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North American Grafting Survey

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Introduction

North American interest in grafted vegetable crops has surged in recent years, but little has been done to assess the current size and recent trend of this market. Fruiting vegetable crops of interest (scions) are grafted onto the root systems of close relatives (rootstocks). This practice imparts some of the rootstock qualities to the scion, including the ability to resist soil-borne diseases, but also may offer increased yields, tolerance to abiotic stress, improved fruit quality, or other favorable attributes.

Photo 1: Watermelon scion (*Citrullus lanatus*; right) ready to be grafted onto rootstock interspecific hybrid squash (*Cucurbita maxima* x *C. moschata*; left).



Photo 3: A tray of grafted watermelon plants, ready to be healed.



Photo 4: A tray of grafted tomato plants, ready to be healed. Grafted Tomato Plants. Reprinted from *Johnny's Select Seeds*, 2020, retrieved from <https://www.johnnyseeds.com/vegetables/tomatoes/grafted-tomato-plants/>

Methods

We developed questions that specifically asked for information regarding annual production and export of various grafted vegetable transplants (tomato, watermelon, eggplant, cucumber, muskmelon, and 'other'). The survey itself was filled out anonymously by participants, satisfying the data collection and management requirements of the Ohio State University Institutional Review Board. The survey was distributed to known North American grafting nurseries (5 in Canada, 11 in Mexico, 14 in USA) by email on November 12th, 2019. The last response was received on November 29th, 2019.

Survey Participation

20 respondents participated in the survey. 3 of these responses were removed by the surveyors for failure to complete the survey, or lack of grafted plant production. All figures are based on the 17 remaining respondents. Of the included respondents, 4 were from Canada, 5 from Mexico, and 8 from the USA.

