Evaluation of the economic impact of the National Control and Eradication Programme for Fruit Flies Procem Patagonia

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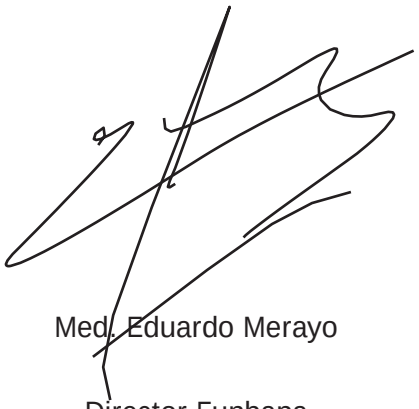
Foreword

After several decades of execution of the Procem Patagonia Project, it was decided to carry out this work whose objective is to establish in a quantifiable and concrete way the benefits of its implementation. The Patagonian Protected Region is the only one in the country internationally recognized as
Free of fruit flies and also free of foot and mouth disease without vaccination.

These achievements were obtained from the implementation, in 1993, of the Sistema Cua- rentenario Patagónico and the specific operational plans. The Barrera Zoofitosa Patagonica Foundation (Funbapa), since 1992, has been working together with the public and private institutions that integrate it in pursuit of the health and productive objectives established in its social purpose.

The present work and its conclusions, carried out between the EEA Alto Valle del Inta and Funbapa, are intended to be a tangible element and input to evaluate the impact of the Programme and its benefits; future decision making and political, institutional and economic validation.



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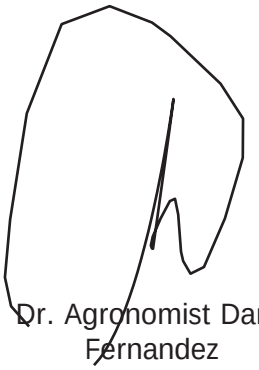

Dr. Agronomist Dario Fernandez

Director Inta Alto Valle

Executive Summary

1 The Procem Patagonia responds to the motivation of foreign trade facilitation, through compliance with health and safety standards that allow access to foreign markets.

2 Among the benefits sought by the control and eradication campaigns of pests and enzymes, Procem specifically seeks:

- Access to a greater number of export markets, thanks to the lifting of phytosanitary restrictions
- Better reputation of the country's agricultural products in foreign markets and better reputation of the health agency after demonstrating its ability to eradicate pests/diseases, which facilitates the agency's negotiations to open new markets.
- To generate a differentiation of the region's products.
- Increase product diversity to existing markets.

3 The installation of sanitary barriers that protect a pest-free area is considered a public good, as the benefit is exclusive (benefits all producers in that area) and not rivalrous. For these reasons, the Procem should continue to be implemented in a public-private manner.

4 The objective of this study is to identify and quantify the benefits that the Programme has generated for the region in relation to the costs required for its operation. To provide new elements, two scenarios are proposed on the evolution of the programme and its relationship with sectoral exports.

5 The methodology used follows the suggestions made in the Programme's first analysis (Funbapa, 2008) and MOSCAMED's impact evaluation scheme in Guatemala (IICA, 2013).

6 On average, the annual cost of the Procem Patagonia and the zoofactory barrier (consider that 50% of its cost is affected to fly control) is approximately 5.54 million dollars, of this total:

- 72 % corresponds to the functioning of the barrier,
- 24%, to the operation of the Procem Patagonia,
- and 4% is the valorisation of institutional contributions (personnel and infrastructure) to Procem Patagonia.

7 The Programme is financed by the tax on fruit leaving the Patagonian Protected Area. Since 2014, the Programme's participation in the collection of the fee has increased. The barrier is not enough to cover its cost with the collection of the fee and has an operational deficit of 50%.

8 The free zone allows the entry to the USA through any airport or port, both from the East coast (Atlantic) and the West coast (Pacific), taking advantage of the exit through Chilean ports, the export to different countries of America from the Pacific coast, possibilities of air exports and the incorporation of new products.

9 The increase in cherry exports by air and the diversification of destinations is significant. In addition, there has been an increase in the volume exported of pears and apples to the United States, and exports through Chilean ports are growing.

10 Total FOB income from cherry exports from Patagonia reached 15.27 million USD (2016), with a projected growth of 30% by 2020 (5 million USD more).

11 The FOB value of apple exports to the US grew from US$2 million in 2009 to US$16.3 million in 2016. Pear trade with the US grew from US$32.9 million in 2012 to US$56 million in 2016.

12 Argentinean exports of pears and apples to Peru, Colombia, Ecuador and Chile are growing, reaching 7,300 tonnes in 2016. The total value of exports grew from less than USD 500 000 in 2007 to more than USD 7 million in 2016.

13 The sector has saved, by avoiding quarantine treatments (cold T107 in transit), the equivalent of 27 million dollars in the period 2006-2016. Fruit exporters avoid spending just over 3 million dollars a year. To this value should be added the savings on inland freight in the United States as they can reach various ports (without recognition they could only unload at the port of Philadelphia).

14 If the volume of 1 675 containers exported from Chilean ports is maintained, the sector would be saving 1,675 million dollars a year in export logistics due to the recognition of Chile de Patagonia as a Fruit Fly Free Area.

15 The income/cost ratio, from the declaration of free area, gives an average value of 15.40. For each dollar spent in the Procem Patagonia and the Barrier, 15.40 dollars are generated in the region in terms of exports and savings in quarantine treatment and logistics when exporting through Chilean ports.

16 In twelve years of free area recognition, there have only been five phytosanitary emergencies due to fruit flies in specific locations, all of which were eradicated according to international standards.

17 Employment directly related to exports due to health status re-presents 13% of employment in the fruit sector.

18 In the positive scenario, growth in production and opening of new markets, an additional $83.6 million will enter the sector from the year ten, in addition, $5.11 million will be saved annually. These benefits, maintaining the current cost of the programme and the barrier, give rise to a benefit/cost ratio of 30.56. In other words, the positive scenario would double the benefit generated by the Programme.

19 In the negative scenario, the elimination of the Programme and the control on the barrier, would imply a net loss of 9.5 million dollars per year (losses 15.2 discounting the savings of 5.76 for not implementing the Programme and lifting the control on the barrier). In addition, what has already been invested in achieving and maintaining the Fruit Fly Free Area, which is more than 62 million dollars, would be lost.

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1. Introduction

In 1994, the National Programme for the Control and Eradication of Fruit Flies (Procem) was created by Resolution EX-IASCAV No. 134 to carry out monitoring and control actions on the pests *Ceratitis capitata (*Mediterranean fruit fly) and *Anastrepha fraterculus (*South American fruit fly) (www.senasa.gov.ar).

The fruit fly was considered one of the most economically important pests for fruit and vegetable production in Argentina, due to the damage it caused to the fruit and the associated economic losses. In addition, as it was considered a quarantine pest in some countries, the export sector had to carry out quarantine treatments. Its presence prevented the development of potential markets such as Southeast Asia or the west coast of the United States and the free circulation through Chile, in order to take advantage of the Pacific Ocean ports and facilitate its commercialization in these markets.

Procem has developed an operational strategy based on the regionalization of the country, with a National Coordination that articulates the activities developed by the Regional Coordination offices. It also works jointly with provincial governments, Inta, national universities, producers' associations, non-governmental organizations (NGOs) and international organizations. It implements actions in the following regions:

- **Patagonia:** pome fruits (pears and apples) and stone fruits (cherry and peach).
- **Mendoza:** grapes for wine making, peach, plum, cherry and pear.
- **San Juan:** grapes for fresh consumption and peppers
- **NEA:** oranges, tangerines and blueberries
- **Calchaquí Valleys of Salta:** wine grapes, peppers and stone fruits on a small scale.

The actions of the Procem in the Patagonia region are executed by Funbapa.

In the Northern Patagonian region, and according to the experience of the staff who carry out and supervise the monitoring, the following hosts have been determined, based on historical records before the declaration of free area:

- Primaries: orange, grapefruit, tangerine, passion fruit, fig, peach, peach tree, peach tree, mem- gloss, kinoto, khaki.
- Secondary: apple tree, pear, tuna, pomegranate, apricot, plum
- Potentials: olive tree, avocado loquat, cherry, almond, mulberry, chilli, aubergine, cherry, vine. These hosts have no regional record of larval samples

Before the start of the Programme, and unlike what happens in other countries such as Mexico or Guatemala, the pest was only detected in the urban areas of some localities of the protected region. Villegas Nigra (1999) indicated that the Mediterranean fruit fly could be more easily introduced into urban or suburban areas of the main cities and the first sources of infestation were the so-called family gardens, in the patios of the houses. Prior to the operation of the barrier, carriers were generally people who brought fruit in from infested areas.

The health programmes are solved by a compulsory contribution fee per every 1,000 kg of fruit leaving the Patagonia Protected Region, as established by IASCAV resolution no. 271/95 and its amendments.

2. Background

The conclusions of the evaluations of the agricultural sector health programmes carried out by the international organizations that generally finance them (IDB) are of interest, highlighting the importance of public and private participation in their implementation.

For the choice of the methodology to be used in this study, the evaluation of programs for fruit fly control in different countries of America was reviewed.

In addition, the development of Procem Patagonia over twenty years was evaluated, consulting the reports and balance sheets, identifying strategies, resources and results.

2.1. Health programmes: public-private intervention

The public/private participation in the Health Programmes that emerge is necessary to respond to the growth of world trade in agricultural products, which has been hardening the health and safety regulations of developed countries (IDB - OVE, 2015).

As the IDB (2015) points out, the main objectives of public health bodies are the preservation of the agricultural heritage from health risks and the protection of the population's health from the consumption of contaminated food. Both of these generic functions are public goods, since their benefits are non-exclusive and not competing. This, added to other market failures present in the area of agricultural production, such as the existence of externalities in production, asymmetric information and coordination failures, justify State intervention in the subsector.

The protection of the agricultural heritage from pests and diseases has two main motivations: *a)* the increase in productivity, obtained from the decrease in production losses and -sometimes- the lower use of agricultural inputs; and *b)* the facilitation of foreign trade, through compliance with health and safety standards that allow access to foreign markets. At this level, there are benefits that clearly constitute private goods (IDB-OVE, 2015).

Permanent services, such as epidemiological surveillance, quarantine control, maintenance of achieved health status, issuance of export and import permits, among others, are mostly public goods, as their provision generates benefits that are non-rivalrous (producers do not compete for profit) and non-exclusive (no producer can be excluded from the benefit generated).

In the case of export and import certification, public intervention addresses a problem of asymmetric information between local producers and external market buyers. However, because in some cases the beneficiaries of some of these permanent services are mostly producers in certain regions of a country (e.g. quarantine activities to prevent re-infestation of areas under phytosanitary control) or individual producers, as in the case of export certification, it is common for producers to be charged for many of these services. For the Procem Patagonia, producers pay the contributive fee.

Actions in the area of agricultural input regulation are justified by the existence of asymmetric information between input producers and producers

and between producers and consumers of agricultural and livestock products. Additionally, the activities of registration and control of agricultural inputs are justified by the presence of externalities: the excessive use of inputs or the use of prohibited or adulterated products can generate environmental damage and/or damage to human health, without the responsible party having to internalize this additional cost, due to the difficulty of relating the incorrect use of inputs with the consequences generated and even measuring the cost of environmental or health damage.

Traceability systems solve problems of asymmetric and external information in production. Given these characteristics, traceability systems can be considered as mixed goods. One possible scheme for providing this service is the assembly and operation of the traceability system by the public sector and the collection of fees from the beneficiaries (IDB-OVE, 2015).

Pest and disease control and eradication campaigns carried out by health agencies, and possible certification by relevant international reference bodies, can generate multiple benefits such as

a. lower production losses caused by the pest/disease, resulting in higher gross production value and economic benefit;
b. lower private costs of treating the pest/disease;
c. Reduced damage to the environment and beneficial wildlife due to reduced use of agrochemicals;
d. access to a greater number of export markets, thanks to the lifting of phyto/zoosanitary restrictions, which can generate greater profitability due to better prices in foreign markets;
e. spillover effect on small and medium-sized producers, who have a greater incentive to produce to higher standards in order to sell their production to exporters, who can access new markets;
f. positive externality to producers in areas close to the areas involved in the campaigns through a lower probability of pest infestation;
g. better reputation of the country's agricultural products in foreign markets and better reputation of the health agency after demonstrating its ability to eradicate pests/diseases, which facilitates the agency's negotiations to open new markets;
h. improvement in the health of the population due to the consumption of safe food - for example, because it contains less agrochemical residues or because it comes from disease-free animals - and less direct exposure to agrochemicals in the case of producers who apply them and of populations close to production areas.

Within this long list of benefits generated by control and eradication campaigns, there are some that are private benefits (exclusive and rival) and others that are so-cial benefits that cannot be appropriated privately, due to the existence of externalities. This means that the campaigns have the characteristics of mixed goods. An example of the existence of externalities is that pest control actions implemented by a producer benefit the neighbouring producer, both by reducing the prevalence of the pest in their plot and by the possibility of *learning* about the technology of eradication from the experience of the proactive producer (*learning spillovers*).

Also, successful eradication campaigns allow for certification of
The use of free or low-prevalence areas that benefit all producers in the area, beyond their participation. These externalities induce producers not to initiate campaigns because of the impossibility of appropriating all the benefits they generate. This justifies the intervention of the State, which can make participation in a certain campaign compulsory, coordinate and supervise the participation of those involved, thus resolving the coordination failure that generates the existence of externalities and that usually leads to the under-provision of a service (a suboptimal balance).

At the same time, the existence of appropriable private benefits - greater quantity and quality

The fact that the State charges for inputs and services provided to producers (vaccines, application services, agrochemicals, biological controllers, etc.), as well as for producers to provide labour for the campaigns, justifies this. This does not eliminate the possibility that in the case of small producers, who cannot finance inputs needed for the campaigns, it is necessary to subsidize their costs in order to ensure their participation and achieve the goal of control or eradication (IDB-OVE, 2015).

As the IADB report in Argentina points out, the health agency provides an additional type of service to agricultural production that consists of promoting integrated pest management (IPM) techniques. The promotion of these practices is a type of agricultural extension service that seeks to correct the negative externalities generated in the environment and human health by the excessive use of agrochemicals. On the other hand, the high initial costs that the adoption of these practices can have -including the cost of learning-, added to the impossibility of appropriating all the benefits it generates, justifies the initial intervention of the State, which can solve the problem of coordination and subsidize the costs at the outset, thus achieving the materialization of benefits that otherwise would not be obtained.

Table 1 presents a classification of the most common services provided by agricultural health organizations according to the market failures that characterize them.

For example, the setting up of an export certification system can be considered a public good, beyond the fact that the certifications are a private good; or the installation of a quarantine station that protects a pest-free area from reinfestation can be considered a club good, since the benefit is exclusive (benefits the producers of that area) and not rivalrous. The implementation of a traceability system was classified as a mixed good because it considers that, by facilitating the tasks of food safety control and epidemiological surveillance, it can be classified as a public good, while obtaining traceability certification can bring private benefits to producers who manage to export to external markets that require such certification.

Table 1. Services provided by health agencies and market failures involved

	Type of good			Market failure		
Services	**Private**	**Public**	**Mixed**	**Asymmetric information**	**Externalities**	**Coordination failures**
Surveillance		X				
Quarantine		X				
Support, surveillance and quarantine laboratory		X				
Export/Import Certification	X			X		
Food safety control		X		X		
Input regulation and control		X		X	X	
Traceability			X	X	X	
Control and eradication campaigns			X		X	X
IPM1			X		X	X

Source: IDB-OVE, 2015.

1. IPM: Integrated Pest Management

There are several factors that threaten the sustainability of the successful provision of services with mixed asset characteristics (campaigns, traceability). In some cases, the achievements of the programmes undertaken by the health authorities run the risk of not being sustained over time because of the weakness in the collection of fees from the private sector for the private goods involved. The lack of willingness to participate and to pay of the actors of the productive chain, jeopardizes the capacity of the health authorities to be able to carry out such programmes.

The results of work in the agricultural health and safety subsector in a country are not immediate, but require many years of work to build technical capacities, generate reputation and credibility among trading partners and international reference bodies, certify low prevalence or eradication of pests and diseases, etc. In turn, the outcomes that it influences - such as increased exports, access to new markets and higher productivity - are affected by many variables, so it is not easy to attribute specific achievements to the health sub-sector. This means that investing in health and safety is often not the most attractive option for governments, as the resources it requires compete with destinations that bring more direct, short-term and politically redi- tuable benefits. Consequently, health agencies are favoured by the existence of influential power groups, beneficiaries of the services provided (usually agro-exporters), who advocate and lobby for the maintenance of support, as well as being willing to make their own contribution (IADB-OVE, 2015).

Within the framework of the concepts mentioned above, it can be stated that the Procem Patagonia specifically addresses the motivation of "foreign trade facilitation, through the fulfilment of health and safety standards that allow access to foreign markets" (IDB, 2015, p. 9). Among the benefits sought by the control and eradication campaigns of pests and diseases mentioned above, Procem specifically seeks *d)* access to a larger number of export markets thanks to the lifting of plant/zoosanitary restrictions, which can generate greater profitability due to better prices in foreign markets; and *g)* better reputation of the country's agricultural products in foreign markets and greater prestige of the health agency, after demonstrating its ability to eradicate pests/diseases, which facilitates the agency's negotiations to open new markets.

These are mixed goods that solve the coordination market failure, obtaining certification of free or low prevalence areas benefits all producers in an area. The installation of sanitary barriers that protect a pest-free area is considered a public good, as the benefit is exclusive (it reaches all producers in that area) and not rival, i.e. its use by one person does not diminish the possible use by others. For these reasons, the Procem must continue to be implemented in a public-private manner.

2.2. The impact assessment of projects

According to the characteristics of the projects, there are many ways to evaluate their outcomes and impacts, which allows for numerous considerations, such as the role of spill-over effects, by-products and the quantification of intangible products, given the need for a broader view of the impacts caused by investments in technology, beyond the economic dimension. Thus, they incorporate the social, environmental, political-institutional and training dimensions (Avila and others, 2007).

With regard to the environmental dimension, Avila and its collaborators (2007) propose the use of the methodology developed by EMBRAPA and it is based on three aspects

a. Technological efficiency, which refers to the contribution of technology to reducing dependence on the use of inputs.
b. Environmental conservation, which evaluates the effects of technology on the quality of the components of the environment: atmosphere, soil productive capacity, water and biodiversity.
c. Environmental recovery, which evaluates the contribution of technological innovation to the effective recovery of degraded soils, degraded ecosystems and areas of permanent preservation and legal reserve.

The importance of the political-institutional and capacity building dimension lies in the actions that the institutions take to bring knowledge or technology to the market or

to the end user. Institutional changes and changes in the level of knowledge are extremely significant for carrying out the innovation process. [1]

This dimension involves changes in the formation of cooperation networks, such as public and private research centres, companies, government, non-governmental organisations (NGOs), among others. It also considers changes in the institutional framework (legal or practical) that alter access to technological, human, financial and knowledge resources, as well as changes in the orientation of public and private business policies.

The training and learning dimension involves training strategies to strengthen relationships between actors, in organizational, scientific and technological aspects, as well as to generate tangible and intangible products and by-products.

The social dimension involves the potential changes that the project induces or could induce on the factors related to the capacity to generate income in the population, the methodology considers the impact on employment, nutrition and health, organization and support networks, and on the sectoral or national policy.

The IDB proposes that both the diagnosis and the evaluation of the health programmes aimed at access to external markets should focus on the export rejections suffered by the countries and their causes, and on the specific difficulties in opening new markets (IDB-OVE, 2015). In addition, the Programmes must specify the market failures they are trying to solve, have estimates of the economic damage caused by the main pests and diseases of different products in different geographical areas, which justify the prioritization of control campaigns, and an analysis of the characteristics of the main beneficiaries (productive stratum, weaknesses for pest/disease control, etc.) and the economic benefits for the country derived from the campaigns (via tax collection, for example).

For the evaluation, the IDB dismisses the use of highly aggregated indicators, such as the increase in agricultural exports or sectoral GDP, whose evolution cannot be directly related to project results, given the multiple factors that influence these variables. Instead, it proposes the use of indicators related to the concrete results of the projects, such as rejections of agricultural exports or the opening of new markets.

It also suggests having, at the country level, an estimate of public expenditure on health and in-care in relation to various indicators (such as rural public expenditure, agricultural GVP, cultivated agricultural surface, heads of livestock, etc.); having estimates of the private sector contribution via fees and tariffs paid for health services, in relation to various indicators (such as total public expenditure on health, agricultural GVP, etc.).

On the other hand, it also suggests including indicators such as the level of residues of pesticides and veterinary drugs in locally consumed foods and indicators of the health of people affected by the application of agricultural inputs. Having ex-post cost-benefit evaluations of the intervention strategies of pest and disease eradication campaigns, in different areas of a country, or of different pests/diseases, helps to plan future campaigns knowing which areas or which products to prioritize. Finally, it recommends having information that allows measuring the benefits of campaigns by producer size (IDB-OVE, 2015).

1 The term innovation refers to the "moment in which the appropriation via the market or not of products, services, processes, methods and systems that did not exist previously, or with some new characteristic different from the current one, is verified" (Avila and others, 2007, p. 9).

2.3. Evaluations of health programmes in other countries

To define the methodology to be used in the Procem impact evaluation, in addition to taking into account the previous recommendations of the IDB and of Flavio Avila et al (2007), the methodologies and indicators used in the recent evaluations of health programmes in Peru, Mexico and Guatemala are presented.

2.3.1 Peru

Lino Salazar et al (2016) present an analysis of the impact of the Fruit Fly Eradication Programme using the Geographical Discontinuous Regression method. This statistical method was possible to implement because the Programme has advanced in stages along the coastal zone of Peru.

In this country, the pest is present in the production areas, affecting yields and quality, so producers must carry out sanitary treatments to control it. Producers' knowledge about the pest and its biological cycle is a relevant element for fly control in the productive areas of Peru.

