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Quinoa Production and Growth Potential in Bolivia, Ecuador, and Peru

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Introduction

Quinoa (*Chenopodium quinoa)* is a pseudocereal grain domesticated and traditionally produced in the Andean region (primarily Peru, Bolivia, and Ecuador). Since colonial times, quinoa has acquired a negative connotation as a food consumed by the indigenous and the poor, limiting its consumption to rural areas of the Andes.

Beginning in the 1940s, quinoa gained attention due to its high nutritional value. Organizations such as the Food and Agriculture Organization of the United Nations (FAO) identified quinoa as a crop that could help achieve food security and campaigned to increase its consumption in the three Andean countries. An increase in the consumption of quinoa, however, did not happen until the 1980s, when consumers in high-income countries became interested in the crop, which ultimately helped upgrade quinoa from "indigenous food" to "superfood" status. As a result, quinoa consumption is no longer limited to the rural areas of the Andes, and quinoa has become a highly sought-after product in the urban areas of the Andes and in high-income countries among consumers interested in healthy, nutritious, gluten-free, and organic foods (CBI, 2020).

As the quinoa market expanded, prices increased. At the same time, researchers raised concerns about the negative effects of high prices on poor quinoa consumers (Bellemare, Fajardo-Gonzalez, and Gitter, 2018) and capital-intensive production on the environment (Risi, 2015). Producers from Bolivia, Peru, and eventually Ecuador were motivated to produce more quinoa to supply the increasing domestic and international demand. As a result, production and exports have significantly increased in these countries, creating incentives for new competitors to enter the market.

Recent trends in production, prices, imports, and exports suggest the global quinoa market is currently mature in major markets such as the United States and the European Union. Andean producers may not see prices return to the highs of the mid-2010s, and the market may experience a decline if demand in the US and EU weakens. However, there may be potential for continued growth in other parts of the world, including China, Japan, Australia, and Russia. The success of such an expansion will depend heavily on successfully meeting international standards related to food safety, organic production, and labeling.

International Demand and Prices

Imports and Prices

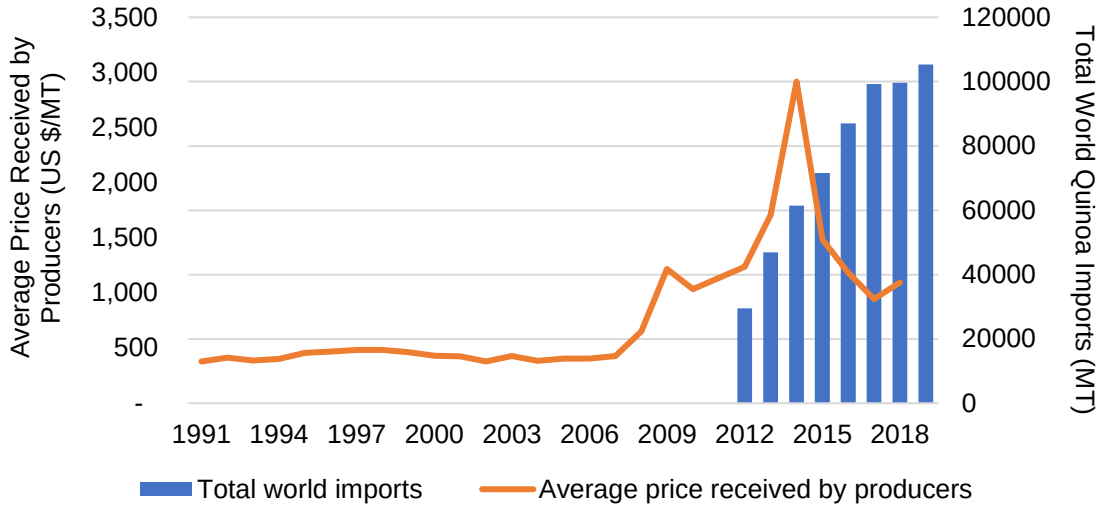
As the international demand for quinoa—measured by total world imports—increased, prices also increased. Figure 1 shows the relationship between prices received by Andean quinoa producers and total world imports. Prices remained steady in the 1990s and early 2000s. Between 1991 and 2007, quinoa prices increased by only 7.81% in Bolivia and 20.52% in Peru (FAO, 2020b). From 2008 to 2014, prices soared by 304.75% in Bolivia and 407% in Peru (FAO, 2020b). Imports increased sharply from 2012 to 2016. Imports have continued to increase since, but at a slower rate (Figure 1).

