

# Lychee

## INTRODUCTION

The lychee, which is locally known as 'litsiyas', is considered a high value fruit crop in the Philippines. It is highly esteemed as a fresh fruit and has good consumer acceptance. However, it is costly and is considered a luxury fruit. This is due to the limited supply of the fruits since the crop is presently grown on a limited scale. No local statistics on production at the national level are available.

Prominent relatives of lychee that are grown in the country are rambutan (*Nephelium lappaceum*) and longan (*Dimocarpus longan*). A relatively unknown indigenous species belonging to the same genus and found growing wild in the Philippines from sea level to 500 m altitude is 'alupag' (*Litchi chinensis* subsp. *philippinensis*). Initial grafting trials indicated its good rootstock potential and compatibility with lychee.

There is no accurate date of introduction of lychee into the Philippines. The earliest recorded statement of its introduction was made by Wester (1916). He stated that lychee was first introduced from China into the Philippines several years earlier at low altitudes but has never fruited. The first recorded event of flowering was in 1931. It was of a 25-year-old tree planted in Rizal. Later, five other trees located in various places were reported to bear fruits. A marcotted tree planted in 1940 in the Mountain Province started fruiting six years later. The original tree from which this marcotted tree was acquired was of seedling origin from Amoy, China and started fruiting 12 years after planting. In 1951, a 4-year-old marcotted tree from Thailand was planted in Bataan, and bore fruits for the first time in 1953. In 1961, a 30-year-old fruiting tree of seedling origin was found in Benguet while a 23-year-old fruiting tree was discovered in Laguna. All these discoveries gave rise to possibilities of growing lychee in the Philippines.

## PRESENT SITUATION OF LYCHEE CULTIVATION IN THE COUNTRY

### Area and Production

Lychee is one of the fruit crops that is very selective in its climatic requirements. In the Philippines, it is therefore grown in areas with a continuous cool (approximately 15 to 19°C) and dry period for almost a month and a warm and humid period after the trees have flowered. The cool period is needed for flower initiation while the warm and humid period is important for a successful fruit set and development. Lychee is therefore found growing predominantly in the highlands of the Cordillera Autonomous Region (CAR) in the northern part of the country, specifically in the provinces of Benguet and Mountain Province (municipality of Bauko), and in Ilocos Sur (municipality of Cervantes). Lychee is observed to thrive at elevations ranging from 1,000 to 1,380 meters above sea level. However, some trees could also be found growing in the lowlands particularly in the provinces of Batangas and Laguna, which are also in the northern part of the country, and Cagayan de Oro in the south, which also experience cool temperatures during the months of December and January.

Being a very minor fruit crop and owing to its limited area of cultivation, no secondary national production data is available. Partial data from the Department of Agriculture's 1995-1996 survey of the fruit growers in selected areas of CAR and Ilocos revealed small sizes of fruit farms. Lychee growers who were interviewed had at least 1,400 m<sup>2</sup> to 1 ha of land, which was also planted to a variety of other fruit trees. Interviewed growers in the Mountain Province had a total of 125 lychee trees while those in Benguet and Ilocos Sur had 36 and 31 trees, respectively.

The volume of lychee production from five fruit farms in the Cordillera highlands was estimated at 1.1 tons/annum. Of this, 0.42 ton (38 percent) was utilized for home use, 0.66 ton (60 percent) for the market and 0.20 ton (2 percent) for other uses. Each grower produced an average of 0.22 ton/annum.

The fruit tree growers of the Cordillera Provinces where most of the lychee trees are grown, may be classified into four groups. The first group is composed of established growers of traditional high value crops like pears and lychee (around 50 trees). This group consists of few growers who are mostly the old settlers in a community. They learned much from their old experiences and have generated their own planting materials. The second group also consists of established growers but their experience is less than 10 years and their crops are mostly citrus (more than 100 trees) with few quantities (10 to 20 trees) of lychee, longan and pear. They are continuously expanding production and are often experimenting on new production techniques. The third group consists of small household growers with less than 100 trees (with about 1 to 5 trees of lychee, longan and pear). This constitutes the majority of fruit tree growers in the Cordillera. The fourth group is composed of a few growers with less than 150 trees, which are predominantly citrus and they are rather pessimistic about their fruit venture due to crop failures.