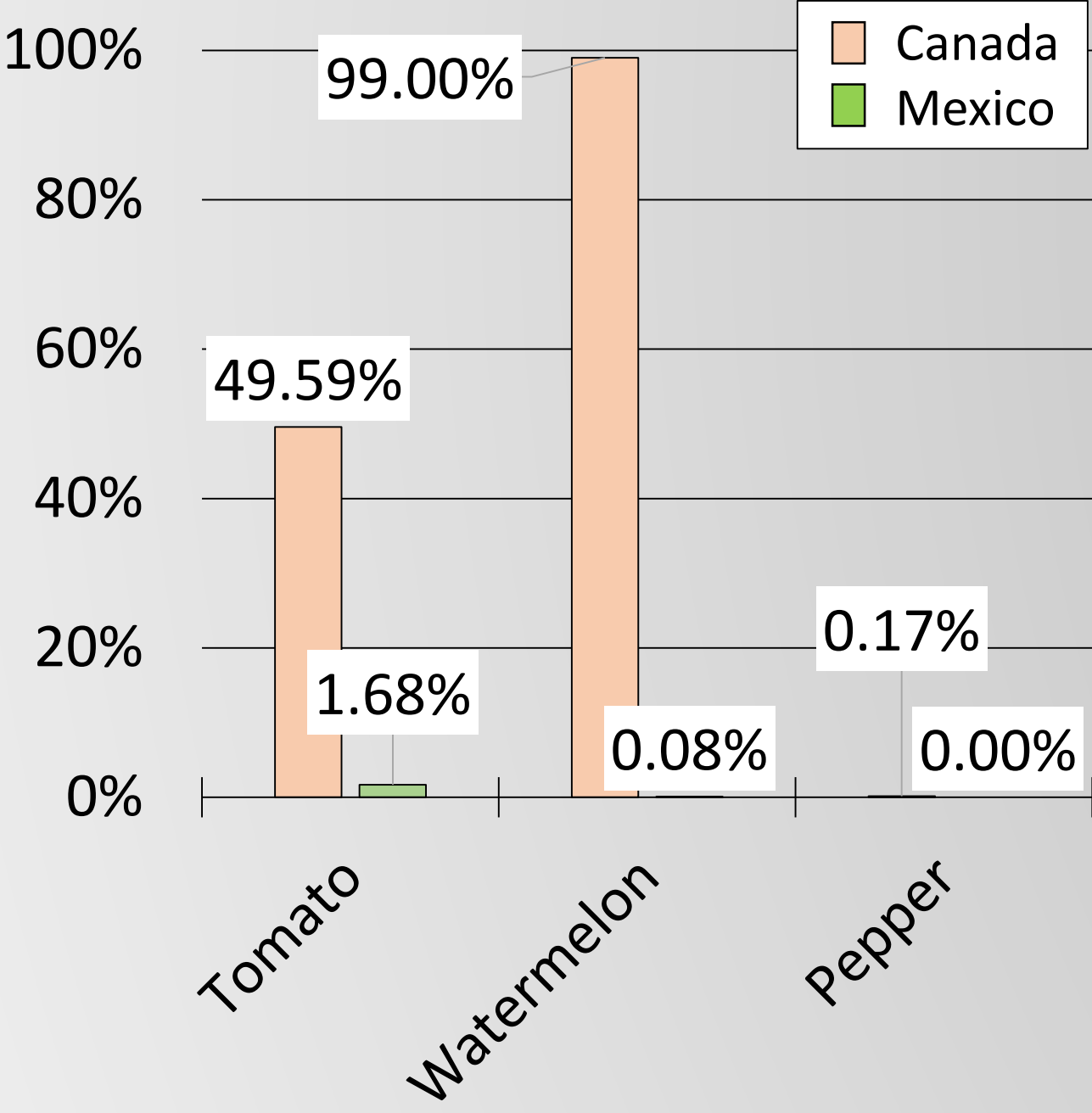


Figure 2: Percentage production of each species exported to the USA.

