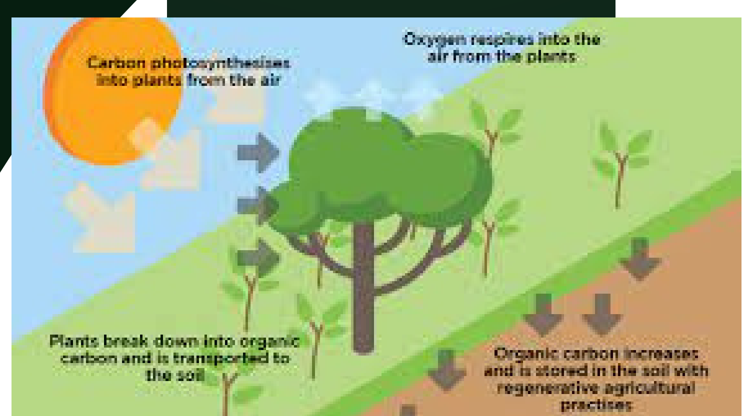
WINTER CROP MEETING 2024

Dryden VFW

Friday, January 19

Serving Broome, Cayuga, Chemung. Cortland, Tioga, & Tompkins Counties



Cornell Cooperative Extension

South Central NY Dairy and Field Crops Program


JULY 17-18 2024
SAVE THE DATE
NorthAmerican MANUREEXPO
Professionalism in Nutrient Management
Auburn 2024 New York
ManureExpo.com
North American Manure Expo visits AUBURN, NEW YORK

Department of Agriculture and Markets

Soil and Water Conservation Committee

Building on Our Successes: Climate and Agriculture

NYC Watershed Agricultural Council Tour

October 12, 2023

agriculture.ny.gov

Kathy Hochul
Governor

Richard A. Ball
Commissioner

Dale Stein
NYS SWCC Chair

Greg Albrecht
AEM Coordinator
Principal Environmental Analyst

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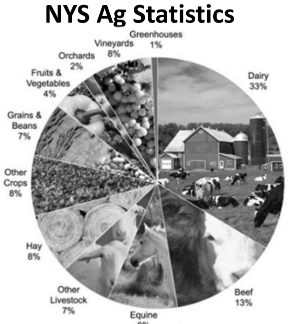
NYS is also an Agricultural State

NYS Ag Statistics



- Annual value of farm products: $5.7 billion
- 33,400 farms statewide
- Approx. 7 million acres (~20% of State)
- Nearly 850 farmers' markets in NYS
- NYS Ag ranks top 10 in US for over 30 farm products……
  - Apples – 2nd
  - Processing Cabbage – 2nd
  - Maple Syrup – 2nd
  - Milk – 3rd
    - Yogurt – 1st
    - Cottage Cheese – 1st
  - Wine/Juice Grapes – 3rd
  - Fresh Mkt Veggies – 5th
  - Floriculture – 9th
  - Among others

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Well-Managed Agriculture as Sustainable Development

Local food and beverage, horticulture, fiber, forest products, therapeutics, and energy +

- Rural economic growth
  - Locally-based transactions
- Jobs
- Taxes paid by farms >> services used
- Conservation and resiliency:
  - Habitat and wildlife corridors
  - Unpaved open space
  - Resiliency for extreme storms and drought
    - Ag is green infrastructure on a broad scale
  - Water and air quality….for multiple purposes
  - Soil health / function
  - Greenhouse gas mitigation
  - Recycling
- Tourism
  - Scenic vistas / Agricultural vistas
- Quality of life

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Agricultural Environmental Management

Core Concepts

- **Open to all farmers**
- **Voluntary, incentive-based**
- **Locally-led & delivered**
  - Farmers
  - Soil & Water Conservation Districts
  - Cornell Cooperative Extension
  - Natural Resources Conservation Service
  - Farm Service Agency
  - Farmer Organizations
  - Other Government Partners
  - NGOs
  - Agri-Business
- **Prioritized based on natural resource needs, local AEM Strategic Plans, and farmer goals**
- **Customized with farm-specific plans**
  - **Science-based (NRCS Stds) and feasible**
  - **Wide range of practice systems**
- **Trust and relationship building**
  - **Farmers make decisions for their farms and the environment**
- **Leads to practice adoption**
- **Promotes teamwork and coordination**
- **Adaptive to future priorities**

AEM Farmers Partnering to Protect Our Environment

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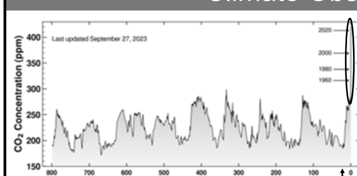
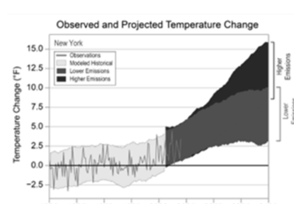
Climate Observations



https://keelingcurve.ucsd.edu



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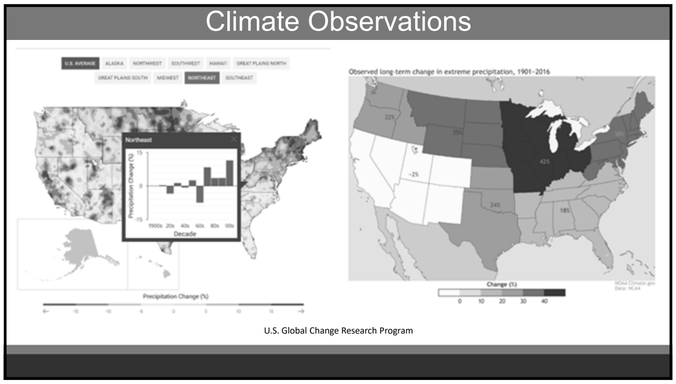
Climate Observations
Northeast
Precipitation Change (%)
Decade
Observed long-term change in extreme precipitation, 1901–2016
Change (%)
U.S. Global Change Research Program

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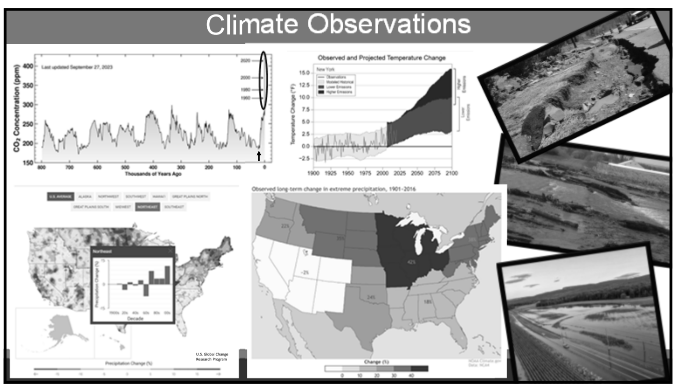
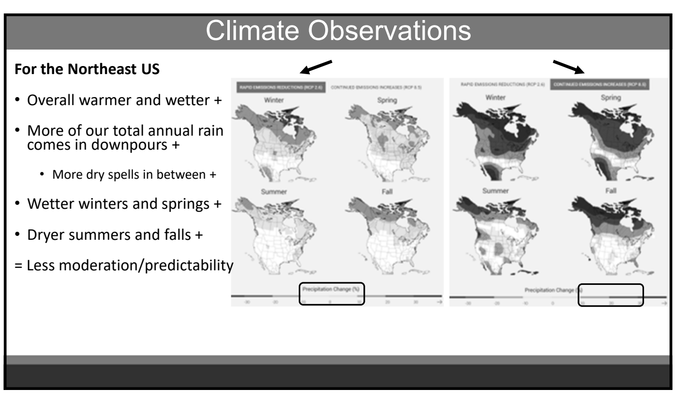

Climate Observations
Last updated September 27, 2023
CO2 Concentration (ppm)
Thousands of Years Ago
Observed and Projected Temperature Change
Temperature Change (°F)
Observed long-term change in extreme precipitation, 1901–2016

