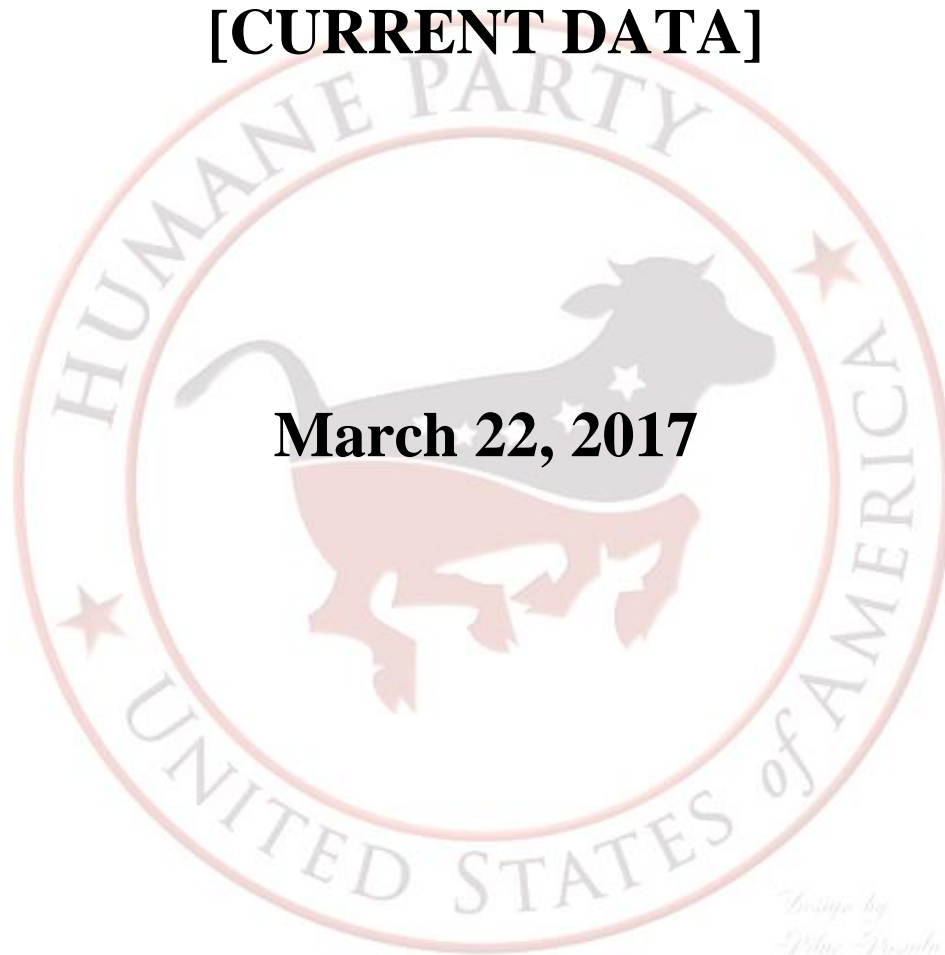


**Animal-based agriculture Vs. Plant-based  
agriculture. A multi-product data  
comparison.**

**[CURRENT DATA]**



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## Report preamble

The present document is meant to highlight the findings by the Humane Party in its analysis of the United States Department of Agriculture (USDA) reports and censuses.

This report presents a comparison between the economic profitability of the animal-based agricultural industries and that of the plant-based agricultural industries. In order to properly encompass these industries, their main products and commodities are analyzed and a comparison is made between the animals being farmed and the plants being grown in equal circumstances, that is, pertaining to pounds created, number of acres used, sales, expenses, and profits generated.

### Bias

There is an ethical obligation to disclose the bias of the preparers and analyzers involved in this report. The Humane Party aims and fights to free all animals from abuse, exploitation, and property status. It is in the Humane Party's interest that the results of this report support its goal insofar as possible. All members involved in this investigation, analysis, and report have acted at the margins of this bias, striving for their judgement to remain unaffected by said bias.

### Sources

In order to ensure the veracity and validity of the results, all data have been extracted from reports and censuses from the National Agricultural Statistics Service (NASS) and the Economic Research Services (ERS), both organs of the USDA. Some data, which were not available from the USDA, were obtained from university studies that are partially funded by the USDA.

### Keywords

Agriculture, plant-based-agriculture, animal-based-agriculture, economic-transition, land-mass, agriculture-analysis, agriculture-comparison.

## Disclaimers

- The data utilized were the most current available. Given that the USDA does not keep the entirety of the data on a streamlined annual basis, the data used in this analysis do **NOT** belong to the same year.
- Animal-based agriculture does not include aquaculture, given the complexity of the data. The authors aim to include this data in future versions of this report.
- Animal-based agriculture has the particularity of commodifying individuals. As such, a “per capita” report was created to illustrate the number of animals in each industry who are kept per acre, the pounds produced per animal, as well as the sales/value, expenses, and net revenue per animal. The “per capita” report is attached at the end of this report as Exhibit 1.
- Plant-based agriculture involves a large number of products; as such, these products are bundled in the following categories:
  - Grains and oil seeds, which include corn, soy, wheat, rice, sorghum, peanuts, barley, oats, canola, and sunflower.
  - Tree nuts, which include almonds, hazelnuts, pecans, pistachios, and walnuts.
  - Fruits, which include citrus, grapes, apples, strawberries, peaches, pears, plums, cranberries, all cherries, blueberries, avocados, and raspberries.
  - Sugar sources, which include sugar beet and sugar cane.
  - Vegetables and melons which include snap beans, broccoli, cabbage, cantaloupes, carrots, cauliflower, celery, corn-sweet, cucumber, dry edible beans, dry pea, dry lentils, lettuce-all, onions, pepper-all, pumpkins, spinach, squash, tomatoes, sweet potatoes, watermelons, potatoes, and green peas.
- Some products are not included, both for animal-based and plant-based agriculture, due to the small fraction of the market they represent.
- Individual reports for each category of plant-based products are attached at the end of the document as Exhibits 2 – Exhibit 6.2. Vegetables and melons (Exhibit 6.1 & 6.2) are split into two exhibits in order to fit the tables to the page size.
- The focal approach of this report is current data. Most data originate from the NASS and the ERS from the USDA.
- Data that are not kept by the USDA were obtained from other sources, such as universities that have stakes in particular crops, most specifically, cost-related data.
- For certain crops, such as broccoli, assumptions were made in order to obtain the data. In the example of broccoli:

California produces 90% of the U.S. broccoli’s crops. U.C. Davis prepared a statewide study of the expenses of broccoli. Based on the numbers of U.C. Davis, a cost per acre value was obtained and applied to the entire country’s production.
- The authors are aware of and understand the limitations presented by including data from different years; however, it is the authors’ belief that by utilizing the most current data, a holistic image can be drawn of the current state of the agricultural industries in the U.S.

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## Findings

### Data collected.

Tables 1-1 and 1-2 are a collection of the data obtained from the USDA reports and censuses. These data are the baseline for most of the findings exposed further ahead.

