

# MASS PROPAGATION AND COMMERCIALIZATION OF PLANTING MATERIALS FOR CITRUS DEVELOPMENT IN THE NORTHERN HIGHLANDS OF THE PHILIPPINES

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## ABSTRACT

Citrus is an important cash crop of many small farmers. Despite the problems besetting the industry, there is an increase in the demand for plant materials. Considering that the industry is heavily dependent on the supply of quality plants, the project aimed to accelerate the production, utilization and commercialization of citrus planting materials.

Following the healthy plant material production scheme, 16,034 plant materials were produced and distributed to 332 growers. The plant materials were produced in three nurseries which were supported by the project, namely: BPI-Baguio, LGU-Balbalan, Kalinga and a private nursery in Bontoc, Mt. Province. Two demonstration orchards were established and a citrus field day was conducted to promote the utilization of healthy plant materials. Six training activities were conducted and 259 were trained on various aspects of citrus production. Information materials, like the citrus technoguide, were developed and distributed to 330 growers.

Investment analyses done on citrus plant material production is profitable, based on indicators like internal rate of return (IRR), benefit cost ratio (BCR), and return of investment (ROI). Private nursery had the highest IRR (263%), BCR (1.85) and ROI (75%).

## RATIONALE

Citrus (*Citrus spp.*) is an important cash crop of many small farmers. It has a wide range of adaptability, many products and by-products, rich in vitamins and mineral, medicinal properties. At present, it ranks fourth to banana, mango and pineapple in terms of area and production. The present area planted to citrus is 37,743 hectares and production volume of 238,631 metric tons (BAS, 2012). However, total production still falls short of the local demand. The deficit in supply has necessitated importation from other countries. For example in 2009 and 2010, the country imported 56, 553 and 16, 328 metric tons of citrus fruits, respectively.

It was once a major fruit industry in the Philippines until its decline, beginning in the 1960's, which resulted to loss of over a million of trees (Altamirano, *et al.*, 1976; Salibe and Cortez, 1968; Martinez and Wallace, 1968). The devastation was brought about by the injudicious sanitation procedures in the propagation of planting materials resulting in the proliferation of virus and virus-like diseases particularly Huanglongbing (HLB), also called Leaf mottling/Greening disease and severe strains of Citrus Tristeza Virus (CTV). To date, CTV, HLB and their insect vectors are reported to be found in all citrus growing areas in the country, resulting to low productivity and loss of trees.

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Citrus is a fruit production venture that is heavily dependent on the supply of quality plant materials (Aubert and Vullin, 1998). Since, citrus is affected by serious problems of diseases, particularly greening and virus diseases, which are primarily carried through the plant materials during propagation, the use of healthy plant material is of primary importance in the management of these diseases (Aubert, 1990). The Food and Fertilizer Technology Center (FFTC) reports that citrus production in Asia, not only suffers from high production costs and low yields, but also from serious problems of diseases, particularly greening and virus diseases, so that the life span of trees is often relatively short. In view of the long time it takes citrus trees to reach maturity, lengthening the life span of trees would make an important contribution to increasing the percentage of productive orchards, and reducing production costs. Other problems include a lack of suitable improved varieties, a lack of disease-free planting material, and the need for new cultural techniques so that farmers can have more control over the timing of the harvest, thus avoiding seasonal surpluses (FFTC publication: Issues on Asean Agriculture, <http://fftc.imita.org/library.php?func=view&style=type&id=20110725095646>).

The availability of suitable improved varieties is another issue confronting the local industry. Since there are no active efforts on citrus breeding, evaluation of introduced varieties was done by the researchers at the Baguio National Crop Research and Development Center (BNCRDC). Through the efforts of the BPI-BNCRDC, ten (10) varieties were registered with the National Seed Industry Council (NSIC), which include the local variety Gayunan, two (2) Ponkan mandarins, Satsuma (Unshui) mandarin, three navel oranges (Washington, Navelate, Navelina) and two common oranges (Hamlin, Trovita), and Magallanes pummelo. These citrus varieties have passed the prescriptive evaluation and were approved by the National Seed Industry Council, thus they are being recommended for commercialization. In addition, BNCRDC researchers validated the use of an improved propagation technique called side grafting, to be more efficient and can be utilized for rapid propagation of quality planting materials (Ochasan, *et al*, 2008). However, to ensure that the plant materials produced are of the highest quality possible, the healthy plant material production system that has been put in place must be followed (Ochasan, *et al*, 2004). Moreover, the healthy seedlings must be kept free of the disease as long as possible after they have been planted, through proper tree and pest management (FFTC, 2003).

Therefore, the citrus industry needs to make adjustments in citrus production technology in order to raise productivity and reduce costs. The local citrus industry faces the challenge of competing with imported citrus in terms of quality and volume. Therefore, it must innovate to be competitive and take hold of the expanding domestic market. Efforts to reduce costs by integrated technology and improved cultural practices particularly on improved disease control will be of major importance (FFTC, 1996). As Doss (2003) pointed out, "Technologies play an important role in economic development. The use of improved technologies has remained the major strategy used by governments to increase agricultural productivity and promote food and livelihood security".

