# Strengthening of the Production of Passion Fruit, Pineapple and Soursop


## Abstract

Farmers in Surinam grow a wide range of tropical fruits, which are consumed fresh or are processed into drinks, pulp or conserved fruit. Most of the fruit production is for local consumption (except bananas), but some export opportunities (all still very small) have emerged lately. Import substitution is another opportunity, which, with the devaluation of the Surinamese dollar, has become more attractive. This project aims at: (a) improving and/or maintaining the genepool of the three selected fruits; and (b) improving the production techniques practiced by farmers, with a specific emphasis on organic alternatives.

# Introduction

In addition to bananas and citrus fruit, farmers in Surinam grow a large number of fruits in relatively small quantities (most crops cover less than 100 ha in total—see table 1). Some of this production is taking place in monoculture orchards, but often also as backyard fruit crops intercropped with other trees or crops.

Most fruit crops other than bananas and citrus in Surinam are grown on a small scale (on average less than 1 hectare per farm) for local purposes (fresh fruit market and processing). There is sometimes also some modest export (in particular mango) – mainly to the Netherlands because of the large Surinamese community living there. Local production of fruit crops in Surinam has often to compete with, until the recent devaluation of the Surinamese dollar, cheaper imports.

**Table 1: Area under production of fruits crops other than bananas and citrus, 2014**

| Other fruits | Area (ha) | Production (ton) |
|---|---|---|
| Avocado | 11.0 | 220.0 |
| Breadfruit | 1.4 | 60.8 |
| Cherries | 24.0 | 692 |
| Carambola | 0.2 | 2.2 |
| Duran | 0.1 | 0.3 |
| Genip | 29.8 | 297.2 |
| Guava | 5.1 | 75.4 |
| Java apple | 0.5 | 28.1 |
| Malay apple | 1.1 | 26.9 |
| Mango | 179.0 | 2,676.0 |
| Papaya | 41.0 | 811.0 |
| Passion fruit | 67.0 | 1,035.0 |
| Pineapple | 62.0 | 1,109.0 |
| Rambutan | 15.4 | 134.9 |
| Sapodilla | 4.5 | 57.2 |
| Soursop | 5.5 | 88.3 |
| Star apple | 0.6 | 7.7 |

Source: LVV Statistics Department.

LVV does not have the capacity or the resources to give all fruit crops permanent research attention. This also would not make sense from an economic point of view – the volume of production is in most instances too small to warrant such an investment. Hence the agricultural innovation strategy (LVV 2013) proposed a rotation strategy – focus on three fruit crops at a time for 3-4 years and then move on to the next three. Only when a fruit crop really takes off in terms of production because of export, a more permanent research program should be considered.

For the upcoming period the following three fruit crops have been selected: passion fruit, pineapple and soursop. Reasons to select these three fruit crops are: (i) all three crops have shown some dynamics lately (substantial growth in area under production in recent years); (ii) possibility for import substitution or export; and (iii) possible expansion of processing possibilities.

# Background

*Passion Fruit*

In 2014, the total area under passion fruit was 67 ha with a total production of about 1035 tons, with a farm gate value of approximately SRD 9.0 million. The area under production has grown quite

rapidly in recent years from 15 ha in 2009 to 67 ha in 2014 (LVV). Average yield per hectare: 15.4 ton, which is slightly better than the Brazilian average of 14.6 ton (EMBRAPA).[1]

The 2008 census reported passion fruit to be cultivated by 159 farms, of which 67 in Sipaliwini. Of the 89 farms in the coastal districts, 59 produced passion fruit in monoculture. The size of these orchards is usually less than 1 ha – the largest passion fruit producers have 1.5-2.0 ha in production. Wanica and Saramacca were in 2008 the main passion fruit producing districts. Given the rapid expansion of passion fruit production in recent years, the number of farms growing passion fruit must have grown quite substantially as well (probably with a factor 3-4), but unfortunately there are no official statistical data to support that.

Passion fruit orchards have a "lifecycle" of 3 years; after the third year production it is in most cases no longer economically profitable. Hence farmers tend to replant after three years using saved seed. Recommended planting distance is 3 metres, which means about 1100 plants/ha. The first harvest starts 6-9 months after planting and after 18 months the maximum yield is reached. In Surinam, the average production is about 15 tons per year. Well-run commercial plantations practicing hand pollination can achieve easily double that yield. Passion fruit has a year-round production with 2 peak periods (January – March and July – August). The fruits are not harvested from the vines; 1-2 times a week the fallen fruits are collected.

In Suriname passion fruit is sold as fresh fruit and juice. There is one large processing factory (Carifruits) and some small ones (e.g., Suri Juice). Carifruits buys passion fruit from a large number of farmers[2] and has currently an estimated market share of 10-12% of the total supply of passion fruit. In the past, Carifruits has been importing passion fruit pulp for its juices factory alongside buying passion fruit locally. This import has become a lot more expensive lately due to the deterioration of the exchange rate and, rather than importing, Carifruits is now considering exporting passion fruit pulp. This requires adherence of Carifruits as well as its suppliers to standards set by the importing party. Carifruits, which has technical expertise on passion fruit production in house, is currently looking for more passion fruit suppliers and exploring options of how to get them certified.

The consensus during the stakeholder meeting was that the off-farm price for passion fruit is currently pretty good, but the market is known for its large price swings in the past.

Main problems in passion fruit production:

1. Initial investment to set up an orchard with a "trellis system" is high.
2. Low yield under natural pollination (natural pollination results in ca. 20% fruit set). Almost 80% of the flowers do not set fruit.
3. Pest & diseases: Especially damage of young fruits by bugs. Use of chemicals is problematic, because it also kills the pollinators, which leads to lower fruit setting. Another problem is the Passiflora Mosaic Virus (PMV), which can be spread by not properly cleaned cutting equipment.
4. Poor pruning, because of lack of knowledge. Most farmers do not carry out regular pruning to increase yield (pruning is supposed to be done regularly). The main reasons for this are: (i) It is a labour-intensive activity; and (ii) They are not aware that pruning is essential for the productivity of passion fruit plants.

[1] There is no FAOSTAT data available for passion fruit.

[2] For some other fruits, Carifruits works with 'outgrower contracts', which obliges farmers to sell to Carifruits at a predetermined price. However, in the case of passion fruit such an arrangement does not exist at the moment.

5. Waterlogging. Proper drainage of many fields is problematic in the rainy season due to weak infrastructure and wrong layout of fields.
6. Lack of good quality planting material. It has been more than 15 years since the introduction of passion fruit seeds from Brazil with heavy, big passion fruits (varieties needed for juice production) for commercial planting. Some farmers have recently imported seeds from Brazil.[3] Import of seeds needs to be carried out carefully; risk of contaminated seeds with PMV. Nowadays the passion fruits do not have the same quality as before; mix of large and small fruits. Knowledge of selection (criteria) of seeds for planting material is limited.
7. Due to the problems mentioned above, cost price of locally produced passion fruit is relatively high and was until the recent devaluation of the SRD higher than that of imported passion fruit pulp.
8. Experience in the past has shown that the local passion fruit market can get easily saturated and farmers are left with unsold produce.

