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IMPACT OF CLIMATE CHANGE ON LIVESTOCK PRODUCTION

Gayathri, S. L. Bhakat, M. and T. K. Mohanty
LPM Division, ICAR-National Dairy Research Institute, Karnal, Haryana 132001

*Corresponding author email: *gayathrisherlylal@gmail.com*

ABSTRACT

Global warming and greenhouse gas effect go hand in hand, leading to climatic vagaries. One of the major green house gases such as methane, whose major contributing holder is said to be the livestock population. The major greenhouse gas emissions sources in livestock production systems are enteric fermentation, manure storage areas, and feed production units. To reduce the environmental sabotage due to green house gases, demands for the implementation of mitigation strategies that aim at reducing theses gases production while safeguarding a adequate source of food for the rising world population. Thus, impact of climate change on livestock population needs global solution.

INTRODUCTION

The global population estimates to be 9.6 billion by 2050 (UNDESA, 2017) and that demands the ever increasing need for food security. To meet the hiking population globally, the milk and meat production must increase t0 1077 and 455 million tonnes, which is double the 2006 production statistics. The achievements in all these predictions needs fulfillment to have a quality life for the common; however, climate change and its associated effects pose a major hindrance in achieving it. Climate change is a global phenomenon that affects the human, animal and environmental ecosystems. The after effect of climatic imbalances is largely impacted to the production systems pertaining to livestock sector.

According to IPCC Fifth Assessment (2013), the global mean surface temperature will increases to 3.7°C, with a likely range of 2.6°C–4.8°C by 2100 leading to 20-30 per cent biodiversity loss. The weather frequency, intensity and duration will change leading to vagaries. Studies reflects that the climatic variation will cause a deviation in production, reproduction and health parameters leading to a change in the growth rate of animals; milk yield and its quality parameters; carcass quality and its yield; egg yield, quality and weight etc. The effect of climatic deviation manifests in animals, especially the production units as direct

and indirect impact. The direct impact is on the metabolic functions, temperature related imbalances in body and morbidity due to extreme climatic conditions. The indirect effect is on the health of the production animals leading to diseases and the marketing units associated with it. The heat stress associated with climate change causes huge economic loss globally and is capable of shattering the stable economy of any country. Among the many reasons responsible for the climatic deviation, the share held by the greenhouse gases is appreciable.

IMPACT ON LIVESTOCK

The impact on livestock due to climatic changes can be studied in different heads such as effect on production, reproduction, metabolism, immunity, health, mortality etc. Climate change leads to extreme weather conditions in terms of increase in number of hot days getting extremely hot, heat waves and cold days getting extremely cold. Some of the extreme weather conditions that badly affect the animal productivity include droughts, heat stress due to hot days and heat waves, storms, desertification and insect menace. The impact of climate change occurs in long term and will affect all the ecosystems including ocean, forest and wildlife, farms and human beings. The variation in hot and cold weather days brings about risk in animals in the form of disease susceptibility and the vectors being available throughout the year rather than finding in a particular season. The increase in temperature due to increased concentration of carbon dioxide and variation in precipitation (IFAD, 2010) causes the emergence of various virulence forms of different disease causing organisms. Henceforth, there will be an imbalance in epidemiological triad between host, agent, and environment, leading to prevalence of diseases in a wider area. Increase in atmospheric temperature and other associated parameters cause stress to the animals, which in turn leads to the reduced feed intake, which would be more in the upcoming days. The irregular patterns in the atmospheric cycle may lead to the extinction of several livestock species that causes huge impact on the livestock production units. The emergence of unpalatable forage species in the grazing land is another added burden to the production units of livestock, which are already in shortage of grazing lands.

Feed quality and water availability are the major areas that require attention during the incidence of climate change. It depends on the location, livestock system (IFAD, 2010) and species of livestock reared. The increase in carbon dioxide affects the plant species, especially the C_3 species, whose growth will be at stake. The C_4 species will grow, but the availability of which is less than 1 per cent of the total available plant species. The resultant increase in temperature decreases the palatability, degradability, digestibility of the forage crops due to the increase in lignin and cell wall components. The extreme climatic conditions affect the grazing lands' forage dynamics, leading to the creation of new varieties of lower value and the

consumption of which by the livestock increases the enteric methane emission. In such circumstances, decrease the level of forage and increase the level of concentrate in the ration in order to compact the emission level. The water usage by the forage crop and livestock is affected severely due to the climate change. The consumption of water by livestock increases by 2-3 times than the normal during rise in temperature. The increase in salinity due to the rise in sea water level can also affect the production systems due to the introduction of higher amount of heavy metals and biological contaminants. It affects the digestion, metabolism, fertility, impairs the digestive, circulatory, nervous, respiratory systems.

IMPACT OF CLIMATE CHANGE ON LIVESTOCK HEALTH

Climate change brings about rise in several uncommon diseases. There are direct and indirect implications on the health of the animals. The direct effect comes due to the increase in temperature causing morbidity and death. The indirect effects are due to the altered microbial population, their association with host and environment, spreading vector-borne diseases throughout the year, new diseases, or the emergence of new variants. The rise in temperature increases the growth of the parasites that live outside the host environment.

