Finances and returns for robotic dairies

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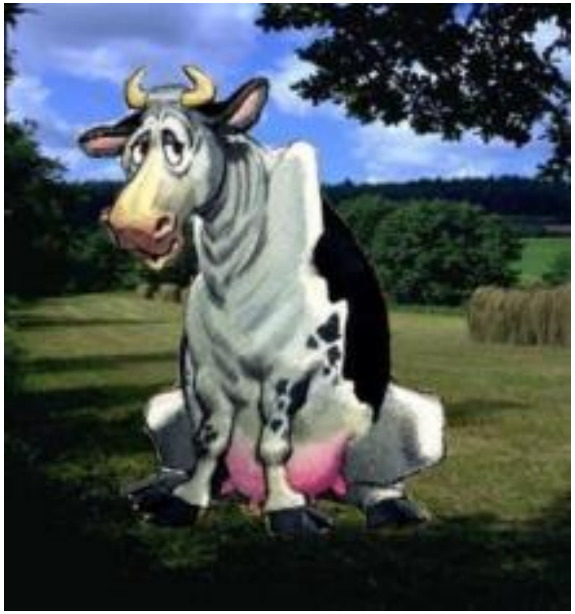
Introduction- Robotic milker usage is growing quickly

- According to estimates there are over 35,000 robotic milking systems (RMS) worldwide
- Sales of milking robots are growing rapidly with 5,180 units sold in 2014 (IFR Statistical Dept, 2015)
- Initially farms in countries with high milk prices, high labor costs and high yielding cows installed RMS (Lind et al., 2000)
- Improved lifestyle is the number one reason for installing robots
- Profitability of robotic milking systems must be considered

Potential AMS Advantages

Provides Data

- Milk production etc
- Over 100 measurements at every milking
- Timely decision making



Other benefits:

- Consistent milking routine
- Higher skilled labor
- Never late for work
- Never needs training
- Doesn’t need scheduling or holidays off

Potential challenges

- “Plug and play,” “Plug and pray,” or “Plug and pay”
- Low Return on Investment? (compared to what?)
- Obsolescence
- Repair costs

Adapted from Bewley, 2015

Outline

- Comparing profitability of robotic systems to parlor systems
  - Herd size effect
  - Milk production effect
  - Labor effect
- Keys to optimizing robot efficiency

http://z.umn.edu/RobotParlor

Cost/Value (small farms)

- Expensive – compared to what???
- Family dairy looking to expand
- Trade offs
  - labor (hired and family)
  - capital investment
  - lifestyle
- Choices:
  - low cost parlor – hired/family labor
  - modern parlor – hired/family labor
  - AMS – family labor

Cost/Value (larger farms)

- Do you need a new parlor?
- How much is the information worth?
- 2X vs 3X vs robot milking
- How much time is spent hiring, training and managing labor?
- Future labor availability
- Trade offs (what devil do you want to deal with?)
  - labor (hiring, training and managing)
  - repair costs
  - on call 24/7
  - trickier feeding management

Conventional farms have greater margin than robot farms

Item	Robot	Conv	P
Gross margin over direct costs	$231,542	$232,519	0.754
Total nonaccountable costs	$79,614	$65,025	0.002
Contractor labor	$21,783	$15,361	0.004
Utilities	$10,337	$8,788	0.021
Mach & Equip maint & ins	$28,088	$24,411	0.136
Land, Bldg, maint & ins	$7,404	$5,371	0.104
Avail for overhead & profit	$151,198	$167,494	0.046

Bijl et al, 2007, JDS, 90:239-248

On a FTE-basis, robots have greater margin than conventional farms

Item	Robot	Conv
Cows/FTE	74	59
Total revenues/FTE	$206,378a	$164,250b
Total costs/FTE	$57,796	$48,463
Margin on dairy production/FTE	$148,582a	$115,787b
Gross margin/FTE	$163,056a	$127,939b
Avail for overhead & profit/FTE	$101,372	$88,429

Bijl et al, JDS, 2007, 90:239-248

[a,b] Difference within row (P <0.05)

FinBin Data indicates that robot farms have higher costs, but greater milk production per cow and FTE

Item	Robot	Conv	Diff
Milk/cow, lb	23,532	21,526	+2006
Milk per FTE, lb	2,206,100	1,542,900	+663,200
Feed cost/cwt milk	$9.57	$10.25	-$0.68
Direct cost/cow/yr	$3,261	$3,189	+$72
Overhead cost/cow/yr	$898	$558	+$340
Net Return/cow/yr	$406	$483	-$77
Dep + Int/cow/yr	$547	$253	+$249

