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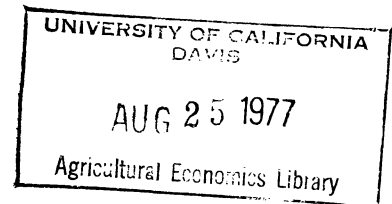
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COCA SUBSTITUTION IN BOLIVIAN AGRICULTURE:
POLITICAL ECONOMY OR EXPEDIENCY?

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*Paper presented at AAEA / WAEA joint
meeting, San Diego, July 31 - Aug. 3, 1977.*

1977

Bolivia - Agriculture

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In recent years, illegal consumption of cocaine in the United States has increased dramatically from levels which have been described as "... insignificant..." in the early 1960s (DCDATF, p. 24). Cocaine is produced from the leaf of the coca plant (*Erythroxylon coca*) which is native to the subtropical river valleys of the eastern slopes of the Andes, and which has been adapted to their piedmont. It ranges from Colombia on the north through Bolivia on the south, although Bolivia and Peru are the most important producers. Coca leaf is harvested from three to four times a year depending on its location and provides a steady flow of income relative to alternative crops which are harvested annually. Historically, most coca leaf has been consumed by chewing or as a medicinal tea with small quantities made into cocaine under government license.

The burgeoning international market for illicit cocaine has precipitated greatly increased production of coca leaf in Bolivia where traffickers have quickly developed an effective processing and marketing system.¹ Especially rapid increases in production of coca leaf are noted in the Chapare Province (a new-lands area of the piedmont), but growth is also occurring in the more traditional production areas of the *Yungas* (subtropical river valleys).

The response of the Bolivian government has been to implement programs for: a) developing viable crop substitutes for coca; and b) improving policing and control. The direction and magnitude of Bolivia's remedial action has been heavily influenced by U. S. attempts to resolve its

domestic drug problem through control of foreign supply of raw materials. The U. S. government is financing the major part of Bolivia's substitution and control programs with grants or soft loans for equipment, materials, and technical advisors. Furthermore, senior U. S. officials in Bolivia have been heavily involved in formulation of these programs which were developed in a superficially integrated effort with Bolivian civil servants ostensibly for resolution of Bolivian problems. Thus, the politico-economic situation surrounding the increased production of coca leaf in Bolivia is evolving along a path reminiscent of the Turkish experience.

This paper presents evidence on the profitability of coca leaf relative to principal crop substitutes in Bolivia's *Yungas*. The findings provide a basis for assessing the likelihood that crop substitution programs will significantly reduce the production of coca leaf and, hence, illegal cocaine.

The Model and Study Area

The internal rate of return to private investment in each crop enterprise was calculated as a measure of relative profitability using traditional benefit-cost procedures. This model lent itself to the problem at hand since coca and economically viable alternative crops are perennials whose profitability must be considered in the scope of multiyear projects. The basic question to be answered was: Which crop enterprise will yield the highest return to private investment over some specified period, which was assumed to be 15 years?

Gross revenues (project benefits) in each year and for each crop were defined as the average value of yields per hectare. Project costs per hectare for each crop included capital costs and variable costs. The

opportunity cost of family labor was assumed to be the rate for day laborers and was 12 percent for all variable capital (the bank rate for operating loans in agriculture).

The initial costs of the orchard and capital items were assumed to be incurred at the beginning of year one and variable costs, replacement of capital items, and gross revenues at the end of each year. Gross revenues less all costs in each year are the annual net benefits, and the rate that makes the present value of the stream of net benefits equal to the initial investment in the orchard is the internal rate of return and the measure of gross private profitability.

Survey data (discussed below) were used to approximate the gross revenues and capital and variable costs during each year of the project. All revenues and costs were expressed on a per hectare basis with product and factor prices held constant at 1975 levels. In every case, revenues and costs are relatively constant for several years then change as the orchard or plantation ages.

Three simplifying assumptions are inherent in this model. First, it is assumed that variable resources can be freely substituted among the alternative crop enterprises. In reality, some resources, such as land, may be used to produce one crop but not another. The consequence is that returns to investment may be maximized by choosing to produce some combination of crops that permit most efficient use of the limited resources.

Second, it is assumed that risk and uncertainty are the same for each crop. However, risk and uncertainty are likely different for each crop. If so, farmers may produce a combination of crops after accounting for risk and uncertainty in order to maximize their returns rather than only the most profitable crop as revealed by benefit-cost analysis.²

Third, the model assumes that relative factor and product prices remain constant over the life of each perennial crop. This is a standard assumption of benefit-cost analysis since it is usually impractical to predict future prices.