The impact evaluation of the Programme took into consideration, through surveys, the knowledge achieved by the producers since its implementation.

This programme was implemented in three phases, from 1998 to 2014, and covered more than one million hectares of agricultural land and 150,000 hectares of host crops in the coastal zone (Senasa, 2015). The programme started in 1998 in the southern regions of the country (bordering Chile) and has been gradually expanded to the northern regions. For each phase, an intervention zone is defined and all agricultural valleys within that region are treated, as leaving valleys untreated imposes serious risks in terms of pest prevalence. Once a phase is concluded and the area is treated, a subsequent treatment region is identified, adjacent to the region addressed in the previous phase.

This implementation strategy generates limits or boundaries of intervention, with treated and untreated agricultural valleys on either side of the boundary. Therefore, the intervention boundary establishes an allocation rule defined by a geographic discontinuity that allows the use of a Geographic Discontinuous Regression (GDR) approach to estimate the Programme impacts. This approach is valid as the determination of the programme boundaries is not related to factors such as pest incidence, crop varieties, farmer or stakeholder characteristics. Specifically, the location of the border is determined simply by budgetary constraints and geographic continuity. This implies that selection within the programme resembles a *randomized control trial* (RCT) process in the vicinity of the intervention border. Therefore, it is expected that agricultural producers in the environment near the border will be similar in terms of their observable and non-observable characteristics (Salazar et al., 2016). This study, carried out in Peru, concludes with respect to the difficulties of primary eradication.

and, therefore, the necessary public participation:

> The challenges related to private pest eradication are threefold. First, the presence of *information asymmetries* prevents farmers from acquiring appropriate knowledge about prevention and control measures, as well as the consequences related to the high prevalence of the pest. Secondly, maintaining a low prevalence of the pest and the existence of free zones requires constant monitoring and control of the transport of host products, imposing serious *coordination problems*. Finally, the presence of externalities is likely to influence individual behaviour. In fact, the benefit of implementing

prevention and control measures by an individual producer will depend heavily on the decision of nearby producers to implement similar measures. Given the difficulties related to private eradication, Senasa - the Peruvian national phytosanitary authority - initiated the Fruit Fly Eradication Programme in 1998, which aims to declare the Peruvian coastal area free of the pest. (Salazar et al., 2016, p. 6)

2.3.2. Mexico

Mexico's Director General of Plant Health highlights:

> Plant health is a fundamental, though intangible, asset for agricultural producers of fruit and vegetables who are susceptible to attack by pests that are regulated by countries that are major importers of these products. In particular, Mexico's status as a Mediterranean fruit fly free country is a *public good that in* itself allows access to fruit and vegetables that Mexico exports to countries such as the United States and Japan, among others, which have the most attractive markets for Mexican exporters of dozens of fruit and vegetable products.
>
> The public good nature of Mexico's phytosanitary status, with respect to Mos-Camed, from which thousands of producers of dozens of products grown throughout the country benefit, fully justifies the use of public funds from the federal government, to maintain the status of a country free of the Mediterranean fly, which is present in the territory of neighbouring Guatemala, and to prevent its populations from advancing into Mexican territory. Since 1977, the Mexican Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food has operated a programme that has been successful in establishing a containment barrier to the possible advance of the pest from Guatemalan territory into Mexican territory. (Trujillo, quoted in Salcedo Baca D, 2009, p. 4)

The following methodology was applied in this work:

> A retrospective model was designed based on the one developed by FAO/IAEA (2007): *Cost Benefit Anaysis Model*: *a Tool for Area-Wide Fruit Fly Management*, which aimed to evaluate comprehensive fruit fly control programmes, based on the sterile insect technique (SIT). For the model used, historical figures of the variables considered, costs of the Programme and direct and indirect benefits generated were taken into account in the calculation of the following economic indicators: benefit/cost ratio (B/C), net present value (NPV), internal rate of return (IRR) and investment recovery period (RP). (Salcedo Baca, 2009, p. 7)

The indicators used are:

> The direct costs to be quantified under the various scenarios include operating and investment costs for the Medfly eradication (1978-1982) and containment strategies (1983-2008), which include costs of sterile fly production, field operations and administration. It also includes the corresponding part of the cost of the Preventive System and National Emergency Device against Exotic Fruit Flies, as well as the network of phytosanitary inspectorates established throughout the country, through which the movement of plant and animal products is controlled, contributing to the phytosanitary surveillance against this pest. All costs are handled in dollars. (Salcedo Baca, 2009, p. 39)

Direct cost indicators:

- Cost of sterile fly.
- Cost of field operations.

- Administrative costs.
- Cost of prevention and emergency system.
- Sanitary barrier.

The direct benefits of effective control of the Mediterranean fruit fly include increases in the volumes and net value of fruit and vegetable production, as well as increased volumes and net values of exports because they come from a pest free area (Salcedo Baca, 2009).

Indicators of direct benefit:

- Increase in the volume produced.
- Increase in net production value (considered as the difference between gross production value and production costs).
- Increase in the volume exported.
- Increase in net export value.

Among the indirect benefits or costs saved by the country through the operation of the Medfis programme, they are considered and quantified: *1)* impact on human health due to the exposure of the rural population to insecticides; *2)* effect on the maintenance and generation of employment in the production of fruits and vegetables, primary hosts of the Mediterranean fruit fly; and
3) reduction in the damage to the environment brought about by moderate insecticide use. Within this last point, the impacts on: *a)* natural enemies, *b)* pollination and *c)* beekeeping are quantified (Salcedo Baca, 2009).

Indicators of indirect profit:

- Reducing the impact on human health.
- Increase in employment in the fruit chain (as a result of increased production and exports)
- Reduction in the use of agrochemicals, reduction in environmental damage, measured through the presence of natural enemies and the activity of bees in pollination and as an economic activity (beekeeping).

Finally, the study makes a causal analysis:

As a complement to the economic evaluation mentioned above, and in order to statistically corroborate the cause-effect relationship between the Medfis programme and the different benefits attributed to it, this study also runs simple linear regression analyses, considering the following function: **Y= f (x) + e**

Where:

Y= Dependent variable represented, separately, by the direct and indirect benefits generated by the Medfis programme in the last 31 years, considered in this study through 1) The net value of national production and exports of fruit and vegetables, primary hosts, of the Mediterranean fruit fly, 2) Savings in the environmental costs of the rural population potentially intoxicated by exposure to the insecticide Malathion, 3) Savings in the elimination of natural enemies that leave secondary pests uncontrolled to the detriment of the crops, 4) savings in the elimination of biological pollinating agents that benefit crops through the transport of pollen, 5) savings in the indiscriminate use of insecticides to control the Mediterranean fly if it becomes established in the national territory, and 6) savings in the negative impact of insecticide application on beekeeping.

X= Independent variable, represented by the Medfisk Programme, conceptualized here in relation to the budgets and investments it has made through the financial resources contributed by Mexico, the United States and Guatemala during the period 1978-2008.

e= random term that does not explain the Programme.

From the statistical point of view, through the technique of regression analysis it is possible to explain how much of the behavior or variation of the dependent variable, represented by the unit in which the variables are handled, causes it or depends on the independent variable (changes represented by the value of the parameter Beta). Likewise, this analysis is useful to show to what extent the Medfisk Program is statistically significant to generate variability in the benefits determined here, represented by the parameter R2. (Salcedo Baca, 2009, p. 43)

2.3.3. Guatemala

This research combines a retrospective analysis of the programme for the period 1978-2011, and a projection of the programme for a ten-year horizon (period 2012-2021).

The projection is made for three scenarios: *a)* the trend of the program continues; *b)* an eradication scenario of the pest reaching a free area in year 10; *c)* the Medfly Program stops operating in Guatemala.

To quantify the impacts generated by the Medfly Programme in Guatemala, a retrospective model from 1978 to 2011 was used, which considered historical data on the costs of the Programme and the benefits related to the production and exports of the host crops of the Medfly that have benefited from the Medfly Programme in that Central American country. Similarly, the effects of the Programme in Belize from 1992 to 2011 were evaluated retrospectively. To measure the effects of the Medfly Programme in Guatemala, Belize and Mexico, from 2012 to 2021, the benefits were projected in terms of the net value of national production and exports of host crops in each country, while the costs took into account the data provided by the Medfly Programme in Mexico, and those set out in the 10-year Strategic Plan for the eradication of the Medfly in Guatemala, for that country and for Belize (IICA, 2013). In order to measure the impact and fulfillment of the objectives mentioned above, the following evaluation will be carried out

The following scenarios were presented separately:

1. The economic impact of the Medfly Programme in Guatemala over the next ten years, taking into account the trend in production and exports of Mediterranean fly host crops, as well as the expenditure and investment that the United States of America, Mexico and Guatemala will continue to make in this Central American nation, as they will do until 2011 (*status quo*).
2. The economic impact of the Medfis programme in Guatemala from 2012 to 2021 as As a result of the eradication of the Mediterranean fruit fly from its territory and, with it, the possibility of producing and exporting greater volumes of the host crops; assuming that the Programme has the financial resources necessary to cover the costs of the plan and that the whole country is considered a free area within ten years.
3. The economic impact on Guatemala if the Medfis programme were to cease operating in its territory over the next ten years.

The same is true for Medfis in Mexico, Belize, the region (Guatemala-Mexico-co-Belize) and, finally, the United States, the analysis of continuing financial support for the Programme for the region versus the advance of the pest in its territory.

In estimating the impacts of the two scenarios for the United States, and APHIS-USDA's personnel management, rather than quantifying the associated costs and benefits

> The number of outbreaks and the cost of eradicating them in the United States over the next 10 years were estimated for the Medfly Programme, as was done for Guatemala, Belize and Mexico, and compared to the cost of continuing to support the implementation of the Programme in Guatemala. (IICA, 2013, p. 86)

The cost and benefit indicators are the same as those used in the work of Salcedo Baca and others (2009).

The outcome measures, benefit/cost ratio and Net Present Value, were calculated for domestic production of the host crops and exports of the same.

The unfavourable effects of the conditions that favoured the growth of the pest and the reduction of resources in Mexico are noteworthy.

> In practice and historically, in years favourable to the pest (i.e. hot, dry weather conditions and increased availability of coffee due to low market prices) which have been combined with levels of funding below requirements, the Mediterranean fruit fly has been able to invade large areas of territory in a short time. (IICA, 2013, p. 72)

The conclusion reached by this study was the following:

> Of the three scenarios evaluated for the period 2012-2021 (*status quo*, eradication of Mediterranean mosquitoes from Guatemalan territory, and exit of the Guatemalan Medfly Programme due to lack of resources to operate it), the one that contemplated the eradication of the pest turned out to be the most profitable and the one recommended to be implemented due to the economic benefits it would generate for the country -mainly employment, economic growth in its agricultural sector and foreign exchange- and for the rest of the cooperating countries (less risk and pressure in the detection of fly outbreaks). (IICA, 2013, p. 180)

3. The Procem Programme in Patagonia

The National Programme for the Control and Eradication of Fruit Flies (Procem) was set up under the auspices of the IASCAV (now Senasa) by Resolution No 134/94.

3.1. Objectives

Main: to declare different regions of the country free of fruit flies with international recognition.

Derived from the main objective, mentioned above, there are others of second degree and, in addition, a set of expectations of economic and also social scope (Funbapa, 2008):

- To achieve that the Free and Released Areas of Fruit Flies are recognized as such by International Phytosanitary Authorities, and their fruit and vegetable offer competes without restrictions in foreign markets.
- Increase exports from restricted market access for products from areas not recognised as fly-free.
- To reduce export costs and thus improve the competitiveness of regional fruit on international markets.
- Reduce agrochemical treatments and, as a result, all costs associated with their use: operational, social and environmental.
- To favour regional fruit and vegetable diversification as a consequence of competitive improvements for the entry of new products in attractive markets.
- To increase investment in the sector, allowing for a greater demand for labour and the consequent impact on the region's socio-economic development.

Among the potentially accessible markets after achieving the status of Fruit Fly Free Region are (Funbapa, 2008):

- Countries and regions that, due to their geographical location, require exports to be made through the Pacific, that is, using the commercial circuit via Chile. These markets include: the west coast of the USA, Mexico, Colombia, Peru, Ecuador and South East Asian countries.
- The demanders of fine fruits (cherries, blueberries, raspberries and strawberries, among others) and, partially, of some stone fruits (peaches, plums) whose export must be done by air, which does not allow the quarantine treatments to be carried out.

3.2. Intervention strategy

To achieve these objectives, the Programme was structured to cover the whole country, gradually covering the regions where fruit and vegetable crops are produced with economic potential that justifies the implementation of the eradication and control programme. The intervention strategy was based on a strong regionalisation of the Programme, with an overall concept of centralised coordination and fully decentralised implementation. To this end, five regions were defined on the basis of orographical and ecological characteristics combined with surface area, distance and ease of communication.

At the beginning of the Programme in the region, the objective was to achieve international recognition of Patagonia as a Fruit Fly Free Area. The current objective is to maintain the international recognition of Fruit Fly Free Area, of economic importance, for the whole of Argentinean Patagonia (Funbapa, 2016).

The original organization:

> Within Funbapa, the Plant Health Commission, composed of Senasa, the Federation of Producers of Río Negro and Neuquén, the Argentine Chamber of Integrated Fruit Growers (CAFI) and a representative of the provinces that are part of the Patagonian region, is responsible for establishing the general objectives and approving the different operational programmes. The National Atomic Energy Commission, the Institute of Health and Quality of Mendoza, the National Meteorological Service, the National Institute of Agricultural Technology (Inta) and the National University of Comahue all participate actively in this programme. At the international level, the Food and Agriculture Organization of the United Nations (FAO), the International Atomic Energy Agency (IAEA), the United States Department of Agriculture and the Livestock Agricultural Service (Chi-le). The support of the CNEA and Inta made it possible to establish an agreement with the International Atomic Energy Agency (IAEA), which resulted in the elaboration of a work plan with the participation of international experts. (Villegas Nigra, 1999, p. 2)

The current organization maintains the original scheme. The Plant Health Commission (CSV) remains the body that defines the strategy of the programme each season. Senasa has ceased to be a formal member of the Plant Health Commission in order to assume the supervisory role of the Programme. Among the institutions, the National Meteorological Service no longer plays an active role and other institutions have a role as consultants or regulatory support. Table 2 shows the most relevant facts since the beginning of the Programme in Pata-
gonia (Annex I).

Table 2. Procem Patagonia timeline

Date	Administrative act	Content
22/03/94	**134/94 IASCAV**	**The Procem is created.**
10/02/99	**194/99 Senasa**	**Declares the Andean Patagonian Valleys a Tephritidae free area.**
16/11/01	**515/01 Senasa**	**Categories are established for the areas: i- diagnostic stage, ii- under control, iii- low prevalence, iv- free area.**
02/02/04	**4/04 Senasa**	**Declares the Patagonia region an Anastrepha-free area.**
04/12/06	**18/06 Senasa**	**Declares the Valleys of Patagonia a Tephritidae free area.**

Source: Own elaboration based on data from Funbapa's Memoirs.

The most important event was the recognition in 2005 by the United States government of Patagonia as a Fruit Fly Free Area (Final rules USDA APHIS, Federal Register, Vol 70 No. 235).

> This recognition crowns years of field work and arduous administrative procedures, which undoubtedly bring great benefits to the region... The presence of the Mediterranean fruit fly (Ceratitis capitata Wied) in some urban areas of Patagonia represented, for many years, a phytosanitary barrier in the international fruit trade, preventing access to new markets and the expansion and diversification of crops. Export to the United States and binational agreements signed with other countries required complex and costly quarantine treatments, such as bromide fumigation of

> methyl or cold treatments in transit, which could only be carried out on USDA-approved ships, with the consequent increase in the cost of freight... Although the whole area is included in the Free Area status, the ecological conditions and their influence on the biology of the pest permittee divide it into two zones: the **Andean Patagonian Valleys**, where the pest is included in the FAO definition of "Non-Active Transitional", and where no control measures are applied in case of capture; and the **Northern Patagonia** area, where in case of capture in urban areas of commercial production zones, eradication is carried out through the Phytosanitary Emergency Plans. (Funbapa, 2005, p. 52)

In March 2013, Chile recognizes Patagonia as a Fruit Fly Free Area (EXEMPTION RESOLUTION 1279/2013. SAG-CHILE). Prior to this recognition, and since 2009, Patagonian fruit could transit through the neighbouring country (Bilateral Protocol, Regulated Transit System). In 2002, through EXENTA Resolution 441/2002, it recognised the Andean Patagonian Valleys as a free area.

In 2000, the bilateral agreement with Israel recognizing Patagonia as free of Anastrepha was carried out.

Progress has been made on agreements with Mexico, China, India, the Philippines and Indonesia.

From the point of view of the Programme's operating cost, a relevant fact is Senasa's contribution of a large part of the trapping inputs and agrochemical products for several years and the sterile fly in its entirety from 2016.

3.3. The plan of activities

The main activities developed by the Programme are (Funbapa, 2017):

- Detection, by trapping and sampling: through the Official Monitoring Network, the traps are visited weekly, and sent to the laboratories where the identification and counting of the captured material is carried out. Samples are also collected from regional hosts and in fruit introducers (concentrator markets, Mayan markets and small markets), this material is sent to the Dissection Centers for analysis. All the information generated is processed in the Programme's Systems Area producing, from there, the corresponding Weekly Reports that reflect the Programme's current evaluation rates. The weekly reports that are issued are Report for Productive Valleys in weekly and monthly form; Report for Chile and other Spanish-speaking countries (weekly); Report for the United States APHIS-USDA, in English (monthly). Monitoring reports on quantity and quality of sterile flies and other preventive controls are also issued (Funbapa, 2007).
- Preventive control of the pest, through the use of the Sterile Insect Technique (SIT), as well as the application of chemical baits. These actions are carried out in those localities that imply a greater risk of re-entry of the pest, fundamentally due to the flow of people and/or goods.
- Staff training, both internal and external. In the areas of insect identification and field operations.
- Institutional communication campaigns, both inside and outside the Protected Region, through radio, print and short television media.
- Internal quality control that ensures the proper functioning of the Programme in time and form. Controls to the field and laboratory personnel to observe and evaluate the procedures and knowledge that were transmitted to them, and to make corrections, if necessary.
- Immediate Action Plans - Emergency Plans follow the guidelines defined in resolution DNPV 152/06, delimiting a regulated area in which an additional trapping network is installed, chemical applications and additional release of sterile flies are made, and the movement of host fruits to and from the regulated area is regulated.

3.4. Emergency Plans

Since the declaration of a free area in 2005, five emergencies have occurred, the most recent being described below:

- 2016: In 2016, an Emergency Plan was implemented in the urban area of the city of Neuquén. Once the capture of Mediterranean flies in Neuquén was confirmed, Senasa started a Phytosanitary Emergency Plan. The Plan involves tasks at the level of Field Operations, Quarantine Regulation of host products and Control of the production involved in the area of influence.
  The trapping network was intensified, the release of sterile flies focused on the domestics near the outbreak and applications of insecticide bait were made in urban and domestic trees. Host fruit was intensively sampled for possible larval foci and any fruit possible to be affected within a 200m radius around each fly capture was removed and destroyed.
  Control posts were installed at the entrance and exit of the protected area supported by mobile patrols that travelled along the alternative roads.
- 2015: Five Immediate Action Plans (IAP) were registered, which are executed upon the interception of a fertile male or non-pregnant female (single capture) of *Ceratitis capitata*. Unlike an Emergency, the areas delimited and the number of additional traps installed are smaller. Furthermore, it does not imply the initiation of control actions.
  In March, a second detection of a female non-inseminated adult Mediterranean fruit fly was confirmed in a trap in the urban area of Villa Regina. Senasa initiated a Phytosanitary Emergency Plan through Resolution 98/2015.
- 2011: The trapping and sampling network was increased in the town of Villa Regina, with a total of 300 traps that completed 5 924 checks in the work area, until the emergency ended on November 15. The release of sterile flies was also intensified**.**
- 2009: In the peri-urban area of General Roca, the Phytosanitary Emergency Plan was launched on 14 April. A Regulated Area was defined, an additional trapping network was installed, fruit samples were taken, bait applications were made, turning and soil insecticides were applied, fruit was destroyed and host fruit movements to and from the Regulated Area were regulated. Once all formal requirements were met and in the absence of new detections, the Emergency was terminated on November 17, 2009.
- 2006: During 2006, the first Plant Health Emergency Plan was implemented in the country. This first experience at a national level came about as a result of a plague outbreak in the town of Cinco Saltos, in the Upper Valley, and the success of the tasks carried out made it possible to maintain the status of Free Area.

3.5. Information on the implementation of the Programme

The following are the main operational indicators of the Programme in Patagonia, through the number of traps used, the amount of material sampled corresponding to host and introducer products (in quantity and kilos), the release of sterile flies and the amount of chemical products applied in the last season considered (2016/2017) in this study. These data can be taken as a reference for the actions carried out between 1997 and 2017. Finally, the staff involved in the tasks of the Procem Patagonia is also analysed.

3.5.1. Phytosanitary Surveillance and Alarm

The total number of traps in operation, on average, between 1996 to date, was 2,300, fluctuating between 2,200 and 2,300. During 2107 there were 2,211 traps distributed in 82 localities in Patagonia, of which 1,091 were located in urban areas and 1,120 in rural areas, according to the following detail:

Table 3. Number of traps year 2017

Zone	Traps		
	Urban	Rural	Totals
High Valley	536	646	1 182
25 May and Catriel	35	25	60
Middle Valley	57	125	182
Colorado River Valley	35	38	73
Conesa Valley	17	33	50
Lower Rio Negro Valley	69	45	114
South of Buenos Aires	54	27	81
South of Rio Negro	41	4	45
Patagonian Plateau	100	45	145
Andean Patagonian Valleys	147	132	279
Total	1 091	1 120	2 211

Source: Funbapa

The traps and attractions used in this period are

- Jackson trap with attractive trimedlure, cuelure or methyl eugenol.
- Mc Phail type trap with attractive torula pellets, with three components (Biolure®) and/or TMA (amine salts) card.