### Data on animal-based agriculture.

Table 1-1 presents the data for animal-based agriculture concerning cows and calves for beef and veal, chickens, eggs, cow's milk, turkeys and pigs and hogs.

Table 1-1 Industries data for animal-based agriculture. All numbers shown in thousands.

Industries Data							
Industry	Cows and calves for beef and veal	Chicken	Egg	Cow milk	Pigs and hogs	Turkeys	Total
Number of animals	82,680	8,690,000	461,013	9,320	148,300	233,000	9,624,313
Pounds	52,400,000	53,400,000	9,640,000	209,000,000	31,736,200	7,040,000	363,216,200
Mass of land (in Acres)	348,596	3,138	1,861	18,628	5,208	779	378,210
Value/Sales	\$79,398,000	\$28,700,000	\$13,500,000	\$41,507,400	\$25,569,856	\$5,710,000	\$194,385,256
Expenses	\$113,142,600	\$24,121,667	\$11,346,429	\$56,430,000	\$25,668,239	\$4,799,191	\$235,508,126
Net Income	-\$33,744,600	\$4,578,333	\$2,153,571	-\$14,922,600	-\$98,383	\$910,809	-\$41,122,870

### Data on plant-based agriculture.

Table 1-2 presents the data for grains and oil seeds, tree nuts, fruits, sugar sources and vegetables and melons.

Table 1-2 Industries data for plant-based agriculture. All numbers shown in thousands.

Industries Data						
Industry	Grains and oil seeds	Tree nuts	Fruits	Sugar Sources	Vegetables and Melons	Total
Pounds	1,532,705,257	3,692,300	52,541,550	139,738,000	131,541,300	1,860,218,407
Mass of land (in Acres)	248,293	1,996	2,712	2,079	7,771	262,851
Value/Sales	\$111,268,604	\$7,618,480	\$18,801,827	\$2,662,996	\$19,272,989	\$159,624,896
Expenses	\$128,436,334	\$9,317,700	\$23,388,795	\$1,852,861	\$16,746,512	\$179,742,202
Net Income	-\$17,167,730	-\$1,699,220	-\$4,586,968	\$810,135	\$2,526,477	-\$20,117,306

Tables 1-1 and 1-2 contain the same data variables except for the “number of animals” in the case of animal-based agriculture. Given the obvious biological differences between plants and animals, this set of data can only be obtained for animals. Even though these data are not used strictly for comparison, they help illustrate the profitability, or lack thereof, of animal-based agriculture.

### Totals comparison.

Taking into consideration the sums of all these industries, we obtain the results shown in Table 1-3:

Table 1-3 Comparison of totals. All numbers shown in thousands.

Industries totals	Animal-based ag.	Plant-based Ag.	Difference
Pounds	363,216,200	1,860,218,407	→ 1,497,002,207
Mass of land (in Acres)	378,210	262,851	→ 115,359
Value/Sales	\$194,385,256	\$159,624,896	→ \$34,760,360
Expenses	\$235,508,126	\$179,742,202	→ \$55,765,924
Net Income	-\$41,122,870	-\$20,117,306	→ \$21,005,564

It is easily observable that plant-based agriculture generates around 1.5 trillion more pounds of product than animal-based agriculture. These 1.5 trillion pounds generated are also grown on less land, as plant-based agriculture utilizes 115 million acres less than animal-based agriculture. In terms of value/sales, animal-based agriculture generates \$35 billion more than plant-based agriculture; however, the expenses generated by animal-based agriculture are substantially higher than plant-based agriculture by a difference of almost \$55.8 billion. As a result, the net income/loss difference between both forms of agriculture is \$21 billion, favoring plant-based agriculture. Both forms of agriculture show a net loss.

With these numbers, we can conclude that plant-based agriculture grows 512% more pounds of food than animal-based agriculture on 69% of the mass of land that animal-based agriculture uses. We can also conclude that, even though animal-based agriculture generates more value/sales than plant-based agriculture, the expenses substantially offset the net income/loss; that is, plant-based agriculture generates half the losses compared to animal-based agriculture, while utilizing 69% of the land that animal-based agriculture requires. Of the total land used for all agriculture, plant-based agriculture represents 41%.

### Per pound analysis<sup>1</sup>.

The data collected permit an analysis of the different types of agriculture from several positions, amongst them, their performance per pound. Tables 2-1 and 2-2 provide the details of pounds generated per acre, value/sales per acre, expenses per acre, and net income per acre; in the specific case of animal-based agriculture, we also obtained the pounds of product per animal.

#### Per pound analysis for animal-based agriculture.

Table 2-1 shows the “per pound analysis” for animal-based agriculture:

Table 2-1 Per pound analysis for animal-based agriculture.

Per Pound Analysis							
Industry	Cows and calves for beef and veal	Chicken	Egg	Cow milk	Pigs and hogs	Turkeys	Average
Pounds per acre	150.32	17,017.21	5,180.01	11,219.67	6,093.74	9,037.23	8,116.36
Pounds per animal	633.77	6.14	20.91	22,424.89	214.00	30.21	3,888.32
Value/Sales per pound	\$1.52	\$0.54	\$1.40	\$0.20	\$0.81	\$0.81	\$0.88
Expenses per pound	\$2.16	\$0.45	\$1.18	\$0.27	\$0.81	\$0.68	\$0.92
Net Income per pound	-\$0.64	\$0.09	\$0.22	-\$0.07	\$0.00	\$0.13	-\$0.05

Table 2-1 shows the following:

Per acre:

- Cows and calves used for beef and veal generate 150 pounds of beef for every acre utilized over the course of a year.
- Chickens generate 17 thousand pounds for every acre utilized over the course of a year.
- 5 thousand pounds of eggs are generated for every acre utilized over the course of a year.
- 11 thousand pounds of cow’s milk are generated for every acre utilized over the course of a year.
- 6 thousand pounds of pig meat are generated for every acre utilized over the course of a year.
- 9 thousand pounds of turkey meat are generated for every acre utilized over the course of a year.

Per animal:

<sup>1</sup> It is important to point out that a per pound analysis does NOT represent profitability of a product given the principles of economies of scales; economy of scale is the proportionate saving in costs attained by an increased production level.

- Each cow/calf for beef/veal generates 634 pounds of beef.
- Each chicken generates 6 pounds of meat.
- Each chicken will lay an average of 21 pounds of eggs per year.
- Each cow will generate 22.4 thousand pounds of milk per year.
- Each pig and hog generates 214 pounds of meat.
- Each turkey generates 30 pounds of meat.

Value/sales per pound:

- Overall, farmers generate a value/sales of \$1.52 for every pound of cow/veal meat.
- Overall, farmers generate a value/sales of \$0.54 for every pound of chicken’s meat.
- Overall, farmers generate a value/sales of \$1.40 for every pound of eggs.
- Overall, farmers generate a value/sales of \$0.20 for every pound of cow’s milk.
- Overall, farmers generate a value/sales of \$0.81 for every pound of pig’s meat.
- Overall, farmers generate a value/sales of \$0.81 for every pound of turkey’s meat.

