Invited Oration

Use of Livestock Resources for Food Security in the Context of Climate Change

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Human population having physical social and economic access to sufficient, safe and nutritious food that meet their dietary needs and food preferences for an active and healthy life, at any given time is considered as food security. Household food security is the application of this concept to the family level, with individuals within households and families as the focus of attention.

Livestock contributes greatly to food security because: (1) they are suppliers of global calories, proteins, and essential micronutrients, (2) they are produced in areas that have difficulty in growing crops, (3) most of the feed for livestock is not appropriate for human consumption, and (4) they provide manure for crop production. The livestock sector contributes to the livelihoods of one billion of the poorest populations in the world and employs more than one billion people especially in developing countries.

Livestock products are an important agricultural commodity for global food security because they provide 17% of global kilocalorie consumption and 33% of global protein consumption. There is growing demand for livestock products, and its rapid growth in developing countries has been clearly identified. Worldwide milk production is expected to increase from 664 million tonnes (in 2006) to 1077 million tonnes (by 2050), and meat production will double from 258 to 455 million tonnes.

Global climate change is primarily caused by greenhouse gas (GHG) emissions that result in warming of the atmosphere. The livestock sector contributes approximately 15% of global GHG emissions and thus may increase land degradation, air and water pollution, and declines in biodiversity at the same time. Climate change will affect livestock production through competition for natural resources, quantity and quality of feeds, livestock diseases, heat stress and biodiversity loss while the demand for livestock products is expected to increase by 100% in 2050.

Therefore, it is a great challenge to maintain balance between productivity, household food security, and environmental preservation, while using livestock resources for food security.

As an example, changes in mixed crop-livestock systems are an adaptation measure that could reduce GHG emission while improving food security. This type of an agricultural system is already in practice in two-thirds of world, producing more than half of the milk, meat, and crops such as cereal, rice, coconut, oil palm, etc

In global context, an integrated cropping, livestock farming and saline pond aquaculture system, which is practiced in Philippines have shown significantly reduced GHG emissions. The system was developed in the 1980s in the central Philippines and has been re-evaluated in terms of its potential to reduce emissions from livestock production, particularly in wet and wet-dry tropical regions. Use of silage from crop by-products and implementation of a feed-lot system of cattle after 300 days, enabled immediate and significant reductions of GHG emissions over extensive cattle grazing. Integration with a saline animal waste processing pond allowed production of natural feed products, cyanobacteria algal mat for use in aquaculture, as crop fertilizer and soil amendment or in the silage manufacture process. Stoichiometrically, bio-processing of waste material in saline ponds provided a novel solution to reduce GHG emissions from feedlots.

In local context, reducing the intensity of emissions of livestock production by coconut -dairy integrated system in southern Sri Lanka showed substantial progress. Dairying in the southern Sri Lanka is mostly a non-commercial activity, carried out by smallholder farmers, with an average herd size of 2-3 cows. The system is relatively extensive. Dairy cows reared under tethered conditions or graze freely under coconut trees, a practice permitted by some plantation owners for several decades. Productivity is very low. The average yield is around 2-3 liters of milk per day, and financial returns are poor. Around 0.5 million hectares of coconut and is estimated to be available for intercropping and cattle grazing, but is hampered by ongoing low productivity. The cattle graze natural herbage, considered weeds by the plantation owners, which vary in supply due to the bi-modal pattern of rainfall. Coconut poonac (oil cake) and rice bran are often given as a supplementary feed as local availability is high. Rice straw is occasionally used in dry seasons. Farmers were shown how to supplement the natural herbage that the cattle were grazing with a high protein tree fodder crop (*Gliricidia sepium* which is a widely cultivated, multi-purpose tree in southern Sri Lanka. At the same time as the tree fodder, farmers also introduced a low-cost concentrate comprising urea, rice bran, molasses and minerals. The productivity gains achieved through feed supplementation imply a reduction in the emissions intensity of milk production in integrated system. The actual effect on emissions intensity was not been measured, so this assumed that the methane yield under the supplemented diet did not differ fundamentally from the methane yield for forage grazing only. The changes to manure management and the substitution of chemical fertilizer by dung and urine have improved plant nutrient and soil fertility status. As dung and urine remained largely aerobic, the production of greenhouse gases were minimized. The increase in nut and copra yield reinforced the willingness of landowners to permit cattle grazing on their land and, via reduction of fertilizer inputs. It was also likely to have reduced the emissions intensity of nut and copra production. Coconut plantation owners benefited from higher nut and copra yields and from reduced inorganic fertilizer, herbicide and weeding costs (up to 40%).

Therefore, it can be suggested that changes in mixed crop-livestock systems can improve efficiency by producing more food on less land using fewer resources, such as water. Improving feeding practices as an adaptation measure could indirectly improve the efficiency of livestock production, while reducing GHG emissions. These practices can reduce the risk from climate change by promoting higher intake or compensating low feed consumption, reducing excessive heat load decreasing the feed insecurity during dry seasons.