U of MN Finbin www://finbin.umn.edu, data from 2011-2015

Assumptions consistent across all scenarios

Item	Value
Chore labor rate	$16.00/hour
Management labor rate	$25.00/hour
Milk Price	$7.71/kg ($17.00/cwt)
Cost per kg/DM	$0.050/kg ($.011/lb)
Loan interest rate	5%
Equity interest rate	5%
Weighted avg cost of capital	3%
Loan term on barn	20 year
Loan term on robot	10 year

240 cow scenario assumes 4 robots and D8 parlor

Investment[1]

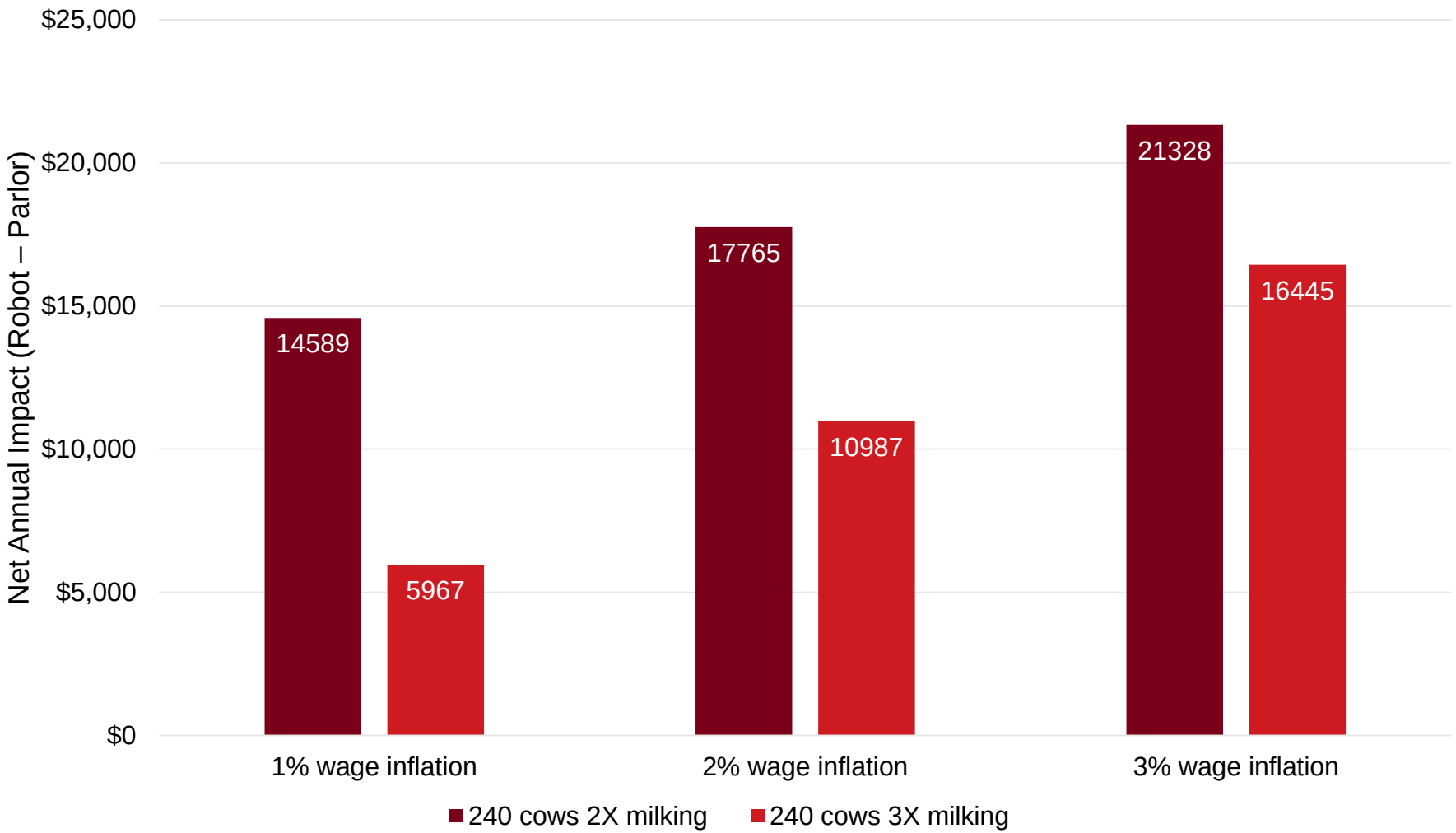
- Robot (4)
  $2,400,000
- Parlor (D8)
  $1,352,000

Milking Labor

- Robot (45 m/r/d)
  2.5 hr/d
- Parlor (64 c/hr)
  2X - 16 hr/d
  3X – 24 hr/d

[1]Includes new barn cost

Four robot system compared to D8 Parlor[1]



