

Is sustainability sustainable?



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Is sustainability sustainable?

- Sustainability: what it is, and what it isn't
- A way forward for agriculture that's affordable, offers continuous advancement and delivers a farmer return on investment

Sustainability isn't
green

Sustainability is
grey

Do consumers understand sustainability?

Grunert et al. (2014) Food Policy 44:177-189



<i>Promoting sustainable agriculture to help farmers, while protecting the local environment</i>	22.0	10.9	13.4
Minimising (soil) contamination when producing food	3.1	3.1	5.3
Protecting wildlife in the rain forest	52.9	48.4	37.8
Reducing the amount of packaging used	1.5	1.6	1.6
Using land and water as efficiently as possible to avoid environmental damage	14.2	15.5	17.6
Don't know	6.3	20.5	24.3
	100.0	100.0	100.0

Do consumers understand sustainability?

University of Wisconsin dining hall survey

Factor	% (n)that selected “not sure what this means” category
Grown under a third-party audited food safety program	12.9% (n=44)
Certified carbon footprint	8.4% (n=28)
Grown with verifiable sustainability practices	4.1% (n=14)
Grown using fair labor standards	4.1% (n=14)
Nutritional value	0.6% (n=2)
Locally grown (within 25 miles of campus)	0.3% (n=1)
Certified organic	0.3% (n=1)
Appearance	0.3% (n=1)
Taste	--
Cost	--

Do consumers understand sustainability?

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ONLY
ONE
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No additives in our tobacco does **NOT** mean a safer cigarette.

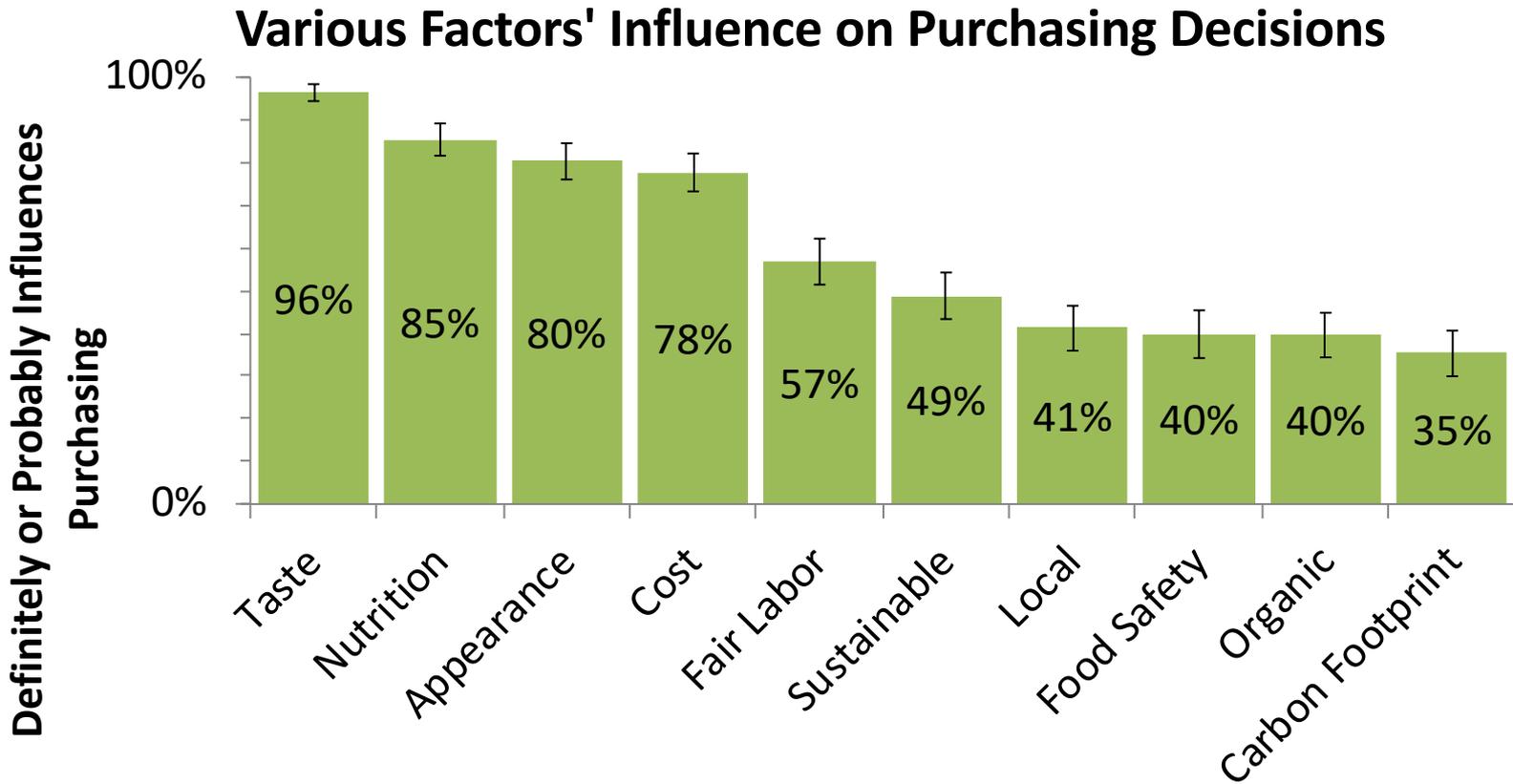
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Sustainability isn't
value-added