*Pineapple*

In 2014, the total area under pineapple was 62 ha with a total production of about 1109 tons, with a farm gate value of SRD 6.4 million. The area under production has increased quite rapidly in recent years from 20 ha in 2009 to 62 ha in 2014 (LVV Statistics). Average yield per hectare: 17.9 ton or 8944 pineapples (assuming an average weight of 2 kg per pineapple). Highest reported yield in the region is Costa Rica with 58.4 ton per hectare (FAOSTAT), which suggests an average planting density of 30,000 pineapples per hectare.

According to the 2008 Census, there are 259 farms growing pineapples, of which 206 in Sipaliwini. In the Sipaliwini district the pineapple plots are very small -- on average 65m2. Pineapple production in Sipaliwini is mostly for own consumption and some local trade. Of the 53 pineapple farms reported in the coastal districts in 2008, only some 26 produced pineapples in monoculture and their farm size varied from 0.5 – 1.2 ha. Those not producing in monoculture had far smaller 'monoculture' areas under production. In the coastal zone, the main pineapple producing area is Para, followed by Marowijne. Given the rapid growth in pineapple production in recent years, we have to assume that the number of pineapple farmers in the coastal zone is now substantially larger than the number reported in 2008.

In the Para district, pineapple production is mainly practiced by Amerindian communities on the so called "intermediate savanna lands",[4] while in the Marowijne district pineapple is planted by Maroon communities on sandy clay and heavy clay soils. Both groups practice predominantly a traditional form of pineapple production.

Within the traditional production system, the farmer opens a plot of ca. 1 ha using the slash and burn method. Most farmers maintain their pineapple production plot for four years (3 ratoons). After three ratoons they have to open a new plot because of the very low yield caused by exhaustion of nutrients of the soil. From the abandoned field the farmer selects the planting material for the new plot. Preferably suckers are being used, which are the ground shoots and the upper laying shoots. Slips and crowns are not used in the traditional system as planting material.

[3] Brazil plants more than 50,000 ha of passion fruit and EMBRAPA (the Brazilian Agricultural Research Institute) has a specific passion fruit research programme.

[4] The savanna lands are characterized by well drained coarse white sandy soils in the B-horizon with a thin ca. 20 cm top-soil consisting of decomposed accumulated organic matter. This type of soil does not hold fertilizer.

Because of the improper land clearing, the ground space cannot be fully utilized for planting (debris, stumps, etc.). Therefore, plant spacing varies from 1.00 - 1.50 m. The plant density per hectare under the traditional system is estimated at ca. 3000 plants per hectare. With an estimated crop damage and failure of 10 % the yield per hectare is about 2700 fruits of ca. 2 kg each which is 5.4 tons/ha.

In 1999, the Inter American Institute for Cooperation on Agriculture (IICA) promoted in the Para district high-density, high-input pineapple production, whereby 30.000 plants/ha are planted. This is typically a high-tech form of pineapple production, using considerable amounts of fertilizer, pesticides and irrigation. High-density pineapple production may easily achieve ten-fold the yield per hectare reported for the traditional, low-density pineapple production (i.e., 54 ton/ha). Most farmers still practice low-density pineapple production, but there is a sizeable group of farmers that has adopted high density production (or a slightly watered down version of it – i.e. 20,000 plants/ha). Surprisingly some of the latter group have adopted organic pineapple production, which is only possible because they farm on very fertile soils on a rotation basis.

Suriname has at least thirteen different, known pineapple varieties. The most favourite varieties grown in Para are Inginasi, Stuger and Bofroe ede. These are sweet to very sweet varieties which are preferred in the domestic market. Other varieties that are recommended are Smooth Cayenne, Inginasi and Ripley Queen.

Pineapple production is mainly destined for the local market. This market has a preference for local, rather sweet varieties. However, the local, traditional varieties tend to be less sturdy than the dominant varieties grown elsewhere and get more easily damaged during transport and processing. In the case of Marowijne, there is some unreported export of pineapple into French Guyana. Since a few years, Surinam has started to import the Montserrat pineapple variety (a very sturdy type) from Guyana. Pineapple import from Guyana grew from 6.5 ton in 2011 to 97.5 ton in 2015. By using a flowering induction technique, the Guyanese pineapple growers can produce year-round. Hence the imported pineapple tends to dampen the seasonal fluctuation in the local supply of pineapple. This is in particular appreciated by local fruit salad makers. Some on-farm experimentation with flowering induction has taken place in Surinam in the past, but the results were apparently not satisfactory.

Most of the pineapple produced in Surinam is sold fresh, but there is also some small-scale pineapple juice and jam processing together less than 1 ton of pineapple per year and some fruit salad makers (the biggest processing about 4 ton per year). A new outlet for pineapple has recently emerged in the form of dried pineapple. The Surinam Candied Fruit company has started a pilot with a few pineapple growers in Para to produce dried organic pineapple for export. Volumes involved are still very small, but the plan is to process 40 ton of pineapple in the near future, with the possibility to extend to 100-200 ton in the long run. The company is working with the pineapple growers to get them certified as producers of organic pineapple.

A plan to establish a pineapple processing plant in the Para district was presented by LVV in 2014, but has not materialized to date. The idea is that the plant will produce pineapple jam, wine and syrup for the local market and pineapple pulp for export. Its projected capacity would require 235 ha of pineapple production, which would mean an enormous expansion of the production. Pineapple growers nearby have already been invited to produce more pineapple, but given the current financial crisis no funding for the plant has been secured to date. One of the requirements for the establishment of this plant is that new varieties are being imported that are more suitable for processing, causing less waste.

Main problems in pineapple production are:

1. Low yields per hectare under traditional method of pineapple production;
2. Lack of varieties that are compatible with processing requirements;
3. No artificial induction of flowering practiced, which leaves local demand for fresh pineapple unmet (hence the import from Guyana) and rules out year-round processing of pineapple, which makes the business plan of such undertaking less attractive;
4. Pest & diseases: a lot of damage caused by birds and animals; and
5. No production manual available for 'organic' pineapple production.

*Soursop*

In 2014, about 88.3 tons of soursop was produced on some 5.5 ha, with a farm gate value of approximately SRD 0.883 million. Average yield: 16.1 ton/ha.[5] After many years of decline in production due to pests and diseases affecting the traditional soursop varieties, soursop has been experiencing a major revival in recent years because of: (a) much attention in the media about the (unproven) health attributes of the tree triggering demand; (b) the import of new soursop varieties from Brazil and Asia; and (c) the fruit catches a very attractive price in the market at the moment (SRD20/kg).