Expenses per pound:

- Overall, farmers incur \$1.52 of expenses for every pound of cow/veal meat.
- Overall, farmers incur \$0.54 of expenses for every pound of chicken’s meat.
- Overall, farmers incur \$1.18 of expenses for every pound of eggs.
- Overall, farmers incur \$0.27 of expenses for every pound of cow’s milk.
- Overall, farmers incur \$0.81 of expenses for every pound of pig’s meat.
- Overall, farmers incur \$0.68 of expenses for every pound of turkey’s meat.

Net income per pound:

- Every pound of beef generates a net **LOSS** of \$0.64.
- Every pound of chicken meat generates a net income of \$0.09.
- Every pound of eggs generates a net income of \$0.22.
- Every pound of cow’s milk generates a net **LOSS** of \$0.07.
- Every pound of pig meat generates a net **LOSS** of less than \$0.01.
- Every pound of turkey meat generates a net income of \$0.13.

**Per pound analysis for plant-based agriculture.**

Table 2-2 shows the “per pound analysis” for plant-based agriculture:

Table 2-2 Per pound analysis for plant-based agriculture.

Per Pound Analysis						
Industry	Grains and oil seeds	Tree nuts	Fruits	Sugar Sources	Vegetables and Melons	Average
Pounds per acre	6,172.97	1,849.40	19,374.59	67,226.98	16,927.20	22,310.23
Value/Sales per pound	\$0.073	\$2.063	\$0.358	\$0.019	\$0.147	\$0.53
Expenses per pound	\$0.084	\$2.524	\$0.445	\$0.013	\$0.127	\$0.64
Net Income per pound	-\$0.011	-\$0.460	-\$0.087	\$0.006	\$0.019	-\$0.11

Pounds per Acre:

- Grains and oil seed crops generate 6 thousand pounds for every acre utilized over the course of a year.
- Tree nuts generate 1.8 thousand pounds for every acre utilized over the course of a year.
- Fruit plantations generate 19 thousand pounds for every acre utilized over the course of a year.



- Sugar source crops generate 67 thousand pounds for every acre utilized over the course of a year.
- Vegetable and melons plantations generate almost 17 thousand pounds for every acre utilized over the course of a year.

Value/sales per pound:

- Overall, farmers generate value/sales of \$0.07 for every pound of grains and oil seeds.
- Overall, farmers generate value/sales of \$2.06 for every pound of nuts product.
- Overall, farmers generate value/sales of \$0.36 for every pound of fruit.
- Overall, farmers generate value/sales of \$0.02 for every pound of sugar source.
- Overall, farmers generate value/sales of \$0.15 for every pound of vegetables and melons.

Expenses per pound:

- Overall, farmers incur \$0.08 of expenses for every pound of grain and oil seeds.
- Overall, farmers incur \$2.52 of expenses for every pound of nuts.
- Overall, farmers incur \$0.44 of expenses for every pound of fruit.
- Overall, farmers incur \$0.01 of expenses for every pound of sugar source.
- Overall, farmers incur \$0.13 of expenses for every pound of vegetables and melons.

Net income per pound:

- Every pound of grain and oil seeds generates a net **LOSS** of \$0.01.
- Every pound of nuts generates a net **LOSS** of \$0.46.
- Every pound of fruit generates a net **LOSS** of \$0.09.
- Every pound of sugar sources generates a net income of \$0.01.
- Every pound of vegetables and melons generates a net income of \$0.02.

**Per pound average comparison.**

Taking into consideration the averages of all these industries we obtain results shown in Table 2-3:

*Table 2-3 Comparison of averages on a per pound analysis.*

Industries Average	Animal-based ag.	Plant-based Ag.	Difference
Pounds per acre	8,116.36 Vs.	22,310.23 →	14,193.86
Value/Sales per pound	\$0.88 Vs.	\$0.53 →	\$0.35
Expenses per pound	\$0.92 Vs.	\$0.64 →	\$0.29
Net Income per pound	-\$0.047 Vs.	-\$0.107 →	\$0.060

On average, plant-based agriculture generates 14 thousand more pounds per acre than animal-based agriculture. Animal-based agriculture generates, on average, 35 cents more of value/sales per pound than plant-based agriculture; however, animal-based agriculture incurs, on average, higher expenses than plant-based agriculture, that is, 29 cents more than plant-based agriculture per pound. Both animal-based and plant-based methods of agriculture incur a loss on a per pound analysis. The net loss per pound is higher for plant-based agriculture than for animal-based agriculture by 6 cents on average.

## Land mass analysis<sup>2</sup>.

The data collected permit the analysis of the two types of agriculture from a land mass perspective, enabling us to determine the value/sales, expenses and net income per acre. Tables 3-1 and 3-2 provide the financial details of each industry per acre.

### Land mass analysis for animal-based agriculture.

Table 3-1 shows the “Land mass analysis” for animal-based agriculture:

Table 3-1 Land mass analysis for animal-based agriculture

Industry	Land Mass Analysis							Average
	Cows and calves for beef and veal	Chicken	Egg	Cow milk	Pigs and hogs	Turkeys		
Value/Sales per acre	\$227.77	\$9,145.95	\$7,254.16	\$2,228.23	\$4,909.73	\$7,329.91	\$5,182.62	
Expenses per acre	\$324.57	\$7,686.96	\$6,096.95	\$3,029.31	\$4,928.62	\$6,160.71	\$4,704.52	
Net Income per acre	-\$96.80	\$1,459.00	\$1,157.21	-\$801.08	-\$18.89	\$1,169.20	\$478.11	

\*Table 3-1 shows the following:

Value/sales per acre:

- Animal-based agriculture generates, in the beef and veal sector, value/sales of \$227.77 per acre.
- Animal-based agriculture generates, in the chicken sector, value/sales of \$9,145.95 per acre.
- Animal-based agriculture generates, in the egg sector, value/sales of \$7,254.16 per acre.
- Animal-based agriculture generates, in the cow’s milk sector, value/sales of \$2,228.23 per acre.
- Animal-based agriculture generates, in the pigs and hogs sector, value/sales of \$4,909.73 per acre.
- Animal-based agriculture generates, in the turkey sector, value/sales of \$7,329.91 per acre.

Expenses per acre:

- Animal-based agriculture incurs, in the beef and veal sector, expenses adding to \$324.57 per acre.
- Animal-based agriculture incurs, in the chicken sector, expenses adding to \$7,686.96 per acre.
- Animal-based agriculture incurs, in the egg sector, expenses adding to \$6,096.95 per acre.
- Animal-based agriculture incurs, in the cow’s milk sector, expenses adding to \$3,029.31 per acre.
- Animal-based agriculture incurs, in the pigs and hogs sector, expenses adding to \$4,928.62 per acre.
- Animal-based agriculture incurs, in the turkey sector, expenses adding to \$6,160.71 per acre.

Net income per acre:

- Every acre of land used for cow and calf meat generates a net **LOSS** of \$96.80.
- Every acre of land used for chicken meat generates a net income of \$1,459.00.
- Every acre of land used for eggs generates a net income of \$1,157.21.
- Every acre of land used for cow’s milk generates a net **LOSS** of \$801.08.
- Every acre of land used for pig and hog meat generates a net **LOSS** of \$18.89.
- Every acre of land used for turkey meat generates a net income of \$1,169.20.

