AN ABSTRACT OF THE THESIS OF

Madilynne J. McGuire for the degree of Honors Baccalaureate of Science in Environmental Economics, Policy, and Management presented on May 24, 2011. Title: Red Raspberry Production Cost Comparison in Oregon and Chile

Abstract approved:

Gregory Perry

Red raspberry markets in both Chile and Oregon are affected by factors in each other's production processes. As seen in the late 1990's changes in pricing and supply can hinder the competitive edge of markets, pushing producers into economic hardship. Thus, the need to know the competition's methods is presented. Oregon raspberry production practices involve larger farms, frequent chemical and fertilizer use, mechanization of harvesting and farm operations, and strict regulations in both international and domestic fresh supply. Chile consists of many small farms, which on average are 3% of the size of Oregon farms. Fertilizer and other chemical use is more approximation and with less frequency, hand-labor dominates farming practices, and regulations are strict on the global market but relax in the domestic fresh market. Commercial presence of raspberries in Chile is larger with higher consumption of the berries and cheaper domestic supply. Now Oregon producers will have insight into differences and possible improvement of their competitive edge in the raspberry market.

Key Words: *Raspberries, Production, Costs, Budget, Chile*
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Red Raspberry Production Cost Comparison in Oregon and Chile

by

Madilynne J. McGuire

A PROJECT

submitted to

Oregon State University

University Honors College

in partial fulfillment of
the requirements for the
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I understand that my project will become part of the permanent collection of Oregon State University, University Honors College. My signature below authorizes release of my project to any reader upon request.

Madilynne J. McGuire, Author

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DEDICATION

To Mom,

Thank-you for your

love and motivation.

Red Raspberry Production Cost Comparison in Oregon and Chile

I. Introduction:

The Willamette Valley is home to a diverse set of crops and cropping systems, the result of rich soil and a Mediterranean climate. Among the crops grown here are raspberries, blackberries, blueberries and strawberries. In fact, the Willamette Valley is a major source of blackberries and raspberries produced in the United States. The dominant raspberry varieties in Oregon are Meeker (70% of commercial plant sales) and Heritage (PNW Extension 17). The West Coast states have the bulk of the US raspberry acreage, with Washington being the dominant producer (figure 1).

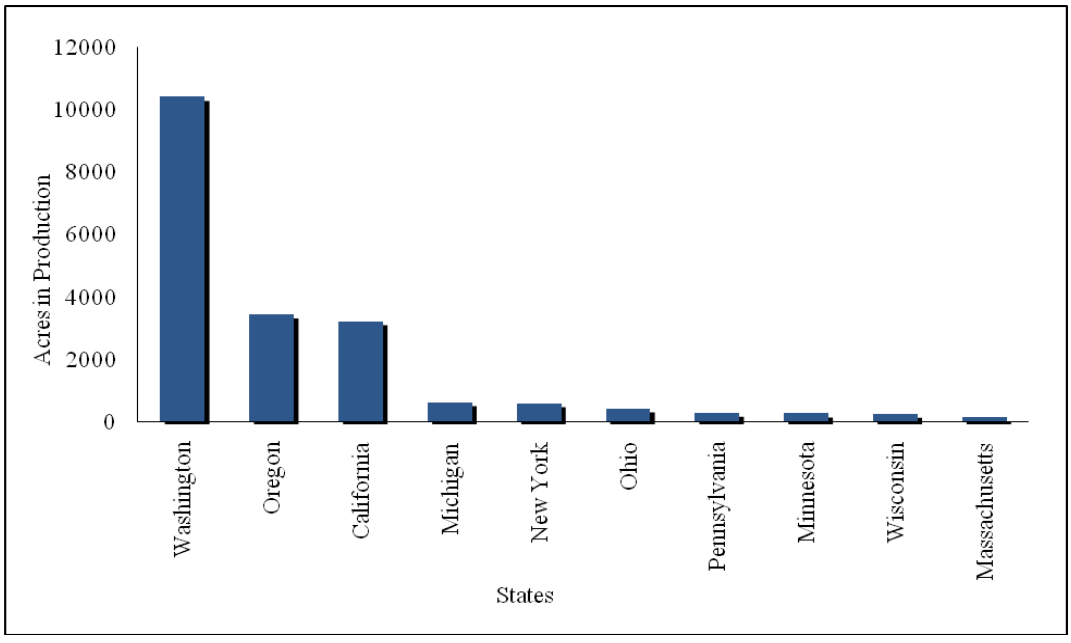

Figure 1. Acres of raspberries in production within the United States as of 2007 (USDA Table 34).

The United State's commercial side of raspberry production is not as popular as blueberries and strawberries. Raspberries are still a popular berry, but consistently rank third in berry consumption in the United States. In 2000-05 raspberry production increased at a rate 3-7% greater than corresponding increases in per capita strawberry and blueberry consumption. Overall, raspberry consumption has tripled since the early 1990s (figure 2) (Pollack and Perez 21).

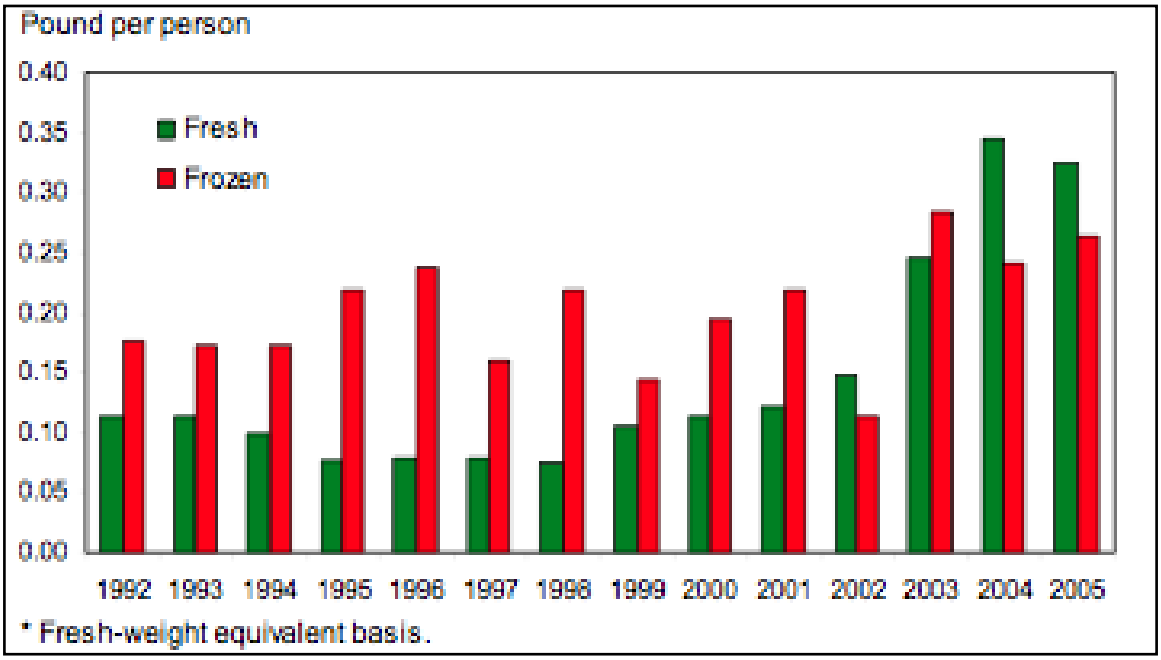

Figure 2. U.S. per capita consumption of fresh and frozen raspberries (Pollack and Perez 21).

Despite lower consumption in comparison to other berries, the raspberry industry still has growing demand for their product and as a result growing imports from other countries (Brown). Figure 3 illustrates that Chile is a major player in the U.S. raspberry market along with Mexico. However, Mexico and Chile have the advantage in two different sides of the market, the fresh and processed markets (figure 3) (Department of Commerce).