### **Varieties**

There are two cultivars, which are predominantly grown in the highlands. These are 'Mauritius' and 'Sinco'. 'Mauritius' is an introduction from South Africa while 'Sinco' is a local seedling selection from China. 'Mauritius' has round to broadly ovate fruits with bright red skin and larger than those of 'Sinco'. Fruits of the latter are round to ovate and dull red.

In the lowlands, an outstanding cultivar from a seedling tree, which was introduced from Thailand in 1968, had been approved by the National Seed Industry Council for commercial planting. It was named 'UPLB Red'. Marcotted and grafted plants from this variety bear fruits in 3 to 4 years from field planting. The trees flower from December to January and the fruits are harvested from April to May. Fruits of 'UPLB Red' weigh 14 g, are ovate to almost round with a rough skin that turns dark red when fully ripe. The aril is 6 mm thick, is 61 percent of the whole fruit by weight and has a total soluble solids (TSS) of 20° Brix .

Recently, the Department of Agriculture (DA) in Lipa, Batangas identified two promising selections for planting in the lowland areas. One of these was named 'Olan' after it's owner. It is a selection from a seed, which was brought from Thailand. The fruit is ovate and weighs 26 g. The aril is 6 mm thick with a TSS of 17.5° Brix and is

62 percent of the whole fruit by weight. The owner claims that this variety is a regular bearer. The other is an unnamed selection of the DA. The fruits are ovate, weigh 18 g and turn rose red when fully ripe. The aril is 6 mm thick, with a TSS of 17° Brix and is 72 percent of the whole fruit by weight.

## **PRODUCTION OF PLANTING MATERIAL**

Lychee is propagated by seeds or by vegetative means. Seedling trees however take a much longer time to bear fruits and they do not reproduce true-to-type. Outstanding varieties are therefore propagated asexually and seedlings are used only as rootstocks in asexual propagation.

The common means of asexual propagation of lychee in the Philippines is by marcotting (air-layering) and grafting. Marcotting is preferred by lychee growers in the highlands since it is simple and gives very satisfactory results. One objection to marcotting is the absence of a strong taproot. The resulting marcotted plants only produce adventitious roots, which do not have a strong anchoring ability and are therefore easily toppled over in times of strong typhoons. Grafting, on the other hand, is popular among propagators in the lowlands since it is less wasteful of propagating materials than marcotting. In addition, grafted plants possess a strong taproot and can therefore anchor the plants better than marcotted plants.

There are a few Government and private nurseries producing asexually propagated lychee planting materials. In the highlands, four nurseries (three private and one Government nursery under the Bureau of Plant Industry of the Department of Agriculture) were identified as sources of planting materials. These nurseries are all producing marcotted plants at a selling price of US\$ 2 to US\$ 3 per piece. In the lowlands, four nurseries (three private and one Government nursery under the Department of Horticulture of the University of the Philippines Los Baños) have also engaged in the multiplication of lychee planting materials. These nurseries produce both marcotted and grafted plants and sell these at US\$ 2 to US\$ 30 per piece depending upon the size of the planting material. The number of nurseries producing planting materials of lychee is few due to the limited demand since lychee could be successfully grown only in limited areas of the country.

## **ESTABLISHMENT OF ORCHARDS**

Lychee is grown predominantly in mixed plantings. It is intercropped with other fruit crops such as banana, Chico, mango and starapple. Elaborate land preparation is not practiced especially when only a few trees are planted. The usual practice in backyard planting is to dig a hole large enough to accommodate the root system of the planting material. The plant is then set in the hole, covered with soil and watered.

For small orchards, the land is first cleared. After clearing, stakes are laid out at a planting distance of 7m x 7m accommodating 204 plants per hectare or 8m x 8 m accommodating 156 plants per hectare. Holes are then dug manually at a size of 50 cm x 50 cm x 50 cm at the places occupied by the stakes. Before planting, the holes are filled with compost materials or dried manure mixed with topsoil. The plants are set in the previously prepared holes with their stems straight and properly aligned

with the other plants in all directions. The soil is packed firmly to remove large air spaces.

The general practice is to plant at the onset of the rainy season, so that the plants can make use of the moisture in the soil for fast establishment in the field. Ridging is recommended in low-lying areas in order to prevent waterlogging. In addition since the tree is not tolerant to wind due to its brittle branches, adequate windbreaks are needed.

Planting of nitrogen-fixing crops like legumes and other vegetables in-between lychee trees is recommended during the early years after planting. This is to maximize the use of the land and for the farmers to derive an income while waiting for the lychee trees to bear fruits.