8


Climate Observations
For the Northeast US
• Overall warmer and wetter +
• More of our total annual rain comes in downpours +
• More dry spells in between +
• Wetter winters and springs +
• Dryer summers and falls +
= Less moderation/predictability
Winter
Spring
Summer
Fall
Precipitation Change (%)

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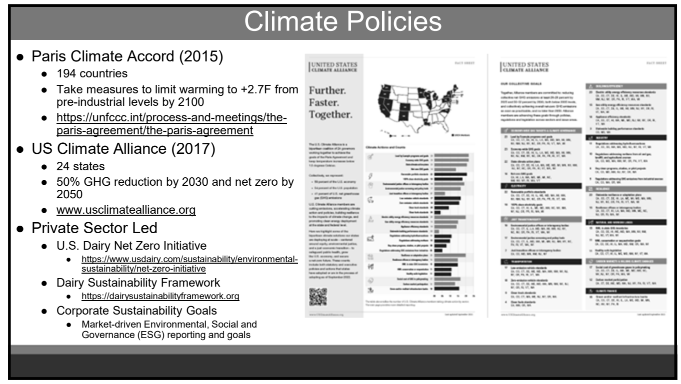
Climate Policies
● Paris Climate Accord (2015)
● 194 countries
● Take measures to limit warming to +2.7F from pre-industrial levels by 2100
● https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
● US Climate Alliance (2017)
● 24 states
● 50% GHG reduction by 2030 and net zero by 2050
● www.usclimatealliance.org
● Private Sector Led
● U.S. Dairy Net Zero Initiative
● https://www.usdairy.com/sustainability/environmental-sustainability/net-zero-initiative
● Dairy Sustainability Framework
● https://dairysustainabilityframework.org
● Corporate Sustainability Goals
● Market-driven Environmental, Social and Governance (ESG) reporting and goals
UNITED STATES CLIMATE ALLIANCE
Further. Faster. Together.

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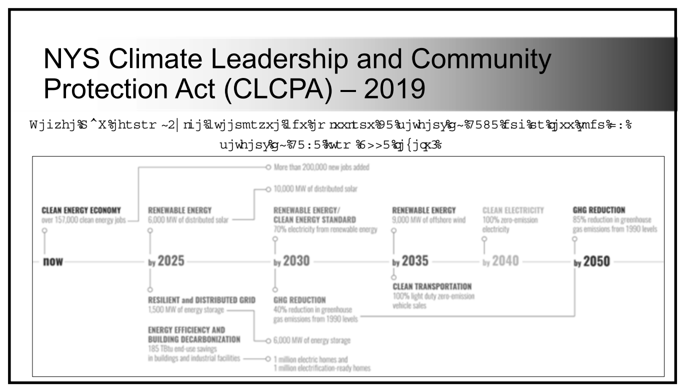
NYS Climate Leadership and Community Protection Act (CLCPA) – 2019
More than 200,000 new jobs added
10,000 MW of distributed solar
CLEAN ENERGY ECONOMY over 157,000 clean energy jobs
RENEWABLE ENERGY 6,000 MW of distributed solar
RENEWABLE ENERGY/ CLEAN ENERGY STANDARD 70% electricity from renewable energy
RENEWABLE ENERGY 9,000 MW of offshore wind
CLEAN ELECTRICITY 100% zero-emission electricity
GHG REDUCTION 85% reduction in greenhouse gas emissions from 1990 levels
now
by 2025
by 2030
by 2035
by 2040
by 2050
CLEAN TRANSPORTATION 100% light duty zero-emission vehicle sales
RESILIENT and DISTRIBUTED GRID 1,500 MW of energy storage
GHG REDUCTION 40% reduction in greenhouse gas emissions from 1990 levels
ENERGY EFFICIENCY AND BUILDING DECARBONIZATION 185 TBtu end-use savings in buildings and industrial facilities
6,000 MW of energy storage
1 million electric homes and 1 million electrification-ready homes

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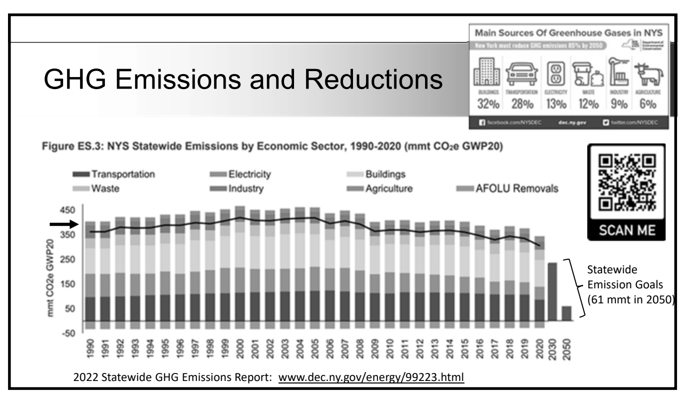
GHG Emissions and Reductions
Main Sources Of Greenhouse Gases in NYS
BUILDINGS 32%
TRANSPORTATION 28%
ELECTRICITY 13%
WASTE 12%
INDUSTRY 9%
AGRICULTURE 6%
Figure ES.3: NYS Statewide Emissions by Economic Sector, 1990-2020 (mmt CO2e GWP20)
Transportation
Waste
Electricity
Industry
Buildings
Agriculture
AFOLU Removals
mmt CO2e GWP20
SCAN ME
Statewide Emission Goals (61 mmt in 2050)
2022 Statewide GHG Emissions Report: www.dec.ny.gov/energy/99223.html

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CLCPA Scoping Plan

SCAN ME

Driven by the Climate Act.

- The Climate Act requires the CAC to develop a Scoping Plan regarding how the state can meet statutory emission limits.
- Public and CAC feedback along with further analyses has informed the final Scoping Plan (started in 2020; finalized in 2022).

The Scoping Plan is multi-sectoral, holistic, and grounded in scenario modeling.

- The Scoping Plan is informed by recommendations from sector Advisory Panels, the Just Transition Working Group, and the Climate Justice Working Group.
- The Scoping Plan considers climate justice, job creation, cost reductions, public health benefits, and minimizing emission leakage.
- The recommendations formed the basis of scenario modeling to show the impact of interacting strategies across sectors.

To review the final Scoping Plan, please visit: https://climate.ny.gov/resources/scoping-plan/

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- Qfsi%Zxj%fsi%Qthfq%Lt{jwsr jsy
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- Jsjwl~%Jkknhnjsh~%fsi%Mtzxnsl%
- Jsjwl~%Nsyjsxn{j%fsi%Ywfij%J}utxji% Nsizxywnjx%
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Ag and Forestry Panel Recommended Strategies - Key themes

- Focus on methane and nitrous oxide reduction of farms and increasing carbon sequestration on farmland and forests through Agricultural Environmental Management (AEM).
- For agriculture, emissions reductions strategies are designed to maintain/improve farm viability and minimize the potential for loss of farms to other parts of US/world.
- Continued/expanded need for applied research, guidelines, extension, training, technical assistance (i.e., people), and funding (*and more funding*….private and public sector investment).
- Methods for measurement, monitoring, reporting, and verification (MMRV) of progress.
- Transitions are beneficial to disadvantaged communities, just, and provide health and other co-benefits (another common priority across all sectors).
- Two key technical themes of the panel:
  - Agricultural Emissions Reductions
  - Carbon Sequestration in Forests and on Farms



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CLCPA Scoping Plan Strategies…

- Energy efficiency measures that achieve the Climate Act energy efficiency requirement
- Transition from fossil natural gas to electrification in buildings
- Zero-emission electricity
- Transportation electrification
- Enhancement of transit, smart growth, and reduced vehicle miles traveled
- Transition to low global warming potential (GWP) refrigerants and enhanced refrigerant management
- **Maximization of carbon sequestration in New York's lands and forests**
- Mitigation of **methane (and nitrous oxide) emissions** across the waste, **agriculture,** and energy sectors
- Diverse portfolio of solutions in industry, including efficiency, electrification, and strategic use of **alternative fuels** and carbon capture technologies for certain industrial applications

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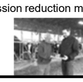
Agricultural Emission Reduction Strategies

Goals relative to 2019 levels: 15% by 2030 and 30% by 2050 (1990 levels)


- **Nutrient Management**
  - Reduce nitrous oxide (N2O) emissions while achieving desired crop yield and quality through continued and expanded nutrient management.
- **Manure Management**
  - Prevent or reduce methane (CH4) emissions from manure management practices.
- **Precision Feeding, Herd, and Forage Management**
  - Reduce methane and nitrous oxide emissions while achieving desired ruminant growth and lactation goals.
  - Additional methane emission reduction may be realized from future feed additives.





