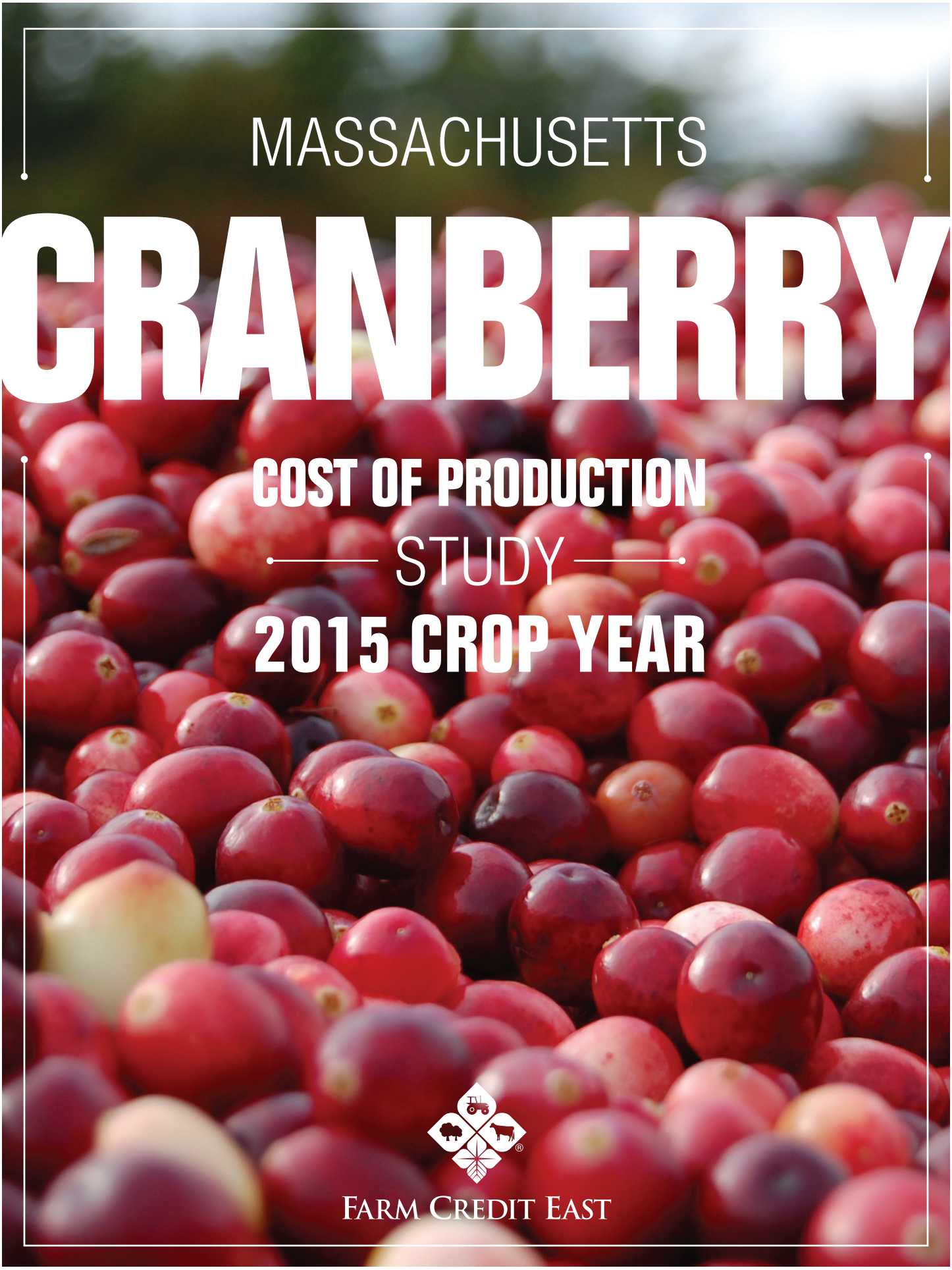

MASSACHUSETTS

CRANBERRY

COST OF PRODUCTION STUDY

2015 CROP YEAR

FARM CREDIT EAST

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Executive Summary

Understanding the cost of production is an important component of profitability analysis. Unlike many non-agricultural industries with relatively consistent output and prices, the Massachusetts cranberry industry experiences fluctuations from year to year, both in terms of average yield and average price received. For this reason, it is even more important for a Massachusetts cranberry grower to understand and manage production costs.

Since 1990, Farm Credit East has published the *Massachusetts Cost of Production Study* to develop meaningful data for growers to measure efficiency, evaluate spending decisions, improve profitability, and plan for the future.

Highlights of the 2015 Study:

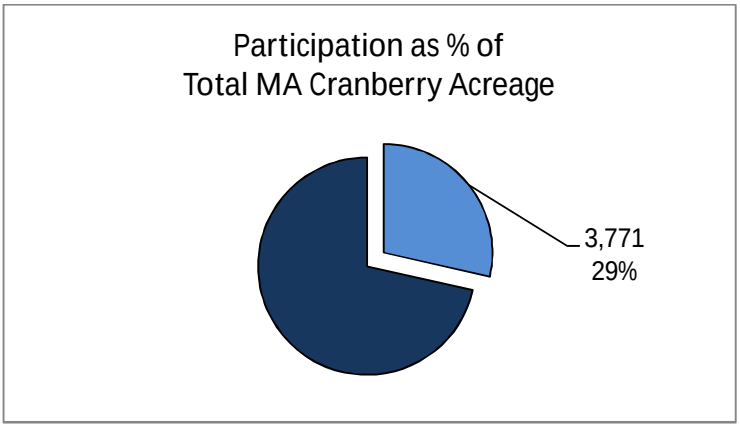
- The cost of producing cranberries in Massachusetts averaged **$5,267 / acre** in 2015, a decrease of 8% from the 2014 cost of **$5,677 / acre** *(pg. 7).*
- The cost of producing cranberries in Massachusetts averaged **$24.88 / bbl** in 2015, a decrease of 19% from the 2014 cost of **$30.62 / bbl** *(pg. 8).*
- **Labor** remains the single highest cost of production expense, accounting for **28%** of all operating costs in 2015. When combined with custom hire expenses, the two categories account for **40%** (before consideration for payroll taxes) *(pg. 10).*
- According to the USDA National Agricultural Statistics Survey, the average price received for cranberries in Massachusetts was **$32.80 / bbl** in 2015, a decrease of 12% from the 2014 average price of **$37.08 / bbl** *(pg. 17).*
- Growers that received a higher than average price spent on average **$5,560 / acre** in 2015. Those that received a lower than average price spent on average **$4,016 / acre** in 2015 *(pg. 18).*
- Larger farms generally spent more on labor per acre than smaller farms. Non-labor costs were relatively consistent across the four size quartiles *(pg. 14, 20).*

Presentation of Data

The information in this study comes from tax returns, financial statements and surveys provided by Massachusetts cranberry growers. In reading this report, please note that all averages provided are weighted averages, which are based on the totals per group versus using each individual farm's average. Additionally, costs related to production are, generally, not separated between fresh and processed fruit production. As a result, all data included in the study has a portion of fresh fruit included. Please note that the costs for fresh fruit generally are higher than processed and yields tend to be lower.

Response Rate Analysis

In previous years only growers with 3 years of useable data were included in the study to provide a more accurate analysis of trends. In an effort to increase sample size, this year's study will only include data from the 2014 crop year for comparison purposes. It must be noted that the data from 2014 does not represent the same grower sample for 2015. For 2015, Data from **50** growers was used, which included **3,771** acres, a **29%** representation of the Massachusetts cranberry industry.



The National Agricultural Statistics Service reported 13,200 acres harvested in MA in 2015

Size

The median farm size was **33** acres. This represents the "middle point" of the data: half of the respondents operate farms smaller than 33 acres and half of the respondents operate farms larger than 33 acres.

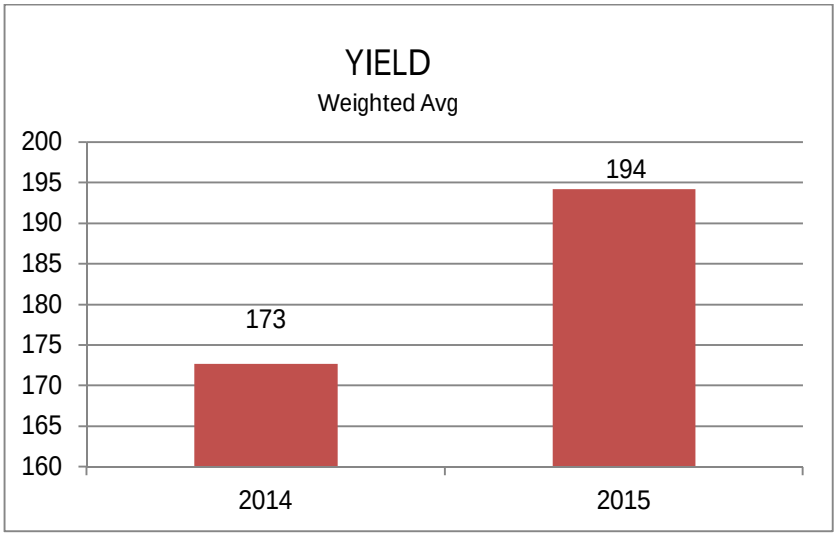
The following tables separate the participants into four quartiles based on size that will be used for analysis throughout the report. As a result of the makeup of the 2015 respondents, there was a general shift downward in the size quartiles from 2014. This shift should be considered when comparing year to year quartile data presented below.

