These are often applied to control chrysomelid beetles (*Epitrix*, *Diabrotica*), blister beetles (*Epicauta*), thrips, and cutworms (*Feltia*), as well as adult Andean potato weevils.

However, after the CARE presence is over, farmers could revert back to using some of the more toxic products, if these are cheaper than less toxic ones or are the only ones available in the market. The safe pesticide use training provided by CARE will then be the only barrier left standing between farmers and potential pesticide misuse. Farmers may choose not to buy red or yellow label products, as these will evoke images of high toxicity and health risks. But even if they elect to buy toxic products, their past training may enable them to treat and use these pesticides with great care, avoiding potentially adverse health and environmental impacts that otherwise would have been unavoidable without such training.

5.3.7.2 Biological control and IPM

As mentioned in the previous section, the biological control component is considered essential to most IPM programs directed at insect pests. Biological control refers to the action of natural enemies (predators, parasitoids, parasites, and pathogens) to help keep pest populations in relative balance, and ideally from reaching damaging levels.

Traditionally, IPM has targeted predominantly insect pests and has achieved its greater triumphs with such organisms. IPM for plant diseases and nematodes is less advanced

Under *classical* biological control, one or a few natural enemies are introduced into a region in an attempt to control a single pest, itself usually an invader from other regions A recent example of a highly successful classical biological control program is provided by the control of the cassava mealybug, *Phenacoccus manihoti* in Africa through the successful introduction of the parasitic wasp, *Epidinocarsis lopezi*.

Within an IPM context, biological control refers mainly to the combined action of naturally-occurring natural enemies in any one agroecosystem. The predatory action of carabid beetles on Andean potato weevil eggs and burrowing larvae would be an element of naturally-occurring biological control in potato fields. Thus, IPM aims at protecting and fostering existing natural enemies, often through actions such as minimizing the intensity of pesticide use, replacing wide-spectrum pesticides with more selective products, and applying these products in a way that is least disruptive to natural enemies. The intent is to maximize their chances of survival and contribution to the natural mortality of target pests.

Periodic inoculations with the parasitoid *Copidosoma koehleri*, for instance (once it has been demonstrated that it is an effective parasitoid of tuber moth larvae in project areas) would be an example of manipulating a natural enemy, a bonafide biocontrol tactic, to increase the mortality of a pest species. This, however, would not necessarily be a biocontrol tactic espoused by MIPANDES at this time.

The use of baculovirus and *Beauveria* under MIPANDES has a definite role compatible with the overall IPM approach. The use of baculovirus for *P. operculella* control, in particular, appears to be yielding excellent results on stored potatoes. The effectiveness of *Beauveria* as a reliable control tactic applied against weevil larvae is still somewhat uncertain, and requires refinement in its production and application techniques. Once proven effective, it could be another valuable tool in the IPM arsenal. However, although the baculovirus is proving to be useful, the effectiveness of *Beauveria* under rural conditions is still uncertain. The IPM program for the Andean potato weevil can readily be implemented without including *Beauveria* applications, as the potential use of this fungus still amounts to one element among fourteen in MIPANDES' IPM menu.

The use of pheromone traps to capture adults of potato tuber moth is, technically, not a biocontrol tactic but belongs to the realm of ethological (behavioral) control tactics.

5.4 Future Considerations

5.4.1 Project sustainability

MIPANDES has been highly successful in achieving most of its stated aims. Its training materials and methods have proven to be remarkably effective in teaching farmers about key pest relationships previously unknown to them and in convincing them about the rationale for adopting the IPM practices espoused by the project. MIPANDES' IPM menu offers a wide selection of practices that farmers can use to reduce populations of Andean potato weevil and

potato tuber moth. Lastly, MIPANDES' pesticide management training has introduced fresh information and a new sensitivity about pesticide use risks, which has reinforced farmers' overall knowledge of these chemicals and improved their ability to make rational decisions regarding their purchase and use.

Although the project has made remarkable gains in only three years, to consolidate such gains and further ensure that MIPANDES' efforts remain sustainable over extended periods, it is advisable that the beneficiary families receive additional assistance and support for at least 2-3 additional years. Three years is hardly sufficient to make allowances for the effects of a wide range of variables, such as weather, price fluctuations, and other pest problems, on Andean potato weevil and potato tuber moth attacks and the outcome of IPM adoption. The short duration of the project is further aggravated by the fact that transfer of IPM practices did not begin until the second year. A continuation of project activities would also allow for a more accurate measurement of project impacts.

CARE intends to continue supporting some of the ongoing IPM activities, including the two planned CEPABs, as long as there is a project presence in place. However, as former MIPANDES host projects come to an end, IPM activities will inevitably also end. For instance, it is anticipated that in 1997 Cajamarca will lose some 20 communities (about 600 families), while the MESA Project in Puno may lose some 24 communities (about 960 families). CARE will continue, to the extent possible, providing support to those communities which are no longer under CARE guidance.

CARE should ensure the sustainability of MIPANDES by further intensifying IPM in its present target areas, especially in those which have received MIPANDES support during two years or less. It is desirable that MIPANDES continues with the intensification process, while it explores ways to further extend its IPM technology to a wider population.

5.4.2 Opportunities for expansion of IPM technology

During fiscal year 1996-97, expansion of the MIPANDES experience will be carried out by CARE in collaboration with PRONAMACHCS under the ALTURA Project. Through this project, it is anticipated that about 10,000 rural families in nine departments will be reached. To this end, approximately 100 or so PRONAMACHCS extensionists will be extensively trained and supervised by CARE staff. In addition, CARE will seek to establish similar partnerships with local NGOs. The MIPANDES training materials will be reproduced and distributed as needed in support of this effort.

Ideally, given time and suitable conditions, the spread of IPM technology should occur spontaneously. Although much of the IPM menu promoted by MIPANDES is being successfully adopted in project areas, and now will be spread to new areas, it still would be highly desirable that CARE has the opportunity to consolidate its IPM experiences by continuing to implement present project activities for another 2-3 years. CARE should, during the intensification stage, systematize the MIPANDES experience, lessons learned, training and extension materials, monitoring system, group management, and interactions with farmers to further optimize the chances of adoption at the diffusion stage.

Rural schools offer another opportunity for large-scale dissemination of IPM technology. The MIPANDES experience shows that children, in particular, are immediately attracted to the project's subject matter. Children readily join the rest of the family in night collecting activities and enthusiastically participate in weevil collecting contests, their catches often matching or even exceeding those of the adults. CARE should consider modifying its training materials for use at the grade school level and distributing them to rural school centers. The the impact of such approach would need to be monitored and evaluated.

CARE is at present positioning itself to further extend this technology to other NGOs and governmental organizations. CARE should indeed seek to interact with NGOs and public sector institutions having both extension capabilities and interest in transferring IPM technology. The one year project with PRONAMACHS under the ANDES Project should provide valuable experience on large scale IPM dissemination. During the course of the MIPANDES Project implementation, CARE had the unique opportunity to acquire a special kind of expertise seldom available to NGOs. CARE should take advantage of this newly acquired capability to provide training and guidance to governmental and non-governmental institutions interested in implementing similar IPM activities. CARE should also consider extending this technology to other Andean countries sharing similar pest problems.

5.4.3 New challenges for CARE

Some of the new challenges facing CARE in the areas of IPM intensification and dissemination were addressed in the previous section. Future MIPANDES activities may be also designed to tackle additional pest problems affecting subsistence-level potato production. For instance, although the project provides control guidelines for one of the two potato tuber moths in the project areas, *P. operculella*, it does not effectively address the management of the other moth, *Symmetrischema* sp.

Another severe pest problem affecting potatoes in the project areas is the late blight, *Phytophthora infestans*. At present, there are few control measures available against the late blight, other than using resistant varieties and fungicide applications. However, CIP may be able to validate a simple set of IPM recommendations, which although not as elaborated as that assembled for the Andean potato weevil, could provide guidelines to CARE extensionists, who in turn need to provide crop protection guidance to farmers.

The two planned CEPABS will need additional support in the promotion of the use of biocontrol agents, beyond the "captive" market anticipated under MIPANDES. Their present annual production target of 4.8 tons of baculovirus is well below the amount needed to protect 16,000 tons of potatoes in the project area, which will require 16 metric tons (16,000 bags) annually.