<sup>2</sup> It is important to point out that a per acre analysis does **NOT** represent profitability of a product given the principles of economies of scales; economy of scale is the proportionate saving in costs attained by an increased production level.

**Land mass analysis for plant-based agriculture.**

Table 3-2 shows the “Land mass analysis” for plant-based agriculture:

*Table 3-2 Land mass analysis for animal-based agriculture*

Land Mass Analysis						
Industry	Grains and oil seeds	Tree nuts	Fruits	Sugar Sources	Vegetables and Melons	Average
Value/Sales per acre	\$448.13	\$3,815.94	\$6,933.13	\$1,281.15	\$2,480.12	\$2,991.69
Expenses per acre	\$517.28	\$4,667.04	\$8,624.57	\$891.40	\$2,155.00	\$3,371.06
Net Income per acre	-\$69.14	-\$851.10	-\$1,691.43	\$389.75	\$325.12	-\$379.36

Table 3-2 shows the following:

Value/sales per acre:

- Plant-based agriculture generates, in the grains and oil seeds sector, a value/sales of \$448.13 per acre.
- Plant-based agriculture generates, in the tree nuts sector, a value/sales of \$3,815.94 per acre.
- Plant-based agriculture generates, in the fruits sector, a value/sales of \$6,933.13 per acre.
- Plant-based agriculture generates, in the sugar sources sector, a value/sales of \$1,281.15 per acre.
- Plant-based agriculture generates, in the vegetables and melons sector, a value/sales of \$2,480.12 per acre.

Expenses per acre:

- Plant-based agriculture incurs, in the grains and oil seeds sector, expenses adding to \$517.28 per acre.
- Plant-based agriculture incurs, in the tree nuts sector, expenses adding to \$4,667.04 per acre.
- Plant-based agriculture incurs, in the fruits sector, expenses adding to \$8,624.57 per acre.
- Plant-based agriculture incurs, in the sugar sources sector, expenses adding to \$891.40 per acre.
- Plant-based agriculture incurs, in the vegetables and melons sector, expenses adding to \$2,155.00 per acre.

Net income per acre:

- Every acre of land used for grains and oil seeds generates a net **LOSS** of \$69.14
- Every acre of land used for tree nuts generates a net **LOSS** of \$851.10.
- Every acre of land used for fruits generates a net **LOSS** of \$1,691.43.
- Every acre of land used for sugar sources generates a net income of \$389.75.
- Every acre of land used for vegetables and melons generates a net income of \$325.12.

**Land mass average comparison**

Taking into consideration the averages of all these industries we obtain the results shown in Table 3-3:

*Table 3-3 Comparison of averages on a per acre analysis.*

Industries Average	Animal-based ag.	Plant-based Ag.	Difference
Value/Sales per acre	\$5,183 Vs.	\$2,992 →	\$2,191
Expenses per acre	\$4,705 Vs.	\$3,371 →	\$1,333
Net Income per acre	\$478 Vs.	-\$379 →	\$857

On average, animal-based agriculture generates better numbers on a per acre basis. Value/sales per acre are higher for animal-based agriculture, generating \$2,191, on average, more in value/sales than plant-based agriculture, and, even though expenses per acre are higher for animal-based agriculture by \$1,333, the net income per acre generated by animal-based agriculture is \$857 higher than for plant-based agriculture on average.

## Financial indices analysis

The data collected permit the calculation of profit and expense financial indices for the different types of agriculture based on value/sales, expenses, and net income, enabling us to determine the profit margin and expense ratio for each industry.

### Financial indices analysis for animal-based agriculture.

Tables 4-1 and 4-2 provide the financial indices of each industry. Table 4-1 shows the “Financial indices analysis” for animal-based agriculture:

Table 4-1 Financial indices analysis for animal-based agriculture

Industry	Financial indices							Average
	Cows and calves for beef and veal	Chicken	Egg	Cow milk	Pigs and hogs	Turkeys		
Profit Margin	-42.50%	15.95%	15.95%	-35.95%	-0.38%	15.95%	-5.16%	
Expense Ratio	142.50%	84.05%	84.05%	135.95%	100.38%	84.05%	105.16%	

#### Profit Margin:

- The cow and calf meat industry generated a **LOSS** equivalent to 42.50% of their total value/sales; for every \$100 of sales, the industry **LOST** \$42.50.
- The chicken meat industry generated a profit of 15.95% in relation to their value/sales; for every \$100 of sales, the industry made \$15.95 of net income.
- The egg industry generated a profit of 15.95% in relation to their value/sales; for every \$100 of sales, the industry made \$15.95 of net income.
- The cow’s milk industry generated a **LOSS** of 35.95% in relation to their value/sales; for every \$100 of sales, the industry **LOST** \$35.95.
- The pig meat industry generated a **LOSS** of 0.38% in relation to their value/sales; for every \$100 of sales, the industry **LOST** \$0.38.
- The turkey meat industry generated a profit of 15.95% in relation to their value/sales; for every \$100 of sales, the industry made \$15.95 of net income.

#### Expense Ratio:

- The cow and calf meat industry had an expense ratio of 142.50%; for every \$100 of sales, the industry had \$142.50 of expenses. This generated a systemic **LOSS**.
- The chicken meat industry had an expense ratio of 84.05%; for every \$100 of sales, the industry had \$84.05 of expenses.
- The egg industry had an expense ratio of 84.05%; for every \$100 of sales, the industry had \$84.05 of expenses.
- The cow’s milk industry had an expense ratio of 135.95%; for every \$100 of sales, the industry had \$135.95 of expenses. This generated a systemic **LOSS**.
- The pig meat industry had an expense ratio of 100.38%; for every \$100 of sales, the industry had \$100.38 of expenses. This generated a systemic **LOSS**.
- The turkey meat industry had an expense ratio of 84.05%; for every \$100 of sales, the industry had \$84.05 of expenses.

**Financial indices analysis for plant-based agriculture.**

Table 4-2 shows the “Financial indices analysis” for plant-based agriculture:

Table 4-2 Financial indices analysis for plant-based agriculture

Financial indices						
Industry	Grains and oil seeds	Tree nuts	Fruits	Sugar Sources	Vegetables and Melons	Average
Profit Margin	-15.43%	-22.30%	-24.40%	30.42%	13.11%	-3.72%
Expense Ratio	115.43%	122.30%	124.40%	69.58%	86.89%	103.72%

**Profit Margin:**

- The grains and oil seeds industry generated a **LOSS** of 15.43% in relation to their value/sales; for every \$100 of sales, the industry **LOST** \$15.43.
- The tree nuts industry generated a **LOSS** of 22.30% in relation to their value/sales; for every \$100 of sales, the industry **LOST** \$22.30.
- The fruit industry generated a **LOSS** of 24.40% in relation to their value/sales; for every \$100 of sales, the industry **LOST** \$24.40.
- The sugar source industry generated a profit of 30.42% in relation to their value/sales; for every \$100 of sales, the industry made \$30.42 of net income.
- The vegetables and melons industry generated a profit of 13.11% in relation to their value/sales; for every \$100 of sales, the industry made \$13.11 of net income.

