Agronomic Education and Credit for Purchasing Fertilizer Bring Environmental and Social Benefits for Coffee Growers–An Update

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An article in this publication in 2007 reported on a successful, privately funded program in Peru which enables farm families to improve their standard of living and better manage land in coffee production. IPNI staff have assisted this program by providing agronomic education. Following is a recap of the story and an update on continued progress of the "Family Program".

Between 1940 and 1950, many small farmers migrated from the highlands of Peru to the northeastern Amazon piedmont to cultivate coffee as a means to improve their standard of living. The activity resulted in small farms located on moderately fertile soils on steep slopes. These families have earned a living from coffee production for many years. Second and third generations of these families found a way of exporting the coffee produced by local farmers through small companies. Comercio & Cia, an example of such an enterprise, has been very successful in marketing Peruvian coffee in the United States and Europe. Beginning in 1994, the company experienced significant growth and now has an important share of coffee exports from Peru. Being part of the coffee production system in its area of influence, Comercio & Cia witnessed the constant decline of yields in its own fields and in the fields of local producers.

Social and Environmental Effects

Low yields were the common denominator of this coffee production area of Peru. It was observed that one of the main limiting factors was nutrient depletion from the fields which were fertilized only with plant and animal residues. Very limited mineral fertilizer was used in coffee production in the area. Constant yield decline drove yields to less than 10 qq of parchment coffee per hectare. On top of low yields and poor income, secondary effects of soil mining were evident.

Low income did not allow savings and consequently producers could not invest in farm improvement. This condition reduced family stability and increased the problems associated with poverty. This vicious cycle continued until growers were forced to abandon farms in search for new land to start the cycle again. Soil degradation was evident due to the negative nutrient balance. Biomass production was low and soil cover was poor, exposing the soil to active erosion. The social conditions of the farmers were deteriorating along with the environment. The system was not sustainable and a radical change was necessary.

Agronomic and Social Assessment of Yield Recuperation

In 1997, Comercio & Cia started to evaluate the possibility of improving coffee yields through agronomic management of the crop. A group of technicians…with knowledge of the agronomic, economic, and social conditions of the producers…was assembled. It was evident that the basic agronomic limiting factor was the progressive soil depletion due to the continuous coffee production without replenishing the nutrients exported with the harvested coffee beans. The residues produced on the farms (pruning material, residues from fruit processing, and animal manures) were not sufficient to maintain high, profitable yields. It was essential to replenish soil nutrients with the use of fertilizers and to maintain the crop through good management practices such as trimming and adequate shade management. Field studies like the one presented in **Figure 1** demonstrated the significant effect of fertilizer application on coffee yield.

Effect of soil nutrition depletion on coffee growth and yield.

The fertilizer rate used in this experiment came from well known uptake data in the literature and nutrient uptake studies conducted by the project (data not shown). Based on this information, the project yield goal was set for 40 to 60 qq of parchment coffee per hectare. This is a realistic yield goal for coffee grown under 30 to 50% controlled shade, a situation which is prevalent for the coffee growing conditions of the area.

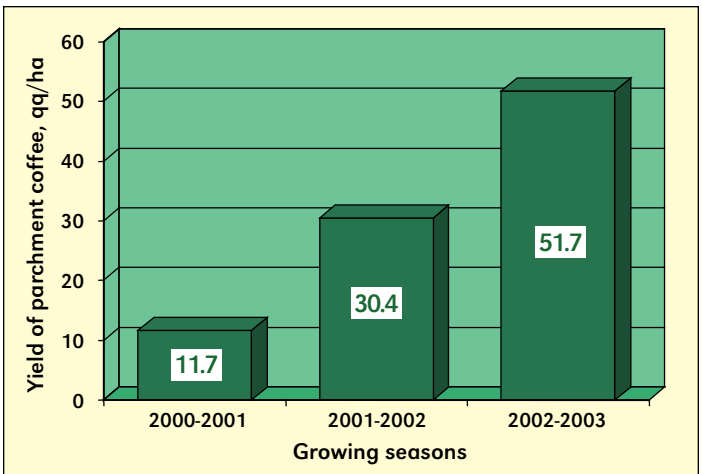

Figure 1. Effect of fertilizer application on the yield of parchment coffee at Loma Santa, Jaén, Peru.

