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**EVALUATION OF INITIAL RESPONSES TO THE ALTERNATIVE CROPS
PROGRAM BY BOLIVIAN FARMERS OF THE CHAPARE REGION¹**

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**A Summary of the Major Findings
in the M.S. Thesis of the Principal Author
at North Carolina State University,
Department of Forestry.**

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INTRODUCTION

Bolivia is currently the world's second largest producer of coca leaf, the raw material from which cocaine is derived. The majority of Bolivia's coca that is eventually processed into cocaine is grown in the lowland tropical region of Bolivia, the Chapare (Labrousse, 1990; Painter and Rasnake, 1989). The United States and Bolivian governments have been promoting the establishment of alternative cropping systems in the Chapare since the mid-1970s.

With the implementation of the 1988 Ley del Regimen de la Coca y Sustancias Controladas (Coca and Controlled Substances Regulation Law), coca cultivation in the Chapare was to be phased out over a period of ten years (Painter and Rasnake, 1989). Coca growers were promised technical assistance in switching to alternative crops, and the Bolivian Institute for Agricultural Technology (IBTA) became the main entity responsible for delivering that assistance. With technical and financial backing from USAID/Bolivia, IBTA has recently intensified its efforts to develop and promote cropping systems to serve as alternatives to coca cultivation.

The purpose of this study was two-fold: (1) to gain a better understanding of the constraints facing farmers in their adoption of alternative crops, and (2) to identify opportunities for future development of the alternative crops program and the Chapare region.

METHODOLOGY AND LIMITATIONS OF STUDY

Drawing on previous studies concerning innovation adoption (Katz, 1963 and Rogers, 1983), the authors hypothesized that a number of factors are instrumental in farmers' decisions to adopt or reject alternative crops promoted in the Chapare. These include:

- an innovation's relative advantage,
- the possibility of loss (risk),
- compatibility with existing needs and values,
- complexity,
- trialability and
- observability

The principal author collected all of the data used in this study during a nine-week stay in the Chapare during which 85 farmers were visited and interviewed. The purpose of the interviews was to identify problems being faced by farmers, understand the farming practices of the region, and determine the attributes of the new crops that were contributing to their adoption or rejection.

Interviews were conducted in an informal manner (Rhoades, 1982), and an average of two to three were completed per day in five of the seven ecological subregions of the Chapare where acid, infertile soils predominate. Interviews were guided by a list of primarily open-ended questions dealing with farmer-perceived problems, farming practices, and farmers' reasons for adopting or rejecting the new crops. IBTA extensionists critically reviewed the contents, wording, and vocabulary used in the interview guide and contributed valuable suggestions for its improvement.

Visits to farmers began with an explanation of the purpose of the study, and farmers were assured that their participation was voluntary. The author first requested a walking tour of the farm site in order to get an idea of the farmer's land-use patterns and farming problems (Rhoades, 1982; Raintree, 1987). After walking around the farm, the principal author, her driver who often served as a Spanish/Quechua translator, the farmer, and an IBTA extension worker returned to the farmer's home where the interview was completed. During the interview, the author recorded detailed notes and took photographs with the farmer's permission (Rhoades, 1982; USAID, 1990). The author avoided asking questions about coca cultivation in order to reassure farmers that coca was not the focus of the visit. Figure 1 indicates the areas visited.

Respondents were chosen by probability sampling. Since the Chapare covers a wide geographical area, two-stage cluster sampling was judged to be the most time- and cost-effective sampling method (USAID, 1990). IBTA extension workers chose individual communities to visit (primary clusters) within the subregions based on the technologies being promoted and safety considerations. The extensionists then chose the promoters (secondary clusters) who were the most active and experienced, since the objective of the study was to conduct interviews with farmers who were already familiar with the alternative crops program. Promoters generated lists of adopters and non-adopters from which the principal author randomly selected respondents. For the purposes of this study, an "adopter" is defined as someone who is trying out at least one alternative crop.

In addition to interviews with farmers, the authors gathered information from key informants, including the director of a school, the doctor of a community health clinic, and a laborer employed by IBTA (Rhoades, 1982 and Chambers, 1985). The principal author also attended a meeting between farmers and representatives of PL480, the credit mechanism for the alternative crops program; and talked with five members of the Association of Maracuya (Passion Fruit) Growers.

