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Improvement of Jersey's Environmental Footprint From 2009 to 2020

Background

While milk plays an essential role in human diets, dairy cattle, along with other livestock production systems, have impacts on the environment due to the release of gaseous emissions and nutrient losses. Concerns about livestock's impact on the climate, air, and water quality have sparked consumer, policymaker, and industry interest in quantifying the environmental impact of food production chains in the United States and around the globe. In 2020, estimates are that 11.2% of the U.S. emitted greenhouse gases (GHG) came from agriculture (i.e., livestock and crop production together).

With its contribution to GHG emissions, the U.S. dairy sector has been thoroughly analyzed to measure its impact. Such studies helped establish carbon footprint baselines for the sector, allowing the industry to measure how the dairy industry has reduced its impact over time. In 2009 research done by Cornell University and Monsanto showed that as of 2007, producing a gallon of milk used 90 percent less land and 65 percent less water, with a 63 percent smaller carbon footprint than in 1944, thanks to improvements made by dairy farmers in cow comfort, cow health and nutrition, and breeding.

Following publication of that research, National All-Jersey Inc. (NAJ) solicited research to measure the environmental impact of using Jersey milk to produce cheddar cheese. NAJ's interest was based on the facts that cheese is the predominant use of milk in the U.S., and that Jersey milk, with its high protein and butterfat content, is ideally suited for cheese production. Dr. Jude Capper and Dr. Roger Cady conducted the research based on 2009 milk production and published the results in the Journal of Dairy Science in 2012. Because reducing environmental impact requires continuous improvement, in 2021 the U.S. Jersey organizations funded an updated analysis led by Dr. Frank Mitloehner of the University of California-Davis with Dr. Cady, Alice Rocha of UC-Davis, and Todd Ward of Direct Dairy Nutrition, NY, providing consulting services. The analysis used 2020 milk production and other performance data.

Scope

The scope of the study focused on the resources required to produce one million metric tonnes of energy corrected milk (ECM) delivered to the farm gate. The analysis did not consider the resources needed to transport milk to a processing plant, nor the resources needed to process, package, and market products to consumers, or end of life disposal. The process involved determining:

1. How many animals, cows, heifer replacements, and bulls, were required to produce one million metric tonnes of ECM,
2. The body mass of those animals
3. The feedstuffs and water needed to support the herd
4. The crops required and the inputs for crop cultivation
5. The environmental impact from the crop production and cattle emissions.

Comparing 2009 results to 2020

The 2020 project incorporated significant differences from the 2009 research. First, the functional unit of product was changed to one million metric tonnes of ECM whereas the 2009 research focused on producing 500,000 metric tonnes of Cheddar cheese. The change was made because ECM is a more commonly used metric in life cycle assessment research to assess dairy's environmental impact, compared to Cheddar cheese. However, the shift did not cause a major change in the environmental outcomes. The feedstuffs, land, and water required along with the manure, methane, nitrous oxide, and CO2 equivalents produced were within one percent for the 2009 study whether the output was ECM or Cheddar cheese.

Second, 2020 production data was obtained from the Council on Dairy Cattle Breeding (CDCB) whereas the 2009 production data came from Dairy Records Management Service (DRMS). The CDCB dataset was national in scope and included many more herds,

production records, and management systems than the previous, more regional DRMS data.

Finally, Life Cycle Assessment (LCA) methodology became more sophisticated and incorporated more variables in the time between the two studies.

Results

Many animal characteristics provided inputs to the analysis. The four found to have the most impact were:

- Production per cow
- Component tests
- Body size
- Non-productive days

Table 1 shows how Jerseys and their performance changed from 2009 to 2020. Jerseys improved production by over 12 pounds per day which computed to a gain of more than 14 pounds per day of ECM when combined with increased butterfat test of 0.09%. Jerseys also reduced their number of non-productive days by shortening calving interval by nearly one-half month and lowering the age at first calving by three months. These improvements resulted in nearly 20% fewer animals needed to produce one million metric tonnes of ECM. The reduction in the animal population translated to nearly one-third less feed required due to changing rations and more efficient production. Given that methane emissions and carbon footprint are directly correlated to feedstuffs, undoubtedly Jerseys reduced their environmental impact significantly during the 11 years between the two studies. However, a 130-pound increase in mature cow weight muted what would have been an even greater reduction in the breed's carbon footprint. Jersey bodyweight in the 2009 study was based on long-established conventional wisdom that mature Jersey cows weighed 1,000 pounds. In 2017 in conjunction with developing GPTAs for Body Weight Composite, the AJCA obtained weights of nearly 1,400 cows representing multiple lactations, states, and management systems. The results of that analysis were used in the 2020 study. In retrospect, the body weight used in the 2009 project was probably too light.