## **CARE AND MANAGEMENT OF ORCHARDS**

### **Training and Pruning of Plants**

Training and pruning of trees are unknown and not practiced by the farmers resulting in trees with a multitude of branches. It is, however, recommended that the shape of the tree be established during the first two years of planting. Regular pruning should be practiced to control the attack of insect pests and diseases. In addition, heavy pruning should be avoided as it induces profuse vegetative growth instead of floral growth.

### **Application of Manure and Fertilizers**

Application of manure and inorganic fertilizers depend on the level of resources of the farmers. Compost and farm manure are usually used as basic sources of nutrients. In some cases, chemical fertilizers are also added. The fertilizers help the trees recover from nutrient depletion, which occurs during heavy fruit loads, and also improve the quality of the fruit produced.

### **Weeding and Mulching**

Farmers do not generally practice weeding and mulching although some fruit growers limit their weeding activity to the removal of weeds by hand around the canopy area. This is done to avoid nutrient competition and to prevent pests from breeding.

### **Supplementary Irrigation**

The practice of irrigating lychee trees is uncommon. If carried out, irrigation is done on a minimal basis. Irrigation of the trees is first done immediately after planting to allow the roots get in contact with the soil. During their growing period the plants are mostly grown under rainfed conditions. At certain times of the year, especially when the dry season is extended, supplementary irrigation is practiced. This is usually done manually.

## **Control of Pests and Diseases**

No serious insect pests or diseases have been known to infest lychee in the country. However, some of the pests, which have been reported to attack lychee, are leaf miners, beetles, Erinose mites and stem and fruit borers. The larvae of the leaf miners tunnel and feed on young flushes producing blisters, blotches or tunnels in the leaf. Spraying with systemic insecticide before and during flushing controls this pest. The larvae of the beetles, on the other hand, feed on stems causing punctures and partial girdling of the stem causing them to wilt or break. Spraying of systemic insecticides, pruning and burning of infested branches effectively controls this pest. Erinose mites cause gall-like symptoms or velvety swellings on the underside of the leaves causing abnormal development of the leaves and premature leaf fall. Control measure consists of spraying with dimethoate every 10 to 14 days before flushing. The larvae of the stem borers, on the other hand, bore tunnels under the bark of the stem which later dry up and die. In addition, the larvae of the fruit borers bore into the fruit and into the seed resulting in rotting of the fruit caused by fungal infestation through the wounds on the fruit. Fruit and stem borers are controlled by spraying with systemic insecticides.

Of particular importance is 'bat attacks' during fruit ripening months. Bats have been recorded to decrease production per tree by as much as 50 percent. Some lychee growers cover their trees with protective nets but this is a tedious and costly practice. Other growers group adjacent fruit clusters together and cover these with plastic bags.

Most lychee growers claim that they have not encountered any serious disease in lychee. Just recently, root rot, which was suspected to be caused by *Clitocybe* sp., has killed a number of trees in the highlands. The growers were advised not to plant on poorly drained soils as this may cause sudden death of the trees even during the juvenile stage.

## **HARVESTING OF FRUITS AND YIELDS**

In the Cordillera, flowering to fruit maturity of lychee takes eight months, from September to April while the harvesting season takes four months, from May to August. In Ilocos Sur, flowering to fruit maturity is from February to April while harvesting is in May. Growers observed that in Ilocos Sur, it takes only three months from flowering to maturity, which was relatively shorter than that in the Cordillera provinces.

Lychees are normally ready for harvesting if the tubercles have become flat and smooth and the colour changes from light green to bright red. Growers in Ilocos Sur and the Cordillera however, considered only the colour as their maturity index. Harvesting was done as soon as the fruits exhibit reddish colouration.

Lychee fruits are usually harvested by cutting or breaking the entire cluster of fruits with a picking pole. Picking the fruits individually is time and effort consuming, thus it is not recommended. Besides, it may cause ruptures on the skin at the stem end, which could serve as an entrance for decay-causing micro-organisms. Fruits are usually kept away from the sun after harvest to avoid browning of the skin. The fruits are then packed or sold immediately after harvesting.

Based on the 1995-1996 figures, production averages per tree ranged from 10-50 kg/tree. This is rather low in comparison to the level of productivity in other lychee producing countries. It has been reported that yields ranging from 125-130 kg/tree were obtained in India and Australia. The primary reason for the variable quality and low yields obtained locally is the low level of cultural management employed.