It is important to point out that this study investigated farmers' reactions to the new crops only at one point in time, while innovation adoption is a process that can be measured best in longitudinal studies. Many of

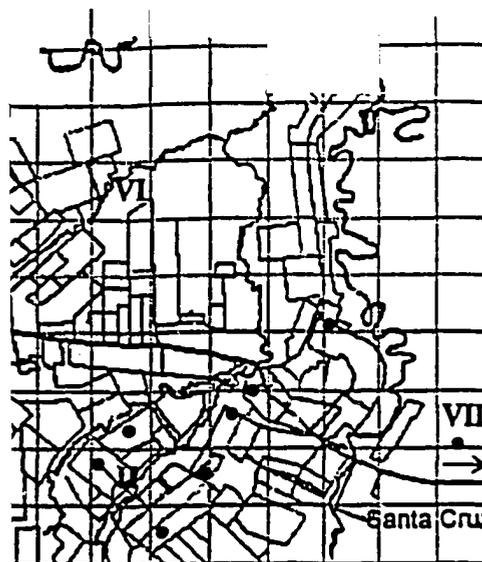
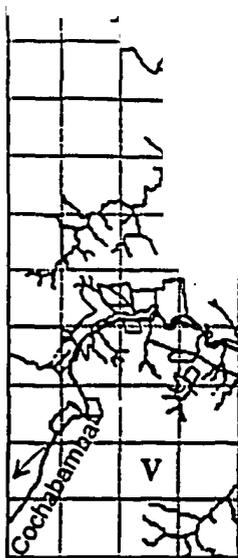


Figure 1. Map of the Chapare with location (solid circles) of communities visited. Roman numbers indicate subregions. Three communities were visited in subregion VIII, which does not appear on the map.

the farmers classified as "adopters" in this study emphasized that they were in the trial stage and were experimenting with the new crops to see which ones worked best. Thus, depending on the outcome of this initial trial period, it is possible that some of the "adopters," defined as farmers who are trying at least one new crop, will eventually become "rejecters," and that some "rejecters" will eventually become "adopters."

RESULTS AND DISCUSSION

Of the farmers interviewed, 46 (54%) were "adopters," that is farmers who were trying out at least one new crop, while 27 (32%) were "rejecters." Twelve farmers (14%) were from subregion VII B, where improved pastures, rather than new crops, were being promoted and there-

fore fell into a third category. New crops evaluated, in decreasing order of preference by the farmers included in this study, were pineapple, citrus, bean, coconut, pepper, passion fruit, peach palm, and macadamia (Figure 2).

Improved pastures is an innovation that has been adopted by an overwhelming majority of cattle owners in the Chapare. Of 27 current or prospective cattle owners, 23 (85 percent) stated they were using improved pastures. Their reasons for doing so were clear-cut; 90 percent of farmers indicated that the improved pastures provide superior growth and/or nutritional value relative to native pastures. Most of the cattle owners, however, had prior experience with improved pastures when they came to the Chapare. The positive prior experiences of farmers and the clarity of benefits demonstrated in the Chapare convinced people to use the improved pastures.

When farmers were asked to identify their most pressing farming-related problems, the three most common responses given were: (1) agronomic problems, (2) a lack of markets or low prices for their products, and (3) transportation difficulties (Table 1).

Agronomic problems included plants plagued by diseases, infertile soils, tenacious weeds, soil compaction and poor growth of pastures. Transportation difficulties included high costs, roads that were impassable during much of the year and in some regions a total lack of available transportation. Finally, an equal number of farmers mentioned problems with credit, including difficulties acquiring credit or paying back loans, and flooding or standing water as being among their most serious farming-related problems.

Twenty-two percent of the farmers responded that there were no major problems. Most of these were farmers for whom coca (38.9%), banana (22.2%), or improved citrus (11.1%) were their most important products.

