Welcome to the webinar on the economics of grazing organic replacement dairy heifers!

- The webinar will start at the top of the hour.
- To type in a question, use the Q and A box on your control panel. We'll be reading the questions aloud after the c. 45-minute presentation.
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Economics of Grazing Organic Replacement Dairy Heifers

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Western SARE
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The Struggles of Switching to Organics

Organic milk producers often begin as conventional dairy operators who then go through what can be a challenging and costly transition process.

- The Transition:
  - Change animal husbandry, and land and crop management.
  - Source new and different inputs, and initiate the certification process.
  - The pasture and cropland providing feed for organic dairies must be managed organically for a minimum of 36 months.

The Struggles Cont.

- Organic dairy herds are required to be fed 100 percent organic feed and to receive organic health care for 12 months before being certified.
- May not be given hormones
- Daily access to outdoors (except during inclement weather)
- Grazed at least 120 days per year
  - At least 30 percent of cows diet must come from pasture grass during grazing season.
  - Soil and water management plan must be a part of the grazing management plan.

The strict requirements as well as cost associated with certification and compliance can increase the costs or production of organic dairy farms as compared to conventional.

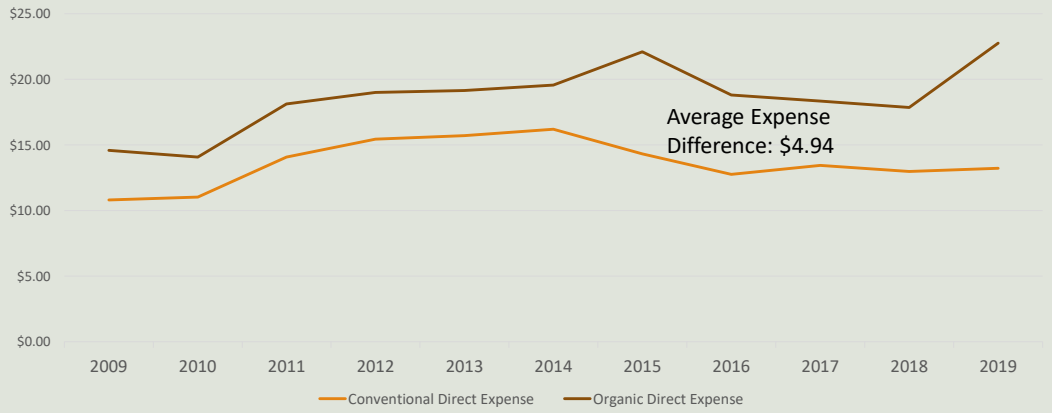
Meeting Demand

Organic milk production has grown significantly over the last 10 to 20 years.

- In 2011, 1,812 farms sold 2.79 billion gallons of organic milk for a total value of $7.63 million
- In 2016, 2,531 farms sold just 4.03 billion gallons for a value of $1.385 billon (USDA, 2017; USDA, 2012).

- Nearly 45% increase in organic milk sales over that period.

Economics of Organic Dairies



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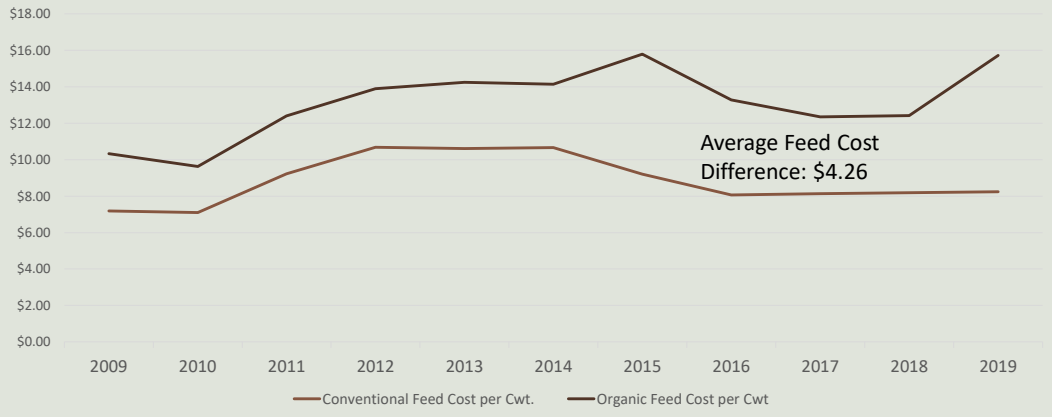