Sustainability is
an expectation

Sustainability is an expectation

University of Wisconsin dining hall survey



Sustainability is an expectation

University of Wisconsin dining hall survey

“If the salad greens met your food value priorities, would you pay more for them?”

Est. Weekly Revenue for Gordon Commons based on Prices Diners Would Pay for Salad

Price	% Gordon Diners Who Would Pay	Total Est. Weekly Salad Consumers*	Total Est. Weekly Gordon Salad Buyers	Price per ½ Pound Salad	Est. Weekly Revenue
\$2.00	97%		6,790	\$2.00	\$13,580
\$2.50	74%		5,180	\$2.50	\$12,950
\$3.00	40%	x 7,000 =	2,800	x \$3.00 =	\$8,400
\$3.50	11%		770	\$3.50	\$2,695
\$4.00	6%		420	\$4.00	\$1,680

Will consumers pay for sustainability?

2009 Deloitte/GMA survey

“...most shoppers would like green products to be price competitive. They often don't understand or buy into the rationale that a green product should be more expensive. **Shoppers don't understand why a green product should cost more if it was manufactured with less packaging or it was transported less distance.**”

Sustainability is
measurable
in factories

Sustainability isn't
easily measured
in agriculture



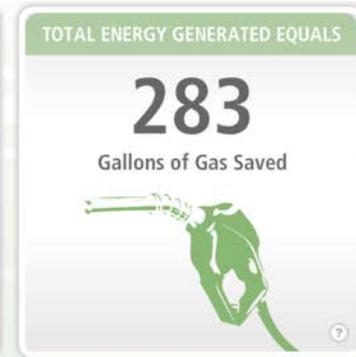
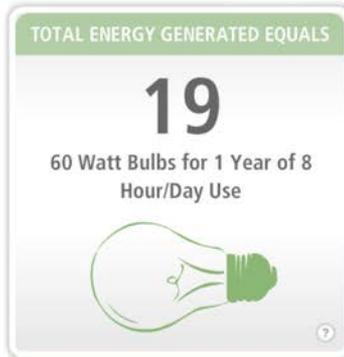
Kettle Foods Wind: **Beloit, WI**

System Size: 10.0 kW DC
Generating Since: September 25, 2007
Last Updated: 8:40am May 7, 2016

