

7.2. Searching for robust strategies through *ex-ante* assessment of agricultural projects in communities under different scenarios

Objectives

- ?? Provide farmers and extension agents with examples of decision-making processes, where farmers plan their long-term strategy facing uncertainty in market prices, climatic conditions, and other factors
- ?? Develop a methodological framework to choose robust strategies, that is, those that produce relatively good results under a range of scenarios, without necessarily being the optimal strategy in any of them
- ?? Contribute to an ongoing effort to help five villages of the municipality of Puerto Lopez in the elaboration of their community development plan
- ?? Help farmers of the EL Turpial village and the UMATA to gauge the economic worth of planning for an irrigation project in the village, and to explore the best cultivation strategies to recuperate investments

Materials and Methods

We collected the various data necessary to run an economical analysis of agricultural projects in the municipality of Puerto Lopez through interviews with farmers and consultation of local literature published by CORPOICA, Corporación Colombia Internacional (CCI) and other national organizations (see Fajardo, 2002¹). Much of these data were incorporated to update the Cultivos y Frutas para Colombia (CUFRUCOL) database (CIAT, 2001²; p 85-87). We calculated the net present value (NPV) and internal rate of return to investment for various strategies proposed by farmers at each farm in three peasant villages, El Turpial, Puerto Guadalupe, and Puerto Alicia, and for the communal lands of the two villages composing the indigenous reserve of Humapo-La Victoria.

In the case of El Turpial, the possibility of irrigation was considered in response to a farmers' request to consider the possibility of implementing an irrigation system (León, 2002¹²). In order to evaluate the economic viability of this irrigation under uncertain conditions, and to choose the most favorable combination of crops, we chose to evaluate and compare the results of a number of strategies under various scenarios (set of external conditions). As a first example, four contrasting scenarios were defined, using combinations of optimistic and pessimistic values for market prices and availability of water for irrigation. A set of cropping systems were chosen, most of which are presently included in at least one of the farms of the village. For each of these cropping systems, the yield of each component was estimated using a water balance and supposing a relationship between relative yield and relative evapotranspiration, both for irrigated and non-irrigated conditions. The NPV of each cropping system over a period of 5 years was estimated considering all production benefits, costs, and investments based on the data

¹ Fajardo, A. 2002. Análisis económico de opciones de producción para pequeños productores en los llanos orientales de Colombia. Internal report, CIAT, Cali, CO.

² CIAT. 2001. Project PE4 Annual Report 2001. CIAT, Cali, CO. 118 p.

compiled by Fajardo (CIAT, 2001¹⁸; p 85-87), as well as the estimated investments for the irrigation system. A linear programming model was elaborated to find the optimal distribution of cropping systems under each scenario, under constraints of land (30 ha available for agriculture in the village), water for irrigation, and labor. A minimal cropping area was specified for cassava and plantain, as crops needed to insure food security.

A set of additional strategies were found by repeating the optimization routines under the same scenarios, but by adding additional constraints, such as removing the possibility of irrigation, or removing the possibility of planting watermelon, which appeared to be the most lucrative crop, both under high and low prices. For each strategy under each scenario, we calculated the NPV and the “regret” (i.e., the difference between the value obtained and the best strategy for each scenario). For each strategy, we then calculated the maximum value of this regret, considering the set of studied scenarios. Following the Savage Criteria (Vallin and Van der Pooten, 2001³), the most favorable strategy is that which presents the lowest value of the maximum regret. The most favorable robust strategies can be found by setting a minimum gain requested for pessimistic conditions (or a maximum loss tolerated), and then applying the savage criteria to the strategies meeting this condition.

³ Vallin, P.; Van der Pooten, D. 2000. Aide à la décision, une approche par les cas. Editions Ellipses, Paris, FR.

Results

Detailed results can be found in reports by Fajardo (2002¹⁷) and León (2002¹²). Results obtained by Fajardo were discussed with farmers, and the methodology of cost analysis was taught to them in workshops carried out in the villages. The more recent results obtained by León will be discussed with farmers during a field visit at the end of October, 2002, which will certainly lead to the consideration of an additional number of strategies. Optimization exercises as an exploratory tool will also be conducted in the other four villages being studied.

For the *atillanura* area, the most lucrative cropping system under both high and low prices was found to be a rotation of maize in the first season with watermelon in the second, dryer season. This was caused by the high market price of watermelon. This is, in effect, a cropping system that is being used with success by farmers in Puerto Guadalupe and El Turpial, but with relatively high risks. Indeed, the farmers have no guarantee that they will be able to sell all their produce, and if they all start cultivating the same crop, the market could become saturated. Unexpected droughts also affect the crop's yield, which is why the farmers are interested in irrigation. This crop also requires a more intensive use of pesticides than do other, more traditionally cultivated crops, causing undesirable environmental impact. Under favorable prices, squash becomes a very interesting option when watermelon is not considered. In addition to being easier to cultivate, it can be stored longer and unsold squash can be consumed locally as a fruit, vegetable, or used to feed animals if they cannot be sold. Under unfavorable price conditions, cassava remains the most lucrative crop, when watermelon and irrigation are not considered. Over a 5-year time span, fruit trees do not have sufficient economic returns to be favored with respect to annual crops. However, this could be different if considering a larger time span and the positive environmental impact of trees on soil stability. Economic return can be considered only one of the factors in a multi-criteria analysis. We intend to continue this study with a multi-criteria analysis including economic return and regrets, environmental effects and services, and food security considerations.

Outputs

We expect farmers and farmer associations to be able to undertake their own economic analysis, combined with an ecological sustainability analysis, with the help of the UMATA. This will help them plan towards economic viability and ecological sustainability of their farms. The possibility of presenting such an analysis can facilitate their obtaining credits and the negotiation of contracts with buyers. Optimization techniques can help them decide how to distribute limited resources, such as labor and water, if irrigation is possible.

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