Figure 2 shows the major importers of quinoa in 2019. The United States imported 30% of the total world imports and the European Union imported 43%. Other important importers were Canada (8%), Australia (3%), Chile (3%), and Brazil (2%). Russia, Japan, the United Arab Emirates, Argentina, and New Zealand together accounted for the remaining 9% (ITC, 2020).

Exports

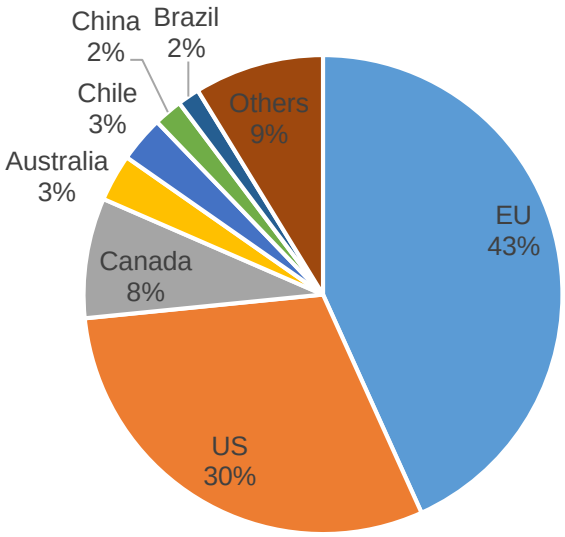
In the last decade, exports of quinoa and the number of exporting countries have increased. In 2012, 25 countries exported 43,646 metric tons (MT) of quinoa, compared to 114,439 MT exported by 53 countries in 2019 (ITC, 2020). Historically, Bolivia has been the major exporter of quinoa worldwide. Since 2014, however, Peru has taken the lead, exporting on average 1.5 times more than Bolivia (Figure 3) (ITC, 2020).

Figure 1. Average Price Received by Producers (US $/MT), 1990–2018, and Total World Quinoa Imports (MT)



Note: Trade data for quinoa are available since 2012, when the specific HS code for quinoa was created. Before 2012, quinoa was reported in the category "Buckwheat, millet, canary seed and other cereal (excluding wheat and meslin, rye, barley, oats, maize, rice, and grain sorghum)" (Coelho, Deriaz, and Tokas, 2020; ITC, 2020).
Source: Average prices are from FAO (2020b); total imports are from ITC (2020).

Figure 2. Quinoa Major Importers in 2019



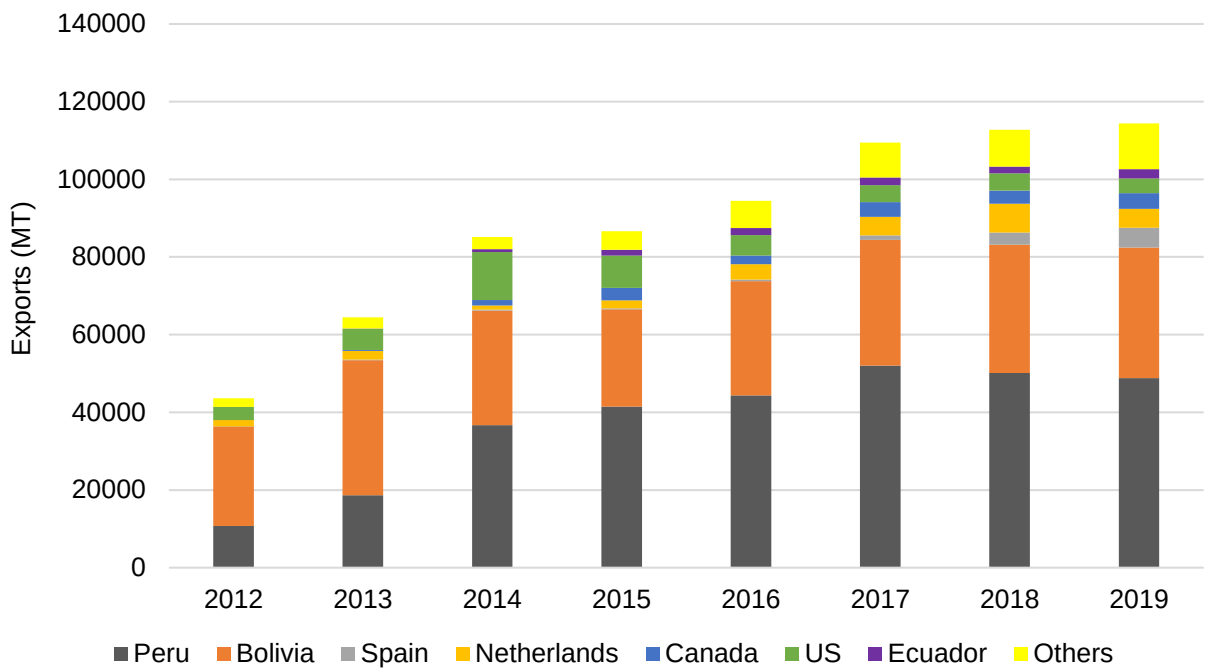
Source: ITC (2020).

