Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Compost: What's the Scoop?

Francis J. Larney

[1] Agriculture & Agri-Food Canada, Lethbridge, AB

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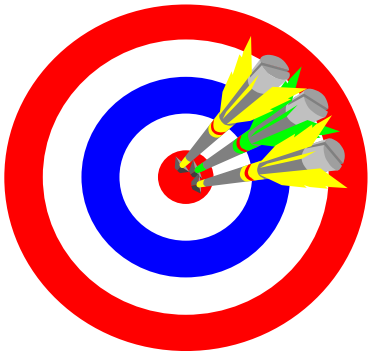
LETHBRIDGE COUNTY

Lethbridge College

Canada

Traditional manure handling

- "Bull's-eye" effect
  - fresh manure hauled short distances from feedlot pen to field
- Land close to feedlots:
  - can receive too much manure
  - affects soil, water and air quality
- Land distant from feedlots:
  - nutrient deficient
- Can composting help?



"What's in a name? That which we call a rose / By any other name would smell as sweet."

Manure

Compost

- Manure compost, e.g. cattle, hog, sheep, horse, poultry
- Leaf and yard waste compost
- Food waste compost
- Municipal solid waste (MSW)/biosolids compost
- Papermill sludge compost
- Vermicompost
- Etc.

Composting 101

- A natural process whereby organic matter is turned into stable humus-like material under managed conditions
- Manure is formed into long narrow windrows
- Composting involves incorporation of air into manure by turning 6-8 times over 3 months
- Followed by 3 months curing

Tractor-pulled windrow turner

Composting 101

Carbon (Carbon dioxide, methane); Nitrogen (ammonia, nitrous oxide)

Water

Heat

Organic Matter (C, N)
Minerals, Water,
Microbes

Windrow

Organic Matter (C, N)
Minerals, Water,
Microbes

Raw Manure

Compost

O_2

Backyard composting

http://www.lethbridge.ca/living-here/Waste-Recycling/Pages/Backyard-Composters.aspx

https://tinyhouseambitions.wordpress.com/2016/02/21/homesteading-diy-compost-bin/

Self-propelled units

http://midwestbiosystems.com/compost-windrow-turner

Benefits of compost and composting

- Reduced volume/transport requirements
- Saleable product
- Improved handling
- More uniform land application
- Less variable nutrient content
- Lower pollution potential: lower application rates
- Less odour nuisance complaints
- Pathogen/weed seed elimination
- Disease suppression

