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Commodity Highlight: Bell Peppers*

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For U.S. consumers, bell peppers are no longer a uniform product category on supermarket shelves. Traditionally thought of as blocky green peppers, differentiation among peppers by color, shape, and growing environment are now important components of the U.S. market.

Bell peppers are widely grown in the United States. According to the 2007 Census of Agriculture data, 9,572 farms were producing bell peppers in that year with the majority (9,379 farms) harvesting peppers for sale in the fresh market. The remaining 2 percent of farms reported harvesting primarily for the processed market. According to USDA, Economic Research Service calculations, farm cash receipts for fresh-market green peppers averaged almost \$640 million annually between 2009 and 2011.

Growing Per Capita Use

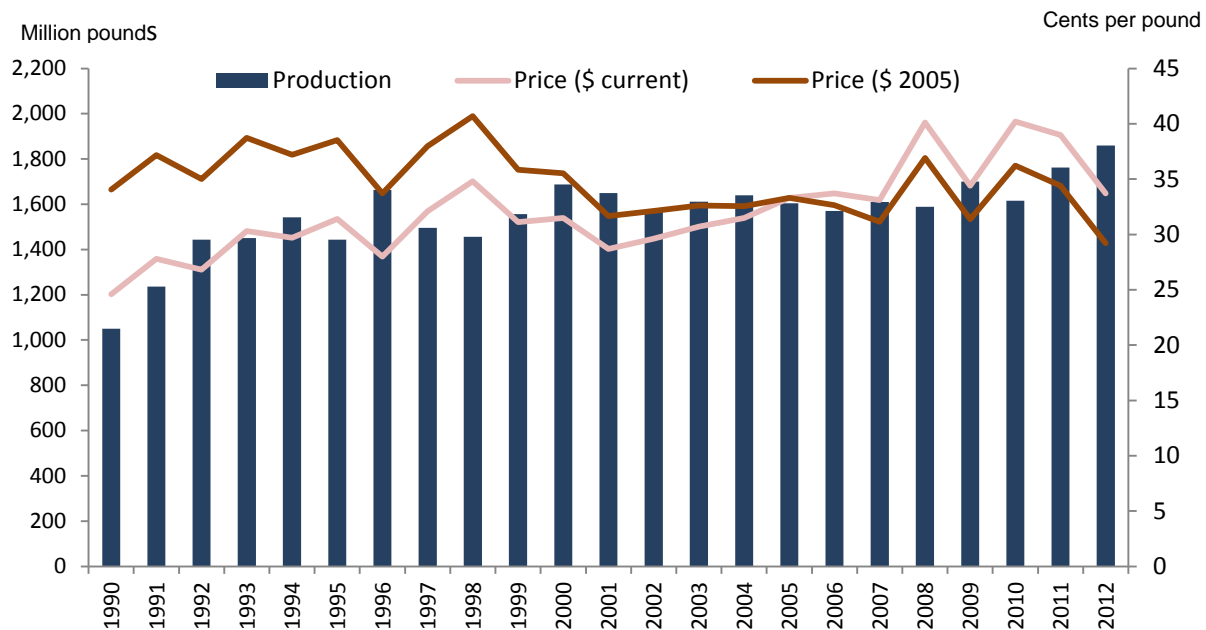
U.S. per capita use of bell peppers remained relatively steady through the 1960s and 1970s at 2.0 and 2.5 pounds per person respectively. Average use approached 4 pounds per person in the 1980s and was over 7 pounds per person in the 1990s. Growth has continued since 2000, but slowed to just 2 percent per year on average between 2000 and 2012. In 2012, per capita use reached a record at more than 11 pounds per person.

U.S. Production

The majority of bell peppers produced in the United States are still grown in the field on raised beds using drip irrigation and mulch. Domestic field production has been increasing since 1960 with the steepest upward trend during the 1980s. Growth continued after 1990, albeit at a slower rate. In 2012, over 1,860 million pounds of field-grown bell peppers were harvested from 55,500 acres in the U.S.

