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Drinking Water for Sheep

Introduction

The importance of proper drinking water treatment for animal husbandry is something that has been proven both scientifically and practically. Numerous water parameters, beginning with temperature and ending with the concentration of organic matter and dissolved solids, have an influence on animal health, behaviour, and well being. Animal health is directly affected by water temperature and drinking water quality.

Water is considered the most-important nutrient because of the vast number of biological functions that rely on water. Life functions such as growth, development, and reproduction may be inhibited by not providing enough fluid water to a flock.

Sheep belong to the family of small ruminants. Sheep possess mobile lips and specialized teeth, due to these traits sheep are capable of picking up little pieces of plants and foliage and can “cut” the grass that they eat. An advantage of these traits is that sheep can consume a larger variety of plants than other ruminants.

The average body temperature of a sheep is 39–40°C. Depending on the time of the day, age, gender, and quality of feed, this average temperature can fluctuate with a variance of 1°C. Temperature regulation in the animal body depends on their metabolic processes.

The breathing frequency per minute (in quite condition) for sheep is calculated at: lamb 15-20, adult sheep 12–15, old sheep – 9-12. In hot weather conditions animals will breathe faster without any pathological changes in their respiratory organs. It is important to consider that sheep have poor tolerance for high humidity and hot weather conditions, but well tolerate cold weather conditions.

Water Supply for Sheep

Water plays a significant role in the raising of grazing animals. Clean, fresh water is a daily necessity for sheep and lambs. It is the most important and often the most overlooked nutrient in a sheep’s diet. Staying well hydrated keeps sheeps’ bodily functions working correctly. Plenty of water flushes toxins from the system, lubricates joints, eyes and nasal passages and helps sheep regulate their body temperature. Sheep do not like murky water and will consume more if it is not fouled. Sheep will consume anywhere from 2 to 10 litres of water per day, depending on their age, physiological state, the content of water in their feed, and environmental conditions. Water intake is positively correlated to feed intake.

Water can be free flowing or provided in ponds, buckets, troughs, tubs, stock tanks, or automatic waterers. Any water sources must be kept clean and free from hay, straw, and faecal matter. Waterers should be checked daily, emptied, cleaned and disinfected when needed. The ideal

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situation is when water is disinfected, which protects animal from waterborn (and sometime airborne) infections.

Environmental Conditions

During the winter, water will be more readily consumed if it is ice-free, ideally not colder than 8-10ºC. During the summer it is ideal if the water source is not warm (below 20ºC). It is not recommended to allow sheep to consume snow as a source of water. Such practices may cause illnesses. Snow is not a suitable replacement for regular water and its consumption may lead to a decrease in normal body temperature. Melted snow also does not contain salts, which may cause an imbalance in mineral metabolism. During periods of high temperatures, greater attention to water quality and availability is crucial for preventing and alleviating heat stress. Range sheep may also require more water due to increased travel requirements to graze. Providing shade to animals, whether on the pasture or in a barn, can also impact water consumption and alleviate heat stress. Increased wool cover can also contribute to heat stress, so sheep with more wool may require more shade and water. Other factors that influence water intake are the amount of handling procedures that may need to be performed. Offering water immediately after shearing or processing allows animals to rehydrate if they were temporarily held off feed and/or water. Animals that are used for trials or handling demonstrations during events should also have continuous access to clean water to minimize stress.

Water Consumption

It is calculated that the average water consumption per day for an adult sheep across different seasons is distributed the following way: spring 3-4 l, summer 5-6 l, autumn 5- 6 l, and winter 2-3 l.

Sheep prefer to drink still water as opposed to running water from a moving stream. It is generally recommended that streams be fenced off and that livestock not be allowed to drink from natural water sources. Giving livestock access to stream bank areas may cause environmental problems, though sheep are more desirable for grazing riparian areas than larger livestock.

Sometimes, sheep will seem to drink very little water. This is probably because they are consuming feeds or forages that are sufficiently high in moisture content. As the grass gets drier or their diet gets drier, they will consume more water.

Where possible, automatic watering devices should be provided. In cold barns should be considered heated automatic bowls and insulated or heated pipes. It is recommended that approximately 40 ewes, 10 rams, or 50-75 feeder lambs can use one watering bowl.

Table 1: Recommended watering space for sheep and lambs (6).

