Climate Resilient Livestock Farming*

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Livestock plays a major role in the agriculture sector of developing countries, contributing 40% to the agricultural GDP. India has a huge population of livestock in the world. It has 56.7% of world's buffaloes, 12.5% cattle, 20.4% small ruminants, 2.4% camel, 1.4% equine, 1.5% pigs and 3.1% poultry. In 2010-11 livestock generated outputs that were worth ` 2075 billion (at 2004-05 prices). This comprised 4% of the GDP and 26% of the agricultural GDP. The total output worth was higher than the value of food grains (12th Five Year Plan - 2012-17). It provides livelihood to many of the world's poorest people in rural areas providing both food and income. It provides food, income, employment and many other contributions to rural development viz. draught power, means of transport, organic manure for crop production and domestic fuel, hides and skin etc. They contributed about 16% income, more so in states like Gujarat (24.4%), Haryana (24.2%), Punjab (20.2%) and Bihar (18.7%). Due to economic growth and urbanization, global demand for foods of animal origin is growing and it is apparent that the livestock sector will need to expand more in future with the growing population. Although the prospect of animal productivity and its share to food security and national GDP is on the upward swing, livestock is adversely affected by the prevailing scenario of heat stress, land and water scarcity and the ensuing climate change.

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Global warming and climate change have become major threats to the sustainability of livestock production systems. In tropical and sub-tropical regions high ambient temperature is the major constraint on animal production. High environmental temperature exerts a negative influence on the performance of livestock population. By 2100, the temperature will be about 1.4-5.8°C more than the 1990 levels (IPCC, 2007). With increase of 1.5°C to 2.5°C, approximately 20 to 30 percent of plant and animal species are expected to be at risk of extinction.The impacts of climate change are visible all over the world, but India is categorized among the most vulnerable areas, as rural economy is primarily dependant on crop-livestock production systems, and almost 70 percent of livestock in India is owned by small and marginal farmers, and landless labourers. Animals of such livestock owners with poor resources are more vulnerable to climate change, and thus at a greater risk. India is currently losing nearly two per cent of the total milk production, amounting to a whopping over ` 2,661 crore due to rise in heat stress among cattle and buffaloes because of the global warming. Majority of the areas in India show higher Temperature Humidity Index (THI= 75 or more) and 85% places in India experience moderate to high heat stress during April, May and June (NDRI Vision 2030, 2011).

There is an urgent need to increase the adaptive capacity of the livestock to heat stress. However, adaptation to climate change is unlikely to be achieved with a single strategy.Therefore, genetic, management and environmental modifications will be helpful in building livestock resilience to climate change among the vulnerable populations.Genetic modifications may be done by increasing the gene flow and introduction of breeds more adapted to the

* This is a summary of the lecture delivered by Prof. (Dr.) A.K. Srivastava at XIII Agricultural Science Congress during Feb. 21-24, 2017 at Bengaluru.

environment. Studies have reported that Zebu cattle are more heat tolerant than European cattle. Preparedness for such transformations will require a significant research commitment. Many studies confirm that animal health and welfare are integral to environmental sustainability. Intensive high-input, high-output systems that appear highly efficient at first glance are in fact energy and resource hungry. Selection of animals for high yield is often directly associated with poor welfare which in itself can significantly contribute to increasing carbon emissions that may further increase the atmospheric temperature which is already a threat to the livestock. Pasture-based systems of livestock rearing can also reduce GHG emissions through grassland's capacity for carbon storage (sequestration). Land and vegetation has the capacity to store carbon at different concentrations.Amount of metabolic heat production is affected by quality as well as particle size of feeds and fodder. Nutritional modifications can be used to reduce the internal heat load on animal. Highly digestible feeds are recommended because poor quality roughage generates a lot more heat than highly digestible rations. If feeding is done during mid-day, feeding under shade can be suggested to minimize exposure of cattle to heat stress. Simple feed technologies like incorporation of good quality green fodder, increment of nutrient density by replacing poor quality roughage with concentrate, feeding properly chaffed dry fodder and hydration of dry straws during hot dry period reduces the internal heat load on animal body. Some of the feed additives like antioxidants and minerals can also be supplemented to minimize the impact of climate.

Animal shelters should be designed to reduce heat load from the external environment in tropical and sub-tropical climate. Design, orientation and height of the shelters, choice of roofing material, open space ventilation and provision of adequate space per animal are some of the important aspects for cooler microenvironment of the animal. During the period of high temperatures the use of water can be used to bring down the micro-environmental temperature within the animal shelters. Use of air cooling systems is also an efficient method. Efficient and affordable adaptation practices for rural poor who are not able to buy expensive adaptation technologies include shading, sprinkling and ventilation to reduce heat stress from increased temperature. The animals in arid zone are reared under extensive system of farming, where the animals go for grazing in the fields during day and are exposed to peak heat. Provision of community shelters in these areas will give a space for the animals to take rest during peak hot hours.

In the future, climate change is expected to be a major force testing resilience of global food production systems. Climate change will have far-reaching consequences for dairy and meat production, especially in vulnerable parts of the world where it is vital for nutrition and livelihoods. Thermal stress not only causes production losses, but is also an important animal well-being issue that merits consideration in management and breeding programs. However, climate change is a multi-faceted challenge that can be mitigated utilizing a variety of available tools and resources as well as holistic approach. Ensuring good animal welfare is paramount in addressing these challenges. Breeds suited to the local environment are often more robust and resilient than industrially farmed breeds. Vulnerable livestock population may require genetic modification to meet the challenges of future climate change. Different selection strategies will result in different adaptation rates to new production conditions. Faster genetic gains for such adaptive traits can be achieved with new technologies, including genomic selection and advanced reproductive technologies. However, in order to realise the full benefits of the tested solutions, livestock farmers require financial, institutional and intellectual support from stakeholders to remain climate-resilient.