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Alternate Dairy Management Practices of Feeding and Watering of Animals followed by Dairy Farmers during Drought in Patan District of Gujarat state, India

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ABSTRACT

India is an agriculture based country and livestock sector plays an essential role in our country GDP and it is highly affected by the climatic variability such as drought, flood, *etc.* Drought is hazard of nature and which affects larger area and may persist for longer duration. Due to low availability of water, the forage crop production get reduced ultimately causing death of livestock due to off feed or eating of poisonous feed during scarcity period. North Gujarat region of Gujarat state comprises of six districts ofwhich Patan district was selected purposively being prone to draught. The present study was conducted in the Harij and Radhanpur talukas of Patan district. Six villages from each taluka were randomly selected. Thus, total 120 respondents were selected for the study. The data were collected by personal interview technique through a structural schedule. In Personal and socio-economic characteristics, majority of respondents (84.16 per cent) belonged to middle age group. Majority of total respondents (39.17 per cent) had low family education status. Majority of respondents (61.67 per cent) came from nuclear families. About 40.00 per cent of farmers had dairy as major occupation during drought period whereas during normal period only 25.00 per cent were in dairy business. 100 per cent of respondents amongst high income group had suffered loss in dairy during draught period. Irrespective of land holding, farmers from low income category were severely affected in terms of decrease in income up to 46.67 per cent from livestock. Herd size reduced up to 70.00 per cent during drought by the farmers owning large herds. Majority of the respondents (66.67 per cent) had experienced of more than the 10 years. In alternate dairy management practices of feeding and watering for animals include offering dry fodder to animals by 100% of respondent during drought period and mixed fodder during normal period. Concentrate mixture was being provided only to lactating animals by 68.33 per cent during drought and 87.50 per cent respondents during normal period. Majority of the farmers were neither feeding salt nor mineral mixture to the animals. Most commonly used alternate feed resource were dried fodder / hay (37.50 per cent), crop residues (33.33 per cent) and tree leaves (20.83 per cent). None of the respondent was storing the feed resources as silage for lean period as they had no knowledge about it. None of the respondent was conserving the water for drought period.

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1. Introduction

India is an agriculture based country and livestock sector is a major part of it. It possesses largest number of total livestock in the world and ranks second in cattle population (199.1million) and first in buffalo population (105.3 million). Livestock sector plays a major role in Indian economy, which is about 4.96 per cent of total GDP and 13.68 per cent of agricultural GDP [1], this sector is highly affected by the climatic variability such as drought and flood. High rainfall leads to flood condition and very less or no rainfall leads to drought condition, Flood affects only certain adjoining area of riversides or area with low drainage facility for few days or months, whereas the drought affects larger area and may persist for longer duration. Droughts in Indian region are mainly due to various kinds of failure of rainfall from southwest monsoon [2].

On an average, 28 per cent of total geographical area of India is at risk to drought. Meteorologically, about 19 per cent deviation of rainfall from the long term mean is considered normal in India [3]. Domestic animals play a crucial role in many developing countries, they constitute as source for traction power, income, in provision of milk and meat [4]. Drought is an insidious vulnerability of nature which is related to a lack of precipitations over an extensive phase of time, usually for a season or more. This deficiency results in a water scarcity for some activities, group or environmental sector. In developing world, livestock is the key of securing for many small holder farmers [5] and is often considered as indicator of wealth. The drought condition leads to scarcity of feed and fodder which leads to loss of body condition and production. Due to low availability of water, the forage crops production get reduced and livestock are forced to eat unwanted and poisonous plants which affect their body system ,leading to loss of body condition, production, and even death of the livestock. Thus such condition leads to direct economic losses to the livestock farmers [6]. Thus, it becomes imperative to understand the Alternate dairy management practices of feeding and watering management of animals followed by dairy farmers during drought conditions. This information of the livestock owners may help the policy makers in making drought mitigation strategies.

2. Materials and Methods

Area of the Study

Patan district is located in northern Gujarat was selected for study. The Union Government has declared 17 districts in Gujarat as drought affected in which Patan district is one of the 33 districts of Gujarat state in western India is drought prone hit list area because of Patan district having 5 rivers but these are Non-perennial River.

