Revealing success

What happened in nine applied technology innovation projects (PITAs)

edited by

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GLOBAL PLANT CLINIC, CABI

June 2007

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CORRECT CITATION

Bentley, Jeffery and Eric Boa (editors) 2007. *Revealing success. What happened in nine applied technology innovation projects (PITAs)*. Global Plant Clinic, CABI, Egham, UK.

This book is also available in Spanish.

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Nothing to do
Many leave their homes to seek jobs and new opportunities. PITAs help to introduce new enterprises.

Tired of Being Poor

Huayllamarca is a big town, but most of the houses are abandoned. Their owners left their things inside, walled up the doors and windows with bricks, and moved to the city or the lowlands, because they were tired of being poor. With a group of Bolivian agronomists I walked down one deserted street after another: no people, no dogs, until we reached the town square and eventually met one person, a large friendly man named Natalio. While his three children played around him, he explained why he was staying. His cows were now giving six litres of milk a day. "If I can sell it for 2.50 Bs. each it's a lot of money." Six litres at 2.50 Bs. is 18 Bolivianos ($2.25). It may not seem like a lot for a family, but it is more money than many people on the Bolivian Altiplano earn per day.

Don Natalio now sells six litres of milk a day because, along with 311 other families in Nor Carangas Province, Oruro, he was a member of a dairy project which was teaching people to grow fodder, vaccinate their cows, cross them with dairy breeds, and make yoghurt and cheese. The project staff shared many of the living conditions with the people, lodging in small, unheated rooms, in the chill of 4000 metres above sea level. They rode motorcycles to the 15 communities, to inject cows and wash milk pails with the villagers. There are many people earning $400 a month, in difficult, thankless jobs, helping the people who are tired of being poor.

Development does indeed work, as Jeffrey Sachs suggests, reflected in the title of a recent booklet by DFID (*Development Works*). It is odd that the value of development was ever doubted in the first place. That may be because of the difficulty of verifying complicated projects in remote places, or partly because of academic cynicism. Doubt also creeps in because development reports usually give the reader a vague idea of what the work was like, even if it was good.

Bolivia is a case in point, one of the poorest and politically unstable countries in the Americas, with high transportation costs; its extreme geographic diversity demands different agricultural solutions for different regions. Starting in the west, between the snow-capped Bolivian Andes, there is a high plain, at 3800 metres (the Altiplano), squarely in the tropics, but dry and cold. It is the homeland of llamas, quinoa, potatoes and other Andean tubers. Moving east, and downhill, the slopes of the Andes harbour arid little valleys, often irrigated, mostly between about 1000 and 3500 metres: they are ideal for growing many crops, from peaches to barley, potatoes, maize, broad beans and grapes.

On the floor of the Amazon Basin there is the massive rain forest, still largely intact, but cleared in parts for sugar cane, soybeans, manioc, rice and other tropical crops. And in the southeast of the country, in the headwaters of the River Plate, there is the dry forest, the Chaco, with pigs, cattle, oranges and maize.

Bolivian agricultural R&D is split among four 'Foundations,' each responsible for one of the four agro-ecozones (Altiplano, Valleys, Humid Tropics, Chaco). The Foundations are funded through Sibta, a branch of the Bolivian government which received support from DFID and other donors.

Writing narrations
Course members write about what they found out during two days of field visits. Photographs are used to stimulate story writing.

Chaco Foundation, Yacuiba.

The Foundations grant small projects (called 'PITAs') to farmers ('beneficiaries') who must be organized in associations. The Foundations tender projects to extension agencies ('suppliers'). In theory, the PITAs are competitively bid, but the Foundations do not pay for pre-project studies, making it difficult for an outsider to become familiar with farmers' problems. In practice, the organizations that are competitive are

those with long experience in the area, who often have close existing ties with local farmers.

This book documents nine small projects (PITAs). The chapters, each self-contained so they can be published separately, were written by Bolivian professionals from the Foundations, and from some of the PITAs, as part of a course that Eric Boa and I taught three times in January and February 2007, to the Humid Tropics, Altiplano and Chaco Foundations. About 12 people attended each course, mostly agronomists and veterinarians, with a sprinkling of economists, plus a farmer, and a journalist. They were mostly local people who had worked on PITAs, usually as project staff but also as supervisors from the Foundations.

The courses started on Monday with training on qualitative field methods (e.g. semi-structured interviews, note taking, photography), and a little planning. Tuesdays and Wednesdays were in the field and Thursdays and Fridays people wrote their papers, which we (Boa and Bentley) helped them to outline, edit, illustrate, and layout. The people who took the course analysed their own PITAs or ones they were already familiar with in some way. so the studies were self-evaluations.

Eager to talk
Don Cristóbal explains how the PITA helped him with his llamas. Ricardo Torres and Humberto Muenala listen carefully and make notes.
Altiplano Foundation, Oruro

All of the project beneficiaries were smallholders, and most of them were poor. The dairy PITAs on the Altiplano, for example, worked with people milking as little as two litres a day. The beekeeping project in the Chaco made one beehive per family. But the people we met on farms were grateful for the attention from the extensionists. Most said they were making a little bit of money thanks to the projects, even if it was just from knitting llama wool by hand.

Many community organizations had been strengthened by working with an extension project, and all the people we talked to wanted more projects, even if it was just for training, which many of them said had given them self-confidence.

Look what we did
Writing self-evaluations is rewarding. You assess success, learn lessons and share results with beneficiaries and colleagues.

Humid Tropics Foundation, Montero.

Some things do get better with time, and agricultural technology is a case in point. The new technology we saw was generally appropriate (new sugar cane varieties, plastic buckets with lids for keeping milk clean, tables and screens for hand-cleaning wool, bee boxes made in the village, from local wood).

Some 400 PITAs in Bolivia teach new ideas to about 300 families each. No one actually knows what the impact is, but it usually positive, judging from what we saw. Even when things did not work well, writing about it helps you do better the next time. With more support, all households could be reached by sympathetic agronomists and veterinarians using the approach described above. It's not too much to ask, and it really works. Read the chapters and find out for yourself.

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Humid tropics

APPLIED TECHNOLOGY INNOVATION PROJECT

CHAPTERS

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APPLIED TECHNOLOGY INNOVATION PROJECT

SELF–EVALUATION

Sweet, lasting success

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EDITORS: Jeffery Bentley and Eric Boa

January 2007

PITA APPLIED TECHNOLOGY INNOVATION PROJECT

Introduction of sugarcane varieties in the north of the department of Santa Cruz

Humid Tropics Foundation: TH-CAZ-CP01/04-01

SERVICE PROVIDER
CITTCA: Centre for Sugarcane Research and Technology Transfer

DEMANDER
UCG: Guabirá Union of Sugarcane Growers

START
August 2004

FINISH
June 2007

FIT FACILITATING TECHNICAL INNOVATION

FIT22 is funded by DFID, UK, and this work was carried out by CABI (www.cabi.org).

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Conclusions

- The cane growers like the new varieties, which fulfilled their expectations for yield and sugar content. The growers want to evaluate the varieties for several years before fully adopting them.
- The growers want to improve their productivity, and exchange experiences to become leaders in their areas. They now have confidence in the growers' association and are optimistic about the future. They have identified new demands like tractors for ploughing.
- Selecting and calibrating the nozzles of the backpack sprayers helps the farmers to control itch grass (a weed), save money and effort, and minimize environmental pollution.
- The cane growers now know how to renew their crops with quality seed. They have group seedbeds for all the members of the cooperatives.
- Smallholders are the main beneficiaries of the project and most of them are colonists from other parts of the country, such as Potosí and Cochabamba. Smallholders from different regions have been assisted efficiently and fairly, including women, whenever possible.

The Abaroa Cooperative selected two of the cane varieties they tested in their seedbed. They hope the varieties will maintain the good yields reached in the last harvest, 150 tons per hectare.

SERGIO JUCHASARA arrived in Santa Cruz years ago from Potosí to harvest sugar-cane. With time and hard work he became a grower, affiliated with the Abaroa Cooperative. He is proud of his three hectares of cane because in 2006 he harvested over 200 tons. The cooperative seedbed is now testing the new varieties delivered by the PITA.

Growing sugarcane is hard work, from ploughing and planting until harvest and hauling the cane to the mill. The grower must face pests, weeds, drought and rain, sugar mill quotas, transportation costs, agrochemicals and changing market prices. Men and women work with sugarcane so that on every Bolivian table we have the finest quality sugar.

Lidia Delgadillo has 20 hectares of cane in the village of San Salvador. She tried several varieties, but is now thinking of renewing her crop. "Now I am going to change every last bit of it. I am going to put in another kind of cane". She will plant the variety RBB 77-26, released by CITTCA (Centre for Sugarcane Research and Technology Transfer), based in Saavedra, Santa Cruz. She also planted the variety UCG 90-20 which CITTCA gave her and she now has three thriving hectares of it.

She was raised as a sugarcane grower; as a girl she worked with her father in the cane fields. Her parents came from Punata, Cochabamba in 1936 to the fertile lands of eastern Bolivia, where they set out to grow cane. "With the sweat of his brow, my father supported the Unagro Mills right from the start", says doña Lidia. When her father died, she continued working the land she inherited, with her husband, Paulino Mamani, and nowadays she sells her harvest to the Guabirá Sugar Mills.

"Before, my parents planted the variety Coimbatore (CO 421). It was sweet and soft. Even the foxes chewed it. Now I plant RB (RBB 77-26) and Norte (NA 56-26). I am multiplying UCG 90-20, which yields more; it has more sugar and it grows back better after being cut", doña Lidia says; she knows her crop and she realizes that soil is the key to yield. She explains that sandy soils burn the plants' roots and so she says that clayey soils are better.

With the CITTCA PITA, doña Lidia can get different cane varieties, and training about what type of soil is best for each variety. Before, she and the other cane growers did not have this support. Like her neighbour, Santos Martínez, doña Lidia asks the technical staff to support them with soil analysis so that they do not "peal it" (make a mistake) when they choose a cane variety to plant.

The sugarcane grower's trade.

Germán Ferrel came to Santa Cruz when he was 12. He worked at everything, even at harvesting cane, until he could get enough money to buy a hectare and become a grower. In 1954 don Germán delivered cane to the sugarcane mills of San Aurelio and La Bélgica. Now he has 15 hectares of the variety RBB 77-26 and in the past five years he has had good yields. In 2006 his harvest reached 880 tons, which he sold to the Guabirá Mill, he is pleased to say, taking into account the rise in sugar prices which benefits the sugarcane growers. They are now satisfied with a variety

DON GERMÁN arrived many years ago from Cochabamba as a sugarcane labourer. Now a grower himself, he hopes to harvest more this year, by using a new variety released by the PITA.

if it has a yield of 70 tons per hectare, and if it can be cut six years in a row.

Don Germán is happy with the support of CITTCA, because the technical staff taught him to manage herbicides and control weeds. This technical knowledge complements don Germán's own experience. He says: "Experience is better than papers; I beat the agronomists," while he uses his machete to cut the weeds in his cane field.

The project also gave him the chance to have seedbeds of different varieties to test on his land. In 2006 he planted the variety UCG 90-20 and would have multiplied it, but it accidentally burned and he only has a little left. This year he hopes to get better results with this variety, and will work hard to plant and multiply it.

For now, don Germán, like the other cane growers in the north of Santa Cruz, has placed his hopes on the new varieties released by CITTCA, as the best alternative to assure them good yields over the next years.

From labourer to cane grower. Sergio Juchasara is from Potosí. Two years ago he decided to grow sugarcane, and become a small-scale grower affiliated with the Abaroa Cooperative. Before that he was a labourer and he always dreamed of becoming a grower, because years of working the sugarcane taught him how to manage it. Married to Josefa Mafaile, a native daughter of Callejón Abaroa, Saavedra Municipality, they have five children, including two in school in Minero. Doña Josefa says she once participated in a workshop on herbicide management, and that they then planted the varieties *Morada* (RBB 77-26) and *Norte* (NA 56-26) because they are high yielding.

Don Sergio planted sugarcane and now has three hectares, which yield between 190 and 280 tons per hectare. He sells most of his crop to the Guabirá Sugar Mills, in Montero. When he became a sugarcane grower, his goal was to get a code (as a registered grower) from the mill, so he could sell his crop. With the code, don Sergio has his sale assured.

With the support of the project, don Sergio says he learned to improve his sugarcane management and get higher yields. In his cooperative they have a joint seedbed with the new varieties released by CITTCA, and the material is distributed among the 30 members according to their needs.

Background

After 1996, The Union of Sugarcane Growers of Guabirá (UCG), the growers' organization, with support from the Guabirá Sugar Mill, used its own money to create an agricultural department to provide technical support to its members and to research the crop. At the initiative of the affiliated farmers, the Guabirá Union and the Guabirá Mill created CITTCA in April 2000, to improve sugarcane yields through research on new varieties and techniques. CITTCA is the only centre for sugarcane research and extension in Bolivia.

Sugarcane growing started in Santa Cruz with local varieties, called *Listada* and *Cayaña*, from the end of the 16th century until 1930. After 1930 new varieties came in, like POJ 28-78

and *Kavangire*, and by 1950 other varieties called *Campo Brasil*, CB 38-22, and CB 40-77. Until then the varieties were soft cane "food for bugs and foxes", and susceptible to disease, so each planting lasted only a few years.