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Figure 1--U.S. bell peppers: Production and season-average grower price, 1990-2012 1/



1/ fresh and processing use

Source: USDA, National Agricultural Statistics Service.

While peppers are grown on a large number of farms across the U.S., production volumes are more concentrated. Between 2008 and 2012, California produced 51 percent of U.S. field-grown bell pepper volume, followed by Florida with 26 percent, Georgia and New Jersey with 6 percent each, North Carolina with 5 percent, Ohio with 4 percent, and Michigan with 2 percent.

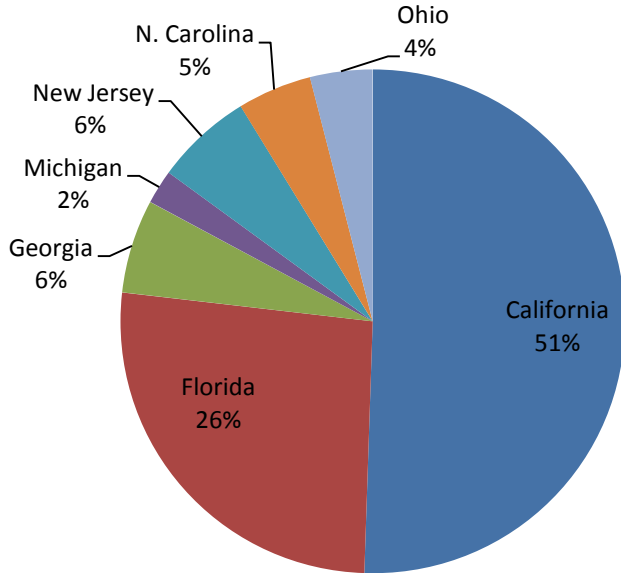
The use of protected-culture technologies (e.g. greenhouse, shadehouse) for peppers has increased over time, but data on the extent and use from year to year are not readily available. The Census of Agriculture revealed an increase in greenhouse pepper operations (both pungent and nonpungent) in the United States from 165 in 1998 to 265 in 2007. In 2007 greenhouse pepper yields averaged 64,500 pounds per acre, double the average yield of 31,340 pounds for field-grown peppers reported by NASS in that year. In 2007 bell pepper production from greenhouse systems totaled over 1.8 million pounds, 3.5 percent of which was grown using hydroponics.

From a global perspective, the U.S. ranked 6th in production of green peppers (both chile and bell/nonpungent) between 2007 and 2011 with approximately 3 percent of reported world production. The largest producers over that period were China with 51 percent of global production, Mexico (7 percent), Turkey (7 percent), Indonesia (5 percent), and Spain (3 percent). While the Netherlands accounted for less than 1 percent of the harvested area of peppers worldwide and ranked 9th in overall production, yields were by far the highest averaging over 237,000 pounds per acre between 2007 and 2011 due to wide use of intensive production practices using protected-culture technologies.

Imports Now Account for Half of Domestic Bell Pepper Use

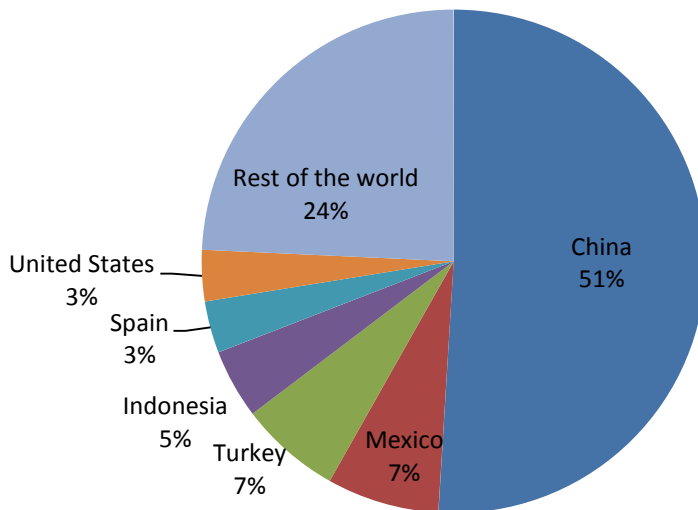
Although increasing, U.S. bell pepper production has not been high enough to satisfy growing domestic demand and imports have accounted for a larger share of the market. Import share of use (fresh and processing bell peppers) has been rising since data were first collected in 1960. In the 1990s, imported share of consumption averaged just over 32 percent, rising to over 45 percent between 2000 and 2012. From 2008 to 2012 the average share of imports was even higher at almost 51 percent, after reaching a record of 53 percent in 2010.

