A Detailed Analysis of US Organic Crops

Analysis Based on 2008 USDA-NASS Data

By

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Background

As a follow-up to the 2007 Census of Agriculture, the National Agricultural Statistics Service (USDA NASS) conducted a first-ever, highly-detailed survey of Organic agriculture for the 2008 crop year. This Organic Production Survey included data in terms of acreage, production and value on a crop by state basis which is beyond what was available in the 5-year Census data.

This analysis was completed by using the Organic Survey and comparing it to the same statistics for overall production (mainly “conventional”) in the same crop year (2008). These data were also from USDA-NASS. For row crops the data is available through Quickstats 1. For citrus crops the data is available in the annual Citrus Fruits Summary. For other fruit and nut crops the data is available in an annual summary of Non-Citrus Fruits and Nuts. The vegetable crop data including strawberries and melons is available in the Vegetables Annual Summary.

Vocabulary for this analysis:
- **Acreage** – the area in acres harvested for each crop or the percent of that area
- **Production** – the total harvested output for a crop in bushels, tons, hundredweights etc
- **Yield** – the harvested output for a crop on a per acre basis
The 1.6 million acres of harvested Organic cropland in 2008 represented 0.52% of the total US cropland.

- Of that area, 546,000 acres were for hay or silage crops but none of those represented as much as 1% of the US total of each crop.
- Only three minor row crops (oats, flaxseed and rye) represented more than 1% of total acres for that crop.
- Of all fruit crops, only apples, avocados, figs, raspberries and blackberries had more than 4% Organic acres. Only apples and figs had more than 4% Organic production.
- Several vegetable crops (lettuce, carrots, spinach, sweet potato, squash, cauliflower, celery and artichoke) had more than 4% Organic acres, but of those only squash, sweet potatoes and spinach had as much as 4% Organic production.

Organic crop acres are highly concentrated in the dry, irrigated, Western states (43% vs 12% for non-Organic).

- As an example, Organic apple acreage is 93% in the West vs 59% for all US apples.
- 97.5% of Organic apple production is in the West vs 71% for all US apples.
In the vast majority of cases national Organic average yields are moderately to substantially below those of the overall, national average

- Examples for row crops include Winter Wheat (60% of overall average), Corn (71%), Soybeans (66%), Spring Wheat (47%) and Rice 59%
- Examples for fruits include Grapes (51%), Apples (88%), Almonds (56%), Avocados (62%), Oranges (43%), Strawberries (58%)
- Examples in Vegetables include Tomatoes (63%), Potatoes (72%), Sweet Corn (79%), Celery (50%) and Cabbage (43%)

In many cases where comparisons can be made on a state/crop level outside of the West, Organic yields are dramatically lower

- Examples include Squash, Strawberries, Apples and Cabbage

These data do not address the question of whether the ratio of harvested to planted acreage is different for Organic and Conventional
A theoretical, large-scale switch to Organic production would require substantially more land to be farmed

- To have Organically produced the full output of 2008 US crops, it would have been necessary to harvest from an additional 131.8 million acres of cropland (based on 58 crops)
- That additional area would represent a 43% increase over current US cropland
- The theoretical, additional cropland needed (206,014 sq miles, 533,576 sq km) would be the equivalent of all the current cropland acres in Iowa, Illinois, North Dakota, Florida, Kansas, Minnesota and Oregon combined
- On a land-area basis, this additional area would be 98% the physical size of France, 77% the size of Texas, 3.7 times the size of Iowa, or 1.3 times the size of California

Growers generally receive a higher price/unit, but when lower yields are taken into account, the net income per acre is only marginally higher than for conventional

- It is not; however, possible to quantify net grower economics from these data because of production cost differences
Discussion of Data Limitations

The 2008 survey was an unprecedented opportunity to make comparisons to overall, “Conventional” production, but the comparisons are not without difficulties.

There are important scale differences between the 2008 Organic survey and standard USDA NASS statistics:

- The Organic study track even a few acres of a given crop in a given state while the normal USDA data drops such units below 1000 acres so in some cases there are no “conventional” numbers to compare with Organic.
- Many key Organic statistics are not reported because they would disclose too much information in cases where only a very small number of producers are involved in a given state/crop.