3.5.2. Fruit sampling

Two types of sampling were carried out:

Host sampling: It was carried out in all the locations of the Programme aimed at cultivated or wild fruit fly hosts.

Sampling in Introducers or Quarantine: It was carried out in the introducers (markets with centrers, vegetable shops, wholesalers) that enter fruit and vegetables to the protected region.

These trapping and sampling actions, by the year 2017, demanded the work of a total of 29 *full* and *part-time* monitors who performed a total of 63,987 tram readings. The Adult Identification Laboratories and Dissection Centers located in Inta Alto Valle, RN - Allen Fruit Growing Secretariat, Funbapa Viedma, Agriculture Directorate in Gaiman-Chubut and Senasa Bariloche, demanded the work of eight laboratory staff responsible for processing the traps coming from the field, in addition to the dissection of 9,440 fruit samples from hosts for a total of 2,951.71 kg composed of 62,081 fruits. In addition, 6,911 samples taken from fruit introducers and risk points were processed for a total of 3,214.01 kg of 19,436 fruits.

Table 4. Material sampled in 2017

	Hosting samples			Sampling in introducers		
Zone	No. of samples	Kgs of fruit	total number of fruits	No. of samples	kg of fruit	total number of fruits
High Valley	7 501	1 907,75	49 188	4 491	1 709,34	10 045
25 May and Catriel	55	32,45	145			
Middle Valley	393	273,52	2 826	596	398,99	2 297
Colorado River Valley	203	228 49	1 798	247	224,97	1 279
Conesa Valley	217	114,58	1 013	264	91,35	561
Lower Rio Negro Valley	448	170,12	2 575	211	76,26	702
South of Buenos Aires	312	138,74	2 690	516	260,44	1 492
South of Rio Negro	117	23,66	516			
Patagonian Plateau	196	62,40	1.330	468	403,95	2 720
Andean Patagonian Valleys				118	48,72	340
Total	9 440	2 951,71	62 081	6 911	3 214,01	19 436

Source: Funbapa

3.5.3. Phytosanitary Control

Due to its status as a Free Area, the Procem Patagonia adopts the strategy of Sterile Insect Releases (TIE). For this purpose, the TSL Vienna 8 temperature genetic sexing strain is used. 60 shipments were received from the Insectarium of the Province of Mendoza. The release began on Thursday, October 20, 2016, and ended in May 2017, in localities of Alto Valle, 25 de Mayo-Catriel, Río Colorado, General Conesa and in the South of the Province of Buenos Aires.

The preparation of the material for the release of the Sterile Insect in the above mentioned locations required the work of eight bagging assistants and one person responsible for the quality control of the released fly. In total, 664,487,798 sterile pupae were released. Part of them were released by land, by the Programme's brigades, and part by air, through a company contracted for this purpose, which required 80 flights totalling 141 hours and 54 minutes.

The weekly sterile insect release followed an average of pupae released according to the following scheme:

Table 5. Sterile Insect Technique, released pupae, year 2016/2017

AREA	No. of cities	Area (ha)	Total pupae released per week
High Valley	9	12 124	19 000 000
May 25th/Catriel	2	840	700 000
Colorado River/La Adela	2	900	950 000
General Conesa	1	150	200 000
South of Buenos Aires	6	890	1 150 000
TOTAL	20	14 904	22 000 000

Source: Funbapa

During the months of March, April and May, based on the positive sampling data of the barrage, the decision was taken to carry out localised releases in areas of possible risk of re-entry of the pest that corresponded to the localities of Carmen de Patagones and Viedma. This was carried out with programme staff through a redistribution of the sterile pupa received

The last date of release of sterile flies was May 22, 2017 in the Alto Valle de Río Negro and Neuquén.

These actions of Autocide Control were complemented with cultural and chemical control in a preventive way as well. Applications of insecticide-bait (active ingredient Spino- sad) were carried out on the aerial part of the trees. Spinosad is a product of the fermentation of a fungus, being one of the products of less toxicity and minimum environmental impact in the market.

These actions demanded the work of a total of 22 workers, including Chiefs and Brigade Assistants. A total of 18,805 litres of bait insecticide, 350 litres of soil insecticide, and a total of 24,335 kg of fruit were destroyed, distributed as follows:

Table 6. Insecticide applications, years 2016/2017 (not including that used in emergencies)

Zone	l of bait	kg of fruit
High Valley	6 680	17 985
25 May and Catriel	0	0
Middle Valley	690	503
Colorado River Valley	100	200
Conesa Valley	0	0
Lower Rio Negro Valley	2 400	3 695
South of Buenos Aires	650	1 837
South of Rio Negro	0	0
Patagonian Plateau	2 075	115
Andean Patagonian Valleys	0	0
Total	12 595	24 335

Source: Funbapa

3.5.4. Staff

During the 2017 season, 62 people were involved in the operational part of the Programme. The administrative management is carried out by Funbapa's staff.

3.6. The Sanitary Barrier

The objective of the Patagonian Quarantine System is to prevent the entry of pests and diseases that are harmful to agricultural production in the protected region, applying the necessary measures and zoo-phytosanitary actions to establish, protect and maintain the area free of pests and diseases with international recognition, contributing, in addition, with the control of the quality and agro-food health (Memorias Funbapa).

Controls on the entry of products of plant origin are part of the National Program for the Control and Eradication of Fruit Flies and, since the beginning of this program, the Quarantine System has provided the necessary quarantine security for certification and maintenance of the Free Area (Memorias Funbapa).

The control of cargoes leaving the Patagonian region is based on the need to guarantee the origin of fruit and vegetable products by means of the perception of the Guide of Origin and

the proof of payment of the Obligatory Contribution Fee. In addition, compliance with existing regulations regarding the authorisation of packing sheds and the identification of the packaging of regional products is required.

As for operations, 47 entry and exit points are controlled in the region. In addition, the Patagonian Quarantine System Flying Patrols carry out control and inspection tasks by operating on alternative roads to the checkpoints.

At the checkpoints, a fee is charged for the disinsectisation of the vehicles. Since 2015, the barrier has been the responsibility of Senasa, resolution 422/2014 Senasa. Until that time... Its functioning was under the orbit of Funbapa.

In addition, the health agency recommends the destruction of fruit in urban areas. Fruit tree owners should be aware that certain pests can affect not only their fruit trees, but also the health status of regions protected against fruit flies. Citizens can help by collecting fallen fruit and fruit that they will not eat. These should be buried at a depth of no less than 30 centimetres or placed in strong, closed containers for later transfer to an appropriate site for destruction. [1]

3.7. Financing

3.7.1. Procem Patagonia: the contributive canon

In 1995, by means of resolution 271/95 of the IASCAV, it was agreed between the Argentine Chamber of Integrated Fruit Growers, the Federation of Producers of Río Negro and Neuquén and the Argentine Chamber of the Industry and Export of Apple, Pear and Related Juices to set a contributive fee for the control and eradication of pests to sustain the programs for the Control and Eradication of Fruit Flies (Procem) and the Program for the Control of Carpocapsa (*Cydia pomonella*, L.). Over time, this fee was updated to cover the costs of both programs. more (Table 7).

Table 7. Value of the contributive canon

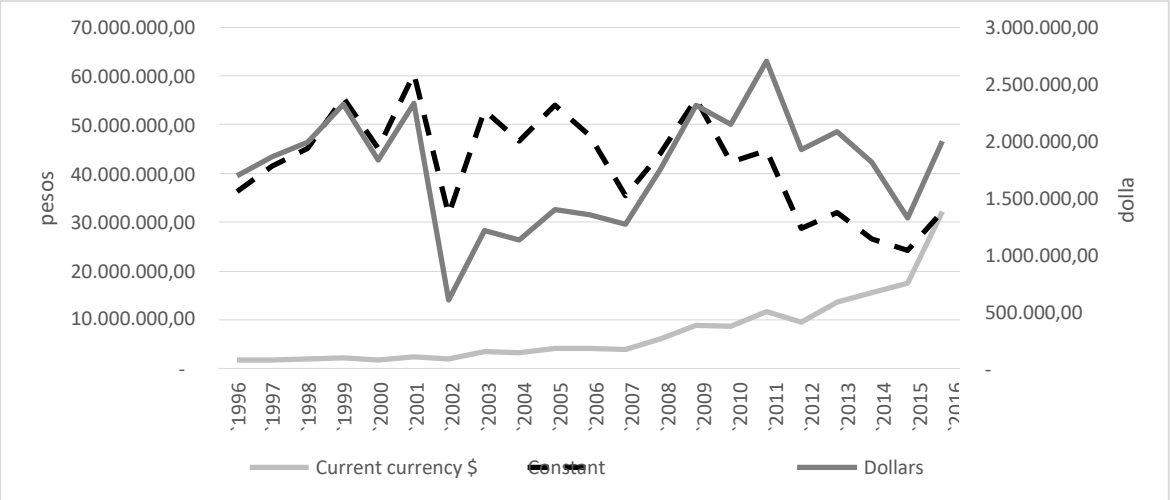
Date	Amount of fee ($/t fruit)	Resolution
11/12/95	1,25	271/95
25/02/97	1,50	93/97
05/02/03	2,50	120/03
16/11/07	3,80	371/07
19/02/09	6,30	129/09
05/10/11	8,00	1017/11
21/03/13	10,00	416/13
05/03/14	12,50	90/14
05/05/16	20,00	168/16
12/04/17	26,51	75-E/17

Source: Own elaboration based on info-leg (Annex II)

1 http://www.senasa.gob.ar/senasa-comunica/noticias/personas-con-frutales-en-sus-casas-pueden-controlar-la-mosca-de-los-frutos

Chart 1 shows the evolution of the annual collection of taxes since its implementation. The values deflated, using the CPI for Neuquén, are expressed in December 2016 currency. From 2009 onwards, there has been a decrease, in constant currency, as a result of the decline in regional production. Expressed in dollars, it has fluctuated between 1.5 and 2 million per year.

Graph 1. Evolution of fee collection, in current and constant currency and in dollars



Source: Own preparation based on data from Funbapa's annual balance sheets

3.7.2. Sanitary-revenue barrier

Resolution Ex-IASCAV No. 258/95 establishes that all cargo, passenger and vehicle transport in general will be de-insecrated before entering the protected region. Resolution No. 129/97 establishes the costs of disinsectisation of means of transport of cargo, passengers and vehicles in general and the loads of sanitary risk that enter the Patagonian Zoo-Phytosanitary Barrier.

The average annual revenue is approximately 4.5 million dollars (Funbapa's estimate).

For the purposes of the evaluation of Procem Patagonia, 50% of the total cost of the barrier is assumed, the rest is assumed to influence the animal health aspect (foot and mouth disease).

4. Aim of this study

Twenty years after the start of Procem, the aim is to measure the changes originated in the fruit sector of the Patagonia region.

The objective is to identify and quantify the benefits that the Programme has generated for the region in relation to the costs required for its operation.

In addition, two possible scenarios of the evolution of the programme and the results of each of them are analysed.

5. Procem Patagonia impact assessment methodology

In Patagonia, the pest is mainly found in urban areas, in backyards, so fruit growers do not include products to control fruit flies in their health plans.

Although there are many species of fruit flies, the only one detected, before the definition of a fly-free area, in some urban areas of the Patagonian region is the Mediterranean fruit fly (*Ceratitis capitata* Wiedemann). In rural areas, the intense cold, insecticide treatments aimed at other insects, cultural work, etc., do not allow the evolution of the pest. In rural areas, intense cold weather, insecticide treatments aimed at other insects, cultural work, etc., do not allow the pest to develop. The phytosanitary campaign carried out in the Patagonian region is of regional coverage, of permanent duration and normal intensity (Villegas Nigra, 1999).

Taking into account that the Procem Patagonia acts territorially, that the presence of the pest occurs mainly in urban and suburban areas, it is not possible to identify producers with treatment and without treatment at the same time, as in the Peruvian case. On the other hand:

- There is no decrease in production as a result of the pest.
- Specific chemical treatments to control it are not carried out in the fruit groves.
- It follows that producers do not treat the pest at the level of their establishments.
- The functioning of the sanitary barrier is of great importance to avoid the introduction of the plague. Also, the monitoring tasks to detect and control its presence immediately.

The proposed methodology takes into account the evaluations carried out in other countries presented in item 2.3. and the impact study carried out at the request of Funbapa in 2008 which includes the following technical indicators for the evaluation of the Programme:

- Total number of fruit fly outbreaks detected (in general and by specific regions)
- Percentage of fruit fly outbreaks eradicated compared to those detected.
- Average reaction time to a confirmed fruit fly outbreak

From a commercial point of view, the suggested indicators focus on exports, disaggregated by type of fruit, productive region, final destination and means of transport. In general terms, it is proposed to observe:

- Tons exported per type of fruit.
- Target markets.
- Degree of diversification of the destination markets.
- Means of transport used in export.

Finally, they suggest adding the direct fiscal and labour impact of the increase in the volume of exports.

Following the suggestions made in the first analysis of the Programme (Funbapa, 2008) and the impact evaluation scheme for Medfis in Guatemala (IICA, 2013), it is proposed to make a retrospective analysis for the period 1996-2016. This analysis is made for the period before recognition (1996-2005) and for the period after recognition as a free area (2006-2016).

The meeting with representatives of the region's fruit sector[1] resulted in the proposal to analyse two scenarios for the next ten years:

Optimistic scenario

This scenario analyses the changes as a result of the continuity of the programme and the success in the negotiations to open new markets. Elements to be considered:

- Increase in the value of exports due to the opening of markets.
- Increased production and export of pips and cherries.
- Cost reduction: no quarantine treatment and more eco-friendly logistics through Chilean ports.
- The costs of the programme and the barrier remain at 2016 levels, considering an emergency plan per year.

Pessimistic scenario

This scenario analyses the consequences for the sector of the closure of the programme and, therefore, the loss of health status. Elements to be considered:

- The entire resource put in from 1996 to 2016 is lost.
- Fruit exported to markets that have the fly as a quarantine pest should consider the cost of quarantine treatment.
- The cherry could not be exported by air, so the increased supply to markets (where the fly is not quarantined) would lead to a drop in price.
- The possibility of opening markets would be lost.
- Difficult to quantify but there is a loss of market confidence in Patagonia's exports.
- The sector saves the annual cost of the programme and 50% of the annual cost of the barrier.

Retrospective Evaluation

Impact Indicators

The indicators defined for the determination of the Programme's cost/benefit ratio are

a. Direct cost indicators: Cost of sterile fly. Cost of field operations. Administrative costs.
   Cost of prevention and emergency system.
   Sanitary barrier: it is considered half of the cost of the barrier, the other half runs to the red area (meats). [2]
b. Indicators of direct benefit:
   Increase and maintenance of the volume exported to certain markets. Increase and maintenance of the net value of exports by reducing the cost of the quarantine system.
   Reduced logistic cost for exporting through Chilean Ports.
c. Indicators of indirect profit:
   Increase in employment in the chain, particularly in relation to exports to quarantine destinations.

1 Federation of Fruit Producers, CAFI, CAPCI, Senasa, Funbapa, COPEXEU, Inta, Province of Rio Negro.

2 Estimate made by Funbapa.

5.1. Cost indicators

The annual costs of the programme include a proportion of the cost of the Sanitary Barrier and the value of institutional contributions, in addition to the annual expenditure for the operation of the programme.

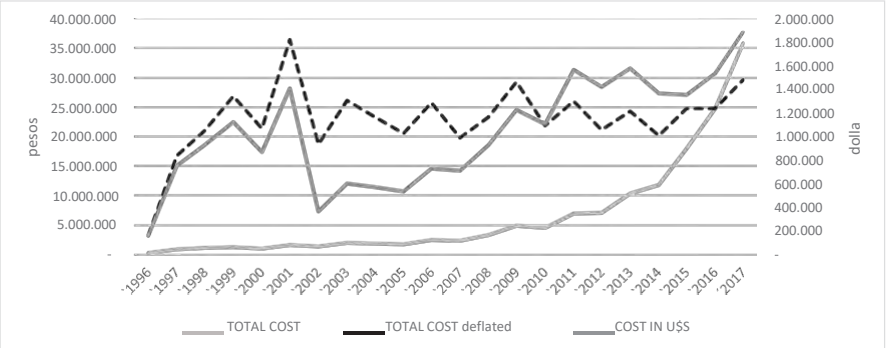
5.1.1. Annual Programme Costs

This indicator shows the information of Funbapa's annual balance sheets regarding the functioning of the Patagonia Procem (Annex III).

On average, the annual cost is more than one million dollars, approximately 20 million pesos (December 2016 currency).

Chart 2 shows the evolution of the cost of spending in current, constant and dual currency since the beginning. In dollar terms it has fluctuated between 0.5 and 1.8 million per year.

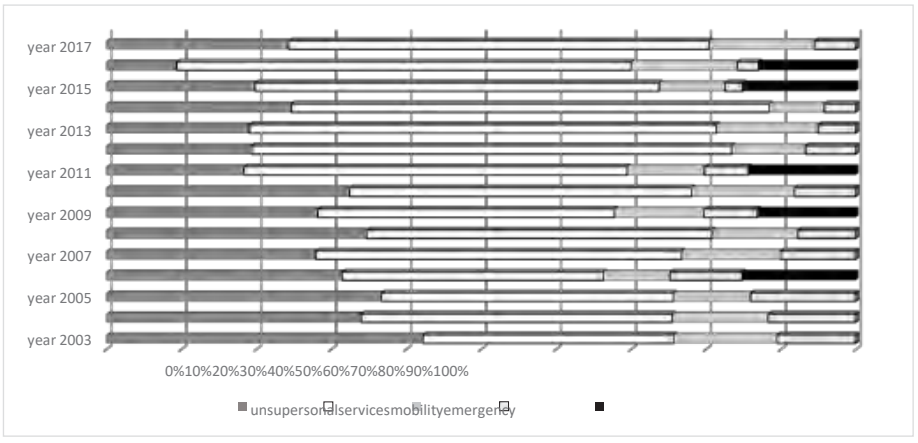
Graph 2. Evolution of the cost of the Procem in current, constant and dollar terms



Source: Own elaboration

Figure 3 shows the relative share of each item in programme costs. Staff has increased its participation, decreasing the relative incidence of inputs.

Figure 3. Impact of the main items on cost

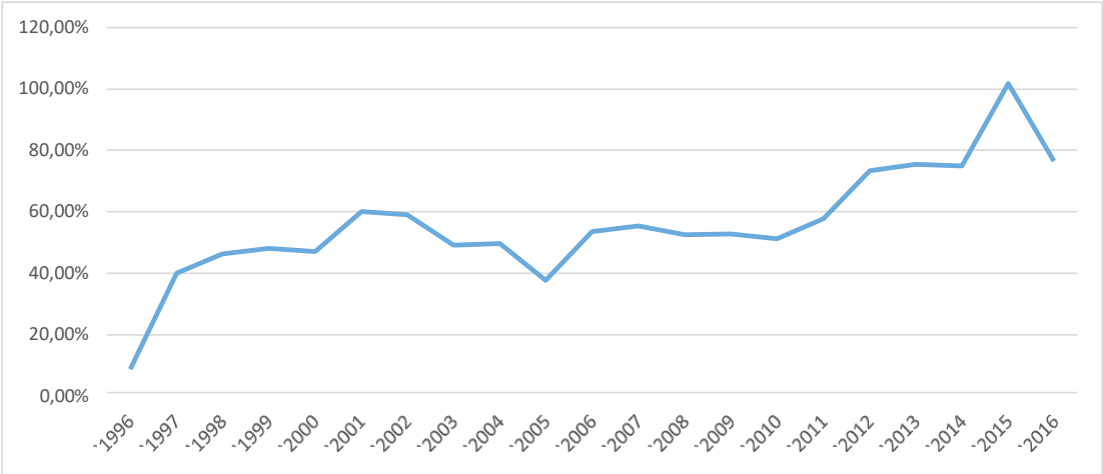


Note: Inputs include sterile flies, laboratory and office supplies, cleaning supplies, chemical brigade supplies, fuel, lubricant, monitoring supplies, clothing. Services includes fly release service, insurance, tickets, freight, electricity, gas, telephone, mail, rent, maintenance costs.

Source: Own preparation based on data from Funbapa's Balance Sheets.

An analysis of the outlay costs of the Procem Patagonia in relation to the collection of taxes shows a significant growth in incidence from 2013 onwards, reaching 100% in 2015 (Figure 4).

Figure 4. Total Procem/Contributory Canon Cost Ratio



Source: Own elaboration

5.1.2. Institutional contributions to the Programme

In addition to the costs actually incurred, the Programme has contributions from national and provincial institutions.

> The characteristic of Procem-Patagonia is that it is fed with personnel resources through the respective agreements agreed by Funbapa with different provincial or municipal organizations, having partially or totally, personnel belonging to the Provincial Governments of Rio Negro, Neuquén, Chubut, La Pampa, Santa Cruz and Buenos Aires. Senasa technicians are also partially affected. (Funbapa, 2006, p. 45)

The institutional contributions are divided into two main categories:

- Staff contribution, Funbapa complements the salary of the agents.
- Contribution in infrastructure, mainly laboratories and offices

Staff

The Provinces of Río Negro, Neuquén, Chubut and Buenos Aires have been contributing with personnel since the beginning of the Programme. These are made effective through provincial agreements with Funbapa. The personnel is affected in a partial or total way for field, laboratory or supervision actions.

Infrastructure

> Senasa: provides laboratory in Bariloche.
> Inta: there is an agreement with Inta whereby Inta provides a laboratory in the EEA Alto Valle. There were other contributions, not yet in force, related to the following topics: supervision of the operation of the agro-meteorological network, processing of data from the stations in a deferred time, technical advice on agro-climatic monitoring and information analysis, updating of equipment and computer programs for the operation of the network.