Traditionally, soursop trees in Surinam are planted 6 metres from each other in a planting bed and can grow quite tall (up to 10 metres). Recently imported varieties, however, can be planted more densely (planting distance 3-3.5 metres), but have to be kept short. With the older varieties, the first harvest only takes place 4 years after planting and it takes six years before the tree reaches its full capacity. On average, a soursop tree has an economic lifespan of about 30 years. Improved varieties are reported to bear fruit earlier. Trees bear fruit year round, but with a peak at the end of the dry period/beginning rainy season.

A recent survey of soursop growers (2015) reported that 90% of the soursop trees are between 0-5 years old, suggesting that a major expansion of soursop production is on its way. Farmers that have planted recently imported soursop varieties claim that the fruits are bigger than the local varieties, are not infected with known pests, and that the trees bear earlier fruit and have a smaller habitat, so that harvesting is easier. Unfortunately, what is unknown, is what type of varieties have been imported and planted by farmers in recent years. This makes the identification of variety-specific characteristics problematic.

The main soursop producing areas are the districts Saramacca, Wanica, and Coronie. In these three districts, some 110 farmers grow soursop – most of them on a rather small scale. Only 18 farmers grow more than 100 trees and of those only 3 more than 400 trees (see table 2). Only a few farmers produce planting material based on saved seeds and supply the others. There is no trade in saved seeds as such.

In Suriname soursop is sold mostly as fresh fruit and sometimes as juice. Carifruits and Suri Juice are reported to produce small quantities of soursop juice, but we have the impression that this is not based on locally produced soursop (the local soursop is at the moment too expensive). Once ripe, the shelf life of soursop is limited. Overseas transport requires cooling and is costly – but it is being done by Colombia and Brazil. No significant export of soursop by Surinam is taking place at the moment, but LAL Farms has shown a serious interest in producing organic soursop to export it in a processed

[5] With an assumed tree density of 278 trees per hectare, average yield per tree is about 58 kg. According to the literature, a well-kept soursop tree can produce about 200 kg/year.

form as an ingredient for food supplements. LAL Farms is already working together with outgrowers producing West Indies cherries. A similar approach is expected to be rolled out for soursop.

**Table 2: Soursop farmers in the main soursop producing districts (2015)**

| District | No soursop farmers | Of which > 100 trees | Of which > 400 trees |
|---|---|---|---|
| Saramacca | 61 | 6 | |
| Wanica A | 6 | 3 | 2 |
| Wanica B | 11 | 1 | |
| Wanica C | 18 | 4 | 1 |
| Coronie | 14 | 4 | |
| Total | 110 | 18 | 3 |

Problems in soursop production:

1. Low yields of old trees;
2. New soursop varieties planted by farmers unknown and the specific characteristics of those varieties (e.g., relative resistance to diseases) undocumented;
3. Traditional varieties prone to pests and diseases. For one pest in particular (soursop wasp) there is no solution. The use of chemical solutions limited as the tree bears fruit permanently.
4. Poor management practices, such as insufficient fertilization, pruning, and pest and disease control.
5. No (organic) production guidelines for soursop available.

## Project justification

Maintaining some level of competitiveness in producing fruit crops is essential in order to: (a) withstand import from elsewhere, (b) offer the consumer in Surinam a wide choice of healthy fruits, and (c) keep a diversified portfolio of potential export opportunities open. For all three fruits, fresh export in large quantities seems to be out of reach because of high transportation costs, small volumes and inadequate cooling infrastructure. The export of processed fruit is for all three fruits a more plausibly option and several initiatives along these lines are currently being implemented or explored (i.e., export of passion fruit pulp by Carifruits, dried pineapple by SCF, pineapple pulp by LVV/Amea Cashew company, and soursop pulp/concentrate by LAL Farms). However, in order to produce for export, farmers have to: (i) adhere to international quality standards; and (ii) raise their productivity in order to compete internationally. Moreover, exporters see in particular opportunities for organically produced fruits, which adds to the quality and production standards farmers have to adhere to.

The interventions proposed for all three crops comprise: (i) a strengthening of the genetic base by introducing improved, imported varieties; (ii) an update of the production manual (including organic production methods); and (iii) promotion of best practices. Together this package should lead to higher yields per hectare and better profitability. In turn, this may also lead to an expansion of the area under production if demand can be secured. As past experiences have shown, the local market can get easily saturated and hence securing an export market outlet before significantly expanding production is important.

For all three crops, small farmers will be the primary beneficiaries of the project.

## Interventions to date

*Passion fruit*

In the past research was done in planting system of passion fruit; there are two types of "trellis" systems: "roof trellis system" and "row trellis system". Based on research conducted by LVV in the past, the latter is advised to farmers because in this system farming practices are carried out better (pruning, pest & disease management, etc.)

Another research done was use of hand pollination for increased yield. Hand pollination increases the yield up to four times compared to yield under natural pollination. As far as known, this practice is carried out on only one farm in the district Brokopondo. Main reasons for farmers of not carrying out hand pollination are: (i) It is labour-intensive; (ii) Time of day to pollinate flowers is during the hottest time of the day (1 – 4 p.m.); (iii) Lack of awareness of this practice by farmers; and (iv) Lack of knowledge of increased yield (up to four times).

Actions taken by LVV to increase passion fruit cultivation in the past include:

1. In the late 1990s, an attempt was made to agree with all stakeholders on a fixed price for passion fruit year round through the National Fruit Committee. This attempt failed.
2. In 2001, passion fruit cultivation was promoted in collaboration with IICA; growers and potential growers received a training on passion fruit cultivation, including use of hand pollination. This led to a sharp increase of passion fruit production but farmers were not able to market their product. The production was greater than the demand. Farmers were stuck with their passion fruit. After this, many farmers gave up growing passion fruit.

*Pineapple*

IICA has helped to introduce high-density pineapple production in Surinam in 1999. Since then no other major interventions have taken place (?).

In recent years, there has been a renewed interest in pineapple production and more specifically in the processing of pineapple into an exportable product. SCF has just started the export of dried pineapple, while an initiative launched by LVV and the Amea Cashew Company in 2014 aims to setup a large pineapple processing plant to produce pineapple pulp for the export.

*Soursop*

No research has been done on soursop for the past 20-30 years. In January 2015, however, Brazilian soursop experts were invited to a workshop organized by LVV in collaboration with LAL Farms.[6] At the workshop, both LVV and LAL Farms received each 100 seeds of seven different Brazilian soursop varieties. LVV has planted these seeds in a nursery and is now at the stage of planting the young trees. The intention is to plant the trees in 2 soil types, namely sandy and clay soil, so LVV can do research on these varieties.

Soursop is one of the crops for which the current crop production manual is based on literature study only.

[6] LAL Farms is a company that is producing West Indian cherries for the export. They have plans to expand with soursop.

## Project objectives

Main objective (i.e., goal): Strengthening of the production of passion fruit, pineapple, and soursop in Surinam

Intermediate objectives (i.e., outcome):

1. Enhanced productivity of the fruit crops targeted; and
2. Organic production techniques promoted as an alternative and adopted by some farmers in niche markets.