In the Cordillera region particularly, despite these problems however, citrus is still being sought by farmers, as evidenced by the increase in demand for plant materials. Recently, there is also a renewed interest in citrus growing due to the government's goal of increasing agricultural land and crop productivity. However, the major constraint to the further development of the citrus industry is the lack of quality plant materials, which means healthy or free from injurious pests and diseases and true-to-type of the variety, as well as the lack of technical know-how on how to manage the trees. The present capacities of the citrus nurseries are not enough to supply the demand of the local growers for their orchard expansion. At present, only the BPI-BNCRDC nursery is the major supplier of quality plants in the Cordillera Administrative Region (CAR). Although, there are few small nurseries but they are not fully following the healthy plant material production scheme that was established. The goal is to have them linked into the system as well as to promote the use of improved technologies such as the use of registered citrus varieties and improved propagation techniques and nursery management. A timely and adequate supply of

healthy plant materials is important considering that the success of the citrus industry is heavily dependent on the supply of quality plants. Furthermore, growers should be capacitated in order to maintain these healthy plant materials as long as possible after they are planted in the field, primarily on the management of pests and diseases.

## OBJECTIVES

General: To accelerate the promotion, utilization and commercialization of high quality planting materials of citrus towards an economically viable and sustainable citrus industry in the northern highlands of the Philippines, particularly in the provinces of Mt. Province and Kalinga.

Specific:

1. To mass produce 10,000 healthy plant materials of the registered citrus varieties, in the context of the healthy plant material production system.
2. To establish two (2) demonstration farms and conduct one (1) citrus field day to raise awareness and promote the production and utilization of high quality citrus plant materials.
3. To train 150 various citrus stakeholders on mass production of healthy plant materials and management of healthy plant materials in the field.
4. To develop at least two (2) information materials, reproduce 300 copies and distributed to 200 stakeholders.
5. To analyze the profitability of citrus nursery.
6. To support policy formulation and advocacy for the development of the citrus industry through linkages and collaboration with various stakeholders at the local level.

## METHODOLOGY

To achieve the expected outputs, the project framework takes into consideration the plant material production flow or the healthy plant material production scheme, the project interventions/activities in every step of the plant material production chain, and the participation of the various stakeholders (Fig. 1).

The healthy plant material production scheme. The production of healthy plant materials starts from the production of basic materials such as budwoods/scions in the Foundation Block (FB), which are mass produced in Budwod Increased Blocks (BIB), and the production of rootstock seeds in Seed gardens. The Level I Foundation Blocks are established and maintained by national government agencies such as the Bureau of Plant Industry, while the Level II is undertaken by other agencies such as the local government agencies. The mass production of healthy seedlings is done in the nurseries, either government or private. These healthy seedlings are then availed by growers for the establishment, expansion or rehabilitation of their orchards for fruit production.

Project interventions/activities. In order to accelerate the production, utilization and commercialization of healthy plant materials, the projects interventions through the various stakeholders (nursery operators, growers, LGU's, government and private individuals or groups) worked together in a concerted and conscious effort to ensure the attainment of the expected outputs.

Firstly, as an integral component of the system, the project supported the maintenance the Foundation/Budwood Increase blocks (Level I) and Seed gardens at the BPI-Baguió City through the provision of supplies for its maintenance and regular indexing against major diseases. The

project likewise supported the establishment of the LGU Foundation Block (Level II) in Balbalan, Kalinga through the provision of mother plants.

Secondly, the project supported three nurseries, namely: BPI-Baguio City, LGU nursery in Balbalan, Kalinga and a private nursery in Bontoc, Mt. Province for the mass production of healthy plant materials. The technology components in the production of healthy plant materials included the: a) use of insect-proof greenhouse in rearing the seedlings, b) use of healthy budwoods of registered citrus varieties only from the Citrus Foundation Block (FB) and Budwood Increase Block (BIB). c). use of side-grafting, a rapid propagation technique d) use of the recommended nursery management practices

Awareness and promotion campaigns. Two major activities were conducted, the establishment of two demonstration farms on the use of healthy plant materials and the conduct of citrus field day.

Capability enhancement. Capacitating the growers is imperative so that they will be able to keep their trees healthy as long as possible after they are planted in the field. The activities involved the conduct of training-seminars; demonstrations and technical assistance on the production of quality citrus plant materials and orchard management.

IEC development, reproduction and distribution. To reinforce their knowledge gained during the various training activities, information and education materials such as technoguide and various leaflets were prepared, reproduced and distributed.

Profitability analysis. A 5-year investment analysis was prepared following the financial/investment analysis by Aragon, 2008.

Policy/Advocacy. The activity included the initiation/review/formulation of policies towards citrus nursery and orchard development among various stakeholders at the local level.

## **RESULTS AND DISCUSSION**

As a result of the project initiatives and interventions, the project was able to accomplish its objectives and expected outputs. A summary of the project accomplishments and the extent to which they were accomplished are shown in Table 1.

### **Mass production and utilization of quality planting materials**

Prior to project implementation, BPI-BNCRDC in Baguio City is the only nursery in the region producing healthy plant materials following the healthy plant material production scheme with an average of 8,000 seedlings per year and average number of clients of 300 per year. As a result of the project's support for mass propagation of healthy plant materials in three nurseries, namely: BPI-Baguio nursery, LGU nursery in Balbalan, Kalinga and a private nursery in Bontoc, Mt. Province, a total of 16,034 healthy seedlings were produced (Table 2). The plant materials were distributed (sold) to a total of 332 clients.

Specifically, at the BPI-Baguio nursery, 6,705 seedlings were produced and distributed to 273 clients (Fig. 2). In Balbalan, Kalinga, the municipal nursery was able to produce 6,379 seedlings and distributed to 43 clients (Fig. 3). On the other hand, the private nursery in Bontoc, Mt. Province, owned by Mr. Tomas Sadcopen, produced 2,950 seedlings and distributed to 14 clients (Fig. 4). Among the registered varieties, varieties Gayunan and Mandarin Ponkan are the most preferred by the growers in the project sites, hence these were the ones that were mostly

propagated. However, in Baguio particularly, the other registered varieties were also propagated to cater to other clients.