Geography of Patan district

Geographical location of Patan is 23.55 degree to 24.41 degree North (Latitude) and 71.31 degree to 72.20 degree East (Longitude). The maximum temperature of Patan district is 45 degree centigrade and the minimum temperature is 7 degree centigrade. Average rainfall in this district is 600 mm. Saraswati River is the main river in this district.

Demographic information of Patan district

According to the 2011 census Patan district has a population of about 1,342,746. The district has a population density of 234 inhabitants per square kilometre (610 /sq mi).

Tools and techniques of data collection

Patan District of Gujarat state was purposively selected for the study because of familiarity with the area, people and language which will be helpful to researcher in collecting needed data for the study. The adoption of improved animal husbandry practices plays pivotal role in overall agricultural development. The injudicious use of traditional/conventional methods of animal husbandry practices created problems of low production and inefficient productivity. The major focus of the present study was dairy management practices regarding feeding and watering management of animals pursued by farmer's during drought and normal period.

Sampling Technique

North Gujarat region of Gujarat has been found to susceptible to drought, and comprises six districts of state. Out of these six districts, Banaskantha and Patan were found to be more drought prone area. The present study was conducted in the Harij and Radhanpur talukas of Patan district because these talukas having highest number of livestock farmers as well as most drought prone area among all talukas of Patan district. Six villages from each taluka were randomly selected. Thus, total 12 villages were selected for the study.

Selection of the respondents

From each selected village, 10 respondents were selected at random making a total of 120 respondents for the study.

Statistical Framework for analysis of data

After data collection, it was compiled, tabulated and analyzed keeping in view the objectives of the study. Frequency distribution, percentage and 't' test analysis *etc.,* were computed by using Statistical Package for Social Sciences (SPSS) software for analysis of the data.

3. Results and Discussions

Profile of the Respondents

Socio-Personal and Economic Characteristics of the Respondents

Age

The working capacity at farm and functioning in the families or group is influenced by the age of respondents.

Table 1. Distribution of respondents as per their age n =120

Sr. No.	Category	Frequency	Per cent
1.	Young age (up to 30 years)	7	05.84
2.	Middle age (31 to 55 years)	**101**	**84.16**
3.	Old age (above 55 years)	12	10.00
Total		120	100.00

Table-1 indicates that about 84.16 per cent of total respondent belonged to middle age group, followed by old age group (10.00 per cent) and young age group (5.84 per cent). [7] also reported that majority of the dairy farmers in hilly area of Uttaranchal had middle age.

Family education status

Standard of family education moulds the farmer's response to improve the practices / technologies and in shaping an enterprise to earn more during odd climatic conditions.

Table 2. Distribution of respondents as per their family education status n =120

Sr. No.	Category	Frequency	Per cent
1.	Low (<3.67)	**47**	**39.17**
2.	Medium (3.68-5.34)	40	33.33
3.	High (>5.35)	33	27.50
Total		120	100.00

Table-2 indicates that about 39.17 per cent of total respondent was from low family education status followed by medium (33.33 per cent) and high (27.50 per cent), respectively. [8] also revealed that majority of the respondents from Bareilly district of Uttar Pradesh had low family education status.

Family type

Family type has potent role in the management of the dairy livestock especially during drought period because the number of the family members depends on family type.

Table 3. Distribution of respondents as per their family type n=120

Sr. No.	Category	Frequency	Per cent
1.	Joint	46	38.33
2.	Nuclear	**74**	**61.67**
	Total	120	100.00

Table-3 indicates that 38.33 per cent of respondent belonged to joint families and rest about 61.67 per cent of respondents hailed from nuclear family. It may be due to that nuclear family give good management power to off beat the stress of drought condition especially in case of low landholding farmers. Farmers have good income source can manage large and joint family in a better way. [9] also revealed that majority of landless families were of nuclear types where as the medium large farmers had large families due to ease in managing large amount of land and resources.

Family occupation status

It referred to the family's major economic activities to earn a livelihood. Table-4 indicates about 40.00 per cent of farmers had dairy as major occupation during drought period whereas during normal period only 25.00 per cent had dairy as major occupation revealed that farmers switched over to dairying and other related enterprises as their major source of the livelihood during the drought period. Similarly [10] examined the extent of livestock, grain storage and inter-household transfers used in smooth consumption against income risk during 1981 and 1984 drought in rural Burkina Faso.