	Ram	**Dry ewe**	**Ewes with lambs**	**Lambs**
	Head (180-300 lb)	Head (150-200 lb)	with 5-30 lb lambs	Head (30-110 lb)
Bowl	10	40-50	40-50	50-75
Nipple	10	40-50	40-50	50-75
Tank	2	15-25	15-25	25-40

It is very important to properly organize the availability of drinking water for sheep. An insufficient water supply is harder on animals than an insufficient food supply. For every kilogram of dry feed, sheep consume 2-3 litres of water. In the cooler seasons of the year, animals require relatively little additional water beyond what they receive through foraging. Hot, drier weather, however, will result in increased water intake. Requirements increase greatly during late gestation and lactation. Ewes

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during gestation drink significantly less than required if the water is cold. This condition may cause dehydration, which will result in a decrease in appetite, which may affect fetal development and survival at birth. It is calculated that lactating dairy ewes consume 100% more water. If problems are detected with milk production, it is important to check the water temperature and the ewe's water consumption. Table 2 provides an estimate of the daily water consumption for different categories of sheep.

Table 2: Water requirement for sheep (1).

Animal Type	Weight Range (kg)	Water Requirement Range[a] (l/day)	Average Typical Water Use[b] (l/day)
Feeder lamb	27-50	3.6-5.2	4.4
Gestating meat ewe/ram	80	4.0-6.5	5.25
Lactating meat ewe plus unweaned offspring	80+	9.0-10.5	10
Gestating dairy ewe/ram	90	4.4-7.1	5.75
Lactating dairy ewe	90	9.4-11.4	10.4

[a] A result of the animals' environment and management.

[b] Typical consumption over a year on a daily basis under average agricultural conditions in Ontario.

In comparison with other animals, sheep need lower amounts of drinking water, but this water must be of a good quality. It should not contain organic matter and nitrates. Otherwise, the animals may get sick. Unclean water can harbour parasites and bacteria that interfere with the health of the flock. It is known that many sheep illnesses may be caused by contaminated water with high organic content. No matter how much animal drink, it really matters what is filled in their drinking reservoirs.

Types of Raw Water

The raw water sources in Manitoba are usually subdivided into two categories: ground or surface waters (Table 3).

Table 3: Water types and water components that require treatment.

Water Type	**Ground Waters**			**Surface Waters**			
Water Source	Deep wells		Shallow wells	Rivers or streams	Lakes	Ponds or dugouts	
Water Supply	Saline water	Fresh water	Surface infiltration	Running water	Supplied by running streams	Supplied by lakes	Supplied by run-off water
Components and Contaminants to be Removed	*Salt & metals*	*Metals*	*Organic matter & metals*	*Turbidity, organic matter, green algae & diatoms*	*Metals, organic matter, blue-green & green algae*	*Metals, organic matter, blue-green & green algae*	*Metals, organic matter, blue-green & green algae*

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Ground water may come from shallow or deep wells, while surface water may be supplied by rivers (or streams), natural lakes, or man-made dugouts or ponds. In Table 3 existing water types in Manitoba and in the Prairie Region of Canada (in general) are summarized. This particular systematic table is simplified and intended for use by the general public. It is not outsourced from any engineering literature, which is why the use of special terms is minimized. In the professional world this subdivision is more complex and will contain many specialized and specific terms.

Important Water Parameters

No matter what water supply is used, it is always important to measure particular raw water parameters. It is recommended to measure certain parameters directly at the water source, while other parameters can and should be measured by a specialized laboratory. The following parameters are recommended to be measured directly at the site: temperature, pH, oxidation reduction potential (ORP), and electrical conductivity (EC), which is often expressed as total dissolved solids (TDS). In reality TDS, as well as salinity are calculated from the measured EC.

Any type water is a dynamic system, which it is trying to balance itself when any of its main parameters are changing. The following examples can be used to explain the dynamic condition of water: a) the pH of well water is not stable, and will start increasing as soon as the water is exposed to the surface; b) pH is a temperature dependant value, and as soon as the temperature of the water changes, it will be affecting the water's pH; c) when the pH of the water is changing, it means that the ionic balance in the water is shifting, which may cause precipitation of the sediment or a change in the water's colour. In practice, this means that if the parameters described above will be measured by the time the water is delivered to the laboratory, then this water may already be significantly different from the actual water collected at the source. Thus, the future design of the treatment process for the water sample measured at the site may differ for the same water sample analysed at the lab.

Water Treatment by Water Type

The main water treatment trains defined by the applications from Table 3 are listed below. This is a very simplified approach, that can be used for the first assessment. Further assessment will require a more detailed review.