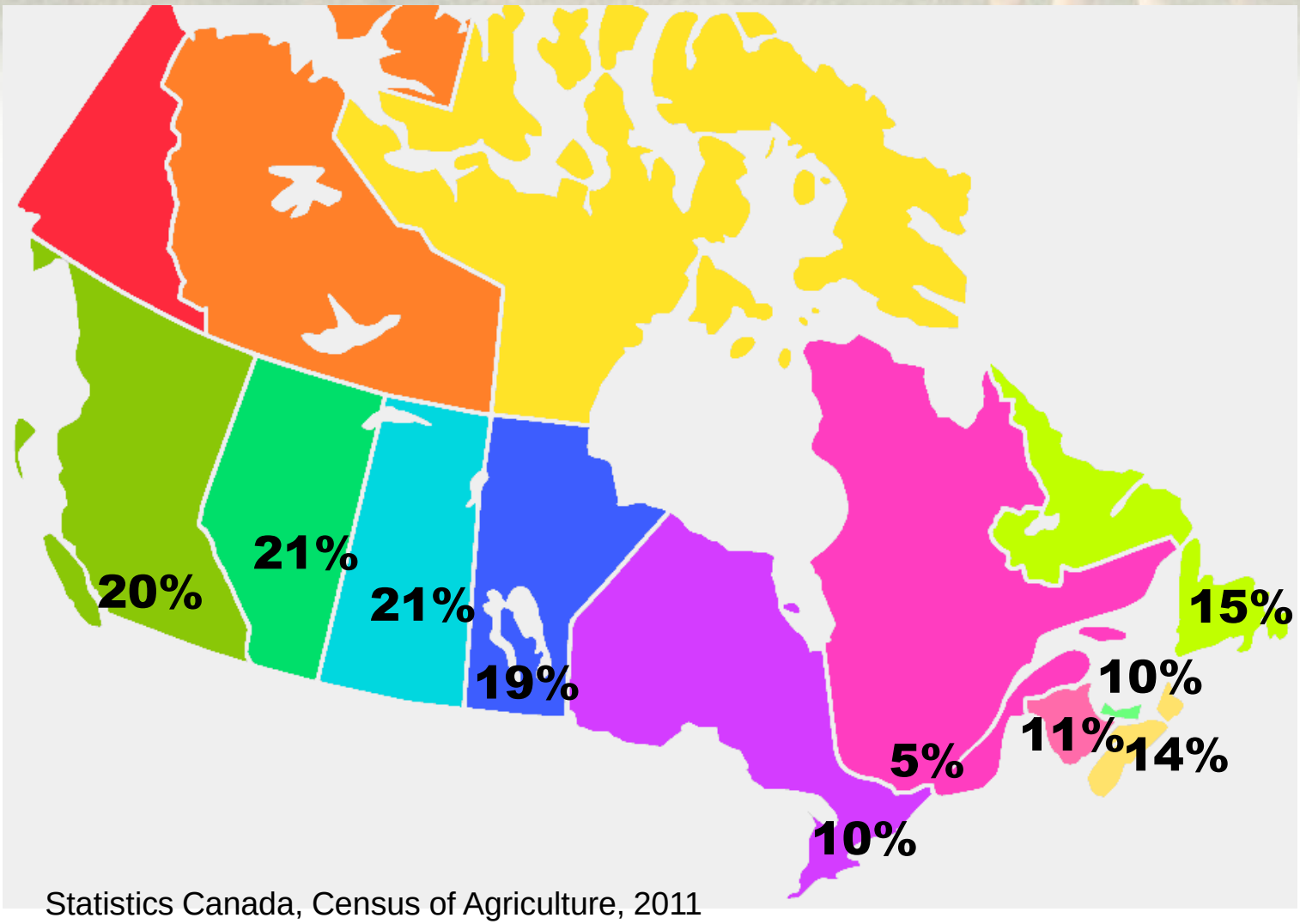
Drawbacks of composting

- Land (compost pad/site)
- Odour
- Weather:
  - hot & dry*:* moisture loss
  - cold: freezing of windrows
  - rain: runoff, limited windrow access
  - wind: finished compost blows!

- Marketing: finding buyers, managing inventory, quality control
- Slower nutrient release
- Carbon and nitrogen losses (happens with all types of handling)
- Greenhouse gas emissions (CO_2, nitrous oxide, methane): happens with all types of manure handling

