STUDIES ON BUFFALO HOUSING AND ASSOCIATED MANAGEMENT PRACTICES IN HARYANA.

By

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CERTIFICATE - I

This is to certify that this thesis entitled " STUDIES ON BUFFALO HOUSING AND ASSOCIATED MANAGEMENT PRACTICES IN HARYANA" submitted for the degree of Doctor of Philosophy in the subject of Livestock Production and Management of the Haryana Agricultural University, is a bonafide research work carried out by Mr.Ajay Kumar Varma under my supervision and that no part of this thesis has been submitted for any other degree.

The assistance and help received during the course of investigation have been fully acknowledge.

MAJOR ADVISOR

CERTIFICATE -II

This is to certify that this dissertation entitled, " STUDIES ON BUFFALO HOUSING AND ASSOCIATED MANAGEMENT PRACTICES IN HARYANA" submitted by Mr.Ajay Kumar Varma to the Haryana Agricultural University in partial fulfilment of the requirements for the degree of Ph.D., in the subject of Livestock Production and Management, has been approved by the Students' Advisory Committee after an oral examination of the same, in collaboration with an External Examiner.

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AJAY KUMAR VARMA

DEDICATED TO

MY

LATE FATHER

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CHAPTER-I

INTRODUCTION

INTRODUCTION

India is the home tract of the world's best riverine-type buffalo "Murrah", which has been used as an improver breed throughout Asia as well as in a number of countries in South East Asia, Eastern Europe and Latin America. The world buffalo population is 138 million, and of this 75 million are in India (FAO 1987). In India buffaloes contribute 52% of the total milk, despite the fact that they constitute only 26% of the total bovine population (Chatterjee and Acharya,1987). The buffalo population increased by about 35% as against 9% in cattle during 1961-82. India ranks third in the world after USSR and USA in milk production (43.9 million tonnes in 1986-87). Milk and milk products are the second largest contributor (Rs.16,000 million) to the gross agricultural produce.

It would not be inappropriate to describe the buffalo as a "triple purpose" animal, i.e. producer of milk, meat and draft. Since buffalo milk has higher fat content, it is more profitable in dairy enterprises. As an excellent draught animal, 10 million buffaloes play an important role in ploughing and carting. They produce 1 million tonnes of meat and by products such as skin, bones, blood etc. The market value of various livestock products, whilst alive and after death, amounts to about Rs.16,000 crore per year in India, roughly 4% of GNP.

The native tract of the famous Murrah breed is Haryana and this state has registered the highest increase in buffalo population (74.1%) during 1961-82 followed by Gujarat, Rajasthan, Uttar Pradesh and Punjab. In Haryana, buffalo production is mostly in the hands of small farmers. Keeping milch buffalo is an important support to crop-farming. It has become an integral part of the traditional village farming system. About 75% of Indian farmers own less than 2 hectare of land. In general, small holdings are mainly diverted to subsistence food crop production. In such a situation where animals have to subsist almost entirely on agricultural by-products, buffalo is the ideal animal that efficiently converts them into milk and add to the regular farm income. In future also dairying shall continue to be an important occupation and a major source of income particularly small farmers and landless labourers.

Today buffalo is playing a vital role in the rural economy. It fits well into the agro-climatic pattern of north-western region of the country. Life of the farming community in this region is intimately associated with the buffaloes. Buffalo receives the utmost care and affection from the farmer and are regarded as a symbol of agricultural prosperity. In Punjab where a farmer had only one cotton quilt, he used it to cover a pregnant she-buffalo, rather than his own pregnant wife (Khurody,1974).

It shows that the people have developed a love and deep affection for their buffaloes and they have long passionate tradition of rearing animals.

Buffaloes are regarded as valuable possession of farmers. Generally farmer in this area aspires to keep a few milch buffaloes for the supply of milk and milk products to his family and add to his family earnings from the sale of surplus milk and its products. The possession of milch buffaloes and their number in a household indicates its socio-economic status. Buffaloe's milk is very popular in these areas and sells at a higher price than that of cow's milk due to its high fat and total solids content.

However, buffalo has so far been a neglected animal in India and the researches have been neither coordinated nor planned in certain areas such as buffalo housing system and the housing associated management practices. This area so far has received little or no attention. There has been a gap in our knowledge pertaining to the various housing systems and various managemental practices and general failure to recognise and exploit the potential of housing for keeping this very productive animal under field conditions.

Ideal housing, which is conducive to good health, comfort and protection from the inclements of weather in this country is lacking except on a few organised

farms. Also, very little information is available regarding the relative merits of different type of houses for buffaloes. Substantial of research work has been carried out at Haryana Agricultural University(HAU) livestock farm on buffalo housing system and its influence on production, reproduction, growth, comfort, physiological reaction etc. and it has been recommended that loose housing system is suitable for buffaloes in the north-western part of the country (Sastry and Georgie,1988). Due to vagaries of nature, inclement weather conditions, lack of knowledge and poor economic conditions of the buffalo keepers in rural area, farmers are using greatly diverse housing systems in different seasons, such as tethering in the open, under trees, in sheltered paddock, closed house where majority of the farmers share the dwelling with buffaloes, in thatched sheds etc. Many farmers, directly or indirectly are spending more on buffalo houses for no benefit because of their poor knowledge, which results into substantial reduction in their profit margins from this enterprise.

It is unfortunate that very little attention has been given to housing system for buffaloes in rural areas to exploit its full potential and it has been completely neglected by farmers in providing them suitable houses for their buffaloes. A few efforts have been made to study the buffalo housing system in rural area but

no systematic attempt has so far been made for analysing economic aspects of the buffalo housing system. Most of the information available on buffalo housing system in rural areas is based on assumption, casual observations, experience and memoirs of some specialist and professional workers. This is not adequate to serve as the basis on which valid guidelines for introducing improved and scientific housing and housing associated management practices for buffaloes can be framed.

Keeping this in view, it was planned to investigate the prevailing buffalo housing system and associate management practices followed by different categories of farmers (landed as well as landless labourers) maintaining milch buffaloes in two agro-climatic zones of Haryana, viz. Karnal and Hisar districts with the following objectives:

1. To study the buffalo housing practices being followed by different categories of farmers.

2. To study the housing associated management practices being followed by different categories of farmers.

3. To make a comparative appraisal of housing and associated management practices in rural areas with those on an organised buffalo farm.

CHAPTER – II

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Housing for buffaloes is generally taken for granted both by the scientists and farmers, since it is the most obvious thing that has to be there just like air and water. On organised farms, houses for buffaloes are considered to be similar to those for cattle and, in villages, farmers house their buffaloes in whatever way they can afford to. Such an attitude is unfortunate considering that animal housing not only helps in moderating the range of microenvironment to which the animals are exposed towards comfort, but also determines the system of feeding and management of stock housed in them.

EXISTING HOUSING SYSTEMS:

Considering the wide variations in the socio-economic and agro-climatic conditions under which buffaloes are reared, it is natural that buffaloes are housed differently in different parts of the world. In parts of southeast Asia (Camoens, 1976; Rabold,1982) and in the northern parts of Brazil (Caberra,1985), where there is problem of flooding in rainy season, the buffaloes are kept on log platforms that rise above water surface. During day time buffaloes swim far and wide for feeding and, by dusk, return to the platforms for rest, safety and feeding of their young ones.

In Caucassian Republics of Soviet Union (Agabeili, 1967), many countries of Europe (Sastry and Gall,1975;

Polichronov and Aleksiev,1979), Middle East (Sevinic,1985) and in parts of South and Central America (Netto,1985; Herra,1987), buffaloes are kept on pasture/ranch except in winter, when they are shifted inside sheds. The Asian small farmer adopts greatly diverse housing systems for buffaloes in different seasons (Sastry,1980) such as - tethering under trees, tethering close to and in the shade of their dwelling quarters, housing in thatched or mud-roofed sheds, enclosing within wood-fenced or mud-walled paddocks etc. During day time the buffaloes are invariably let out for grazing, roaming around or wallowing in ponds etc.

A scoring system was developed (Raut,1982) for twenty most important attributes (space, hygiene, sanitation, shed structures, water source, thermal comfort etc.) of buffalo houses in the villages of Dhulia district of Maharashtra (India) in such a way that each buffaloes could get a maximum total score of 24, which means the most ideal housing. Majority of the buffaloes had total scores between 10 and 14, the poorest scores occuring in the rainy season (Table 1). There were significant correlations between daily milk yield and floor area (0.236) and total score for housing conditions (0.588). This indicates great scope for allround improvement in housing system for buffaloes.

jackets) in winter. During summer too, majority were kept indoors (mainly for safety), which was not ideal from the point of thermal amelioration. Mostly temporary wood or mud mangers of unspecific size and shape are used.

On organised farms in India, buffaloes are housed in old colonial semi-closed type barns, or, more recently, in semi-open loose house i.e., paddock with partial shelter (Gill and Rurki,1981; Sastry and Georgie,1985). Generally similar types of houses are used for housing dairy buffaloes in Pakistan (Ashfaq,1974; Cady et al.,1983), Bulgaria (Hinkovsre and Alexiev,1985) and Italy (Sastry and Gall,1985). Though buffaloes are housed loose in groups in such loose houses, they are milked in a separate milking barn.

On farmers' holdings, young buffalo calves are kept inside human dwellings or near adult buffaloes but separately tethered (on earthern floor). On organised farms (in India and elsewhere) maintaining dairy herds, calves are, kept in most diverse ways-in individual cages with raised floors, individual cells with or without bedding, in small groups on raised slatted floors, in loose houses with or without bedding or as small group in fenced paddocks.

Bagga (1967) reported that common sheds are used for all kinds of animals without distinction between sick, weak or healthy animals by all except 4.17 per cent of the respondents in the course of a study on calf rearing

Table 1: Distribution of buffaloes according to total score on housing conditions in different seasons in Dhulia district of Maharashtra (India)

Score	Distribution of animals (%)		
	Winter	Summer	Rains
⩽ 6	-	-	20.4
6 -8	7.8	5.5	9.3
8 - 10	22.5	23.3	36.1
10 - 12	27.1	24.6	21.7
12 - 14	24.0	21.9	18.1
14 - 16	10.1	13.7	2.4
⩾ 16	8.5	11.0	-
Total	100.0	100.0	100.0

Source: Raut (1982).

It was observed by Srivastava and Promila(1983) that in villages around Ludhiana city of Punjab (India), 82% of the people having buffaloes kept them in human dwellings. As high as 78% of houses were of closed type, the remainder only partially open; 92% of sheds having only one side open (poorly ventilated). Buffalo sheds had either no drainage (22%) or liquid manure was allowed to collect in pits after draining down an unevenly sloped eartherm floor. All the buffaloes were kept indoors (often covered in jute cloth

jackets) in winter. During summer too, majority were kept indoors (mainly for safety), which was not ideal from the point of thermal amelioration. Mostly temporary wood or mud mangers of unspecific size and shape are used.

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practices and problems in the villages of Hisar district. He further reported that the walls and roofs of the sheds were mostly "Kutcha" and thached in some cases. The common materials used as bedding for the animals included sand, wheat bhusa, crop residues of bajra etc., 'Pucca' mangers for the animals were provided by only 5 per cent of the respondents. Windows and ventilators in the sheds were found only in a few cases, even though many respondents expressed a liking for keeping the sheds clean and airy.

Gera (1967) surveyed villages of Hisar block to study problems in dairy development and reported that animals were housed in human habitation by 81.7% of the respondents. A majority (76.4 per cent) of the respondents were in favour of constructing animal sheds outside the village. Social, cultural, economic biases and lack of cooperation were the reasons for the non-construction of community milking sheds.

Verma (1967) studied dairy husbandry practices of nomadic Gujjars in Sirmour district of Himachal Pradesh with special reference to pastoral animal husbandry. He reported that freshly calved animals were provided with good bedding and if possible housed in a separate corner of the house.

Daniel (1969) investigated buffalo husbandry practices prevalent among farmers of Hisar block. All the respondents, except one, had 'Kutcha' floors in their animal sheds which

were constructed by putting the earth and plastering (62.5 per cent) or ramming the earth and then plastering (34.4 per cent). A majority of the respondents provided bedding of sand or waste fodders and replaced it daily. None of the cattle keepers reported using any disinfectant. Animals were tied in the shed after giving them bath (37.5 per cent) or tied under a shady tree (46.9 per cent) to save them from severe temperature during summer.

Mikkileni (1976) made a study of adoption of a few selected dairy practices in upland and delta areas of Vijaywada Taluk (Andhra Pradesh). He reported that all the 21 dairy practices selected were adopted by the dairy farmers but the adoption of balanced feeding, concrete flooring for the cattle shed, growing of improved varieties of fodder and practice of artificial insemination on the herd were low.

Patil (1976) conducted a study of dairy cattle management practices in rural areas of Bangalore. It was reported that 73 per cent of the farmers had good shelter for housing their animals, 23 per cent moderate and 4 per cent of the farmers kept their animals in the open air.

Singh (1978) made a study of some selected factors affecting adoption of dairy innovation by different categories of dairy farmers in the milk shed area of Ludhiana Milk Plant (Punjab). He observed that marginal dairy farmers had more favourable attitude towards dairy than

others, whereas small dairy farmers were highly motivated. Practices like protective vaccination, clean watering to the dairy animals and 'pucca' shelter were adopted more, whereas practices like dehorning and deworming and castration of male calves were poorly adopted.

Grewal (1980) observed that the common belief that dirt floors are more comfortable for animals was belied by his findings on the effect of floors on Murrah buffalo heifers. He noted that buffalo calves housed on brick floors grew faster and remained healthier.

Sastry et al. (1980) reported that in Indian villages farmers kept their animals exclusively on dirt floors. The general belief is that animals are more comfortable on dirt floors. They concluded that there is no justification for such a belief, at least for during hot season. Only on Govt. farms concrete or brick floors are provided in animal houses.

Tikku (1981) investigated the migratory dairy farming in Jammu and Kashmir. He reported that the Dodigujjar herdsmen trek with their dairy buffaloes to the plains around Jammu in winter and the pastures of Pir Panchal during summer, living during temporary dwellings which accommodate both the family and animals.

Khurody (1974) narrated a scene many years ago in a village in Punjab where a farmer had only one cotton quilt,

which he used to cover his pregnant she-buffalo, rather than his pregnant wife. This showed the deep concern of farmers for the comfort of his animals.

Singh (1986) reported better housing and management for buffaloes in adopted villages of Hisar district compared to that in non-adopted villages.

HOUSING STANDARDS:

Practically, there are no standards for space requirement and specifications of structures based on experimental evidence designed to guage animal comfort, optimum production and suitability to a specified management systems for buffaloes.

Based on deliberations among experienced animal husbandry specialists, rather than on empirical findings, the Bureau of Indian Standards, New Delhi has brought out standards on space requirements and construction details for cattle and buffalo farms of different sizes (I.S.I., 1968a; Mehta et al.,1979). There is a sort of insistence that cattle houses in this country be constructed as per these specifications. A bulletin on dairy cattle housing including buffaloes, brought out by the Punjab Agricultural University (Kooner et al.,1969) gives details of loose housing, which the authors recommend for the semi-arid regions.

The loose housing system, in principle, allows animals to be housed loose and comprises of an open paddock with a partial shelter. The various experiments conducted at Haryana Agricultural University,Hisar and described by Sastry and Georgie (1985), in fact, indicated that the space requirements recommended by the Bureau of Indian Standards are more or less adequate.

A loafing space of 1.8 to 2.0 m^2 and a manger space of 53 cm were found adequate for two year old buffalo heifers (Varma and Tripathi, 1980). Whereas, a shed space of 4.37 m^2 was found to be desirable for milch buffaloes (Raut,1982). Keeping all the above points in mind, Sastry (1988) gave guidelines on lay out designs and space requirements in loose houses (Table 2).

Table 2: Requirements of shed space (m^2) manger and water trough space (cm) for buffaloes under loose housing system.

Item	Bull	Buffaloes	Calves	Down-calvers
Sheltered area	12	4	1(old 2)	12
Open paddock area	120	8	2(old 4)	12
Manger front Space	-	60.75	40.50	-
Width of manger	60	60	40	-
Depth of manger	40	40	15	-
Height of inner wall of manger	50	50	30	-
Max.animals per shed	1	50	30	1

Source: Sastry (1988).

MICROCLIMATE IN ANIMAL HOUSE

The conditions inside the animal houses are affected to a considerable extent by the meteorological factors of the external environment, the construction it-self and the animals housed therein (Padmanabhamurthy,1980). The macro-climate-microclimate relationships are different in different seasons (Singh et al.,1985a). Meteorological data from series of studies carried out in semi-arid climatic zone on the microclimate in the open, in the loose house with brickpavement and partial asbestos-roofed shelters and in normal brick-walled asbestos roofed barns and sheds, as well as in hollow brick-roofed barns are presented in Table 3. While the maximum temperature inside the barns was similar to that in the open in all seasons, it was invariably higher in the loose house by about $2^{o}C$ in all seaons. Humidity, though higher in the loose house than in the open, was highest in the barn house. In another set of experiments (Karki et al.,1980; Mehla,1982; Singh, 1982) from which, data comparing loose house and a large asbestos-roofed shed with cross-ventilation (through ground to roof-height wire-net covered spaces) was available, again the maximum temperature was higher in loose house than in this shed and in the open. The atmospheric humidity was also higher in the hot seasons in the loose house than in the shed, though in cold seasons the humdity was similar. The minimum temperature tended to be, in

Table 3: Microclimate in different types of animal housing

Season/Climate classification	House conditions				
	Open	Tree shade	Loose housing	Asbestos-roofed shed	Asbestos-roofed barn
Maximum temperature (^{o}C)					
Summer	40.7	-	41.1	-	40.6
Winter	20.7	-	22.4	-	20.3
Rains	36.1	-	36.7	-	36.1
Summer	-	38.5	40.0	39.4	-
Hot dry	41.2	-	42.6	39.4	-
Hot humid	36.4	-	28.3	36.7	-
Mild cold	27.1	-	26.7	24.9	-
Severe cold	20.0	-	19.7	18.7	-
Minimum temperature (^{o}C)					
Summer	25.4	-	27.6	-	29.1
Winter	4.9	-	5.3	-	8.6
Rains	25.3	-	26.3	-	26.9
Summer	-	27.0	27.0	-	-
Hot dry	23.2	-	26.4	28.1	-
Hot humid	26.9	-	28.3	29.1	-
Mild cold	10.6	-	15.0	15.2	-
Severe cold	5.6	-	9.3	10.2	-
Relative humidity (%)					
Summer	40.1	-	48.2	-	51.7
Summer Morning	-	66.7	68.7	-	-
Evening	-	45.4	42.6	-	-
Winter	51.3	-	54.6	-	60.7
Rain	54.4	-	52.4	-	57.3
Vapour pressure (mm Hg)					
Hot dry	11.7	-	18.3	16.5	-
Hot humid	22.5	-	26.1	24.4	-
Mild cold	8.2	-	10.5	10.3	-
Severe cold	7.3	-	8.5	8.2	-

Source: Sastry and Georgie (1985).
Note : All recordings were made with animals present.

comparison to that in the open, consistently higher by 1^{o} to $2.5^{o}C$ in the loose house, by 2^{o} to $4^{o}C$ in barn and 2^{o} to $5^{o}C$ in the shed, with the difference between indoor and outdoor values being far wider in coller seasons (Table 3). A study comparing tree shade with loose house, also supports this conclusion (Bempong, 1983). However, the findings of this study that the temperature-humidity index (THI) in the open (tree shade) and loose house was similar (Table 3), gives an indication that thermal load on the animal under these two conditions may not be very different in humid summer. Elsewhere, at the Indian Veterinary Research Institute (IVRI), Izatnagar, lower humidity level was reported in the loose house (Singh et al., 1977) and at the National Dairy Research Institute, Karnal, lower humidity was recorded inside closed house than in the open during dry and mild hot climates in contrast to reports from the Haryana Agricultural University,Hisar (Table 3). Such difference in humidity profile in different housing systems could be due to design differences of the houses; the loose house at IVRI was not so open as that at H.A.U. Asbestos-roofed loose house produced a more moderate microclimate than the open (Satya Pal et al., 1973). The microclimate in the loose house could be further improved (Sastry et al.,1973) by an additional hessian shelter in the open area of the loose house along with showering the buffalo heifers housed therein

(Sastry et al.,1973), which is depicted in table 4.

Table 4: Effect of alterations on sheds and loose houses on microclimate during summer months

Particulars or studies	Climate variables: Max. temp. °C	Min. temp. °C	Ambient temp. °C 0700 hr	Ambient temp. °C 1600 hr	Relative humidity % 0700 hr	Relative humidity % 1600 hr	Vapour pressure mm Hg
Asbestos-roofed half-walled sheds							
1.a) Unaltered	42.3	30.0	30.8	38.4	46.0	29.7	-
b) Altered with wet khas panels above half-walls	32.9	31.6	31.5	32.7	61.5	52.1	-
2.a) Unaltered	-	-	31.0	42.5	42.0	20.0	-
b) Altered with wet khas panels above half-walls	-	-	33.0	36.5	43.0	45.0	-
3.a) Unaltered	Mean daily	39.4	-	-	Mean daily	33.3	-
b) Altered with paddy straw panels above half-walls and 25 cm thick paddy straw roof cover that was kept wet	Mean daily	35.1	-	-	Mean daily	39.1	-
4.a) Unaltered	36.3	27.5	-	-	-	-	18.5
b) altered with extra double layered hessian shelter over the whole shed	35.8	28.1	-	-	-	-	19.5

Sources: 1. Misra et al.(1963): 2. Misra and Sengupta (1965): 3. Chalapathy and Rao (1981): 4. Sastry et al.,(1973).

Some earlier reports from Mathura (Misra and Sengupta,1965; Misra et al.,1963) described the micro-climate in conventional half-walled shed for buffaloes and the attempts to improve the animal comforts by providing cooler atmospheric conditions in these houses (Table 4). The provision in summer of wet khas (fine roots of a plant that absorb and retain water) tatti panels hung from roof to the level of half-walls of the sheds reduced the ambient temperature of sheds in the morning but increased it in the afternoon, the humidity levels were always higher in such sheds. On the other hand, in a similar house with no such additional wet panels, though the reduction in ambient temperature was only marginal, humidity was not unduly increased (Table 4). In half-walled asbestos-roofed sheds, the temperature could be reduced during the hottest months by 4 to 5°C(39.9 to 35.0°C) by closing the open spaces of the shed with paddy straw panels and covering the roofs with 10 cm thick paddy straw kept wet during the noon hours, without causing undue indoor rise in levels of humidity (Chalapathy and Rao,1981).

However, taking into consideration the need to protect the animals from intense thermal radiation, as well as the necessity to have adequate ventilation in any protective shelter consistant with optimum performance, the loose house in functionally the most suitable and with the least capital investment.

ANIMAL RESPONSES TO TYPE OF HOUSING

Physiological reactions:

Animal responses like rectal temperature, pulse rate and respiration rate under different housing conditions were well within physiological limits in growing calves as well as lactating buffalo-cows (Table 5), and the changes, if any, under different housing regimes were minimal. However, the direction of change is of interest. In growing animals housed in loose houses, during hot or humid conditions the morning rectal temperature was lower, and in cold conditions higher. This indicated that the loose house environment was better than that in the barn or the shed during the night. The evening rectal temperature, which reflects the day time heat load on the animals, was also lower in the growing animals kept in the loose house than those kept in the closed shed during hot weather. But the barn type house caused a lower heat load in hotter climates than the loose house for lactating cows. The direction of rectal temperature response was generally in favour of the loose house in cold weather. The extent of changes in respiration and pulse rate was of little physiological consequence when you consider the normal range of variations one encounters with these parameters.

Table 5: Differences in physiological reactions of buffaloes housed in closed type houses vis-a-vis those in loose house

Housing systems compared	Season	Rectal Temp. (°C)		Resp. rate (counts/min)		Pulse rate (counts/min)	
		Morning	Evening	Morning	Evening	Morning	Evening
		Lactating buffalo-cows					
Barn	Summer	-0.2	+0.2	-2.1	+2.5	-0.9	-0.6
	Rainy	-0.5	0.0	-2.1	-0.6	-3.3	-2.6
	Winter	-0.4	+0.3	+1.0	+5.3	-3.2	-0.5
		Growing buffalo heifers					
Shed	Hot dry	0.0	-0.1	+5.2	+14.4	-0.4	+1.8
	Hot humid	-0.3	-0.1	+1.7	-0.1	-1.0	+1.9
	Mild cold	+0.7	+0.2	+1.5	+6.5	-0.9	+3.0
	Severe cold	+0.2	+0.3	+1.2	+6.1	+3.0	+3.0

Compiled on the basis of data from Thomas et al.(1978). Yadav (1981), Yadav(1982), Karki (1981),Mehla(1982).

Note: 1. (+) increase or (-) decrease in the loose house compared to the housing mentioned in the first column.

