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Mexico: Conservation of lychee fruits through refrigeration and packing.

1. Poverty

1.1 Poverty in Mexico

México is a developing country that has a great quantity of population with food problems because of low resources. The politic, social, and economic problems of the country cause an impact in the poorest people. This country has an extensive diversity of ethnicities. There are more than 6 million indigenous people (INEGI, 2010) and now they have a strong social underdevelopment. As a consequence, they do not have economic growth. Most of the indigenous people in Mexico have focused on subsistence cultivation without the use of technologies and techniques that make production easier and more profitable.

1.2 Poverty in Northern Mountain Chain of Oaxaca

There are a lot of indigenous communities in the South of the country. Oaxaca is one of the states with the highest amount of communities. This state is divided into eight regions, and the poorest region is the northern mountain chain of Oaxaca, which is formed by 77% of indigenous population between Chinantecos, Mixes, and Zapotecos (OAXACA GOVERNMENT, 2011). There are 176,489 inhabitants from which more than half of them suffer from poverty. In addition, 57.9% of the kids under 5 are suffering malnutrition problems (ENSANUT, 2006). Another problem is that 55.3% of them don't have health service, and in the segment of education this region has the lowest level (OAXACA GOVERNMENT 2011), a clear example is that 22.4% of people above 15 don't know how to read (OAXACA GOVERNMENT 2011). There aren't populations with more than 15,000 inhabitants in this region, so their activities are rural. They mainly work on the growing of maize, beans, and vegetables that are used for their own consumption. This provokes a problem because if the crops don't grow or fall, then their diet is affected.

2. Lychee in Northern Mountain Chain of Oaxaca

2.1 The Chinantecos and their change of coffee – lychee

The Chinantecos that live in this region have been producing coffee, but the sales were very low, so then they decided to grow some other products. When Oaxaca's government found out about this situation, they wanted the Chinantecos to have a revenue, so they analyzed it and then decided to give this community lychee trees in order to harvest these fruits.

2.2 The reasons why Oaxaca's government decided to give lychee trees.

- ***The Northern Mountain Chain of Oaxaca has the ideal climate.*** It has a subtropical climate with annual rains between 48 to 63 inches, minimal temperatures about 50⁰ F, it has average moisture of

80%, sandy slimes and a lot of zinc. All these characteristics are ideal for growing the lychee tree. (INEGI maps Oaxaca 2011)

- **The little investment for the production of lychee.** The cultivation and production of the trees and the lychee fruit need a low investment. The use of fertilizers is optional (OEIDRUS, SAGARPA 2011), it doesn't need an irrigation system because it rains almost all the year and its moisture is very high (OEIDRUS, SAGARPA 2011); it just needs water for two months before the fruit is ready (March and April).
- **The Chinantecos and the income.** Subsistence cultivation is the most used within the indigenous people, however the Chinantecos weren't using this method with coffee production and the government wasn't willing to return to the same method because it did not fulfill the community's needs. The introduction of this product gave the community the opportunity to have an extra income during the time where their maize crops were not enough.
- **Nutritional Value.** The lychee fruit is composed between 76% and 87% of water in the pulp, its content of protein is very low between 8% and 1.5%, sugar content is between 11.8% and 20.6%. The acidity is variable between .20% and 1.1%, the calorific value is about 65 calories per 3.52oz. The Lychee fruit has a strong quantity of Vitamin C. Fruits with a high quantity of this vitamin help the immune system, which with the lack of health services in the community may prevent certain diseases.

The next table shows the comparison of this vitamin with some other tropical products.

Fruit	Vitamin C in Ounces
Lychee	.00176 oz.
Pineapple	.00105 oz.
Mango	.00105 oz.
Orange	.00194 oz.
Watermelon	.00105 oz.

(ASERCA, December 1996)

3. Lychee production characteristics.

3.1 Advantages of lychee production

Nowadays it is known that in this region there are more than 400 hectares producing lychee fruit (OEIDRUS lychee study 2011), the producers' Committee of Lychee in Oaxaca plans to duplicate this by December 2013.

All of this because of:

- The people live in poverty and they know that for the Lychee production it needs a low investment.
- The inversion is very accessible for poor people.

Expenses per hectare:

Year 1	\$1250.35 USD
Year 2	\$166.26 USD
Year 3	\$166.26 USD
Year 4	\$166.26 USD
Year 5	\$545.00 USD
Year 6	\$696.50 USD

(Producer's committee of lychee in Oaxaca)

- Nowadays all the lychee of first quality is bought for Japanese businessmen that export it.
- The possibility that these trees could have problems of plague is very low.
- The government gives the lychee trees in this region since they were given to the Chinantecos.
- The majority of the lychee producers control their areas divided between the cultivation of their consumption and their cultivation to lychee production.

3.2 Problems that affect the production of lychee

Today the Chinantecos after the change from coffee production to lychee haven't been economically favored and this happens for the next factors:

- ❖ The Northern Mountain Chain of Oaxaca doesn't have good road services; they only have rustic roads without pavement. As a consequence there is a slow transaction between the farmer and the buyer, and because of this the lychee fruit could be degraded with time.
- ❖ All the Chinantecos that produce lychee can't preserve their fruits. The buyers look for the product, but it has to be within 72 hours of the harvest because if not the fruit doesn't have its original properties. If they do not do it within this time, then all their economic profits will be lost.
- ❖ They don't have a packing or processing system for the product.