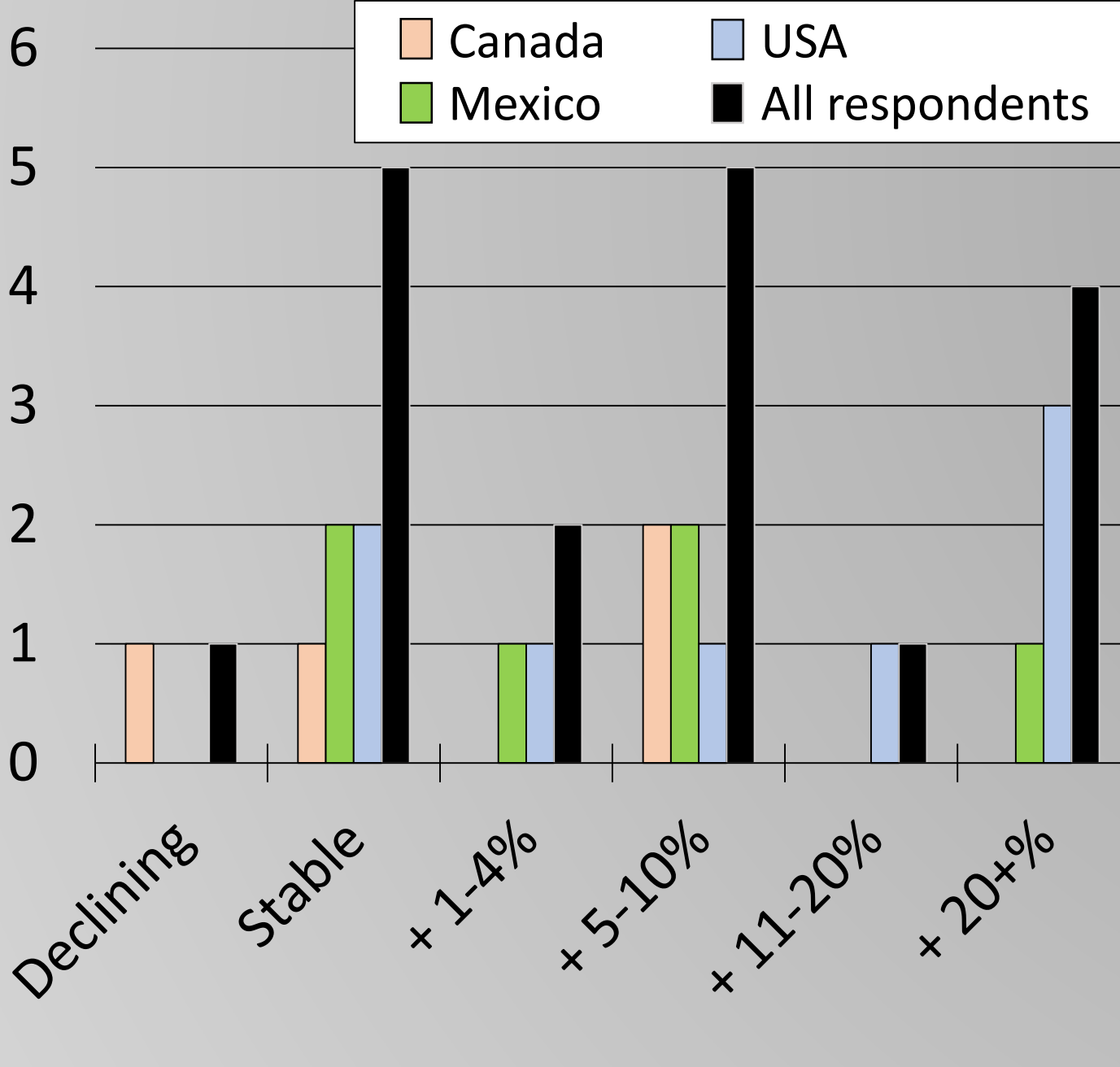


Figure 3: Responses to "How do you see the annual grafting market demand?" by country.

- Canada exports the most plants to the USA (nearly 8 million), with Mexico only exporting 382,500 grafted plants due to to USDA-APHIS regulations.
- The majority of exported plants are tomato, followed by watermelon. Little is exported besides these crops.

- 6 out of 8 of US respondents indicated that demand for grafted plants was growing, with 4 of those estimating over 11% growth per year.
- Only 1 respondent (Canadian) indicated that demand for grafted plants is declining.

