BIBLIOGRAPHY

PACIS, JENNY D. APRIL 2008. Impact of Tissue Cultured Banana Technologies on Livelihood of Growers in Bayabas Sablan, Benguet. Benguet State University La Trinidad, Benguet.

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ABSTRACT

This study primarily aimed to determine the impact of tissue cultured banana technology on livelihood of growers in Bayabas Sablan. Specifically, the study aimed to determine: 1) the profile of farmers planting tissue cultured banana; 2) the factors that influence the farmers to adopt the technology and 3) the positive impact and negative impact on livelihood of banana growers adopting the technology. The data were gathered by means of survey questionnaires which were supplemented by personal interview of the respondents. Descriptive statistics was employed for the analysis of the data.

Results revealed that tissue cultured banana growers were mostly of the middle aged group and were male. Majority of the tissue cultured banana growers have formal education and most of them owned an upland area cultivated for bananas of about 910 square meters and below.

The respondents were mostly influenced by CHARM and technician who have introduced the technology.

The major problems identified by the respondents in the adoption of the technology were: high mortality, one time used of tissue cultured banana suckers and high acidity of the soil.

With regard to the positive impact of the technology adoption, 40% of the respondents rated that there was a significant increase in their income after the adoption of the said technology. Some have been able to pay their debts and most of them claimed to help in the employment of other people. Meanwhile, the negative impact of adopting the technology were high mortality, one time used of banana suckers, high price of suckers and late procurement of planting material.

Result of this study further revealed that tissue cultured banana growers should follow cultural practices of growing bananas especially the management of aphids and immediate eradication of plant infected with BBTV to attain considerable yield of banana.

Cost and return analysis for the 15 respondents were categorized into two groups: banana growers with an area of 910 square meters and below and those banana growers with an area of more than 911 square meters cultivated for banana. The result showed that both groups gained positive income amounting to Php 8,964.56 and Php 19,142.83 respectively.

TABLE OF CONTENTS

INRODUCTION

Rationale

Sablan is one of the smallest towns in Benguet. Its terrain is mountainous. Creeks and mountains separate barangays as well as sitios. The municipality of Sablan is located at the South Eastern part of the province of Benguet. Kapangan, Burgos, La Union bound it on the north, on the south by Tuba, on the eastern part by Tublay, and La Trinidad, and on the west by municipality of Aringay, La Union.

The estimated land area is 91.60 square kilometers (kms.) or 9,160 hectares (has.) this constitutes 5.45% of the land area of the province of Benguet. It has eight (8) barangays. The barangays of the municipality of Sablan are the following: Balluay, Banangan, Banengbeng, Bagong, Bayabas, Palali, Pappa and Poblacion.

The climate of Sablan is comparable to climate of Benguet classified under two (2) pronounced seasons. Wet seasons are from May to November while the dry season is from December to April.

The municipality of Sablan is traversed by the Baguio-Naguilian road and is the first town towards the City of Baguio and the province of Benguetor rather the “gateway “to the city and the province of Benguet which is almost twenty-one (21) kilometers.

Sablan is basically an agricultural town. Mountain soils are generally fertile and temperate climate is making it ideal for farming activities. Due to temperate climate, the place is suitable for all kinds of crops like cassava, ginger, gabi, camote, ube, and other orchard crops like coffee, citrus, avocado, santol, mango, banana, and some other fruits.

Banana is one of the many crops that are commonly grown in barangay of Sablan especially in Bayabas. Majority of the farmers living in barangay Bayabas usually plant

banana not just for family consumption but also as a source of livelihood (Caliging, 2007).

The banana bunchy top virus (BBTV) is the most dreaded disease of banana because it can wipe out plantations that are neglected with pest management practices.

In the early 1970's the bananas in the municipality of Sablan and Tuba, Benguet were infected with BBTV disease which wipe out the banana plantations, causing shortage of supply and brings huge economic losses to farmers.

The Sablan officials and banana growers were alarmed by the BBTV so they looked for ways to combat these diseases. According to Ramon Anacioco, the municipal agriculturist officer of Sablan, the local government introduced a new technology to solve the problem and eventually revive the industry of Sablan. The tissue cultured banana gives the farmer a promising result that leads to the increase of tissue cultured banana users. Nowadays, the growers of Sablan are using the new technology to overcome the losses of farmers that can be brought by BBTV.

Even though the new technology is giving them a good performance, there is still a need to study the productivity, cost and return of production, and the management of tissue cultured banana to guide, help and inform individual, groups, researchers, entrepreneurs and farmers about tissue culture.

Statement of the Problem

The study was conducted to determine the impact of tissue cultured banana technology in livelihood of growers in Bayabas Sablan, Benguet.

Specifically, this research sought to answer the following:

1. What is the profile of farmers planting tissue-cultured banana?
2. What are the factors influencing the farmer to adopt the tissue-cultured technology?
3. What are the positive impacts of the technology on farmers livelihood specifically in terms of its contribution to provide
    a) Income
    b) Employment
4. What is the negative impact of adopting the technology on farmer's livelihood specifically in terms of labor?
5. What is the trend in the output or yield produced by banana growers upon adoption of the technology?

Objective of the Study

The study aimed to determine the impact of tissue cultured banana technology on livelihood of growers in Bayabas Sablan.