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Agriculture and Forestry Advisory Panel

of the NYS Climate Action Council

Richard Ball, Chair, Commissioner NYS Department of Agriculture and Markets
Peter Innes, NYS Department of Environmental Conservation
Rafael Aponte, Rocky Acres Community Farm
Amanda Barber, Cortland County Soil and Water Conservation District
John Bartow, Empire State Forest Products Association
Michelle Brown, The Nature Conservancy
Tom Gerow, Wagner Lumber Company
Suzanne Hunt, HuntGreen LLC and Hunt Country Vineyard
Peter Lehner, EarthJustice
Samantha Levy, American Farmland Trust
Robert Malmsheimer, SUNY Environmental Science and Forestry
John Noble, Noblehurst Farms
Julie Suarez, Cornell University
Ned Sullivan, Scenic Hudson
Donna Wadsworth, International Paper
Elizabeth Wolters, New York Farm Bureau
Peter Woodbury, Cornell University
Nelson Villarrubia, Trees New York

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Carbon Sequestration Strategies for Forests and Farms

Goals: return to 1990 C seq. levels by 2030 and more by 2050

- **Avoided Conversion of Forest and Farmland**
  - Maintain and enhance the state's carbon stocks and carbon sequestration potential through avoided forest and farmland use conversion.
- **Forest Management**
  - Increase carbon sequestration through improved, sustainable forest management practices. Secure forest regeneration, improving forest health and productivity, and restore degraded forests.
- **Soil Health**
  - Reduce net GHG emissions and increase carbon sequestration/storage and other environmental benefits through adoption of soil health management practices.
- **Agroforestry**
  - Adding trees into areas of agricultural production to increase carbon sequestration and other environmental benefits.
- **Reforestation/Afforestation**
  - Tree plantings focused on underutilized agricultural lands. Increasing tree density in understocked forests.
- **Climate Focused Bioeconomy**
  - Renewable bio-based feedstocks, rather than fossil fuel-based feedstocks, to produce products that achieve the climate and social justice goals of the CLCPA.

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Next Steps - everyone has a role….

- **Continue collaborating, innovating, implementing, and <u>adopting</u> practices…**
  …good for farms and the environment
- Tactical plans for individual Scoping Plan priorities
- Applied research, updated tools and guidelines, and training
- Public sector funding and policy to facilitate larger pool of private sector investment and practice adoption
  - NYS AGM / SWCC, NYSERDA, NYS DEC, USDA, etc.

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Funding Programs to Help Advance AEM on Farms

Funding programs to advance AEM on farms

- Locally-led and sponsored by your **<u>Soil & Water Conservation District</u>** to support planning, implementation, and adoption of BMP Systems
  - Funded through the EPF via NYS AGM / NYS Soil and Water Conservation Committee
    - **AEM Base Program**
    - **Agricultural Non-Point Source Pollution Abatement and Control Program (AgNPS)**
    - **Climate Resilient Farming (CRF)**
    - **Source Water Buffer Program**
    - **Ecosystem Based Management (EBM) Programs**
    - **State Aid to Districts**
- Other Programs from NYSAGM (Farmland Protection Grants), NYSDEC, USDA-NRCS (EQIP, CSP), USDA-FSA, NYSERDA, Cornell PRO-DAIRY (Dairy Advancement Program), USEPA, and others….

\+ <u>Significant, on-going investment by farmers</u>.

https://agriculture.ny.gov/soil-and-water/agricultural-environmental-management

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Agricultural Environmental Management

Daily, incremental progress is meaningful and makes the difference.

Keep up the good work….and keep doing it together.

Greg Albrecht
AEM Coordinator
Principal Environmental Analyst
Div. of Land and Water Resources
Dept. of Agriculture and Markets
NYS Soil and Water Conservation Committee

607.229.4654
Greg.Albrecht@agriculture.ny.gov

https://agriculture.ny.gov
https://agriculture.ny.gov/soil-and-water/soil-water-conservation-committee

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Agricultural Environmental Management (AEM) Framework

- **AEM** – a consistent framework for over 20 years to partner with farmers on environmental management and farm viability
- **Follows a 5-Tiered approach (voluntary, science-based, and confidential)**
  - Inventories basic farm information and interests (Tier 1)
  - Assesses existing stewardship and environmental risks (Tier 2)
  - Develops conservation plans (Tier 3)
  - Implements Best Management Practices (BMP) Systems using NRCS CPS (Tier 4)
  - Evaluates outcomes and updates plans (Tier 5)
- **AEM is the key framework for the State's agricultural conservation initiatives**
  - AEM related technical assistance and cost-share programs via SWCDs
  - 9 Element Watershed Management/TMDL Planning/HABs Action Plans
  - NYS Grown and Certified
  - NYS DEC CAFO Permit
  - Climate Action Council Scoping Plan – Ag and Forestry Chapter

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AEM <u>Base</u> Program

Non-competitive funding for Districts to provide…..

1. conservation <u>technical assistance</u> through AEM's 5-Tiers

   and

2. <u>cost-share funding with farmers to implement BMP Systems in Tier 4</u> ($50K max/farm; $100K max/District; two-year cycles)

AEM Tier	Purpose	NRCS 9 Step Process
Tier 1 – Inventory (Questionnaire)	Basic farm info and interests	1. ID Issues & Opps 2. Determine Objectives 3. Inventory Resources 4. Analyze Resource Data 5. Formulate Alternatives 6. Evaluate Alternatives 7. Make Decisions
Tier 2 – Assessment ("Tier 2 Worksheets")	Identify existing stewardship, resource concerns, and opportunities	
Tier 3 – Planning	Develop conservation plans	
Tier 4 – Implementation	Implement conservation practices based on the plans	8. Implementation
Tier 5 – Evaluation	Evaluate plans, practices, and programs	9. Evaluation

AEM Base Program Coordinator: Greg Albrecht
(greg.albrecht@agriculture.ny.gov)

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Ag Non-Point Source Water Pollution Program

About:

- AgNPS program was created in 1993
- First Round of AgNPS was awarded in 1994
  - $340,000
- Approximately, $240 million has been awarded for AgNPS projects
- $13 million available for projects in Round 29
  - RFP out in early 2023

Program Goals:

- Water quality protection
- Reduce and/or prevent the non-point source contribution from agricultural activities in watersheds across the State
- Utilize AEM Framework and Soil and Water Conservation Districts to implement the program

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Climate Resilient Farming (CRF) Grant Program

- **Launched in 2015 (Rounds 1-6)**
  - **~$20** million awarded
  - **270** farms
  - **~390,000** metric tons of CO_2e/yr estimated emissions reduction
    - Includes 15 cover/flare projects to date
- **Three tracks (as of Round 6):**
  1. Manure storage cover and flare systems
  2. Riparian, floodplain, and upland water management systems
  3. Healthy Soils NY

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Program Impact

CRF Program Estimate of CO2e/Year Emission Reductions (2015-2022), derived from USDA's COMET Planner and IPCC calculation of methane per unit of livestock at 20-year GWP