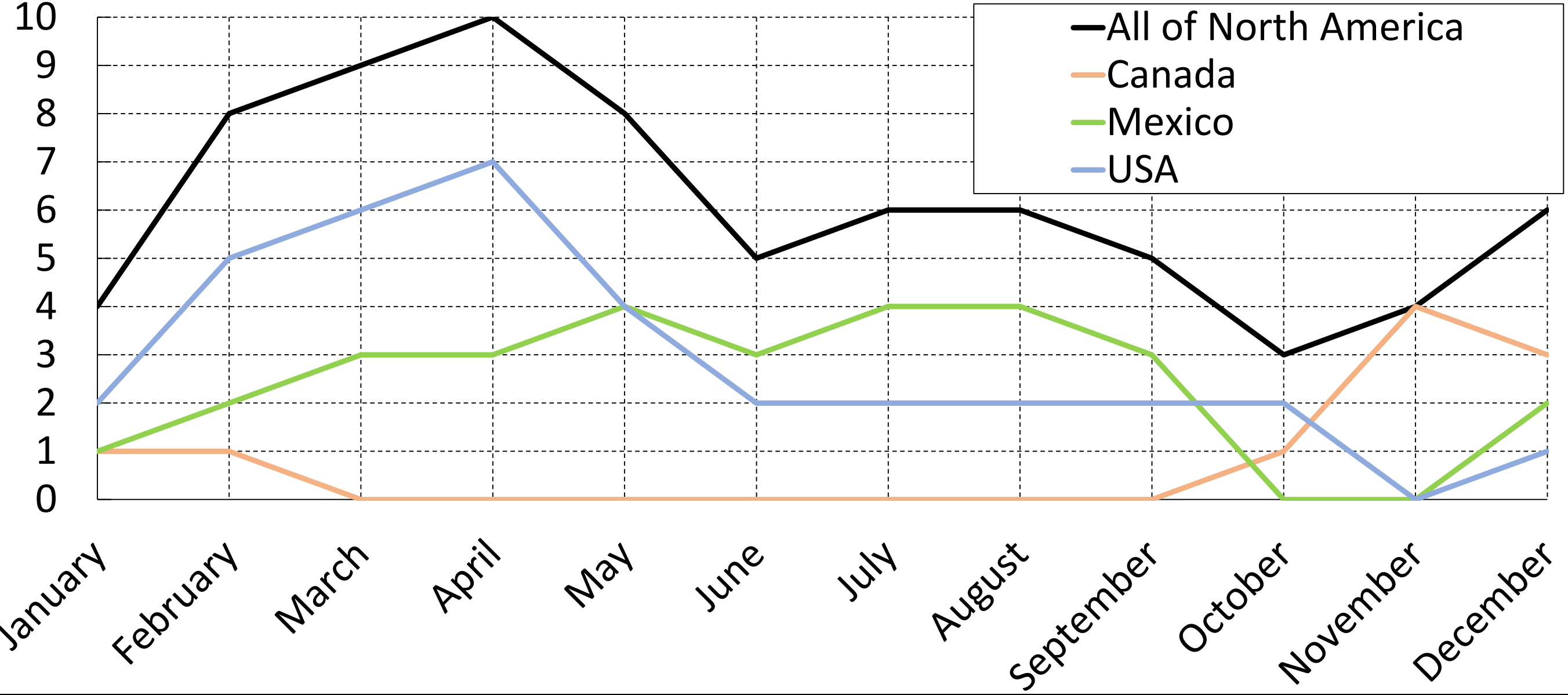


Figure 4: Busiest months of production, as reported by country.

- The busiest months of production were early spring for USA, late fall/early winter for Canada, and spring through fall for Mexico
- Total production in North America peaked in April, and reached a low in October

Discussion

- The North American grafted vegetable transplant industry is present, but visibility of the market size is based on 4 - 8 year old estimates.
 - Evidence collected suggests that the demand for grafted transplants is rising in North America and has significantly increased in the USA specifically (Figures 1-D, 3; Table 1).
 - The survey conducted indicates a 19% growth in production of grafted plants in 2019 versus 2015 estimates. However, only 17 out of the 30 invited participants contributed data to this survey. Therefore, the numbers presented here should be considered a conservative estimate of the true market size. We successfully surveyed 56.7% of our target audience. We received responses from 57% (8 of 14) of USA, 80% (4 of 5) of Canadian, and 45% (5 of 11) of Mexican grafting nurseries that we reached out to.
 - Grafted tomatoes have consistently been the most grafted species of crop in North America since 2012. Now, watermelon has come to occupy 24% of total production, nearly doubling its production since 2015 estimates (Figures 1-A; Table 1).
 - Demand for grafted vegetable transplants appear to be rising according to survey participants, especially watermelon in the USA (Figure 3, Table 1). Industry members should watch closely for the direction of these trends in coming years.
- References:** 2012 and 2015 grafting estimates c/o Dr. Chieri Kubota.