The Chulumani area of the South *Yungas* was selected as the study site for several reasons. First, it is one of the three important coca-producing areas in the *Yungas*. Second, other crops are also commercially important and are viable alternatives to coca. Third, farmers in the Chulumani area were generally more favorably disposed to cooperate in providing survey data. Finally, an informal survey of the *Yungas* suggested the Chulumani area was the most dynamic with an obvious increase in the plantings of coca.

A formal sample of agricultural production, costs, and returns for the agricultural year (October, 1974 - September, 1975) was taken among 43 campesino farmers with 1-6 hectares in the Chulumani area. This strata represents approximately 66 percent of all farmers in the rural areas within a 15 to 20 mile radius of the city of Chulumani. The initial survey was carried out in October of 1975 and later augmented in January of 1976. The sample was taken by conglomerations of population (since the campesinos tend to live in extended communities) with systematic selection to cover the entire study area.

Based on the results of the field survey, five enterprises were chosen for analysis: coffee, oranges, coca for the legal market, coca for the illicit market, and coffee and oranges in association (coffee/oranges). A few respondents reported growing other commercial crops including avocados, other citrus, and mangoes, but the quantities produced were relatively small. No annual crops were reported grown for commercial purposes. Perennial

crops produced in limited commercial quantities (e.g., avocados and mangoes), annual crops produced for subsistence (e.g., vegetables), and new exotic crops (e.g., cabuya--a fiber) were not considered in the analysis because the potential for increasing marketings is so limited that any substitution of these crops for coca would require only a very small proportion of the total land area currently in coca. The only crops which presently have potential export markets sufficient to effect a significant reduction of land area in coca through substitution are oranges and coffee, and international markets remain to be developed.

Analyses of the profitability of coca for both the legal and illicit markets is based on a dual structure in the price data for coca. The average price paid for a basket of coca leaf (approximately 30 lbs.) in the legal La Paz market during 1975 was \$b.350, with a minimum price of \$b.320 and a maximum of \$b.380. When marketing costs (transportation, taxes, and unloading) of \$b.44.50 are subtracted, the average price of coca at the farm gate for the legal market in La Paz was \$b.305.50 with a high of \$b.335.50 and a low of \$b.275.50. Interestingly, the modal price in the survey was \$b.300. However, approximately eight of the farmers producing coca reported average annual prices in excess of the maximum La Paz price (on a farm gate basis), and a slightly larger number (ten) reported prices much below the minimum. It is probable these farmers were all selling in an illegal market with those reporting relatively low prices giving false information in the survey. In the analysis, it was assumed the legal price was the La Paz average adjusted to reflect sales at the farm gate (\$b.305.50). The illegal price was assumed to be the average of the eight survey prices over the maximum La Paz farm gate price, weighted by production (\$b.373.74).

Results of the Analysis

Coca, at the illegal price, has the highest internal rate of return (31.8 percent) followed closely by coffee/oranges (28.3 percent), coffee (24.5 percent) and oranges (23.3 percent), while coca for the legal market (22.4 percent) is slightly less profitable than other crop enterprises. The rate of return to all crop enterprises is relatively high and much greater than the cost of agricultural credit at the Agricultural Bank of Bolivia (12 percent). It is interesting to note that coca and coffee/oranges, the most profitable crops, also comprise the two most popular crop enterprises, both in terms of numbers of farmers growing them and area.

It is tempting to infer from these results that substitution of alternative crops for coca will be relatively easy. However, this strong conclusion depends on the validity of assumptions underlying the analysis. Three simplifying assumptions were made: (1) variable resources can be freely substituted among the alternative crop enterprises; (2) risk or uncertainty is the same for all crop enterprises; and (3) factor and product prices remain constant. It is probable that all three assumptions are violated with the bias of making legal and illegal coca relatively more profitable.

First, land resources are definitely not freely substitutable among the various crop enterprises. Coca is produced on the most marginal land both with respect to soil quality, gradient, and location. While oranges and coffee can be produced on such land, it is not economic to do so since yields would be seriously reduced. Concomitantly, costs of production would be greatly increased because of the difficulty of weeding and harvesting on the steep slopes and increased costs of transporting the product to the road. It has been estimated that as much as 50 percent of the land in coca in the

Chulumani area cannot be used to produce oranges or coffee (MACA). If so, coca is the only economically viable crop on approximately 20 percent of the total cultivated land area in the survey, since 40 percent of cultivated land in the survey was in coca.

Second, risk is likely greater in producing oranges and coffee than coca. Both oranges and coffee are introduced to Bolivia and require the flowering, setting, and maturation of fruit--a process that is extremely sensitive to vagaries of weather and pests. In contrast, coca, an indigenous plant, is cultivated for its leaf which is harvested from three to four times per year and is less sensitive to variations in weather and pests. Furthermore, it is the only crop to which pesticides are generally applied. Thus, there is probably a much greater variation in the annual production of coffee and oranges than in coca leaf, suggesting greater risk in production.³

Since the demand for coffee, oranges, and coca tends to be inelastic, larger variations in the annual production of coffee and oranges than coca result in even greater fluctuations in and uncertainty about their prices. Consequently, the uncertainty of maintaining family income is reduced, and the return to private investment is increased by producing coca relative to oranges and coffee. Ergo, the return to private investment in coca is more than revealed in the project analysis.