Table-4 further reveals that none of the small land holder had agriculture as major occupations during drought. There was overall reduction of 69.09 per cent in the farming during drought from the normal period. About 10.00 per cent reduction in the agriculture as minor occupation was also observed during drought.

Although majority of the landless respondent were labourers during both the period in the study area, however there was overall 133.33 per cent increase during drought period for their livelihood. About 16.67 per cent of the respondents had service as the major occupation during the both drought and normal period and no affect was found due to adverse whether condition.

Table 4. Impact of drought on family occupation status of respondent n=120

Occupation	Period	Category	
		Major	**Minor**
Agriculture	Normal	55(45.83%)	50(41.67%)
	Drought	17(14.17%)	45(37.50%)
Per cent change		**-69.09%**	**-10.00%**
Dairy	Normal	30(25.00%)	60(50.00%)
	Drought	48(40.00%)	65(54.17%)
Per cent change		**+60.00%**	**+8.33%**
Service	Normal	20(16.67%)	10(8.33%)
	Drought	20(16.67%)	10(8.33%)
Per cent change		**00**	**00**
Labour	Normal	15(12.50%)	00
	Drought	35(29.16%)	00
Per cent change		**+133.33%**	00

Actual land holding

Farmers actual land holding shows their social status and progressiveness. In present study, they were categorized on the basis of their actual land holding. Farmers having no land were landless, having less than 2.5 acre of land came under marginal farmers category, farmers owing 2.5-5.0 acre of land were small and farmers having more than 5.0 acre of land were considered under the medium large group.

Annual Income

Gross income included the income from all resources and earning of all members of family. The findings in Table-6 show that the distribution of respondents according to income during drought and normal periods. Income decreased up to 100.00 per cent and 71.42 per cent of respondents amongst high income group and medium income group, respectively.[11] also revealed that severe drought occurred in the crop year 1999-2000 in Iran imposed a direct cost of 605 million USD, equivalent to 30.3% of the total value added of the other agricultural sub sectors (livestock, fisheries and forestry) and rest of the economy. [12] also reported decrease in income during drought due to fluctuated cattle population because of cattle mortality was linked to pre drought population and was influenced by factors such as disease epidemics in Kenya. According to [13] loss of income from livestock declined in livestock population due to severe mortality during a major drought between 1991 and 1995 in central Queensland.

Table 5. Distribution of respondents as per their land holding n = 120

Sr. No.	Category	Frequency	Per cent
1.	Landless	20	16.67
2.	Marginal farmer (up to 2.5 acre)	28	23.33
3.	Small farmer (Between 2.5 to 5.0 acre)	**36**	**30.00**
4.	Large farmer (Above 5.0 acre)	**36**	**30.00**
Total		120	100.00

Table-5 shows that 16.67 per cent farmers were landless and 83.33 per cent were landholders. Among the landholders, majority (30.00 per cent) were small and large farmers followed by marginal farmers (23.33 per cent).

Table 6. Impact of drought on annual incomen=120

Sr. No.	Income groups	Period	Frequency	Per cent
1.	Low (<25,000)	Normal	75	62.50
		Drought	110	91.67
Per cent change			**+46.67**	
2.	Medium (Between 25,001-50,000)	Normal	35	29.17
		Drought	10	8.33
Per cent change			**-71.42**	
3.	High (Above >50,000)	Normal	10	8.33
		Drought	00	00
Per cent change			**-100.00**	

Herd size

Drought conditions lead to various kinds of stress on livestock and livestock owners which included scarcity of feed and fodder, lack of water and high maintenance cost, spread of diseases *etc.*Table-7 shows that herd size reduced up to 70.00 per cent during drought by the farmers owning large herds *i.e.* more than nine animals.

Whereas it increased about 166.67 per cent among farmers owing small size of herd. The change was more as the increase in number of animals during drought. [12] also reported that drought was the single most important environmental factor that fluctuated the cattle population because of cattle mortality was linked to pre drought population and was influenced by factors such as disease epidemics and poor nutritional quality in forage during drought in Kenya. According to [13] the livestock population declined severely during a major drought between 1991 and 1995 in central Queensland, Australia due to mortality. [14] also found 52 per cent decline in cattle number during drought period. The other quantified factors included low calving rate and high adult and calf mortality and its interaction with high incidence of diseases.