Production system differences:

- The Organic study only tracked “harvested cropland acres.” This can obscure the following differences that are sometimes detailed in the overall USDA NASS reports:
  - Irrigated vs non-irrigated acres (tracked for major row crops in some, but not all states).
  - Fresh vs processed uses (tracked separately in the major producing regions on a national basis).
  - Planted vs harvested acres (tracked for most non-Organic row crops and major vegetable crops).
  - Prime land vs marginal land (not tracked in any statistics).
  - “Baby vegetable” systems (e.g. in spinach and leaf lettuce and carrots) are more common in Organic production and account for some of the yield differences because multiple crops/year are not captured in the statistics.

Where known (and based on feedback), these potentially confounding factors will be highlighted.
National Overview
In 2008 there were 2.2MM acres of USDA certified Organic cropland, but only 1.6MM of those were harvested. It is not clear from these data whether the remaining acres were unplanted parts of farms or planted acres not harvested. Since there were 309.6MM acres of total US cropland in 2008, the percent harvested as Organic represents only 0.516% of the total.

There were also 5.4MM acres of certified Organic pasture in 2008, but these are not part of the national “cropland” number.
Organic cropping is heavily weighted towards the irrigated, desert West, mainly because of disease pressures in wetter areas.

There is also a higher concentration of Organic in the Northeast, probably because of proximity to major population centers.
Compared to national plantings, 2008 Organic crops consisted of a much larger proportion of fruits and vegetables, a similar proportion of animal feed crops (hay, silage...), and a smaller proportion of row crops (corn, soy, wheat...).
Commodity Pricing and Per Acre Gross Returns
Highest Priced Organic Commodities

Price and Income/Acre for Organic Crops

<table>
<thead>
<tr>
<th>Crop</th>
<th>Price Relative to Non-Organic</th>
<th>Relative Income</th>
<th>Relative Price</th>
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</thead>
<tbody>
<tr>
<td>Tomatoes</td>
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<td>Proso Millet</td>
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<td>Grapefruit</td>
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<td>Cabbage</td>
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<td>Figs CA</td>
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</tr>
<tr>
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<tr>
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<tr>
<td>Plums and Prunes</td>
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<tr>
<td>Avocados</td>
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</tbody>
</table>

Relative income is relative price * relative yield

Organic Price or Income Relative to US Average
Moderately Priced Organic Commodities

Price and Income/Acre for Organic Crops

Relative income is relative price * relative yield
Low Priced Organic Commodities

Relative income is relative price * relative yield
Vegetable Crops: National Level
Organic Vegetable Crops 2008

Harvested Acres x 1000

Organic Vegetable Crops as a Percent of US Total

Organic as a Percent of US Total

%Value
%Production
%Acres

Organic Vegetable Crops 2008

- Lettuce
- Tomatoes
- Carrots
- Potatoes
- Spinach
- Sweet Corn
- Snap Beans
- Broccoli
- Sweet Potatoes
- Onions
- Squash
- Cantaloupes
- Cauliflower
- Celery
- Watermelon
- Herbs
- Cabbage
- Garlic
- Bell Peppers
- Artichokes
- Fresh Cut Herbs
- Green Peas
- Other Vegetables
- Food crops under glass

Organic Vegetable Crops as a Percent of US Total

- Lettuce
- Tomatoes
- Carrots
- Potatoes
- Spinach
- Sweet Corn
- Snap Beans
- Broccoli
- Sweet Potatoes
- Onions
- Squash
- Cantaloupes
- Cauliflower
- Celery
- Watermelon
- Herbs
- Cabbage
- Garlic
- Bell Peppers
- Artichokes

Organic as a Percent of US Total

%Value
%Production
%Acres
Vegetable Crops: Relative Yields

Relative Yields for Organic Vegetables

- Sweet Potatoes
- Snap Beans
- Sweet Corn
- Squash
- Broccoli
- Potatoes
- Cauliflower
- Watermelon
- Tomatoes
- Onions
- Cantaloupes
- Celery
- Bell Peppers
- Garlic
- Cabbage
- Spinach
- Carrots
- Lettuce
- Artichokes

Percent of Overall Average
Fruit and Nut Crops: National Level
Fruit and Nut Crops: Relative Yields