By 1970 a new variety called *Norte Argentino*, NA 56-26, was introduced, which rapidly displaced the earlier varieties, and within a few years 90% of the sugarcane area was planted in it, because it was robust, pest-resistant, easy to harvest and long-lasting. RBB 77-26, released in 1980, now holds second place.

After 2002, CITTCA had promising varieties like UCG 90-20, UCG 96-10 and CITTCA 85-22, which seem to have good yields.

New varieties were welcome. In Santa Cruz sugarcane is low-yielding, just 45 tons per hectare, because of poor management, bad seed quality and dependence on just one variety (*Norte Argentino*). It now shows symptoms of mosaic virus and ratoon stunting disease, which lower yields. Faced with this situation, the Guabirá Growers' Union expressed a demand for a project to the Humid Tropics Foundation, to introduce new varieties to the growers, which was approved and carried out, with smallholders as the main beneficiaries.

LIDIA DELGADILLO is a member of the San Salvador Cooperative, born into a sugarcane growing family. Her parents left her about 20 hectares so she could keep farming.

What the PITA did

In 2004 CITTCA started the PITA called "Introduction of sugarcane varieties in northern Santa Cruz", to:

- Introduce 60 varieties from other countries and pre-select 10
- Release another five varieties which CITTCA had already studied and had ready
- Train 200 growers in crop management
- Provide 200 growers with three tons each of seed, of the released varieties
- Train 1200 sugarcane growers in the monthly meetings
- Have a bank of 200 sugarcane varieties for further research

Harvesting the first success. When the technical staff of CITTCA started to train sugarcane growers, they were met with some reactions of disbelief, mistrust and caution, because no one had come to give them training before, and when someone did show up, they didn't come back. After a few visits, little by little, the staff earned the growers' trust. The first year, at the end of 2004, 78 sugarcane growers signed up for training (and as a condition to get the new varieties). Eight of them did not show up; they preferred to wait and see what happened, although later they were sorry they did not take part.

For three years they conducted courses and demonstrations on managing the new varieties, to receive them for free, and produce high quality seed. After seeing the 70 growers who received seed the first year, and another 70 the second year, more and more are now signing up.

"We are committed to planting well, taking good care and not selling the new varieties to be crushed at the mill. That is why those of us who planted them first, now have plenty of seed to plant on our land, and it is here in the joint seedbed, for anyone in the cooperative who wants it," says Wilson Alvarez. He and Raimundo Maíz received the technical talks and visits from CITTCA, and planted the seedbeds that today are their pride and hope.

Results

On a rainy day in January, 2007 nine growers from the Abaroa Cooperative, who had evaluated the nine varieties, told us about their impressions of which ones they wanted to plant in their own fields. They chose two. They all thought UCG-96-10 was the best of the new varieties, compared with *Norte Argentino*, which they all now grow.

They discussed it thoroughly, until they concluded that the best thing about it is that it yields well on the higher ground (the parts that do not easily flood), yields the most, tillers rapidly, and is good because it beats the itch grass, which is a difficult weed to control.

PEDRO LUIZAGA likes the new sugarcane varieties, because they are high-yielding. If they yield well for a few years, the cane growers will adopt them.

They agreed that they still had to get to know the varieties better and that based on what they have already seen, they must harvest it at the right time, because some varieties lose weight if they stay in the field too long, and so they lose sugar.

The second favourite was UCG-90-20. Most of the growers liked it, and chose it to start renewing their cane fields. They liked it because it not only yielded well, but also withstood bugs, grew fast and tillered well. They also believe that it will have a high sugar rating in the mill. There is only one question: "Will it last?" they all ask, because adoption depends very much on that. The *Norte Argentino* lasts for 10 years or more without replanting, and if the new varieties lose their yield in a few years, it will not be worthwhile to plant them.

"We smallholder cane growers do not have tractors or machinery. We cannot change our cane every three or four years," says don Wilson. "If the yield drops it is expensive and difficult for us. For us a good variety has to yield well for seven or more years, and we still don't know; we have to wait before we can tell (if the new variety is good)."

From the first year of the project until the third year, CITTCA distributed 420 tons of seed, enough to plant 42 hectares, with 140 families. They hope that in 2007 some 15,000 tons will enter the mill. Then the growers will see the yield. Other growers have also received cane to grow their own seed, planting seed grown by the farmers who got it the first year.

We improve by working less, saving more. With the project, the growers improved their labour efficiency, in the control of weeds, which sprout rapidly because of the humidity. As the farmers say, "Controlling weeds is the most complicated job and now we realize that it is risky, because of the previous use of herbicides. Here we used to use poisons carelessly, with no knowledge of good management".

The sugarcane growers of Callejón Abaroa say that after 2005 they received training in pesticide management, and listened to radio programs by CITTCA, broadcast about mid-day, when they are resting, as confirmed by Santos Martínez. He considers himself a new grower, with his seven years' experience and seven and a half hectares under cultivation. "I was always interested. The first year I did not participate, because I had some other jobs, but now I go to all the meetings at the cooperative in Minero".

Don Santos said: "The best things they showed us, which we learned and appreciated because now they are practical and useful are: how to recognize and prepare products for a good control of weeds and pests; also the practice of how to apply them so that we waste less product and water."

Two nozzles spray faster than one.

Ismael Ortiz, nicknamed 'Cricket' by his workmates, told us that with the training he received, he saved money and expense. Before the project, he used 20 litres of pesticides to cover one furrow 150 metres long. He used nozzles with very big holes. He never changed them and they were worn out. He now uses new nozzles, with small holes, as the project told him, and with 100 litres he covers a hectare.

Gregorio Flores, a grower in Callejón Abaroa, says that with the project, they learned to use the right measures for their crops. "Now we don't poison the plants like before and we don't make ourselves sick when we spray. Now we know how much agrochemical we should use".

Elsewhere, in the Cooperative 'El Fortín', we confirmed that the growers value what they learned about weed control and equipment. Pedro Luizaga, a dynamic farmer, showed us that after the talks, he decided to change his nozzles. He even tried a more efficient way of spraying his cane. "I found this wand in Montero with two nozzles and now with no effort, walking at a normal pace, I spray the furrow, without going from plant to plant. It covers well and one barrelful of mix is enough for a hectare," he says with pride.

An important achievement of the project was the creation of seedbeds administered by some of the cooperatives, who organized themselves to manage the varieties together. The Abaroa Cooperative has 30 members and was created in 1973.

Sergio Juchasara, vice-president of the Cooperative, says that before the project, there were no seedbeds, and no support for the growers. They got their seed from their own fields. In a few cases they bought it or exchanged mature cane for seed. Now the Cooperative has a group seedbed with two hectares and the varieties UCG 90-20, and CITTCA 85-22. With other, neighbouring growers, they produce seed of two additional varieties. Their yields are between 160 and 180 tons per hectare. In one of their meetings, the members determined how much seed they would give to each person who requested it. They manage the seedbed with funds from the Cooperative.

The growers of Abaroa appreciate being able to receive seed selected for multiplication. "Years ago we did not know, and now we have better guidance", admits Wilson Alvarez, cane grower.

Raimundo Maíz reports that before the project, they worked in a routine way, but now they know how to manage chemicals and varieties. They learned to recognize the soils so they would know which type of variety they would use. In the training events, the growers have seen the disk plough, which

does a better job ploughing under crop stubble, which lets air and water into the soil, and breaks the compacted layers in the top 20 centimetres. But the Rome plough (a heavy plough with several disks) does not do that. With the disk plough, the crop takes root better.

Now what comes next? The small sugarcane growers are satisfied with the results, but unsure about what will happen when the project ends, because they have new demands that arise from the innovations. Lidia Delgadillo is satisfied with the new varieties that the staff of CITTCA gave her and she is excited about renewing her old sugarcane fields.

But her biggest concern is to keep receiving technical support, especially for soil analysis which would allow her to know what varieties to plant in different soils. She said that they need soil analysis and information to decide the best variety for each type of soil. "Imagine if we don't know that, we could be thinking that the variety is no good and it could be that the soil is not right for it." The other growers confirmed that they needed to know the soil better.

CITTCA • Humid Tropics Foundation
APPLIED TECHNOLOGY INNOVATION PROJECT

SELF–EVALUATION

Growing with sugarcane

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Marco Antonio Siñaniz

EDITORS: Jeffery Bentley and Eric Boa

January 2007

Transfer of technology for integrated pest management, integrated soil management, seedbeds, weed control in the provinces of Warnes, Obispo Santistevan and Sara, department of Santa Cruz

Humid Tropics Foundation: TH-CAZ-CP01/05-02

SERVICE PROVIDER

CITTCA: Centre for Sugarcane Research and Technology Transfer

DEMANDER

UCG: Guabirá Union of Sugarcane Growers

START

March 2006

FINISH

May 2007

FIT22 is funded by DFID, UK, and this work was carried out by CABI (www.cabi.org).

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Conclusions

- The smallholder growers are happy with the sugarcane PITA and with the work by CITTCA, because they have learned to use herbicides and control weeds, and they have new sugarcane varieties.
- The use of recommended varieties, planting in the right months, and weed control, allow smallholders to increase yields on small areas, increasing their harvests and their incomes, so they can rent or buy more land, machinery, improving their homes and living standards.
- The sugarcane PITA has given positive results.

Side by side: Soybeans (far left) are popular for their high and stable prices. To make sugarcane as attractive as it once was, sugarcane growers needed new techniques to increase yields without increasing costs. This PITA is now providing new ideas, and the growers are paying attention.

LUCIANO COIMBRA, proud of his farm, harvests his sugarcane to compete in the first sugarcane growing championship.

Víctor Quena, smallholder sugarcane grower, invited us to sit down. "I have been in sugarcane for 10 years. I used to plant in October and November, but then I planted in March and April, following the recommendations of the agronomist from CITTCA. I have noticed that there is a lot of difference planting in those months, since the crop takes root better. Before, I would weed my crop by hand. Now I have equipment," and standing up, with a gesture of pride he shows us a weed-cutter, Still brand. "With this it is faster and easier," he says.

Don Víctor is from Potosí. He lives with his family in Copaibo some 30 kilometres from Montero. He is a smallholder with 10 hectares of sugarcane, and he says that until recently his yields were very low, 30 tons per hectare, because he did not know how to manage the crop, when to plant, how to plough or control weeds. And his field was planted only in the variety *Norte Argentino* (NA 56-26) which he got from neighbours, and he was unaware of other varieties.

Starting two years ago, he and his friends in El Copaibo Cooperative started receiving training from CITTCA. The extensionist visits them often, gives them monthly technical talks, and shows them practices according to the season. Putting into practice what the extensionist taught him has allowed don Víctor to increase his yields, reaching 50 tons per hectare in the 2006 harvest. That increased his household income by 50%.

Now don Víctor raises his crop better and hopes to keep improving his yields until he reaches 100 tons per hectare, adopting the practices that the extensionist recommends and planting a new variety in his field, like UCG 90-20. (This and the other new varieties mentioned in this article were selected by the PITA "Introduction of sugarcane varieties," described in the previous chapter). Don Víctor knows that he can do it, since a neighbour harvested 162 tons per hectare with this new variety.

Like don Víctor, the other sugarcane growers dream of producing more cane and growing economically with their crop. This includes Raúl Vargas, whose goal is to plant more, improve his yield and income, and buy a house in Montero, to give a better life and education to his children.

Background

Santa Cruz is the department with more people from other departments in Bolivia, like Cochabamba, Potosí and Chuquisaca. Many of them work in agriculture. Sugarcane is one of the most important crops in the department, generating employment not just for the farmers but for labourers, truckers, industry and commerce.

In spite of the importance of the crop, it has low yields of 45 tons per ha, while in Brazil, cane yields over 80 tons per ha. The Bolivian

farmers are unfamiliar with several of the practices for good sugarcane management, because of a lack of training. Eighty percent of the growers are small to medium-holders, with 20 to 50 hectares of land.

DON VÍCTOR (left) is happy with the new sugarcane varieties from CITTCA. He works with their agronomist ARMANDO ESPINOSA (right), who grew up on a sugarcane farm and knows local conditions well.

CITTCA is the only sugarcane research centre in Bolivia, and it belongs to the Guabirá Sugar Mill and the Guabirá Union of Sugarcane Growers (UCG) which unites over 32 institutions of smallholders. Eighty percent of the stock of the Guabirá Mill belongs to the growers, who walk into the mill when they deliver their cane, and verify for themselves the percentage of sugar in their crop.

CITTCA was created to serve sugarcane growers, to give them new technologies to increase productivity, raise growers' incomes and improve their quality of life. The Union has its own mill (Guabirá). The technical staff of the other mills in the country also attend the annual seminars of CITTCA where they learn the latest advances in technology. In this way, CITTCA reaches thousands of families.

What the PITA did

The Guabirá Union of Sugarcane Growers (UCG) seeks solutions to low yields. So it made a demand to the Humid Tropics Foundation. They accepted the demand, since it came from a group of small to medium sugarcane growers. The Foundation publicly requested bids from institutions for a project on technology transfer.