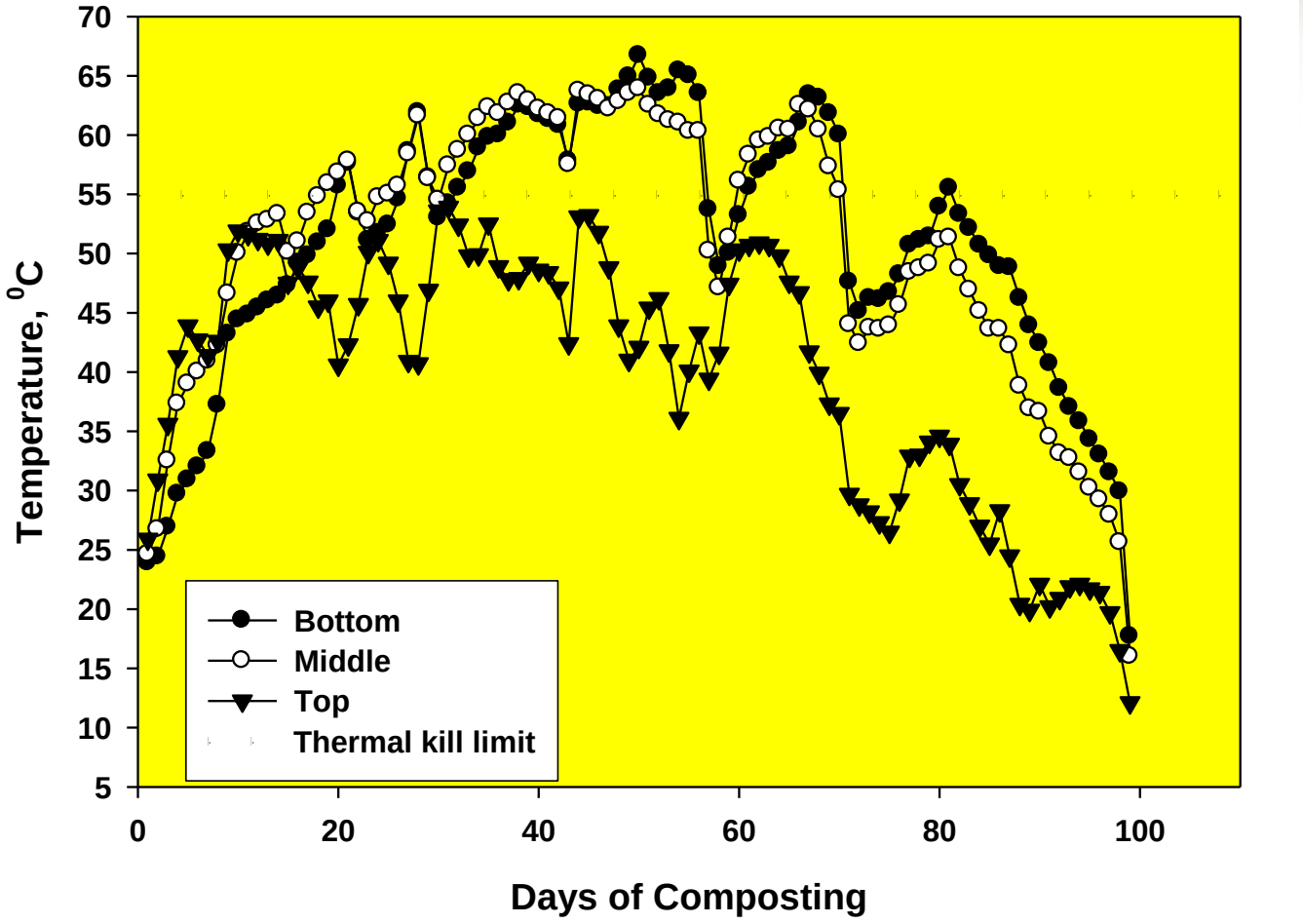
$$\frac{\text{No. of farms using “other manure” (composted, processed, dried, stored etc.)}}{\text{No. of farms producing or using manure (all types)}} \times 100$$

Not percent cropland area!



Statistics Canada, Census of Agriculture, 2011

Wood-chip bedded manure: windrow temperature



Moisture

- A major drawback of summer composting is loss of water on turning
- If too dry (<40%) – microbes shut down and end up with dry manure not compost
- If too wet (>70%) – not enough oxygen
- “Just right” moisture content for composting is 50-60%

Winter composting:

- Better water retention as no evaporation
- Temperatures can be maintained in cold weather if windrow dimensions are large enough

Nutrient dynamics during composting:

- N concentration decreases
  - However, the N remaining is in a more stable form than in raw manure
- C concentration decreases
  - but again the carbon remaining is more stable
- P concentration increases during composting
  - P losses are minimal, so same mass of P in less dry matter