[1]Robot milk per cow +5 lb/day for 2x milking and -2.0 lb/d for 3X milking

1500 cow scenario assumes 25 robots and D24 parlor

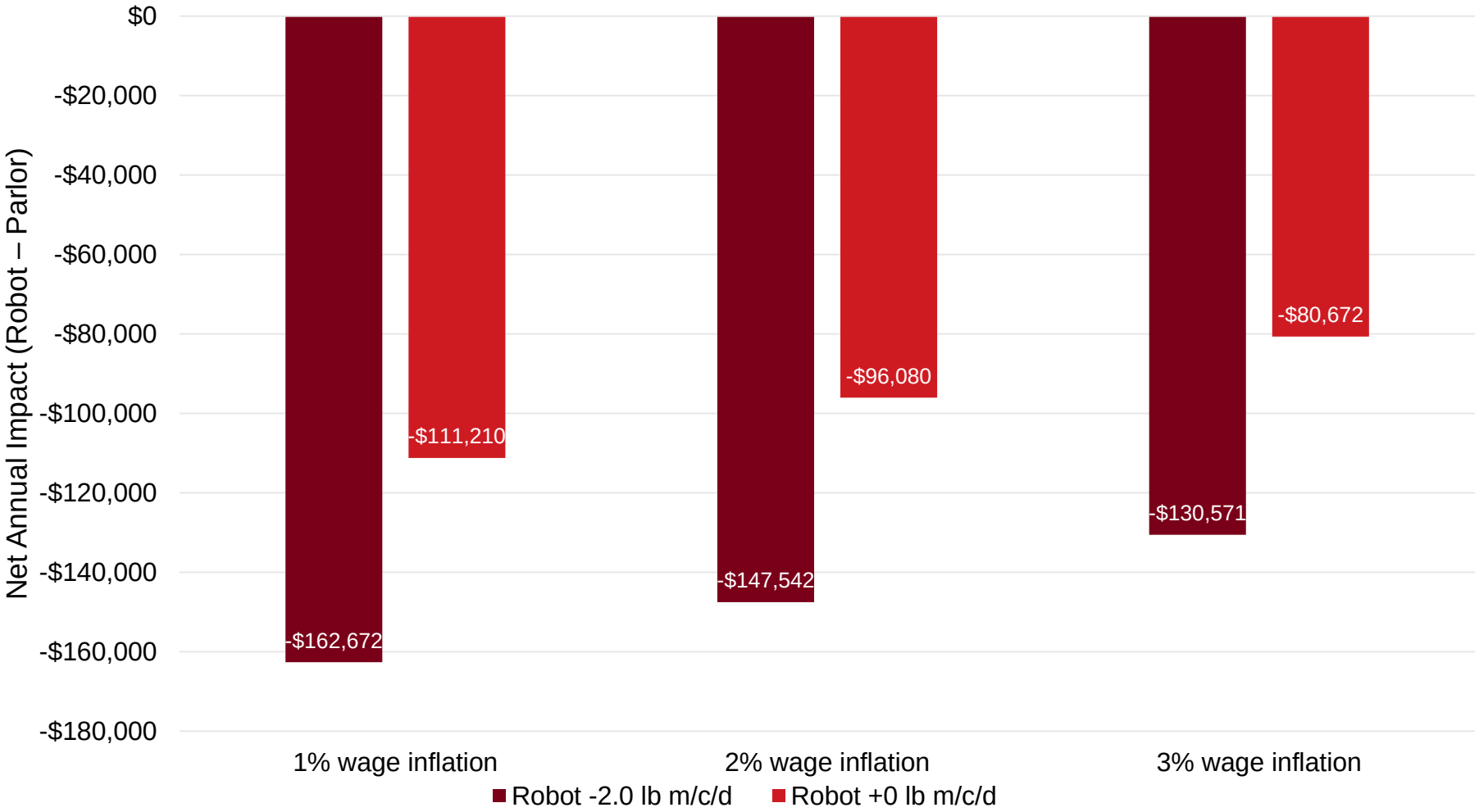
Investment

- Robot (25)
  $13,750,000
- Parlor (D24)