Table 1

Performance Metrics	2009	2020	% Change
Total ECM, MT	1,000,000	1,000,000	
Total milk, MT	892,459	884,171	-0.9%
Lactating cows	117,271	106,548	-9.1%
Total animal population	241,526	193,365	-19.9%
Feedstuffs, MT	1,448,259	974,625	-32.7%
Daily milk yield, (lb)	46.0	58.2	26.5%
ECM milk yield, (lb)	51.6	65.9	27.7%
Milk fat, %	4.80	4.89	
Milk protein, %	3.70	3.70	
Calving interval, (mo)	13.7	13.2	
Dry period, (d)	60	60	
Cull rate, %	30.0	37.6	
Number of lactations	3.00	2.42	
Age at first calving, (mo)	25.3	22.3	
Body weight - mature (lb)	1000	1130	13.0%

The increase in cull rate combined with a decrease in number of lactations can be explained by two factors. First, the 2020 dataset was national in scope and included more large-scale dairies than in 2009. Second, increasing use of sexed semen provided more replacement heifers and allowed for more intensive culling. Nevertheless, Jerseys reduced their feedstuffs required to produce one million metric tonnes of ECM, and that represents a remarkable improvement in the breeds' sustainability.

Looking forward, continuous improvement to reduce Jersey's environmental impact will depend on continuing to improve production per cow, increasing butterfat and protein tests, and maintaining, but not increasing, the size of the cow. Coincidentally, these three factors will also improve Jersey's profitability.

Beyond the realm of genetics, new technologies designed to reduce enteric and manure methane emissions will continue helping not only this breed, but the entire sector continuously reduce their environmental impact while continuing to provide nutritious food for the human population.

NAJ Milk & Component Outlook - *March 2023 Jersey Price Comparisons*

March '23 STATISTICAL BLEND PRICE

Northeast (Boston)	$19.93
Appalachian (Charlotte)	$21.50
Southeast (Atlanta)	$22.12
Florida (Tampa)	$23.51
Mideast (Cleveland)	$18.91
Upper Midwest (Chicago)	$18.29
Central (Kansas City)	$18.48
California (Los Angeles)	$18.79
Southwest (Dallas)	$19.44
Arizona (Phoenix)	$19.24
Pacific Northwest (Seattle)	$18.50
ALL FMMO MARKET AVERAGE	**$19.88**

Prices reflect Federal Order minimum blend prices for city shown.

March '23 MONTHLY MILK VOLUME (Million #)

Northeast (Boston)	2,361
Appalachian (Charlotte)	486
Southeast (Atlanta)	306
Florida (Tampa)	224
Mideast (Cleveland)	1,631
Upper Midwest (Chicago)	3,036
Central (Kansas City)	1,580
California (Los Angeles)	2,836
Southwest (Dallas)	1,224
Arizona (Phoenix)	474
Pacific Northwest (Seattle)	739
ALL FMMO MARKET TOTAL	**14,897**

Total Grade A milk volume sold under FMMO during month.

March '23 JERSEY REGULATED BLEND PRICE

Northeast (Boston)	$23.85
Appalachian (Charlotte)	$26.40
Southeast (Atlanta)	$24.80
Florida (Tampa)	$26.91
Mideast (Cleveland)	$22.89
Upper Midwest (Chicago)	$21.99
Central (Kansas City)	$22.15
California (Los Angeles)	$20.14
Southwest (Dallas)	$23.16
Arizona (Phoenix)	$22.61
Pacific Northwest (Seattle)	$21.35
ALL FMMO MARKET AVERAGE	**$23.30**

Prices reflect FMMO minimum prices at Jersey component values.