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- ABOUT US



- Minute
- Today
- 3 Days
- Week
- Month
- Year

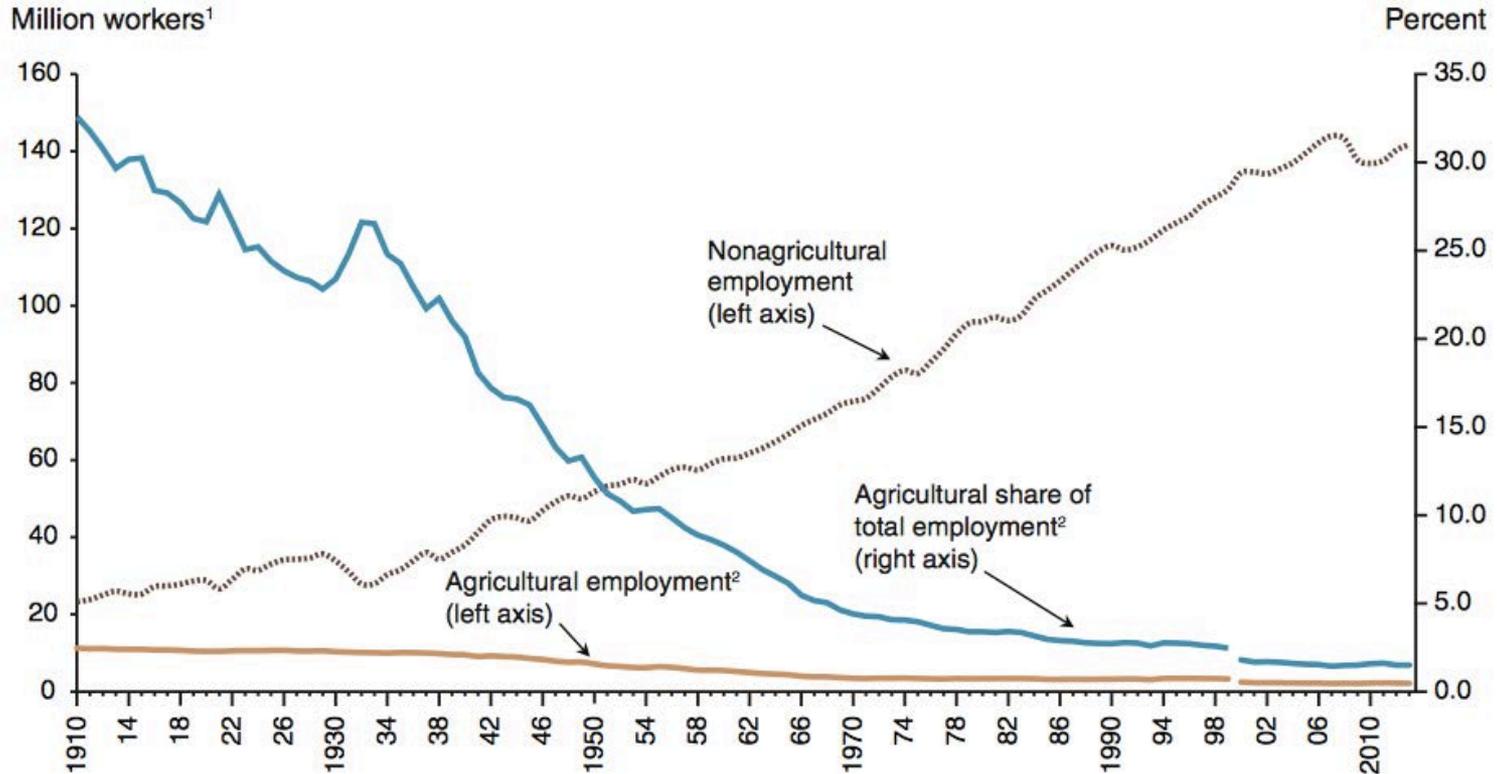


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Sustainability is
hard to communicate

Agricultural and nonagricultural employment, 1910-2013

Agriculture's share of total U.S. employment fell during the 20th century



¹Persons at least 14 years old prior to 1947; persons at least 16 years old in 1947 and later years.