2. Morning: 07.00 hr; evening between 1500 hr and 16.00 hr.

Systems of housing as well as alterations in managemental practices in addition to the housing provided to the animals have also received the attention of several workers. Comparison between such conditions has also been made on the basis of extent of change in physiological reactions (Table 6). A consistent trend of lower rectal temperature in animals in loose house systems is evident, whereas alternating between the open and the shed resulted in higher evening rectal temperatures in all seasons except mild cold regime. The extent of drop in rectal temperature varied between 0.4° and 1.3°C. In a study, considerable drop in both respiration and pulse rates was recorded by showering or providing cool drinking water (Thomas et al.,1975) though, other reports showed that the effect on such ameliorative measures were only marginal. Also, in the loose house without any additional managemental practice to ameliorate heat load, the pulse rate and respiration rate were not unduly high (76.4±0.48 and 55.4±2.45 counts/min.) in the lactating buffaloes in this study (Singh,1982). It can thus be said that loose house system can very considerably be improved in the direction of better thermal comfort to the animals by additional managemental adjuncts like wallowing or spray cooling (Gangwar et al.,1980; Mehta et al.,1979) or by water showers and provision of cool (20.5°C) drinking

Table 6: Difference in physiological reactions due to some additional managemental practices under different housing types

Housing type and management practice	Season or month		Difference in Rectal temp.	Resp.rate (counts/min.)	Pulse rate (counts/min.)
1. Half-walled shed wet khas tatti over half-walls	Summer	M	-	+1.5	+2.4
		E	-	-8.9	-2.8
2. Asbestos roofed shed inside during day and in the open at night months; and vice-versa in the cold months	Hot dry	M	0.0	+7.5	-0.3
		E	+0.9	-0.1	+1.2
	Hot humid	M	0.0	+2.7	+1.2
		E	0.3	+7.2	-0.5
	Mild cold	M	+0.5	+1.5	-2.9
		E	-0.4	+0.2	+1.8
	Severe cold	M	+0.5	+2.8	+3.2
		E	+0.1	+2.4	+4.2
3. Loose house a) Wallowing	Hot dry	M	-0.7	-3.2	-
		E	-1.0	-3.3	-
	Hot humid	M	-0.6	-2.3	-
		E	-0.6	-2.4	-
b) Spray cooling	Hot dry	M	-0.5	-3.4	-
		E	-0.8	-2.3	-
	Hot humid	M	-0.4	-2.4	-
		E	-0.4	-2.4	-
4. Loose house Showering	May/June		-1.1	-1.6	-2.6
Cooling drinking water	May/June		-0.8	-2.8	-1.2
Showering+ cool drinking water	May/June		-1.3	-3.6	-2.6

Note: 1. M. Morning; E. evening; (+) increase or (-) decrease due to the alteration described in the first column.

2. Compalied from reports of Misra et al.(1963) and Roy et al., (1962) for item 1, from reports of Karki(1981) and Mehla (9182) for item 2, from reports of Gangwar et al.(1980) and Mehta et al.(1979) for item 3 and from reports of Radadia et al.(1980c) for item 4.

water (Thomas et al.,1975), though the last may not be so easily practicable under all farming conditions.

Feed and water economy:

Under a high ambient environment, suppression of appetite leading to reduced feed intake and enhanced water loss from surface through evaporation results in increased water intake. These criteria were used in comparing housing management systems by several groups of workers (Table 7). There was no specific conclusion as to the direction of change in feed and water intake, not to speak about quantities involved. Part of evaporative heat loss is achieved without much energy cost and provision of ad lib. water is of least importance to the management cost apart from the fact that this condition is usually implied in any good management system. Thus, the fact that in loose house, demand for water is considerably higher than that in shed in summer (varying between 20 and 26% increase in water intake) may not be taken as a point against loose house system. On the other hand, that loose house system has almost invariably high humidity except in rainy season (Yadav, 1981), increased appetite and feed intake is a much weightier point in its favour. The extent of increase in feed/drymatter intake was greater when further managemental assistance for thermal comfort was provided, even though while considering the data (Table 7) it must not be forgotten that much of the differences observed were due to

Table 7: Alterations in water and feed consumption on account of housing management

Description	% change in + Water intake		Feed dry matter intake	References
Housing types:				
Open vs barn	-2.7		-	Satya Pal et al.(1973)
Barn vs loose house	+11.9	S	+11.0	Yadav (1982)
	-8.3	R	-24.4	Yadav (1981)
Shed vs loose house	+26.0	S(Dry)	+14.7	Karki (1981)
	+21.2	S(Humid)	+ 6.2	Singh et al.(1985b)
	-1.1	W(Mild)	0.8	Mehla (1982)
	-2.8	W(Severe)	+7.9	Singh et al.(1985b)
Managemental adjuncts to housing				
Day-night alteration between				
Open and shed depending	+20.5	S(Dry)	+10.5	Karki (1981)
	+22.9	S(Humid)	+0.1	Singh et al.(1985b)
On season	+14.0	W(Mild)	+0.5	Mehla (1982)
	-16.1	W(Severe)	+2.7	Singh et al.(1985b)
Half-walled shed covered by				
Wet khas tatti	-12.0		+44.1	Roy et al.(1962)
Cool drinking water	-22.7		+16.4	Radadia et al. (1980a)
Showers in loose house	-15.7		+16.4	Radadia et al. (1980a)
Showers+cool drinking water in loose house	-14.0		+24.2	Radadia et al. (1980a).

+ Increase (+) or decrease (-) over the first-mentioned housing type or control condition. S:Summer, R:Rainy, W:Winter. Other unspecified data are for hot season.

differences in types of animals, production levels, period effects etc. The per cent time spent on feeding activity was also better under loose house (Singh, 1982). The crude-fibre digestibility during hot dry period in growing buffalo heifers (Singh, 1982) was 54% in loose house compared to that (43%) in shed and in the open during night and in the shed during day (47%), though the corresponding figures (Singh et al.,1985b) for hot humid period were 54, 58 and 62%. Water consumption (requirement) for different categories of buffaloes under loose housing systems are given in Table 8.

Table 8: Water requirements for drinking for buffaloes under loose housing system of management(actual consumption data from several reports)

Type of animal	Season	Water intake during 24 hr.(Litres/animal)
Calf	Winter	11.8
	Summer	18.4
Heifer(above 2 years)	Winter	27.5
	Summer	55.3
Heifers (1-2 years)	Winter	18.3
	Summer	23.5
Lactating buffalo	Winter	59.0
	Summer	63.9
Dry buffalo	Winter	45.1
	Summer	55.5

Source: Sastry (1988).

Growth:

Young buffalo-calves of 3 to 4 months of age showed better growth response when individual pens were provided to them within a large shed with high roofs. The pens were provided with a dung and slaked lime bedding in the winter, but no special bedding in summer (Sastry, 1988). However, much of the work on growth response of buffalo-calves were made with older animals housed in groups. Significant differences were obtained in growth response measured (Tripathi et al.,1972) under loose house and when the open area in the loose house was covered by tarpaulins in the summer, with calves (6 months-1 year old) receiving two sprinklings of water at 10.00 and 14.00 hr for 5 min. Almost the same trend was obtained (Thomas et al.,1975) even when the plane of nutrition was revised by 10% above the requirement. The weekly weight gain they reported for animals under tarpaulin covered loose house was 3.22 kg as against 2.79 kg for simple loose house. Use of paved floors as against dird floors practised in villages for growing buffaloes was also studied during summer (Rohilla et al.,1988; Sastry et al., 1981) as well as winter (Grewal et al.,1982). Calves reared on brick-lined floors fared better (grew by 7% and 14% faster) than calves reared on dirt floors. The latter practice was also hygienic, especially during berseem feeding period, i.e. winter.

Reports comparing growth responses under shed, loose house and alternating between shed and open, in much older buffalo heifers are available (Karki et al.,1980; Singh, 1982; Singh et al.,1985b). These reports showed that relative growth rate as well as the daily weight gain were higher in the loose house during winter and summer. The growth efficiency was also studied in terms of dry matter, digestible crude protein and total digestible nutrient intakes per unit weight gain (Table 9), which also indicated that economic efficiency of growth was best under loose house (Singh, 1982).

Table 9: Growth and efficiency of feed utilization of growing buffaloes kept under different housing conditions (Singh, 1982)

Parameter	Type of housing	Seasons				Overall
		Hot dry	Hot humid	Mild cold	Severe cold	
Daily weight gain (kg)	S	0.452	0.459	0.429	0.327	0.417a
	S+O	0.446	0.524	0.464	0.355	0.452ab
	LH	0.617	0.483	0.438	0.535	0.518b
DM intake/kg gain (kg)	S	6.53	8.06	8.71	13.43	9.28
	S+O	6.32	7.06	8.10	11.97	8.36
	LH	5.66	8.04	8.60	8.35	7.66
DCP intake/kg gain(kg)	S	0.67	0.75	0.69	1.01	0.78
	S+O	0.70	0.62	0.67	0.97	0.74
	LH	0.58	0.70	0.75	0.67	0.68

Continued....

Parameter	Type of housing	Seasons				Overall
		Hot dry	Hot humid	Mild cold	Severe cold	
TDN intake/kg gain (kg)	S	4.30	5.40	4.61	8.11	5.62a
	S+O	3.65	4.70	4.45	7.06	4.97ab
	LH	3.26	4.04	4.67	5.12	4.21a
Cost/kg gain (Rs.)	S	-	-	-	-	9.21a
	S+O	-	-	-	-	8.77ab
	LH	-	-	-	-	6.90a

Note: S, inside shed; S+O or, inside shed during day in the open at night in summer and vice-versa in winter; LH, inside loose house; Overall average bearing same or no superscripts for each parameter do not differ significantly between types of housing.

Reproductive performance:

The least studied aspect of animal response to housing in buffaloes is their reproductive performance. This is unfortunate because of the well-recognized drop in reproductive efficiency during summer in these animals. Housing and managemental practices should have thus received attention on a priority basis, aimed at alleviating this production bottle-neck. Protection from solar radiation clearly improved the seminal attributes of buffalo-bulls as well as the incidence of oestrous activity in the buffalo-cows in the summer (Roy et al.,1962)

A marginal improvement was recorded in the seminal attributes of Murrah buffalo bulls housed in sheds that are kept cool by covering the asbestos roof with wet paddy straw and cutting off incidental solar radiation by covering all open spaces with paddy straw panels (Chalapathy and Rao,1981).

The reproductive performance of lactating buffaloes in a loose house system with thermal ameliorative measures like spray cooling or wallowing in summer was best when wallowing was allowed (Mehta et al.,1979). Increased frequency and intensity of heats were observed in pre-pubertal heifers that were kept on moving into sheds during day and out into the open at night in summer(and also provided with higher plane of nutrition) as compared to those that were in a shed throuthout (Bidarkar,1985).

Field experience, however, indicated that loose housing system may be congenial for better reproduction management of buffaloes. The data from herds at the Government Livestock Farm and Haryana Agricultural University, Hisar (Gupta et al.,1981), Punjab Agricultural University, Ludhiana (Mehar Singh and Chauhan,1980) and NDRI, Karnal (1982), showed that the loose house system reduced the magnitude of seasonal differences in conception rates in comparison to tethered-in-barn (with grazing allowed for some hours) system used at the former Progeny Testing Farm, Hisar (Sastry,1984). This could be the consequence of more

successful heat detection possible in the loose house due to easiness in bull parading and observations of cow behaviour (Kooner et al.,1969).

Symptoms of oestrus/heat:

The task of detecting buffaloes that are "in heat" (inclined to receive the male) is slightly difficult because buffaloes exhibit shorter and feebler symptoms or silent heat periods, particularly in summer. Lack of overt symptoms of heat is one of the major impediments to the wide spread use of AI service in buffaloe. A considerable skill in the recognition of signs of heat and combination of methods is necessary if loss of breeding time is to be avoided and a higher rate of fertility is to be achieved. There are marked variations in the intensity of heat signs among individuals.

Johri (1960) reported that the she buffaloe, when it comes to oestrum, shows restlessness, bellows off and on, may show a temporary decrease in milk yield and, in some cases, there may be swelling of teats due to filling up of the teat with the milk. The vagina is moist and a clear glary discharge comes out which progressively becomes thicker as the duration of heat increases. The she buffalo have also been seen to stand or hang-on to the buffalo bull. The symptom of jumping on other buffaloes (Homosexual activity) is not so common as it is seen in the case of cows. Some of the buffaloes do not bellow.

Frequent micturation denoting restlessness has been observed.

Al-Sheikh and El-Fouly(1971a) found that in the Egyptian buffaloe the percentage of ovulations associated with strong, intermediate and weak symptoms of heat was 58.06, 16.13 and 19.35 respectively and 6.45% of ovulations were silent.

Gill et al.(1973) observed following frequencies (%) of physical manifestations of heat in buffaloes:bellowing, free flowing cervical mucus, red vulval lips, mounting other buffaloes as 25.16, 16.98, 64.78 and 8.81% respectively of the cases. On rectal palpation of genital organs 85.53% were found to have turgid or coiled cornua.

Eusebio (1975) observed that the signs of heat in Philippinese Caribo buffaloes are barely noticeable. The most conspicuous signs were general restlessness, frequent passing of small quantities of urine and lack of appetite. In no case was an Indian buffalo observed to mount other females when in heat. The buffaloes also grunt when in heat in a characteristic way, that is peculiar to this species. Some Murrah buffaloes were observed to emit a pre-mounting grunt in the presence or absence of a bull. Some tended to be restless, presumably as active heat approached, while others stood quitely with heat held in the air, other buffaloes became attracted only when the bull came around and made sexual advance. Some females approaching the male and rubbing their body against his and

placing herself in a position to be covered.

Shafie et al.(1982) found that signs of heat were more intense in the cold than in the hot season. Jankiraman (1982) suggested that buffaloes should be bred at standing heat, a prime symptom of which is frequent urination. He further observed that during gestational heat seen between 50-75 days after insemination with or without interest of teaser but frequent urination is not seen. From this station, Devaraj and Jankiraman (1983), in a later report, stated that frequent urination was a constant sign of a buffalo in heat-both pubertal and post-partum.

Mohindersingh and Misra (1982) found that, in Murrah buffaloes, the homosexual mounting during heat was not seen which is quite common in cattle, but a thin copious and clear mucous discharge was noted in most of the cases.

Rao et al.(1982) too observed the following to be the prominent signs of oestrus in Murrah buffaloes in the Deccan Plateau region, viz. bellowing, switching of the tail, frequent micturation, oedema and congestion of the vulva, moist and glistening vulva with a stingy discharge of mucous, relaxation of cervical canal and tonicity of uterus. In Pakistan, Kazimi (1983) observed the changes in behaviour and in the external genetalia of 25 oestrus Nili-Ravi heifers and found that the signs

of behavioural oestrus varied among the females but the lips of the vulva were enlarged in all except one case.

Rao and Kodagli (1983) studied the oestrus signs in Surti buffaloes and heifers and noted as follows:

Signs	Buffaloes	Heifers
1. Hyperaemia of vaginal and vulval mucous membrane	87.81%	83.44%
2. Mucous discharge	83.66%	75.49%
3. Frequent urination	83.58%	51.72%
4. Bellowing	68.76%	50.99%

A decrease in milk yield occurred in 75.93% of buffalo cows. Sings of oestrus were marked in 56.17% of buffalo cows and 41.05% in heifers.

Thus all the well known symptoms of oestrus do occur in buffaloes. However, there seems to be considerable difference in the occurance or not of specific symptoms as well as intensity of symptoms between breeds, seasons, geo-climatic regions and between different feed-in and management regimen. From the evidence that is accumulating, there are reasons to believe that in India the seasonality in reproduction is more pronounced in buffaloes than in cows. It may be mentioned here that the climate alone might not have been responsible for all these variations and other factors like change in nutrition and husbandry practices might have contributed to these factors.

HEALTH, HYBIENE AND SANITATION PRACTICES:

Though no specific experiments were conducted, it was observed at the Haryana Agricultural University that very rare were the health problems concerned with keeping animals loose as group in loose houses (feet, teat and tail injuries, injuries from fights exposure etc.). The buffaloes, the new ones being added to the existing ones in a shed, may be restless only during the first day or two. Soon they fit in to the social order of the shed. However, over-crowding or inadequate manger space leads to harassment of docile buffaloes, which are generally high yielding buffaloes. Paved floors were found to be better than earthen floors (the village practice) for growing buffaloes from hygiene and worm problems point of view (Grewal et al., 1982; Rohilla et al.,1988; Sastry et al.,1981). In Italy, buffaloes housed on cement floors were found to be more prone to leg and feet injuries than those housed on earthen floors (de Francisis,1985). Paddocks and pasture that are sloped (for drainage) seems to be more detrimental to buffaloes in this respect than flat paddocks and pastures.

CHAPTER-III

MATERIALS AND METHODS

MATERIAL AND METHODS

In order to achieve the objectives of this study as laid down in chapter-I, a field survey was conducted during January to October, 1988. The desired information on buffalo housing and associated management practices being followed in rural Haryana as well as at Haryana Agricultural University livestock farm was collected by personal interview of the farmers and by visits to their farm to take visual observations and actual measurements on the various desired aspects.

The present study was undertaken in four villages- two in Karnal district namely Gogripur and Mehmoodpur and two in Hisar district namely Shahpur and Patan. To fulfill the third objective of the study relevant observations were recorded on Haryana Agricultural University livestock farm also.

The main consideration for the selection of these districts was that having almost similar density of buffalo population they represent different agro-climatic conditions (dry and wet) with different cropping pattern.

From each village about 50 households were selected from different socio-economic strata (landless, small, medium and big) by proportionate sampling. The socio-economic strata was decided on the basis of cultivable land holding as landless (having no cultivable land),

small (having land holding upto 2.5 acre), medium (having land holding between 2.51 to 7.5 acre) and big (having land holding above 7.5 acre).

The desired information were collected using a specially developed questionnaire and schedule keeping in view the ovjectives of investigation. The questionnaire was designed to elicit information on the following aspects.

a) Particulars of farmer and his farm.
b) Buffalo housing systems.
c) Associated management practices.
d) Health, hygiene and sanitation practices.
e) Comparison of existing rural housing systems with institutional farm housing.

Pre-testing of the specially developed questionnaire was done in a village. The pre-testing helped in altering the contents and sequence of the questions at certain places and finalising the procedure of filling the schedule. After modifications in the light of the pre-testing the final interview schedule was prepared (Appendix - II) which helped in obtaining more concise information.

Information was collected from each sample household by interviewing the head of family and taking visual observations and actual measurements. Also, information on the awareness of the farmers towards the ideal practices and reasons for implementing the existing practices were also cited. The mode in which information

was recorded on the various items is described below.

1. Farmers/farm particulars: Farmers were interviewed regarding their age, occupations, education, family members, total land holding per cent irrigated land, source of irrigation, total area under fodder crops in different seasons and herd strength, etc.

2. Buffalo housing systems: Interview, visual observations and actual measurements were taken on the following aspects.

I. Type of house: Open, under tree, lean to, sheltered paddock, closed house and combination of above practices.

II. Location of shed: Inside dwelling, near dwelling, separate from dwelling, in fields, no shed etc.

III. Location of paddock: Inside dwelling, near dwelling, separate from dwelling, in fields, no shed etc.

IV. Sharing of shed by livestock: Buffalo alone, buffalo+man, buffalo+cattle, buffalo+cattle+man.

V. Dimensions of shed and paddock: Length, width, total area, area per adult unit. It was measured with the help of a measuring tape.

VI. Roof: Following observations were recorded:

a) Material of roof: concrete, thatch, mud, stone slab, wood, Asbestos and combination of above any two.

b) Features of roof: Flat, single slope, double slope, other type.

c) Slope of roof: Vertical fall per meter cross length was recorded using a meter rod and a foot-scale.

d) Extension of eaves was measured using a metre rod.

e) Height of roof at ridge, eaves and flat height of roof from ground was measured using a measuring tape.

VII. Walls: Following observations were recorded:

a) Existence of wall in shed and paddock

b) Material of walls: cemented, mud, bricks, bricks+cement, and bricks+mud.

c) Height of wall from ground

d) Thickness of wall.

e) Per cent shed perimeter covered.

VIII. Floor:

a) Type of floor: Dirt (Katcha), paved, bricks, brick+mud, brick+cement.

b) Existence of drainage.

c) Evenness of floor: Good, so-so and bad.

d) Slope of floor: Vertical fall per meter cross length was measured by using a metre rod placed on spirit level at three locations along the shed widty and the average taken.

IX. Manger:

a) Provision of manger in shed and paddock

b) Length per adult unit (total length/adult unit).

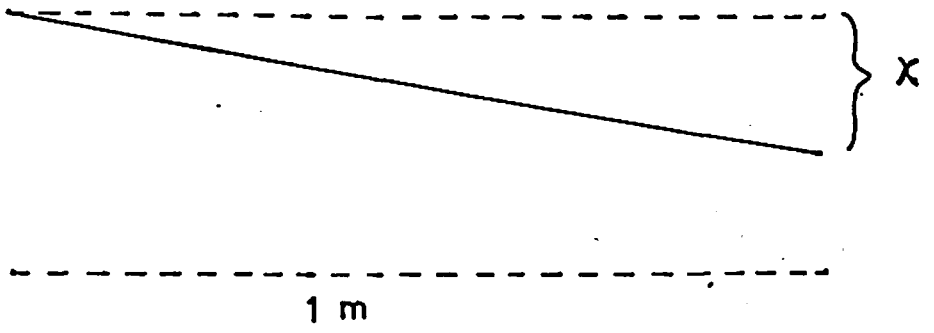

Fig. 1: Slope of floor/roof, expressed as the vertical fall(x) in cm per metre cross length.

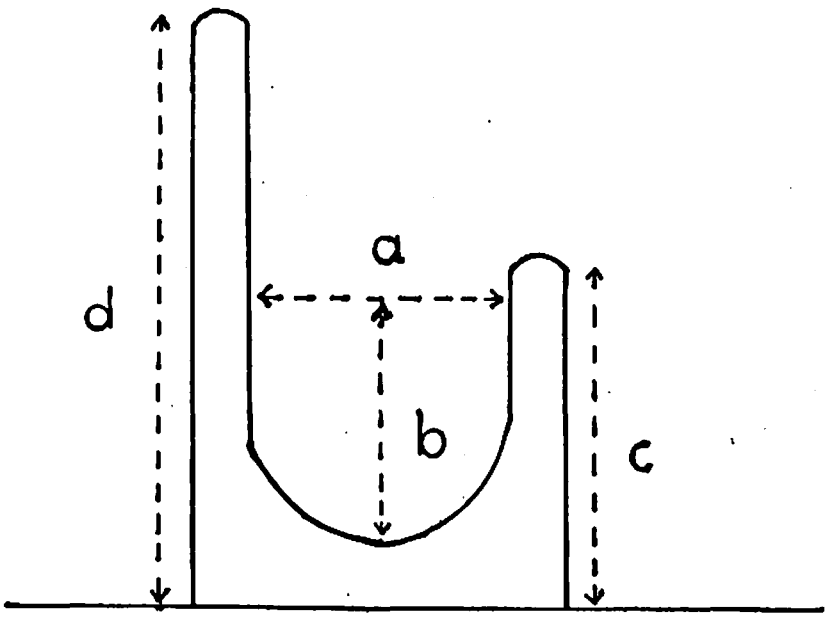

Fig. 2. Dimensions of manger : a) width; b) depth; c) height of inner wall; d) height of outer wall.

c) Height of inner wall measurement.
d) Height of outer wall measurement.
e) Depth of manger.
f) Width of manger.

X. Watering practice.
a) Mode of water supply: Use of water trough, buckets, taking animals to water source and combination of above any two or more.
b) Source of water: Canal, tubewells, pumping set, wells, Johar, water works, etc.
c) Material of water troughs: Pucca, metal, old drums.
d) Design of water trough: Long, round, triangular, rectangular, other.
e) Length of water trough per adult unit.
f) Quantum of water supplied per day per adult unit by verification.
g) Treatment of water: Settling, cooling, no treatment etc.,
h) Frequency of providing drinking water in summer and winter.

XI. Ventilation in buffalo houses:
a) Whether provided or not.
b) Number of windows.
c) Total area of window.
d) Window area per adult unit (total window area/adult units).
e) Height of window from ground.

XII. Alterations made to the structure (floor, wall and roof). of buffalo houses and protection provided to animals in summer and winter.

a) Bedding, curtain, others for animal houses.

b) Jacket/Jhules etc., for animals.

3. Associated management practices:

I. Seasons specific movement of buffaloes.(Summer, winter and rainy).

a) During day time: open, under tree, under shed + human dwelling, closed house.

b) During night: Open, under tree, under shed+ human dwelling, closed house.

c) Provision of bedding in different seasons viz. summer, winter and rainy.

d) Material used: Sand, waste fodder, bhoosa, earth etc.

II. Gromming of buffaloes: Never, with hand, with straw, with gunny bags and others.

III. Frequency of wallowing in summer, winter and rainy season.

IV. Duration of wallowing.

V. Washing of buffaloes daily in different seaons.

VI. Milking management.

a) Place of milking: Same place as housed, at separate clean place or other places.

b) Pre-milking cleanings: washing whole animal, only hind quarter, only udder and teats, milkers hand, milking vessels.

c) Method of milking: Dry-full hand, dry hand-stripping, wet handfull hand, wet hand-stripping, thumb in, thumb out, stripping at the end, udder cleaning at the end.

d) Calf suckling: Before milking, after milking and both times.

e) Amount of milk left for young calves.

f) When colostrum feeding allowed.

g) How milkers tackle the problematic animals at milking time: Beats animals, provides extra concentrate, tries phooka, waits and tries after some time, uses oxytocin, waits for next time.

XII. Reproduction management:

a) Most common symptom of heat: Doka, bellowing, milk production goes down, off feed, frequent urination, vaginal discharge, mounting others and use of teaser bull.

b) Most common season of service.

c) How buffaloes are served: Stray bull, improved bull, A.I., others.

d) Owners of the bull: Panchayat, self, other farmers.

e) Why A.I. preferred: Cheap, improved bull, nearby and easy, friends or relatives insist, advised by specialist and progeny fetch good price.

f) Why A.I. not preferred: A.I. is not good, I don't know A.I., low conception, repeat many times, needs time and afforts, A.I. not available in village, A.I. staff not good, natural service is more convenient and bull is available in village.

4. Health, hygiene and sanitation practices:

I. Shed hygiene and sanitation practices.

a) Cleaning of shed per day.

b) Method of cleaning: Dry sweeping, washing.

c) Disposal pattern of dung : Solid, liquid and other waste separately, solid liquid together, solid, liquid and waste together.

d) Most common use of dung: Manure, fuel, other use.

e) Use of disinfectants for shed.

f) Protection against insect: None, provide screen, make smoke, spraying insecticides, others.

g) Frequency of spraying insecticide.

To build rapport with the selected respondents the researcher paid visits in all the villages even before conducting interviews. The researcher's professional experience greatly facilitated in rapport building. The researcher is well conversant with the farming community and local Haryanvi dialect which facilitated in collection of reliable data for the study.

Before administering the schedule, the objectives of the study were explicitly explained to the farmers. The questions in the schedule were presented to them in their own dialect ensuring that they perceived the questions correctly so as to avoid any interpretational variation of the questions by the respondents. The answers obtained were recorded and only one respondent was interviewed at a time.