Relative Yields for Organic Fruit

Percent of Overall Average

- Raspberries
- Sweet Cherries
- Apples
- Other Tree Nuts
- Peaches
- Pears
- Avocados
- Plums and Prunes
- Strawberries
- Blueberries
- Grapefruit
- Blackberries
- Almonds
- Grapes
- Oranges
- Lemons
- Tangerines
- Tart Cherries

Percent of Overall Average
Row Crops: National Level
Row Crops: Relative Yields

Relative Yields for Organic Row Crops

Percent of Overall Average

- Canola
- Rye
- Oats
- Dry edible beans
- Peanuts
- Corn
- Cotton
- Flaxseed
- Soybeans
- Peas, lentils etc
- Winter Wheat
- Rice
- Durum Wheat
- Spring Whet
- Sorghum
- Proso Millet
- Safflower

0 20 40 60 80 100 120
Animal Feed Crops: National Level
Organic Hay is one of few crops which has a higher average US yield than the national average. Since all hay is low input, this difference may reflect the land quality or irrigation potential on the small amount of land devoted to Organic Hay (<0.7% of the total). Still, in terms of acreage, Hay is the largest single Organic crop.
Relative Yields for Organic Animal Feed Crops

- Hay
- Sorghum Silage
- Corn Silage

Percent of Overall Average
Vegetable Crops: State Level

Potatoes  Squash  Cabbage  Sweet Corn
Peppers, Celery, Cantaloupe, Garlic
Watermelons, Cabbage, Carrots, Snap Beans, Spinach, Broccoli, Sweet Potatoes, Lettuce, Lentils
Organic Potatoes represented 7.5% of 2008 acres in the US, 5.4% of total production, but 7.9% of total potato payments. Organic potatoes sold at 1.5 times the price for conventional so with 72% of the yield that represented a net advantage of 1.05 times the gross per acre income. To have produced all the 2008 potatoes Organically would have required 408,000 additional acres – a 39% increase.

* Top Potato producing states (>50,000 acres harvested) * States with less than 100-acres of Organic potatoes
Organic Squash represented 7.7% of 2008 acres in the US. For these states with complete data, Organic Squash represented 5.5% of acres and 4.7% of total production. 64% of Organic acres were in Oregon and California. In wetter areas, Organic yields averaged 29% of those in conventional

* Top Squash producing states (>5,000 acres harvested)
Direct comparisons were only possible for the above states that represent 63% of all US Cabbage acres. For these states, Organic Cabbage represented 1.5% of acres, 0.7% of production and 2.7% of total payments. For these states average Organic yields were 46% of conventional but at 4.1 times the price/CWT the gross value per Organic acre was 1.9 times that of conventional. These values are similar to the national picture. To have produced all US 2008 US Cabbage organically would have required 88,400 additional acres, an increase of 143%.

* Top Cabbage producing states (>5,000 acres harvested)
Sweet Corn: Yields

Organic Yield as a Percent of US Average

Additional Vegetable Crops: Yields (1 of 2)

Bell Peppers

- Organic Yield
- US Yield

Organic Yield as a Percent of US Average

Cantaloupes

- Organic Yield
- US Yield

Celery

- Organic Yield
- US Yield

Garlic

- Organic Yield
- US Yield

Organic Yield as a Percent of US Average
The seemingly low yields for carrots, spinach and lettuce are misleading because “baby” versions of those crops are commonly harvested for Organic and multiple crops can be harvested in a year.
Fruit Crops: State Level

- Apples
- Strawberries
- Avocados, Grapes, Other Berries, Grapefruit
- Oranges, Peaches, Pears, Plums/Prunes
- Raspberries, Cherries, Tangerines
- Figs, Almonds
Apples: Yields (1 of 2)

* Top Apple producing states (>19,500 acres harvested)

<table>
<thead>
<tr>
<th>Region</th>
<th>Organic Acres</th>
<th>Organic Production</th>
<th>Organic Value</th>
<th>Organic Yield</th>
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<tr>
<td>East</td>
<td>1.1%</td>
<td>0.44%</td>
<td>0.62%</td>
<td>0.39%</td>
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<tr>
<td>Midwest</td>
<td>1.04%</td>
<td>0.47%</td>
<td>0.61%</td>
<td>0.45%</td>
</tr>
<tr>
<td>West</td>
<td>9.6%</td>
<td>7.01%</td>
<td>6.79%</td>
<td>0.73%</td>
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</table>
The Organic Apple industry is highly concentrated in the dry, irrigated West because of the difficulties controlling diseases and insects in the humid Midwest and East.
Organic Strawberries represented 2.9% of 2008 acres in the US and 1.7% of total production. 75% of Organic acres were in California vs 67% on non-Organic acres. To convert to 100% Organic would require 46,624 additional acres – an 87% increase