Figure 2--Share of bell pepper production in top 7 States (fresh & processing)*



*Average share of U.S. production, 2007-11
 Source: USDA, National Agricultural Statistics Service, *Vegetables Summary*.

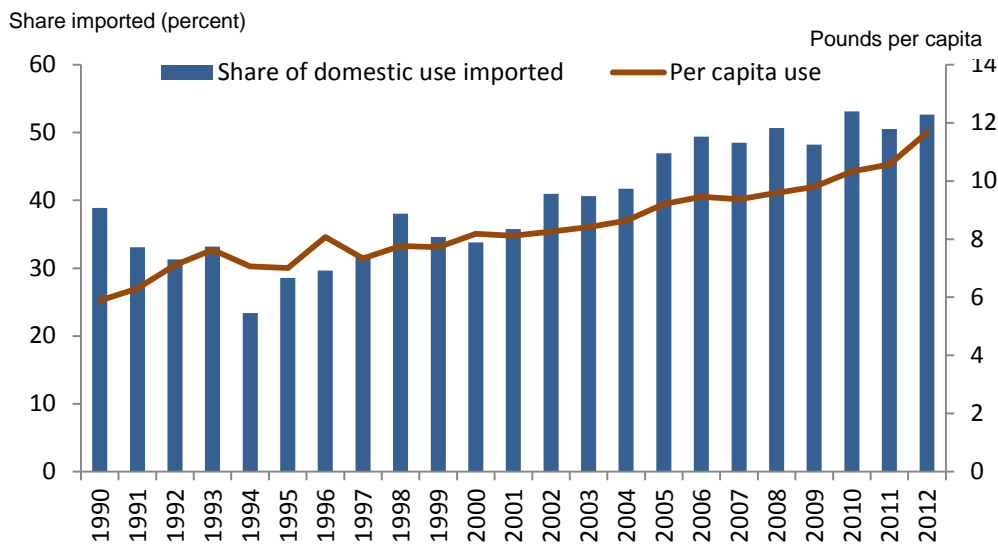
Figure 3--Top 7 world producers of green chiles and peppers*



* Average share of 2007-11 world production.
 Source: United Nations, Food and Agricultural Organization.

Annual import volumes were relatively steady in the 1980s, but climbed in the 1990s with 7.4 percent average annual growth in volume imported between 2008 and 2012. In these last 5 years, import volume of all bell peppers (fresh and processed) averaged 1.6 billion pounds on a fresh-weight basis (over 910 million of which were fresh), reaching a record 1.9 billion pounds in 2012 (1.1 billion pounds of which were fresh). While the average growth rate in fresh pepper imports has been higher than that for processed peppers over time, levels in both markets continue to increase.

Figure 4--U.S. bell pepper share of use imported and per capita use, 1990-2012



Source: USDA, Economic Research Service.

In 2012, Mexico supplied over 75 percent of fresh bell pepper imports to the U.S. Canada was the next largest supplier, accounting for 17.5 percent of fresh import volume, followed by the Netherlands with 3 percent and the Dominican Republic with 1.5 percent. The majority of fresh imports enter the U.S. in the first quarter of the calendar year when domestic shipments are typically lower. This contra-seasonal pattern was stronger in the 1990s compared with 2000-09 and 2010-12. In processed markets, China (36 percent), India (31 percent), and Mexico (23 percent) were the largest import suppliers of dried & dehydrated bell peppers during 2012 while Peru (56 percent), Turkey (32 percent), and Spain (7 percent) dominated the relatively small import market for canned bell peppers.

