



# **Trends in Agricultural Production, Exports, and Transportation in Washington State**

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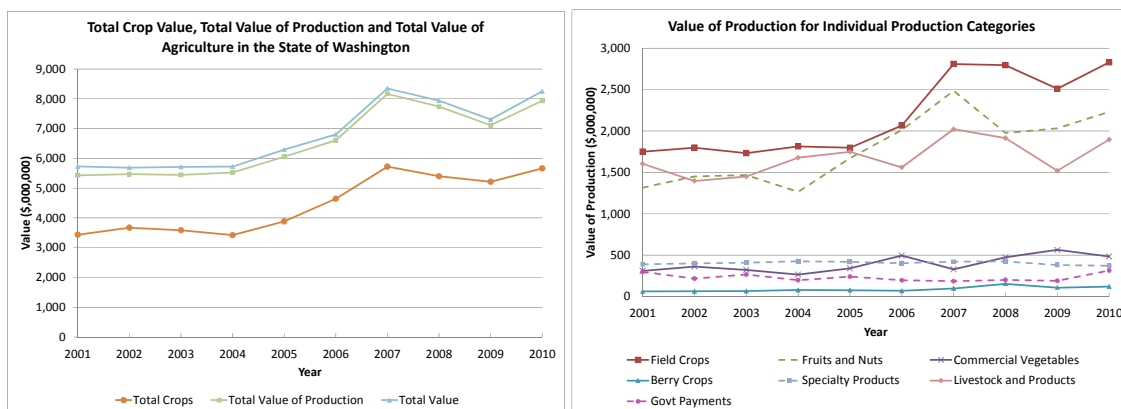
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## Introduction

Washington state agriculture generated a primary value of production of \$7.9 billion in 2010, a value that has steadily increased from \$5.4 billion in 2001 (see Figure 1a). As shown in Figure 1b, the value of production is dominated by three groups of products, (1) field crops – principally wheat, potatoes and corn, (2) fruit and nut crops – predominantly apples, cherries, pears, and grapes, and (3) livestock and livestock products – mostly milk, milk powder, and cheese. Figure 2 summarizes the changes in value of some of the major crops for Washington State over the period 2001 to 2011 and shows the dominance of apples, milk, wheat and potatoes in the value of production of agricultural commodities in the state. The figure also shows changes in other crops, such as increases in cherry, and corn production, and a large reduction in asparagus output. Table 1 (at the end of the document) summarizes changes in production and value of selected crops in Washington from 2001 to 2011.



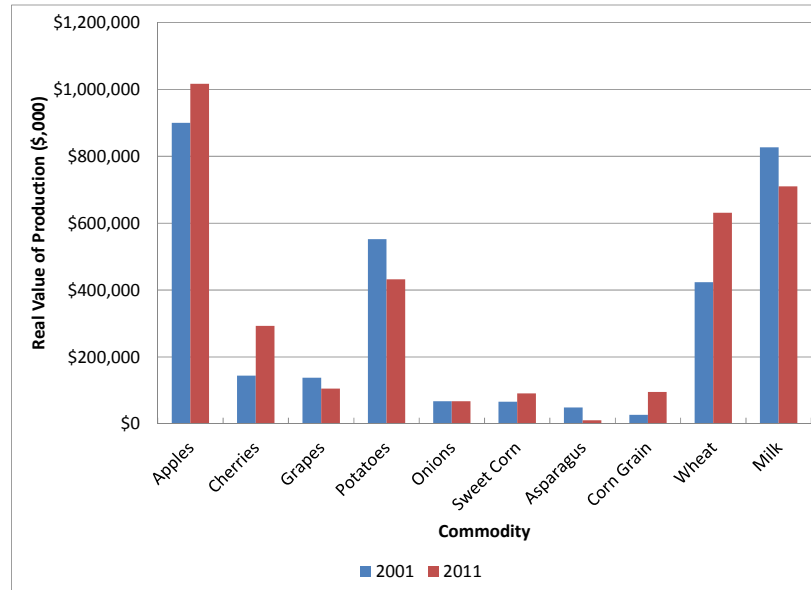
**Figure 1a:** Total crop value, total value of agricultural production, and total value of agriculture, including government payments in the state of Washington (NASS-USDA).

**Figure 1b:** Value of production for individual production categories and government payments for the period 2001 to 2011 (NASS-USDA).

Vegetables, berry, and specialty crops, such as flowers and nursery products have lower total values of production, but generate a significant value of production in the state economy.

Production of apples, cherries, pears, hops, carrots and red raspberries in Washington state place the state first in the U.S. for the production of those commodities. Agricultural producers in the state also produce significant value in wheat, milk, potatoes, hay, grapes, corn, and numerous other horticultural crops, such as blueberries and strawberries. While much agricultural production is consumed within the U.S., exports of some products provide highly profitable markets for producers in the state, particularly for wheat and many of the horticultural crops,

such as apples, cherries, berries and potatoes. Also, the state has a large food processing industry that undertakes primary or secondary<sup>1</sup> processing of some of the crops and again much of this is also exported.



**Figure 2:** Changes in the real value of production of major crops in Washington state 2001 to 2011.

Agricultural production in Washington is similar to that in other states in the US and around the world, in that in any one year individual producers will change their production mix, based on expected prices and yields and weather or market conditions, to best achieve the goals of their business. These changes in production mix may cause the aggregate production of some crops or other agricultural outputs to vary markedly from year to year. In this report we will present trends in production and exports of the major agricultural products of Washington State, how the transportation of some of these products has changed in terms of mode of transport, and also what some of these production trends may imply for transportation requirements into the future.

As the fifth largest exporting state in the country, Washington State is a global gateway to the Pacific Rim, Canada, and Alaska. The state’s strategic location positions it as an important and growing gateway for trade access to Alaska; producers, suppliers and markets in Washington, Oregon, and California; and as a key transportation hub for Asian and Canadian trade.