2015 FARM SIZE (QUARTILES)	
Smallest 25%	< 19 Acres
25% - 50%	19 to 33 Acres
50% - 75%	33 to 93 Acres
Largest 25%	> 93 Acres

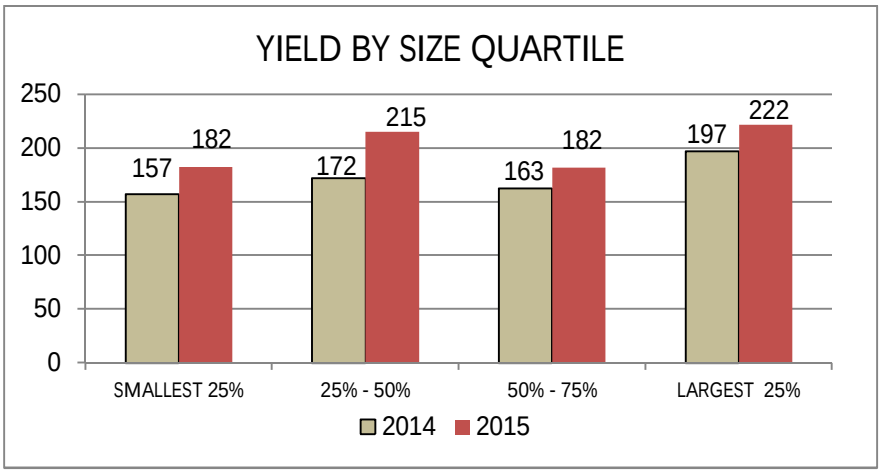
2014 FARM SIZE (QUARTILES)	
Smallest 25%	< 23 Acres
25% - 50%	24 to 44 Acres
50% - 75%	44 to 137 Acres
Largest 25%	> 137 Acres

Yield of Respondents

The average yield for participants in the study was **194** Bbls / acre in 2015, 12% higher than the 2014 average of **173** Bbls / acre.



The chart below separates the participants into the four quartiles according to size and shows the average yield for 2015 and 2014.



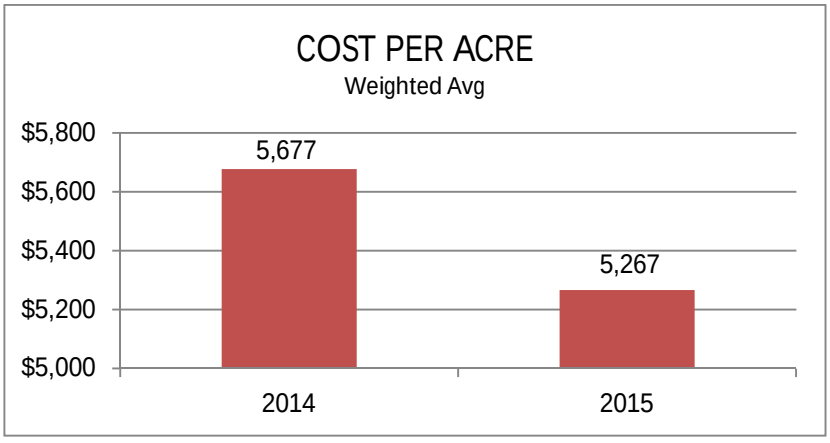
According to the data, the average yield increased across all four quartiles. This increase is consistent with the increase in average yield reported for all of Massachusetts in 2015 by USDA National Agricultural Statistics Services (see Appendix for further detail).

The data also highlights an important point, that there is not necessarily a correlation between size and yield, particularly when analyzing individual growers. For example, some participants achieved high yields on small farms while others achieved low yields on large farms.

It's also important to note that the chart above demonstrates that the largest sized group achieved the highest yield. It does not, however, conclude that an increase in acreage will lead to a corresponding increase in production for a particular grower.

Cost of Production – Per Acre Analysis

The average cost of production for 2015 was **$5,267 / acre**, a decrease of 8% from the 2014 cost of **$5,677 / acre**.



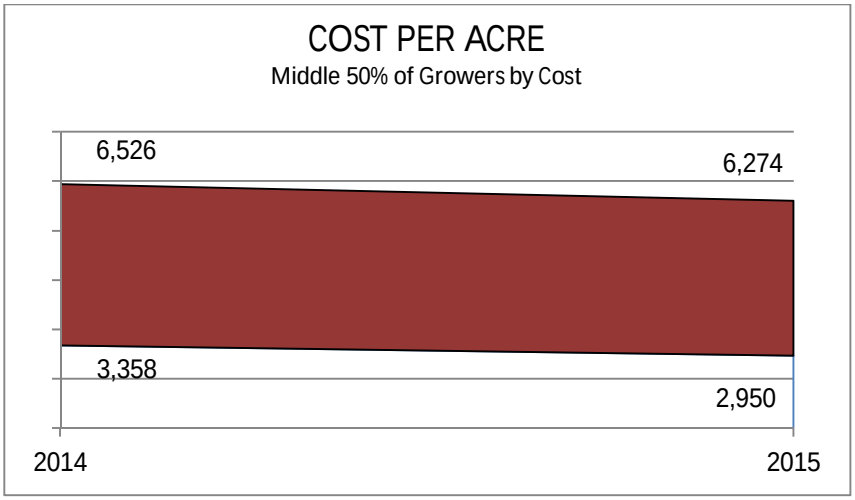
The costs included in the per acre analysis consist of operating expenses but not capital expenses. Loan repayments and equipment purchases are not included in the $5,267 / acre (or any measurements to follow in this study unless noted otherwise).

There is an important distinction between operating costs and cash requirements. When determining the amount of cash required for a given cranberry grower to cover all expenses and obligations, it is important to add debt servicing and required capital expenditures to the average costs discussed in this study.

Comparing the lowest cost quartile with the highest cost quartile, a range can be determined for the middle 50% of growers. As the next chart demonstrates, the middle 50% spent **between $2,950 / acre and $6,274 / acre** in 2015.

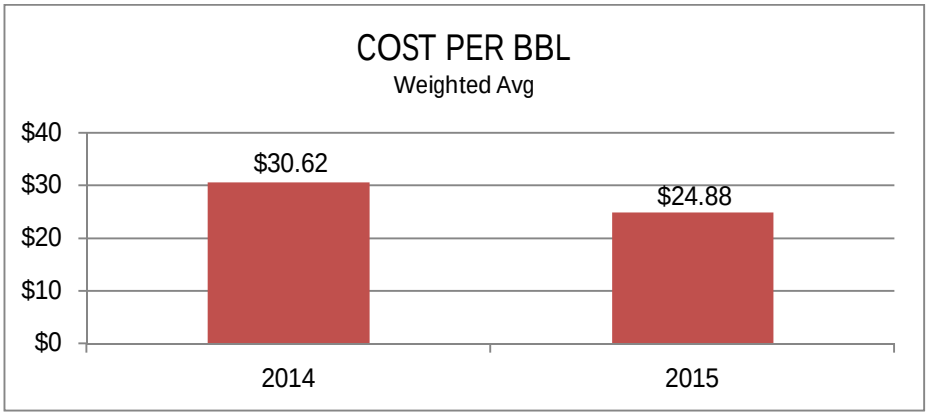
Observing the middle 50% is often used to remove any outliers and determine where the more reasonable values in a data set lie. This range provides insight into the fluctuating costs between various growers.

Even after removing the very low cost growers and the very high cost growers (top 25% and bottom 25%) a difference of $3,324 per acre still exists among the middle 50% of growers.



Cost of Production – Per Barrel Analysis

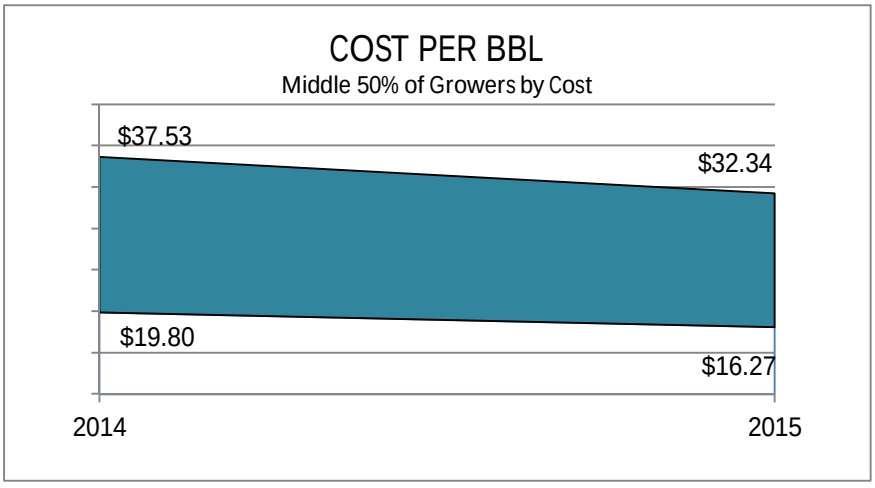
The weighted average cost of production for 2015 was **$24.88 / barrel**, a decrease of 19% from the 2014 cost of **$30.62 / barrel**.