CRF Program	Program Round Funding Level	Track 1 (Methane Management) Estimated CO2e/Year (MT) using 20-year GWP of x84	Track 2 (Water Management) Estimated CO2e/Year (MT)	Track 3 (Healthy Soils NY) Estimated CO2e/Year (MT)	Total Estimated CO2e/year (MT)
Round 1	$1,400,000	48,056	40	73	48,200
Round 2	$1,500,000	0	325	111	436
Round 3	$2,800,000	19,665	192	981	20,838
Round 4	$2,300,000	160,906	62	1,082	162,050
Round 5	$4,000,000	87,298	1,058	1,191	89,547
Round 6	$8,000,000	59,691	636	8,168	68,463
Total:	**$20,000,000**	**375,616**	**2,313**	**11,606**	**389,534**

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CRF Round 7

SCAN ME

- **Round 7**
  - $15 Million available
  - 80% State cost-share
  - Request for Proposals out in early 2023

Track	Proposed Funding Available
Track 1: Livestock Management: Alternative Waste Management & Precision Feed Management	$5,000,000
Track 2: Adaptation & Resiliency	$6,000,000
Track 3: Healthy Soils NY	$4,000,000

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CRF Round 7 and Beyond

CRF Track 1

- **Proposed Expansion Track 1 to Alternative Waste Management & Precision Feed Management**
  - Manure Storage Cover and Flare
  - Solid Separation Equipment
  - Waste Management through Composting
  - Bedding Alternatives to sand for cover and flare preparation
  - Innovative Manure Treatment Technologies
  - Pasture Based Management
  - Compost Bedded Pack
  - Precision Feed Management

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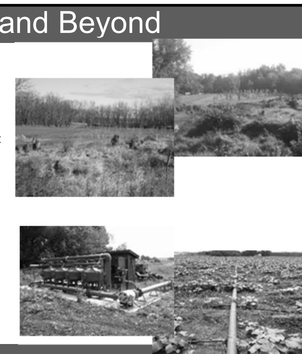
CRF Round 7 and Beyond

CRF Track 2

- **Proposed Expansion Track 2 to Adaptation & Resiliency (emphasis on water management for flood and drought)**
  - Riparian Buffer System
  - Stream Corridor and Shoreline Management System
  - Erosion Control System – Structural
  - Irrigation Water Management System
  - Access Control System
  - Prescribed Rotational Grazing System
  - Integrated Pest Management
  - Weather monitoring systems and tools
  - Green Infrastructure Systems



New York State Agriculture and Markets

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CRF Round 7 and Beyond

CRF Track 3

- **Soil Health (and Agroforestry)**
  - Cover crops, conservation tillage, structural soil conservation practices, conservation crop rotations, buffers, etc.
  - Outreach eligible expense
  - Equipment eligible expense
    - e.g., draghose systems associated with improved NM and SH
- **Proposed example of an agroforestry system**
  - Tree/shrub Establishment and Preparation (NRCS 612 and NRCS 660)
  - Structures for Wildlife (NRCS 649)
  - Conservation Cover (NRCS 327)
  - Critical Area Planting (NRCS 342)
  - Alleycropping (NRCS 311)

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CRF Round 7 and Beyond

Beyond Round 7

- Carbon Farm Plans – cost-share for planning
- Increased funding with Climate Smart Commodities grant (and other funding sources as available)
- Improved ways to incentivize implementation, operation, and maintenance
- Better quantification tools

Your help and input is needed.

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Thank you

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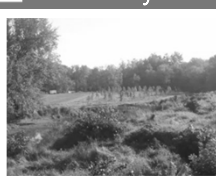

Brian Steinmuller
Assistant Director
518.764.2615 / Brian.Steinmuller@agriculture.ny.gov

Greg Albrecht
AEM Program Coordinator / CNMP Specialist
607.229.4654 / Greg.Albrecht@agriculture.ny.gov

www.agriculture.ny.gov
https://agriculture.ny.gov/soil-and-water/soil-water-conservation-committee

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Farm Greenhouse Gas (GHG) Inventory

Introduction
Greenhouse gases (GHGs) contribute to warming of the earth's atmosphere and can be released from both natural and anthropogenic (human) activities. Because GHGs accumulate in the atmosphere, they contribute to rising temperatures and more frequent occurrence of extreme weather events. This factsheet describes the main sources of GHGs from dairy farm activities, carbon sequestration as a way to reduce emissions, and the role of software tools for GHG inventory assessments for dairy.

Greenhouse Gases and CO_2e
The three main GHGs from dairy farms are: carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4). To account for differences in potency to warm the atmosphere, each GHG is assigned a global warming potential (GWP). Inventories can differ in what is used as GWP. New York law has chosen to use the "20-year GWP", established by the Intergovernmental Panel on Climate Change (IPCC), where CH_4 is 84 times more potent than CO_2 and N_2O is 264 times more potent than CO_2 (which has a value of 1). The GWP of each GHG is expressed as "carbon dioxide equivalent" or CO_2e, because the other gases are compared to CO_2. To convert from a ton of CH_4 to ton of CO_2e, simply multiply by 84.

Major Emissions sources from Dairy Farms
Dairy farms are a large source of CH_4, mostly from enteric emissions from the cows themselves, and from manure management (Figure 1). Therefore, these areas are the primary target for reducing CH_4 emissions with milk production efficiency and manure management.

Carbon Sequestration
Carbon can be captured from the atmosphere and added to soil or trees in a process called carbon sequestration. When this process is not easily reversible, it can reduce carbon in the atmosphere and hence reduce the farm's GHG footprint. A good example of more permanent carbon sequestration is carbon stored in a tree for 100 years which is then used as building material for another 200 years. Improving soil carbon storage through soil health practices is less permanent but important too as it can increase soil fertility, improve water storage during drought, as well as increase infiltration and reduce erosion during extreme precipitation events. Soil health activities that help farms adapt to extreme weather include reduced tillage and planting cover crops to increase soil organic matter, or having woody habitats such as hedgerows, riparian buffers or forest surrounding production fields.

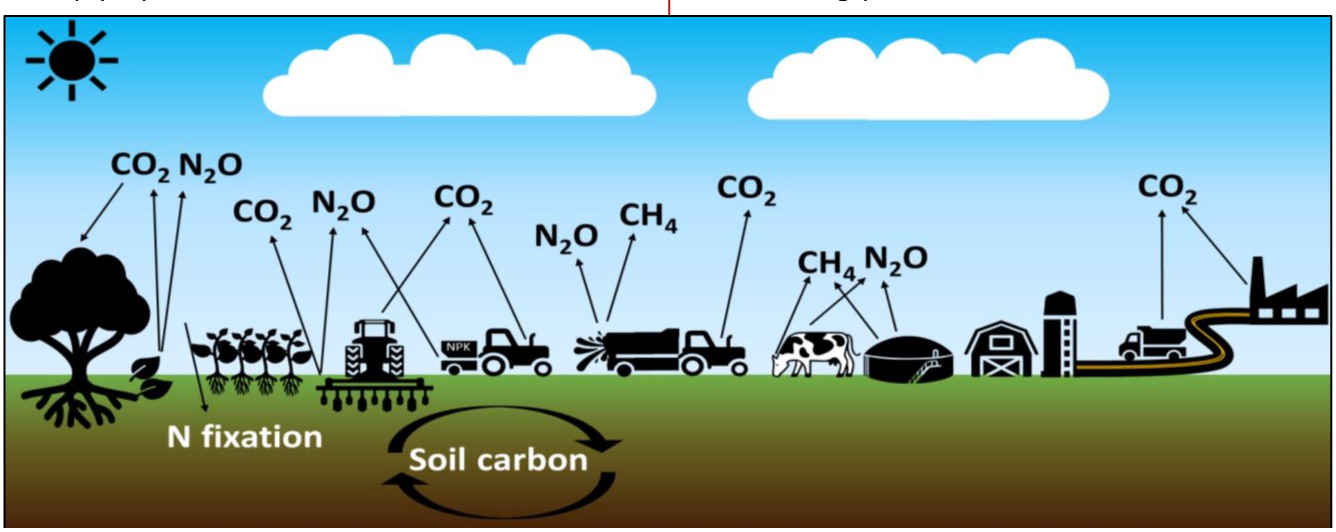

Figure 1: The main sources and potential sinks of greenhouse gases (GHGs) used to calculate the carbon footprint on a dairy farm. These include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

GHG Inventory of Dairy Farms

A farm's GHG inventory (also referred to as footprint) is determined by adding all GHGs emitted from the farm (on a CO_2e basis) and subtracting the carbon sequestered by systems that store carbon for a long time such as forests.