Washington’s transportation system functions as an interconnected network of gateways and transportation corridors – inland barge, seaports, airports, rail, and highway systems – that

<sup>1</sup> Primary processing involves very little processing, such as in the freezing of peas or corn, secondary processing may involve cooking, preserving, or further preparation of product.

provide access to markets, create jobs and economic growth, and link business, government, and economic activities together locally, nationally, and internationally.

The Ports of Seattle and Tacoma provide resources for exporters from Washington and nearby states to export product, either by air or sea, to markets in Japan, China and the rest of Asia. International trade moving through these two seaports exceeded \$70 billion in 2010. This constituted over 92% of the value of international imports entering through Washington, and almost 63% of waterborne international exports.<sup>2</sup> The proximity of these ports to other export destinations also reduces the costs of transporting agricultural products to markets outside of Asia (i.e. India and the Middle East). As the globalized economy continues to evolve and develop, so to must Washington's ports. The Port of Seattle has recently obtained six new cranes that will allow it to handle the largest container ships in the world. The port is also modernizing and replacing grain facility equipment and controls that will allow it to maximize operational efficiency and continue grain terminal operation.<sup>3</sup>

Railroads play a major part in the movement of containers, automobiles, and merchandise from Washington's seaports to final markets. Approximately, 40% of the state's rail traffic is related to activity at the ports.<sup>4</sup> Agricultural products such as wheat, corn, and soybeans, from the Midwest and eastern Washington, travel by barge and rail to the Lower Columbia seaports. The majority of commodities destined for Washington State, based on railroad waybills, are agricultural products (Figure 3).

In 2009 Washington state rail system carried 102.5 million tons of freight; 60.9 million tons arrived in the state from other states and Canada, while 20.8 million tons shipped from the state to other states and Canada. Over 20.8 million tons moved within the state's border or through the state without loading and unloading. Farm products are the primary commodity and made up 36% of the total rail freight tonnage in Washington.

In 2007, 72% of the freight shipped and received via Lower Columbia ports in Washington was moved by rail, and 34% via Puget Sound ports by rail. Rail accounted for approximately 40% of

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<sup>2</sup> Port of Seattle. *2010 Foreign Waterborne Trade Report*. Retrieved as of December 2011 from: [http://www.portseattle.org/About/Publications/Statistics/Seaport/Documents/2010\\_Summary%20of%20Foreign%20Waterborne%20Trade.pdf](http://www.portseattle.org/About/Publications/Statistics/Seaport/Documents/2010_Summary%20of%20Foreign%20Waterborne%20Trade.pdf).

<sup>3</sup> Port of Seattle. *News Room*. Retrieved as of December 2011 from: <http://www.portseattle.org/Newsroom/News-Releases/Pages/default.aspx>

<sup>4</sup> BST Associates. *2009 Marine Cargo Forecast: Technical Report Final. (March 23, 2009)*. Prepared for the Washington Public Ports Association and the Washington State Department of Transportation. Retrieved as of August 2011 from: AAR. *Freight Railroads in Washington-2009*. Association of American Railroads. Retrieved as of August 2011 from: <http://www.aar.org/Railroads-States/Washington-2009.pdf>.

total Puget Sound Container tonnage. Rail tonnage is dominated by corn, soybeans and sorghum shipped in from the Midwest, but is also critical for containerized cargo and automobiles (*ibid*). Columbia River seaports, especially the Ports of Vancouver, Kalama, and Longview, play major roles in the movement of exported agricultural products. Lower Columbia River grain exports are expected to increase by about 9% by 2030. These ports face competition from the Mississippi River and Gulf Coast ports, although they are less exposed than their Puget Sound counterparts because of the volume of grain that is shipped to these ports by barge.<sup>5</sup>

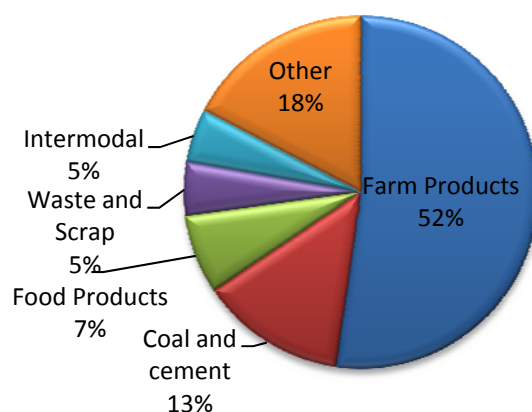


Figure 3: Farm Products Comprise the Majority of Goods Bound for Washington by Rail

### **Field crop cereal, legume and oilseed crops**

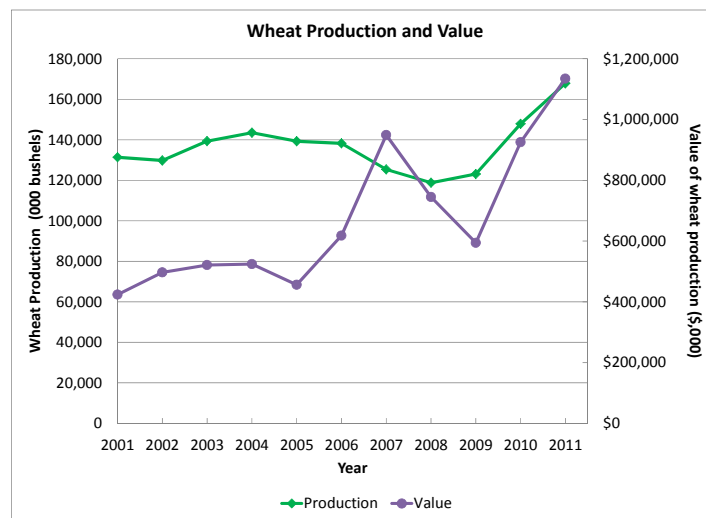
Washington state is a major producer and exporter of cereal grains and legumes. Producers in the state grow wheat, barley, oats, lentils, dry peas, canola, maize, chickpeas, and many minor crops, such as mustard, safflower and flax.

