



## Research Article

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# THE IMPORTANCE OF SHEEP SHELTERS IN COLD CLIMATE REGION

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### Abstract

Sheep farming is one of the important elements of animal husbandry. Since animals spend the winter and summer seasons in different regions in sheep breeding, sheep farming is shaped depending on pastures. This situation results in differences to meet animal needs such as feeding and accommodation of animal, drinking water, etc. depending on the structure of the region. Sheep breeders focus on animal nutrition and they do not show too much care to structures and surrounding areas of animal barn. Large amount of waste are released into the environment when sheep are grazing in different pastures. Appropriate shelter should be designed for animals to protect from rain and snow in winter, hot in summer especially at times when the sun's intense, and environmental pollution. Several factors have great importance for proper designing of animal shelter. Sufficient space should be left per animal and animal shelters should have adequate ventilation and waste management systems. Otherwise, due to the structural problems, some negative results will occur. Animals may be hurt each other, harmful gases increase and reaches dangerous levels, environmental pollution happens; stress in animals, reduction in feed consumption and results in reduced of yield. Considering all these factors, suitable for sheep farming in cold climate regions and designed according to local conditions, healthy, efficient and applicable plans and recommendations will present in our study.

**Keywords:** Climate, Sheep, Sheep breeding, Sheep shelter planning, Waste management, Farm management

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### 1. Introduction

Sheeps are important sources of milk, meat and wool. There is some dispute between farmers over whether sheep require housing or not. Because they are dependent on grazing in the field and for them readily adapt to a wide range of climates and available feed supplies. Some animal owners believe that it is more suitable to keep sheep outdoors; however heavy cold

winters can be fatal for sheep.

Farmers and managers have a responsibility to provide adequate shelter for their sheep. A suitable shelter allows sheep to better cope with the different climatic extremes that can occur throughout the year and can increase their productivity. Healthy sheep can tolerate a wide range of temperatures if they are acclimatised and have feed and water adequately. However, shelter can develop the welfare of the animal and decrease

production losses.

Whole-year open systems of sheep are a low-cost keeping system, but especially during winter special regard is required because the insulating effect of barns is missed. Because of varied reactions of adaptation to cold climate sheep are able to cope with out-wintering. But reactions have to be supported by a suitable keeping system to prevent heat loss which could lead to cold stress (Wassmuth, 2003).

Substantial dietary energy may be diverted from productive functions to the generation of body heat when animals are subjected to extreme cold stress. Failure to produce sufficient heat can result in death. Besides this, cold stress cause to the development of secondary changes and possibly disease. Physiological adaptation occurs in animals when prolonged exposure to even mildly cold conditions and it lead to increases in thermal insulation, appetite, basal metabolic intensity and alterations in digestive functions. Much of the reduced productivity and nutritional efficiency which seen in ruminant production systems during the colder part of the year, can be explained for by these adaptive changes (Young, 1983).

When high rainfall and high winds combined with cold temperatures without shelter conditions will especially cause mortality in newly shorn sheep and young animals Newborn lambs have low cold tolerance, small energy reserves and poor insulation so they need a roofed shelter with a straw-bedded floor and with 3 side walls (Wassmuth, 2003).

The impact of the cold weather will depend on its duration, rainfall, wind speed and temperature. All of them effectuate the 'wind chill' factor which can double heat loss. First way, any water evaporated from the skin, will cool the body just like as sweating. Second way, rain falling on the sheep, lodging shortly in the fleece and finally dripping off will reduce warmth from the skin. When wet and cold, sheep may be reluctant or unable to move (Erickson, 2016). The values about wind chill factor are given in Table 1 (Richardson, 2012).

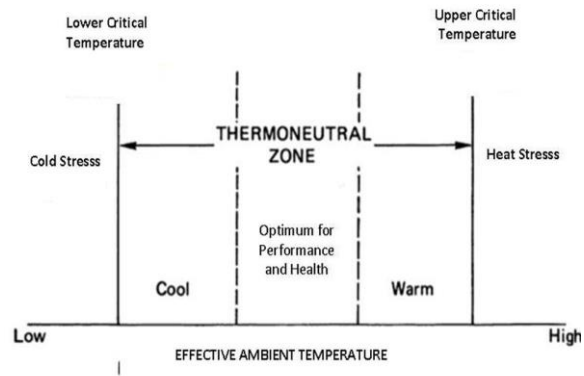
**Table 1.** Wind chill factor values

	Actual Air Temperature (°C)						
	10	4	-1	-7	-12	-18	-23
WS	Wind Chill Factor						
8	9	2	-3	-8	-15	-21	-26
16	4	-2	-8	-15	-22	-29	-34
24	2	-5	-12	-21	-28	-34	-41
32	0	-8	-16	-23	-31	-37	-46
40	-1	-9	-18	-26	-33	-39	-48
48	-2	-11	-21	-29	-36	-42	-51
56	-3	-12	-21	-29	-34	-44	-54
64	-3	-12	-22	-29	-38	-47	-56
72	-4	-13	-22	-30	-39	-48	-57
80	-4	-13	-23	-31	-40	-48	-58