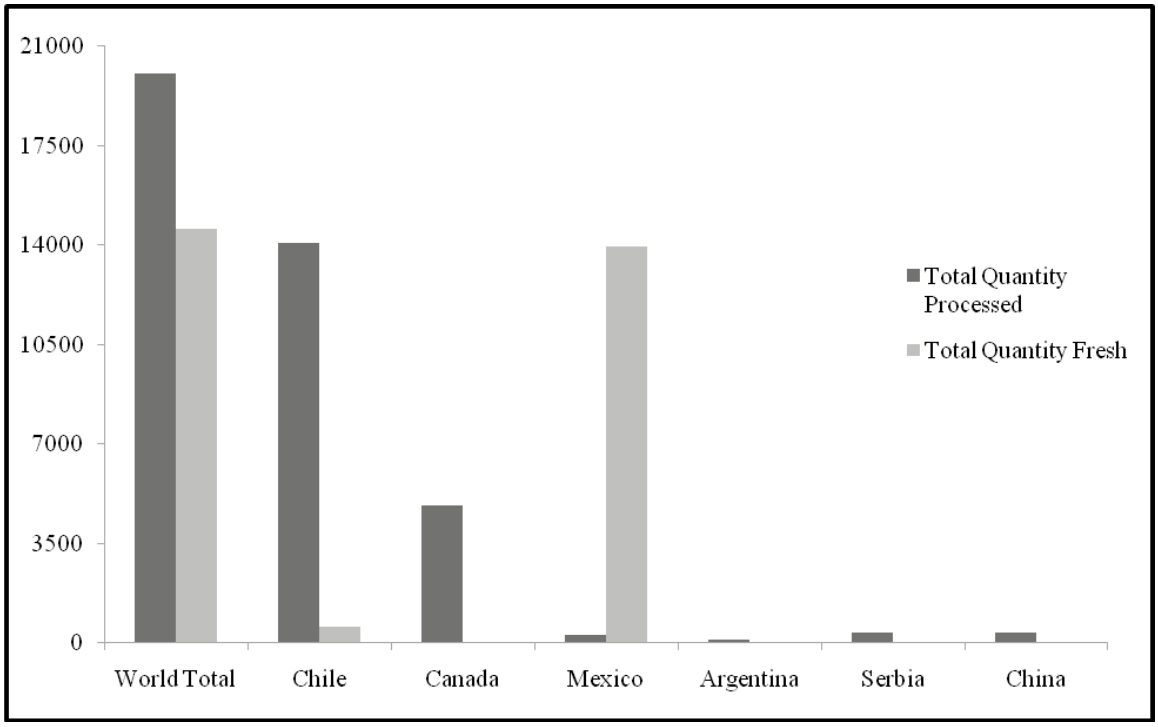

Figure 3. Raspberry imports into the U.S. market: Processed and Fresh.

Mexico's influence on the red raspberry industry is in the fresh market. In the years 1995-2010 Mexico has been a contributor to imports into the U.S. Additionally, in the past four years Mexico has out produced Chile in U.S. fresh raspberry imports. Mexico is able to preserve their advantage in the fresh raspberry industry due to their proximity to the United States. For Mexico, transportation costs are less and the delivery time is quicker due to their proximity. Thus, for the fresh market Mexico's produce is delivered more quickly and more cheaply than Chile. However, in the processed raspberry imports Chile, along with Canada, have maintained their position as the main importers into the United States.

Oregon and Chilean raspberry production have the potential to be affected by factors in the other's production process. From 2002-2009 imports of frozen berries to the United States from Chile has grown and sustains a large portion of the American frozen

raspberry consumption (figure 4). Frozen raspberries are more important to the competitive relationship between the U.S. and Chile because supply of individually quick frozen (IQF) raspberries is year round. In the fresh market, there exists a cooperative relationship, in which one fills the others demand during their own production season. In 2000 imports of frozen raspberries into the U.S. accounted for 28% of the raspberry supply, and this trend has continued through the present (Buccola and Gopinath 2).

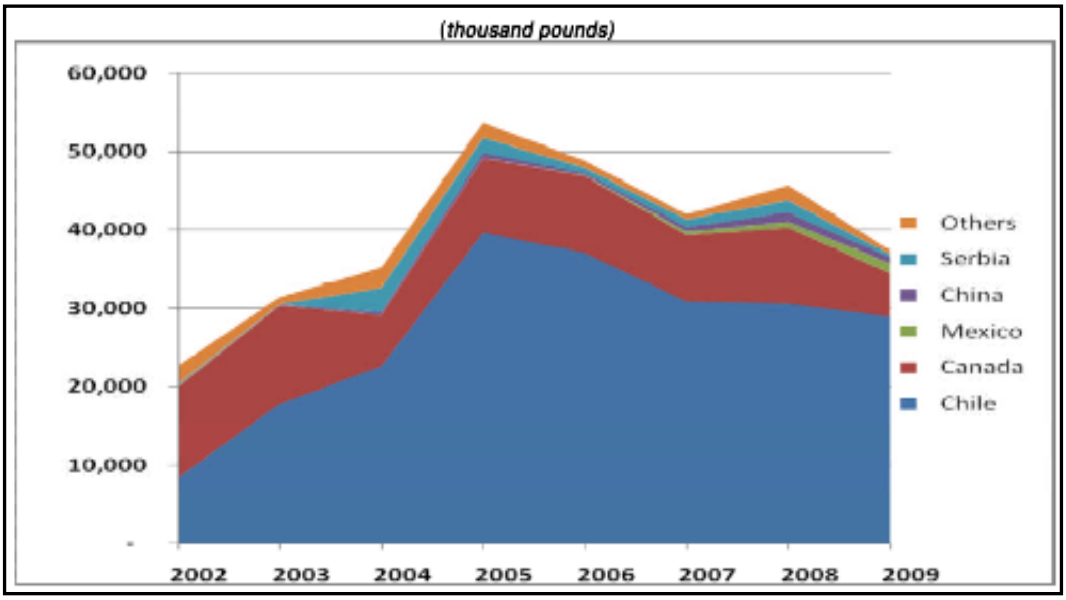

Figure 4. Processed red raspberry imports into the United States (Washington Red Raspberry Commission).

Due to the large portion of imports of frozen raspberries for the United States a comparison between Chile and Oregon will benefit local producers in knowing differences between operation practices. A better understanding of the advantages each country has in raspberry production allows Oregon producers to alter practices to improve and maintain competitiveness on an international market, as well as to project how competitive Chilean raspberry farmers are likely to be in the future.

Effects of Chilean red raspberry production factors on the United States were seen in 2001, when the IQF Red Raspberry Fair Trade Committee filed a material injury

petition to Commission and Commerce due to Chilean subsidized individually quick frozen (IQF) raspberries. The subsidized frozen raspberries from Chilean farmers made U.S. producers less competitive because Chilean prices were lower and more affordable. The United States International Trade Commission found “that an industry in the United States is materially injured by reason of imports of IQF red raspberries from Chile that are alleged to be subsidized by the Government of Chile and sold in the United States at less than fair value” (United States International Trade Commission 18). This finding stopped future dumping of subsidized raspberries on the U.S. market. This shows the competitive relationship between U.S. and Chilean raspberry producers.

The focus of this overview will be on the production costs of the industries and those factors altering the distribution of costs. These factors have been outlined as differences in production, labor, regulations, and commercial presence. Since the last red raspberry budget was created for Oregon 18 years ago, the raspberry industry has changed and is continuing to modernize.

II. Methodology

The methodology used to produce a red raspberry enterprise budget for Oregon was similar to that used for other enterprise budgets, involving input from a panel of producers and OSU experts working in this area of agricultural extension. The 2009 Enterprise Budget for Marion Blackberries was used as a starting point in putting together this budget for raspberries. A committee of farmers was asked questions to adapt prices and methods of production in the blackberry budget to reflect raspberry production practices. The final reporting format of the Red Raspberry enterprise budget was based on the Marion Blackberry budget (Julian).

Production data in Chile were gathered in person in March 2011. While in Chile, arrangements were made to meet with raspberry producers near and around Valdivia, which is home to the Universidad Austral de Chile. Professor Rodrigo Echeverria of the UACh faculty arranged two meetings with producers, who reflected the average Chilean red raspberry farm. Before traveling to the operations, spreadsheets were prepared with possible inputs and other factors of production.

Once at the farms, owners gave tours of their property and explained the raspberry operation. After the general explanation of methods, timeline, and objectives, the producers were asked questions pertaining to operation costs using the prepared spreadsheet. Before coming to the farm varying input costs were predicted and extra room was left on the spreadsheet for differences. To obtain the input costs the producers were asked the timeline and methods of pre-harvest, harvest, and post-harvest, and what

inputs such as, pesticides, fertilizers, labor, beehives, and irrigation water, etc. Pictures were also taken to accurately describe the raspberry operations in Chile.