Wheat is the largest grain crop produced in the state, and is the highest contributor, of the grain crops, to total value of production. The area sown to wheat over the last 10 years has remained relatively constant at around 2.2 to 2.5 million acres, with 2.2 to 2.4 million acres harvested. Average yield per acre has been steadily increasing from 56 bushels per acre in 2001 to 72 bushels per acre in 2011; however there is variability in year to year yields, with average yields in 2008 being 53 bushels per acre. Total annual production of wheat ranged from 3.5 to 5

<sup>5</sup> BST Associates. 2009 Marine Cargo Forecast: Technical Report Final. (March 23, 2009). Prepared for the Washington Public Ports Association and the Washington State Department of Transportation. Retrieved as of August 2011 from: <http://www.wsdot.wa.gov/NR/rdonlyres/575F0BFF-16FF-4699-9005-32766227B3BE/0/MCF2009FinalReport3232009.pdf>

million tons (or 119 to 168 million bushels), with a value range of \$423 million to \$1.1 billion in nominal terms, see Figure 4.

In contrast to wheat, production of barley has declined significantly over the period 2001 to 2011. In 2001, 430,000 acres of barley was sown and 420,000 harvested, in the period 2009 to 2011, this area had fallen to between 90,000 to 125,000 acres sown, and 81,000 to 115,000 harvested. For barley producers there has been one benefit over this period in that prices have risen from \$2/bushel in 2001 up to \$5.10/bushel in 2011, this price rise has helped somewhat in maintaining the total value of barley production.



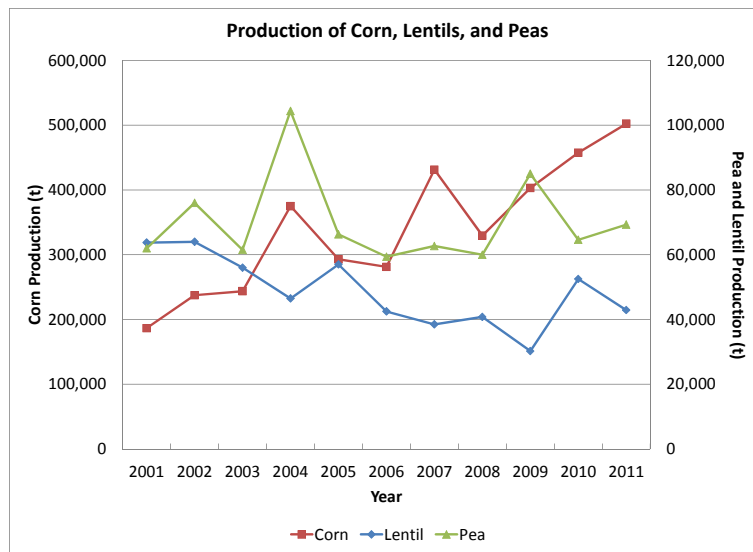
**Figure 4:** Wheat production and value over the period 2001 to 2011 (Source: NASS 2013).

Dry peas and lentils are grown by grain producers in rotation with the cereal crops to provide a crop break and to fix nitrogen. The areas sown to these crops have varied over the period 2001 to 2011, with a slight downward trend apparent for both crops. However, yields have also been variable in the same period, and the combined effects of changes in yields and areas can be seen in Figure 5. This figure shows that production of lentils is trending downward, whereas pea production, although variable has no distinct trend.

Production of corn for grain on the other hand has increased over the period, and production appears to be maintaining an upward trend, as area harvested for grain has increased from 55,000 acres in 2001 to 125,000 acres in 2011. Corn yields have also lifted in the same period generating the upward sloping line in Figure 5. The area and value of production of other minor crops has varied over the period, but given that these crops constitute a very small proportion of crop production and value, they will not be discussed in detail. However, the production of some

crops, such as canola, may expand into the future depending on the fit of these crops into producer plans. In 2011 canola production was separated from the “other crops” category in USDA data collection processes indicating that production is expanding sufficiently to warrant a separate category in the data collection process.

Exports of wheat<sup>6</sup> from Washington ports have varied considerably with a low in 2005 of \$585 million to a high in 2010 of \$2.8 billion, but with no clear trend. The level of maize exports has been similar to wheat in that there is no clear trend, with much variability across years. On the other hand the value of exports of legumes and pulses has increased over period, with exports of dry green peas and lentils increasing significantly over that period, exports of chickpeas also increasing markedly.



**Figure 5:** Production of corn for grain, dry peas and lentils in the period 2001 to 2011 (Source NASS 2013).

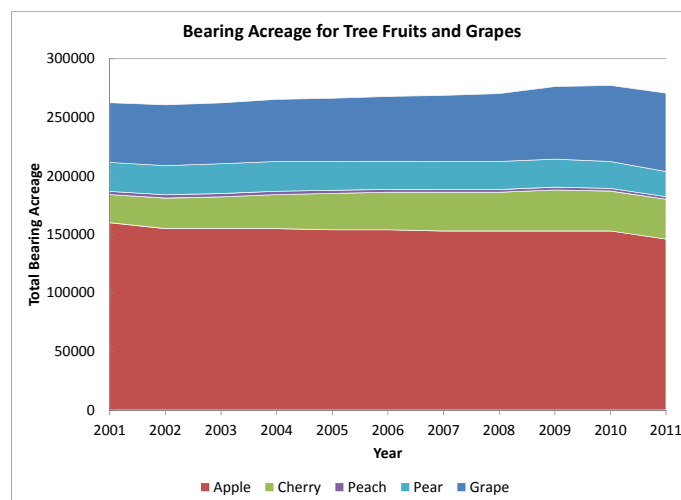
### Tree fruit, grapes and berry crops

Deciduous tree and vine fruits, such as apples, pears, cherries, peaches, and grapes all make significant contributions to the value of agricultural production in the state of Washington. Apples generate the highest value of production of any agricultural commodity in the state, while cherries, grapes and pears are ranked 7<sup>th</sup>, 9<sup>th</sup> and 10<sup>th</sup>, respectively, in value of production in the state. Berry production, blueberry, red raspberry, strawberries and cranberries, also contributes a significant value to the economy of the state.