In 2019, Bolivia, Ecuador, and Peru accounted for 74% of the international market of quinoa—43% from Peru, 29% from Bolivia, and only 2% from Ecuador. Newly producing countries accounted for the remaining 26%: Spain and the Netherlands contributed 5% and 4% of the market, respectively. Canada exported 4% and the United States 3%, while France, Germany, Belgium, and Italy together accounted for 10% of total world exports (Figure 3) (ITC, 2020).

Peru

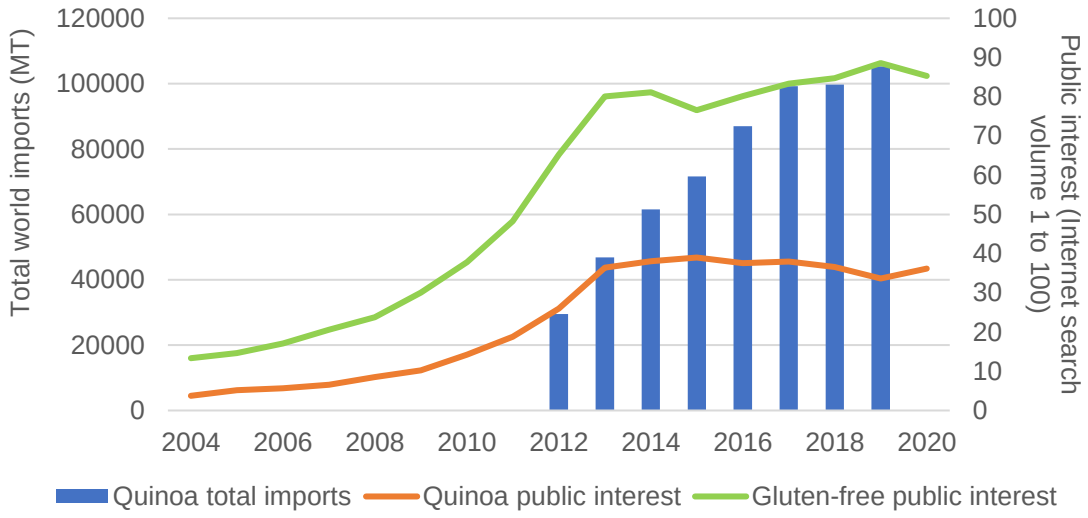
In 2002, Peru's foreign policy started focusing on opening new foreign markets, establishing commercial relationship through new trade agreements (MINCETUR, 2020). For instance, Peru has free trade agreements in force with the United States and Canada since 2009, with Japan since 2012, and with the European Union since 2014 (Soto, 2015). This strategy benefited the quinoa sector. Peru went from exporting 10,712 MT of quinoa to 21 countries in 2012 to 48,781 MT to 61 countries in 2019. Peru not only increased quinoa

Figure 3. Major Quinoa Exporting Countries, 2012–2019



Source: ITC (2020).

Figure 4. Worldwide Public Interest in Quinoa, 2004-2020 and Total World Imports of Quinoa, 2012-2019



Source: Interest in quinoa is from Google Trends (2020); total world imports is from ITC (2020).

exports by 355.38%, but also diversified its trading partners (ITC, 2020). In 2019, the major destinations for Peru's quinoa were the United States (33%) and the European Union (36%). Other partners were Canada, Brazil, Chile, Mexico, Australia, Russia, and Israel.

Bolivia

Bolivia started exporting its signature variety, Quinoa Real, in 1974 (Gamarra et al., 2019). While Bolivian exports of quinoa increased from 25,662 MT in 2012 to 33,677 MT in 2019, its share in the international market declined from 59% to 29%. During the same period, Peru's market share increased from 24% to 43%. Unlike Peru, Bolivia has developed few trade partnerships. Between 2012 and 2019, Bolivia exported approximately 83% of its quinoa to the United States and the European Union only (ITC, 2020), exhibiting a high level of dependency on those two markets.

Ecuador

Until 2016, Ecuador imported quinoa to meet its domestic and international demand (SIPA, 2018). Currently, Ecuador's production exceeds domestic demand, leaving enough surplus to supply the international market. Similar to Bolivia, Ecuador has few trade partners. In 2019, 30% of total exports went to the European Union, 23% to Canada, 23% to the United States, 21% to Israel, and 3% to other countries (ITC, 2020).