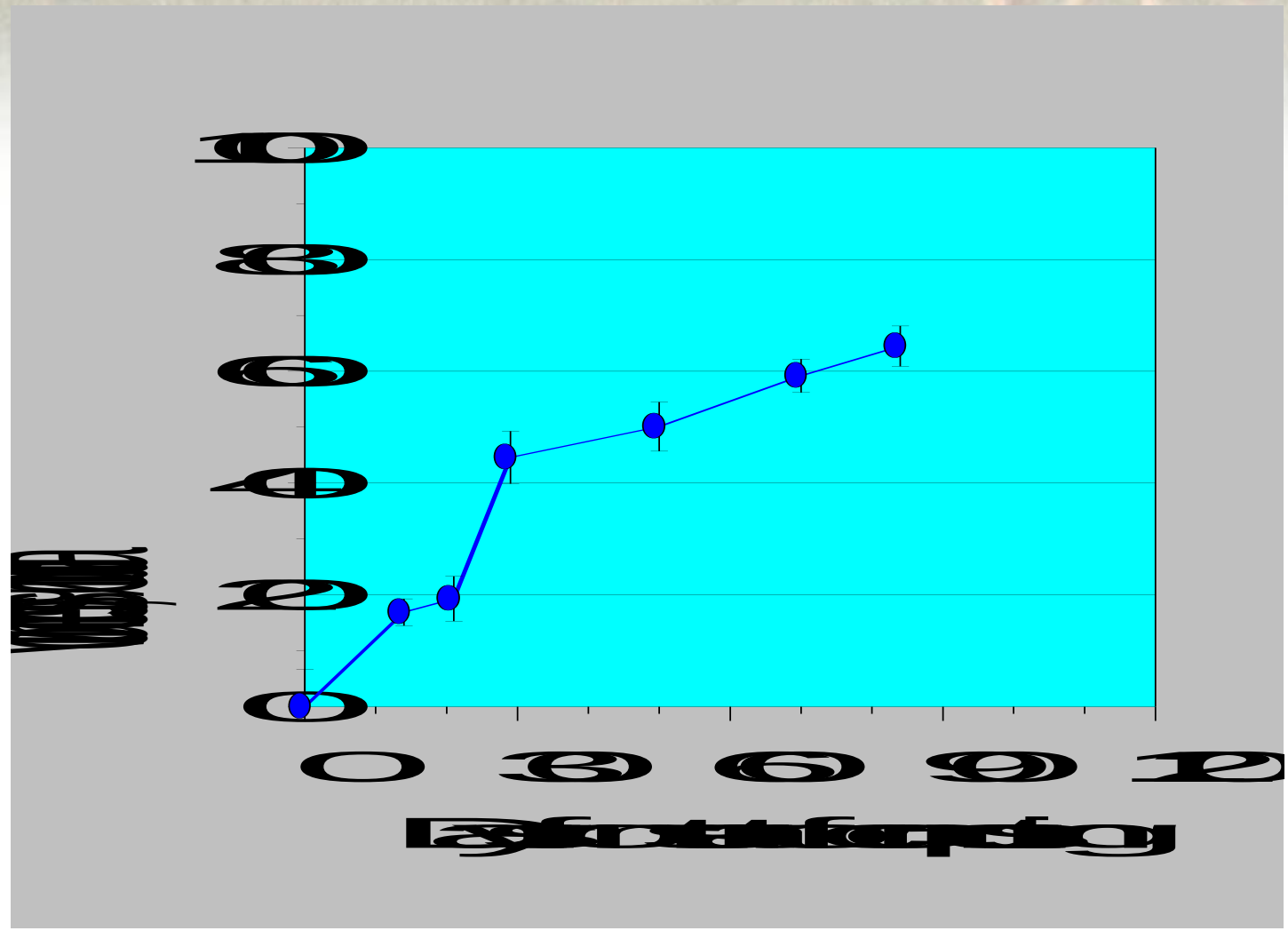
Weed seed viability

Effect of length of composting period on weed seed viability. Values are expressed as percent total viable seeds (germinated seeds + seeds with a positive tetrazolium test).

