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Economic Feasibility of Genotyping for Feed Efficiency and Reduced Methane Emissions: Benefits and Barriers to Adoption on Canadian Dairy Farms

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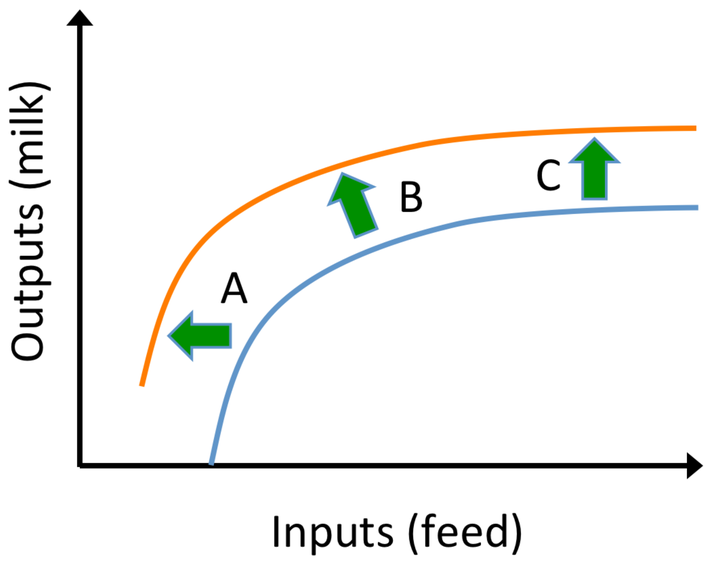
BACKGROUND

- Genomics allows animals to be selected for preferred traits (such as feed efficiency) early in their lifecycle without time consuming and expensive testing methods[1]
- Feed is the highest variable cost in dairy
- Methane emissions are highly correlated to feed intake[2]
- Thus, improving feed efficiency leads to decreased methane emissions
- Benefits for producers and the environment

TECHNOLOGY ADOPTION

- Genomic selection for feed efficiency and reduced methane emissions shifts the production possibilities frontier outward
- Dairy farmers may alter their operations in several ways due to this new technology



A. Farmers reduce the amount of feed needed and produce the same amount of milk

B. Farmers both reduce feed use and increase milk output

C. Farmers use the same amount of feed but produce more milk

OBJECTIVES

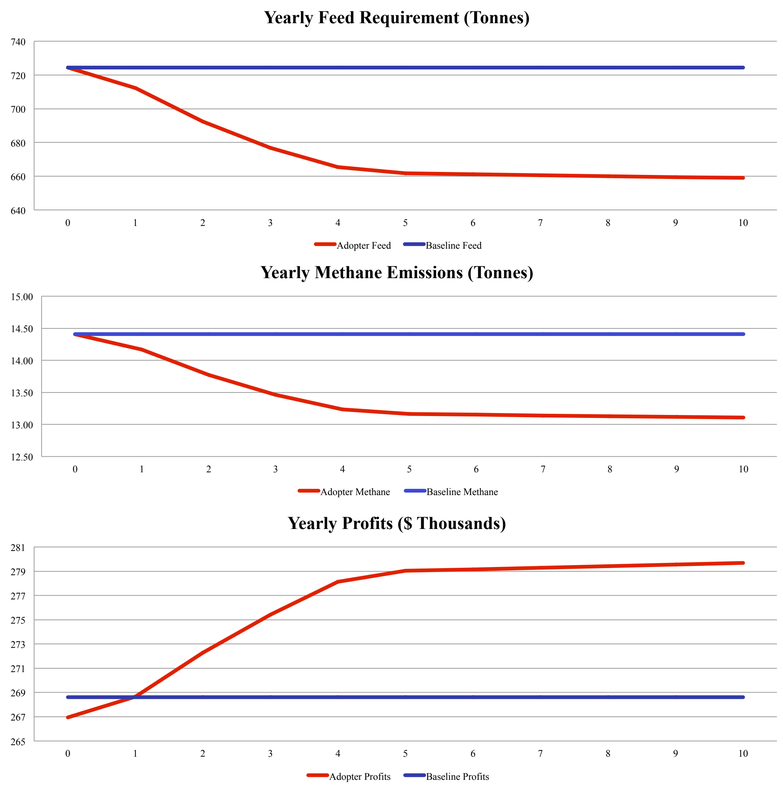
i) To estimate the NPV from farm level adoption of genomic selection for feed efficiency/reduced methane emissions
ii) To examine potential barriers to adoption and their influence on NPV/ adoption
iii) To explore management decision changes (*i.e.,* herd size expansion, increased cash cropping, emissions permit trading/rebates, etc.)

METHODS

- Dynamic 25-year farm budgeting model
- Key parameters:
  1) feed intake and methane output of feed efficient heifers & cows versus average
  2) cost of genotyping & artificial insemination (AI)
- Potential real options analysis: Delay adoption? Use AI and/or genotype?

PRELIMINARY RESULTS

- Deterministic result of an increase in NPV of approximately $140,000 for average farm in total over 25 years from an 8.4% reduction in feed consumption
- Represents a 456 kg/cow/year reduction with additional reduction each year from genetic progress



POLICY IMPLICATIONS

- Increased competitiveness for Canadian dairy producers
- Reduced environmental footprint due to lower methane emissions per unit of output
- GHG Policy: emissions permit trading/ taxation as a source of revenue or a cost for dairy?

	CO_2	Methane (CH_4)
Estimated Social Cost ($/tonne)	$40.7	$1,165

Source: Environment and Climate Change Canada[3]

- What role will quota play? Producers may wish to expand or contract their herd sizes
- Will producers switch fields to cash crops, substituting away from feed crops?
- How can other livestock sectors learn from dairy biotechnology advances?

WHAT TO LOOK FORWARD TO?

Canadian dairy producers will be surveyed to better estimate their willingness to pay for genotyping and their attitudes towards adoption.
Stochastic models will be applied across a variety of regions and farm sizes.

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REFERENCES

1) Saatchi et al., (2011) *Genetics, Selection, Evolution,* 43**,** 40.
2) De Haas et al., (2011) *Journal of Dairy Science* 94:6122-6134.
3) Environment and Climate Change Canada (2016) "Technical Update to Environment and Climate Change Canada's Social Cost of Greenhouse Gas Estimates".