According to the National Agricultural Statistics Service, total Massachusetts cranberry production increased 14% from 2014 to 2015. Increased production will lead to lower per barrel costs, even if total cost per acre is largely unchanged.

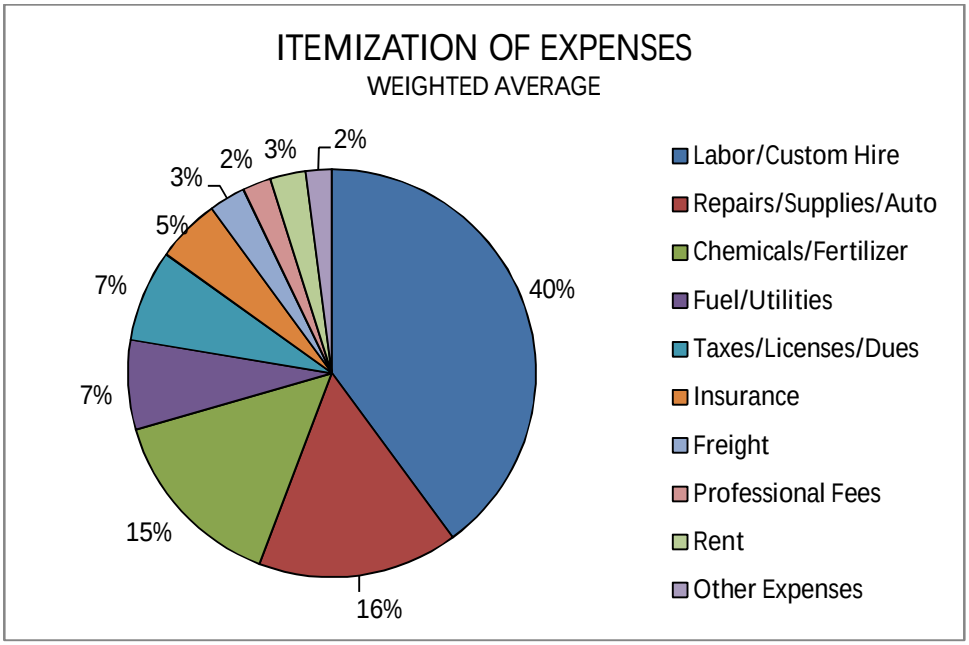
For example, if a 50-acre grower spends $5,000 per acre each year and experiences an increase in production from 120 Bbls / acre to 150 Bbls / acre, his Cost / Bbl will decrease from $41.67 to $33.33.

While a decrease in the average cost per barrel may result from decreased costs, it can also result from the increase in production discussed in the Yield section of this study. Comparing the lowest cost quartile with the highest cost quartile, a range can be determined for the middle 50% of growers. As the next chart demonstrates, this range was **$16.27 / Bbl** to **$32.34 / Bbl** in 2015. This range demonstrates there is a variance of $16.07 / Bbl even after removing the very low cost and very high cost growers (top 25% and bottom 25%).



Cost of Production – Itemized Expenses

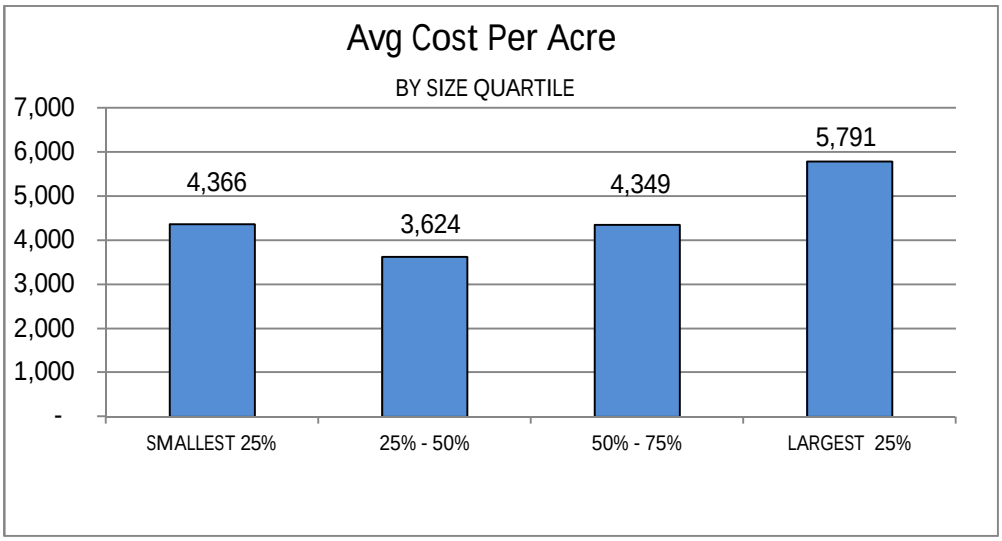
EXPENSES	$ / ACRE	$ / BBL	%
Car and Truck Expense	$57	$0.27	1%
Chemicals	472	2.23	9%
Custom Hire	656	3.10	12%
Fertilizer	309	1.46	6%
Freight	154	0.73	3%
Fuel	205	0.97	4%
Insurance	267	1.26	5%
Labor	1,453	6.86	28%
Rent	125	0.59	2%
Repairs	345	1.63	7%
Supplies	439	2.07	8%
Taxes	319	1.51	6%
Utilities	170	0.80	3%
Professional Fees	120	0.57	2%
Licenses/Permits/Dues	67	0.32	1%
Office Expenses	24	0.11	0%
Other Expenses	85	0.40	2%
TOTAL EXPENSES	$5,267	$24.88	100%

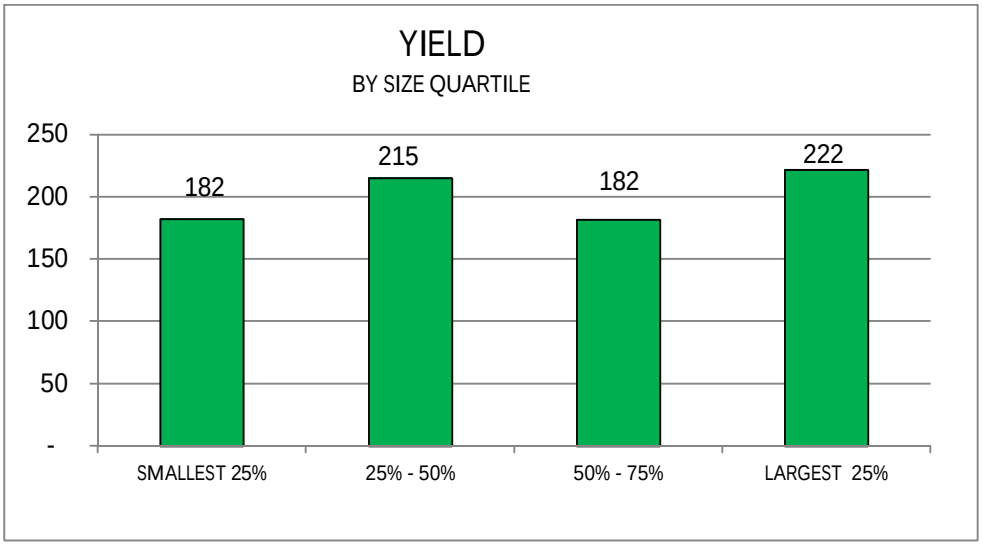


Cost Per Acre Compared to Yield

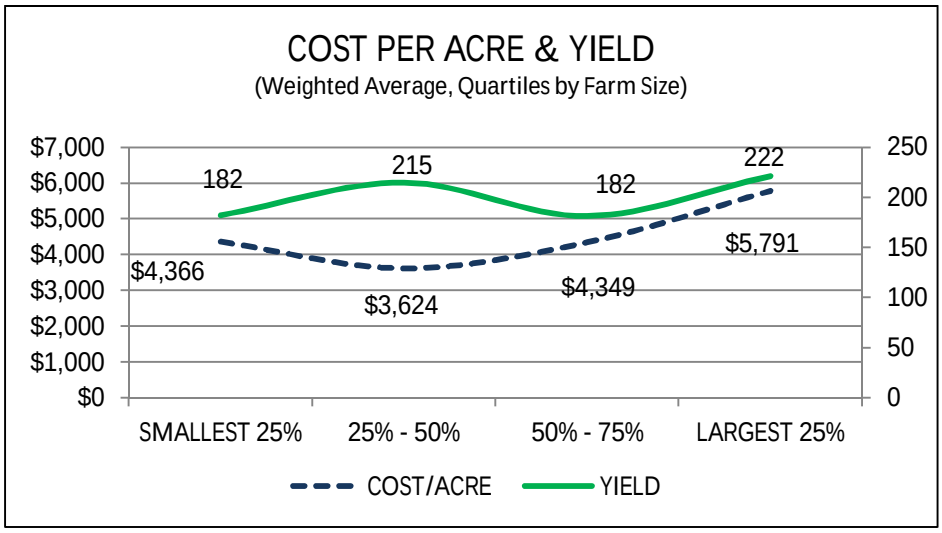
When analyzing an individual grower, there is no statistical correlation between the cost of inputs and the yield generated. However, when analyzing the four quartiles divided according to size, an idea of efficiency can be implied.

