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A FEASIBILITY STUDY OF ESTABLISHING A VIRUS-FREE BANANA SEEDLING PROPAGATION FACILITY IN BARANGAY MASAYA, BAY, LAGUNA

by

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Working Paper No. 2009-21

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February 2009

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Introduction

Banana is one of the major income-generating crops of the Philippines owing to the fact that it is one of the country's major export crops. Though the banana crop is very susceptible to climatic changes and typhoon occurrences (because of its succulent stem), banana farming is still prevalent in the country. This can be attributed to the high demand for banana fruits, both locally and internationally, not to add that the fresh fruit can command a high price especially in the world market.

Aside from being vulnerable to typhoons, another major problem faced by our banana farmers is the prevalence of diseases like the bunchy top virus, black sigatoka, moko and dry rot diseases, which are caused by viruses carried by insects like aphids and corm weevil. This problem has historically lowered the productivity of the country’s banana farms (even rendered some farms with no produce at all) and this had disheartened some of our banana farmers, thus, causing them to shift from planting banana to other crops. To reduce the problem regarding the mentioned diseases, tissue culture or micro propagation can be adopted. Tissue culture or micro propagation is the only effective way to produce virus-free banana plantlets.

Background of the Product/Technology*

Banana micro propagation in the Philippines began when the International Research Development Center (IRDC), Canada invited Dr. Ricardo Lantican, who was then the director of the Institute of Plant Breeding, UPLB, to submit a project proposal on banana. The objective was to promote the planting of saba, a cooking/dessert type and bunchy top resistant banana variety and to use micropropagation to produce virus-free plant materials. The proposal was prepared by Lilian Pateña and Ramon C. Barba.

In barely a year, the team composed of Lilian F. Patena (project leader), Olivia P. Damasco (M.S. thesis student), Ma. Concepcion E. Umali (research assistant) and Alfinetta B. Zamora (vice Patena who took a study leave) and Ramon C. Barba (consultant) completed the micro propagation of 50 banana cultivars. The team wrote a paper, which was submitted and emerged as finalist for the CSSP Best Paper award in 1984.

Furthermore, a training course was prepared by Lilian F. Patena and this was implemented by Alfinetta B. Zamora with six trainees coming from Malaysia, Thailand and Philippines.

One of the Filipino trainees, Adonis Jadraque, a staff member of the Twin Rivers Research Center (TRRC) in Davao had set up a laboratory to mass produce their Cavendish strain 'Umalag.' The result was very successful such that the other private corporations set up their own laboratories with the assistance of Lydia Magnaye, the other Filipino trainee from BPI-Davao to micropropagate their own export variety.

* Written by Prof. Lilian Pateña and Ramon C. Barba

According to Dr. Recel, Director of Twin Rivers (1995) in a paper entitled "Commercial Application of Rapid Micropropagation Techniques in the Philippine Banana Industry," RP-German Biotechnology Conference, Legaspi City, "The projected banana expansion program requires about 30-34 million plantlets plus another 10 million for annual replanting dead or missing hills and 10 million for conversion of old and tall varieties. Such an enormous plantlet requirement creates the need for a rapid mass propagation technique." The present estimated production is 100 million plantlets a year. DOLE Philippines alone has the capacity to produce 22 million plantlets a year.

The micropropagation technology was quickly adopted by private banana corporations in Davao as well as private growers to replace the use of bulky, often diseased suckers, for better yield, uniform maturity and better disease control.

Banana companies are now practicing replanting after every harvest instead of allowing the succeeding suckers to continue on to the next generation, thereby increasing the requirements of planting materials many times over. The use of micropropagated plants allow better disease control, more uniform growth, size of harvested fruit and timing of harvest.

Clean plants were used to rehabilitate banana regions ravaged by disease such as those in the Cordillera and Quirino provinces.

Lilian F. Patena and her team (R.C. Sotto, J.G. Dimaculangan, G.R. De Leus, I.G. Banasihan and R.C. Barba) used the banana micropropagation technique to isolate a lakatan variety, 'Lilak,' with improved characteristics.

Dr. Agustin Molina, Regional Director of INIBAP, reported that micropropagation is the most important technology generated by research for banana. It is used not only to provide clean planting materials but also to eliminate certain virus diseases such as bunchy top.

The technology is featured in SALINLAHI, Science Heritage Center, DOST, as one of the outstanding contributions of the Philippines to science and technology, one of few agricultural inventions featured.

Ramon C. Barba brought the technology to Singapore while he was director of research of Plantek, a biotechnology company owned by Tata of India, Sumitomo of Japan, and NPI of the United State to produce millions of banana planting materials for plantations of Malaysia, Thailand and Indonesia.

