



# LIVESTOCK AND WATER QUALITY

January 2000

## HOW MUCH WATER DO LIVESTOCK NEED?

Water consumption guidelines for various types of livestock in temperate climates are shown in Table 1.

Table 1 - Consumptive water requirements for livestock in Saskatchewan during 1996 (Modified from CCREM 1987)

Class of livestock	Daily water requirement (L)
<i>Beef cows</i>	55
<i>Dairy cows</i>	160
<i>Pigs</i>	7 to 10
<i>Laying hens</i>	0.25 to 0.30
<i>Sheep</i>	2 to 7

## IS WATER QUALITY IMPORTANT TO LIVESTOCK?

Yes, several different aspects of water quality can affect yield and performance of livestock. Some of these aspects will be summarized in this fact sheet.

## CAN I USE SALINE WATER FOR LIVESTOCK?

The effect of saline water on livestock and poultry production is summarized in Table 2.

## CAN CHEMICALS AND MICRO-ORGANISMS IN THE WATER BE OF CONCERN?

There is a significant amount of knowledge regarding chemicals found in water supplies and their effect on livestock. However, the microbial quality of livestock drinking water can also be important. Knowledge of the effects of disease-causing microorganisms on livestock is limited, and only tentative guidelines can be given. This lack of knowledge, has given rise to recommendations that are not consistent from one agency to another. To achieve benefits in terms of herd health and performance, one must avoid contamination of watering supplies for livestock and possibly treat these water supplies to ensure that the water is clean or contains only low concentrations of disease-causing microorganisms. Guidelines for chemicals and tentative guidelines for microorganisms are given in Table 3.

WOR-109-2000-01



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Table 2 - The use of saline waters for livestock and poultry (modified from NRC 1974)

Total Dissolved Solids (TDS) in water (mg/L)	Comments
< 1,000	These waters have a relatively low level of salinity and should present no serious burden to any class of livestock or poultry.
1,000 to 3,000	These waters should be satisfactory for all classes of livestock and poultry. They may cause temporary and mild diarrhea in livestock not accustomed to them or watery droppings in poultry (especially at the higher levels), but should not affect their health or performance.
3,000 to 5,000	These waters should be satisfactory for livestock, although they might very possibly cause temporary diarrhea or be refused at first by animals not accustomed to them. They are poor waters for poultry, often causing watery faeces and (at the higher levels of salinity) increased mortality and decreased growth, especially in turkeys.
5,000 to 7,000	Avoid the use of these waters for pregnant or lactating animals even if non-lactating dairy and beef cattle, sheep, swine and horses may tolerate these salinity levels. These waters are not acceptable for poultry, almost always causing some type of problem, especially near the upper limit, where reduced growth and production or increased mortality will probably occur.
7,000 to 10,000	These waters are unfit for poultry and probably for swine. Considerable risk may exist in using them for pregnant or lactating cows, horses, sheep, the young of these species, or for any animals subjected to heavy heat stress or water loss. In general, their use should be avoided although older ruminants, horses, and even poultry may subsist on them for long periods of time under conditions of low stress.
> 10,000	The risks with these highly saline waters are so great that they cannot be recommended for use under any conditions.

## CAN BLUE-GREEN ALGAE BE A PROBLEM FOR LIVESTOCK?

Yes. Blue-green algae growths during the summer in dugouts is a concern especially if livestock is watered directly from a water source. Most blooms of blue-green algae contain either brain toxins (neurotoxins) or liver toxins (hepatotoxins). A 100 kg (220 lb) calf need only consume just over 1 L of water to produce death, depending on the toxin present in the blue-green algae bloom. One of the most effective ways to avoid problems with blue-green algal toxins is to water cattle out of troughs rather than by direct watering. How do I know if there are blue-green algae in my water supply. Look at the fact sheet "Algae in surface water supplies" for ways of

identifying the presence of blue-green algae. This fact sheet also makes recommendations for controlling blue-green algal blooms.

## IS WATER QUALITY IMPORTANT TO THE DELIVERY SYSTEM SUPPLYING WATER TO LIVESTOCK?

Yes. Poor water quality can cause pipes and bowls to rust, and nozzles to plug, and thereby prevent an adequate supply of water to the livestock. When restricted flow devices are used (such as chicken nipple waterers), clogging of flow nozzles can be a problem when using either surface or ground water sources.

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Table 3 - Recommended maximum concentrations for selected chemicals and micro-organisms in livestock drinking water. \*Information from CCREM 1987, Australian Water Quality Criteria 1974, BCMOELP 1994, NRC 1974 , NRC 1998, Manitoba Agriculture 1992.