**Expense Ratio:**

- The grains and oil seeds industry had an expense ratio of 115.45%; for every \$100 of sales, the industry had \$115.45 of expenses. This generated a systemic **LOSS**.
- The tree nuts industry has an expense ratio of 122.30%; for every \$100 of sales, the industry had \$122.30 of expenses. This generated a systemic **LOSS**.
- The fruit industry has an expense ratio of 124.40%; for every \$100 of sales, the industry had \$124.40 of expenses. This generated a systemic **LOSS**.
- The sugar sources industry has an expense ratio of 69.58%; for every \$100 of sales, the industry had \$69.58 of expenses.
- The vegetables and melons industry has an expense ratio of 86.89%; for every \$100 of sales, the industry had \$86.89 of expenses.

**Financial indices average comparison**

Taking into consideration the averages of all these industries, we obtain the results shown in Table 4-3:

Table 4-3 Comparison of averages for financial indices

Industries Average	Animal-based ag.	Plant-based Ag.	Difference
Profit Margin	-5.16% Vs.	-3.72% →	1.44%
Expense Ratio	105.16% Vs.	103.72% →	

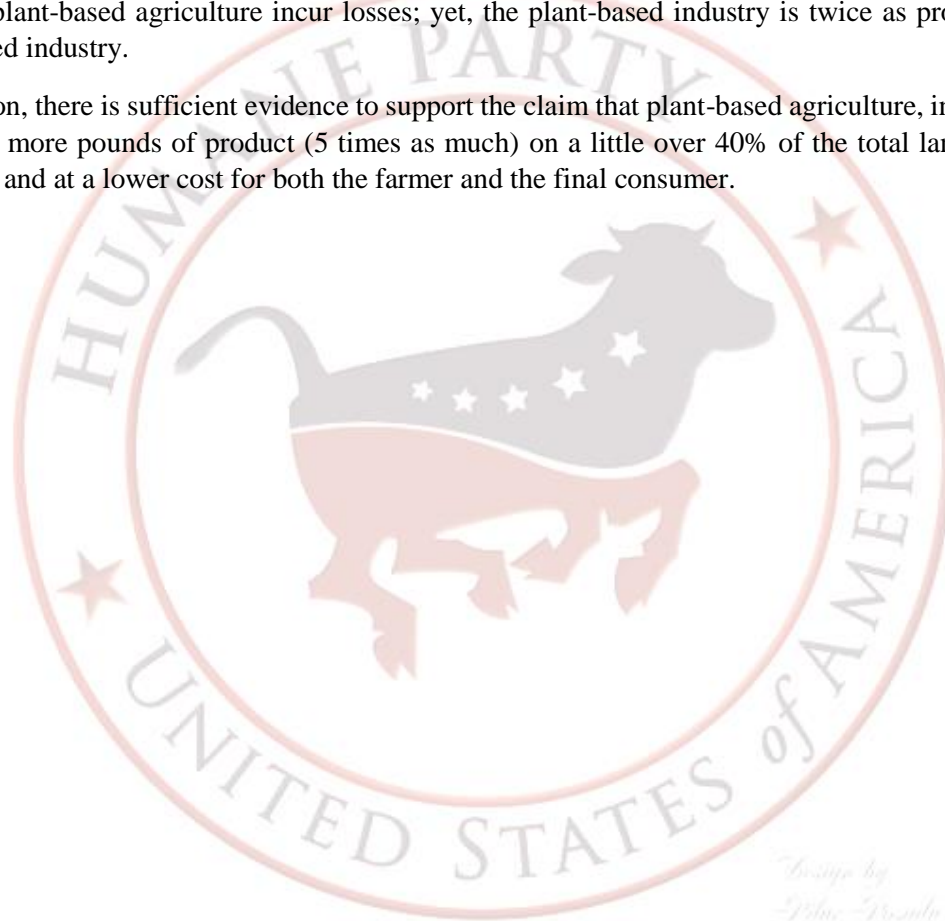
On average, plant-based agriculture is a more profitable form of agriculture than animal-based agriculture by a factor of 1.44%; for every \$100 sold, plant-based agriculture industries will make an average of \$1.44 more than industries within animal-based agriculture. It is important to keep in mind that these are industries generating hundreds of billions of dollars in sales/value, thus a factor of 1.44% in such a context becomes largely representative.

## Result merging

Even though plant-based agriculture utilizes 69% of the total land mass used for animal-based agriculture in the U.S., plant-based agriculture generates 512% more pounds of product than animal-based agriculture. On a per acre basis, plant-based agriculture produces 14,000 more pounds than animal-based agriculture. There is sufficient evidence to support the conclusion that plant-based agriculture is more land efficient than animal-based agriculture.

From a sales/value perspective, animal-based agriculture has a value 9% higher than plant-based agriculture. The sales/value difference equals \$34.7 billion, with the animal-based agriculture generating only 16% of total pounds of product (combining animal-based and plant-based agriculture). However, animal-based agriculture incurs 13% more expenses than plant-based agriculture. Ultimately, both animal-based and plant-based agriculture incur losses; yet, the plant-based industry is twice as profitable as the animal-based industry.

In conclusion, there is sufficient evidence to support the claim that plant-based agriculture, in the U.S., can produce far more pounds of product (5 times as much) on a little over 40% of the total land utilized for agriculture, and at a lower cost for both the farmer and the final consumer.



## Exhibits

*Exhibit 1 Per capita analysis table for animal-based agriculture.*

Per Capita Analysis							
Industry	Cows and calves for beef and veal	Chicken	Egg	Cow milk	Pigs and hogs	Turkeys	Average
Number of animals per acre	0.24	2,769.28	247.72	0.50	28.48	299.10	557.55
Pounds per animal	633.77	6.14	209.10	22,424.89	214.00	30.21	3,919.69
Revenue per animal	\$960.30	\$3.30	\$29.28	\$4,453.58	\$172.42	\$24.51	\$940.57
Expenses per animal	\$1,368.44	\$2.78	\$24.61	\$6,054.72	\$173.08	\$20.60	\$1,274.04
Net Income per animal	-\$408.13	\$0.53	\$4.67	-\$1,601.14	-\$0.66	\$3.91	-\$333.47

*Exhibit 2 Grains and oil seed category analysis. \*"Industries Data" numbers in thousands.*

Industries Data												
Industry	Corn	Soy	Wheat	Rice	Sorghum	Peanuts	Barley	Oats	Canola	Sunflower	Total	
Pounds	1,060,362,660	258,400,260	138,580,500	22,414,500	29,894,616	5,684,610	9,565,536	2,072,640	3,075,200	2,654,735	1,532,705,257	
Mass of land (in Acres)	94,004	83,433	50,154	3,150	6,690	1,671	3,052	2,828	1,714	1,597	248,293	
Value/Sales	\$57,583,090	\$34,040,664	\$10,768,565	\$3,398,598	\$1,472,335	\$1,163,818	\$1,092,189	\$785,392	\$493,833	\$470,120	111,268,604	
Expenses	\$63,483,721	\$39,543,070	\$15,520,657	\$3,051,689	\$2,104,674	\$1,509,715	\$1,280,863	\$1,009,935	\$481,497	\$450,513	128,436,334	
Net Income	-\$5,900,631	-\$5,502,406	-\$4,752,092	\$346,909	-\$632,339	-\$345,897	-\$188,674	-\$224,543	\$12,336	\$19,607	-17,167,730	