CITTCA bid for, and won the contract. It aimed to improve sugarcane yields through transfer of appropriate technology at each stage of the crop, so the farmer could apply it. Based on previous, on-farm research, CITTCA taught farmers the following topics to improve sugar cane production:

Soil management. Choose suitable soils for planting sugarcane. Plough them in advance and use the right tools according to the type of soil.

Quality seed. Use vigorous seed, without mixing varieties. Take seed from healthy, young plants, which are no more that one year old.

Plant in autumn, from March to June (in the southern hemisphere), at the start of the dry season, when the soil is still moist. Since sugarcane grows for 14 months, this allows growers to cut in the dry season, when it is easier to harvest the cane. Plant at a distance which allows the use of machinery (1.3 to 1.5 metres) and a depth of 25 to 30 centimetres, placing two cuttings of sugarcane side by side, all down the furrow.

Weeds. Control starts with ploughing. Use cane cultivators, hand weeding, herbicides or a combination of them. Fifteen days after planting, before the cane sprouts, hoe the surface to eliminate the first generation of weeds and level the soil, taking care not to dig up the buried sugarcane. Apply herbicides early, an important suggestion; before the PITA the farmers applied too late. Spraying when the weeds are small saves money, uses less chemical and allows a better control.

Cultivate with a tractor at 45 days, which can be done with a disk harrow, a chisel harrow or a cultivator, trying to level the furrows. After 60 days apply herbicides. Cultivate a second time at 80 days, to hill up the soil around the cane.

Pests. Manage them by using resistant varieties, planting on the right date, cultural control (cultivating, hilling up, harrowing, removing damaged plants) and biological control (CITTCA rears beneficial insects to kill pests).

The technology transfer PITA started early in 2006, with the following teaching methods:

- Seminar workshops
- Field days and technical tours
- Demonstration plots
- Technical talks in the various institutions
- Radio programs
- Pamphlets
- Individual visits to farmers

Besides the PITA, the Guabirá Sugar Mill gives funds to support growers to renew and plant more sugarcane in 2006. The project took this opportunity to teach growers about planting, reducing investment risks and assuring the planting of their sugarcane fields.

Results

To observe the adoption of technologies taught by CITTCA and the improvement in sugarcane growers' yields, the 'first championship in sugarcane growing' was held. The growers entered one lot of at least three hectares. Four areas were defined for competition, to give competitors similar conditions, taking Guabirá as the starting point. The areas were:

- Area 1: Guabirá to Montero-Warnes
- Area 2: Guabirá to Okinawa
- Area 3: Guabirá to Chané
- Area 4: Guabirá to Portachuelo, Rincón de Palometilla

There were two categories, one for first year cane and another for older sugarcane (since sugarcane is cut over several years). Twenty two sugar cane growers signed up for first year cane, and 11 for older cane. An evaluation committee was formed with CITTCA, UCG, IAG and the Humid Tropics Foundation. The evaluation steps were:

- Measure the area.
- Harvest six small parts of the lot, to form a sample of 6 – 12 tons. This was hauled to the Guabirá Mill to measure sugar content and to weigh it.
- Yield data were collected in tons per hectare of cane and tons of sugar per hectare.
- After evaluating each participant, the data were tabulated and the winner announced.

The winning farmer harvested 162 tons per hectare. He is an inspiration for the other growers. For example, Víctor Quena, mentioned at the start, said that he knew he could harvest 100 tons, because his neighbour got 162.

Demonstration plots. Pedro Huallpa, a medium-scale grower with 30 hectares in Copaibo, manages a demo plot with the PITA. He has nine furrows of each of the five varieties that CITTCA is releasing. Don Pedro showed us that several of these new varieties are much taller than *Norte*, the most widely planted one. "It's a lovely variety," he said in a tone of admiration, standing by the three-metre tall plants of thick cane (see cover).

In the demonstration plot, the neighbours come to try the new practices, to see how each variety behaves under excellent management. CITTCA has done research in farmers' fields for years, to ensure that the new ideas work under real conditions, and don Pedro has done experiments with CITTCA for nine years.

They tested many varieties to see which ones would do well under many different conditions. Don Pedro still grows some of

them. That is why the agronomists from CITTCA are confident that the new varieties will be high-yielding and long-lasting. Whenever the growers say that they want to wait and see if the new varieties still yield well in five years, the CITTCA agronomists just smile, imagining a better future.

Field days are the way the growers take part and learn the most.

SEREBÓ • Humid Tropics Foundation
APPLIED TECHNOLOGY INNOVATION PROJECT

SELF–EVALUATION

Goodbye soybean pests

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EDITORS: Jeffery Bentley and Eric Boa

January 2007

Improve soybean production in the integrated area of Santa Cruz department through the introduction of technology to manage weeds and diseases

Humid Tropics Foundation: TH-SOY-CP01/04-04

SERVICE PROVIDER

SEREBÓ: Services for Research, Training, Technical Assistance

DEMANDER

ANAPO: Association of Oil crop and Wheat Growers

START

November 2004

FINISH

May 2007

FIT22 is funded by DFID, UK, and this work was carried out by CABI (www.cabi.org).

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Conclusions

- Now the farmers are more familiar with the weeds and diseases, in particular how to recognize early stages of Asian rust. They know how to control them and can teach others about the right use of products.
- The farmers are harvesting 50% more soybean.
- Organized in groups, the farmers sell their soybeans for higher prices, so they earn more. In the future they can combine their resources to pay for technical advice that the PITA introduced.
- All the farmers that sold as a group joined ANAPO. They trust ANAPO more than the agricultural supply shops, which used to sell them any old poison.
- When the project ends, the group wants an agreement with the municipal government, to continue receiving technical assistance.

Friends and enemies. Extension agents and staff from the Humid Tropics Foundation work wtih growers to control persistent weed problems.

Don EULOGIO CONDORI now knows how to recognize pests and diseases and manage them.

The farmer Enrique González recalls "Last year a technician came from an agricultural supply shop, and he gave us a poison, like Mancozeb and he said it would control the rust disease. He left the poison and the dose of how much we should put per hectare. But while attending the courses by the agronomists from Serebó and the crop trials that they did on our land, testing different products, we realized that the product he gave us to control rust did not actually control the disease."

"Now we know which products control the disease and how to apply at the right moment so as not to lose yield, and that way we earn more. That is why I am grateful to the project for the training and the demonstration plots in our community."

Background

The village of Nueva Esperanza (New Hope) is 105 kilometres northwest of the city of Santa Cruz, in the municipality of Okinawa. The first farmers who came here were from Potosí, Cochabamba and Chuquisaca, in the 1960s. Only four of them are still living: the other residents are the children of that first group, born in Nueva Esperanza.

When they arrived, it was all natural forest. They cut it down with axes and burned the trees. They planted with sticks or hoes and the first crops were rice, then sugarcane and cotton; some people had cattle. The size of the plots varied from 25 to 50 ha.

After 1986 people started to plant soybeans, which were easy to sell in local markets, had a more or less stable price, and because credit was available. The farmers started on a small scale of two to five hectares each. Now they plant between 25 and 50 hectares of soybean per household every summer, and in the winter they plant wheat.

Weeds are a particular problem in young soybean plants. After many years of using herbicides, the weeds began to acquire resistance and the chemicals could no longer control them. But the farmers did not understand how the chemicals worked, or how the weeds had become resistant to herbicides. The most important resistant weeds were: weedy amaranth (*Amaranthus quitensis*), itch grass (*Rottboellia cochinchinensis*), wild sorghum (*Sorghum* sp.), and jungle rice (*Echinochloa colona*).

Soybeans had many diseases, especially Asian rust, a fungus (*Phakopsora pachyrizi*). Soybean diseases generally became important around 2000, and now the main disease is Asian rust. It is highly damaging, depending on the weather and stage of the crop attacked. In the last two seasons, Asian rust has been more aggressive, and in the summer season of 2005/2006 some farmers lost 80 percent of

their crop. In some cases they were not able to repay their loans.

With the PITA, farmers produce more and sell at a good price. This allowed HERIBERTO CONDORI to buy himself a planter, a necessary piece of equipment for large fields

They barely harvested between one and one and a half tons per hectare. Some of them lost their whole crop to rust. Worse yet, some farmers depended on the supply shops that sold a package of seed and pesticides, which was adequate sometimes, but in general did not give good results and people got poor yields.

SEREBÓ was created as part of ANAPO to conduct technical innovation projects within the framework of the Bolivian System of Agricultural Technology (SIBTA). SEREBÓ now works with soybean growers, especially smallholders.

ANAPO represents soybean producers in Santa Cruz department, in recent years reaching more smallholders in the north of this large region. ANAPO recognized that pests and diseases were becoming more resistant to pesticides. That was captured in a PITA, financed by the Humid Tropics Foundation. The farmers were not affiliated with ANAPO and poorly organized. Some of them received technical assistance from the farm supply shops, which gave them credit to buy agrochemicals.

After ANAPO completed the demand survey for the PITA, growers were split in two camps. One side, thinking that ANAPO only worked with large growers, was mistrustful, and wanted to see concrete results before they took part. The other side was interested in learning to use transgenic soybeans, which some growers had already planted for two years, and to see the effectiveness of new agrochemical products on the market. The positive camp was also interested in group sales; some growers had already heard that ANAPO had organized groups of smallholders who negotiated soybeans at high prices.

What the PITA did

SEREBÓ did adaptive research to find the most effective products to overcome weed resistance and to control diseases such as Asian rust and mildew. At first, the PITA identified communities and leaders to jointly plant demonstration plots, where they did trials to recommend how to combat weeds and diseases.

SEREBÓ trained the soybean growers through workshops, technical tours, field days, demonstration plots and technical visits. The farmers are pleased with the workshops. They say that at first they could not identify weeds and diseases, but they learned how, and now they can solve these problems.

On field days, farmers visit the trials in groups and learn to recognize pests and diseases and when to apply the right chemicals in the right way. They see which chemicals control weeds and diseases that ruin their soybeans. They learn to apply agrochemicals in ways that protect their health and the environment. These events are practical, because the farmers learn in the field.

Farmers also learn in the classroom, at night, when they have more time. In each community, they learn to defend soybean from its pests. The teachers are the project staff and sometimes specialists come.

The growers also receive visits from the agronomists (extensionists) in their fields, at least once a week the growers say. This is a good opportunity to monitor damage and get immediate advice on how to fight the pests. These visits are done all year long, since growers plant two crops here (winter and summer).

PITA staff write bulletins about soybean problems, and the written recommendations are shared with everyone. They write about weeds that are resistant to several chemicals, soybean diseases, agrochemical prices and a technical manual about growing soybeans. These publications are written in a clear, simple style; they are easy to read and the farmers have the advice in writing.

DON JULIÁN (left) observes rust fungus in his soybean with the help of a magnifying lens and extensionist JORGE SERRANO.

The weeds and diseases PITA is the first institution to give technical assistance to the farmers of Nueva Esperanza on the control of herbicide-resistant weeds and the early identification and timely control of Asian rust. The PITA extensionists explain the difference between products for controlling weeds vs. diseases. While the shopkeepers only mention the products that they have for sale.

To control weeds, the PITA recommends: a) evaluating weeds in the field, b) finding the recommended herbicide, c) rotating herbicides of different modes of action and working with pre-emergent herbicides, which are applied to the soil before the crop germinates, since the weeds have become resistant to many of the other herbicides.

The PITA recommended planting herbicide-resistant soybeans and spraying glyphosate to eliminate weeds in fields with diverse and resistant weeds

For fields with many and diverse resistant weeds, the PITA recommendation is to plant RR soybeans (transgenic, resistant to herbicides) and apply the herbicide glyphosate at high rates (three litres per hectare) to rid the field of weeds.

The project recommends the safe use of agrochemicals, triple washing of containers, and sending empties to a collection centre for recycling. The PITA also teaches non-chemical ways of controlling pests and diseases:

- Crop rotation
- Hoe the weeds that escape herbicide applications
- Clean the headers of harvesting machines before they enter the field

The best control observed in the field and recommended by the PITA for the control of Asian rust are the triazole fungicides such as Folicur and Poker, store-bought mixes of strobirulins and triazoles such as Priori Xtra or Opera, or tank mixes of triazoles with carbendazim at rates recommended by the manufacturer.

Results

Integrated management, combining chemical and non-chemical control is a pragmatic approach, one that farmers appreciated.

The growers did not know at first how to prepare pesticides to control weeds and diseases. The PITA taught them what to do. The growers share what they learn with their neighbours. The women take little part because the men were always the ones that grew soybeans. Now some 10% who attend

PITA-organised events are women. In some families the women make the decisions about weed and disease control, and for selling the harvest.

Now the farmers trust the advice of SEREBÓ and are satisfied. They feel that the project helps them to get better yields and more money. They feel better trained and they know more about soybeans. They say they will continue growing soybeans, because now they know how to manage their fields.

MARGARITA CONDORI, beneficiary of the soybeans weeds and diseases PITA.

The PITA beneficiaries learned how to recognize the advanced symptoms of Asian rust. The early stages of the disease are indistinct and more difficult to detect, though this is when fungicides are most effective. Through training, the farmers are improving their ability to catch the disease at a crucial stage. If left too late, fungicide application is ineffective and wasteful.