During the interview, care was taken to keep alive the interest of the respondent by giving technical information to him on scientific animal husbandry. It took almost 2 to 4 hours to administer a schedule to each respondent depending upon the efficiency of the respondent to reply the questions posed to him.

The data so collected were first tabulated on a master table form from which appropriate tables were formulated keeping in view the specific objectives of the study. The quantitative data were appropriately analysed to draw meaningful inferences.

The study being of an exploratory nature, it was found desirable to collect the data fairly exhaustively. Then only the data directly pertaining to buffalo housing and associated management practices were chosen out of it and analysed. Frequencies were obtained for each

message and percentages were calculated to draw inferences. At some parameters where variation were apparently low, chi-square tests were applied to determine the association between different variables. The findings of the study are presented in detail in the following chapter.

CHAPTER-IV

RESULTS

RESULTS

The results of this investigation, conducted to elucidate the housing and associated management practices being followed by different categories of farmers in the state of Haryana and to make a comparative appraisal of buffalo housing and associated management practices in rural areas with those on an organised farm, are reported and discussed in this chapter. The compiled information are presented in the Appendix-I in the form of Table 10 to 26 given at the end of the thesis.

The data were collected by personal interviews of the farmers using a specially developed questionnaire from two different agro-climatic zones of the state of Haryana namely wet zone and dry zone. The two districts selected for this study were Karnal and Hisar. Karnal is situated in the wet zone and Hisar in the dry zone. The results have been presented here under the following broad categories:

1. Particulars of farmer and his farm.
2. Buffalo housing systems
3. Associated management practices.
4. Health,hygiene and sanitation practices.
5. Comparison of existing rural housing systems with institutional farm housing systems.

PARTICULARS OF FARMER AND HIS FARM

To know about the socio-economic conditions of the buffalo keepers, their age, educational status, main and subsidiary occupations and number of family members were recorded.

Age:

The data regarding age of the buffalo keepers are presented in Table 10a. From the data it was observed that a large percentage of farmers were above twenty years of age (99% and 97%) in both Karnal and Hisar districts. Out of those about 35% were above 40 years of age. Those who were in the age group of 30-40 years comprised of 35% and 26% and the remaining farmers were in the younger age groups of 20-30 years (36 and 29%) in the villages of Karnal and Hisar districts respectively. In Karnal district it was found that majority of the big farmers (75%) belonged to the younger generation (20-30 years) whereas in Hisar district 86.6% farmers were of older age (above 40 years). Thus, it seems that most of the buffalo keeping householders of the study area are in the age group of beyond 30 years, nearly half of them being above 40 years.

Educational status:

The distribution of farmers engaged in buffalo keeping according to their educational status is shown in Table 10b. In Karnal district, majority of the farmers

were literate (65%) but the rate of literacy amongs buffalo keepers in Hisar district was quite low (36%). There were only 19% with primary education, 19% middle school pass, 23% matriculates, about 3% were graduates and 1% were post graduates in Karnal district. The corresponding figures for Hisar district were primary 13%, middle 14%, matriculation 7% and graduate 2%.

No post-graduate farmer was found to be engaged in buffalo keeping in Hisar district. Karnal district was more prosperous than Hisar district interms of agriculture and industry as well as better communication facilities and also better irrigation potential, which might have attributed to the higher literacy rate among buffalo keepers.

Main and subsidiary occupations:

The data pertaining to main and subsidiary occupations of sample households of both the districts are presented in Table 10c. A perusal of the data revealed that, on an average, 50% of households were mainly dependent on crop farming in Karnal district. In Hisar district it was slightly less (43%). Amongst the landless labourers, 44.4% were casual labour in Karnal district whereas the corresponding figure for the Hisar district was 85.5%. For the householders the primary occupation was crop farming for 46.5%, casual labour for 24%

(almost all of whom were landless), service for 15.5% and dairying with buffaloes for only 8.5%. Whereas for most of the householders (87.5%) dairying with buffaloes was the most common secondary occupation in either district.

Distribution of family members:

The distribution of the family members of the sample households shows (Table 10d) that 5-10 members were the most common family size (66%) out of which almost half of the members being children in most of the holding (49.7%). The trend was more or less same in both the districts.

Land holding of the sample households:

The distribution of the landed households according to the size of their operational holdings is shown in the Table 11a. Majority of the farmers (30%) in Karnal district and 19% in Hisar district were medium farmers having land holdings between 2.6 to 5.0 acres. Farmers having land holding between 5.1 to 10.0 acres were 13% in Karnal district, whereas the corresponding figures for Hisar district was 17%. Only 7.0% farmer had land holding more than 10.0 acres in Karnal district and 10% in Hisar district, while buffalo keepers having no land for cultivation were 27% and 41% in Karnal and Hisar districts, respectively.

Per cent land irrigated:

In Karnal district all the land was irrigated on the holdings of all the categories of farmers while in Hisar district only 76.2% of land holdings was having irrigation facilities upto 80% of the area. The remaining 23.8% land was having irrigation facilities to the extent of less than 80% (Table 11b).

Mode of irrigation:

Tubewell were the most common source of water for irrigation (95.9%) for almost all the categories of farmers in Karnal district, that from canal was a meagre 2.7%. In Hisar district the canal water was found to be the most common source of water in only 54.2% of holdings. The remaining 27.1% of farmers were using combination of two sources i.e., canal+tubewell for irrigation purposes (Table 11c).

Area under fodder crops:

It was observed that 13% of the medium farmers of Hisar district did not use at all their land for fodder production in either season i.e., Rabi or Kharif (Table 11d). This was so because of scanty irrigation facilities and bigger family size and resulting pressure for exclusive land use for grain production. It was further observed that (35.6%) sample households in Karnal district were using 10-20% of their land for fodder production in Rabi

season while 55.9% were using less than 5% of their land for fodder production in Hisar district. For fodder production during Kharif season, 75.3% of farmers were using more than 20% of their land in Karnal district while in Hisar district only 5-10% of the land was being used by 39% of farmers for fodder production during Kharif. It is clear from the data that farmers of Karnal district are more progressive in terms of proper feeding of their livestock than farmers of Hisar district; and they seem to be aware of the value of green fodder in buffalo feeding practices.

Herd strength:

The profile of livestock kept by the various categories of farmers are presented in Table 12. Most of the holdings (89.6-100%) were having one to two animals in each category i.e., milk buffaloes, heifers, calves, and bullocks. The same was the case for cattle population also (96.4-100%). Both in Karnal and Hisar districts, all the landless as well as small farmers were keeping 1-2 milch buffaloes, despite the fact they have no or little land.

The medium farmers of Karnal district (96%) were having one to two buffaloes and the rest 4% were having three to five milch buffaloes. But in case of Hisar district all categories of farmers were keeping only one to two milch buffaloes.

As many as 88.7% of various categories of farmers in Karnal district and 97.1% in Hisar district were having one to two heifers. Those having 3-5 heifers were only 8.1 and 2.9% respectively in Karnal and Hisar district, while those having more than 5 heifers were 3.2 and 0.0% respectively.

The number of farmers who were having 1-2 calves were 84.3% and 94.5% in Karnal and Hisar districts respectively. This was significantly higher as compared to the corresponding figures for 3-5 calves which were 15.7 and 5.5% respectively. So far as cattle population of both the districts are concerned, 97.2% of the farmers, were maintaining 1-2 milch cows, and rests were having 3-5 milch cows. All the farmers of both the districts were having 1-2 cattle heifers and 1-2 calves.

Amongst landed farmers of Karnal district all were having 1-2 bullocks while in case of Hisar district 3.6% were maintaining 3-5 bullocks and rests 1-2 bullocks.

BUFFALO HOUSING SYSTEMS

Type of housing:

The data collected from the various categories of respondents regarding housing of buffaloes are presented in Table 13. It was found that only 4.3% small farmers of Karnal district did not have any house to provide shelter for their animals and they were keeping them in the open.

Fig. 3. Housing buffaloes under trees.

Fig. 4. A 'lean to' to the wall of the dwelling with dirt floor.

None of the buffalo owners were keeping their animals solely under tree, lean to and sheltered paddock alone throughout the year. Except 2.6% medium farmers, none was keeping their animals solely in closed houses alone throught-out the year.

Almost all the farmers (99%) did not keep their buffaloes generally at a single place throughout the year or even for a whole day and night. The type of houses provided by the various categories of farmers were mainly dependent on the economic status of the farmers. They kept their buffaloes, in combination, at different places. It was found that majority of the farmers (78%) in both the districts were keeping their buffaloes, in combination, in the open, under tree and in closed house from time to time depending on the prevailing climatic conditions. On an average 12% farmers were keeping their buffaloes, in combination in the open, under tree and in a sheltered paddock, 7% in combination, in the open, under tree, in sheltered paddock and in closed house, only 2% in combination, in the open, in sheltered paddock and in a closed house. There is a common belief amongst the farmers that animals should be provided with closed house atleast during winter night. This may be the reason for keeping animals in a combination of open, under tree and closed house.

Fig. 5. An improvised lean-to shelter with brick-lined floor.

Fig. 6. A well made, brick-floored, tree shaded paddock adjoining the dwelling.

Location of shed:

The location of the shed wherever the farmers are providing for keeping buffaloes is presented in Table 13b. Perusal of the data reveals that 31% farmers of Karnal district were keeping animals right inside their dwelling and exactly the same percentage near their dwellings. But 36% keep buffaloes at a place separate from their dwelling in Karnal district. On the contrary, in Hisar district, 56% keep their buffaloes right inside their dwelling, 29% near their dwelling and only 14% separately from their dwelling.

On the whole in 43.5% holdings, the animals were kept inside the human dwelling, in 30% holdings, very close to the human dwelling and in 25% holdings separate from dwelling.

But among landless farmers of Karnal (66.7%) were keeping buffaloes inside dwellings, 14.8% near dwellings and 18.5% separate from dwellings. The corresponding figures for Hisar district were 70.7, 24.4 and 4.9% for inside dwelling, near dwelling and separate from dwelling, respectively. This may be due to the greater economic backwardness of landless farmers of Hisar district than that of the Karnal district. Keeping animals inside human dwelling or near the dwelling is not desirable from health point of view, which may lead to Zoonotic and

Fig. 7. The buffalo kept within the human dwelling.

Fig. 8. Cattle and buffaloes housed together.

cantagious diseases and serious health hazards to human. It is not beneficial for the either.

Location of paddock:

Only 24% farmers keeping buffaloes, did not provide paddock for their animals in Karnal district (Table 13c). Out of those who were providing paddock, in 36% holdings they were situated near dwelling and in 40% cases paddocks were separate from dwellings. In Hisar district, the picture was somewhat different, where majority (96%) of farmers provided paddocks, which were situated near dwellings (57%) or separate from dwellings (37%).

Sharing of shade by livestock:

Keeping buffaloes and cattle together was found to be the most common practice in both the districts (Table 13d). It was observed that in 36.5% cases in both the districts farmers were keeping buffaloes and cattle together, whereas in 31% cases buffaloes were kept alone.

People of this part of the country have high affinity for their buffaloes. Thus, as high as 26% farmers of the sample households were themselves sharing the same shed along with their buffaloes. It is quite surprising that it was just now the landless farmers who did not have separate house for their animals due to

obvious economic crunch, but even 8.3% big farmers of Karnal district and 16.7% big farmers of Hisar district were sharing the same shed with their buffaloes.

Shed area per adult unit:

Majority of the farmers (51%) of the sample households were providing more than 4 m^2 shed area per adult unit and about 35% between 3-4 m^2 area per adult unit (Table 13e). In Karnal district only 9% farmers are providing 2 m^2 shed area per adult unit, whereas in Hisar district it was found in only 5% cases. This might be due to more pressure on land in Karnal district for intensive agriculture.

Paddock area/open area per adult unit:

Paddock or open area provided per adult unit varied greatly among the holdings (Table 13f). On an average in 45% cases it is more than 4 m^2 per adult unit and in 47% cases it varied from 2-4 m^2.

Particulars of roof:

Material of roof: In both the districts surveyed, farmers were using different materials for roofing that included thatch, concrete, stone slabs, mud with bricks, wood and thatch.

In 65% of the holdings the roof was made of thatch and mud and 15.5% cases of thatch alone in Hisar district.

Fig. 9. A well made shelter with adjoining paddock in which the buffaloes are kept tethered individually- such houses are very rare.

Fig.10. Small-capacity manger and unhygienic floor- a common feature of buffalo house.

Whereas in Karnal district, it was 36% and 13.5%, respectively (Table 14a). Brick and mud roof came next. In Karnal district it was 35.9 and 17.2% respectively. Only in 5.4% of the sample households the farmers were using wood and mud as roofing material for buffalo sheds.

Type of roof: Two types of roof-flat and single sloped, were being adopted by different categories of farmers in the sample housedholds. Majority of the farmers (91.4%) were using flat roof, as these districts fall in low rain fall area followed by single sloped (6.5%), none used double sloped roof (Table 14b).

Slope of roof: Slope of roof has been expressed as in its height per meter length. Data on this feature is presented in Table 14c. The single sloped rooves in 40% cases were having less than 10 cm fall per meter length and in about 40% sample households were having more than 16 cm fall per meter length in Karnal district. Whereas the corresponding figures for Hisar district were 71.4% and 28.6% respectively. It may be due to more rain fall in Karnal district as compared to Hisar district that more farmer in the Karnal district were keeping more slope.

Extension of eaves: There was practically no extension of eaves beyond the walls in both the districts (90.9%) in buffalo houses (Table 14d).

Thickness of roof: Thickness of roof is very important item in animal houses from thermal insulation point of view. In 74.2% cases the thickness of roof varied between 11-20 cm, less than 10 cm in 12.9% cases and 21-30 cm in 11.8% sample houses. Only in 1.1% cases of both the districts thickness of roof was found to be more than 30 cm (Table 14e).

Height of flat roof from ground: Height of flat roof from ground was found 2.6-3.0 m in 40.9% houses, 2.1-2.5 m in 28.5% houses and more than 3 m in 22% cases (Table 14f). Two to three meter height of roof from ground is the ISI recommended optimum for a buffalo house. The practices prevalent in these two districts as regards height of roof, thus were good.

Particulars of walls:

Materials of wall: The walls of animal houses were of brick, mud, brick plastered with mud, brick plastered with cement etc. In Karnal district, 57% buffalo keepers used brick and 5.6% mud as construction material for buffalo houses. Whereas in Hisar district, the corresponding figures were 29.9 and 51.5% respectively. Brick lined with cement was used by 32.6% respondents in Karnal district but significantly less number of respondents (10.3%) used this material in Hisar district (Table 15a).

Height of wall: The height of walls varied between 2-3 meters in majority of the cases (Table 15b) wherever walls were provided for sheds.

Thickness of walls: Thickness of the wall was found to be more than 30 cm in 69.4% cases in both the districts and between 21-30 cm in 29% cases (Table 15c).

Sides of shed covered: About 70% of sheds were covered on all four sides, 19.3% on three sides, 9.2% on two sides and 1.6% on one side only (Table 15d). Sheds covered from two sides which are said to be most ideal from ventilation point of view were not followed by majority of the respondent, which might be due to security reasons. Security is an important need in villages.

Per cent shed perimeter covered: The wall covered on an average more than 75% of the sheds perimeter in 61.8% of holdings in Karnal district and 87.6% in Hisar district (Table 15e). This again indicates that the trend was to enclose the shed by walls as far as possible, which might not be ideal under warm conditions. The little extent (less than 25%) shed perimeter not covered was generally the width of the entrance.

Particulars of floor:

Type of floor: Type of floor is very important from animal as well as human health point of view and for clean milk production. Majority of the farmers in both

the districts (78.5%) have provided Kutcha/mud floors in their animal houses followed by brick's floor (in 17.2% cases). As regards the type of floor in Karnal district, 58.4% farmers have provided dirt (mud/Katcha) floor but in Hisar district as high as 96.9% farmers have provided dirt floor, i.e. unpaved. This significant difference between the districts was found among all categories of holdings (Table 16a). Brick floor is considered better than dirt floor. Because 32.6% farmers of Karnal district provided brick floor as compared to Hisar district in which only 3.1% have the same floor. Brick lined with cement is considered the best floor for animal houses. Very few farmers (6.8%), that too only in Karnal district have provided a floor of brick lines with cement. It is very clear from the data in Table 16 as regarding the type of floor used in animal houses, that households of Karnal district were significantly more modern than those of Hisar district.

Existence of drainage channel:

In majority of the animal houses (90.5%) there were no provision of drainage channel in both the district (Table 16b). In Karnal district 15% farmers provided drainage but the corresponding figure of Hisar district was only 4%. This significant difference might be due to poor knowledge ignorance or even due to lack of necessity in the drier Hisar region.

Evenness of floor: By taking visual observations of animal houses it was found that the surface of floor in 22% houses in Karnal district had good evenness, 20% so-so evenness and in majority of houses (58%) the evenness was bad and the surface had bumps and pits. The corresponding figures for Hisar district were 12.23 and 65% respectively (Table 16c).

Slope of floor: Slope of floor in animal houses is also important from drainage point of view and thus must be considered at the time of construction of floor, so that urine etc. flows out smoothly and the animal gets good surface to lie on. But farmers of both the districts were found to be ignorant about it (Table 16d). Majority of the houses (86%) in both the districts irrespective of the land holding category, were found to provide no slope to the floors. A few number of houses (7.5%) provided slope in houses @ 1.2 cm vertical fall per meter cross length which is satisfactory. In some of the houses (6.4%) the floor had a slope of more than 2 cm vertical fall per meter cross length, which is also considered good.

Particulars of mangers:

Provision of manger in shed and paddock: Generally no manger was provided by farmers of sample households (67.5%) inside the shed, significantly higher number in Hisar district (81.8%) than in Karnal district (54%) did so. This variation exists among all the categories of farmers (Table 17a). As far as provision of manger in paddock/open lot is concerned, in 89.1% of the holdings manger was provided, where most of the feeding was done. Most of the sheds were used only for tying the animals during winter at night there, hence provision of manger was very rare in sheds.

Manger length per adult unit: Manger length was measured in the animal houses in both the districts and presented in Table 17b. These indicated that in 90.7% sheds and in 93.3% paddocks/open lots, adequate manger length (more than 56 cm per adult unit)was provided by all categories of farmers. This matched the ISI specification also. It can be concluded that farmers are well aware about the proper manger length for their livestock.

Height of inner wall of the manger: Information on height of inner wall of the manger, measured in animal houses in both the districts is presented in Table 17c. It was observed that, there was a considerable variation in the height of inner walls of the manger among different

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categories of farmers in both the districts.

Among the buffalo owners providing mangers in shed 15.4% were found to have inner wall of mangers very low (less than 25 cm). In 13.5% cases inner wall of manger in paddock was also found to be less than 25 cm. Such low inner manger wall is liable to lead spillover of fodder from the manger at the time of actual feeding. Rest of the farmers, who provided mangers either in shed or in paddock were found provide 25 to 35 cm high inner walls to the mangers. As it is evident from the Table 17a, 46% of Karnal district farmers have provided manger inside the shed as compared to only 19% in Hisar district.

Height of outer wall of manger: Height of the outer wall of a manger situated in paddock (in the open area) is very important, as it is from this side the feed/ fodder is dropped into the manger. Also it can protect feeds from other stray animals and most importantly it prevent animals throw out feed while eating from the manger. Therefore, outer wall in a manger should be about 1.25 m high which is ideal. Height of outer wall in the mangers situated either in shed or paddock were measured in the sample households and the information is presented in Table 17d. In majority of the mangers (73.8%) found in sheds the outer wall was more than 125 cm but in 66.3% mangers, which were found in paddock the outer wall was less than 75 cm. This is due to the fact that

Fig. 11. Dirt floor with uneven surface, no drainage and dirty. Mangers made of mud.

Fig. 12. Open paddock alongwith manger and watering source also showing condition of the floor.

farmers were using the manger from both the sides for feeding their animals in the same manger.

Depth of manger: Measurement of depth of manger provided in shed and paddocks by different categories of farmers in both the districts are presented in Table 17e. Perusal of data showed that depth provided in the manger in shed and paddock by all most all the categories in sample households were inadequate i.e. 20-30 cm. Less than 20 cm depth in a manger is ideal for the calves but not for the adult animals as per ISI standards. But majority of the sample households provided less than 30 cm depth. The ideal depth of manger is considered 40 cm for adults, which was provided by only 2.5% of the farmers in both the district. Further, it was the landless and small farmers who provided the smallest depth in mangers.

Width of manger: Majority of the farmers (67.7% in sheds and 59.3% in paddock) provided smaller width of manger (30-50 cm) which was not adequate for adult animals (Table 17f). The desirable width for a manger either in shed or paddock was more than 50 cm and this was recorded among 32.2 and 40.5% respondents in sheds and paddocks respectively.

Watering facilities:

Facilities for clean drinking water is as important as feeding. In rural areas, most of the animals suffer

from endoparasites, especially roundworms due to dirty and cantaminated drinking water. Considering the importance of drinking water various aspects related to the watering facilities for buffaloes were studied in Karnal and Hisar districts and the data pertaining to this are presented in Table 18.

Mode of providing water: Provision of separate drinking water though was found to be rare in both the districts(Table 18a). It was observed that largest number of farmers i.e. 46% and 56% in Karnal and Hisar districts respectively, preferred to provide drinking water in buckets. Remaining farmers either took their animals directly to water source or used both the means as it would be evident from the Table 18a. Significantly higher percentage of farmers of Hisar district (41%) took their animals to water source than respondents of Karnal district (11%).

Source of water: The most common source of water used by the sample households, in decending order, were pumping set (57%), canal (37%) and tubewell (4%) in Karnal district. Whereas in Hisar district the most common source of water was water works (55%) followed by water ditches (Johar 40%) and pumping set (2%). In Karnal district water ditches (Johar) was used only by 2% respondents for drinking water purposes (Table 18b).

As far as the source of drinking water is concerned water ditches (Johar) are known to supply most dirty unwholesome and contaminated water, which creates digestive disorders and other diseases in the animals. Ground water table of Hisar district is low and supply of water through water works is limited. That is why significantly higher percentage of the farmers used Johar as source of drinking water in Hisar district whereas the situation was not so bad in Karnal district.

Water troughs: Only 3.5% of the farmers were found to be having water through for their animals. All the water troughs were cemented, long (42.9%) and rectangular (42.9%) in shape (Table 18c and 18d). Length of water trough provided per animal was only 21-30 cm in 66.7% cases followed by less than 20 cm in 33.3% cases, which was inadequate (Table 18e).

Quantum of water/buffalo/day: Farmers were asked about the quantum of water needed every day per buffalo. Generally the farmers would tell how many buckets as measures of water were provided. From this the quantum of water in litres was estimated. The data is presented in Table 18f. In Karnal district 45% respondents provided about 31-40 litres water per day per buffalo, whereas in Hisar district the same amount of water

provision was confirmed by only 22% farmers. It is evident from the data regarding overall situation for water provision that among those providing water in vessels as many as 36.5% respondents provide 31-40 litres water followed by 26.5% who provide more than 50 litres, 26% who provide 41-50 litres and 6% provide less than 30 litres water per day per buffalo. However, 13% farmers were ignorant about the quantum of water needs of a buffalo i.e. they could not tell how much water they were providing.

Treatment of water: Farmers of both the district from all the categories did not treat the water (settling, cooling etc.) in any way before use (Table 18g).

Frequency of providing drinking water per day: Frequency of providing drinking water is almost similar among the different categories and district for the sample households (Table 18h). During summer, 77% farmers of Karnal district and 73% respondents of Hisar district were found providing drinking water 2-3 times per day. However, 24.5% farmers offered water more than 3 times a day.

Ventilation in houses:

For better productivity micro-climate inside sheds must be optimum and to maintain the desired micro-climate proper ventilation is needed, via which sufficient fresh

air will come inside to remove detrimental levels of water vapour, ammonia, carbon dioxide, dust, air-borne micro-organisms etc.

It is evident from the information provided in Table 21a that almost all the respondents of sample households keep their animal inside closed house during winter night. Animals confined in a close environment increase the carbon dioxide and moisture content of the house and add ruminant gases, ammonia from faeces and urine and microscopical particles of dust from feed also accumulate. Therefore, looking in to the importance of ventilation, visual observations of animal houses were taken in both the districts and the results are presented in Table 19.

Whether ventilation provided: No special provision was made for ventilation in buffalo houses in 91% sample households in Hisar district and 65% holdings in Karnal district which means buffalo houses were poorly ventilated (Table 19a). However, ventilation was found in the buffalo houses in 35% holding in Karnal district which was significantly higher than that in Hisar district (9%). This may be because of poor knowledge regarding importance of ventilation; farmers appear to have a wrong notion that cold draught could be more harmful than a suffocated ill ventilated dwelling.

Number of windows in buffalo houses: As it is evident from the Table 19b, out of the 21% ventilated buffalo houses, 12.5% houses had one window, 5.5% 2 windows and rest had provided more than 3 windows in buffalo houses. The number of windows in animal houses provided by all the categories of farmers of Karnal district were found to be significantly higher over that in Hisar district.

Window area per adult unit: In majority of cases (63.6%) in both the districts and categories of farmers, the windows area provided per adult unit was less than 0.25 m^2 (Table 19d). The ideal window area (more than 0.70 m^2 per adult unit) were provided by only 15.9% farmers in both the districts.

Height of window from floor: None of the houses in both the districts were found having cross ventilation. However, height of windows was at desirable level i.e. about 1 meter high from the ground in 95.5% holders (Table 19e) which allows flow of air near at the level of the animals.

Seasonal alterations to shed structures: The climatic conditions of Haryana are extreme-intense cold in winter and burning heat in summer season. Therefore, to overcome the vagaries of nature, it is desirable that some need-based season-specific alterations should be made in animal houses also so as to buffer the climatic extremes.

Farmers were asked about the alterations made to the floors, walls and roof of the animal houses during extreme hot and cold seasons. In summer no changes were made to the shed structure by any category of farmers in both the districts (Table 20). Whereas in winter, all most all the farmers were providing bedding, especially to the calves. The bedding material used by the respondents was generally the previous day's waste fodder straw. Curtains of gunny bags were used to cover the empty spaces in the walls by 52.5% farmers in the sample households in winter season. No alterations were made to the roof by any categories of farmers in either district. Also 31% respondents of Karnal district and 88% in Hisar district were found to cover the animals with jackets/jhules during winter mostly high yielders, young and sick animals.