  $6,786,000

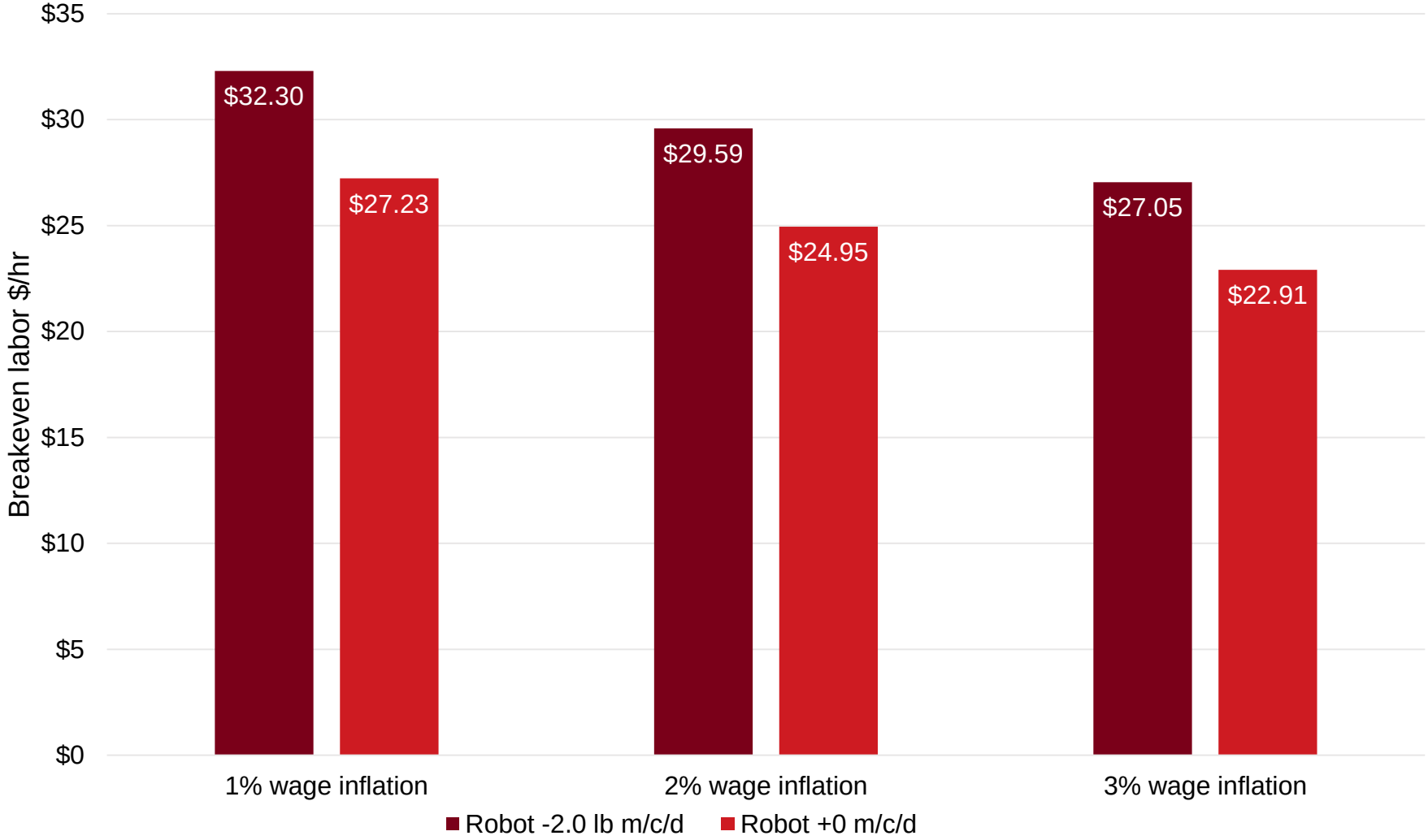
Milking Labor

- Robot (45 min/RMS/d)
  16.75 hr/d
- Parlor (200 c/hr)
  81.2 hr/d

Net annual income for a 1500 milking cow dairy - 25 robots compared to D24 parlor

