

# Transition and Sustainability Strategies on Organic Farms NSERC Strategic Grant



**Nova Scotia  
Agricultural  
College**

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# Outline

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- Strategic grant overview
- Amendments and rotations
- Soil sustainability
- Crop variety selection and seeding rate
- Weeds Insects and diseases

# The Co-investigators

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- NSAC
  - Ralph Martin
  - Phil Warman
  - Emmanuel Yiridoe
  - Jeff Hoyle
  - Tess Astatkie
  - Nabil Rifai
  - Alan Fredeen
- U of M – Martin Entz
- AAFC Brandon – Cynthia Grant
- Collaborators
  - 11 Researchers from AAFC, U of G, McGill, Slovakia, U of M, NSAC, Dalhousie, U of S
  - 13 graduate students
  - 32 technicians and summer students
  - >60 farms from SK to NS
- Communication
  - 10 refereed publications
    - (2 submitted)
  - 19 oral/poster presentations
  - 21 other communications

# Organic

Transition

Sustainability

Management

Farming Systems

Livestock

**Crop Rotation**

Forages

Pests

Soil Fertility

Environment

Insects

Weeds

Amendments

Systems

Soil Quality

Degradation

Economics  
A. Riofrio\*

Modelling  
Georgallas/Fredeeen

# Rotations And Amendments

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Are forages and livestock-based amendments necessary in crop rotations?



**Forages**



**Ruminants**



**Monogastrics**



## Anchor plots at Carmen MB in 2003



# Is isonitrogenicity possible when designing organic research?

Available N (% of total)	Assumed	Actual
Alfalfa	30%	26.5
Ruminant Compost	25%	22.0 (yr 1) 1.4 (yr 4)
Monogastric Compost	50%	22.9 (yr 1) 1.4 (yr 4)

Note: Different composts were used in Yr 1 and Yr 4

# Rotations And Amendments

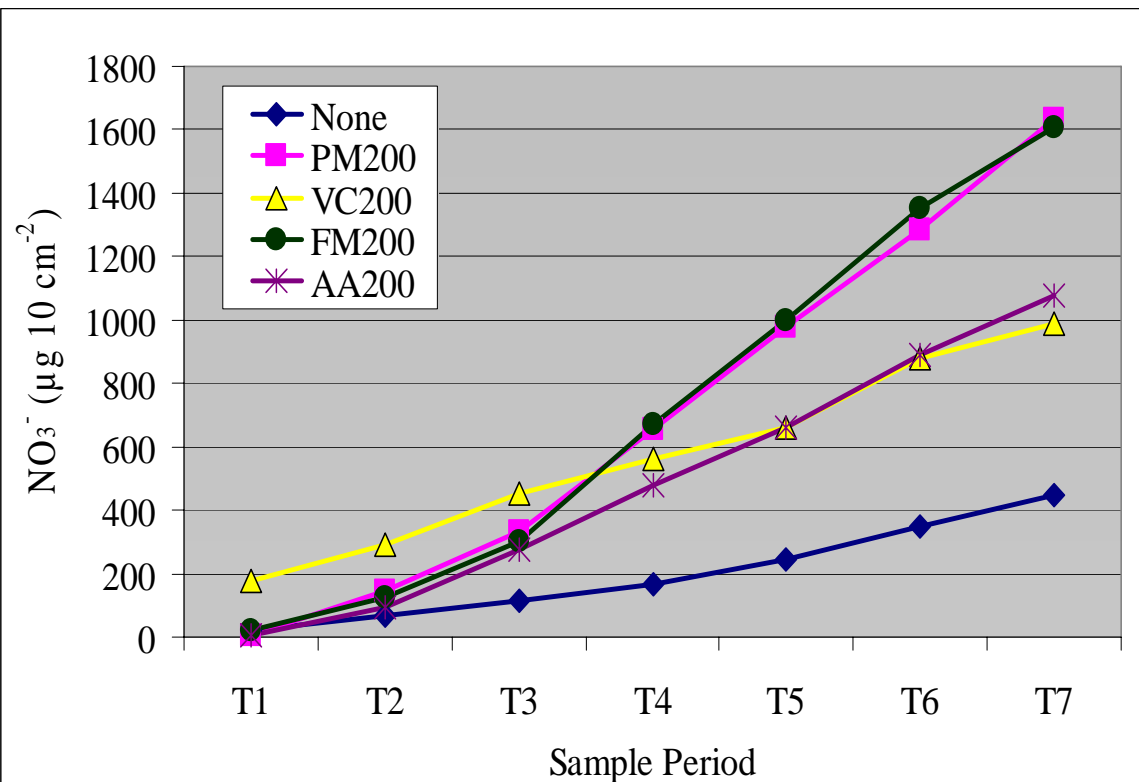
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- Management history had a significant influence on N availability, forage effect, weeds and insects
- Alfalfa effect greater in year of application
- Composts had greater effect in subsequent years
- Compost N availability difficult to predict, may cause immobilization
- Ruminant compost provided the highest tuber yield (NS)
- Compost applications significantly increased soil extractable P