²The breaks in the lines indicate a definition change. From 2000 onward, estimates of agricultural employment actually are for "agricultural and related industries." Veterinary and landscaping services were removed from agricultural employment while forestry, fishing, hunting, and trapping were added (U.S. Dept. of Labor, 2003, p. 20). This resulted in a net decrease of about 800,000 "agricultural" employees between 1999 and 2000 and reduced the agricultural share of total employment from 2.5 percent to 1.8 percent.

Source: USDA, Economic Research Service, compiled from U.S. Department of Labor, Bureau of Labor Statistics data in U.S. Executive Office of the President, 2014, pp. 378-379; and U.S. Census Bureau, 1975, p. 126.

Bad news: Eating local, organic won't shrink your carbon footprint

Grass-fed vs. grain-fed? Wild vs. farmed? Vegetarian vs. vegan? Science shows what's greenest

By Emily Chung, CBC News | Posted: Nov 07, 2017 5:00 AM ET | Last Updated: Nov 08, 2017 7:57 AM ET



Switching to a vegetarian diet is one way to greatly reduce the environmental impact of your food consumption, according to two researchers who have done the math. (Dean Fosdick/Associated Press)

ADVERTISEMENT

An advertisement for the CBC TV App. At the top center is the CBC logo, a red stylized flower-like shape inside a white rounded square. Below the logo, the text "CBC TV APP" is written in a bold, black, sans-serif font. At the bottom of the ad, there are two black buttons with white text and icons. The left button says "Download on the App Store" and features the Apple logo. The right button says "GET IT ON Google Play" and features the Google Play logo.

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Sustainability is
about values and tradeoffs

PRODUCERS

Why The Arctic Apple Means You May Be Seeing More GMOs At The Store

February 1, 2017 · 3:10 PM ET

GRANT GERLOCK

FROM



Arctic Apples are genetically engineered to produce less of the enzyme that turns sliced apples brown.

Courtesy Okanagan Specialty Fruits



MAKING THE PERFECT FRUIT EVEN BETTER

HOW APPLES BROWN

When an apple is cut, bitten or bruised, an enzyme called Polyphenol Oxidase (PPO) triggers the browning reaction



40% WASTED
About 40% of apples grown are wasted

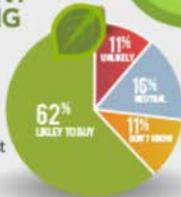


71% MORE

Kids eat 71% more apples when they're pre-sliced

CONSUMERS WANT A NONBROWNING APPLE!

After learning that the browning reaction can be turned off, the majority of consumers expressed interest in buying these apples



HOW DO WE STOP BROWNING?



One way to think of it

We replace one piece of a "railway track" (the PPO genes) on a coast-to-coast railway (genetic code) with a slightly different piece of track



Another way to think of it



ARCTIC® APPLES ARE JUST AS SAFE & HEALTHY AS ALL APPLES



Values and tradeoffs: Local foods vs. greenhouse gases

- Food-related GHG emissions:
 - 83% in raw agricultural production
 - 11% in transportation
 - 4% in final delivery from producer to retail – “food miles”
 - 150% more GHG emissions from red meat than chicken or fish

“Shifting less than one day per week’s worth of calories from red meat and dairy products to chicken, fish, eggs, or a vegetable-based diet achieves more GHG reduction than buying all locally sourced food.”

- Weber and Matthews, Environ. Sci. Technol., 2008

Sustainability is
about agriculture, but...

Sustainability isn't
just about growing more

Agricultural production

- 90% of U.S. water use
- 83% of the average U.S. household carbon footprint/year for food consumption is agricultural production
- Food production and distribution accounts for 17% of U.S. energy use



Food waste

- 40% of food produced is never eaten
- Food waste accounts for 300 million barrels of oil per year and 25% of all water consumption
- If we reduced food waste by 25%, we could feed 43 million people 3 meals a day
 - Ronald Cotterman, Sealed Air Corp.