Meanwhile the IPB Plant Cell and Tissue Culture Laboratory (PCTCL) micropropagated banana to serve the original purpose of the project from 1984 to 1995. After that, propagation was discontinued because of a budget constraint.

Lately, the Department of Agriculture recognized the need for planting materials and awarded IPB a grant to produce seeds and vegetatively propagated plants. This included a portion for the PCTCL to mass produce virus-free banana planting materials in 2006. Virus-free plantlets of different varieties, e.g. saba, lakatan, latundan, and others were produced (indexed by BIOTECH, UPLB) and distributed starting August 2007. This project is now part of the National Seed Foundation's regular activities and is being conducted by Lilian F.

Patena (Head, PCTCL, CSC-IPB) and her team composed of M.B.C. Ines, L.S. Caymo, R.C. Barba and other PCTCL support staff. Virus-free banana plantlets are now available at the Institute of Plant Breeding all-year round.

Description of the Product/Technology

Production of virus-free banana seedlings is made possible by micropropagation. Micropropagation is the practice of multiplying stock plant material to produce a large number of offspring plants, using modern plant tissue culture methods. It is used to provide an adequate number of plantlets by multiplication from the original plant for planting from a stock plant which does not produce seeds, or does not respond well to vegetative propagation. The plants that were bred through conventional plant breeding methods will be the subject of the micropropagation method to improve production yield and to accelerate plant growth.

Micropropagation of banana is done to eliminate diseases caused by viruses. It is only through micropropagation that diseases caused by viruses can be completely eliminated.

The production of banana seedlings through tissue culture has two parts: the laboratory operations and the nursery operations. The laboratory operations include the following processes: preparation of explants, preparation of the media, explanting, subculture/multiplication of tissue cultured plantlets and in vitro rooting/regeneration of plantlets. The nursery operations, on the other hand, include: potting out the seedlings (for acclimatization) and bagging. Refer to Figure 1 for the illustration of the micropropagation process.

Nature of the Study/Research Conducted and Methodology

The study aimed to assess the viability of establishing a virus-free banana seedling propagation facility in Masaya, Bay, Laguna. The project's viability was assessed based on its feasibility on the four business functions namely: marketing, production, organization/management and finance.

The main purpose of the facility was to provide high quality and virus-free seedlings to the banana farmers, which can enhance the productivity of their farms while at the same time generating enough income to sustain its operations.

To determine the marketing viability, the authors had identified potential target markets for the product of the facility (virus-free banana seedling). It was determined whether there was a demand and supply gap in the identified target market. The paper had proposed appropriate marketing strategies to be able to cater to the needs of the target market as well as to completely sell the volume produced by the facility. Some of the results of the market analysis also include the determination of the most appropriate price for each plantlet in which the pricing strategy of the competitors as well as the willingness of the customers to pay for the product were considered. The most effective promotional strategies were also proposed as promotion is a critical factor to successfully market the banana seedlings.

In terms of production, sources of raw materials and inputs were identified. The production level at which the business will generate enough income to cover the costs and the investments was determined.

The research had also identified the critical functions for the operations of the business so as to hire the qualified employees for this type of project. The number of personnel as well as the type of skills, required to man the propagation facility were determined.

The initial investment requirements, which include the fixed asset investments, the working capital and the pre-operating expenses, were computed to ascertain the amount that should be raised in order to establish the business project. Moreover, financial analysis was done to determine the sustained profitability of the facility. The tools of analysis used were IRR, NPV and payback period. Sensitivity analysis was conducted to determine the sensitivity of the project to forces in the external environment. Considering also that the business will be established in an environment that is characterized by complexity, dynamism and uncertainty, potential risks and problems that the business will be encountering were also identified. Recommendations were formulated to address the identified potential risks and problems.

Summary of Findings

It was found that establishing a virus-free banana seedling propagation facility is feasible in all of the business aspects.

Market Aspect

The domestic market for banana fruits promises an increasing demand. Demand for banana fruits significantly increased from 12.54% to 17.09% from 2006 to 2007. This has a great implication to the proposed facility as this trend will encourage farmers to engage in

banana farming. Absorption of the projected produce of the facility is achievable because the emerging practice among banana farmers is that they clear their plantation after the first set of harvests and replace the crops with new sets of seedlings. This is mainly because the next set of fruits will be smaller, thus of lower quality if such crops were not replaced after the harvest.

