Extended Abstract

Paper/Poster Title	Greenhouse Gas Mitigation in Dairy Production considering Incentives and farm heterogeneity

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Abstract	*200 words max*

Reducing emissions from livestock production is at the forefront of the ongoing policy discourse aimed at reducing the environmental impact of agricultural emissions and achieving net zero goals. This study examines farmer incentive to adopt breeding practices with the potential to improve farm-level environmental outcomes in dairy cattle. The study employs two regionally representative bioeconomic simulation models in Canada to account for possible spatial heterogeneity. The analysis also accounts for the role of revenues from the emerging carbon offset market. We find that whilst farmer uptake of breeding technologies can reduce the level of GHG emissions, producer incentives differ widely across agroecological zones. Further, we find that the effectiveness of incentives offered by the additional revenue from offset markets depends on scale, highlighting potential aggregation opportunities.

Keywords	Net zero, farmer incentives, greenhouse gas emissions, dairy
JEL Code	Q12 Micro Analysis of Farm Firms Q56 Sustainability Q58 Government Policy

Introduction	*100 – 250 words*

Reducing Greenhouse gas (GHG) emissions from livestock systems has been identified as critical to reducing overall agricultural GHG emissions and achieving net zero goals. Agriculture accounts for about one fifth of GHG emissions globally (OECD, 2022). A significant proportion of these emissions – an estimated 50% - is attributable to on-farm nitrous oxide and methane emissions from the livestock sector (Lassey, 2007). The relevant considerations for achieving the desired environmental outcomes at the farm-level includes the choice of pathway and the design of right incentives. Pertaining to the latter, it is widely acknowledged that there is scope for considerable reduction in GHG emissions through practices such as breeding, on-farm manure management, feed additives and other practices. For example, new opportunities have emerged for the application of novel breeding technologies to identify and select for low emitting cows. Along with this, are emerging institutions that offer additional revenue opportunities for livestock farmers in the new carbon economy. Farmer uptake of these new breeding tools and the resulting on-farm environmental outcomes depends on the proper alignment of incentives. There is also the question of complementarities in different management practices and possible heterogeneities across different geographical zones. This paper evaluates farmers' incentive to improve environmental outcomes using breeding technologies. The analysis is based on data from Canada's dairy sector.

Methodology	*100 – 250 words*

The study develops bio-economic stochastic farm level simulation models for two regional representative dairy farms in Canada. This is used to assess producer incentive to adopt different breeding and management strategies to achieve net zero. The modelling approach accounts for region-specific agroecological variables, milk yields, genomic improvement in resilience traits (i.e., feed efficiency, disease resilience, methane emissions) scenarios and different manure management practices. The model also accounts for differences in farm costs and input use. The simulation allows for stochasticity in economic and biological variables.

Results	

The results show that breeding technologies offer an economically feasible pathway to achieving net zero goals by reducing emission intensities in livestock herds. However, these incentives differ spatially. Further, the full range of benefits are only obtainable if combined with complementary on-farm environmental management practices. The results further show that additional revenue from offsets market may be inadequate to incentivise change given the scale of emission reductions at the farm-level. These results shed light on the economic incentives faced by farmers, the impact of different breeding and management strategies and the critical considerations for effective policy design to enhance adoption.

Discussion and Conclusion	*100 – 250 words*

Breeding for environmental traits in livestock such as methane reduction and feed efficiency improvements can be a viable option for achieving net zero goals. Public policies to stimulate uptake should consider the spatial differences in farmer incentives and the role of complementary farm practices.