All of the farmers would like to have a technical person who could advise them immediately and efficiently. That is a problem, because of its high cost, but organized in groups, the farmers can be advised by the staff of SEREBÓ and ANAPO. They have had rewarding experiences selling soybeans in groups, as shown in the table 1. Under this scheme, the soybean smallholders are willing to pay some costs for technical assistance through their local organizations, with direct contributions, besides seeking the support of ANAPO, municipalities and the prefecture.

Heriberto Condori is a farmer, the son of one of the founders of the community. After experimenting for several years with rice and cotton, he devoted himself to planting soybeans, but as the years passed, new pests and diseases appeared. With the arrival of this PITA, they stopped being a problem, since now he can identify problems and knows which chemical products to use, when to apply and how to handle them safely.

Besides, with the help of the weeds and disease PITA, they organized a group to sell soybean in grain, and the members earned more than selling individually. Don Heriberto is grateful for the assistance from the PITA staff. He now has more sources of information, and not just the supply shops, as was the case in earlier years.

The beneficiaries said that the project fulfilled 100% of its goals. They increased their yield by 50%, more that the proposed 20%. Now they harvest two tons, or two and a half, per hectare.

The project serves growers of all regional origins, social and economic conditions, men and women. They use sustainable practices to manage soil: direct planting and crop rotation. They manage agrochemicals and their containers safely. The growers joined ANAPO after receiving technical services. They

TABLE 1: Individual and group soybean sales on the local market, Santa Cruz

YEAR	TONS NEGOTIATED	PRICE/INDIVIDUAL (US $)	PRICE/GROUP (US $)	DIFFERENCE (US$/ TON)
Summer 2004/05	18,000	220	250	30
Winter 2005	32,000	168	183	15
Summer 2005/06	22,000	165	173	8
Winter 2006	8,000	190	205	15

established strategic alliances with the municipalities and ANAPO. The farmers who took the training have adopted many of the technologies, as shown in table 2.

Twenty two growers from Nueva Esperanza sold their soybeans at nine dollars ($9) above the slated (daily) price, negotiating 3000 tons as a group. They joined with friends and neighbours to negotiate a sale of soybeans in large volumes to get better prices. They went with the agronomist from ANAPO to the processing plant. They talked to the buyer and then delivered their product. Industry pays more for volume deliveries.

Now the growers buy agrochemicals without depending on the agricultural supply shops, since they now pay in cash, instead of on credit. By paying cash, they pay less, and get whatever they want. If they buy on credit they have to take the package that the shop recommends.

Even some of the farmers not reached directly by the project learned the practices and increased their yields. Some of them joined the group sales.

Now the growers trust the people from ANAPO. "ANAPO is now an ally of ours!" The growers are going to keep receiving technical assistance, because they joined ANAPO.

There is trust among the members of the sales groups. It strengthens their knowledge to share experiences and to sell as a group, earning more money for the large volume.

Their relation with the agricultural supply shops is still strong, but growers recognize that the shops exist to sell. They help when they can but only SEREBÓ and ANAPO can provide growers with the advisory and technical service that directly serves growers' needs.

At the end of the evaluation the growers organised a barbecue lunch. On behalf of all the growers, don Eulogio Condori thanked the PITA staff for what they had done. His heartfelt comments came with warm endorsements from his fellow growers and showed the sincere gratitude and genuine respect that had been won.

TABLE 2

ADOPTION OF PRACTICES OR TECHNOLOGIES	USE THE TECHNOLOGY
Herbicides – weed control	100%
Fungicides – disease control	100%
Transgenics	50%
Group selling	70%

Altiplano

APPLIED TECHNOLOGY INNOVATION PROJECT

CHAPTERS

EDAS • Altiplano Foundation
APPLIED TECHNOLOGY INNOVATION PROJECT

SELF–EVALUATION

Wool from live llamas

Ricardo Torres, Humberto Muenala

EDITORS: Jeffery Bentley and Eric Boa

January 2007

PITA APPLIED TECHNOLOGY INNOVATION PROJECT

Training and the use of llama fibre by camelid owners of the 12 ayllus of the province Saucarí, department of Oruro

Altiplano Foundation : 45-01/05/C16

SERVICE PROVIDER

EDAS: Agriculture, Livestock and Social Development Team

DEMANDER

CAO-S: Body of Local, Indigenous Authorities of Saucarí

START

November 2005

FINISH

April 2007

FIT FACILITATING TECHNICAL INNOVATION

FIT22 is funded by DFID, UK, and this work was carried out by CABI (www.cabi.org).

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Conclusions

- Llamas were in decline, barely valued for their meat and with few other prospects for earning money. Now the herders want more llamas, which now make money for their owners. Llamas do not damage the soil when they walk, and when they eat, they do not pull the plants up by the roots.
- Many women were involved with this pita, attending courses and becoming leaders of their organizations. Already women crafters are benefiting from the regular supply of llama fibre.
- A technique introduced by the PITA, pulling out thick bristles (hairs), makes the fibre finer and more valuable.
- The llama wool project also improved health of the animals, and showed people how to deworm.

A member of a group of women who meet regularly in Toledo to hand process llama fibre. They want to start selling their own products.

CRISTÓBAL LAPACA CHAMBI raises llamas in Culluri. Always optimistic, he relishes the opportunity to make money from animals he knows well but had limited commercial potential before the PITA started.

Background

In the Province of Saucarí, in Oruro, people raise llamas, sheep and cattle. Several institutions have supported livestock raising in Saucarí. The first one was PAC (Program for Smallholder Self-Development), which worked with farming and livestock in general, including rural construction. When PAC ended, another institution appeared, UNEPCA (Executing Unit for Camelid Projects). It supported llamas and alpacas owners who produced meat, wool and hide. In Toledo, capital of Saucarí, a group of women who work with handicrafts were organized, with the PPC (Camelid Pilot Project).

The NGO EDAS works directly in Saucarí Province, with livestock, agriculture and rural construction. EDAS is carrying out the llama wool PITA. The demanders are the Body of *Originario* (Local, Indigenous) Authorities of Saucarí (CAO-S). The project trains livestock owners to make use of llama fibre, shearing the animals live, removing the bristles, and selling the wool.

Llama products like meat, hide and wool were once very cheap, but thanks to projects supported by the Altiplano Foundation, llama owners have raised their prices. A kilo of meat once cost 5 Bs. ($0.63); now it is 10-13 Bs. ($1.25-1.63). The hide with the fibre was sold for 8-15 Bs. ($1-1.88) and now the sheared wool sells for 10 Bs., just for a pound of fibre.

Cristóbal Lapaca Chambi says: "We want to use llama fibre, and even process finished products, whether clothing like sweaters, shawls, stockings or other things. That way we sell a bit more expensively, at a fair price and it would be good to have some help finding a market."

Llama fibre was once rejected because it had too many bristles. Alpaca wool was in greater demand and more expensive. But llama fibre becomes finer than alpaca wool if the bristles (Spanish, *cerda*; Aymara, *uywi*) are removed: one by one, by hand. Without the bristles, llama wool measures 17 microns and alpaca wool is 22 microns. Women hand classify the fibre, by touch, separating it into quality grades based on thickness: the extra-fine from the first, second and thick.

What the PITA did

CAO-S, the organization of *Ayllus* (local territorial and kinship-based groups), with the

Llama wool is not exactly wool

People call llama hair 'wool', but technically it is not, because it is straight, not curly. Llama hair does not have grease (lanoline), nor is it covered with scale-like cuticles, while wool does have lanoline, and is covered with facets, like a pineapple. Technically, llama hair is not wool, but fibre.

support of EDAS, answered the call for proposals by the Altiplano Foundation to conduct the llama wool PITA. It supports the communities with courses and strengthens local organizations (AGCHY, AGAP, AGASU, OMAP, GAPSA, and others).

Wool sheared from a live lama, on a drop cloth, to keep it clean.

In the animal health campaigns, the llama-herding families learn to give their animals injections and baths to control diseases and parasites such as ticks, lice and mange. They now know how to shear the fibre of live llamas, with shears. They place the animals on drop-cloths to keep the fibre free of dirt, straw and other impurities. They learn to keep the llamas still, to shear them easily, and to get whole locks of nicely sheared wool. Whereas before they used knives or pieces of tin cans for shearing sheep, and they did little or no shearing of llamas.

The herders have learned to remove the bristles from llama fibre and they know that fibre without bristles is finer than that of alpacas. The llama owners are convinced that to have good fibre, the animals must be healthy and well fed. So the people carry out animal health campaigns and grow nutritious fodder like alfalfa, barley, festuca and other grasses.

Some families who have few animals are buying more llamas to increase their *tamas* (flocks of llamas). A few years ago, llama meat was cheaper than mutton. Now the price of llama meat is on the rise, as is the price of the hide, and of course the price of wool. The llama owners know that llamas earn income. The people are now interested in taking better care of their animals.

With support from the Altiplano Foundation, a buying centre has been built in Toledo for all the communities of Saucarí Province. Nine sub-centres are also being built in the communities of Untavi, Pacariza-Huayllani, Challa Cruz, Sica Ullami, Collpahuma, Culluri, Challarito, Tijllacahua, and Cari Cari. The centre in Toledo and the sub-centres have tables for removing the bristles.

The tables have screens to hold the sheared locks; the wool is selected and the bristles are hand-removed. Altiplano women learn to card, spin and weave in their childhood. The centre has shears, work clothes, animal health products and scales for weighing the fibre. Sweaters, weavings and other pieces are displayed at markets and fairs.

A marketing study and a business plan were done to understand the supply and demand of llama wool. They found that three companies are keen to buy llama fibre: Coproca in La Paz, Fotrama in Cochabamba and Altifibers in La Paz. Prices fluctuate between 7 and 10 Bs. ($0.88 to $1.25) per pound. Now the beneficiaries know the prices and where to sell the wool.

Contacts have been made and talks are well-advanced to sell llama wool to the Altifibers company of La Paz. And some of the wool is now sold to a group of craftswomen in Toledo who are part of the project.

Imported shears from Germany are good at cutting fibre but difficult to hold in small hands.

Busy Hands. Transforming llama wool is the responsibility of enterprising craftswomen, who hand-remove the bristles from the llama wool, making it finer and more valuable.

Results

The herders of this province once had little interest in llamas, but are now building up herds with both breeds, *t'ampulli* (hairy llamas) or *q'ara* (bigger llamas, with little wool, for meat) and they are sowing fodder. They also shear vicuñas. The vicuñas are rounded up with the Kory Qarwa group, which works with the Puma Foundation (wildlife conservationists). The whole town surrounds the vicuñas and herds them into wire corrals to shear them. The project staff supported this campaign. The families who have sheared vicuñas have already sold their fibre.

Cristóbal Lapaca Chambi explains that the project started with animal health. "Before, we did not vaccinate. Now we de-parasitized twice. We did not know how to breed llamas. I had one male llama that was *muru* (had round ears), and now I have young ones like that because of improper breeding. With fibre, we have practiced shearing and we have had practical and classroom training. And they have helped us in the vicuña shearing campaign. We are rebuilding our herds. Llamas used to be undervalued. It is true that they do not have large quantities of wool, but the project has offered us a fair price. Before, we sold at 5 Bs. to 10 Bs., with the hide. Now we sell the wool for 10 Bs. And it is flattering."

When asked if he wanted to continue, he said yes. "We have to improve. Mine are *q'aras*. We know about removing the bristles, and we are going to improve. I have the idea becoming better. I always yearned for this, and to have a finished product. We have a craft centre and we want the project to keep supporting us."

He added that "The problem for us is the market. Keep working with fair prices for the raw materials and labour. There must be management; we participated in the llama contest and I came in second-place. We want to continue improving. We are keen to improve."

With the PITA's support, herders have removed the parasites from their animals. Don Cristóbal says: "For some people it was the first time they had removed parasites. Our animals were *putisito* (very small) attacked by the *jamaku* (tick) and they would die. Flock by flock, they were all benefited. We have done *ayni* (labour parties) to remove the parasites."

Don Cristóbal thinks that a rural business would be a good idea, because "we want to aim towards a final product. With organization we can go better and capture resources for camelids". Forming a rural business in Toledo will generate more possibilities for selling fibre.

Delfín Layme explains: "Three years ago we planted 100 hectares. And now 33 hectares of alfalfa, barley, so our animals improve with fodder. EDAS (with the local government of Toledo and others) held camelid contests. This was in our favour. We needed a push, an injection. We want continuity to be given; then we will walk on our own." In the contest, the families took their best llamas (*t'ampulli* and *q'ara*) to Toledo, and from there

the best ones went to the departmental contest in Oruro, where they were judged by a jury. A llama from the province came in second place in its category in the national contest in Cochabamba.

The people learned several things with the project. Delfín Layme says "We can prevent (diseases), prepare the doses of medicine and inject. We have learned how to use proper shears. We must know about feeding llamas with introduced pastures and fodders. We are going to keep ploughing and we want to grow more (fodder)."

María Mena Mamani Arevillca of the community of Culluri says "Now I know how to cure sick llamas. I just need some help grabbing them."

Some of the new practices have not been easy. María Mamani says "I cannot inject the llamas by myself, because they are too big. Sheep are easy. I had a hard time understanding the dosage. I was afraid it was going to die, but it didn't die."