Overall, the total output is 60% more than the project target of 10,000 asexually propagated citrus seedlings. The project contributed to about 200% increase in the available healthy plant materials of citrus, since the average yearly production in the region is 8,000 seedlings per year. Consequently, since there was an increase in available plant materials, clients who availed of plant materials also increased, from an average of 300 persons availing of plant materials, the project served an additional of 330 clients. Although most of these newly planted,

**FIG. 1. PROJECT FRAMEWORK**

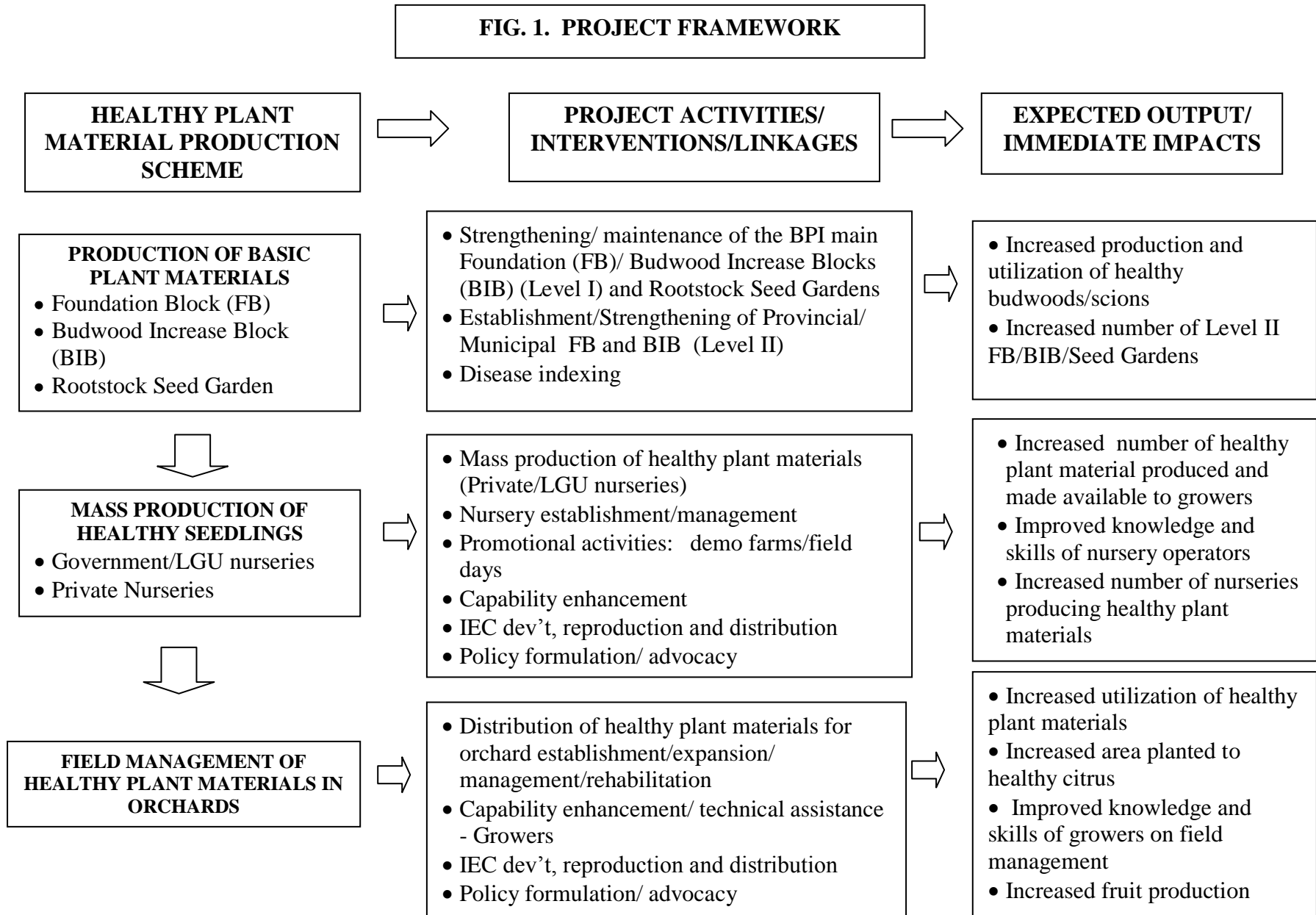


Table 1. Summary of project accomplishments.