The Institute of Microbiology and Agricultural Zoology (IMYZA-CICA-Inta Castelar) controlled during a period that the percentage of sterility was higher than ninety-nine and eight percent (99.8 %).

Province of Río Negro: offices and laboratory of the Secretariat of Fruit growing (located in Allen). At the beginning, the Programme had in this place the office for the coordination, meeting room, offices for the monitoring chief, for the release chief, computer and administration room, bagging and emergency room for flies, fruit ripening room, quality control laboratory and supplies warehouse. The offices are currently located in General Roca, through a Funbapa-Provincial Water Department agreement.

Province of Chubut: facilities of the plant health laboratory based in Gaiman The identification laboratory and office of the region's brigadistas operate here.

For the quantification of these contributions, laboratories and offices are weighted with the equivalent of a rent, in the case of staff, the estimated salary including contributions (Table 8). The total contributions to the Programme are $3,806,000 per year (values as of December 2016), equivalent to $230,600 per year.

Table 8. Value of contributions to the Procem

Institution/Agency	Item provided	Value $/year
Province of Río Negro	Offices, laboratory	282 000
Province of Río Negro	Staff	1 300 000
Province of Chubut	Offices, laboratory	60 000
Province of Chubut	Staff	1 040 000
Buenos Aires Province	Staff	1 040 000
Senasa	Laboratory	42 000
Inta	Laboratory	42 000

Source: Own elaboration based on Procem Patagonia data

Note: the reference values used are for laboratory $ 3 500/month; for offices in Roca $ 20 000/month, offices Gaiman $ 5 000/month. Supervisory staff salary with contributions of $50,000/month; technical field staff salary with contributions of $40,000/month.

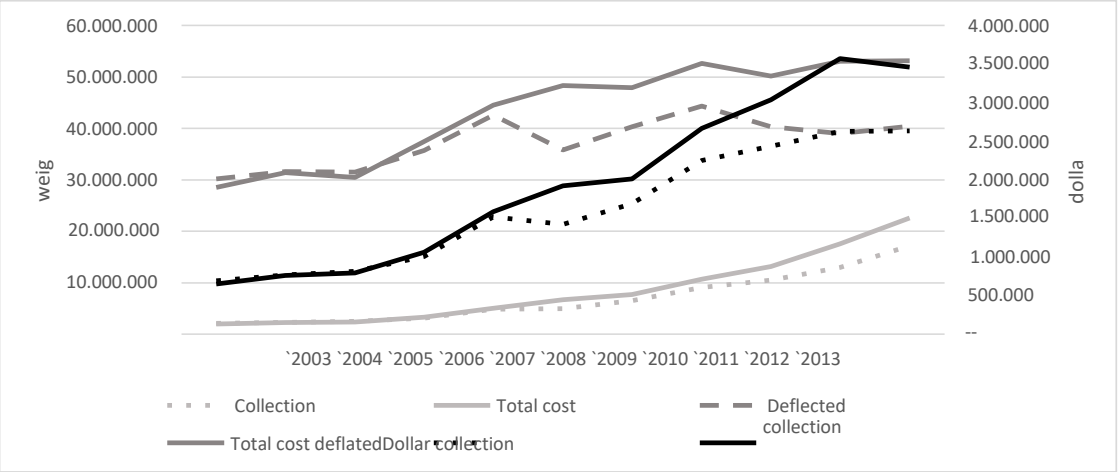
5.1.3. Cost of health barrier

Funbapa estimates that 50% of the barrier task is devoted to phytosanitary control, this is the percentage used to indicate the proportional cost of the zoofitoid barrier affected to the maintenance of the fly free area.

The total cost of the barrier in recent years, since it has been in the orbit of Senasa, averages eight million dollars, while the collection at the checkpoints is close to four or five million dollars. Applying the proportionality to the Fly Programme, we consider a barrier cost of four million dollars, half of which is financed by the collection of the barrier itself.

Figure 5 shows the evolution of 50% of the costs and collection of the barrier for the period 2003-2013 (Funbapa's balances). Since 2015, the barrier is administered by Senasa (Senasa resolution 422/2014).

Figure 5. Revenue and cost of the health barrier, proportion affected by flies



Source: Own elaboration based on Funbapa's data

5.1.4. Total cost and financing

The total annual cost of maintaining Patagonia as a free area is 5.54 million dollars, of which 72% corresponds to the barrier, 24% to the operating costs of the Programme and 4% to contributions from the provinces, Senasa and Inta.

This cost is financed in part by the collection of the barrier - $2.19 million - and the tax levy - $2 million - giving a total of $4.19 million.

With these values, the operational deficit is approximately 1.35 million dollars a year, explained by the functioning of the barrier that is not covered by the collection.

5.2. Indicators of direct benefit

Among the advantages of the free zone are mentioned:

- 5.2.1. Increase and maintenance of the volume exported to certain markets: entry to the USA through any airport or port, both on the East Coast (Atlantic) and the West Coast (Pacific), also taking advantage of exit through Chilean ports. Export to different countries of America from the Pacific coast, with the consequent decrease in export logistics. Incorporation of other products (cherries, fine fruits, etc.) Possibility of air exports.
- 5.2.2. Reduction of costs by elimination of quarantine treatment In addition, losses due to loss of quality due to this treatment are reduced.
- 5.2.3. Reduction of logistic costs: exports through Chilean ports are less expensive.

5.2.1. Exports to the USA and other Pacific Rim countries

As of the 2005-2006 season, with the recognition of the Fruit Fly Free Area by Senasa, the Government of the United States and, later, Chile, the possibility of incorporating other products and ports of departure was opened (Borges et al., 2016). Table 9 shows the evolution of exports from the free zone to the USA from that season onwards.

In addition, a recent newspaper article3 highlights the significant jump in fruit shipments from the Rio Negro Valley and Neuquén that left through Chilean ports. The volume of 8,620 tons as of 24 February 2018 shows an increase of about 54% compared to 2017 and represents 15% of the total output of Argentine pears and apples to overseas markets. Most of the executives consulted underline the low costs of the Chilean ports, the very good logistics they present and the commercial predictability they have.

Table 9. Exports from the free zone to the USA, in tonnes

Season	Nugget (t)	Cherry (t)	Expensive (t)
2005-06	52 476,00	-	-
2006-07	55.080,20	301,50	84,00
2007-08	72 789,00	514,85	200,20
2008-09	47 050,60	223,55	249,00
2009-10	38 247,40	220,75	391,20
2010-11	50 411,40	471,50	404,20
2011-12	40 827,80	421,55	160,60
2012-13	58 698,00	224,90	317,60
2013-14	62 637,20	181,80	90,40
2014-15	69 274,80	354,85	129,60
2015-16	61 779,00	427,20	-

Source: Own elaboration based on data from Borges and others 2016

For the period analysed, the increase in EC air exports is significant. In addition, there has been an increase in the volume exported of pears and apples to the United States, in a context of retrenchment of exports of both products to the traditional markets of Brazil, Russia and the European Union.

The productive and commercial analysis of cherry, pear and apple, and also plum/peach/nectarine are presented separately.

5.2.1.1. Cherry production and export in Patagonia (Annex IV)

The main producing areas in Argentina are Mendoza, Neuquén and Río Negro. It is followed by Chubut, Santa Cruz and Buenos Aires (Gómez Riera et al., 2014).

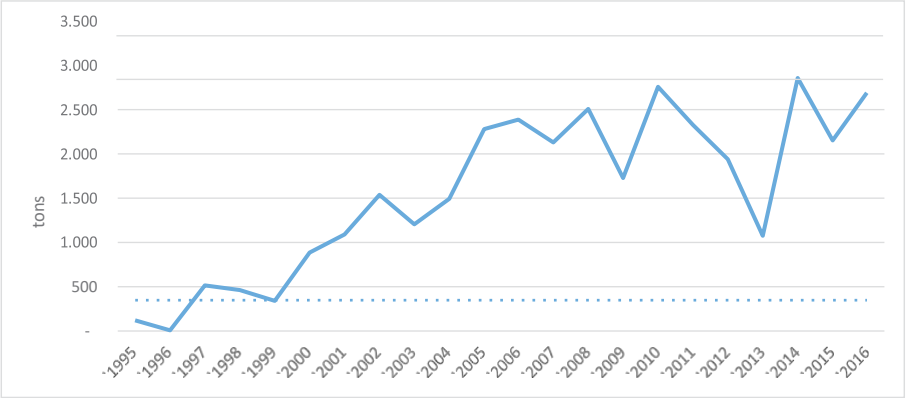
According to the data provided by the 2016 Statistical Yearbook of the Northern Patagonia Regional Center of Senasa, the region has 606 hectares of cherries, of which 383 hectares are located in Río Negro and 223 in Neuquén. The Patagonian production amounts to 6 200 t, with a growth potential up to 8 000 t by 2020 (Caminiti, 2017).

Export

At the country level, of the less than 1 000 t exported annually in the 1990s, as of 2005 the figure exceeds 2 000 t.

3Lojo, J. (13 March 2018). Exports of fruit from the Valley through Chilean ports grow. *Rio Negro newspaper*.

Figure 6. National exports



Source: Own elaboration based on FAO and Senasa data

In addition to the growth in the volume of cherry exports, the number of cherry countries has increased, with 27 countries up to 2005 and 42 countries at present.

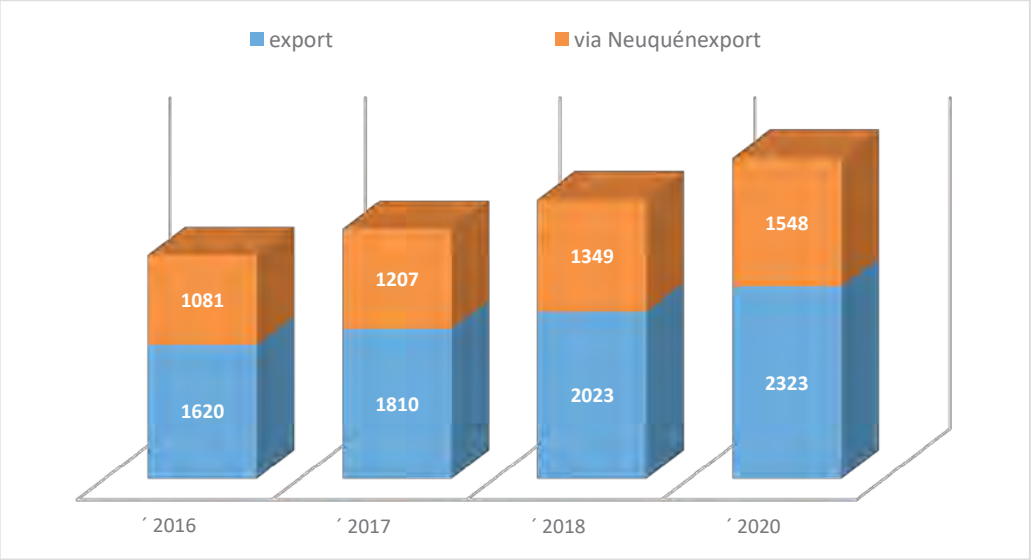
In recent years, the destinations for Argentine cherries have changed from the traditional markets of Canada, the United States and the EU to those of Qatar, the United Arab Emirates, Saudi Arabia, Bahrain, Kuwait, India, Singapore and Hong Kong (www.capci.com.ar).

The 2016/2017 season (operations from October 2016 to March 2017) registered a total export volume of 4,233 t, generating a foreign exchange income of 21.53 million dollars, with an average FOB Buenos Aires of 5.09 USD/kg (Caminiti, 2017).

Patagonia has become the main export region for fresh cherries in the Argentine Republic. More than 70% of the cherries exported annually originate from this region, and of these, more than 45% come from North Patagonia.

> Unlike other regions, NorPatagonia maintains a growing trend, increasing its implanted area every year, and entering new tables at its full productive capacity every year, estimating that by 2018 it will reach between 5,000 and 7,000 exportable tons [...] the regional companies allocate around 80% of their volume to foreign markets, being the region with the highest participation in exportable volumes. At national level, more than 70% of cherry shipments are made by air (data for the 2015/2016 season). The regional exports surpass this national average for air transport, considering how important it is for these companies to enter the international markets as a first fruit, anticipating the important volumes of the neighbouring Chile, the biggest world exporter of the South hemisphere. (Caminiti, 2016, p. 3)

Graph 7. Air Export Projections - Tonnes/year



Source: Caminiti, A., 2016

In December 2016, the first export of regional cherries from Neuquén airport to Miami, United States, was carried out. This type of exports is produced in a Fruit Fly Free Area, a sanitary title held by the Patagonian region, which produced, among other benefits, the possibility of entering this important market by air and without the quarantine treatments required for regions with a lower phytosanitary status.

> Patagonia enjoys a recognized and valued identity at an international level, with a beneficial health status. The quality of our cherries can and should be promoted in order to capitalise on this intangible value provided by our favourable location. The important dynamics of the markets as a result of globalization, has reoriented the destinations of the Argentinean cherries from the traditional markets of Canada, United States and countries of the EEC, to the preferential markets of the Asian East (Qatar, Arab Emirates, Saudi Arabia, Bahrain, Kuwait, India, Singapore and Hong Kong). (Caminiti, 2014, p. 6)

In summary, 70% of the country's total exports (4,300 t) come from the Pa- tagonia region (3,010 t). Patagonia sends 70% by air (2 107 t) at an average FOB value of 6 USD/kg, the rest reaches an FOB value of approximately 5 USD/kg, the total income reaches 15.27 million USD in 2016 (Table 10), with a growth projection to 2020 of 30% (five million USD more).

Table 10. Cherry FOB value of Patagonian exports (million dollars)

Year	Argentina	Patagonia
2002	**3,36**	**1,68**
2003	**3,04**	**1,58**
2004	**3,94**	**2,13**
2005	**5,52**	**3,09**
2006	**6,76**	**3,92**

Year	Argentina	Patagonia
2007	7,57	4,54
2008	8,06	4,92
2009	6,98	4,33
2010	9,55	6,59
2011	8,34	6,76
2012	8,81	7,58
2013	8,61	8,52
2014	15,15	12,88
2015	10,03	8,53
2016	17,97	15,27

Source: Own elaboration based on INDEC data. The value of Patagonia is adjusted by discounting the value of Mendoza's exports (IDR Foundation, 2015)

> The volume of fruit that came out in the last 10 years has doubled. In terms of foreign exchange, the country's income has tripled from $7.5 million ten years ago to $21.5 million now. (Caminiti, 22 December 2017, *Agrovalle Magazine*)

The Argentine cherry industry is taking advantage of the faster services from Valpa- raíso to take advantage of the Asian market. The CAPCI manager said: "What I can say is that, between last season and this one, operations through Chile have increased with maritime shipments" (*Agrovalle Magazine,* 22/12/17).

5.2.1.2. Production and export of pears and apples (Annex V)

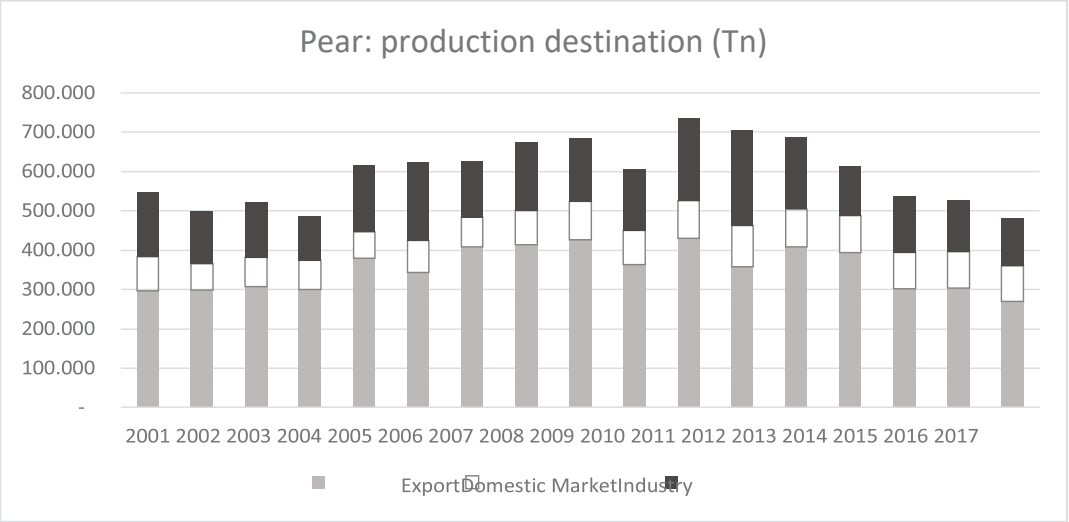
With respect to the cultivation of pome fruit trees, the main agricultural production in Northern Patagonia, statistics show a decrease in the total production of both pears and apples (Figures 8 and 9). In 2016, total production was approximately 1.09 million tons, with almost equal shares between pear and apple (531,669 t of pear and 562,006 t of apple). [4]

> The lack of generational change in the activity and the advanced age of a significant proportion of small and medium-sized producers, together with the problems linked to the expansion of non-conventional hydrocarbon production and urban expansion in the country's main production region, have aggravated the situation. (Storti, 2016, p. 15)

Exports account for 48% of pear production (251 636 tonnes) and 15% of apple production (75 925 tonnes).

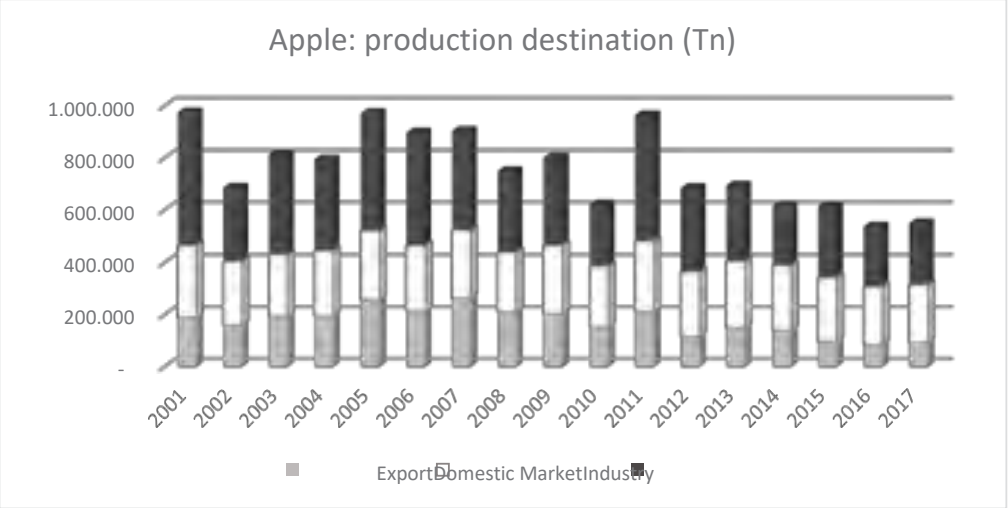
4 Senasa, Monthly Statistical Report for October 2017

Figure 8



Source: Zubeldía, H., 2017

Chart 9



Source: Zubeldía, H., 2017

Export to the United States

In a context of shrinking area and production of pears and apples, there is an increase in exports to the United States. Total exports of pears and apples increased from 7% to 16% of foreign trade in these fruits. The volume by species is 42 356 tonnes of pears and 10 739 tonnes of apples in 2016.

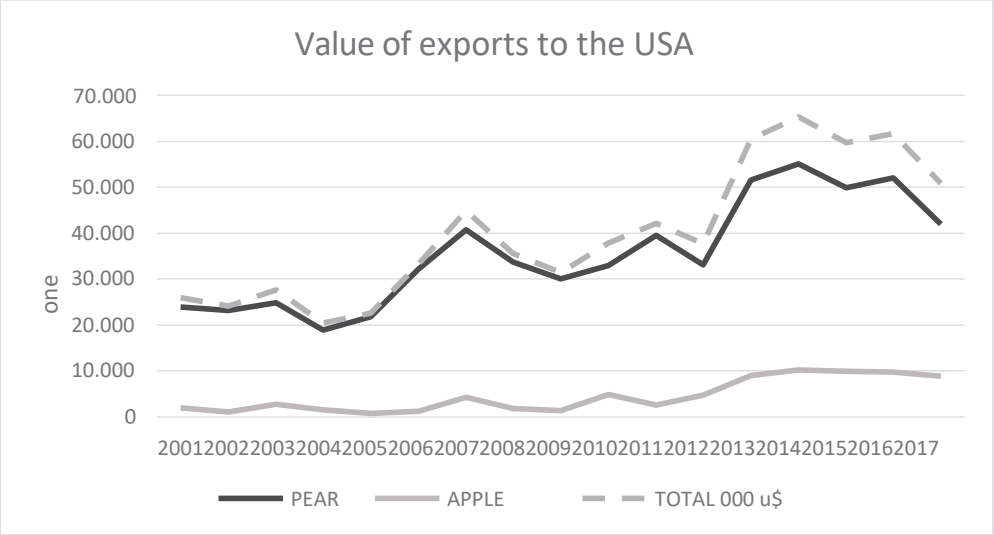
The average export in the 2001-2005 period, prior to recognition, was 24,074 t, of which 22,520 t corresponded to pears and 1,554 t to apples. The average volume exported in the period 2006-2017 reflects a growth of 94% (46 485 t between pears and man- zanas); proportionally, the growth of apple was higher (264%), although it remains only 10% of the total exported of fresh pome fruit to the United States (Zubeldía, 2017).

> If we look at the behaviour of the main importing countries for apples and pears, Brazil, the USA and Russia are the main destinations for Argentine exports of both fruits [...] representing 57% of apple exports and 71% of pear exports. In both cases, it can be seen that for Russia and the USA, Argentina shows a better performance of its sales in relation to the evolution of the destination markets. (Storti, 2016, p. 39)

The value of apple exports to the US grew from US$2 million (FOB value) in 2009 to US$16.3 million in 2016. Pear trade with the US grew from US$32.9 million in 2012 to US$56 million in 2016 (source: Centro Pyme ADENEU, based on NOSIS data). The 2016 value corresponds to 10 739 t of apple and 42 356 t of pear (Senasa, 2016, p. 31 and 36).