Abbreviations and notes for this article: qq = quintals (in the context of this article, quintal = 100 lb or 45 kg); ha = hectares. USD = US dollar.

Low coffee production with poor crop management and without fertilizer application (left), in contrast with the abundant production in fields with good crop management and fertilizer application (right).

The experiment presented in **Figure 1** was designed to test the effect of this defined nutrient rate on coffee yield over a 3-year period. Knowing that the soils were depleted of nutrients, it was expected that the response would be evident in the second and third year. It was important to demonstrate a yield response to fertilizer application, but it was more important to demonstrate the yield potential after the plant stands regain the supporting biomass which is lost as a result of constant nutrient depletion. Timing and form of fertilizer application were also studied. IPNI was actively involved in the basic agronomic training of the technicians of the project and collaborated in the field research as advisor and provider of information.

It was demonstrated that coffee yield and quality were dependent on the nutrient and crop management fitted for the area. However, external factors made the situation even more dramatic. International coffee prices fell in 1999 and coffee producers of the world had to face the worse price crisis in 100 years. The fall of international prices translated into reduction of local prices and Peruvian producers found themselves in an even worse situation. Under these conditions, yield level was more important than ever. Farmers had witnessed the effect of good agronomic management on production and there was interest to improve coffee fields. Several farmers declared their fields organic with the hope of obtaining a better income with the price difference of the organic coffee in front of the conventionally grown coffee. Nevertheless, low yields made this type of production also unprofitable despite the price incentive.

Development of the Family Program: a) community organization; b) training; c) fertilizer availability; d) fertilizing coffee; e) effect on plant growth; f) plentiful production.

The research conducted in the area of the project had been able to demonstrate that the solution to the declining yields of coffee was relatively simple from the agronomic standpoint. Making inputs, mainly fertilizers, available to the farmers was the key thing needed to increase and make coffee production profitable in the area. However, the project was also able to determine that the social condition prevalent in the area was perhaps the main limiting factor of coffee production. Poverty derived from low yielding fields did not allow farmers to invest in fertilizers. Government intervention in the area was minimal and private banks did not provide credit to small farmers due to the high risk involved and the lack of legal ownership documentation of the farms which could serve as collateral. It was clear that improving coffee production in the area was more than agronomy.

The Family Program

Comercio & Cia decided to initiate an ample project with small farmers to achieve the proven possible yield increments. The need was evident for designing a project to help farmers organize and legalize their land, to make credit for fertilizer available, to train farmers in the agronomic management of the crop, and to organize the chain of production so harvested coffee could be sold in a secure way and at a fair price.

The Family Program has a favorable effect on the environment. Nutrient depletion eliminates soil cover and degrades the environment (left). Crop and shade management and fertilizer use promote growth, accumulate residues, and improve soil fertility and biodiversity (right).

The Family Program was then born under the slogan: **"More and better coffee to strengthen the family in harmony with the environment."**

One of the most important factors of the project was to make credit available to the families who join the program. This credit was provided without interest for 3 consecutive years to the farmers who joined the program the first year. The time frame was based on the expected yield response of stressed coffee fields growing in nutrient depleted soils. The collateral was the production which was to be sold to the company at standard price.

The objective of the Family Program is to recuperate soil fertility to increase coffee production and to improve family income through balanced fertilization, best crop management practices, generation and efficient use of farm residues (leaves and trimmed branches, pulp from fruit processing and animal manures), rational use of natural resources (soil, water, forest), and reforestation. The Family Program officially initiated activities during the 2003-2004 coffee growing season with producers who summed a total area of 950 ha of land under coffee. The farmers did not commit all land under coffee to the program and requested credit to fertilize only part of the coffee fields. The program effectively covered a total of 450

Table 1. Evolution of average yields and prices paid to farmers involved in program.