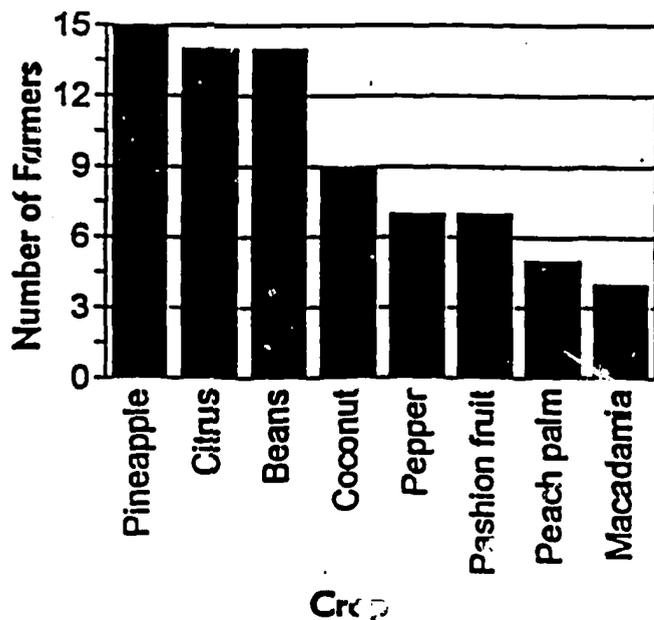


Figure 2. Alternative crops planted by farmers. Only crops planted by at least 3% of interviewed farmers are included in the figure.

Table 1. Farmer-Perceived Problems

Problems	Percent
1. Agronomic problems	30.9
2. Lack of markets or low prices	29.6
3. No major problems	22.2
4. Transportation	21.0
5. Credit-related problems	7.4
6. Flooding or standing water	7.4

(1) Table includes responses that were given by more than five percent of the farmers who responded to this question.

(2) Each farmer could give from one to four responses.

(3) Sample size = 81.

Farmers' reasons for planting alternative crops are shown in Table 2. In contrast, Table 3 lists farmers' reasons for not planting the new crops. By comparing farmers' reasons for adopting versus rejecting the alternative crops, one can begin to understand which attributes of the new crops are contributing to their adoption or rejection.

Table 2. Farmer's Reasons for Adopting Alternative Crops

Reason	Percent
1. Belief in market potential	55.3
2. Problems with coca	26.3
3. Nutrition of family	23.7
4. Superiority of improved citrus	15.8
5. Crop diversification	10.5
6. Recommendation of IBTA	10.5

(1) The table includes reasons that were given by more than 10 percent of the farmers who responded to this question.

(2) Each farmer gave from one to three responses.

(3) Sample size = 38.

The market potential of a new crop was the most common reason given for planting it. Farmer decisions were based on knowledge that a market for the product currently exists or a belief that the product would become industrialized in the near future. Several farmers suggested the need for processing and export facilities for fruits in order to strengthen markets and increase employment in the region. The second reason given was that since the future of coca appeared dismal, it was necessary to look for alternatives to coca production. The third most common reason farmers planted alternative crops was to improve the nutritional status of their families.

Table 3. Reasons Farmers Rejected Alternative Crops

Reason	Percent
1. Large investment required (plants and chemicals)	48.8
2. Plants will not grow well	34.2
3. Lack of markets	24.4
4. Length of production time	14.6
5. Not familiar with plants	12.2
6. Other (5 responses)	12.2

(1) The above table includes reasons that were given by more than 2.5 percent of the farmers.

(2) Each farmer gave from one to four responses.

(3) Sample size = 41.

(4) Note: Responses of both "rejecters" and "adopters" who were not planting some of the new crops for specific reasons are included in this table.

The most common reason farmers gave for not planting some or all of the alternative crops was the large investment required in order to purchase and maintain the new plants. The second reason stated by farmers was the belief that the plants would not grow well. The third reason was the uncertainty of markets for the alternative products. The fourth most common reason given for not planting alternative crops was the lengthy period of time required for the plants to reach production age. Finally, five farmers stated that they had not planted the alternative crops because they were not yet familiar with them. Each of the first four reasons will be discussed in turn.

Large Investment Required

Nearly half of the farmers who identified their reasons for rejecting some or all of the alternative crops mentioned the high cost of establishing the new plants due to the cost of the propagules. When the price of the propagules (Table 4) is considered in relation to the daily wage of a rural laborer at 10 bolivianos or 2.86 US dollars (1990), it is clear that buying even a few propagules represents a major investment to many farmers. Farmers were also quick to point out that if the plants die, the farmer is not reimbursed but simply loses his or her money.