Specifically this study aimed;

1. To know the profile of farmers planting tissue-cultured banana.
2. To briefly discus the factors that influence the farmers to adopt the technology.
3. To find out the positive impacts of using the technology on farmers livelihood.

4. To find out the negative impact of using the technology on farmers livelihood.
5. To document the trend in yield produced by farmers when technology was adopted.

Importance of the Study

This study was conducted to present the problems encountered by the tissue cultured banana growers of Bayabas Sablan, Benguet. It also highlights the positive and negative impact of adopting the new technology on farmer's livelihood in Bayabas Sablan.

The findings and result of this study will provide information on banana growers in their decision making on what to be done to improve banana production.

Furthermore, this assessment will help in understanding the problems of banana producers and may come up with recommendations that will ease the problems of producers. This study could also serve as a reference material for future researches and other related to the topics.

Scope and Delimitation

The study focused only on the discussion of the impact of tissue cultured banana technology on livelihood specifically on lakatan variety.

The study was conducted at Bayabas Sablan, Benguet from November- January 2008. This was done through research from internet, library with encyclopedia, books, and dictionaries as references. Furthermore, a one on one interview with the respondents was done.

REVIEW OF LITERATURE

The Banana Industry of Sablan

Sablan is a well-known banana-producing municipality in Benguet. It produces three main varieties which are cavendish, lakatan, and dinurado.

Ramon Anacioco (2007) stated that in the early 1960's up to middle 1970's, banana is the number one source of income of farmers in Sablan. Lakatan variety is mostly produced during this time because of its high value. The said variety is highly in demand in the market especially in US bases here in the Philippines. Sablan also exports bananas to Japan to boost the income of banana growers. However, during the early 1970's, banana in the municipality of Sablan and Tuba were infected by banana bunchy top virus (BBTV). In the 1980's, the bananas of Sablan was totally wiped out, but due to high the demand of banana, the municipality wants to revive its banana industry. During 1990's, Sablan asked the assistance of the National Government for the rehabilitation. As a response, the national government gives financial assistance, procurement of banana tissue culture, conducts training and seminars to farmers, and monitors and evaluate how was the project is doing.

With the help and assistance of the National Government, the banana industry of Sablan was continuously recovering from its losses. According to Professor Bony Ligat, the new technology adopted by the farmers in Bayabas gives them a good result that their income boosted and some even became rich.

Tissue-Cultured Banana Technology

Henri-Louis Duhamel du Munceau's pioneered experiments in 1756 on wound healing of plants demonstrated spontaneous callus formation on the decorticated region of elm plants. His studies, according to noted biologist Gautheret could be considered a "foreword for the discovery of plant tissue culture" (Razdan, 1996).

According to Razdan, knowledge of tissue culture has contributed greatly to our understanding of the factors responsible for growth, metabolism, differentiation, and morphogenesis of plant cells. Plant–tissue is presently of great interest to molecular biologist, plant breeders, and industrialist. Tissue culture methods have been employed as an important aid to conventional methods of plant improvement.

For tissue-culture, the hearts or shoots of banana plants are cleaned and placed on Petri dishes where cells continue to divide and grow, forming a callus. Tissue-cultured calli are divided several times (sub-cultured) to produce up to 2000 plantlets from one mother plant. Before being transplanted to a nursery, the tissue-cultured material grows shoot and roots on special nutritive media. Then the tissue- cultured plants are acclimatized in a shaded nursery before being transplanted in farming fields (ISAA, 2006).

Tissue-cultured plantlets have four advantages over traditionally propagated planting material. First, they are clean: the sterile conditions under which tissue-culture is carried out eliminate fungal diseases, nematodes, and bacteria. Second, the trees were far more productive, reaching maturity earlier and bearing fruit bunches up to 50% heavier than traditionally raised trees. Elsewhere, tissue-cultured plants typically produce 50 tons of fruit per hectare per year under favorable climate conditions. Third, the trees are more

uniform and will all reach maturity at the same time. Finally, each tree produces up to 1,015 suckers per year which is more than the number of traditionally propagated trees. This offered a rapid means of multiplying and disseminating better planting material (ISAA, 2006).

Furthermore, a result of study conducted in Cavite showed that the introduced varieties of banana exhibited better field performance compared to the local varieties in all sites planted. Likewise, all tested varieties of banana grew best in hilly area and it showed more tolerance to BBTV though they did not replace the local varieties in terms of consumer preferences for fresh bananas (Crucido, et al., 2007).

Impact of Tissue Culture on Livelihood

A good number of poor marginal farmers including housewives have already changed their job by cultivating tissue cultured banana as economic value of the crop has benefited them than the other crops.

In one of the studies accounted in Dhaka, Rina Parveen, a housewife of Dodapara village under Thakurgaon, Jagannathpur union of Sadar Upazila in the district has achieved success by cultivating tissue cultured banana. She raised a banana garden by planting 448 seedlings of Mecher variety, produced by tissue culture on 25 decimals. She got 115 to 118 bananas from each of the plants and the average length of the banana was nine inches without using any kind of steroid fertilizers. She earned Taka 53,760 by selling the banana while spent Taka 28,000 as production cost. Rina is very happy with the tissue cultured seedlings and said these are much productive than the seedlings produced in traditional way (Ahmed, 2006).