U.S. exports of bell peppers pale in comparison to imports. Export volumes have averaged less than 15 percent of import volumes annually since 1990. Export value averaged \$98 million annually between 2008 and 2012. By far the largest export market for U.S. fresh bell peppers is Canada, accounting for approximately 95 percent of the total.

Differentiating Through Product Color

Peppers available in the market today include elongated, square (or blocky), and miniature in multiple colors (red, yellow, orange, and purple, as well as green). Color has become an import way to differentiate peppers and can significantly affect price. Colored peppers (other than green) cost more to produce because they are actually ripened green peppers with the final color determined by variety. Extra time spent maturing on the vine often means greater yield losses for the grower with increased exposure to weather and pest uncertainty.

Consumers typically pay a premium for orange, red, yellow or purple bell peppers over green ones. Between 2008 and 2012, advertised retail prices averaged \$2.45 per pound nationally for conventionally grown red peppers, 70 percent more than field-grown green peppers (USDA/AMS). Similar price patterns are reported in wholesale markets where prices for red and yellow peppers were approximately 2.5 times higher than those for green peppers in 2011. Orange peppers commanded the highest wholesale price, 3 times that of green peppers. Packaging, which includes multiple item bags or “stoplight packs” has proven to be an important marketing strategy that takes advantage of the color options now available in peppers.

Table 1--U.S. bell peppers, all uses: Supply, utilization, and price, farm weight, 1960-2012

Year	Supply			Disappearance			Season-average price		Trade share of:	
	Production 1/	Imports 2/	Total	Exports 2/	Total	Per capita use	Current dollars 1/	Constant dollars 1/ 3/	Consumption imported	Supply exported
	----- Million pounds -----			----- Lbs/person -----			\$/cwt	2005\$/cwt	---- Percent ----	
1960s	407.2	23.3	430.5	14.2	416.2	2.2	9.5	46.9	5.0	3.3
1970s	493.5	97.9	591.4	36.5	554.9	2.6	15.4	47.4	17.4	5.9
1980s	769.0	187.9	956.9	80.2	876.7	3.7	22.8	38.4	21.7	8.5
1990s	1,433.6	614.5	2,048.1	139.8	1,908.4	7.2	29.7	36.9	32.3	6.9
2000	1,687.9	781.2	2,469.1	157.6	2,311.5	8.19	31.50	35.53	33.8	6.4
2001	1,649.4	828.9	2,478.3	161.7	2,316.6	8.12	28.70	31.66	35.8	6.5
2002	1,566.8	975.6	2,542.4	161.3	2,381.1	8.26	29.60	32.13	41.0	6.3
2003	1,611.8	994.5	2,606.3	159.2	2,447.0	8.41	30.70	32.62	40.6	6.1
2004	1,640.0	1,057.4	2,697.4	162.8	2,534.6	8.64	31.50	32.55	41.7	6.0
2005	1,603.6	1,279.4	2,883.0	156.4	2,726.6	9.21	33.30	33.30	46.9	5.4
2006	1,571.0	1,396.5	2,967.5	139.8	2,827.7	9.46	33.70	32.64	49.4	4.7
2007	1,610.0	1,370.9	2,980.9	152.8	2,828.1	9.36	33.10	31.14	48.5	5.1
2008	1,588.8	1,447.4	3,036.2	147.0	2,889.2	9.48	40.10	36.92	50.1	4.8
2009	1,699.7	1,453.3	3,153.0	139.9	3,013.1	9.80	34.40	31.38	48.2	4.4
2010	1,615.6	1,700.2	3,315.8	115.9	3,199.9	10.33	40.20	36.22	53.1	3.5
2011	1,761.8	1,666.0	3,427.8	131.2	3,296.7	10.57	39.00	34.41	50.5	3.8
2012 p	1,859.3	1,931.2	3,790.4	122.6	3,667.8	11.67	33.70	29.21	52.7	3.2

P = preliminary. --- = not available. Cwt = 100 pounds.