The first graph shows the average cost of production for each of the four quartiles, while the second graph shows the average yield for the same four quartiles.





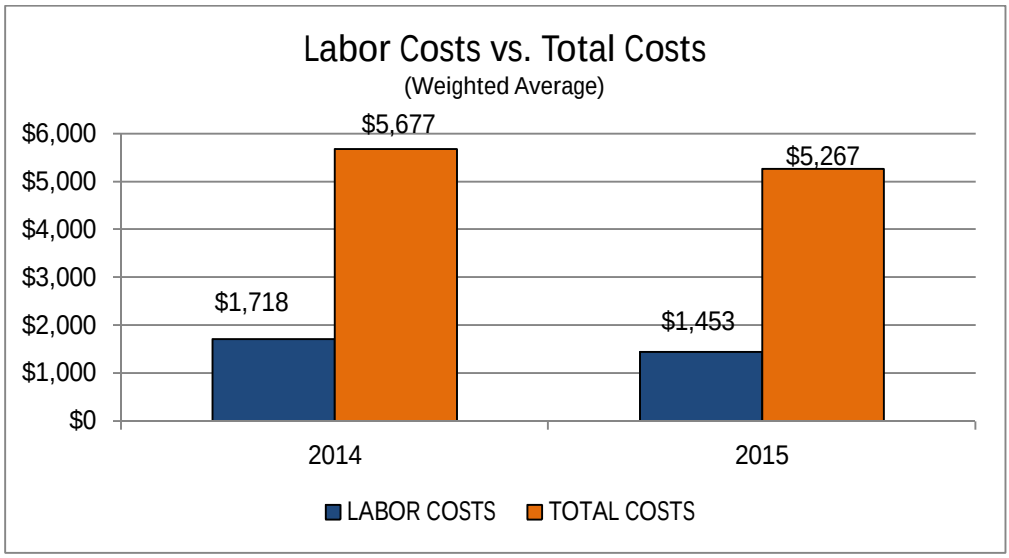
While the expectation is that the cost per acre and yield tend to increase across the four quartiles, the second quartile appears to be the most efficient of the groups.



The ability to maintain low "per acre" costs while still generating a high yield will result in low "per barrel" costs. This measurement is considered by many to be the driving factor of profitability.

Labor Expense and Its Impact

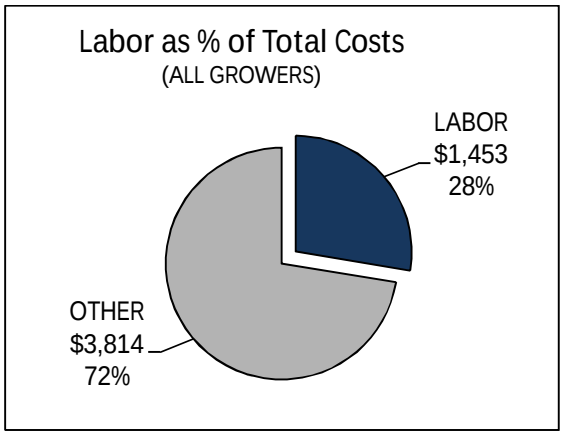
Labor was the single largest cost, ranging between a quarter to a third of the total cost of production.



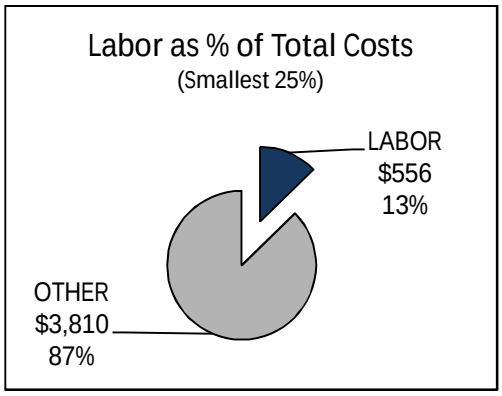
For purposes of this study, "Labor" includes actual wages paid combined with employee benefit programs provided. It does not include payroll taxes or workers' compensation insurance, as these were often combined with "Taxes" or "Insurance" on the source documents used to prepare this study.

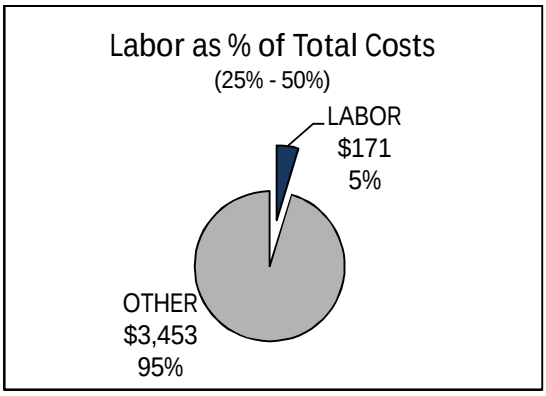
Additionally, unpaid owner labor is not included in the "Labor" category. An attempt was made for this year's study to gather data related to unpaid owner labor but there were not enough responses to reasonably quantify hours worked. As a result there is no unpaid owner labor imputed in the costs described in this report. The consequence of this are discussed in the Owner Labor section

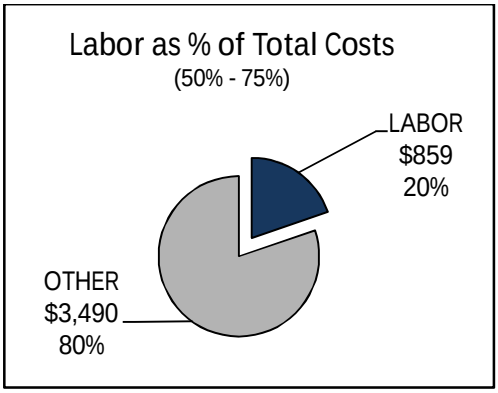
The chart below shows the average breakdown between Labor Costs per acre compared to all other costs per acre.

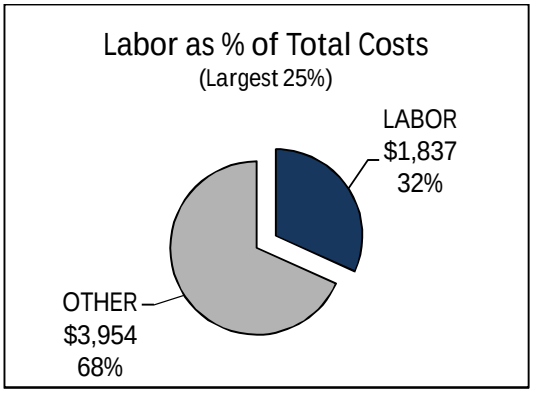


The pie charts below depict the ratio of labor costs / acre to non-labor costs / acre, broken out by farm size.







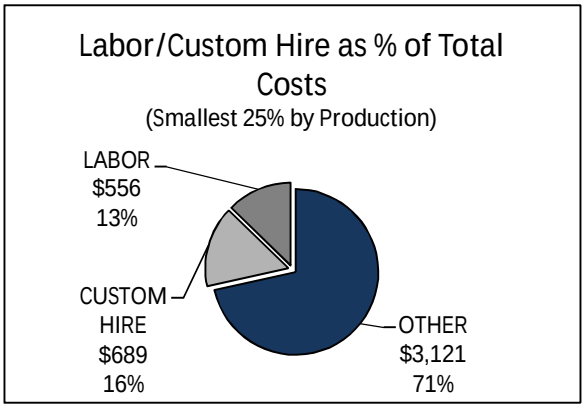


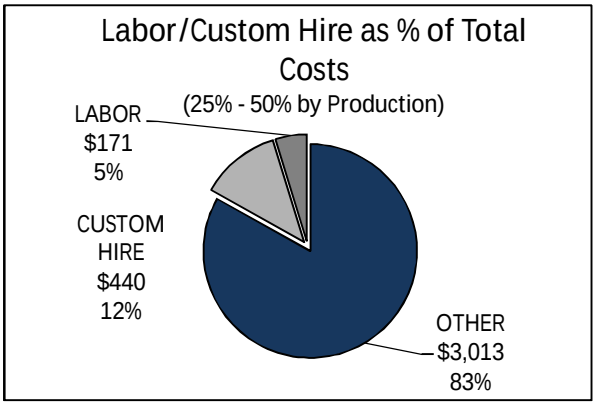
FARM SIZE (QUARTILES)	
Smallest 25%	< 19 Acres
25% - 50%	19 to 33 Acres
50% - 75%	33 to 93 Acres
Largest 25%	> 93 Acres

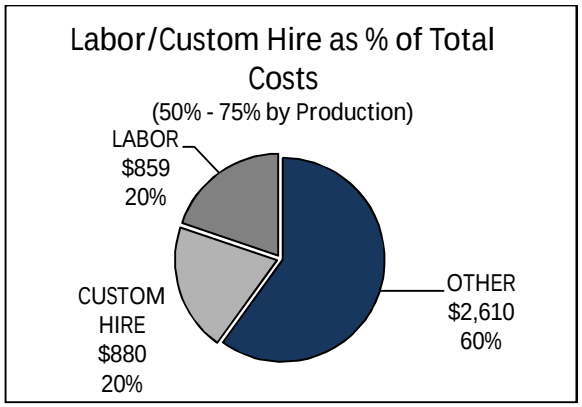
The assumption would be that the size of the operation influenced the amount of labor. In general, the larger the farm, the more labor required. This is generally the case, with the exception of the 25% - 50% group. This group appears to have significantly smaller portion of labor vs other costs than expected. One possible explanation for this could be that some owners in the smallest size grouping are less involved with the operations and require more outside labor.