WS: Wind Speed (km/h)

Given values in table show that coldness which felt by sheeps are can be so varied from actual air temperature. Only healthy animals with sufficient body fat could be wintered outdoors and animals must have experience with area and winter conditions (Richardson, 2012).

The effectiveness of various responses to cold stress are maximal at the lower boundary of the thermoneutral zone (TNZ) and this point called the lower critical temperature (LCT). This situation provides understanding of interrelationship between domestic animals (sheep, cow etc.) and their environment. Domestic animals must increase its rate of metabolic heat production to maintain homeothermy in cold zone (Figure 1). In this zone, increases in metabolic heat production also increased environmental heat demand for animals who capable of maintaining constant body temperature (Anonymous, 1981).



**Figure 1.** Thermal zones and temperatures

A summary of estimated LCT's for sheeps is found in Table 2. These values should be considered only as indicators of cold-sensitivity as, in practice, the actual LCT can vary considerably depending upon specific shelter conditions (age, breed, thermal acclimation, lactation, nutrition, feeding, hair or wool coat and behaviour etc.) estimated effects for some of these factors are shown in Table 2 (Anonymous, 1981).

**Table 2.** Lower critical temperatures for sheep

Sheep	LCT (°C)	Source
Shorn, maintenance-feeding	25	1
Shorn, full feed	13	2
5mm fleece, maintenance	25	3
5mm fleece, fasting	31	3
1mm fleece, maintenance	28	3
10mm fleece, maintenance	22	3
50mm fleece, maintenance	9	3
100mm fleece, maintenance	-3	3

1. Ames 1969; 2. Brink and Ames, 1975; 3. Blaxter, 1967

Taking into consideration the factors mentioned above all necessary precautions should be taken to minimise the effects of both cold and hot weather. Sheep should

be preserved of dangerous circumstances like injury, disease, fire, flood via suitable shelter and proper management.

### 2. Materials and Methods

Turkey has been one of the big sheep and goat producers of Europe and the West Asia and North Africa (WANA) region in the 20th century (Gürsoy, 2006). Turkey's sheep and goat management systems evolved through, thousands of years of adaptation and adjustment to the natural resources, topography, climate and the ever-changing production environments. There are three basic systems, the nomadic, sedentary and transhumant (Kaymakçı and Sönmez, 1996). The nomadic system, which involves about % 10 of the flocks in the sheep industry mainly in the Southeast and Eastern Turkey, is declining because it cannot keep up with the social and economic changes (Gürsoy, 2006).

The number of the sheep in Turkey has been 33 239 147 according to the 2016 year end statistics Central Anatolia Region has approximately %9 of this total number. Niğde which has cold climate is the most important sheep producer province in Central Anatolia Region region. (Anonymous, 2016).

In this study, results of the observations and surveys carried out on the registered sheep producers of Niğde province and districts are studied. A comprehensive survey is being conducted in Niğde region but some parts of the survey have not been completed yet because of harsh weather conditions. The aim of the all survey reported here was to summarise the beliefs, knowledge and experiences of sheep producers in Niğde region with providing shelter for sheep in a locality where cold wet weather is common over this period. It will carried out in conjunction with experimental studies in the same region. The specific aim of the completed parts of survey reported here is to summarise currently sheep shelter and shelter management conditions in that area.

The main material of the study is primary data obtained from surveys of the sheep producers. As secondary data in the study is TÜİK (Turkish Statistical Institute), Turkish State Meteorological Service and Sheep and Goat Breeders Association of Turkey databases and national and international researches on the subject was used.

Sheep farmers were asked whether any sheep waste storage ponds that they have. They were also asked whether there were any aspects concerning shelter that they felt needed to be investigated by research. Observations, surveys and farmers negotiations been continued in both summer and winter. Finally, shelter plans that could be useful for the region were presented.