The CARE-PRONAMACHCS agreement will pose an uncommon challenge for CARE, in that although CARE will be providing the IPM training and technical guidance, it will not have administrative control of PRONAMACHCS field staff.

As future MIPANDES activities are implemented and pest damage decreases, beneficiary families may begin profiting from increasing amounts of higher quality surplus potatoes. In this regard, MIPANDES could be seen as the first stage in a process that would lead to the development of commercialization and/or transformation of potatoes, as a significant surplus is

generated and maintained. As such, this process fits well with CARE's stated aim to train farmer groups in production and marketing techniques, ensuring the rational management of their resource base. This strategy would allow farmers not only to meet their own food consumption needs, but also to generate marketable surpluses to increase family income.

To the extent possible, the relative impact of individual IPM practices in the menu should be recorded and quantified in each of the implementation zones. To accelerate the adoption process, the training and extension strategy should be modified to include both IPM and life cycle from the beginning. The video has proven to be a powerful training and promotional tool, and should be used during the early stages of new training programs.

CARE should also consider including other crops, such as quinua, cañihua, oca, barley, and maize in its future IPM interventions. In some areas, livestock (alpacas, sheep, and cattle) are also of prime importance to farmers. Livestock are also attacked by pest organisms, such as scabies, which may cause weight loss and even death.

5.4.4 Strategic alliances between CARE and CIP or other institutions in relation to IPM implementation

The strategic alliance between CARE and CIP has proven to be both highly valuable and effective in furthering the aim, shared by both institutions, of helping subsistence farmers in project areas to reduce pest damage which adversely affect their already sub-standard potato crop yields. It is evident that without such alliance neither of these two institutions, would have been able by itself to bring about the results that their combined efforts were able to achieve. To the extent possible, CIP and CARE should make an effort to maintain this strategic alliance, in some form, in order to continue implementing joint activities as opportunities are identified to further help improve subsistence-level potato production in Perú. Their agreement could be fine-tuned to better conform to the interests and needs of the respective institutions.

6.0 Recommendations

The field portion of the final evaluation of the MIPANDES Project was carried out during November 18 - December 3, 1996 by a team of four evaluators. The team visited each of the four main project implementation areas in the departments of Cajamarca, La Libertad, Ancash, and Puno. The evaluation was based on reviews of project documents and records, field visits, interviews with farmers and extensionists, and a final survey of farmers carried out by CARE extensionists, using a survey instrument generated by the evaluation team.

The project was found to have met or exceeded most of its targeted objectives, as specified in the project's logframe. Indeed, for such a short-lived project, MIPANDES has in many ways surpassed expectations as to its consequences and impacts in target communities. The only area where the project failed to meet its objectives is in the implementation of the two planned CEPABs.

The principal recommendations of this evaluation, most of which are associated with future MIPANDES-related activities, are listed below.

- CARE should have the opportunity to consolidate its IPM experiences by continuing to implement current project strategies and activities for another 2-3 years, under a MIPANDES II In this regard, CARE should ensure the sustainability of this project by further intensifying IPM in its present target areas. It is desirable that CARE pursues this intensification process, while it continues to explores ways to further extend its IPM technology to a wider population.

- CARE is now in a position to collaborate with and provide guidance to local NGOs and public sector institutions having both extension capabilities and interest in transferring IPM technology. CARE should employ its newly acquired IPM capability in providing training and guidance to governmental and non-governmental institutions interested in implementing similar IPM activities.

- CARE should make an effort to maintain its strategic alliance with CIP in order to continue implementing joint activities as opportunities are identified to further help improve subsistence-level potato production in Perú. The agreement could be fine-tuned to better conform to the interests and needs of the respective institutions. If such alliance is no longer possible, CARE should consider establishing a partnership with a research institution, such as INIA, or a suitable university.

- CARE should consider including other crops, such as quinua, cañihua, oca, barley, and maize in its future IPM interventions.

- CARE should consider adjusting its existing training materials for use at the grade school level and offering them for distribution to rural school centers. If CARE opts for this approach, its impact will need to be monitored and evaluated.

- In future IPM training programs, the videos should be used first to stimulate interest and serve as an introductory feature for the other training materials and programs.

- CARE should, during the intensification stage, systematize the MIPANDES experience, lessons learned, training and extension materials, monitoring system, group management, and interactions with farmers to further optimize the chances of adoption at the diffusion stage.

- MIPANDES' base line diagnosis and monitoring system are essential tools for development projects, since they are designed to document achievements and provide discipline and guidance to project activities. These elements need to be strengthened in any future MIPANDES actions, particularly when operating at the pilot level, ensuring that the extension staff is made aware of their aims and applications and revising them on a regular basis until they become practical and useful tools.

- CARE extensionists who continue to be engaged in IPM activities should receive pertinent additional training. A three day workshop in selected IPM topics, once a year, and occasional field visits by IPM specialists would provide the added knowledge and stimulus needed by extensionist to continue performing adequately in this area.

- To further enhance its usefulness and applicability, CARE should make an effort to develop the IPM training guidelines initially compiled by CIP to train field-level extensionists into a more systematic and comprehensive IPM training manual.

The following recommendations apply to the support needed by the two CEPABs:

- CARE needs to continue providing technical assistance and support to the CEPABs, at least for one full year after these become operational. To the extent possible, these micro-enterprises should remain initially under CARE management and be turned over to the communities by the end of the first year of operation.

- CARE needs to invest in all required product and process registrations required by Peruvian law, as outlined in section 5.2.1.4. A qualified specialist should be contracted to design an attractive packaging for these products, and funds need to be assigned for their marketing. The CEPABs will need working capital, and its workers need to be compensated with a suitable salary.

- A few CARE extensionists need to be trained in all aspects of the production and use of the microbiological agents to provide timely guidance to CEPABs when so required, since personnel from qualified laboratories such as CIP's may not be readily available to help solve unexpected problems that are likely to arise during routine operations.

- Training and technical assistance should include both production techniques and micro-enterprise management, including organization, legal requirements, administration, and commercialization.

- By virtue of having to function under rural conditions, the CEPABs need to have adequate quality assurance provided by a qualified laboratory, as well as a reliable supply of inoculum.

- CARE should also consider promoting the use of Baculovirus not only on seed potato, but also on tubers destined for human consumption.

- The application of *Beauveria* for control of Andean potato weevil larvae under rural community conditions needs refining, particularly with regard to dosage and humidity requirements, before its use becomes more widespread.

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ANEXO 1

TÉRMINOS DE REFERENCIA (TOR)

EVALUACIÓN FINAL

PROYECTO MANEJO INTEGRADO DE PLAGAS PARA COMUNIDADES ANDINAS (MIPANDES)

CARE-Peru	Proyecto Manejo Integrado de Plagas para Comunidades Andinas (MIPANDES)
Persona Contacto:	Francesco Boeren, Gerente ARN
Ciclo de Financiamiento del Proyecto	Octubre 1993-Setiembre 1996
Financiamiento	USAID, CARE-USA

I. INTRODUCCIÓN

La propuesta metodológica para la evaluación final de MIPANDES se basa en la estrategia del Proyecto que ha planificado iniciar su implementación con actividades de educación sobre la identificación y el ciclo de vida de las plagas, acompañadas por la capacitación en el uso adecuado de plaguicidas. La introducción de prácticas de MIP así como el inicio de implementación de los Centros Comunales de Producción de Agentes de Control Biológico (CEPABs) se planificaron para el segundo año de intervenciones. En función de esta planificación, se planteó, como estrategia de evaluación, que la de medio camino se concentre en medir los conocimientos de los agricultores sobre las plagas, los plaguicidas y el MIP, las actitudes de los miembros de la comunidad sobre las plagas, los plaguicidas y el MIP, y la adopción de algunas prácticas de uso seguro de plaguicidas. La evaluación final del Proyecto deberá concentrarse en medir la adopción de prácticas de MIP y de uso seguro de plaguicidas, actitudes sobre plaguicidas y plagas y el logro de los objetivos del Proyecto. Adicionalmente, se desea que la evaluación final identifique las lecciones aprendidas que permitan retroalimentar similares experiencias a futuro.