## Project outputs and activities

Project outputs and activities are summarized in table 3. For all three crops, the project aims at three interventions: (1) Provide farmers access to better varieties; (2) Promote better production practices; and (3) Offer alternative organic solutions for those farmers aiming that market.

**Table 3: Project outputs and activities**

| Fruit crop | Outputs | Activities |
|---|---|---|
| Passion fruit | 1. High-yielding, disease-free passion fruit seed made available to farmers | 1.1 Importation of high-yielding and disease-free passion fruit seed from Brazil<br>1.2 Screening, characterization, and validation of the imported seed<br>1.3 Validated seeds multiplied and distributed among farmers as a one-off exercise to replace the current genepool |
| | 2. New passion fruit production manual released and promoted | 2.1 Survey of production practices and problems<br>2.2 Literature review.<br>2.3 International consultation/study tour to Brazil<br>2.4 Drafting of the production manuals (including recommendations for organic production)<br>2.5 Testing of the manuals with farmer panels<br>2.6 Production of the manuals (text, layout, etc.) both in printed form as well as electronically<br>2.7 Promotion campaign around the production manuals among fruit growers<br>2.8 Production of short YouTube movies to highlight specific good practices<br>2.9 Use of social media and text messaging to reach out to farmers |
| | 3. Farmers made aware of and trained in best practices | 3.1 Training of farmers in best practices (two courses of three days, 25 participants each)<br>3.2 Training of farmers in hand pollination (two courses of one day, 25 participants each)<br>3.3 Training of farmers in seed selection (two courses of one day, 25 participants each)<br>3.4 Training of farmers in organic production practices (two courses of three days each, 25 participants each)<br>3.5 Demonstration of best practices on-station or on-farm |
| | 4. Biological bugs control mechanism tested | 4.1 Literature review<br>4.2 Design trial<br>4.3 Setup and implementation of trial<br>4.4 Production research report |

| Fruit crop | Outputs | Activities |
|---|---|---|
| Pineapple | 5. Two new pineapple varieties validated and existing varieties characterized | 5.1 Acquisition of the MD2 and Montserrat pineapple varieties in vitro<br>5.2 Screening, characterization, and validation of imported varieties<br>5.3 Characterization of existing varieties |
| | 6. Small pineapple nursery/gene bank established and operational | 6.1 Acquisition of land<br>6.2 Construction of the nursery and gene bank<br>6.3 Construction of composting facility in order to produce a good growing medium<br>6.4 Drafting of a pineapple propagation protocol<br>6.5 Appointment/assignment of staff<br>6.6 Training of staff<br>6.7 Acquisition of disease-free planting material to start the nursery and gene bank<br>6.8 Production and sale of both new and old pineapple varieties |
| | 7. Artificial induction of flowering of pineapple tested | 7.1 Artificial induction of flowering trial<br>7.2 Drafting research report |
| | 8. New pineapple production manuals released and promoted | 8.1 Survey of production practices and problems<br>8.2 Literature review.<br>8.3 International consultation/study tour (Brazil)<br>8.4 Drafting of the production manuals (including recommendations for organic production)<br>8.5 Testing of the manuals with farmer panels<br>8.6 Production of the manuals (text, layout, etc.) both in printed form as well as electronically<br>8.7 Promotion campaign around the production manuals among farmers<br>8.8 Production of short YouTube movies to highlight specific good practices<br>8.9 Use of social media and text messaging to reach out to farmers |
| | 9. Farmers made aware of and trained in best production practices | 9.1 Training of farmers in good agricultural practices (two trainings of three days each, 25 participants per training)<br>9.2 Training of farmers in organic pineapple production (two trainings of three days each, 20 participants per training)<br>9.3 Training of farmers in artificial induction of flowering (two trainings of one day each, 25 participants per training)<br>9.4 Training course on postharvest quality management of pineapple (two trainings of five day each, 25 participants per training) |
| | 10. Organic solutions tested | 10.1 Depending on soil type, research the possibility of sustaining soil fertility cost-efficiently by using 'organic' fertilizer in pineapple production<br>10.2 On-farm trials of organic pineapple production<br>10.3 Given the availability of organic inputs, determine the optimal formula for 'organic' fertilizer for pineapple production<br>10.4 Conduct research into appropriate rotation crops to restore the soil fertility after pineapple production |

| Fruit crop | Outputs | Activities |
|---|---|---|
| Soursop | 11. Most popular newly planted soursop varieties described and characterized. | 11.1 Survey of soursop trees planted by farmers<br>11.2 In situ monitoring of the production characteristics of the most popular varieties<br>11.3 Publication of soursop variety characteristics and 'how to' recognize a variety |
| | 12. New soursop production manual released and promoted | 12.1 Survey of production practices and problems<br>12.2 Literature review.<br>12.3 International consultation/study tour (Brazil)<br>12.4 Drafting of the production manuals (including recommendations for organic production)<br>12.5 Testing of the manuals with farmer panels<br>12.6 Production of the manuals (text, layout, etc.) both in printed form as well as electronically<br>12.7 Promotion campaign around the production manuals among farmers<br>12.9 Production of short YouTube movies to highlight specific good practices<br>12.10 Use of social media and text messaging to reach out to farmers |
| | 13. Farmers made aware of and trained in best production practices | 13.1 Training of farmers in best production practices (3 days, 4 locations, 25 participants each)<br>13.2 Training seed selection (1 day, 4 locations, 25 participants)<br>13.3 Training nursery (1 day, 4 locations, 25 participants each)<br>13.4 Training course on postharvest quality management of soursop (5 days, 4 locations, 25 participants each)<br>13.5 On-farm demonstrations of best practices in soursop production |
| | 14. Use of 'bagging' tested to control pests in soursop production | 14.1 Test the use of fruit bags to control pest infestation (in particular wasp) in an organically accepted manner |

## Project results

Project results are summarized in the results matrix below.