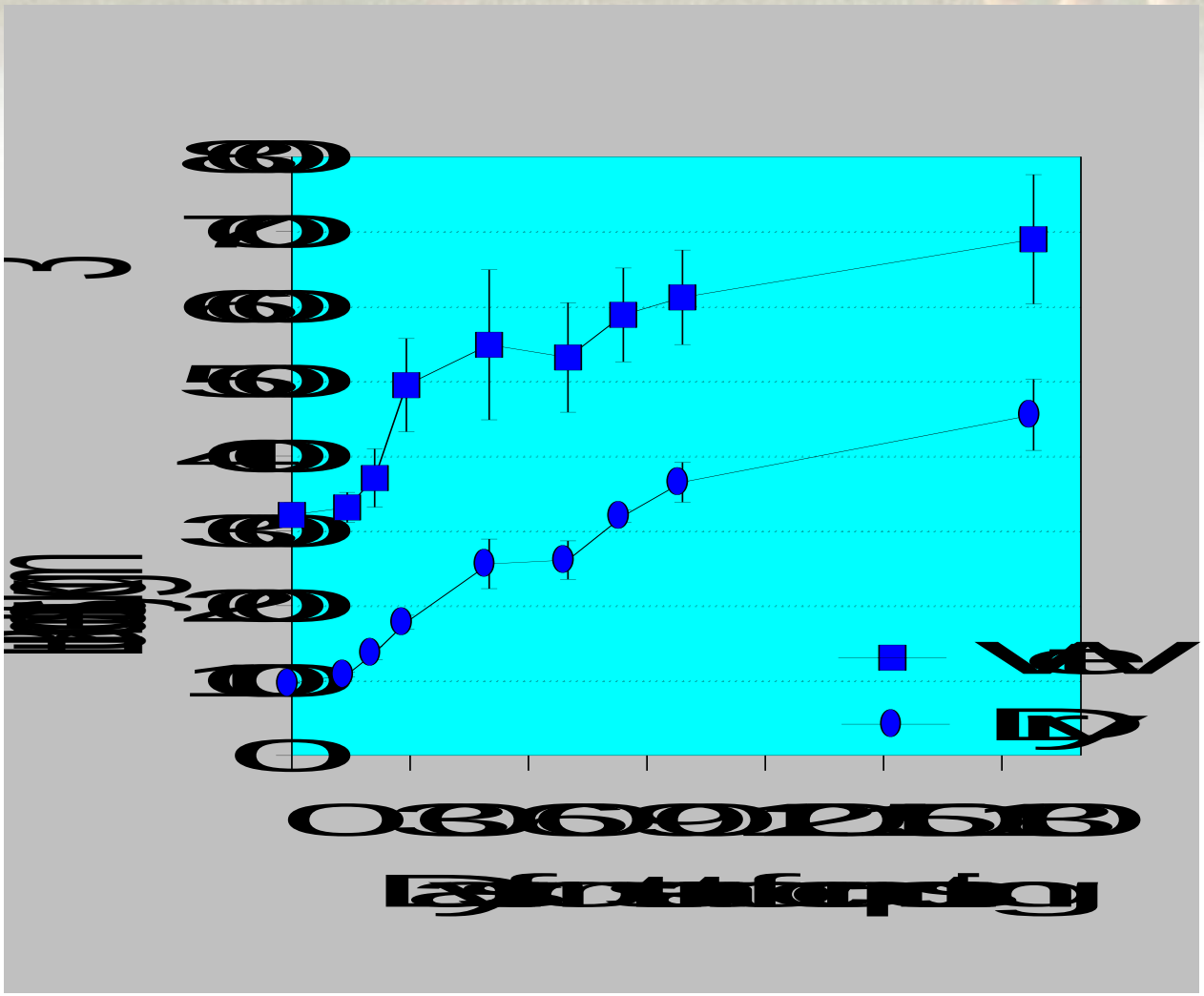
Day	14	21	29	50	70
			Redroot pigweed (*Amaranthus retroflexus* L.)		
Control	73	78	74	78	77
Composted	5	4	0.4	0	0
			Wild buckwheat (*Polygonum convolvulus* L.)		
Control	27	36	33	34	32
Composted	26	11	12	1	1