II. ANTECEDENTES GENERALES

A. CARE

Desde mediados de los ochenta, CARE, a través de sus Proyectos de Agricultura y Recursos Naturales, ha contribuido a solucionar muchos de los problemas que afectan a la agricultura del Perú: bajos rendimientos, desastres climáticos, ausencia de crédito rural y de conocimiento técnico a nivel de los agricultores pequeños y medianos. CARE ha estado involucrado en el trabajo de alivio de emergencias y en actividades de

desarrollo en el Perú desde su respuesta al mundialmente conocido terremoto de 1970 en Huaraz, que sepultó a una ciudad entera en materia de segundos.

Los esfuerzos de desarrollo de CARE-Perú están agrupados en cuatro principales sectores: Agricultura y Recursos Naturales; Salud y Población; Apoyo Alimentario y Nutrición; y Desarrollo de Pequeñas Actividades Económicas. En la actualidad, CARE-Perú opera en 14 sub-sedes, además de la sede principal de Lima, y cerca de 500 miembros nacionales del personal. La misión implementa actualmente 20 proyectos en los cuatro sectores programáticos y tiene un presupuesto para el AF 1997 de $19 millones, el tercero mayor de las casi 60 oficinas de CARE en el mundo.

A nivel mundial, CARE trabaja en estrecha cooperación con agricultores individuales o cooperativizados, con comunidades, con organizaciones no gubernamentales (ONGs) locales, y con ministerios de agricultura de 50 países para ayudar a los pobres a manejar sus escasos recursos y de esta manera mejorar su estándar de vida. Durante los últimos cinco años, CARE ha tenido como objetivo la reducción del uso de plaguicidas como contribución importante a la sostenibilidad de la producción agrícola. CARE fue la primera agencia no gubernamental de desarrollo en adoptar una Política de Plaguicidas y tiene un programa altamente exitoso de MIP en Nicaragua, en donde se ha reducido el uso de plaguicidas entre los agricultores participantes en un 84%. Ambos sirven como modelos para otras agencias internacionales y organizaciones no-gubernamentales. Asimismo, en Sri Lanka, Bangladesh y en Centro América, se están revisando proyectos que expandirán vastamente el trabajo de CARE en MIP.

B. PERU

La región montañosa andina peruana ha sido tradicionalmente descuidada ya que el desarrollo del Perú se ha centrado alrededor de Lima y la región costera, más poblada. La gran mayoría de los pequeños agricultores utilizan tecnologías tradicionales que son adecuadas para su subsistencia, pero resultan limitadas cuando se apunta hacia un incremento sostenido de la producción. El cultivo de la papa, que es uno de los principales cultivos alimenticios para altitudes que van de 1,000 a 4,200 metros, es crucial para la supervivencia de las comunidades andinas de subsistencia. Los rendimientos de papa en los Andes -- lugar de origen de la papa -- están entre los más bajos del mundo. Esta baja productividad es el resultado combinado de condiciones climáticas adversas, baja calidad genética de la semilla del tubérculo, falta de capital para comprar fertilizantes, y perdidas significativas de producción causadas por enfermedades fungosas y plagas insectiles. Esta situación coloca al campesino andino en el fondo de la escala de pobreza del Perú; de acuerdo a las estadísticas, el 47% de esta población no es capaz de satisfacer sus requerimientos mínimos de alimento.

III. ANTECEDENTES DEL PROYECTO A SER EVALUADO

Un problema significativo para los pequeños productores de papa de la Sierra y el Altiplano peruano, es la creciente pérdida de producción causada por el ataque de las plagas insectiles al cultivo, así como el creciente gasto en plaguicidas que los productores deben realizar para controlarlas. Entre las plagas insectiles más perjudiciales a la papa se encuentran el gorgojo de los Andes (Premnotrypes latithorax, P. sutiricallus y P.vorax) y la polilla de la papa (Phthorimaea operculella,

Symmetrischema plaesiosema y Eurysaca melanocampta), las cuales causan pérdidas en producción entre 40 y 60% de la cosecha . El Centro Internacional de la Papa (CIP) ha conducido, por muchos años, investigaciones a nivel de laboratorio, invernadero y campo sobre las dos plagas principales que afectan este cultivo, y ha generado tecnologías que ya se encuentran listas para ser transferidas a los agricultores andinos.

El Proyecto de Manejo Integrado de Plagas para Comunidades Andinas (MIPANDES), iniciado en Setiembre 1993 en los departamentos de Cajamarca, La Libertad, Ancash, y Puno, se ha basado en más de 15 años de experiencia técnica de campo en las áreas de agricultura y recursos naturales por parte de CARE-Perú, y en los 8 años de diligente investigación en MIP de la papa por parte del CIP.

El Objetivo Final del Proyecto es que, para 1996, 3,500 familias que actualmente viven a niveles de subsistencia en 117 comunidades serranas del Perú hayan incrementado su disponibilidad de alimentos y su ingreso familiar a través de una reducción sustancial de las pérdidas físicas y monetarias causadas por el gorgojo de los Andes y la polilla de la papa.

El proyecto MIPANDES ha trabajado con grupos organizados de pequeños agricultores del sector campesino, con los **Objetivos Intermedios** de:

- Capacitarlos en la identificación de plagas y en los aspectos biológicos más importantes, tales como el ciclo de vida de las plagas insectiles claves del cultivo de papa;

- Promover cambios de actitud y adopción de prácticas de reducción y uso seguro de los plaguicidas;

- Introducir las prácticas de manejo integrado de plagas, enfatizando la promoción de medios no químicos de control de las plagas agrícolas; y

- Establecer Centros de Producción de Agentes de Control Biológico (CEPAB) de las plagas agrícolas, manejados por las propias comunidades.

Las principales estrategias del proyecto para lograr sus objetivos fueron:

1. La educación de las comunidades campesinas en los aspectos biológicos relevantes para una comprensión de la dinámica poblacional de las plagas y de sus ciclos de vida, y las consecuencias de ello para afrontar su control.

2. La capacitación de las comunidades objetivo del Proyecto en el uso adecuado de los plaguicidas agrícolas, incluyendo los aspectos de selección, manipuleo, aplicación, protección individual, almacenamiento, primeros auxilios, etc.

3. La extensión dirigida a introducir el concepto de Manejo Integrado de Plagas en las comunidades participantes, de 4 proyectos andinos de CARE, a través de la oferta de un "menú" de prácticas de MIP opcionales (prácticas de control integrado

desarrolladas por el CIP), lo cual a su vez implica el desarrollo de una mayor capacidad decisoria por parte del agricultor en su enfrentamiento con las plagas.

4. La promoción de la organización comunitaria para el manejo de los centros de producción de agentes de control biológico, para asegurar la difusión y sostenibilidad de una de las prácticas no-químicas - el control biológico - como opción accesible para un gran número de agricultores.

Cuatro de los proyectos multi-anuales del Sector de Agricultura y Recursos Naturales de CARE -- que constituyeron la población objetivo para el Proyecto MIPANDES -- implementan actividades dirigidas a mejorar la infraestructura agrícola clave, la producción animal, y las técnicas de cultivo. Estos proyectos son: el Proyecto Norandino de Desarrollo Agrícola (ANDES) en Cajamarca y La Libertad; el proyecto CHAVIN en Ancash; y los Proyectos Waru Waru y de Manejo y Estrategias Para la Seguridad (MESA) en Puno. MIPANDES se implementó en forma traslapada con estos cuatro Proyectos de CARE.

En el Proyecto MIPANDES se intentó que los grupos de pequeños agricultores garantizaran una significativa participación y manejo de las actividades del proyecto por parte de las mujeres. Se ha buscado que las responsabilidades tradicionales de las mujeres rurales en la selección y almacenamiento de semilla, así como su participación global en la campaña de cultivo tengan un papel importante. Adicionalmente, se ha buscado que las mujeres asuman un rol principal en la producción de agentes biológicos de control de plagas. Este énfasis en las mujeres es especialmente importante ya que, debido a la migración de los varones a las ciudades en busca de trabajo, más y más viviendas rurales están siendo encabezadas por mujeres.