Tissue culturing of banana plants, a biotechnology initiative increase the yield by five times of the traditional farming is becoming popular among banana growers in Oman, middle East, Pakistan, Sri Lanka and Africa. Recently, agro-technology major Jains Irrigation System exported the first consignment of its grand-Nain variety of tissue cultured banana plants in Oman. It plans to further export around 66,000 plants by the end of this year. But since the market potential for banana is very high in the Middle East, the demand is met through exports from the Philippines, India, and South American countries (Thomas, 2007).

In the highland of Kenya, almost every farm household has a small banana orchard. Bananas are important both for food and for cash, providing the women who grow and market them with a small but much needed source of income to pay for household necessities. Because of the decline of coffee, many families are becoming more dependent on bananas for their livelihood. At the same time, however, banana yields are declining mainly because of the build up of pest and diseases. This problem was addressed by dynamic partnership of the county's public sector biotechnology researchers, private sector biotechnology industry and innovative farmers. The central technical ingredient of the project is tissue culture or micro propagation. The planting materials where distributed to the farmers and a formal training on the management of the introduced technology was also conducted. For the farmers who were successful with the use of the new technology, the payoff has been considerable. The heavier and more predictable fruiting of the tissue cultured bananas have made the fruiting easier to market commercially. Furthermore, the demand for tissue cultured plantlets of banana and other crops has provided new jobs in the growing biotechnology sector, while the increased

production of banana should in due course stimulate the development of processing industries. If this will be achieved, an innovation in planting material technology will have catalyzed the transformation of a neglected subsistence crop into a new source of prosperity (Economic and Social Department, 2001).

Meanwhile, Esther Gachugu who was a project beneficiary of International Service for the Acquisition of Agro biotechnology Applications (ISAAA) demonstrated similar experience. She was one of the demonstration farmers and an early adaptor of tissue cultured technology in Nairobi, Kenya. Her family's modest banana plot was transformed into profitable enterprise, yielding the equivalent of up to US $300 from a single day's sale of fruit in Nairobi. Among her investment is a new kitchen, which allows her to feed her family in comfort (Wambugu, 2001).

In Lagawe Ifugao, the Provincial government has stepped up its program and efforts to assist farmers and enhance their capability for coffee and banana production as an additional industry and source of livelihood. The project on banana production has been showing a steady growth recovering after the propagation of the banana tissue cultured seedlings which are resistant to the banana disease called "bunchy top" that wipe out the banana industry of Ifugao since the early 1990's. As a result of the project study, the banana producers are claiming that they are deriving a remarkable income from this industry since the introduction of the banana tissue cultured suckers. A nursery for the production of seedlings is now established in Nayon, Lamut to cater the needs of the banana growers (Cadalig, 2006).

Impact of New Technologies on Livelihood

Biotechnologies are pursued for private sectors, and the situation of the appropriability problem in plant breeding is an important potential source of increased profitability (Swanson, 2002).

A researched conducted by Sankula (2006) on six biotech crops (corn, cotton, canola, papaya, squash, and soybean) shows that American has made decisions to choose biotechnology-derived crops for the last 10 years because they realized significant and positive benefits from planting these crops. Biotechnology provided best hope to growers by providing enhanced pest protection thereby improving yields with the use of minimal inputs. American grower's confidence in biotechnology-derived crops is due to positive impacts provided by these crops in terms of enhanced crop yields, improved insurance against pest problems, reduced pest management costs, lowered pesticide use, and overall increased in grower returns.

Another research from ISAA's study on *Bt* maize resulted that Bt maize could meet the subsistence requirement of a family of five (in the Philippines), in which a conventional grower of banana could not do. *Bt* maize hybrids consistently performed better than their corresponding conventional maize hybrids, in terms of yield, production cost, profitability and capacity to meet subsistence needs of families. Although biotech seed corn cost about 80 percent more than the conventional hybrid seed, Randy Hautea, director of the ISAA office in the Philippines, said the net income of farmers who planted *Bt* corn increased about 34%, on average. *Bt* corn enhanced with a naturally occurring soil protein that protects plants from insect pests such as corn borer-significantly boost farmers income. Moreover, according to the secretary of agriculture, *Bt* corn is now

planted on about 49,000 acres of land in the Philippines. The government approved the commercial planting of the crop as a way “to help the poor of our country” (ISAA, 2002).

Operational Definition of Terms

Tissue culture. It is the growth in artificial medium of cells derived from living tissue.

The growth of isolated plant or animal cells or small pieces of tissue under controlled condition in a sterile medium that is design to meet particular growth requirements of the cell or tissue (Mckean, 2005).

Biotechnology. The use of microorganisms, such as bacteria or yeasts, or biological substances, such as enzymes, to perform specific industrial or manufacturing processes.

It is most briefly defined as the art of utilizing living organisms and their products for the production of food, drink, medicine or for other benefits to the human race, or other animal species (Phillips, 2007).

Callus. It is a hard formation of tissue especially new tissue formed over a wound (Team of experts, 2000).

Micropropagation. It is a tissue culture technique for plant propagation in which offspring is cloned from tissue taken from a single plant (http.dictionary.reference.com).

Plant breeding. It is the purposeful manipulation of plant species in order to create desired genotypes and phenotypes for specific purposes (Carr, 2008).

It is the application of genetic principles to produce plants that are more useful to humans.

Morphogenesis. It is the origin and development of morphological characteristics (Team of experts, 2000).