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1/ Source: USDA, National Agricultural Statistics Services. From 1990-91, production was estimated by ERS based on available State data. In 2000, NASS added estimates for Georgia, New York, and Pennsylvania. Domestic production excludes non-bell sweet peppers such as pimiento and banana. 2/ Source: U.S. Dept. of Commerce, U.S. Census Bureau. Includes canned and dehydrated imports, adjusted to a fresh-weight basis. Conversion factors for peppers: Canned to fresh = 2.41, Dried/dehy to fresh = 8.0.

3/ Grower prices for 1981-91 based on available State data. Deflated by the gross domestic product implicit price deflator, 2005=100. Source: USDA, Economic Research Service.

Despite the premium for color, individual multicolored peppers are the least desirable for wholesalers. For example, a pepper labeled “red and green” or “turning red” brought less than one-third the price per pound than that of a fully red pepper in 2011 (USDA/AMS). Color-transitioning peppers commanded almost one-third less than even uniformly green peppers at wholesale.

Differentiating With Protected-Culture Technologies

Protected-culture technologies for pepper production come in many forms that allow the grower some degree of control over various factors including weather events, pests, water and land use, pesticides, and fertilizer inputs. Shade houses are open structures that screen plants from extreme sunlight and wind. Greenhouses use glass or plastic to keep out pests and provide greater control over growing conditions including temperature, humidity, and atmospheric composition. Currently, greenhouse definitions and labels are not standardized, which has caused some tension in the industry as producers and handlers seek to differentiate their products for consumers.

Consumers may not always be able to tell the difference between field- and protected-culture peppers when making a purchase. However, retailers often mention more even supplies and consistent quality as positive attributes of peppers grown with protected-culture technologies. According to AC Nielsen data from 2009, peppers grown in greenhouses accounted for over one-fourth of total pepper sales between late 2008 and September 2009, with volume of sales increasing rapidly from year to year.

The U.S. Department of Commerce began collecting trade data for bell peppers grown under cover (identified as greenhouse in HS codes) in 2002. Since that time, both the volume and share of protected-culture pepper imports has been on the rise. From 2008 to 2012, imports averaged over 440 million pounds per year. In 2012, a record high of 555 million pounds accounted for 48 percent of total fresh bell pepper imports to the U.S. While this was a record volume, the actual share of bell peppers grown under cover peaked in 2011 at 53 percent.

Table 2--Average monthly bell pepper shipments in the United States by source

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-----annual volume (100,000 pounds)-----												
Domestic:												
1990-99	358	277	413	563	697	664	422	233	247	366	542	478
2000-09	516	507	712	896	1099	1183	819	749	760	883	879	564
2010-12	325	359	523	659	831	1144	899	944	881	901	961	498
Imports:												
1990-99	617	608	519	277	161	101	90	92	108	87	153	419
2000-09	973	820	785	604	475	269	237	296	323	289	374	720
2010-12	1450	1306	1080	924	846	372	373	516	612	444	588	1011
-----percent of annual volume from source-----												
Domestic:												
1990-99	7.0	5.5	7.9	11.0	13.4	12.9	7.6	4.0	4.2	6.4	10.5	9.6
2000-09	5.4	5.3	7.5	9.4	11.5	12.3	8.5	7.8	7.9	9.2	9.2	5.9
2010-12	3.6	3.9	5.6	7.2	9.4	12.8	10.2	10.7	9.9	10.2	10.9	5.5
Imports:												
1990-99	19.8	19.4	16.1	8.3	4.5	3.0	2.7	2.7	3.0	2.6	4.6	13.3
2000-09	15.9	13.4	12.7	9.8	7.8	4.3	3.8	4.8	5.2	4.6	6.0	11.6
2010-12	15.3	13.8	11.3	9.7	8.9	4.0	3.9	5.4	6.4	4.7	6.2	10.6

Source: USDA, Economic Research Service based on data from USDA, Agricultural Marketing Service, *Fresh Fruit and Vegetable Shipments*.