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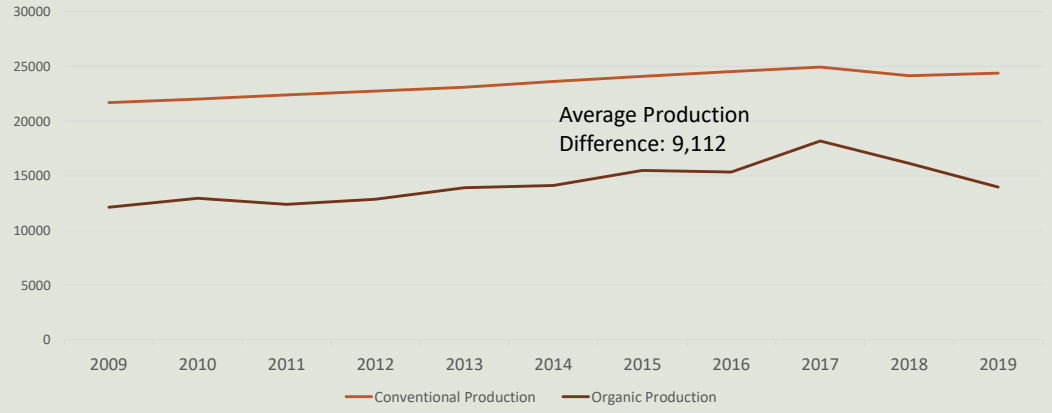

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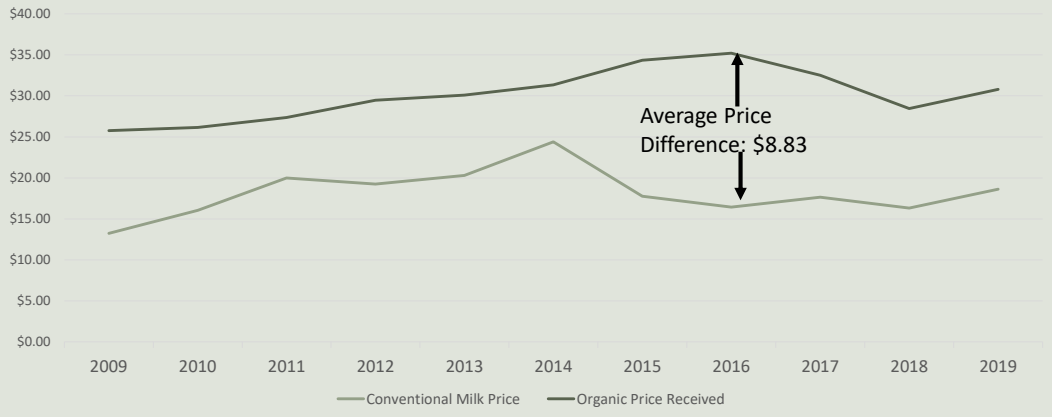