As a side note, professors at UACh suggested financial records are more limited in their details than is the case for U.S. farmers. This was the situation for the two participating Chilean raspberry producers. Their records of production were simple costs, yield, price received, and profit summaries. The generality of records is a product of family run operations, that are not restricted by a variety of taxes and business operations. The only tax producers pay is a value-added tax (IVA) of 19%. This is not a large burden to raspberry producers because they are reimbursed the IVA they pay on inputs, after they sell their production.

Once all Chilean records were obtained, variable costs, fixed costs, and net worth were calculated and arranged into a spreadsheet to be presented to raspberry producers in the Willamette Valley of Oregon, and compared to Oregon data. The Chilean operation #1 will be referred to as Temuco producer (Table 2) and operation #2 as the Mafil producer (Table 3).

Oregon data for the enterprise budget was obtained after the data gathering effort in Chile. Chilean data was presented at the North Willamette Research and Extension Center for Oregon producers and discussion followed about differences in production, labor, regulation, and commercial uses of raspberries. After the presentation producers were asked how their costs and production had changed since the last enterprise budget for raspberries in 1993. Each variable was brought into question and the committee of producers and extension agents settled on a number.

After all data were collected, budgets were prepared using Excel spreadsheets and formulas adapted from the Marion Blackberry budget. A comparison was then made to highlight differences and similarities between Oregon and Chile.

III. Data:

The Oregon enterprise budget estimates the typical costs of producing red raspberries in the Willamette Valley. While efforts were made to reflect common practices, it is not representative of any particular farm and should be used only as a guide to estimating actual costs. The major assumptions used in constructing this budget are discussed in the following sections.

Land: This budget is based on a 300-acre farm with 60 acres in production of red raspberries. The budget includes production costs for 1 acre. The established stand is assumed to have a 15-year life. A land lease charge of $150 per acre is included to represent the cost of leasing or owning land. The previous crop was strawberries.

Labor: Hired labor is valued at $13.50 per hour which includes all costs associated with withholding taxes, record keeping, and payroll overhead. Equipment operator labor is valued at $19.00 per hour. All hired labor is paid on an hourly basis except for labor used for pruning and tying canes. These two operations are paid at a piece rate. Owner labor is valued at $19.00 per hour and is used for cultivation, chemical applications, irrigation, planting, training canes, rodent control, and hauling during harvest.

Capital: Opportunity costs of capital are charged at a rate of 8.5 percent for current, intermediate, and long-term capital provided by the owner/operator.

Machinery and Equipment: Irrigation is applied using a drip system, valued at $1,000-1,200 per acre. The cost of the well is valued at $100,000 and

provides enough water for 60 acres. A machine shed and all farm machinery equipment are owned by the operator, along with a machine harvester. Due to increase costs in labor, most operations have purchased a raspberry picker. An over-the-row harvester is leased for $34,000 per year, if an additional harvester is needed. A detailed breakdown of machinery values used in this budget is shown in Appendix 1. Estimated machinery costs are shown in Appendix 2.

Establishment and Harvest: This budget is based on a 3-year establishment period using the Meeker variety. Raspberry plants are spaced 2.5 ft by 10 ft. Following planting, a trellis is constructed using 150 steels posts and 16 wooden end posts with anchors per acre. The first crop is harvested in the third year. A total of 4,500 lbs per acre are harvested each year over 10 pickings. Pruning, tying, and cultivation are followed by the planting of a cover crop.

A typical full production year's economics costs and returns are in Table 1. 6,000 lbs per acre of red raspberries are harvested over 15 pickings. In this budget a price of $1.15 per lb is used to calculate gross income. (This is based on the average of actual prices received for processed raspberries from 2007-09.) Red raspberries sold in the fresh market receive a price of 1.71 per pound. (This is based on the average of actual prices from 2007-09) (Mertz A-67). No attempt was made to estimate a separate establishment enterprise budget for this crop.

Over the long run, this study estimates that yields of 6,000 lbs per acre require a price of $1.36 per lb. to cover total costs (Table 1). Prices or yields below these levels suggest possible periods of economic losses during which owner provided labor and capital will likely not receive the rates budgeted in the

study ($13.50/hour and 10 percent interest, respectively). Any individual farm's red raspberry production costs and returns could differ from the results estimated and discussed in this budget.

Table 1. Red Raspberry Full production, Dollars Per Acre Economic Costs and Returns in Oregon.

			Quantity	Unit	$/Unit	Total	Price/lb
Red Raspberries			6,000	lbs	1.15	6,900	1.15
Total **gross** income						6,900	1.15
VARIABLE CASH COSTS	**Description**		**Labor**	**Machinery**	**Materials**	**Total**	**Cost/lb**
Fungicide spray	9	appl.	94.04	84.48	250.00	428.52	0.07
Insecticide spray	5	appl.	52.24	46.93	35.00	134.18	0.02
Fertilizer - broadcast band	2	x/acre	13.06	8.13	200.00	221.20	0.04
Rodent control	1	appl.	13.50	0.00	10.00	23.50	0.00
IPM scouting	2.50	hours	33.75	0.00	10.00	43.75	0.01
Herbicide	2	appl.	13.78	9.30	25.00	48.08	0.01
Cultivation	4	x/acre	29.50	18.96	0.00	48.46	0.01
Cane suppression spray	1	appl.	10.45	9.39	25.00	44.84	0.01
Bee hive	2	hive/acre	0.00	0.00	100.00	100.00	0.02
Machine harvest	13	x/acre	239.71	301.35	0.00	541.06	0.09
Harvester laborers	63.1	hours	851.59	0.00	0.00	851.59	0.14
Load & haul berries	13.00	$/lb	0.00	0.00	0.05	300.00	0.05
Berry Comm. (1% gross)	0.01	$/lb	0.00	0.00	69.00	69.00	0.01
August training	58	hours	776.25	0.00	0.00	776.25	0.13
Flail canes	1	x/acre	6.15	3.66	0.00	9.81	0.00
Subsoiler	1	x/acre	7.38	4.74	0.00	12.11	0.00
Harrow	1	x/acre	7.38	4.74	0.00	12.11	0.00
Seed cover crop between rows	1	x/acre	6.53	4.20	15.00	25.73	0.00
Irrigation, repairs & maint.	6	hours	76.95	0.00	15.00	91.95	0.02
Irrigation, water and power			0.00	0.00	75.00	75.00	0.01
Trellis, repairs & maint.	2	hours	27.00	0.00	20.00	47.00	0.01
Portable toilet	1	Unit/acre	0.00	0.00	50.00	50.00	0.01
Pickup	1	x/acre	0.00	195.02	0.00	195.02	0.03
ATV	1	x/acre	0.00	18.50	0.00	18.50	0.00
Shop and machine shed	1	x/acre	0.00	0.00	53.00	53.00	0.01
Miscellaneous and overhead	1	x/acre	0.00	0.00	200.00	200.00	0.03
Interest: operating capital	6	mons	0.00	0.00	87.56	87.56	0.01
Total **variable** costs			2,259.24	709.40	1,239.61	4,508.21	0.75
FIXED CASH COSTS					**Unit**	**Total**	**Cost/lb**
Pickup & ATV insurance					acre	55.51	0.01
Property insurance					acre	25.00	0.00
Property taxes					acre	30.00	0.01
Total **fixed cash** costs						110.51	0.02

FIXED NON-CASH COSTS	Unit	Total	Cost/lb
Mach. & equip. - dep., & int.	acre	2,569.06	0.43
Pickup & ATV - dep. & int	acre	180.11	0.03
Irrig. & trellis - dep. & int.	acre	243.00	0.04
Shop & machine shed	acre	146.67	0.02
Land interest charge	acre	400.00	0.07
Total **fixed non-cash** costs		3,538.83	0.59
Total **fixed** costs		3,649.35	0.61
Total of all costs per acre		**$8,158**	**$1.36**
Net projected returns		**-$1,258**	**-$0.21**

Table 2. Red Raspberry Operation #1 in Temuco, Chile.