Type	Average yield, qq/ha		Average price, USD/qq		Average value, USD/ha	
	2006	2010	2006	2010	2006	2010
Family Program	30	40	80	120	2,400	4,800
Organic Program	10	12	87	128	870	1,536

ha. After all, this was a new project and much was heard about the allegedly negative effect of fertilizer use by many different organizations of the region. For this reason, the use of fertilizers by a small group of farmers generated much discussion and controversy. The opponents indicated, among other things, that the use of fertilizers would only degrade the soil more. Obviously, this did not happen and the families in the program enjoyed high coffee yields. Observing the benefits of the fertilizer and crop management on yield, the farmers committed all their coffee fields to the program and new requests to join the program were received. The program expanded rapidly and 7,500 ha of coffee production belonging to 2,500 households were committed for the 2005-2006 cycle. In the 2009-2010 cycle of production, 15,000 families were involved covering an area of approximately 12,500 hectares.

Benefits of the Family Program

This private enterprise program evolved to comply with the social responsibility of the community that observed and supported the initiation and development of Comercio & Cia. The international coffee price has reached an acceptable level and this has made the program more valuable. Farmers now obtain excellent yields and receive good prices.

The outcome of the program after 7 years of working with small coffee producers has been very positive. The basic objectives of recuperating soil fertility to increase coffee yields and family income through organization, agronomic training and credit for fertilizer have exceeded expectations. The positive result has expanded to entire communities in the coffee growing areas of the Peruvian northeast. Families have increased coffee production, which has had important repercussions on productive and social investments. The tangible effects of the program are as follows.

Economic Benefits

Higher coffee production with better bean and cup quality has resulted in higher income, which improves the profitability of the program households and promotes savings and investment. The evolution of coffee yields and prices received by farmers is presented in **Table 1**.

Farmers participating in the program have recognized that there is little they can do to control international coffee prices. They also realize that the best approach to cope with fluctuating international coffee prices is through the production of higher coffee yield per unit area, making a more efficient use of external and internal inputs. They are convinced that a well managed farm stabilizes high yields, and this way they can enjoy the times of high international coffee prices, or protect their investment during periods of low coffee prices. High and stable yields have generated savings that make farmers less dependent on credit and less vulnerable to the fluctuating coffee prices or adverse changes in climate that could affect their plantations.

At the moment, many farmers have changed the layout of their coffee fields to make better use of the available land, and there is incentive to renovate old coffee plantations with new seedlings grown from select seeds. The use of these and other best management practices (BMPs) have promoted yields, which now range between 40 to 50 qq of parchment coffee per hectare per cycle.

High, stable yields help protect farmers from fluctuating international coffee prices.

The good outcomes from better crop and fertilizer management have encouraged farmers to invest in better infrastructure to process harvested berries. They have constructed better and bigger pools to ferment and wash their coffee berries, and have purchased equipment to remove the skin and pulp from seeds. Farmers have also invested in trays and solar covers to carefully dry the parchment coffee to ensure that the quality of the final product remains high.

Seedling production in a well-managed nursery provides homogenous planting material, which ensures high yields.

Many farmers have diversified farm production in the spaces liberated by the improved distribution of lands dedicated to coffee. Crops like corn, cassava, passion fruit, sugarcane, as well as livestock production and fish have been included in the normal operation of the farm. This generates food and extra income to the family, particularly at times during the year when coffee is not harvested.

Solar drying facilities preserve coffee bean quality.

The communities at the Coipa and Chirinos districts of the San Ignacio province and at the San José del Alto district of Jaén Province are the regions that have changed markedly after seven years of participating in the Family Program. At the moment, the landscape of the communities is greener with more canopy coverage, and coffee plantations are clean,

orderly and show the effect of adopting basic technology. Surrounding villages and towns are more dynamic with new and diverse businesses supported by the higher income of farm owners and hired labor.