United States traders highlight the increase in "organic pears imported from Argentina". As part of the efforts to achieve a twelve-month organic pear programme, Oneonta Starr Ranch Growers (OSRG) of Wenatchee, Washington, has incorporated the certified organic varieties Williams Bartlett, Autumn Bartlett and Green Anjou from Argentina (Agrovalle Magazine, 23/3/18).

Figure 10. Pear and apple exports to the United States



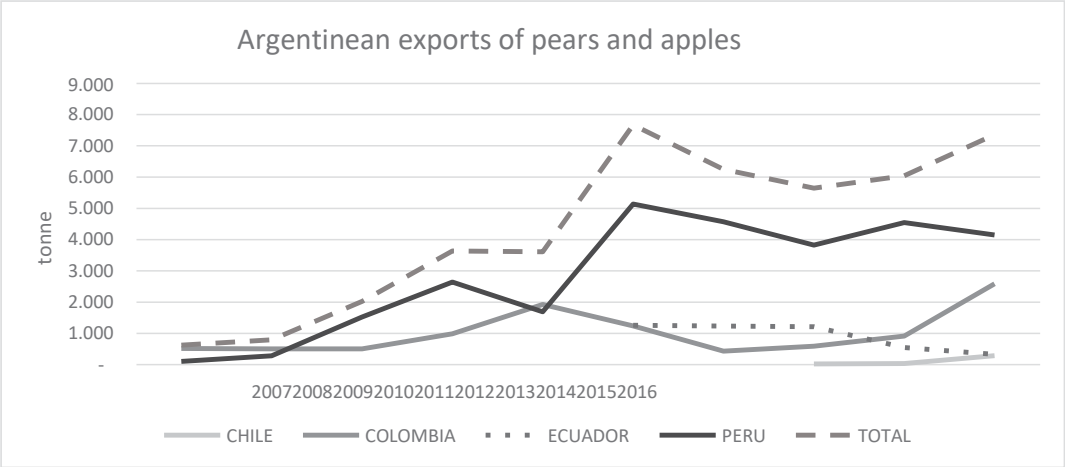
Source: Own elaboration based on information from Zubeldía, H., 2017

Exports to Pacific destinations

From the MINAGRO (Storti, 2016), the possibility of expanding trade with Latin American countries such as Peru, Colombia, Ecuador, Venezuela and Mexico, where Chile currently maintains a significant presence, is highlighted. Similarly, progress could be made in negotiations with China and India - markets with great potential due to their size - as well as with countries in North Africa, the Middle and Far East.

In this sense, Argentinean exports of pears and mangos to Peru, Colombia, Ecuador and Chile are growing, reaching 7,300 tons in 2016.

Figure 11. Evolution of exports to Pacific destinations

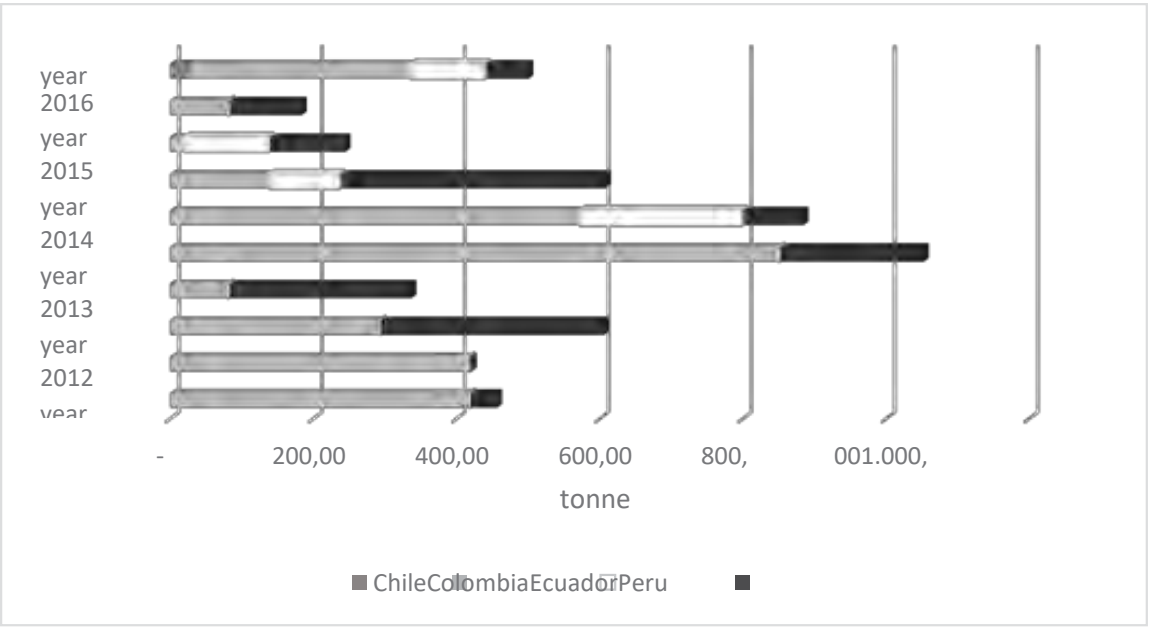


Source: Own elaboration based on Senasa data

Peru and Colombia lead this group of countries, Ecuador and Chile are recent destinations. By 2012, Peru is far ahead of the rest. In Peru, pears carry the most weight, while in Colombia, apples carry the most weight (Annex V).

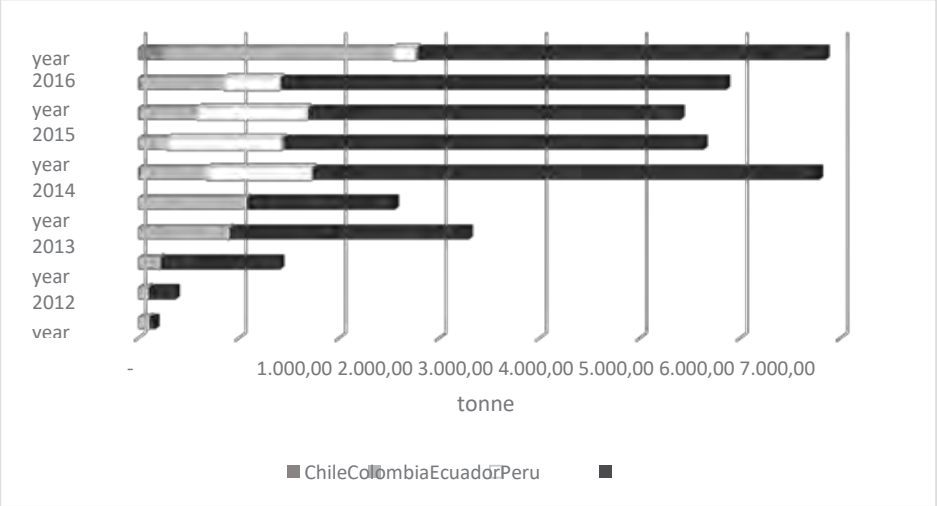
In pear, the main variety exported to these countries is Packham's (82%), and since 2012 D'Anjou (15%) has also become important. In apples, Granny Smith is the most important (41%), led by Red Delicious, Gala and, since 2015, Cripp's Pink has been increasing its share (29%).

Figure 12. Apple exports by country of destination



Source: Own elaboration

Figure 13. Pear exports by country of destination



Source: Own elaboration

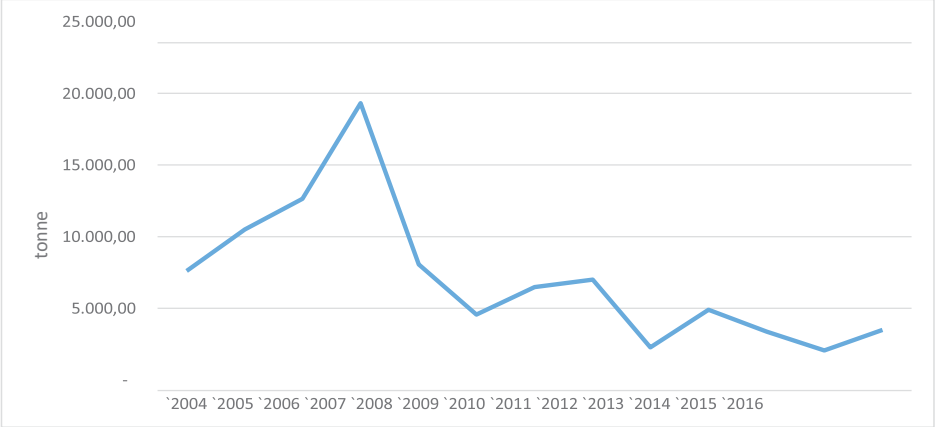
The total value of exports grew from less than USD 500 000 in 2007 to more than USD 7 million in 2016. The average price for the ten years analysed (2007-2016) is USD 0.90/kg for Peru, USD 0.80/kg for Colombia and USD 0.76/kg for Ecuador. The FOB value of pear and apple exports in 2016 was USD 7.8 million (Annex V).

Export to Mexico5

As a risk mitigation measure, the fruit is subjected to cold treatment in transit during its journey to Mexico, thus ensuring that pears and apples are free of Mediterranean and South American fruit flies. This measure will be maintained until Mexico's recognition as a free zone is issued.

Chart 14 shows a first period, 2004-2007, of growth from which volumes fall to 3,493 t in 2016.

Graph 14. Volume exported to Mexico - pears and apples



Source: Own elaboration based on COPEXEU data, years 2015 and 2016, Senasa data

5 COPEXEU report on CAFI website.

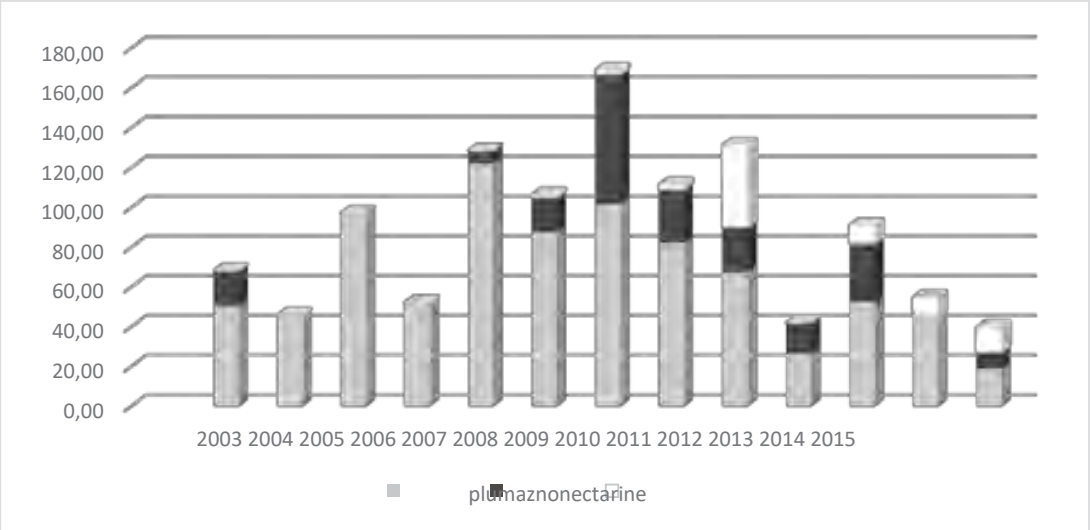
Practically 100% of exports are pears, in 2007 alone the volume of apples reached 10% of the total exported to Mexico. Transport is mainly in containers.

5.2.1.3. Production and export of plums, peaches, nectarines (Annex VI)

The average of 2003-2005 exports from Patagonia to the United States was 63 t/year, for the period 2006-2015 it was 74.2 t/year. Graph 15 shows the important fluctuations in exports of these fruits. The largest share corresponds to plum. The value of exports grew from an annual average of the first period of 48,373 USD to 169,170 USD/year as of 2006 (INDEC, foreign trade).

Likewise, a retraction of the exported volume is observed as from 2011. It will reach 40 tonnes in 2015, worth $74,000 (INDEC, foreign trade).

Figure 15. Exports of stone fruits to the United States



Source: Own preparation based on Borges et al., 2016

5.2.1.4. Total income

Table 11 summarizes the export revenues to the markets that have recognized the free area, the United States and Chile, as well as the Pacific markets that can be addressed more competitively by exporting from Chilean ports.

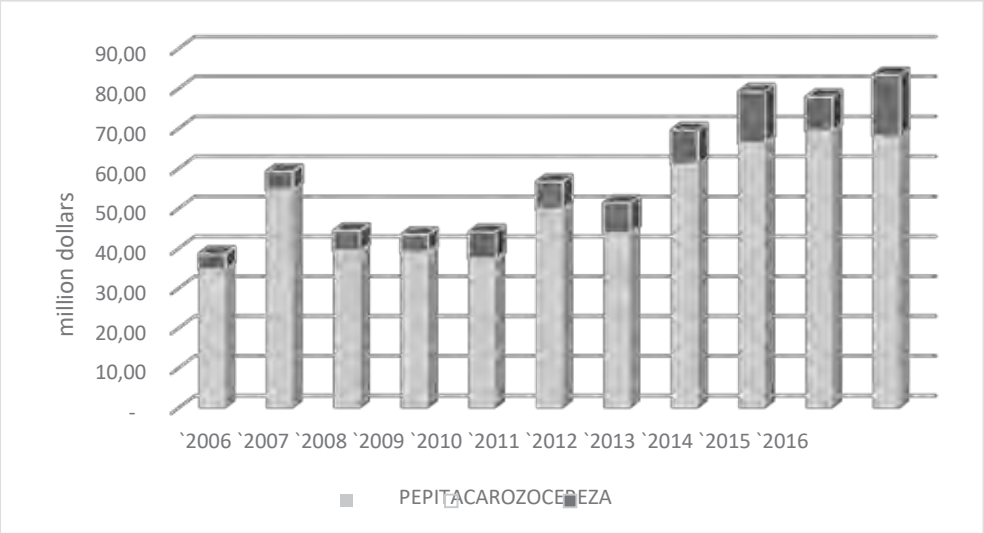
In ten years, income (FOB value in dollars) has doubled for pome fruits and almost tripled for cherries. Stone fruits have not been consolidated in exports. The total value exceeds 83 million dollars (2016).

Table 11. Exports from Patagonia to the United States, Mexico, Chile, Colombia, Ecuador and Peru FOB value in millions of dollars

Year	Nugget	Carozo	Cherry	Total
2006	**34,77**	**0,02**	**3,92**	**38,71**
2007	**54,63**	**0,10**	**4,54**	**59,28**
2008	**39,41**	**0,17**	**4,92**	**44,50**
2009	**38,76**	**0,37**	**4,33**	**43,46**
2010	**37,33**	**0,20**	**6,59**	**44,12**
2011	**49,82**	**0,15**	**6,76**	**56,73**
2012	**43,84**	**0,05**	**7,58**	**51,46**
2013	**61,03**	**0,11**	**8,52**	**69,67**
2014	**66,35**	**0,09**	**12,88**	**79,32**
2015	**69,40**	**0,05**	**8,53**	**77,98**
2016	**68,16**	**-**	**15,27**	**83,43**

Source: Own elaboration

Figure 16. Value of exports from Patagonia as a Fruit Fly Free Area



Source: Own elaboration

5.2.2. Reduction in cost by elimination of quarantine treatment

The recognition of the free area made it possible to export without the need for quarantine treatment.

The treatment value is USD 1 500 per container6 equivalent to 70 USD/tonne, and 6-8 % of the warehouse freight value for a freight of 230 USD/pallet the value is approximately 16 USD/tonne (source: qualified informants).

6 Pear container, 20 pallets of 63 boxes/pallet, 18.3 kg/box (23,058 tons/container). Apple container, 21 pallets of 49 boxes/pallet, 19.5 kg/box (20,065 tonnes/container).

The determination is made considering the percentage of exported fruit in containers and in the warehouse and the value of the quarantine treatment. Industry estimates indicate the growth of containerised exports.

Table 12 estimates the sector's savings since the recognition of the free area, considering exports to the United States and countries on the Pacific coast.

Table 12. Savings in the fruit sector by not carrying out quarantine treatment

Year	Export by container	Container savings USD	Winery savings USD	Total Savings (USD)
´2006	30 %	1 299 150,00	1 060 040,10	2 359 190,10
´2007	35 %	979 125,00	687 437,80	1 666 562,80
´2008	40 %	1 119 000,00	412 462,68	1 531 462,68
´2009	45 %	1 016 550,00	299 617,78	1 316 167,78
´2010	50 %	1 497 750,00	365 164,10	1 862 914,10
´2011	55 %	1 332 375,00	264 312,09	1 596 687,09
´2012	60 %	2 391 300,00	3 85 974,96	2 777 274,96
´2013	65 %	2 958 150,00	3 85 298,76	3 343 448,76
´2014	70 %	3 442 950,00	355 111,26	3 798 061,26
´2015	75 %	3 319 875,00	266 793,10	3 586 668,10
´2016	80 %	2 892 000,00	160 301,26	3 052 301,26

Source: Own elaboration based on data of volume exported to USA and Pacific countries.

The proportion of containerized exports are estimates by regional traders. The sector has saved the equivalent of US$27 million in the period 2006-2016. In the absence of significant changes in export volumes and quarantine treatment values, the sector will avoid spending more than 3 million dollars a year.

In addition, the possible loss of quality of the fruit as a result of the long quarantine treatment must be considered. We have not obtained any data from the sector to assess this decline, which is why only this qualitative mention is made.

5.2.3. Reduction of costs by trading through Chilean ports

In recent years, exports through Chilean ports have shown an upward trend. During 2017 (Schilling, 2018), 1 675 containers of Argentinean fruit (mainly pears) left Chile, mainly through the Port of Coronel. Until March 2018, 738 containers have been exported through this route, with approximately 17 500 tons of fruit.

The port manager considers that this growth can be explained by

> From Argentina, the cargo leaves in the afternoon, they pass through the pass in the morning and at three or five o'clock in the afternoon they are already in the terminals of the Bio Bio Region and this makes us more competitive when using the bioceanic corridor. For closeness and efficiency, the ports of the region have been "awarded" by the Argentinean fruit exporters who, more and more, decide to reach Asia, Europe or the United States through the terminals of this area of Chile. (Schilling, 2018)

It further holds that

> The fruit sellers on the other side of the mountain range value the quality of service in the traceability of the fork from the moment it leaves the warehouse until it enters the stacking area. What we have managed to do, in conjunction with the shipping company, and by getting closer to the customers, is to be able to give these containers flexibility so that they can enter directly and give them a bit of slack when they arrive very early or very close to closing time. This has been allowing Argentine exporters to value the service and we have received positive comments, as exporters compare this service and tell us that it is very different from what they have in Argentina.

Consulted the commercial operators of the region regarding the cost difference, it can be established that, on average, the export by Chilean ports is USD 1 000/container cheaper than exporting by Buenos Aires port.

If the volume of 1 675 containers exported from Chilean ports is maintained, the sector would be saving 1,675 million dollars a year in export logistics thanks to the recognition of Chile.

As there is no information on containers exported through Chile in the 2009-2016 period, since the bordering country allows the transit of Patagonian fruit, an estimate of the evolution is made, taking the 2017 volume (100%) as a reference:

Table 13. Savings from exports through Chile

Year	% compared to 2017	Saving USD
2010	20 %	335 000
2011	25 %	419 000
2012	30 %	502 000
2013	35 %	586 000
2014	40 %	670 000
2015	45 %	754 000
2016	50 %	838 000

Source: Own elaboration

Accumulated savings for the period 2010-2017 reach US$5.8 million.

6. Results

The results of the impact of the Procem Patagonia are presented according to the indicators defined in Section 5.

6.1. Retrospective analysis 1996-2016

6.1.1. Programme costs 1996-2005

In total, from the time the Programme was launched and up to the year of the free area recognition (2006), just over USD 700 000 was invested in infrastructure and USD 23.32 million in current expenditure over the ten years (Annex III).

Of this total, 59% corresponded to the functioning of the Barrier and 41% to the Procem Pata- gonia (10% is institutional contribution).

6.1.2. Income/cost ratio 2006-2016

In the ten years since the recognition of the free area, the income to the sector was generated as detailed in Table 14.

Table 14. Income generated as a Fruit Fly Free Area

Year	Exports	Saving on quarantine treatment	Export savings for Chile	Total (million dollars)
2006	38,71	2,36	-	41,07
2007	59,28	1,67	-	60,95
2008	44,50	1,53	-	46,03
2009	43,46	1,32	-	44,78
2010	44,12	1,86	0,33	46,31
2011	56,73	1,60	0,42	58,75
2012	51,46	2,78	0,50	54,74
2013	69,67	3,43	0,59	73,69
2014	79,32	3,79	0,67	83,78
2015	77,98	3,59	0,75	82,32
2016	83,43	3,05	0,84	87,32

Source: Own elaboration

The operating costs of the Barrier and the Programme since the survey are shown in Table 15.

Table 15. Barrier and Programme Costs (millions of dollars)

Year	Procem Budget	Institutional contributions	Barrier	Total (million dollars)
2006	0,72	0,11	1,06	1,89
2007	0,70	0,11	1,59	2,40
2008	0,92	0,14	1,92	2,98
2009	1,22	0,18	2,01	3,41
2010	1,10	0,18	2,67	3,95
2011	1,56	0,19	3,04	4,79
2012	1,41	0,20	3,57	5,18
2013	1,57	0,21	3,46	5,24
2014	1,36	0,22	4,00	5,58
2015	1,34	0,22	4,00	5,56
2016	1,53	0,23	4,00	5,76

Source: Own elaboration

The income/cost ratio (Table 16) determines how many dollars enter the Patagonia region (as a result of its recognition as a Fruit Fly Free Area) for every dollar spent on the implementation of the Procem Patagonia, including the Barrier. The ratio of income to cost is always greater than one, giving an average value of 15.40.