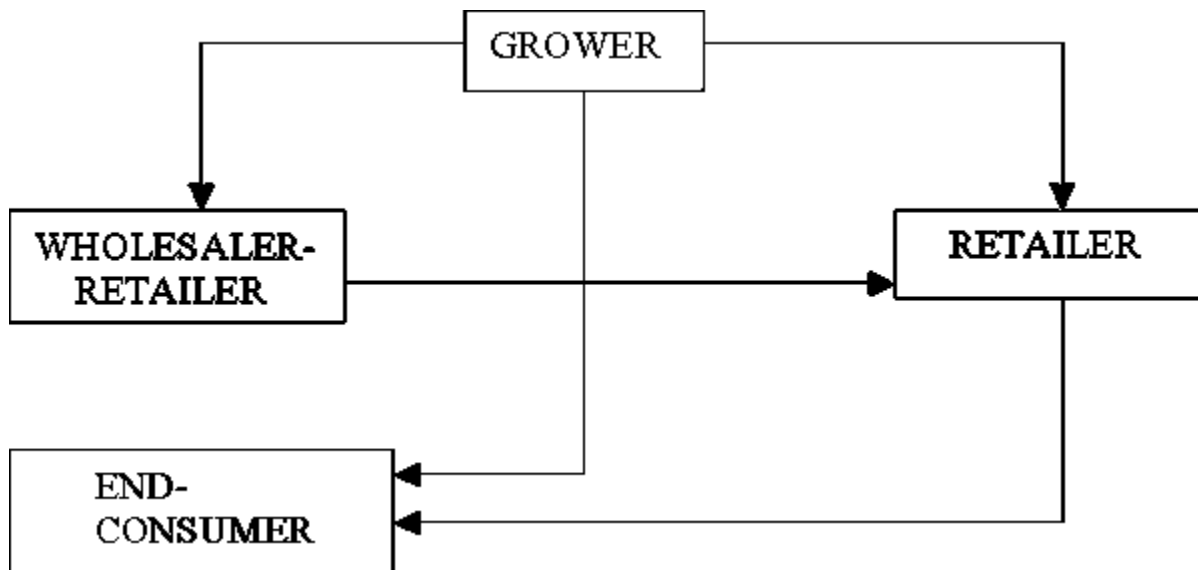
## 7. MARKETING

Traders use plastic bags for retail selling and trays or cartons for the bigger volumes, which are provided by importer-wholesalers. Lychee fruits are sold on a per kilogram basis. Farm gate price ranges from P80/kg to P120/kg.

The channels of distribution of lychees in the country consist of two types of market outlets namely, wholesaler-retailer and retailer. Wholesaler-retailers cater to the needs of retailers, institutional buyers and end-consumers. They sell either in bulk or small quantities within the locality through the fruit stalls which they occupy. Retailers, on the other hand, operate either as ambulant vendors or fruit stand owners and sell small quantities of fruits to the consumers. Wholesaler-retailers and retailers obtain fruits directly from the growers.

The trade flow of lychee is illustrated in figure 1 below.

**Figure 1. Marketing channels of lychee.**



The small harvest volume limits the marketing flow of the fruits within the area or vicinity of the municipality or province. The small quantity of fruits harvested is directly sold by the growers themselves who regularly transport vegetables to the market and sell excess production of lychees to increase their income. The low yield of lychees in some areas resulted to the direct marketing of the fruits by the growers to neighbours and friends within the municipality.

Farmers with a sizeable production either deliver the fruits to the market or have them picked up from the farm or house by the trader. The 'suki' system is the most common relationship between the farmer and trader. This is characterized by the trader becoming the regular customer of the farmer as a result of the good relationship between these two players in the trading system due to the good prices offered by the trader who often buys the majority of the farmer's produce.

Table 1 shows the quantity and value of lychees imported from 1991 to 1995. The average annual growth rate of lychee imports is 8.18 percent. The country is generally a net importer of lychee due to its limited production owing to the crop's subtropical characteristics. In 1995, the Philippines imported 1,374 metric tons of lychee valued at US\$ 0.52 million. This is 5.48 percent lower than the previous year recorded at 1,454 metric tons. In terms of value, the price of lychee has dropped by approximately 24 percent from US\$ 383.76 per metric ton in 1995 to US\$ 290.70 per metric ton in 1996.