<sup>6</sup> The value of exports from Washington ports may also include product from other states.

Bearing acreage of tree fruits and grapes are shown in Figure 6. From this figure we can see that the total acreage for the fruits have been relatively constant from 2001 to 2011. However, there are differences within the individual fruits, cherry and grape areas have increased over the period, while apples and pears declined slightly. Also, within the pear acreage, the mix of pear types has changed with an increase in winter pear production at the expense of Bartlett pears.

Trends in the yields for the tree fruits have varied over the period 2001 to 2011. Cherry and grape yields have been relatively constant, whereas apple and pear yields have increased, in contrast peach yields have shown slight decline over the same period. These changes in yields coupled with bearing acreage changes have impacted on total production of the fruits discussed. Figure 7 presents the production of apples, cherries, pears and grapes, and from this figure we can see that there is an upward trend in the production of three of the four fruits, with cherries showing the largest movement, but pear production remaining relatively steady.



**Figure 6:** Total bearing acreage of apples, cherries, peaches, pears and grapes in the period 2001 to 2011.

Over the period analysed prices for most fruits increased, mostly by at least 50 to 100% except for grapes not used in wine production. This increase in unit values also increased the total value of production for all tree fruits shown, even the value of production of pears rose simply due to the price rise. This increase in value is demonstrated in Figure 8, where we can see a significant upward trend in the value of the four crops shown.

The majority of apples produced, between 75% and 85%, are sold in the fresh market, with the remainder being processed for canning, juicing, drying or other apple products. There is a trend in the apple market for a higher percentage of apples to go into the fresh market. In 2001 73% of



apples went to the fresh market, by 2011 that percentage had increased to 84%, even though production had increased slightly over the same period. A similar story holds for cherries, with between 79% and 85% of the crop being sold in the fresh market, and the remainder being processed.

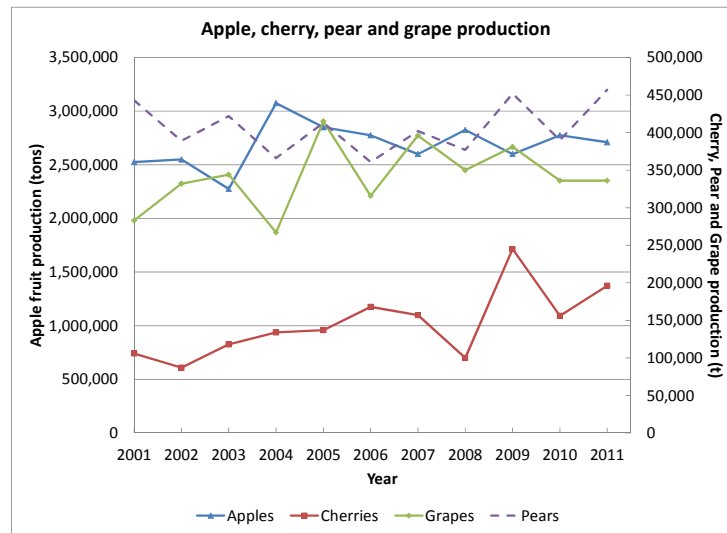
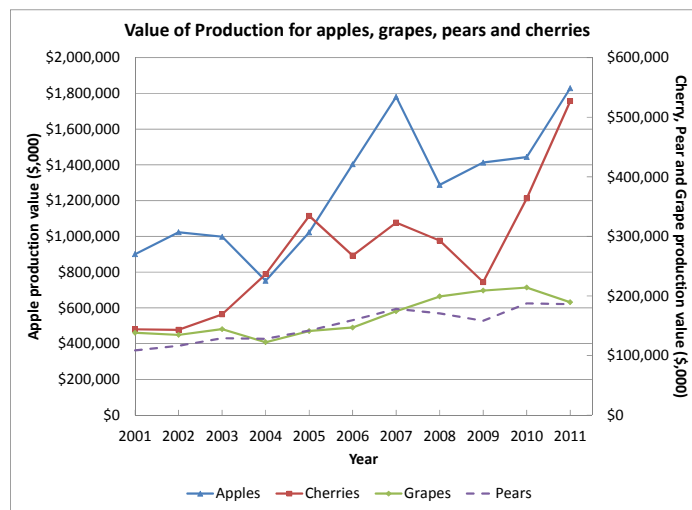


Figure 7: Production of apples, cherries, and grapes in the period 2001 to 2011.

Much of the increase in apple and cherry production and fresh market allocation has been to satisfy a significant growth in exports of fresh apples and cherries. In 2004 the export value of apples and cherries was \$266 and \$26 million, respectively; by 2011 these values had increased, at a constant rate over the period, to \$770 and \$230 million each. Pear exports also rose as a consequence of the change in the mix of pear varieties, away from Bartlett pears, principally used in processing and canning, toward the fresh consumption varieties of winter pears.

Berry production, blueberry, strawberry, red raspberry and cranberry, has been relatively constant over the period 2001 to 2011 for all types except for blueberries. In 2001 blueberry area harvested was 2,000 acres, but by 2011 harvested area had increased to 7,000 acres. This larger area and a lift in yield per acre increased total blueberry production to 61 million pounds, with a value of production of \$122 million. Harvested area and yields of strawberries, red raspberries and cranberries have remained constant over the period. However, prices for these three crops have fluctuated in the same time frame, hence total value of production has ranged from \$20 to \$57 million, \$3.6 to \$9.5 million, and \$7 to \$10 million, for red raspberries, cranberries, and

strawberries, respectively. Exports of berries are relatively low with an export value in 2011 of \$17 million, but this value has increased gradually over the period of study.