Season-specific diurnal movement of buffaloes: As discussed earlier, the climatic condition of Haryana are extreme. Therefore, farmers were compelled to protect their animals from vagaries of adverse climatic condition. Hence they move their animals from place to place depending upon the season.

It was found (Table 21) that at night majority of the respondents (83.5%) in both the districts kept their animals in open during summer and rainy season. Whereas

in winter season almost all the respondents (98.5%) kept their buffaloes inside closed shed or inside their own dwelling (Table 21a).

Perusal of the Table 21b indicates that 83 and 72.5% respondents of all categories of sample households kept their animals during day time in winter and rainy season respectively in the open paddock, while in summer 48.5% farmers kept their animals in the open and 42.5% farmers under tree irrespective of their category. This situation existed in both the districts.

Negligible number of farmers kept their buffaloes indoors during day time in all seasons. Such farmers generally the medium and big farmers of Karnal and Hisar districts who have generally more spacious animal houses.

Hygiene and sanitation practices:

For maintenance the animal health, prevention of various diseases and clean milk production it is important to maintain the proper hygienic conditions on the farm. Considering these facts, respondents of sample hoseholds were asked about the hygiene and sanitation practices followed by them in Karnal and Hisar districts and the results derived from the study are presented in Table 22.

Sheds cleaning: Most of the farmers (87%) irrespective of categories of district were found to clean the animal sheds 1-2 times in a day (Table 22a) while the remaining

12.5% farmers claimed to clean the animal houses 3-4 times in a day.

Invariably, dry sweeping was found to be the most common method of cleaning the animal shed irrespective of categories of districts (Table 22b), while washing was practiced by a few farmers-that too in Karnal district. Irrespective of the categories of districts, in all cases the manure collected from the animal houses by the respondent of sample households, included dry dung, urine as well as other feed waste (Table 22c).

The most prevalent use of dung was as fuel in 86.5% cases followed by 13.5% as manure+fuel in both the districts (Table 22d). The perusal of the table reveals that all the landless farmers used dung for fuel purpose only in both the district. However, the big farmers used it both as fuel and manure in almost equal proportions.

Pest control : To maintain the hygienic condition in the animal farm regular use of disinfectant is considered desirable. But in present study, 95% of the farmers, irrespective of categories or districts were found to use no disinfectants whatsoever for cleaning sheds. Only 6% respondents of Karnal district and 4% farmers of Hisar district used phenyl occasionally for cleaning the sheds (Table 22e).

Responses of respondents regarding protection measures against insects etc. indicated that making smoke in the animal shed was the most common measure (43.5%) followed by spraying insecticides (10%) once or twice in a year(19%) by Malaria Eradication Scheme workers (Table 22f and 22g). Significantly higher proportion (75%) of respondents of Hisar district were using protection measure i.e. smoke against insect, than farmers of Karnal district (12%).

Farmers of Hisar district were compelled to use more smoke because of higher infestation of insects, mosquitoes etc. due to unhygienic condition prevalent in animal sheds.

Frequency of spraying insecticides in Hisar district was significantly higher (14%) as compared to Karnal district (6%). Once or twice in a year was found to be most common frequency of use of insecticides in both the districts (Table 22g).

ASSOCIATED MANAGEMENT PRACTICES

Provision of bedding to young animals: The bedding was used for animals by most of the farmers during winter. The bedding considered of different materials like dry sand, dry dung, waste fodder, wheat straw, dry earch etc. (Table 23a). Almost all the farmers (98.5%) provided bedding for young calves, high milkers and sick animals

inside the shed during winter especially at night. Waste fodder was found to be the most common bedding material (62.6%) followed by wheat straw (22.3%) and dry sand (8.2%).

Grooming:

From the perusal of Table 23b it is clear that significantly higher number of respondents (82%) groom their buffaloes in the Hisar district, while only 60% followed this practice in Karnal district. Higher percentage of farmers who groomed their animals in Hisar district could be due to greater exposure to the technical know-how. Many farmers are ignorant about the advantages of grooming. It was noted that majority of the respondents (77%) were using bare hands for grooming of their animals in Hisar district and only 21% were using this techniques in Karnal district (Table 23b). Straw and gunny-bags were also used by 26% and 12% farmers in Karnal district, while the corresponding figures were 2 and 2% respectively for Hisar district.

Wallowing: Though, wallowing is a much prevalent practice in rural areas, interestingly 28% farmers in Karnal district and 16% farmers in Hisar district never allowed their buffaloes wallowing (Table 23c). Significant difference was observed with regard to this wallowing practice in the Karnal and Hisar districts. It is evident from the data given in this table that 44%

respondents of Hisar district took their buffalo for wallowing once daily and 40% twice daily during summer whereas in Karnal district 22% respondents take their buffaloes for wallowing once daily and 50% twice daily during summer. Interestingly as high as 45% respondents take the buffaloes for wallowing once daily and 39% twice daily even during winter and rainy months in Hisar district. The corresponding figures for Karnal district were found 34 and 38% once daily and twice daily respectively. This difference could be due to the fact that Hisar being drier and hotter than Karnal, resulting in greater necessity for more frequent wallowing in the former district.

It was also observed that comparatively higher number of respondents (29% and 25%) of Hisar district allowed their animals wallowing for more than three hours daily, whereas only 27 and 12% farmers of Karnal district did so during dry summer and hot humid season (Table 23d). The data further indicated that during summer higher number of respondents (28%) allowed their buffaloes wallowing for more than three hours daily, whereas 20%, 23.5% and 7% of the farmers allowed wallowing for 2-3 hr, 1-2 hr and ½-1 hr respectively. In rainy season 27% did so far 1-2 hours, 19% for 2-3 hours, 18.5% for more than three hours and only 11% for ½-1 hour, respectively. No major variation was observed

between categories and districts in respect of time allowed for wallowing daily by respondents of sample households.

Washing: Apart from wallowing, the respondents were also asked how many times they wased their buffaloes during summer and winter months. It can be seen from Table 23e that, irrespective of categories or districts, majority of the respondents (63.5%) claimed to have washed their buffaloes more than once daily during summer. Another 29% respondents did not wash their buffaloes at all. In winter seasons 64% respondents did not bother to wash their animals, while 23% followed this practice only once in a week, that too with warm water. But 7.5% respondents were found to be well aware of the need for cleanliness and claimed to wash their animals once daily.

Milking management: Considering the importance of milking management, the different categories of respondents in the two districts were interviewed on the various aspects of milking followed by them. The information on these aspects is presented in Table 24.

Majority of the farmers (96%) used to milk their buffaloes wherever they were kept, but 4% respondents were using separate clean place for milking. No significant difference was observed between the categories and district (Table 24a) in this respect.

During the course of investigation it was observed that 95.5% respondents did not wash the whole body of the buffaloes prior to milking. None of the respondents were found to be aware of the need for washing hind quarters before milking for clean milk production (Table 24b). Majority of the farmers (96.5%) washed udder and teats before milking, however, all the respondents (whoever milks) of the sample households washed their own hands (milkers' hands) and milking vessels before milking. This high proportion of respondents following the above ideal practice reflect their awareness of the importance of these practices in quality milk production.

It was observed that, none of the respondents was using the recommended dry-hand full-hand method of milking in either of the districts. All the farmers were using wet-hand full-hand method of milking. Wet-hand milking is not desirable as it is liable to cause cracks on teat skin and it must be avoided. Putting thumb against the teats at the time of milking, which is a wrong method of milking from the teat health point of view, was found to be more prevalent in Hisar district (92%) as compared to Karnal district (60%). It was further observed that almost all respondents did neither striping nor the udder was cleaned at the end of milking (Table 24c).

The calves were allowed suckling both before and after milking. Before milking calves were allowed to suckle for let down of milking and after milking, to meet their milk requirements, especially during young age (Table 24d).

Views of the farmers were also obtained regarding milk left for young calves. The information based on such questionings is presented in Table 24e. The amount of milk feeding was enquired only up to three months of age of the calves. Majority of the respondents (51%) claimed that they allowed one full quarter upto three months of age to both male and female calves in both the districts. Significantly higher number of respondents of Karnal district (61%) were found to be following this practice than those of Hisar district (41%). However, 24% respondents reported that two full quarters were offered to the calves upto three months of age, while only half of a quarter of milk was left for calves by 19.5% respondents. Some of the landless farmers of Karnal district reported that they provided very small quantity of milk, equivalent to almost one fourth of a quarter only for let down of milk during the first month of life.

Some of the farmers frankly admitted the lesser availability of milk to the male calves. The reason

for this was given as poor economic value of male calves.

Respondents were also asked about the colostrum feeding practices. The Table 24f shows that 79% farmers fed colostrum (allow suckling) only after the fall of placenta, which is not desirable. Suckling of colostrum was followed by 9% within 1-2 hours, by 5.5% within 2-4 hours and by only 3.5% within 1 hour after fall of placenta. Farmers of Hisar district were found to be more knowledgeable about colostrum feeding practices than those of Karnal district.

Only 2 and 5% respondents fed colostrum within one hour after birth in Karnal and Hisar districts respectively, which happens to be the most desirable interval. Significantly higher percentage of farmers (88%) in Karnal district fed colostrum only after fall of placenta, while this figure for Hisar district was only 70%. Remaining 12% and 30% farmers fed colostrum before fall of placenta in the same two districts respectively.

Farmers were also asked regarding the mode of tackling of buffaloes that suddenly jumped and held up the milk. This is rather a common problem. The findings revealed that majority of the respondents (58% in Karnal and 73% in Hisar districts) tackled such type of buffaloes by providing additional concentrate. Another 28% respondents of Karnal district stated that under such a

situation, they wait for some time and tried again to take out the milk from udder while the corresponding figure for Hisar district was only 2% (Table 24g). Use of oxytocin, to facilitate let down in such type of problematic animals was resorted to by 7% and 19% farmers in Karnal and Hisar district respectively. Beating of animals for let down was also being practiced by 6% farmers in both the district.

Reproduction management: Considering the importance of reproduction management in the overall management package of buffaloes, several aspects of it were also studied (Table 25).

Common symptoms of heat: It is an acknowledged fact that if heat detection is done properly in buffaloes then efficiency of reproduction in terms of conception rate is likely to be high.

Respondents opinion was sought on the most common symptom of heat in buffaloes and the results are presented in Table 25a. The data given in this table reveals that for 90% of the respondents of Karnal district the most common symptom of heat was bellowing followed by DOKA*

* DOKA is a phenomenon in which the teats of the buffalo remain engorged as in let-down, about 6 to 8 days before the actual onset of heat.

(5%), off feed (2%) and vaginal discharge (2%). Only 1% were using teaser bull for heat detection in Karnal district. The corresponding figures for Hisar district were bellowing (78%) followed by DOKA (14%), vaginal discharge (6%) off feed (1%) and mounting others (1%). In Karnal district 3.7% landless farmers were found using teaser bull for heat detection. In fact they were using their draft buffalo bull for the said purpose.

The respondents were also enquired about what they considered the next most common symptom of heat in both the districts. Interestingly 45% were using DOKA as the second most important symptom of heat, followed by vaginal discharge (17%), drop in milk production (13%), frequent urination (7%), mounting others (6%), bellowing (6%) and 2% were using teaser bull in Karnal district where as in Hisar district the second most common symptom of heat reported by the respondents was different, as 41% found viginal discharge, 38% DOKA 7% mounting on others, 7% bellowing, 6% drop in milk production and 1% each frequent urination and off-feed.

Respondents opinion was also sought on the most common season of service and the result is presented in Table 25b. It was revealed that 75.5% farmers in both the districts bred their buffaloes in winter and rest in rainy season.

The answers of the farmers about breeding of their buffaloes was recorded and the information obtained are presented in Table 25c. As many as 47% farmers in Karnal district used improved bull for serving their buffaloes naturally, whereas the corresponding figure for Hisar district was a slightly lower i.e. 43%. Strangely, majority (51%) of the respondents in Hisar district allowed stray bulls to breed their buffaloes while the corresponding figure for Karnal district was 32%. A significantly higher percentage of buffalo keepers (12%) resorted to artificial insemination in Karnal district whereas only 6% farmers followed this breeding technique in Hisar district.

Out of 9% respondents in Karnal district who were using draft bull for breeding purposes, 7.4% were landless but none were found using draft bulls for breeding purposes in Hisar district.

The improved bull used in both the district belonged either to Panchayat (49.2%) or to other farmers (39.9%). As high as 77.3% farmers in Karnal district used bulls belonging to other farmers of the same village, whereas 93.7% farmers in Hisar district used bulls belonging to the village Panchayat (Table 25d). Farmers of Karnal district had significantly more awareness of the importance of breeding bull. No doubt,

landless and a few small farmers were using their draft bulls for the breeding purposes, but majority of the big (45.5%) and medium (32.4%) land holders were maintaining bulls specifically for breeding their buffaloes. It is interesting to note that such farmers were charging approximately Rs.20/- per service from other farmers. It shows that respondents of Karnal district were more aware of the importance of bull for breeding purposes.

It was further attempted to find out the reasons for prefering or not prefering artificial insemination as the case may be. During the course of interview majority of the respondents prefering A.I. in both the district (75.8%) gave reasons for the preference of artificial insemination, because the progeny born out of artificial insemination fetched good price in the market and they produced comparatively more milk (Table 25f). Other respondents (15.1%) reported that the semen used for artificial insemination was of improved bull. It was interesting to know that 16.6% landless buffalo owners of Karnal district preferred artificial insemination for their buffaloes because this facility was available very near at a cheapter rate.

Reasons for not adopting the A.I. practice for their buffaloes were also recorded in sample households of both the districts and figures obtained are presented in Table 25g. The common reasons given by the farmers of Karnal district for not prefering A.I. listed in descending order is as follows:

A.I. is not good (27.4%), low conception from A.I. (24.7%), A.I. is not available in villages (20.5%), ignorant of A.I. (9.6%), natural service is more convenient (8.2%), bull is available in village (5.5%) and 4.2% felt that A.I. staff do not take interest, it needs time and wages to take their animals at A.I. centre and animal repeats many times when A.I. is done. The corresponding figures in Hisar district was low conception due to A.I. (37.2%), good bull is available in village (23.4%), A.I. is not good (20.2%), ignorant of A.I. (7.5%), A.I. facilities are not available in village (7.4%), A.I. staff is not good (3.2%) and 1.1% said that it needs time and wages to take their animals at A.I. centre.

COMPARISON OF EXISTING RURAL HOUSING SYSTEMS WITH INSTITUTIONAL FARM HOUSING SYSTEMS:

A comparative appraisal of housing and housing associated management practices being followed in both the districts with that on H.A.U. farm, is presented in Table 26. The data given in this table indicated

that none in the villages practiced loose housing system as such but majority of the farmers (78%) kept buffaloes partly in the shed and partly in the open or under tree or under sheltered paddock, which was akin to loose housing somewhat. Farmers always kept their buffaloes thethered but at H.A.U. farm buffaloes are always loose except at milking time.

In villages buffaloes are housed along with other animals (36.5%), whereas at H.A.U., buffaloes are kept alone. The H.A.U. practice in this respect was followed by 31% farmers.

Space provided per adult unit by farmers was found to be comparable with that on H.A.U. farm. The shed floor in villages was invariably of dirt (78.5%) with no slope (86%) and no drainage (90.5%). Whereas at H.A.U. farm the floor was made of brick lines with cement, with a good slope (0.55 cm per meter) and with suitable drainage channels.

Roof in villages was generally flat (91.4%) of mud (47.8%), 11-20 cm thick (74.2%) and 1.9-2.4 cm high from ground (77.8%), while at H.A.U. it was 2.5 m high, single sloped and made of asbestos sheets of 1.5 cm thickness. Walls in villages were full (up to roof level) and made of bricks (43%), while they were half (1.5 m tall) and made of bricks, and cement on H.A.U. Farm.

There was scope for improvement of manger and water trough design in villages specially increasing depth. Most of the mangers were made of bricks lined with mud (55%) while at H.A.U. it was cemented. Water troughs were absent in most of the holdings (90%), animals being watered either directly at pools or with buckets.

No separate calf or milking shed was provided in villages but at H.A.U. these were provided separately. No washing facility in the shed were available in villages but at H.A.U. there were such facilities. In villages animal movement with season was a common practice (100%) but not so at H.A.U. farm and the animals were loose. Majority of the farmers (87%) cleaned animal sheds twice daily and dung was used for both as fuel and manure (100%), but at H.A.U. sheds were cleaned daily once and dung is used only for manure purposes.

Majority of the farmers in villages (95%) were not using any disinfectant and 90% were also not using any insecticides to control flies, mosquitoes etc. But at H.A.U. farm disinfectants and insecticides etc. were regularly used.

CHAPTER-V

DISCUSSION

DISCUSSION

PARTICULARS OF FARMER AND HIS FARM

It has been revealed by several studies that particulars like the farmer's age, family size, educational background, socio-economic status, land holding etc. influence not only the size and scale of his dairy unit but also the level of his husbandry and productivity of the stock (Halyal,1968; Kakoty,1975; Tyagi, 1975; Singh, 1976; Awanti, 1981; Srivastava and Promila, 1983; Malik and Sohal,1984; Malik and Patel, 1987; Bhoite et al.,1987).

The herd size and the main occupation of farmers are said to influence his responsiveness to the adoption of improved management practices (Dhumal, 1974; Tyagi, 1975; Singh, 1976; Awanti, 1981; Srivastava and Promila, 1983; Malik and Sohal, 1984 and Bhoite, 1987). The size and characteristics of the sample households investigated in the present study follow the general trend to that in the country as a whole (NCA 1976), in that the landless, small and medium farmers constitute the bulk (about 80%) of the households.

The farmers in the present study area were generally beyond 30 years of age, are illiterate or poorly educated, had crop farming as the main occupation with buffalo keeping as the most common subsidiary occupation, especially for the landless and small farmers.

More than 80% of land was irrigated (more so in Hisar district) by canal and tubewell and most of the farmers kept about 10% of their land under fodders during Rabi season while about a quarter of the farmers did so during Kharif also. This trend of land area under fodder production was generally higher than that found in other states of the country excluding Punjab (NCA 1976). All the farmers, irrespective of size of land holding, possessed 1-2 milch buffaloes, 1-2 heifers, 1-2 calves and a pair of bullocks. Most of the landless and small farmers had no bullocks in Hisar district. The reports of the previous research workers regarding the herd size and composition across categorie was divergent. It was reported that in Punjab and Haryana regions, all householders keep buffaloes while the landless may not be able to keep buffaloes in Eastern and Southern states (Tyagi, 1975; Malik and Sohal,1984; Malik and Patel, 1987; Mahanta et al.,1988). In Haryana the buffaloes are of superior quality and are maintained for milk production for domestic consumption as well as for trading. Hence, buffalo keeping was popular for all categories of householders (Sastry et al.,1988).

TYPES AND MODES OF BUFFALO HOUSING

The system of housing followed by buffalo keepers in Karnal and Hisar districts can not be strictly classified as open, closed, semi closed or loose housing systems. They keep buffaloes at different places in the open, under trees, under lean-to shelter or even in a shed but not at a static location all the time. They keep on moving the buffaloes from place to place as per the seasons and also between day and night (Tikku, 1981; Srivastava and Promila, 1983). In the present instance, the majority farmers (78%) used the open space, the tree shed and the closed shed in combinations. Such a dynamic shelter concept is in consonance with the highly variable seasonal and diurnal climatic profile which prompts the livestock owners of this region to provide the suitable micro-environment to their animals at different parts of the day or season. In most cases the place of keeping buffaloes at night was inside the human dwelling (44%) or it is adjacent to the human dwelling (30%). This could be due to safety considerations because even when an open paddock is used it is mostly located in close proximity to the dwelling (47%).

Though, buffaloes were found to be housed alongwith other animals in 30% holdings, they were generally kept alongwith cattle (37%) and the owner shared a common

dwelling with his buffaloes in 26% cases. This finding is in agreement with the reports of Bagga (1967), Gera (1967) and Tikku (1981). Most of the farmers provided around 4 m^2 of covered area and a little more than that of paddock area per one adult unit of buffaloes, which was also observed by Raut (1982) earlier.

Though, the covered area provided per adult unit was adequate as per standards (ISI 1968a; ISI 1968b; ISI 1970a; Kooner et al.,1969; Sastry and Georgie,1988). The paddock area provided however, seemed to be below the prescribed standard by around 50%. This aspect of inadequate open area should be viewed from the overall housing system practiced by the farmers. The paddocks provided by the farmers in the present study area were actually used as temporary places for tethering animals unlike the open area of loose house system where the animals are free to move about. Besides, for parts of the day the farmers also took their animals out for grazing/watering/wallowing. Hence, the paddock provided by the farmers in their livestock housing cqmplex cannot be strictly compared with that of the open area of loose house system.

There is no comparable information for the field as regards the space provided by the farmers to their buffaloes. However, Raut (1982) has reported that in

Dhulia district of Maharastra, farmers did provide a shed space of 4.37 m^2 per milch buffaloes. Also Varma and Tripathi (1980) reported that for buffalo heifers a loafing space of 1.86 m^2 is adequate.

A more detailed discussion regarding movement of buffaloes by farmers from one place to another during different seasons will be given in a latter section.

Particulars of roof:

Half of the sample households across all land holding categories used hatch and mud as roofing material especially in Hisar district. The roof construction comprised of thatch, spread over wooden poles placed one to two feet apart as support and a three to four inches mud covering over the thatch material. This type of roof was preferred more in Hisar district because it is more dry and hot; it is incidentally the cheapest roof material, 75% landless farmers of Hisar district and 68% landless farmers of Karnal district used this type of roof. Other common roofing materials used were brick and mud (17.2%) and thatch alone (15%). While bricks + mud was used by better off farmers, more so in Karnal district, thatch alone was used by a quarter of landless farmers in either district, mostly for economic reasons.

The roof were mostly of flat type, more so in Hisar district, wherever sloped roof was provided (8.5%) a slope of more than 10 cm fall per metre length was provided. Generally, there were no eaves extending beyond the walls and roof is 10-20 cm thick. The height of flat roof varied from 2-3 m or more which was more or less as per recommendaded level (ISI,1970; Sastry and Georgie, 1988), whereas the sloped roofs had much lower height both at ridge and at the eaves, which is not desirable from ventilation and thermal comfort point of view.

Practically no published reports are available regarding the details of roof of animal houses under farmers' household conditions. Though Bagga(1967) reported that the roof of animal houses in Hisar district was generally "Katcha", implying thereby that they are made up of mud and/or thatch. Though the mud+ thatch roof provide good thermal insulation, yet it may not be desirable for the possible harbouring insects and pests.

Particulars of walls :

Walls not only provide support to the roof but also protection to animals from sun, rain and winds. Walls also provide security to animals, which is important

under Indian conditions. However, in hot regions the walls may hinder adequate ventilation and cause unfavourable micro-climate in animal houses during summer days (Razdan, 1965; Thomas, 1969; Sastry and Georgie,1985).

But unfortunately, almost all the farmers provided floor to roof level walls in the buffalo sheds in the study area. Even for paddocks full height walls (2-3 m) were provided by 49% householders in Karnal district and 36% house holders in Hisar district. This could have adversely affected the micro-climate in animal sheds atleast during those months when ventilation needs are much crucial. The walls are generally made of bricks in Karnal district and mud in Hisar district. Whereas 80% of landless farmers used mud in Hisar district, the same proportion of farmers in Karnal district used bricks with cement for walls, which may be due to the fact that the rain fall is more in Karnal district. The walls are generally more than 30 cm thick and they cover all the sides of shed i.e. 75% of shed perimeter with small space for entrance. Ragga (1967) has reported that mud is the most common material used for walls of animal houses in Hisar district.

In organised farms with loose housing system, the walls are normally 1 to 1.5 m high, thus, allowing free flow of air inside the shed. This is beneficial under tropical situation but the farmers in the study area

apparently disregarded this point of optimum comfort to the housed animals, constructing barn type shed with full walls perhaps due to the overriding consideration of security of his livestock assets.

Particulars of floors:

Across the different categories of land holdings the majority farmers (79%) kept their buffaloes on dirt floors. Upto 33% farmers of Karnal district had brick floors while such cases were only 17% in Hisar district. None provided drainage channels, especially in Hisar district, nor the floors had evenness slope for effective drainage. All these obviously contributed to unhygienic conditions in the shed especially where the floors were made of dirt (Sastry et al.,1981; Grewal et al.,1982; Rohilla et al.,1988). Earlier workers (Daniel,1969; Mikkileni, 1976) have also indicated that dirt floors are the most common in village livestock houses.

Particulars of manger:

Mangers are of crucial importance in animal houses as the effectiveness of feeding depends largely on its appropriateness to the animals housed in the sheds. In the study area, irrespective of categories majority farmers (80-90%) provided mangers in the open or paddock. However, 19% farmers in Hisar district and 46% in Karnal district also provided mangers in the sheds to facilitate feeding of animals when they are tethered inside.

Since the animals are left mostly in the open at night and cooler parts of the day, the open area manger is more commonly found. Most of the farmers provide more than 70 cm of manger length per adult unit which is adequate as per recommended standar (ISI,1969; Kooner et al.,1969; Varma and Tripathi, 1980; Sastry and Georgie,1988). When the overall dimension of the mangers were considered, it emerged that the capacity of manger was far short of the desired level. Not only the depth and width of the manger were found to be less than 30 cm and 50 cm respectively, in most of the cases, the inner and outer walls were also much too short, i.e. less than 55 cm and less than 75 cm, which might result in spillage of fodder at the time of feeding unless the mangers are refilled with roughage in piece meal.

In fact the manger dimension provided by majority of farmers appeared suitable for young stock but not as such for adult stock. It may be inferred that the manger normally provided by farmers are inadequate for adult animals. Educating the farmers for optimum sized manger will improve the overall feeding management efficiency at the farmer's level.