Chemical Name	Guideline	Units	Application
Alkalinity (as CaCO <sub>3</sub> )	500	mg/L	Alkalinity levels above 500 mg/L can have a laxative effect. Lower levels may have a laxative effect if sulphate is present in the water.
Aluminum (Al)	5,000	µg/L	Maximum Concentration
Antimony (Sb)	5	mg/L	Causes decreased growth and longevity in mice
Arsenic (As)	500	µg/L	If arsenic levels in feed are low, up to 5 mg/L can be tolerated (arsenic is used as feed additive to enhance growth in poultry and pigs)
Bacteria		counts per 100 mL	No definite guidelines for presence of microbes in livestock drinking water sources. Suggestions are given. Total bacteria < 10,000, total coliform < 1, faecal coliform < 1-10, faecal strep. < 3-30. Some reports suggest that total coliforms need only be < 5,000.
Barium (Ba)	300	mg/L	Depressed weight gain in chickens
Beryllium (Be)	100	µg/L	Guideline
Boron (B)	5,000	µg/L	Guideline value, safe concentrations may be as high as 40 mg/L
Cadmium (Cd)	20	µg/L	Draft Guideline
Calcium Ions (Ca)	700	mg/L	Guideline value when magnesium is present
	1,000	mg/L	Guideline value when magnesium is absent
Chloride (Cl)	15,000	mg/L	Reduced growth in immature chickens, but effect largely overcome by adding Na and K
Chromium (Cr)	1,000	µg/L	Guideline
Cobalt (Co)	1,000	µg/L	Guideline value. Cobalt is an essential trace element; toxicity symptoms will likely not become apparent until levels an order of magnitude higher than the recommended level is reached.
Copper (Cu)	1,000	µg/L	Guideline value for cattle. Copper is essential to animal health and is often a feed additive. Revise levels downwards if supplements are given or feed is high in copper.
	500	µg/L	Guideline value for sheep
	5,000	µg/L	Guideline value for pigs and poultry
Cyanide (CN)	103	mg/L	Fatal to cows and ducks.

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Fluoride (F)	2	mg/L	Guideline value, but mottling of teeth may occur at this level. If fluoride is included in feed, concentration should not exceed 1 mg/L.
Hardness (as CaCO <sub>3</sub> )	No guideline		Hardness has no effect on water safety, but can result in the accumulation of scale in water delivery pipes. The scale mainly consists of magnesium, manganese, iron and calcium carbonates. Water with more than 120 mg/L as CaCO <sub>3</sub> is considered hard
Iodide (I)	50	mg /day	Reduced reproduction in sheep, 2,500 mg/L no effect on pigs, 625-5,000 mg/L caused reduced egg production, egg size, and hatchability in laying hens.
Iron (Fe)	300	µg/L	No toxicity guideline established. Veal calves will have increased coloration of meat at iron levels as low as 0.1 mg/L; this level can also give milk an oxidized flavour. Iron can present problems in restricted flow drinking water lines where iron precipitation may plug the line. Iron will also present problems when water is disinfected and can encourage bacterial slime growth in water supply lines.
Lead (Pb)	100	µg/L	Guideline value. Chronic lead poisoning may occur at levels of 0.5 to 1.0 mg/L.
Magnesium (Mg)	6,000	mg/L	Reduced growth and bone mineralization in immature chickens. An upper limit of 300-400 has been suggested for dairy cows. Magnesium form part of the hardness in water.
Manganese (Mn)	>0.05	mg/L	No toxicity guideline established. Manganese together with iron will discolour fixtures. Manganese and iron can present problems in restricted flow devices in drinking water lines where manganese precipitation may plug the line. Manganese will also present problems when the water is to be disinfected.
Mercury (Hg)	3	µg/L	Guideline value. Mercury is a health hazard to animals and to human consumers.
Molybdenum (Mo)	500	µg/L	Guideline value. An essential element, but it is toxic (linked to intake of copper sulphate. Cu:Mo ratio of 2:1 will prevent poisoning. Sheep, swine and poultry are more tolerant than cattle to poisoning.
Molybdenum (total)	50	µg/L	Maximum Criterion. British Columbia maintains a 10 times lower value for molybdenum.
Nickel (Ni)	1	mg/L	Guideline value. A Ni level of 5 mg/L caused birth problems in rats after several generations of exposure
Nitrate (NO <sub>3</sub> -N)	100	mg/L	Guideline value. Nitrate may impair the oxygen-carrying capacity of the blood by reducing hemoglobin to methemoglobin. At the guideline level there has been small increases in methemoglobin in pigs
Nitrite (NO <sub>2</sub> -N)	10	mg/L	Guideline value. Nitrite may impair the oxygen-carrying capacity of the blood by reducing hemoglobin to methemoglobin.

