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# Modelling Options for Greenhouse Gas Emission Reductions: An Analysis of the Agricultural Sector in Sri Lanka

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## Abstract

Reducing Greenhouse Gas (GHG) emissions is crucial for mitigating climate change. Agriculture is a significant contributor to GHGs. This study evaluates several options available for GHG emission reduction, related to crops, livestock and energy use in the agricultural sector in Sri Lanka. The data related to $CO_2$, $CH_4$ and $N_2O$ emissions, paddy yield and the area of cultivation were obtained from the database of the Food and Agriculture Organization of the United Nations and the Department of Agriculture. Paddy crop was modelled by assuming cultivation of an indigenous paddy variety, which uses organic fertilizer, in 5%, 10%, 15%, 20% and 25% of the total area available for paddy cultvation in the country. The avoided urea application and associated reduction of $N_2O$ emissions were considered. Use of petroleum was replaced with renewable energy sources (biomass). $CH_4$ emissions from dairy and non-dairy cattle were modelled by assuming 5%, 10%, 15%, 20% and 25% replacement with feed additives, which reduce methane emissions from ruminants. Damage cost was calculated for the period from 2025 to 2050. According to the results, the social cost of carbon with the cultivation of an indigenous paddy variety for rainfed paddy ranges from USD 141 million to USD 111 million in 2025. The cost ranges from USD 484 million to USD 382 million for irrigated paddy. The benefit from organic paddy cultivation was higher than that of paddy cultivated using chemical fertilizer. Both the cost of fertilizer and the global damage cost were lower for organic paddy. With renewable energy replacing 25% of petroleum use, damage cost of $CO_2$, $CH_4$ and $N_2O$ emissions can be reduced to USD 7 million, USD 186 million and USD 1877 million respectively. With the reduction of $CH_4$ emissions by 25%, the damage cost related to dairy cattle will be reduced to USD 36 million from USD 48 million in 2025. It will be reduced by USD 14 million for non-dairy cattle. Damage cost increases from 2025 to 2050, for all the options considered. The study reveals that the damage cost of GHGs can be reduced by introducing suitable options and highlights the importance of mitigating the impacts of GHG emissions. The outcomes of the study are important for policy-making in the agriculture sector.

**Keywords:** Greenhouse gas emissions, Social cost of carbon, Crops, Energy use, Livestock