Exploring the AdaptationStrategies to Meteorological DisastersFollowed by Dairy Farmers ofIndianSundarbans

Abstract

Breeding, feeding, health care and sheltermanagement play a crucial role in maximizing the potential of dairy animalsfor milk production and protecting them from meteorological disasters.This study involved a sample of 180 dairy farmers, selected randomly from the Kakdwip, Namkhana, and Sagar blocks in the Sundarbans region of India, to explore the management strategies they adopted.The findings of the study revealed that themajority of the respondents (74.45%) were rearing indigenous breeds. The majority (70.00%) of the farmers in the study area were in touch with local para vets for any immediate veterinary assistance.(71.67%)of dairy farmers utilizedcrop residues,tree leaves and grazing practices as alternatives used to cope with fodder shortagescaused by the disaster and 20.56 percent of dairy farmers were feeding less concentrate and less green fodder as feed during the disaster conditions. Preventive measures,such as vaccination, were adopted by (61.11%) of the respondents to maintain the health of animals.Among animal sheds only, 6.11 percent of farmers built raised sheds from ground level to avoid injury or death. Therefore, the management of breeding, feeding, health care and shelter among dairy farmers in the Sundarbans region needs improvement. It can be possible by organizing awareness programs on breeding services, providingseeds of high-yielding varieties bydairy cooperatives for fodder cultivation, equipping veterinarians for timely health care and financial helpfor better shed construction.

Keywords:Breeding;Feeding; Health care;Shelter;Management strategies;Meteorological disasters; Sundarbansregion;Dairy Farmers

1. Introduction

Dairy farming is one of the vital partsof the Indian economy among rural areas,thatnot only offers employment and livelihood to millions of farmers but also contributes to the nation’s economy. India stands first in milk production with 187 million tonnes in 2019. Milk production contributed the largest share in the livestock sector, accounting for 67.2 percent in

2017. Moreover, milk and milk products provided more than 20.60 percent of the total output of paddy, wheat, and pulses in 2017. Annually, 8.4 million farmers depend on dairy farming for their livelihoods, of which 71 percent are women (Agriculture Skill Council of India). Dairy provides employment opportunities throughout the year to rural households. The country has reached self-sufficiency in milk production as 73 million farmers are involved in the dairy sector, especially women (International Farm Comparison Network, Dairy Report, 2018). This sector plays a significant role in achievingfood security, reducing poverty, creating employment opportunities for women and providing a regular source of income for rural households.

The livestock sector issuffering due to therepeated occurrence and intensity of meteorological disasters like cyclones, floods and droughts. Dairy animals play a key role in crop production systems in several farming situations. Disasters affect farmers through changes in the supply and prices of stock. Disasters destroy crops and may lead to a decline in fodder supplies. As a result,farmers areforced to sell animals. Meteorological disasters pose major problems such as nutritional requirement of animals, transmission of waterborne and vector-borne diseases, disposal of carcasses, snake bites to animals and vaccination(Sen and Chander, 2003). Climate change is the key cause of meteorological disasters that unpleasantly affects livestock production systems, especially in developing countries. Policy makers and researchers agree at this point those disasters significantly impact the livestock sector. Weather- related natural hazards like floods and cyclones are frequently witnessed at a head of Bay of Bengal.

Sundarbans is a famous biodiversity hotspot and a UNESCO heritage site. Sundarbans region lies near to the Bay of Bengal. The region of Sundarbans is not static due to depression of lands, earthquakes, tidal waves and cyclones. The region has now started to witness climate change. The fluctuation of water levels, temperatures and wind flow alters the topology. The course of rivers, sizes of sand dunes among other things, also changes with it. The Sundarbans' history has a record of terrible natural disasters. Life has become miserable in this area due to repeated cyclones, tidal waves, floods, earth quakes, heavy rainfall. These disasters have a deep impact on the local economy. As the coastal plain of

Bengal is located in the tropical belt, cyclones are more regular in the region. The agriculture and livestock economy of this area were totally destroyed by the calamities. Cyclones destroyed the crops, water supply system and communication. These disasters harm farmers who depend on dairy farming in the region. Recentlyunprecedented damage has been unleashed by Amphan cyclone in 2020. It is considered the strongest cyclone to hit the region in 50 years.

So, it is crucial to know the unexplored managementstrategies to identify the strengths and weaknesses of those strategiesfollowed by dairy farmers of Sundarbans regionand devise an appropriate governmentintervention. The present study was undertaken to gather information regarding existing breeding, feeding, healthcare and sheltermanagement strategies followed by the dairy farmers of the Sundarbans region.

2. Methodology

In2021, a study was carried outin the Sundarbans region of India. A field survey was conducted to collect the information aboutbreeding, feeding, healthcareand shelter management strategies followed by dairy farmers regarding meteorological disasters in the Sundarbans region.The Sundarbans region was selected purposively.The Sundarbans region of India is covered by five subdivisions. From these five subdivisions, one subdivision (Kakdwip) was chosen randomly which has four blocks. From the Kakdwip subdivision three blocks namely Kakdwip, Namkhana and Sagar blocks were selected randomly. Six villages were randomly selected from each block.A sample of 10 dairy farmers from each village were selected randomly andthe total respondents of the study were 180 dairy farmers, thus the current study covered 18 villages.The selected farmers were interviewed, and the desired information was collected with the help of a pre-tested interview schedule.

