



International Agricultural Trade and Policy Center

**THE ECONOMIC IMPACT OF INVASIVE SPECIES IN THE
ORNAMENTAL COMMODITY IN PUERTO RICO: TOWARDS
ESTABLISHING A MULTIDIMENSIONAL FRAMEWORK FOR
DATA COLLECTION AND ANALYSIS**

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The International Agricultural Trade and Policy Center (IATPC) was established in 1990 in the Food & Resource Economics Department (FRED) of the Institute of Food and Agricultural Sciences (IFAS) at the University of Florida. Its mission is to provide information, education, and research directed to immediate and long-term enhancement and sustainability of international trade and natural resource use. Its scope includes not only trade and related policy issues, but also agricultural, rural, resource, environmental, food, state, national and international policies, regulations, and issues that influence trade and development.

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- Disseminate agricultural trade related research results and publications;
- Interact with researchers, business and industry groups, state and federal agencies, and policymakers to examine and discuss agricultural trade policy questions.

Programs in the IATPC have been organized around five key program areas.

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- Demand Systems and International Trade
- State and Local Government Policy and Agricultural Competitiveness.

There are 10 faculty from the Food & Resource Economics Department who conduct research in these program areas for the IATPC. Each of these program areas has a set of projects that have been undertaken to address these critical areas of need. Faculty have acquired additional grant funds of more than one million dollars over the last three years to augment these programs.

Abstract

The ornamental commodity in Puerto Rico is valued for its economic contribution in the agricultural sector, its contribution to the esthetics of natural scenarios that impact the tourism sector, and for its environmental role. In the fiscal year 2001, ornamentals generated 4.8% of the total Agricultural Gross Product. In that year the production value at farm level was \$34.1 million, the export value \$0.5 million, and the import value \$11.5 millions. Of the local production value, 1.5% was exported and 34.3% of the ornamental local market value was imported. The active trade traffic in Puerto Rico is a factor that increases the risk of the introduction of invasive species that affect the agricultural sector. It is necessary to estimate the economic impact of the established invasive species and those with high potential for introduction. The economic analysis must consider the impact on production, on market, and on the environment. The direct and indirect impact on market and non-market areas has to be estimated. The study presented in this paper pretends to gather economic data on the ornamental commodity and biological data on invasive pests and diseases to initiate the development of a comprehensive species risk management framework that incorporates the economic impact of invasive species

Key Words: invasive species, ornamental, economic impact analysis

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Introduction:

The ornamental commodity in Puerto Rico is valued for its farm and market income, environmental role and the esthetics added to natural scenarios. This commodity impacts the economic development potential in the agricultural and tourism sectors. Ornaments generate 4.8% of the total Agricultural Gross Product (Department of Agriculture 2002). In fiscal year 2001 ornaments contributed \$34.1 million at farm level. The tourism activity in fiscal year 2001 attracted 4.9 million visitors, who spent \$2,728.1 million on the island. (Junta de Planificación 2002).

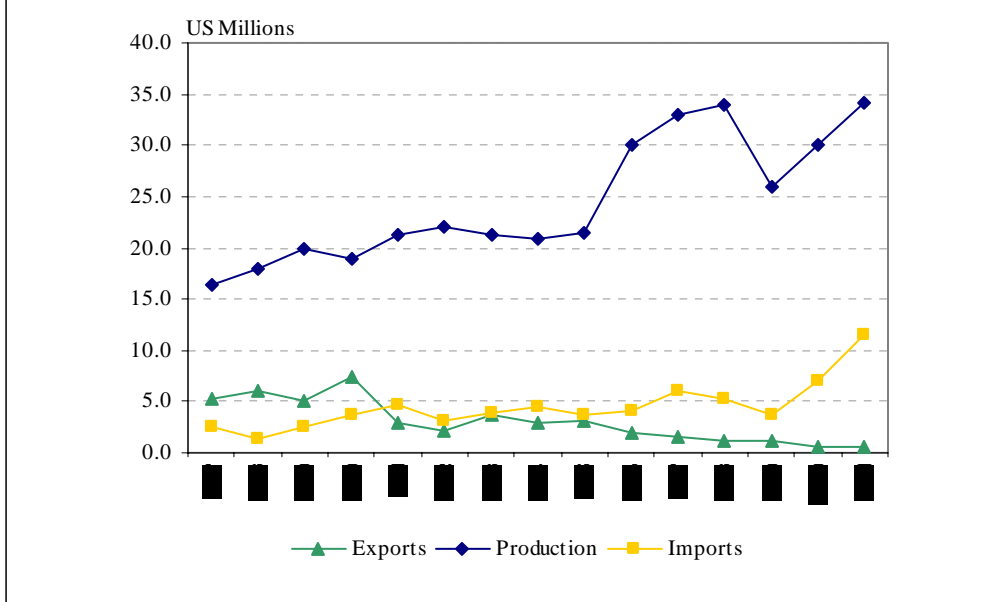
The ornamental commodity exhibited an increase in the value of local consumption. From 1987 to 2001 the value of local consumption increased 230.9%, an average of \$26.0 million per year (Department of Agriculture of P.R 2002). In the year 2001, 74.0% of the consumption value was generated on the island, versus 18.4 % in 1987. From 1987 to 2001 the value of local production increased 109.9%, an average of \$24.5 million per year. In the same period, imports increased 360.2%, an average of \$4.5 million per year. From 1987 to 2001 the export value decreased 90.0%, an average of \$3.0 million per year (Fig. 1).