**Figure 8:** Value of production of grapes, cherries, and apples over the period 2001 to 2011.

One sector of growth in the fruit crops is that in exports of processed fruit products. This sector has grown from relatively low base to be worth approximately \$90 million in 2011. Most of the growth has been in frozen fruit products; however processed cranberry products have had a significant increase from nothing to \$12 million in several years.

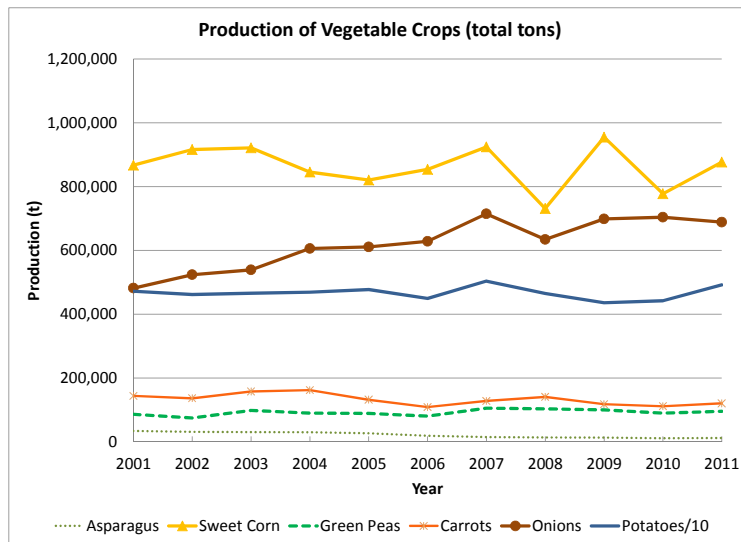
### **Commercial Vegetables**

Commercial vegetable production, excluding potatoes, generated a range in value of production of between \$310 and \$563 million in the period 2001 to 2011. The largest vegetable crop in production value is potatoes, with other crops such as onions, green peas, sweet corn, carrots, and asparagus producing values greater than \$10 million per year.

The area and yield of the potato crop has varied over the period of study, from 134,000 to 162,000 acres harvested and, 570 to 660 hundredweight per acre, respectively; production therefore has been relatively flat over the study period. The value of the potato crop ranged from \$430 to \$650 million, with a slight upward trend in the latter half of the study period as can be seen in Figure 10.

Onion production is, on average, the second highest valued crop in Washington. Area harvested increased by approximately 4,400 acres, and yield slightly increased over the period, leading to a rise in total production as seen in Figure 9. The value of onion production varied widely over the

period, from a low of \$27 million in 2004 to a high of \$227 million in 2006. The variability in value of production can be seen in Figure 10.



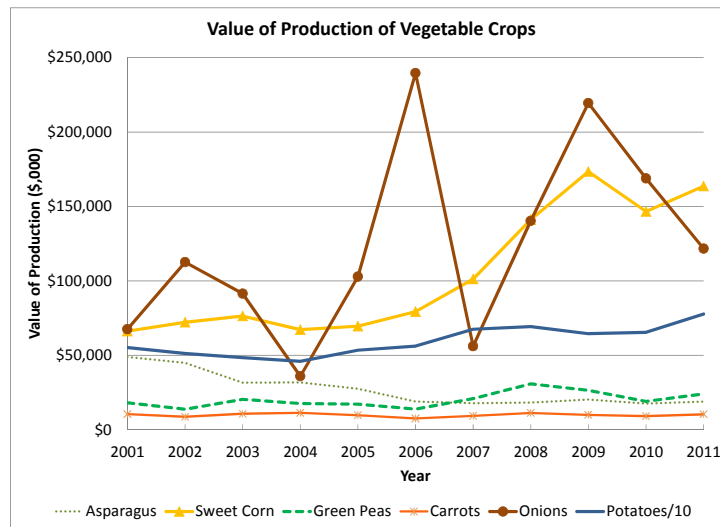
**Figure 9:** Production of major vegetable crops in tons in Washington over the period 2001 to 2011. (Note that the value of potatoes in the graph is the true value divided by 10 due to scaling.)

Sweet corn production, for the fresh and processed markets, has remained relatively constant over the period 2001 to 2011. Some variation in area harvested can be seen in Figure 9, but the main driver of sweet corn production has been an increase in yield per acre, from 7.5 tons per acre in 2001 to 9.5 tons per acre in 2011. This yield increase and a concurrent rise in prices has led to significant lift in the value of sweet corn production from a low in 2001 of \$66 million to the high of \$163 million in 2011, as shown in Figure 10.

The area harvested of greens peas used in processing has tended to be variable over the study period; with a slight downward trend in the last several years. On the other hand, the yield of green peas has increased over the same period. From Figure 10 we can see that these counteracting factors caused the value of green pea production to remain relatively constant over the time period of interest.

Asparagus production in Washington State has declined significantly over the period of study. In 2001 19,000 acres of asparagus was harvested; however by 2011 this area had declined to 6,500 acres, leading to a decline in total production of approximately 22,000 tons. A slight increase in yield per acre and an upward trend in prices in the latter half of the study period

reduced the overall impact on the value of production. But as can be seen in Figure 10, the value of production fell from \$49 million in 2001 to \$19 million in 2011.



**Figure 10:** Value of production of the major vegetable crops in Washington (Note that the value of potatoes in the graph is the true value divided by 10 due to scaling)

The production of carrots for processing shows a slight downward trend as seen in Figure 9, mostly due to a fall in area planted from 4,500 acres to 3,400 acres over the period 2001 to 2011. There has been some variability in area planted, but the total value of production has been relatively constant at an average of approximately \$10 million.