No critical study appears to have been made on the merits and demerits of variable manger dimensions even under farm conditions, leave alone under field conditions.

Compared to the ISI specifications and other recommendations the mangers used by different categories of farmers were found to be inadequate. Incidentally the dimensions of the mangers provided by landless labourers were by far, the smallest which might have been due to their economic conditions.

Watering facilities:

The most common means of providing drinking water was with buckets alone or with buckets as well as by taking animals to water source. Only about 4% farmers provided some kind of concrete water trough. The most common source of drinking water for buffaloes was pumping set followed by canal in Karnal district and water works followed by water ponds (Johar) in Hisar district. Other sources included pumping set and tubewells. The cemented water troughs were elongated in shape and provided 21-30 cm trough length per animal. Nearly 63% farmers claimed to provide 31-50 litres of water per buffalo per day while the remaining 27% provided more than 50 litres. On an average these values were in general on the lower side compared to the earlier reports for buffalo especially for lactating animals during summer months (Misra et al.,1963; Radadia et al.,1980a; Radadia et al.,1980b; Sastry et al.,1980b; Singh, 1982; Singh et al.,1985a; Singh et al.,1985b).

The main reason for lower intake of water by the buffalo as indicated by the farmers could partly be due to restricted availability of water in or near the dwelling where the buffaloes are kept most of the time of day and night because of limited hours of water supply from water works. Besides, for major part of year the buffaloes are taken for grazing/loafing/wallowing, when they get water from canal/johar/pumping set etc. The amount of water consumed by the buffaloes outdoor is not properly quantified by the farmers. Besides, water is provided for drinking only 2-3 times per day and not continuously as it is recommended. In view of the above it is advisable for the buffalo owners to have some water stored at home 15-20 litres per animal so that buffaloes can be given as additional drink in the late evening during summer. This coupled with the water given during day time will fulfill the needs of the lactating buffaloes.

Provision of ventilation:

Majority of the farmers (91% in Hisar district and 65% in Karnal district) did not provide any special ventilation in the buffalo shed. Such inadequate ventilation has been stressed by earlier workers also (Bagga, 1967). Even those (18%) who provided some ventilation did so mostly by providing 1 or 2 windows, with less than

1 m^2 area in 55% cases and $\angle 2$ m^2 window area in another 30% cases, this worked out to less than 0.25 m^2 of window area per adult unit (63.5%), which was grossly inadequate. The situation seemed to be equally bad in both the districts. However, notwithstanding the small size of the window, it was provided at a height of 1 m from the ground, which atleast allows flow of breeze at the animal body surface level.

On the whole the ventilation provided in the buffalo shed cannot be considered adquate, though the animals were kept in the sheds for a relatively shorter period during the 24 hour cycle both in summer and winter. Ideally the animals should be housed in well ventilated shed/shelter so long as they remain indoor. Otherwise there will be built up of harmful gases (ammonia, carbon-dioxide and water vapour etc.). Unfortunately there are no controlled resports/data on ventilation optima in animal houses under semi-arid tropical conditions for critical comparison with the present findings on buffalo house ventilation.

Season-specific house modifications:

Haryana falls in the semi-arid tract of north-west India where there is wide variation in ambient temperature between summer and winter and even between

day and night. So as to protect the animals from extremes of such weather conditions it is necessary to take certain corrective measures to ameliorate the micro-environment in sheds to facilitate the thermolytic or thermogenic behaviour of the aminals by way of scientific logic (Tikku, 1981). Such measures are the more important for the growing and the milch in the present study as attempt was made to find out how the buffalo keepers of Haryana help to create a congenial environment for their buffaloes in the shed to maximize performance.

It was observed that none of the farmers made any alterations to the floors, spaces in the wall or roof during summer whereas several workers (Roy et al., 1963; Misra et al., 1963; Misra and Sengupta, 1965; Tripathi et al., 1975; Chalapathy and Roy, 1981; Gill and Rurki, 1981; Srivastava and Promila ,1983) have furnished evidence that provision of additional coverage to the roof, its wetting, provision of curtains in the wall spaces and their wetting during hot summer do create comfortable conditions for the buffalo housed in them as reflected in their improved performance under conditions of modified summer micro-environment. The farmers were obviously ignorant of such beneficial measures. However, they did try to improve the thermolytic efficiency of their buffaloes by allowing wallowing twice daily in 45% cases and once

daily in 33% cases and washing buffaloes more than once in 64% cases (Daniel, 1969). The wallowing time varied between 1-3 hours per day during summer, However there were 22% farmer did not allow wallowing at all to their buffaloes even during summer. This practice was followed more or less in the same pattern by all the categories of farmers more so in Hisar district. The overall beneficial effect of different managemental means to keep the animals cool during hot summer months has already been well-documented in a recent review (Sastry and Georgie, 1988).

Majority of the farmers provided bedding, especially to calves during winter. Besides, 53% farmers across all categories hang curtains made of jute in the empty spaces on walls. In addition, as many as 88% farmers in Hisar district and 81% farmers in Karnal district did cover their animals with jackets/Jules made of gunny bags during winter (Verma,1967; Daniel,1969; Srivastava and Promila, 1983). Provisions of bedding to young calves during winter is a standard management practice. But how far such insulating winter protective measures are beneficial to adult buffaloes is not known. However, there are reports indicating that winters in Haryana are not severe enough to affect production of buffaloes adversely and thus do not warrant any special protection measures during winter

(Thomas et al.,1978). Obviously the farmers seems to be more concerned about adverse effect of cold, rather than that of heat stress on production performance of their buffaloes. Evidence emanating from scientific studies, however, do not corroborate the farmers' apprehension of alleged cold stress. The responses of the buffalo owners further indicated that majority of the farmers kept their buffaloes in the open or under tree during night in summer and rainy seasons whereas they keep the buffaloes either in their own dwellings or in a closed house at night during winter. But during day majority of the farmers were keeping their buffaloes in the open or under the tree irrespective of the season; keeping in the open sun being practiced more (83%) in winter. It is logical to keep the buffaloes in the open sun during day in winter but similar practice during summer may not be desirable if the results of the studies of Singh et al.(1985a); Singh et al.(1985b) is an indication. Patil (1976) reported that in rural areas of Bangalore, majority of the farmers provided good shelter to their animals but 4% farmers kept their animals in open air.

HYGIENE AND SANITATION PRACTICES

The farmers were found to be cleaning the buffalo shed generally once or twice a day by dry sweeping and lifting solid, liquid and other waste together. Mostly such wastes are used as fuel only. None used any disinfectant for sheds (Daniel, 1969). About 12% in Karnal district and 75% in Hisar district, irrespective of the category, made smoke in buffalo houses as a measure of controlling insects. Only in about 10% cases spraying of insecticides was done by the visiting personnel of Malaria Eradication Programme. Hisar being drier the menances of flying insects might be warranting, smoking by more farmers. The frequency of use of bedding, wallowing, washing in different seasons was already discussed in the previous section. Waste fodder and straw from the previous day was most commonly beeding material used by farmers for calves during winter. The buffaloes were groomed by about half of the farmers (more in Hisar district) using bare hands or straw.

Another interesting observation was that 40% and 39% farmers respectively allowed wallowing of their buffaloes even during winter and rainy season. About 29% farmers in summer and 64% in winter did not wash their buffaloes even once in a day which is not desirable from hygiene point of view. Previously

Bagga (1967), Verma (1967), Daniel (1969) and Dhiman (1988) too reported that sand, previous day's waste fodder and straws were the common bedding materials used by farmers during winter for calves and pregnant animals.

Milking management:

The quality of milk produced and to some extent the quantity is dependent on the place, environment where it is done. If the milking is carried out at the same place where animals are maintained it is likely that the quality of milk will be lower because of dust, dung, filth and bad odours existing there. But unfortunately this was what exactly almost all the farmers normally did. Besides, the practice of washing the animals before milking was also followed. The only cleaning operation practiced by all the farmers were washing of milking vessels, washing of milker's hands and washing of udder and teats before milking. They did neither stripping at the end nor cleaned the udder at the end of milking. All these practices are likely to result not only in production of poorer quality milk but cracks on teats also (Sandhu, 1987; Sastry et al., 1988). Another undesirable practice was allowing the calf to suckle at the end of milking, which is one of the contributing factors to udder injury (Sandhu, 1987).

Thus, there is considerable scope for improving the milking management followed by farmers. As regards tackling buffaloes that had let down problem, the farmers appeared to follow desirable methods like providing additional concentrate (67%) giving time for tempramental adjustment, trying after some times (15%) and use of oxytocim (13%). Since weaning is not practised in buffaloes it is desirable to know how much milk the farmers ordinarly spare for the calf and to see whether the amount is as per recommended level (Arora, 1987). In general, above half of the farmers left one full quarter for suckling by the young calves and about 24% farmers left even 2 full quarter. Leaving quarter for the calves without consideration for the level of production of buffaloes is not very rational because this might result in over feeding of calves of high yielding dams and under feeding of calves of low yielding dams. Both of which are undesirable from the calf health point of view (Varma et al., 1987; Sastry and Varma, 1988). It was seen that yield of one quarter can be as high as 4-5 litres (Sastry et al.,1988). When such a quarter is left for a new born calf weighing about 30 kg, the milk may exceed the 1/10th body weight level (Arora, 1987) by 35-40%. Dubey and Kumar (1981) have also reported that majority farmers left two teats and 35% one teat for the calves to suckle.

Regarding colostrum feeding the desired practice (Arora, 1987; Sastry and Varma, 1988) of allowing suckling within one hour after birth was followed by only 5% farmers. Majority of farmers (80%) allowed suckling of colostrum by calves only after the expulsion of placenta. If the expulsion of placenta is delayed due to one or other reason, the calf may not get the desired level of immunoglobulines at the crucial phase of its neo-natal life making it more vulnerable to various calf-hood diseases (Khirwar, 1981; Arora,1987). Bagga (1967), Rath (1977), Roy (1980) and Awanti (1981) have also stressed that the crucial need of feeding colostrum soon after birth is not taken to seriously by the farmers. Perhaps this could be the reason for high level of calf mortality seen among buffalo calves (Sastry and Varma, 1988).

REPRODUCTION MANAGEMENT

Buffalo is generally considered as a problem breeders and efficiency of its breeding is to a great extent dependent on successful detection of heat and servicing. The place and mode of housing are likely to influence heat detection (Kooner et al., 1969). Hence, aspect of heat detection and service were also studied.

It was observed that all the category of farmers in both the districts (84%) used "bellowing" as the main symptom of heat. This symptom can be readily recognised by the farmers both by sound and sight wherever the buffaloes are kept. However, "Doka", a phenomenon when teats become turgid as in let down and which occurs 5-8 days before onset of oestrus, was identical as main symptom of heat by 10% farmers and as next common symptom by 42% farmers. Vaginal discharge, drop in milk mouning others and frequent urination were regarded as secondary symptoms by 29%, 10%, 7% and 4% of the farmers respectively. Thus, the farmers mostly relied on bellowing and Doka for heat detection. Some of the previous workers have also considered bellowing as the main symptoms of heat in buffaloes (Johri, 1960; Gill et al., 1973; Roy et al.,1982 and Sandhu, 1987). There are, however, others (Sheokand, 1980; Sandhu, 1987) who have indicated the importance of Doka for heat detection in buffaloes.

Across various land holding categories and districts the farmers observed that the winter (75%) and rainy (25%) were the main seasons for maximum service. As high as 42% farmers used stray bull for breeding,45% farmers used improved bulls for breeding that either belonged to village Panchayat (49%) or to other farmers (40%). Only 22% farmers in Karnal

district especially big farmers had own breeding bull. Only 9% farmers bred their animals through A.I. out of which the landless were the maximum user. Thus A.I. is not generally preferred by the farmers for breeding their buffaloes in these districts. The most common reasons given by the farmers for not preferring A.I. are low conception rate (32%). A.I. not good (23%) good bull not available in village (13%), A.I. facility not available in village (13%) and no knowledge about A.I. (8.4%).

It may be noted that low conception could be possibly the only genuine reasons. All other reasons listed above were due to the problems concerning with the organisation of A.I. and extension efforts (Kaura, 1967). The presence of stray bulls could also be a big hindrence to A.I. (Girdhar, 1968). It was earlier reported (Singh, 1976) that in Karnal district the farmers preferred A.I. for cattle in 97% cases mainly due to the fact that it may result in the birth of crossbred calf. But such a benefit namely birth of superior progeny is not being appreciated by majority. The small proportion of farmers who actually follow A.I. did generally believe that the calves born out of A.I. would be superior. On the whole a lot needs to be done from organisation point of view to make the

Haryana farmers realise that A.I. with semen from superior pedigree or proven sire is desirable in buffalo for rapid genetic improvement.

COMPARISON OF EXISTING RURAL HOUSING SYSTEMS WITH INSTITUTIONAL FARM HOUSING SYSTEMS

The details of loose housing as it exists in the organised farms in the semi-arid locality were discussed and their merits stressed in various papers and summarised in a review by Sastry and Georgie (1988). On H.A.U. farm also, loose housing system is being practiced. The village housing system as recorded in present study were compared with that at H.A.U. to determine how far the farmers in the two districts followed the loose housing system which was considered suitable even for small buffalo farm units (Kooner et al., 1969; Sastry, 1980; Rout, 1982; Srivastava and Promila, 1983; Dhiman, 1988).

It was observed that no farmer constructed loose house as such but were using a mixed and mobile system of buffalo keeping (78%) alternating their housing in the shed and in the open as dictated by the compulsion of diurnal and seasonal climatic variations. This system can be technically considered as similar to loose house in structure with the main difference that the

buffaloes are kept tethered by farmers. The covered area provided by farmers were seen to be even more than that provided at the University animal farm. The paddock area provided was less by half under the farmer's system. The materials used by farmers for floors, roofs and wall was mostly of temporary nature (Katcha) whereas they are of permanent nature (pucca) at the H.A.U. animal farm. Apart from this the major difference in housing design and material, the lower height of the roof and much too extensive wall covering on all sides tended to make rural buffalo housing deficient from ventilation, hygiene and climatic comfort points of view. Besides absence of drainage, even slope of the floors, smaller size of manger and water troughs (wherever provided) also characterized the farmers' housing system. The farmers normally used the same place for all the categories of animal and moved them indoors to outsides and vice-versa as per needs, whereas there are separate sheds for separate purposes at H.A.U. animal farm, and the adoption of loose house system does not necessitate diurnal and/or seasonal movement of animals. The regular use of disinfectants and insecticide which are integral part of management in loose house at H.A.U., animal farm were found to be rarely used by the farmers.

Thus, the housing systems followed by farmers can be considered as broadly akin to loose housing in that the farmers also provide shed/shelter as well as open/loafing area. The main difference was that unlike in the traditional loose house, the animals are kept tethered in the farmers housing system. Without basically disturbing the traditional housing system generally used by majority farmers in Haryana, there is certainly scope of improving its efficiency, comfort and utility by following minor modifications in the overall infrastructure by proper flooring, surface slope, drainage provision, appropriate ventilation by more window space, proper manger and watering facilities. Raut (1982) after considering the various buffalo shed condition, in Dhulia district of Maharastra and Srivastava and Promila (1983) in Ludhiana district Punjab have also emphasised the need for improvement with above mentioned shed condition for keeping the buffaloes comfortable to maximize production.

CHAPTER–VI

SUMMARY

SUMMARY AND CONCLUSIONS

A field study was undertaken to find out the buffalo housing system and associated management practices being followed by different categories of farmers in Karnal and Hisar district of Haryana and to make a comparative appraisal of buffalo housing system and associated management practices in villages with that of H.A.U. animal farm. From each district two villages and from each village 50 households, from different socio-economic-strate were selected by proportionate sampling method. The desired information was generated using a specially developed questionnaire and schedule, supplemented with visual observations and actual measurements. All the 200 selected respondents were interviewed and the relevant information regarding particulars of farmers, their land holding size, buffalo housing system, and associated management practices, hygiene and sanitation practices and other management practices were recorded. The qualitative data so generated were given a quantitative orientation interms of per cent size of population adopting/not adopting the particular parameters of housing and associated management package and tabulated in that fashion to draw meaningful inferences.

2. The profile of the responderts in the study area revealed that about 80% of the households were landless, small and medium. They were generally above 30 years of age in both the districts. Among the literacy rate ~~of~~ among respondents of Karnal district was 65% against a rate of 36% ~~of~~ for Hisar district.

3. Crop farming was the main occupation but bovine rearing with 1-2 milch buffaloes, 1-2 heifers and 1-2 calves, was the subsidary occupation in both the districts.

4. The most common family size was 5-10 members, of which nearly half of the members were children in most size of the holdings in both the districts. Among the land-owning households, majority were medium farmers holding between 2.5 - 5 acres of land in both the districts.

5. In Karnal district 100% land was irrigated while in Hisar district it was about 77%.

6. Tubewells were the most common source of water for irrigation (96%) in Karnal district, whereas in Hisar district canal water was the main source of water for nearly 55% of holdings.

7. Farmers of both the districts realised the value of green fodder in buffalo feeding. But farmers of Karnal district allocated significantly more land area for fodder production during both Rabi and Kharif seasons, than those of Hisar district. Generally small farmers used more land (10%) for fodder culti-

vation, more so in Karnal district.

8. Above ninety per cent of the farmers irrespective of land holding size in both the districts were having one to two animals in each category i.e., milch buffaloes, heifers, calves. Almost the same was the trend in case of cattle also.

9. Majority farmers (99%) did not normally keep the buffaloes at a single fixed place during the day or across different seasons. A substantial proportion of farmers in both the districts followed the mixed practice of keeping their buffaloes in the open, under tree shade or in closed house from time to time depending on the prevailing climatic conditions.

10. Significantly higher percentage of farmers (56%) of Hisar district kept their buffaloes right inside their own dwelling than farmers of Karnal district (31%). Again 36% farmers provided separate shed for their buffaloes distinct from their dwelling in Karnal district, whereas the corresponding figure for Hisar district was only 14%.

11. The location of paddock provided by the farmers was almost similar to the trends in the location of shed in both the districts.

12. Keeping buffaloes and cattle together were also a common practice in both the districts (36%).

13. Irrespective of land holding size of the farmers in either districts, more than half of the respondents were found to provide more than 4 m^2 shed area per adult unit and another 35% 3-4 m^2, whereas the paddock or open area provided by 45% farmers were 4 m^2 per adult unit and in 47% cases it varied from 2-4 m^2.

14. In 65% of the holdings the buffalo shed roof was made of thatch and mud and in 15.5% cases of thatch alone in Hisar district, whereas in Karnal district it was 36% and 13.5% respectively. Brick + mud roof was relatively less common in either districts.

15. More than 90% of the roofs were of flat type, having a small slope (<10 cm fall per meter) in majority of the houses in either districts.

16. There were practically no extension of eaves of buffalo sheds beyond the wall in both the districts. Thickness of the roof in majority (74.2%) of the cases was 11-20 cm in both the districts. Height of flat roof from ground was found 2.0 - 3.0 meter in more than 69% shelters in both the districts.

17. In Karnal district 57% buffalo keepers used brick and 5.6% mud as construction material for buffalo houses whereas in Hisar district the corresponding figures were 29.9 and 51.5% respectively. Bricks lined

with cement was used by 32.6% farmers in Karnal district but significantly less number of farmers (10.3%) used this materil in Hisar district.

18. The height of walls varied from 2-3 meters whereas the thickness was around 30 cm in majority of the cases in both the districts.

19. The sheds have walls on all the four sides in 70% cases. This trend was seen in all the categories and in both the districts. It was also seen that the walls covered more than 75% of the shed's perimeter in 62% of holdings in Karnal district and 88% holdings in Hisar district.

20. Floor condition in the animal houses was better in Karnal district. In this district 58.4% farmers provided "Katcha" floor but in Hisar district the corresponding figure was 96.9%. 58.4% farmers in Karnal district provided "Katcha" floor followed by brick floor in 32.6% cases, whereas the corresponding figures were 96.9% and only 3.1 respectively in Hisar district. This difference between the two districts was found among all categories of holdings. Though, provision of drainage channel was rather uncommon in both the districts, yet in Karnal district it was relatively more than that in Hisar district. Evenness of the floor surface was also better in Karnal district.

21. Farmers of both the districts were found to be equally ignorant about need for slope in the animal houses. Though, a few houses have given slope @ 1-2 cm vertical fall per meter cross length, more so in Karnal district.

22. Among all the categories of farmers, significantly higher number of respondents in Hisar district (81%) did not provide manger inside the shed than those in Karnal district (54%). In 90% of the holdings the manger was provided in the paddock, where major part of the feeding was done.

23. Adequate manger length (more than 56 cm per adult unit) was provided by all categories of farmers in both the districts in 90.7% shed and 93.3% paddocks respectively.

24. In majority cases, the height of the innerwall of manger was found to be below the minimum prescribed norm. In 15.4% cases of mangers in shed and in 13.5% mangers in paddock, the height of inner wall was even less than 25 cm.

25. The depth of the manger was also found to inadequate i.e. less than 20 cm in 61.5% cases and 21-30 cm in 38.5% cases in both the district. The desirable standard width of manger was observed in 32.3% shed and

40.7% paddocks. In remaining cases the depth of the manger was found to be inadequate i.e. between 30-50 cm (67.7%) sheds and 59.3% in paddocks.

26. Nearly half of the respondents used bucket to provide drinking water. Significantly higher number of respondents of Hisar district (41%) took their animals to water source than respondents of Karnal district (11%). The most common source of water was pumping set (57%) in Karnal district whereas in Hisar district it was water works (55%) followed by water ditches (40%) But in Karnal district significantly less number (2%) used water ditches as a source of water. Only 3.5% respondents provided cemented water trough which was long and rectangular in shape and provided only 21-30 cm space per adult unit in both the districts.

27. 36.5% of the farmers provided 31-40 litres of water per day, 26%; 41-50 litres and 26.5% more than 50 litres of water in both the districts. During summer, 75% farmers and in winter 86% farmers in either districts offered drinking water 2-3 times per day.

28. No special provision was made for ventilation in buffalo houses in 91% holdings in Hisar district, but in Karnal, this figure was only 65%, which was very low. However, out of the 21% ventilated houses, the number of

windows provided by all the categories of farmers in Karnal district was found to be significantly higher over that in Hisar district. In 64% cases in both the districts window area provided per adult unit was very small (less than 0.25 m^2). However, the windows were at a desirable height (about 1 meter) in 96% holders. None of the houses was having cross ventilation.

29. To buffer the climatic extremes in winter almost all the farmers (98.5%) were providing bedding, especially to the calves. The bedding material was the previous day's waste fodder/straw etc. Curtains of gunny bags were used to cover the walls by 52.5% farmers in winter. In summer no changes were made. 31% farmers in Karnal district and 88% in Hisar district covered the animal with jacket/Jhules, during winter, mostly to young calves. During summer 78% farmers allowed wallowing 1-2 times daily and 68.5% practised washing 1-2 times daily in both the districts across all categories of farmers.

30. Majority (75.5-83.5%) of the respondents in both the districts kept their animals in the open at night during summer and rainy seasons, whereas in winter season 98.5% kept their buffaloes inside closed shed separately (53.5%) or inside their own dwelling (46%).

During day time, irrespective of categories or districts 83% and 72.5% in winter and rainy seasons respectively, kept their animals in the open while in summer 48.5% farmers kept their animals in open and 42.5% under tree shades.

31. Most of the farmers (87%) in both the district cleaned their animals' shed 1-2 times a day, invariably by dry sweeping. All respondents (100%) collected dung, urine and other waste together, 86.5% of which was used as fuel and the remaining 13.5% as manure. Majority of the respondents (95%) did not use disinfectants for cleaning animal sheds whereas 82% farmers in Karnal district and 11% in Hisar district provided no specific protection against insects. But 75% farmers of Hisar district used smoke for controlling the insects etc. in animal shed. Although making smoke was the most common measure for insect control; spraying insecticides by 10% respondents once or twice in a year was also observed.

32. Only 47% farmers in Karnal district groomed the buffaloes using bare hands and straw whereas in Hisar district 77% of the respondents groomed their animals by bare hands.

33. It was observed that 22% respondents never took their buffaloes for wallowing in both the districts. In summer comparatively higher number of respondents (29%) allowed their animals wallowing for more than 3 hours a day while 27% respondents allowed wallowing up to 2 hours daily in rainy season. There was not much difference within the categories or districts regarding wallowing time. Even during winter, 36% respondents washed their buffaloes atleast once in a week with warm water.

34. Almost all the farmers (96%) milked their buffaloes wherever they were housed and did not follow the practice of washing the whole body of buffaloes prior to milking (95.5%). However, all the farmers washed udder and teats (96.5%), milker's hands (100%) and milking vessels (100%) before milking. Wet hand, full hand method of milking was used by all the respondents. Putting thumb in against the teats at the time of milking was found more prevalent in Hisar district (92%) as compared to that in Karnal district (60%). Neither stripping was done nor the udder was cleaned at the end of milking by almost all the respondents. The calves allowed sucklking both the times. More than half of the respondents left milk equivalent to one full

quarter up to three months of age. Majority (79%) fed colostrum only after the expulsion of placenta; only 4.5% farmers allowed suckling within one hour after birth. Milch buffaloes with let down problems (sudden jumping and holding up of milk outflow) were tackled by most of the farmers (65.5%) by providing additional concentrates. Oxytocin was also used by the farmers (13%), more so in Hisar district.

35. Majority of farmers (84%) in either district used bellowing by the buffaloes as the most common symptoms of heat 'Doka' (41.5%) and vaginal discharge (29%) were the next most common symptoms of heat in buffaloes observed by farmers. Few big farmers of Karnal district used teaser bull for heat detection. 75.5% farmers in both the districts bred their buffaloes during winter and rest during rainy season. Irrespective of farm size categories or districts, 45% farmers used improved bull for serving their buffaloes naturally. Significantly higher percentage of respondents of Hisar district (51%) allowed stray bull mating of their buffaloes while the corresponding figure for Karnal district was 32%. Higher percentage of farmers (12%) resorted to A.I. in Karnal district whereas only 6% farmers followed this technique

in Hisar district. The improved bull used belonged to either the village Panchayat (49.2%) or two other farmers (40%). Even draft bulls were used for service by 9% farmers in Karnal district. In both the districts 75.8% farmers adopting A.I. as breeding technique have two reasons for preferring A.I. viz., the progeny of A.I. bull fetched good price and also produced comparatively more milk. The common reasons given by the majority farmers for not adopting A.I. technique were low conception (31.7%), A.I. not good (23.4%), bull not available in the village (15.6%) and A.I. facility not available in the village (13.2%).