From: J. Bloom's *American Wasteland*

Source: www.kpbs.org

Sustainability is
crowded



Challenges in sustainability standards

- Currently a high altitude approach that requires on-the-ground input
- Grower engagement is difficult given a lack of incentive to participate
 - More paperwork and traceability = more cost
 - Once a benchmark is set, improvement may be requested/required
 - No return on investment, no premium price

A way forward

Characteristics of a good farm sustainability program

- Developed in partnership
- Simple for farmers to use, but...
- Detailed enough to be useful to the supply chain
- Objective, science-based and defensible
- Reconnects people with where their food really comes from
- Realizes the third sustainability pillar... ECONOMICS
- Customized to commodity, production system and geography
- Delivers a return on investment for farmer participation by optimizing production
- Drives continuous advancement

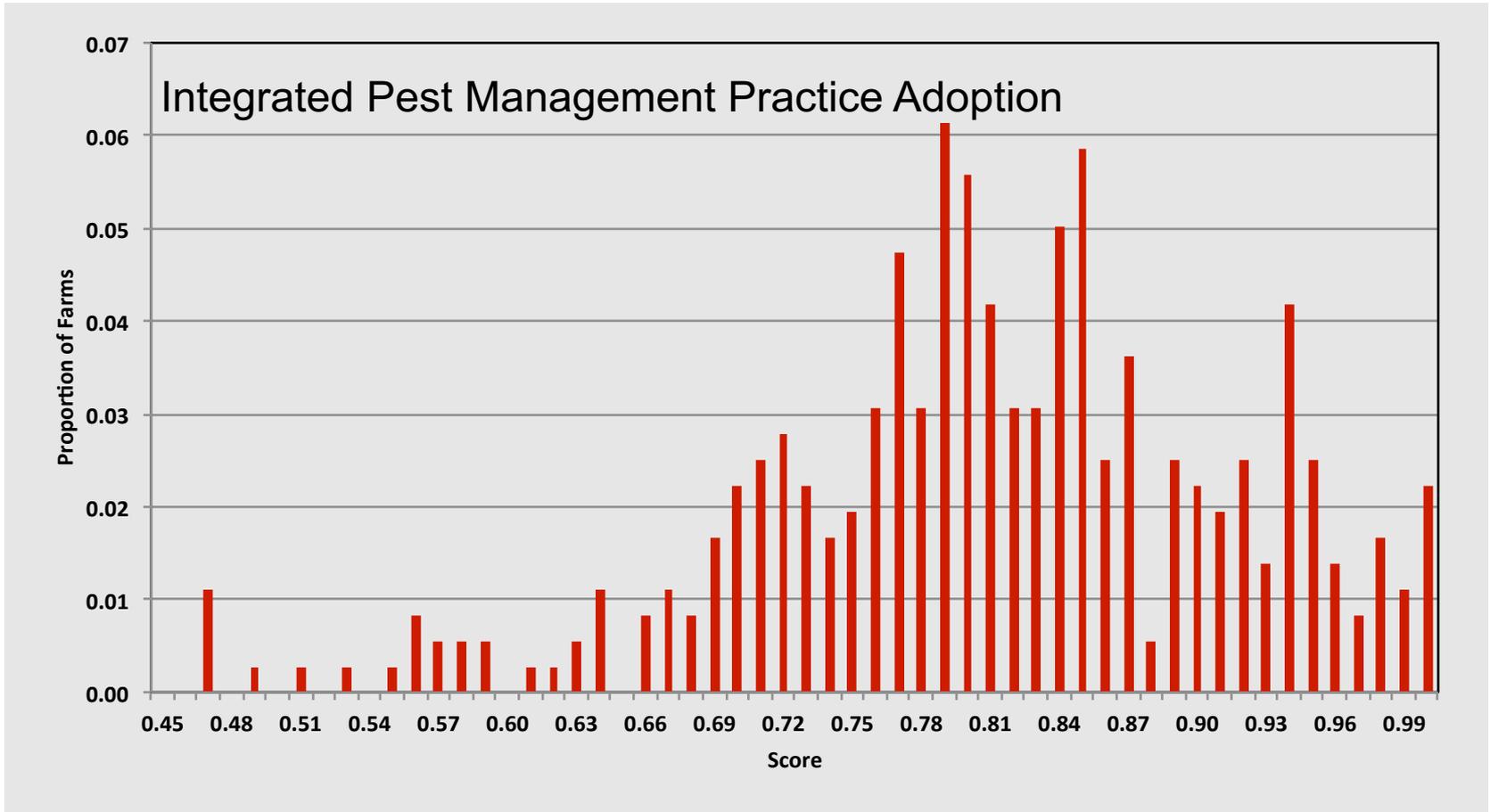
Analytics bring breakthrough benefits

- Inspired by fingerprint and face recognition science
- Single number measures practice adoption intensity
- Results similar to a curved exam, on a scale of 0 to 1
- Self-interpreting
- Objective

Peer-Reviewed Process



Frontiers of Sustainability



Survey results	2009	% change since	
		1999	1989
Cranberry production practices			
Percentage of acreage scouted for insect, plant disease and weed pests	67	+8	+15
Average number of times marshes were scouted per season	14	--	--
Percentage of acreage on which pest management decisions were influenced by scouting	92	--	--
Average number of miles the cranberry crop traveled to a receiving facility	35	--	--
Percentage of growers:			
that hired a professional scout	77	0	+22
using pest thresholds to make pesticide decisions	97	+4	+29
using non-chemical cultural practices for pest management	88	+6	+11
calibrating pesticide and fertilizer equipment	98	+8	+10
basing fertilizer inputs on soil tests	88	+14	+29
basing fertilizer inputs on cranberry tissue tests	88	+15	+32