Exports of vegetables and processed vegetable products are dominated by prepared potato products; this product constitutes about 70% of total export value of processed vegetable products. Over the period 2004 to 2011 exports of this type of product increased by approximately 300%, however, exports of other products, such as frozen corn and other frozen vegetables also increased by similar margins. The value of exports of fresh potatoes and onions also increased over the period of study.

### **Other Crops of Value**

Washington also produces several other crops of significance to the economy of the state, hay, hops, mushroom, seeds for forages and vegetables, and essential oils, such as spearmint and peppermint. Hay production is undertaken on an average of 800,000 acres, with yields a little variable over the period 2001 to 2011, but averaging approximately 4 tons per acre. Prices of hay have been somewhat variable, but in the last two years prices have risen due to drought in other regions of the USA. These price rises have seen the value of hay production increase from

\$375 million in 2001 to \$684 million in 2011. A significant amount of hay is exported from Washington state, mostly to Asia, and this value has increased by 150% from 2004 to 2011.

Hop production area has varied over the period, from 19,382 acres in 2004 to 30,585 acres in 2008; from this peak in 2008 area harvested has declined, as prices declined due to oversupply in the world hop market. Because of variability in hop prices, the value of production of hops has ranged from \$71 million in 2003 to \$265 million in 2009, but again due to area reductions, value of production in the years after 2009 has declined to average approximately \$150 million.

Mushroom growing is conducted in controlled atmosphere buildings, however this does not mean that production cannot decline. From 2001 to 2011 the area of mushroom production declined by 38,000 square feet. However, this decline in area has been counteracted by an increase in yields, over the period total volume of sales has remained relatively constant, and there has been a slight increase in production over the latter part of the study period. This increase in production has lifted the value of production from \$14 million in 2001 to approximately \$21 million in 2011.

The major forage seeds produced in Washington are alfalfa and Kentucky blue grass. From 2001 to 2011 the area harvested of each species has declined significantly, alfalfa down by 4,000 acres from 14,500, and Kentucky bluegrass down from 50,000 acres to 29,000 acres. As seen with other crops yield per acre is variable but the yields of both crops have tended to increase over the period, however, these yield increases have not offset the area reduction and total production has fallen 30% for Kentucky bluegrass and 10% for alfalfa. The increases in yields and contemporaneous increases in prices of both seed types have led to a rise in the value of the two crops, from \$14 million to \$20 million, and \$23 million to \$31 million, for alfalfa and Kentucky bluegrass, respectively.

Peppermint and spearmint production has varied over the period. Area harvested of peppermint has declined from 22,500 acres to 16,500 acres and yield has remained relatively constant, however, price has doubled over the same period, thus value of production has increased from \$22 to \$35 million. Spearmint production on the other hand has fluctuated from a low of 9,200 acres in 2003 to a high of 13,800 acres in 2009, in 2011 harvested area was 11,600 acres, yield has also varied across the study period. The only trend observable in spearmint production was a steady increase in price, this higher price lifted the value of spearmint produced from \$13 million

to \$33 million. The value of exports followed a similar trend to prices and increased by approximately 100% over the period studied.

### **Livestock and Livestock Products**

Livestock and livestock products are ranked third in terms of total production behind field crops and fruit and nut production. The category is dominated by milk production, but sales of cattle for slaughter also made a significant contribution to the value of agricultural production in Washington. Egg production, although small relative to dairy and beef production, also generated a substantial level of value to the state's economy. The number of beef cattle in Washington declined over the period 2001 to 2011 by approximately 50,000 head, in contrast, the number of dairy cows increased, but by only 17,000 head.

Milk production increased by approximately 10% over the period 2001 to 2011, driven mostly by an increase in milk production per cow, there was also a slight increase in milk-fat percentage over the same period. The price of milk and milk-fat varied widely over the period, from low of \$12 to a high of \$20.70 per hundredweight for milk, and a low of \$3.27 to \$5.49 per pound of milk-fat. The variability in both prices led to an unstable value of production with a range of \$671 to \$1,273 million.

The export of milk products, particularly milk powder and whey, was also highly variable across the study period, with a low of \$102 million and a high of \$399 million value of total milk product exports. Milk powder and whey export values followed the pattern of the value of exports and was similarly highly variable. Cheese exports appear to be on an upward trend, without as much variability as the products mentioned before.

Overall production of beef appears to be trending slightly downwards as a consequence of lower beef cow numbers, which is offset to some degree by higher dairy cow numbers. Price variability for both cows and younger stock affected the total value of production of the beef industry, and over the past decade this value has fluctuated over a range of \$551 to \$708 million with no discernible trend. Exports of beef in various forms, frozen or chilled, have in general been increasing, with some variability across the time period studied.

The number of laying hens has been on the increase since 2001 and is currently at 6.7 million hens. Egg production per hen increased slightly over the period of study and as a consequence

total egg production also rose of the period. The unit value of eggs varied over the period, but appears to be on a slight upward trend, and this has led to a growth in value of production, which in the past 5 years has surpassed \$100 million per year.

### **Transportation Trends.**

#### ***Moving Washington's Wheat***

More than 56% of all wheat grown in Washington came from seven southeast Washington counties— Adams, Asotin, Columbia, Franklin, Garfield, Walla Walla, and Whitman—in 2008. Grant, Douglas, and Lincoln Counties grew 25% of the total.<sup>7</sup> Whitman County has been the number one wheat-producing county in the United States every year since 1978. Despite the physical growing of wheat being concentrated to a few counties, the ripple effects of wheat production is felt throughout the state in the form of jobs and revenue in food processing, transportation, as well as wholesale and retail industries.