Size of land base	14.8acres				
Operation Diversity					
Blueberries	8.6acres				
Red Raspberries (Meeker)	4.4acres				
TOTAL GROSS INCOME	**Quantity**	**Unit**	**$/Unit**	**Total**	**Price/lb**
Red Raspberries	29,768	lbs	0.81	24,111.68	0.81
	6765.3	lbs/acre			
Total **gross** income				24,111.68	0.81
VARIABLE CASH COSTS	**Total**	**Cost/Acre**	**Cost/lb**		
Harvest Labor	$5,655.83	$1,285.41	$0.19		
Pruning and Training	$2,109.70	$479.48	$0.07		
Energy for Irrigating (Temporary)	$421.94	$95.90	$0.01		
Fertilizers	$295.36	$67.13	$0.01		
Agri-chemicals	$316.46	$71.92	$0.01		
Transport to Freezers	$1,582.28	$359.61	$0.05		
Total **variable** costs	$10,381.57	$2,359.45	$0.35		
FIXED CASH COSTS	**Total**		**Cost/lb**		
Miscellaneous	N/A	N/A	N/A		
Overhead	N/A	N/A	N/A		
Facilities	N/A	N/A	N/A		
Salaries for Manager	$156.82	$35.64	$0.01		
Total fixed costs	$156.82	$35.64	$0.01		
TOTAL COSTS	$10,538.38	$2,395.09	$0.35		
Total Costs per acre	$2395.09	$544.34			
Net Projected Returns	$13,573.29	$3,084.84			

Table 3. Red Raspberry Operation #2 in Mafil, Chile.

Size of land base		14.8	acres		
Operation Diversity	Red Raspberries (Heritage)	4.94	acres		
	Red Raspberries (Meeker)	9.88	acres		
TOTAL GROSS INCOME		**Quantity**	**Unit**	**Total**	**Price/lb**
Red Raspberries		110,250	lbs	84,892.50	0.77
		7,449.32	lbs/acre		
Total **gross** income				84,892.50	0.77
VARIABLE CASH COSTS	**Descriptions**	**Total/acre**	**Total**	**Cost/lb**	
Fertilizers	*NPK* (89.3 lbs/acre, 267.91 lbs/acre, 89.3 lbs/acre), *Lime* (714.42 lbs/acre), and *Nitrate* (2 applications)	$213.61	$3161.43	$0.03	
Fumigation	(2-3x) Poliven 1.79 lbs/acre	$8.54	$126.39	$0.00	
Disc and Harrow	7 times/month	N/A	N/A	$0.00	
Rodent Control	Yearly	$1.43	$21.10	$0.00	
Irrigation	Monthly	$11.40	$168.78	$0.00	
Insecticides	1 application	$12.82	$189.74	$0.00	
Rot Control/ Disinfectant		$102.53	$1517.44	$0.01	
Transportation	Daily (30 days)	$85.52	$1,265.70	$0.01	
Pruning	$8.44/row, 20 rows/acre	$185.68	$2748.06	$0.02	
Mowing	7 times/month	N/A	N/A	N/A	
Harvesting Labor	$0.24/lb	$1,787.84	$26,460	$0.24	
Total **variable** costs			$35658.64	$0.32	
FIXED CASH COSTS		**Total/acre**	**Total**	**Cost/lb**	
*Irrigation System Est.		$854.43	$12,645.56	N/A	
*Tractor	90 hp	N/A	$14,767.93	N/A	
*Lawn Mower (Small Tractor)	18 hp	N/A	$2,531.65	N/A	
*Weed Whip		N/A	$801.69	N/A	
*Harrow		N/A	$4,219.41	N/A	
Subsoiler	Rent: 3 times/ year at $63.29	$12.83	$189.87	$0.00	
Total **fixed** costs			$189.87	$0.00	
TOTAL COSTS		$2,422.20	$35848.51	$0.33	
Total Costs per acre		$2,422.20			
Net Projected Returns		$49,043.99			

IV. Differences in Production Practices

Chilean agriculture has a number of similarities with U.S. agriculture in the 1960's and 1970's. Chile has more small farming operations, a cruder utilization of fertilizers, chemicals, fungicides, etc., longer production lives of raspberries, differing yields, and a lack of detailed records from small farmers. On the other hand Oregon production has larger farms, more precise applications of chemical inputs (fertilizers, chemicals, fungicides, etc), and shorter length of raspberry plant lives.

1. Oregon Farm Size and Yield

The average Oregon farm is 300 acres with 60 acres in production of raspberries. The majority of larger farms are located in the Willamette Valley. Outside the valley are smaller farms, which focus on local, fresh markets. On average, these farms are smaller and are harvested by hand, they also receive lower yields. These lower yields per acre in Eastern Oregon contribute to a lower overall average yield for the state.

When compared to a national Chilean average, Oregon has higher yields (6,561 pounds/acres) than the Chilean average (4,455 lbs/acre). However, average yields for the two Chilean farms (7,107 lbs/acre) are well above the country's average and exceed the average yield for Oregon. The overall average for Oregon is reduced because of the small (often hand-picked) farms outside the Willamette Valley that sell to the fresh local market (PNW Extension 2). Additionally, lower yields are a reflection of varying climates that are colder and drier than the areas

surrounding the Willamette Valley, which is the main area of raspberry production. Soil also has significant impacts on variations in raspberry yields. This difference is seen between Washington and Oregon. Oregon soil has more clay content, this a major reason for lower yields when compared with Washington. However, soil data for the Chilean farms was unavailable. Thus, it cannot be determined that differences in soil type and drainage exist between Chile and Oregon, and as a result be the cause of variations in yields.

2. Chilean Farm Size and Yield

The average Chilean raspberry operation is much smaller than Oregon, with only 1.9 acres in production (Dominguez 7). As seen with the Temuco and Mafil operation, respectively (Tables 2 and 3), producers have diversity among crops. Temuco also grew blueberries, while Mafil raised bees. This is similar to Oregon producers who diversify their operation to take advantage of differing yields and market prices among berries and other crops.

Despite the crude pesticide management system followed on the Chilean farms, they still obtain a yield that is comparable to Oregon. In the specific case of the two Chilean raspberry producers, their yield is higher than the average Oregon yield. In 2010 Temuco produced 6,765 lbs/acre and Mafil grew 7,449 lbs/acre. It should be noted that these two farms are south of the heart of Chilean raspberry production.

On the national scale the U.S. has the advantage in yield. Chile averages 4,455 lbs/acre, while the US averages at 6,561 lbs/acre (Dominguez 7)

(Washington Red Raspberries 8). The lower Chilean averages are the result of many small, inefficient farms in the Talca–Chillán area. Another possible theory is the differences in climate between the northern raspberry producers near Talca and the southern producers. A similar yield difference is seen between Washington and Oregon (Commodity Data Sheet Red Raspberries).

3. Fertilizer and Pesticide Use

Chemical application in Oregon is shifting to a minimization and essential use method for many producers. The fewer chemicals used results in less regulation, lower costs, and better consumer opinions in general. However, the application of chemicals is still a necessary part of the American agricultural system and although the consumers support movement toward 'natural' and 'organic,' they do not tolerate fruit flies in their berries.

Thus in the US and Oregon chemical applications are more extensive and precise for commercial raspberry producers, because "in order to gain benefits from fertilization, crop management must be appropriate and timely" (PNW Extension 49). Through soil and tissue sampling and the help of extension agents, producers in Oregon are able to evaluate whether fertilizers are needed and if so, which type and quantity to use (PNW Extension 50). Nutrient information aids both current and future years of raspberry yields; Oregon producers utilize sampling often to accurately and efficiently apply fertilizers. The value of soil testing can be seen in lower fertilizer costs at $200/acre compared to Chilean

applications of $213.61 to $295.36/acre. It should also be noted that for Chile fertilizer costs represent 30% of the cost for raising crops (Campillo).

A Chilean raspberry producer was asked about the type and quantity of chemical applications utilized on his farm. He replied they did not use as many chemicals when compared to the United States. This was his belief, and after examination of the two production systems it is true. Oregon has more frequent use of chemical inputs when compared to Chile. For the Mafil operation, the low use of chemicals was used as a market advantage in the fresh raspberry market in the local area around Valdivia, Chile. Mafil sold 60% of his raspberries for export; the other 40% was sold in the local fresh market.