**Table 1. Quantity (metric ton) and value (FOB US\$) of Philippine lychee imports from 1991 to 1995.**

	1991	1992	1993	1994	1995
Quantity	1,481.225	681.030	1,009.411	1,453.835	1,374.099
Value	485,755	212,536	385,392	554,345	527,328

**Source: National Statistics Office, Bureau of Agricultural Statistics**

## **8. POTENTIAL FOR LYCHEE PRODUCTION DEVELOPMENT**

Highland areas of the Philippines have potential for the commercial production of lychee. In fact, previous attempts to grow this crop in the country have shown that it performs well in certain areas. For example, 'Sinco' and 'Mauritius' lychee were found to be highly promising in the Cordillera highlands. In addition, there were reports and observations on fruiting trees of lychee in some lowland areas of the Philippines. However, despite these potentials, only limited attention has been given to this crop.

Lychee is considered a traditional high value crop and it possesses good consumer acceptance. Because of this, substantial local demand for lychee exists. This offers good market opportunities, which should encourage commercial production of this crop in the country. The increasing trend in the demand for sub-tropical fruits translate to large market potential available locally that is being taken advantage of by imported products. If the trend continues, liberalization could continue to allow imported fruits to penetrate the domestic market. As of the moment, the low importation for lychee opens possibilities to introduce this fruit in key cities in the Philippines once volume is available. This would only be possible through expansion of production not only in the highlands but in the lowlands as well. Suitable cultivars for tropical conditions should therefore be identified and proper growing techniques should be practiced so as to produce a large volume of high quality fruits.

With available highland areas suitable to sub-tropical fruit production and the introduction and planting of cultivars suited to lowland growing conditions, the Philippines can save on the precious foreign exchange and maintain balance of trade through reduction in volume of lychee imports. The development of the lychee industry will also contribute to improvement of employment and income of highland farmers and rural women and will encourage better land use and protection of the fragile highland areas of the country.

Some of the immediate concerns at present include the continuous monitoring of existing lychee trees, conducting trials of the existing materials at various locations and introduction of known superior varieties for inclusion in the trial. Trial plantings of lychee trees may be conducted in the farmer's fields where verification experiments on technologies like cincturing, irrigation and fertilization could be done.

Studies conducted by the RP-German Fruit Tree Project from 1987-1989 suggested two factors that would determine the potential of lychee to penetrate the market. These are the capability of the producers to bring whatever produce they could to the market at the best possible price and the ability of the local cultivars to be introduced and accepted into the fruit market that is dominated by imported lychee cultivars. The main concern and challenge therefore, is whether or not the locally produced lychee can compete with the imported ones in terms of sustained supply, fruit quality and prices. An integrated research and development programme on lychee to adequately address these concerns is therefore in order.

## **9. CONSTRAINTS IN LYCHEE PRODUCTION DEVELOPMENT**

### **Lack of suitable varieties**

Varietal improvement of lychee has been very limited. Varieties of lychee were introduced into the country but their field performance has not been thoroughly evaluated in potential growing areas. For example, between 1986 and 1996, varieties of lychee were introduced by the RP-German Fruit Tree Project of the Bureau of Plant Industry and preliminary evaluation indicated that some of the collection has potential for commercial planting in the Cordillera highlands. These varieties had not been tested in other highland areas of the Philippines. In addition, there were reports that certain varieties of lychee have been fruiting in the lowland areas of Laguna and Batangas. With such available genetic materials, it is important that they be tested under various elevations of the country to identify which cultivar performs best in a particular area. In addition, varieties that are adapted to the constantly high temperature of the humid tropical lowlands should be introduced for trial planting in the country.

### **High cost of production inputs including planting materials**

Expansion of lychee cultivation to other highland and lowland areas can be achieved with the intensification of asexual propagation of selected cultivars. Some promising cultivars have already been identified and are being propagated in a few nurseries. However, these are very expensive and ordinary farmers could not afford to buy these materials in great quantities. Inexpensive high quality planting materials should



therefore be produced by both Government and private nurseries to facilitate dissemination of outstanding lychee cultivars.

### **Limited production technology**

As of the moment, there is no locally developed technology available on plant nutrition and irrigation, flower induction, pests and diseases and post-harvest handling. The technology available is patterned from other countries. The present state of fertilization programmes for lychee is wanting for specific information on the amount of fertilizer to use and method of fertilization. Fertilizers are not applied according to the requirements of the trees. Most of the available recommendations are on an interim basis usually projected and derived from farmer's actual experience, which varies according to locations and existing conditions. No extensive or integrated research has so far been conducted to answer many of the important questions on fertilization of lychee under local conditions.