METHODOLOGY

Locale and Time of the Study

The study was conducted in Bayabas Sablan, Benguet where most tissue cultured banana are produced, starting November 2007 to January 2008.

Respondent of the Study

The respondent of the study were traditional banana growers of Bayabas Sablan, Benguet who are now using the newly introduced technology. A sample of 15 banana growers was chosen at random.

Data Collection

The researcher conducted interviews on October 2007. The interview schedule was prepared by the researcher to collect the needed data and necessary information on the production and marketing of tissue-cultured banana. The questionnaire used was adopted from another study titled “Impact of Improved Vegetable Farming Technology on Farmer’s Livelihood in the Philippines.”

Data Analysis

The collected data were consolidated, categorized, and tabulated. Descriptive statistics such as frequency and percentage averages were used. Ranking and column graph were also used to aid the interpretation of the data.

RESULTS AND DISCUSSION

Demographic Profile of the Respondents

Table 1 shows the profile of the respondents according to sex, age, highest educational attainment, number of household members, crop planted, number of fulltime agricultural labor, sources of income, total earnings per year, farm characteristics, farm irrigation, farm ownership, area cultivated for banana, duration of banana production, production of banana according to area, quantity sold for banana according to area, and sales for banana according to area.

Age. The age of the respondents ranges from 30-80 years old. Most of them (53.33%) belonged to age bracket 30-40 years old. This was followed by the age bracket 41-50, representing 20% of the respondents. The remaining 26.66% of the respondents belong to the age brackets 51-60 and 71-80 years old. The result shows that most of the middle aged people adopted the new technology.

Gender. Out of 15 respondents 11 or 73.33% were male and only 4 or 26.67% were female. Results shows that majority of the tissue cultured banana growers were male.

Educational attainment. The educational attainment was classified into four classifications: elementary undergraduate, elementary graduate, high school and college.

Most of the respondents (26.67%) finished elementary. This has the same rate with high school and college graduate. This was followed by 20% of respondents who were elementary undergraduate. Result shows that majority of the banana growers who adopted the technology have had formal education. However, the farmers commented

that knowledge in banana production is more important than level of education attained to become successful in the business.

Number of household members. Most of the respondents (53.33%) claimed to have a range of 3 to 5 household members. This was followed by a percentage of 46.67 with a ranged of 6 to 8 household members.

Crops planted. All of the respondents were planting tissue cultured banana and majority were male with a percentage of 73.33 compared to the female having only 26.67% or 4. On the other hand, out of 15 respondents, only 7 or 46.67% were planting both tissue cultured and traditional bananas. Out of the 7 respondents who were planting both, 4 or 57.14% were male and 3 or 42.86% were female. Result shows that majority of the male were planting tissue cultured and traditional bananas.

Number of fulltime agricultural labor. Out of 15 respondents, 53.33% claimed to have employed one fulltime agricultural laborer. This was followed by 26.67% who employed 2 persons. Next to this figures were the number of respondents who did not employ labor and those that employed 3 labors.

Sourced of income. Majority of the respondents (60%) source out their income from farming and non-agricultural activities such as planting agricultural crops, income from driving, being a barangay official or contractors. This was followed by 40% or 6 out of 15 respondents who claimed to source out their income from agricultural activities only.

Total earnings per year. Out of 15 farmers, 9 mentioned that they earn income from other sources. The amount of income earned varies with the outcome of the other employment.

Based on Table 1, most of the farmers (66.67%) earn Php 5, 000-Php 15, 000 income from farming. On the other hand, those farmers who have other sources of income earn as much as Php 41,000 and above, but most of them (53.56%) claimed to earn Php 5,000-20,000.

Farm characteristics. The farm characteristics were divided into two land category; upland and lowland. Majority of the respondents (66.67%) rely on rain to water their crops compared to 33.33% who used rain and underground water to irrigate their lands.

Farm ownership. Out of 15 respondents, 86.67% claimed to own the land they are tilling. Meanwhile, 13.33% claimed to own some part of the land and the rest were rented for a price of 3,000 per year.

Area cultivated for bananas. The farmers were grouped into two; those with a land area of 910 square meters and below cultivated to tissue cultured banana and those with more than 911 square meters.

There were 9 farmers who belong to the former group and 5 belonging to the latter who were interviewed.

Duration for banana production. Most of the respondents (73.33%) claimed to have duration of below 1 year and 3 months from planting to harvesting compared to 26.67% who have duration of more than 1 year and 4 months. The respondents claimed to start planting during rainy season on the month of June or July.

Production of banana according to area in fingers. Most of the respondents (66.67%) having an area of 910 square meter and below claimed to harvest a range of 9,001-17,831 fingers. This was followed by a range of 170-9,000 (22.22%) and the least

was 17,832-26,662 fingers with a rate of 11.11%. On the other hand, 66.67% of the respondents who owned more than 911 square meters claimed to harvest a range of 8,500-29,000 fingers. Few of them (33.33%) harvest around 29,000-49,501 fingers annually.

Quantity sold according to area in fingers. Out of 15 respondents, 9 were having an area of 910 square meters and below and 4 or 66.67% claimed to sell 8,500-29,000 fingers for every harvest. This was followed by 2 or 33.33% selling 29,001-49,501. While 4 or 66.67% of the respondents who own an area of more than 911 square meters claimed to sell 8,480-18,480 fingers compared to 2 or 33.33% selling 38,483-48,483 fingers.