El proyecto MIPANDES inició sus actividades con la firma del convenio de cooperación entre la AID y CARE en Setiembre de 1993. Adicionalmente, se suscribió un convenio de cooperación entre CARE y CIP, a fin de complementar las destrezas de ambas instituciones en la implementación del proyecto: La primera como institución de amplia experiencia en asistencia técnica y extensión, y la segunda como prestigiosa entidad internacional generadora de tecnología de vanguardia.

IV. OBJETIVOS DE LA EVALUACIÓN

El propósito de la evaluación final del Proyecto MIPANDES es brindar información clave sobre los impactos o logros del proyecto, e identificar las principales lecciones aprendidas que permitan mejorar o retroalimentar proyectos similares, orientando la toma de decisiones por parte de las instituciones participantes.

Los objetivos de la evaluación final son:

a) Evaluar los impactos del proyecto en los planos: Tecnológico (conocimiientos y adopción de prácticas); medio ambiental y biológico; y en lo socio-económico.

b) Determinar el cumplimiento de metas en relación a los Objetivos Intemedios y Final del proyecto, así como evaluar el proceso de implementación.

c) Identificar las lecciones aprendidas para el diseño, implementación, generación de materiales de capacitación, y servicios de extensión.

d) Recomendar proyecciones a futuro en términos de: difusión, sostenibilidad, nuevos retos, investigación aplicada, y alianzas estratégicas.

V. TEMAS DE LA EVALUACION

a) Impactos/ resultados

- El impacto directo que el Proyecto MIPANDES ha tenido sobre la seguridad alimentaria y el ingreso de las familias campesinas participantes, através de la reducción de pérdidas y del gasto en el control de las plagas. En este sentido será importante utilizar como referencias el estudio de base y comunidades testigo.

- El impacto del proyecto en la participación de las mujeres y niños, tanto en las labores de sensibilización y difusión de conocimientos y prácticas, como en aspectos de salud .

- El impacto indirecto que el Proyecto MIPANDES ha tenido en disminuir los problemas de salud de las familias participantes causados por intoxicaciones con plaguicidas y en la reducción de la contaminación ambiental a nivel de finca y comunidad, resultante de un uso racional y discriminado de plaguicidas.

- Los resultados de la transferencia de tecnología, en cuanto a conocimientos, actitudes y prácticas, en los temas impartidos por el proyecto (ciclo de vida de las plagas, uso seguro de pesticidas, prácticas no-químicas de control y uso de agentes de control biológico).

b) Cumplimiento de metas y el proceso de implementación:

- Las metas logradas en función de lo programado, y en relación al cumplimiento de los objetivos final e intermedios del proyecto: a) conocimientos biológicos y actitud en relación a las plagas; b) actitud con respecto a los plaguicidas y las prácticas adoptadas para su uso adecuado; c) actitudes con respecto al MIP y prácticas adoptadas; d) funcionamiento de los CEPAB; todos ellos en comparación con la información disponible en el Estudio de Base realizado al inicio de actividades y con relación a las comunidades testigos no intervenidas

- Evaluar la producción de material didáctico, su valor de uso y los procesos de validación seguidos.

- Revisar y discutir la lógica del diseño original del Proyecto y su relevancia para los resultados finales del Proyecto. En relación a este aspecto, discutir el alcance del Estudio de Base y del Sistema de Monitoreo.

- Revisar y documentar los cambios ocurridos durante la implementación del Proyecto desde el momento de su concepción (Documento Propuesta y Plan Operativo Multianual

- Evaluar la participación de la mujer y niños en las actividades del Proyecto

- Evaluar la contribución del CIP al Proyecto, tanto en los aspectos de capacitación como de asistencia técnica; sistematizar las lecciones aprendidas, desde el punto de vista de CARE, sobre consorcios con centros de investigación para la ejecución de proyectos.

- Evaluar los avances en la instalación de Centros de Producción de Agentes de Control Biológico, principalmente revisando y discutiendo, no sólo los aspectos técnicos del proceso de producción, sino también los gerenciales y de mercadeo.

- Evaluar el nivel técnico de los integrantes de las comunidades que manejan los CEPABs y la sostenibilidad técnica independiente de los Centros; recomendar sobre la necesidad de continuar con asistencia técnica esporádica a los Centros por parte de CARE o CIP.

c) Lecciones aprendidas

Identificar y discutir las principales lecciones aprendidas en cuanto a la implementación de MIPANDES:

-la definición de los problemas a enfrentar y el menú tecnológico.

- las características deseables de las prácticas para que sean sostenibles y accesibles.

-la metodología de extensión y capacitación.

-las ventajas y desventajas de integrar el proyecto con otros proyectos de desarrollo agrícola de CARE.

- las ventajas y desventajas para CARE de asociarse con organismos de investigación, tales como el CIP, para ejecutar este tipo de proyectos.

- las consideraciones a tomar en cuenta para la preparación de extensionistas en un plan MIP.

- la pertinencia de incluir temas de uso seguro de plaguicidas en un programa de MIP; y la mayor o menor importancia que pueda conferirse a los controles biológicos dentro de un menú de prácticas no químicas.

d) Futuro

-Analizar la sostenibilidad de las intervenciones del Proyecto al futuro y dar recomendaciones para asegurarla, incluyendo consideraciones de financiamiento adicional o complementario;

-Recomendar los ajustes que fueran necesarios para el diseño e implementación de una iniciativa de difusión a futuro que trascienda los alcances de MIPANDES, a nivel de

los agricultores y de las instituciones del desarrollo rural (Ministerio de Agricultura, ONG´s, etc);

-Analizar la factibilidad de asumir nuevos retos, en términos de problemas a enfrentar.

-Analizar las posibles alianzas estratégicas entre CARE , CIP u otras instituciones, para darle mayor alcance y aportes a la institucionalización de las iniciativas de MIP.

VI. METODOLOGÍA SUGERIDA

Los presentes TORs han sido preparados para facilitar y guiar el proceso de la evaluación final del Proyecto MIPANDES. La evaluación final se guiará por la metodología aceptada por CARE y deberá referirse al cumplimiento de los objetivos y metas y al posible impacto del Proyecto en las comunidades participantes-

A. EQUIPO EVALUADOR

La evaluación deberá ser realizada por un equipo, con una integración mínima de: a) un especialista en MIP y con experiencia en extensión-transferencia de tecnología, como lider del equipo; b) un agrónomo generalista, con experiencia en agroeconomía. Los miembros del equipo deberán tener amplia experiencia de trabajo en proyectos de desarrollo agrícola, de preferencia en MIP, y tener conocimientos y experiencia en ecosistemas andinos y ser totalmente bilingües.

B. DURACIÓN

Se estima que un equipo de dos evaluadores requerirá un mínimo de tres semanas netas de trabajo.

C. PREPARACIÓN POR PARTE DE CARE-PERU

1. Programa. Un programa detallado y completo de la evaluación será preparado por CARE-Perú, anticipadamente a la llegada del equipo evaluador, en consulta con el Líder, y se pondrá a disposición del equipo. El programa incluirá entrevistas con los participantes del proyecto (personal de CARE, de las comunidades y del GOP) así como visitas al CIP, a las áreas de intervención del proyecto y a la Misión de la AID en Perú. El personal del Proyecto deberá facilitar las visitas del equipo evaluador a los lugares programados.

2. Presentación. El General del Sector ARN de CARE-Perú presentará al equipo evaluador la historia y los principales logros y problemas encontrados durante la implementación del Proyecto MIPANDES.

3. Documentación del Proyecto. CARE-Perú deberá poner a disposición del equipo evaluador todos los documentos generados por el proyecto MIPANDES, incluyendo la propuesta, el estudio de base, el sistema de monitoreo, los planes multianuales y anuales, PIRs, el Informe de la Evaluación del Medio Camino, así como todos los materiales de capacitación, audiovisuales y otros producidos por el Proyecto dirigidos a extensionistas y a agricultores.

D. PREPARACIÓN POR PARTE DE LOS EVALUADORES

El equipo evaluador deberá leer, anticipadamente al inicio de la evaluación, todos aquellos materiales relevantes, incluyendo como mínimo la Propuesta del Proyecto presentada a la USAID, el Plan Multianual 1993-6, la información del Diagnóstico de Base preparados al inicio de las actividades del Proyecto y el Informe de la Evaluación de Medio Camino, así como los TORs.