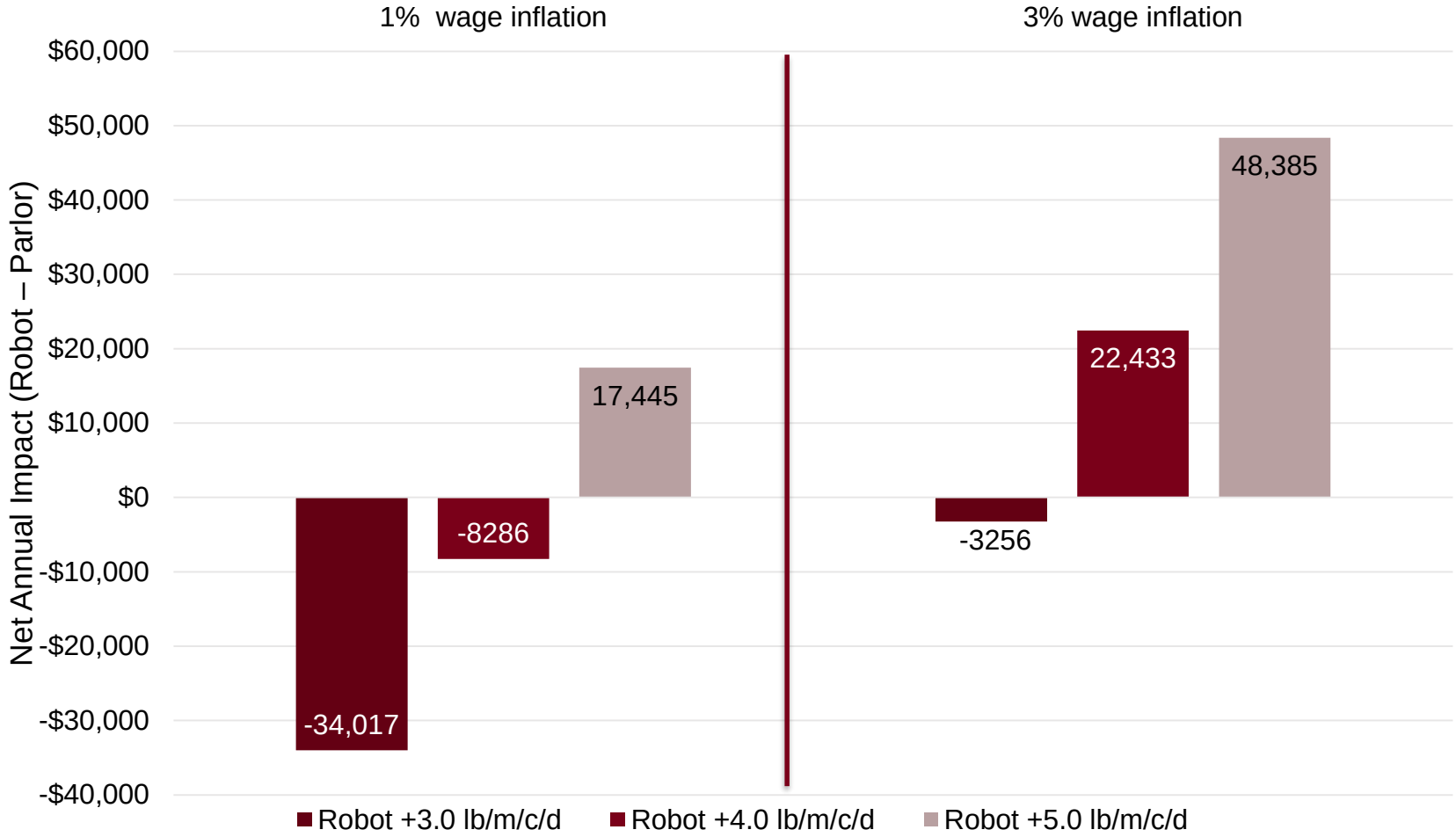


Breakeven labor rate for 1500 milking cow dairy - 25 robots compared to D24 parlor



Milk production and wage inflation affect annual impact

25 robot system compared to D24 Parlor



Affect of labor and lifespan on annual profitability per robot for 4 robot system[1]

		Robot lifespan (years)				
		8	10	13	15	17
Projected Milking Labor (min/robot/d)	38	($9045)	($6223)	($3475)	($2167)	($1103)
	45	($9526)	($6717)	($3989)	($2694)	($1644)
	60	($10,489)	($7706)	($5016)	($3748)	($2725)

2 lb/cow/d decrease in milk yield

		Robot lifespan (years)				
		8	10	13	15	17
Projected Milking Labor (min/robot/d)	38	($5618)	($2789)	$62	$1439	$2572
	45	($6159)	($3283)	($452)	$912	$2031
	60	($7122)	($4272)	($1480)	($143)	$950