Nationwide, 40% of harvested wheat is exported; however, 85 to 90% of Washington State wheat is sold to export markets, 70% of which went to Asia in 2009/10. Effective and efficient in-state transportation—from field to ship waiting at a Columbia River port—determines whether eastern Washington wheat farmers can compete internationally. Global wheat prices typically include delivery to port, so every cent of in-state transportation cost reduces farmers' profit by an equivalent amount. Washington State's wheat growers get a big boost from Washington's low-cost multimodal system that allows them to deliver commodity goods on demand to global markets.

Wheat prices were up in the 2010-11 marketing year due in part to strong demand for wheat and reduced world supplies. These prices resulted in significantly higher 2011 first quarter total landed costs for shipping wheat to Japan over the previous year. Overall transportation costs were significantly lower than last year but slightly above the fourth quarter 2010. The costs of shipping U.S. wheat to Japan from the Pacific Northwest during the first quarter 2011 were slightly increased over the fourth quarter 2010. Transportation costs from Kansas and North Dakota through the PNW increased over 1% from quarter to quarter, but decreased 22 and 13% from year to year.<sup>8</sup>

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<sup>7</sup> United States Department of Agriculture: Washington Agricultural Statistics Service. 2010 Washington Annual Agricultural Bulletin. Retrieved as of November 2011 from: [http://www.nass.usda.gov/Statistics\\_by\\_State/Washington/Publications/Annual\\_Statistical\\_Bulletin/annual2010.pdf](http://www.nass.usda.gov/Statistics_by_State/Washington/Publications/Annual_Statistical_Bulletin/annual2010.pdf)

<sup>8</sup> USDA-AMS. *Grain Transportation Report (May 19, 2011)*. Retrieved as of December 2011 from: <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELPRDC5094521&acct=graintransprt> .

Over 60% of Washington wheat exports ultimately travel by barge from ports along the 400-mile Columbia-Snake River system to Portland. About 36% is transported by rail to coastal grain terminals.<sup>9</sup> Recent extended lock outages along the Columbia River System provided ample opportunity to evaluate the importance of the river system to wheat movement. The scheduled maintenance outage was conducted between December 2010 and March 2011 and eliminated barge traffic on much of the upper Columbia River and the entirety of the Snake River system. Additionally, the outage placed increased demands on other modes of transportation. Between 1991 and 2010 downriver tonnage of commodities exceeded 139 million tons. Over this period, wheat comprised about 70%, or 96 million tons of the total 139 million tons, of commodities transported downriver. General declines in wheat moving downriver have been observed over the last decade. Between 1996 and 2000, an average of 5.5 million tons moved down river. The following two five year intervals saw declines to 4.8 million and 4.4 million consecutively.

The lock outage occurred between December 2010 and March 2011. Typically, February moves the second highest quantity of wheat, with an average of 403,000 tons. January and December also move large amounts downriver, with anywhere from 297,000 to 373,000 tons of wheat moved. March is the month in which the year-low historically occurs with a tonnage of 254,000. The duration of December to March moves 36% of the region's annual wheat harvest. Southeast Washington moves 33% of its harvest during this period. During the months of January and February of the three-year period leading up to the lock outage, wheat movement constituted in excess of 80% of the tonnage moving down river.

In the months leading up to the lock outage, researchers with the Freight Policy Transportation Institute (FPTI) at Washington State University conducted a survey of wheat elevators in the Pacific Northwest. Of the elevators surveyed in the southeast Washington region, 97.5% moved their wheat by truck-barge, 1.5% by rail and 1% by truck. These eight elevators processed more than a third of all Pacific Northwest wheat. Elevators in Northern Washington, generally north of I-90, handled another third of the wheat; however, these elevators typically move their wheat by rail, 71%, with only 15% moving by truck-barge.

During the lock outage, transportation adjustments had to be made by all parties involved in the movement of wheat and other commodities up and down the river system. Class I rail operators

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<sup>9</sup> Washington Grain Commission. *Washington Wheat Facts 2010-2011*. Retrieved as of November 2011 from: <http://www.wawg.org/PDFs/Buyers/2010WF4Web.pdf>



increased the number of weekly trains, mostly the number of trains moving west to accommodate wheat. Wheat producers and state commissions spread the word of the disruption and prepared for the changes by increasing movement prior to the lock outage as well as increasing storage capacity. Movement of wheat through the barge system in the months leading up to the outage was 15% higher than average. The high prices of wheat at this time made the choice to move more wheat sooner, a relatively easy choice for many producers.<sup>10</sup>

According to industry interviews conducted by FPTI researchers, wheat shipments that normally moved by barge transportation under normal conditions were moved by truck and rail during the lock outage. With several 110 railcar loading facilities in the Pacific Northwest, including those located in eastern Washington, shippers planned to take on high volumes of wheat during the lock outage. Ritzville Warehouse Company, a grain elevator in Washington expected three times the normal winter business during the lock closure. These railcar loading facilities have access to hundreds of miles of track and elevators, making this mode efficient and affordable, more so than direct trucking, for traditional barge customers. Southern Washington elevator firms typically moving 35% of the wheat between December and March, moved only 4% of the wheat during the outage, a 95% decrease, reflecting their great dependence on the barge system.<sup>11</sup>

### ***Moving Other Crops***

In the 2009-10 crop year, over 32.3 million boxes of Washington State apples, each weighing about 42 pounds, were harvested and exported to more than 60 countries around the world. These exports annually account for about 30% of the state's apple harvest and primarily come out of north central Washington and the Columbia Basin.<sup>12</sup>

U.S. trade volume in apples has increased since the early 1990s, largely due to increases in import traffic. Fresh apple imports have increased 44% since the early 1990s, through 2007. Exports similarly increased 25% over this period. With Washington providing more than 65% of the fresh apples produced in the U.S., it is of no surprise that the Ports of Seattle and Tacoma shipped more than 80% of the containerized apple exports, mostly in refrigerated containers.