with weather stations on the marsh	41	+11	+22
basing pest management decisions on recorded weather or pest data	95	+8	+26
that kept records for production practices, such as pest and nutrient management	97	+6	+16
utilizing soil moisture monitoring technology in irrigation scheduling	36	+12	+27
that tested the uniformity of their irrigation system	55	+23	+30
using electricity (rather than fuel) to power irrigation pumps	7	-3	-8
using both electricity and fuel to power irrigation	23	+2	-1
that have created a nutrient management plan	73	+60	+60
with a conservation plan	33	+26	+26
recycling plastics, cardboard, etc. from the farm	79	+20	+43
Grower education and experience			
Average number of years individual growers have been in the cranberry business	26	--	--
Percentage of growers:			
that participate in grower education events	85	-8	-1
that subscribe to cranberry trade journals	98	+5	+9
that host or conduct on farm research	43	+8	+6
that were certified pesticide applicators	96	+1	+14

Farmer reports

Delivering an ROI, driving continuous advancement

Farmer John, Johnson County, WI

	Your Score	Grower Average
Overall Score	84%	86%
Sub-Component Scores	Your Score	Grower Average
Soil Health	72%	90%
Pest Management	93%	88%
Disease Management	89%	86%
Weed Management	84%	83%
Technology Use	82%	87%
Community	88%	83%
Water Use	92%	89%
Record Keeping & Planning	77%	88%
Energy Use	87%	83%
Natural Areas	95%	84%
Professional Development	74%	81%
Employee Management	76%	87%
Economics	78%	90%

SCORE COMPARISON

Survey Practices	Below Average	Average	Above Average	Actual Score
Soil Health	X			72%
Pest Management			X	93%
Disease Management		X		89%
Weed Management		X		84%
Technology Use		X		82%
Community		X		88%
Water Use			X	92%
Record-Keeping & Planning	X			77%
Energy Use			X	87%
Natural Areas			X	95%
Professional Development	X			74%
Employee Management	X			76%
Economics	X			78%

Your three most significant practices

1. Use tissue test to determine supplemental nutrient application
2. Use IPM to determine insect management
3. Plant disease resistant varieties