1. Saline (or heavily mineralised) ground water containing metals (deep wells). The following parameters are important for the determination of the necessary treatment: pH, EC, ORP, total metals[1], hardness[2], and anions. Without going into details, the treatment sequence should be the following: oxidation (precipitation of metals), filtration (metals removal), softening (replacement of calcium and magnesium by sodium), demineralisation by reverse osmosis (RO), and disinfection. In certain cases, the metal removal step will require pH correction[3]. If the TDS of the RO water will be below 30 mg/l, then this water will need to be remineralised prior to disinfection. For remineralisation, blending with water produced by filtration can be used (in particular ratio).
2. Non-saline deep well water containing metals is usually hard. This is why the following parameters should be analysed: pH, EC, ORP, total metals, hardness. If the hardness is within the acceptable limits for application, then the treatment will consist of oxidation (metals precipitation), filtration (metals removal), and disinfection. If the hardness exceeds acceptable limits, then it would need to be removed (or decreased), which may include softening and

1 In the metal scan is important to look for the concentrations of iron (Fe), manganese (Mn), arsenic (As), uranium (U).
2 Hardness is calculated out of the metal scan by concentrations of calcium (Ca) and Mg (magnesium).
3 A pH increase prior to filtration is required when manganese is present in the water when water pH is below 7.8.

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demineralisation via RO.

3. Shallow well water may contain metals and organic matter. The recommended parameters required for measurement are pH, EC, ORP, total metals, and TOC (total organic carbon). This water may change seasonally, which may require adjustment of the treatment setup during a particular season. In general, the treatment sequence should consist of the following: oxidation, flocculation/coagulation (addition of flocculants for precipitation of organic matter from water), filtration (removal of floc that contains metals and organics), and disinfection.
4. Usually all surface waters will contain thin particles (turbidity), micro-algae, and organic matter (colour). Some of the surface waters may also contain metals. This is why the parameters recommended for testing are the same as those for shallow wells: pH, EC, ORP, total metal scan, and TOC. The treatment steps used for the surface waters are very similar to the treatment recommended for shallow wells. The additional parameter to be considered for the surface water treatment is the presence of micro-algae, with special attention to blue-green algae, also called cyanobacteria. Certain micro-algae can produce harmful algae blooms (HAB)(4). The cyanobacteria is a special group of microorganisms that can produce toxins, which may be life threatening for humans and animals. The removal of toxins is a complicated process, this is why it is always recommended to prevent micro-algae distribution and algal blooms by minimising wash (with run-off) and discharge (with wastewater) of nutrients into the water streams.

Conclusions and Recommendations

It is important to apply the proper treatment process for the drinking water used in sheep barns. In order to have good quality drinking water in barns, it is important to remember the following tips:

1. Treat and disinfect water supplied to any barn.
2. Identify and classify the raw water source.
3. Analyse raw water. Remember that certain parameters should be measured at the source.
4. Do not accumulate manure or used straw from the barn close to a raw water source (pond or well).
5. Identify required treatment sequence based on the water type and analytical results.
6. Design and set up treatment system according to the identified treatment process. Use of professional advise at this stage may be helpful.
7. Always apply disinfectant that has a measurable residual in the distribution and open waterers to prevent recontamination.
8. Remember that there are only two water disinfectants that have measurable residual. These disinfectants are chlorine and chlorine dioxide. Both disinfectants have quite short reaction time for elimination of pathogens.
9. Hydrogen peroxide that is very often used for water “disinfection” is not a disinfectant, it is oxidant with weak disinfection properties. Its time for reaction with water for oxidation may take up to 24 hours.
10. Do not combine two oxidants and/or disinfectants without checking on their potential interference. These chemicals can often neutralize each other, and the disinfection effect will be reduced or nullified.

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11. Flush distribution lines regularly. It is especially important procedure when the water temperature in the lines increases above recommended levels.
12. Empty and clean water tanks and reservoirs daily.
13. Try to keep water temperature in the waterers between 10 ^{o}C and 20 ^{o}C.
14. Size and place waterers correctly to make easy water access to all animal.
15. When planning for vaccination or medication via water, flush all lines with higher than regular concentration of disinfectant. Start using anti-oxidant for neutralisation of disinfectant at the point of entry to the distribution several days prior to vaccination (regular treatment before injection point of anti-oxidant in distribution must continue).
16. Continue dosage of anti-oxidant several days after vaccination.
17. Do not sacrifice treatment steps for immediate savings. These immediate savings may cause larger expenses in the long run.

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