E. METODOLOGÍA SUGERIDA

A los efectos de poder evaluar los principales componentes del Proyecto MIPANDES, extensión, capacitación y centros de producción, se sugiere una combinación de métodos cuali y cuantitativos con alta participación de los funcionarios de CARE y de las comunidades beneficiarias.

El equipo evaluador deberá generar las preguntas de la evaluación en función del esquema del Proyecto, o sea del problema que el Proyecto intentó resolver, de las causas identificadas y de las acciones (estrategia y actividades) que el Proyecto desarrolló.

Las siguientes metodologías se sugieren para la evaluación final:

1. Revisión de datos. El cumplimiento de los objetivos intermedios, de acuerdo a los indicadores claves, podrá ser evaluado cuantitativamente comparando las cifras del diagnóstico de base, realizado al inicio de las actividades del Proyecto, con las reportadas a través de los sistemas de monitoreo y seguimiento del Proyecto durante su ejecución (PIRs).

2. Revisión de documentos. La revisión de documentos del Proyecto (PIRs, informes semi-anuales, informe de la evaluación de medio camino, materiales de difusión y de capacitación publicados, audiovisuales producidos, etc.) deberá proporcionar información sobre el cumplimiento de metas y avances y logros generales del Proyecto, tanto cuali como cuantitativamente.

3. Observaciones. Las visitas a las áreas de acción del Proyecto, observando las parcelas de los agricultores, los centros de producción de agentes de control biológico y las comunidades proveerá información sobre la receptividad que el Proyecto tuvo a nivel de las comunidades y la adopción de las tecnologías promocionadas.

4. Entrevistas. Con el personal del Proyecto (a nivel gerencial y de campo), con miembros de las comunidades, con representantes del GOP, con científicos del CIP y otros proporcionarán información, por un lado, sobre la aceptabilidad y reconocimiento del Proyecto, y por otra, sobre el nivel de conocimientos de los agricultores sobre las prácticas MIP y de manejo de plaguicidas.

F. PRESENTACIÓN DE RESULTADOS Y RECOMENDACIONES

Finalizado el proceso de evaluación, el equipo evaluador deberá presentar los principales resultados, lecciones aprendidas y recomendaciones a las autoridades de la Misión CARE-Perú (CD, ACDs, Gerente del Sector ARN). El líder del Equipo Evaluador será el responsable, frente a CARE-Perú, de entregar el Informe Final de la evaluación en el plazo y formato acordado al inicio de la evaluación.

ANEXO 2

A 2.1 Metodologia de la encuesta durante la evaluación final

La evaluación final del proyecto MIP utilizó varias fuentes de información, las cuales fueron generadas por el proyecto mismo, principalmente, el estudio de base y la información generada por el seguimiento y monitoreo del proyecto. Además de estas dos fuentes de información, se aplicó una encuesta durante la evaluación final.

La encuesta aplicada durante la evaluación se concentra en los siguientes puntos: Los conocimientos adquiridos sobre el ciclo biológico del gorgojo y la polilla, prácticas MIP que realizan los participantes del proyecto, el uso de insecticidas, el ahorro al aplicar prácticas MIP, la disminución de daños y preguntas sobre impacto. Una copia de la encuesta se presenta al final del presente anexo.

Se cuenta con 479 encuestas procesadas, con la siguiente distribución:

Ancash	98
La Libertad	135
Puno y	80
Cajamarca	166

La encuesta se clasificó en dos grupos: a) Unidades operativas oficialmente con proyecto MIP y b) Unidades operativas testigo, dentro del ámbito de trabajo del proyecto CARE. No se logró generar información representativa del grupo "testigo" en términos de calidad, debido a la influencia del proyecto con las prácticas MIP. Inclusive en las unidades operativas testigo dentro de CARE había llegado las practicas MIP. Debido a que los agricultores "Sin" en realidad han recibido capacitación en forma no oficiall del MIP (gorgojo y polilla).

Como resultado se tiene: una base de datos de las 479 encuestas, lista de variables y lista de códigos y una primera salida de resultados.

En el anexo 3 se presenta los resultados de la encuesta.

A 2.2 Reducción en daño de cosechas

Los agricultores con el proyecto MIPANDES, y que manifestan tener reducciones de daño en su cosecha indican:

El 46% de los mismos considera que esta reducción es minima, no mayor al 25% del daño inicial. El 39% indica que el daño inicial se redujo hasta 50%, lo que es un efecto moderado de las prácticas MIP. Sólo 15% de los agricultores tuvieron reducciones mayores al 50% de los daños iniciales, lo que es ya un efecto significativo.

Frente a la pregunta: En cuanto disminuyó el daño de su papa, al aplicar prácticas MIP. Para 479 familias encuestadas, sin discriminar si estuvieron o no oficialmente con el proyecto MIPANDES, el 69 % manifestó que si había disminuido el daño por plagas. Ello muestra la influencia de los proyectos CARE- Perú en la globalidad de sus áreas de influencia.

Al comparar entre lugares, la reducción de daños; es mayor en el departamento de Libertad (98%). Por otro lado el que presenta menor porcentaje de reducción es el departamento de Ancash (63%). (Ver cuadro A.1).

Comparando las unidades familiares que "no recibieron" oficialmente los conceptos MIP, con aquellos que "si lo recibieron", se observa el incremento porcentual de 71% a 95%, de los agricultores que opinan la disminución del daño. (Estos porcentajes son mayores, porque se calculan en base a las encuestas con respuesta, o sea sin considerar a las encuestas sin respuesta).

A 2.3 Cálculo de los ingresos adicionales a nivel familiar por reducción del daño de cosechas

El incremento del ingreso familar por reducción del daño de cosechas, se ha calculado en base a la siguiente lógica y en base a la información proveniente de las entrevistas y las encuestas, aplicadas durante la evaluación final:

El cálculo se efectúa para una parcela que usa como semilla 1 saco de papa, que corresponde a 550 metros cuadrados. Este tamaño hipotético (que usa 1 saco de semilla de papa) es con fines de facilitar un cálculo económico. Sin embargo los agricultores beneficiarios cultivan aproximadamente 0.82 hectareas de papa en promedio.

Tamaño de la parcela 0.05 ha.	= 1 saco (de semilla de papa)
1 saco	= 70 kg
Reducción del daño promedio	= 30%
Producción total en 0.05 ha.	= 5 sacos de papa
Daño inicial sin MIP	= 3 sacos
Daño con prácticas MIP	= 2 sacos

El incremento del ingreso por reducción de daños se calcula: multiplicando el aumento en el volúmen de papas sanas por su precio.

Incremento neto de papas sanas (3-2=1)	= 1 saco = 70 kilos
Precio de papa	= S/0.50/kg.
Incremento por ingreso (S/0.05 X70)	=S/ 35.00
Tasa de cambio 1 US$	=S/2.50
Incremento en ingreso en US $	=$ 14

Es decir, el beneficio económico neto por usar MIP y lograr una reducción en el nivel de daño, será de US $ 14, por parcela de 550 metros cuadrados .

A 2.4 Cálculo de ahorros al reducir aplicaciones de plaguicidas por nivel de ahorro.

Para el cálculo de los ahorros en primer lugar se eligió un grupo de los entrevistados, que indicaron que sí ahorraron; como segundo paso se tabuló por lugar y nivel. Los niveles de ahorros fueron:

Nivel bajo de ahorro	S/. 0-49	o	US$ 0-19
Nivel moderado	S/. 50-100	o	US$ 20-40
Nivel alto	mayores a S/.100	o	US$ > 40

La gran mayoría de los agricultores perciben, que haciendo el MIP tienen un ahorro monetario, atribuido principalmente a un menor gasto en insecticidas. Los agricultores que han recibido capacitación formal en MIP, son los que más cuantifican sus ahorros.

El 30 % de los agricultores entrevistados indicaron que tuvieron un ahorro superior a US $40, por campaña y por familia. Esto refleja el caso en que se efectuaba dos o más aplicaciones de insecticidas con las dosis recomendadas.