36. Unlike at the H.A.U. animal farm none farmers in the study group practiced loose housing in the strict sense. But majority of the farmers kept their buffaloes in a flexible and dynamic micro-climate partly in shed and partly in the open or under tree or paddock depending on time of the day and year.

Considerable variation in various parameters of buffalo housing and associated management practices under organised large farm conditions of the H.A.U. herd and those found under village conditions of variable land holdings and economic strata were observed.

CONCLUSIONS

On the basis of the findings of the present investigation entitled, "Studies on buffalo housing and associated management practices in Haryana," the following conclusions can be drawn:

1. The farmers are using a flexible system of housing buffaloes that include keeping them in the shed and in the open in turns as necessitated by diurnal and seasonal changes.

2. Materials of the roof and wall are predominantly of "Katcha" type. Height of roof is lower, than normal full walls were covering on all the four sides of the buffalo house leaving space for just a door on one side, which is not conducive to the creation of ideal micro-climate inside, especially during hot and hot humid season.

3. Absence of drainage, no slope of the floor, unevenness of floor surface, small size of manger and water troughs are some of the major shortcomings encountered in village buffalo houses. The hygienic conditions inside animal shed are also far from ideal since there is no tradition of using disinfectants or insecticides. The absence of proper ventilation is also an important lacuna of buffalo housing system prevalent in the villages.

4. Buffaloes are washed regularly, even during winter with warm water and are also allowed wallowing for 1-3 hours in summer and rainy seasons, which is desirable and beneficial practice from comfort and milk production point of view.

5. Farmers are ignorant of the need for modifying shed structures temporarily during summer like additional coverage to roof and its wetting and provision of pannels or curtains in wall spaces and their wetting. They do provide bedding to calves during winter and use jackets/ Jhules; the latter was not needed as per experimental proof under controlled study.

6. Though, certain aspects of milking management like washing udder and teats, milkers' hand and milking vessels before milking operations are reasonably suitable followed by farmers, yet the common practice of putting thumb "in" during milking as observed in present study is potentially harmful because such practice can lead to udder injury and mastitis in long run.

7. The common practice of farmers leaving one full quarter for suckling by calves, may cause over-feeding of calves of high yielders and under-feeding of calves of low yielders. Colostrum suckling is allowed for calves only after the expulsion of placent, which may prove to be

somewhat delayed in many instances and may lead to inadequate build up of antibodies in the calf's passive immune system making them more vulnerable to early mortality.

8. Bellowing is the main symptom of heat followed by DOKA and vaginal discharge that are used by farmers for heat detection. Winter is the main season of service. A.I. is not popular in villages due to non-technical reasons; they used improved bull belonging to the village Panchayat or stray bulls for breeding purposes. "Low conception from A.I." is the main reason for failure of A.I. in buffaloes in villages, followed by problems concerned with effective organisation of A.I. itself.

9. To overcome the defects noticed in the housing and associated management practices for buffaloes in the farmers' holdings, a codified and tested package of "Transferable technology" is needed for educating and motivating the farmers as regards the better practices. This would help in improving the production and reproduction efficiency of village buffaloes.

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A P P E N D I C E S - I

Table 10: Particulars of the farmers-owners of the studied households (% total within each category)

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overal
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200
a) Age											
<20 years	-	-	2.6	-	1.0	4.8	7.7	-	-	3.0	2.0
20-30 years	44.4	39.1	15.8	75.0	36.0	41.5	23.1	25.8	6.6	29.0	32.5
30-40 years	29.6	47.8	36.8	16.7	35.0	29.3	23.1	32.3	6.6	26.0	30.5
>40 years	25.9	13.0	44.7	8.3	28.0	24.4	46.2	41.9	86.6	42.0	35.0
b) Educational status											
Illiterate	44.4	17.4	42.1	25.0	35.0	73.2	76.9	51.6	53.3	64.0	49.5
Primary	18.5	26.1	15.8	16.6	19.0	12.2	15.4	16.1	6.7	13.0	16.0
Middle	18.5	30.4	10.5	25.0	19.0	9.8	7.7	22.6	13.3	14.0	16.5
Matric	14.8	26.1	26.3	25.0	23.0	2.4	-	6.5	26.7	7.0	16.0
Graduate	-	-	5.3	8.4	3.0	2.4	-	3.2	-	2.0	2.5
Post-graduate	3.7	-	-	-	1.0	-	-	-	-	-	0.5

Continued....

Table 10 continued..

Particulars	Karnal district (2 villages) Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Hisar district (2 villages) Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	Overall (N=200
(c) Main(M) and Subsidiary(S) occupations											
Crop Farming M	-	43.5	73.7	100.0	50.0	-	38.5	77.4	93.3	43.0	46.5
S	-	-	-	-	-	-	-	-	-	-	-
Crop+Dairying M	-	4.3	-	-	1.0	-	-	-	-	-	0.5
S	-	26.1	23.7	-	15.0	-	23.1	19.4	6.7	10.0	12.5
Casual labour M	44.4	-	-	-	12.0	85.4	7.7	-	-	36.0	24.0
S	-	-	-	-	-	-	-	-	-	-	-
Farming+Casual labour M	-	13.0	-	-	3.0	2.4	23.1	3.2	-	5.0	4.0
S	-	-	-	-	-	-	-	-	-	-	-
Service M	33.3	26.0	23.7	-	24.0	7.3	7.7	16.1	-	9.0	16.5
S	-	-	-	-	-	-	-	-	-	-	-
Dairy M	22.2	13.0	2.6	-	10.0	4.9	23.1	3.2	6.7	7.0	8.5
S	100.0	73.9	76.3	100.0	85.0	100.0	76.9	80.6	93.3	90.0	87.5
d) Distribution of family members of the sample household											
Adult ≤2	48.2	60.9	42.2	8.3	44.0	52.4	61.5	33.3	13.3	42.0	43.0
3-5	44.4	26.1	28.9	25.0	32.0	28.6	30.8	36.7	40.0	33.0	32.5
>5	7.4	13.0	28.9	66.7	24.0	19.0	7.7	30.0	46.7	25.0	24.5
Children ≤2	30.4	47.6	36.0	-	32.9	54.3	33.3	30.0	33.3	40.2	36.8
3-5	43.5	52.4	60.0	60.0	53.2	37.1	66.7	50.0	46.7	46.7	49.7
>5	26.1	-	4.0	40.0	13.9	8.6	-	20.0	20.0	13.1	13.5
Total ≤ 4	18.5	30.4	28.9	8.3	24.0	34.1	23.1	12.9	-	21.0	22.5
5-10	70.4	69.6	63.2	50.0	65.0	61.0	69.2	67.7	80.0	67.0	66.0
>10	81.1	-	7.9	41.7	11.0	4.9	7.7	19.4	20.0	12.0	11.5

Table 11: Particulars of farms of the households studied (% total within each category)

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
a) Total land owned											
None	100.0	-	-	-	27.0	100.0	-	-	-	41.0	34.0
⩽2.5 acre	-	100.0	-	-	23.0	-	100.0	-	-	13.0	18.0
2.6-5.0 acre	-	-	78.9	-	30.0	-	-	61.3	-	19.0	24.5
5.1-7.5 acre	-	-	21.1	-	8.0	-	-	38.7	-	12.0	10.0
7.5-10.0 acre	-	-	-	41.7	5.0	-	-	-	33.3	5.0	5.0
>10.0 acre	-	-	-	58.3	7.0	-	-	-	66.7	10.0	8.5
b) Per cent land irrigated											
⩽25%	-	-	-	-	-	-	-	12.9	-	6.8	3.0
26-50%	-	-	-	-	-	-	7.7	12.9	6.7	10.2	4.6
51-80%	-	-	-	-	-	-	-	-	26.6	6.8	3.0
>80%	-	100.0	100.0	100.0	100.0	-	92.3	92.3	66.7	76.2	89.4
c) Mode of irrigation											
Canal	-	8.7	-	-	2.7	-	53.8	64.5	33.3	54.2	31.0
Tubewell	-	91.3	100.0	91.7	95.9	-	46.2	12.9	-	16.9	56.3
Pumping set	-	-	-	-	-	-	-	-	-	-	-
Canal+Tubewell	-	-	-	8.3	1.4	-	-	19.4	66.7	27.1	12.0
None	-	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	3.2	-	1.7	0.7

Continued...

Table 11 continued

Particulars		Karnal district(2 villages)					Hisar district (2 villages)					Overall (N=200)
		Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	
d) Per cent area under fodder												
None	Rabi	-	-	-	-	-	-	-	6.5	-	3.8	1.5
	Kharif	-	-	-	-	-	-	-	6.5	-	3.4	1.5
≤5%	Rabi	-	-	10.5	8.3	6.8	-	-	67.7	80.0	55.9	28.0
	Kharif	-	-	-	8.3	1.4	-	-	6.5	6.7	5.1	3.0
5.1-10%	Rabi	-	17.4	39.5	41.7	32.9	-	53.8	16.1	20.0	25 .4	29.5
	Kharif	-	-	7.9	8.3	5.5	-	23.1	38.7	53.3	39.0	20.5
10.1-20%	Rabi	-	30.4	36.8	41.7	35.6	-	2.7	9.7	-	8.5	52.5
	Kharif	-	4.3	18.4	41.7	17.8	-	7.7	35.5	40.0	30.5	23.5
>20	Rabi	-	52.2	13.2	8.3	24.7	-	5.5	-	-	6.8	23.5
	Kharif	-	95.7	73.7	41.7	75.3	-	69.2	12.9	-	22.0	51.5

Table 12: Herd strength and composition in the studied households (% total within each category)

Particulars		Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	Overall (N=200)
		a) Buffaloes										
Milch buffaloes	1-2	100.0	100.0	96.0	75.0	93.4	100.0	100.0	100.0	100.0	100.0	96.9
	3-5	-	-	4.0	25.0	6.6	-	-	-	-	-	3.1
	>5	-	-	-	-	-	-	-	-	-	-	-
Heifers	1-2	100.0	85.7	96.0	55.6	88.7	100.0	100.0	100.0	90.9	97.1	91.7
	3-5	-	14.3	-	33.3	8.1	-	-	-	9.1	2.9	6.3
	>5	-	-	4.0	11.1	3.2	-	-	-	-	-	2.1
Calves	1-2	100.0	80.0	83.3	70.0	84.3	88.2	100.0	100.0	88.9	94.5	89.6
	3-5	-	20.0	16.7	30.0	15.7	11.8	-	-	11.1	5.5	10.4
	75	-	-	-	-	-	-	-	-	-	-	-
Bullocks	1-2	100.0	100.0	100.0	100.0	100.0	-	-	100.0	-	100.0	100.0
	3-5	-	-	-	-	-	-	-	-	-	-	-
	75	-	-	-	-	-	-	-	-	-	-	-

Continued....

Table 12 continued..

Particulars		Karnal district (2 villages) Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Hisar district (2 villages) Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	Overall (N=200)
b) Cattle												
Milch cows	1-2	100.0	100.0	88.9	100.0	96.4	100.0	-	100.0	100.0	100.0	97.2
	3-5	-	-	11.1	-	3.6	-	-	-	-	-	2.8
	>5	-	-	-	-	-	-	-	-	-	-	-
Heifers	1-2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	3-5	-	-	-	-	-	-	-	-	-	-	-
	>5	-	-	-	-	-	-	-	-	-	-	-
Calves	1-2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	3-5	-	-	-	-	-	-	-	-	-	-	-
	>5	-	-	-	-	-	-	-	-	-	-	-
Bullocks	1-2	-	100.0	100.0	100.0	100.0	100.0	100.0	94.4	91.7	94.7	96.4
	3-5	-	-	-	-	-	-	-	5.6	5.3	5.3	3.6
	>5	-	-	-	-	-	-	-	-	-	-	-
c) Total adult units (All bovines)												
1-2		44.4	30.4	13.1	8.3	25.0	70.7	46.1	29.0	20.0	47.0	36.0
2.1 - 5		55.6	34.8	50.0	16.7	44.0	29.3	38.5	58.1	40.0	41.0	42.5
5.1 - 10		-	30.4	31.6	41.7	24.0	-	15.4	12.9	40.0	12.0	18.0
>10		-	4.4	5.3	33.3	7.0	-	-	-	-	-	3.5

Table 13: Type and modes of housing for buffaloes on different categories of sample households (% total within each category)

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
a) Type of house/housing											
Open(1)	-	4.3	-	-	1.0	-	-	-	-	-	0.5
Under tree(2)	-	-	-	-	-	-	-	-	-	-	-
Lean-to(3)	-	-	-	-	-	-	-	-	-	-	-
Sheltered paddock(4)	-	-	-	-	-	-	-	-	-	-	-
Closed house(5)	-	-	2.6	-	1.0	-	-	-	-	-	0.5
(1+2+4)	18.5	13.1	13.2	33.3	17.0	4.9	7.7	13.0	-	7.0	12.0
(1+2+5)	63.0	65.2	76.3	58.3	68.0	90.2	84.6	80.6	100.0	88.0	78.0
(1+2+4+5)	11.1	13.1	7.9	8.3	10.0	4.9	7.7	3.2	-	4.0	7.0
(1+4+5)	7.4	4.3	-	-	3.0	-	-	3.2	-	1.0	2.0
b) Location of shed/place of keeping buffaloes											
Inside dwelling	66.7	13.1	23.7	8.3	31.0	70.7	38.5	48.4	46.6	56.0	43.5
Near dwelling	14.8	39.1	36.8	33.4	31.0	24.4	46.2	22.6	40.0	29.0	30.0
Separate from dwelling	18.5	43.5	39.5	50.0	36.0	4.9	15.4	29.0	6.7	14.0	25.0
In fields	-	-	-	8.3	1.0	-	-	-	6.7	1.0	1.0
No shed	-	4.3	-	-	1.0	-	-	-	-	-	0.5
c) Location of paddock if provided											
Not provided	33.3	21.7	18.4	25.0	24.0	4.9	-	3.2	6.7	4.0	14.0
Inside dwelling	-	-	-	-	-	-	-	-	-	-	-
Near dwelling	37.0	39.1	36.8	25.0	36.0	61.0	61.5	51.6	53.3	57.0	46.5
Separate from dwelling	29.7	39.1	44.7	50.0	40.0	34.1	38.5	45.2	26.7	37.0	38.5
In fields	-	-	-	-	-	-	-	-	13.3	2.0	1.0
No shed	-	-	-	-	-	-	-	-	-	-	-

Continued....

Table 13 continued...

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
d) Sharing of shed by livestock											
Buffalo alone	25.9	47.8	34.2	25.0	34.0	31.7	53.8	16.1	20.0	28.0	31.0
Buffalo+Man	44.4	4.3	5.3	8.3	16.0	58.5	23.1	22.6	16.7	36.0	26.0
Buffalo+cattle	18.5	39.2	52.6	66.7	42.0	7.3	15.4	54.8	75.0	31.0	36.5
Buffalo+cattle+man	11.1	4.3	5.3	-	6.0	2.4	-	6.5	8.3	4.0	5.0
Buffalo+others	-	-	2.6	-	1.0	-	7.7	-	-	1.0	1.0
No shed	-	4.3	-	-	1.0	-	-	-	-	-	0.5
e) Shed area/adult unit(m^2)											
Area(m^2) 0	18.5	8.7	5.3	16.7	11.0	2.4	7.7	-	6.7	3.0	7.0
1	-	-	-	-	-	-	-	-	-	-	-
2	3.7	13.0	13.1	-	9.0	2.4	7.7	9.7	-	5.0	7.0
3	7.4	17.4	15.8	16.6	14.0	7.3	15.4	19.4	46.7	18.0	16.0
4	33.3	4.3	21.1	25.0	21.0	17.1	15.4	19.4	13.3	17.0	19.0
>4	37.0	56.5	44.7	41.7	45.0	70.7	54.1	51.6	33.3	57.5	51.0
f) Paddock or open area/adult unit(m^2)											
0	16.7	14.3	19.4	22.2	17.7	-	-	-	-	-	8.0
∠2	11.1	4.8	3.2	22.2	7.6	5.1	-	3.2	-	3.1	5.1
2-3	5.6	19.0	22.6	22.2	17.7	20.5	-	19.4	30.7	18.8	18.3
3.1-4	22.2	28.6	19.4	11.1	21.5	17.9	7.7	29.0	46.2	24.9	22.9
4.1-5	11.1	14.3	3.2	-	7.6	25.7	38.5	12.9	7.7	20.8	14.9
>5	33.3	19.0	32.2	22.2	27.8	30.8	53.8	35.5	15.4	33.3	30.8

Table 14: Particulars of roof of buffalo houses on different categories of holdings (% of total within each category)

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
a) Material of roof											
Concrete	4.5	-	8.3	30.0	7.9	2.5	-	16.1	28.6	10.3	9.1
Thatch	22.7	9.5	13.9	-	13.5	22.5	8.3	16.1	-	15.5	14.5
Asbestos	-	-	-	-	-	-	-	-	-	-	-
Brick+mud	4.5	33.3	52.8	50.0	35.9	-	-	-	-	-	17.2
Wood+mud	-	14.3	5.6	-	5.6	-	25.0	6.4	-	5.2	5.4
Stone slabs	-	-	2.7	-	1.1	-	8.3	6.4	7.1	4.1	2.7
Thatch+mud	68.1	42.8	16.7	20.0	36.0	75.0	58.4	54.9	64.3	65.0	51.0
Wood	-	-	-	-	-	-	-	-	-	-	-
b) Feature of roof											
Flat	72.7	85.7	100.0	90.0	88.8	90.0	91.7	96.8	93.8	91.4	91.4
Single slope	22.7	4.8	-	-	6.7	10.0	8.3	3.2	6.2	6.4	6.5
Double slope	-	-	-	-	-	-	-	-	-	-	-
Other type	4.6	9.5	-	10.0	4.5	-	-	-	-	2.2	2.1

Continued....

Table 14 continued.....

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100	(N=200)
c) Slope of roof (Verticle fall/m cross length)											
0.00	-	-	-	-	-	-	-	-	-	-	-
∠0.1m	42.9	33.3	-	-	40.0	75.0	100.0	50.0	-	71.4	52.9
0.11-0.15m	28.6	-	-	-	20.0	-	-	-	-	-	11.8
0.16-0.20m	14.3	33.3	-	-	20.0	-	-	50.0	-	14.3	17.6
> 0.20m	14.3	33.3	-	-	20.0	25.0	-	-	-	14.3	17.6
Steep	-	-	-	-	-	-	-	-	-	-	-
d) Extension of eaves beyond walls(cm.)											
0.0	75.0	90.5	91.7	90.0	86.8	95.0	91.7	93.5	100.0	94.8	90.9
∠25	-	-	-	-	-	5.0	-	-	-	2.2	1.1
25-50	4.2	9.5	5.5	-	5.5	-	-	3.2	-	1.0	3.2
50-75	8.3	-	-	10.0	3.3	-	-	3.2	-	1.0	2.1
> 75	12.5	-	2.8	-	4.4	-	8.3	-	-	1.0	2.7
e) Thickness of roof (cm.)											
∠10 cm	27.3	9.5	11.1	10.0	14.6	5.0	16.7	19.4	7.1	11.3	12.9
11-20 cm	72.7	76.2	66.7	60.0	69.7	82.5	66.7	77.4	78.6	78.4	74.2
21-30 cm	-	14.3	19.4	30.0	14.6	12.5	16.6	-	14.3	9.3	11.8
>30 cm	-	-	2.8	-	1.1	-	-	3.2	-	1.0	1 .1

Continued...

Table 14 continued..

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
f) Height of sloped roof(m) at ridge(m)											
∠1.8 m	-	-	-	-	-	25.0	-	-	-	14.3	5.6
1.9-2.4m	100.0	50.0	100.0	100.0	90.9	50.0	100.0	100.0	-	85.7	77.8
2.5-3.0m	-	50.0	-	-	9.1	25.0	-	-	-	-	16.6
73.0 m	-	-	-	-	-	-	-	-	-	-	-
g) Height of sloped roof at eaves(m)											
∠1.5m	-	-	-	-	-	25.0	-	-	-	14.3	5.6
1.6-2.0m	83.3	100.0	50.0	-	72.7	75.0	100.0	100.0	-	85.7	77.8
2.1-2.5m	16.7	-	50.0	100.0	27.3	-	-	-	-	-	16.6
>2.5m	-	-	-	-	-	-	-	-	-	-	-
h) Height of flat roof (m)											
∠1.5m	-	-	-	-	-	2.5	-	-	-	1.0	0.5
1.6-2.0m	4.5	4.8	5.5	-	4.5	-	-	3.2	-	1.0	2.7
2.1-2.5m	40.9	28.6	13.9	20.0	24.7	47.5	33.3	22.6	7.1	32.0	28.5
2.6-3.0m	27.3	47.6	36.1	40.0	37.1	32.5	58.3	51.6	50.0	44.3	40.9
>3.0m	9.1	14.3	44.4	40.0	28.1	7.5	-	22.6	42.9	16.5	22.0
N.A.	18.2	4.8	-	-	5.6	10.0	8.3	-	-	5.2	5.4

Table 15: Particulars of walls of buffalo houses in different categories of holdings (% total holdings within each category)

Particulars		Karnal district (2 villages)					Hisar district (2 villages)					Overall
		Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
a) Existence of walls												
Shed	Yes	92.6	95.7	100.0	100.0	97.0	100.0	100.0	96.8	100.0	99.0	98.0
	No	7.4	4.3	-	-	3.0	-	-	3.2	-	1.0	2.0
Paddock	Yes	21.7	47.6	66.7	60.0	48.8	36.6	15.4	19.4	13.3	25.0	35.9
	No	78.3	52.4	33.3	40.0	51.2	63.4	84.6	80.6	86.7	75.0	64.1
b) Material of walls												
Cemented		-	-	-	-	-	-	-	3.2	-	1.0	0.5
Mud		18.2	4.8	-	-	5.6	80.0	50.0	32.3	14.3	51.5	29.6
Bricks		50.0	61.9	63.9	40.0	57.0	17.5	25.0	38.7	50.0	29.9	43.0
Brick+mud		4.5	-	5.6	10.0	4.5	2.5	16.7	12.9	-	7.2	5.9
Brick+cement		27.3	33.3	30.5	50.0	32.6	-	8.3	12.9	35.7	10.3	21.0
Others		-	-	-	-	-	-	-	-	-	-	-
c) Height of walls(m)												
<1.5m		-	-	-	-	-	2.5	-	-	-	1.0	0.5
1.5-2.0m		9.1	14.3	5.5	-	7.9	20.0	8.3	6.5	-	11.3	9.7
2.1-2.5m		72.7	47.6	25.0	40.0	43.8	57.5	41.7	41.9	14.3	44.3	44.1
2.6-3.0m		18.1	38.1	63.9	50.0	44.9	7.5	41.7	38.7	64.3	29.9	37.1
3.1-3.5 & above		-	-	5.5	10.0	3.4	2.5	-	9.7	21.4	7.2	5.4
No		-	-	-	-	-	10.0	8.3	3.2	-	6.2	3.2

Continued...

Table 15 continued...