In addition to the initial cost of the plants, farmers stressed that the total cost is elevated by the agrochemicals, for example fertilizers, required by the new plants. Of 41 people questioned, 34 stated that they were not using granular fertilizers. Of these 34, seven were promoters. At the price of \$35.00 to \$40.00 for a 46 kilogram sack of granular fertilizer, it is not

Table 4. Price List for Plant Propagules

COMMON NAME	SCIENTIFIC NAME	UNIT	PRICE \$US
PERENNIAL CROPS			
Bixa dye	Bixa orellana	Plant	0.15
Citrus	Citricos sp.	Plant	1.5
Coconut	Cocos nucifera	Plant	3.5
Coffee	Coffea arabica	Plant	0.06
Cocoa	Theobroma cacao	Plant	0.50
Star fruit	Averrhoa carambola	Plant	0.50
Sour sop	Annona muricata	Plant	0.60
Macadamia	Macadamia integrifolia	Plant	13.0
Black pepper	Piper nigrum	Plant	1.47
Pineapple	Ananas comosus	Sprout	0.14
Peach palm	Bactris gasipaes	Plant	0.30
Passion fruit	Pasiflora edulis	Plant	0.16
ANNUAL CROPS (Seeds)			
Rice	Oryza sativa	25 lbs.	5.0
Beans	Phaseolus vulgaris	Kg	0.70
Peanut	Arachis ipogea	Kg	1.0
Corn	Zea mays	Kg	0.55
TREE CROPS			
Several Species		Plant	0.08

Source: La Jota Experiment Station, IBTA/Chapare, Bolivia. 1991

Table 5. Reasons for Not Using (Granular) Fertilizers

Reason	Percent
1. Too much expense involved	42.4
2. Not necessary	33.3
3. Don't know how to use them	18.2
4. Harmful to use them	6.1
5. Benefit might not outweigh cost	6.1

- (1) A total of 41 farmers were asked whether or not they used fertilizers. Thirty-four people (82.9%) responded that they did not. Of these 34, 33 were asked why they did not use fertilizers, and all of their responses are shown above.
- (2) Two other farmers stated that it was harmful to use agrochemicals, but these were not included in the above tallies since the author was unable to determine whether or not the farmers were referring specifically to fertilizers.

surprising that the high cost of fertilizers was the most common reason given for not using them (Table 5).

It is important to point out that although farmers rarely used granular fertilizers, they commonly used foliar fertilizers for their coca plants. It would be interesting to investigate whether foliar fertilizers were less expensive or more available than the granular variety, or whether farmers believed that returns per unit input were justified for coca but not for other crops.

In addition to the expense involved, farmers, including three promoters, stated they did not use granular fertilizers because they did not know how. Clearly, farmers require more assistance in the area of agrochemicals, in terms of technical as well as financial assistance, in order to carry out the cultural practices recommended for the alternative crops.

Although PL480 loans were intended to ease some of the financial difficulties associated with establishing alternative crops, farmers stated that there were serious problems associated with the agricultural loan system. Of the farmers interviewed, 32 percent stated that loans were difficult to obtain, primarily because the farmers lacked official title to their lands. Of the 26 farmers interviewed who did have PL480 loans, 10 stated that it was difficult to pay back the loans with money generated from the project for which the loan was taken. A major difficulty farmers identified was that it takes at least three years for many of the new crops and cattle to produce a return, while the 13 percent annual interest is due at the completion of the first year. Furthermore, several farmers stated that interest payments were problematic because one had to pay in U.S. dollars, which were continually increasing in value relative to bolivianos. These concerns, in addition to farmers' doubts as to whether the alternative crops would grow well or yield products for which there are markets made nearly 24 percent of the farmers interviewed reluctant to take out loans that they may not be able to pay back.