El 30 % de entrevistados tuvieron ahorros de US $ 20 - 39 por campaña y por familia, esto representa a los agricultores que aplicaban insecticidas en dosis recomendadas.

El 40 % los agricultores ahorran montos menores a US$ 19 por familia, que corresponde a una aplicación de insecticida de bajo precio y en dosis bajas.(Ver cuadro A.1).

A 2.5 Cálculo de los ingresos adicionales por prácticas MIP

El incremento en el ingreso familiar por aplicación de las prácticas MIP, estaría conformado por los conceptos anteriormente calculados, es decir:

a) ahorro por la menor aplicación de pesticidas, US$ 19 en una campaña.
b) incremento en los ingresos por reducción del daño en las cosechas, US$ 14 por cada saco sembrado (0.055 ha).

Incremento neto en el ingreso familiar = 19 + 14 = US$ 33

Esta cifra de US$ 33, representaría un ahorro mínimo, asumiendo que un agricultor solamente sembrará 1 saco de semilla; pero en promedio, se sabe que un agricultor siembra 0.82 ha. de papa en el año. Esto representaría un ingreso de US$ 228.

(Ingreso medio = US$ 19 + 0.82/0.055 x 14)

Cuadro A.1

Reducción de daños con MIP (número de encuestados)

Departamento	Total	No Respon-dieron	si	sin MIP no	sin MIP si	con MIP no	con MIP si	Total si	% vertical
Ancash	98	28	23	6	39	2	62		63%
Cajamarca	166	20	7	7	123	10	130		78%
Puno	80	16	17	6	36	4	53		66%
La Libertad	135	3	0	0	132	0	132		98%
Total	479	67	47	19	330	16	377		
Porcentaje	100%		10%		69%		79%		

Cuadro A.2

Ahorros con MIP (número de encuestados que indican niveles de ahorros) por menor aplicación de plaguicidas

Departamento	Total	nivel de ahorro en US $ bajo 0 - 19	moderado 20 - 39	alto > a 40
Ancash	23	5	8	10
Cajamarca	37	24	7	6
Puno	23	18	4	1
La Libertad	123	35	43	45
Total	206	82	62	62
Porcentaje	**100%**	**40%**	**30%**	**30%**

PREGUNTAS PARA LA EVALUACION FINAL DEL PROYECTO MIPANDES

Fecha	
Comunidad o Lugar	
Provincia	
Departamento	
Nombre del encuestado	
Tiempo con MIPANDS (años)*	
Tipo de parcela que trabaja con MIPANDES**	
Area de papa que tuvo en la ultima campaña	
Area total cultivada en la ultima campaña	
Sexo	
Edad	

* 0= si no trabaja
  1, 2 o 3 años
** C= Comunal
  G= Grupal
  I = Individual

1. Conocimientos

¿Conoce Ud. el ciclo biologico del gorgojo?	
¿De quien lo aprendio?	
¿Aplica este conocimiento en el control del gorgojo?	
¿Conoce Ud. el ciclo biologico de la polilla?	
¿De quien lo aprendio?	
¿Aplica este conocimiento en el control de la polilla?	

2. Practicas MIP

	Gorgojo	Polilla
¿Que practicas MIP realiza?		
¿Por que?		

CUANTA AREA DE PAPA TUVO EN LA ULTIMA CAMPAÑA?

El área cultivada de papa asciende a 0.55 ha. en promedio para el grupo sin MIP. El área cultivada de papa es mayor (0.82 ha.) para el grupo con MIP. El área cultivada de papa es mayor en el departamento de Puno, comparado a los otros lugares.

CUADRO 2:

AREA CULTIVADA DE PAPA A NIVEL FAMILIAR: CON Y SIN PROYECTO POR DEPARTAMENTO (HA).

	TIPO DE BENEFICIARIO						TOTAL		
	SIN MIP			CON MIP					
	AREA PAPA			AREA PAPA			AREA DE PAPA		
	N	PROM.	STD	N	PROM.	STD.	N	PROM	STD
DEPTO									
ANCASH	45	0.42	0.50	43.00	0.77	0.83	88	0.59	0.70
CAJAMARCA	26	0.28	0.20	130.00	0.77	1.44	156	0.69	1.33
LIBERTAD	4	0.42	0.15	131.00	0.84	0.54	135	0.82	0.54
PUNO	40	0.87	1.00	40.00	1.00	1.11	80	0.93	1.05
TOTAL	115	0.55	0.71	344.00	0.82	1.06	459	0.75	0.99

CUANTO FUE EL AREA TOTAL CULTIVADA DURANTE LA ULTIMA CAMPAÑA?

El área total cultivada a nivel familiar fue de 1.5 ha para el grupo sin MIP y 2.07 ha para el grupo con MIP. esto es en el promedio para cada uno de los grupos encuestados. Nuevamente el área cultivada en el departamento de Puno es mayor (1.92 - 2-72 has) para el grupo si y con proyecto respectivamente.

CUADRO 3:

AREA TOTAL CULTIVADA: A NIVEL FAMILIAR, SEGUN DEPARTAMENTOS (HA).

	TIPO DE BENEFICIARIO						TOTAL		
	SIN MIP			CON MIP					
	AREA PAPA			AREA PAPA			AREA DE PAPA		
	N	PROM.	STD	N	PROM.	STD.	N	PROM	STD
DEPTO									
ANCASH	50	1.22	0.84	39.00	1.40	1.07	89	1.30	0.95
CAJAMARCA	28	1.35	1.03	136.00	1.67	1.57	164	1.61	1.49
LIBERTAD	4	2.00	0.91	131.00	2.48	1.17	135	2.47	1.16
PUNO	40	1.92	1.20	40.00	2.72	2.07	80	2.32	1.73
TOTAL	122	1.50	1.05	346.00	2.07	1.52	468	1.92	1.44

SEXO

La mayoría de los encuestados y de los participantes en el proyecto son de sexo masculino (85.5%), el 14.5% son de sexo femenino. En Cajamarca y la Libertad apenas el 12.3% de los beneficiarios (con proyecto MIP) son mujeres. Sin embargo, la participación del sexo femenino es mayor en los otros dos departamentos.

CUADRO 4:

DISTRIBUCION PORCENTUAL DE SEXO DE LOS ENCUESTADOS CON Y SIN PROYECTO, POR DEPARTAMENTO

		TIPO DE BENEFICIARIO					
DEPARTAMENTO		SIN MIP		CON MIP		TOTAL	
		SEXO		SEXO		SEXO	
		F	M	F	M	F	M
ANCASH	N	10	45	9	33	19	78
	%	18.2	82.0	21.4	78.6	19.6	80.4
CAJAMARCA	N	1	27	17	121	18	148
	%	3.6	96.4	12.3	87.7	10.8	89.2
LIBERTAD	N	0	4	16	114	16	118
	%	0	100.0	12.3	87.7	11.9	88.1
PUNO	N	8	31	8	32	16	63
	%	6.4	24.6	20.0	80.0	20.2	79.8
TOTAL	N	19	107	50	300	69	407
	%	15.1	84.9	14.3	85.7	14.5	85.5

EDAD

La edad promedio de los encuestados fue de 37.9 años. La edad promedio fluctua entre 39.5 y 37.3 años, para los grupos sin y con MIP, respectivamente. Se observa que en el promedio las edades de los encuestados son similares entre los departamentos, aunque los agricultores del departamento de La Libertad son ligeramente más jovenes.

CUADRO 5:

LA EDAD DE LOS ENCUESTADOS: CON Y SIN PROYECTO, POR DEPARTAMENTO

	TIPO DE BENEFICIARIO						TOTAL		
	SIN MIP			CON MIP					
	EDAD			EDAD					
	N	PROM.	STD	N	PROM.	STD.	N	PROM	STD
DEPTO									
ANCASH	52	38.42	11.42	42.00	41.10	12.23	94	39.62	11.80
CAJAMARCA		35.79	16.26	138.00	36.58	14.31	166	36.45	14.61
LIBERTAD	4	33.00	15.53	130.00	35.82	11.36	134	35.73	11.44
PUNO	39	44.18	12.16	40.00	40.75	12.50	79	42.44	12.73
TOTAL	123	39.47	13.31	350.00	37.31	12.93	473	37.88	13.05

CONOCE EL CICLO BIOLOGICO DEL GORGOJO?