pH	6.5-8.5	pH units	Guideline values. If pH is lower than 5.5, acidosis and reduced feed intake may occur in cattle, but is unlikely to have an effect on pigs. Chlorination efficiency is reduced at high pH. A low pH may cause precipitation of some antibacterial agents delivered through the water system (for example sulphonamides).
Selenium (Se)	50	µg/L	Guideline value. An essential element, but at high levels can be toxic.
Sulphate (SO <sub>4</sub> )	1,000	mg/L	Guideline value. Sulphate interacts with copper metabolism in most animals. High sulphate water consumption often requires changes to the mineral mix that one needs to give to the animals. This has two components, increasing the copper, and decreasing some other minerals.
Sulphide (H <sub>2</sub> S)	<1.0	mg/L	This is not a toxicity guideline, but a taste and smell advisory. Levels above 25 mg/L are required to cause decreased growth in chickens.
Tin (Sn)	5	mg/L	This is not a guideline, but this level caused decreased longevity in mice and rats; fatty degeneration of liver, vascular changes in kidneys.
Titanium (Ti)	5	mg/L	Few rats survived to third generation
Tributyltin (Sn)	250	µg/L	Guideline
Tricyclohexyltin	250	µg/L	Interim Guideline
Triphenyltin Hydroxide	800	µg/L	Guideline
Trihalomethanes (THM)	350	µg/L	Interim Guideline
Uranium (U)	200	µg/L	Guideline value. Uranium is present in feed and the guideline is set as part of the overall consumption pattern. Phosphorus supplements to cattle may provide a considerable amount of uranium.
Vanadium (V)	100	µg/L	Guideline value.
Zinc (Zn)	50	mg/L	Guideline value. This is an essential element for livestock, but at high levels it can exert toxicity. The lowest recorded effect was at 20 mg/L where the rumen microbes in cattle were affected (decreased digestion of cellulose)

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Clogging can occur when particles in the water accumulate in the nozzles. The high levels of dissolved organic matter in dugouts and some well water may also provide sufficient food for bacteria and fungi to

grow in nipple tips. Precipitation of iron and manganese, as well as growth of iron and manganese bacteria, are additional concerns for ground water sources.

## WHERE CAN I GET MY WATER ANALYZED?

Commercial laboratories that are able to analyze the composition of chemicals and microorganisms in water include: Envirotest Laboratories (Saskatoon), BDS Laboratories (Qu'Appelle), and Saskatchewan Research Council (Saskatoon).

## THE USE OF SASKATCHEWAN WATER FOR LIVESTOCK

Typically, surface water (dugouts, rivers and lakes) will be of suitable water quality for livestock in regard to all inorganic chemicals, providing they are not influenced by ground water or saline soils.

Microbial problems are the major concerns with surface water. The problems are worsened when animals are watered directly from the water source. Although the effects of microbially unsatisfactory water on livestock has not been clearly established, it is likely that reductions in production (weight gain, general health) will occur. Livestock should never be directly watered from any surface water source to protect their own health and to prevent environmental contamination of water bodies.

Microbial problems can also be of concern in shallow ground water sources (40 m or less). In addition, shallow wells in agricultural may be often contaminated with nitrate, which can reach levels of concern for livestock watering. Deeper aquifers often have salinity problems, as well as high levels of specific ions, such as sulphate.

## THE BIGGER PICTURE

The livestock sector in Saskatchewan represents a large part of the agri-food industry. There is limited knowledge available about the overall impact of generally poor water quality on livestock, either in terms of general animal health or production. Improvements in animal health, weight gain, and production could likely be considerable if water source protection was always implemented and suitable water treatment systems were developed for the

livestock industry. Microbial contamination must be avoided to protect water quality. Water treatment must target removal of microorganisms and specific ions (such as iron and manganese) which can present problems in restricted flow devices. Appropriate water source selection, management and protection of these sources are all critical issues to ensure a safe water supply is used for livestock watering.

## ACKNOWLEDGEMENTS

This publication was authored by H.G. Peterson. Copyright © 1999 by WateResearch Corp. and Agriculture and Agri-Food Canada-Prairie Farm Rehabilitation Administration

Strategic support and funding for this publication has been provided by the Canada-Saskatchewan Agri-Food Innovation Fund (AFIF) and WateResearch Corp.

This Fact Sheet is a part of the publication Water Quality Requirements for Saskatchewan's Agri-Food Industry, identifying key water quality needs for each sector. These guidelines were compiled from a variety of references, primarily including extension publications, reports, books and internet sources. Water quality is a vast and complex subject and readers are encouraged to consult with experts and refer to the scientific literature for a greater understanding into specific water quality needs.

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Information from several different sources was used to produce this fact sheet including:

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