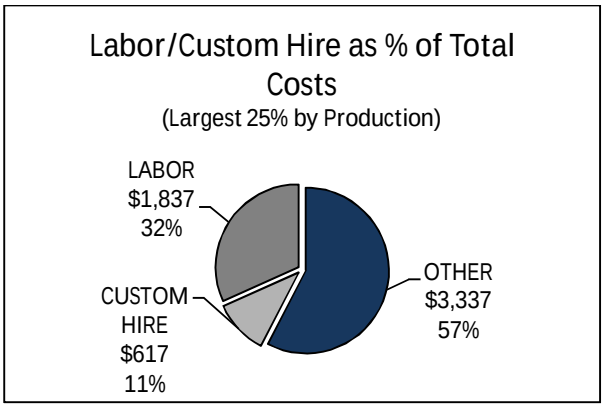
Custom Hire and Labor

The custom hire expense typically is related to independent contractors being used for specific labor-type tasks such as harvesting, mowing or weeding. It is being included in the discussion to give a more accurate depiction of all labor-type costs compared to total costs.









The data in the previous graphs reinforces the fact that labor-type expenses make up the majority of the total operating costs. The data also lends credence to the possibility that the smallest group rely more on outside help to run their operations.

A key point to highlight is that the lower labor costs related to the smaller farms would imply a more efficient operation but the data may be skewed due to the smaller farm owners providing the majority of the labor without accounting for its cost.

Owner Labor

In order to properly analyze the cost of production, it is important to consider additional costs that may not show up on a tax return or income statement. Specifically, the cost of labor may need to be adjusted to account for the time and resources provided by an individual owner. Including a value for this cost may lead to a more accurate representation of the true cost of production.

Two common methods used to determine a value for owner labor are "Replacement Cost" considerations and "Opportunity Cost" considerations.

Replacement Cost

Understanding what it would cost to hire a new bog manager in place of an existing manager is an important step to calculate a value for owner labor. For demonstration purposes, let's consider a 30-acre grower that operates a cranberry bog entirely by themselves and is nearing retirement. While their calculated cost of production may be $4,000 / acre, they also need to consider what it would cost to hire an outside manager to take care of the bogs when they retire.

If they paid someone $30,000 to manage the bogs, this would equate to an additional $1,000 per acre in operating costs. Even if they continue to operate the bogs by themselves, it can be argued that their true cost of production is $5,000 / acre rather than the calculated value of $4,000 / acre.

Opportunity Cost

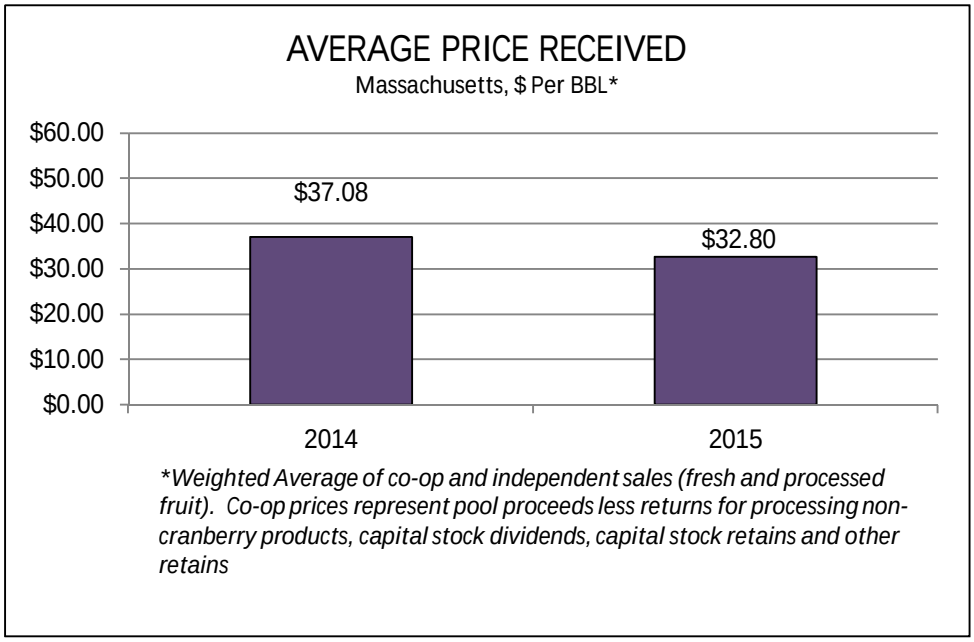
A second consideration for valuing owner labor is the concept of opportunity cost: the cost of something "given up" to pursue a particular action. If a cranberry grower works 2,200 hours a year on a cranberry bog, they are giving up the opportunity to work 2,200 hours doing something else. If they could generate a $45,000 salary in a different industry, they experience an opportunity cost of $45,000 by working on the cranberry bog.

Using the same hypothetical situation as above, the 30-acre grower has an actual cost of $4,000 / acre and an additional opportunity cost of $1,500 / acre. Depending on the analysis, the true cost of production is really $5,500 / acre rather than the calculated value of $4,000 / acre.

As stated in the "Labor Expense & Its Impact" section, the response rate for owner labor hours was too low to effectively analyze the impact on cost.

Price Received

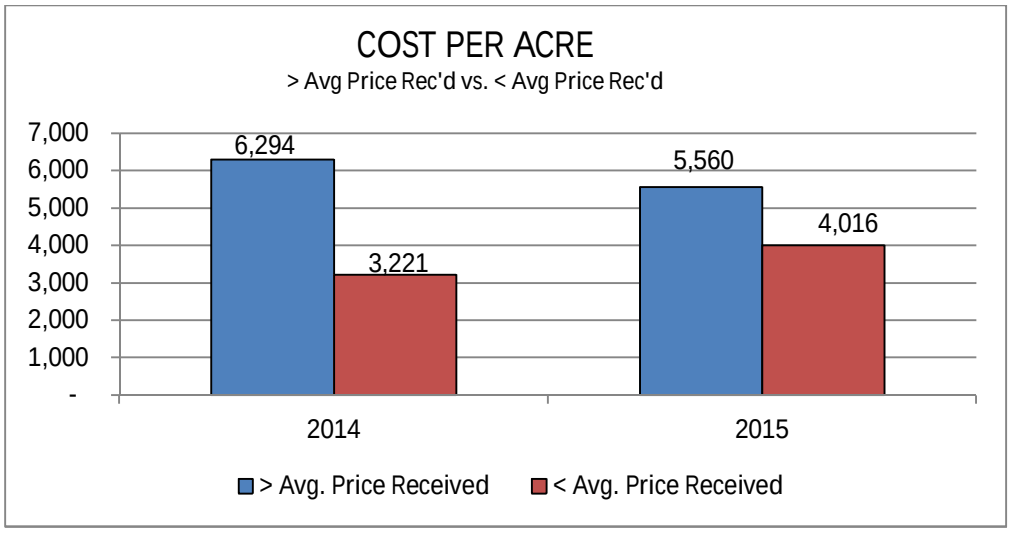
According to the National Agricultural Statistics Service, the average price received for Massachusetts growers in 2015 was **$32.80** / Bbl, an **12%** decrease from the 2014 average price of **$37.08** / Bbl.



SOURCE: USDA, National Agricultural Statistics Service

As with any commodity, the price fluctuates from year to year and from buyer to buyer. During the time period of this study, some handlers paid a price per barrel that exceeded the average cost of production, while other handlers paid a price lower than the average cost of production.

Consequently, more cash was available to invest in some bogs as compared to other bogs. Growers that received an above average price spent **$5,560 / acre** in 2015. On the other hand, growers that received a below average price spent **$4,016 / acre** in 2015, which is 73% of the amount spent by their counterparts.