Casi el 100% de los que participan con el Proyecto MIPANDES conocen el ciclo biológico del gorgojo. Es interesante observar que la mayoría de los agricultores que no trabajan oficialmente con MIPANDES también conocen el ciclo biológico del gorgojo (63%).

CUADRO 6: CONOCIMIENTO SOBRE EL CICLO BIOLOGICO DEL GORGOJO: CON Y SIN PROYECTO, POR DEPARTAMENTO

DEPARTAMENTO		TIPO DE BENEFICIARIO SIN MIP		CON MIP	
		SI	NO	SI	NO
ANCASH	N	38	17	43	0
	%	69.1	30.9	100.0	0.0
CAJAMARCA	N	10	18	133	5
	%	35.7	64.3	96.4	3.6
LIBERTAD	N	3	0	131	0
	%	100.0	0.0	100.0	0.0
PUNO	N	28	12	40	0
	%	70.0	30.0	100.0	0.0
TOTAL	N	79	47	347	5
	%	62.7	37.3	98.5	1.5

DE QUIEN APRENDIO EL CICLO BIOLOGICO DEL GORGOJO?

Casi todos los encuestados, respondieron que aprendieron el ciclo biologico del gorgojo de CARE. Solamente el 1.1% de los beneficiarios sin proyecto y el 3.7% de los beneficiarios con proyecto MIP aprendieron de otras instituciones, como el SEIMPA- Ministerio de Agricultura y últimamente PRONAMACHS.

CUADRO 7: INSTITUCIONES DE LAS CUALES SE APRENDIO EL CICLO BIOLOGICO DEL GORGOJO: CON Y SIN PROYECTO, POR DEPARTAMENTO

DEPARTAMENTO		TIPO DE BENEFICIARIO			
		SIN MIP		CON MIP	
		CARE	OTROS	CARE	OTROS
ANCASH	N	38	1	39	4
	%	97.4	2.6	90.7	9.3
CAJAMARCA	N	10	0	133	0
	%	100.0	0.0	100.0	0.0
LIBERTAD	N	1	2	131	0
	%	33.3	66.7	100.0	0.0
PUNO	N	28	0	40	0
	%	100.0	0.0	0.0	0.0
TOTAL	N	77	3	343	4
	%	96.3	3.7	98.9	1.1

APLICA EL CONOCIMIENTO DEL CICLO BIOLOGICO DEL GORGOJO, EN SU CONTROL ?

Casi todos (96.5%) de los participantes en el Proyecto, aplican sus conocimientos del ciclo biológico del gorgojo en el control del mismo. Inclusive los agricultores que no participan en forma oficial del MIP, (68.6%) llegan a aplicar prácticas MIP.

CUADRO 8: PORCENTAJE DE ENCUESTADOS QUE APLICAN CONOCIMIENTO DEL CICLO BIOLOGICO DEL GORGOJO: CON Y SIN PROYECTO, POR DEPARTAMENTO

DEPARTAMENTO		TIPO DE BENEFICIARIO			
		SIN MIP		CON MIP	
		SI	NO	SI	NO
ANCASH	N	16	13	36	5
	%	55.2	44.8	87.8	12.2
CAJAMARCA	N	7	3	127	6
	%	70.0	30.0	95.5	4.5
LIBERTAD	N	3	0	131	0
	%	100.0	0.0	100.0	0.0
PUNO	N	22	6	39	1
	%	78.57	21.43	97.5	2.5
TOTAL	N	48	22	333	12
	%	68.6	31.4	96.5	3.5

CONOCE UD. EL CICLO BIOLOGICO DE LA POLILLA?

El 88.7% de los agricultores entrevistados que participan en el Proyecto MIP conoce el ciclo biológico de polilla. En el grupo sin MIP, la mayoría desconoce el ciclo biológico de la polilla. El conocimiento sobre el ciclo biológico de la polilla resalta en el departamento de La Libertad, el 100% del grupo con MIP, manifiestan conocer el ciclo biológico de la polilla.

CUADRO 9: FRECUENCIA DE CONOCIMIENTO DEL CICLO BIOLOGICO DE LA POLILLA: CON Y SIN PROYECTO, POR DEPARTAMENTO

DEPARTAMENTO		TIPO DE PROYECTO			
		SIN MIP		CON MIP	
		SI	NO	SI	NO
ANCASH	N	14	27	37	6
	%	34.1	65.9	86.0	14.0
CAJAMARCA	N	5	22	105	26
	%	18.5	81.5	80.2	19.8
LIBERTAD	N	1	2	131	0
	%	33.3	66.7	100.0	0.0
PUNO	N	19	21	33	7
	%	47.5	52.5	82.5	17.5
TOTAL	N	39	72	306	39
	%	35.1	64.9	88.7	11.3

APLICA EL CICLO BIOLOGICO DE LA POLILLA EN SU CONTROL?

Casi todos (94%) los participantes en el Proyecto MIPANDES aplican sus conocimientos del ciclo Biológico de la polilla en el control del mismo. También un porcentaje considerable (59%) de los encuestados sin MIP aplican las prácticas MIP en el control de la polilla.

CUADRO 10: PORCENTAJE DE AGRICULTORES QUE APLICAN CONOCIMIENTO DE LA POLILLA: CON Y SIN PROYECTO, POR DEPARTAMENTO

DEPARTAMENTO		SIN MIP		CON MIP	
		SI	NO	SI	NO
ANCASH	N	12	2	35	1
	%	85.7	14.3	97.2	2.8
CAJAMARCA	N	3	2	93	9
	%	60.0	40.0	91.2	8.8
LIBERTAD	N	1	0	131	0
	%	100.0	0.0	100.0	0.0
PUNO	N	7	12	24	8
	%	36.8	63.2	75.0	25.0
TOTAL	N	23	16	283	18
	%	59.0	41.0	94.0	6.0

CON PRACTICAS MIP PUEDE ALMACENAR POR MAS TIEMPO SU PAPA DE CONSUMO?

El 96% del grupo con el Proyecto MIP almacenan por más tiempo su papa al implementar prácticas MIP: este porcentaje es menor (74.2%) para el grupo sin Proyecto. Es importante observar que las prácticas MIP influye inclusive al grupo de control.

CUADRO 11: FRECUENCIA DE MAYOR ALMACENAMIENTO DE PAPA PARA CONSUMO: CON Y SIN PROYECTO, POR DEPARTAMENTO

DEPARTAMENTO		TIPO DE PROYECTO SIN MIP SI	SIN MIP NO	CON MIP SI	CON MIP NO
ANCASH	N	23	6	33	1
	%	79.3	20.7	97.1	2.9
CAJAMARCA	N	5	6	120	12
	%	45.5	54.5	90.9	9.1
LIBERTAD	N	1	0	131	0
	%	100.0	0.0	100.0	0.0
PUNO	N	20	5	36	0
	%	80.0	20.0	100.0	0.0
TOTAL	N	49	17	320	13
	%	74.2	25.8	96.1	3.9

ACTUALMENTE USA INSECTICIDAS (MAS, MENOS, IGUAL) QUE ANTES DE TRABAJAR CON MIPANDES?

El 77.3% del grupo con proyecto MIP declara usar menos insecticidas que antes del proyecto. El grupo sin MIP uso menos insecticidas (50.5%), en este mismo grupo sin embargo, el 23.08% declara que no saben.

CUADRO 12: FRECUENCIA DEL USO DE INSECTICIDAS (MAS, MENOS, IGUAL) COMPARADO ANTES DEL PROYECTO: CON Y SIN PROYECTO, POR DEPARTAMENTO

DEPARTAMENTO		TIPO DE BENEFICIARIO							
		SIN MIP				CON MIP			
		NO SABE	MAS	MENOS	IGUAL	NO SABE	MAS	MENOS	IGUAL
ANCASH	N	0	2	25	11	0	1	32	2
	%	0.0	5.26	65.79	28.95	0.0	2.86	91.43	5.71
CAJAMARCA	N	14	2	2	1	44	13	65	5
	%	73.68	10.53	10.53	5.26	34.65	10.24	51.18	3.94
LIBERTAD	N	0	1	1	2	0	0	128	0
	%	0.0	25.0	25.0	50.0	0.0	0.0	100.0	0.0
PUNO	N	7	1	18	4	7	1	26	1
	%	23.33	3.33	60.0	13.33	20.0	2.86	74.29	2.86
TOTAL	N	21	6	46	18	51	15	251	8
	%	23.08	6.59	50.55	19.78	15.64	4.60	77.31	2.45

CUANTAS APLICACIONES DE INSECTICIDAS REALIZA, INCLUYENDO LOS GRANULADOS AL SUELO?