Objectives/ Expected Outputs	Accomplishments/Outputs/% Accomplishment
1. Mass produce 10,000 healthy plant materials of the registered citrus varieties, in the context of the healthy plant material production system.	<ul style="list-style-type: none"> <li>• 16,034 healthy plant materials produced and distributed to 332 clients (160% accomplished)</li> <li>• 3 nurseries supported/established (BPI-Baguio, LGU nursery- Balbalan, Kalinga, private nursery-Bontoc, Mt. Province.</li> <li>• Supported the maintenance of BPI-Baguio- Level I Foundation/Budwood Increase Block/Seed garden</li> <li>• Supported the establishment of Level II Foundation block in LGU-Balbalan, Kalinga.</li> </ul>
2. Establish two (2) demonstration farms and conduct one (1) citrus field day to raise awareness and promote the production and utilization of high quality citrus plant materials.	<ul style="list-style-type: none"> <li>• Two (2) demo farms on the use of healthy plant materials were established in each project site: Balbalan, Kalinga and Bontoc, Mt. Province</li> <li>• One (1) citrus field day was conducted in Bontoc, Mt. Province</li> <li>• Exhibited/conducted taste test of the NSIC registered varieties of citrus</li> </ul>
3. Train 150 various citrus stakeholders on mass production of healthy plant materials and management of healthy plant materials in the field.	<ul style="list-style-type: none"> <li>• 259 trained (172.6% accomplished); six (6) training activities conducted</li> <li>• Topics include: rapid propagation techniques, nursery establishment and management, orchard establishment and management, management of HLB, pruning and fertilization</li> </ul>
4. Develop at least two (2) information materials, reproduce 300 copies and distributed to 200 stakeholders.	<ul style="list-style-type: none"> <li>• Four (4) IEC materials developed (200% accomplished): Citrus technoguide, Rapid propagation technique by side-grafting, HLB identification and management, Rapid Field Test Kit for HLB</li> <li>• 400 copies reproduced (133% accomplished)</li> <li>• 330 copies distributed (165% accomplished)</li> </ul>
5. Analyze the profitability of citrus nursery.	<ul style="list-style-type: none"> <li>• Investment analysis of the three (3) nurseries prepared (100% accomplished).</li> </ul>
6. Support local policy formulation and advocacy for citrus dev't thru linkages with stakeholders at local level	<ul style="list-style-type: none"> <li>• Conducted meetings; reviewed existing policies; resolution submitted to LGU</li> <li>• Approval of proposed municipal ordinance by local officials is still underway</li> </ul>

some are already in their first year of bearing (Fig. 5, 6). Thus with more than 16,000 seedlings already planted it can be expected that an additional of about 50 hectares would have been newly planted or rehabilitated.

Most importantly, as a result of the project support, two nurseries: one LGU and private are actively producing healthy plant materials of citrus. These nurseries are expected to sustain their production even after the project with the continuing technical support of BPI.

Moreover, as an integral component of the healthy plant material production system, the project's support both to the Level I Foundation/Budwood Increase Block and the Seed garden at the BPI-Baguio (Fig. 7), and the establishment of the Level II Foundation Block in the municipal nursery in Balbalan, Kalinga (Fig. 8), ensured the availability and sustainability of basic materials (budwood/scion/seeds) for the mass production of healthy plant materials.

Table 2. Number of healthy plant materials produced and clients served by three project-supported nurseries.

Nurseries	Number of Plant Materials Produced and Distributed	No of clients served
BPI-Baguio nursery	6,705	273
LGU-nursery Balbalan, Kalinga	6,379	43
Private nursery- Bontoc, Mt. Prov.	2,950	14
<b>TOTAL</b>	<b>16,034</b>	<b>330</b>



Fig 2. Nursery at BPI-BNCRDC, Baguio City, which was utilized in the mass production of quality planting materials.



Fig. 3. Production of healthy citrus plant materials at the LGU municipal nursery in Balantoy, Balbalan, Kalinga.



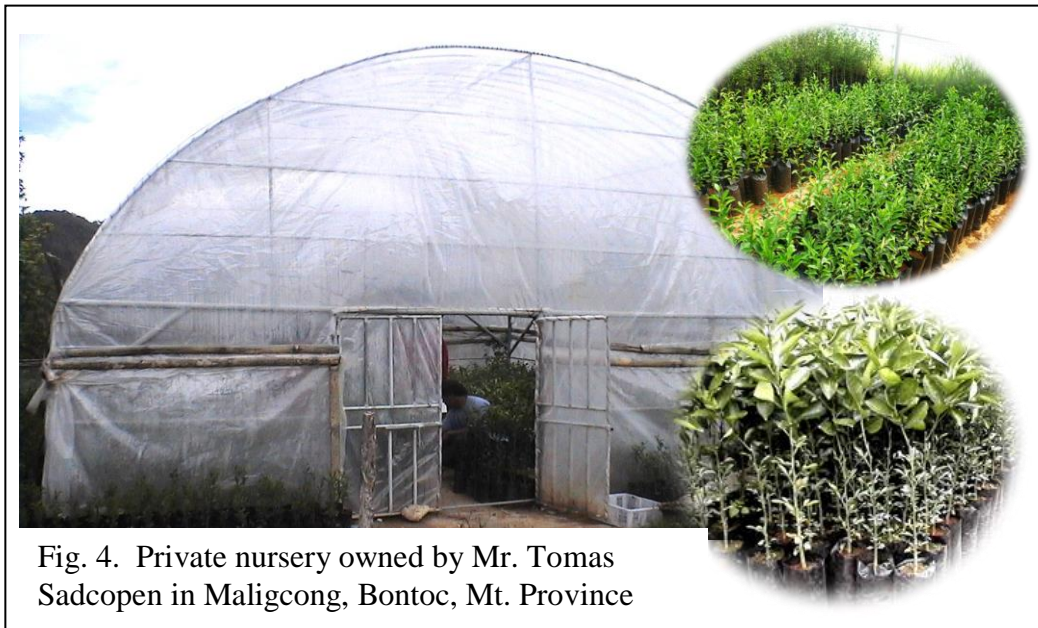


Fig. 4. Private nursery owned by Mr. Tomas Sadcopen in Maligcong, Bontoc, Mt. Province



Fig. 5. An orchard in Pozorrubio, Pangasinan planted with pummelo seedlings from BPI-Baguio nursery (2 hectares)