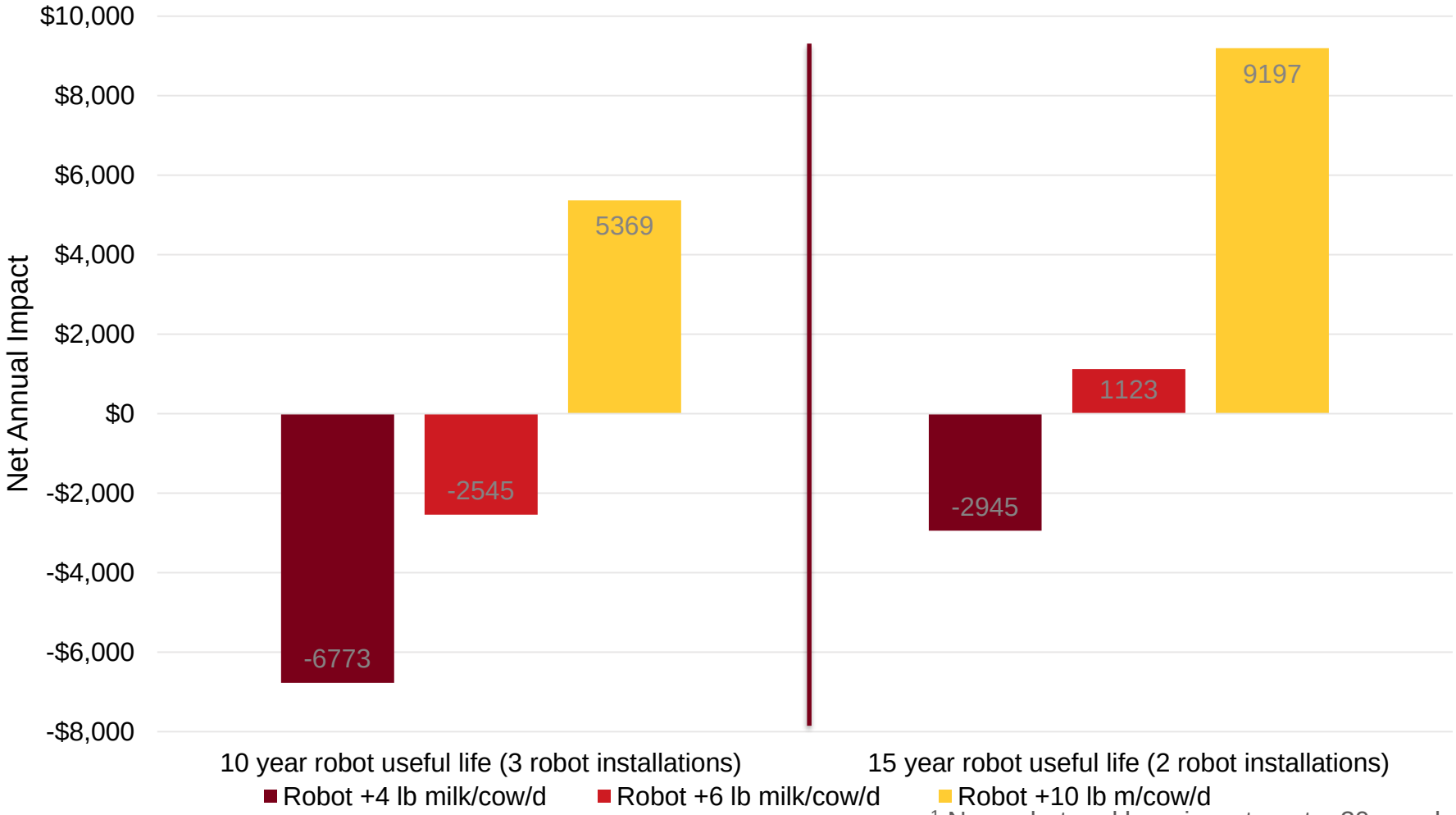
No change in milk yield

		Robot lifespan (years)				
		8	10	13	15	17
Projected Milking Labor (min/robot/d)	38	($2329)	$527	$3851	$5026	$6228
	45	($2810)	$133	$3067	$4499	$5687
	60	($3774)	($855)	$2039	$3445	$4606