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
d) Thickness of wall(cm)											
⟨15cm	-	-	-	-	-	-	-	-	-	-	-
16-20 cm	9.1	-	-	-	2.2	2.5	-	-	-	1.0	1.6
21-25 cm	40.9	66.7	22.2	30.0	38.2	7.5	-	12.9	28.6	11.3	24.2
26-30 cm	-	-	8.3	-	3.4	5.0	16.7	6.5	-	6.2	4.8
⟩30 cm	50.0	33.3	69.4	70.0	56.2	85.0	83.3	80.6	71.4	81.4	69.4
e) Sides of shed covered											
One side	-	14.3	-	-	3.4	-	-	-	-	-	1.6
Two side	22.7	9.5	5.5	20.0	12.4	7.5	8.3	6.5	-	6.2	9.1
Three side	4.5	33.3	30.5	30.0	24.7	7.5	8.3	25.8	14.3	14.4	19.3
Four side	72.7	42.9	63.9	50.0	59.5	85.0	83.4	67.7	85.7	79.4	69.9
f) Per cent shed perimeter covered											
⟨25%	-	-	-	-	-	-	-	-	-	-	-
25-50%	4.5	23.8	8.3	20.0	12.4	7.5	-	6.4	-	5.2	8.6
51-75%	13.6	33.3	25.0	40.0	25.8	2.5	-	12.9	14.3	7.2	16.1
⟩75%	81.8	42.9	66.7	40.0	61.8	90.0	100.0	80.7	85.7	87.6	75.3

Table 16: Particulars of floors in buffalo houses on different categories of holdings (% of total within each category)

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	N=200)
a) Type of floor											
Dirt	68.2	61.9	55.5	40.0	58.4	100.0	91.7	96.8	92.8	96.9	78.5
Paved	-	-	-	-	-	-	-	-	-	-	-
Bricks	27.3	33.3	33.3	40.0	32.6	-	8.3	3.2	7.2	3.1	17.2
Brick+mud	4.5	-	-	10.0	2.2	-	-	-	-	-	1.1
Brick+cement	-	4.8	11.1	10.0	6.8	-	-	-	-	-	3.2
Others	-	-	-	-	-	-	-	-	-	-	-
b) Whether drainage channel exists											
Yes	3.7	13.0	23.7	8.3	15.0	-	-	6.5	13.3	4.0	9.5
No	96.3	87.0	76.3	91.7	85.0	100.0	100.0	93.5	86.7	96.0	90.5
c) Evenness of floor											
Good	18.5	8.7	26.3	41.7	22.0	4.9	15.4	22.6	6.7	12.0	17.0
So So	14.8	34.8	13.2	25.0	20.0	17.1	38.5	25.8	20.0	23.0	21.5
Bad	66.7	56.5	60.5	33.3	58.0	78.0	46.1	51.6	73.3	65.0	61.5
d) Slope of floor (vertical fall/metre cross length)											
0.0 cm	90.9	76.2	63.9	60.0	73.0	100.0	100.0	96.8	92.8	97.9	86.0
$<$0.5 cm/m	-	-	-	-	-	-	-	-	-	-	-
0.6-1.0 cm/m	-	-	-	-	-	-	-	-	-	-	-
1.1-1.5 cm/m	-	-	8.3	-	3.4	-	-	-	-	-	1.6
1.6-2.0 cm/m	-	14.3	11.1	20.0	10.1	-	-	3.2	7.2	2.1	5.9
2.1-2.5 cm/m	4.5	9.5	5.5	10.0	6.7	-	-	-	-	-	3.2
$>$ 2.5 cm/m	4.5	-	11.0	10.0	6.7	-	-	-	-	-	3.2

Table 17: Particulars of mangers in buffalo houses in different categories of holdings (% of total within each category)

Particulars		Karnal district (2 villages)					Hisar district (2 villages)					Overall
		Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
a) Provision of manger												
Shed(S)	Yes	29.6	47.8	55.3	50.0	46.0	17.1	8.3	12.9	46.7	19.0	32.5
	No	70.4	52.2	44.7	50.0	54.0	82.9	91.7	87.1	53.3	81.0	67.5
Paddock(P)	Yes	89.5	85.7	75.7	70.0	80.7	95.1	100.0	100.0	86.7	96.0	89.1
	No	10.5	14.3	24.3	30.0	19.3	4.9	-	-	13.3	4.0	10.9
b) Length per adult unit (cm)												
⩽25 cm	S	-	-	-	-	-	-	-	-	-	-	-
	P	5.9	-	-	-	1.5	5.1	-	-	-	2.1	1.8
26-40 cm	S	-	9.1	9.1	-	6.5	-	-	-	-	-	4.6
	P	-	5.5	-	-	1.5	-	-	3.2	-	1.0	1.2
41-55 cm	S	14.3	-	4.5	-	4.3	14.3	-	-	-	5.3	4.6
	P	5.9	-	4.0	-	3.0	2.6	7.7	6.5	-	4.2	3.7
56-70 cm	S	-	9.1	18.2	16.7	13.1	28.6	-	25.0	14.3	21.1	15.4
	P	17.6	22.2	8.0	-	13.4	5.1	-	3.2	-	3.1	7.4
⩾70 cm	S	85.7	81.8	68.2	83.3	76.1	57.1	100.0	75.0	85.7	73.6	75.3
	P	70.6	72.3	88.0	100.0	80.6	87.2	92.3	87.1	100.0	89.6	85.9
c) Height of inner wall (Animal side) (cm)												
⩽25 cm	S	25.0	54.5	-	-	17.4	28.6	-	-	-	10.5	15.4
	P	47.1	5.6	4.0	14.3	16.4	15.4	30.8	3.2	-	11.5	13.5
26-40 cm	S	25.0	-	19.1	-	13.0	57.1	-	25.0	-	26.3	16.9
	P	17.6	27.8	28.0	-	22.4	38.5	30.8	22.6	23.1	30.2	27.0
41-55 cm	S	50.0	27.3	47.6	66.7	45.6	14.3	100.0	-	57.1	31.6	41.5
	P	23.5	44.4	48.0	57.1	41.8	30.7	15.4	38.7	61.5	35.4	38.0
⩾55 cm	S	-	18.2	33.3	33.3	24.0	-	-	75.0	42.9	31.6	26.2
	P	11.9	22.2	20.0	28.6	19.4	15.4	23.0	35.5	15.4	22.9	21.5

Table 17 continued

Particulars		Karnal district (2 villages) Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Hisar district (2 villages) Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	Overall (N=200)
d) Height of outer wall(cm)												
⟨75 cm	S	25.0	9.1	4.8	16.7	10.9	71.4	100.0	75.0	28.6	57.9	24.6
	P	58.8	33.3	16.0	57.1	35.8	84.6	84.6	93.5	84.6	87.5	66.3
76-100 cm	S	-	-	-	-	-	-	-	25.0	-	5.3	1.5
	P	-	5.6	20.0	-	9.0	2.6	-	-	7.7	2.1	4.9
101-125cm	S	-	-	-	-	-	-	-	-	-	-	-
	P	5.9	16.7	20.0	14.3	14.9	2.6	-	3.2	-	2.1	7.4
⟩125 cm	S	75.0	90.9	95.2	83.3	89.1	28.6	-	-	71.4	36.8	73.8
	P	23.5	44.4	44.0	28.6	37.3	10.3	15.4	3.2	7.7	8.3	20.2
No	S	-	-	-	-	-	-	-	-	-	-	-
	P	11.8	-	-	-	3.0	-	-	-	-	-	1.2
e) Depth of manger(cm)												
⟨20 cm	S	50.0	90.9	71.4	66.7	71.7	57.1	-	50.0	14.3	36.8	61.5
	P	70.6	55.6	64.0	85.7	65.7	59.0	61.5	41.9	53.8	53.1	58.3
21-30 cm	S	50.0	9.1	28.6	33.3	28.3	42.9	100.0	50.0	85.7	63.2	38.5
	P	29.4	38.9	32.0	14.3	31.3	35.9	38.5	58.1	46.2	44.8	39.3
31-40 cm	S	-	-	-	-	-	-	-	-	-	-	-
	P	-	-	-	-	3.0	5.1	-	-	-	2.1	2.5
⟩ 40 cm	S	-	-	-	-	-	-	-	-	-	-	-
	P	-	5.5	4.0	-	-	-	-	-	-	-	0.9
f) Width of manger (cm)												
⟨30 cm	S	-	18.2	-	-	4.3	-	-	-	-	-	3.1
	P	-	-	-	-	-	10.3	7.7	6.5	-	7.3	4.3
31-40 cm	S	37.5	9.1	4.8	-	10.9	-	-	40.0	16.7	15.8	12.3
	P	35.3	11.1	8.0	14.3	16.4	7.7	7.7	6.5	7.7	7.3	11.0
41-50 cm	S	50.0	54.5	66.7	50.0	58.7	28.6	-	60.0	33.3	36.8	52.3
	P	41.2	33.3	40.0	28.6	37.3	38.5	28.5	58.0	69.2	48.9	44.2
⟩ 50 cm	S	12.5	18.2	28.5	50.0	26.1	71.4	100.0	-	50.0	47.4	32.3
	P	23.5	55.6	52.0	57.1	46.3	43.6	46.1	29.0	23.1	36.5	40.5

Table 18: Particulars of watering facilities available for buffaloes on different categories of holdings (% total within each category)

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
a) Mode of providing water											
1. Use of water trough	-	-	5.3	16.7	4.0	-	7.7	-	13.3	3.0	3.5
2. With buckets	40.7	69.7	36.8	41.6	46.0	80.5	76.9	32.3	20.0	56.0	51.0
3. Taking animal to water source	7.4	4.3	15.8	16.7	11.0	19.5	15.4	67.7	66.7	41.0	26.0
4. 2 and 3	11.1	4.3	15.8	-	10.0	-	-	-	-	-	5.0
5. 3 and 2	40.7	21.7	26.3	25.0	29.0	-	-	-	-	-	14.5
b) Most common (1) and next common (2) source of water											
Canal 1	98.1	26.1	36.8	33.3	37.0	-	-	3.2	-	1.0	19.0
2	18.5	4.3	10.5	8.3	11.0	-	-	3.2	-	1.0	6.0
Tubewell 1	-	-	5.3	16.7	4.0	-	-	3.2	6.7	2.0	3.0
2	3.7	-	-	-	1.0	2.4	-	-	-	1.0	1.0
Pumping set 1	51.9	73.9	52.6	50.0	57.0	2.4	-	-	6.7	2.0	29.5
2	37.0	21.7	36.8	25.0	32.0	12.2	7.7	6.5	13.3	10.0	21.0
Wells 1	-	-	-	-	-	-	-	-	-	-	-
2	-	-	2.6	-	1.0	7.3	-	-	-	3.0	2.0
Johar 1	-	-	5.3	-	2.0	29.3	15.4	64.5	40.0	40.0	21.0
2.	-	17.4	23.7	25.0	16.0	39.0	69.2	29.0	20.0	37.0	26.5
Water works 1	-	-	-	-	-	68.3	84.6	29.0	46.6	55.0	27.5
2	-	-	-	-	-	22.0	15.4	25.8	26.7	23.0	11.5
Not known	40.7	56.5	26.3	41.7	39.0	17.1	7.7	35.5	40.0	25.0	32.0

Continued

Table 18 continued

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
c) Material/type of water troughs/vessels											
Constructed(pucca)	-	-	100.0	100.0	100.0	-	100.0	-	100.0	100.0	100.0
Metal(tasla/ bucket)	-	-	-	-	-	-	-	-	-	-	-
Old drums	-	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	-	-	-
d) Design/shape of water troughs/vessels											
Long	-	-	-	50.0	25.0	-	100.0	-	50.0	66.7	42.9
Round	-	-	-	-	-	-	-	-	-	-	-
Triangular	-	-	-	-	-	-	-	-	50.0	33.3	14.3
Rectangular	-	-	100.0	50.0	75.0	-	-	-	-	-	42.9
e) Trough/vessel/length/animal											
⩽20 cm	-	-	50.0	50.0	50.0	-	-	-	-	-	33.3
21-30 cm	-	-	50.0	50.0	50.0	-	100.0	-	100.0	100.0	66.7
31-40 cm	-	-	-	-	-	-	-	-	-	-	-
> 40 cm	-	-	-	-	-	-	-	-	-	-	-
f) Quantum of water/buffalo/day											
⩽30 litres	11.1	8.7	10.5	25.0	12.0	-	-	-	-	-	6.0
31-40 litres	40.8	60.9	44.7	25.0	45.0	36.6	7.7	16.1	6.7	22.0	36.5
41-50 litres	37.0	21.7	18.4	-	22.0	14.6	53.8	19.4	6.7	20.0	26.0
> 50 litres	11.0	8.7	26.3	25.0	18.0	43.9	30.8	22.6	40.0	35.0	26.5
Not known	-	-	-	25.0	3.0	4.9	7.7	41.9	46.6	23.0	13.0

Continued..

Table 18 continued

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
g) Treatment of water											
None	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Settling	-	-	-	-	-	-	-	-	-	-	-
Cooling	-	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	-	-	-
h) Frequency of providing drinking water/day											
Once Summer	3.7	-	-	-	1.0	-	-	-	-	-	0.5
Winter	11.1	-	18.4	-	10.0	9.8	-	12.9	6.7	9.0	9.5
2-3 times Summer	81.5	78.3	76.3	66.7	77.0	78.0	76.9	74.2	53.4	73.0	75.0
Winter	88.9	100.0	81.6	100.0	90.0	90.2	100.0	87.1	93.3	91.0	86.0
7 3 times Summer	14.8	21.7	23.7	33.3	22.0	22.0	23.1	25.8	46.6	27.0	24.5
Winter	-	-	-	-	-	-	-	-	-	-	4.5

Table 19: Details of ventilation in buffalo houses on different categories of holdings (% total within each category)

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
a) Whether provided											
No ventilation	70.4	65.2	63.2	58.3	65.0	97.6	92.3	87.1	80.0	91.0	79.0
Specially provided windows	29.6	34.8	36.8	41.7	35.0	2.4	7.7	12.9	20.0	9.0	21.0
b) Number of windows											
0	74.1	69.6	63.2	58.2	67.0	97.6	92.3	87.1	80.0	91.0	79.0
1	22.2	17.4	13.2	16.7	17.0	2.4	7.7	12.9	13.3	8.0	12.5
2	-	8.7	21.1	8.3	11.0	-	-	-	-	-	5.5
3	-	-	-	8.3	1.0	-	-	-	-	-	0.5
4 and >	3.7	4.3	2.6	8.3	4.0	-	-	-	1.0	1.0	2.5
c) Total area of windows (m^2)											
$\leq 1\ m^2$	75.0	28.6	60.0	40.0	54.3	100.0	100.0	50.0	25.0	55.5	54.5
1.1-1.5 m^2	25.0	28.6	6.7	-	11.4	-	-	50.0	25.0	33.3	16.0
1.6-2.0 m^2	25.0	28.6	13.3	20.0	17.1	-	-	-	-	-	13.6
2.1-2.5 m^2	-	14.2	-	40.0	8.6	-	-	-	-	-	6.8
2.6-3.0 m^2	-	-	13.3	-	5.7	-	-	-	-	-	4.5
$\geq 3.0\ m^2$	-	-	6.7	-	2.9	-	-	-	50.0	11.1	4.5

Continued....

Table 19 continued..

Particulars	Karnal district (2 villages) Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Hisar district (2 villages) Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	Overall (N=200)
d) Window area/adult unit (m^2)											
$\leq 0.25\ m^2$	62.5	42.8	73.3	80.0	62.8	100.0	-	75.0	66.7	66.7	63.6
$0.26-0.40\ m^2$	12.5	28.6	20.0	-	71.1	-	-	-	-	-	13.6
$0.41-0.55\ m^2$	-	14.3	-	20.0	5.7	-	-	-	-	-	4.5
$0.56-0.70\ m^2$	-	-	-	-	-	-	100.0	-	-	11.1	2.3
$0.71-0.90\ m^2$	-	-	-	-	2.9	-	-	25.0	33.3	22.2	2.3
$> 0.90\ m^2$	25.0	14.3	6.7	-	11.4	-	-	-	-	-	13.6
e) Height of window from floor (m)											
≤ 1.0 m	100.0	100.0	93.3	100.0	97.1	100.0	100.0	75.0	100.0	88.9	95.5
1.1-1.5 m	-	-	6.7	-	2.9	-	-	25.0	-	11.1	4.5
1.6-2.0 m	-	-	-	-	-	-	-	-	-	-	-
> 2.0 m	-	-	-	-	-	-	-	-	-	-	-

Table 20: Alterations made to structures of buffaloes houses during extremes of seasons on different categories of holdings (% total within each category)

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
a) Summer											
Floor											
None	100.0	91.3	100.0	100.0	98.0	100.0	100.0	100.0	100.0	100.0	99.0
Bedding	-	8.7	-	-	2.0	-	-	-	-	-	1.0
Others	-	-	-	-	-	-	-	-	-	-	-
Wall spaces											
None	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Curtains	-	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	-	-	-
Roof											
None	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Extra shelter	-	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	-	-	-
Treatment to animal											
Wallowing once	11.1	26.1	28.9	16.7	22.0	29.2	69.2	51.6	46.7	44.0	33.0
Wallowing twice	59.3	34.8	42.2	83.3	50.0	48.8	23.1	38.7	33.3	40.0	45.0
Washing once	3.7	4.3	10.5	-	6.0	2.4	23.1	6.5	-	6.0	6.0
Washing more than once	55.6	65.2	52.6	41.7	55.0	82.9	76.9	58.0	66.7	72.0	63.5

Continued....

Table 20 continued

Particulars	Karnal distric (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
b) Winter											
Floor(for calves)											
None	3.7	-	5.3	-	3.0	-	-	-	-	-	1.5
Bedding	96.3	100.0	94.7	100.0	97.0	100.0	100.0	100.0	100.0	100.0	98.5
Others	-	-	-	-	-	-	-	-	-	-	-
Wall spaces											
None	51.9	43.5	50.0	66.7	51.0	46.3	53.8	25.8	66.7	44.0	47.5
Curtains	48.1	56.5	50.0	33.3	49.0	53.7	46.2	74.2	33.3	56.0	52.5
Others	-	-	-	-	-	-	-	-	-	-	-
Roof											
None	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Extra shelter	-	-	-	-	-	-	-	-	-	-	-
Others	-	-	-	-	-	-	-	-	-	-	-
Animal											
None	63.0	73.9	65.8	83.3	69.0	7.3	7.7	16.1	20.0	12.0	40.5
Jacket	37.0	26.1	34.2	16.7	31.0	92.7	92.3	83.9	80.0	88.0	59.5
Others	-	-	-	-	-	-	-	-	-	-	-

Table 21: Season specific day-night movement of buffaloes vis-a-vis houses on different categories of holdings (% total within each category)

Particulars		Karnal district (2 villages)					Hisar district (2 villages)					Overall
		Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
a) Where animals kept at night												
Open	S	70.4	78.3	71.0	66.7	72.0	87.8	100.0	100.0	100.0	95.0	83.5
	W	3.7	-	-	-	1.0	-	-	-	-	-	0.5
	R	70.4	73.9	65.8	50.0	67.0	82.9	92.3	83.9	80.0	84.0	75.5
Undertee	S	7.4	8.7	10.5	16.7	10.0	7.3	-	-	-	3.0	6.5
	W	-	-	-	-	-	-	-	-	-	-	-
	R	11.1	-	10.5	16.7	9.0	9.8	7.7	9.7	-	8.0	8.5
Under shed+ human dwelling	S	14.8	13.0	10.5	16.6	13.0	4.9	-	-	-	2.0	7.5
	W	77.8	47.8	16.3	33.3	46.0	63.4	23.1	38.7	33.3	46.0	46.0
	R	14.8	26.1	10.6	33.3	18.0	7.3	-	-	-	2.0	10.0
Closed house	S	3.7	-	2.6	-	2.0	-	-	-	-	-	1.0
	W	18.5	52.2	73.7	66.7	53.0	36.6	69.2	58.1	66.7	52.0	52.5
	R	-	-	10.6	-	4.0	-	-	-	-	4.0	4.0

Continued.....

Table 21 continued..

Particulars		Karnal district (2 villages) Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Hisar district (2 villages) Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	Overall (N=200)
b) Where animals kept during day												
Open	S	70.4	65.2	60.5	66.7	65.0	41.5	23.1	32.3	13.3	32.0	48.5
	W	88.9	91.3	89.5	83.3	89.0	95.1	92.3	100.0	100.0	97.0	83.0
	R	85.2	69.6	81.6	66.6	78.0	73.2	61.5	64.5	60.0	67.0	72.5
Undertree	S	22.2	21.7	28.9	16.7	25.0	53.7	69.2	61.3	66.7	60.0	42.5
	W	-	-	-	-	-	4.9	7.7	-	-	3.0	1.5
	R	7.4	8.7	5.3	-	6.0	24.4	30.8	29.0	20.0	26.0	16.0
Under shed+ human dwelling	S	7.4	8.7	5.2	8.3	6.0	4.8	7.7	3.2	-	5.0	5.5
	W	3.7	8.7	5.3	8.3	6.0	-	-	-	-	-	3.0
	R	3.7	13.0	10.6	16.7	10.0	2.4	7.7	3.2	13.3	5.0	7.5
Closed house	S	-	-	5.3	-	2.0	-	-	-	6.7	1.0	1.5
	W	-	-	5.3	-	2.0	-	-	-	-	-	1.0
	R	-	-	2.6	-	1.0	-	-	3.2	6.7	2.0	1.5

S = Summer

W = Winter

R = Rainy

Table 22:. Shed hygiene and sanitation practices followed by buffalo owners on different categories of holdings (% total within each category)

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
a) Shed cleaning times/day											
0	-	-	-	-	-	-	-	-	-	-	-
1-2	77.8	82.6	84.2	91.7	83.0	87.8	92.3	90.3	100.0	91.0	87.0
3-4	18.5	17.4	15.8	8.3	16.0	12.2	7.7	9.7	-	9.0	12.5
7 4	3.7	-	-	-	1.0	-	-	-	-	-	0.5
b) Method of cleaning											
Dry sweeping	96.3	95.7	100.0	100.0	98.0	100.0	100.0	100.0	100.0	100.0	99.0
Washing	3.7	4.3	-	-	2.0	-	-	-	-	-	1.0
Others	-	-	-	-	-	-	-	-	-	-	-
c) Disposal pattern of dung (Solid=S, Liquid=L, waste=W)											
S, L & W separately	-	-	-	-	-	-	-	-	-	-	-
S+L together	-	-	-	-	-	-	-	-	-	-	-
S+L+W together	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
d) Most common use of dung											
Fertilizer	-	30.4	10.5	33.3	15.0	-	15.4	9.7	46.7	12.0	13.5
Fuel	100.0	59.6	89.5	66.7	85.0	100.0	84.6	90.3	53.3	88.0	86.5
Sold	-	-	-	-	-	-	-	-	-	-	-

Continued ....

Table 22 continued ...

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (N=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
e) Use of disinfectants for shed cleaning											
None	100.0	82.6	94.7	100.0	94.0	92.7	100.0	100.0	93.3	96.0	95.0
Phenyl daily	-	-	-	-	-	-	-	-	-	-	-
Phenyl sometimes	-	17.4	5.3	-	6.0	7.3	-	-	6.7	4.0	5.0
f) Protection against insects											
None	92.6	73.9	86.8	58.3	82.0	9.8	-	16.1	13.3	11.0	46.6
Provide screen	-	-	-	-	-	-	-	-	-	-	-
Make smoke	7.4	8.7	7.9	41.7	12.0	87.8	84.6	67.8	46.7	75.0	43.5
Spraying insecticides	-	17.4	5.3	-	6.0	2.4	15.4	16.1	40.0	14.0	10.0
Others	-	-	-	-	-	-	-	-	-	-	-
g) Frequency of spraying insecticides											
Never	100.0	82.6	94.7	100.0	94.0	97.6	84.6	83.9	60.0	86.0	90.0
Weekly	-	-	-	-	-	-	-	-	-	-	-
Fortnightly	-	-	-	-	-	-	-	-	-	-	-
Monthly	-	-	-	-	-	-	-	-	-	-	-
1 or 2 in a year	-	17.4	5.3	-	6.0	2.4	15.4	16.1	40.0	14.0	10.0

Table 23: Hygiene related management practices of buffaloes on different categories of households (% total within each category)

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
a) Provision of bedding to young stock											
When											
Never	3.7	-	5.3	-	3.0	-	-	-	-	-	1.5
In summer	-	-	-	-	-	-	-	-	-	-	-
In winter	96.3	100.0	94.7	100.0	97.0	100.0	100.0	100.0	100.0	100.0	98.5
In rains	-	-	-	-	-	-	-	-	-	-	-
Material used											
Dry sand	7.4	13.0	-	-	5.2	12.2	23.0	3.2	13.3	11.0	8.2
Dry dung	7.4	8.7	-	8.3	5.3	9.8	-	-	-	4.0	4.6
Waste fodder	66.7	69.6	63.2	83.3	64.9	46.3	46.2	71.0	86.7	60.0	62.6
Bhusa	18.5	8.7	28.9	8.3	19.6	31.7	30.8	25.8	-	25.0	22.3
Earth	-	-	7.9	-	4.1	-	-	-	-	-	2.2
b) Grooming of animals											
Never	44.4	26.1	39.5	58.3	40.0	17.1	23.1	12.9	26.7	18.0	29.0
With hand	22.2	26.1	15.8	25.0	21.0	80.5	79.9	83.9	53.3	77.0	49.0
With straw	18.6	43.5	23.7	16.7	26.0	2.4	-	-	6.7	2.0	14.0
With gunny bag	11.1	4.3	21.1	-	12.0	-	-	-	13.3	2.0	7.0
Others	3.7	-	-	-	1.0	-	-	3.2	-	1.0	1.0

Continued....

Table 23: Hygiene related management practices of buffaloes on different categories of households (% total within each category)

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
a) Provision of bedding to young stock											
When											
Never	3.7	-	5.3	-	3.0	-	-	-	-	-	1.5
In summer	-	-	-	-	-	-	-	-	-	-	-
In winter	96.3	100.0	94.7	100.0	97.0	100.0	100.0	100.0	100.0	100.0	98.5
In rains	-	-	-	-	-	-	-	-	-	-	-
Material used											
Dry sand	7.4	13.0	-	-	5.2	12.2	23.0	3.2	13.3	11.0	8.2
Dry dung	7.4	8.7	-	8.3	5.3	9.8	-	-	-	4.0	4.6
Waste fodder	66.7	69.6	63.2	83.3	64.9	46.3	46.2	71.0	86.7	60.0	62.6
Bhusa	18.5	8.7	28.9	8.3	19.6	31.7	30.8	25.8	-	25.0	22.3
Earth	-	-	7.9	-	4.1	-	-	-	-	-	2.2
b) Grooming of animals											
Never	44.4	26.1	39.5	58.3	40.0	17.1	23.1	12.9	26.7	18.0	29.0
With hand	22.2	26.1	15.8	25.0	21.0	80.5	79.9	83.9	53.3	77.0	49.0
With straw	18.6	43.5	23.7	16.7	26.0	2.4	-	-	6.7	2.0	14.0
With gunny bag	11.1	4.3	21.1	-	12.0	-	-	-	13.3	2.0	7.0
Others	3.7	-	-	-	1.0	-	-	3.2	-	1.0	1.0

Continued....

Table 23 continued...

Particulars		Karnal district (2 villages) Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Hisar district (2 villages) Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100	Overall (N=200)
c) Wallowing												
Frequency												
Never		29.6	39.1	28.9	-	28.0	22.0	7.7	9.7	20.0	16.0	22.0
Daily once in summer (S)		11.1	26.1	28.9	16.7	22.0	29.2	69.2	51.6	46.7	44.0	33.0
Daily once in winter & rainy (R)		29.6	43.5	31.6	33.3	34.0	31.7	69.2	54.8	40.0	45.0	39.5
Daily twice in summer		59.3	34.8	42.2	83.3	50.0	48.8	23.1	38.7	33.3	40.0	45.0
Daily twice in winter & rainy		40.8	17.4	39.5	66.7	38.0	46.3	23.1	65.5	40.0	39.0	38.5
d) Time spent for wallowing per day(hours)												
½ hr	S	-	-	-	-	-	-	-	-	-	-	-
	R	-	-	-	8.3	1.0	-	-	-	6.7	1.0	1.0
½-1 hr	S	7.4	8.7	15.8	8.3	11.0	2.4	7.7	3.2	-	3.0	7.0
	R	14.8	17.4	26.3	16.7	20.0	-	7.7	3.2	-	2.0	11.0
1.1-2 hr	S	14.8	21.7	18.4	-	16.0	36.6	30.8	25.8	26.7	31.0	23.5
	R	29.6	21.7	18.4	8.3	21.0	39.0	30.7	25.8	33.3	33.0	27.0
2.1-3 hr	S	7.4	13.0	18.4	58.3	19.0	22.0	30.8	9.7	33.3	21.0	20.0
	R	14.8	17.4	5.3	33.3	14.0	24.4	30.8	22.6	20.0	24.0	19.0
7 3 hr	S	40.7	17.4	21.1	33.3	27.0	19.5	23.1	48.4	20.0	29.0	28.0
	R	3.7	4.3	15.8	33.3	12.0	17.1	23.1	38.7	20.0	25.0	18.5
No wallowing	S	29.6	39.2	26.3	-	27.0	19.5	7.7	12.9	20.0	16.0	21.5
	R	37.1	39.2	34.2	-	32.0	19.5	7.7	9.7	20.0	15.0	23.5

Continued.....