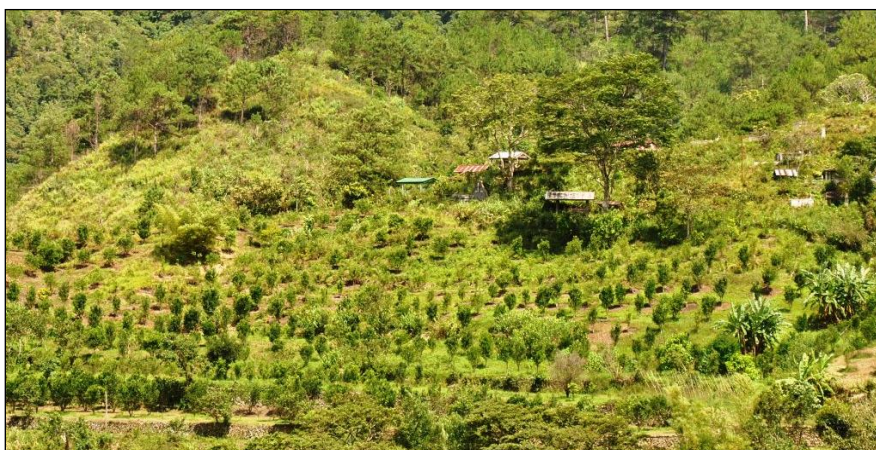


Fig. 6. An orchard in Balbalan, Kalinga planted with Gayunan produced from LGU nursery



Fig. 7. (left) Foundation Block; (right) Budwood Increase block in Baguio City



Fig. 8. Level II Budwood Foundation Block established at the municipal nursery in Balbalan, Kalinga

#### Establishment of demonstration farm.

The two (2) demonstration farms were established in Balbalasang, Balbalan, Kalinga and in Maligcong, Bontoc, Mt. Province with farmer cooperators, Hon. Allen Jesse Mangoang and Mrs. Fe Fanged, respectively (Fig. 9). The demo farm in Kalinga was established in May 2009 with 150 gayunan seedlings, while in Maligcong, Bontoc it was established in November 2009 with a total of 120 seedlings. Both demonstration farms are being properly maintained by the farmer-cooperators. Initial inputs of organic fertilizers were provided as well as continuing technical support. To date, the trees in both farms remained healthy with no indications of re-infection any of the virus and virus like-diseases and are already in their first year of bearing.

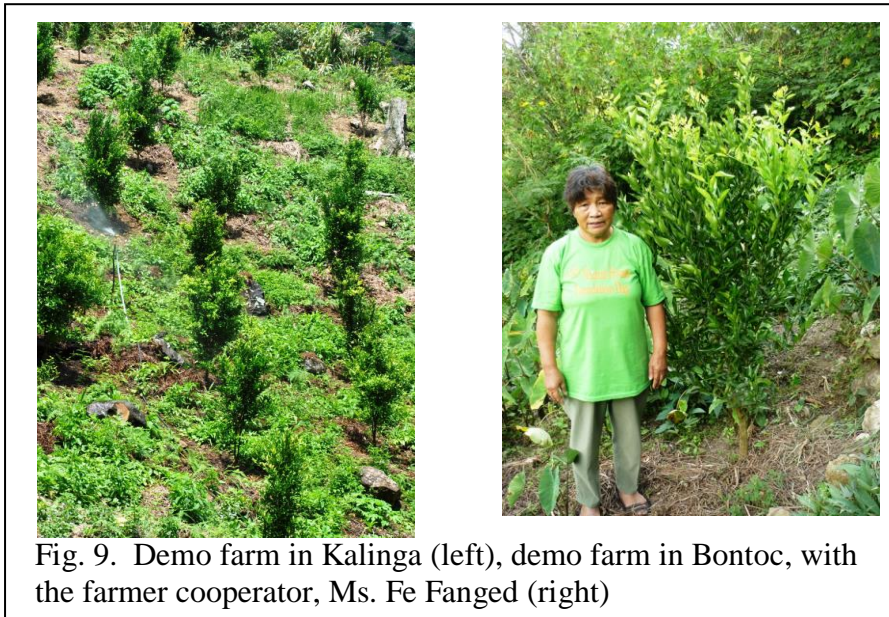


Fig. 9. Demo farm in Kalinga (left), demo farm in Bontoc, with the farmer cooperater, Ms. Fe Fanged (right)

Conduct of citrus field day. The citrus field day was conducted in collaboration with the local government of Bontoc, Mt. Province in December 9, 2010 (Fig. 10). Eighty five (85) participated in the activity. Since the primary aim of the activity is to promote the various technologies on citrus production particularly the use of the registered varieties of citrus, the participants were given the opportunity to actually see, taste and evaluate the different NSIC registered and other promising citrus varieties. A workshop followed where the growers identified the priority needs of the local citrus industry. Among the priorities identified are: the need for a strong policy support, hence a resolution to this effect was submitted by the citrus growers association to the municipal council through the committee on agriculture for consideration; promotion of organic citrus production; and provision of iodine test kits for the expansion of the monitoring and eradication of Huanglongbing.

#### Capability building

Six (6) training activities were conducted with a total of 259 participants (Table 3). Two (2) trainings were conducted in Bontoc, Mt. Province, three (3) in Balbalan, Kalinga, and one (1) in Baguio City. Interestingly, a greater majority of the growers indicated that they have not participated in any training on citrus for the past five years. These could be due to the fact that citrus have been relegated as a priority crop for the past several years. In Balbalan, Kalinga, particularly, the training focused on nursery establishment & management, asexual propagation; orchard establishment and management. Those trained were citrus growers, nursery workers and local government technicians. One (1) training/hands-on demonstration was conducted primarily for the nursery workers in the municipal nursery and LGU technicians on the rapid propagation technique (side grafting) and nursery management. The two consecutive trainings in barangays Talalang and Pantikyan were conducted prior to the distribution of plant materials to the intended farmers by the local government of Balbalan



Fig. 10. A promotional banner for the citrus field day (top); different NSIC registered citrus varieties were displayed and taste test was done by the participants (below).