The proposed target market for the produce of the facility are the end users or the banana farmers in the adjacent barangays and towns of the facility's location and institutional buyers such as academic institutions that require banana seedlings for experiments and government institutions that are involved in development programs. The volume to be produced by the facility is barely 2% of the expected demand of the proposed target market. This fact is already an assurance that there is a large market for banana seedlings, most particularly, tissue cultured, virus-free banana seedlings. Banana farmers are now more aware of the benefits that tissue-cultured seedlings offer. In addition, the government and some concerned institutions are now encouraging farmers to replenish their banana crops yearly so as to avoid the occurrence of disease which lowers the productivity of banana farms.

Production Aspect

Banana is propagated asexually, therefore, instead of seeds (or embryos), suckers are used for propagation. Sword leaf suckers are the most effective raw materials to use as the parts utilized for micropropagation are the shoot tips. To ensure that the plantlets to be produced are virus-free, the suckers should also be assured that they come from uninfected mother plants. Moreover, it is crucial that all materials to be used are sterilized. High quality sucker and equipment are available at the National Plant Genetics Resources Laboratory (NPGRL). Each sucker may produce 3,000 plantlets or more depending on its proliferation

quality. The proposed propagation facility will operate at 45,073 plantlets per year production level with one screen house having 18 seedbeds. The prevailing mortality rate for facilities like this is 2% and the going-rate price is P30.00 per plantlet. The complete process (tissue-culture) from the procurement of the suckers to producing the banana seedling will take ten months.

Organization/Management Aspect

The facility, since it will just operate on a small-scale basis, will just need a simple organizational structure and a few personnel. The functions that are important for the operations of the facility include: the tissue culture process itself (laboratory operations) and the activities in the nursery like irrigating the seedlings, spraying and fertilizing. Thus, a skilled worker, that is, one who is knowledgeable in how the tissue culture is done, a laborer and one who would oversee the entire operations of the facility are needed. The personnel of the facility should also know the benefits tissue-cultured banana seedlings could offer so that they can educate their banana farmers/customers.

Financial Aspect

The initial capital required for a facility with 45,073 plantlets capacity is approximately Php 3,014,030.00, about 80% of which comprises the cost for the construction of the building and for land acquisition. The needed working capital is approximately half a million pesos. Establishing the propagation facility is financially feasible as shown by the computed NPV, which is positive and IRR, which is higher than the discount rate. In all the scenarios analyzed, it was found that the project is still financially viable. Please refer to Table 1 for the summary of the financial and sensitivity analyses results.

One of the most major concerns of the banana industry is the vulnerability of the fruits and plants to various pests and diseases. Tissue-cultured banana seedlings are not guaranteed 100% free of such pests and diseases. Eradication of diseases may be achieved if the propagation facility as well as the farmers execute proper sanitation procedures, pesticide application and proper management practices consistently.

One potential problem the facility may face is the increase in the prices of laboratory inputs like chemicals and nursery inputs like pesticides and fertilizers. This scenario can decrease the profit margin of the business.

Conclusions and Recommendations

The technology itself has a high potential for commercialization. The target market for the technology are the many commercial-scale banana farms specifically in Davao.

In the same manner, the product of the technology has a high demand as we also have many small-scale farmers. As proof, just in Laguna alone, a small-scale propagation facility (as the one proposed in this feasibility study) can only cater to 2% of the total banana seedlings demand. There is a large market for the product of the technology and it will never be exhausted as replanting of banana after every harvest is very much recommended to eradicate diseases, thus, improving farm productivity.

Another aspect that UPLB might look into is to establish its own propagation facility. In terms of the technical aspect, UPLB has no problem as the developers came from the university. It is proposed that the role of the UPLB for the established propagation facility is in technical assistance (production side). The institution can then hire people who will be in charge of the marketing, distribution and overall management of the propagation facility. A

propagation facility can be a good source of income for the university. This venture can generate enough cash flow for the university to support or finance activities conducted by the university. It is high time that UPLB start making money out of the technologies that have been developed within its premises.

It is also proposed that the coordination and cooperation between the Department of Agribusiness Management and Institute of Plant Breeding and UPLB Biotechnology should be strengthened. Development and conceptualization of technologies are done by IPB and UPLB Biotechnology. The Department of Agribusiness Management is willing to conduct market researches, feasibility studies and techno-managerial studies to determine the marketability, the potential demand as well as the business viability of these technologies.

Areas for Further Research

It is recommended that a study or review of the process should be conducted and if reengineering is needed, by all means, this must be done. Proper coordination and complementing of the processes involved in commercializing technologies is very crucial for successful technology commercialization.