Demand, Prices and Life Cycle

The "quinoa boom" occurred from 2011 to 2015. The remaining question is what would happen next. Using the concept of product cycle (Grossman and Helpman, 1991; see Belton, Reardon, and Zilberman, 2020, for an application to seafood), this section explains the dynamics of the quinoa market and sheds light on potential opportunities and challenges quinoa producers and sellers may face.

A product's cycle is defined through the relationship between the quantity sold and sales (and profits). This cycle has four stages—introduction, growth, maturity, and (eventually) decline. As quinoa penetrated the international market (as evidenced by imports and prices), consumers have changed their behavior, and many have adopted (or not adopted) the product. Figure 4 shows the relationship between imports, measured in metric tons (ITC, 2020) and public interest in quinoa and gluten-free products, measured by the volume of Google searches (Google Trends, 2020). We propose that the dynamics of imports, prices, and public interest in quinoa can help understand the life cycle of quinoa as a product:

1. Introduction stage (2004–2010). In the early 2000s, quinoa was a novelty food in high-income countries and emerged as a gluten-free and high-protein product. Prices and profits were low during this period. Only two countries, Bolivia and Peru, were major suppliers of quinoa. Worldwide public interest in quinoa, measured in volume of Google searches, slowly increased during this stage (note that public interest in quinoa is similar to interest in gluten-free products).

2. Growth stage (2011–2015). A period of strong growth. Imports rapidly increased in the United States, Canada, and the Western European countries, causing world prices of quinoa to soar. In 2013, Western European countries imported 96% more quinoa compared to 2012 and 117.8% more in 2014 than in 2013. Public interest in quinoa grew strongly.

3. Maturity stage (2016–present). Although imports of quinoa in Western Europe, the United States, and Canada continued to increase, the rate growth slowed. The average growth rate of imports from this region was 8.87% from 2016 to 2017, -4.15% from 2017 to 2018, and 3.78% from 2018 to 2019 (ITC, 2020). Similarly, public interest in quinoa (as indicated by Google searches) has been steady since 2016. Prices started to decline as supply from established and new producing countries increased and Spain, Italy, France, Germany, the United States, and Canada entered the market. Apart from the three Andean countries, quinoa production data from other countries are limited. Given that the area planted per producer is low, quinoa production is more likely to be lumped into general categories such as "cereals" or "grains." Bazile, Jacobsen, and Verniau (2016), however, reported only eight countries cultivated quinoa in the 1980s, compared to more than 75 countries in 2015.

4. Decline stage: A stage characterized by a decline in sales and profits. There is no evidence that quinoa has reached this stage yet.

As quinoa has reached its maturity stage in some countries, quinoa producers may need to design new business strategies to avoid reaching the decline stage. The following section identifies the global market opportunities and barriers for the quinoa market.

Trade Opportunities and Barriers

Opportunities:

1. New markets: Countries such as China, Japan, Australia, and Russia are increasing their consumption of quinoa. China's quinoa imports, for instance, increased from 20 MT in 2014 to 2,044 MT in 2019 (ITC, 2020). These countries are still in the introduction or growth stage and could be the next market quinoa producers and processors need to explore.

2. Value added products: Quinoa is primarily exported as a grain. Value-added quinoa products such as flour, energy bars, or soups may be attractive for existing and new markets (CBI, 2020), but many of these products are made in importing countries such as the United States. Peru already produces energy bars, popped quinoa, and quinoa flakes. However, these products are only sold in local and regional markets because processing plants have limited capacity to produce large volumes or their equipment is not sophisticated enough to produce a product that meets international standards (Fairlie, 2016).

3. Organic quinoa: The product life cycle analysis presented above applies to conventionally

produced quinoa. European consumers, particularly those concerned about health and the environment, are increasingly interested in organic quinoa (CBI, 2020). Thus, the market for organic quinoa is still growing.

Barriers

1. Organic certification: To export organic quinoa to the European Union, the United States, and Canada, producers need to obtain an internationally recognized certification following accepted standards. The certification process can be long and expensive, increasing costs by 10%–20% compared to conventionally grown quinoa (Coelho, Deriaz and Tokas, 2020). In addition, production costs for organic quinoa are almost double those of conventionally produced quinoa (Fairlie, 2016). Due to potentially higher yields and organic price premiums, however, organic quinoa production can be profitable for producers (Fairlie, 2016).