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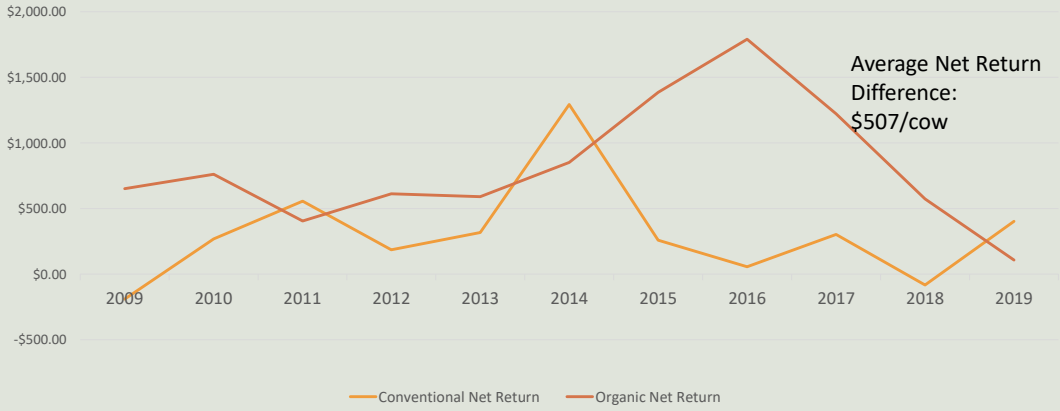
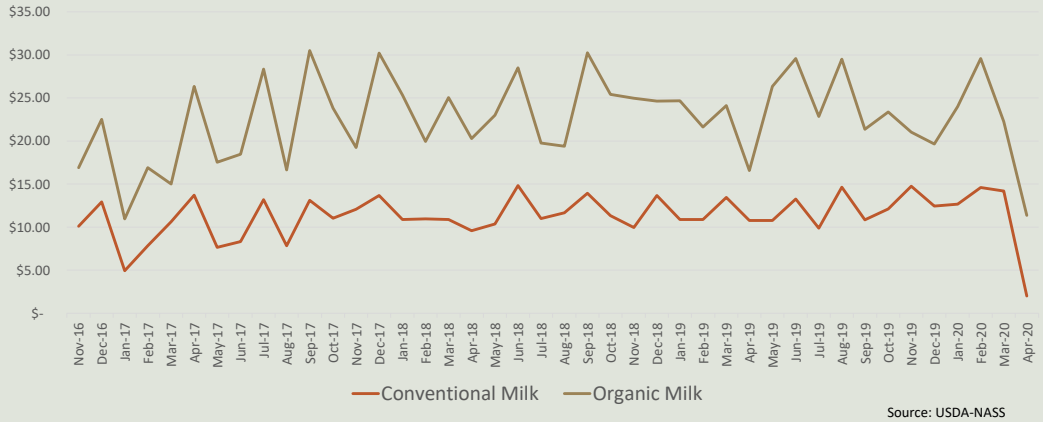
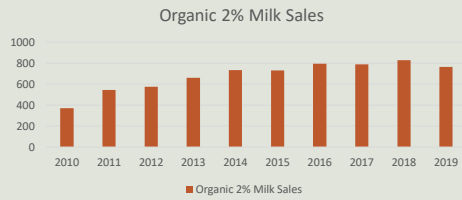


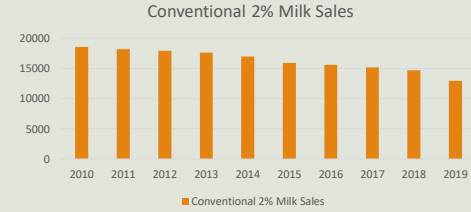
Economics of Organic Dairies-Milk Price

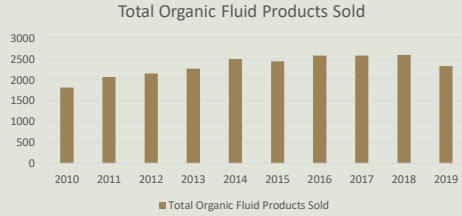


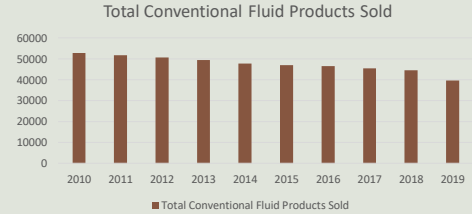
Source: USDA-NASS

Economics of Organic Dairies-Milk Sales









Meeting Demand Cont.

- Greene and McBride (2015) pressures to meet rising organic dairy demand are increased by the 2010 policy change requiring organic dairy cattle to be grazed at least 120 days per year.
  - Suggested with stricter pasture rules raising costs in the organic dairy sector, higher producer prices for organic milk would be required to attract dairy farmers to the organic sector.
  - Concluded by suggesting that to continue to meet increasing demand, research is needed on ways to lower costs and improve the quality of pasture-based dairy systems.

Our current study, in part, answers the call for this type of needed research and demonstrates one possible method of increasing the economic sustainability of largely pasture based organic dairies.