En el promedio global el número de aplicaciones de insecticidas es de 2.5 veces. El número promedio de aplicaciones entre el grupo con y sin proyecto es similar, a excepción de La Libertad donde el grupo sin MIP llega a aplicar 4.75 veces en el promedio.

CUADRO 13: NUMERO DE APLICACIONES DE INSECTICIDAS: CON Y SIN PROYECTO, POR DEPARTAMENTO

DEPTO	TIPO DE BENEFICIARIO						TOTAL		
	SIN MIP			CON MIP					
	CUANTO APLICA			CUANTO APLICA			CUANTO APLICA		
	N	PROM.	STD	N	PROM.	STD.	N	PROM	STD
ANCASH	48	2.62	1.21	42.00	2.31	0.60	90	2.48	0.99
CAJAMARCA	21	2.14	1.90	127.00	2.72	1.36	148	2.64	1.45
LIBERTAD	4	4.75	1.89	129.00	2.67	1.49	133	2.73	1.53
PUNO	24	2.04	1.85	29.00	1.41	1.02	53	1.70	1.48
TOTAL	97	2.46	1.65	327.00	2.53	2.53	424	2.51	1.43

AHORRA UD. APLICANDO LAS PRACTICAS MIP?

El 96% de los encuestados que participan en el Proyecto MIP ahorran aplicando las prácticas MIP; como tambien el 71% de los encuestados sin MIP.

CUADRO 14: FRECUENCIA DE AHORRO AL APLICAR PRACTICAS MIP: CON Y SIN PROYECTO, POR DEPARTAMENTO

DEPARTAMENTO		TIPO DE BENEFICIARIO			
		SIN MIP		CON MIP	
		SI	NO	SI	NO
ANCASH	N	22	9	36	2
	%	71.0	29.0	94.7	5.3
CAJAMARCA	N	5	4	117	8
	%	55.6	44.4		
LIBERTAD	N	1	0	131	0
	%	100.0	0.0	100.0	0.0
PUNO	N	16	5	35	2
	%	76.2	23.8	94.6	5.4
TOTAL	N	44	18	319	12
	%	71.0	29.0	96.4	3.6

CUANTO AHORRO EN LA ULTIMA CAMPAÑA AL APLICAR PRACTICAS MIP?

El ahorro promedio durante la última campaña al aplicar prácticas MIP son mayores (S/.36.49) para el grupo con MIP que el grupo sin MIP (S/.28.83). En Ancash los niveles de ahorros son mayores, llegando en el promedio a S/.101.70 y los ahorros mas bajos se reportan en Cajamarca con S/.4.89

Estos resultados se refieren solamente a las entrevistas que manifestaron que sí ahorraron en la última campaña al aplicar prácticas MIP.

CUADRO 15: NIVELES DE AHORRO AL AP -1XLICAR PRACTICAS MIP: CON Y SIN PROYECTO, POR DEPARTAMENTO (EN NUEVOS SOLES)

	TIPO DE BENEFICIARIO						TOTAL		
	SIN MIP			CON MIP					
	CUANTO APLICA			CUANTO APLICA			CUANTO APLICA		
	N	PROM.	STD	N	PROM.	STD.	N	PROM	STD
DEPTO									
ANCASH	9	57.11	38.88	20.00	101.70	83.76	29	87.86	75.05
CAJAMARCA	6	0.83	2.04	108.00	4.89	13.92	114	4.68	13.58
LIBERTAD	1	5.00		108.00	59.03	62.91	109	58.53	62.83
PUNO	7	19.86	15.99	17.00	17.35	9.62	24	18.08	11.51
TOTAL	23	28.83	34.82	253.00	36.49	57.49	276	35.85	55.95

DISMINUYO EL DAÑO DE SU PAPA AL APLICAR LAS PRACTICAS MIP?

El 96.5% y el 76.5% de los encuestados con y sin proyecto MIP respectivamente, indican que disminuyó el daño de su papa al aplicar prácticas MIP. El 100% de los entrevistados en Ancash y en la Libertad lograron que disminuya el daño de la papa al aplicar prácticas MIP.

CUADRO 16. FRECUENCIA DE DISMINUCION DE DAÑO AL CULTIVO DE PAPA AL APLICAR PRACTICAS MIP: CON Y SIN PROYECTO, POR DEPARTAMENTO

DEPARTAMENTO		TIPO DE BENEFICIARIO SIN MIP		CON MIP	
		SI	NO	SI	NO
ANCASH	N	25	7	38	0
	%	78.1	21.9	100.0	0.0
CAJAMARCA	N	8	4	123	8
	%	66.7	33.3	93.9	6.1
LIBERTAD	N	1	0	131	0
	%	100.0	0.0	100.0	0.0
PUNO	N	18	5	36	4
	%	78.3	21.7	90.0	10.0
TOTAL	N	52	16	328	12
	%	76.5	23.5	96.5	3.5

EN CUANTO DISMINUYO EL DAÑO DE LA PAPA AL APLICAR PRACTICAS MIP?

La disminución en el daño al cultivo de la papa debido al uso de prácticas MIP son mayores para el grupo con MIP 34.11% comparado a 27.97% del grupo sin MIP. En el caso de disminución de daño al cultivo de la papa, para el grupo con MIP, esta disminución es similar entre departamentos (30.69% - 35.50%).

CUADRO 17: DISMINUCION PORCENTUAL EN EL DAÑO AL CULTIVO DE LA PAPA: CON Y SIN PROYECTO, POR DEPARTAMENTOS

	TIPO DE BENEFICIARIO						TOTAL		
	SIN MIP			CON MIP					
	CUANTO DISMINUYO			CUANTO DISMINUYO			CUANTO DISMINUYO		
	N	PROM.	STD	N	PROM.	STD.	N	PROM	STD
DEPTO									
ANCASH	17	34.88	30.02	34.00	35.50	33.19	51	35.29	31.87
CAJAMARCA	9	15.56	17.22	121.00	34.59	19.05	130	33.27	19.48
LIBERTAD	1	20.00		129.00	34.06	20.51	130	33.95	20.47
PUNO	11	28.18	14.54	29.00	30.69	16.24	40	30.00	15.65
TOTAL	38	27.97	23.92		34.11	21.30	351	33.44	21.65

USA HONGO Y/O BACULOVIRUS EN SU ALMACEN DE PAPA?

En el grupo con MIP, la mayoría de los entrevistados (69.3%) usan hongo blanco y/o baculovirus. De lo contrario, en el grupo sin MIP, la mayoría (86.6%) de ellos no usan hongo blanco y/o baculovirus. En Cajamarca, un grupo de encuestados indican que solo fueron expuestos a Baculovirus y hongo blanco a nivel de proyecto, como demostración (22.7% del grupo con MIP y 6.7% sin proyecto).

CUADRO 18: USO DE HONGO BLANCO Y/O BACULOVIRUS EN ALMACEN DE PAPA: CON Y SIN PROYECTO, POR DEPARTAMENTO

DEPARTAMENTO		SIN MIP		CON MIP	
		B VIRUS SI	HONGO B NO	B VIRUS SI	HONGO B NO
ANCASH	N	6	30	29	11
	%	16.7	83.3	72.5	27.5
CAJAMARCA	N	3	11	68	25
	%	20.0	77.3	51.5	18.9
LIBERTAD	N	0	2	128	2
	%	0.0	100.0	98.5	1.5
PUNO	N	1	28	12	28
	%	3.5	96.5	30.0	70.0
TOTAL	N	10	71	237	66
	%	12.2	86.6	69.3	19.3