2. Pesticide residue limit: Producers need to follow pesticides limits indicated by the Codex Alimentarius Maximum Residue Limit (MRL), which sets international food standards (CBI, 2020). With production of quinoa expanding to the coastal area of Peru, the use of pesticides has intensified (Soto, 2015; Latorre and Jacobsen, 2017). As a result, Peruvian exports could be threatened if farmers continue to heavily rely on pesticides for pest control.

3. Branding: According to CBI (2020), European buyers are interested on supporting commitment to social and environmental impact of the business. Quinoa has been recognized for a sustainable type of production. Thus, the use of a sustainable label could help quinoa producers capture premium prices. Expansion of production area to the plains of the Altiplano, however, is raising concerns as the production practices used in this area are capital intensive (Risi, 2015) and may threaten the opportunity to consider quinoa under the sustainable label.

4. Food safety standards: Exporters are required to comply with the food safety standards of importing countries. In 2019, the World Health Organization (WHO) adopted the Standard of Quinoa as part of the Codex Alimentarius (Coelho, Deriaz and Tokas, 2020). Andean countries may need to invest in modern equipment to produce value-added products meeting food safety standards.

5. Labeling regulations: Countries require foreign products to meet labeling requirements, including product name, physical condition, list of ingredients, consumption date, place of origin, exporter, and importer contact information (CBI, 2020). In addition, the label should include any certification logo. New production practices in Andean countries, however, could prevent them from using labels such as organic, all natural, and fair trade.

Production

Recall that Peru, Bolivia, and Ecuador have traditionally been the major producers of quinoa worldwide. Until the early 1990s, production of quinoa remained steady. Since quinoa's popularity increased in the international market, the three Andean countries have used different strategies to meet the increasing demand and capture the benefits of higher prices.

Peru

Quinoa can be produced in different agroclimatic zones (Fairlie, 2016), which allowed Peru to not only strengthen the regions where quinoa has been typically grown but also to expand its production to the coastal region (Dirección General de Políticas Agrarias, 2017). The area of quinoa harvested in Peru almost quadrupled, from 8,081 ha in 1990 to 28,889 ha in 2000. This increase in the harvested area led to an increase in production of 350.3%, from 6,260 MT to 28,191 MT. As the area allocated to quinoa continued rising, production increased 45.8% over 2000–2010 and 179.3% over 2010–2015 (Figure 5).

In addition to area expansion, Peru invested resources in research and education. The introduction of enhanced varieties and farmers' training on best management practices led to productivity gains. Quinoa yields increased by 26% from 1990 to 2000, by 19.2% from 2000 to 2010, and by 14.4% from 2010 to 2018 (FAO, 2020a). Peru produced 86,011 MT of quinoa in 2018, 21.6 % higher than Bolivia's production but only using half as much land as Bolivia (FAO, 2020a). Currently, Peru is the leading producer in terms of volume and productivity.

The expansion of quinoa production into the coastal area has raised concerns related to environmental impacts because producers in this area are using more pesticides for pest and diseases (Soto, 2015; Latorre and Jacobsen, 2017). This situation has led to the reduction of exports. In 2014, three shipments of quinoa from Peru were found to have pesticide residues above the maximum threshold, preventing them from entering the United States (El Comercio, 2014a). Additional research is needed to evaluate potential environmental impacts that could compromise the sustainability of quinoa production in the coastal area (Latorre and Jacobsen, 2017) and the international reputation of the Peruvian quinoa.