Background and Supplementary Information

- This is a the fourth webinar in a series of webinars highlighting this particular research.
- January 9, 2020: Pasture Mixtures to Improve Sustainability of Organic Pasture-Based Dairy: Nutritive Quality and Dry Matter Intake, by Blair Waldron of the USDA ARS
- February 20, 2020: Effects of Different Pasture Mixes on Heifer Growth and Development. Jacob Hadfield, USU Extension
- March 19, 2020: Forage Legumes in Pasture and Successful Inter-seeding, by Mike Peel, USDA ARS Forage and Range Lab, Logan UT.

Summary of the grazing study

- A grazing experiment was conducted at the Utah State University Intermountain Pasture Research Farm located near Lewiston, UT, USA.
- The details of the experimental design and herbage measurements can be accessed by reviewing the January 9, 2020 webinar.
- The details of heifer growth performance measurements can be accessed by reviewing the February 20, 2020 webinar.
- In brief, yearling Jersey heifers were grazed on 8 pasture treatments: tall fescue ('Fawn', TF), meadow bromegrass ('Cache', MB), high-sugar orchardgrass ('Quickdraw', OG), and high-sugar perennial ryegrass ('Amazon', PR) in monoculture and as binary mixtures with birdsfoot trefoil ('Pardee', BFT).

The Operation

- A replacement dairy heifer producer
  - Considering switching from conventional to organic
  - We consider the use of one of the pasture treatments used in the Lewiston grazing study as the primary forage to fulfill the grazing requirement of organic dairy cows.
  - Do the economic benefits outweigh the costs?

Can producers reasonably expect a positive annual net financial impact by utilizing one of the pasture treatments within an organic operation versus feeding a total mixed ration (TMR) within a conventional system?

Methods

- Partial Budgets can be used to evaluate the expected annual net financial impact of a potential decision.
- Partial budgets consider four categories of financial changes:
  - Increased revenue
  - Decreased expenses
  - Decreased revenue
  - Increased expenses

Partial Budget

- First two categories (increased revenue and decreased expenses) represent positive changes anticipated from making a change
- Second two categories (decreased revenue and increased expenses) represent negative changes anticipated from making a change
- The annual net financial impact of the decision is calculated as the sum of the positive and negative changes.

Pasture Treatment Payback Period

- The pasture treatments are perennials; establishment costs incurred the first year
- Establishment cost represents the initial cost of the 'investment'
- Net annual financial impact from the partial budget represents the annual change to cash flow
  - Payback period of each pasture treatment calculated to compare performance
    - Payback period= Initial cost of the investment / annual expected increase to cash flow
    - Once the establishment costs have been covered, the annual net financial impact of the pasture treatment is the benefit producers could expect from using the selected forage versus TMR feeding in a confined lot

Partial Budget Assumptions

- Number of heifers: 100
- Days on Feed: 105
- Pasture Utilization: 85%
- Dry Matter intake (kg/day/cow): 7.17 (amount fed to target 0.8 kg ADG)
- Price conventional short bred heifer: $800
- Price conventional open heifer: $400
- Organic premium ($/hd.): $225

Partial Budget Categories

Positive Impacts		Negative Impacts	
Increased Incomes		**Increased Expenses**	
Sale of Replacement Heifers		Forage value	
		Chilean nitrate Fertilizer	
		hydrolyzed poultry feathers	
Total Increased Incomes	$0	**Total Increased Expenses**	$0
Decreased Expenses		**Decreased Incomes Expected**	
TMR		Sale of Replacement Heifers	
Total Decreased Expenses	$0	**Total Decreased Incomes**	$0
Total Positive Impacts	**$0**	**Total Negative Impacts**	**$0**
		NET ANNUAL FINANCIAL IMPACT =	**$0**

Decreased Expenses

- TMR
  - $0.175/kg.
    - 2017 and 2018 feed rations used in conjunction with the past 5 years historical average for feed components
  - 7.17 kg fed per day per cow, 105 days, 100 heifers

- **$13,175 decrease in expenses as a result of not feeding TMR**

Increased Expenses: Forage Value

- Producer may own the land but there is always an opportunity cost to consider
  - $205/ hectare rental rate for irrigated cropland average from 2014-2019 for Utah (USDA-NASS, 2019)

- Forage treatment value $/kg. can be calculated as
  - $FV_i = \frac{GR}{(HM_i * HE_i)}$
  - where FV_i is the calculated forage value for the ith pasture treatment ($/kg), GR is the assumed grazing rate ($/hectare), HM_i is the pre-graze herbage mass (kg/hectare) for the ith pasture treatment, and HE_i is the assumed harvest efficiency percentage for the ith pasture treatment.