Aurora Apaza of Cáceres tells us that "Those of us who do not have land or livestock, buy sheared fibre, raw material that is, then we remove the bristles, we spin it and we weave. Then we sell the finished clothing. This helps us very much."

Tin can for shears. Llama herders on the Altiplano used to shear their animals with knives or with pieces of sardine cans. The project gave them shears. Now llama owners shear their animals faster and get better wool.

WIÑAY • Altiplano Foundation
APPLIED TECHNOLOGY INNOVATION PROJECT

SELF–EVALUATION

No longer slaves to their animals

Florentino Siacara Choque, Rómulo Caso Coca,
José Luis Quisbert Ríos, José Luis Pozo J., Javier Rollano Murillo

EDITORS: Jeffery Bentley and Eric Boa

January 2007

PITA APPLIED TECHNOLOGY INNOVATION PROJECT

Technological innovation in the transformation of dairy products and adequate management of dairy herds, municipality of Caracollo

Altiplano Foundation: 45-01/05/L8

SERVICE PROVIDER

WIÑAY: Integrated Services Firm

DEMANDER

Community of Collpaña

START

December 2005

FINISH

April 2007

FIT FACILITATING TECHNICAL INNOVATION

FIT22 is funded by DFID, UK, and this work was carried out by CABI (www.cabi.org).

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Conclusions

- The small creamery is working, making dairy products and selling them.
- People deliver fresh milk to a pick-up truck that goes to each farm.
- The smallholders like the project, because they receive money. They do not have to make cheese, or make long walks to sell it.
- The beneficiaries worry about what will happen when the project ends.

Conditions are harsh in the Altiplano yet with help and encouragement new dairy enterprises have been successfully established.

Agronomist ARMANDO MAMANI of Wiñay collects the milk every day, writing down the amount delivered by señora Hilaria, farmer and president of the Milk Producers' Association, who also records in her own book how much milk she turns in.

Background

Caracollo is on the Central Altiplano at 3900 metres above sea level. Before 1952 there were haciendas with one big landowner in each community. Because of that, the local people did not have an opportunity for education or other aspirations. There was much poverty.

The families sustained themselves by raising sheep, llamas, burros and cattle. Each one of these species was important. The sheep gave meat and wool, and they were easy to sell. The llamas were for fiestas and for ritual sacrifices to the *Pacha Mama* (Mother Earth), and for their meat. The burro carried loads and bulls ploughed the earth. Livestock and agriculture only gave enough to eat, for the family to survive. No one figured the costs of production.

People cared for the animals out of routine, to care for the family's honour (he who had few or no animals was considered a lazy, worthless man). But either way, the peasants were slaves to their animals, whether they had many or few.

The Bolivian Altiplano has scant rain and little vegetation. The climate is cold with a long winter and temperatures below 10 oC. Frost and hail are frequent and so are long droughts. There is a generalized poverty on the Altiplano. It is a great surprise that, under these high risk conditions, the farmers of the municipality of Caracollo produce potatoes, quinoa, broad beans, sheep, llamas and cattle.

In years of poor harvests, food is scarce in the villages, leading to malnutrition, disease and the death of children. The adults can fight hunger by chewing coca. The youth migrate to the lowlands or the cities, seeking work.

After the agrarian reform of 1952 the rural people were no longer the slaves of the landowners. They worked the land just for themselves. They till the land in *aynoqas* (they divide their land into large open fields, with one field devoted to potatoes, others to other crops and several in fallow). Every family has plots in each *aynoqa*. The harvest belongs to the family that planted the parcel, but after the harvest, the animals graze anywhere in the *aynoqa*.

From 1963 through the 1970s, the communities divided up the *aynoqas* into individual plots. This brought benefits and

RUTH FERNÁNDEZ said that a cow with small nipples is difficult to milk. It tires the hands . She would really like to buy a mechanical milker.

problems. The benefits: everyone could improve their plot, fertilizing it, putting in irrigated vegetables, planting alfalfa, or making greenhouses or walled fields. The problems: the livestock could no longer roam loose, but had to be carefully herded by each household, to protect the plots all 12 months of the year, with most of the responsibility for herding falling on the women and children, who became even more enslaved to this task.

People received occasional technical assistance from the government, NGOs and the agrarian bank also supported them. For instance, they dipped the sheep to prevent mange, gave training, planted alfalfa and other pastures, improved the breeds of sheep and gave credit. Nevertheless, progress was slow. After implementing the Law of Popular Participation in 1994 the communities had greater access to state funds. But the money from co-participation (for the municipalities) was not enough, until it improved with direct taxes on oil and gas.

RUTH FERNÁNDEZ of Santa Fe earns 20 to 25 Bs. ($2.50 to $3.13) every day, selling milk. And she no longer makes long walks to sell cheese.

Now in Caracollo the cropland is private property and the pasture lands are communal. The farmers of the communities of Ventilla Pongo and Santa Fe have between 10 and 20 hectares each, of which over half are arable, enough to raise milk cows.

Some local farmers started with dairy in about 1995, when they were trained by projects they solicited through CADESA (Associated Communities for Agricultural and Livestock Development). CADESA then belonged to the Development Corporation of Oruro, but is now under the prefecture, which also gives occasional technical assistance to the communities, as does World Vision. Since 2005 APROLEC (Association of Dairy Producers of the Municipality of Oruro) has helped the farmers of Santa Fe to build stables, racks for storing hay, and milk cans.

What the PITA did

After 2006, the consulting firm Wiñay (which means 'to grow' in Quechua), implemented a Dairy PITA, co-financed by the Altiplano Foundation, the municipal government of Caracollo and the farmers of five communities. The new training awakened farmers' interest in dairy. They sell their milk to a small creamery that belongs to all the farmers.

The directors of the creamery, who are representatives of each community, sell the dairy products in the communities, in Caracollo and in the city of Oruro.

Wiñay gives technical support to five communities in the municipality of Caracollo (Humacollo, Ventilla Pongo, Yarvicoya, Santa Fe, Collpaña) to produce milk. They have an elected president, vice-president and secretary-treasurer, and a board of directors representing the five communities, with their 200 members.

The Association has a constitution and legal documents, such as a tax number, business licence and health registry. In July, 2006 PROLECA (Association of Dairy and Meat Producers of the Altiplano) was legally created.

It started by planting alfalfa to have fodder and to guarantee milk production. Building stables reduces the risk of diseases, which lower milk production at high altitudes.

With support from the PITA they bought a house for the creamery, equipped with a pasteurizer, a refrigerator, a table for bagging

milk and making cheese, and a machine to seal the bags. This micro-dairy processes just 200 litres of milk a day into yoghurt and cheese. The milk is collected from all five communities. The creamery buys the milk for 2 Bs. ($0.25) a litre, paid every two weeks. Every member keeps a notebook for writing down the amount of milk collected. The agronomist who picks up the milk also keeps a record. Every day the milk is collected in aluminium milk cans and taken to the plant in a pick-up truck.

With the PITA, people received training every month, daily technical visits, and weekly training in each community for the whole family on cattle management, animal health, how to make cheese, yoghurt, custard and chocolate milk.

Esmeregildo Hinojosa Quispe, president of PROLECA, said that the milk and cheese used to be sold in Caracollo and Colquiri. It was hard work. The women walked for many kilometres from their homes to places where they could sell, often carrying a child. On the way they were hungry, tired and cold. They masked their hunger by chewing coca. Now, he says, it is easy; with the help of the project they have a sure market, and the convenience of delivering the milk on-farm to responsible people who take it to the milk plant in Caracollo, where it is hand-crafted into cheese and yoghurt, sold in Oruro to institutions like SEDEGES (Departmental Service of Social Development) and to El Negrito, a restaurant. The yoghurt is also sold in the communities themselves, and the children really like it.

The farmers said that previously they only had creole cattle (local breeds), to fatten and sell at the fairs. This earned them a sporadic income. As the dairy farmers bought better cows like Holstein and brown Swiss, at the suggestion of the PITA, they felt happy because now they were earning money every day.

Víctor Cori, a farmer in Ventilla Pongo, motivated by the project and his own best interest, has a vision of selling his creole cows and buying improved cattle. He says that he will have more milk to sell and so he will earn more. He must improve his stable, build a milking parlour, drinking troughs and mangers.

CRISTINA QUISPE (left) and her niece Andrea in the little milk plant, which one person can manage, for the benefit of 300 families.

Results

The members want to produce more, buy the dairy plant more equipment, and provide the municipality with the school breakfast. There are still a few hurdles. For example, people complain that sometimes the milk payments are late. They also wonder how they will collect the milk once the project truck is gone. But as we see in the following sections, most of people's comments are positive.

Zenón and Juana Hinojosa said that dairy is profitable "because we know for certain that every day we receive an income of 10 to 12 Bs. ($1.25 to $1.50) for five or six litres of milk which we get from a little cow we bought at the fair on 20 January."

Don Zenón says that until recently he would buy cattle at the fair, fatten them and sell them. "I was a meat seller (*mañazo*), but I realized that that business was too much work, because I had to look for cattle to buy in other communities as well. To get it, I had to walk for two or three days, sometimes without eating, just chewing coca, and I often earned nothing, because that's how that business is. Now with our new activity, dairy, I have an income every day and I am thinking

of buying two or more cows and devoting myself just to producing milk. Another advantage is that my five children drink milk, because sometimes I leave some for them to drink."

As a young man, don Santiago was a musician in a band (see cover photo of this chapter). "Now I am 66 years old. Only recently, in 2001, after many years, my wife and I realized that you can earn money from milk production." Don Santiago says that he belongs to two dairy associations: APROLEC and now PROLECA "who supported us with the building of two stables and with some equipment, like the hay bailer. I have four creole cows. I now milk between 10 and 13 litres a day, depending on the feed and attention we give the animals".

They feed the cow a bit to keep her calm while milking her. Doña Ruth learned to milk many years ago when she started as a dairy farmer with APROLEC.

Doña Ruth "cares for and milks the cows, while my husband plants, cuts and hauls the fodder. I used to make cheese and I had to take it to sell in Colquiri, but many times I could not sell it and I had no one to leave in charge of the animals, because sometimes I would lose a whole day. Now, with the project I deliver (the milk) right at home. I don't waste my time and I don't have those long, hard walks."

Eustaquia Quispe is a young woman with four children. She said that she has worked with dairy for 10 years. "I have 22 improved Holstein cows. We produce up to 60 litres per day. Now we are producing 32 litres. I have cows that produce up to 15 litres. I used to work very hard making cheese and yoghurt and walking every other day to sell in Colquiri, while carrying my little son. Now with the project I deliver all my production to our milk plant for 2 Bs. ($0.25) and they even come to my house to collect it in the project pick-up truck."

"We share the dairy work with my whole family: my children, my mother-in-law and my husband. But I am the one who spends the most time milking, caring for the cows, while my husband takes charge of hauling the fodder and of the animals' health, because he has his syringes and his medicines to cure our cows."

"Now my husband has gone to work in a nearby mine, because our children are on vacation and they help care for the animals. So I say that I also earn money. But if I were in the city I would just be waiting for my husband's salary."

"On Sundays I don't deliver milk or sell it. I use all 32 litres to make things for my children to eat, because they also like to drink milk, and eat yoghurt and cheese."

Eustaqia is determined to succeed. She wants to continue the improvements that she has brought to her family with the help of this PITA.

DOÑA EUSTAQUIA and her family are happy because they sell milk to the mini-dairy. They no longer have to make long, punishing walks to sell their cheese.

FEDEPLO • Altiplano Foundation
APPLIED TECHNOLOGY INNOVATION PROJECT

SELF–EVALUATION

Better milk, a better life

Iber Paco Gonzales, René David Cabrera, Félix Bustos Saca

EDITORS: Jeffery Bentley and Eric Boa

January 2007

PITA APPLIED TECHNOLOGY INNOVATION PROJECT

Making cheese and dairy products in the municipality of Huayllamarca, Oruro

Altiplano Foundation: 45-02/05/25

SERVICE PROVIDER

FEDEPLO: Federation of Milk Producers, Department of Oruro

DEMANDER

Nor-Carangas Provincial Association of Dairy Producers

START

April 2006

FINISH

July 2007

FIT FACILITATING TECHNICAL INNOVATION

FIT22 is funded by DFID-UK and this work was carried out by CABI (www.cabi.org).

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Conclusions

- Producing a little milk helps people to earn enough money to stay and work in the area, avoiding migration.
- The project beneficiaries call themselves "members" because they identify with the project. Hundreds of people have learned to make cheese and other products, and to produce more milk.
- The projects are not isolated efforts; some of them build on earlier successes, like this PITA which helps people to make cheese and yoghurt, thanks to earlier projects that brought alfalfa and improved cows.
- The PITA introduces appropriate technology. For example it does not promote pure breeds, but crosses of milk breeds with creoles (local breeds). The PITA does not have mechanical milking parlours, but introduces simple techniques: water for washing one's hands, and plastic pails with lids to keep the milk clean. The beneficiaries do not wean the calves, but let them suckle their mothers' milk, which calms the cows, so they can be milked on the open plains.