Table 7. Impact of drought on herd size owned by respondent n=120

Sr. No.	Cattle equivalent	Period	Frequency	Per cent
1.	Small herd size (<5.90)	Normal	30	25.00
		Drought	80	66.67
Per cent change			**+166.67**	
2.	Medium herd size (Between 5.90-9.40)	Normal	40	33.33
		Drought	25	20.83
Per cent change			**-37.50**	
3.	Large herd size (Above >9.40)	Normal	50	41.67
		Drought	15	12.50
Per cent change			**-70.00**	

Experience in livestock farming

Experience plays a major role in the livestock management and help in maintaining good income from livestock.

Alternate Dairy Management Practices of Feeding and Watering Management of animals followed by Dairy Farmers

Alternate dairy management practices play an important role in securing maximum benefit from livestock. Feed and fodder management maintains the production of the animals and reduces its stress during adverse conditions.

The feed and fodder management practices included type of feed, sources of feed, use of alternative feed resources, salt and mineral mixture, grazing management, fodder cultivation and to conservation / storage and weeds used as feed resources by the livestock farmers.

Table 8. Distribution of respondents as per their experience in dairy farming n=120

Sr. No.	Experience (in years)	Frequency	Per cent
1.	Low (<5)	10	8.33
2.	Medium (Between 6-10)	30	25.00
3.	High (Above >10)	**80**	**66.67**

Table-8 shows that 66.67 per cent of the respondents belonged to high experience group, whereas 25.00 per cent of the respondents belonged to medium experienced group and rest had less than 5 years of experience in dairy farming.

Types of feed offered

Table 43 indicates that cent per cent respondents offered either dry fodder (during drought period) or mixed fodder (during normal period). Concentrate mixture was being provided to lactating animals by 68.33 per cent during drought and 87.5 per cent respondents during normal period. 16.67 per cent of the respondents were offering concentrate to pregnant animals during normal period. Treatment of fodder was done by soaking and chaffing. Respondents were not aware about the maintenance ration. They provide concentrate to the lactating animals in the form of sani by soaking the dry or mixed fodder along with concentrate. [15] also reported that in Bundelkhand region stall feeding was practiced for all type of animals during morning and evening. Animals were send for grazing for 5-7 hours daily and lactating animals were fed 1-1.50 kg of concentrate daily in the form of sani.

Frequency and interval of feeding

Cent per cent respondents feed the animals twice in a day during normal periods and also send their animals for grazing for more than 6 hours a day. Sixty five per cent of the respondents provide feed once daily to their animals during evening at interval of 24 hrs, as the farmers thought that the animals get required amount of feed during grazing (Table-10). According to [15] region stall feeding was practiced for all type of animals during morning and evening in Bundelkhand.

Table 9. Distribution of respondents according to the types of feed offered n=120

Period	**Exclusively dry fodder feeding**			
	Calves	Adult	Pregnant	Lactating
Drought	**120**	**120**	**120**	**120**
	100.00%	**100.00%**	**100.00%**	**100.00%**
Normal	-	-	-	-
	-	-	-	-
Period	**Mixed fodder feeding**			
	Calves	Adult	Pregnant	Lactating
Drought	-	-	-	-
	-	-	-	-
Normal	**120**	**120**	**120**	**120**
	100.00%	**100.00%**	**100.00%**	**100.00%**

Period	**Concentrate feeding**				**Treatment of fodder**	
	Calves	Adult	Pregnant	Lactating	Soaking	Chaffing
Drought	-	-	-	**82**	120	120
	-	-	-	**68.33%**	100.00%	100.00%
Normal	-	-	20	**105**	120	120
	-	-	16.67%	**87.50%**	100.00%	100.00%

Table 10. Distribution of respondents according to the frequency and interval of feeding n=120

Period	**Frequency of feeding**			**Interval in feeding**	
	Once	Twice	Grazing dependent	12 hrs	24 hrs
Drought	**78**	42	120	42	**78**
	65.00%	35.00%	100.00%	35.00%	**65.00%**
Normal	-	**120**	120	**120**	-
	-	**100.00%**	100.00%	**100.00%**	-