A first step in calculating GHG emissions is to set the boundary of the assessment. A dairy inventory includes emissions and sequestration resulting from all activities on the farm, including crop production, grazing of animals, feeding of animals, manure storage and treatment, and energy and fuel use associated with these activities, and may or may not include the "upstream emissions" which come from the production and transport of products such as feed and fertilizer imported onto the farm. Once a product (such as milk or a crop) leaves the farm, the emissions are the responsibility of the next stakeholder in the supply chain.

Looking at on-farm GHG emissions from agriculture in the United States (which is estimated at 10% of the total emissions), 58% are from N_2O, 41% from CH_4 and 1% from CO_2 (Figure 2).

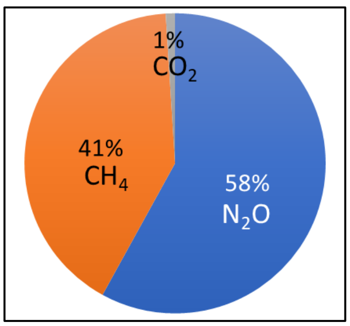

Figure 2: U.S. Agricultural greenhouse gas emissions according to the U.S. Annual Greenhouse Gas Inventory for 2019 (USEPA 2021). This does not include farm energy use.

Feed production, manure management and enteric fermentation from cows are the major sources of CH_4 and N_2O on a dairy. Farms can improve their inventory by improving milk production efficiency, reducing methane from manure storage and improving nitrogen use efficiency. Additionally, carbon sequestration by improved management of woodlands can lower the inventory.

Inventories can be reported per unit of fat and protein corrected milk (FPCM; volume basis), per animal, per unit of land area for crops, and per farm. For the overall GHG inventory of the dairy industry, total emissions need to be taken into account.

GHG Inventory Assessment Tools

Modeling tools are needed to estimate a farm's GHG emissions and monitor impact of management changes and progress made over time. Various tools exist, ranging in scope and complexity. For dairy farms, a whole farm tool should capture both field and animal processes and on-farm management practices. Simpler models that aim to do this apply a multiplication factor to each of the practices on the farm to estimate whole farm GHG emissions and carbon sequestration. These models, called emission factor or empirical models, capture conditions for a farm and allow for running of simple scenarios to guide management decisions. However, these models do not typically account for external influences such as weather and they do not allow for use of more detailed dietary or field management information. Process or simulation models are more complex and require greater data input. Although process models are often impractical for farms to run, they are useful research tools that can guide development of beneficial management practices for the farm. All tools will need to be evaluated prior to adoption, to ensure that input data are relevant to local farming practices and output is consistent with local emission data.

In Summary

The three main greenhouse gases from dairy farms are CO_2, N_2O, and CH_4. Estimating GHG inventories for farms can help identify opportunities for reducing emissions.

Additional Resources

- Intergovernmental Panel on Climate Change (IPCC). https://www.ipcc.ch/.
- Natural and Working Lands. https://blogs.cornell.edu/workinglands/
- USEPA (2021). U.S. Annual Greenhouse Gas Inventory for 2019. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks.

Disclaimer

This fact sheet reflects the current authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this fact sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of discharge levels from agricultural land.

For more information

Cornell University Cooperative Extension

Nutrient Management Spear Program
http://nmsp.cals.cornell.edu

Olivia Godber, Jeni Wightman, Kirsten Workman, and Quirine Ketterings

2022

Cornell University
Cooperative Extension

Agronomy Fact Sheet Series **Fact Sheet #124**

Single-Strip Spatial Evaluation Approach

Conducting on-farm research is the most reliable way to answer questions like "Can I reduce nitrogen side-dress rates?", "Should I add sulfur?", or "Does planting green impact the corn crop that follows?". On-farm research can help a farmer improve overall production efficiency, farm profitability, and environmental stewardship. In the past, on-farm research required randomized trials with at least *four* replications (randomized complete block designs, see Agronomy Fact Sheet #68). This approach takes up space and can slow down field work during busy times on the farm. Here we introduce a new approach, the Single-Strip Spatial Evaluation Approach (SSEA), that takes away a major barrier to implementing on-farm research and provides more reliable results.

Why SSEA?

Because yield monitors take readings every second as a harvester goes through a field, they generate dense spatial data, allowing for targeted evaluations and improved statistical analysis. The SSEA uses yield monitor data to answer research questions using a single treatment strip per field (Figure 1).

How Does SSEA Work?

There are six steps to be followed when conducting on-farm research using the SSEA.

Step 1: Equipment requirement

Use of the SSEA requires harvesting with a yield monitor system to collect yield and moisture data every second during harvest. Reliable data are essential, so farms that conduct on-farm research using SSEA will need to ensure yield monitor systems are well-calibrated (Agronomy Fact Sheets #104, #105).

Step 2: Define the study question

A study question in the SSEA consists of a comparison of two treatments, typically a "business as usual" approach versus a management change such as a different application rate, change in tillage method, change in timing, method of application, or materials.

Step 3: Select field and strip location

The SSEA is most useful for farms that already have yield stability zone maps (Figure 1). In such maps, each field has up to four colors: green for zones that are consistently (across years) yielding higher than the whole farm average yield, red for zones that are consistently low yielding (below farm average), and blue and yellow for zones that are highly variable in yield over the years but on average higher (blue) or lower (yellow) than the whole farm average. For more information on yield stability zone maps, see Agronomy Fact Sheet #123.

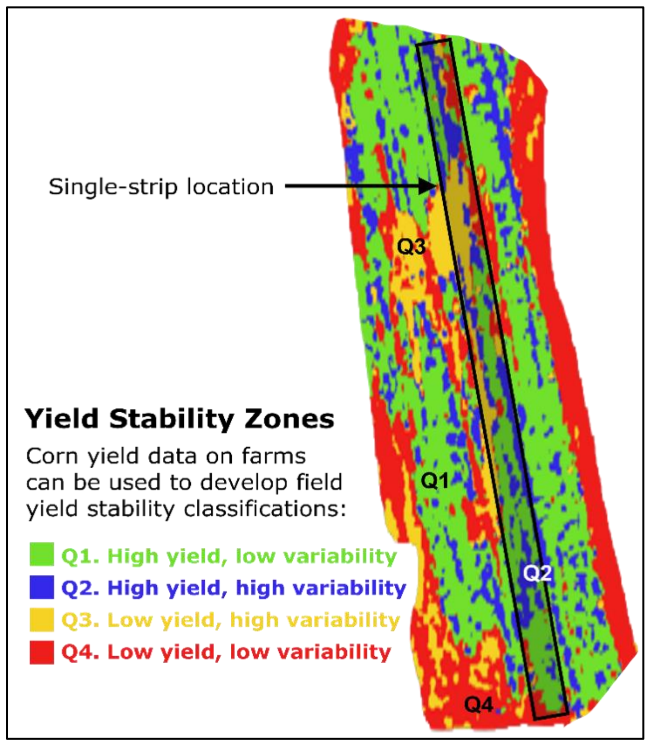

Figure 1: When a farm has yield stability zones (requires three years of yield data or more), the single-strip spatial evaluation approach (SSEA) can target specific zones by placing single-strip treatment covering a specific set of zones (mostly green and blue in this example).

Field selection will be determined by the research question. For example, if a farmer wants to know if more N is needed for higher-yielding areas, fields with green yield stability zones should be selected.