In Bontoc, Mt. Province, the training focused on management of pests and diseases particularly Huanglongbing which is threatening the expansion of citrus production in Mt. Province (Fig. 11). As a result of the first training conducted in October 2008, the provincial government of Mt. Province formed a task force to conduct monitoring and detection of HLB using the technology on Iodine-starch test which was demonstrated during the training-seminar. The project supported the activity by providing an Iodine test kit to the office of the provincial agriculturist heading the task force and to the citrus growers association.

Moreover, to further enhance the knowledge and skills of the growers, and as a culminating activity for the project, to bring the growers together, an International Training-Workshop on “Health Management and Horticultural Practices on Citrus Orchard” was conceptualized and conducted in Baguio City on November 22-23, 2011 in collaboration with the National Taiwan University (NTU), through the Fertilizer and Food Technology Center (FFTC), where two Taiwanese citrus experts, Prof. Hong- Ji Su and Prof. Ming-Hsuing Lu were invited as the main resource speakers (Fig. 12). A total of 45 participants were invited mainly from the two project sites: Balbalan, Kalinga and Bontoc, Mt. Province. Topics discussed ranged from production of healthy plant materials, rapid propagation, pest management, fertilizer management and tree management (pruning). Besides lectures/discussions, the participants visited a commercial pummelo orchard in Pozorrubio Pangasinan, using quality plant materials from BPI-Baguio nursery and installed with modern irrigation facilities. The resource speakers demonstrated tree management (pruning), after which the participants had the opportunity of pruning several trees.

Based on the post-evaluation assessment, majority of the participants indicated that their level of knowledge and skills increased from ‘low’ to ‘high’ on the use and production of healthy plant materials, while from ‘low’ to ‘medium’ on the tree management technologies such as fertilizer application, pruning and pest management, as some said they still have to see the results in their orchards.

Moreover, it is noteworthy to mention, based on the latest citrus production data of BAS (updated April 2012), that although there is a decrease in the number of bearing citrus trees in Cordillera Administrative Region (CAR) from 117,023 in 2009 to 116,728 in 2011, as well as the production volume from 3,314.66 metric tons in 2009 to 3,122.84 in 2011, in both project sites however, that is in Mountain Province and Kalinga, there was an increase in production volume of citrus from 397.49 and 63.23 metric tons in 2010 to 427.06 and 65.42 in 2011, respectively. On the other hand, production volume in all other provinces in CAR decreased. This could be partly attributed to the capability building activities and other initiatives implemented by the project in these provinces, since one of the reasons cited by BAS for low productivity, besides typhoon damage, was the attack of pests and disease, which resulted in low productivity and loss of trees.

Table 3. Capability building and promotional activities undertaken in the project areas.

Title of the Activity	Inclusive Date/s	Location	Nature of Participants	No. of Participants	Collaborating Agencies
1. Seminar-workshop on the management of citrus pests and diseases	Oct. 23, 2008	Bontoc, Mt. Prov	citrus growers, LGU technicians	30	OPAG-Mt. Province; OMAG-Bontoc
2. Seminar-Demonstration on side shoot grafting	March 2009	LGU nursery	LGU technicians; nursery workers	13	LGU-Balbalan
3. Citrus orchard establishment and management	Dec 6-7, 2010	Talalang Balbalan, Kalinga	citrus growers, LGU technicians	46	LGU-Balbalan
4. Citrus orchard establishment and management	Dec. 8-9, 2010	Pantikyan, Balbalan, Kalinga	citrus growers, LGU technicians	40	LGU-Balbalan
5. Citrus Field Day cum seminar-workshop	Dec. 9, 2010	Bontoc, Mt. Province	growers, LGU technicians, (housewives, local officials)	85	OMAG-Bontoc, Bontoc LGU - FITS
6. International Training-Workshop on “Health Mgt and Horticultural Practices on Citrus Orchards”	Nov. 21-24, 2011	Baguio City	growers, technicians, others	45	FFTC, NTU
TOTAL				259	



Fig. 11. Citrus training conducted in Bontoc, Mt. Prov.



Fig. 12. Promotional banner (top left); some of the participants with resource speakers and the Vice Governor of Kalinga (top right); Prof. Hong Ji-Su, demonstrating side shoot grafting (down left); Prof. Ming-Hsuing Lu, demonstrating pruning of trees.

## 6. IEC development, production and distribution

The various information materials developed were: the citrus technoguide; leaflets on side grafting technique, HLB detection and management, and use of iodine test kit for HLB detection (Fig. 13). During the citrus field day in Bontoc, the 85 participants were provided with a copy of the citrus technoguide, in lieu of the usual certificate of attendance (Fig. 14). Fifty copies each of the citrus technoguide and other IEC materials were also given to the local government of Balbalan, Kalinga and in Bontoc, Mt. Province, through their Municipal Agriculturists (Fig. 15). These were intended to be distributed to other citrus growers within their municipalities. Others were given to walk-in clients. A total of 330 information materials were distributed.





Fig. 14. Distribution of IEC materials (Citrus technoguide) to participants during the citrus field day.



Fig. 15. Ms. Lilia Sagallon, Municipal Agriculturist of Balbalan, Kalinga (top) and Mr. Renato Falag-ey, Mun. Agric of Bontoc, Mt. Prov. and FITS Manager (below), receiving 50 copies each of the citrus technoguide.