Figure 1: Grafted plant production in North America

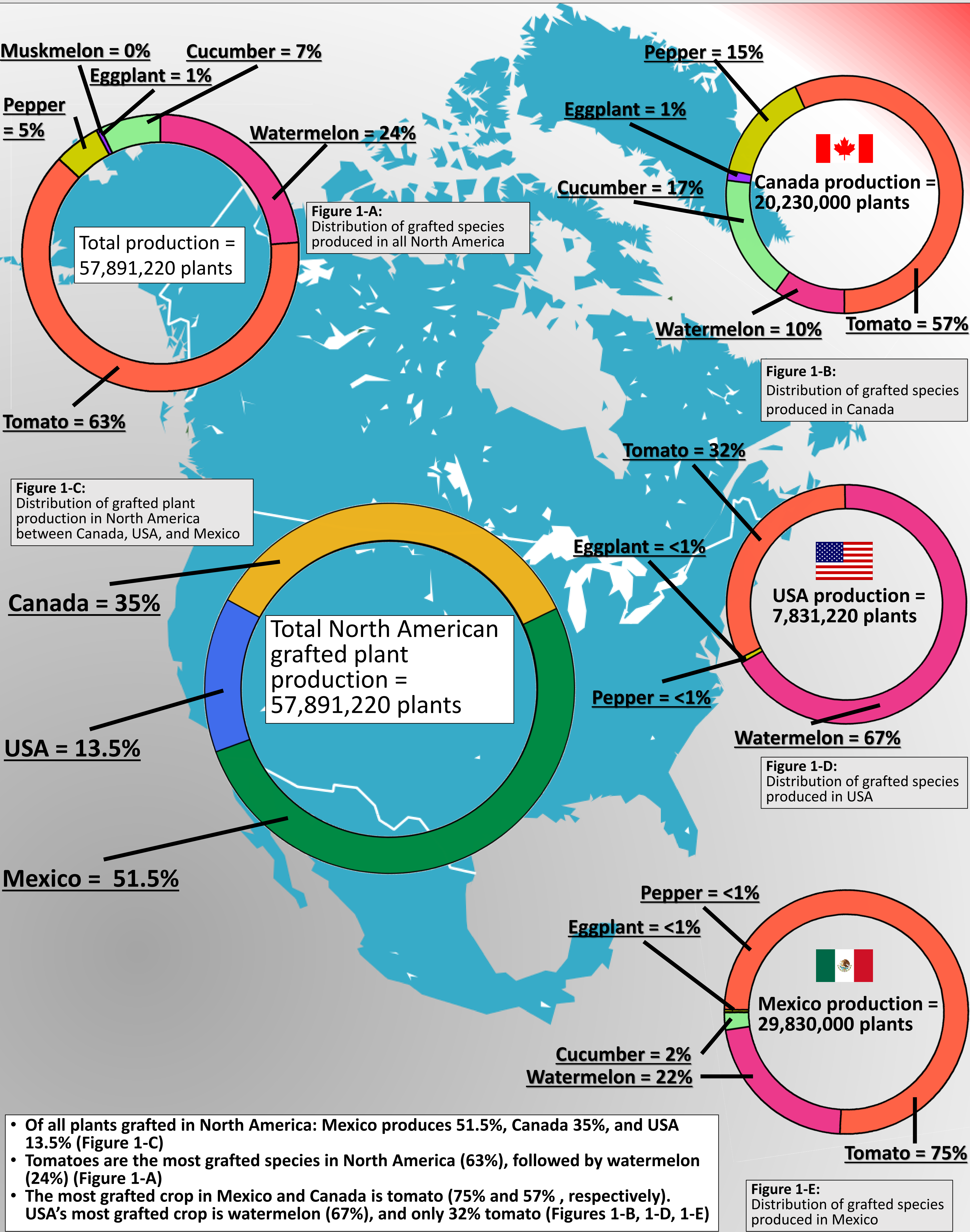


Table 1: Estimates for production and usage of grafted plants in North America (c/o Dr. Chieri Kubota), as well as the results of this survey. A "-" denotes that no data is available.

Country	Grafted Species	Use (plants per year)		Production (plants per year)		
		Estimates		Estimates		Survey Results
USA	Tomato	~10 million	~18 million	<0.1 million	<1 million	2,525,000
	Watermelon	-	~200k	-	<1 million	5,255,200
	Others	-	<1 million	-	<1 million	51,020
	Total	~10 million	>18 million	<0.1 million	<1 million	7,831,220
Canada	Tomato	~10 million	-	~20 million	-	11,500,000
	Watermelon	-	-	-	-	2,000,000
	Others	-	-	-	-	6,730,000
	Total	~10 million	-	~20 million	-	20,230,000
Mexico	Tomato	>20 million	-	>20 million	-	22,520,000
	Watermelon	>7 million	-	>7 million	-	6,500,000
	Others	-	-	-	-	810,000
	Total	>27 million	-	>27 million	-	29,830,000
All of North America Grand Total		>47 million	-	>47 million	-	57,891,220

- Production of grafted plants in USA is nearly 8 times higher than the most recent estimates (2015)
- Production of grafted watermelon (esp. for USA usage) has increased by 59.5% since 2015.
- Grafted plant production has increased by nearly 11 million plants per year over 2012 and 2015 estimates (23.4% increase), and now approaches 58 million per year.
- USA is still reliant on imported tomatoes from Canada to meet yearly demand.