March, '23 JERSEY BLEND WITH ESTIMATED PROTEIN OR CHEESE YIELD PREMIUMS

Northeast (Boston)	$24.14
Appalachian (Charlotte) (includes protein prem.)	$26.79
Southeast (Atlanta)	$24.80
Florida (Tampa)	$26.91
Mideast (Cleveland) (includes protein premium)	$23.44
Upper Midwest (Chicago) (includes cy premium)	$22.27
Central (Kansas City)	$22.15
California (Los Angeles)	$20.14
Southwest (Dallas)	$23.16
Arizona (Phoenix) (includes protein)	$23.01
Pacific Northwest (Seattle)	$21.35
ALL FMMO MARKET AVERAGE	**$23.47**

Includes a protein premium of $0.05 for every 0.01% increase in protein over the market average.

March '23 DOLLAR DIFFERENCE: JERSEY MILK WITH PREMIUMS VS. STATISTICAL BLEND PRICE

Northeast (Boston)	$4.21
Appalachian (Charlotte)	$3.28
Southeast (Atlanta)	$2.68
Florida (Tampa)	$3.40
Mideast (Cleveland)	$4.53
Upper Midwest (Chicago)	$3.98
Central (Kansas City)	$3.67
California (Los Angeles)	$1.35
Southwest (Dallas)	$3.72
Arizona (Phoenix)	$3.77
Pacific Northwest (Seattle)	$2.85
ALL FMMO MARKET AVERAGE	**$3.40**

Prices reflect difference between Jersey price with premiums, and the statistical blend price.

March '23 PERCENT DIFFERENCE: JERSEY MILK WITH PREMIUMS VS. STATISTICAL BLEND PRICE

Northeast (Boston)	21.1%
Appalachian (Charlotte)	14.0%
Southeast (Atlanta)	12.1%
Florida (Tampa)	14.5%
Mideast (Cleveland)	24.0%
Upper Midwest (Chicago)	21.8%
Central (Kansas City)	19.9%
California (Los Angeles)	7.2%
Southwest (Dallas)	19.2%
Arizona (Phoenix)	19.6%
Pacific Northwest (Seattle)	15.4%
ALL FMMO MARKET AVERAGE	**17.1%**

Percent difference in Jersey price with premiums, over the statistical blend price.

ESTIMATED JERSEY MILK COMPOSITION	Mar-23
Butterfat	5.01
TRUE Protein	3.90
Other Solids	5.73
Solids Not Fat (SNF)	9.63
Cheese Yield (90% Fat Recovery, 38% Moisture)	13.43
CME Block Cheese Price	$ 2.16

REGULATED MILK PRICES	Mar-23
FMMO Milkfat	$ 2.7300
FMMO True Protein	$ 2.4085
FMMO Other Solids	$ 0.2338

AVERAGE JERSEY PRICE ADJUSTMENT PER CWT:	Mar-23
FMMO Milkfat Adjustment	$2.56
FMMO True Protein Adjustment	$1.43
FMMO Other Solids Adjustment	($0.01)

NAJ Milk & Component Outlook - *2023 Prices through March*

2023 AVERAGE STATISTICAL BLEND PRICE FOR EACH FEDERAL ORDER

Northeast (Boston)	$20.84
Appalachian (Charlotte)	$22.75
Southeast (Atlanta)	$23.31
Florida (Tampa)	$24.90
Mideast (Cleveland)	$19.72
Upper Midwest (Chicago)	$18.71
Central (Kansas City)	$19.22
California (Los Angeles)	$19.42
Southwest (Dallas)	$20.14
Arizona (Phoenix)	$20.11
Pacific Northwest (Seattle)	$19.20
ALL FMMO MARKET AVERAGE	**$20.76**

Prices reflect Federal Order minimum blend prices for city shown.