Table 23 continued...

Particulars	Karnal district (2 villages)					Hisar district (2 villages)					Overall
	Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
e) Washing of buffalo/day											
Summer											
Daily once	3.7	4.3	10.5	-	6.0	2.4	23.1	6.5	-	6.0	6.0
Daily > once	55.6	65.2	52.6	41.7	55.0	82.9	76.9	58.0	66.7	72.0	63.5
Weekly once	-	-	2.6	-	1.0	2.4	-	-	6.7	2.0	1.5
No	40.7	34.8	21.1	58.3	38.0	12.3	-	35.5	26.6	20.0	29.0
Winter											
Daily once	-	4.3	2.6	-	2.0	9.8	23.1	6.4	16.6	13.0	7.5
Weekly twice	7.4	4.3	7.9	8.3	7.0	7.3	7.7	-	-	4.0	5.5
Weekly once	7.4	13.0	10.5	8.3	10.0	29.3	7.7	45.2	33.3	36.0	23.0
No	85.2	78.4	79.0	83.4	81.0	53.6	61.5	48.4	40.1	47.0	64.0

Table 24: Milking management of buffaloes on different categories of holdings (% total within each category)

Particulars		Karnal district(2 villages)					Hisar district (2 villages)					Overall
		Landless (n=27)	Small (n=24)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
a) Place of milking												
Same place as housed		100.0	95.7	92.1	91.7	95.0	97.6	100.0	93.5	100.0	97.0	96.0
Separate clean place		-	4.3	7.9	8.3	5.0	2.4	-	6.5	-	3.0	4.0
Other places		-	-	-	-	-	-	-	-	-	-	-
b) Pre-milking cleaning												
Washing whole animal	None	96.3	100.0	100.0	100.0	99.0	97.6	84.6	83.9	100.0	92.0	95.5
	Some	3.7	-	-	-	1.0	2.4	15.4	16.1	-	8.0	4.5
	Hind quarters	-	-	-	-	-	-	-	-	-	-	-
	Udder+ teats	96.3	100.0	100.0	100.0	99.0	100.0	84.2	87.1	100.0	94.0	96.5
	Milker's hand	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	Milking vessel	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Continued

Table 24 continued..

Particulars		Karnal district (2 villages) Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Hisar district (2 villages) Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	Overall (N=200)
c) Method of milking												
Dry hand-full hand		-	-	-	-	-	-	-	-	-	-	-
Dry hand-stripping		-	-	-	-	-	-	-	-	-	-	-
Wet hand-full hand		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wet hand-stripping		-	-	-	-	-	-	-	-	-	-	-
Thumb in		74.1	39.1	57.9	75.0	60.0	90.2	100.0	90.3	93.3	92.0	76.0
Thumb out		25.9	60,9	42.1	25.0	40.0	9.8	-	9.7	6.7	8.0	24.0
Stripping at the end	Yes	-	-	-	-	-	-	-	3.2	-	1.0	0.5
	No	100.0	100.0	100.0	100.0	100.0	100.0	100.0	96.8	100.0	99.0	99.5
Udder cleaning at the end	Yes	-	-	-	-	-	2.4	7.7	6.5	6.7	5.0	2.5
	No	100.0	100.0	100.0	100.0	100.0	97.6	92.3	93.5	93.3	95.0	97.5
d) Calf suckling												
Before milking		-	-	-	-	-	-	-	-	-	-	-
After milking		-	-	-	-	-	-	-	-	-	-	-
Both times		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Continued .....

Table 24 continued...

Particulars	Karnal district (2 villages) Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Hisar district (2 villages) Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	Overall (N=200)
e) Milk left to young calves											
2 full quarter	14.8	26.1	26.3	25.0	23.0	26.8	23.1	25.8	20.0	25.0	24.0
1+½ quarter	3.7	-	2.6	-	2.0	2.4	15.4	3.2	6.7	5.0	3.5
1 full quarter	59.3	65.2	57.9	66.7	61.0	48.8	30.8	38.7	33 .3	41.0	51.0
½ of a quarter	14.8	8.7	10.5	8.3	11.0	22.0	30.8	29.0	40.0	28.0	19.5
¼ of a quarter	3.7	-	-	-	1.0	-	-	-	-	-	0.5
Only for letdown	3.7	-	2.6	-	2.0	-	-	3.2	-	1.0	1.5
f) When colostrum feeding allowed (after the birth)											
Never	-	-	-	-	-	-	-	-	-	-	-
½ hr	-	4.3	-	-	1.0	2.4	-	-	-	1.0	1.0
Within ½ - 1 hr	3.7	-	-	8.3	2.0	-	15.5	6.5	6.7	5.0	3.5
Within 1 - 2 hr	3.7	4.3	2.6	16.7	5.0	2.4	23.0	22.6	13.3	13.0	9.0
Within 2 - 4 hr	-	-	2.6	-	1.0	7.2	-	12.9	20.0	10.0	5.5
Before fall of placenta	-	4.3	5.2	8.3	3.0	-	-	3.2	-	1.0	2.0
After fall of placenta	92.6	87.1	89.6	66.7	88.0	88.0	61.5	54.8	60.0	70.0	79.0
g) How difficult milker buffaloes tackled											
Beaten animal	11.1	4.4	-	16.7	6.0	2.4	7.7	12.9	-	6.0	6.0
Try phooka	-	-	-	-	-	-	-	-	-	-	-
Provide some concentrate	37.0	73.9	60.5	66.7	58.0	92.7	76.9	48.4	66.7	73.0	65.5
Try after sometime	48.1	21.7	23.7	8.3	28.0	-	7.7	3.2	-	2.0	15.0
Use oxytocin	3.7	-	13.2	8.3	7.0	4.9	7.7	35.5	33.3	19.0	13.0
Wait for next term	-	-	2.6	-	1.0	-	-	-	-	-	0.5

Table 25: Reproduction management practices followed by buffalo owners on different categories of holdings (% total within each category)

Particulars		Karnal district (2 villages)					Hisar district (2 villages)					Overall
		Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	(N=200)
		a) Most(M) and Next (N) common symptoms of heat looked for										
DOKA	M	11.1	-	5.3	-	5.0	4.9	7.7	29.1	13.3	14.0	9.5
	N	48.2	43.6	42.1	50.0	45.0	36.6	38.4	41.9	33.3	38.0	41.5
Bellowing	M	77.8	91.3	94.7	100.0	90.0	85.4	76.9	67.7	80.0	78.0	84.0
	N	11.1	8.7	2.6	-	6.0	4.9	15.4	3.2	13.3	7.0	6.5
Drop in milk	M	-	-	-	-	-	-	-	-	-	-	-
	N	18.5	4.3	15.8	8.3	13.0	12.2	-	-	6.7	6.0	9.5
Off feed	M	3.7	4.3	-	-	2.0	-	-	-	6.7	1.0	1.5
	N	11.1	-	2.6	-	4.0	-	-	-	-	-	2.0
Frequent urination	M	-	-	-	-	-	-	-	-	-	-	-
	N	7.4	8.7	7.9	-	7.0	-	-	3.2	-	1.0	4.0
Vaginal discharge	M	3.7	4.3	-	-	2.0	7.3	15.4	3.2	-	6.0	4.0
	N	3.7	13.0	23.7	33.3	17.0	41.5	23.1	48.4	40.0	41.0	29.0
Mounting others	M	-	-	-	-	-	2.4	-	-	-	1.0	0.5
	N	-	17.3	5.2	-	6.0	4.8	23.1	3.2	6.7	7.0	6.5
Teaser	M	3.7	-	-	-	1.0	-	-	-	-	-	0.5
	N	-	4.3	-	8.3	2.0	-	-	-	-	-	1.5

Continued .....

Table 25 continued....

Particulars	Karnal district(2 villages) Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Hisar district (2 villages) Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	Overall (N=200)
b) Most common season of service											
Summer	-	-	-	-	-	-	-	-	-	-	-
Winter	74.1	82.6	76.3	75.0	77.0	73.2	76.9	74.2	73.3	74.0	75.0
Rains	25.9	17.4	23.7	25.0	23.0	26.8	23.1	25.8	26.7	26.0	24.5
c) How buffalo is served											
Stray bull	37.0	30.4	29.0	33.4	32.0	41.5	46.2	58.1	66.7	51.0	41.5
Improved bull	37.0	56.5	47.4	50.0	47.0	53.7	38.5	38.7	26.7	43.0	45.0
Artificial insemination	18.5	8.7	10.5	8.3	12.0	4.8	15.4	3.2	6.6	6.0	9.0
Drafting bull	7.4	4.3	13.1	8.3	9.0	-	-	-	-	-	4.5
d) Owner of the bull											
Panchayat	-	4.8	-	-	1.1	92.3	100.0	93.0	100.0	93.7	49.2
Self	9.1	4.8	32.4	45.5	21.6	-	-	3.3	-	1.1	10.9
Other farmer	90.9	90.4	67.6	54.5	77.3	7.7	-	3.3	-	5.3	39.9
e) If A.I. preferred, why?											
Cheap	8.3	-	-	-	3.7	-	-	-	-	-	3.0
Improved bull	8.3	-	33.3	-	14.8	50.0	-	-	-	16.7	15.1
Nearby and easy	8.3	-	-	-	3.7	-	-	-	-	-	3.0
Adviced by specialist	-	-	-	-	-	-	50.0	-	-	16.7	3.0
Friends or relatives insist	-	-	-	-	-	-	-	-	-	-	-
Fetch good price	75.0	100.0	66.7	100.0	77.8	50.0	50.0	100.0	100.0	66.6	75.8

Table 25 continued...

Particulars	Karnal district (2 villages) Landless (n=27)	Small (n=23)	Medium (n=38)	Big (n=12)	All (n=100)	Hisar district (2 villages) Landless (n=41)	Small (n=13)	Medium (n=31)	Big (n=15)	All (n=100)	Overall (N=200)
f) If A.I. not preferred, why not?											
A.I. is not good	11.8	42.0	32.2	10.0	27.4	12.8	27.3	30.0	14.3	20.2	23.4
Don't know A.I.	11.8	15.8	10.7	-	9.6	7.7	9.1	10.0	-	7.5	8.4
Low conception	35.3	21.1	25.0	10.0	24.7	33.3	36.4	33.3	57.1	37.2	31.7
Repeated many times	-	-	-	10.0	1.4	-	-	-	-	-	0.6
Needs time and effort	5.8	-	-	-	1.4	2.6	-	-	-	1.1	1.2
Not available in villages	11.8	15.8	21.4	40.0	20.5	7.7	9.1	6.7	7.1	7.4	13.2
A.I. staff not good	-	5.3	-	-	1.4	-	-	6.7	7.1	3.2	2.4
Natural convenient	17.6	-	3.6	20.0	8.2	-	18.1	-	-	-	3.6
Bull available in village	5.9	-	7.1	10.0	5.5	35.9	-	13.3	14.3	23.4	15.6

Table 26: Comparison of buffalo housing and allied management practices in villages with that on HAU farm

Parameters		Practice followed by majority of farmers: Most common	Practice followed by majority of farmers: % following it	Practice on HAU farm	Whether HAU practice seen in villages: Yes/No	Whether HAU practice seen in villages: If yes, % farmers following that
Housing system		Shed+open	78	Loose house	No	-
How buffaloes housed		with other animals	36.5	Buffaloes alone	Yes	31.0
Covered area/A.U.(m^2)		> 5	51·0	3.69	Yes	30.5
Paddock area/A.U.(m^2)		> 5	30.8	9.82	Yes	30.8
Floor	Type	Unpaved	100.0	Paved	No	-
	Surface	Dirt	78.5	Bricks+cement	Yes	3.2
	Slope	No	86.0	0.55 cm/m	Yes	14.0
Roof	Material	Mud	47.8	Asbestos	No	-
	Type	Flat	91.4	Single slope	Yes	6.5
	Height	1.9-2.4m	77.8	2.5 m	Yes	77.8
	Thickness	11-20 cm	74.2	2.0 cm	No	-
Wall	Presence	Yes	98.0	100%	No	-
	Part/full	Full	-	Half	No	-
	Material	Bricks	43.0	Brick+cement	Yes	21.0
	Coverage of shed perimeter	Yes	> 75.0	68.6%	Yes	73.3
Drainage provided		No	90.5	Yes	Yes	9.5

Continued.....

Table 26 continued.....

Parameter		Practice followed by majority of farmers: Most common	Practice followed by majority of farmers: % following it	Practice on HAU farm	Whether HAU practice seen in villages: Yes/No	Whether HAU practice seen in villages: If yes, % farmers following that
Manger	Type	Brick+mud	55.0	Cemented	Yes	3.0
	Length/A.U.	>0.70 m	75.3	0.74 m	Yes	75.3
Water trough:	Type	Cemented (long)	100.0	Cemented (round)	No	-
	Length/A.U.	20-30 cm	66.7	40 cm	Yes	66.7
Whether buffalo loose		Tethered	100.0	Loose	No	-
Animal movement due to season		Yes	100.0	No	No	-
Separate shed for calves		No	-	Yes	No	-
Separate milking place		No	-	Yes	No	-
Washing facilities in shed		No	-	Yes	No	-
Dung clearance		Daily twice	87.0	Daily once	Yes	3.0
Use of dung		Fuel+manure	100.0	Manure alone	No	-
Disinfectants used		None	95.0	Phenyl	Yes	5.0
Insecticides used		None	90.0	Melathion	Yes	10.0

A P P E N D I C E S - II

DEPARTMENT OF LIVESTOCK PRODUCTION AND MANAGEMENT

HARYANA AGRICULTURAL UNIVERSITY, HISAR

FARMER'S INTERVIEW SCHEDULE

Project Title : Studies on buffalo housing and associated management practices in Haryana.

PARTICULARS OF FARMER AND HIS FARM

1. Name of the farmer : _____
2. Father's name : _____
3. Age of the farmer : _____
4. Caste : _____
5. Main occupation : Crop farming/crop+dairy/ casual labour/farming+ cacual labour/others (specify)
6. Subsidiary occupation : _____
7. Educational qualification of farmer : Illiterate/Primary/ Middle/Matric/Graduate/ Post-graduate.
8. Total family members : _____
   a) Adult males : _____
   b) Adult females : _____
   c) Children above 10 years : _____
      i) Male : _____
      ii) Female : _____
   d) Children below 10 years : _____
      i) Male : _____
      ii) Female : _____

9. Total land holding : _____

   a) Total area : _____

   b) Irrigated : _____

   c) Unirrigated : _____

10. Source of irrigation : Canal/tubewell/pumping set/any other.

11. Total area under fodder crops :

   a) Rabi : _____

   b) Kharif : _____

12. Herd strength : _____

   a) Buffaloes : _____

      i) Adult buffaloes : _____

      ii) Buffaloes in milk : _____

      iii) Heifers : _____

      iv) Calves : _____

         Male : _____

         Female : _____

      v) Bullocks : _____

   b) Cattle : _____

      i) Adult cows : _____

      ii) Cows in milk : _____

      iii) Heifers : _____

      iv) Calves : _____

         Male : _____

         Female : _____

      v) Bullocks : _____

BUFFALO HOUSING PRACTICES

1. Type of house/housing : Open/under tree/lean to/ sheltered paddock(loose house)/closed house/ other type.

2. Location of shed : Inside dwelling/near dwelling/separate from dwelling/infields/in grazing land/other.

3. Sharing of sheds : Buffaloes alone/buffalo+ man/buffalo+cattle/ buffalo+other(specify).

4. Dimension of shed :
   a) Length(m) : _____
   b) Breadth (m) : _____
   c) Total area (m^2) : _____
   d) Area per animal (m^2) : _____

5. Roof :
   a) Material : Concrete/thatched/mud/ Asbestos/wood/brick+mud/ other(specify).
   c) Features : Flat/single slope/ double slope
      Angle of slope _____
      Extension of eaves(m) _____
   c) Dimension of roof :
      i) Length (m) : _____
      ii) Breadth (m) : _____
      iii) Thickness (m) : _____
   d) Height of roof : ___
      i) Height of ridge (m) : _____
      ii) Height of eaves (m) : _____
      iii) Height of flat roof (m) : _____

6. Walls : _____

a) Materials : Cement/mud/bricks/ wood/sticks /brick+ mud/brick+cement/others.

b) Dimension :

i) Height (m) : _____

ii) Length (m) : _____

iii) Width (m) : _____

iv) Coverage : 1/2/3/4/sides covered

7. Floor :

a) Type :Dirt/paved/bricks only/ Bricks+mud/bricks+ cement/others(specify)

b) Slope : _____

c) Drainage channel : Yes/No

d) Evenness of surface : Good/So so/bad

8. Manger :

a) Total length (m) : _____

b) Length/adult unit(m) : _____

c) Height of manger (inner wall) from ground (m) : _____

d) Depth of manger(m) : _____

e) Width of manger(m) : _____

f) Height of manger(outer wall)from ground (m) : _____

9. Water trough :

a) Provided : Yes/No

b) If yes:Total length(m) : _____

Length/adult unit(m) : _____

c) Type : Pucca/bucket/drums/ others.

d) Design : Long/round/triangular/ other design.

e) Height of water trough from ground(m) : _____

f) Depth (m) : _____

g) Width (m) : _____

h) Quantum of water/adult unit/day(Lit.) : _____

i) Source of water : Canal/tubewell/pumping set/wells/johar/diggy water works/others.

j) Water treatment: : Setting/filtering/ treatment/cooling/ others.

10. Ventilation (windows) :

a) 0/1/2/3/more :

b) Size of window : _____

Length(m) : _____

Breadth (m) : _____

c) Height from floor(m) : _____

11. Manure clearance and disposal :

	Liquid	Dung	Other wastes
Direct to pits			
Direct to fields			
To manure pits			
Used as fuel			
Let off			
Sold			

12. Sanitation practices :

a) How many times do you clean animal shed/day : _____

b) Mode of cleaning : Dry sweeping/washing with water/others

c) Do you use any disinfectant : Yes/No

d) If yes,which disinfectant :

At the interval of : _____

e) Do you take any step to check flies,mosquotoes, etc. : Yes/No

f) If yes, what are the steps : Provide screen/make smokes/spraying insecticides/other.

g) How frequently : Weekly/fortnight/monthly/ 2/3/4/times in a year.

h) in which season mostly : Summer/winter/rainy.

13. Seasonal and diurnal alterations in system of housing :

a) Do you use some extra material to protect your sheds in different seasons : Yes/No

b) If yes,what do you do for : _____

Floor	Summer	:	_____
	Winter	:	_____
	Rainy	:	_____
Roof	Summer	:	_____
	Winter	:	_____
	Rainy	:	_____
Wall	Summer	:	_____
	Winter	:	_____
	Rainy	:	_____

(Name the materials used,i.e., beding materials,gunny bags,curtains).

14. Seasonal/specific movement/ care of animals :

a) Where the animals are kept at night :

Summer : _____

Winter : _____

Rainy : _____

b) Where the animals are kept during day :

Summer : _____

Winter : _____

Rainy : _____

c) Do you provide any protection media to your animals in different seasons : Yes/No

d) If yes, what is that thing : Mud/jacket/Jhules/ tarpauline/others.

e) In which season and at what time : Summer Winter Rainy

Day :

Night :

f) Do you use any medicine to protect animals for ticks/lice,etc. : Yes/No

g) If yes,which medicine : _____

h) At what interval : Weekly/monthly/fort-nightly/some times.

i) In which season mostly : Summer/winter/rainy.

15. Costs of house/maintenance/ housing management :

a) Age of shed (years) : _____

b) Costs of construction :Rs._____

c) Approximate annual maintenance cost : Rs._____

d) Labour wages/day for shed cleaning,etc.

Family labour(hr) : _____

Hired labour (hr) : _____

Total (hr) : _____

REPRODUCTION MANAGEMENT

1. How do you detect heat : From Doka/milk production reduced/left feed/ mounting on others/ frequency of urination/ from the discharge of vaginal opening/uneasiness/bellowing/other symptoms.

2. Where do you take your buffaloes for service : Stray bulls/improved bull/A.I.

3. To whom does the bull belong : Panchayat/farmer/other.

4. Do you prefer A.I. for your buffaloes : Yes/No

a) If yes, why : _____

b) If no, give reasons : _____

i) A.I. is not good : _____

ii) I don't know A.I. : _____

iii) Conception is low in A.I. : _____

iv) It needs time and wages to take the buffaloes to A.I. centre : _____

v) A.I. facilities are not available in village : _____

vi) Staff does not take interest. : _____

vii) Any other reasons (Specify) : _____

5. Service period of buffaloes (months) calved in different seasons : Summer Winter Rainy

6. Calving : Normal/difficult

a) If difficult what : Delayed birth/dead calf/retained placenta/ discharges.

b) How treated : Self/village quack/ stockman/VAS/None.

7. Age at first calving(months) : _____

8. Calving interval(months) : _____

9. Do you sell buffaloes : Yes/No

10. If yes mostly which : Heifers/new calves/ older calves/old animals.

MANAGEMENT PRACTICES

1. Do you provide bedding for your animals : Yes/No

2. If yes
a) What is the kind of bedding : Dry sand/earth/waste fodder/bhusa/others.

b) In which season : Summer Winter Rainy

3. Do you groom your animals : Yes/No

4.	If yes, how	: With hand/with bhusa/ with gunny bag/others.
5.	How many times do you offer water to your animals	: _____
	Smmer	: _____
	Winter	: _____
	Rainy	: _____
6.	Do you take your buffaloes for wallowing	: Yes/No
7.	If yes, how much time they spent for wallowing in different season(hours)	:
	Summer	: _____
	Winter	: _____
	Rainy	: _____
8.	Do you wash your buffaloes	: Yes/No
9.	If yes, how many times	: Time Hours
	Summer	:
	Winter	:
10.	Do you take your animals to a dry and clean place for milking	: Yes/No
11.	Do you milk at the same place	: Yes/No
12.	Do you wash buffaloes before milking	: Yes/No
13.	a) Whole body of the animals	: Yes/No
	b) Only hind quarters	: Yes/No
	c) Teats only	: Yes/No
	d) Udder only	: Yes/No
	e) Milkers hand	: Yes/No
	f) Milking buckets	: Yes/No

14. What method of milking do you follow :

a) Dry hand method : _____

b) Wet hand method : _____

d) Full hand method : _____

i) Thumb in/ Thumb out : _____

d) Stripping at the end of milking : Yes/No

e) Do you wipe to udder clean after milking : Yes/No

f) When the calf is allowed to suckle(not let-down) before milking/after milking/both times. : _____

15. Is colostrum fed to calf : Yes/No

16. If yes,at what time after calving(hours) : Within 1/2/1/2/4 after 4/before fall of placenta/after fall of placenta.

17. How much colostrum allowed for calf : All/half/one quarter/ half of a quarter/ ¼th of a quarter/ ad lib.

18. How much milk is left for calf : Upto 1 1-2 2-3 3-6

One full quarter

Two full quarter

One half quarter

Two half quarter

Full+half quarter

19. How much time take in falling of placenta(hours) : _____

20. Some time animal suddenly refuse to give milk, what do you do :

a) Beat the animal : _____

b) Try Phooka (insert tail in to vagina) : _____

c) Try again after some time : _____

d) Provide some concentrate : _____

e) Drugs : _____

f) Others : _____

STUDIES ON BUFFALO HOUSING AND ASSOCIATED MANAGEMENT PRACTICES IN HARYANA

By

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(An abstract of the dissertation submitted to the Haryana Agricultural University in partial fulfilment of the requirements for the degree of Ph.D. in the subject of Livestock Production and Management).

A field study was conducted to assess the buffalo housing system and the associated management practices being followed by various categories of farmers in Karnal and Hisar districts of Haryana vis-a-vis the practices followed at Haryana Agricultural University, Animal Farm. The desired information was collected using a specially designed questionnaire and schedule supplemented with visual observations and actual measurements.

It was found in the sample survey that the farmers predominently maintained their buffaloes under shed and in open area depending upon the seasonal and diurnal variations of climatic environment. Materials used for the construction of roof and walls were mostly 'Katcha' type, height of roof lower, full wall covering of all the four sides of buffalo house, leaving space just for a door on one side, was not conducive for the creation of an ideal micro-climate inside especially during hot season.

Manger dimensions were generally lesser than required. Water troughs were scantily used. Floors without slope and unevenness of floor surface were noticed. Lack of proper ventilation and drainage were observed. Farmers were not using any disinfectants or insecticides and cleaning of dung from shed was done only twice a day and milking was normally done where the buffaloes were housed. Proper sanitations, in the houses/shelters as well as conditions of hygienic and clean milk production were absent in many instances.

Farmers were unaware of cheap and effective management innovations like use of additional coverage to foof, provision of pannels or curtains in wall spaces and their wetting during summer season for maximising production. However, grooming, washing and wallowing of animals, washing of udder, teats, milking vessels and milker's hands before milking were done as required.

It was found that colostrum feeding to new born calves were allowed only after the expulsion of placenta which is somewhat belated for the proper development of the calf's immune system. Leaving one quarter of udder milk for suckling by calves was a common practice which may lead to either under or over feeding. Artificial insemination was not very popular amongst the farmers because of ignorance and organisational constraints of this potential breeding technique.

It was inferred from the present study that to improve the production and reproduction efficiency of buffaloes maintained by the farmers in the villages a well-developed package of "Transferable technology" should be launched.