Per Pound Analysis												
Industry	Corn	Soy	Wheat	Rice	Sorghum	Peanuts	Barley	Oats	Canola	Sunflower	Average	
Pounds per acre	11,279.97	3,097.10	2,763.10	7,115.71	4,468.55	3,401.92	3,134.19	732.90	1,794.17	1,662.33	3,944.99	
Value/Sales per pound	\$0.054	\$0.132	\$0.078	\$0.152	\$0.049	\$0.205	\$0.114	\$0.379	\$0.161	\$0.177	\$0.15	
Expenses per pound	\$0.060	\$0.153	\$0.112	\$0.136	\$0.070	\$0.266	\$0.134	\$0.487	\$0.157	\$0.170	\$0.17	
Net Income per pound	-\$0.006	-\$0.021	-\$0.034	\$0.015	-\$0.021	-\$0.061	-\$0.020	-\$0.108	\$0.004	\$0.007	-\$0.02	

Land Mass Analysis												
Industry	Corn	Soy	Wheat	Rice	Sorghum	Peanuts	Barley	Oats	Canola	Sunflower	Average	
Value/Sales per acre	\$612.560	\$408.000	\$214.710	\$1,078.920	\$220.080	\$696.480	\$357.860	\$277.720	\$288.117	\$294.377	\$444.882	
Expenses per acre	\$675.330	\$473.950	\$309.460	\$968.790	\$314.600	\$903.480	\$419.680	\$357.120	\$280.920	\$282.100	\$498.543	
Net Income per acre	-\$62.770	-\$65.950	-\$94.750	\$110.130	-\$94.520	-\$207.000	-\$61.820	-\$79.400	\$7.197	\$12.277	-\$53.661	

Financial indices												
Industry	Corn	Soy	Wheat	Rice	Sorghum	Peanuts	Barley	Oats	Canola	Sunflower	Average	
Profit Margin	-10.25%	-16.16%	-44.13%	10.21%	-42.95%	-29.72%	-17.27%	-28.59%	2.50%	4.17%	-17.22%	
Expense Ratio	110.25%	116.16%	144.13%	89.79%	142.95%	129.72%	117.27%	128.59%	97.50%	95.83%	117.22%	

Exhibit 3 Tree nuts category analysis. \*"Industries Data" numbers in thousands.

Industries Data						
Product	Almonds	Hazelnuts	Pecan	Pistachios	Walnuts	Total
Pounds	1,900,000	62,000	254,300	270,000	1,206,000	3,692,300
Mass of land (in Acres)	890.00	30.00	543.49	233.00	300.00	1,996
Value/Sales	\$5,325,000	\$86,800	\$560,220	\$669,600	\$976,860	\$7,618,480
Expenses	\$5,554,500	\$81,000	\$1,227,200	\$1,165,000	\$1,290,000	\$9,317,700
Net Income	-\$229,500	\$5,800	-\$666,980	-\$495,400	-\$313,140	-\$1,699,220
Per Pound Analysis						
Industry	Almonds	Hazelnuts	Pecan	Pistachios	Walnuts	Average
Pounds per acre	2,134.83	2,066.67	467.90	1,158.80	4,020.00	1,969.64
Value/Sales per pound	\$2.803	\$1.400	\$2.203	\$2.480	\$0.810	\$1.939
Expenses per pound	\$2.923	\$1.306	\$4.826	\$4.315	\$1.070	\$2.888
Net Income per pound	-\$0.121	\$0.094	-\$2.623	-\$1.835	-\$0.260	-\$0.949
Land Mass Analysis						
Industry	Almonds	Hazelnuts	Pecan	Pistachios	Walnuts	Average
Value/Sales per acre	\$5,983.146	\$2,893.333	\$1,030.783	\$2,873.820	\$3,256.200	\$3,207
Expenses per acre	\$6,241.011	\$2,700.000	\$2,257.999	\$5,000.000	\$4,300.000	\$4,100
Net Income per acre	-\$257.865	\$193.333	-\$1,227.217	-\$2,126.180	-\$1,043.800	-\$892
Financial indices						
Industry	Almonds	Hazelnuts	Pecan	Pistachios	Walnuts	Average
Profit Margin	-4.31%	6.68%	-119.06%	-73.98%	-32.06%	-44.54%
Expense Ratio	104.31%	93.32%	219.06%	173.98%	132.06%	144.54%



Exhibit 4 Fruits category analysis. \*"Industries Data" numbers in thousands.

Industries Data													
Product	Citrus	Grapes	Apples	Strawberries	Peaches	Pears	Plums	Cranberries	All Cherries	Blueberries	Avocados	Raspberries	Total
Pounds	17,120,000	15,354,160	10,039,000	3,086,700	1,694,420	1,641,040	455,360	856,300	929,360	654,250	448,020	262,940	52,541,550
Mass of land (in Acres)	737.80	1,022.70	315.88	58.95	99.79	48.94	67.22	40.90	127.88	112.22	59.28	20.32	2,711.88
Value/Sales	\$3,340,000	\$5,561,719	\$3,394,185	\$2,219,144	\$605,794	\$500,416	\$331,197	\$267,527	\$845,952	\$859,172	\$295,797	\$580,924	\$18,801,827
Expenses	\$3,762,780	\$7,895,244	\$3,523,326	\$2,521,586	\$585,368	\$415,990	\$500,981	\$215,420	\$1,139,845	\$1,185,480	\$681,720	\$961,055	\$23,388,795
Net Income	-\$422,780	-\$2,333,525	-\$129,141	-\$302,442	\$20,426	\$84,426	-\$169,784	\$52,107	-\$293,893	-\$326,308	-\$385,923	-\$380,131	-4,586,968
Per Pound Analysis													
Industry	Citrus	Grapes	Apples	Strawberries	Peaches	Pears	Plums	Cranberries	All Cherries	Blueberries	Avocados	Raspberries	Average
Pounds per acre	23,204.12	15,013.36	31,781.06	52,361.32	16,979.86	33,531.67	6,774.17	20,936.43	7,267.44	5,830.07	7,557.69	12,939.96	19,514.76
Value/Sales per pound	\$0.195	\$0.362	\$0.338	\$0.719	\$0.358	\$0.305	\$0.727	\$0.312	\$0.910	\$1.313	\$0.660	\$2.209	0.70
Expenses per pound	\$0.220	\$0.514	\$0.351	\$0.817	\$0.345	\$0.253	\$1.100	\$0.252	\$1.226	\$1.812	\$1.522	\$3.655	1.01
Net Income per pound	-\$0.025	-\$0.152	-\$0.013	-\$0.098	\$0.012	\$0.051	-\$0.373	\$0.061	-\$0.316	-\$0.499	-\$0.861	-\$1.446	-0.30
Land Mass Analysis													
Industry	Citrus	Grapes	Apples	Strawberries	Peaches	Pears	Plums	Cranberries	All Cherries	Blueberries	Avocados	Raspberries	Average
Value/Sales per acre	\$4,526.972	\$5,438.270	\$10,745.172	\$37,644.512	\$6,070.688	\$10,225.092	\$4,927.060	\$6,541.002	\$6,615.202	\$7,656.140	\$4,989.828	\$28,588.780	11,164.06
Expenses per acre	\$5,100.000	\$7,720.000	\$11,154.002	\$42,774.996	\$5,865.999	\$8,500.000	\$7,452.856	\$5,266.993	\$8,913.395	\$10,563.892	\$11,500.000	\$47,296.014	14,342.35
Net Income per acre	-\$573.028	-\$2,281.730	-\$408.829	-\$5,130.483	\$204.690	\$1,725.092	-\$2,525.796	\$1,274.010	-\$2,298.194	-\$2,907.753	-\$6,510.172	-\$18,707.234	-3,178.29
Financial indices													
Industry	Citrus	Grapes	Apples	Strawberries	Peaches	Pears	Plums	Cranberries	All Cherries	Blueberries	Avocados	Raspberries	Average
Profit Margin	-12.66%	-41.96%	-3.80%	-13.63%	3.37%	16.87%	-51.26%	19.48%	-34.74%	-37.98%	-130.47%	-65.44%	-29.35%
Expense Ratio	112.66%	141.96%	103.80%	113.63%	96.63%	83.13%	151.26%	80.52%	134.74%	137.98%	230.47%	165.44%	129.35%