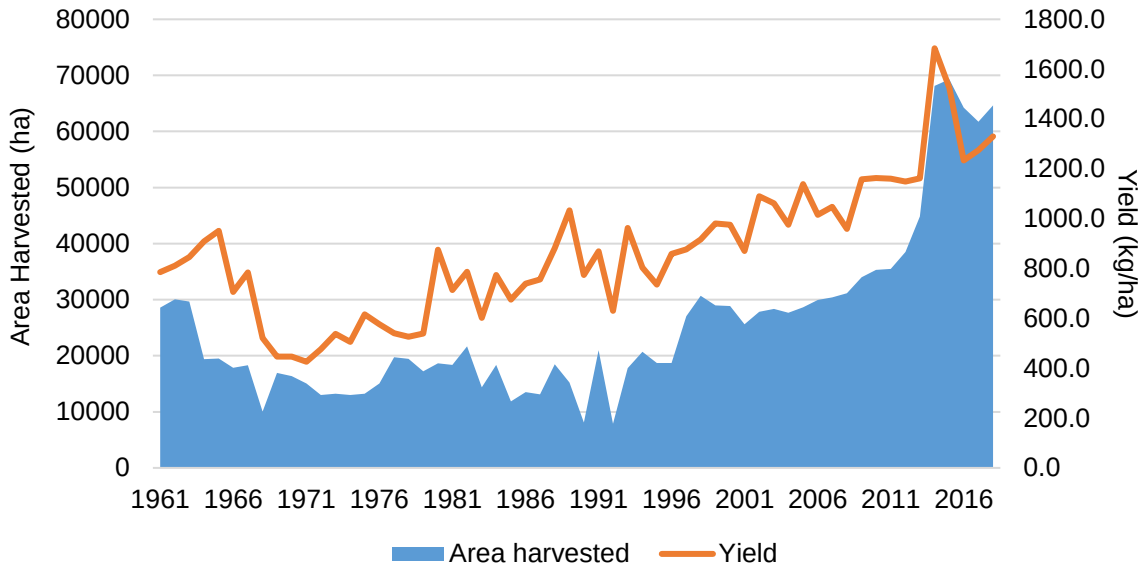
Bolivia

Quinoa has always played an important role in Bolivian

culture. Before the 1980s, this crop was primarily produced for the local market (Gandarillas et al., 2015). Quinoa was usually planted in the foothills, hill slopes, and mountains of the Bolivian Altiplano under an agropasture system (Gandarillas et al., 2015; Del Barco-Gamarra, Foladori, and Soto-Esquivel, 2019). Since the 1980s, quinoa production has expanded to the plains of the Altiplano and other nonquinoa production regions. Currently, seven out of the nine departments in Bolivia plant quinoa.

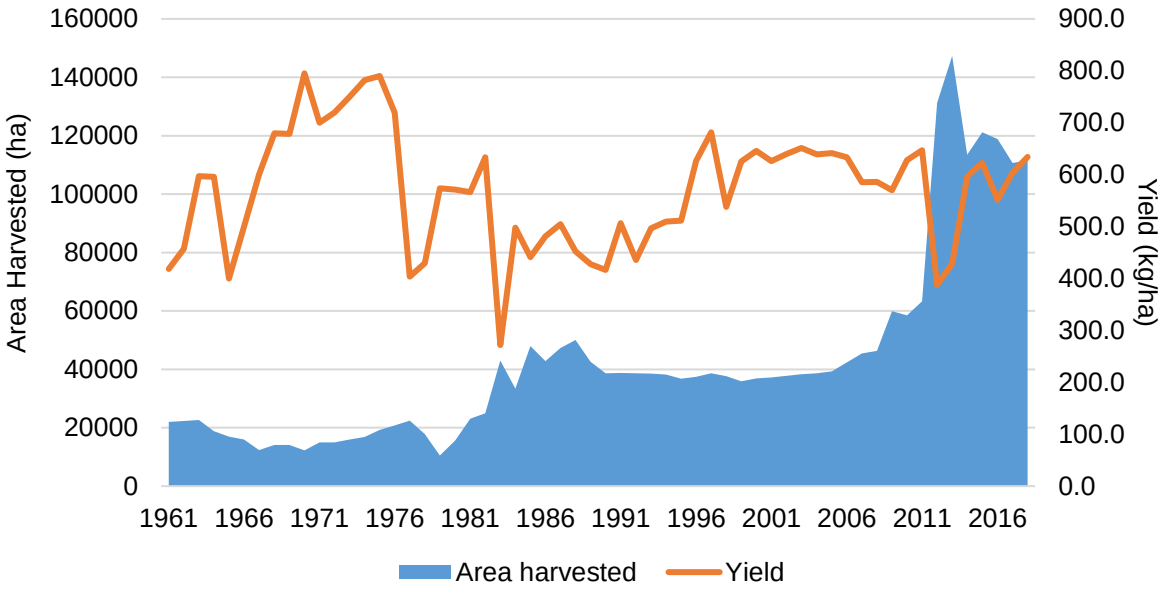
The area of quinoa harvested increased from 15,640 ha in 1980 to 38,615 ha in 1990. Bolivia barely changed its area allocated to quinoa during the 1990–2000 period. To supply the increasing international demand, the area harvested increased from 39,302 ha in 2005 to 58,496 ha in 2010, a 48% increase. Production soared from 25,201 MT in 2005 to 36,724 MT in 2010 and 63,075 MT in 2013, when 147,312 ha were harvested (Figure 6), the largest amount of land allocated to quinoa production. In 2018, 111,605 ha of quinoa were harvested, producing 70,763 MT, an increase of 12.19% (FAO, 2020a).