**Results matrix**

| **Project objective:** | To strengthen the production of passion fruit, pineapple, and soursop | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Outcome indicators** | **Base** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Target** | **Means of verification** |
| *Increased productivity* | | | | | | | | |
| Indicator 1: Increased yield/ha passion fruit | 15.4 ton | 0% | 0% | 5% | 10% | 15% | 30% | 1. Production statistics collected by LVV<br>2. Follow-up survey of farmers trained<br>Comments: For both pineapple and soursop the yield per hectare depends strongly on the chosen plant density. In both instances, there is a notable move towards higher plant density. Hence the more ambitious targets set for these fruits. Not considered is the fact that organic production may have a yield dampening effect. |
| Indicator 2: Increased yield/ha pineapple | 17.9 ton | 0% | 5% | 10% | 15% | 20% | 25% | |
| Indicator 3: Increased yield/ha soursop | 16.1 ton | 6% | 12% | 18% | 24% | 30% | 50% | |
| *Organic production techniques promoted as an alternative and adopted by some farmers in niche markets* | | | | | | | | |
| Indicator 1: Number of passion fruit, pineapple, and soursop farmers that have been certified as organic producers | 0 | 0 | 0 | 5 each | 10 each | 15 each | 50 each | 1. Statistics of the 'organic' certification agency or from processing companies working with organic outgrowers.<br>Comments: There is no local certification agency in place yet, but it is expected to come on board. In the meantime, processing companies may use alternative ways to proof that their product is organic. |
| **Output indicators** | **Base** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Target** | **Means of verification** |
| *1. High-yielding, disease-free passion fruit seed made available to farmers* | | | | | | | | |
| Indicator 1: Validation completed | 0 | | | 1 | | | 1 | 1. Validation report with recommendations |
| Indicator 2: Seeds distributed | 0 | 0 | 0 | 30 ha | 30 ha | 30 ha | 90 ha | 1. Sales/distribution statistics.<br>Comment: Three-year production cycle → one-third of plants to be replaced every year |
| *2. New passion fruit production manual released and promoted* | | | | | | | | |
| Indicator 1: Manual published | 0 | | 1 | | | | 1 | 1. Manual (both in printed form and electronically) |
| Indicator 2: Best practices YouTube movies released | 0 | | 3 | 3 | | | 6 | 1. YouTube movies uploaded on the website |
| *3. Passion fruit farmers informed and trained in best practices* | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Indicator 1: Number of printed manuals distributed | 0 | 0 | 100 | 50 | 25 | 25 | 200 | 1. Stock figures |
| Indicator 2: Number of downloads of YouTube movies | 0 | 0 | 600 | 600 | 300 | 300 | 1800 | 1. Website statistics<br>Comment: There is standard software to record and analyse the number of website page visits and downloads |
| Indicator 3: Number of farmers trained in best practices | 0 | 0 | 50 | 0 | 0 | 0 | 50 | 1. List of attendees; 2. Training evaluation forms summary and analysis; and 3. Training materials used |
| Indicator 4: Number of farmers trained in hand pollination | 0 | 0 | 50 | 0 | 0 | 0 | 50 | 1. List of attendees; 2. Training evaluation forms summary and analysis; and 3. Training materials used |
| Indicator 5: Number of farmers trained in seed selection | 0 | 0 | 0 | 50 | 0 | 0 | 50 | 1. List of attendees; 2. Training evaluation forms summary and analysis; and 3. Training materials used |
| Indicator 6: Number of farmers trained in postharvest handling of soursop | 0 | 0 | 0 | 0 | 50 | 0 | 50 | 1. List of attendees; 2. Training evaluation forms summary and analysis; and 3. Training materials used |
| Indicator 7: Number of farmers that visited demonstrations | 0 | 0 | 100 | 100 | 100 | 100 | 400 | 1. Annual progress reports specifying activities undertaken and number of farmers reached. |
| *4. Biological bugs control mechanism tested* | | | | | | | | |
| Indicator 1: Research report | 0 | | | 1 | | | 1 | 1. Research report made available |
| *5. Two new pineapple varieties validated and existing ones characterized* | | | | | | | | |
| Indicator 1: Validation completed | 0 | | | 1 | | | 1 | 1. Report with recommendations available |
| *6. Pineapple nursery / gene bank established and operational* | | | | | | | | |
| Indicator 1: Facility completed | 0 | | 1 | | | | 1 | 1. Inspection |
| Indicator 2: Planting materials sold | 0 | | | 5,000 | 5,000 | 5,000 | 15,000 | 2: Sales statistics |
| *7. Artificial induction of flowering of pineapple tested* | | | | | | | | |
| Indicator 1: Research completed and released | 0 | | | | 1 | | 1 | 1. Research report |
| *8. New pineapple production manual released and promoted* | | | | | | | | |
| Indicator 1: Production manual released | 0 | | 1 | | | | 1 | 1. Manual available both in printed form and electronically |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Indicator 2: YouTube movies released highlighting specific | 0 | | 2 | 2 | | | 4 | 1. YouTube movies uploaded on the website |
| *9. Pineapple farmers informed and trained in best production practices* | | | | | | | | |
| Indicator 1: Number of printed manuals distributed | 0 | 0 | 100 | 50 | 25 | 25 | 200 | 1. Stock figures |
| Indicator 2: Number of downloads of YouTube movies | 0 | 0 | 400 | 400 | 200 | 200 | 1200 | 1. Website statistics |
| Indicator 3: Number of farmers trained in best practices | 0 | | 50 | | | | 50 | 1. List of attendees; 2. Training evaluation forms summary and analysis; 3. Training materials used |
| Indicator 4: Number of farmers trained in organic production | 0 | | 40 | | | | 40 | 1. List of attendees; 2. Training evaluation forms summary and analysis; 3. Training materials used |
| Indicator 5: Number of farmers trained in artificial induction of flowering | 0 | | | | 50 | | 50 | 1. List of attendees; 2. Training evaluation forms summary and analysis; 3. Training materials used |
| Indicator 6: Number of farmers trained in post-harvest handling of pineapple | | | | 50 | | | 50 | 1. List of attendees; 2. Training evaluation forms summary and analysis; 3. Training materials used |
| *10. Selected organic solutions for pineapple production tested* | | | | | | | | |
| Indicator 1: Recommendation of feasibility organic pineapple production per soil type | 0 | 1 | | | | | 1 | 1. Research report and recommendation |
| Indicator 2: Two, three year on-farm trials of organic pineapple production completed | 0 | | | | | 1 | 1 | 1. Research report |
| Indicator 3: Optimal organic fertilizer/ compost formula identified | 0 | | | 1 | | | 1 | 1. Research report and recommendation |
| Indicator 4: Recommendation which rotation crops to grow in order to restore soil fertility | 0 | | | 1 | | | 1 | 1. Research report and recommendation |
| *11. Most popular newly planted soursop varieties described and characterized* | | | | | | | | |
| Indicator 1: Research report completed and released | 0 | | | 1 | | | 1 | 1. Research report |
| *12. New soursop production manual released and promoted* | | | | | | | | |
| Indicator 1: Production manual released | 0 | | 1 | | | | 1 | 1. Manual available both in printed form and electronically |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Indicator 2: YouTube movies released highlighting specific | 0 | | 3 | 3 | | | 6 | 1. YouTube movies uploaded on the website |
| *13. Soursop farmers informed and trained in best practices* | | | | | | | | |
| Indicator 1: Number of printed manuals distributed | 0 | 0 | 100 | 50 | 25 | 25 | 200 | 1. Stock figures |
| Indicator 2: Number of downloads of YouTube movies | 0 | 0 | 400 | 400 | 200 | 200 | 1200 | 1. Website statistics |
| Indicator 3: Number of farmers trained in best practices | 0 | | 100 | | | | 100 | 1. List of attendees; 2. Training evaluation forms summary and analysis; 3. Training materials used |
| Indicator 4: Number of farmers trained in seed selection | 0 | | | 100 | | | 100 | 1. List of attendees; 2. Training evaluation forms summary and analysis; 3. Training materials used |
| Indicator 5: Number of farmers trained in nursery | 0 | | | 100 | | | 100 | 1. List of attendees; 2. Training evaluation forms summary and analysis; 3. Training materials used |
| Indicator 6: Number of farmers trained in postharvest handling of soursop | 0 | | | 100 | | | 100 | 1. List of attendees; 2. Training evaluation forms summary and analysis; 3. Training materials used |
| Indicator 7: Implementation of on-farm demonstrations of best soursop practices | 0 | 1 | 1 | 1 | 1 | 1 | 5 | 1. Annual progress reports specifying activities undertaken and number of farmers reached. |
| *14. Use of 'bagging' tested to control pests in soursop production* | | | | | | | | |
| Indicator 1: Recommendation on the use of bags to control pests | 0 | | 1 | | | | 1 | 1. Research report and recommendation. |

## Project implementation

The project will be led by the head of the fruit crop division of ODLOAV, in close collaboration with various divisions within ODLOAV (Seed Unit, Agrohydrology, Entomology, Nematology and Mycology) and staff of ODL –i.e., extension, modern media and statistics.