## Investment/Profitability Analyses

A five-year investment analysis was done for the three nurseries namely: BPI-Baguio nursery, LGU-Balbalan municipal nursery, and a private nursery in Bontoc owned by Mr. Tomas Sadcopen. The three nurseries are described in Table 4 and these were compared and analyzed based on the following parameters: returns based on projected annual sales, fixed capital investment, material inputs, labor inputs, repairs and maintenance cost and overhead costs (Table 5). The data used in the computation were provided by the nursery operators.

Results of the analyses showed that the technology is economically viable or profitable based on the various profitability indicators such as the internal rate of return (IRR), benefit-cost ratio (BCR), net income and return of investment (ROI) (Table 6). Among the three nurseries, the private nursery had the highest values on IRR (263%), BCR (1.85) and ROI (75%). This is followed by the LGU-managed nursery with IRR of 229%, BCR of 1.65 and ROI of 70%. On the other hand, the BPI nursery had the highest net income of P244, 407.00, while IRR, BCR and ROI values are 93%, 1.50, and 52%, respectively.

The major factors in the differences were the cost of fixed capital investment, of which BPI nursery has the highest of P472, 000.00 compared to the private nursery with P209, 300.00 and the LGU-managed nursery with P219, 300.00; and the price per seedling, of which BPI and LGU nursery is P50.00/seedling while the private nursery is P75.00/seedling. The former is due to the price ceiling by the government (DA Administrative Order No. 22, S. 2012). The cash flow analyses of each nursery are presented in Appendix A.

Table 4. Description of the three nurseries.

<b>Nursery/location</b>	<b>Area/Production Capacity</b>
1. BPI-Baguio nursery	<ul style="list-style-type: none"><li>• 140 m<sup>2</sup> plastic/screen house, concrete flooring, raised beds</li><li>• 7,000 seedlings</li><li>• Price per seedling = P50.00</li></ul>
2. LGU- Balbalan municipal nursery, Balbalan, Kalinga	<ul style="list-style-type: none"><li>• 100 m<sup>2</sup> plastic house, raised beds</li><li>• 6,000 seedlings</li><li>• Price per seedling = P50.00</li></ul>
3. Private nursery – Mr. Tomas Sadcopen, Bontoc, Mt. Province	<ul style="list-style-type: none"><li>• 60 m<sup>2</sup> plastic house, concrete flooring</li><li>• 3000 seedlings</li><li>• Price per seedling = P75.00</li></ul>

Table 5. Summary of returns and costs of the three nurseries.

Nursery	RETURNS	COSTS (yearly), PhP				
	Annual Sales PhP, (less mortality)	Fixed Capital investment	Material Input requirement	Labor Requirement	Maintenance /Repairs	Overhead Costs
BPI-Baguio	P332,500	P472,100	P51,350	P33,600	P35,000	P10,500
LGU-Balbalan	P237,500	P219,300	P34,350	P31,600	P30,000	P18,500
Private nursery	P209,250	P209,300	P23,550	P24,125	P30,000	P8,500

Table 6. Summary values of the profitability indicators of the three nurseries, based on cash flow analysis.

Indicators	BPI-Baguio nursery	LGU- Balbalan nursery	Private nursery
Net Present Value (NPV, r=20%)	P356,813.00	P291,459.00	P307,60.00
Internal Rate of Return (IRR)	93%	229%	263%
Sum of discounted gross benefits	P1,065,497.00	P742,461.00	P667,380.00
Sum of discounted gross costs	P708,685.00	P451,002.00	P359,775.00
Benefit Cost Ratio (BCR)	1.50	1.65	1.85
Average Sales	P367,893.00	P253,520.00	P229,950.00
Average O&M	P106,450.00	P90,450.00	P62,175.00
Depreciation	P17,037.00	P10,010.00	P11,310.00
Total Cost	P123,487.00	P100,460.00	P73,485.00
Net Income	P244,407.00	P153,060.00	P156,465.00
Return of Investment (ROI, %)	52%	70%	75%

#### Policy/Advocacy

Appropriate policy support from the local government is crucial in developing, promoting and sustaining the citrus industry. In view of this, several efforts were done to bring together the various stakeholders to initiate the formulation of a local policy towards citrus development, particularly in regards to production of healthy plant materials or nursery establishment and orchard development. First, in Bontoc, Mt. Province, a meeting was initiated with the office of the provincial agriculture of Mt. Province, together with the officers of the Bontoc citrus cooperative in March 17, 2009 (Fig. 16). The provincial and municipal chairpersons of the committee on agriculture were also invited; however, they were not able to attend due to other concerns. As a result of the meeting, a resolution was drafted and submitted both to the municipal and provincial chairpersons on agriculture. The matter was followed up during a meeting with the municipal mayor, for which he reiterated his support. Moreover, during the citrus field day, one of the invited officials again assured the citrus growers that the municipal government will support such initiatives. The matter is still being deliberated upon by concerned officials.

In Kalinga, however, the local government has been fully supportive to the citrus development such that they allotted additional funds for the expansion of the nursery and issued a memorandum to all households to plant at least 10 trees each in their backyard.