Plants Will Not Grow Well

While farmers agreed that the new crops seemed to be growing well at the experiment stations, several doubted that the crops would grow equally well on their own farms due to different soil conditions and farmers' lack of technical expertise. Furthermore, farmers had seen the new crops growing poorly or suffering from diseases on neighbors' or promoters' farms. Although the poor performance of the plants may have been partially due to farmers' improper use of agrochemicals, the farmers' observations were nevertheless consistent with Tosi's predictions that, because of the climatic conditions prevalent in the bulk of the Chapare, truly tropical perennials, which require year-round

uniform temperatures and photoperiods, are likely not to grow well (Tosi, 1983). Nevertheless, since there is much inter-varietal variation in climatic tolerances within a species, it is possible that certain varieties of alternative crop species could be identified that do grow well. It is unfortunate that many of the new crops were taken to farmers' and promoters' fields before sufficient research was done to indicate whether or not the varieties being used would actually grow well in the regions where they are promoted.

Over half of the farmers interviewed reported that they made their decisions as to what to plant where based on the results of their own experiments on their own land. This information has important implications for strategies designed to promote the planting of alternative crops.

Lack of Markets

Farmers' doubts about the market potential of the alternative crops were another factor that discouraged adoption. An additional concern expressed by farmers was that if everyone started planting alternative crops and there were only domestic markets for their products, the markets would soon become saturated and prices would fall. It is interesting to note that the most popular alternative crop, pineapple, and banana, a popular traditional crop, were among the few crops which had an international as well as a domestic market.

Length of Production Time

Given the fact that the interest on agricultural loans was due at the end of the first year and farmers were expected to reduce their coca cultivation before their alternative crops had time to produce an economic return, it is not surprising that the lengthy production time necessary for most of the alternative crops was an additional factor discouraging their adoption. Farmers pointed out that without an outside source of income, it would be impossible to support their families, buy the agrochemicals needed by the new plants, and repay the interest on the agricultural loans while waiting for the new crops to begin producing an economic return.

Because the sampling was done so that approximately one half of the people surveyed were "adopters" and one half were "rejecters," this study did not attempt to evaluate the proportion of the total population that was actually trying out the new crops. However, the promoters and the key informants estimated that between ten and fifteen percent of the total population was doing so.

Among the limitations of this study is the fact that the principal author was in the region for only nine weeks; therefore it is possible that some

important issues were overlooked. By the end of the seventh week in the field, however, no new issues were surfacing, and the authors are reasonably confident that the sample size was adequate.

Due to the authors' limited amount of time in the region, farmers were unable to get to know the interviewer well, and as a result farmers may not have been as candid as was hoped. The interview techniques used, however, should have countered this problem to some degree.

The viewpoints of non-adopters may have been under-represented in this study since it was more difficult to locate and interview non-adopters than adopters. As a result, more adopters and fewer non-adopters were interviewed than had been planned.

Other limitations of the study include the possibility that IBTA extension workers promoted some of the alternative cropping systems more frequently or more enthusiastically than others. Furthermore, the new crops were introduced at different times, and some crops are promoted in more subregions than others. Thus, based on the data presented in this study, it is difficult to state conclusively which of the new crops were the most popular.

The presence of the coca eradication program in the region increased tension and handicapped the author's ability to conduct this study. Because of an evacuation of the area early in the study, several interview days were lost. The author, having been advised not to remain in the communities after dark, could not interview farmers at home in the evening when many of them might have found it most convenient to talk. Finally, certain communities had to be avoided altogether because of safety considerations.

CONCLUSIONS

The results of this study indicate that capital requirements and expected profitability are the attributes of the new crops that most strongly influenced farmers' initial adoption and rejection decisions.

The three alternative crops most often planted by the farmers interviewed were pineapple, improved citrus, and bean. Pineapple and bean were among the crops that could be tried out on a small scale with the least investment. These crops also offered the clearest benefits. Farmers planted bean for their high nutritional value, pineapple and improved citrus for their good market potential, and improved citrus for its clear advantages over the natural citrus used by more than half of the citrus growers. There was a promising export market for banana, a popular traditional crop whose production and marketing IBTA was working to improve. Finally, among the crops tested, pineapple, bean, improved citrus, and banana were also among the crops most well-suited to the climate and soil conditions prevalent in the Chapare.

Because farmers were aware that the future of coca was problematic and that government incentives were in place to encourage the establishment of alternative production systems, the introduced crops were compatible with farmers' needs to look for alternatives to coca cultivation. However, farmers rejected alternative crops for a combination of reasons.