### 3. Results and Discussions

It was observed that the waste and manure generated by the sheep shelter enterprises stored directly on the top of the exposed soil without taking any measures in the research area. As a result of the uncontrolled waste management sheep waste can pollute surface and underground water resources.

Agricultural pollution can be described as either point source or diffuse pollution. Point source pollution is pollution of a waterway from a single discharge point such as a pipe, tank or building. Point source pollution can be caused by manures, slurry, silage effluent, uncollected dirty water, fuel oil, pesticides or sheep dip. Most of the sheep breeders in the region reported that sheep spraying applications was uncontrolled and did not have any special areas for sheep.

Uncontrolled storage, application or disposal of pesticides can have desructive effects on rivers and water supplies. Pesticides (such as sheep dips) applied directly to farm animals, are classified as veterinary medicines. Contamination of clean water supplies or groundwater with sheep dip can cause the poisoning of both people and animals. This situation can also mean the loss of drinking water supply, possibly forever. Sheep dipping facilities must be attentively sited. Must not be sited within 10 metres of any waterway (rivers, streams drains and wetlands) and it never site within 50 metres of a spring, well or borehole as far away from one as possible (Anonymous, 2008).

It was seen that traditional methods is applied mostly by farmers in Niğde region. Traditional sheep and goat shelters are usually poorly lighting and have inadequate ventilation and drainage. Housing sheeps and other farm animals within the family house can have serious results like outbreak of diseases. Housing farm animals in near human areas also causes spread of parasites and bacterial and viral infections it could be transmitted to humans especially to the children.

Sheeps are grazed on summer seasons without any precautions to protect environment and in winter months sheeps are kept in closed shelters.

Closed shelters has bad conditions for animals in study area. Most of the enterprises do not have an auxiliary equipment section, a waste storage systems and they have bad drainage systems and insufficient ventilation systems.

More recently, sheep manure and urine from a farmstead point source is collected and spread back on the farmland to avoid ground or stream water pollution as an environmental concern. Two general systems of manure storage and handling are in use: perforated floors above a collection pit or cellar and deep litter systems (Berge, 1997).

On deep litter systems the floor should be made of

gravel or sand. A plastic membrane could be installed below the gravel for the seepage to protect the ground water. A concrete floor could need much more bedding material to ensure dry and clean conditions. (Nedkvitne and Nygaard, 1970).

To prevent seepage the pit needs waterproof floor and sides. For well-stocked and well-fed shelters, 1.2 m deep pits below the floor gives enough manure space for 5 months. A deeper and/or more expensive cellar is not needed. (Berge, 1997).

Space requirements must be calculated for sheep accommodations to decide how many sheep can be housed in a given area. Recommended housing spaces are given Table 3 (Anonymous, 1982).

**Table 3.** Recommended housing space (m<sup>2</sup>) for sheep and lambs

	Dirty Area	Open shed	A	B
Bred ewe	20	8	12-16	8-10
Ewe with lambs	25	12	16-20	10-12
Ram	20	8	20-30	14-20
Feeder lamb	15-20	6	8-10	4-6

A: Confinement (Dirt Floor); B: Confinement (Slatted floors)

To maintain sheep health the quality of drinking water provided should be adequate. Watering points should be sufficient capacity and allow access safely. Regular evaluation should be made of the quality and quantity of water supplies. It is seen that the water resources are not frequently controlled in the examined enterprises. To assist in the removal of excessive heat, moisture, carbon dioxide, dust, noxious gases and infectious organisms from the environment, sheep shelters should be designed either for effective natural ventilation or with mechanical ventilators. Internal distribution of air is required in a manner suitable to the location of the animals and the design of the building. Sheep should not be kept in, or exposed to any environment where the air is so contaminated with dust or noxious chemicals as to be harmful to their welfare (Anonymous, 2017b). It be seen that the most of surveyed enterprises cannot meet the ventilation, lighting and hygiene conditions.

Effects of cold weather to sheep and unhealthy growing conditions are presented. Especially, the effects on the health and welfare of sheep are discussed with regard to free access, external areas, exposure solar radiation, ventilation and lighting, indoor climate and hygiene and noise. Evidence is provided about the relationship

between bad shelters, sheep welfare and problems of udder health with increased risk of mastitis and reduced yield and quality of milk (Caroprese, 2008).

Animals without shelter need to more energy for normal functioning and it results less into production.

Animals must be provided with shelter in times of extreme temperatures. This can minimise the impact of climate effects and prevent suffering or possibly death (Anonymous, 2017a).