The SSEA *can* be used without zone maps, but conclusions can only be drawn for the area where the strip was placed and the control strips surrounding it (not per zone). If a farm has less than three years of yield monitor data for a row crop (corn silage, corn grain, soybeans, small grains), it is recommended to continue to collect yield data so that yield stability maps can be generated in future years and research findings can be extrapolated to other fields.

Step 4: Implement the strip

Trial implementation requires putting in a single strip of an alternative treatment across a field in the direction of harvest (longer=better). The strip width must be at least two and no more than four chopper or combine widths and have adequate space for equally wide control strips on both sides (*do not place the strip at the field edge*). All other crop management practices (pest control, seed bed preparation, fertility management, etc.) should be applied uniformly across the entire field including the strip area. Mark both the name of the field and the strip location in the field (GPS coordinates for each of the four corners). The GPS locations will be essential for evaluating yield data and drawing conclusions.

Step 5: Data collection

Ensure the yield monitor is well-calibrated, flow and moisture sensors are working properly, and data are cleaned post-harvest. Harvest the field as if the trial were not in it (do not stop or adjust for harvesting of the strips) to ensure data quality. If additional information (e.g. corn stalk nitrate test, forage quality, or soil samples) is helpful to answer zone-based research questions, make sure to sample (and geo-reference) both within and left and right of the actual strip location within a zone.

Step 6: Statistical analyses

Yield data within the strip and both sides directly surrounding it are used to evaluate if the treatment impacted yield that year using a spatial regression model. Yield responses are evaluated per zone. The statistical model determines if the treatment impacted yield. Table 1 represents our level of confidence in the estimated average yield response. This allows a farmer to compare which zones achieved the yield response needed to cover the cost of treatment and where the management change was less likely to pay off.

Table 1: Example of results of a single-strip spatial evaluation approach (SSEA) in a field with four yield stability zones (Q1, Q2, Q3, Q4). The table shows how confident we are that a specific yield response was obtained.

Confidence table for treatment yield response

	Yield response (tons/acre)	Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)
Loss	≤ −1.00	0	0	0	0
	≤ −0.75	0	0	0	0
	≤ −0.50	0	0	0	0
	≤ −0.25	1	1	0	0
Benefit	≥ 0	97	95	100	100
	≥ 0.25	90	85	100	100
	≥ 0.50	76	65	99	100
	≥ 0.75	55	40	95	98
	≥ 1.00	33	19	87	92
	≥ 1.25	15	6	71	79
	≥ 1.50	5	2	49	59
	≥ 1.75	1	0	27	36
	≥ 2.00	0	0	12	17

High | Somewhat | Neutral | Low | Not confident

New York On-Farm Research Partnership

A farmer who shares yield and SSEA data with the New York On-Farm Research Partnership, will receive a report that show impact of the treatment per zone as illustrated in Table 1. Sharing of data aids in development of science-based guidance. Individual farm data or reports will be held strictly confidential.

Additional Resources

- Nutrient Management Spear Program Agronomy Fact Sheet Series: nmsp.cals.cornell.edu/index.html.
- New York On-Farm Research Partnership: nmsp.cals.cornell.edu/NYOnFarmResearchPartnership/.

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For more information

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Quirine Ketterings, Jason Cho, Manuel Marcaida, Subhashree Navaneetha Srinivasagan, Sunoj Shajahan, Juan Carlos Ramos, Kirsten Workman, Joseph Guinness

2022

Manure Can Offset Nitrogen Fertilizer Needs and Increase Corn Silage Yield Value of Manure Project 2022 Update

blogs.cornell.edu/whatscroppingup/2023/02/15/manure-can-offset-nitrogen-fertilizer-needs-and-increase-corn-silage-yield-value-of-manure-project-2022-update/

Juan Carlos Ramos Tanchez[1], Kirsten Workman[1,2], Allen Wilder[3], Janice Degni[4], and Quirine Ketterings[1]
Cornell University Nutrient Management Spear Program[1], PRO-DAIRY[2], Miner Agricultural Research Institute[3], and Cornell Cooperative Extension[4]

Introduction

Manure is a tremendously valuable nutrient source. When used appropriately (right rate, right timing, right placement method), it can help build soil organic matter, enhance nutrient cycling, and improve soil health and climate resilience. Sound use of manure nutrients can decrease the need for synthetic fertilizer, thus, lowering whole farm nutrient mass balances and contributing to reduced environmental footprints.

Current guidance for nitrogen (N) credits from manure recognize that N availability depends on the solids content of the manure (lower first year credits for manure with >18% solids than for liquid manure). It also recognizes that the amount of N in manure is affected by how it is collected, stored, treated (solid liquid separated, composted, digested, etc.), and land-applied (timing and method). Higher shares of manure N will be available to crops when manure is applied closer to when crops need it and if manure is injected or incorporated into the soil right after it is applied versus left on the surface.

In the past two decades since manure crediting systems were developed, many different manure treatments technologies have been implemented on farms and re-evaluation of the N crediting system for manure is needed. Furthermore, recent studies have shown that manure can increase yield beyond what could be obtained with N fertilizer only. Thanks to funding from New York Farm Viability Institute (NYFVI) and the Northern New York Agricultural Development Program (NNYADP), we initiated the “Value of Manure” statewide project to evaluate the N and yield benefits of various manure sources and application methods. Three trials were conducted in 2022. Here we summarize the initial findings.

What we did in 2022

Trials were implemented on three farms. Each trial had three strips that received manure and three that did not, for a total of six strips (Figure 1a). Strips were 1200-1800 ft long and 50-80 ft wide. When corn was at the V4-V6 stage, each strip was divided into six sub strips (Figure

1b) and sidedressed at a rate ranging from 0 to up to 192 pounds N/acre, depending on the farm. All three farms applied liquid untreated manure, ranging from 7,525 to 15,000 gallons/acre in the spring.

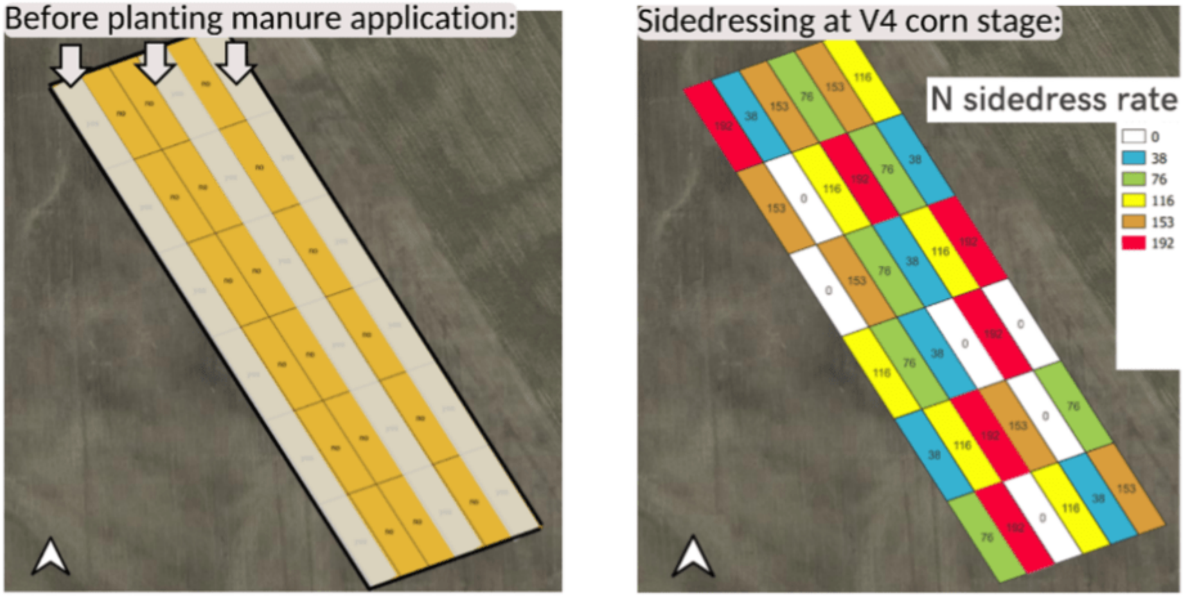


Figure 1. Layout of a Value of Manure study plot. Three strips received manure before planting (1a). At the V4-V6 corn stage each of the six strips received six different inorganic N sidedress rates (1b).