Larney and Blackshaw, 2003

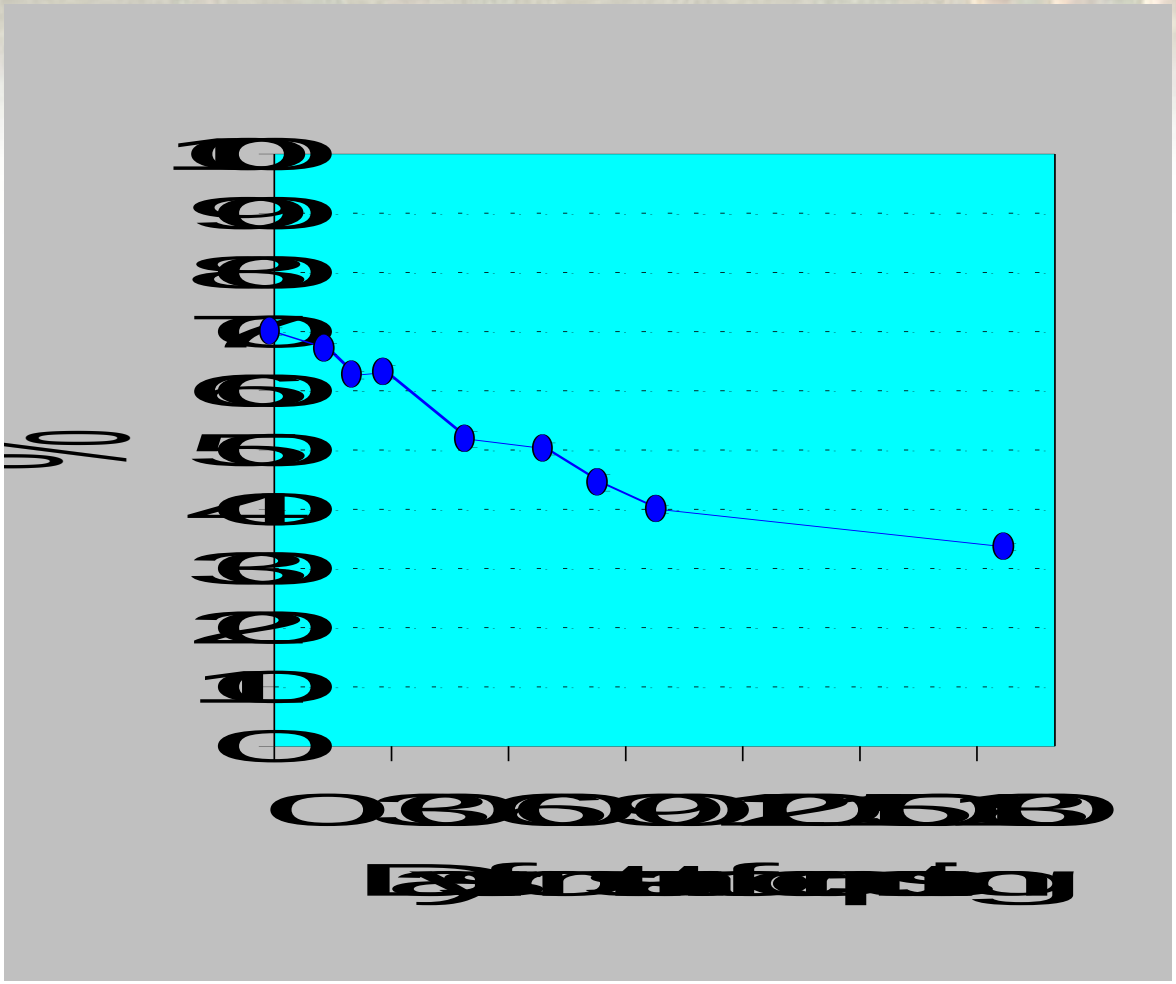
Volume loss (shrinkage)



Bulk density: weight in a given volume



Moisture content



Cost of haulage requirements

- **Shrinkage = 70% of initial volume**
- **Truck volume: 12 m^3**

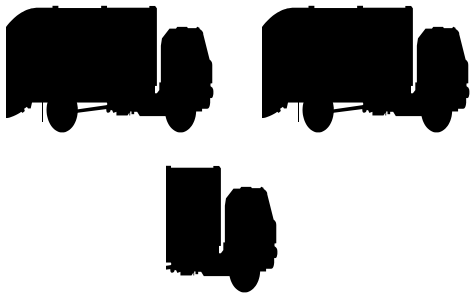
Fresh Manure

Volume: 100 cu. m

Truckloads = 8.3

Compost

Volume: 30 cu. m



Truckloads = 2.5

Haulage scenario, feedlot manure
('as is', equivalent wet wt. basis)

Treatment	H_2O	Dry Matter	N	P
		kg/tonne wet wt.		
Fresh	651	349	5.6	1.6

Haulage scenario, feedlot manure
('as is', equivalent wet wt. basis)

