JOURNAL OF VETERINARY ADVANCES

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J Vet Adv 2012, 2(7): 407-412

Online version is available on: www.grjournals.com

ISSN: 2251-7685

Original Article

Climate Change Impacts on Livestock and Adaptation Strategies to Sustain Livestock Production

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Abstract

This study examines perceive climate change impacts and adaptation strategies to sustain livestock production adopted by livestock. Majority of the respondents perceived that climate change has negative impact on productive and reproductive performance of livestock, increased incidence of livestock diseases and parasitic infestation, decreasing trend of feed and fodder resources, water. Majority of the respondents perceived an increased environmental temperature, decreased precipitation, increased frequency of extreme weather conditions and summer season length. Most of the farmers preserved fodder crop in farm of hay for adverse climatic condition, followed mixed livestock farming, diversifying farming practices and changed planting date, provided bedding and warmth to their animals to protect them from extreme cold, similarly during hot days farmers provided cold water and shed to protect their animals as adaptation strategies for sustain livestock production.

Key Words: Climate change impacts, agro-climatic zones, Adaptation strategies, livestock production

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Received on: 02 May 2012
Revised on: 21 Jun 2012
Accepted on: 28 Jun 2012
Online Published on: 30 Jul 2012

Introduction

Livestock sector both contributes to and is affected by climate change. Climate change affects livestock both directly and indirectly. Houghton *et al*. (2001) concluded that direct effects from air temperature, humidity, wind speed and other climate factors influence animal performance: growth, milk production, wool production and reproduction. The impact of climate change on animal production has been categorized by Rotter and Van de Geijn (1999) as: a) availability of feed grain, b) pasture and forage crop production and quality, c) health, growth and reproduction and, d) disease and their spread. Animal health may be affected by climate change in four ways: heat-related diseases and stress, extreme weather events, adaptation of animal production systems to new environments, and emergence or re-emergence of infectious diseases, especially vector borne diseases which are critically dependent on environmental and climatic conditions. The livestock production is an integral part of mixed farming systems practiced in the entire length and breadth of India.

Furthermore while vulnerability to climate change has hardly been documented in the context of India; experimental studies have been conducted on effects of season and climate on production, performance and other physiological parameters of dairy animals. These studies have revealed that milk yield of crossbred cows in India (e.g., Karan Fries, Karan Swiss and other Holstein and Jersey crosses) are negatively correlated with temperature-humidity index (Mandal *et al*. 2002a). The influence of climatic conditions on milk production has been also observed for local cows which are more adapted to the tropical climate of India. The estimated annual loss at present due to heat stress among cattle and buffaloes at the all-India level is 1.8 million tonnes, that is nearly two per cent of the total milk production in the country, amounting to a whopping over Rs 2,661 crore (Upadhaya, 2010). According to Tailor and Nagda (2005) heat stress has detrimental effects on the reproduction of buffaloes, although buffaloes are well adapted morphologically and anatomically to hot and humid climate. Upadhya *et.al, (*2007) stated that thermal stress on Indian livestock particularly cattle and buffaloes has been reported to decrease oestrus expression and conception rate. Maurya (2010) concluded that the length of service period and dry period of all dairy animals was increased from normal during drought. The outbreak of the disease was observed to be correlated with the mass movement of animals which in turn is dependent on the climatic factors (Sharma *et al*. 1991). Singh *et al*. (1996) reported that higher incidence of clinical mastitis in dairy animals during hot and humid weather due to increased heat stress and greater fly population associated with hot–humid conditions. In addition, the hot–humid weather conditions were found to aggravate the infestation of cattle ticks like: *Boophilus microplus, Haemaphysalis bispinosa and Hyalomma anatolicum* (Basu and Bandhyopadhyay, 2004; Kumar *et al.,* 2004). Keeping view in mid a study on climate change impacts on livestock as perceived by farmers and adaptation strategies to sustain livestock production different agro climatic zones of India was conducted.

Material and Methods

The present study was conducted in two agro climatic region i.e. Western Himalayan region and Middle Gangetic plain region of India. Stratified randomly sampling technique was used for selection of blocks, villages and respondents. From each district three blocks and six villages were selected. In this way 6 blocks and 12 villages from both the district were taken into consideration, from each selected village ten livestock owners having at least two large animals were selected randomly to make 120 total respondents for the investigation. Semi structured interview schedule were used for the purpose of data collection. Besides primary data, some necessary secondary data were also collected from department of Meteorology.Frequency distribution, percentage, mean score and Cattle equivalent score etc. were computed by using Statistical Package for Social sciences (SPSS) software and Microsoft excel.