In the case of pineapple, the option will be explored to mobilize an external partner to implement this component.

**Table 4: Time table**

| Activity | 1-i | 1-ii | 1-iii | 1-iv | 2-i | 2-ii | 2-iii | 2-iv | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 Importation of high-yielding and disease-free passion fruit seed (from Brazil) | | | | | | | | | | | |
| 1.2 Screening, characterization, and validation of imported passion fruit seed | | | | | | | | | | | |
| 1.3 Validated seeds multiplied and distributed among farmers as a one-off exercise to replace the current genepool | | | | | | | | | | | |
| 2.1 Survey of production practices and problems, yields, etc | | | | | | | | | | | |
| 2.2 Literature review. | | | | | | | | | | | |
| 2.3 International consultation/study tour to Brazil | | | | | | | | | | | |
| 2.4 Drafting of the production manuals (including recommendations for organic production) | | | | | | | | | | | |
| 2.5 Testing of the manuals with farmer panels (stakeholders consultation) | | | | | | | | | | | |
| 2.6 Production of the manuals (text, layout, etc.) both in printed form as well as electronically | | | | | | | | | | | |
| 2.7 Promotion campaign around the production manuals among fruit growers | | | | | | | | | | | |
| 2.8 Production of 4 short YouTube videos to highlight specific good practices | | | | | | | | | | | |
| 2.9 Use of social media and text messaging to reach out to farmers | | | | | | | | | | | |
| 3.1 Training of farmers in best practices | | | | | | | | | | | |
| 3.2 Training of farmers hand pollination | | | | | | | | | | | |
| 3.3 Training of farmers in how to obtain and select seed | | | | | | | | | | | |
| 3.4 Training of farmers in organic production | | | | | | | | | | | |
| 3.5 Demonstration of best practices on-station or on-farm | | | | | | | | | | | |
| 4.1 Literature review on bugscontrol | | | | | | | | | | | |
| 4.2 Design trial | | | | | | | | | | | |
| 4.3 Setup and implementation of trial for bugscontrol for 18 months | | | | | | | | | | | |
| 4.4 Research report | | | | | | | | | | | |
| 5.1 Acquisition of the MD2 and Montserrat pineapple varieties in vitro | | | | | | | | | | | |
| 5.2 Screening, characterization, and validation of imported varieties (1 cyclus of 3 years) | | | | | | | | | | | |
| 5.3 Characterization of existing varieties | | | | | | | | | | | |
| 6.1 Land clearing and preparation | | | | | | | | | | | |
| 6.2 Construction of the nursery and gene bank | | | | | | | | | | | |
| 6.3 Establishment of a composting facility to secure a good growing medium for plants | | | | | | | | | | | |
| 6.4 Drafting of a pineapple propagation protocol | | | | | | | | | | | |
| 6.5 Appointment/assignment of staff | | | | | | | | | | | |
| 6.6 Training of staff | | | | | | | | | | | |
| 6.7 Acquisition of disease-free planting material to start the nursery and gene bank | | | | | | | | | | | |
| 6.8 Production and sale of both new and old pineapple varieties | | | | | | | | | | | |
| 7.1 Artificial flowering trial | | | | | | | | | | | |
| 7.2 Drafting research report | | | | | | | | | | | |
| 8.1 Survey of production practices and problems, yields, etc | | | | | | | | | | | |
| 8.2 Literature review. | | | | | | | | | | | |
| 8.3 International consultation/study tour (Brazil) | | | | | | | | | | | |
| 8.4 Drafting of the production manuals | | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8.5 Testing of the manuals with farmer panels | | | | | | | | | | | |
| 8.6 Production of the manuals (text, layout, etc.) both in printed form as well as electronically | | | | | | | | | | | |
| 8.7 Promotion campaign around the production manuals among fruit growers | | | | | | | | | | | |
| 8.8 Production of 4 short YouTube videos to highlight specific good practices | | | | | | | | | | | |
| 8.9 Use of social media and text messaging to reach out to farmers | | | | | | | | | | | |
| 9.1 Training of farmers in good agricultural practices (two trainings of three days each, 25 participants per training) | | | | | | | | | | | |
| 9.2 Training of farmers in organic pineapple production (two trainings of three days, 20 participants per training) | | | | | | | | | | | |
| 9.3 Training of farmers in artificial induction of flowering (two trainings of one day each, 25 participants per training) | | | | | | | | | | | |
| 9.4 Training of farmers in post-harvest handling of pineapple | | | | | | | | | | | |
| 10.1 Depending on soil type, research the possibility of sustaining soil fertility cost-efficiently by using 'organic' fertilizer in pineapple production | | | | | | | | | | | |
| 10.2 Setup of two on-farm trials of organic cultivation of pineapple in Para and Marowijne | | | | | | | | | | | |
| 10.3 Determine the optimal formula for 'organic' fertilizer for pineapple production, given available materials | | | | | | | | | | | |
| 10.4 Conduct research into appropriate rotation crops to restore the soil fertility after pineapple production | | | | | | | | | | | |
| 11.1 Survey of soursop trees planted by farmers | | | | | | | | | | | |
| 11.2 In situ monitoring of the production characteristics of the most popular varieties | | | | | | | | | | | |
| 11.3 Publication of soursop variety characteristics and 'how to' recognize a variety | | | | | | | | | | | |
| 12.1 Survey of production practices and problems , yields, pesticide use, and technology/knowledge transfer and adoption | | | | | | | | | | | |
| 12.2 Literature review | | | | | | | | | | | |
| 12.3 International consultation/study tour (Brazil) | | | | | | | | | | | |
| 12.4 Drafting of the production manuals | | | | | | | | | | | |
| 12.5 Testing of the manuals with farmer panels | | | | | | | | | | | |
| 12.6 Production of the manuals (text, layout, etc.) both in printed form as well as electronically | | | | | | | | | | | |
| 12.7 Promotion campaign around the production manuals among fruit growers | | | | | | | | | | | |
| 12.8 Production of 4 short YouTube videos to highlight specific good practices | | | | | | | | | | | |
| 12.9 Use of social media and text messaging to reach out to farmers | | | | | | | | | | | |
| 13.1 Training of farmers in good production practices | | | | | | | | | | | |
| 13.2 Training of farmers in seed selection | | | | | | | | | | | |
| 13.3 Training of farmers in nursing of planting material | | | | | | | | | | | |
| 13.4 Training of farmers in post-harvest handling of soursop | | | | | | | | | | | |
| 13.5 On-farm demonstration of best soursop practices | | | | | | | | | | | |
| 14.1 Consultation of a pest & diseases specialist for 1 week from Brazil in Suriname | | | | | | | | | | | |
| 14.2 On-farm(?) validation of 3 types of fruit bagging material to control soursop pests | | | | | | | | | | | |

## Project partners

In the case of passion fruit, local partners will include passion fruit farmers and passion fruit processors such as Carifruits and Surifruits. IICA will be an important partner as it has worked with passion fruit producers in the past and could help with establishing international contacts.