New enterprises help isolated communities survive. Those most likely to succeed build on existing resources and know-how.

CÉSAR VALDEZ washes his hands and the cow's udder before milking. He takes half the milk and leaves the rest for the calf. That way the milk comes out quickly and the cow is more relaxed. Otherwise it would be impossible to milk a skittish cow in an unfenced pasture.

Background

No one lives in the roofless houses in the ghost towns all along the road to Huayllamarca. Because of its extreme poverty, Huayllamarca is a town from which many people have left, just like the other towns in western Oruro. People migrate to the cities, and to other countries. Mostly adults and old people stay behind, with few young people. The population is falling. Santiago de Huayllamarca is the capital of the province of Nor Carangas, 150 kilometres northeast of the city of Oruro at an altitude of 3750 metres. The place is so high that even the cows get altitude sickness.

For many years, the local people have raised cows, sheep, llamas and other animals. But the cows produced little milk, and it was of poor quality. The people made cheese in the traditional way, using a *sullu* (Aymara: the stomach of a sheep foetus) as the rennet to curdle the milk.

The people of Huayllamarca have some micro-irrigation, thanks to the streams flowing from a small range of hills. They have small fields of fodder. The livestock live on natural pasture during the rainy season, but from August until December there is a shortage of fodder. Those with more land under micro-irrigation grow alfalfa, barley and oats for their animals. The alfalfa came in with a Danish project, in the 1980s, and people still grow it. Alfalfa allowed them to feed their cattle better, but the cows were still creoles, which gave little milk.

But milk cows from an earlier PITA on dairy farm management, also led by FEDEPLO changed the scene, since they improved cows genetically. They brought purebred cattle Holstein and brown Swiss and crossed them with the creoles. This let people have cows that withstood the difficult conditions (rough pasture, rocky hills, and altitude sickness), but which gave milk. They also held animal health and nutrition programs (preventative and curative medicine, nutritious fodder and balanced rations).

The current PITA built on those advances of earlier projects, with training on how to produce more and better milk.

What the PITA did

In March 2006, FEDEPLO with SEA (Agricultural and Livestock Enterprise Service) started a dairy PITA in Huayllamarca in collaboration with the Altiplano Foundation. The beneficiaries are 312 rural households, members of an institution called APPLENCA (Nor Carangas Provincial Association of Dairy Producers). Each farmer has an average of five dairy cows. The technical team, veterinarian Félix Bustos, agronomists Marisol Trujillo and Silvia Quispia, reorganized the farmers of APPLENCA, who wanted to produce more milk. FEDEPLO organized 15 modules (groups), one per community, throughout the whole province of Nor Carangas:

Huayllamarca, Choquellusta, Joronco, Chojñahuma, Puerto Ñequeta, Romero I, Choquechambi I, Choquechambi II, Río Bamba, Pumiri, Belén de Choquecota, Llanquera, Tacawa, Bella Vista and San Miguel.

Eight litre milking pail. The lid keeps the milk clean. An appropriate technology introduced by the PITA.

The PITA taught the people to grow forage (alfalfa, barley and oats), to give their animals nutritious feed and balanced rations. César Valdez explains that "With the project we learned to manage feed, animal health and to program our alfalfa fields". They learned to de-parasitize their animals, give them minerals, vitamins, vaccinations, treat their diseases, select breeding animals, and learned about animal reproduction (age and weight at first breeding, when to breed, diagnosing pregnancy, birth and other topics), as well as cleanliness while milking.

Alfalfa is a good forrage, introduced by a previous project: hardy and nutritious.

Every two weeks, agronomist Silvia gives them a class, community by community. Since the farmers work all day, she teaches them in the evenings, in practical courses. The people bring the milk, even if it is just two litres, and they learn to make cheese. Dairy farmer Inés Fernández says that in the courses, people learn to make cheese like: Swiss, mixed, fresh and carnival (blended with herbs, spices, and fresh chilli peppers).

Before, they only knew how to make sheep cheese. Very little whey comes out of sheep cheese, but cows' milk is more watery, and eight litres of milk makes just one kilo of cheese (and seven litres of whey). When the people saw that they were alarmed. They hated to throw away so much whey. Silvia solved this problem, teaching people to make refreshing drinks from whey; "delicious," they say. They also made custard (*flan*), milk candy (*manjar*), caramel (*dulce de leche*), yoghurt, fruit-flavoured yoghurt, and flavoured milk.

People took the lessons to heart. Elderly resident Máximo Apaza told us how to make cheese. First the cow must be hygienically milked, washing the udder with warm water and drying it with a clean rag. Second, measure the acidity with a solution of 70% alcohol and 30% water. Mix the milk with the solution, in even parts. (If it forms lumps, it is too acidic, and must not be used). Third, filter the milk into a pot and pasteurize it at 65 degrees. Then cool it to 45 degrees. Fourth, put rennet into the milk; after 10 to 15 minutes the milk curdles. Fifth, after it curdles, cut it with a knife into little cubes, separating out the whey that remains. Last, add salt to taste and pour it into molds and press it.

Dairy products are easy to sell locally. Bernardo Gómez says they sell cheese and other products at the local fair, held every two weeks in Huayllamarca. Everyone sells at the fair, once in a while. They also sell yoghurt and other products to local government employees and in the schools, to the students and teachers.

Results

Inés Fernández explains that the PITA helped the people to earn more money. Before, the cows ate what they could find. Now the pastures are controlled; the cows are given nutritious feed like alfalfa, and barley grain.

Before, the beneficiaries each had one milk cow. Now they have five. "With the project we are organized. There is a board of directors (one representative from each of the 15 modules)."

Bernardo Gómez is a farmer, a member of the project, and a brick layer. We visited the small cheese factory that don Bernardo was building in the municipal slaughter-house. The local government of Huayllamarca donated this space because the milk project is useful for the whole municipality. "This will be important for our area. This way we can make quality products." The little cheese factory has one room for pasteurizing and making the cheese, and another for ageing it. Thanks to the new cheese factory, the beneficiaries feel more committed to the PITA. They feel that they own the two-room factory.

Don Natalio Canqui Flores explains that "Economically it is a lot of income. Here in our area, milk by the litre sells for 2.50 Bs. ($0.31). If you have six litres, you do well". He explains that improving the breeds was important. Now people are selling their creole cattle, because they do not give milk, to buy milk cows. Don Natalio has two cows, which give 10 litres a day, and two cows that will calve in March.

BERNARDO GÓMEZ is dairy farmer, a member of the project and one of the workers building the little cheese factory. He hopes that the two-room factory will help them to produce more.

Chaco

APPLIED TECHNOLOGY INNOVATION PROJECT

CHAPTERS

NUEVO MILENIO • Chaco Foundation
APPLIED TECHNOLOGY INNOVATION PROJECT

SELF – EVALUATION

Raising bees, instead of killing trees

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EDITORS: Jeffery Bentley and Eric Boa

January 2007

Implementing pilot apiaries for managing productive apiaries to be developed in the communities of Villa Carmen, Busuy, San Francisco del Inti and El Palmar

Chaco Foundation: 73/04

SERVICE PROVIDER

NUEVO MILENIO (New Millennium)

DEMANDER

ASOPROMIEL (Association of Honey Producers)

START

March 2006

FINISH

March 2007

FIT22 is funded by DFID-UK and this work was carried out by CABI (www.cabi.org).

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Conclusions

- The beneficiaries learned to manage bees, capturing wild colonies safely, and caring for them in bee boxes.
- This allowed beneficiaries to earn money by selling honey, propolis, nucleus colonies (starter hives) and boxes.
- The most important thing about the project is the beneficiaries' change of attitude, since they no longer cut down trees to remove the honey; instead they raise bees, preserving the forest.
- In El Palmar, bee keepers were able to sell honey to Yacuiba, but due to the constant rains, they could not harvest honey yet in San Francisco del Inti.

Keeping bees in boxes, instead of collecting wild honey, allows beekeepers to harvest more, without cutting down trees in the forest.

CECILIO HERRERA, of San Francisco del Inti, is happy with what he learned on the project. He never thought of learning how to manage his own hives and bees, but now he knows how.

Background

Before the PITA, some beneficiaries gathered honey in the traditional way. They got a group together and went to the forest to take honey from wild hives, to take home. With axe and smoke they chopped the tree down to extract the bees' honey. This destroyed the trees. The honey hunters used no protection, and the bees stung them, sometimes twenty times per person. Many people made crude, rustic hives because they couldn't afford to buy bee boxes.

For example, in El Palmar, Valentina Sigler used to make rustic boxes from scrap lumber she scavenged from the sawmill. She says it was difficult to build boxes before she got training, but she did it, because the honey was valuable, for feeding her family. When she needed money, she would sell honey in nearby markets. They ate the honey to prevent various diseases, especially respiratory ones. Other people mixed honey with medicinal herbs.

There were some cases of earlier technical assistance; PROMARENA carried out a project in El Palmar, where they made an apiary (a group of hives), and trained a small group of beekeepers.

The Chaco has a diversity of trees, weeds and fallow plants, some of which bloom in summer and others in winter. That is just what bees need: flowers all year. Flowers determine the success of beekeeping since the bees need lots of nectar to make honey. The Chaco has areas with good vegetation and flowering which can be used to raise bees. Trees, even common weeds, have good flowers for bees. There must be staggered flowering in high forest and fallow fields, so that there is always food for the bees.

What the PITA did

In March, 2005 the Chaco Foundation financed a beekeeping PITA in the communities of San Francisco del Inti, Busuy, El Palmar and Villa El Carmen. The supplier was NUEVO MILENIO, a one-person consulting firm. The villagers learned to capture swarms, transfer colonies, raise queens, provide supplemental feeding, diagnose and control pests and diseases, collect pollen and propolis and make by-products.

Capturing a swarm is one way to get a colony. People find a wild swarm, in a tree, for example. They put an open box beneath the tree, and pound hard on the branch. The bees fall into the box, which is closed, and the bees are taken to a new hive.

Transferring a colony is when people topple a tree and put the queen in a bee nucleus box (a small box for carrying bees), and all the bees follow her in.

Bee boxes and ants. Some hives are reared in boxes provided by the project. Others are built by the people. The hives shown here could have problems because ants can enter by climbing the tall weeds. One must smear grease on the stand to keep the ants away from the hives.

Raising queens. One must replace queens every two or three years to produce hives. It is a good idea to form a bee nucleus. With this technique you can have many queens to start future hives in a short time.

Supplemental feeding. In the dry season when there is little nectar from the flowers, give the bees a little syrup made from sugar, boiled water and some herbs like *cedrón, poleo* or others.

Pest and disease control. The beekeepers learned to diagnose and control basic diseases like varroa (a mite that attaches itself to bees), European foulbrood (a bacterium), and ants.

Making by-products. Bee products can be used to cure some diseases. Propolis is a gummy, anti-fungal and antibiotic disinfectant that bees make from tree sap. Propolis syrup relieves cough and throat ailments.

The PITA helped each community site its apiary near flowers and water, in a safe place. The apiary should be at least 200 metres from a house and fenced in to keep livestock from bothering the hives.

Then the hives (maximum 20 or 30 per apiary) are placed three meters apart so that the hives do not bother each other, because they may fight for food or territory. In beekeeping PITAS, the villagers defined the activities they would do: some produced honey or pollen, sold bee nucleus colonies (starter hives), and others made bee boxes.

Some beneficiaries have two or more hives which they protect against ants. Beekeepers put wool soaked with used engine oil around the legs of the stand, or they put the legs in empty sardine cans filled with oil. They are attentive to their hives, checking them every ten days to two weeks, and controlling ants and weeds in the apiary. Some have the hives in their fields, and others near their homes.

The PITA gave much training in bee carpentry, to make bee boxes from local materials. There is abundant wood in the area, which helps keep costs down.

The beekeepers learned to install and place their boxes. They used local materials, like tree trunks, as the stands for the boxes. They learned to prevent ants climbing the stands.

A complete hive consists of two boxes: a lower one (with the queen and the brood) and an upper one (with honey). A standard hive has the following parts:

Top cover, protects the wood of the hive from the sun and rain.

Inner cover, helps keep the hive cool.

Honey super (the upper box, with honey) has 10 little frames, with wire, where the bees make their honeycombs.

Brood chamber with 10 frames and a floor, the lower box where the queen lives, with the brood combs.

Between the two boxes, one puts a queen excluder screen, which keeps the queen from going to the upper box, so that brood does not get mixed with honey.

Hives in the Bolivian Chaco are built from cedar or *timboy* for the main body of the boxes. Cedar is a light, durable wood which, like *timboy*, makes it easy to harvest and move the hives. They use *quina*, *algarrobo* (mesquite) or *lapacho* for the cover and floor, because it is durable.

Some communities make their own hives; others make them with a carpenter, giving him the wood and only paying for the labour and the use of the machinery.

TEODORO RAMOS is a carpenter. This year he thinks he will install at least 10 hives to make honey and earn money. Here he shows the floor of a box which he made from mesquite, a hardwood.

Results

Women and men, youth and children participated in this project. They are no longer afraid of bees, which was hard for them at first. But now the people have more practice and know how to manage the bees.

A man named David told us about his life as a beekeeper. Before, he would cut down trees for the honey, then with the PROMARENA project he got some training and with the PITA he learned to capture wild bees, to form bee nukes and to do mechanized honey harvesting.

