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Addressing Food Grain Losses in India: Energy Trade-Offs and Nutrition Synergies

Authors : Matthew F. Gibson, Narasimha D. Rao, Raphael B. Slade, Joana Portugal Pereira, Joeri Rogelj

Abstract : Globally, India's population is among the most severely impacted by nutrient deficiency, yet millions of tonnes of food are lost before reaching consumers. Across food groups, grains represent the largest share of daily calories and overall losses by mass in India. If current losses remain unresolved and follow projected population rates, we estimate, by 2030, losses from grains for human consumption could increase by 1.3-1.8 million tonnes (Mt) per year against current levels of ~10 Mt per year. This study quantifies energy input to minimise storage losses across India, responsible for a quarter of grain supply chain losses. In doing so, we identify and explore a Sustainable Development Goal (SDG) triplet between SDG_2, SDG_7, and SDG_{12} and provide insight for development of joined up agriculture and health policy in the country. Analyzing rice, wheat, maize, bajra, and sorghum, we quantify one route to reduce losses in supply chains, by modelling the energy input to maintain favorable climatic conditions in modern silo storage. We quantify key nutrients (calories, protein, zinc, iron, vitamin A) contained within these losses and calculate roughly how much deficiency in these dietary components could be reduced if grain losses were eliminated. Our modelling indicates, with appropriate uncertainty, maize has the highest energy input intensity for storage, at 110 kWh per tonne of grain (kWh/t), and wheat the lowest (72 kWh/t). This energy trade-off represents 8%-16% of the energy input required in grain production. We estimate if grain losses across the supply chain were saved and targeted to India's nutritionally deficient population, average protein deficiency could reduce by 46%, calorie by 27%, zinc by 26%, and iron by 11%. This study offers insight for development of Indian agriculture, food, and health policy by first quantifying and then presenting benefits and trade-offs of tackling food grain losses.

Keywords : energy, food loss, grain storage, hunger, India, sustainable development goal, SDG
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