The relatively large capital investment required due to the initial cost of some of the plants and the expensive agrochemicals needed for their maintenance discouraged farmers. The unfamiliar agrochemicals were also incompatible with farmers' current practices. From the farmers' perspective, anticipated profitability was low due to farmers' doubts about the new crops' market potential and ecological suitability to the region. Finally, a loan system that demands payments before crops mature and does not forgive loans in the case of crop failure makes the risk involved in the adoption of alternative crops unacceptable for the majority of farmers.

Although previous studies concerning the adoption of agricultural innovations have found farm size and educational level to be predictors of adoption behavior, the present study suggests that these factors are secondary to a farmer's weighing of costs, risks, and expected benefits vis a vis his individual situation.

There was strong evidence that farmers of the Chapare are not in general averse to change. Farmers overwhelmingly adopted the practice of using improved pastures and there were actually shortages of some alternative crops—pineapple plantlets, for instance. In this study, the major obstacle to innovation adoption seems to be new crops whose adoption presents unacceptably high levels of risk coupled with low anticipated profitability.

RECOMMENDATIONS

Based on the results of this study, the authors offer the following recommendations for the development of the alternative crops program and the Chapare region:

1. Strategies to lower the prices of the plant propagules, such as IBTA's recently offered two-for-one repayment option for pepper plants, would encourage more farmers to try out the alternative crops. In the long term, propagules could be produced in community nurseries, with farmers' contributions of labor counting toward their purchase of propagules. Insurance costs should be built into the price of the plants sold so that if a farmer purchases a plant propagule and the plant dies, a farmer will be reimbursed or will receive a replacement plant.

2. Transportation of fertilizers and lime into the Chapare, both from other countries and from other regions within Bolivia, is largely responsible for their elevated cost. These costs could possibly be lowered by taking advantage of

natural lime deposits within the region. The feasibility of developing small-scale lime-processing centers throughout the Chapare therefore warrants further study. Also implementation of a soil testing and fertilizer recommendation program in IBTA would lead to improved efficiency in lime and fertilizer use, producing increased economic returns to farmers.

3. Since there is much inter-varietal variation within a species as far as climatic tolerances are concerned, it is advisable to identify and concentrate on those varieties and seed sources of the alternative crop species which grow in environments most similar to those of the Chapare. Promising varieties should be grown in the Chapare on an experimental basis. The most vigorous individuals of the most suitable varieties could then serve as seed sources.

4. Unless farmers see that the new crops actually grow well on their farms, they can not be expected to purchase or plant them. Therefore, once promising varieties and seed sources have been identified, greater emphasis should be placed on performing on-farm research in coordination with farmers. Not only would farmers become more involved in the development of the alternative crops program, but they would be further capacitated in basic plant research techniques. Research involving substantial risks of failure, however, should not be done in farmers' fields.

5. The PL480 loan system should be restructured so that repayments are scheduled to correspond to the first harvest and sale of plant products.

6. Market information should be developed and made available to farmers in order to increase perceived (and real) benefits to farmers.

7. Clearly, farmers require more assistance in the use of agrochemicals in order to be able to carry out the cultural practices recommended for the alternative crops. Promoters or para-professionals could be trained to provide basic education to all farmers in this area, and integrated pest management should be included in the curriculum.

8. Training courses should be as practical and "hands-on" as possible, conducted in farmers' fields with the instructor and the students going through the lesson together step by step. Since over one half of the farmers interviewed said they would like to know more about their soils and what to plant where, showing farmers how to recognize different types of soils and how to judge where to plant new crops would help them to feel more confident about working with the new plants. Implementation of a soil testing and fertilizer recommen-

dation program within IBTA would also help farmers feel better prepared to work with alternative crops.

9. Farmers should have consistent technical backstopping through every stage of the process, from the planting to the maintenance to the marketing of the alternative crops.

10. Roads that become impassable during much of the year make the reliable transportation of fruits to market impossible. A feasibility study concerning the establishment of small-fruit processing centers throughout the Chapare may be warranted; such centers could enable processed fruit products, rather than fresh fruits, to be shipped out.

11. The development of cooperatives or other private-sector strategies could facilitate production, delivery of inputs, transportation, and marketing of alternative crops.

12. Sustainable forestry, such as natural forest management, is a promising development option for the Chapare, especially in regions that prove to be ecologically unsuitable for farming.

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