Mexico is by far the largest supplier of bell peppers grown under cover to the United States, averaging 45 percent of imports between 2002 and 2012, and 62 percent of imports in the last 5 years. Prior to 2006, Canada had been the foreign supply leader but in 2012 Canadian shipments accounted for only 23 percent of protected-culture imports, followed by the Netherlands with 5 percent. From all sources, import volumes tend to be highest December through April. Imports from Mexico are higher during the winter and early spring months while Canada and the Netherlands are primary import suppliers during the summer months.

Mexico Makes Use of Shade Houses

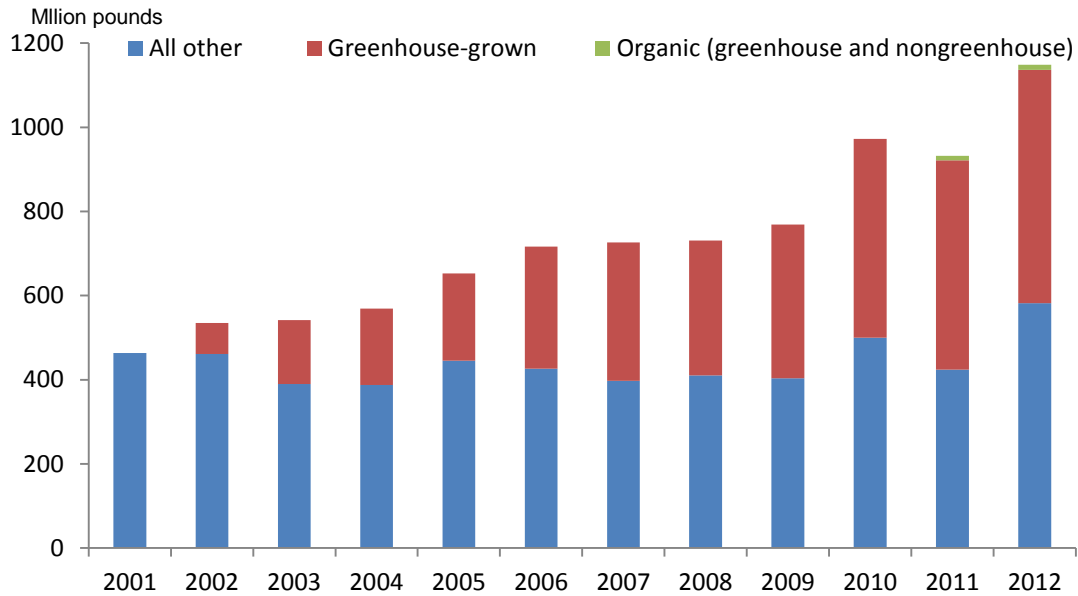
In Mexico, use of protected-culture technologies for all fruit and vegetables is on the rise; up from 1,850 acres in 1999 to 37,000 acres in 2010 (USDA, Foreign Agricultural Service, 2010). The majority of the vegetables grown in these systems are tomatoes, but other crops including cucumbers and peppers are popular as well. Protected-culture technologies are reported to be concentrated in Sinaloa (28 percent), Baja California (14 percent), Baja California Sur (11 percent), Sonora (11 percent) and Jalisco (10 percent). The Mexican Government has invested in infrastructure for protected agriculture because of the potential to produce more volume and as a way to improve employment opportunities in rural communities. Still, not every operation that moved to protected-culture technologies has been successful and there are reports of abandoned structures, particularly in the last few years.