Third, it is probable that prices will increase for coca relative to coffee and oranges if illegal demand for cocaine continues to grow. Higher prices for oranges will be dependent on growth in internal demand for years to come given the extremely high costs of marketing citrus from the *Yungas* in the international market. Short supplies of coffee on the world market

has sharply boosted world prices and stimulated increased interest in expansion of coffee production in Bolivia's *Yungas*. However, other countries have already reacted to the shortage and increased plantings of coffee, while consumer boycotts have reduced demand. World coffee prices have already softened and will probably decline more in the next few years. Assuming factor prices constant (or all increasing in the same proportion) and a relative increase in the price of coca, the analysis underestimates the relative profitability of coca production.

Finally, the fixed nature of the investment in coca also severely restricts the possibility for substitution. Once a farmer has made the relatively sizable investment in coca,⁴ it is sunk since the life of the coca plant is as much as 30 years. As long as variable costs of production are covered, his propensity would be to continue producing. The fact that coca is highly profitable makes it all the more unlikely that farmers will readily substitute other crops for their coca.

Conclusions and Implications

The principal conclusion of this research is that public programs for promoting and encouraging the substitution of other crops for coca in Bolivia's *Yungas* are likely to be ineffective with relatively low rates of return to such public investment. Currently, several such programs exist or are being implemented by the Bolivian government with U. S. financing and technical assistance. In early 1975, a grant of \$0.8 million (USAID Project 511-11-995-727.1) was made which provided for four technical advisors, equipment and materials, and a line of supervised credit in a pilot project for determining the feasibility of substituting other crops for coca (USAID/

PROP). Finding crop substitutes for coca was given sharp impetus after the one-day visit of Dr. Henry Kissinger (then, U. S. Secretary of State) to Santa Cruz during early 1976. The pilot project was subsequently augmented to accelerate achievement of project goals. More importantly, a combined loan and grant of approximately \$11 million (USAID/PID) for "Accelerated Rural Development in the Yungas and Chapare," with the goal, "...to increase the per capita income of small farmers (sic)...through increasing the production of foodstuffs," (p. A4) was almost immediately proposed for authorization in 1977 and provides for four additional technical advisors, roads, rural electrification, and credit.

There are several implications. First, effective policing and control measures for either illegal cocaine or coca leaf are prerequisites if crop substitution programs are to be successful. However, the cost of achieving the necessary level of control is likely prohibitive simply because of the vastness and inaccessibility of the areas to be policed especially in the case of illegal cocaine. On the other hand, political problems associated with controlling production of coca leaf are extremely serious and probably preclude effective control of the raw material. These considerations at least partially explain Bolivia's current thrust toward substitution programs although the government is also emphasizing policing and control also with U. S. financial and technical assistance.

Second, U. S. emphasis on controlling the supply of cocaine (or any other illegal substance) at its foreign source should probably be reconsidered with more resources being devoted to policing supply at other levels in the marketing process and controlling and resulting domestic final demand.

Finally, the study provides additional evidence that programming decisions for U. S. foreign aid based on political expediency are likely to be inefficient and not in the best (economic) interest of either third-world peasants or American taxpayers (see Wennergren and Whitaker).

Footnotes

*This article is based on Working Paper 007/76 of the Consortium for International Development (CID) which was produced under GOB/USAID Contract 511-92 between CID and Bolivia's Ministry of Rural Affairs and Agriculture (MACA). The authors express appreciation to E. Boyd Wennergren, Jay C. Andersen, Terry F. Glover, and John Keith for review of an earlier draft without implicating them in any errors. The views expressed are not necessarily those of CID, MACA, USAID, or Utah State University.

1. Production and consumption of coca leaf is legal but officially discouraged in Bolivia.
2. The complexities raised by these abstractions can be explicitly be incorporated into more sophisticated models, e.g., a dynamic linear programming model under conditions of risk and uncertainty, but resources were not available for such an in-depth study.
3. Reliable time series data on production of coca leaf were not available so actual variance in annual production of coffee and oranges could not be compared with coca.
4. The initial investment for a hectare of coca (\$850) is almost three times as great as coffee/oranges which is the next most expensive.

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ABSTRACT

Bolivia, with concessional U. S. aid, is implementing programs for substituting other crops for *E. coca* from which cocaine is derived. Survey data are analyzed to determine the profitability of alternative crops. Results indicate coca is the most profitable and imply low returns to public investment in crop substitution programs.