* Top Strawberry producing states (>2,000 acres harvested)
Additional Fruit Crops: Yields (1 of 4)

Avocados
- California (CA) yield: 2 tons/acre, Organic yield 67% of US average
- Florida (FL) yield: 4 tons/acre, Organic yield 40% of US average
- Hawaii (HI) yield: 3 tons/acre, Organic yield 44% of US average

Grapes
- United States (US) yield: 2 tons/acre, Organic yield 51% of US average
- California (CA) yield: 6 tons/acre, Organic yield 64% of US average

Other Berries
- Organic yield as a percent of US average:
  - US Blackberries: 56%
  - OR Blackberries: 56%
  - US Blueberries: 57%
  - CA Blueberries: 32%
  - FL Blueberries: 21%

Grapefruit
- United States (USA) yield: 10 tons/acre, Organic yield 57% of US average
- Texas (TX) yield: 10 tons/acre, Organic yield 96% of US average

Organic Yield as a Percent of US Average
Additional Fruit Crops: Yields (2 of 4)

- **Oranges**
  - USA: 43%
  - CA: 88%
  - FL: 14%

- **Peaches**
  - US: 79%
  - CA: 40%
  - OR: 64%
  - WA: 140%

- **Pears**
  - USA: 76%
  - CA: 27%
  - OR: 61%
  - WA: 86%

- **Plums and Prunes**
  - US: 59%
  - CA: 61%
  - OR: 34%

**Organic Yield as a Percent of US Average**

- Oranges: 140%
- Peaches: 64%
- Pears: 61%
- Plums and Prunes: 86%
Additional Fruit Crops: Yields (3 of 4)

**Raspberries**

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<tr>
<th>Pounds/Acre</th>
<th>Organic Yield</th>
<th>US Yield</th>
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<tr>
<td>16000</td>
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<tr>
<td>18000</td>
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</table>

**US** 93%, **CA** 88%, **WA** 15%

**Cherries**

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<tr>
<th>Tons/Acre</th>
<th>Organic Yield</th>
<th>US Yield</th>
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**Sweet US** 91%, **Sweet OR** 82%, **Tart US** 24%

**Tangerines**

<table>
<thead>
<tr>
<th>Tons/Acre</th>
<th>Organic Yield</th>
<th>US Yield</th>
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<tbody>
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<td>12</td>
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</table>

**USA** 34%, **CA** 30%

Organic Yield as a Percent of US Average
Additional Fruit Crops: Yields (4 of 4)

Organic Yield as a Percent of US Average

Figs

- Organic Yield
- US Yield

Almonds

- Organic Yield
- US Yield
Row Crops: State Level

Winter Wheat
Soybeans
Spring Wheat
Oats
Dry Edible Beans
Corn for Grain
Barley
Other Row Crops
Organic Winter Wheat represented 0.8% of 2008 acres but only 0.5% of total production.
100% conversion to Organic would have required 10.4MM additional acres, a 49% increase.

* Top Winter Wheat producing states, >1MM acres (Organic data not available for KS)
Organic Soybeans represented 0.13% of 2008 acres in the US, 0.09% of total production, but 0.17% of total soybean payments. Organic soybeans sold at 2 times the price for conventional so with 66% of the yield that represented a net advantage of 1.3 times the gross per acre income. To have produced all the 2008 soybeans Organically would have required 38.2MM additional acres – a 51% increase.

* Top Soybean producing states (>3MM acres harvested)
Organic Spring Wheat represented 0.7% of 2008 acres but only 0.4% of total production. 100% conversion to Organic would have required 8.4MM additional acres, a 62% increase. The higher Organic yields in OR and WA probably represent a different ratio of irrigated to rain-fed production.