He said he now has eight hives, and is also in a group with seven other people. He likes beekeeping because it takes little time and he just has to monitor his hives, with the support of his wife and children. He makes his own boxes and his youngest son is good at finding the queen when they capture swarms.

The beneficiaries are pleased to have learned a new activity to earn income, especially by selling honey. In El Palmar 80% of the beneficiaries harvested honey. For example, don David got 18 to 20 kilos per hive. They also like the other activities like building bee boxes in the carpentry shop and making bee nucleus colonies, which consists of taking a strong hive, with brood frames, honey and pollen reserves, and bees in two or three frames, which can be the nucleus of a future hive.

Valentina Sigler says "Now with the project we have learned how to make modern boxes and how to manage them". The beneficiaries know how to produce bees' honey, but none of them have honey to sell. They said they could not harvest because of the constant rain.

In El Palmar some people have successful hives, which make honey, as part of the PITA. hey have more previous experience, and they have nearby fallow land, with annual flowering plants (weeds), so there is more nectar for their bees than in San Francisco del Inti.

Don Francisco and the *corregidor* (a local constable, in communities too small to have police) of Inti are building a wall around the school. They need these jobs, because activities like beekeeping, planting corn and raising hogs are not enough to make a living. Don Francisco said that they learned a lot, and that each one of the 19 beneficiaries has had a hive for over a year.

But things went badly in Inti because it rained too much and the bees could not work well. The hives were in a bad place. The vegetation is all trees, which have already blossomed and there are few annual plants. So the hives must be moved to another place with staggered flowering.

They never harvested honey, but the bees bring back lots of pollen, and the people could have collected it, but the supplier did not give them the stipulated pollen traps. After the bees killed his prize rooster, don Francisco moved the hive far away from the house.

Cecilio Herrera in Inti did not take good care of his boxes, because he spent more time on his carpentry work. "In the place there are few flowers, so we did not harvest honey." When we asked him if he had ever made a bee box in his carpentry shop, he said no, but

that he would like to, if there were buyers. Ants destroyed don Cecilio's colony, and those of four other people, but he now has an active hive.

They learned a lot and they liked the project and hope that one day they will harvest some honey. "My brother got some beautiful honey." Don Cecilio has his hive near his house and say that the bees are not aggressive. "The PITA taught us to manage bees, but we are the ones who have not done enough to overcome our problems, to have more hives."

CIRO CARDOZO explains how to make the frames that go in the bee box. The frame is ready to put in the press, to install the wires. He says it is easy to put in the wires with this press because it is fixed to a table.

The beneficiaries in Inti said that the project training was good, but that few of them have harvested honey. So some members became discouraged and three of them left the project. But they said they learned to capture swarms, feed bees, build boxes and produce nucleus colonies. The beneficiaries said that even though they got little honey this year, they will keep going until the supplier completes the technical assistance

Don Ciro and don Teodoro say that building boxes is an interesting way to earn money and that in 2006 they did not farm, because they earned enough making bee boxes (for PITAs and private beekeepers). They say they just started beekeeping when the project came; before that, they just built bee boxes. "Raising bees is good but the rain was not in our favour and in that place we could not harvest, but I spend more time building the boxes. It is more profitable."

They are building 145 boxes for a beekeeping project in Caraparí which is also financed by the Chaco Foundation. The work keeps them busy for a month.

Many beekeepers bottle honey to sell at regional fairs. On 11 June 2006 at the Belgrano School in Yacuiba, the PITA put on a fair where the beekeepers from Busuy, Inti, El Palmar and Villa El Carmen put their products on sale: honey, propolis and pollen. The honey was sold in glass and plastic jars of one-quarter, half and one kilo. The beekeepers said that the fair was a success because they sold everything and opened a market for their products.

In San Francisco del Inti, FRANCISCO PÉREZ is pleased to promote beekeeping. He teaches his neighbours and helps them produce honey and other products.

CCIMCAT • Chaco Foundation
APPLIED TECHNOLOGY INNOVATION PROJECT

SELF–EVALUATION

New pigs for the ladies of Cañitas

Miguel Rosas Oller, Jorge Veizaga, Juan Chinchilla

EDITORS: Jeffery Bentley and Eric Boa

January 2007

Improving pig production with women farmers from the women's organization of the community of Cañitas

Chaco Foundation: 20/03

SERVICE PROVIDER

CCIMCAT: Centre for training and research for the rural women of Tarija

DEMANDER

Communities of Cañitas, La Salada, La Grampa, Cañón Oculto

START

December 2004

FINISH

December 200

FIT22 is funded by DFID-UK and this work was carried out by CABI (www.cabi.org).

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Conclusions

- The concept of introducing a new breed was sound, and the beneficiaries liked the training they received.
- The pig barn was important for the breeder pigs. It was built, but the feeding was poorly planned, and there was not enough feed. So each beneficiary could not be given two improved pigs, which was the main point of the project.
- The beneficiaries of the pig PITA live in poverty, but they want to make their business grow.
- There is a strong market demand for meat from improved pigs. This cannot be met without improved pig barns. The Chaco Foundation is now starting another PITA (on improving pig barns), which could help people to improve incomes and their quality of life.

The pig barn for the purebred breeder sows and their piglets.

LEFT: Purebred white pigs are delicate. They have to stay in the barn and eat balanced rations, but they fatten up faster.

RIGHT: Creoles are well adapted, and cheap to raise, but low-yielding.

Background

The Chaco is famous for its delicious pork. Many people prefer raising creole pigs (the local breed, descended from animals brought from Spain centuries ago) because they are tougher than purebreds, even though they take longer to fatten and are smaller than the improved breeds. People give the pigs a bit to eat in the morning, and turn them loose to find their own food (wild herbs and fruits, and waste). At night the pigs are given a little more food, so that they come back home. It is a cheap way to rear hogs, but low-yielding. Many pigs are lost and they also bother the neighbours.

In the dry season there is not enough food for the pigs. So every year at harvest the farmers store maize in corncribs (see photo). To raise better pigs, the women of the communities of Cañitas, La Salada, La Grampa, and Cañón Oculto decided to request a PITA.

What the PITA did

The PITA intended to give two improved pigs to each beneficiary, to cross them with their own creole pigs. That way they could produce pigs with the hardiness of the creoles, but which would give more meat, like the improved ones. They brought eight white sows and a boar to the community of Las Cañitas, where the PITA made a brick barn, with a roof, with large stalls for sows to nurse piglets. As piglets reached 20 kilos they were to be distributed to the beneficiaries. But purebred hogs need more medicine, vaccinations, and their white skin gets sunburned.

Dr. Richard, an excellent veterinarian, taught the women to vaccinate, castrate and care for the pigs. But the PITA did not take anticipate the food for nine large hogs, who would not wander around lose, but would stay in the barn. So the women had to bring 45 kilos of maize and eight kilos of soybeans to each monthly meeting. They paid 80 Bs. ($10) at the start and 10 Bs. ($1.25) every month to maintain the breeders in Cañitas.

On the road to Cañitas we met the president of the women's association, Lourdes Padilla, who told us that one sow had had 16 piglets, but 10 died, because there was not enough food for the sow. "Those hogs are eating up my family's maize," doña Lourdes said. They were also out of medicine.

The hogs were good mothers and they had many piglets. We saw the one that had had 16, but she only had 12 nipples, so she could only nurse 12 piglets. The women could have

EUGENIA MARTÍNEZ prepares a balanced meal for her pigs. In the trainings she learned to make it from maize and soy meal and to add vitamins.

MACARIO CÁCERES is one of the hog producers who started adopting new technologies some time ago. He sells using his mobile phone.

saved the other piglets with baby bottles, but they did not have milk to give to pigs. Since there was not enough feed for the sow, she did not give enough milk. Only six piglets survived. It was not for lack of will. The beneficiaries lived in four different communities, some of them 40 kilometres from Cañitas. They were poor women, and maize was hard to come by. They did all they could to bring maize, but it was difficult to get the food to the barn.

The PITA also gave pamphlets to the beneficiaries, about feeding hogs. The papers are important because they have illustrations which make them easy to understand. Written material helps answer the farmers' questions, and a reminder how to do things.

Results

As the following case suggests, many people in the area are recent arrivals from the interior, but the newcomers have been successful. They have land, well-built houses and sometimes a better income and quality of life than the people who are from the area.

Paulina Vargas is a successful migrant from central Bolivia, and a serious farmer. She had 50 creole pigs in 2006, but she sold many of them for Christmas. The PITA only gave her one improved pig. Even though he had every opportunity to mate with the creoles, the pig was not interested in having offspring. Even worse, he killed and ate barnyard chickens, which doña Paulina would not stand for. Finally Dr. Richard helped doña Paulina castrate the pig. We thought that perhaps doña Paulina had not fed the pig enough, which was why he ate chicken, and did not reach sexual maturity.

Petrona González, in Cañón Oculto, is a promoter. Dr. Richard trained her to help the women with their animals. She is the secretary-treasurer of the Women's Organization of the Community of Cañitas. Her mother-in-law received an improved pig, which died of pseudorabies, and now there are no more replacement piglets. The lady is very upset. The supplier has not been to the community since October.

Doña Petrona received an improved sow, but it would not mate. We thought that perhaps the pig was not eating enough, which was why it was not becoming sexually mature. But the pig looked fat enough. "I plant two hectares of maize, just for my pigs," said doña Petrona.

Macario Cáceres in La Grampa is the husband of Eugenia Martínez, one of the beneficiaries. They have been professional pork producers for some 10 years, and have made several changes. They have purebred hogs, fed on

Corncribs (*trojes*) are little cabins for storing maize. In the Chaco farmers cannot raise pigs without a big cornfield and a corncrib.

Lots of interest, but no money. FABIOLA LIMÓN says that the training was very useful. She is satisfied with the pigs she got, but she could not afford to start a hog barn.

maize that they grind in their own mill. Don Macario sells at least four products (piglets to fatten, butchered piglets to roast, pork, and breeder pigs).

Don Macario and doña Eugenia's hog barn is modern and clean. They wash it out with a high-pressure hose. They received both of the pigs that they were supposed to get from the PITA, but they say that many people did not. Some hog raisers in La Grampa, although they are not beneficiaries of the PITA, are starting to raise pigs in barns that they keep clean.

Nora Sibaute in La Grampa is enthusiastic about hog raising. Doña Nora named her purebred pig 'Reina' (Queen) and treats her like a queen indeed. Even though doña Nora has little land, and has no money to buy other hogs, she buys vitamins and soybean meal for Reina, who spends the day in the garden, eating fresh ears of maize.

Doña Nora worries when Reina sunburns her ears, and she strokes the pig to sleep at nap time. "She is my baby, my queen." Reina has gone into heat five times, and each time, doña Nora borrows a boar and brings him to the garden. But Reina only plays with him, and won't let him mount. Something is going on with these pigs, uninterested in reproduction, and it is not for lack of food or kindness.

Doña Nora says that the project was 'regular'. They learned a lot, and Dr. Richard was an outstanding teacher. Each month the technical team came from Tarija and took the women in a vehicle to Cañitas (40 kilometres away) for the meetings. It was difficult for the poorest women to turn in a hundred pounds of maize, and the soybean meal, for each meeting. They had to buy it, and money was always short. Even so, doña Nora liked the project, but she would like to get the other pig she was promised, to keep Reina company.

We talked with some butchers in the farmers' market in Yacuiba. They say that their customers prefer the meat from improved pigs, and are prepared to pay more for it. They said they buy meat from farmers or from people they know.

Even without the PITA, many local farmers are changing their pig-rearing practices. Little by little they are improving their pigsties of wood and earth. They are making walls, sheet-metal roofs, and cement floors. Some of them vaccinate and they tend their pigs when they are sick. People are starting to raise purebred hogs, and to improve their feed. This PITA has allowed some of the poorer community members, especially women, to make some of those changes as well.

DOÑA NORA in La Grampa recently started raising pigs. She is pleased with the purebred pig she received, and with the training.

SISTEAGRO • Chaco Foundation
APPLIED TECHNOLOGY INNOVATION PROJECT

SELF–EVALUATION

A hot market for peppers

Luis Antonio Barja S., Federico Alvarado Vedia, Ariel Canedo R.

EDITORS: Jeffery Bentley and Eric Boa

January 2007

PITA APPLIED TECHNOLOGY INNOVATION PROJECT

Action to support chilli pepper production

Chaco Foundation: 07/02

SERVICE PROVIDER

SISTEAGRO

DEMANDER

The community (OTB) of Villa El Carmen

START

December 2005

FINISH

October 2007

FIT FACILITATING TECHNOLOGY INNOVATION

FIT22 is funded by DFID, UK, and this work was carried out by CABI (www.cabi.org).

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Conclusions

- Farmers welcomed more support and became more enthusiastic about growing chilli peppers (*ají*). They valued the higher prices earned as a group through the Association of Chilli Pepper Producers (ASOPROAJÍ).
- ASOPROAJÍ is now organizing itself as a legally-recognized entity with statutes and regulations. This will allow it to sign agreements and sales contracts with other companies.
- This PITA was defined so broadly that specific problems, like a new virus disease, were difficult to resolve.
- Technical support has been deficient, and more training is needed. The beneficiaries also bear some responsibility for slow progress, because they thought at first that their existing knowledge of growing chilli pepper was enough.