Sale according to area in pesos. Majority of the respondents (66.67%) having an area of below 910 square meters claimed to earn 15,483-20,483. This was followed by 480-5,480; 5,481-10,481 and 10,482-15,482 having the same rate of 11.11%. On the other hand, majority of the respondents (66.67%) having an area of more than 911 square meters claimed to earn around 19,000-29,900 followed by 16.67% earning around 49,903-59,903 pesos.

Table 1. Profile of the respondents

CHARACTERISTICS	FREQUENCY	PERCENTAGE
Age		
30-40	8	53.33
41-50	3	20
51-60	2	13.33
61-70	0	0.00
71-80	2	13.33
TOTAL	15	100
Educational Attainment		
Elementary Undergraduate	3	20
Elementary Graduate	4	26.67
High School	4	26.67
College	4	26.67
TOTAL	15	100
Number of Household Members		
3-5	8	53.33
6-8	5	46.67
TOTAL	15	100

Table 1. Continued…

CHARACTERISTICS	FREQUENCY	PERCENTAGE
Crop Planted		
Tissue Cultured Banana		
Male	11	73.33
Female	4	26.67
TOTAL	15	100
Tissue Cultured and Traditional Banana		
Male	4	57.14
Female	3	42.86
TOTAL	7	100
Number of Fulltime Agricultural Labor		
Male		
0	2	13.33
1	8	53.33
2	4	26.67
3	1	6.67
TOTAL	15	100
Source of Income		
Agriculture(including Livestock)	6	40
Agriculture and Non-agriculture	9	60
TOTAL	15	100

Table 1. Continued…

CHARACTERISTICS	FREQUENCY	PERCENTAGE
Total Earnings per year		
Agriculture		
5,000-15,000	10	66.67
16,000-25,000	2	13.33
26,000-35,000	3	20
TOTAL	15	100
Non-agriculture		
5,000-20,000	5	55.56
21,000-40,000	2	22.22
41,000 and above	2	22.22
TOTAL	9	100
Farm Characteristics		
Land Category		
Upland	10	66.67
Upland and Lowland	5	33.33
TOTAL	15	100
Farm Irrigation		
Rainfed	10	66.67
Rainfed and underground water	5	33.33
TOTAL	15	100

Table 1. Continued…

CHARACTERISTICS	FREQUENCY	PERCENTAGE
Farm Ownership		
Owned	13	86.67
Owned and Rented	2	13.33
TOTAL	15	100
Area Cultivated for banana		
< 910 square meter	9	60
> 911 square meter	6	40
TOTAL	15	100
Duration for Banana Production		
< 1 year and 3 mos.	11	73.33
> 1 year and 4 mos.	4	26.67
TOTAL	15	100
Production of Bananas according to area in fingers		
910 square meter and above		
170-9,000	2	22.22
9,001-17,831	6	66.67
17,832-26,,662	1	11.11
TOTAL	15	100

Table 1. Continued…

CHARACTERISTICS	FREQUENCY	PERCENTAGE
>911 square meter		
8,500-29,000	4	66.67
29,001-49,501	2	33.33
TOTAL	6	100
Quantity sold for Banana according to area in fingers		
<910 square meter		
160-10,000	4	44.44
10,001-19,841	4	44.44
19,842-38,482		
38,843-48,483	1	11.11
TOTAL	9	100
>911 square meter		
8,480-18,480	4	66.67
18,481and above	2	33.33
TOTAL	6	100

Table 1. Continued…

CHARACTERISTICS	FREQUENCY	PERCENTAGE
Sales of bananas according to area in pesos		
910 square meters and below		
480-5,480	1	11.11
5,481-10,481	1	11.11
10,482-15,482	1	11.11
15,483-20,483	6	66.67
TOTAL	9	100
>911 square meter		
19,000-29,900	4	66.67
29,001-39,901		
39,902-49,902		
49,903-59,903	1	16.67
59,904-69,904	1	16.67
TOTAL	6	100

Factors Influencing Adoption of the Technology

Matrix ranking was done with the farmers in the study area to determine the factors influencing adoption of the technology. The farmers were asked to use ranking from 1 to 10 with 1 for least important and 10 for most important. The resulting ranks were consolidated to get the average total scores and the corresponding rank of each factor as shown in Table 2.

The most important factor influencing adoption of the technology that was identified by the farmers was the influence of Cordillera Highland Agricultural Resource Management (CHARM). CHARM is a government institution tasked to implement the rehabilitation of the affected area of the said virus on bananas. Influence of technician was identified as the next factor that largely affected the farmers to adopt the technology. Other factors like availability of sucker, "productive", "clean" and influence of neighbor are likewise counted to have influenced the farmers to use the new technology.

Table 2. Factors influencing adoption of tissue cultured banana

LEVEL	FACTORS	AVERAGE SCORE	RANK
Variety Specific	Productive	7.2	4
	Clean	6.67	5
	Available Sucker	7.8	3
Location Specific	Influence of CHARM	9	1
	Influence of Neighbor	4.67	6
	Influence of Technician	8.75	2

Positive Impact of Technology Adoption on
Farmer's Livelihood on Income

Income. The impact of adopting the technology on farmer's livelihood and income was gauged by slight decreased and increased in income that the farmers reported by using the technology. Tables 3 and 4 show the "before and after" income rating that the farmers reported.