Table 16. Income/Cost Ratio in Dollars

Year	Enter	Cost	Income/Cost
`2006	41,07	1,89	21,73
`2007	60,95	2,40	25,40
`2008	46,03	2,98	15,45
`2009	44,78	3,41	13,13
`2010	46,31	3,95	11,72
`2011	58,75	4,79	12,26
`2012	54,74	5,18	10,57
`2013	73,69	5,24	14,06
`2014	83,78	5,58	15,01
`2015	82,32	5,56	14,81
`2016	87,32	5,76	15,16

Source: Own elaboration

6.1.3. New Fly Targets and Control Efficiency

In twelve years of free area recognition, five outbreaks have been detected in specific locations, all of which were eradicated in the shortest possible time.

The programme has demonstrated an efficient monitoring and control system, following the procedures established by Senasa to limit production in the identified area, giving buyers certainty that the sanitary status achieved is being maintained.

6.1.4. Indirect impact, impact on employment

The determination of this result is made for the total cherry production in Pata gonia, because the highest percentage is exported mainly by air as a consequence of the sanitary status.

The regional labour demand is approximately 300 permanent jobs and 6,000 temporary jobs for harvesting and packing.

> The sector requires approximately 250 to 300 permanent jobs, and mobilizes an average of 10 temporary jobs per hectare for high-season activities (harvesting and packing), which will increase year by year due to the increase in productivity and the productive incorporation of new areas, and implementing a specific refrigeration and packing technology for the management of this fruit. (Caminiti, 2014, p. 5)

In the case of pome fruit trees, employment is considered proportional to the volume exported to United States destinations and those using Chilean ports to reduce time and freight costs.

Taking the references of the MINAGRO1 regarding the employment registered in the fruit sector in the provinces of Río Negro, Neuquén and Mendoza (Storti, 2016), the incidence of regional exports to the USA, Mexico, Chile, Colombia, Ecuador, Peru and Venezuela is presented.

Employment in the region is 91.5% of the total (discounting Mendoza, there are 27,100 jobs in the primary sector and 10,300 jobs in the industrial stage), totalling 37,400 jobs.

On the basis of the production marketed fresh to the destinations mentioned above, 68 272 tonnes between pears and apples, the impact on employment in the chain is equivalent to 3 550 jobs.

Ultimately, employment directly related to exports due to the maintenance of health status is approximately 5 000 jobs (between permanent and temporary labour).

6.2. Scenarios

6.2.1. Increase in fruit exports - Positive (Annex VII)

The participants in the sector propose analysing a scenario in which the area cultivated with cherry, apple and pear trees grows. There are no clear indications to propose growth in exports of plums, peaches and nectarines, which is why variations in production and exports will not be taken into consideration.

Information on the behaviour of the international trade in fresh fruit pays for this scenario, which has increased to around 80 million tonnes in the last decade. In percentage terms, world trade in fresh fruit grew by more than a third in the period 2006-2016 and is valued at 75 billion dollars. The export of fresh fruit from Latin America to North America (including Mexico) has grown above average (*Agrovalle Magazine*, 30/3/18).

In this growth, bananas have the largest share (20 million tonnes), followed by apples (8.6 million tonnes), oranges (6.7 million tonnes), potatoes (2.5 million tonnes) and

1 According to data from the Observatorio de Empleo y Dinámica Empresarial (OEDE), in 2015, average employment in the "fruit growing - except vines for wine making - and nuts" sector in the main producing provinces (Río Negro, Neuquén and Mendoza) will amount to 29,657 jobs, while 11,254 jobs will be created in the "fruit, vegetables and legumes preparation" sector. Between 2010 and 2015, employment in the crop sector increased by 15.5%, while in fruit, vegetable and legume preparation it increased by 26.8% (Storti, 2016).

mandarins (5.1 million tonnes), grapes (4.3 million tonnes), pineapples (3.6 million tonnes), watermelons (3.3 million tonnes), lemons (3.1 million tonnes), pears (2.7 million tonnes) and peaches and nectarines (2.1 million tonnes) (*Agrovalle Magazine*, 30/3/18).

The estimates made in this scenario are based on current parameters with a pro-Moderate growing season. Thus, for cherry trees it is estimated that 100 ha are planted annually, for apple trees 1 000 ha/year, while for pear trees 500 ha/year.

This surface growth is reduced by the eradication of older plantations, older than thirty years in cherry and apple trees and older than forty years in pear trees. As a result, each year, for the decade analysed, 99 hectares of cherry trees, 215 hectares of apple trees and 150 hectares of pear trees are incorporated.

Of the total production, 70% is assumed to be exported in cherries, 20% in apples and 60% in pears. In view of the opening of the Chinese market from 2019 onwards, a staggered growth in the volume exported is projected, reaching 20% of the total in cherries and 10% in both pears and apples by 2026.

The prices considered for exports to China come from the Argentine Foreign Ministry (2015) and the value reached by the Chilean cherry (*América Economía*, 18/1/18). For the rest of the exports, the average value of the last seasons is maintained.

With these parameters, by 2026 the value of cherry exports would double (28 million dollars more), the value of apple exports would increase by 16% (18.7 million dollars) and the increase in pear would be 14% (36.6 million dollars).

In total, thanks to the maintenance of the Procem Patagonia and the increase of the fruit area, after ten years an additional 83.6 million dollars would enter the region annually (totalling 487.5 million dollars in exports). With a total export volume of 9,055 tons of cherries, 117,754 tons of apples and 340,834 tons of pears. Of this volume, 63% of the cherries, 20% of the apples and 23% of the pears are destined for the quarantine markets, mainly the United States, Pacific destinations and China.

Associated with this growth in exports, the sector's savings have increased due to the lack of quarantine treatment for exports to countries where the fly is a quarantine pest, as well as savings in export logistics due to the volume that leaves through Chile.

The savings, after ten years, from avoiding quarantine treatments will be 3.35 million dollars per year. Savings in logistics would reach 1.76 million dollars a year.

As a result, in the positive scenario described above, an additional $83.6 million will be paid to the sector from year ten onwards, and the sector will also save $5.11 million per year. These benefits (88.71 million dollars per year), maintaining the current cost of the programme and the barrier (without additional expenses), result in a benefit/cost ratio that would rise from 15.40 in the initial situation to 30.56 after ten years. In other words, the positive scenario would double the benefit generated by the Programme.

Finally, including the indirect impact on direct sources of employment (primary production), this scenario would involve 1,750 additional jobs in the pome fruit sector, and 49 permanent and 985 temporary jobs in the ceramics sector.

6.2.2. Elimination Procem Patagonia - Negative

The pessimistic scenario is the elimination of the Procem Patagonia, thus losing the sanitary status achieved as a free area.

The consequences of the elimination of the Programme and the Barrier (only 50% of the cost) can be quantified with different indicators. On the one hand, the investment and operational expenditure for the operation of the Barrier and the Programme for twenty years (1996-2016) would be lost, the export of the fruit to countries where the fly is a quarantine pest would only be possible by carrying out quarantine treatments, and the cherry could not be exported by air.

Although it has not been quantified, the negative impact on the Patagonia region of not being able to maintain its health status is undeniable. Furthermore, it would put the brakes on all negotiations

commercial activities that have been carried out since the recognition of the free area.

Below are some estimates of the losses that would be incurred by the sector:

1) Loss of investments and cost of the Programme and the Barrier

During the twenty years of operation of the Procem Patagonia, a cost of more than 20 million dollars has been incurred. To this value must be added the contributions of the institutions (4.84 million dollars) and 44.5 million dollars corresponding to 50 % of the cost of the Sanitary Barrier. The loss of health status would mean the loss of more than 70 million dollars spent on the programme over twenty years.

2) Price drop of cherry because it cannot be exported by plane

Considering that air exports from Patagonia, 2 107 tonne/year, are no longer carried out, this volume must be directed to the markets that remain, i.e. the domestic market and exports to countries where flies are not quarantined and can be reached by sea and land.

An increase in the volume marketed implies a decrease in the price, price elasticity coefficient -0.8. Since the coefficient for cherries is not available, the coefficient for pears is used.

This analysis of price decline is only done for the volume that is directed to the domestic market, it is assumed that, in exports, the volume is distributed in greater quantities, so there are no significant changes that modify the price in the market.

Considering that an additional 1 000 t/year are allocated to the internal market, the price falls by 48.5%, generating a drop in income compared to the situation with the Procem in force of $3.4 million.

The drop in the volume exported and the lower price of destinations reached by ship or truck, compared to air exports, implies a decrease in export revenues of $7.1 million.

In other words, the closure of markets for cherries, and the impossibility of exporting them by air, represents a reduction in income to the sector of 10.5 million dollars a year.

3) Increased cost of quarantine treatment and logistics

It is assumed that the value of exports is maintained because the same markets are reached by carrying out the quarantine treatment. The additional cost of the treatment is US$3.05 million per year.

The increase in the logistic cost of not being able to export through Chilean ports is 1,675 million dollars a year.

The loss of health status would mean an increase in export costs of $4.72 million per year.

4) Savings on the annual cost of the Programme

The only positive indicator from the economic point of view would be the savings for the sector and the state of maintenance of the Programme and 50% of the Health Barrier.

Savings from eliminating 50% of the cost of the barrier: $4 million per year. Savings due to suspension of Procem actions: 1.76 million dollars/year.

The sector's savings would be 5.76 million dollars a year.

In summary, we can say that the elimination of the Procem Patagonia would imply a net loss of 9.465 million dollars per year (losses: 10.5 + 4.725; savings: 5.76). In addition to the loss of what has already been invested in achieving and maintaining the Fruit Fly Free Area, 62.5 million dollars.

7. Conclusions and recommendations

This analysis aims to highlight the Fruit Fly Eradication Programme in Patagonia. Based on the study carried out and taking into account that it should be considered as a contribution to the study of the repercussions on production and regional society of the maintenance of a Fruit Fly Free Area, it can be established that the implementation of this Programme is highly beneficial in the current framework, the proposed scenarios and established projections. The main conclusions of this work are the following:

a. The protected region where Procem Patagonia is implemented is part of the current international legal framework on phytosanitary measures, whose objective is to avoid barriers to trade, establishing the minimum risk criterion, for which it is taken into account that Patagonia is a fruit fly free area and has a phytosanitary emergency plan in case of reinfestations. These plans were successfully implemented on five occasions and are recognized and evaluated in their execution by the highest authority governing phytosanitary policies in Argentina (Senasa) and by international organizations.
b. The maintenance of the free area makes it possible to apply to the phytosanitary authorities of other countries for the necessary permit to export a significant number of species, mainly pears, apples, stone fruit trees and berries, among the most important, without the need to carry out compulsory quarantine treatments. It is worth noting the use of air transport for products such as cherries, constituting a fundamental benefit for their commercialisation in markets with restrictions.
c. The income from the programme is diverse and can be mentioned as: increased exports of cherries by air, increased exports of pears and apples to the United States and Pacific countries such as Peru, Colombia, Ecuador and Chile.
d. The financial profitability indexes indicate that for every dollar invested in the Procem Patagonia, 15.20 dollars enter the region.
e. The social importance of the Programme in the region is evidenced by the fact that 13% of the labour involved in the pome and cherry chain is related to the destination markets that recognise Patagonia as a Fruit Fly Free Area.
f. The possibility of transiting through Chile allowed the sector to reduce logistics costs by approximately 1.675 million dollars a year.
g. In an optimistic scenario of growth in the production and export of cherries, apples and pears, as well as expanding the destination markets, it would mean doubling the income from exports and saving costs in relation to the cost of the Programme.
h. In a pessimistic scenario of discontinuity of the Procem in Patagonia, fruit would be redirected to other destinations, with the consequent fall in prices. Furthermore, costs would increase due to the four-year treatment and logistics through Argentine ports instead of those in Chile. This loss is approximately 9,465 million dollars per year. Finally, the investment made throughout twenty years, just over 62 million dollars, would be in vain as from the end of the Programme.

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ANNEX I-Export protocols -Senasa (www.senasa.gob.ar)

Chile-SAG, resolution 3882/2013 (1/7/13).

It establishes as a phytosanitary requirement for the import of apples and pears from Argentina, it must be verified by Senasa, which comes from a fruit fly free area recognized by SAG (otherwise cold quarantine treatment).

China, 16/11/2004.

Pears and apples must come from the *Ceratitis* and *Anastrepha* free area established by Senasa and approved by the *General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China* (AQSIQ).

United States, Workplan for Pre-shipment Program for Cherries, Apple, Pears, Plums, Necatrines and Peaches from Fruit Fly Free Areas 2012.

USDA-APHIS-PPQ recognizes the Argentine Patagonia and the Central and Southern oases of Mendoza as free of *Ceratitis capitata* and *Anastrepha fraterculus*. The plan complies with the pre-shipment programs at origin without the need for quarantine treatment.

Once the requirements stipulated in the Work Plan have been met, the Senasa inspector will issue a phytosanitary certificate stating that "the consignment was produced in an area free of *Ceratitis* and *Anastrepha*".

Senasa and USDA-APHIS-PPQ will coordinate, during the export season, visits to the fly free areas (maximum two visits per season per Senasa regional centre).

Israel, 2008, bilateral agreement, conditions for the import of apples, pears and quince from Argentina

Only *Anastrepha* is restricted. The Upper and Middle Valleys are free of *Anastrepha. In* addition, the Patagonia region has been recognized as a Fruit Fly Free Area by the USA, MERCOSUR countries and others.

Mexico, 2009, work plan with cold quarantine treatment (for *ceratitis* and *anastrepha*).

SMC Mexico's work plan mentions that cold treatment will be carried out until Mexico's recognition as a free zone is issued.

ANNEX II-Contributory levy

Table 17. Annual Revenue

Year	Values in current currency	Deflated values	Dollar values
1996	1.698.165,21	11.207.660,31	1.698.165
1997	1.863.159,21	12.231.938,25	1.863.159
1998	1.986.832,30	12.924.147,97	1.986.832
1999	2.322.448,32	15.285.931,88	2.322.448
2000	1.832.277,53	12.173.977,38	1.832.277
2001	2.331.939,24	15.660.498,30	2.331.939
2002	2.061.265,98	10.997.959,43	604.477
2003	3.581.101,32	16.842.820,40	1.209.831
2004	3.382.061,99	15.233.864,70	1.131.124
2005	4.264.398,18	17.518.824,33	1.398.163
2006	4.166.441,54	15.434.736,44	1.348.363
2007	4.001.695,59	12.199.110,00	1.266.359
2008	6.058.992,29	17.101.324,17	1.751.154
2009	8.846.799,50	23.408.275,11	2.315.916
2010	8.583.213,56	19.908.956,65	2.145.803
2011	11.673.976,13	25.435.999,10	2.702.309
2012	9.480.808,74	18.606.865,18	1.926.993
2013	13.563.466,72	22.776.409,03	2.080.286
2014	15.548.797,79	22.353.167,17	1.816.448
2015	17.556.104,54	23.073.717,87	1.320.008
2016	32.199.929,59	32.199.929,59	1.999.996

Source: Author's elaboration based on data from Funbapa, Annual balances

Note: The CPI of the Province of Neuquén was used for deflation, considering a base month of December 2016.

ANNEX III-Costs Procem Patagonia

Table 18. Annual costs in current, constant and dollar currency

Year	Current currency $	Constant currency	Dollars
`1996	147.756	3.163.725	147.756
`1997	744.990	16.570.916	744.990
`1998	919.090	20.908.999	919.090
`1999	1.117.255	26.716.445	1.117.255
`2000	861.064	21.162.386	861.064
`2001	1.401.330	36.309.741	1.401.330
`2002	1.214.707	18.583.453	356.219
`2003	1.760.131	26.003.020	594.639
`2004	1.675.909	23.147.824	560.505
`2005	1.610.839	20.351.698	528.144
`2006	2.229.916	25.543.667	721.656
`2007	2.220.832	19.684.857	702.795
`2008	3.181.789	23.113.604	919.592
`2009	4.661.172	29.094.602	1.220.202
`2010	4.393.071	21.647.825	1.098.268
`2011	6.739.676	14.684.833	1.560.110
`2012	6.949.179	13.638.334	1.412.435
`2013	10.221.150	17.163.834	1.567.661
`2014	11.631.707	19.967.235	1.358.844
`2015	17.874.346	24.602.726	1.343.936
`2016	24.596.640	24.596.640	1.527.742
´2017	35.714.864	29.422.056	1.879.730

Source: Own preparation based on data from Funbapa's annual balance sheets
Note: The CPI of the Province of Neuquén was used for deflation, considering a base month of December 2016.

ANNEX IV-Production and export of cherries

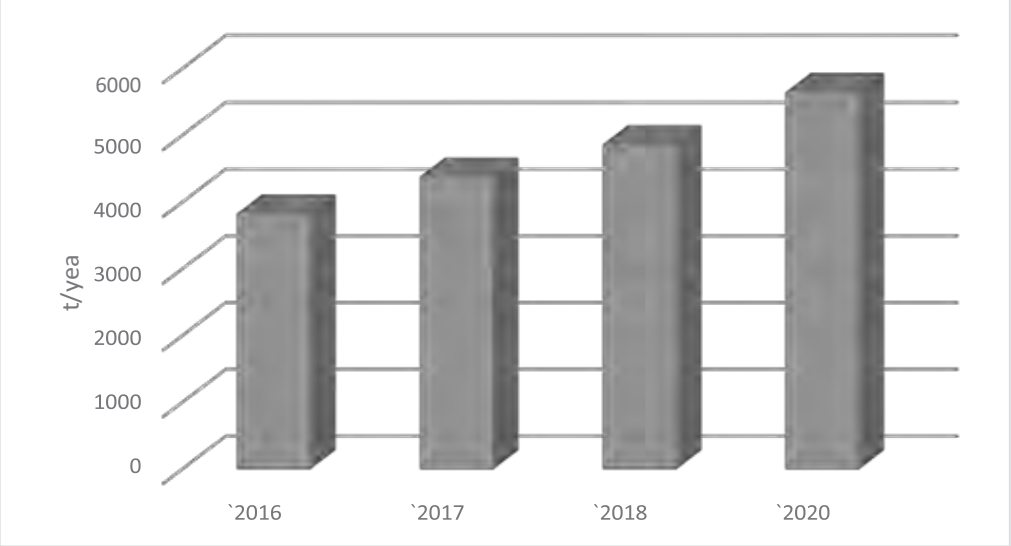
The area under cherry cultivation in Argentina is almost 3 000 ha, of which about 1 200 ha are in Mendoza (Gómez Riera et al., 2014).

> In a straight line, from north to south, there is a distance of about 2,400 kilometres between the northern plantations of the province of Mendoza and the southernmost production centre, located in the province of Santa Cruz. This range of latitudes allows Argentina to have a long harvest. (Caminiti, 2014)

The main producing areas in Argentina are Mendoza, Neuquén - Río Negro. They are followed by Chubut with 360 ha, Santa Cruz with 200 ha and Buenos Aires with 50 ha. Of the country's total production, 51% is destined for the domestic market and the rest for export (Gómez Riera et al., 2014).

According to the data provided by the 2016 Statistical Yearbook of the Northern Patagonia Regional Center of Senasa, the region has 606 hectares of cherries, of which 383 hectares are located in Río Negro and 223 in Neuquén. Projections of production estimate for 2020 to reach 5,648 t (Graph 17).

Figure 17. Production of Río Negro and Neuquén. Projection Tons/year.



Source: Caminiti, A., 2016

In Santa Cruz, in Los Antiguos, around 200 hectares of cherries are cultivated with average yields of 6 thousand kilograms per hectare, totalling a production of 1 200 tons. Fifty percent of Santa Cruz's production is sold to Europe (England and Spain) and the United States. The remaining 50 percent is sold on the local market. On the other hand, the discards (between 5 and 7 percent of the harvest) are sent to be processed into maraschino, sweet or canned food. The total production of cherries in the valley, as expressed by respondents, is 768 000 kg (Apostolo et al., 2010).

The production in Chubut reaches 1 150 t, Table 19 shows the growth of exports of the cherry produced in this province.

Table 19. Chubut cherry exports

Year	Net weight (t)	FOB value (thousand USD)
`2010	391	1.309
`2011	470	1.584
`2012	540	1.715
`2013	398	1.192
`2014	498	1.445
`2015	430	1.413
`2016	800	3.534

Source: Own elaboration based on data from Estadisticas de Chubut

In summary, Patagonian production amounts to 6,200 tons, with a potential to grow to 8,000 tons by 2020 (Caminiti, 2017).

The national harvest extends from October and November, with a strong concentration in December, continuing through January and in some cases into early February.

> This allows us to approach international markets with first fruits, obtaining excellent international prices, then supplying the end of the year festivities, to finally be able to supply the Spring Festival in China (Chinese New Year), a period that usually falls between January and February, being the best time of the year for the sales of wax in that market. (Caminiti, 2014)

Export

At the country level, of the less than 1 000 t exported annually in the 1990s, as of 2005 the figure exceeds 2 000 t. In 2008, 2,630 tons were exported and almost 8 million dollars were received by the country. This figure will rise to 4,300 tons in 2016 (Caminiti, 2017).

The analysis of Argentine cherry exports in the period 1995-2016, since the beginning of the Procem, is subdivided into two subperiods: 1995-2004, from the beginning of the programme until one year before Patagonia was recognised as a fruit fly free zone by the USA; 2005- 2016, from the time it was declared a free zone until today (last available statistics).

The source of information used is FAO, from 1995 to 2013 inclusive; the period 2014-2016 is reported by Senasa statistics.

Table 20 shows the main destinations of Argentine cherry exports, in addition, the volume growth between both sub periods for most markets, particularly significant in the United States.