Diversification of farm activities ensures food diversity and income.

Social Benefits

As its name suggests, the main social benefit of the Family Program is the strengthening of the economic and unity of the family. This situation serves as a foundation for several other social benefits that derive directly from stable and solvent households. Notable examples include the implementation of basic sanitation by farmers participating in the program such as the construction of functional latrines, improvement of the local infrastructure, and the installation of electricity on these farms.

Greener and more orderly landscape is a product of basic technology adoption.

One of the most distressing signs of low and unstable yields was the lack of employment among communities in the region. Commonly, the main source of employment in the region ended once the coffee harvest season was complete. Both the landless population and farmers themselves were forced to look for jobs outside of their communities, generally in construction or services in distant cities. Alternatively, some were forced to move deeper into the forest to clear new lands and start again. Better yields require more hand labor, not only at harvest time but also during the complete season. Activities related to BMPs such as pruning, shade management, plantation renovation, fertilizer application, etc., need constant attention. Farmers also expend time in other implemented crops, or in animal care. All these profitable activities maintain farmers' self employed status and open stable job opportunities to the landless labor force.

Schooling is an important social benefit driven by better household income. Famers in the communities involved in the project have been able to keep their children in school to finish primary and secondary levels. Cultural levels of the families in the program keep improving, which has a decisive effect in the development of the community. Some farmers can send their children to continue their education at colleges in the city. However, most youngsters join the work force after finishing high school and take advantage of job opportunities that have resulted from the implementation of the program. Furthermore, they have the motivation to grow coffee on their own using the credit provided by the program. It is gratifying to see the attitude of this second generation of coffee farmers who eagerly embrace the new coffee technologies. This new generation is now leading the change and is instrumental in community organization, acting as coordinators for agronomic and credit training and in other roles.

Environmental Benefits

Finally, the environmental effect of the program is undisputed. The vigorous growth from coffee plants not only produces more fruit yield, but it also produces abundant biomass that is left in the field after trimming. Higher yields also result in larger amounts of pulp from the processing of fruit, which also comes back to the field after being composted. All of this additional recycling of nutrients increases soil organic matter and promotes the recuperation of soil fertility. The abundant cover from leaf litter and trimmed branches protects the soil against erosion. Nutrients applied to the soil also feed the surrounding trees that provide shade within coffee fields. Shade grows vigorously, creating good habitat, which in turn promotes biodiversity.

An important effect of the program is its ability to allow people to make a living on their existing farm area, which reduces the potential for deforestation of new sites to produce coffee. Actually, farmers satisfied with the good results in coffee production started to see reforestation as another long term economic and environmental investment. Thus, coffee producers are now reforesting areas of the farm not suitable for coffee or other crops (i.e., the perimeter of the farms, road sides and water ways). As time passes, farmers are spending more time in reforestation activities and progressively increasing their investment to the environment. The majority of the participating farms are located at the top of watersheds and reforestation at these particular sites will benefit the regional environment and contributes to the conservation of the main water sources of the region.

Awareness is also being raised among farmers about the need to treat the residual waters coming from the process of washing and de-pulping harvested coffee berries. Work is being conducted to find ways of using less water for processing purposes and to treat waste waters before disposing them in water bodies. Newly constructed washing pools also contribute by reducing water use in the washing process.

Reforestation on the perimeter of the farm is an economic and environmental investment.

Conclusion

After 7 years of implementation, the Family Program has demonstrated that a complete program of rural development can lead to effective crop management that increases coffee yields in socially marginal areas lacking governmental and private attention. The current good international coffee prices make production very profitable. However, if prices were to fall again due to shifting international conditions, the only way to attenuate the situation would be through efficient crop management that can maintain high yields. BC

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