Treatment	H_2O	Dry Matter	N	P
		kg/tonne wet wt.		
Fresh	651	349	5.6	1.6
Compost	360	640	9.0	3.3

Haulage scenario, feedlot manure ('as is', equivalent wet wt. basis)

Treatment	H_2O	Dry Matter	N	P
		kg/tonne wet wt.		
Fresh	651	349	5.6	1.6
Compost	360	640	9.0	3.3

-44%

Haulage scenario, feedlot manure ('as is', equivalent wet wt. basis)

Treatment	H_2O	Dry Matter	N	P
		kg/tonne wet wt.		
Fresh	651	349	5.6	1.6
Compost	360	640	9.0	3.3

+83%

Haulage scenario, feedlot manure ('as is', equivalent wet wt. basis)

Treatment	H_2O	Dry Matter	N	P
		kg/tonne wet wt.		
Fresh	651	349	5.6	1.6
Compost	360	640	9.0	3.3

+60%

Haulage scenario, feedlot manure
('as is', equivalent wet wt. basis)

Treatment	H_2O	Dry Matter	N	P
		kg/tonne wet wt.		
Fresh	651	349	5.6	1.6
Compost	360	640	9.0	3.3

+106%

More economical to haul N and P as compost instead of manure

Compost

1 km

30 km

High soil N and P

Low soil N and P

Cross-sectoral benefits

- Livestock sector
  - Move nutrients further afield
- Crop sector
  - Enhance soil quality/soil health
- Oil and gas sector
  - Soil amendment for wellsite/pipeline reclamation

Compost Knowledge Gaps

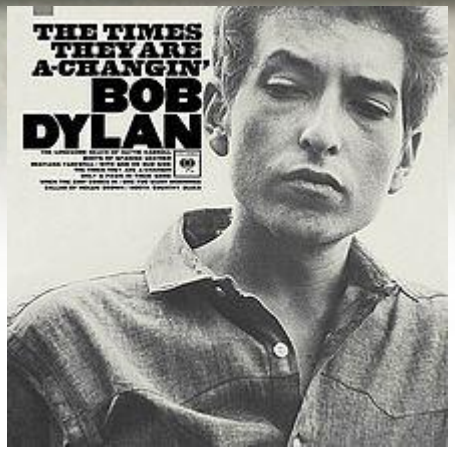
- Soil health/microbial activity
- Nutrient release characteristics
- Behaviour in cropping systems
- Plant disease suppression
- Imported vs. indigenous organic matter in soil reclamation
- Economics

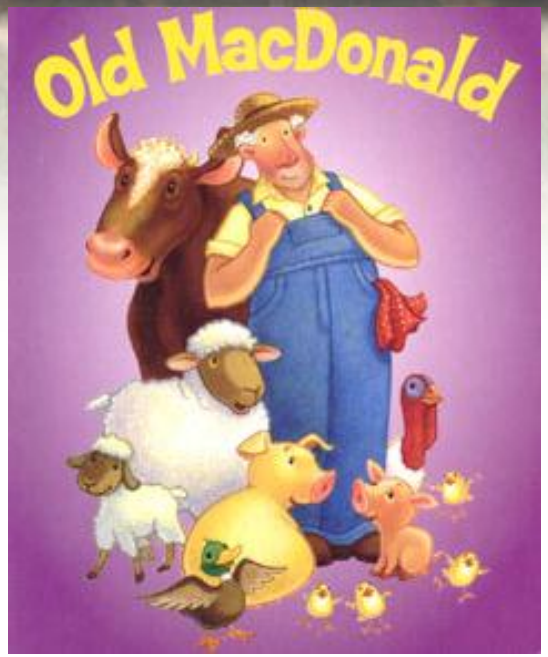
Thank you!

Jean-François Millet (1814-1875), *Peasant spreading manure*, 1854-1855, French. Oil on canvas. 81.3 × 111.8 cm. Courtesy of the North Carolina Museum of Art, Raleigh, NC

Canada

The times they are a-changin'.....





- Specialization has made farms less diverse
- Traditional link between crop and livestock production not what it was
- Manure management has become an environmental issue