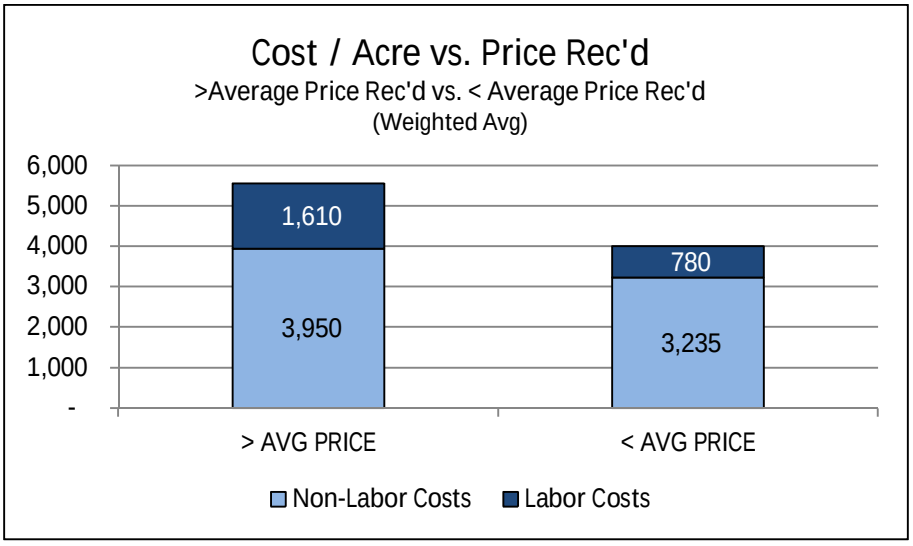


An important conclusion can be derived from this analysis: rather than addressing the question "What does it cost to grow cranberries in Massachusetts?" this study more accurately addresses the question, "What do growers spend on a cranberry operation in Massachusetts?" 'Cost' would be driven by the needs of the bog and 'spending' would be driven by the cash available.

In other words, **growers appear to spend based on the income available.**

The difference between these two groups of growers results primarily from the differing amounts of labor spent by each group. While nearly all cost categories were somewhat higher for the growers that received an above average price, it was the cost of labor that significantly drove the cost of production higher than their counterparts in 2015; 29% of total costs compared to 19% of total costs, respectively.

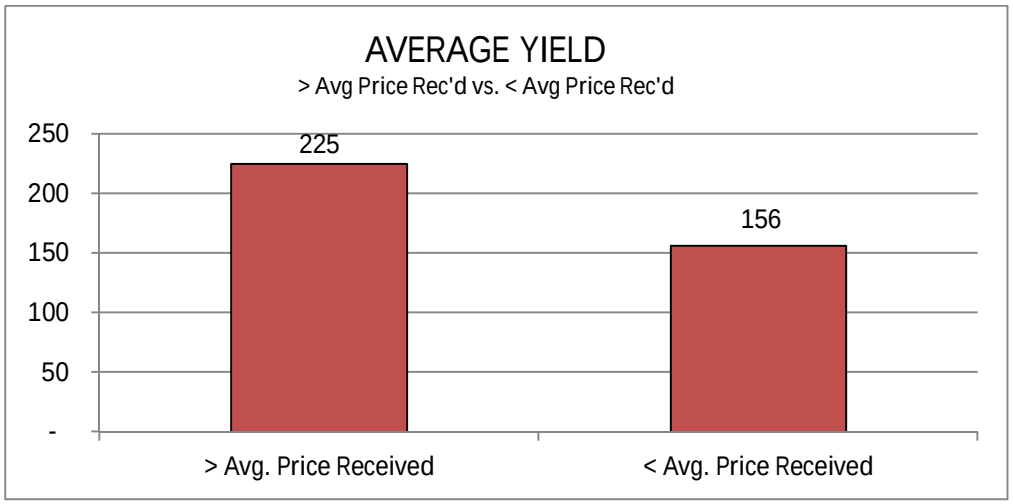
The average labor cost for growers that received an above average price was **$1,610 / acre** compared to **$780 / acre** for their counterparts. All other operating expenses, ("non-labor costs") averaged **$3,950 / acre** compared to **$3,235 / acre.**



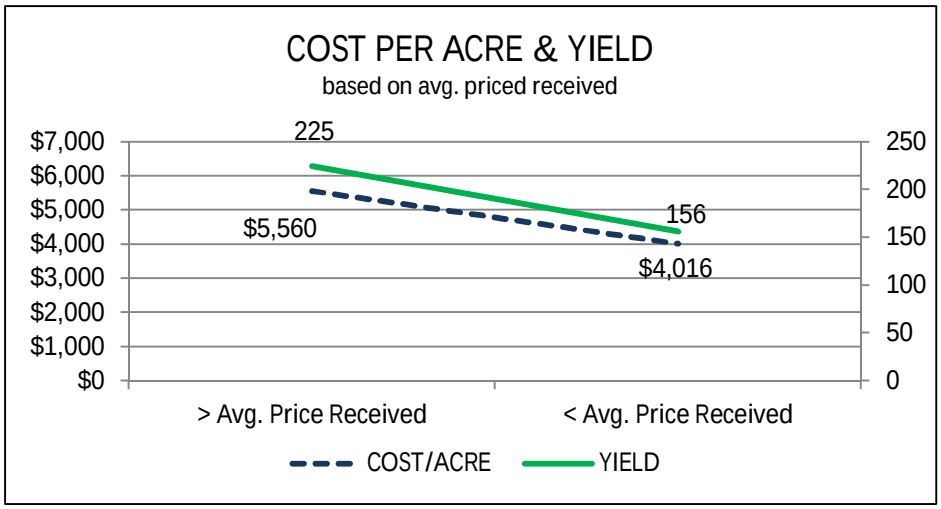
The previous graph implies that there appears to be a "base range" for the cost of production without consideration for labor between $3,235 and $3,950 per acre. The data also implies that the amount spent on labor depends on the ability of the operation owner to perform the work, as well as the amount of cash available based on the price received.

In other words, **additional income is often invested in labor more than any other growing expense.**

Based on the assumption above that price received is a driver of money put into growing, how does that difference affect the yield of the growers?



Growers that received an above average price had an average yield of 225 bbls / acre compared to 156 bbls / acre for the grower who received less than the average price, an difference of 44%.

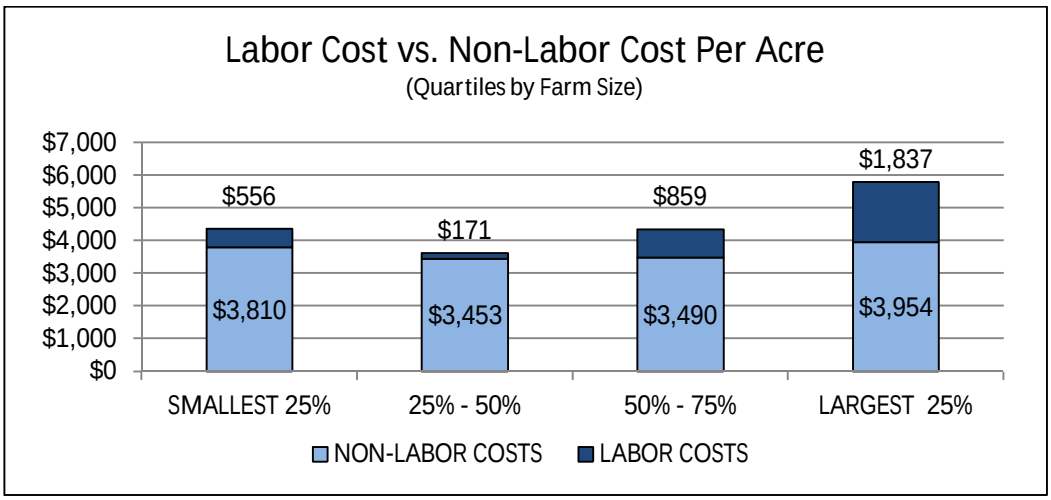


The average yield for the grower receiving an above average price is greater by 44% but the average cost per acre is also greater by 38%, implying a modest increase in efficiency.

Economies of Size

For agricultural purposes, the term "economies of size" implies that the cost of production per unit decreases as the size of the farm increases. Cost reductions per unit should be achieved as a result of fixed costs being spread out and possible volume discounts on supplies. Typically, the benefit from increased size flattens out.

The graph below shows the average cost of production divided into the four quartiles of grower **size**. (The first column represents the smallest 25% of the growers in the study; the fourth column represents the largest 25% of the growers, etc.) While the "non-labor" costs appear to be relatively consistent across the board, it is clear that the "labor costs" per acre generally increase across the four size groups. See the discussion in the Owner Labor section for the dip in the 25% - 50% group.



This observation parallels the earlier observation regarding the price received in that there appears to be a "base" cost of production. This base cost of approximately $3,600 / acre appears to be consistent across all size growers. This base cost / acre would imply that there doesn't appear to be economies of size achieved in the cranberry industry.