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Figure 1. **The Ornamental Commodity in Puerto Rico: Production, Exports and Imports Value from 1987-2001**



In fiscal year 2001, Puerto Rico imported \$2,142.6 million in food. In the same year \$66.6 million in agricultural products was exported. The island’s strategically geographic position and the consumer’s acquisitive value allow active trade traffic. However, this active trade in fresh agricultural commodities increases the risk of the introduction and spread of invasive species associated with pests and diseases.

The Economic Research Service of the United States Department of Agriculture (USDA-ERS 2003) presents 1999 Executive Order 13112, which defines an invasive species as one that is nonnative, alien, or exotic to the ecosystem under consideration, and one whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health. In addition, the definition considers the costs and benefits, or net damage, of an alien species, because the benefits exceed the costs of some nonnative species, including some crops, livestock and ornamental plants.

The rate of introduction of invasive species in Puerto Rico is evident in the results reported by Serrano and Franqui (Serrano et al. 2001). They reported that between 1963 and 1999 one to six exotic insects were introduced per year, an average of 1.4 major insect pest species. Five families of major insect pests (Pseudococcidae, Diaspididae, Coccidae, Aphididae and Aleyrodidae) of ornamentals were introduced, representing 68.7% of the introduced species (Franqui 2003). Aside from the Homoptera family the other important interceptions are mainly associated with cut flowers. Most of these

introductions came from Caribbean Countries, Central and South America and the United States. The majority of the interceptions made in the Luis Muñoz Marín International Airport came from Dominican Republic, Colombia, Costa Rica, Antigua, Barbados, Dominica and Grenada. Franqui reported that cut flowers from Colombia are the cultivars with the most invasive species intercepted in Puerto Rico (Franqui 2003).

In fiscal year 2001, the external trade statistics reported that \$0.5 million of ornamentals was exported while \$11.5 million was imported in Puerto Rico. Historically the most important importers to Puerto Rico are Colombia, Panama, Costa Rica, United States and Dominican Republic. Puerto Rico exports ornamentals to the United States (U.S.), British and U.S. Virgin Islands, and others Lesser Antilles.

The introduction and spread of invasive species which have affected ornamentals have also occurred in the time range evaluated by Serrano and Franqui. The economic impact of those pests and diseases must be estimated, considering market, non market and environmental damages. The Council for Agricultural Science and Technology (CAST), in a 2002 issue paper expressed, that if non-native species become pests, the economic risks include lost production, diminished quality, increased production costs, decreased flexibility in production/management decisions, and increase risks for human health, (Council for Agricultural Science and Technology 2002). Evans remarked that the research agenda on invasive species has been developed by biological science researchers, and much of the previous “economic” research on invasives has been conducted by non-economists (Evans 2002). As such, the economic analysis suffers either from various methodological problems (e.g., incorrect economic valuation, ignoring non market environmental damages) or from being peripheral to the biological study.

A limitation for the economic impact analysis is that there are several different institutions collecting various information regarding pest interception, introduction, spread and control. Although there is a collaboration accords among institutions, the information collected by them is not compiled in a coordinated manner, hence creating one of the difficulties in assessing what the economic impact could be on the sector if a given pest or disease were introduced.

In April 2003 a proposal titled “Economics of Managing Invasive Species in Tropical and Subtropical Areas in the United States of America” was approved by T-STAR initiative. The objectives of this proposal are to develop a comprehensive species risk management framework that incorporates the economic impact of invasive species and to develop a collaborative interdisciplinary network of institutions and persons involved with invasive species management.

The study presented in this paper pretends to initiate the process of identifying the data sources and of gathering the information needed for the methodology presented in the project “Economics of Managing Invasive Species in Tropical and Subtropical Areas in the United States of America.”

Objectives:

1. To gather economic data on the ornamental commodity and biological data on invasive pests and diseases to initiate the development of a comprehensive species risk management framework that incorporates the economic impact of invasive species.
2. To identify institutions and persons involved with ornamental invasive species management in Puerto Rico.
3. To identify the availability of the data needed for evaluation of the economic impact.