Three practices to most improve your score

1. Use no-till
2. Provide safety training to employees
3. Correct tire inflation to reduce soil compaction

Your score if had adopted these practices: 93%

Educational Resources

- Sweet Corn Bio-IPM Workbook: “Field Preparation”
- UW Pesticide Applicator Training: <http://ipcm.wisc.edu/pat/>

Reconnecting people to food and farms

Sustainable cranberry production in Wisconsin

Technology... Community...Stewardship

All in a little red fruit

The Wisconsin cranberry industry continues to advance in ways that optimize production based on the latest research while protecting the environment. These improvements in sustainable cranberry production were captured in a recent grower survey conducted by the University of Wisconsin-Madison and the Wisconsin State Cranberry Growers Association.

Optimizing production with technology...

- **Growers send their plants to the doctor.** 92% of growers send soil and plant tissue to laboratories for nutrient analysis to help decide if fertilizer is needed.
- **Growers take their plants' temperature.** 92% monitor temperature in their cranberry production beds to know exactly when damaging frost is around the corner. They use this information to decide when they will use water sprinklers to protect the crop.
- **57% of growers use cutting edge soil moisture monitoring equipment to determine when their crop needs irrigation.** It is expected that the number of growers adopting this technology will increase in the next few years as the new tools are refined, and the growers are supporting research to make this happen.
- **And when in doubt, they consult the experts.** 69% of cranberry growers hire an independent crop consultant or integrated pest management (IPM) expert, trained and updated with the latest tools, to provide regular advice on crop and pest management.

Did you know?

Many people picture cranberries growing in water. Cranberry production beds are only flooded for brief periods of time, and in fact cranberry plants don't grow well if "their feet are too wet." Temporary floods are used to drown insect pests that aren't very good swimmers, to protect the plants during cold periods and during harvest.



Technology... Community...Stewardship

All in a little red fruit

Valuing family and community...



- **Cranberry growers are community leaders.** 31% of growers report involvement in local service and civic organizations, and 28% serve as local community leaders, such as on school boards, local government committees and conservation commissions.
- **They support their neighbors.** The average cranberry marsh has 4.4 full-time employees and 7.9 part-time employees.
- **Cranberries are an integral part of the rural economy.** 81% buy their farm inputs from local sources within the state when available.



Dedicating themselves to being stewards of the land and the environment...

- **It's not just about the cranberries.** For every acre in cranberry production, a grower owns on average 6.3 acres that are conserved as wildlife habitat. A diversity of species, ranging from eagles to wolves, can often be seen around the marsh.
- **Over half of the growers have attended ecological education events in the past 3 years.** 52% have conducted on-farm research in collaboration with scientists, such as universities and cooperative extension.
- **There's always more to learn.** 64% of growers reported attending continuous education events in the past year that focused on farm, crop and ecosystem management.



From decision-support to decision-making

Using big data and machine learning

- We already collect and report vast amounts of “sustainability” data from behind the farm gate
- Next steps: use this data and machine learning to make a predictive tool
- Add economics and a “farm simulator” interface to explore risks and benefits before turning a wheel

Using big data and machine learning to turn sustainability reporting into a predictive tool

Variable	Mean	Minimum	Maximum	LASSO	Marginal Effect
Yield - barrels	354	26	695		
Nitrogen - lb	44	0	74	2.03	0.15
Phosphorus - lb	34	0	106	0	0
Potassium - lb	98	0	221	0	0
# of applications	6.5	0	10.0	11.7	6.8

Using big data and machine learning to turn sustainability reporting into a predictive tool