The difference for Chile is they have fewer applications of chemicals throughout the season, so have lower input costs for the entirety of the season. The total input costs in Chile were at $0.35/pound to $0.38/pound, for the two producers. In Oregon total costs are estimated at $0.64/pound. This variance in input costs is seen because of fewer chemicals and lower labor costs. The distribution of costs for Oregon can be seen in the following graph (figure 5). Fertilizers and chemicals only account for 9% of cash cost totals in Oregon.

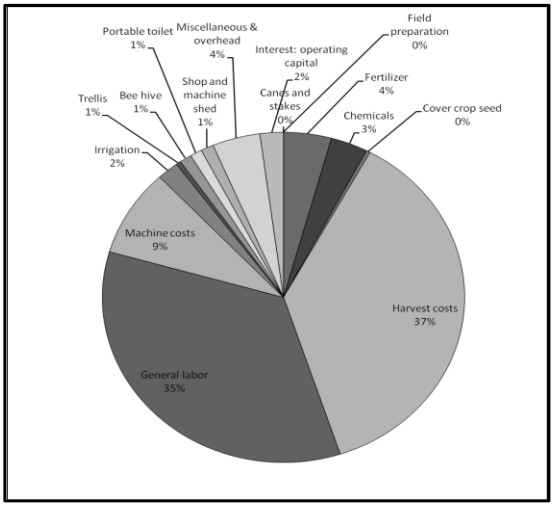

Figure 5. Distribution of costs per acre in Oregon.

In the Temuco raspberry operation, fertilizer was applied via granules and hand spread throughout the fields. However, exact amounts of chemicals per acreage of raspberry plants were not a concern of the producer. Temuco estimated the amount of fertilizer used by its cost of $295.36/acre (Table 1). The larger Chilean raspberry producer had more extensive records. Producer #2 knew the approximate amounts of Phosphorus, Potassium, and Nitrogen per acre along with other chemicals applied. This level of detail is beneficial for the producer so he/she can adjust applications in following years, depending on which chemicals were more beneficial.

The crudeness of chemical applications on Chilean farms is a reflection of the lack of soil and plant testing. They do not know the nutrient needs of their operation, which the soil and plant testing could provide. According to both Chilean producers, they know of the technology to test their soil, but the price and access to such testing is not worth the benefit. As a result, producers alter chemical applications based on plant performance from previous years without the added knowledge of nutrient levels and the possible presence of disease or fungi in the soil.

It would prove beneficial to Chilean raspberry producers to improve application of chemicals, because of the high cost of fertilizer and pesticides. The distribution of costs for Temuco and Mafil in Chile is shown graphically in figures 6 and 7. Fertilizer and other chemical costs account for 6% of input costs in Temuco and 14% of input costs in Mafil.

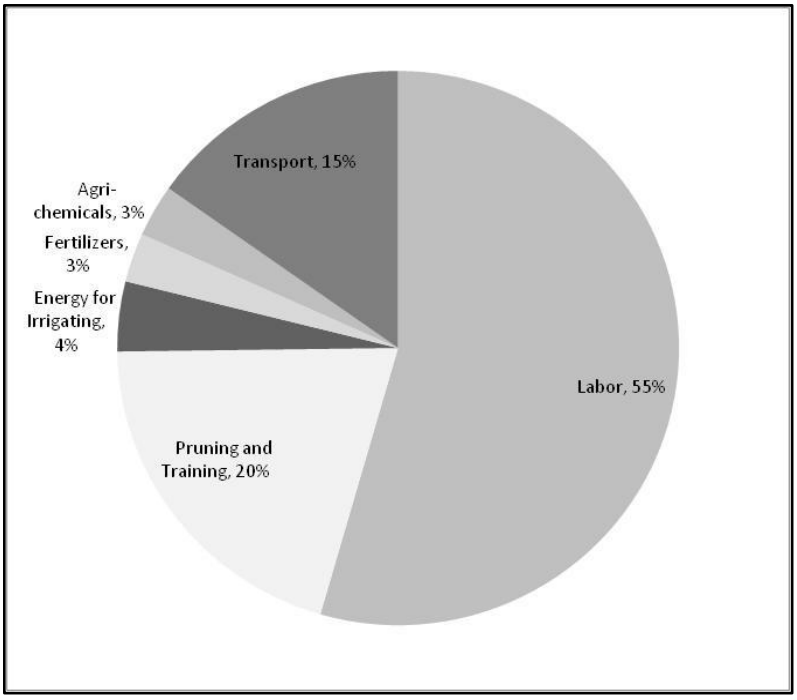

Figure 6. Distribution of costs for Temuco operation in Chile.

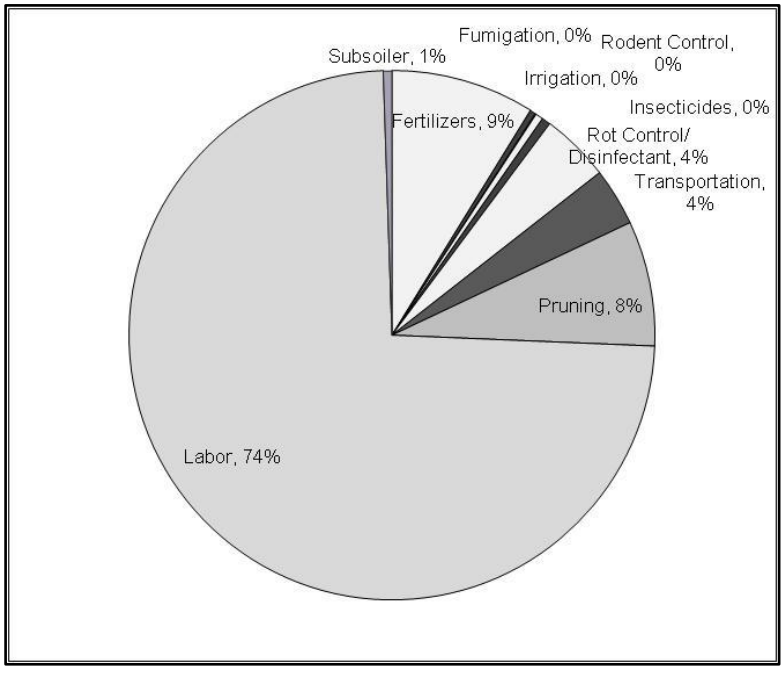

Figure 7. Distribution of cost for Mafil operation in Chile.

V. Labor Versus Capital

In the past agriculture in the United States was able to pay for hand labor and still make a profit, due to a cheap supply of labor from children and migrant workers. However, because of recent immigration and worker reforms the price of hand labor has increased in the United States and made it more economical for many producers to switch to mechanized operations. This switch has and is occurring in the United States, but other countries' agricultural operations remain largely ran by hand labor when hand land is cheaper than mechanization. This was one of the three major operation differences seen between red raspberry production in the United States and Chile.

1. Labor and Machines in Oregon

For Oregon raspberry production, the shift from hand labor to mechanical labor is readily apparent. According to a report at the International Raspberry Organization conference in 2010, mechanized production accounts for 99% of all US production (Washington Red Raspberries 8). Estimations place the distribution of labor in Oregon above 90% mechanized (Dominguez 7) (figure 8). This mechanization of the raspberry industry is not just the use of tractors to carry out field operations (as is done in Chile), but involves mechanical harvesters as well.

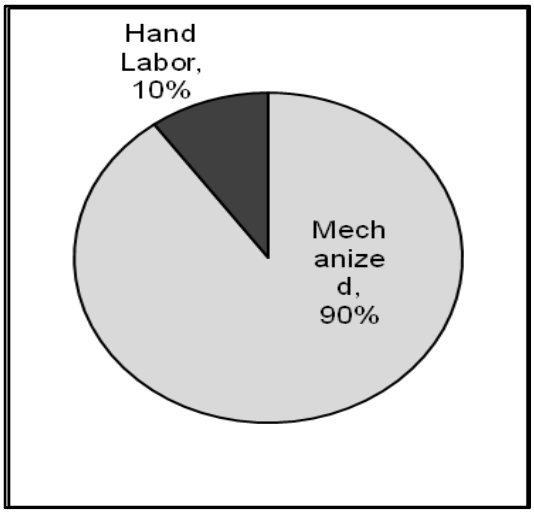

Figure 8. Distribution of labor of raspberry operations in Oregon.