2 lb/cow/d increase in milk yield

[1]New robot investment only – no new barn investment

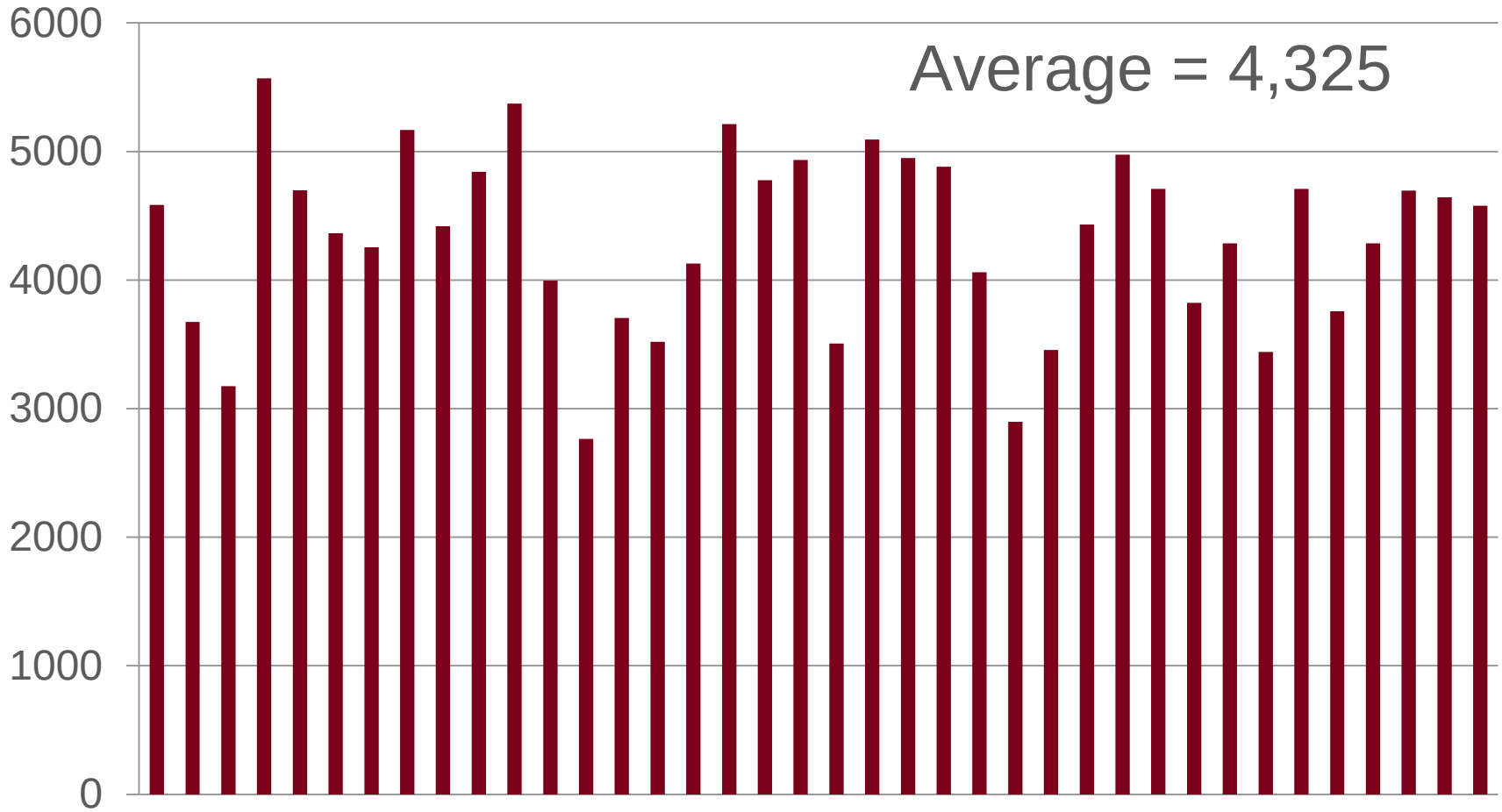
Affect of production and useful life on annual profitability for 4 robot system[1]



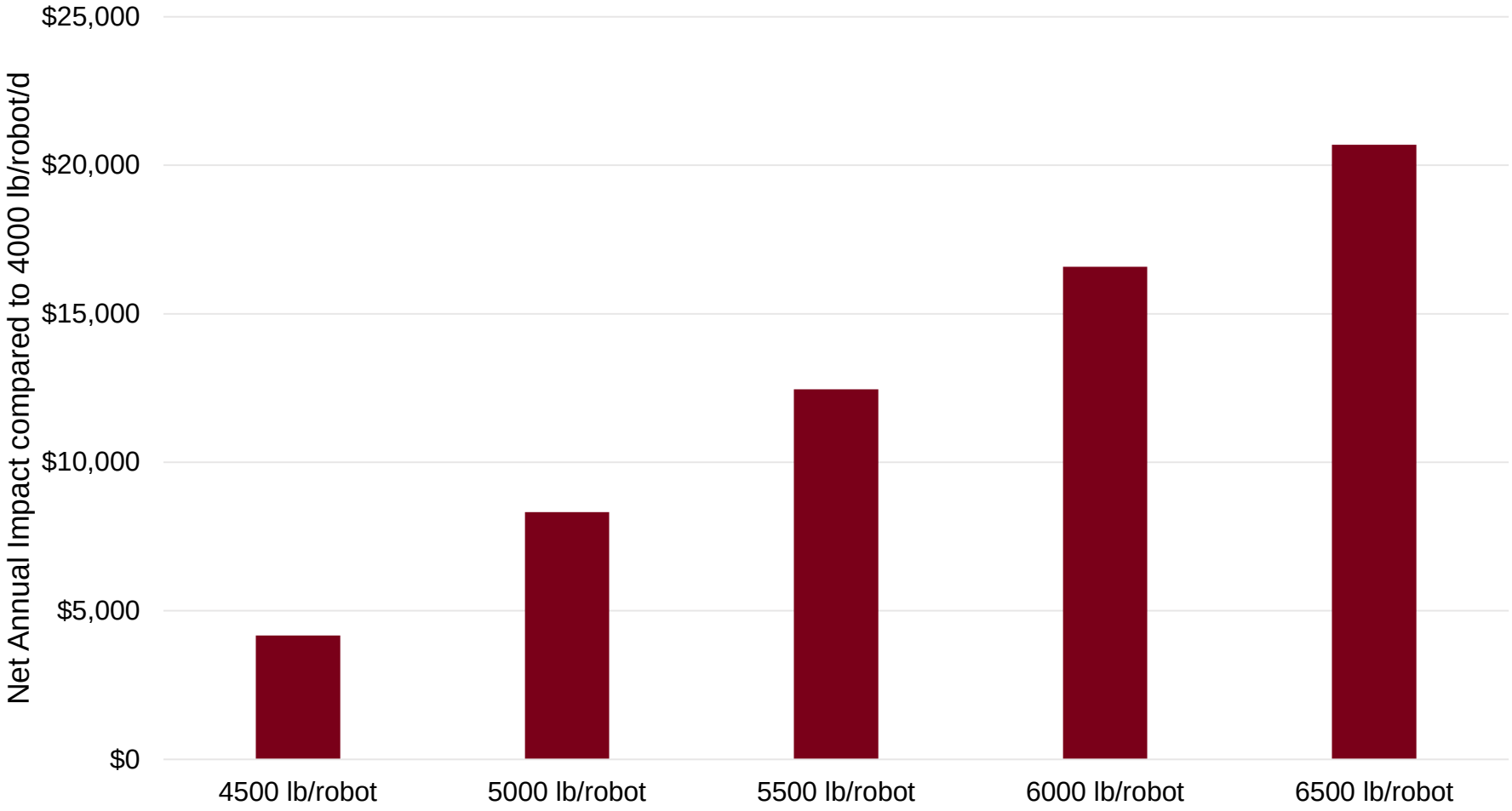
[1] New robot and barn investment – 30 year barn life