Table 20. Evolution of cherry exports by destination (tonnes)

Country	PROM 95-04	PROM 05-16
United Kingdom	316,00	506,17
United States	30,00	335,75
Spain	103,44	286,00
Brazil	64,11	281,18
China, Hong Kong SAR	35,20	198,44
France	101,25	113,67
Netherlands	155,13	99,17
Italy	42,43	44,75
Germany	20,57	32,00
Canada	31,63	26,73
TOTAL	765,20	2.237,58

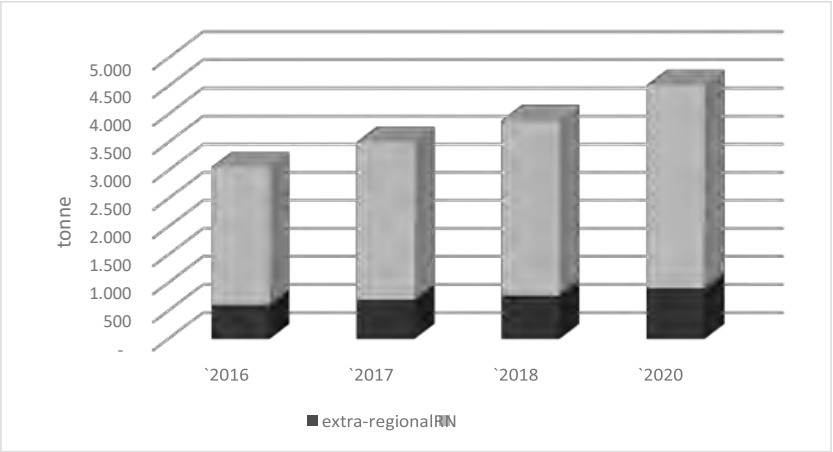
Source: Own elaboration based on FAO and Senasa data

The average FOB values for each sub-period show an increase in the price of the product from 3.04 USD/kg for the period 1995-2004 to 3.87 USD/kg for the period 2005-2016.

The 2016/2017 season (operations from October 2016 to March 2017) registered a total export volume of 4,233 tons, generating a foreign exchange income of 21.53 million dollars, with an average FOB Buenos Aires of 5.09 USD/kg (Caminiti, 2017). Among the various destinations, according to the Caminiti report, A. 2017, the UK has the best average valuation at USD 6.76/kg FOB (687,155 t operated), followed by the Netherlands at USD 6.08/kg (309.54 t), Senegal at USD 6.06/kg (low operated volume, 3.56 t), India and Kuwait at USD 5.70/kg (23.68 and 20.08 t, respectively), the United Arab Emirates at USD 5.24/kg (266.92 t), and Italy at USD 5.14/kg (264.46 t). Within the main destinations, the USA averaged 4.96 and Hong Kong 4.47 USD/kg. The lowest prices were recorded for operations to Russia at USD 3.49/kg (low volume traded, 3.92 t), and Brazil at USD 3.77/kg (35.78 t). In South America, the values recorded for destinations such as Colombia and Uruguay stand out, low volumes traded with an average of 5.18 and 5.12 USD/kg (4.80 and 6.04 t, respectively).

> Unlike other regions, NorPatagonia maintains a growing trend, increasing its implanted area every year, and entering year after year its productive fullness, estimating to reach by 2018 between 5,000 and 7,000 exportable tons [...] the regional companies destine around 80% of their volume to the external markets, being the region of the Argentine Republic with the highest participation in exportable volumes (depending on the year between 57 and 70%). (Caminiti, 2016, p.3)

Figure 18. Regional Exportable Volumes Projection - Tons/year

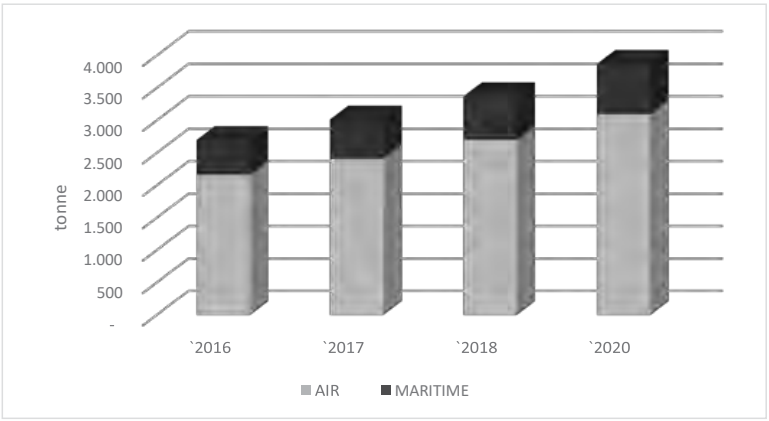


Source: Caminiti, A., 2016

Sea, land and air exports

At national level, more than 70% of cherry shipments are made by air (data season 2015/2016). Regional exports exceed this national average for air transport, considering how important it is for these companies to enter international markets as a first fruit, anticipating the important volumes from neighbouring Chile, the largest world exporter in the Southern hemisphere. (Caminiti, 2016)

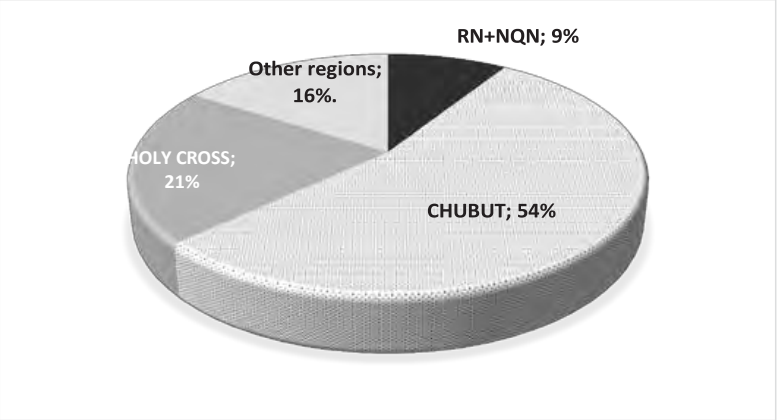
Graph 19. Exports by regional transport route. Tons/year



Source: Caminiti, A., 2016

The Patagonian region concentrates 84.36% of the sea shipments made from Argentina to other countries, mainly from the provinces of Chubut and Santa Cruz, using sea logistics in search of the best international niches for late fruit (February to March), where prices improve significantly (6 USD/kg and 7.3 USD/kg FOB Argentina for fresh cherries average of February 2011 and 2012 respectively). (Caminiti, 2014)

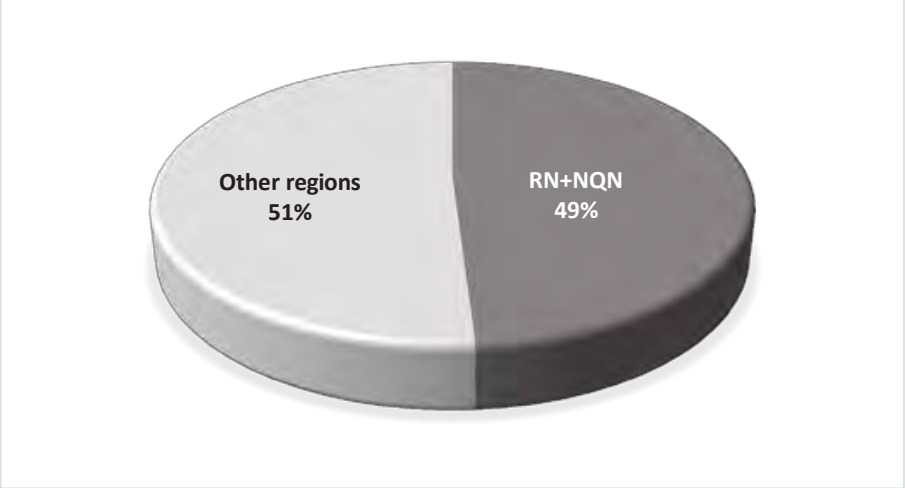
Figure 20. Tonnes exported by sea - 2011/2012 season



Source: Caminiti, A., 2014

It also concentrates 48.77% of land shipments from Argentina to the exterior, fruit originating exclusively from the provinces of Río Negro and Neuquén, destined for MERCOSUR (mainly Brazil).

Figure 21. Tonnes exported by land - 2011/2012 season

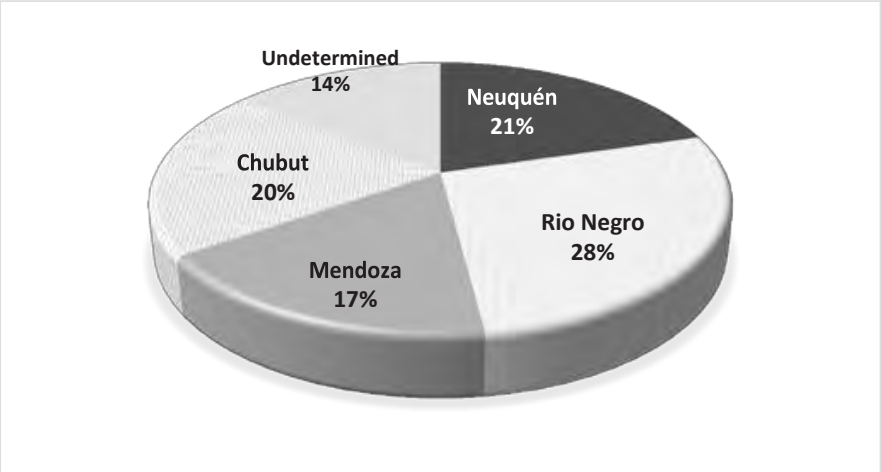


Source: Caminiti, A., 2014

The provinces of Neuquén and Río Negro send the largest national volume by air, with 47% of total exports. The cost of air exports is approximately 1.6 USD/kg. [1] This value has no significant differences if it is done from Ezeiza or Neuquén airports.

1 Personal communication with Eng. Aníbal Caminiti.

Graph 22. Percentages exported by air - 2011/2012 season



Source: Caminiti, A., 2014

The importance of arranging direct flights abroad from Neuquén City International Airport is that it allows to bring forward the income in international markets, participating in a few days to the important exit of the Chilean offer of cherries, obtaining better prices as a first fruit (Caminiti, 2014).

> Exports via EZEIZA AIRPORT (1), are considered as principle cargoes operated by commercial warehouses, which are mainly destined for the EU, the Middle East and other countries (not China or the USA). The same applies at the end of the season, in this case mainly with fruit from Chubut and Santa Cruz. Exports via NEUQUEN AIRPORT (2) are estimated to come mainly from Rio Negro and Neuquén, operated by charter flights to China (East Asian countries) and the USA. (Caminiti, 2016)

The availability of wineries at Ezeiza airport is 5,000 t, finding a limit that must be overcome with Neuquén airport, taking into account the growing trend of the volume produced in the region and, therefore, the expectation of increasing export volumes (Cámara Argentina de Productores de Cereza Integrados, http://www.capci.com.ar/).

In December 2016, the first export of regional cherries from Neuquén airport took place. Senasa carried out the phytosanitary and documentary control tasks of the first shipment of North Patagonian cherries of the 2016 season, which left for Miami, United States, from Neuquén International Airport.

A total of 47 tons of cherries were produced in Vista Alegre and San Patricio del Chañar, in the province of Neuquén, and in Chimpay, in the province of Río Negro. In compliance with the agreements reached with the Animal and Plant Health Inspection Service of the United States, samples were sent for analysis by Senasa entomologists in the days prior to shipment, to later carry out the documentary review, the weighing of the cargo and the traceability control at the Centenario Phytosanitary Reservation, Neuquén. This type of exports takes place in a Fruit Fly Free Area, a sanitary title held by the Patagonian region, which produced, among other benefits, the possibility of entering this important market by air and without the quarantine treatments required for regions with a lower phytosanitary status.

> Patagonia enjoys a recognized and valued identity at an international level, with a beneficial health status. The quality of our cherries can and should be promoted in a

> to capitalise on this intangible value provided by our favourable location. The important dynamics of the markets as a result of globalisation have redirected the destinations of Argentinean companies from the traditional markets of Canada, the United States and the EEC countries to the preferential markets of East Asia (Qatar, Arab Emirates, Saudi Arabia, Bahrain, Kuwait, India, Singapore and Hong Kong). (Caminiti, 2014)

In summary, 70% of the country's total exports (4,300 t) come from the Pa- tagonia region (3,010 t). Patagonia sends 70% by air (2 107 t) at an average FOB value of 6 USD/kg, the rest reaches an FOB value of approximately 5 USD/kg, the total income reaches 15.27 million USD in 2016 (Table 8), with a growth projection to 2020 of 30% (five million USD more).

Table 21. FOB value of Patagonian exports (millions of dollars)

Year	Argentina	Patagonia
2002	**3,36**	**1,68**
2003	**3,04**	**1,58**
2004	**3,94**	**2,13**
2005	**5,52**	**3,09**
2006	**6,76**	**3,92**
2007	**7,57**	**4,54**
2008	**8,06**	**4,92**
2009	**6,98**	**4,33**
2010	**9,55**	**6,59**
2011	**8,34**	**6,76**
2012	**8,81**	**7,58**
2013	**8,61**	**8,52**
2014	**15,15**	**12,88**
2015	**10,03**	**8,53**
2016	**17,97**	**15,27**

Source: Own elaboration based on INDEC data. The value of Patagonia is adjusted by discounting the value of Mendoza's exports (IDR Foundation, 2015)

The potential of the Chinese market for cherries

The neighbouring country, Chile, exports several fruits to China,

> Chile is currently China's largest supplier of fresh fruit, having overtaken Thailand last season. This is a very significant fact, because historically the vast majority of the fruit imported by China was supplied by Southeast Asia. (Ronald Bown, President of ASOEX)

The Chilean cherry begins its million dollar promotion in China, with the aim of developing greater consumption of Chilean cherries. The campaign has two specific objectives:

> First, it seeks to increase the consumption of Chilean cherries in China, especially before and after the Chinese New Year festivities, in order to achieve a sustained consumption of

> consumers when our export cherries become available in this important market. The second objective is to position our brand in the minds of the consumers in order to associate our brand with the differentiating attributes of our country. (Simfruit, 2017)

The Chinese market is still closed for Argentine cherries; the national government, together with members of the industry, are working hard on the issue. "Entering China is our main objective, it is a market that gives many possibilities. Chile exported in 2013 68.00 tons and almost 75% of them were destined for the Chinese market" (Caminiti, 2014).

The establishment of a protocol for cherry exports between Argentina and China is on the agenda of both countries, preceded by table grapes and blueberries. To this end, the maintenance of the Procem in Patagonia is fundamental.

Argentine Chamber of Integrated Cherry Producers (CAPCI)

The cherry producer-marketer sector has organized itself in the Argentine Chamber of Integrated Cherry Producers (CAPCI - http://www.capci.com.ar/).

The objective of the CAPCI is to represent and promote the interests of the cherry producing, packing, manufacturing and exporting sector of the Argentine Republic, and to boost its productive and commercial development.

Since 2013, the CAPCI is formed by production and marketing companies from Patagonia and the province of Mendoza. [2]

The member companies of the CAPCI invest for the expansion of the activity. Cherries Ar- gentinas are incorporating anti-hail nets and rain protection covers for their new plantations of early varieties, is investing 12 million dollars in a packing house and planting 150 new hectares of cherries (*Agrovalle Magazine*, 22 December 2017). Engineer Caminiti states that "the area of Rio Negro and Neuquén is prosperous in terms of cherries. Every year, the planted area and the production volume increase" (*Agrovalle Magazine*, 22 December 2017).

According to Chamber statistics, the destinations of cherry exports are

- Hong Kong 40
- North America 36 %.
- Europe 23
- United Kingdom 15
- Middle East 5
- South America 3,5
- Asia 2,5

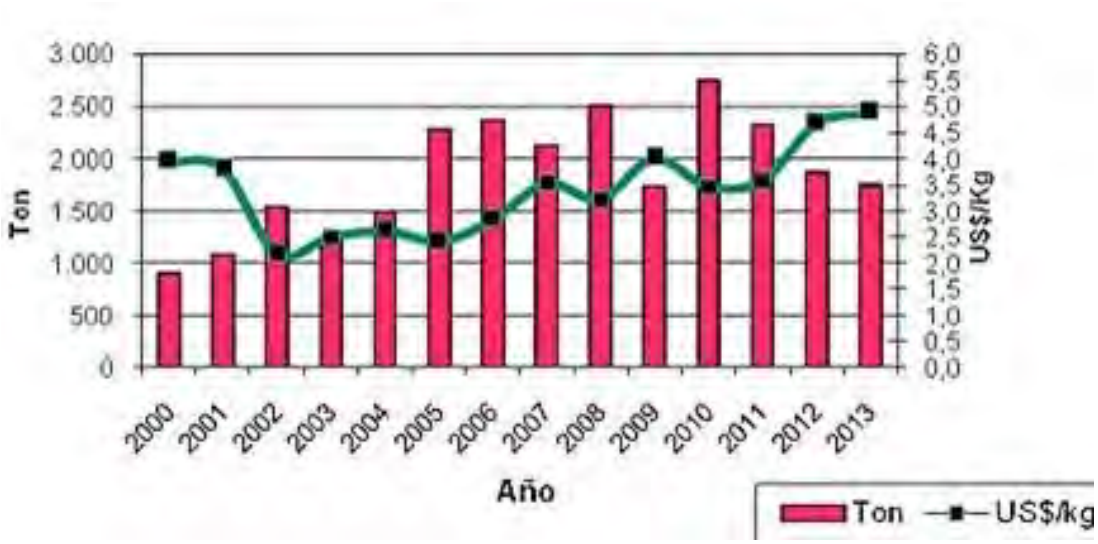
The bulk of Argentina's production clashes in international markets with that of Chile.

> We cannot compete with Chile's volumes, but with the fruit from northern Patagonia we can adjust our logistics and ship by air and anticipate the income of large Chilean volumes to the international market. (Caminiti, 2014)

In Chart 23, the camera shows the evolution of exports and their average value.

2 Vista Alegre S.R.L. (Neuquén), Ceco S.A. (Río Negro), Carleti S.A. (Mendoza), Guizzo (Mendoza), Miele S.A. (Río Negro), Cerezas Argentinas S.A. (Río Negro), Frutos de los Lagos S.A. (Chubut), Southern Crops by Rio Alara S.A. (Buenos Aires), Cooperativa Agrofrutícola el Oasis Limitada (Santa Cruz), Natafrut S.R.L. (Mendoza), Alta Arbolada S.A. (Mendoza, de Carleti), Huerta Hermanos S.H. Delfina Cherries (Neuquén).

Figure 23. Argentine Fresh Cherry Exports



Source: Argentine Chamber of Integrated Cherry Producers

The Argentine cherry industry is taking advantage of the faster services from Valpa- raíso to take advantage of the Asian market. The manager of the Chamber said: "What I can say is that, between last season and this one, operations through Chile have increased with maritime shipments" (*Agrovalle Magazine*, 22 December 2017).

ANNEX V-Production and export of pip fruit

Table 22. Río Negro and Neuquén apples

Year	Area (ha)	Production (t)	Export (%)
2001	27.446	976.142	20%
2002	26.041	686.949	24%
2003	26.098	816.380	24%
2004	26.155	796.195	25%
2005	26.212	972.799	27%
2006	25.535	898.364	24%
2007	24.857	905.316	29%
2008	24.180	750.230	28%
2009	24.517	802.340	26%
2010	23.812	622.386	25%
2011	23.484	966.127	22%
2012	22.921	685.079	17%
2013	22.556	694.979	22%
2014	21.857	574.649	25%
2015	21.401	623.671	17%
2016	20.495	547.006	16%

Source: Zubeldía, H., 2016

Table 23. Rio Negro and Neuquén Pears

Year	Area (ha)	Production (t)	Export (%)
2001	17.203	547.297	54%
2002	17.294	498.413	60%
2003	18.362	522.773	59%
2004	19.430	486.796	62%
2005	20.497	613.770	62%
2006	21.175	622.414	55%
2007	21.853	625.923	65%
2008	22.531	672.882	62%
2009	23.719	683.728	62%
2010	23.539	607.288	60%
2011	23.823	734.295	59%
2012	23.778	704.832	51%
2013	23.494	686.071	59%
2014	23.148	615.245	64%
2015	22.691	549.758	57%
2016	22.169	522.414	58%

Source: Zubeldía, H., 2016

Table 24. Northern Patagonia 2007-2016 - Pears and apples
Exports (t) by country/region of destination

Destination	year 2007	year 2008	year 2009	year 2010	year 2011	year 2012	year 2013	year 2014	year 2015	year 2016
Brazil	141.217	135.201	169.214	163.131	201.655	171.077	181.709	175.937	136.652	117.267
Europe	312.221	269.022	244.770	158.984	186.693	109.907	152.737	129.755	62.316	79.628
Russia	123.846	152.428	123.785	113.207	153.287	115.544	118.435	100.775	81.273	73.971
North America	56.675	37.953	41.353	36.789	46.717	37.956	52.323	63.026	63.264	64.605
Others	11.544	10.585	13.496	14.061	25.451	17.978	25.698	42.527	42.233	51.385
Mexico	14.832	7.025	4.543	6.008	6.637	1.905	4.365	3.302	2.071	3.493
Africa	12.594	14.358	34.446	26.415	23.612	21.227	23.661	20.156	11.565	2.715
TOTAL	672.929	626.572	631.607	518.595	644.052	475.594	558.928	535.478	399.374	393.064
%Am. North	8%	6%	7%	7%	7%	8%	9%	12%	16%	16%

Source: Senasa, yearbook 2016

Exports of pome and stone fruit trees

For exports of pome and stone fruit trees the destinations considered are the United States, Chile, Colombia, Ecuador, Mexico, Peru and Venezuela. The period analysed depends on the availability of information according to the source consulted.

For the volume exported to the United States the source of information is COPEXEU (Annex VIII). This corresponds to exports with pre-shipment certification of Patagonian origin. The information available is from the beginning of COPEXEU's actions, season 1982-1983. For the purposes of this work, the period 1995-2016 is considered.

The value of seed exports to the United States was taken from the report prepared by engineer Héctor Zubeldía based on data from the March of the Fruit Business bulletin.

The volume exported to Mexico of pears and apples is also taken from COPEXEU, for the period 2004-2014, completing the years 2015 and 2016 with information from Senasa.