# Nutrient Supply Rates Of Amendments

Cumulative  $\text{NO}_3^-$  supply curves (PRS<sup>TM</sup> probes) over 88 days in an impoverished soil amended with an equivalent of 200 kg/ha total N

None – unamended, PM - poultry manure compost, VC - vermicastings, FM – feather meal, AA – alfalfa meal



# Soil Sustainability

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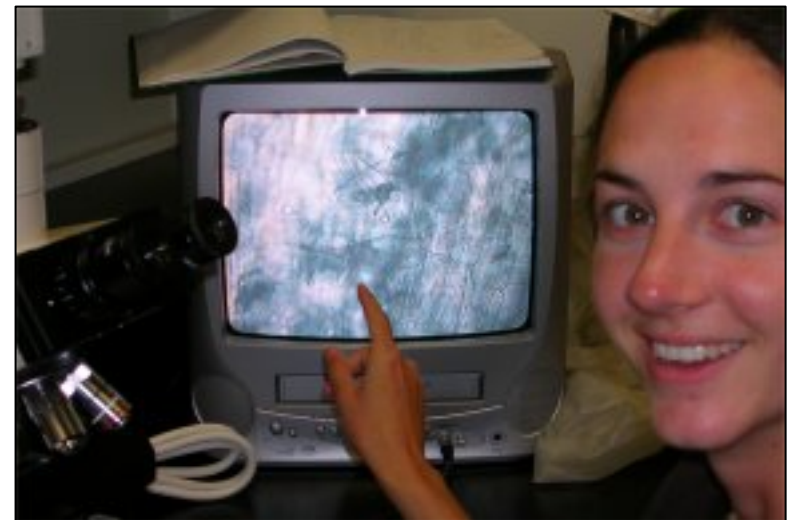
- How does organic management affect soil phosphorus availability?
- How does organic management affect soil C and susceptibility to erosion?



# How does organic affect soil P availability and mycorrhizae?

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- Glenlea long-term rotation
- Labile P lower in organic rotations than
- Annual rotations had higher labile P than rotations with alfalfa (harvested & removed)
- AMF and spores higher in organic than conv.; no rotation effect



# Soil Tillage and Erosion Susceptibility

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- Soil properties:
  - Texture
  - % Organic matter
  - Wet & dry aggregate stability
- Paired comparisons:
  - organic vs. conventional &
  - organic vs. organic farms



# Soil Tillage and Erosion Susceptibility

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- Zero-till practices uncommon on organic farms, however, they use more forages, cover crops, green manures, and composts
- Soil carbon lower under organic management, however, aggregate stability equal to conventional or higher
- Rotation had larger effect on soil carbon than whether organic or conventional; soil carbon higher in rotations including perennial forages



# How can a forage crop be used on organic farms?

(without removing for sale)



# Mulching Experiment

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- MB

- Wheat yields when 3.9 and 5.2 t/ha alfalfa mulch applied equivalent to 20 and 60 kg/ha of fertilizer N
- At equivalent yields, grain protein with mulch was higher than with fertilizer
- Highest mulch rate provided higher N uptake & yield in second crop than fertilizer N
- Weed problems at low rates

- NS

- High rates smother crop, encourage weeds
- Low rate (1 t/ha) had yield and economic benefit



# Crop Variety Selection

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- Is it necessary to breed varieties for organic production on organic land?
- Is there an advantage to intercropping varieties of the same crop?



# Varietal Intercropping & Yield Stability

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- 2 modern (Barrie & 5602HR) and 2 heritage varieties (Red Fife and Marquis)
  - Monoculture and all combinations of varieties
- Barrie and Marquis more susceptible to disease; yields suffered alone and in intercrops
- Mixtures outyielded Barrie & Marquis monocrops, but not different from Red fife and 5602HR
- Variety characteristics more important than if modern or heritage
- Mixtures contribute to yield stability

# Wheat – weed interactions at variable seeding rates

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- Objective
  - Evaluate the effects of higher seeding rates of spring wheat and high fertility on weed competition, and grain yield and quality



# Increase Seeding Rate!

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- Increasing seed rate increased yield & decreased weed biomass (especially in fertilized plots)
- Increasing seeding rate by 25% over conventional standard is appropriate



# Thermal weed control

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- Compare the efficacy and energy use efficiency of, hot water steam, flaming and infrared thermal units under field conditions
- Considering energy use efficiency, recommended flame weeding at 2.5 km/hr to control most young weeds provided there is low risk of fire