*Design by  
Pete Wright*

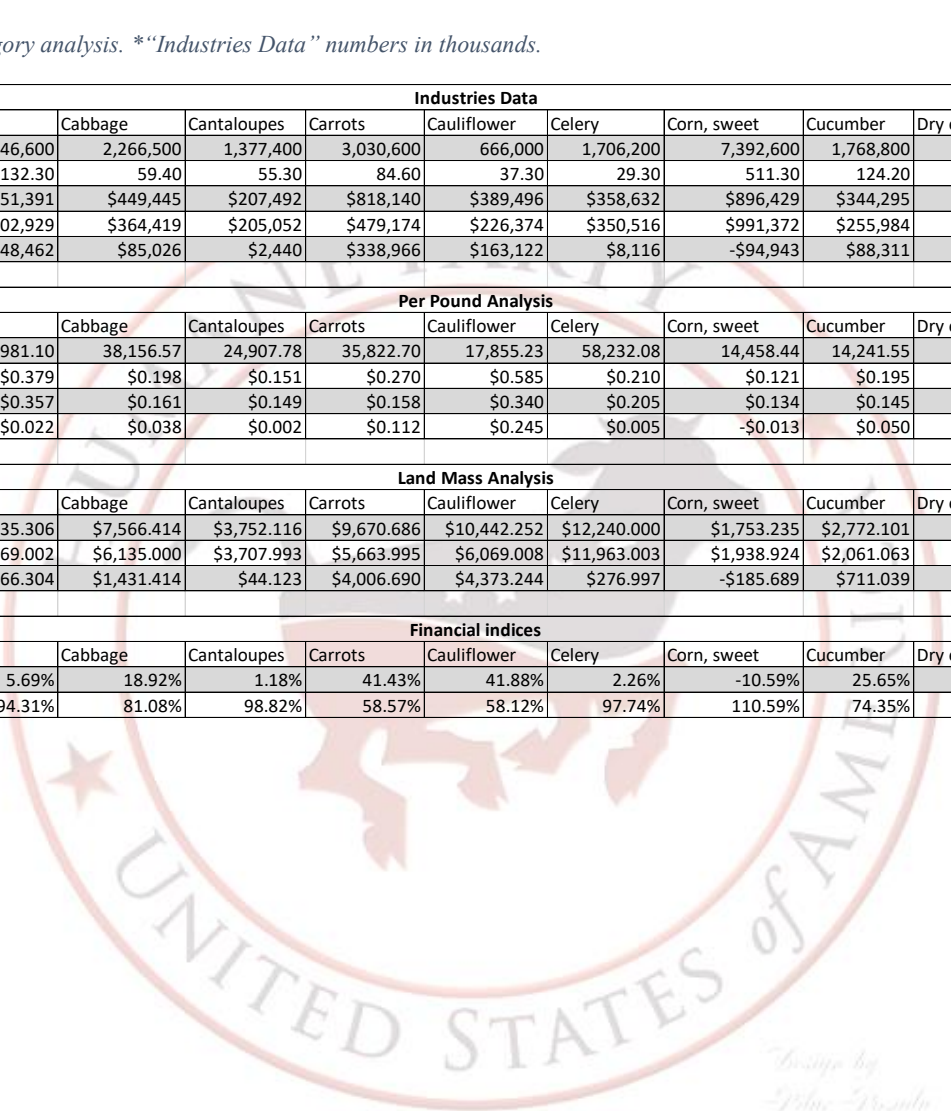
Exhibit 5 Sugar sources category analysis. \*"Industries Data" numbers in thousands.

<b>Industries Data</b>			
Product	Sugar beet	Sugar cane	Total
Pounds	73,762,000	65,976,000	139,738,000
Mass of land (in Acres)	1,163.00	915.60	2,079
Value/Sales	\$1,667,874	\$995,122	\$2,662,996
Expenses	\$1,246,734	\$606,127	\$1,852,861
Net Income	\$421,140	\$388,995	\$810,135
<b>Per Pound Analysis</b>			
Industry	Sugar beet	Sugar cane	Average
Pounds per acre	63,423.90	72,057.67	67,740.79
Value/Sales per pound	\$0.023	\$0.015	\$0.019
Expenses per pound	\$0.017	\$0.009	\$0.013
Net Income per pound	\$0.006	\$0.006	\$0.006
<b>Land Mass Analysis</b>			
Industry	Sugar beet	Sugar cane	Average
Value/Sales per acre	\$1,434.113	\$1,086.852	\$1,260
Expenses per acre	\$1,071.998	\$662.000	\$867
Net Income per acre	\$362.115	\$424.853	\$393
<b>Financial indices</b>			
Industry	Sugar beet	Sugar cane	Average
Profit Margin	25.25%	39.09%	32.17%
Expense Ratio	74.75%	60.91%	67.83%

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Blue Prints

Exhibit 6.1 Vegetables and melons category analysis. \*"Industries Data" numbers in thousands.