Methodology:

The methods for the project “Economics of Managing Invasive Species in Tropical and Subtropical Areas” involve the development of a comprehensive risk management framework. This framework involves a biological profile of a pest or disease and the economic effect and measurement. The biological profile includes the physical effects that a pest has on a host, the number of potential hosts, the effects of existing control measures, and the effects of existing management practices. This information is needed to estimate the economic effect.

The economic impact of invasive species on the ornamental commodity is used as a case study in order to achieve the three objectives presented. In order to achieve objective one, economic data on production, market and ornamental trade was gathered and analyzed. The gathered data provided information regarding the commodity outlook in Puerto Rico, ranking the ornamental crops by economic importance. The biological data was gathered from the institutions, scientists and persons involved with invasive species. The identification of the most important established pests and diseases for ornamental crops was determined by using the information provided by the biological experts. A list was compiled of established and possible future introductions of invasive species with potential economic impact on ornamentals.

In order to achieve objective two, interviews, both telephone and email communication, were established with institutions, scientists and persons involved with ornamental and invasive species. Both available and unavailable biological, surveillance and economic data was identified.

Results and Discussion:

The Statistics Office of the Department of Agriculture of Puerto Rico conducts an annual survey of ornamental growers to gather information regarding production, sales value and cultivated land area. This survey estimated the distribution per cultivar of the total sales value at farm level in 2001. The following sales value sharing is ranked by its economic importance: flowering plants, 27.4%; foliage, 23.0%; lawn, 22.7%; palm trees, 12.5%; poinsettias, 8.2%; orchids, 4.6%; and cut flowers, 0.9%. In 1987, of the total farm sales value, 85.6% was attributed only to foliage. Lawn contributed 7.8% and there were no

palm tree sales reported. The farm value of the ornamental commodity in Puerto Rico doubled from 1987 to 2001 and showed a diversification in its cultivars.

In 2001 the growers reported the average sales value per cultivated area or unit. The sales values per land cultivated were: flowering plants, \$175,612 per hectare (\$71,098 per acre); foliage, \$44,823 per hectare (\$18,147 per acre); palm trees, \$40,520 per hectare (\$16,405 per acre); cut flowers, \$19,975 per hectare (\$8,087 per acre); and lawn, \$19,965 per hectare (\$8,083 per acre). The sales value per unit for poinsettias was \$3.4; for orchids, \$3.01.

The External Trade (Junta de Planificación 2001) statistics reported an import value of \$11.5 million in 2001; 70.1% of the imports came from the US and the rest from foreign countries. Colombia is responsible for 47.2 % of the total import value from foreign countries. Most of the imports of foreign countries are cut flowers. Costa Rica, Thailand, China and Ecuador are other countries from which cut flowers are imported into Puerto Rico.

The exportation from Puerto Rico to US and Caribbean islands accounts for \$0.5 million; 54.9% of the exports were shipped to British and U.S. Virgin Islands and the other Lesser Antilles. Puerto Rico stopped ornamental exports to the European market in 1998. In 1987 that market received 11.3% of the total exportation value.

The Department of Agriculture of Puerto Rico growers survey did not gather information regarding costs of control, loss of production and diminished quality due to invasive species. The survey lacks information related to market price at consumer level.

Biological Profile:

The biological data was gathered from scientists, local and federal regulatory plant protection agencies, and persons involved with invasive species. Crop protection scientists of the University of Puerto Rico provided information for pest and disease introductions, spread, hosts and damage. The "Sanidad Vegetal" Division of the Department of Agriculture of Puerto Rico and the Animal and Plant Health Inspection Service (APHIS-USDA) provided information of interceptions, surveillance and spread of the invasive species. Information from crop protection scientists and producers was gathered in order to select the most important pests and diseases, per ornamental cultivar. Table 1 presents a list of the most economically important established pests and disease in the ornamental commodity. This table also includes a list of invasive species with risk of future introductions.

Table 1. --Pests and diseases of economic importance in the ornamental commodity

Cultivar	Scientific name	Common Name	Effects
Flowering Plants, Foliage, and Cut Flowers	<i>Cerococcus deklei</i>	Hibiscus scale, grenade scale	Leaves turn yellow, gradual defoliation, few or none flowers, drying branches, cause plants dead
	<i>Maconellicoccus hirsutus</i>	Pink hibiscus mealybug	Direct losses caused by feeding and associated physiological disorders caused by a toxin.
	<i>Icerya Purchasii</i>	Cottony cushion scale	Turn yellow new and younger stems, reduce plants' grow and strength
	<i>Homoptera: Aleyrodidae</i>	White flies	Turn leaves yellow, defoliation, grow reduction and virus vector.
	<i>Contarinia macculipennis</i>	Blossom midge	Causes deformed, discolored buds and blossoms, and in severe infestations, premature bud or blossom drop.
	<i>Diaprepes abbreviatus</i>	Diaprepes root weevil	The larvae are in the soil where they feed on the roots of the host. They girdle the taproot, resulting in plant mortality.