Figure 5. Peru Quinoa Area Harvested and Yield, 1961-2018



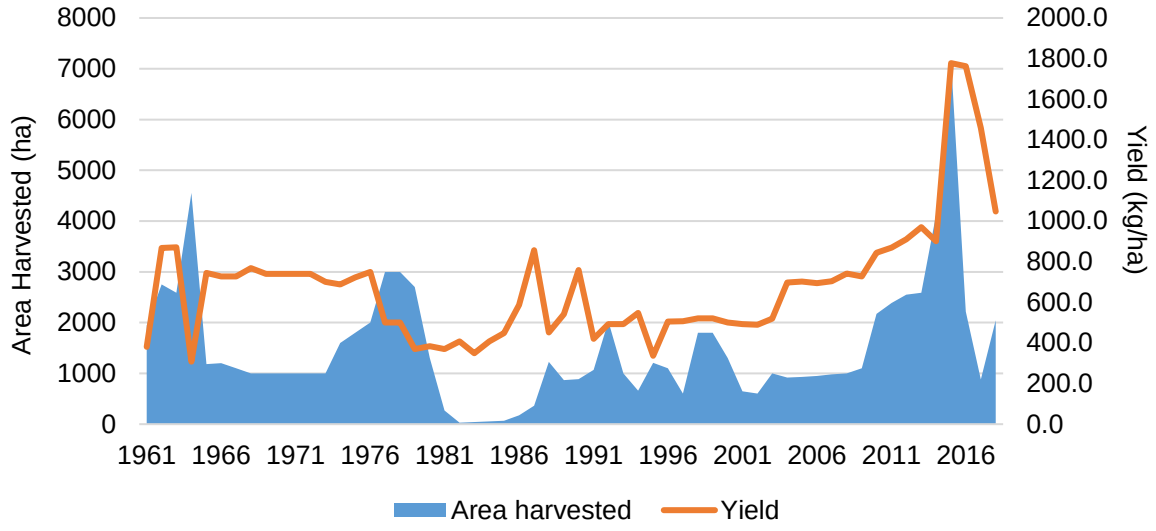
Source: FAO, (2020a).

Figure 6. Bolivia Quinoa Area Harvested and Yield, 1961-2018



Source: FAO (2020a).

Figure 7. Ecuador Quinoa Area Harvested and Yield, 1961-2018



Source: FAO, (2020a).

The expansion of quinoa into the plains of the southern Altiplano has resulted in a decline in yields (Figure 6) because of using a capital-intensive (higher use of pesticides and machinery) production system in highly erodible soils (Gandarillas et al., 2015). Between 2000 and 2018, quinoa yields in Bolivia were, on average, 47% lower than in Peru and 21.23% lower than in Ecuador (FAO, 2020a). Concerns about agro-ecological and social vulnerability in this area are increasing (Winkel et al., 2015; Del Barco-Gamarra, Foladori, and Soto-Esquivel, 2019). Additional research is needed to evaluate these potential issues.

Ecuador

In Ecuador, quinoa is a secondary crop produced by smallholders in the highlands region (SIPA, 2018). In 2015, the area harvested reached 7,148 ha (Figure 7), the highest amount of land this country has allocated to quinoa, producing 12,707 MT (FAO, 2020a). This area represented only 5.90% and 10.31% of the area harvested in Bolivia and Peru, respectively. Because prices in Ecuador plummeted by 55% in 2015 (Enriquez, 2018), the area harvested decreased to 2,048 ha in 2018, leading to a production decline of 83% (FAO, 2020a).

Other Countries

France, Germany, Spain, and Italy have recently begun cultivating quinoa. Spain has become the biggest quinoa producer in Europe. Other countries cultivating quinoa in Europe are Poland, Bulgaria, Portugal, and Czech Republic (CBI, 2020).

In the United States, quinoa was introduced by Colorado State University as a crop that could be adapted to the Rocky Mountain region. Washington State University is also investigating the crop's adaptability to the Pacific Northwest region (Peterson and Murphy, 2015).

Value Chain

In the Andes, quinoa has typically been produced by small-scale producers. Due to their scale of production, they lack (i) the capacity to export or commercialize the product in larger markets, (ii) the bargaining power to negotiate better prices and other conditions, and (iii) the ability to meet the quality and safety standards of larger and more demanding markets (Fairlie, 2016).

The market for quinoa has experienced notable changes. Before the "quinoa boom" of the mid-2010s, producers generally sold their quinoa on the local market, which allowed them to market the crop when they needed cash. As the foreign demand for quinoa increased, producers have been encouraged to work in associations or to sell their production to aggregators in order to meet volume and quality requirements (Fairlie, 2016, El Comercio, 2014b).