The Oregon raspberry industry has shifted towards more mechanization because labor costs have become too high to justify hand labor. For example, in 1993 general farm, labor with all expenses included, was valued at $7 per hour. Now, in 2011, it is valued at $13.50 (see Data section). This is a 93% increase over 18 years. A mechanical harvester with one operator and four field graders can harvest as much acreage as 80-85 workers harvesting the fruit by hand. (PNW Extension 81-83). In a mechanical operation, operators are paid at a rate of $19 per hour. Additionally, the use of a mechanical harvester removes the concern over inconsistent supply of seasonal hand labor. During critical harvest periods if shortages of hand labor occur, such that the product cannot be harvested in a timely manner greater losses to yield occur.

Though the purchasing of a mechanical harvester is extremely costly (valued at $153,000) the labor cost savings quickly justify the purchase. When creating the production budget with Oregon raspberry producers, it was noted that few farmers operate without owning a mechanical harvester. Renting harvesters in

Oregon costs $34,000 per year. Producers rent harvesters to improve harvesting time and efficiency if yield warrants the need for an added harvester and crew.

2. Labor and Machines in Chile

Labor dominates the agricultural scene in Chile. It is similar to the United States in, that for smaller operations, operators rely more on manual labor and less on mechanization to complete farming operations. However, the presence of basic machines like tractors is also uncommon. When asked which machines were present on an operation of 14.8 acres of both blueberries and raspberries the producer in Temuco, Chile replied they owned a backpack sprayer, pruning shears, and a weed whip. However, this operation was large enough to merit the hiring of a full-time employee that managed the farm for 4 months out of the year, and they provided him with housing. Fields in this operation were prepared with a borrowed tractor on a less than yearly basis.

In another raspberry operation in Mafil, Chile totaling 14.8 acres, there were two tractors, one weed eater and a disk for the tractors. One of the tractors was a riding lawn mower. A larger mower was rented 3 times/year to maintain the area between rows. However, a raspberry harvester was not utilized by either operation. This finding was not surprising because labor costs are extremely low (Table 2 and 3).

These findings were typical of the Chilean raspberry industry. According to a presentation at the International Raspberry Organization conference, 98% of the Chilean harvest is done by hand. The remaining 2% is mechanically harvested

(Dominguez 7) (figure 9). This is a reflection of the dominating presence of small farms in Chile. It is more affordable for the farms to pay for labor than purchase a mechanical harvester. Another barrier towards mechanizing the agricultural system is the high cost of fuel, which averages around $5-6 U.S. dollars/ gallon.

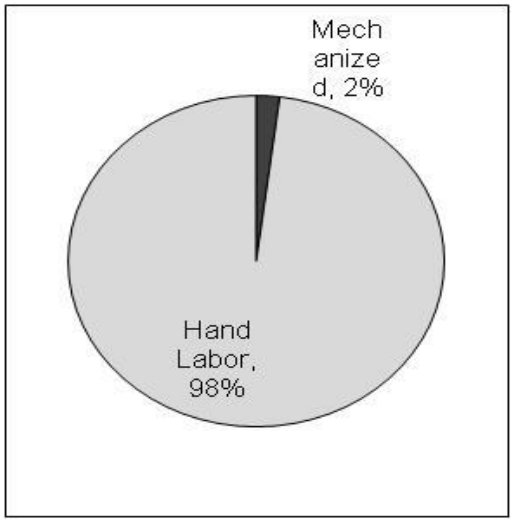

Figure 9. Labor distribution of raspberry operations in Chile.

Data from the two Chilean farms demonstrates labor costs for harvesting range from $0.19- $0.24 per pound, compared to $0.14 per pound for harvest labor (operators) and $0.09 per pound for mechanical harvest for Oregon producers. Thus overall, mechanical harvesting costs in Oregon is $0.23 per pound. To clarify, Oregon producers rarely utilize hand labor as a primary means of harvest. Possible reasons for unexpectedly high labor costs in Chile (as expressed by Oregon producers and extension agents) include the growing standard of living within Chile, but more likely is the growing value of the Chilean peso in terms of the US dollar. As a result of exchange rates Chilean labor is now more costly.

An interesting irony in the whole mechanization issue is that US farmers

speak highly of the mechanical raspberry pickers produced in Chile.. These harvesters sell for $153,000.00 in the U.S. Currently, Chile has created some of the most innovative designs in machine harvesting. For example, they have created a harvester that uses twisters of air to detach the fruit from the plant. As a result less fruit and blossoms are damaged. However, because 52% of the farms in Chile are less than 2 acres the machine must be bought cooperatively to distribute the costs and justify the purchase of the harvester (Steeves 13-14). And, as noted previously, the vast majority of Chilean raspberries are harvested by hand.

A couple of other items about labor in Chile are worth noting. Many of these farms are small and rely heavily on family labor. As a result there is little in the terms of individual wages, instead profit is used to support the family as a whole. Laborers are hired more frequently throughout the harvest. A picker earns about at $12.65/day, assuming he/she picks around 15 boxes (4.41 pounds/ box) per day. To put this into perspective the gross national income according to UNICEF is $9,460. This rate is only a fraction of general farm labor in the U.S. at $13.50/hour. In the United States GNI is $47,240. Agricultural rates for labor were not taxed, according to the two producers.

The second note is concerning provisions for laborers. The farm manager for the Temuco farm lived in provided housing as part of salary that was a small square building, which was constructed out of tin sheeting. At the main buildings of both operations, hand-washing and restrooms were present, however not convenient. Also there are no breaks throughout the day, workers are paid on what they accomplish, not on how much time they spend harvesting.

VI. Regulation Restrictions

Chile's food processing and production industries as a whole are of a similar level as the US for the global market, meeting Codex Alimentarius Commission standards. These food standards are established by the United Nation's Food and Agricultural Organization and the World Health Organization. The objective is to protect consumer health and ensure that in the food trade, fair practices are upheld (Codex Alimentarius). In fact regulations as a whole are sometimes even more particular in meeting CODEX, than those set by the EPA independently (Mendelowitz 21).

Regulations are often more relaxed in Chile concerning sanitation on the farm, when compared to the strict rules faced by American raspberry, more generally berry producers. The concern is of future restrictions among US producers, regulations that can be seen as hindering production. Viewing Chile as in the decade of 1970, when describing sanitation and labor provisions is a general overview. Yet, their policies are tightening in the past ten years to strengthen the confidence in agriculture (Agriculture in Chile). Quality control is the exception, with entry into international markets forcing Chileans to meet quality standards demanded in the global market.

1. Oregon Regulations

Oregon regulations are comparable to Chilean quality control, which is seen "as the only country who can supply their own domestic demand for both quantity and quality for blueberries" (Brown). Similar results can be assumed for other berry markets. This trend is a result of Chile meeting the quality demand of

their country and also exporting to meet U.S. regulations. However, the difference arises in the growing intensity of proposed regulations for agricultural producers.

When interviewed, a committee of Oregon raspberry producers invited by the extension service to attend, expressed their concern over the growing strictness in regulations. These measures and others are in response to recent E. Coli outbreaks in food sources; food sources which carried the E. Coli due to irrigation water with the presence of cattle and wildlife feces. The push for growing sanitation regulations is to improve consumer opinion and protect public health.

Increased concern over the impact of workers on the raspberry production has resulted in the need for producers to provide necessary amenities to their employees. These include portable toilets and hand washing stations. Additionally, labor must comply with the regulations concerning work week hours and breaks (exceptions may apply). The costs associated with providing these amenities are approximately $50/acre.

2. Chilean Regulations

Interviewed producers expressed no concern for increased restrictions in the sanitation area. In general producers in Chile have more freedom as they produce raspberries. In the raspberry production system of Chile there are many small operations. Regulating such farms individually would be difficult, so the processing companies mandate and enforce production standards. It was seen the standards were in place by the processing companies that bought the product. No

regulation regarding domestic fresh berries was mentioned by farmers or found to be present in regulations.

Stricter standards were in place for those facilities that processed raspberries in quick frozen or other methods and then sold them on the global market or domestic processed market. Chilean sanitation standards are a product of the Codex regulations. Under Codex standards for quick frozen raspberries, products must be "handled under such conditions as will maintain the quality during transportation, storage and distribution up to and including the time of final sale" (Codex Standard).

