

Review Article

CLIMATE CHANGE AND IT'S IMPACT ON LIVESTOCK – A REVIEW

P.B. Hase^{1*}, M.G Patil² and P.R. Rathod³

Post Graduate Institute of Veterinary and Animal Sciences, Murtijapur Road,
Opposite of Dr P.D.K.V, Akola 444 001
E-mails: pravintoo@gmail.com

Abstract: Climate change is one of the most important environmental challenges with profound implications for several different sectors such as livestock rearing, food production, natural ecosystems, freshwater supply and health. The Earth's climate system has change both globally and regionally since the reindustrialize era. Climate change is widely viewed as a major environmental issue of greater concern than, for instance freshwater scarcity, deforestation and desertification, freshwater pollution, and loss of biodiversity. Livestock plays a very important role in the mixed farming system of the country contributing about 25 per cent of Gross Domestic Products (GDP) from agricultural sector. India has the largest population of cattle and buffaloes and the highest producer of milk in the world. India has also the second largest population of goats and one of the leading countries in poultry sector. There has been a tremendous increase in milk, meat and egg production since independence. However, owing to various reasons viz., low genetic potential, scarcity of feeds and fodders, diseases, poor management practices etc., the productivity is quite low. Climatic conditions of a place have also an important bearing on livestock production and productivity. Climatic factors like ambient temperature, humidity, solar radiation and wind velocity are the important ones which make up the physical environment of the animal having direct and indirect influences on animal's responses towards climate. Temperature and humidity are the most crucial with the former being the most researched one. Extremes of hot and cold weather are creating stress to any animal and the effects are more severe under hot and humid climate. The varied effects of undesirable climate on animals are pertaining to feed and water intake, physiological, biochemical and endocrinological aspects, reproduction, health and productivity etc. Thus, the positive and negative effects of the environment on the livestock have been discussed in a way to undertake some protective measures.

Keywords: Climate change, Livestock, Reproduction.

CLIMATE CHANGE AND ANIMAL REPRODUCTION

High ambient temperature suppresses oestrus symptoms resulting in long service periods and interference in ovulation. Other reproductive parameters like age at puberty, oestrous cycle length duration of oestrus, ova abnormalities, embryonic mortality, gestation length and faetal size, incidence of oestrus with weak signs, percentage of silent heat, ovulation failure, service period and number of services per conception may increase [5]. Summer stress has negative

*Received Feb 20, 2017 * Published Apr 2, 2017 * www.ijset.net*

effect on fertility in lactating cows mainly due to high ambient temperature [12]. Heat stress reduces the length and intensity of oestrus. Heat stress can cause increased cortisol secretion and ACTH (Adreno corticotrophin hormone) has been found to block estradiol induced behaviour. The effects could be due to hypothalamus- pituitary- adrenal axis. There is a significant decline in conception rate. Effects of high temperature on early embryonic development are more than in the later stages of pregnancy. Acute thermal stress increases blood concentration of prolactin [12], anti diuretic hormone [3], aldosterone in nonruminants [8] and catecholamines and glucocorticoids in cattle [1].

There is seasonality in buffaloes with regard to heat and conception rate. Singh and Singh [10] reported data on calvings observed over a period of one year at one organised farm. Post - partum oestrus interval and service period was the longest (175.4 and 248.9 days) among animals that calved in January (cold) and the shortest (61.9 and 114.3 days) among animals that calved in September (warm humid season).

It appears that by the time uterine involution is complete among buffaloes calving in winter, the weather starts warming up with the result that animals shy off from breeding .But those animals calving in hot and humid months pass off into winter favorable for conceiving and their reproductive set up is ready for next conception. The climate, particularly temperature has a significant effect on reproductive behaviour of buffalo owing to its effect on animal reproductive systems as well as effect on availability of nutrients to the animals.

EFFECT OF LIVESTOCK ON ENVIRONMENT

Livestock contribute positively to the environment in many [2] : (i) Saving of natural resources as dung is used as fuel place of fuel wood (ii) Saving of chemical fertilizers as dung is used as manure and thus green house gas emission is prevented in the process of fertilizer manufacture, (iii) Saving land due to recycling of agricultural byproducts as animal feed (iv) Prevention of emission of greenhouse grasses specially due to draught power used in agriculture-However livestock also contribute negatively particularly in form of CH₄ emission which has several times (40-60) global warming potential as compared to CO₂ .Global warming and ozone depletion due to increased emission of green house gases (IPCC, 1996)(IPCC- Inter Government Panel on climate change) in atmosphere has drawn worldwide attention. Carbon dioxide, methane and nitrous oxide are the main gases emitted from agricultural system including livestock. CH₄ is the second contributor to global warming after CO. Enteric fermentation of the feeds in the ruminants and emission from dung produced and its managerial aspects are 2 major sources of CH₄ production from

livestock. Indian ruminants contribute about 13.2 per cent of total CH₄ emitted by world livestock (WRI, 1990: Annual CH₄ produced by Indian livestock is estimated to be 10.0 Tg (WRI, 1990), 10.4 Tg (EPA,1993) 8.9 Tg [7] , 7.26 Tg [4] and 10.0 Tg [11].