Table 1. Financial and Sensitivity Analyses Results

Scenario	**Assumptions**	**NPV** (at k = 14%)	**IRR**
Base Scenario	➢ Constant prices of inputs ➢ No price increase for the produce (plantlets)	Php 435,293.03	17%
Scenario 1	➢ Selling price of banana plantlets is higher by 6% than the prevailing price ➢ Constant prices of inputs	Php 929,567.94	21%
Scenario 2	➢ Price of inputs, specifically chemicals, is higher by 10% than the current prices ➢ Selling price of plantlets is constant ⇨ Look at the effect of inflation on the viability of the proposed business	Php 452,246.09	17%
Scenario 3	➢ Production volume decreases by 98 plantlets every month ➢ Selling price is constant at P30.00 per plantlet ➢ Constant prices of inputs ⇨ Look at the effect of drought on the viability of the proposed business. Drought can cause farmers to shift from planting bananas to other crops which are less sensitive to drought, thus may cause decrease in demand for banana plantlets.	Php 264, 317.27	16%

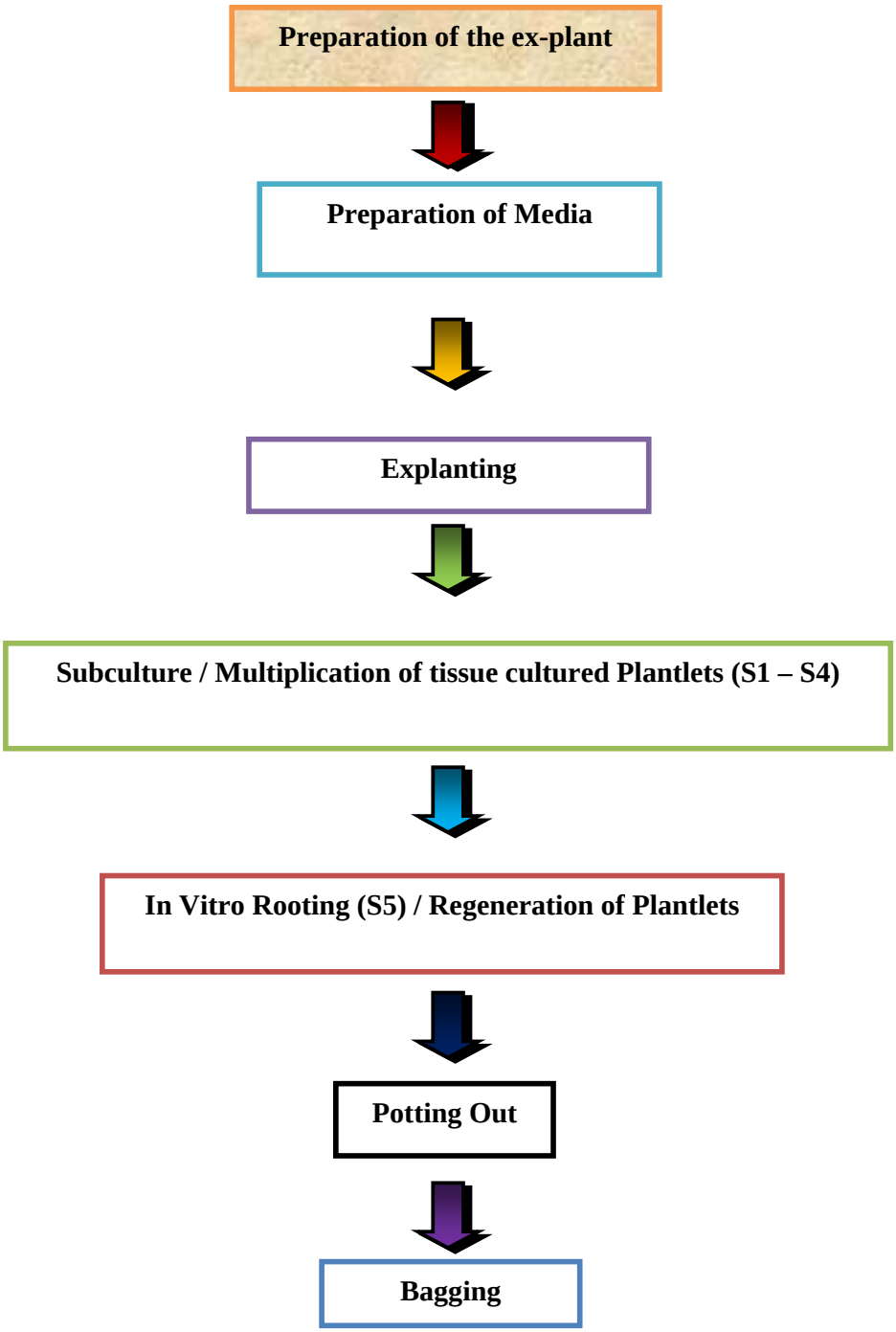

Figure 1. Banana Micro Propagation Process

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