Forage Value Increased Expense Example

Example: Tall fescue + birdsfoot trefoil

$$FV_i = \frac{GR}{(HM_i * HE_i)} = \frac{205}{(3443 * 0.85)} = \$0.07/\text{kg}.$$

100 heifers requiring 7.17kgs per day for 105 days results in increased forage expense for Tall fescue + birdsfoot trefoil of $5,274.

The forage value for the other various treatments can be calculated similarly.

Increased Expenses: Organic Fertilizers

- Chilean nitrate (sodium nitrate, 15-0-2, N-P-K) applied at 28 kg N ha^{-1} to all treatments in April (both monoculture and mixtures)
- Grass monocultures receive a second application of 28 kg N ha^{-1} of Chilean nitrate in July
- Grass monocultures also receive 35 kg N ha^{-1} in the form of hydrolyzed poultry feathers annually as a slow-release source of Nitrogen

- Price Chilean nitrate fertilizer $9.26 kg N
- Price hydrolyzed poultry feathers $9.19 kg N

Increased/decreased Income: Sale of Organic Heifers

Net change in income between grazing on the selected forage treatment as compared to feeding TMR in a dry lot is

$$\Delta I = \left[\left(N(1 - C_f)(P_o + O_p)\right) + \left(N(C_f)(P_b + O_p)\right] - [(N(1 - C_{dl})(P_o)) +$$

Conception Rates

- Funston and Larson (2011) found no significant difference between final pregnancy rates when comparing Angus beef heifers fed exclusively in a dry lot versus heifers grazed on corn residue and grass during the winter with some supplemental dry lot feeding when necessary.
  - Some evidence (p=0.08) that AI pregnancy rates lower for the grazing heifers as compared to the dry lot fed heifers.

Thus, we might expect only a small decrease in conception rates of the pasture fed heifers as compared to the TMR fed heifers holding all else constant.

- "All else" was not constant.
  - We found significant differences in total BW gain among the treatments. In general the monoculture grazed heifers gained less on average as compared to the BFT mixed treatments as well as the TMR.

Conception Rates Cont.

The literature is somewhat divided as to the effect of BW gain prior to breeding on the overall conception rates

- Krpálková et al. (2014) found that both conception rate to first service and overall conception rate in the first breeding season decreased with increasing ADG between 6 and 14 months of age
- Brickell et al. (2009) found that more services per conception were required for heifers with an increased growth rate from 30 days of age until breeding
- Hayes et al. (2019), however, found that an increased ADG overall between birth and breeding has a positive effect on conception rates at first service

Conception Rates Cont.

Hayes felt that this contradictory finding could be due to differences in cow type and management system.

- Specifically, their study was an observational study using a pasture-based system where as the other studies mentioned were not strictly pasture-based.
- As our study is pasture based, we feel it is most appropriate to align or assumptions with Funston and Larson (2011) as well as Hayes et al. (2019)
  - 5% reduction in conception rate for all pasture fed heifers
  - Additional 5% reduction for monoculture grazed heifers

Our average first service conception rate for TMR fed heifers was 53%

Our assumed conception rates for mixed forage and monoculture fed heifers are 48% and 43% respectively.