Milk per robot

Farms averaged over 2 tons of milk per robot



Net Annual impact by milk yield per robot[1]



[1]Net annual impact per robot compared to 4000 lb/robot/d

High milk per robot is possible

Device Name	Milk Yield last 24hrs	Avg Yield Per Day Last 7 days	Milk Yield To Tank Last 24hrs	Avg Yield To Tank Per Day Last 7 days	Avg. Yield / Milking Last 24h	Milkings Last 24hrs	Divert Milking Last 2
VMS 1	6778.9	6399.7	6778.9	6388.2	39.9	170	
VMS 2	6148.9	5915.7	6148.9	5830.9	41.3	149	
VMS 3	6492.4	6131.8	6492.4	6131.8	40.1	162	
VMS 4	6871.5	6319.4	6871.5	6255.0	40.4	170	

A major factor affecting high yield per robot is high yield per cow.

There is a significant correlation between yield per cow and yield per RMS (r = 0.83)

Salfer and Endres, unpublished

Visits per day, milking speed cows per robot and concentrate per cow is associated with more milk per robot.

Variable	Estimate
Milking visits per day	746.3
Milking speed	387.0
Cows per RMS unit	70.8
Concentrate per cow	92.8

Salfer and Endres, unpublished

Milking time, speed

	Milking time (minutes)	Milking speed (L/min)
Average	5.5	2.8
Minimum	4.5	2.3
Maximum	6.3	4.7

Salfer and Endres, unpublished

Residual feed, alley scraping and stall surface is associated with less milk per robot.

Variable	Estimate
Residual feed per cow	-177.5
Alley scraping	-460.5
Stall surface	-394.6

Salfer and Endres, unpublished

Keys to increasing milk per robot

- High milk production per cow
  - Fetch early lactation cows more frequently to maximize lactation potential
  - Well balanced diets and excellent transition cow program
  - High reproductive efficiency
  - Excellent cow comfort
  - Low somatic cell count
- Minimize box time per cow
  - Cows that attached fast
  - Cows that milk fast
  - Carefully thought out milking permission settings
    - Each 5 seconds more/milking = one less cow
- Minimize free time
  - May increase the number of fetch cows in free flow systems

Reduced box time per cow

- Select for cows that milk and attach fast
- Keep RMS equipment in top working condition
- Singe udders
- Trim tail switches

Milk per cow

Milkings per day, milking speed, concentrate and exit lane length is associated with more daily milk per cow.

Variable	Estimate
Milking visits per day	14.8
Milking speed	7.5
Concentrate per cow	2.0
Length of exit lane	0.7

Salfer and Endres, unpublished

Residual feed and failed milkings is associated with less daily milk per cow.

Variable	Estimate
Residual feed per cow	-4.4
Failed milking visits/cow	-1.1

Salfer and Endres, unpublished

Summary

Main management factors affecting profitability include:

- Milk production per robot
- Milk production increases compared to other milking systems
  - Trading manual to more productive management labor
- Labor savings compared to other milking system option

Summary

Other factors include:

- Robot useful life
- Wage inflation

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