3.3 Profit forecast and relationship problems

All of these factors had a consequence: the maximum of production and the profits go down. The first quality fruit is generally sold to the buyers that export it to 1.51 dollars, a young tree produces between 132.27 pounds to 154.32 pounds per month, 35% of the production is the first quality and this is equivalent to 46.29 pounds; and there are approximately 150 trees per hectare, so in a year they make \$4,543 by hectare. All this projection is supposing that all the production can be sold with a product of the best quality, nevertheless this does not occur all the time with the current producers because the product is not conserved until the buyers come and it degenerates. It is necessary to preserve the fruit in the period where there aren't buyers and it is mandatory to improve the roads in order to transport the products on time so they do not degenerate.

4. Proposal

The communities of the Northern mountain chain of Oaxaca live under the same conditions. One of the problems that cause the economic issues is the lack of production that generates income. They don't have a mutual support in which they could lean. I propose the creation of cooperatives with resources supply of all the members that may contribute with resources that they have and benefit from them. Promoting a

change in their production and, instead of producing only subsistence crop, to produce both their consumption crop and one product that generates an income. This will not need a great inversion and will give the community some extra income. The product that I propose is the Lychee tree. The objective of this cooperative is that the people can organize to achieve a developed system in which they change their form of crop.

They will need the following:

- I. Create a committee where they can all explain their techniques of plantation and processing
- II. Plant lychee trees in their lands to start the growth.
- III. Generate simultaneous crops, through planting subsistence crops already used for the Chinantecos (cabbage, lettuce, radish, onion, squash, carrot, cauliflower, broccoli, tomato, cucumber, bean, pea, and others). Lychee trees need 26ft between one another so it's easy to plant. With this form the people can have the same form of subsistence in 4 years but they are making an economic heritage with enormous benefits.
- IV. Knowing the regional situation of roads and form of sale, the creation of pack centers and refrigeration chambers are needed because it is important to preserve the fruit to keep their value and this is the unique and ideal form to make this.
- V. The perfectly measures and equipment that can be for a refrigeration chamber and a machine of packing area for this situation are the following:
 - Refrigeration chamber: The best temperature to refrigerate a fruit is between 30°F and 59°F, it is composed of 4 walls of masonry with measures 19.68 ft. x 39.37 ft. x 8.53 ft., a machine of conservation, two evaporation machines and sliding doors 4.92 x 8.53 ft. This refrigeration chamber has a capacity of 40 tons.
 - Packing Area: 4 walls of masonry with measures 32.8 ft. x 65.15 ft. x 8.53 ft. One condensing unit, two evaporation machines and sliding door with measures 4.92 x 8.53 ft. which can be useful to take the weight of the lychee and to separate them (the fruit of first and the fruit of second quality). After this they can store only the lychee of the first quality and with the lychee of second quality they could make different products like jam, liquor, ice cream, and syrup.
- VI. In this way, the use of the fruits would be in its maximum, knowing that men are the workers in the field, women in this project can have the opportunity of working in the packaging, organization, and fabrication of the elaborated products. This will give them the opportunity to participate in the family economy.
- VII. The cost of the cooling and packing are \$132,647 (freeze electric industry of Papaloapan). These costs can't be covered by the people of the region, however the cooperatives have to be involved in their organization and generate strategies in order to recover their investments. SAGARPA a Mexican governmental institution, impulse a support called "Trópico Húmedo" (humid tropics) that consists on funding integrated crop and activities with potential and market that improve the viability of the projects preferably under a development scheme. They also help with support and capacity developments, technology innovations and rural extensionism to strengthen the compatibility of the producers. This governmental support provides up to 100 percent of the investment of the project if is to technologic development and rural extensionism without exceeding an amount of 5 million.

5. Conclusion

With the tracing of these steps, I believe that the people could achieve economic growth and could see their results in this life circle. This system of production has many positive characteristics that give strength to this project, the 0 investment by the producers thanks to government support generates acceptance by the people, the weather conditions doesn't affect in all the tree, the market is secured in the fruits of first quality and products made also could be factor of exportation. The organization system through cooperatives achieved immense benefits like community cohesion, participation of the women's in different areas.

The reason that causes the poverty in this region has been the adaptation to the actual society, because the subsistence crop that they use is not the appropriate nowadays; the manners of the people need to change to adapt with this society. But untreated that they try make this and all the problems disappear, all of us in the world have the work to make a change, without our help their social development couldn't be effective, because although a person that lives in poverty takes a entrepreneurial attitude to get the change doesn't have with the economics and educational resources that can make this effective.

Knowing the data poverty in this region, in this country and in all this world we understand that the present political system cant end with the poverty, or maybe they don't want, whatever reasons are nowadays the people suffer lack of economic opportunities. In the Northern Mountain Chain of Oaxaca the kids aren't go to school and their fathers job more than 10 hours in a day, with this way the people are sentenced to live with lack of basic things. Because they don't have opportunities to have an economic growth, for this reason is that exist the MDG's to change the life quality of the poor people, to give opportunities to growth economically through methods like technology, in my proposal it is offering a support to several goals of MDG'S:

- ✓ **Improvements in food security and economic development.** Because with this project the habitants of Northern Mountain Chain of Oaxaca could in 100% the food security and boost the economic development non-existent between many of the people
- ✓ **Child and maternal health.** The infantile malnutrition in this region is the 57.9% in 5-years-old minors and in times of food shortage they could have income to be able to buy lacking food. (OAXACA GOVERNMENT, 2011)
- ✓ **Gender equality.** Since in my proposal the woman and the man work like a team, so in this way there can be more equity.
- ✓ **Environmental sustainability.** Seeing that my project becomes effective the population will plant trees, so it will be improvements to the environment.

Finally I think that the Unity Creates the strength and this is the thing that we need to end with the poor in 2015.

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