Additionally, when it comes to quality control for raspberries in Chile strict standards are maintained to preserve their reputation on the global market. Chile is an exporter of raspberries and as such all processed raspberries are under the regulations of Codex. As a result of the 70-80 freezers throughout the country, the small farmers deliver to the cold storage facilities where their product is consolidated before transportation to the freezer. This setup of processing has allowed for enough regulation to create a trace back system for quality control. According to Tom Krugman, "The Chilean industry fully understands the catastrophic consequences of product contamination and has taken the steps to minimize the potential for future contamination" (Krugman 2).

VII. Commercial Presence

One noticeable difference between Chile and the United States is the commercial presence of raspberries. Raspberries and raspberry products are more popular in Chile. Raspberry juices are served at local restaurants, bars, and national fast-food. Local raspberry farmers also sell fresh produce from bicycles and trucks on the streets. Higher consumption of raspberries is not necessarily in regards to health benefits, but juices are a popular part of many Chilean menus. Another aspect affecting consumption of Chilean raspberries is that they are less expensive than American raspberries. Estimations of Chilean frozen raspberry prices are around $0.97/pound (Dominguez 13).

In the United States raspberries are a not the most popular berry. See the graph below for a comparison with blueberries and strawberries. Raspberries have ranked third in fresh berry consumption in the US, by a large margin behind strawberries. However, popularity is beginning to grow as mentioned in the introduction (figure 10).

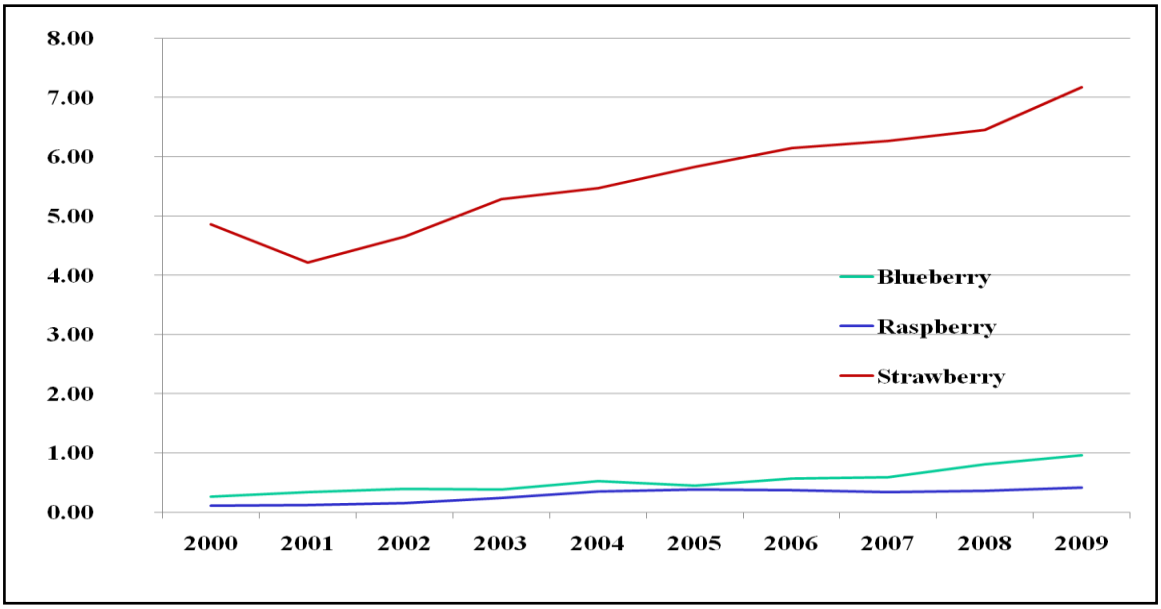

Figure 10. Fresh berry consumption in the United States from 2000-2009.

In Chile raspberries account for 28% of the berry production (figure 11). This is a key difference between Chile and the United States. It is true that production methods, labor, and regulations differ between the two countries but the difference in consumption ultimately makes all the difference. Increasing the popularity of raspberries is a goal of U.S. production (Washington Red Raspberries).

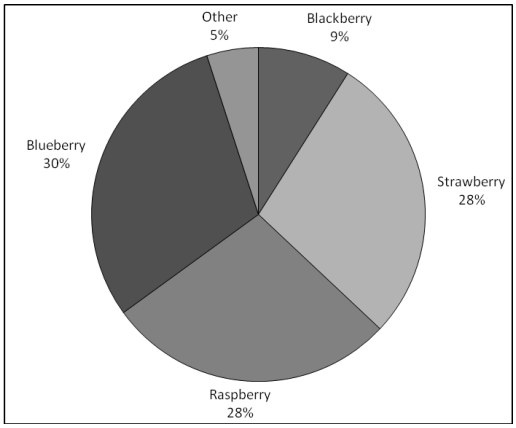

Figure 11. Berry production in Chile as of 2010 (Dominguez 4).

Lower popularity of raspberries in the U.S. is possibly a result of high prices. In comparison to other fruits, raspberries are the second or most expensive fruit in fresh, processed and frozen markets. Large differences in price between raspberries and other fruit causes barriers to increasing raspberry consumption (figure 12).

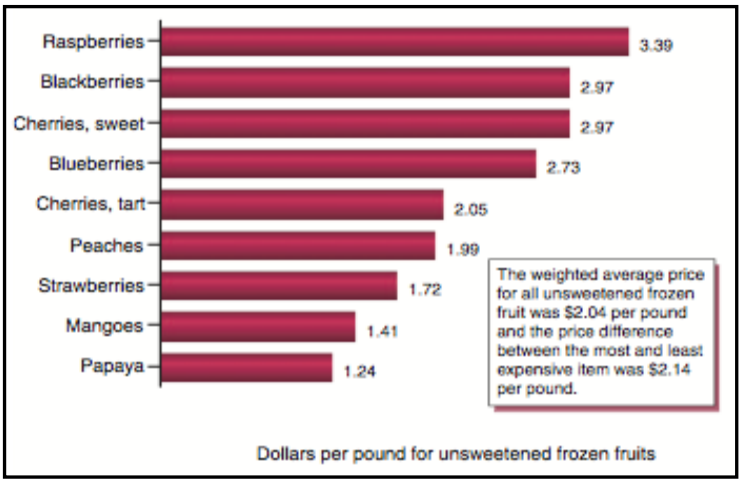

Figure 12. Price of frozen fruit in the United States (AC Nielsen Homescan).

VIII. Considerations for the Oregon Market

Comparisons between Chile and the U.S. open eyes to the production differences that exist between the two countries. This information can offer alternate strategies for raspberry production and the market in general. The main push to improve the Oregon raspberry industry is to increase consumption and popularity of raspberries. To take a cue from the Chilean industry encouraging consumption of frozen raspberries and raspberry juice through advertising campaigns, could be a possible new market.

The push for more consumption of raspberries is a goal of the U.S. industry, however other dimensions should be considered that affect the competitive relationship between the U.S. and Chile. Currently the Chilean peso is strong and increasing in value relative to the American dollar. The rising value of their peso creates a possibility for Oregon producers to more readily compete with Chile on a global scale. As seen in the unexpectedly high portion of labor costs in Chile, the rising value of their currency makes the raspberries produced more expensive. Rising values of the Chilean peso allows U.S. producers to sell raspberries which are more comparable in price while still preserving quality. Oregon producers are helped in the short-run by rising prices in Chilean currency. Until the economy adjusts completely to represent the new and changing values of the peso, Oregon producers will benefit by providing exports of frozen raspberries to Chile at a lower competitive price and in meeting domestic demand in frozen raspberries.

Increasing Chilean labor rates that result in a higher input costs, will affect U.S. production. If labor rates increase at a faster rate in Chile than the U.S. a situation would be presented, similar to that of increasing value of the Chilean peso. American

raspberries would be more competitive with the newly increased price in Chilean raspberries, to account for growing labor costs. In the long-run if labor costs continued to increase at a high-rate in comparison to the U.S. possible changes in the distribution of labor from hand-labor to mechanized harvest may also occur. Accompanied with this change would be the possibility of expanding farm sizes and the disappearance of small plots into farms operated by large raspberry producers or processors.