In the case of pineapple, local partners will include pineapple farmers and pineapple processors such as SCF (producing dried pineapple) and possibly a new pineapple processing plant, which has been under planning since 2014. Finding funding for this plant is at the moment problematic. IICA will be an important partner as it has worked with pineapple farmers in the past and could help with establishing international contacts. In the case of soursop, local partners will include soursop farmers and processors. At the moment few processors source their soursop locally. It is cheaper to import. LAL Farms is expected to start a soursop out-growers' scheme. LAL Farms is expected to ship processed soursop to Switzerland and to sell it to a company that produces food supplements.

EMBRAPA 's fruit division (or other Brazil-based entities) is the most logic international partner for this project. The current passion fruit varieties and many of the new soursop varieties have their origin in Brazil. In the case of pineapple, Costa Rica may also come into the picture as a partner that could provide clean, in-vitro planting material of the MD2 variety.[7] Something could also be learned from neighbouring Guyana, which is exporting pineapple under circumstances quite similar to that of Surinam.

## Project budget

A summary of the budget is provided per output in table 5. The general project cost budget line includes project management, stationary, equipment and vehicles that are not output specific.

Overall budget of the project is just over US$ 811,000, of which roughly US$ 532,000 will be financed by the IDB loan and US$ 279,000 by LVV (mostly salaries). Detailed budget tables are available in Excel form and will be made available as an annex.

**Table 5: Budget table**

| **Output** | **Fund** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** | **Total** |
|---|---|---|---|---|---|---|---|
| | | *(US$)* | | | | | |
| *Passion fruit* | | | | | | | |
| Output 1 | IDB | 4,705 | 1,105 | 3,275 | 550 | 0 | **9,635** |
| | LVV | 2,948 | 2,948 | 9,916 | 7,228 | 0 | **23,041** |
| Output 2 | IDB | 15,196 | 8,400 | 200 | 0 | 2,896 | **26,692** |
| | LVV | 7,843 | 8,325 | 3,125 | 400 | 5,693 | **25,385** |

[7] Pineapple research in Costa Rica seems to be predominantly conducted by private multinationals dominating the industry. There is apparently little public pineapple research. INTA's fruit crops program does not cover pineapple.

| Output | Fund | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
|---|---|---|---|---|---|---|---|
| Output 3 | IDB | 2,028 | 3,534 | 1,644 | 2,904 | 1,014 | **11,124** |
| | LVV | 800 | 2,460 | 1,230 | 1,930 | 763 | **7,183** |
| Output 4 | IDB | 1,495 | 640 | 590 | 0 | 0 | **2,725** |
| | LVV | 1,697 | 661 | 1,161 | 0 | 0 | **3,519** |
| *Pineapple* | | | | | | | |
| Output 5 | IDB | 27,785 | 1,220 | 1,160 | 0 | 0 | **30,165** |
| | LVV | 8,180 | 3,380 | 3,380 | 0 | 0 | **14,940** |
| Output 6 | IDB | 191,730 | 4,080 | 3,080 | 2,080 | 1,080 | **202,050** |
| | LVV | 13,700 | 11,600 | 11,600 | 11,600 | 11,600 | **60,100** |
| Output 7 | IDB | 0 | 13,605 | 2,140 | 2,390 | 0 | **18,135** |
| | LVV | 0 | 3,380 | 3,380 | 4,380 | 0 | **11,140** |
| Output 8 | IDB | 13,796 | 8,400 | 200 | 0 | 1,496 | **23,892** |
| | LVV | 5,754 | 8,325 | 3,125 | 400 | 3,604 | **21,208** |
| Output 9 | IDB | 0 | 3,450 | 10,100 | 635 | 0 | **14,185** |
| | LVV | 0 | 2,460 | 2,015 | 530 | 0 | **5,005** |
| Output 10 | IDB | 26,010 | 9,050 | 20,750 | 0 | 700 | **56,510** |
| | LVV | 5,598 | 13,128 | 16,344 | 608 | 2,216 | **37,893** |
| *Soursop* | | | | | | | |
| Output 11 | IDB | 1,180 | 980 | 1,980 | 0 | 0 | **4,140** |
| | LVV | 2,520 | 1,920 | 2,420 | 0 | 0 | **6,860** |
| Output 12 | IDB | 13,796 | 8,400 | 200 | 0 | 1,496 | **23,892** |
| | LVV | 6,554 | 8,325 | 3,125 | 400 | 3,604 | **22,008** |
| Output 13 | IDB | 2,028 | 4,809 | 16,919 | 1,014 | 1,014 | **25,784** |
| | LVV | 800 | 2,410 | 3,620 | 700 | 763 | **8,293** |
| Output 14 | IDB | 0 | 7,180 | 0 | 0 | 0 | **7,180** |
| | LVV | 0 | 5,720 | 0 | 0 | 0 | **5,720** |
| General project costs | IDB | 32,800 | 4,500 | 4,500 | 4,500 | 4,500 | **50,800** |
| | LVV | 2,600 | 2,600 | 2,600 | 2,600 | 2,600 | **13,000** |
| **Subtotal** | **IDB** | **332,549** | **79,353** | **66,738** | **14,073** | **14,196** | **506,909** |
| | **LVV** | **58,993** | **77,642** | **67,041** | **30,776** | **30,841** | **265,293** |
| Contingency 5% | IDB | 16,627 | 3,968 | 3,337 | 704 | 710 | **25,345** |
| | LVV | 2,950 | 3,882 | 3,352 | 1,539 | 1,542 | **13,265** |
| **Total** | **IDB** | **349,176** | **83,321** | **70,075** | **14,777** | **14,906** | **532,254** |
| | **LVV** | **61,943** | **81,524** | **70,393** | **32,315** | **32,383** | **278,558** |
| | **All** | **411,119** | **164,845** | **140,468** | **47,091** | **47,289** | **810,812** |

## Human resources

The human resources that have been budgeted to implement the various activities have been summarized below (see table 6). In its peak year (year 2), this project will command inputs from various researchers, adding up to some 616 days. With the other projects coming on board at around the same time, not all this staff time may be available – some overall coordination of activities may be needed here.