IMPACT OF CLIMATE CHANGE ON LIVESTOCK DUE TO HEAT STRESS

Every animal maintains their body temperature within the thermo-neutral zone. When the temperature increases beyond their upper critical temperature of tolerance limit, heat stress occurs. During such circumstances, animal acclimate themselves by reducing the feed intake, increasing the water intake, altering their physiological and reproductive functions, changing the respiratory function. The factors responsible for the impact of heat stress on livestock depend on humidity, temperature, genetic potential, species, stage of life, and nutritional status. The livestock reared in the higher altitude are affected more, than the lower ones, as the lower altitude raised animals have better adaptability. The animals which are reared under confined environmental conditions have less affected due to climate change. The warm and humid condition can also cause stress to animals leading to behavioural changes and metabolic variations. The feed nutrient utilization and feed intake is badly affected due to heat stress. The reduced feed intake impairs the digestive and metabolic functions, leading to deficiency in sodium and potassium, which causes metabolic alkalosis, negative energy balance, altered feed conversion efficiency, and reduced body weight gain in dairy cattle.

Animal production is affected due to heat stress and several studies are in progress to estimate the degree of loss incurred in the livestock sector globally. The high producing animals are highly sensitive to

heat stress than the low producing animals, due to high metabolic heat production, the milk yield declines. Ewe, doe and buffalo cows are also affected by heat stress leading to reduced milk production. The ewes are more prone to temperature humidity variation. In goats during hot climate, the water reduction mechanism is activated and the milk quality, quantity is affected. In buffaloes, heat stress causes altered physiological functions in terms of respiratory rate, pulse and rectal temperature. Beef production units face the adverse effect of heat stress in terms of reduced body weight gain, carcass weight and reduced feed intake among the animals. The piglet mortality level rises during heat stress, as the sow milk production declines due to increased temperature. Heat stress in poultry causes reduction in body weight gain, carcass weight, feed intake, protein: muscle calorie content among broilers, decline in egg production due to imbalance in the reproductive system, and reduced egg quality among layers.

The animal reproduction parameters are adversely affected due to heat stress. The growth of oocyte and its quality, impaired embryonic development and reduced pregnancy rate are the common manifestation in cows and pigs. Infertility in cows, lower sperm count in bulls, boars; cocks are the few reported effects of heat stress. In general, the health conditions of the animals are altered in terms of metabolism of glucose, protein, lipids, hormones and free radicals, saliva production and longevity. As the feed intake is reduced due to the heat stress, chances of lameness will increase and owing to the negative energy balance state associated with the reduction in feed intake may enhances the chances of ketosis among the livestock. The prolonged exposure to heat stress can affect the immune system adversely, thereby leading to reduced colostrum immunoglobulin in colostrums of dairy cattle which impairs calves immunity, impaired functions of lymphocytes and neutrophils leading to flaws in defence mechanism towards the bacteria. Studies reported that chances of mastitis may increase during hotter days especially during summer among dairy cattle. In addition, an increase in 1-5ºC can cause mortality in grazing cattle due to the heat waves generated.

IMPACT OF LIVESTOCK ON GHG EMISSION (CLIMATE CHANGE)

According to global livestock environmental assessment model (GLEAM), globally, livestock contributes 14.5% of the total annual anthropogenic GHG emissions. The primary greenhouse gases i.e., CO_2, CH_4 and N_2O that contributes 27, 44 and 29 per cent, respectively, to the anthropogenic emission. The increase in these gases leads to a decline in productivity and lowers the efficiency of livestock units. The global warming potential of CH_4 is 34 CO_2-eq, while N_2O is 310 CO_2-eq (IPCC, 2013) and the livestock sector emits 7100 Tg CO_2-eq per year. Studies reported that the livestock sector, directly and indirectly, contributes to the GHG emission in their production, reproduction, feeding, housing and management activities.

The direct form of emission includes enteric fermentation, excretion and respiration, where as the indirect form of emission includes farm operations, livestock product processing, feed crops, transportation, manure application and land usage for livestock production units. Enteric fermentation is the largest contributor of the sector's emissions with 39.1%, followed by manure management, application, and direct deposit with 25.9%, feed production with 21.1%, land use change with 9.2%, post-farm gate with 2.9%, and direct and indirect energy with 1.8%. The usage of fertilizers for feed production is of major concern as the process of manufacturing fertilizers contributes 40 million tonnes of CO_2 annually and 0.2 million tonnes N_2O-N of global N_2O emission from mineral fertilizer per year.

CONCLUSION

Climate change is a phenomenon that is occurring globally, and the impacts of which -are multidimensional. The interlinked cobweb of existences is affected, and the balance is disturbed badly. The livestock sector is shattered in terms of its production units. The pillars of production systems are contributing enormously to the emission of greenhouse gases. The ever increasing human population demands increased production as well as productivity per unit area, leading more emission of GHG. The heat stress caused due to the increase in temperature affects production, reproduction, metabolism, immunity etc. Thus, it's high time that focused research on the several components of climate change must be conducted extensively to understand the emission mechanism and come up with mitigation strategies.

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