Cont. Table 1. --Pests and diseases of economic importance in the ornamental commodity

Cultivar	Scientific name	Common name	Effects
Flowering Plants, Foliage and Cut Flowers	<i>Homoptera:</i> <i>Aphididae</i>		Virus vectors.
	<i>Rhizoctonia solani</i>		Major nursery plant soil disease.
	<i>Phytophthora spp.</i>		Quality losses on petals and foliage infected.
Lawn	<i>Scapteriscus abbreviatus</i>	Short winger mole cricket	Damage seeding, feeding aboveground on foliage or stem tissue, and bellow ground on roots. Southern mole cricket does much more tunneling injury than tawny mole cricket.
	<i>Scapteriscus Didactylus</i>	West Indian mole cricket	
	<i>Scapteriscus vicinus</i>	Tawny mole cricket	
	<i>Scapteriscus borelli/I</i>	Southern mole cricket	
	<i>Rhizoctonia solani</i>		
Palms	<i>Ceroplastes rubens.</i>	Red wax scale	Attacks palms and cycads. Their damage is greatest on palms and can cause yellowing of the leaves with the infestation of sooty mould in shaded areas.
	<i>Bursaphelenchus cocophilus/I</i>	Red ring disease	Leaves become short and deformed, and turn yellow-bronze. As leaves change color and dry up, they wilt and die.
	<i>Rhynchophorus palmarum/I</i>	Palm weevil	Red ring disease vector.

1/ risk of future introductions

Cont. Table 1. --Pests and diseases of economic importance in the ornamental commodity

Cultivar	Scientific name	Common name	Effects
Palms	<i>Rhinostomus barbirostris</i> /I	Bearded coconut weevil	Red ring disease vector.
	<i>Myndus crudus</i> /I		Lethal yellow vector
	<i>Thielaviopsis basicola</i>		Causes that plants are stunted and roots badly rotted.
Poinsettias	<i>Homoptera: Aleyrodidae</i>	White flies.	Turn leaves yellow, defoliation, grow reduction and virus vector.
	<i>Phytophthora spp.</i>		Quality losses on petals and foliage infected.
Orchids	<i>Contarinia macculipennis</i>	Blossom midge	Causes deformed, discolored buds and blossoms, and in severe infestations, premature bud or blossom drop.
	<i>Cymbidium spp.</i>	Cymbidium mosaic virus	Causes blotchy local lesions developing slowly; not systemic
	<i>Erwinia carotovora</i>	Bacterial soft rot	Causes foliar spots and blights.

1/ risk of future introductions

The identification of the important pests and diseases in the ornamental commodity allows us to identify institutions and persons involved with ornamental invasive species management in Puerto Rico. Although there is a great amount of biological data for physiological behavior of pests and diseases and records of intervention, introduction, and surveillance, this information is unevenly diffused across agencies, scientists and producers. It is necessary to compile the information in a way to facilitate exchange of data and experience among groups. A link between crop protection scientists, regulatory plant protection agencies and economists is needed. The groups need to develop a guide

for asking questions that facilitates the gathering and compilation of data for economic impact analysis.

Economic Impact: Identification of available data

The summary of the status of available data needed for economic impact evaluation is reported. The summary classifies the data according to direct and indirect market effects and non-markets effects.

Market Direct Impact:

- Information related to valuation of benefit and cost of ornamental invasive species is partially available. Information for quantities bought and sold and market prices at farm level is available.
- There is a lack of information of cost and returns. There is not aggregated information for direct producer cost, and change in product quality due to pests and disease. A growers survey has to be done to gather the direct producer costs and changes in products quantity and quality.
- There is a need to estimate the federal and commonwealth agencies' investment in the intervention, surveillance and control of invasive species.
- To determine pest impact on trade, international phytosanitary requirements for ornamentals must be compiled.
- The biological profile information related to invasive species' pathological or physical effect, potential host, and established and future introductions is available.

Market Indirect Impact:

- The indirect market impact of ornamental invasive species in Puerto Rico is highly related to the tourism sector. The beauty of the tropical scenarios is one of the main attractions for visitors. The invasive species associated with ornamental plants, especially palm trees, have the potential for a negative impact on the tropical landscaping and, therefore, on tourism. Scientists have already identified palm tree invasive species with a high introduction potential like, for example, lethal yellow. There is available biological information for pest and diseases. Economic information has to be gathered.

Non-Market Impact:

- It is necessary to identify sources and gather information to estimate non-markets environmental damage. Data related to the impact of invasive species on ecological and hydrological native systems have to be gathered. It is necessary to gather and analyze socioeconomic data for the estimation of the economic externalities' effects on the environment.

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