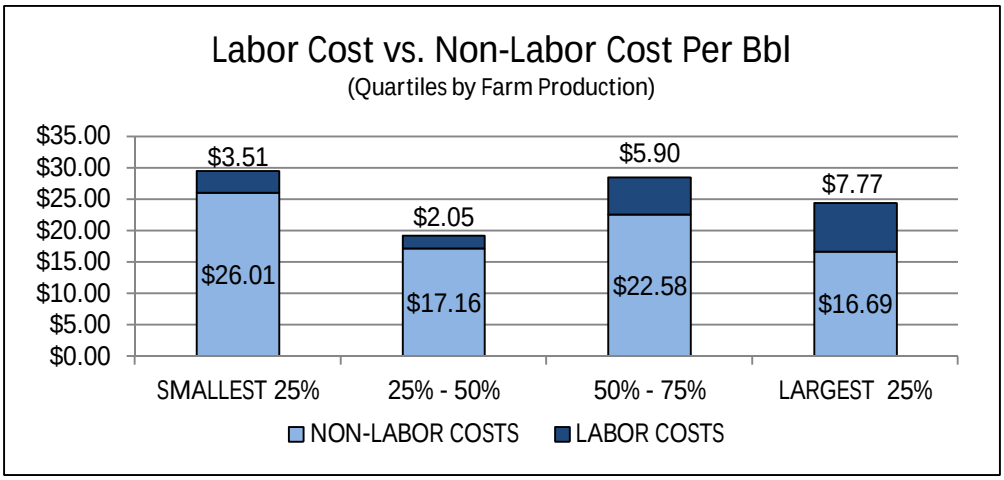
Economies of Scale

The term "economies of scale" implies that the cost of production per unit decreases as the number of units produced increases. As some businesses in certain industries expand, they become more efficient and can reduce the average cost to produce a unit.

All quartile data prior to this was based on size. However, as stated above, economies of scale are based on production. For purposes of the economies of scale production, the table below shows the four quartiles based on production.

FARM PRODUCTION (QUARTILES)	
Smallest 25%	< 2,924 Bbls
25% - 50%	2,924 to 7,012 Bbls
50% - 75%	7,012 to 16,367 Bbls
Largest 25%	> 16,367 Bbls

The graph below shows the average cost of production divided into the four quartiles of grower **production**. (The first column represents the smallest 25% of production in the study; the fourth column represents the largest 25% of production, etc.) Again, the "labor costs" per barrel increase across the four production groups, with the 25% - 50% dip noted in previous sections.

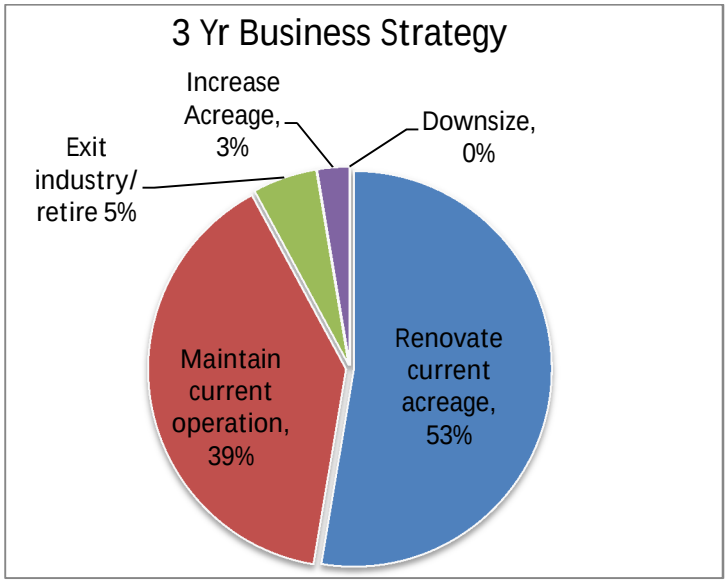


However, the "base" cost of production that was inferred above in the price received and economies of size sections does not appear to be true when looking at groups based on production. This could be the result of some participants in the study having poor crops due to other environmental factors such as frost, pests or drought. Because of this it would be inappropriate to assume that this means a diseconomy of scale exists.

Additional Information

This year's study is attempting to provide additional information to help provide more insight into the strategies and concerns of growers in Massachusetts. While all participants in the "numbers" portion of the study described in the previous sections did not provide answers to the following questions, there were enough responses to be considered useful for this report.

Growers were asked to choose the option that best describes their business strategy for the next three years. The results are show in the following graph:



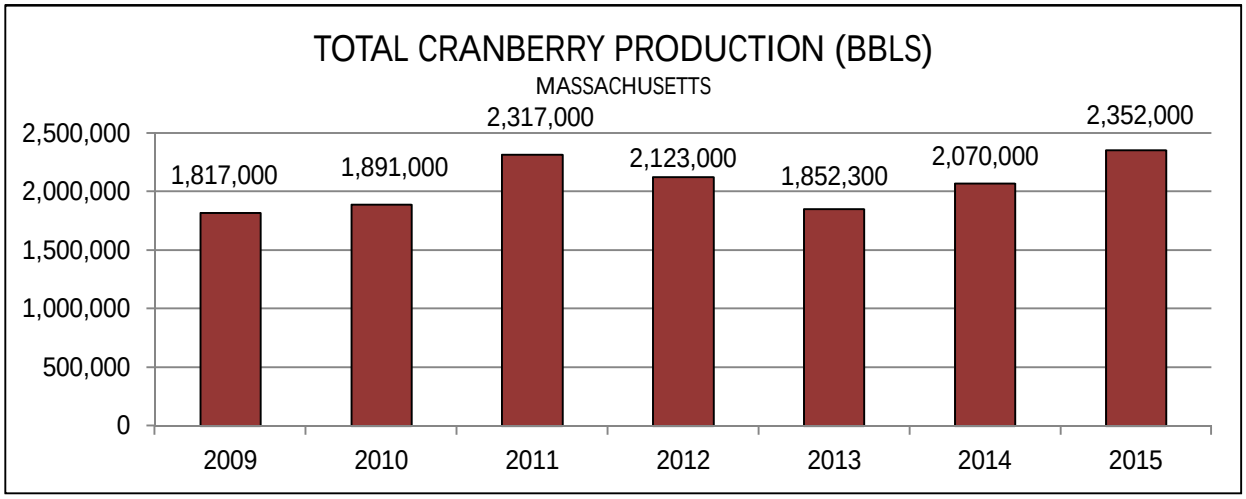
Additionally, they were asked to rank a list of concerns from most concerning to least.

Concern	Average Ranking
Price received	1
Cost of supplies/labor	2
New/Changing Regulations	3
Finding Labor	4
Weather	5
Taxes	6
Paying Debt	7
Availability of Financing	8
Cost/Availability of Insurance	9

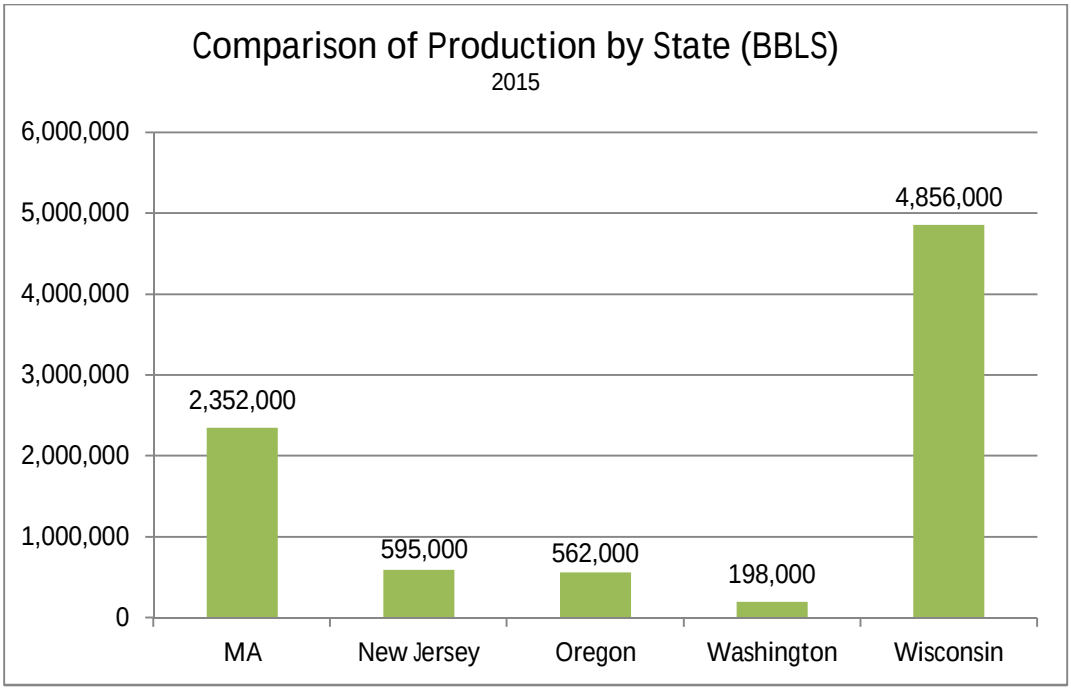
The data above shows the average ranking for each item and highlights price received, cost of supplies/labor and new/changing regulations as the top three concerns. It should also be noted that price received was overwhelmingly ranked as the most concerning issue, ranking 1st (highest concern) from 76% of the respondents.