Most operations (reported at over 50 percent) prefer shade houses to greenhouses because of their lower costs and greater adaptability to Mexico's warm climate. More intensive technologies — such as hydroponics — are rare, but many operations rely on drip irrigation. Export markets for higher-valued bell peppers from protected-culture technologies are those counties with strict import standards (because quality and safety standards are easier to attain in the more controlled environment) and higher average incomes.

Canada Invests in Greenhouse Technology

Between 2008 and 2011, the total area used for all greenhouse fruit and vegetable production in Canada steadily increased, averaging 125 million square feet (Statistics Canada). In 2011, Canada produced 199 million pounds of

Figure 5—U.S. bell pepper imports by type of production, 2001-12



* Data reporting for greenhouse-grown peppers began in 2002, Data reporting for organic peppers began in 2011.
Source: U.S. Department of Commerce, U.S. Census Bureau.

greenhouse peppers worth C\$300 million. Production is nearly year-round, with harvest beginning in March and extending through December. The area under rigid plastic has decreased significantly over time in favor of glass or polyethylene protection. Nearly two-thirds of production is concentrated in Ontario, followed with most of the rest in British Columbia.

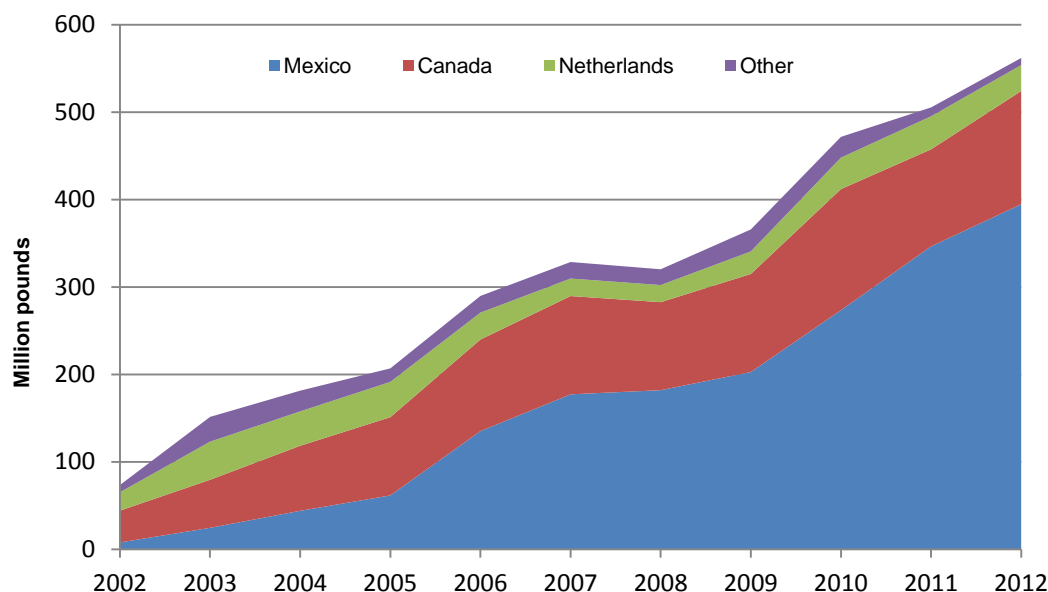
Canadian greenhouse pepper production dwarfs that of field production. In 2010 twice as many peppers were produced using protected-culture technologies compared with field production. The majority of both field and greenhouse peppers are exported to the United States, but again greenhouse peppers dominate with two-thirds of the shipments to the U.S. grown in protected-culture technology systems.

U.S. Protected-Culture Technology Pepper Industry Is Smallest in North America

High yields and the opportunity to extend the regular growing season create an opportunity for higher returns to growers, which has contributed to growth in the use of protected-technologies for vegetables in the United States. Still there are significant challenges for greenhouse production of bell peppers. Initial investment, maintenance costs, and management intensity are high relative to field production. In particular, when compared with commodities more widely produced in protected-culture technology systems (i.e. tomatoes, cucumbers) growers have encountered difficulty in interplanting peppers. Interplanting is a practice vital to maintaining continuous output from a given space; thus maximizing return per square foot.