Soils on farm A were Lima and Honeoye (Soil Management Group [SMG] 2), farm B had a Hogansburg soil (SMG 4), and farm C had Valois and Howard soils (SMG 3). The farms implemented and harvested the trial. The Cornell team sampled for general soil fertility, Pre-Sidedress Nitrate Test (PSNT), Corn Stalk Nitrate Test (CSNT), and silage quality. Each trial was harvested with a yield monitor.

What we have found so far

Corn silage had a different response to manure and inorganic N sidedress in each of the study farms (Figure 2). Farm A responded to both the application of manure and inorganic N fertilizer. In that farm manure application was able to offset 58 lbs N/acre and presented a 0.6 ton/acre yield advantage at the Most Economic Rate of N (MERN), the rate of N that maximizes economic returns, compared to plots with inorganic N fertilizer application only (Figure 3). The application of inorganic N fertilizer and manure had no impact on the yield of farm B, showing that the field already had enough N and did not need any N addition (fertilizer or manure). At farm C, yield did not respond to the application of inorganic N sidedress (the field by itself provided enough N to the crop), but yield was higher when manure was applied: on average manured plots yielded 1.5 ton/acre higher than the no-manure plots. The MERN for farms B and C was 0 lbs N/acre both with manure and without it.

The PSNT and CSNT levels of the manured plots were higher than their no-manure counterparts for all three studies, showing that manure supplied N (Table 1). Both manure and no manure plots in farm A had optimum CSNT levels at the MERN, showing that manure was able to offset 58 lbs N/acre.

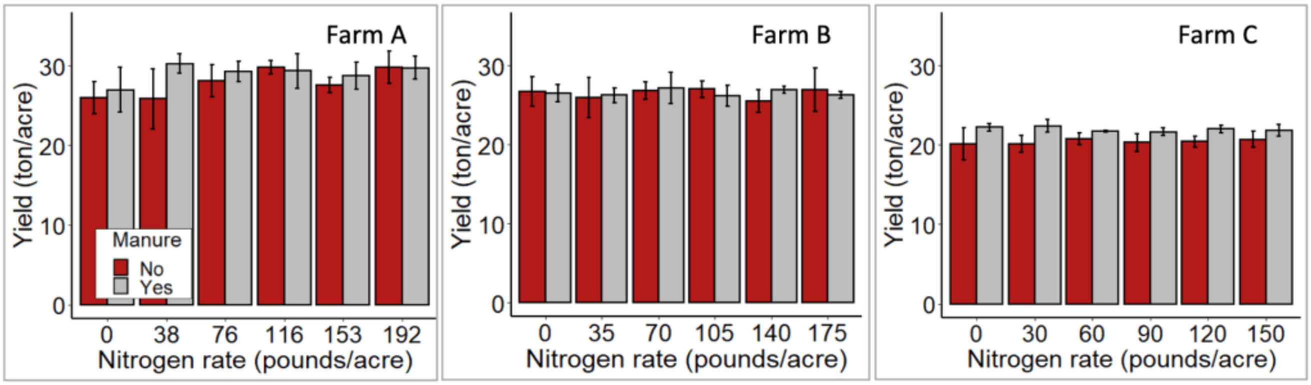


Figure 2. Effect of manure application and different nitrogen sidedress rates on corn silage yields in three New York farms. Error bars are standard deviations.

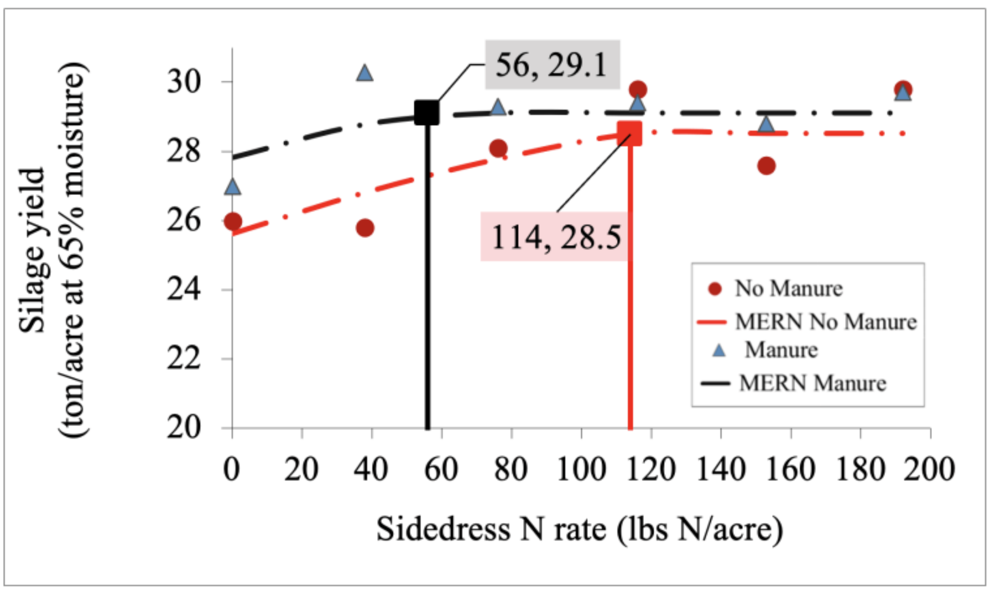


Figure 3. Most economic rate of N (MERN) in farm A. Without manure, the MERN was 114 lbs N/acre with a yield at the MERN of 28.5 tons/acre. With manure, the MERN was 56 lbs N/acre, with a yield at the MERN of 29.1 tons/acre.

Table 1. Effect of manure application on Pre-Sidedress Nitrate Test (PSNT) and Corn Stalk Nitrate Test (CSNT) at the Most Economic Rate of Nitrogen (MERN) of nitrogen fertilizer applied at sidedress time. The MERN for farm A was 56 lbs N/acre with manure, 114 lbs N/acre without manure. The MERNs for farms B and C were 0 lbs N/acre. For CSNT: L = Low, M = Marginal, O = Optimal, E = Excess.

	PSNT (ppm)		CSNT at MERN (ppm)	
Manure	Yes	No	Yes	No
A	57	29	1,276 O	1,557 O
B	23	15	3,759 E	1,462 O
C	113	62	7,931 E	639 M

Conclusions and Implications (and Invitation)

The trials of 2022 show the range of possible responses, with one trial not showing a yield or N benefit of the manure, one trial showing a yield increase when manure was applied that was not due to N addition, and one showing both a yield and N fertilizer benefit from manure. This shows the importance of targeting manure application to fields with low past N credits, where it will be most likely to cause a yield respond. Additional trials are needed with various manure sources (raw manure, separated liquids, solids, digestate, etc.) before we can draw conclusions about the N and yield benefits of manure. Join us for the 2023 Value of Manure project and obtain valuable insights about the use of manure in your farm! If you are interested in joining the project, contact Juan Carlos Ramos Tanchez at jr2343@cornell.edu.

Additional Resources

The NMSP Value of Manure Project website and on-farm field trial protocols are accessible at: http://nmsp.cals.cornell.edu/NYOnFarmResearchPartnership/Value_of_Manure.html (website) and http://nmsp.cals.cornell.edu/NYOnFarmResearchPartnership/Protocols/NMSP_Value_of_Manure_Protocol2023.pdf (protocol).

Acknowledgments

We thank the farms participating in the project for their help in establishing and maintaining each trial location, and for providing valuable feedback on the findings. For questions about this project, contact Quirine M. Ketterings at 607-255-3061 or qmk2@cornell.edu, and/or visit the Cornell Nutrient Management Spear Program website at: http://nmsp.cals.cornell.edu/.