APPENDIX

PRODUCTION

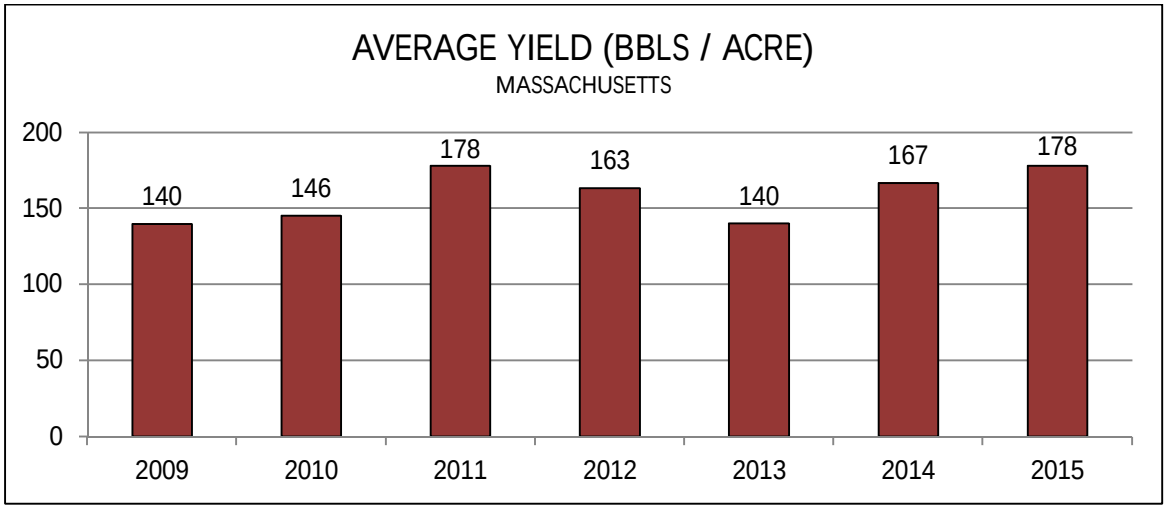


SOURCE: USDA, National Agricultural Statistics Service

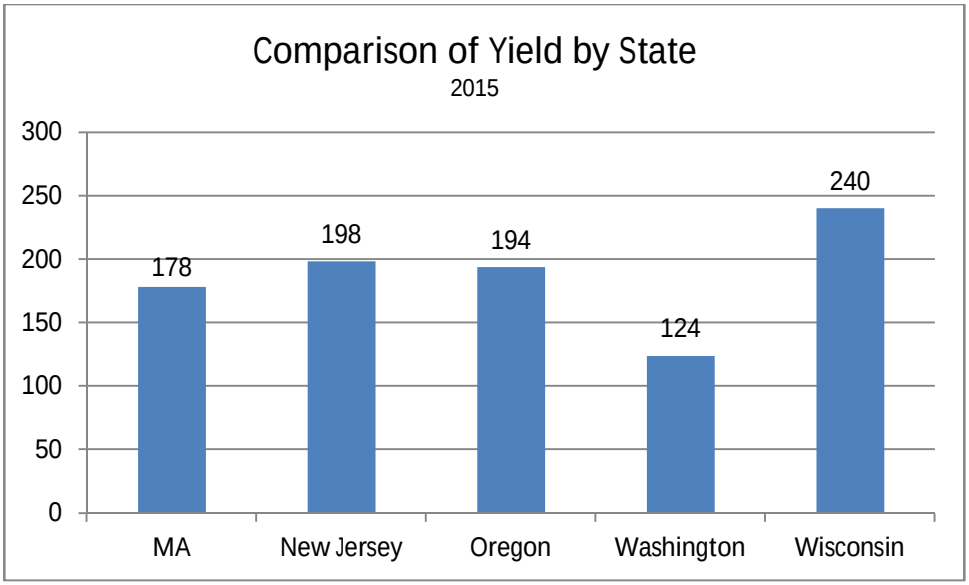


SOURCE: USDA, National Agricultural Statistics Service

YIELD

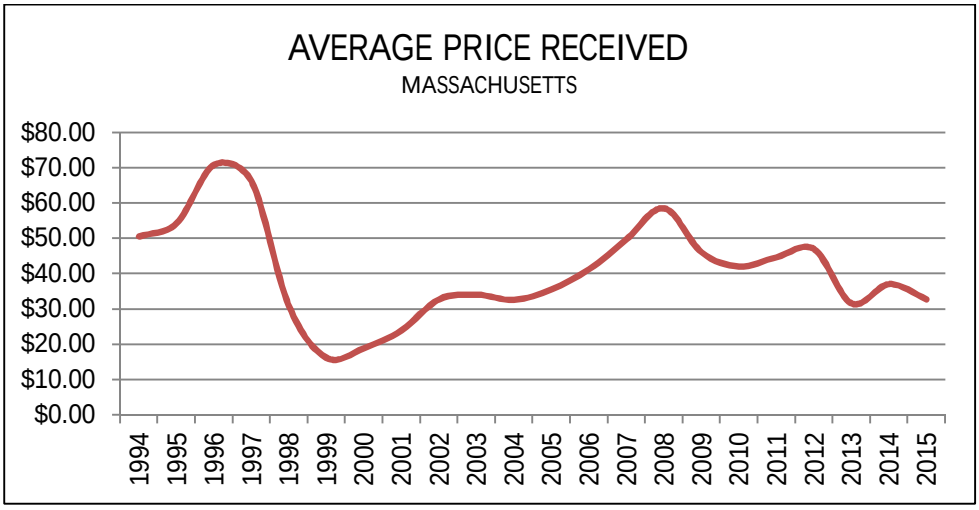


SOURCE: USDA, National Agricultural Statistics Service

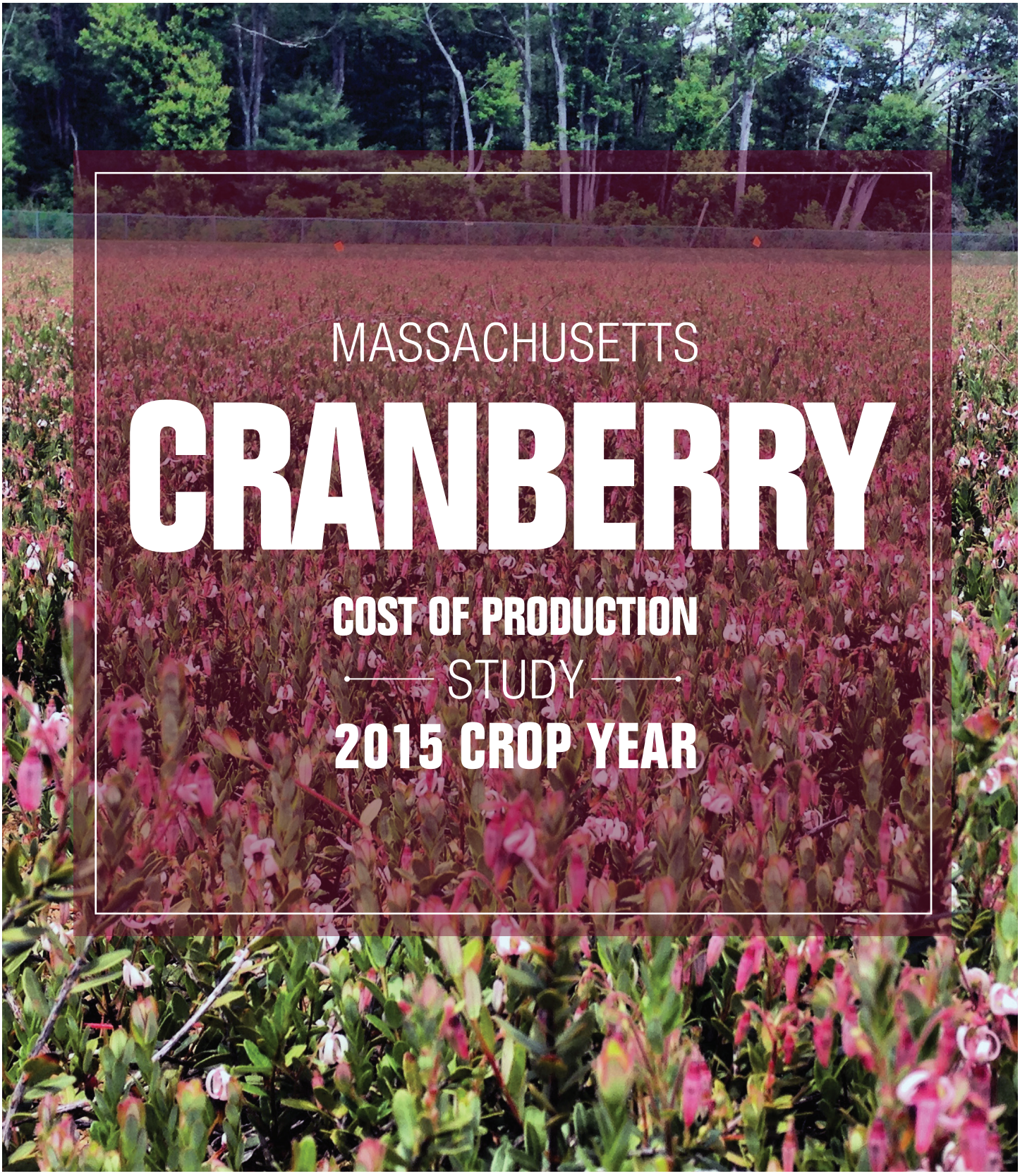


SOURCE: USDA, National Agricultural Statistics Service

PRICE RECEIVED



SOURCE: USDA, National Agricultural Statistics Service



MASSACHUSETTS

CRANBERRY

COST OF PRODUCTION STUDY

2015 CROP YEAR

FARM CREDIT EAST