3. Results and Discussion

Breeding management

Table 1: Distribution of respondents according to management strategies followed for breeding (n=180)

S.no	Management strategies	Frequency	Percentage
1.	**Suitable breeds in disaster vulnerable areas**		
	Crossbreds	33	18.33
	Indigenous breeds	134	74.45
	Both	13	7.22
2.	**Breeding methods followed during disastrous conditions**		
	Natural	134	74.45
	AI	33	18.33
	Both	13	7.22
3.	**During disaster breeding, related information gathered from**		
	Qualified veterinary doctors	30	16.67
	Para vets	126	70.00
	Local quacks	24	13.33

Breeding management strategies playa key role in increasing the productivity of animalsin the disaster-prone areas. The factors like selection of breeds suitable to the location, breeding methods and enhancement of genetic pool of livestock in the concerned areashould be taken into consideration in breeding management.From the data furnished in Table 1, it can be seen that under the various breeding management strategies followed by the dairy farmers in disasters hit areas, the majority of the respondents (74.45%)were rearing indigenous breeds because of their easy availability, ability to strive well on low-cost management systems as well as they were more immune to diseases and had betteradaption to the local environment.The finding was supported by the study of **Maiti et al**,**Sultana**and **Tyagi**.Crossbreds were reared by only 18.33 percent of respondents. Similar findings were observed by **wangdi**.

Table 1,further indicated that 74.45 percent of dairy farmers followed natural breeding for their cattle as compared to the artificial insemination,followed by 18.33 percent of the respondents. This is due to inefficient cross-breeding program as well as limited number of crossbred animals available in the study area. The findings were in line with the work of**Odend'hal andDas et al.**On the other hand, 7.22 percent respondents had followed both natural breeding and artificial insemination for their dairy animals. It can also be noticed that majority (70.00%) of the farmers in the study area were in touch with local para vets for any immediate veterinary assistance, as the services of the para vets were easily available to farmers via phone call. Similar findings were observed by **Kumar et al and Das et al**.Only 16.67 percent of the respondents had contact with veterinary doctors for breeding related information. Similar results were reported by **Sameer Kumar Dasand Hema Tripathi**. On the other hand, 13.33 percent of the farmers in the region contacted local quacks. Sometimes distant locations and hardship in movements due to lack of transport facilities, farmers of the area were forced to contact the local quacks. Similar findings were reported by **Patnaik et al** and **Das et al**.

Feeding management

Table 2: Distribution of respondents according to management strategies followed for feeding (n=180)

S.no	Management strategies	Frequency	Percentage
1.	**Feed provided for dairy animals during disaster conditions**		
	Less concentrate and less green fodder	37	20.56
	Less green fodder & more dry fodder	31	17.22
	Any available feed	112	62.22
2.	**Alternatives used to cope up fodder shortage due to disaster**		
	Use of crop residues	51	28.33
	Crop residues + tree leaves + grazing the animals in open fields/bunds	129	71.67
3.	**Feed additives to cope up extreme hot/cold weather**		
	Mineral mixture	56	31.11

	No knowledge	124	68.89
4.	**Source of water during an extreme weather event**		
	Tube well	40	22.22
	Pond	140	77.78
5.	**Fodders used during meteorological disasters conditions**		
	Use of crop residues/sugarcane bagasse	87	48.33
	Use of tree leaves/vegetables	93	51.67
6.	**Manger used to feed animals**		
	Cement	116	64.44
	Plastic	64	35.56

Feed management strategies were the key to reducing the negative impact of disasters on animal health. From Table 2, it can be observed that 62.22 percent of the dairy farmers feed any materials whichever was available during disaster situation.Further, due to scarcity of feed and fodder during floods, 20.56 percent of dairy farmers were provided concentrates and green fodder in a lower amountthan required for their animals. Apart from this, 17.22 percent of farmers were feeding low quantity of green fodderduring cyclonic conditions, it was difficult to get the green fodder, so usually farmers provided more dry fodder especially leguminous crops (e.g., Lathyrus) to dairy animals as a main source of feed.Similar findings were reported by **Bakshi et al.** It can also be seen that the majority (71.67%) of the farmers were feeding crop residues such as paddy straw, tree leaves of mangrove especially,*Avicennia* sp. to the animals and they are letting the animals graze in the open fields/ bunds as an alternative to cope up with fodder shortage.The findings were in line with the work of**Ghosh et al. and Mishra et al.**Around 48.33 percent of farmers were providingcrop residues only during disaster conditions. Because the paddy straw is available throughout the year, farmers preferred to feed straw to livestock.**Rasool et al, Kabir et al and Anitha et al**in their study found similar results.Furthermore,77.78 percent of respondents reported thatsource of water during an extreme weather event was a pond.Themajority of the households in Sundarbans possessed a pond in

whichwater remains available throughout the year and through which the need of water for dairy farming activities was being met by the farmers.