* Top Spring Wheat producing states (>1MM acres harvested)
Organic Oats represented 2.9% of 2008 acres in the US, 2.5% of total production, but 3.2% of total potato payments. Organic oats sold at 1.3 times the price for conventional so with 72% of the yield that represented a net advantage of 1.08 times the gross per acre income. To have produced all the 2008 oats in the states shown above Organically would have required 210,000 additional acres – a 30% increase

* Top Oat producing states (>100,000 acres harvested)
Organic Dry Edible Beans represented 0.86% of 2008 acres in the US, 0.69% of total production, but 0.93% of total payments. Organic Dry Beans sold at 1.34 times the price for conventional so with 81% of the yield, that represented 1.08 times the gross per acre income. To have produced all 2008 US Dry Beans organically would have required an additional 344,000 acres, a 24% increase.

* Top Dry Edible Bean producing states (>100,000 acres harvested)
Direct comparisons were only possible for the above states that represent 41% of all US Corn acres. For these states, Organic Corn represented 0.25% of acres, 0.19% of production and 0.2% of total payments. For these states average Organic yields were 77% of conventional so at 1.06 times the price/bu the gross value per Organic acre was only 82% of conventional. To have produced all US 2008 US Corn organically would have required 32MM additional acres, a 40% increase.

* Top Corn producing states (>2MM acres harvested)
For these states, Organic Barley represented 0.83% of acres, 0.6% of production and 0.81% of total payments. For these states average Organic yields were 72% of conventional but at 1.36 times the price/CWT the gross value per Organic acre was 98% of that of conventional. To have produced all the 2008 Barley for these states Organically would have required 1.85MM additional acres, a 39% increase.

* Top barley producing states (>500,000 acres harvested)
Additional Row Crops: Yields (1 of 3)

**Peanuts**
- USA: 78%
- TX: 86%

**Prosso Millet**
- US: 36%
- CO: 29%
- NE: 26%
- SD: 50%

**Rice**
- US: 59%
- CA: 55%

**Rye**
- US: 91%
- GA: 59%

Organic Yield as a Percent of US Average
Additional Row Crops: Yields (2 of 3)

- **Safflower**
  - USA: 31%
  - UT: 69%
  - CA: 22%

- **Sorghum**
  - TX: 52%
  - KS: 52%
  - NM: 41%

- **Durum Wheat**
  - US: 59%
  - MT: 89%
  - ND: 67%

- **Flaxseed**
  - USA: 57%
  - MN: 57%
  - MT: 57%
  - ND: 57%
  - SD: 57%

Organic Yield as a Percent of US Average
Additional Row Crops: Yields (3 of 3)

Cotton

Organic Yield

US Yield

Sorghum Silage

Organic Yield

US Yield

USA

69%

CA

82%

PA

95%
Animal Feed Crops: State Level

Hay
Corn Silage
Organic Hay represented 0.67% of 2008 acres in the US, 0.74% of total production, but 0.57% of total Hay payments. Organic hay sold at 0.77 times the price for conventional so with 110% of the yield, that represented a net of 0.85 times the gross per acre income.

* Top Hay producing states (>2MM acres harvested)
To have produced all 2008 US Corn Silage Organically would have required an additional 6000 acres, a 25% increase.
About the Author, Steve Savage

I have been an independent agricultural technology consultant since 1996. I was originally trained as a Plant Pathologist (Ph.D. UC Davis 1981), but have worked broadly throughout agriculture since then. I have worked for Colorado State University (field research on tree fruit and grapes), DuPont (fungicide screening for global markets), and Mycogen (biological control and natural products). I have since consulted for many major and minor technology companies, grower groups, and academic institutions.

I first learned about Organic from my grandfather in the 1960s, assisting him as he gardened based on guidance from “Organic Gardening” magazine. I met some of the pioneers of the commercial Organic segment in the late 70s. I spent many years of my career working on the development of pest control products that would fit within the Organic guidelines. I have continued to track these technologies and the Organic market in a variety of consulting projects over the past 13 years. While I respect growers who are able to maintain a viable business in the Organic niche, I do not see it as a viable solution for the overall sustainability and production challenges we face on a global level.

In July of 2009 I began blogging about agriculture and agricultural technology on a variety of websites as well as my own site: Applied Mythology (http://appliedmythology.blogspot.com). The analysis presented in this slide set was done as part of this unpaid avocation, not for any client, commercial or otherwise.

Much of the data used for this analysis was in pdf format so there is the potential of manual entry error. I welcome corrections and feedback of any type at feedback.sdsavage@gmail.com