**Table 6: Human resources involved in the implementation of the project**

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
|---|---|---|---|---|---|---|

| | Days | | | | | |
|---|---|---|---|---|---|---|
| Research staff – HL | 437 | 616 | 398 | 142 | 161 | 1,738 |
| Reserach staff – ML | 554 | 656 | 673 | 501 | 293 | 2,671 |
| Research staff – LL | 415 | 570 | 512 | 344 | 240 | 2,075 |
| | | | | | | |
| Extension staff – HL | 32 | 52 | 56 | 4 | 10 | 155 |
| Extension staff – ML | 79 | 107 | 123 | 50 | 70 | 428 |
| Extension staff – LL | 345 | 67 | 67 | 0 | 330 | 809 |
| | | | | | | |
| Modern media staff – HL | 15 | 90 | 90 | 15 | 15 | 225 |
| Modern media staff – ML | 0 | 30 | 30 | 0 | 0 | 60 |
| Modern media staff – LL | 0 | 30 | 30 | 0 | 0 | 60 |
| | | | | | | |
| Statistical staff – HL | 9 | 0 | 0 | 0 | 9 | 18 |
| Statistical staff – ML | 10 | 0 | 0 | 0 | 10 | 21 |

## Capital items

Table 7 summarizes the main capital items that will be purchased for the execution of the project. The single biggest investment is that into a small pineapple nursery / gene bank, which should assist the industry to obtain disease free planting material of both local and imported varieties and at the same time help to safeguard the wide range of local pineapple varieties.

**Table 7: Capital items that will be acquired for the project**

| Activity | Capital item | Cost | Date of acquisition | | | | |
|---|---|---|---|---|---|---|---|
| | | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| Overall project | Pickup | 25,000 | 1 | | | | |
| | Laptop | 1,000 | 1 | | | | |
| | Desktop | 1,500 | 1 | | | | |
| | copy machine | 800 | 1 | | | | |
| Activity 5.2 | Hydrofoor complete | 600 | 1 | | | | |
| | Sprayer tanks | 55 | 3 | | | | |
| | Motor sprayer | 200 | 1 | | | | |
| | Waterpump | 500 | 1 | | | | |
| Activity 6.2 | Pineapple nursery and genebank | 125,000 | 1 | | | | |
| | Equipment | 50,000 | 1 | | | | |
| Activity 6.3 | Compost camp 8 X 6 m2 | 1,000 | 1 | | | | |
| | concrete floor | 500 | 1 | | | | |
| | Shredder | 2,000 | 1 | | | | |
| | wheel barrow | 200 | 1 | | | | |
| | moisture meter for compost | 40 | 2 | | | | |
| | temperatue meter for compost | 40 | 2 | | | | |
| | Tarpaulin | 100 | 1 | | | | |
| Activity 7.1 | Hydrofoor complete | 600 | | 1 | | | |
| | Sprayer tanks | 55 | | 3 | | | |
| | Motor sprayer | 200 | | 1 | | | |
| | Waterpump | 500 | | 1 | | | |
| Activity 10.3 | Compost camp 8 X 6 m2 | 1,000 | 2 | | | | |
| | concrete floor | 500 | 2 | | | | |
| | Shredder | 2,000 | 2 | | | | |

## Service contracts

Table 8 provides an overview of the services that have to be contracted as part of the implementation of the project. Indicative terms for consultants to be hired for the project are provided in Annex A.

**Table 8: Service contracts**

| | | | Date of acquisition | | | | |
|---|---|---|---|---|---|---|---|
| **Activity** | **Service contract** | **Cost** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| Activity 1.2 | Land clearing and preparation | 600 | 1 | | | | |
| | Tractor lease | 400 | 1 | 1 | | | |
| Activity 2.6 | Editing services | 500 | | 1 | | | |
| | Printing services | 6000 | | 1 | | | |
| Activity 3.2 | Soil analysis | 354 | 2 | 1 | 1 | 1 | 1 |
| | Tractor lease | 200 | 2 | 1 | | | |
| Activity 8.6 | Editing services | 500 | | 1 | | | |
| | Printing services | 6000 | | 1 | | | |
| Activity 10.1 | Foreign expert | 500 | 14 | | | | |
| | Soil analysis | 350 | 10 | | | | |
| Activity 10.3 | Soil analysis | 350 | | | 2 | | 2 |
| | Economist | 2000 | | | 1 | | |
| Activity 10.4 | Soil analysis | 350 | | 12 | 12 | | |
| Activity12.6 | Editing services | 500 | | 1 | | | |
| | Printing services | 6000 | | 1 | | | |
| Activity 13.2 | Soil analysis | 354 | 2 | 1 | 1 | 1 | 1 |
| Activity 14.1 | Foreign expert | 500 | | 7 | | | |

# Annex A: Indicative Terms for Consultants to be Hired by the Project

Activity 10.1.2: Modelling of soil nutrient balance for different soil types over a three-year pineapple production cycle

Input needed from a (foreign) expert in modelling soil nutrient balances (most likely a soil scientist by training) for 14 working days.

TOR

Working under the direct supervision of the project leader, the foreign expert will:

1. Select, in consultation with local experts, in the principal pineapple production areas four representative locations with different soil types for which the soil nutrient balance will be modelled;
2. Take soil samples of pineapple fields at different stages of production and get them analysed;
3. Organize in collaboration with LVV staff the collection of other data needed for the modelling;
4. Make the necessary calculations in order to model the soil nutrient balance; and
5. Make recommendations how to grow pineapples in a sustainable way on the different soil types.

Activity 10.3.6: Technical and economic analysis of on-farm trials

Input needed from a local economist for about 20 days in analysing the results of on-farm trials with different formula of 'organic' fertilizers.

TOR

Working under the direct supervision of the project leader, the economist will:

1. Organize during the on-farm trials the collection of data specifically needed for the economic analysis, such as the costs to produce 'organic' fertilizers, application rates, etc.;
2. Based on this data and the technical parameters provided by the technical counterpart (such as the quality and composition of the different organic fertilizers) make a cost-benefit analysis of the use of the different 'organic' fertilizers.
3. Make a recommendation whether 'organic' fertilizers pay off and which ones are the most attractive economically.

Activity 14.1: Consultation of a pest & diseases specialist for 1 week from Brazil in Suriname

Input needed from a foreign expert (most likely from Brazil), who has specific knowledge about pests and diseases affecting soursop. Experience with using bags in soursop production as a protection against pests and diseases is essential.

TOR

Working under the direct supervision of the project leader, the expert will:

1. Visit the principal soursop production areas in Suriname and investigate the problems farmers encounter with their soursop production;
2. Provide technical advice to the project team how best to organize the validation trial with regard to 'bagging' soursop fruit; and

3. Give a seminar to LVV staff and other interested parties on how to control pests and diseases in soursop production and how to improve Surinamese soursop production practices.