In the current situation of rising oil prices, the likelihood of further oil price increase should be considered. If oil prices continue to increase farms run largely by machines, like in Oregon, will show rising input costs. Rising input costs will present a different situation for U.S. producers, in that they will be less competitive with Chile in the IQF red raspberry market. Necessity to cover input costs will push Oregon producers to charge a higher price for frozen raspberries to cover total costs or to suffer an economic loss. If variable costs are covered economic losses due to high oil prices can be suffered in the short-run. Further difficulty arises because frozen/processed raspberry price is approximately $0.56/pound lower than fresh berry price. Lower prices for frozen raspberries makes covering costs more difficult, than in the fresh market. Rising oil prices could potentially decrease the amount of mechanized labor and return harvesting practices more towards hand-labor. However, further problems result from a possible switch to hand-labor because agricultural labor shortages have occurred in recent years.

Technologically, Chile has the knowledge and equipment equivalent to the U.S. The present situation of extremely small raspberry operations, the lack of extension services or agricultural education programs, and the economic barriers to technology discourage the utilization of advanced equipment and tests in Chile. If Chile improves the

distribution of knowledge and improves accurate application of chemicals and fertilizers, there exists the possibility of higher yields. Technological and knowledge increases may cause higher yields, thus shifting supply and lowering price. Lower prices would make Chilean raspberries even more competitive in the global market, if their reputation for quality is preserved. Protection for the U.S. industry in this regard comes from the establishment of infrastructure. Already in existence are extension services (which educate producers and assist in production research and decisions) and utilized technology. In available information there exists no guarantee of technological advantage over Chile in raspberry production. However, the established system will provide a quicker turn around in comparison to Chile and preserve the U.S. competitive edge.

Possibilities are boundless in the scenarios that may confront the Oregon and Chilean raspberry markets in future years. Predictions have been stated concerning changes in oil, technology, labor, and currency. All point to the conclusion that there are no perfect speculations, only that the factors of production for Chile and the U.S. affect one another. Now Oregon producers have insight into their competition to understand the differences and improve their ability to compete with Chilean raspberry producers.

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APPENDICES

Appendix A. Machinery Cost Assumptions.

Machine	Size or Description	Market value	Hours or *miles* of annual use	Expected life (years)	Salvage Value
Tractor	4 wheel dr 60hp, new	$ 50,000	193	20	$ 6,416
Raspberry Picker	Over the row, 75hp	153,000	97	20	19,632
Air-blast sprayer	300 gallon unit, PTO, new	13,000	99	15	1,248
Mower	Flail, 4' unit	6,000	6	15	576
Weed sprayer	3 point, 200 gallon unit	6,000	22	15	576
Cultivator	6' unit disk/ripper	3,500	31	15	336
Planter	6' unit	5,000	8	15	480
Fertilizer spreader	Broadcast bander	3,000	14	15	288
Pickup	1/2 ton 4x4, gas, new	22,000	*12,000*	10	8,319
ATV	4 wheeler, new	5,500	*3,000*5		2,465
Portable toilets	Rental units, include servicing	1,000	N/A	N/A	0
Irrigation system	Drip	30,000	N/A	20	5,000
Trellis system	per acre	2,000	N/A	20	0
Harrow	6 ft	2,500	100	4	250
Subsoiler	3 shank	1,000	100	20	100
Seed Drill	4 ft	1,200	200	10	120
Farm Truck	2 ton, used	16,800	*6,000*	45,000 miles	5,600
Shop and machine shed	40ft x 80ft Pole barn with partial slab floor	40,000	N/A	30	0

Appendix B. Machinery Cost Calculations.

		--- Variable costs ---		------ Fixed costs ---		
Machine	**Size or Description**	**Fuel & Lube**	**Repairs & Maint.**	**Depr. & Interest**	**Insurance**	**Total**
		----- Costs per hour -----				
Tractor	4 wheel dr 60hp, new	$10.49	$0.58	$23.71	$1.32	$36.10
Raspberry Picker	Over the row, 75hp	$10.49	$12.69	$144.31	$8.00	$175.50
Air-blast sprayer	300 gallon unit, PTO, new	0.00	6.00	14.03	0.43	20.46
Mower	Flail, 4' unit	0.00	0.26	99.09	3.05	102.39
Weed sprayer	3 point, 200 gallon unit	0.00	1.76	29.47	0.91	32.13
Cultivator	6' unit disk/ripper	0.00	1.14	12.04	0.37	13.55
Planter	6' unit	0.00	1.10	64.76	1.99	67.85
Fertilizer spreader	Broadcast bander	0.00	0.77	23.31	0.72	24.80
Harrow	6 ft	0.00	0.27	2.33	0.14	2.74
Seed Drill		0.00	1.26	0.43	0.03	1.72
Subsoiler	3 shank	0.00	0.75	0.93	0.06	1.74
		----- Costs per mile -----				
Pickup	1/2 ton 4x4, gas, new	$0.28	$0.05	$0.22	$0.07	$0.62
Farm Truck	2 ton	$0.23	$0.17	$0.71	$0.07	$1.17
ATV	4 wheeler, new	$0.07	$0.05	$0.32	$0.08	$0.52
		----- Costs per acre -----				
Portable toilets	Rental units, include servicing	0.00	0.00	0.00	0.00	50.00
Irrigation system	Drip	0.00	15.00	138.75	0.00	153.75
Trellis system	per acre	0.00	20.00	104.25	0.00	124.25
Shop and machine shed	40 ft x 80 ft Pole barn with partial slab floor	0.00	53	146.67	0.00	199.67

Appendix C. Estimated cost of each operation with power-unit for a 10' between row spacing.

				-- Machine costs --		
Operation	**Miles per hour**	**Acres per hour**	**Labor cost per acre**	**Variable cost per acre**	**Fixed cost per acre**	**Total cost per acre**
Raspberry Picker	1.00	1.03	$18.44	$23.18	$152.32	$193.94
Air-blast sprayer	3.00	1.82	$10.45	$9.39	$21.72	$41.55
Mower	3.00	3.09	6.15	3.66	41.14	50.95
Weed sprayer	3.50	2.76	6.89	4.65	20.09	31.63
Cultivator	2.50	2.58	7.38	4.74	21.51	33.62
Planter	2.50	2.42	7.84	5.04	22.85	35.72
Harrow	2.50	2.58	7.38	4.74	21.51	33.62
Subsoiler	2.50	2.58	7.38	4.74	21.51	33.62
Seed Drill	3.00	2.91	6.53	4.20	19.04	29.77
Fertilizer spreader	3.00	2.91	6.53	4.07	16.86	27.46

Appendix D. Input assumptions to establish harvest production Red Raspberries, (per acre).

	Full
Prices per lb	$1.15
Lbs per acre	6,000
Raspberry commission fee (1% goss)	1%
Cost of general farm labor, per hour	$13.50
Cost of tractor driver, per hour	$19.00
Cost to load & haul berries, per lb	$0.05
Cost of fertilizer (spreader granular 80 lbs Nitrogen)	$200.00
Cost of herbicide	$25.00
Cost of fungicides	$250.00
Cost of insecticide	$35.00
Cost of cane suppression compound	$25.00
Cost of rodent materials	$10.00
Cost of pheromone traps	$10.00
Cost of bee hives	$50.00
Cost of irrigation water and power	$75.00
Cost of cover crop seed	$15.00
Hours of labor, prune and tie	57.5
Hours of irrigating labor	5.7
Hours to maintain trellis labor	2.0
Hours of IPM scouting	2.5
Hours of labor, hand hoe	1.0
Hives per acre	2.0
Portable toilets per acre	1.0
Laborers on harvester	5.0
Times for fertilizer	2.0
Times for herbicide	2.0
Times for fungicides	9.0
Times for insecticide spray	5.0
Times for cane suppression spray	1.0
Times for cultivation	4.0
Times for harrow	1.0
Times for seed drill	1.0
Times for subsoiler	1.0
Times to flail canes	1.0
Times to harvest	13.0
Property taxes	$30
Property insurance	$25
Land values	$10,000
Miscellaneous & overhead	$200
Fuel use/gal for tractor	3.0
Gasoline price	$2.87
Diesel fuel price	$3.04
Operating interest rate	8.5%
Machinery interest rate	8.5%
Land interest rate	4.0%
Establishment interest rate	10.0%
% of operating capital borrowed	50.0%
Months to borrow operating capital	6
Planted canes	0