Results and Discussion

Perceived impact of climate change on livestock sector

Data presented in table 1 indicated that majority of respondents (78%) observed that climate change affects agriculture and animal husbandry, 58.3 percent perceived negative impact of climate change on productive performance of livestock, 56.6 percent told that climate change had negative impact on milk production and lactation length (58.3%). Around (50.8%) respondents told that climate change had positive impact on dry period. Majority of respondents (63.3%) perceived negative impacts of climate change on reproductive performance of livestock. Whereas (59.16%) respondents told that there were decreased length and intensity of oestrous period of their animals and (57.5%) respondents told that there were decreased conception rate of their animals. Many farmers told that there were increased cases of repeat breeding in their animals. Majority of respondents (60.83%) replied that climate change have an effect on livestock disease incidences. Most of the respondents of western Himalayan region reported increased cases of Heamaturia whereas respondents of Middle Gangetic Plain region reported increased cases of Surra (Aprotozoan disease) in their animals. Majority of respondents (83%) told that there were increased incidences of parasitic infestation in livestock. 79.1 percent respondents told that due to climate variability feed and fodder resources are decreasing and also (95%) respondent's perceived shortage of dry fodder. Large number of respondents (95.8%) replied that there was decreased quantity of self grown fodder/grasses. In case of Western Himalayan region respondents (86.6 %) told that there was decreased availability and growth of fodder trees whereas 13.33 percent observed it stayed constant and (95%) respondents replied that there were decreased water resources. Majority of respondents (82%) replied that there was depletion of ground water level. About 69 percent respondents told that there was decreased availability of water for irrigation. Majority of respondents (77.5 %) replied that there was decreased number of natural water resources.

Table1: Perceived impact of climate change on livestock sector

S.N.	Perceived impact	Percentage
1	Climate change affects agriculture and animal husbandry	78
2	Negative impact of climate change on productive performance	58.3
3	Negative impact on milk production	56.6
4	Negative impacts on lactation length	58.3
5	Positive impact on dry period	50.8
6	Negative impacts on reproductive performance	63.3
7	Decreased length and intensity of oestrous period	59.1
8	Decreased conception rate	57.5
9	Effect on livestock disease incidences.	60.8
10	Increased incidences of parasitic infestation in livestock	83
11	Feed and fodder resources are decreasing	79.1
12	Shortage of dry fodder	95
13	Decreased water resources	95
14	Depletion of ground water level	82
15	Decreased availability of water for irrigation	69
16	Decreased number of natural water resources	77.5

Livestock management strategy adopted by farmers under climatic change scenario

Over centuries, livestock producers have traditionally adapted to climatic changes by building on their in-depth knowledge of the environment in which they live. Farmers own perception and local traditional knowledge help them in evolving measures and technique to deal with situations arising due to climatic vagaries. These measures and techniques are locale specific, require no external help and are inherently scientific. Documentation of such practices and techniques, farmer to farmer dissemination and sharing such innovative approaches at large platforms have helped in influencing research

agenda of academic institutions and setting the priorities. A number of questions were asked to assess the strategies adopted by the local communities to cope with climate change. The respondents reported a diversity of coping strategies that included both modern and traditional methods. From table2 following inferences can be easily drawn: Majority of the farmers (90%) preserve fodder crop in form of hay for adverse climatic condition; They also stored wheat straw, paddy straw, and crop residues to feed their animals in lean period; Majority of the respondents (89%) changed the planting dates; It was very interesting to note down that majority of farmers (81%) did traditional prayer to get rid of adverse climatic conditions; Majority of respondents (79%) told that they provide bedding for livestock during extreme winter/ cold to prevent them from cold stress; Majority of farmers (65%) were grown variety of crops (crop diversification) in their field, for e.g. vegetables, fruit, flower and other cash crop; Majority of farmers (60%) told that they sown new crop varieties which required less water(draught resistant), less time to mature(early maturing), pest resistant and well adopted for water logging area (flood resistant); Plantation fodder tree lines around animal shed/ house to reduce effects of cold/ heat waves was an important coping strategy adopted by most of the farmers (55%); Migration along with livestock was one of the coping strategies of many of the framers (53%) during adverse climatic conditions; about 48 percent of the respondents kept more livestock and reduced reliance on crops; Majority of the respondents (44%) told that they destock their large animals during adverse climatic conditions and keep smalls animal those are well survive in above said conditions, required less water and feed; About 38 percent of the respondents told that they destock their livestock during adverse climatic condition; About 34 percent of the respondents told that they sold their animals to fulfil their daily requirement (food, clothes, school fee etc.); Only about 27 percent of the respondents insured their livestock; About 10 percent respondents told that they replaced exotic breeds (Holstein Frisian, Jersey) to indigenous/local breeds (Sahiwal, Haryana, Red Sindhi, Tharparker etc.) which were well adapted to native climatic conditions; Farmers told that local breeds required less water, resistant to many of the diseases and well survive in adverse climatic condition; About 8 percent of the respondents leaved livestock farming and start business/other occupation (carpentry, Tailor, etc.); About 5 percent of the respondent did rain water harvesting.