It is perceived that the adoption of improved production technology developed by the research system for lychee can bring about visible and significant changes to the fruit industry of the Philippines.

### **Weak technology promotion and adoption**

Technology transfer is weak, thus the need for technical capability enhancement. To have sustainability in technology promotion and adoption, institutional linkages need to be strengthened, thus, the need for the involvement of the local government units, state colleges and universities and the Department of Agriculture. Available knowledge and technology is often confined mainly to a few research institutions. Fine-tuning of these technologies is needed before they can be recommended to commercial growers.

### **Limited government support**

Despite the potential of lychee production in the Philippines, the Government has not accorded this crop a priority status for research and development. Currently, in the Cordillera the attention remains on rice and vegetable crops. In fact, the priority fruits identified by the Department of Agriculture in this region are banana and citrus. As of the moment, the Government believes that local lychee production can not compete successfully in the global market.

### **Physical constraint**

The major physical constraint to lychee production development in the country is the absence of adequate irrigation facilities, especially in the remote mountainous areas. The lack of water resources for irrigating newly transplanted crops and for the crops' maintenance is a key concern among the growers.

## 10. GOVERNMENT POLICIES AND PLANS FOR RESEARCH AND DEVELOPMENT OF LYCHEE

There have been a few research and development projects conducted on lychee. Below is a brief historical profile of these projects from 1989 to 2000.

On May 17-19, 1994, the Philippines participated in the Expert Consultation on Tropical Fruit Species, which was held in Malaysia at the Malaysian Agricultural Research and Development Institute (MARDI), Serdang, Malaysia. This consultation came up with three recommendations for lychee research and development in the country. First was the collection and introduction of lychee varieties that can adapt to tropical conditions. The other two recommendations were the evaluation for better performing varieties and the conduct of compatibility studies using *L. chinensis*ssp. *Philippinensis*.

Title of Project	Implementing Agency	Duration
Propagation technique in lychee and longan	RP-German Fruit Tree Programme - Bureau of Plant Industry - National Crops Research and Development Centre	1989-1994
Performance trial of lychee	RP-German Fruit Tree Programme - Bureau of Plant Industry - National Crops Research and Development Centre	1989-1997
Varietal trials of lychee	Department of Agriculture - Cordillera Administrative Region	1990-1991
Developing a lychee based farming system	Department of Agriculture - Cordillera Administrative Region	1991-1994
Micro-propagation of <i>Litchi chinensis</i> Sonn.	RP-German Fruit Tree Programme - Bureau of Plant Industry-National Crops Research and Development Centre	1996-1998
Performance trials of promising varieties of lychee and rambutan	Department of Agriculture - Southern Tagalog Integrated Agricultural Research Centre	1996-1998
Breeding of selected fruit crops: 1. Citrus, cashew, jackfruit, durian, lychee, longan, chico and mango	Institute of Plant Breeding - University of the Philippines Los Baños	1996-2000

In 1999, an Integrated Research and Development Programme (IRDP) for sub-tropical fruits in the highlands was conceptualized. The sub-tropical fruits included apple, longan, loquat, lychee, macadamia, peach and pear. The IRDP covered selected areas in six geo-political regions of the country (CAR, 4, 7 10, 11 and 12) and had three basic components, namely: a) market and technology assessment; b) technology promotion and adoption; and c) technology generation. The University of the Philippines Los Baños, University of the Philippines La Granja, Cavite State University, Mindanao State University, Bureau of Plant Industry, and the Department of Agriculture would implement the programme for 5 years. Overall coordination and monitoring would be provided by the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development. Unfortunately, this programme was not implemented since the Government believed that the development of the sub-tropical fruit industry in the country to compete globally is not possible. Its recommendation was to use the scarce financial resources for research and development programmes to develop and commercialize major fruit crops such as banana, citrus and mango.

On March 23, 2001, the National Network for the Conservation and Sustainable Use of Plant Genetic Resources (PGR) for Food and Agriculture was launched. This network is composed of the Bureau of Plant Industry, the National Plant Genetic Resources Laboratory, the Department of Agriculture and State Universities and Colleges (SUC's).

It was created to establish a national system for collecting, conservation, regeneration, multiplication, characterization, evaluation, documentation and utilization of plant genetic resources of the Philippines. With the establishment of this network, the Bureau of Plant Industry - Baguio National Crops Research and Development Centre, which is a member of the PGR Network, plans to improve their germplasm activities on sub-tropical fruits, which include lychee among others