# Alternative Methods For Colorado Potato Beetle Control

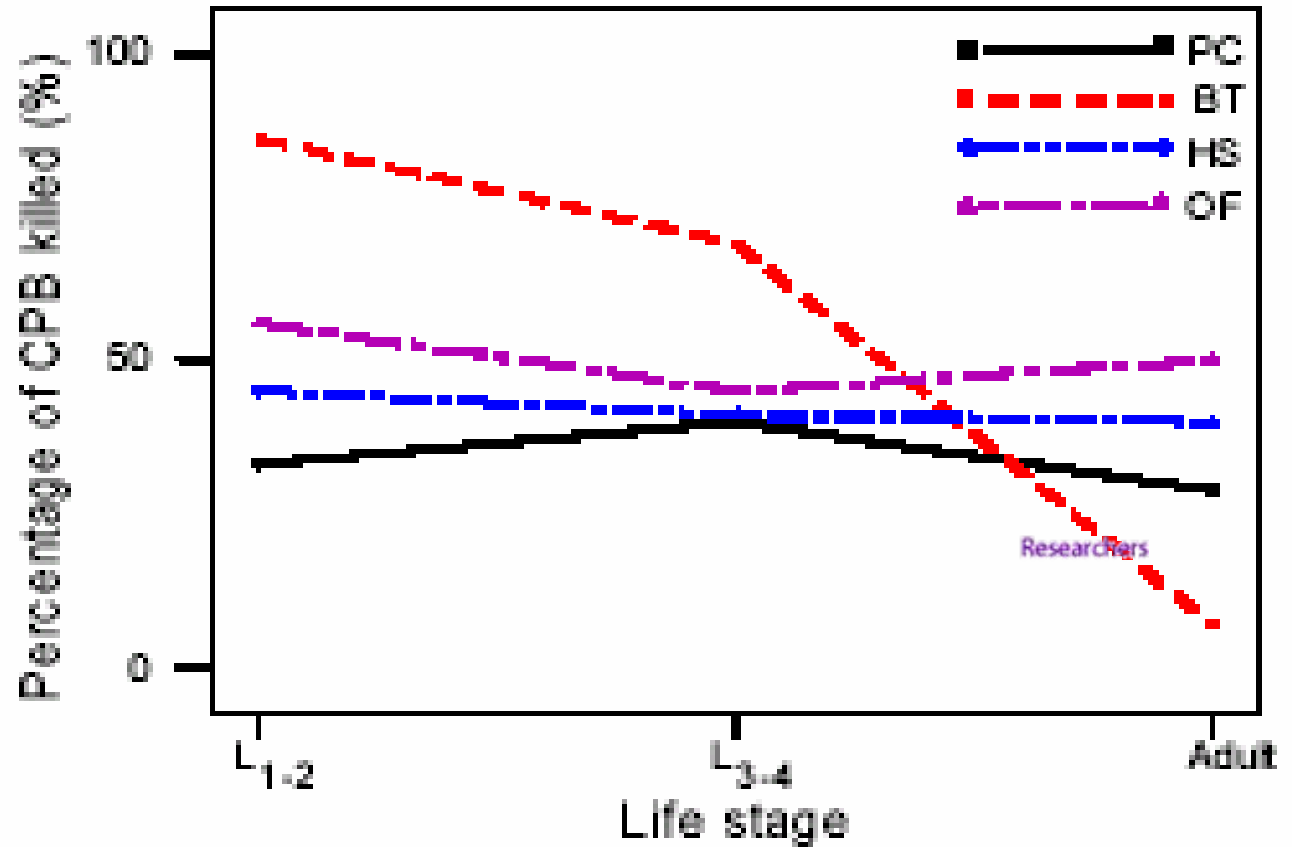
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- Objective
  - Evaluate the efficacy of
    - Intercropping tansy, flax, marigold, horseradish, and bush beans
    - Commercial plant extract sprays: Hot Pepper Wax™, Garlic Barrier AG®, and Neemix 4.5®
- Participants
  - NSAC – T. Moreau\*, P. Warman, J. Hoyle

# Colorado Potato Beetle Control

- Neemix was significantly more effective than hot pepper wax and garlic
- Companion planting at low densities proved ineffective





Percentage of CPB at different life stages killed by four control methods:

PC – pneumatic collector, BT - Bacillus thuringiensis, HS – hot steam, OF – open flame

# For More Information

Visit [www.oacc.info](http://www.oacc.info)

[www.oacc.info/ResearchDatabase/res\\_welcome.asp](http://www.oacc.info/ResearchDatabase/res_welcome.asp)

## Contact

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- OACC Office: 902-893-7256



# Weed Control

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- Weed competitiveness is affected by management history (e.g. transition from pasture vs. annual cropping)
- Mulching can help control weeds if crop not smothered
- Weed competitiveness affected by fertility levels and timely tine weeding operations
- Increasing seeding rate in wheat can reduce weed competition
- Timely tine weeding in potatoes can reduce weed density by over 75%