For the other countries the database is INDEC for pear and apple species, although they reflect the country's total exports (not only from Patagonia), more than 90% originate in the provinces of Río Negro and Neuquén. COPEXEU provides information on volume and FOB value in dollars since 2002.

The situation is different for plum, peach and nectarine, because exports from North Patagonia are a much lower percentage than those from Cuyo. For this reason, the volume exported is taken from the yearbooks of Senasa and Funbapa. In terms of value, the average FOB price per year and species is taken from the NOSIS base (data sent by the Centro Pyme ADENEU).

Growth in exports to the United States

Table 25. Fresh apple, main export destinations

Destination	2005	2010	2015
Russia	23,2%	16,0%	14,9%
Brazil	18,7%	28;2%	26,2%
USA USA			15,9%
Netherlands	13,0%		
Algeria		11,0%	

Source: Own elaboration based on INDEC (Storti, 2016)

Table 26. Fresh pears, main export destinations

Destination	2005	2010	2015
Russia	20,3%	21,7%	17,8%
Brazil	19,7%	36,0%	37,5%
USA USA			15,6%
Italy	17,1%	10,5%	

Source: Own elaboration based on INDEC (Storti, 2016)

Table 27. Volume exported to the United States in tons

Season	Pear	Apple	Subtotal nugget	Plum	Nectarine	Peach	Subtotal stone
95-96	19.700	3.100	22.800	0	0	0	0
96-97	36.000	2.220	38.220	0	0	0	0
97-98	38.000	1.320	39.320	0	0	0	0
98-99	48.000	3.440	51.440	0	0	0	0
99-00	52.000	1.840	53.840	0	0	0	0
00-01	46.000	3.680	49.680	260	0	0	260
`01-02	48.000	2.040	50.040	200	146	52	398
`02-03	54.000	5.060	59.060	44	0	0	44
`03-04	40.000	2.440	42.440	0	0	0	0
`04-05	50.000	1.560	51.560	134	0	0	134
`05-06	52.000	1.740	53.740	84	0	0	84
`06-07	66.000	5.180	71.180	176	0	24	200
`07-08	44.000	2.160	46.160	200	0	44	244
`08-09	44.000	2.160	46.160	200	0	44	244
`09-10	30.000	6.580	36.580	196	120	72	388
`10-11	44.000	5.040	49.040	220	102	68	390
`11-12	34.000	5.440	39.440	104	0	54	158
`12-13	48.000	8.940	56.940	200	22	86	308
`13-14	52.000	10.540	62.540	66	24	0	90
`14-15	54.000	14.340	68.340	84	30	14	128
`15-16	48.000	12.060	60.060	0	0	0	0
`16-17	42.000	11.820	53.820	100	0	0	100

Source: Own elaboration based on COPEXEU data

Table 28. Volume exported to Mexico of pears and apples

Year	Pear	Apple	Total
`2004	7.273,15	334,75	7.607,90
`2005	10.353,96	168,36	10.522,32
`2006	12.253,19	378,96	12.632,15
`2007	17.390,23	1.932,25	19.322,47
`2008	7.801,34	266,23	8.067,57
`2009	4.566,28	-	4.566,28
`2010	6.211,44	258,81	6.470,25
`2011	7.013,81	-	7.013,81
`2012	2.274,78	-	2.274,78
`2013	4.885,09	-	4.885,09
`2014	3.364,93	-	3.364,93
`2015	2.071,00	-	2.071,00
`2016	3.493,00	-	3.493,00

Source: Own elaboration based on COPEXEU 2004-14 data, Senasa 2015-16

Table 29. Volume of pome fruits exported to Pacific destinations (tons)

Year	Chile	Colombia	Ecuador	Peru	Venezuela	Total	of the total
2002	-	1.377,23	0,04	-	969,51	2.346,78	0,49%
2003	-	560,49	-	-	176,96	737,45	0,14%
2004	-	946,96	-	-	114,66	1.061,62	0,20%
2005	-	1.921,33	-	-	461,36	2.382,69	0,33%
2006	23,52	833,10	-	20,58	885,68	1.762,88	0,28%
2007	-	674,05	-	106,59	2.125,00	2.905,64	0,39%
2008	22,15	327,27	-	270,20	2.196,52	2.816,14	0,40%
2009	21,28	508,23	-	1.464,36	500,64	2.494,51	0,38%
2010	-	1.091,39	-	2.924,05	230,94	4.246,38	0,71%
2011	-	2.165,33	-	1.909,69	1.360,16	5.435,19	0,77%
2012	19,55	1.163,43	1.334,35	5.739,52	744,61	9.001,46	1,71%
2013	-	432,03	1.249,21	4.906,18	485,71	7.073,13	1,17%
2014	43,04	931,56	1.537,10	7.096,94	1.098,87	10.707,50	1,93%
2015	653,02	952,15	565,91	7.652,86	505,40	10.329,34	2,35%
2016	607,45	3.615,57	353,51	6.336,62	46,12	10.959,27	2,73%

Source: Own elaboration based on INDEC data

Table 30. Apple (volume exported in tonnes)

Destination	Year 2013	Year 2014	Year 2015	Year 2016
Chile	-	22	247	119
Colombia	199	20	62	329
Ecuador	98	196	-	104
Peru	307	107	80	61
Venezuela	-	562	335	-
TOTAL	604	907	724	613
% export	0,4%	0,64%	0,74%	0,68%

Source: Own elaboration based on Senasa data

Table 31. Pear (volume exported in tons)

Destination	Year 2013	Year 2014	Year 2015	Year 2016
Chile	-	22	408	443
Colomba	316	912	890	3.194
Ecuador	1.170	1.383	566	226
Peru	4.686	6.994	7.549	6.207
Venezuela	489	308	170	46
TOTAL	6.661	9.619	9.583	10.116
% export	1,63%	2,45%	3,18%	3,33%

Source: Own elaboration based on Senasa data

Table 32. Pears - FOB values of exports by Pacific (dollars)

Year	Colombia	Peru	Venezuela	Chile	Ecuador	TOTAL
2012	327.694	6.485.624				6.813.318
2013	185.456	4.588.638	59.390			4.833.484
2014	730.332	7.227.727		26.667	28.520	8.013.246
2015	439.735	5.968.032		437.707		6.845.474
2016	1.283.524	5.671.375		534.591		7.489.490

Source: Own elaboration based on data from Centro Pyme adeneu (NOSIS base)

Table 33. Apple - FOB values of exports by Pacific (dollars)

Year	Colombia	Peru	Venezuela	Chile	TOTAL
2009	130.038	206.753	104.294		441.085
2010	75.572	164.244			239.816
2011	429.003	221.843			650.846
2012	110.623	102.339			212.962
2013	138.426	269.473	78.204		486.103
2014		103.933		29.540	133.473
2015	809	101.373		267.736	369.918
2016	123.916	64.491		112.986	301.393

Source: Own elaboration based on data from Centro Pyme adeneu (NOSIS base)

Table 34. FOB value of seed exports millions of dollars

Year	Chile	Colombia	Ecuador	United States	Mexico	Peru	Venezuela	Total	% exp.
2002	-	0,69	-	22,86	1,39	-	0,46	25,39	13%
2003	-	0,33	-	26,65	2,62	-	0,09	29,68	13%
2004	-	0,46	-	19,70	3,68	-	0,08	23,92	10%
2005	-	0,89	-	26,39	5,78	-	0,29	33,34	10%
2006	0,01	0,54	-	25,59	7,87	0,02	0,74	34,77	11%
2007	-	0,47	-	38,29	13,52	0,11	2,24	54,63	13%
2008	0,01	0,30	-	28,92	7,00	0,31	2,86	39,41	8%
2009	0,02	0,46	-	31,96	4,46	1,33	0,53	38,76	8%
2010	-	0,85	-	28,32	5,75	2,13	0,28	37,33	8%
2011	-	1,86	-	36,85	7,56	1,85	1,70	49,82	8%
2012	0,01	1,06	1,12	31,82	2,63	6,25	0,95	43,84	9%
2013	-	0,38	1,01	47,23	6,46	4,93	1,03	61,03	11%
2014	0,06	1,02	1,41	50,82	4,26	7,27	1,52	66,35	13%
2015	0,72	0,81	0,45	57,88	2,32	6,54	0,68	69,40	19%
2016	0,68	3,56	0,29	53,65	4,33	5,60	0,05	68,16	20%

Source: INDEC

ANNEX VI - Export of stone fruits

Table 35. FOB value of stone fruit exports in millions of dollars

Year	USA USA	Colombia	Venezuela	of the total
`2003	0,04			0,72%
`2004	0,03			0,56%
`2005	0,05			1,24%
`2006	0,02			0,33%
`2007	0,10			1,43%
`2008	0,17			1,98%
`2009	0,37		0,002	8,04%
`2010	0,20			2,80%
`2011	0,15			2,15%
`2012	0,05			1,33%
`2013	0,11	0,02		2,83%
`2014	0,09			2,98%
`2015	0,05			3,51%
`2016	-			0,00%

Source: Own elaboration based on average price per species year of NOSIS, applied to the regional volume according to data from Funbapa and Senasa

Table 36. Volume exported of stone fruits to Pacific destinations (tons), share in total exports

Year	Total exports	Colombia	Venezuela	of the total
`2003	9.657,90			0,00%
`2004	8.065,78			0,00%
`2005	6.725,95			0,00%
`2006	8.415,85			0,00%
`2007	9.542,00			0,00%
`2008	9.873,00			0,00%
`2009	4.879,00		1,87	0,04%
`2010	6.345,00			0,00%
`2011	6.832,00			0,00%
`2012	3.213,00			0,00%
`2013	3.709,00	20,00		0,54%
`2014	2.319,00			0,00%
`2015	1.708,00			0,00%
`2016	662,00			0,00%

Source: Own elaboration based on data from Funbapa 2003-13 and Senasa 2014-16.

ANNEX VII-Positive scenario

1. Increased production and export

1.1. Cherry

The criterion is that 100 ha are added each year during the ten years of the analysis. Each year, one hectare leaves the system due to age (over 30 years old, according to Senasa 2016), therefore giving 99 ha net to be incorporated into production.

An average production (including young plants and climatic adversities) of 6 t/ha is considered. Of the total produced, 70% is exported.

Assuming the opening of the Chinese market, the volume exported each year increases from 2019. The reference price is Chile's export price to China of 9 USD/kg. For exports to other destinations the current average value of 5.09 USD/kg is maintained.

Table 37. Projection production-export of cherries

Year	Sup ha	Tons	Exported volume t	China	Export China USD	Other exports USD	Total exports USD	Difference from 2016
2016	**1.166**	**6.996**	**4.897**	**-**	**-**	**24.926.748**	**24.926.748**	
2017	**1.265**	**7.590**	**5.313**	**-**	**-**	**27.043.170**	**27.043.170**	**2.116.422**
2018	**1.364**	**8.184**	**5.728**	**-**	**-**	**29.159.592**	**29.159.592**	**4.232.844**
2019	**1.463**	**8.778**	**6.144**	**15**	**8.295.210**	**26.584.612**	**34.879.822**	**9.953.074**
2020	**1.562**	**9.372**	**6.560**	**15**	**8.856.540**	**28.383.571**	**37.240.111**	**12.313.363**
2021	**1.661**	**9.966**	**6.976**	**18**	**11.301.444**	**29.117.264**	**40.418.708**	**15.491.960**
2022	**1.760**	**10.560**	**7.392**	**18**	**11.975.040**	**30.852.730**	**42.827.770**	**17.901.022**
2023	**1.859**	**11.154**	**7.807**	**20**	**14.054.040**	**31.793.362**	**45.847.402**	**20.920.654**
2024	**1.958**	**11.748**	**8.223**	**20**	**14.802.480**	**33.486.499**	**48.288.979**	**23.362.231**
2025	**2.057**	**12.342**	**8.639**	**20**	**15.550.920**	**35.179.637**	**50.730.557**	**25.803.809**
2026	**2.156**	**12.936**	**9.055**	**20**	**16.299.360**	**36.872.774**	**53.172.134**	**28.245.386**

Source: Own elaboration

After ten years, the value of cherry exports will have grown by just over 28 million dollars over current earnings.

1.2. Apple production and export growth

The criterion is that 1 000 ha are planted each year. 785 ha/year leave the system due to advanced age (over 30 years old, according to Senasa 2016). The net increase in area is 215 ha/year. The average production (considering young plants and climatic adversities) is 26 t/ha.

The export rate is 20%. Of this total, a percentage goes to China, the price

in this market is 1,646 USD/t (Argentine Chancellery, 2015). For the rest of the destinations, the current average value of 1,100 USD/t is considered (Zubeldia, 2017).

Table 38. Projection of production-export of apples

Year	Sup ha	Tons	Exported volume t	China	Export China USD	Other exports USD	Total exports USD	Difference from 2016
2016	20.495	532.870	106.574	-	-	117.231.400	117.231.400	
2017	20.710	538.460	107.692	-	-	118.461.200	118.461.200	1.229.800
2018	20.925	544.050	108.810	-	-	119.691.000	119.691.000	2.459.600
2019	21.140	549.640	109.928	5	9.047.074	114.874.760	123.921.834	6.690.434
2020	21.355	555.230	111.046	5	9.139.086	116.043.070	125.182.156	7.950.756
2021	21.570	560.820	112.164	7	12.923.536	114.743.772	127.667.308	10.435.908
2022	21.785	566.410	113.282	7	13.052.352	115.887.486	128.939.838	11.708.438
2023	22.000	572.000	114.400	8	15.064.192	115.772.800	130.836.992	13.605.592
2024	22.215	577.590	115.518	8	15.211.410	116.904.216	132.115.626	14.884.226
2025	22.430	583.180	116.636	9	17.278.457	116.752.636	134.031.093	16.799.693
2026	22.645	588.770	117.754	10	19.382.308	116.576.460	135.958.768	18.727.368

Source: Own elaboration

1.3. Pear production and export growth

The criterion is that 500 ha are incorporated each year, from which 350 ha must be subtracted by age (over forty years old, Senasa, 2016), therefore the net increase in area is 150 ha/year, during the decade analysed.

The average production value, considering young plants and climatic adversities, is 24 t/ha, the export percentage being 60%. The destination to China is growing year by year, with a value of 1375 USD/t (Argentinean Ministry of Foreign Affairs, 2015). For the remaining volume, the current average value of pear exports is considered, 820 USD/t (Zubeldia, 2017).

Table 39. Projection of production-export of pears

Year	Sup ha	Tons	Exported volume t	China	Export China USD	Other exports USD	Total exports USD	Difference from 2016
2016	22.169	532.056	319.234	-	-	261.771.552	261.771.552	
2017	22.319	535.656	321.394	-	-	263.542.752	263.542.752	1.771.200
2018	22.469	539.256	323.554	-	-	265.313.952	265.313.952	3.542.400
2019	22.619	542.856	325.714	5	22.392.810	253.730.894	276.123.704	14.352.152
2020	22.769	546.456	327.874	5	22.541.310	255.413.534	277.954.844	16.183.292
2021	22.919	550.056	330.034	7	31.765.734	251.683.623	283.449.357	21.677.805
2022	23.069	553.656	332.194	7	31.973.634	253.330.839	285.304.473	23.532.921
2023	23.219	557.256	334.354	8	36.778.896	252.236.356	289.015.252	27.243.700
2024	23.369	560.856	336.514	8	37.016.496	253.865.860	290.882.356	29.110.804
2025	23.519	564.456	338.674	9	41.910.858	252.718.240	294.629.098	32.857.546
2026	23.669	568.056	340.834	10	46.864.620	251.535.197	298.399.817	36.628.265

Source: Own elaboration

Table 40. Total value of export growth in the decade

Year	Cherry	Apple	Pear	TOTAL
2016	-	-		-
2017	2.116.422	1.229.800	1.771.200	5.117.422
2018	4.232.844	2.459.600	3.542.400	10.234.844
2019	9.953.074	6.690.434	14.352.152	30.995.661
2020	12.313.363	7.950.756	16.183.292	36.447.411
2021	15.491.960	10.435.908	21.677.805	47.605.673
2022	17.901.022	11.708.438	23.532.921	53.142.381
2023	20.920.654	13.605.592	27.243.700	61.769.946
2024	23.362.231	14.884.226	29.110.804	67.357.261
2025	25.803.809	16.799.693	32.857.546	75.461.048
2026	28.245.386	18.727.368	36.628.265	83.601.020

Source: Own elaboration

2. Reduction in cost of quarantine treatment

Following the logic developed for the retrospective analysis, this saving is considered for the estimated export volumes in the positive scenario.

Of the total exported, 12.5% of apples and 12.8% of pears are destined for countries which would require quarantine treatment in the absence of the Programme.

Of the total volume, 80% is exported in containers and 20% in the warehouse.

Table 41. Savings from not performing quarantine treatment

Year	Apple		Pear		TOTAL USD	Additional to 2016 USD
	Container USD	Winery USD	Container USD	Winery USD		
2016	796.747	44.894	2.126.453	137.705	3.105.799	
2017	805.105	45.365	2.140.841	138.636	3.129.948	24.149
2018	813.464	45.836	2.155.229	139.568	3.154.097	48.298
2019	821.822	46.307	2.169.617	140.500	3.178.246	72.447
2020	830.180	46.778	2.184.005	141.432	3.202.395	96.596
2021	838.538	47.249	2.198.393	142.363	3.226.544	120.744
2022	846.896	47.720	2.212.781	143.295	3.250.693	144.893
2023	855.254	48.191	2.227.169	144.227	3.274.842	169.042
2024	863.613	48.662	2.241.557	145.159	3.298.991	193.191
2025	871.971	49.133	2.255.945	146.090	3.323.139	217.340
2026	880.329	49.604	2.270.334	147.022	3.347.288	241.489

Source: Own elaboration

3. Savings in logistics by exporting through Chile

Considering that 67% of exports to the United States and Pacific countries are made through Chile, the savings in logistics are estimated.

Table 42. Savings when exporting through Chile

Year	USA USA and Pacific destinations		Exporting through Chile		Containers for Chile		Saving USD
	Apple (t)	Pear (t)	Apple (t)	Pear (t)	Apple	Pear	
2016	13.322	40.862	8.926	27.377	445	1.187	1.632.164
2017	13.462	41.138	9.019	27.563	449	1.195	1.644.864
2018	13.601	41.415	9.113	27.748	454	1.203	1.657.564
2019	13.741	41.691	9.206	27.933	459	1.211	1.670.264
2020	13.881	41.968	9.300	28.118	463	1.219	1.682.964
2021	14.021	42.244	9.394	28.304	468	1.227	1.695.665
2022	14.160	42.521	9.487	28.489	473	1.236	1.708.365
2023	14.300	42.797	9.581	28.674	477	1.244	1.721.065
2024	14.440	43.074	9.675	28.859	482	1.252	1.733.765
2025	14.580	43.350	9.768	29.045	487	1.260	1.746.465
2026	14.719	43.627	9.862	29.230	491	1.268	1.759.166

Source: Own elaboration

ANNEX VIII. COPEXEU

Committee of Producers and Exporters of Fresh Fruit and Vegetables for the **United States**
For exports to the United States, in Río Negro and Neuquén, fruit inspection work has been carried out since 1998 at the Villa Regina Phytosanitary Reservation, where the Export Committee (COPEXEU1) is the link between the health bodies of both countries, i.e. Senasa and the Animal and Plant Health Inspection Service of the US Department of Agriculture. (Aphis/Usda). One of the Committee's objectives is to promote the qualification of the different production regions in our country.

By having the permanent advice of the USDA Office. APHIS. IS, based in Argentina, a partnership between the private and the public sector was formed to implement the internationally recognized programs and protocols for the pre-shipment certification of exports and eradication of pests and diseases considered quarantine by the U.S. and other countries with similar or higher zootechnical requirements. The pre-shipment certification has allowed us to open and grow in the export of pears and apples to the United States of America by guaranteeing, in advance, the free entrance of our exports to the United States. Each year a work plan is validated by the National Directorate of Plant Protection.
tal (DNPV) of Senasa, the Committee of Fruit and Vegetable Producers and Exporters for the USA (COPEXEU) and the Foundation Zoofitosanitary Patagonian Barrier (Funbapa), for the development of certification actions for exports of pome and stone fruit from Rio Negro and Neuquén to the USA, and for the export of apples and pears under a systemic approach and with cold quarantine treatment from Río Negro and Neuquén to the United Mexican States (Protocols subscribed No. IF-2017-08492902-APN-PRES# Sena- sa). This work plan is being carried out with resources provided by COPEXEU (since 2009). In 2016, COPEXEU contributed to Funbapa the amount of $819,000. This amount corresponds to the cost of the activities carried out in compliance with the provisions of the Agreement, considering a low volume complementary export protocol to the markets of the United Mexican States and the United States of America, of two million
(2 000 000) of eighteen kilogram (18 kg) packages.

During the 2016 season, COPEXEU hired the staff of the programme's inspection tables, taking charge of the remuneration, overtime and coverage of an Asegu- radora de Riesgo del Trabajo (ART), this amount being deducted from the Funbapa's contribution. The staff was trained by Senasa and by the United States Department of Agriculture (USA).

In 2017, COPEXEU contributed to Funbapa the amount of $ 675 873 for the same volume in 2016. As in 2016, COPEXEU hired the personnel, this amount being debited from the anterior figure (Senasa, Resolution 323-E/2017)**.**

1 COPEXEU, the Committee of Producers and Exporters of Fresh Fruit and Vegetables for the USA, Business Chamber, was founded in 1987 on the initiative of integrated producers of Patagonian pears and apples, with the intention of opening up the US market to our agricultural exports in general and fruit and vegetables in particular. It has the support of the then National Secretariat of Agriculture, Livestock and Fisheries and of the governments and businessmen of the regional economies for the establishment of a Permanent Office of the USDA. APHIS. IS in Argentina, which would allow for the recognition *in situ of the* monitoring of the programmes implemented by Argentina.

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Patricia Villarreal and others
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