Besides this factors mentioned above sheeps also need shelter for some specific reasons which are described; Easy management, to develop product quality, to protect the sheep's in various weather conditions, for protecting human health and environment, for care of pregnant sheep and lamb accurately, for highly milk production, to protection of sheep from harmful animals and thief. These reasons was told to producer who lives in study area but most of them didn't accept these factors or didn't found it feasible.

The main requirement of good animal housing is that it should alter or modify the environment for the benefit of animals. Animal housing should be planned to reduce stress of animal from extreme climates and to allow optimal animal performance in terms of growth, health and reproduction. The basic climatic factors from which protection is needed are high and low temperatures, humidity, solar radiation, wind and rain. Additionally with suitable housing systems ensure to protecting feed and equipment from damage, to saving labour and in support of effective management, including breeding.

Sheep and goat housing should meet animal requirements and serve a producer's needs at the lowest possible cost. Small ruminant housing needs to (Anonymous, 2009) :

- Must be strong enough to last a long time and be big enough for the all of animals to be accommodated comfortably. It must allow free movement for all animals;
- Must be well-drained or have well-maintained dry bedding and clean easily. Sheep and goats cannot tolerate mud well; therefore shelters should be built only on well-drained ground;
- Must receive morning sunshine equally and be well lighted and ventilated. Air circulation, temperature, dust levels, relative air humidity and gas concentrations should be at levels that will not damage animals;
- Must have suitable isolation pens for sick or injured animals as away from the main shelter building as possible.

According to the Turkish State Meteorological Service data; average minimum temperatures of Niğde (1950-2015) are -4.5 °C (January) and -3.6 °C (February).

Gürel and Olgun (1996), suggested that open sheep shelter for Polatlı district which has -9 °C projecting degree. Niğde has cold and snowy climate. Open shelters can be a problem in cold climates for various reasons, in this case closed barn is can be preferable. For these

conditions, fully or partially closed and rigid-base stables may be used. A project example that may be appropriate for the study area are given in Figure 2 (Anonymous, 2014).

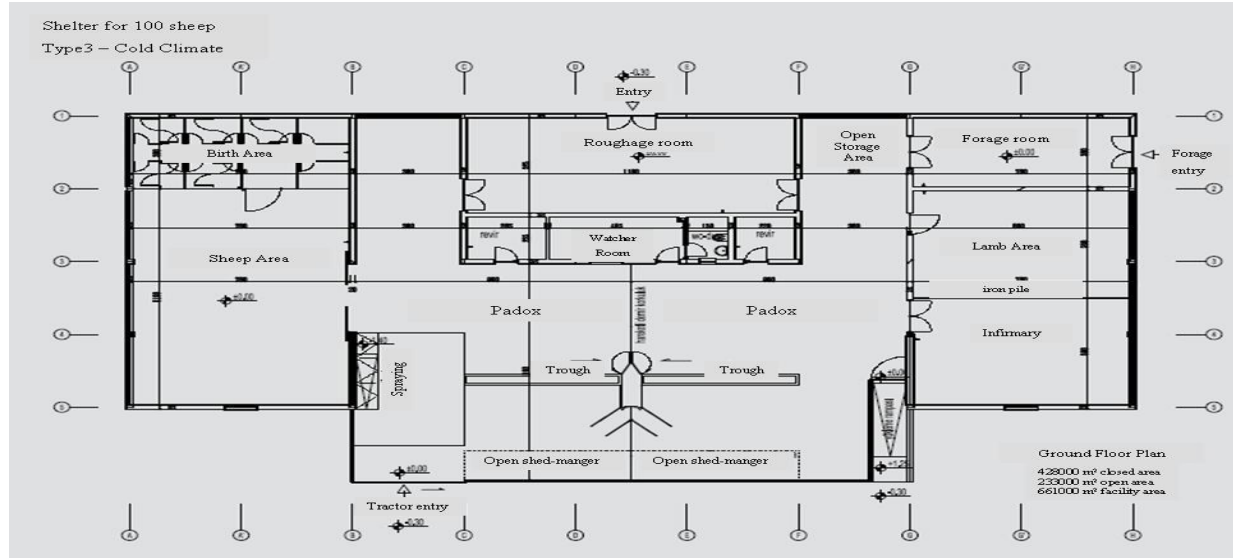


Figure 2. Sample Project

Sheep shelters do not have to be expensive if they are well planned. So the shelters must be carefully planned before being built.

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