Associations collect the grain from members and conduct standard post-harvest activities (including cleaning, washing, and packing) needed to market the grains. In addition, quinoa, different from other cereals and grains, needs washing to remove the saponin, which gives quinoa a bitter flavor. Establishing the infrastructure for post-harvest activities is costly and may constrain small-scale farmers from entering the quinoa business.

Depending on the size of the aggregator, these collect the grain from farmers and process the quinoa or sell it to other processing plants. Generally, aggregators and processing plants are considered medium to large scale

(Fairlie, 2016).

In the coastal region of Peru, quinoa is produced primarily by large-scale farmers, which employ more technology for the production and processing of quinoa. Many of the large-scale farmers have the installed capacity to complete all of their own post-harvesting handling and processing (Fairlie, 2016).

Policies

The governments of Bolivia, Ecuador, and Peru have supported the quinoa sector by promoting research and development in quinoa through their National Institutes of Agricultural Research (INIAF-Bolivia, INIAP-Ecuador, and INIA-Peru). These institutes have developed improved varieties of quinoa that are adapted to the climatic conditions of the regions where quinoa is currently produced in each country (Peralta and Mazón, 2015; Risi, 2015; Soto, 2015).

Peru

The National Secretary of Plants and Animal Health (SENASA) conducts rigorous monitoring on pesticide residues, heavy metals traces, and mycotoxins to assure the quality of the product. SENASA trains quinoa producers, processors, and exporters. In addition, the government supported the creation of a Quinoa Taskforce to provide quinoa stakeholders—producers, processors, and private and public institutions—with a space to discuss current challenges and design strategies to expand the consumption of quinoa (Fairlie, 2016). Local governments also promote training and extension activities.

Bolivia

Bolivia has benefited from the work of international organizations and its government, which has conducted research related to quinoa since the 1970s. Bolivia proudly commercializes its Quinoa Real variety and is seeking to protect it through a designation of origin (Risi, 2015).

Ecuador

In the last decade, the government also provided producers with inputs and production loans to help recipients increase their production and motivate nonquinoa producers to switch from other traditional crops to quinoa production (SIPA, 2018). Processors and aggregators, on the other hand, usually receive aid from foreign organizations because the investment for infrastructure is high. The government has not played an important role in processing and marketing, as evidenced by Ecuador's late entrance to the foreign market.

Price Effect on Consumers

There is a concern that high quinoa prices, driven by the increase in foreign demand, may be hurting the nutrition of poor quinoa consumers in the Andes (Blythman, 2013; *The Economist*, 2016). Higher prices make quinoa less affordable for Andean consumers, who may either allocate the same level of expenditure to buy less quinoa than they did before the quinoa boom or allocate a higher level of expenditure to buy the same amount of quinoa, limiting their ability to afford other types of nutritious food (Stevens, 2017). Some evidence in the literature, however, concludes that higher quinoa prices benefited both quinoa consumers and producers (Stevens, 2017; Bellemare, Fajardo-Gonzalez, and Gitter, 2018).

These results can be explained in three ways. First, the majority of quinoa consumers in the rural areas of the Andes are also producers. Thus, they have profited from higher prices, which has enabled them to access other types of foods—fruit, vegetables, and, following Bennett's Law, meat—making their diets more diverse (Gandarillas et al., 2015). Second, consumers who are not producers are not hurt because quinoa represents a small share (no more than 4%) of the average household's food expenditure (Stevens, 2017). Last, Bellemare, Fajardo-Gonzalez, and Gitter (2018) speculate that there may have been a trickle-down effect from the increased welfare of net quinoa producers to net quinoa consumers.

Conclusion

Over the last two decades, demand for quinoa increased dramatically, leading to a sudden increase in price, which culminated in the quinoa price spike of 2014. Producers from Bolivia, Peru, and eventually Ecuador were motivated to produce more quinoa to supply increasing domestic and international demand. Farmers in these countries expanded both production area and intensity. The governments in these countries have supported quinoa production through research and development for enhanced varieties and access to credit and inputs. Nevertheless, support to processors and exporters has been limited.

Because quinoa is being produced more intensively, environmental concerns have been raised. In Bolivia, expansion into the southern Altiplano may have caused losses in productivity and land may have become more eroded. In Peru, use of pesticides in the coastal region may have not only caused harm to the environment but also may have violated the pesticide use restrictions of the United States, the European Union, and the Canadian markets. There is limited evidence to support these concerns and future work in this area is needed.

Recently, international prices of quinoa have declined, back to their pre-2010 levels. To remain competitive, Andean countries need to open new markets and explore the market for value-added products. These strategies will help quinoa producers thrive in the current stage of quinoa's product life cycle.

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