Other coping strategy adopted by farmers

Provide cold water during hot and humid climate.

Provision of shade to reduce heat stress.

Provide fresh air/ fan/cooler during extreme hot condition.

Kept their animal outside during night during summer.

Loose housing system.

Freed their animal during adverse climatic condition in search of feed and safe place.

Elevated animal house/shed/shelter.(Noelle O'Brien 2001)

Constructing "Manchans"(hanging bamboo platforms inside houses)

Provision of alaw (fire) in animal shed during extreme cold (Meena et.al.2008).

Rotational lopping of vegetative biomass of fodder trees, shrubs, herbs and grasses.

To minimize landslide, they were started to conserve forest, promote plantation and safe landing of running water during the rainy period

Coping strategies of farmers to various climate vagaries vary from household to households and region to region based existing support system and their indigenous knowledge.

Conclusion

There is a serious threat of climatic changes (in the form of severe droughts, floods, intense rainfall, and landslides) undermining development programmes and millennium development goals aimed at reducing poverty. Climate induced disasters directly affect the livelihood of the farmers. Since livelihood of the farmers is based on agriculture and animal husbandry, all of the respondents said that decrease in the animal-agricultural production weakened the economic condition. Currently India is spending 2.5% of its

total GDP on measures to control the adverse impact of climatic change, which is a big amount for any developing nation. As livestock is and will play very important role in rural economy, it is necessary to find suitable solution to reduce the ill effect of climate change on livestock production.

Table.2: Livestock management strategy adopted by farmers under climatic change scenario

S.N.	Strategy	Percentage	Ranks	References
1	Change in livestock/herd composition (large animal vs. small animal during adverse climatic conditions	44	X	Seo and Mendelsohn (2006b); Kurukulasuriya and Mendelsohn (2006;
2	Reduction in livestock number	38	XI	Kabubo-Mariara (2008), Herrero *et al*. (2009
3	Replacement of exotic breeds to local breeds	10	XIV	Bradshaw et. al., (2004); Nhemachena and Hassan (2007); Hoffmann, 2008
4	Keeping more livestock and reducing reliance on crops	48	IX	Kabubo-Mariara (2008); Maurya (2010)
5	Preservation of fodder	90	I	Chatterjee *et. al.* (2005)
6	Crop diversification	65	V	Chatterjee *et. al.* (2005)
7	New fodder crop variety/type	60	VI	Bradshaw *et. al*. (2004); Nhemachena and Hassan (2007)
8	Change planting dates	89	II	Bradshaw *et. al*. (2004); Nhemachena and Hassan (2007);
9	Provide bedding for livestock during extreme winter/cold	79	IV	Meena et.al.,(2008)
10	Plantation fodder tree lines around animal shed/ house to reduce effects of cold/ heat waves	55	VII	Chan (1995); Valtorta *et al*., (1996)
11	Selling of livestock in order to buy food	34	XII	Dirie and Mohammed (1999); Swaminathan(2009b); Manyatsi *et al*.,*(*2010)
12	Migration along with livestock during adverse climatic conditions	53	VIII	Geevan *et. al*.(2003); Pathan(2009)
13	Livestock insurance	27	XIII	Swanson et. al. (2008); Shanker Ravi.K.(2010)
14	Farming to non- farming (Business)	08	XV	Bradshaw et al. (2004); Maddison(2006); Nhemachena and Hassan (2007)
15	Rain water harvesting	05	XVI	Tiwari, *et al.* (2010)
16	Traditional Prayer	81	III	Alexander (2011); Manyatsi *et al*.(2010);

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