

Modeling mitigation efforts on regional dairy farms

High Plains Dairy Conference
March 5-6 2024


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Agenda


- What is the process?
- Regional results
- Other modeling efforts

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Modeling and regional experts convene to discuss inputs and outputs of project



Regional experts:
 Researchers
 Extension employees
 S/R and cooperative representatives
 Local on-farm advisors (CCAs, nutrient management planners, nutritionists, etc.)



Model:
 Integrated Farm System Model
 Run by Al Rotz



Inputs:
 Farm size and region
 Milk/cow
 # Replacements
 Typical ration
 Manure

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In each state/region 2-3 farms are chosen, and intermediate and maximum scenarios are run

- Why 2-3 farms?
 - It is impossible to find 1 farm that represents all dairies of a region
- Why intermediate and maximum scenarios?
 - Intermediate – deemed feasible by the local experts – most likely items to be adopted and at rates of adoption that seem plausible
 - Maximum – best case scenario, all reasonable (cost, technology/advisory support) barriers alleviated

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Open lot system showed a maximum reduction of 45% of the GHG footprint

	2200 – open lot
More efficient protein & P feeding	13.4
Enteric methane inhibitor, 30% reduction	25.3
Heifers in barns (for manure handling/collection)	
Scraped feed lane, slurry storage	25.2
Anaerobic digester with electricity production	34.9
AD with covered basin & flare	38.2
AD, nutrient extraction, no digestate storage	38.4
Solid separation and use as bedding	
Electrical use efficiency improved 50%	39.4
Solar panels to produce electricity	42.5
Nitrification inhibitor, 50% reduction of N2O	42.7
Reduced replacement rate (improved health)	44.3
Animal mortality reduced 30% (improved health)	44.9

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When housed and manure capture can occur, maximum reduction increases

	2200 – open lot	3450 – freestall
More efficient protein & P feeding	13.4	8.5
Enteric methane inhibitor, 30% reduction	25.3	19.9
Heifers in barns (for manure handling/collection)		19.4
Scraped feed lane, slurry storage	25.2	
Anaerobic digester with electricity production	34.9	46.1
AD with covered basin & flare	38.2	55.7
AD, nutrient extraction, no digestate storage	38.4	
Solid separation and use as bedding		56.1
Electrical use efficiency improved 50%	39.4	57.3
Solar panels to produce electricity	42.5	60.6
Nitrification inhibitor, 50% reduction of N2O	42.7	60.9
Reduced replacement rate (improved health)	44.3	61.2
Animal mortality reduced 30% (improved health)	44.9	61.7

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Overall GHG footprint changes

	START	INTERMEDIATE	MAXIMUM	% REDUCTION
2200 ID	1.09	0.72	0.60	45%
3450 ID	1.15	0.63	0.44	62%
80 PA	0.99	0.74	0.56	44%
350 PA	0.98	0.66	0.50	50%
1500 NY	0.92	0.58	0.46	50%

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What are the remaining emissions?

- Enteric methane
 - Reduced by ~40%
- Manure emissions
 - Reduced by ~90% in scenarios with manure capture
 - Reduced by 20-40% in scenarios with manure capture challenges
- Nitrous oxide
 - Direct reduced by 30-50%
 - Indirect reduced by 30-60%
- CO2 on farm
 - Reduced by 20-40%
- Purchased (scope 3) emissions
 - Reduced by 25-50%

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Next Steps

- Continuing modeling efforts in WI, CA, TX/NM
- Typically takes ~6 months to finish each state
- Use data to focus in on where research/innovation is still needed
- Will publish final results





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Other modeling efforts

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Pilot Farm Testing

-  33 farms, 15+ states
-  30 to 10,000 cows
-  8 dry lot dairies
-  Preliminary results will be shared with working group mid-March

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Thanks!

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