Use of alternate feed resources

Alternate feed resources are those resources which occupies the place of the main feed. Table 45 shows that the most commonly used alternate feed resource were dried fodder / hay, crop residues (33.33 per cent) and tree leaves (20.83 per cent) used by respondent during drought period. All of the respondents utilized crop residues in the form of feed resources especially during drought period. These crop residues were straws of wheat, green gram and black gram. [16] studied the effect of different level of poplar supplementation on ewe reproductive rate and found it increased by approximately 20 and 30 per cent, for the low (0.75 kg / ewe / day) and high (1.5 kg / ewe / day) treatment groups, respectively at scanning, lambing and weaning. [17] revealed that willow supplementation of beef cattle grazing in dry. Sparse summer pasture in New Zealand reduced live weight loss during drought period. Willow fodder block proved beneficial in increasing ewe reproductive rate and a supplementary feed during drought. They stated that pasture and trees need to be managed as a tree pasture system in order to produce herbage of higher nutritive value and more efficient utilization of willow fodder blocks as a supplementary feeds in New Zealand [18].

Table 11. Distribution of respondents according to the use of alternate feed resources n=120

Period	**Alternate feed resources used**		
	Tree leaves	Dried fodder (Hay)	Crop residues
Drought	25	**45**	40
	20.83%	**37.50%**	33.33%
Normal	**40**	30	40
	33.33%	25.00%	33.33%

Use of salt and mineral mixture

The salt and mineral mixture plays an important role in the body activity especially when the requirements of other feeds are increased. [Table-11] indicates that majority of the farmers were neither feeding salt nor mineral mixture to the animals except only 8.33 per cent of the respondents who were feeding mineral mixture and iodized salt. This revealed that the farmers had poor knowledge about the importance of mineral mixture and salt in animals feeding.

Supplemental feeding

None of the respondents used any kind of supplemental feed in any period which is clearly in Table-12. Supplemental feed such as urea molasses block, minerals brick and probiotic were not utilized by the respondents as they were completely unaware about it.

Table 12. Distribution of respondents according to the use of salt and mineral mixture and supplemental feeding n=120

Period	**Uses of Salt and mineral mixture**			**Supplemental feeding**	
	Mineral mixture	Normal salt	Iodized salt	Yes	No
Drought	10	2	10	-	**120**
	8.33%	1.67 %	8.33%	-	**100.00 %**
Normal	10	2	10	-	**120**
	8.33%	1.67 %	8.33%	-	**100%**

Grazing Management

Table-13 indicates that cent per cent of the respondents allowed grazing to their animals during drought period and 70.83 per cent during normal period**.** The grazing was followed as continuous stray type reported by the cent per cent of the respondents during normal period.After harvesting the rabi crop, the people release their animals free to graze as there were no cultivation of crops during zaid and minor cultivation during kharif due to erratic rainfall. The free stray grazing system is locally known as “Charavu”. Similar type of the finding was found but the various workers in the Uttar Pradesh [15], [19] and [20] about the annaprath.

Table 13. Distribution of respondents according to their grazing management practices n=120

Period	**Grazing of animals**		**Duration of grazing**	
	Yes	No	Upto 6 hrs	6-12 hrs
Drought	**120**	-	**120**	-
	100.00 %	-	**100.00%**	-
Normal	**85**	35	**85**	-
	70.83%	29.17%	**70.83%**	-

Period	**Grazing methods followed**		
	Rotational	Continuous	Mixed
Drought	-	**120**	-
	-	**100.00%**	-
Normal	-	**85**	-
	-	**70.83%**	-

Fodder Cultivation Practices

Bajara, sorghum, wheat, mustard, black gram and cowpea were the major fodder crop cultivated by them (Table-14). [19] revealed berseem as green fodder and wheat and peas straws (dry fodder) during rabi were used in Bundelkhand region of Uttar Pradesh. Sorghum contributed about 58.00 per cent of total kharif availability of livestock feed in the study area.

Table 14. Distribution of respondents according to their fodder cultivation practices n=120

Period	**Type of fodder crops cultivated**					
	Cow pea	Bajara	Sorghum	Wheat	Black gram	Mustard
Drought	-	-	-	-	-	-
	-	-	-	-	-	-
Normal	65	84	84	84	55	60
	54.17%	70.00%	70.00 %	70.00%	45.83%	50.00%

Fodder conservation / storage practices

Farmers having no land conserved the fodder by working in large farmer’s field. Table-14 shows that none of the respondent stored the feed resources as silage as they had no knowledge about it. The farmers also did not know about the hay but due to tradition of drying, the sorghum and bajara crops after harvesting kept it as strover (hay).