Greater downtime between planting cycles for bell peppers has limited growth in the use of protected-technology systems relative to other vegetable crops. While the total number of greenhouse operations did increase over the past decade, there was a decrease in space dedicated to pepper production. Total area declined from 1.5 million square feet for pepper production in 1998 to 1.2 million square feet in 2007. Total sales also declined from \$5.3 million to \$2.2 million. Production by State is impossible to define fully due to disclosure restrictions by NASS. However in 2007, New York reported the largest number of greenhouse pepper operations with 29, while California reported the largest production with over one-third of national output.

Figure 6--U.S. greenhouse pepper imports by country, 2002-12*



* includes organic and nonorganic peppers
 Source: U.S. Commerce Department, U.S. Census Bureau.

Organic: Another Way to Differentiate Peppers

USDA/NASS first collected data on domestic organic bell pepper production in 2008. That year there were 1,044 operations producing 12 million pounds of organic bell peppers on 870 acres across the U.S. California led production with nearly 8 million pounds or 75 percent of the total. Sales of organic bell peppers (market value) totaled \$8 million. By 2011, there were fewer farms (502) producing 15.5 million pounds of certified organic bell peppers on 901 acres. Sales totaled over \$11 million and production remained concentrated in California with 412 farms and 11.1 million pounds of output. In 2011, Florida had 83 certified organic bell pepper operations producing almost 2 million pounds.

Although organic product makes up only a small share of all bell pepper imports, in 2011 about 41 percent of the organic peppers available for domestic consumption were imported. That year the United States imported 10.7 million pounds of organic bell peppers (1.1 percent of total bell pepper imports). Volume was slightly higher in 2012 at 12.2 million pounds. The vast majority (86 percent) of these imports came from Mexico, followed by the Netherlands with 12 percent. It worthwhile to note that in 2012, 60 percent of U.S. organic bell pepper imports came from protected-culture technology systems. Currently, there are no data available for U.S. exports of organic bell peppers. However, as the U.S. only exports a small share of domestic pepper production the figure is likely very small.

Advertised retail prices of organic green peppers averaged \$1.95 per pound or 36 percent more than their nonorganic counterparts between 2009 and 2011 (USDA/AMS). In 2011 when data on advertised prices for red organic peppers became available, this category commanded the highest premium. Annual average price for organic red peppers was \$4.02 per pound in 2011 versus \$2.00 for organic green peppers, \$2.53 for nonorganic red peppers, and \$1.44 for nonorganic green peppers. Price patterns were similar in 2012 with reported advertised prices (annual average) at \$3.09, \$2.10, \$2.49, and \$1.44 per pound for organic red peppers, organic green peppers, nonorganic red peppers, and nonorganic green peppers respectively.

Bell peppers with the highest reported wholesale price in 2011 were organic, red, and greenhouse grown (USDA/AMS). Average wholesale prices for green conventional field-grown peppers were less than 20 percent as much in the same year. Peppers grown in greenhouses, but without organic certification, still received a substantial premium over nonorganic field-grown peppers.

More Choices for Consumers

Bell peppers are no longer a uniform product category. Combinations of color, growing technologies, shape, size, and/or organic production practices all exist in differentiated bell pepper markets. Traditional blocky peppers can now be found in red, yellow, orange, and purple as well as green. With a sweet taste, fewer seeds, and convenience as a snack, miniature varieties are growing in popularity at both retail food stores and foodservice outlets. Production and sales of elongated peppers in multiple colors have expanded rapidly. More expensive growing methods such as greenhouse or organic are most often (but not always) used for colored pepper production that offers the possibility of higher returns. Development of new varieties has expanded offerings in multiple shapes and sizes and promises to widen the choices available to consumers even further.

For More Information

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