Industries Data												
Product	Snap beans	Borccoli	Cabbage	Cantaloupes	Carrots	Cauliflower	Celery	Corn, sweet	Cucumber	Dry edible beans	Dry Pea	Dry lentils
Pounds	2,009,800	2,246,600	2,266,500	1,377,400	3,030,600	666,000	1,706,200	7,392,600	1,768,800	2,871,200	2,773,700	1,268,500
Mass of land (in Acres)	249.30	132.30	59.40	55.30	84.60	37.30	29.30	511.30	124.20	1,662.00	1,382.00	933.00
Value/Sales	\$441,029	\$851,391	\$449,445	\$207,492	\$818,140	\$389,496	\$358,632	\$896,429	\$344,295	\$871,407	\$298,208	\$350,985
Expenses	\$397,251	\$802,929	\$364,419	\$205,052	\$479,174	\$226,374	\$350,516	\$991,372	\$255,984	\$586,686	\$334,444	\$222,054
Net Income	\$43,778	\$48,462	\$85,026	\$2,440	\$338,966	\$163,122	\$8,116	-\$94,943	\$88,311	\$284,721	-\$36,236	\$128,931
Per Pound Analysis												
Industry	Snap beans	Borccoli	Cabbage	Cantaloupes	Carrots	Cauliflower	Celery	Corn, sweet	Cucumber	Dry edible beans	Dry Pea	Dry lentils
Pounds per acre	8,061.77	16,981.10	38,156.57	24,907.78	35,822.70	17,855.23	58,232.08	14,458.44	14,241.55	1,727.56	2,007.02	1,359.59
Value/Sales per pound	\$0.219	\$0.379	\$0.198	\$0.151	\$0.270	\$0.585	\$0.210	\$0.121	\$0.195	\$0.303	\$0.108	\$0.277
Expenses per pound	\$0.198	\$0.357	\$0.161	\$0.149	\$0.158	\$0.340	\$0.205	\$0.134	\$0.145	\$0.204	\$0.121	\$0.175
Net Income per pound	\$0.022	\$0.022	\$0.038	\$0.002	\$0.112	\$0.245	\$0.005	-\$0.013	\$0.050	\$0.099	-\$0.013	\$0.102
Land Mass Analysis												
Industry	Snap beans	Borccoli	Cabbage	Cantaloupes	Carrots	Cauliflower	Celery	Corn, sweet	Cucumber	Dry edible beans	Dry Pea	Dry lentils
Value/Sales per acre	\$1,769.069	\$6,435.306	\$7,566.414	\$3,752.116	\$9,670.686	\$10,442.252	\$12,240.000	\$1,753.235	\$2,772.101	\$524.312	\$215.780	\$376.190
Expenses per acre	\$1,593.466	\$6,069.002	\$6,135.000	\$3,707.993	\$5,663.995	\$6,069.008	\$11,963.003	\$1,938.924	\$2,061.063	\$353.000	\$242.000	\$238.000
Net Income per acre	\$175.604	\$366.304	\$1,431.414	\$44.123	\$4,006.690	\$4,373.244	\$276.997	-\$185.689	\$711.039	\$171.312	-\$26.220	\$138.190
Financial indices												
Industry	Snap beans	Borccoli	Cabbage	Cantaloupes	Carrots	Cauliflower	Celery	Corn, sweet	Cucumber	Dry edible beans	Dry Pea	Dry lentils
Profit Margin	9.93%	5.69%	18.92%	1.18%	41.43%	41.88%	2.26%	-10.59%	25.65%	32.67%	-12.15%	36.73%
Expense Ratio	90.07%	94.31%	81.08%	98.82%	58.57%	58.12%	97.74%	110.59%	74.35%	67.33%	112.15%	63.27%



*Designed by  
Philip M. Smith*

Exhibit 6.2 Vegetables and melons category analysis continuation. \*"Industries Data" numbers in thousands.

Industries Data												
Garlic	Lettuce (all)	Onions	Peppers (all)	Pumpkins	Spinach	Squash	Tomatoes	Sweet potatoes	Watermelons	Potatoes	Green peas	Total
369,000	8,981,100	7,186,700	2,031,900	1,607,000	722,200	611,700	28,747,000	3,154,600	3,992,300	44,072,500	687,400	131,541,300
24.60	283.80	138.30	68.60	70.40	48.60	37.40	364.80	168.10	118.50	1,034	153.90	7,771.00
\$268,665	\$2,880,973	\$925,861	\$898,627	\$205,445	\$292,531	\$164,598	\$2,055,987	\$705,690	\$579,548	\$3,922,711	\$95,404	\$19,272,989
\$385,211	\$2,727,491	\$456,390	\$907,921	\$306,592	\$267,300	\$228,140	\$1,113,976	\$625,500	\$675,450	\$3,722,400	\$113,886	\$16,746,512
-\$116,546	\$153,482	\$469,471	-\$9,294	-\$101,147	\$25,231	-\$63,542	\$942,011	\$80,190	-\$95,902	\$200,311	-\$18,482	2,526,477
Per Pound Analysis												
Garlic	Lettuce (all)	Onions	Peppers (all)	Pumpkins	Spinach	Squash	Tomatoes	Sweet potatoes	Watermelons	Potatoes	Green peas	Average
15,000.00	31,645.88	51,964.57	29,619.53	22,826.70	14,860.08	16,355.61	78,802.08	18,766.21	33,690.30	42,623.31	4,466.54	24,768.01
\$0.728	\$0.321	\$0.129	\$0.442	\$0.128	\$0.405	\$0.269	\$0.072	\$0.224	\$0.145	\$0.089	0.138789642	0.25
\$1.044	\$0.304	\$0.064	\$0.447	\$0.191	\$0.370	\$0.373	\$0.039	\$0.198	\$0.169	\$0.084	\$0.166	0.24
-\$0.316	\$0.017	\$0.065	-\$0.005	-\$0.063	\$0.035	-\$0.104	\$0.033	\$0.025	-\$0.024	\$0.005	-\$0.027	0.01
Land Mass Analysis												
Garlic	Lettuce (all)	Onions	Peppers (all)	Pumpkins	Spinach	Squash	Tomatoes	Sweet potatoes	Watermelons	Potatoes	Green peas	Average
\$10,921.341	\$10,151.420	\$6,694.584	\$13,099.519	\$2,918.253	\$6,019.156	\$4,401.016	\$5,635.929	\$4,198.037	\$4,890.700	\$3,793.724	\$619.909	5,452.54
\$15,658.984	\$9,610.610	\$3,300.000	\$13,235.000	\$4,355.000	\$5,500.000	\$6,100.000	\$3,053.662	\$3,720.999	\$5,700.000	\$3,600.000	\$740.000	5,025.36
-\$4,737.642	\$540.810	\$3,394.584	-\$135.481	-\$1,436.747	\$519.156	-\$1,698.984	\$2,582.267	\$477.037	-\$809.300	\$193.724	-\$120.091	427.18
Financial indices												
Garlic	Lettuce (all)	Onions	Peppers (all)	Pumpkins	Spinach	Squash	Tomatoes	Sweet potatoes	Watermelons	Potatoes	Green peas	Average
-43.38%	5.33%	50.71%	-1.03%	-49.23%	8.63%	-38.60%	45.82%	11.36%	-16.55%	5.11%	-19.37%	6.35%
143.38%	94.67%	49.29%	101.03%	149.23%	91.37%	138.60%	54.18%	88.64%	116.55%	94.89%	119.37%	93.65%

*Designed by  
Philip M. Wright*

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