Example Completed Partial Budget: Meadow Brome + BFT

Meadow Brome + BFT			
Positive Impacts		**Negative Impacts**	
Increased Incomes		**Increased Expenses**	
Sale of Replacement Heifers	$20,500	Forage value	$4,583
		Chilean nitrate Fertilizer	$5,796
		hydrolyzed poultry feathers	$0
Total Increased Incomes	$20,500	**Total Increased Expenses**	$10,379
Decreased Expenses		**Decreased Incomes Expected**	
TMR	$13,175	Sale of Replacement Heifers	
Total Decreased Expenses	$13,175	**Total Decreased Incomes**	$0
Total Positive Impacts	**$33,675**	**Total Negative Impacts**	**$10,379**
		NET ANNUAL FINANCIAL IMPACT =	**$23,296**

Establishment Costs

Table 1. Fixed Establishment Costs

Category	Value
Tractor and Planter	
Repair Costs $ hour^{-1}	8.33
Fuel Costs $ hour^{-1}	13.20
Lubrication $ hour^{-1}	1.98
Labor $ hour^{-1}	16.50
Planter Costs $ hour^{-1}	15.50
Total Costs $ hour^{-1}	55.51
Hectare hour^{-1}	2.94(mono); 1.47 (mix)
Total Costs $ hectare^{-1}	23.62(mono); 47.24 (mix)
Seed Cost $ hectare^{-1}	66.68(TF)-160.52(OG-BFT)
Establishment Costs $ hectare^{-1}	90.30-270.76

Based on 150 horse power tractor and 15 foot drill

Results

Table 2. Pasture treatment establishment costs, annual net financial impact, payback period, and break-even organic premium

Pasture Treatment	Establishment Cost		Annual Net Financial Impact		Payback Period (years)		Break-Even Organic Premium
Meadow Brome + BFT	$4,665	c	$23,177	a	0.20	b	-$8
Tall Fescue + BFT	$4,783	bc	$21,683	a	0.22	b	$8
Perennial ryegrass + BFT	$5,134	b	$21,177	a	0.24	b	$13
Orchard Grass + BFT	$5,568	a	$21,341	a	0.26	b	$11
Meadow Brome	$3,411	e	$2,151	b	1.59	a	$198
Orchard Grass	$4017	d	-$1363	b	N/A		$230
Tall Fescue	$2,695	f	-$1243	b	N/A		$232
Perennial ryegrass	$4,602	c	-$19,053	c	N/A		$392

Note: Estimates are based on 105 days of feeding for 100 head of replacement dairy heifers
Pasture treatments followed by different letters (a,b,c,d,e,f) are significantly different (p = 0.05).

Results Continued

The BFT mixture treatments all have similarly low payback periods (no statistical difference, p=0.05) suggesting that they are better investments as compared to the other monoculture pasture treatments.

This finding is in line with previous research findings.

- Waldron et al. (2018) within their study, beef steers were grazed on four pasture treatments; tall fescue mixed with alfalfa, tall fescue mixed with birdsfoot trefoil, and tall fescue in monoculture fertilized and unfertilized.
- Found that the most value added (USD/steer) as well as the highest net returns (USD/ha) could be expected from grazing beef steers on the BFT mixed treatment.
- Grazing pastures of tall fescue mixed with alfalfa or BFT was more economically viable than grazing tall fescue in monoculture either fertilized or unfertilized.
- Our results would similarly suggest, all BFT mixed pasture treatments in this study have the potential to be economically viable. Conversely, no monoculture pasture treatments, other than meadow brome, would be expected to be economically viable as they have an expected negative annual net financial impact.

Conclusions

Based on payback period the 'meadow brome + BFT' treatment would be the optimal forage treatment choice.

- The BFT mixture treatments all have similarly low payback periods
- Producers should consider carefully seed availability and cost as well as the individual needs of their operations.
- Break-even analysis on the assumed organic price premium reveals that for all treatments other than meadow brome + BFT a positive price premium is required for organic heifers though the other BFT mixture treatments would all be expected to break even with relatively low (<$15) organic premiums.

Conclusions Continued

- Dairy farmers considering a change from conventional to organic replacement heifer programs should select a forage treatment most suitable for their soil and climate and should plant as a mixture with a tannin-containing, non-bloating legume such as birdsfoot trefoil.

- Before making this large operational change, individual farmers must consider the reliability of the organic dairy market in their area as well as the projected price premium for organic dairy replacement heifers as the economic success of an organic heifer development program relies heavily on strength of the organic market.

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