Health care management

Table 3: Distribution of respondents according to management strategies followed for health care (n=180)

S.no	Management strategies	Frequency	percentage
1.	**Health management under adverse meteorological disaster conditions**		
	Preventive measures like vaccination	110	61. 11
	No practices followed	70	38.89
2.	**Management of reproductive problem**		
	Consult veterinarian/para vet/local quacks	60	33.33
	No knowledge	120	66.67

Availability of veterinary services and related infrastructure in meteorological disaster-prone areas like Sundarbans should be of utmost importance to provide emergency health care to the animals in the area during such disasters. The dairy farmers should possess a basic kit for the treatment of animals which should consist of medicines for common diseases as well as a first aid kit for wound treatment. It can be observed from Table 3, that preventive measures like vaccination of animals for various diseases in consultation with a veterinarian was adopted by 61.11 percent of the respondents, as it would reduce the chances of infectionduring outbreaks of disaster conditions.These observations are in consonance with **Anitha et al and Pankaj et al**. Whereas, 38.89 percent of the respondents were not following any kind of practices to maintain the health of animals. It was evident that consulting the veterinarian/para vet/local quacks during reproductive problems was followed by 33.33 percent of the farmers during disaster events.This was in accordance with the finding of **Sanjay Kumar**.Still majority of farmers (66.67%) had no knowledge about the reproductive problems faced by animals during disaster conditions.

Shelter management

Table 4: Distribution of respondents according to management strategies followed for shelter management (n=180)

S.no	Management strategies	Frequency	percentage
1.	**Type of Housing**		
	Loose/open housing system	146	81.11
	Conventional housing system	34	18.89
2.	**Height of the animal shed**		
	Raised from the ground	11	6.11
	At the ground level	169	93.89
3.	**Materials used in flooring the animal shed**		
	Cement concrete floor	56	31.11
	Brick's/Earthen flooring	119	66.11
	Stones	5	2.78

Shelter management is an important aspect regarding the safety of animals during disaster management in disaster-prone areas like Sundarbans. The animal shed should be located at a good altitude in flood-affected areas and the animal shed should be built with strong materials in cyclone-prone areas to avoid injury or death by the destruction of the shed due to extreme wind waves.These observations are in consonance with**Mondal**.It is evident from Table 4, that the loose/open house system was used by 81.11 percent of the farmers, as free and open space was safer during a disaster.Similar findings were observed by**Pankaj et al**. Further, 18.89 percent were using the conventional housing system. It can also be observed that, the animal shed was built at ground level by 93.89 percent of farmers. This may be due to more cost involvement in building raised sheds from ground level. Raised animal sheds from the ground were built by only 6.11 percent of farmers.The findings were supported by the study of **Mishra et al, Pyne et aland Mondal**.Earthen flooring for animal shed was used by 66.11 percent of farmers as it was easy to construct and involved less cost.It was consistent with the findings

of**Das et al.**Cement flooring was used by 31.11 percent of farmers.The findings were in line with the work of**Veldandi et al**and**Ambazamkandiet al.** On the other hand, very few farmers that is, 2.78 percent farmers used stone as flooring material in their animal sheds. It was also noticed, most of the animal sheds in the study area were having no proper ventilation.**Mandal et al.**reported in tropical cyclone-prone coastal areasthe shape and dimensions of animal houses, roofing materials, roof design and slope of the roof are very important concerns to withstand high wind speed. Thefoundation of building animal houses, walls, ventilation and other structural elements need special attention to reduce the risk of structural damage.

4. Conclusion

The study explored breeding, feeding, health care and shelter management strategies followed by the dairy farmers of Sundarbans region and identified their strengths and weaknesses.Popularization of the cross-breeding programme/breed upgradation programme should be implemented by local veterinary officials and the state livestock department in the study area to increase the production and productivity of milk in the study area. Respondents in the study area depended on local quacks for veterinary services. State government should equip the veterinarians in the study area to deliver veterinary services at the farmer's door step which will help in upliftment of the condition of dairy farmers. Farmers utilizedcrop residues, tree leaves andgrazing practicesin open fields/bunds to cope with fodder shortagescaused bythe disasters. There is a need to explore options for improved fodder cultivation to supplement the existing resources and ensure consistent quality feed availability during disasters.From the study, cost of concentrates and feed additives, non-availability of seeds of high-yielding varieties of fodder crops was the major factors affecting in the feeding aspect. So, dairy cooperatives should provide these inputs for encouraging small and medium herd size farmers in dairy farming. Promoting the construction of pucca or semi-pucca sheds and concrete flooring materials can facilitate better sanitation, protection and comfort for the dairy animals during disasters, leading to improved health and productivity. It was found that financial help in building pucca cattle shed and coastal embankments will enhance the capability to deal with severe cyclonic storms.Specialized training and first-hand knowledge of scientific dairy farming practices can help the dairy farmers savetheir animals during meteorological disasters, which is only possible through the intervention of extension services and the government.

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