Table 15. Distribution of respondents according to their feed and fodder conservation practices n=120

Period	Storage / Conservation of fodder		Conservation methods followed		
	Stored	Not stored	Strover (hay)	Crop residues	Crop by product
Drought	-	**120**	-	-	-
	-	**100.00%**	-	-	-
Normal	**120**	-	**120**	**120**	-
	100.00%	-	**100.00%**	**100.00%**	-

Water Management

Data on water management practices included sources of drinking water, interval and frequency of watering, distance of drinking water source and water conservation methods followed by the livestock farmers were collected.

Source of drinking water

Drinking water sources included both surface and underground water source. The surface water source included ponds, lake, canal and rivers whereas the underground water sources included well, hand pump and tubwell. Table 16 indicates that 50 per cent of the respondents from patan district had surface drinking water sources during drought period. In Patan district, Saraswati river was the main surface source of the drinking water which also get dried during the drought period.

Distance of drinking water source from livestock shelter

Underground water sources were <500 meter distance narrated by on average of nine per cent of the respondents. About 42.00 per cent of the respondent reported >1000 meter distance for underground water (Table-16).

Interval and frequency of watering

Table 17 indicates that all the respondents were offering water two times at the interval of 12 hrs in *i.e.* during morning and evening. However during drought most of the respondents release their animals for grazing in the morning and offer water during evening after returning from grazing.

Water conservation

Results indicated in Table-17 that none of the respondent was conserving the water for drought period. However, NREGA is quite beneficial in the field of water conservation by maintaining the old ponds which will surly provide the water for longer duration as compared to previously. This was also supported by the [21] urgent need is the launch of "A Pond in Every Farm" movement. This can be done by permitting NREGA workers to build Jal Kunds in the farms of small and marginal farmers.

Table 16. Distribution of respondents according to their drinking water managementn=120

Period	Uses of surface water source			Uses of underground water source		
	Lake	Pond	Canal	Well	Hand pump	Tub well
Drought	-	**60**	-	-	120	120
	-	**50.00%**	-	-	100.00%	100.00%
Normal	**70**	20	30	-	120	120
	58.33%	16.67%	25.00%	-	100.00%	100.00%

Period	Distance of surface water source			Distance of underground water source		
	<500 meter	500-1000 meter	>1000 meter	<500 meter	500-1000 meter	>1000 meter
Drought	60	40	20	10	60	50
	50.00%	33.33%	16.67%	8.33%	50.00%	41.67%
Normal	60	40	20	20	70	30
	50.00%	33.33%	16.67%	16.67%	58.33%	25.00%

Table 17. Distribution of respondents according to their frequency and interval of watering to daily animals and adaption of water conservation n=120

Period	Frequency of watering			Interval of watering		
	8 hrs	12 hrs	24 hrs	Once	Twice	Thrice
Drought	-	**120**	-	-	**120**	-
	-	**100.00%**	-	-	**100.00%**	-
Normal	-	**120**	-	-	**120**	-
	-	**100.00%**	-	-	**100.00%**	-

Period	Conservation of water	
	Yes	No
Drought	-	**120**
	-	**100.00%**
Normal	-	**120**
	-	**100.00%**

Conclusion

The socio-economic status of livestock keepers was highly affected due to loss of production and productivity of livestock, change in livestock dynamics and other practices due to drought, thus the outcome of the present study may help in maintaining the demographic and socio-economic status of livestock owners by adopting drought mitigation strategies developed under study. Farmers belonged to landless and marginal groups were less educated and had nuclear families due to lack of resources. Farmers having less land and resources shifted to dairying and other livestock related activities during drought for major sources of livelihood. Productivity of land decreases during drought led to scarcity of feed and fodder and increase of mortality, morbidity of young calf animals and loss of production cause high economic loss to rural livelihood. Dairy farmers in the study area indicated a set of constraints facing in animal management during drought and lack of water, feed and fodder ranked highest among them.

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