Besides environmental pollution, CH₄ emission from ruminants presents a loss of 6-8 per cent of GE intake. Khan [7] reported cattle population in developed/developing countries led to 58 % and 42 % in CH₄ production. Indian cattle comprising about 16 per cent of world cattle population emit less than 10 per cent of total CH₄ produced by world cattle population. Loss of energy due to CH₄ production by ruminants is in the order of cattle > buffalo > goat > sheep. India is losing energy worth Rs. 2.2 crores a day in CH₄. Though CH₄ production can not be totally eliminated, however, if reduced by 1 per cent, Rs.45.38 lakhs could be saved [9]. Global warming can have physical, environmental and socioeconomic consequences. Climatic changes could cause change in precipitation pattern, ocean circulations, marine system, soil moisture, water liability and rise in sea level. With rising temperature, alteration in vector-borne disease, global population would be more vulnerable to health hazards causing disruption in settlement patterns and large scale migration [6].

There are various factors which affect methane emission from ruminants like quality, type of diet consumed by the animals, feeding frequency, ruminant species, production level of the animals, forage type, use of ionophores, processing of feeds, use of halogenated : impounds etc. So, a strategy involving these factors needs to be evolved so as to reduce CH₄ production by the ruminants.

CONCLUSION

Among the different climatic variables, high temperature and humidity are prominent ones in influencing an animal's response with regard to feed and water intake, growth/milk production and: imposition, biochemical and endocrinological changes, reproduction, wealth and hence overall productivity. The interaction of these variables is complex and it is most difficult to alleviate the cumulative effects of these factors. Management strategies involving physical modification of the environment, selection or development of less sensitive animals breeds and nutritional management if followed, can help in alleviating the ill effects of unfavorable climatic conditions. The animals also have both negative and positive effects on environment. The negative effects being chiefly due to methane emission which has several times global warming potential as compared to carbon dioxide, ethane emission from ruminants also reduces the efficiency of energy utilization. So, a strategy involving modification of the factors affecting methane production viz., quality and type of diet

consumed by the animals, feeding frequency, production level, feed processing methods, use of ionophores / halogenated compounds should be followed so as to minimize the production of methane by the ruminant animals.

REFERENCES

- [1] Alvarez, A. and Johnson, M.B. (1973). Environmental heat exposure on plasma catecholamine and glucocorticoids. *Dairy Sci.* 56:189.
- [2] Dixit, A.K. (2005). Some interrelationships between livestock and environment I India. *Ind. Anim.Sci.*75: 1444-1447.
- [3] El-Nouty, F.B., Albana, I.M., Davis, T.P. and Johnson, H.D. (1980). Aldosterone and ADH response to heat and dehydration in cattle. *J. Appl. Phys.: Environ. Exercise Physiol.*48:249.
- [4] Garg A. and Sukla, P.R. (2002). Emission Inventory of India. Tata McGraw hill Publication Co. Ltd.p.04.
- [5] Hafez, E.S.E. (1968). *Adaptation of Domestic Animals*. Lea and Febiger. Philadelphia, U.S.A.
- [6] Haque, N. (2001). Environmental implications of methane production: diet and rumen ecology. "Nutrition and dietetics under clinico therapeutic conditions of pet and farm animals" (Short course) held at IVRI, Izatnagar from March 20 to April 18,2001: 355-361.
- [7] Khan, M.Y. (1996). Feeding strategies for management of gaseous pollutants produced by farm animals. In: *Monitoring effects of environmental pollutants on animal health* (Short Course) held at IVRI, Izatnagar.p.116-118.
- [8] Lipsett, M.B., Swartz, T.L. and Thon, N.A. (1961). Hormonal control of sodium, potassium, chloride and water metabolism. In. *Mineral Metabolism, Vol-IB* (Eds.: C.L.Comar and F.Bommar), Academic Press Uk Singh, G.P. (2001).
- [9] Livestock production and environmental protection. *In Proc "Animal Nutrition Conference"* held at NDRI, Karnal, Haryana. 9, 2001.
- [10] Singh, G and Singh, G.B. (1985). Effect of month of calving on post partum oestrous interval and service period in Murrah buffaloes. In *Proc: First World Buffrie Congress, Cairo*. Pp-960.
- [11] Singhal, K.K. and Madhu Mohini. (2002). Report on "Uncertainty in methane nitrous oxide from livestock in India". National Dairy Research Institute, Karnal-132001, Haryana.
- [12] Wetterman, R.P. and Tucker, H.A. (1974). Relationship of ambient temperature to serum prolactin in heifers. *Proc.Soc.Expt,Biol.Med.* 146:908.
- [13] Wolfenson, D., Roth, Z. and Meidan. (2000). Impaired reproduction in heat stressed cattle- basic and applied aspects. *Animal Reproduction* .34:89-101.