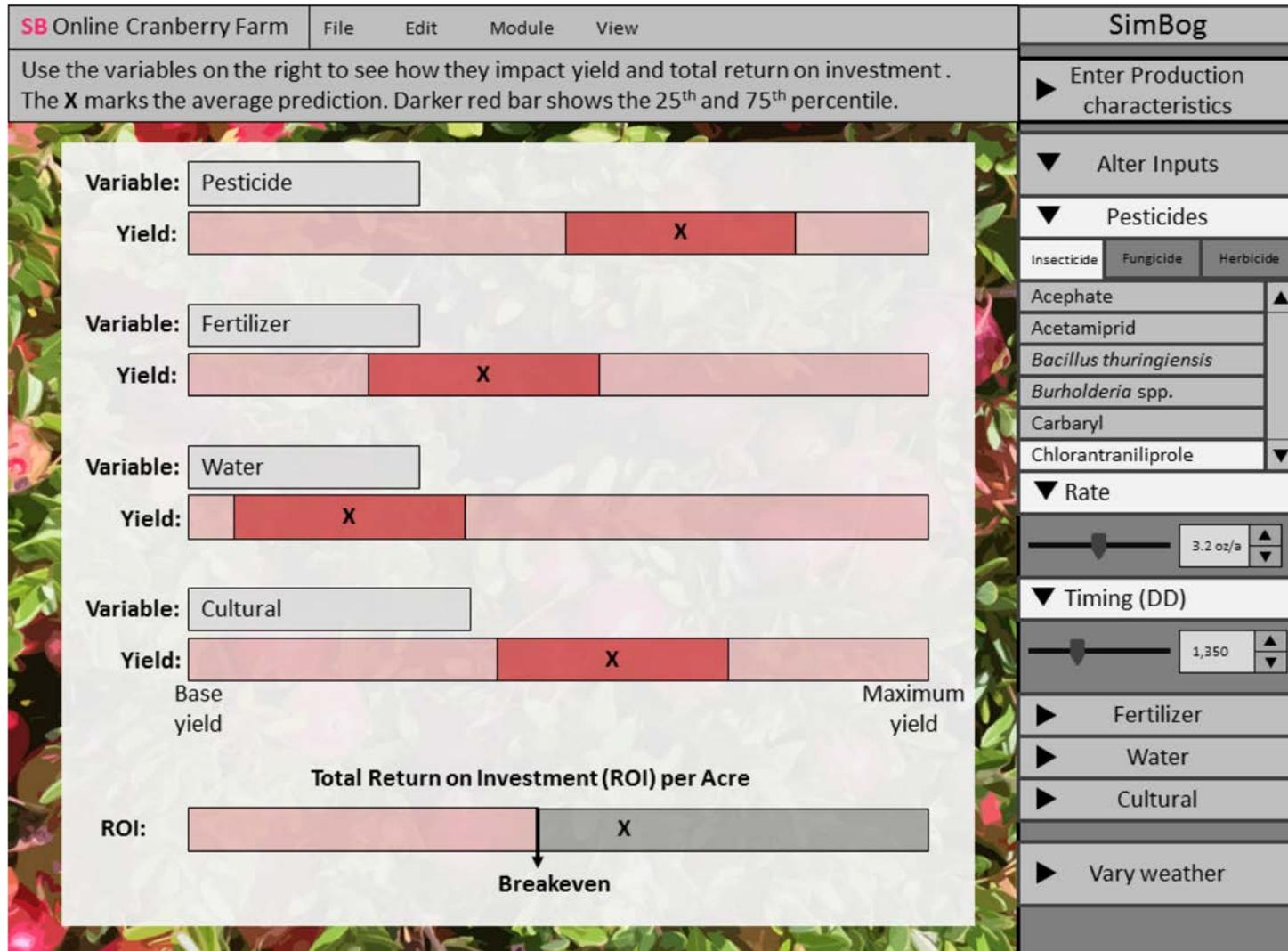
Added barrels

1. Variety
2. Carbaryl (based on few uses)
3. Chlorpyrifos
4. Propiconazole
5. # of fertilizer applications
6. Most recent sanding year

Reduced Barrels

1. Variety
2. Thick ice
3. # ice formation floods
4. Some herbicides (minor injury in absence of weeds has slight yield impact???)

Using big data and machine learning to turn sustainability reporting into a predictive tool



Sustainability isn't going
away

So let's handle it in a way
that we ALL get something
out of it:

Consumers

Supply chain

Farmer