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<sup>10</sup> Simmons, Sara and Ken Casavant. [FPTI Research Report #2](#). "Industry Preparations for the Columbia-Snake River Extended Lock Outage, July – December 2010." February 2011.

<sup>11</sup> Simmons, Sara and Ken Casavant. [FPTI Research Report #9](#). "Industry Reactions to the Columbia-Snake River Extended Lock Outage, December 2010-March 2011." June 2011.

<sup>12</sup> Washington Apple Commission. *International*. Retrieved as of November 2011 from: <http://www.bestapples.com/international/index.aspx>

In 2008, 88,7824 jobs in the Columbia Basin and North Central Washington regions were directly dependent on the efficiency of our freight system: 36,051 in agriculture, forestry, and mining, 16,988 in manufacturing (processed food and other sectors), 4,029 in transportation, warehousing, and utilities, and 31,656 in wholesale or retail trade.<sup>13</sup>

According to the Washington Potato Commission, Washington-based processors turn nearly 90% of the annual potato yield into value-added products, increasing the value of the crop nearly six-fold. Nine out of every ten of the state's potato crop is marketed outside of Washington; exports to overseas market account for a significant portion of sales.<sup>14</sup> % . Most of these processed products are frozen. Washington ports handle 71% of the processed potato exports; the Port of Portland handles another 5%.

### **Conclusion**

Agricultural producers in Washington State produce a wide range of crops and other food outputs, this production generates significant wealth for the state, but also requires a vast network of transportation infrastructure to maintain the vibrancy of agriculture in the state. As farmers in the state alter their plans to adjust for changing prices and tastes, production of commodities rise and fall, in this report we have shown that the output of some products has increased, such as cherries, and corn, both sweet and grain, but production of other crops has fallen, such as asparagus and barley. Also, significant growth has occurred in the processed food sector, and much of this growth has been due to higher export demand, thus increasing the demand for transport services. The major growth in the state's agricultural production has been in fresh products requiring rapid transport as they have limited storage life, such as cherries, sweet corn, and other berries. This is particularly so as the main markets for these products and others are international, thereby requiring a transport system that can deliver the products to market with limited losses. Growth has occurred, and will continue, in grapes for wine production, and this will impose further load on the transport systems within the state as winery production will need to reach markets beyond the cellar door. Expansion in the processed food sector, mostly in frozen products, will also require specialized transport services, as again the growth in this sector has been in exports.

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<sup>13</sup> Office of Financial Management. *2009 Washington State Data Book. Local Government and Special Districts*. Retrieved as of November 2011 from: <http://www.ofm.wa.gov/databook/>. Values include Benton, Chelan, Douglas, Ferry, Grant, Kittitas, Klickitat, Okanogan, Pend Oreille, Stevens, and Yakima Counties.

<sup>14</sup> Washington State Potato Commission. *Spud Facts 2012*.

Table 1. Summary of changes in production and value of major commodities produced in Washington State over the period 2001 to 2011.

	Unit of Production	2001	2011	2001	2011	Change in production 2001 to 2011
Commodity		Production		Value		
Wheat	bu	131,350,000	167,880,000	\$423,681,000	\$1,134,673,000	28%
Barley	bu	21,000,000	8,510,000	\$41,160,000	\$43,401,000	-59%
Corn Grain	bu	10,450,000	28,125,000	\$26,752,000	\$171,563,000	169%
Lentils	cwt	1,280,000	840,000	\$12,032,000	\$28,308,000	-34%
Dry Peas	cwt	1,240,000	1,386,000	\$7,936,000	\$21,206,000	12%
Apples	t	2,525,000	2,710,000	\$900,250,000	\$1,443,890,000	7%
Cherries	t	106,000	196,000	\$144,072,000	\$526,986,000	85%
Grapes	t	283,000	336,000	\$138,195,000	\$189,396,000	19%
Pears	t	443,000	457,000	\$108,627,000	\$186,269,000	3%
Blueberry	#	15,550,000	61,000,000	\$11,688,000	\$122,000,000	292%
Strawberry	#	16,000,000	12,500,000	\$8,262,000	\$8,971,000	-22%
Red Raspberry	#	76,050,000	72,300,000	\$37,784,000	\$44,336,000	-5%
Cranberry	Barrels	142,000	115,700	\$3,838,000	\$6,461,000	-19%
Potatoes	t	4,720,000	4,920,000	\$552,240,000	\$777,360,000	4%
Asparagus	t	34,200	12,000	\$48,910,000	\$18,936,000	-65%
Sweet Corn	t	867,360	877,200	\$66,268,000	\$163,686,000	1%
Green Peas	t	86,190	95,700	\$18,148,000	\$24,116,000	11%
Carrots	t	144,000	120,700	\$10,512,000	\$10,380,000	-16%
Onions	t	481,900	688,500	\$67,497,000	\$121,686,000	43%
Hay	t	3,088,000	3,376,000	\$375,328,000	\$683,680,000	9%
Hops	#	50,779,600	51,308,100	\$91,911,000	\$141,097,000	1%
Mushrooms	#	12,522,000	12,430,000	\$16,711,000	\$20,530,000	-1%
Alfalfa Seed	cwt	115,000	103,000	\$13,800,000	\$20,500,000	-10%
Kentucky Bluegrass Seed	cwt	305,000	217,000	\$22,875,000	\$30,800,000	-29%
Peppermint	#	2,209,000	1,716,000	\$22,532,000	\$35,006,000	-22%
Spearmint	#	1,484,000	1,798,000	\$13,208,000	\$33,269,000	21%
Milk	#	5,480,000	6,125,000	\$827,000,000	\$1,276,983,000	12%
Beef Cattle	#	835,560,000	667,720,000	\$661,541,000	\$708,145,000	-20%
Eggs	millions	1,339	1,924	\$62,544,000	\$142,005,000	44%

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