Both farmers indicated high income rating before adopting the technology. From the group cultivating 910 square meters and below, 77.77% rated their income from 7 to 8. On the other hand, 83.33% of those cultivating above 911 square meter rated their income from 6 to 8.

After adopting the technology, the first group gave a lesser rating for their income but is still high. On the other hand, the second group claimed to have a little increase on their rate of income. From the group cultivating 910 square meter and below, 77.78% rated their income from 6 to 8 as against 83.33% from the other group with a rate of 7 to 9.

With regard to marketing, the farmers estimated the price of banana per finger as 2.33 pesos. The farmers reported that the bananas planted in the municipality of Sablan have high salability since Sablan is a known producer of sweet bananas due to its favorable climate. Some also claimed that the used of tissue cultured banana resulted to increased productivity which has led to slight increased on the farmers income.

When farmers were asked about the change in their income before and after adoption of the technology, 40% of them rated that indeed there was a significant increase in their income.

Table 3. Description of income by farmers before adopting tissue cultured banana area planted (score 1-10; 1 is lowest and 10 is highest)

AREA CULTIVATED TO BANANA	INCOME RATING BEFORE ADOPTING THE TECHNOLOGY					
	4	5	6	7	8	TOTAL
910 square meters and below	0	2	0	3	4	9
	0%	22.22%	0%	33.33%	44.44%	100%
>911 square meters	1	0	1	2	2	6
	16.67%	0%	16.67%	33.33%	33.33%	100%
TOTAL	1	2	1	5	6	15
	6.67%	13.33%	6.67%	33.33%	40%	100%

Table 4. Description of income after adopting tissue cultured banana according to area planted (score 1-10; 1 is lowest and 10 is highest)

AREA CULTIVATED TO BANANA	INCOME RATING BEFORE ADOPTING THE TECHNOLOGY						
	4	5	6	7	8	9	TOTAL
910 square meters and below	0	2	1	5	1	0	9
	0%	22.22%	11%	55.55%	11.11%	0%	100%
>911 square meters	1	0	0	2	2	1	6
	16.67%	0%	0%	33.33%	33.33%	16.67%	100%
TOTAL	1	2	1	7	3	1	15
	6.67%	13.33%	6.67%	46.67%	20%	6.67%	100%

Provided employment. Table 5 shows the impact of adopting tissue cultured banana technology on employment.

With the adoption of the technology, the farmers claimed that a lot of people were gainfully employed especially during cleaning activity and cleaning in preparation for land cultivation. This phenomenon is specially pointed out by farmers having an area of more than 911 square meter or those who are planting not below 300 suckers. The respondents also claimed that tissue cultured banana need to be maintained well so it would not be easily attacked by banana bunchy top virus and other pest and diseases of bananas.

Table 5. Impact of adopting tissue culture banana on employment

PARTICULARS	OWN LABOR			HIRED LABOR		
	No.	Percentage	Rank	No.	Percentage	Rank
Cleaning						
1-2	6	40	2	7	46.67	2
2-4	9	60	1	8	53.33	1
TOTAL	15	100		15	100	
Land Preparation						
1-3	12	80	1	5	33.33	2
3-6	3	20	2	10	66.67	1
TOTAL	15	100		15	100	

Table 5. Continued…

PARTICULARS	OWN LABOR			HIRED LABOR		
	No.	Percentage	Rank	No.	Percentage	Rank
Planting						
1-2	11	73.33	1	13	86.67	1
2-4	4	26.67	2	2	13.33	2
TOTAL	15	100		15	100	
Harvesting						
1	13	86.67	1	13	86.67	1
2	2	13.33	2	2	13.33	2
TOTAL	15	100		15	100	

Negative impact of using tissue cultured banana technology. Table 6 shows the average score of some indicators relating to the negative impact of using tissue cultured banana. High mortality rate was considered to be the number one factor that negatively impacts the banana growers in terms of productivity. Other factors that brought negative impact to farmers were one time used of tissue cultured banana sucker, high priced of sucker, late procurement of planting material, low adoptability of farmers and high labor cost.

Table 6. Negative impact of using tissue cultured banana technology

CHANGES	AVERAGE SCORE	RANK
High Mortality	6.07	1
Tissue cultured banana suckers are used for one cropping	3	2
High Price of sucker	2.67	3
Late procurement of planting material	2	4
low adaptability of farmers	0.53	5
High labor cost	0.47	6

Level of Satisfaction with the Current Price of Banana per Finger and Cost of Improved Sucker

Table 7 shows that 12 out of 15 respondents were satisfied with the current price of banana per finger compared to 3 or 30% who were neither satisfied nor dissatisfied. On the other hand, 6 or 40% of the respondents were satisfied with the current price of improved sucker. Meanwhile, 40% were dissatisfied of the sucker cost while 20 % were neutral or neither satisfied nor dissatisfied.

Table 7. Level of satisfaction of the respondents on the current price of banana per finger and cost of improved sucker

PARTICULARS	CROP PRICE	RANK	%	SUCKER COST	RANK	%
Satisfied	12	1	80	6	1	40
Neutral	3	2	20	3	2	20
Dissatisfied	-	-	-	6	1	40
TOTAL	15		100	15		100

Major Changes Occurred as a Result of Technology Adoption

Most of the respondents claimed that there was no tremendous change in their income when they adopted the technology but some claimed to have paid their debts and have augmented source of their income as a result of technology adoption (Table 8).