Soybean Weed Control PRE/POST

Mike Hunter CCE NCRAT

Dec-23

Lambsquarter	**Pigweed/Waterhemp**	**Velvetleaf**	**Common Ragweed**	**Jimsonweed**
PRE	PRE	PRE	PRE	PRE
FirstRate	all Group 15	metribuzin	FirstRate	FirstRate
Valor SX	Reflex/Flexstar	FirstRate	Lorox	metribuzin
Lorox	Valor SX	Pursuit	metribuzin	Pursuit
metribuzin	Lorox	Python	Valor SX	Reflex/Flexstar
Pursuit	metribuzin			Valor SX
Prowl	Prowl			
Python	**Pigweeds only**			
	Pursuit			
	Python			
	FirstRate			
POST	POST	POST	POST	POST
Harmony SG	Reflex/Flexstar	Resource- *Excellent*	FirstRate- *Excellent*	Basagran
Raptor/Beyond Extra	Cobra-*90 PHI in NY*	Basagran	Cobra-*90 PHI in NY*	Classic
Basagran- Fair	**Pigweeds only**	Classic	Reflex/Flexstar	Cobra-*90 PHI in NY*
	Pursuit	Cobra-*90 PHI in NY*		Reflex/Flexstar
	Raptor/Beyond Extra	FirstRate		
	Harmony SG	Pursuit		
	Classic	Raptor/Beyond Extra		

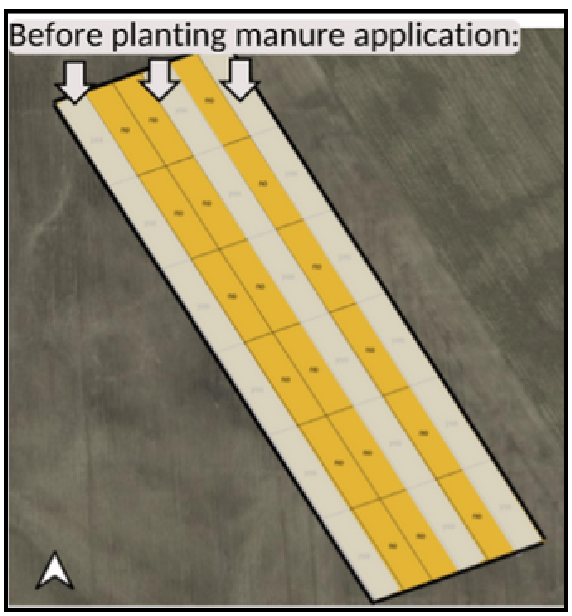
Black Nightshade	**Marestail (Group 2,9)**	**Field Horsetail**	**Biennial Wormwood**	**Spreading Orach/Atriplex**
PRE	PRE	PREPLANT burndown	PRE	PRE
all Group 15	metribuzin	glyphosate + Python	Python	metribuzin
Pursuit	Sharpen	Liberty + Python	Valor SX	FirstRate
Valor SX			Metribuzin	Pursuit
Reflex/Flexstar				
POST	POST	POST	POST	POST
Cobra-*90 PHI in NY*	Xtendimax	Liberty + Enlist One	Liberty-C	Pursuit + Basagran
Pursuit	Engenia	Enlist One	glyphosate- S/C	Harmony SG
Raptor/Beyond Extra	Enlist One	Liberty	Basagran- S/C	
Reflex/Flexstar	Liberty			

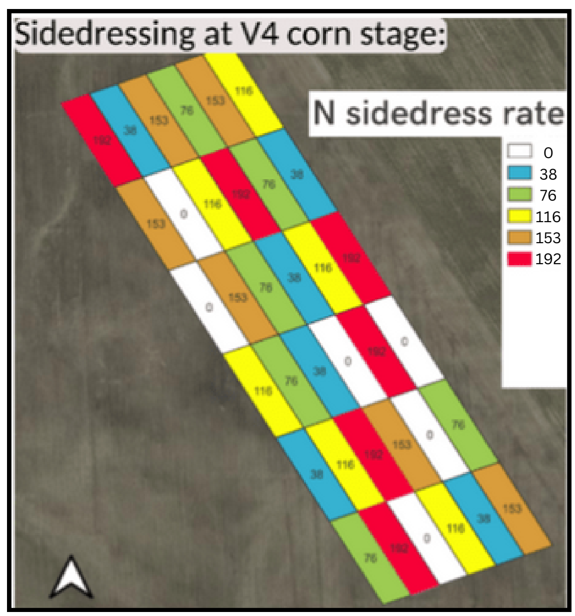
Crabgrass	**Foxtails**	**Fall Panicum**	**Barnyardgrass**	**Witchgrass**
PRE	PRE	PRE	PRE	PRE
all Group 15	all Group 15	all Group 15	all Group 15	all Group 15
Prowl- *Good*	Prowl- *Good*	Prowl- *Good*	Prowl- *Good*	Prowl- *Good*
Lorox- *Fair*	Lorox- *Fair*	Lorox- *Fair*	Lorox- *Fair*	Lorox- *Fair*
Pursuit- *Fair*	Pursuit- *Fair*	Pursuit- *Fair*		
POST	POST	POST	POST	POST
all Group 1	all Group 1	all Group 1	all Group 1	all Group 1
Pursuit- *Fair*	Pursuit- *Good*	Pursuit- *Fair*	Pursuit- *Good*	
Raptor/Beyond Extra- *Fair*	Raptor/Beyond Extra-*Good*	Raptor/Beyond Extra- *Fair*	Raptor/Beyond Extra-*Good*	

Join us!
Value of Manure Project

If I use manure:
How much can I save on fertilizer $$?
Will my corn yield increase?

“This study helps us put a number on the value of manure.
It was a very easy to implement without taking my time away."
Andy Miller, Osterhoudt Farms





We are looking for participants for the 2024 growing season! Interested?

Contact Quirine Ketterings (qmk2@cornell.edu) or Juan Carlos Ramos (jr2343@cornell.edu)

NMSP Nutrient Management Spear Program

NY farm viability INSTITUTE

Northern New York Agricultural Development Program

Nutrient Management Spear Program

"Relevant questions and sound science for agricultural profitability and protection of the environment"

We improve the profitability and competitiveness of New York dairy, livestock and cash grain operations while maximizing environmental protection.

Agriculture makes a significant contribution to New York's economy. We assess current knowledge, conduct research, identify educational needs, facilitate technology and knowledge transfer, develop management tools, and aid in on-farm implementation of nutrient management strategies to increase farm sustainability across the state.

We partner with farmers, Certified Crop Advisers, nutrient management planners, Cornell Cooperative Extension specialists, Soil and Water Conservation District staff, SUNY campuses and state and federal agencies.

1 million

acres impacted by our nutrient management guidelines for NY agriculture

150

on-farm research partnerships to improve farm economic and environmental sustainability

130

graduate, undergraduate and postdoctoral researchers involved in our team since 2000

Cornell CALS
College of Agriculture and Life Sciences

OUR FOCUS

1 LAND GRANT RESPONSIBILITY

Develop, implement, and support science-based guidance for nutrient management of New York dairy and cash grain operations.

2 SOIL HEALTH & CLIMATE RESILIENCY

Evaluate beneficial management practices such as conservation tillage and cover cropping to reduce greenhouse gas emissions and improve soil health.

3 PRECISION AGRICULTURE

Facilitate zone-based field management, on-farm research, and in-season adjustments using drones, satellite imagery and yield monitoring.

4 DAIRY SUSTAINABILITY

Collaborate with the dairy industry to assess whole-farm nitrogen, phosphorus, soil carbon, and greenhouse gas sustainability indicators.

5 ON-FARM RESEARCH

Conduct on-farm trials to help farmers make data-driven decisions that increase profit and minimize environmental impact for whole-farm sustainability.

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