2023 MILK VOLUME (Million #)

Northeast (Boston)	6,788
Appalachian (Charlotte)	1,391
Southeast (Atlanta)	909
Florida (Tampa)	650
Mideast (Cleveland)	4,551
Upper Midwest (Chicago)	8,823
Central (Kansas City)	4,398
California (Los Angeles)	7,536
Southwest (Dallas)	3,644
Arizona (Phoenix)	1,336
Pacific Northwest (Seattle)	2,104
ALL FMMO MARKET TOTAL	**42,130**

Total Grade A milk volume sold under FMMO.

2023 AVERAGE JERSEY REGULATED BLEND PRICE

Northeast (Boston)	$25.06
Appalachian (Charlotte)	$26.44
Southeast (Atlanta)	$26.93
Florida (Tampa)	$28.51
Mideast (Cleveland)	$23.97
Upper Midwest (Chicago)	$22.53
Central (Kansas City)	$23.00
California (Los Angeles)	$21.11
Southwest (Dallas)	$23.85
Arizona (Phoenix)	$23.46
Pacific Northwest (Seattle)	$22.15
ALL FMMO MARKET AVERAGE	**$24.27**

Prices reflect FMMO minimum prices at Jersey component values.

2023 AVERAGE JERSEY BLEND WITH ESTIMATED PROTEIN OR CHEESE YIELD PREMIUMS

Northeast (Boston)	$25.36
Appalachian (Charlotte) (includes protein prem.)	$26.84
Southeast (Atlanta)	$26.93
Florida (Tampa)	$28.51
Mideast (Cleveland) (includes protein premium)	$24.53
Upper Midwest (Chicago) (includes cy premium)	$22.83
Central (Kansas City)	$23.00
California (Los Angeles)	$21.11
Southwest (Dallas)	$23.85
Arizona (Phoenix) (includes protein)	$23.87
Pacific Northwest (Seattle)	$22.15
ALL FMMO MARKET AVERAGE	**$24.45**

Includes a protein premium of $0.05 for every 0.01% increase in protein over the market average.

2023 AVERAGE DOLLAR DIFFERENCE: JERSEY MILK WITH PREMIUMS VS. STATISTICAL BLEND PRICE

Northeast (Boston)	$4.51
Appalachian (Charlotte)	$3.41
Southeast (Atlanta)	$3.09
Florida (Tampa)	$3.61
Mideast (Cleveland)	$4.78
Upper Midwest (Chicago)	$4.14
Central (Kansas City)	$3.76
California (Los Angeles)	$1.65
Southwest (Dallas)	$3.74
Arizona (Phoenix)	$3.74
Pacific Northwest (Seattle)	$2.95
ALL FMMO MARKET AVERAGE	**$3.58**

Prices reflect difference between Jersey price with premiums, and the statistical blend price.

2023 AVERAGE PERCENT DIFFERENCE: JERSEY MILK WITH PREMIUMS VS. STATISTICAL BLEND PRICE

Northeast (Boston)	21.6%
Appalachian (Charlotte)	14.5%
Southeast (Atlanta)	12.9%
Florida (Tampa)	14.5%
Mideast (Cleveland)	24.2%
Upper Midwest (Chicago)	22.2%
Central (Kansas City)	19.6%
California (Los Angeles)	8.4%
Southwest (Dallas)	18.6%
Arizona (Phoenix)	18.6%
Pacific Northwest (Seattle)	15.4%
ALL FMMO MARKET AVERAGE	**17.3%**

Percent difference in Jersey price with premiums, over the statistical blend price.

ESTIMATED JERSEY MILK COMPOSITION	2023
Butterfat	5.05
TRUE Protein	3.92
Other Solids	5.73
Solids Not Fat (SNF)	9.65
Cheese Yield (90% Fat Recovery, 38% Moisture)	13.54
CME Block Cheese Price	$2.19

REGULATED MILK PRICES	2023
FMMO Milkfat	$2.7397
FMMO True Protein	$2.5264
FMMO Other Solids	$0.2261

AVERAGE JERSEY PRICE ADJUSTMENT PER CWT:	2023
FMMO Milkfat Adjustment	$2.59
FMMO True Protein Adjustment	$1.51
FMMO Other Solids Adjustment	($0.01)

The *NAJ Milk Component Outlook* is published by National All-Jersey Inc, 6486 East Main Street, Reynoldsburg, OH 43068.