An Analysis of Ecuador’s Rose Industry and its Impact on Water Quality

By: Kate Krekowski, Civil Engineering and Global Resource Systems, Iowa State University

Introduction

In 1991, the United States enacted the Andean Trade Preference Act (ATPA) to combat the drug production and the trafficking of coca in Andean countries such as Ecuador. The goal of ATPA was to promote and strengthen the legal industries within the four Andean countries by offering trade benefits such as the elimination of tariffs on products like flowers.

The enactment of ATPA combined with Ecuadorian policy reforms helped develop and strengthen numerous traditional and nontraditional industries within the country. One such business was Ecuador’s floriculture industry. Flowers such as roses are best grown at high altitudes where there is high light intensity and plenty of water, making the Andean Region of Ecuador (La Sierra), a prime area for flower farms.

Since 1991, Ecuador’s flower industry has grown to become a major part of Ecuador’s economy at 9% of the total nonpetroleum export earnings. However, there are many issues associated with the industry. The primary problems include the pest susceptibility and intensive nutrient management of high-value flowers such as roses. In order to grow high quality export ready roses, large inputs of fertilizers and pesticides (primarily fungicides and insecticides) are used. While these chemicals help maintain the quality and quantity of roses grown, the inputs are degrading water quality and harming aquatic species throughout the Andean Region of Ecuador.

Materials and Methods

A literature review and content analysis were performed using data collected from Parks Library at Iowa State University, and various online searches. The following materials were used: peer reviewed journals, non-peer reviewed journals, online news articles, books, governmental websites, and general websites. Interviews of both academic and industry contacts were conducted in order to gather information related to chemical usage, soil classification, pest management strategies, etc. Experts interviewed included: Juan Carlos Velez, Carolina Cordova Martinez, Christopher Currey, Lee Nonnecke, and Gail Nonnecke.

Overview of the Soil Resources

In Ecuador, soil classification depends on elevation, temperature, rainfall and geographic location. The soil in the Andean region is primarily derived from volcanic ash, but is highly variable. The major soil tracts include: Andosols (red), Pseudogley (brown), Leptosols (grey), Cambisols (orange). These soils are ideal for growing plants such as roses as they contain high levels of nutrients, organic matter, and fertility.

Overview of the Water Resources

Ecuador is home to over 2,000 rivers and streams, many of which originate in the Andean Region of the country. This region’s abundance of water makes it an ideal location for growing roses. Having a reliable and pure water source helps the rose farms avoid risk, as roses require frequent irrigation. To minimize the undesirable effects some pesticides and fertilizers have on both the water environment, humans and other species, the following strategies should be developed and institutionalized by Ecuadorian rose farms and the associated Ecuadorian rose industry:

1. Integrated Pest Management (IPM) which uses pesticides only when practices have been implemented and they are warranted
2. Water Recycling System to capture and treat excess water
3. Economic analysis for eco-market development to offset any costs of sustainable production systems to benefit water quality
4. Development of FlorEcuador Certification levels to encourage rose farms to implement more sustainable practices

Overview of the Rose Industry

Primary Growing Locations of Roses in Ecuador

- 62.3% of Ecuador’s roses are grown in the Pichincha Province, which is located in the north-central region
- 27.7% of Ecuador’s roses are grown in the Cotopaxi Province, which is located in the central region of the country

Optimal Growing Conditions

- High altitude (9,186 – 9,842 feet above sea level)
- Moderate climate with little wind
- Rich volcanic soil
- Abundant and direct sunlight
- Long growing cycle (15 wk. vs. typical 8 wk. for roses grown at sea level)

The Growing Process

Greenhouses

- Grow roses in the soil instead of containers
- Plants irrigated using river water or another local water source
- Plants treated with pesticides and fertilizers

Post-Harvest Room

- Classify and bunch roses based on type, quality, length and width of stem and color
- Once classified, roses are moved to cold storage

Processing and Packing

- Roses are wrapped, boxed and labeled to ensure quality is maintained when transported

Chemical Usage

Pesticides

- Rose growers use fungicides, insecticides, nematocides, and herbicides to protect their plants from pests, such as botrytis and mildew, aphids and nematodes, respectively

- Iprodione fungicide Toxic to crustaceans and fish, carcinogen, suspected endocrine disruptor

- Dodecmorph acetate fungicide Skin and eye irritant

- Propineb + cyamylan fungicide Skin and eye irritant

- Thiocyclam insecticide Toxic to amphibians and fish, harmful if swallowed/ingested

Fertilizers

- Rose farms use nitrate- and phosphate-based fertilizers to maintain soil fertility and provide essential elements for high-quality rose production

- Calcium nitrate Ca and N are added to aid in the development of cell wall structure and maintain healthy leaves

- Potassium nitrate K and N are added to maintain healthy leaves

- Ammonium nitrate N is added to maintain healthy leaves

- Phosphate-based P is added to maintain healthy leaves

Results

Pesticides and fertilizers help rose farms grow high-value flowers, but these chemicals are often detrimental to both the environment and humans. Both the pesticides and fertilizers used have negative effects on aquatic ecosystems. For instance, pesticides such as iprodione and thioctyclam are known for their high toxicity to crustaceans, fish and amphibians. Fertilizers also can be toxic to these species as the excess nutrients added to water bodies can cause eutrophication, which causes oxygen depletion and even fish kill.

Ecuador has the largest number of endangered species in the world, many of which live in the Andes, and the toxicity of these chemicals is alarming. If high enough levels of pesticides and other forms of chemical pollution enter into the rivers, streams and lakes throughout the Andes, many of these species could go from endangered to extinct. A few of the species that could be affected include: the Silver Marsupial frog (Gastrotheca plumbea), Guenther’s Marsupial frog (Gastrotheca guentheri) and the Andean catfish (Astroblepus affidus).

Recommenations

To minimize the undesirable effects some pesticides and fertilizers have on both the water environment, humans and other species, the following strategies should be developed and institutionalized by Ecuadorian rose farms and the associated Ecuadorian rose industry:

1. Integrated Pest Management (IPM) which uses pesticides only when practices have been implemented and they are warranted
2. Water Recycling System to capture and treat excess water
3. Economic analysis for eco-market development to offset any costs of sustainable production systems to benefit water quality
4. Development of FlorEcuador Certification levels to encourage rose farms to implement more sustainable practices

Literature and Images Cited


I would like to thank the following individuals for their valuable assistance with this project: Gail Nonnecke (Project Advisor), Carolina Martinez, Lee Burras, Christopher Currey, Juan Carlos Velez, and Mike Weber. I would also like to thank the Global Resource Systems Program and the Honors Program.