DON TEODORO takes notes as we discuss the PITA. He is keen to learn what will happen after the project ends.

DON TEODORO'S house with a gazebo (*pahuichi*) in the garden. The *pahuichi* is a freestanding roof, made from straw and wood. It is like the living room, shady, and a place to get out of the rain: perfect for sorting harvested crops.

Background

Certain crops, like chilli pepper (*ají*), promise to raise people out of poverty, if they can grow more, and sell it for higher prices. Many farmers in the Chaco are poor, without basic services such as electricity and drinking water, because of low local and national government support, and because their work does not earn enough money.

Farmers told us they had practically given up growing chilli peppers, because they only sold them to wholesale buyers – truckers from the interior of Bolivia. The prices were getting lower and lower, and on top of that, the buyers would cheat the farmers with trick scales that would not register 100 pounds, even if loaded with over 50 kilos.

The market is demanding more and more chilli pepper. Many fresh chilli peppers are sold to the cities in the interior, as the main ingredient in homemade hot sauce (*llajwa*). But it is not in farmers' best interest to sell that way, because they lose the added value from processing the peppers.

To improve the prices they got, some of the farmers in this community started to organize themselves and successfully requested a PITA.

What the PITA did

In 2005 Chaco Foundation financed a chilli pepper PITA to teach farmers to improve the yields and sales. There were 120 members in six communities: Busuy, Villa El Carmen, Tierras Nuevas, Yaguacua, Villa Ingavi, Villa Primavera. The demander was the OTB (grassroots territorial organization, i.e. a legally-recognized, organized community) of Villa El Carmen. This gave the farmers a chance to sell chilli pepper, at good prices, but they still had many problems: several pests and diseases, weak technical assistance, and no financial support.

With the PITA, they made one organized, group sale. The staff of the PITA talked to the farmers about selling their harvest to a processing firm in Cochabamba, a big city in central Bolivia. Several of them refused to deliver their crop, because in the past they had been swindled. But ten farmers did sell, and were delighted to get a good price, paid in cash.

The PITA is helping people to change their lives: improving their harvests and sales and teaching them to pick the best place to grow chilli peppers, choosing the healthiest most productive plants to prepare their own seed, controlling pests and diseases, and explaining good techniques for harvesting, grinding and selling chilli peppers.

Results

An early success of the PITA was to improve prices, an important step in gaining support for the project. The farmers got prices between 90 Bs. and 120 Bs. ($11.25 and $15) for a hundred pounds, while the buyers had been paying a maximum of 70 Bs. ($8.75) for the finest quality chilli peppers.

SANTIAGO TEJERINA has high hopes for this season, encouraged by new opportunities for earning money.

In light of that experience, more farmers joined, reaching 120 members and planting more area to the crop. In Busuy they went from almost no chilli peppers planted in 2005 to 25 hectares in 2006, one hectare per member. Years ago, they used to plant much more, but they gave it up because of the falling prices.

But progress has been uneven. Those who planted their own chilli pepper seed have a disease, which they were unsure about. They planted chilli peppers after growing maize with too much herbicide, and they say the herbicide carried over almost killed the new plantings. They need better technical assistance, to avoid spraying fungicides to control symptoms that, as we found out, clearly suggest a virus.

There is a maggot which causes the fruit to fall (*chorrera del aji*). In spite of this and other problems, farmers are enthusiastic about chilli peppers, and think that with the help of the staff of the PITA they will find solutions that work.

Nicolás González in Busuy is keen on chilli peppers and plans to plant them next season, encouraged by the higher prices and because he feels more confident, thanks to the training. Don Nicolás says that they are improving their knowledge and are learning more than before.

He takes notes during our interview. He wants to know our names and where we come from. Other farmers join the conversation under the gazebo (*pahuichi*) and tell us how they rated the PITA.

In collaboration with the PITA and the municipal government, the farmers' association are creating a buying centre. They want to install a semi-mechanized pepper dryer, similar to others that are working well in Muyupampa, the result of another PITA, and a chilli pepper mill (included in the PITA'S budget). This will allow them for the first time to sell ground chilli pepper, for which market demand is high.

Some chilli pepper seedbeds have not been transplanted this year because of heavy and persistent rains and a shortage of tractors to plough their fields. Local varieties were attacked by the virus disease and some owners have abandoned their chilli pepper crop. They say that the improved seed arrived too late for them to make their seedbeds.

NICOLÁS GONZÁLEZ, president of the chilli pepper growers in Busuy, says that progress has been slow but positive.

Chilli pepper plants drowned by weeds. The heavy rains make it difficult to weed regularly and lead to other pests and diseases

Weeds hurt the chilli peppers. The farmers hoe and the weeds grow right back. The people want to learn to use herbicides, but they do not have the money to buy them. The flooded fields not only make weeding difficult but have led to more pests and diseases.

Teodoro Rocha and his family are really interested in chilli peppers; almost all of their harvest is for market. They want to plant a larger area. Don Teodoro says that he received the most training in seedbed management. He hopes to get more training soon so he can control the chilli maggot.

Don Teodoro says that they produce chilli peppers fairly well, but that the low prices hurt them. They want to improve the prices with support from the PITA, by selling as a group and delivering directly to Cochabamba, which they plan to do.

Don Teodoro hoed the weeds four times during this season. That is a lot of work. He said almost all of the chilli peppers are diseased, possibly the 'virus'. Although technical assistance was deficient, the PITA did make contact with expert technical assistance that farmer groups could not access[1].

The PITA introduced improved seed from Huacareta, including Huacareteño, and Punta de Lanza, acquired from the chilli pepper Growers' Association of Huacareta, who have already worked with another PITA since 2003. Wherever farmers planted that seed, the plots have just one or a few diseased plants. The farmers call this symptom '*churquera*' (from the Quechua *chhurku*, 'curled'). It is a disease still without a solution and there is a lot of it in unimproved chilli pepper plants.

At another farm, don Federico showed us one healthy and one diseased chilli pepper plant. There were many plants killed from the root, possibly a case of residual atrazine (herbicide still in the soil, after planting maize) or perhaps a soilborne fungus disease such as *Pythium* or *Phytophthora*, both found in waterlogged soils.

The farmers call this disease '*pasmo*' (an old Spanish folk name for disease). They say it does not let the crop ripen. The flowers fall, so no fruit forms. This chilli pepper also has what local people call '*chorrera*' (from the Spanish word for 'stream', because the fruit streams off the plant), which comes from a small fly which lays its eggs on the fruit buds. Next, fungi and bacteria get in through the insect's entry hole, making the fruit rot and fall to the ground.

Without access to good technical advice it is difficult for farmers to know what to do. The PITA found it difficult to cope with pests and diseases.

All of the farmers mentioned certified seed from Spain, and classified seed from Huacareta, Chuquisaca, made available through the PITA. Better quality seed gives farmers the confidence to grow more chilli peppers.

Don Ernesto Serrudo from Caiza has problems with his chilli pepper. Even though he replanted his field three times, he has not managed to get strong, healthy plants. They are diseased, and in the gaps where his chilli died, he is now growing peanuts and flowers. He is worried, but he says that with technical assistance he will find a solution. He used his

[1] The Global Plant Clinic confirmed in early 2007 that the disease is pepper mild mottle disease. It is transmitted mechanically and in seeds but not by insects.

own seed from his previous crop. He did receive selected seed, but he says he got it much too late for planting. The PITA needs to organise this better in future.

They plant some 25 hectares of chilli peppers in Caiza, more or less one hectare per farmer. Don Ernesto has had a bad experience with the 'virus' – he stresses that it is a disease and not a 'lack of nutrients'. The staff of the PITA could have helped him more: spraying fungicide is a waste of money.

In Villa El Carmen, the agricultural supply shops is more interested in selling products than giving technical assistance. Several farmers applied fungicides to control virus. Many of the farmers know how to read and many say they would like to take part in practical activities in the field, for example to control the chilli fly (*la chorrera*), and to receive more written material and manuals.

Despite problems with diseases, ERNESTO SERRUDO will continue to plant because of good prices

Even though he has had serious problems with his chilli peppers this season, don Ernesto says he will try again next season. He attributes the crop failure to the heavy rains which also led to more pests and diseases. Overall, he is encouraged by the good prices fetched through the group sale and by the possibility of grinding chilli peppers to earn even more. This is only possible because the PITA will invest in a motorized mill.

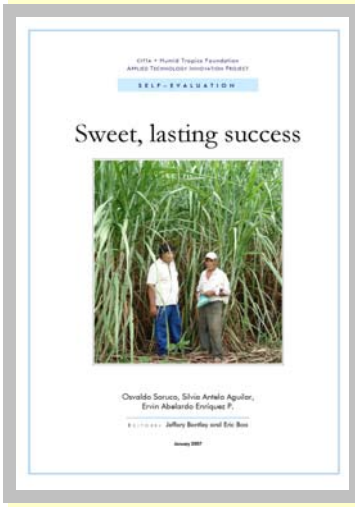
Whenever don Ernesto goes to the field he takes his slingshot (also called catapult, shanghai, bean shooter, flipper; Spanish: *honda*) to frighten birds or other animals from his crop. Birds bother many crops the world over, something future projects should consider more carefully.

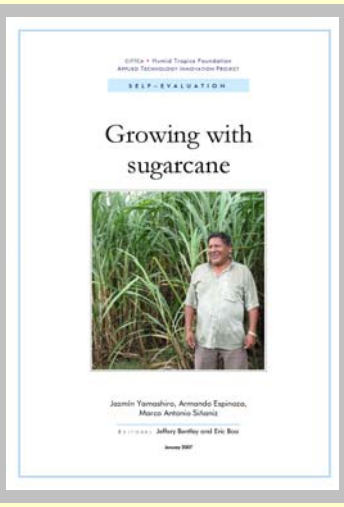
Over the two days we spoke to more than 10 growers, each one adding new details about how they had benefited from the PITA but also wanted to see improvements.

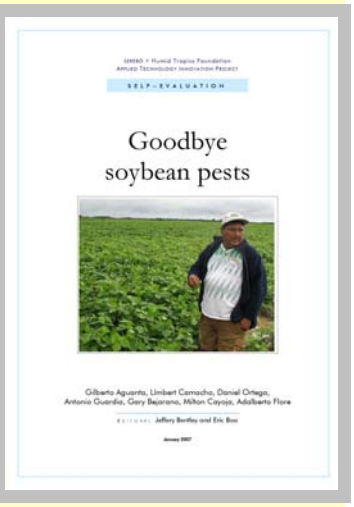
Don Santiago Tejerina, another beneficiary, prepared his seedbed but then had an accident, so this year he had to abandon his crop of chilli pepper. He is now better and plans to plant more next year, encouraged by the good price achieved through the organized sale, and by the agreement signed to sell chilli pepper direct to manufacturers in Cochabamba. In earlier years don Santiago got good harvests, but had to sell cheap.

We showed him the virus-like symptoms, and he became excited. He said the plant stops growing and loses its fruit. He was also unable to get good technical assistance. The PITA was weak on technical problems, but strong in increasing grower confidence and making more profitable markets accessible. Farmers are still convinced that growing chilli peppers is a way out of poverty.

Humid Tropics Foundation







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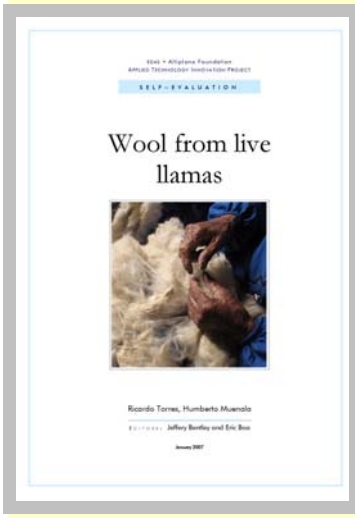

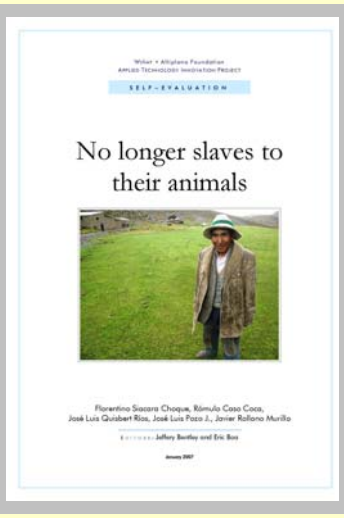

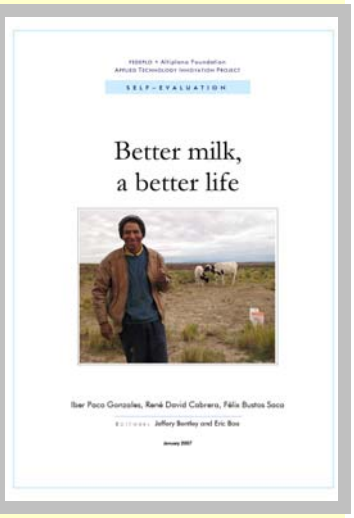

Chaco Foundation