Table 8. Major changes occurred as a result of technology adoption

CHANGES	AVERAGE SCORE	RANK
Paid Debts	2.73	2
Increase Household Income	2.40	3
No Change	3.33	1

Problems Encountered

The respondents reported that the major problems they experienced were the decreasing productivity of tissue cultured banana due to the acidity of the soil and high

mortality because their plant were still attacked by banana bunchy top virus and other pest and diseases of banana during its growing stage.

Table 9. Cost and analysis according to area planted

PARTICULARS	<910 SQUARE METERS	>911 SQUARE METERS
Sale	16,525.56	34,224
Cost of Product		
Input cost	4,561	10,281.17
Sucker	2,016.67	5,666.67
Fertilizer	857.5	1,257
Pesticide	187.5	557.5
Hired Labor	3,000	2,800
Imputed cost	3,000	4,800
Family labor	3,000	4,800
Total cost	7,561	15,081.17
Net Returns	8,964.56	19,142.83

Cost and Return Analysis According to Area Planted

Cost and return analysis for the 15 respondents were categorized into two; those having an area of 910 square meters and below and those having an area of more than 911 square meters.

Table 9 shows the distribution of cost, sales income, and returns for the 2 groups. It shows that people having an area of more than 911 square meters have higher net

returns than those having an area of 910 square meters and below. Result shows that it is better to apply the concept of economies of scale to gain more profit.

Trend in adopting Tissue Cultured Banana in terms of Yield

Figure 1 show that the annual yield of farmers was increasing from year 1992 to 1996 but it suddenly decreased on year 1997. In year 2003, the yield decreased due to high mortality and acidity of soil. Another probable cause of decline may also attribute to "mutation," a case where tissue cultured banana bear many suckers that cannot bear fruit.

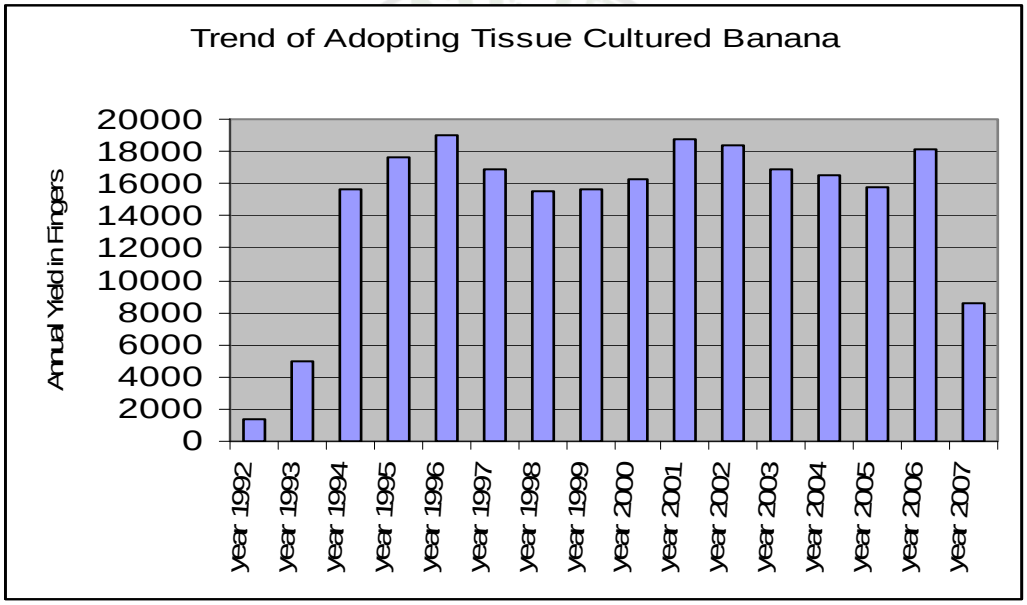

Figure 1. Trend in adopting tissue cultured banana in terms of yield

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study was conducted in the area of barangay Bayabas Sablan, Benguet with the following objectives: 1) to know the profile of farmers planting tissue cultured banana; 2) to briefly discuss the factors that influence the farmers to adopt the technology; 3) to find out the positive impacts of using the technology on farmer's livelihood and 4) to find out the negative impact of using the technology on farmer's livelihood.

There were 15 respondents chosen from the said area. The ages of the respondents ranges from 30-40 years old. Majority of them were male and mostly were educated finishing elementary, high school and college.

Majority of the respondents owned an upland area where they use rain to water their crops. They usually plant banana during rainy season of June or July and this last up to 1 year and 3 months. Most of them have an area of 910 square meters and below cultivated purposely for banana. Majority of them source their income from agriculture and non-agricultural activities.

The factors that influenced the farmers to adopt the technology were due to the influenced of Cordillera Highland Agricultural Resource Management Project (CHARM) and encouragement of Field Technician.

Farmers have identified some positive impacts that were experienced by farmers upon adoption of the new technology. These include slight increase in farmer's income

and employment for other people. As a result of slight increased on their income, the farmers reported that they were able to pay their debt.

For marketing practices, most of the respondents were satisfied with the current price of banana per finger which 2.25 pesos as well as the cost of improved suckers. They claimed to sell 8,500-29,000 fingers for those who have an area of 910 square meters and below with a sale ranges from 18,483-20,483 pesos. While 8,480-18,480 fingers for those having an area of more than 911 square meters with a sale ranges from 19,000-29,000 pesos.