Fig. 16. Meeting with staff from the office of the Provincial Agriculturist in Mt. Prov. and citrus growers association to draft a resolution re: citrus development in Mt. Province

## CONCLUSION

1. The project results clearly indicated that adequate and timely production of healthy plant materials of citrus is possible through the healthy plant material production scheme, the use of improved technologies such as the use of rapid propagation technique (side grafting) for asexual propagation and improved nursery management practices. The system also includes the strengthening, expanding and sustaining the source of basic materials (Foundation/Budwood Increase blocks, and seed gardens). Moreover, the project underscored the crucial role of the local government and private nurseries, in the commercial production of healthy plant materials. The concrete impact of these efforts will be evident on the increase in area planted/harvested and production volume, which are expected to be reflected on succeeding data to be generated by BAS.
2. The establishment of demonstration farms and the conduct of field days contributed in increasing the awareness and promoting the various technologies on citrus production due to the increase in the number of clients availing of healthy plant materials, since the growers were made aware of the importance on the use healthy plant materials and as well as the availability of the various registered varieties.
3. The capability building activities are efficient and effective means of enhancing the knowledge and skills of the growers on improved technologies, considering that a greater majority of the growers stated that they did not attend any training on citrus for the past 5 years. It is expected then that the growers who were trained would be able to maintain their trees and keep them healthy as long as possible in the field, as well as they will be able to rehabilitate (manage) the existing trees to improve their productivity.
4. IECs also contributed significantly in further enhancing and reinforcing the learning of the growers during the training-seminars, as these served as a ready reference for the growers.
5. The investment analyses clearly showed that commercial citrus nursery, following the healthy plant material production scheme is a profitable business enterprise as indicated by the various economic indicators under the three nursery management systems, that is, whether government or privately- managed.
6. Policies/advocacies at the local level are recognized by the various citrus stakeholders as crucial for the further development of the citrus industry. Although, the resolution submitted to the local government of Bontoc has yet to gain ground to becoming a municipal ordinance, the participation and support of the local government has been manifested.

## **RECOMMENDATIONS**

1. Due to the incessant demand for citrus plant materials, local governments and private nurseries should sustain the mass production of quality plant materials following the healthy plant material scheme and utilizing the improved technologies on propagation and nursery management. On the other hand, BPI, as a national government agency should further strengthen and maintain the production of the basic plant materials, provide continuous technical assistance and implement regulatory services.
2. The established demonstrations farms should be maintained and supported by the local government in the municipalities where it was established, for it to continue to serve as showcase in the use of healthy plant materials and improved technologies.
3. Extension, education and training support should be continued and strengthened. New growers should also be made capable of maintaining their healthy trees.
4. The reproduction information materials should continue and developing other materials that would benefit the growers, as well as possibly translating these into local dialects. However, in the Cordillera region in particular, English is mostly preferred.
5. Since the investment analyses showed that citrus nursery is a profitable enterprise, the establishment of more private and LGU nurseries in other municipalities should be encouraged, to serve the growers within the municipality, reduce costs in transporting the seedlings, increase utilization, and thus increase the citrus production areas.
6. Policy formulation at the local level should be pursued. The initial efforts made on the proposed formulation of a municipal ordinance on citrus development should be followed up and supported. On the other hand, the national government should expedite the passage of the revised nursery accreditation (with special provision for citrus nurseries) and the revised quarantine regulation on the movement of citrus plant materials, which are important regulations in support to citrus development.

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## APPENDIX A

### Cash flow analysis (5 years)

1. BPI-BNCRDC nursery					
Year	1	2	3	4	5
<b>Gross Benefits</b>					
Sales	332,500	332,500	332,500	332,500	332,500
Residual Value					176,967
<b>Total</b>	<b>332,500</b>	<b>332,500</b>	<b>332,500</b>	<b>332,500</b>	<b>509,467</b>
<b>Gross Costs</b>					
Fixed Capital Cost	469,100	0	0	0	0
O & M Cost	100,450	100,450	130,450	100,450	100,450
<b>Total</b>	<b>569,550</b>	<b>100,450</b>	<b>130,450</b>	<b>100,450</b>	<b>100,450</b>
<b>Net Benefits</b>	<b>(237,050)</b>	<b>232,050</b>	<b>202,050</b>	<b>232,050</b>	<b>409,017</b>
2. LGU Balbalan nursery, Balbalan, Kalinga					
Year	1	2	3	4	5
<b>Gross Benefits</b>					
Sales	237,500	237,500	237,500	237,500	237,500
Residual Value					80,100.00
<b>Total</b>	<b>237,500</b>	<b>237,500</b>	<b>237,500</b>	<b>237,500</b>	<b>317,600</b>
<b>Gross Costs</b>					
Fixed Capital Cost	217,300	0	0	0	0
O & M Cost	84,450	84,450	114,450	84,450	84,450
<b>Total</b>	<b>301,750</b>	<b>84,450</b>	<b>114,450</b>	<b>84,450</b>	<b>84,450</b>
<b>Net Benefits</b>	<b>(64,250)</b>	<b>153,050</b>	<b>123,050</b>	<b>153,050</b>	<b>233,150</b>
3. Private nursery – Bontoc, Mt. Province					
Year	1	2	3	4	5
<b>Gross Benefits</b>					
Sales	209,250	209,250	209,250	209,250	209,250
Residual Value					103,500
<b>Total</b>	<b>209,250</b>	<b>209,250</b>	<b>209,250</b>	<b>209,250</b>	<b>312,750</b>
<b>Gross Costs</b>					
Fixed Capital Cost	209,300	0	0	0	0
O & M Cost	56,175	56,175	86,175	56,175	56,175
<b>Total</b>	<b>265,475</b>	<b>56,175</b>	<b>86,175</b>	<b>56,175</b>	<b>56,175</b>
<b>Net Benefits</b>	<b>(56,225)</b>	<b>153,075</b>	<b>123,075</b>	<b>153,075</b>	<b>256,575</b>

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