Problems encountered by banana growers that resulted to its negative impact on farmer's livelihood were; high mortality, tissue cultured banana suckers were used for one cropping only and high acidity of soil which resulted to decreasing productivity of tissue cultured banana.

Conclusions

1. Most of the respondents were male and majority of them belong to the middle age group. Most of them also have formal education and majority of them source out their income from farming and non-agricultural activities.

2. The field technicians and government institution (CHARM) played an important role in farmer's adoption of the technology. Most of the farmers in this study indicated that the tissue cultured suckers they planted were introduced to them by CHARM and the field technician.

3. Majority of the respondents mentioned that adoption of tissue cultured banana brought an increase in income and provided employment for others.

4. The major problems encountered by banana growers were high mortality, one time used of banana suckers and high acidity of the soil.

5. Adopters of the technology presently experiencing deteriorating harvest have attributed such phenomenon to declining soil fertility due to continuous cultivation, heavy pest and disease infestation. Another probable cause of decreased on productivity was due to mutation.

Recommendations

1. Tissue cultured banana growers should follow cultural practices of growing bananas especially the management of aphids and immediate eradication of plant infected with banana bunchy top virus so as to not to repeat the negative externalities of the crop performance.

2. Cordillera Highland Agricultural Resource Management Project should continuously monitor the tissue cultured banana growers and the field technicians should fully teach the farmers regarding the cultural practices of growing bananas.

3. Banana growers should be aware of attending seminar and meetings of Bayabas Banana Growers Association regarding tissue cultured banana production and updates about the technology to enhance their knowledge managing their farm.

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APPENDIX

Survey Questionnaire

Impact of Tissue Cultured Banana Technologies on Livelihood of Growers in Bayabas Sablan, Benguet

Crop: _____Tissue cultured banana _____Traditional banana

DEMOGRAPHIC PROFILE

A. General Information

A.1 Name: _____ Sex: _____ Age: ____ Education: _____

B. Household Information

B.1 Please describe the following information about your household

Particulars	Male	Female
No. of household members		
No. of Full time Agricultural labor		

B.2 Please indicate the source of your household income

Income Source	Total Earnings per year
Agriculture (including Livestock	
Non-Agriculture	

C. Farm Characteristics

C.1 Please provide the following details about your landholding (area in square meter)

Land category	Irrigated	Rain fed	Ownership	Total
Lowland				
Upland				

C.2 Details about land utilization and crop production in the last cropping year

Crops	Area	Duration (month-month)	Production (No. of Fingers)	Quantity Sold	Sales

D. Crop Cultivation situation (on selected crop) and Technology adoption

D.1 Please score the factors that influence you to adopt tissue cultured banana?

1- Lowest
10- Highest

Factors	Score (1-10)
Influence of CHARM	
Influence of a Technician	
Influence of Neighbor	
Others	

D.2 When did you start growing tissue cultured banana?

Year	Variety	Source
	Lakatan	
	Cantong	
	Tumok	

D.3 Input used and cost

Inputs	Amount used	Cost
Sucker or planting material		
Chemical fertilizer		
Pesticide		
others		

D.4 What method of watering do you use in farming?

____ Rain fed

____ Underground water

E. Market, positive impact of using tissue cultured banana and influencing factor

E.1 How much price do you get for your crop per finger?

Variety	T.C Lakatan	T.C Cantong	T.C Latundan	T.C Tomok
Minimum (P/Finger)				
Maximum (P/Finger)				
Average (P/Finger)				

E.2 Do you get price information about the crop in the area before and after planting and harvesting?

	Yes/No	From whom
Before planting		
Before harvesting		

E.3 Please check your level of satisfaction with the current price of the crop and cost of improved sucker?

Level of Satisfaction	Crop Price	Sucker Cost
Highly satisfied (5)		
Satisfied (4)		

Neutral (3)		
Dissatisfied (2)		
Highly dissatisfied (1)		

F. Yield difference and changes due to variety adoption

A. INCOME

F.1 How much yield (Fingers/sq.m) do you get from tissue cultured plant?

Variety	Yield
Lakatan	
Cantong	
Tumok	
Others	

F.2 Please rate your income from growing the crop before and after using the improved sucker?

1- Lowest
10- Highest

Income	**Score (1-10)**
Before using improved sucker	
After using improved sucker	

F.3 What major changes occurred as a result of variety adoption?

Changes	**Score (1-10)**
Paid debts	
Increased household income	
Decreased in household income	
No change	
others	

B. EMPLOYEMENT

G.1 Olease provide the following details on labor and inputs use during last season

Activities	**Own Labor**		**Hired Labor**		**Wage rate**	**Total cost**
	Male	Female	Male	Female		
Cleaning						
Planting						
Harvesting						

H. Negative impact of adopting the technology

H.1 Please score the negative impact of adopting the technology

Negative impact	**Score (1-10)**
Mortality	
Labor cost	
Price of sucker	
Late procurement of planting material	
Used for one cropping only	

Others	

H.2 Please score the positive impact of adopting the technology

Positive impact	**Score (1-10)**
High salability	
Productive	
Others	

I. Production over the years in the use of tissue culture banana

I.1 Please indicate the yield throughout the year

	Year															
Yield (fingers	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007

ThANk You Very much!!!