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Water intake and quality for dairy cattle

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DAIRY & ANIMAL SCIENCE

DAS 95-8

Water intake and quality for dairy cattle

WATER INTAKE

Introduction

A. Water is often overlooked as an important nutrient.

B. Water intake problems may limit milk production and growth, and adversely affect health.

C. Animals need a plentiful supply of good, clean water for:

1. normal rumen fermentation and metabolism
2. proper flow of feed through the digestive tract
3. good nutrient digestion and absorption
4. normal blood volume
5. tissue needs

D. Lack of good data on effects of quality problems on performance. Must depend largely on experiences, and further research must be encouraged.

Requirements for water

Expected intakes for various dairy cattle may be found in Table 1. Note that drinking water for producing cows depends on milk level and ration water intake.

A. Requirement for milking cows includes water from both drinking and the ration consumed.

B. Ration intake depends primarily on amount of silage, haylage, or fresh forage consumed as opposed to hay and grain.

C. Intake may be considered a problem if it varies more than ± 15 to 20% of expected.

D. Intake may vary according to:

1. higher at air temperatures over 80°F

2. lower at air temperatures under 50°F

E. Possible causes of inadequate intake include:

1. lack of supply or drinking devices, corroded valves, pipes clogged from iron-bacteria slime or scale

2. inadequate pressuit in the system; not enough animals can drink in a short period of time; use 20 lb. minimum pressure

3. low chemical quality

a. very acidic

b. very alkaline

c. hydrogen sulfide (rotten egg odor)

d. metallic taste from iron, manganese sulfates

e. high total dissolved solids content

4. pollution

a. bacterial--high total bacteria counts (most common) coliform from fecal or nonfecal sources

- other types, especially Streptococci and Pseudomonas
- iron-loving bacteria--restrict flow, bad taste

b. algae, especially blue-green type

c. chemicals

d. sites of contamination

- water source
- pressure tank, reservoir
- drinking device (feed or manure)

5. stray voltage

a. around drinking devices

b. around surface upon which animal stands

F. Signs of inadequate intake

1. firm, constipated manure

2. low urine output

3. infrequent drinking

4. high packed-cell volume or hematocrit in blood

a. over 38 percent in a group of dairy cows

b. other causes:

- dehydration from toxins
- fever

5. considerable unexplained drop in milk production

6. drinking of urine, puddles-may also result when salt, potassium, and protein are lacking

G. Possible causes of excessive intake

1. excessive salt or sodium bicarbonate intake

2. abnormally high urine production

a. mercury contamination of feed or water

b. excessive protein, NPN, or nitrate intake

H. Signs of excessive water intake

1. excessive urine production

2. abnormally loose manure (diarrhea)

- normal in color and smell

3. relatively bloated condition, especially in calves--may also result from sucking habit

I. Determining water intake

1. measure average daily consumption from drinking devices

a. use water meter on lines to drinking devices only, not milk house, etc. (available from most water companies or their suppliers)

b. keep cattle from other sources of drinking water and pasture

c. obtain data over a period of at least 5 to 10 days to minimize weather differences

2. keep track of number and type of animals (dry cows, calves, heifers, etc.)

3. subtract expected intakes for animals other than milking cows from total drinking water

4. determine average daily ration for cows in milk

5. compute water intake from ration (forage and grain); test silages, haylages and high-moisture grains to improve accuracy

6. calculate total water intake from drinking and ration

7. determine average daily milk production for the period from amounts shipped, plus any used on the farm or discarded

8. compute average daily water intake per lb. of 4% fat corrected milk produced

a. 1 gallon of water weighs 8.34 lbs.

b. 1 cubic foot of water weighs 62.4 lbs.

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DAIRY & ANIMAL SCIENCE

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WATER QUALITY

Introduction

A. Water quality problems occur more frequently in mining areas.

B. Mine drainage and/or industrial wastes sometimes are involved.

C. Cows are more sensitive to water problems due to:

1. large intakes which may run from 200 to 300 lbs. per cow or more daily in high-producing herds

2. relatively high incidence of ulcers or breaks in the lining of the rumen and rest of the digestive tract

3. rumen pH needs to be within a relatively narrow range for good metabolism (6.4 to 7.0) in cattle not on fattening rations

4. rumen microflora and metabolism may be altered by water with a high total bacteria count

Chemical quality

A. Hard water generally does not adversely affect cows. Include calcium and magnesium intake from water in ration formulation if water contains over 500 ppm Ca or 125 ppm Mg. Also include sodium from water in formulation of anionic rations if levels are considerably above average.

B. Chemical treatment of water to reduce bacteria counts generally does not adversely

affect cattle.

C. A combination of high sulfate and high magnesium content may result in loose manure or diarrhea.

D. Hydrogen sulfide (which has a rotten egg odor) may increase problems with anemia and those related to copper, selenium, and vitamin E nutrition.

E. High sulfate levels may increase needs for selenium, vitamin E, and copper.

F. High iron, manganese, or molybdenum content may increase needs for copper, or result in more iron-bacteria problems.

G. Acidic water with a pH of under 5.1 may increase problems related to chronic or mild acidosis in some cases.

1. reduced milk production
2. depressed milkfat test
3. poor gains and growth
4. lower feed intake
5. more infectious and metabolic problems

H. Alkaline water with a pH of over 9.0 may result in problems related to chronic or mild alkalosis in some cases.

1. symptoms similar to mild acidosis
2. amino acid and B-complex vitamin deficiencies may occur due to lack of rumen synthesis
3. more likely to interfere when rations contain excessive amounts of protein, minerals and buffers, especially rations high in alfalfa

I. High copper content may lead to liver damage. It may result from severe corrosion of copper lines, mine drainage, treatment of ponds for algae, etc.

J. Nitrate levels over 100 ppm as NO3 may adversely affect cattle and those over 44 ppm may harm young human infants. Levels of 500-1000 ppm N03 may cause moderate symptoms of toxicity in cattle while those over 1000 ppm may result in acute symptoms and death. The guidelines for cattle assume normal levels of N03 in ration.

1. more reproductive problems in adult cattle

2. reduced gains in young stock

3. no appreciable effects on milk production

4. nitrite levels in water over 4.0 as N02 may be toxic to cattle

a. symptoms similar to high nitrate intake from feed and/or water; infertility, including abortions at very high intakes

b. reduce gains and growth

c. respiratory distress due to lack of oxygen

d. gray-brown mucous membranes and chocolate-brown colored blood

5. see Fact Sheet DAS 92-107 for details on the prevention and control of nitrate toxicity in cattle. (This fact sheet is not available on-line. Send e-mail to inquire about getting a copy.)

K. Lead contents over .10 ppm may be toxic.

1. may result from discarded batteries contaminating water supplies

2. may result from severe corrosion of lead pipes

L. Water with over 125 ppm magnesium or 250 ppm sulfate may be too laxative. Less magnesium may be laxative if sulfate is relatively high.

Bacterial quality

A. For sanitation (washing equipment, udder, teats):

1. total coliform count should be zero

2. total bacterial count should be relatively low

B. For animal consumption:

1. calves fecal coliform count should be zero

2. adult fecal coliform count should be 10 or under

C. Polluted water may adversely affect cattle.

1. more calf problems and losses
2. more off-feed, ketosis, or acetonemia problems with cows
3. chronic or intermittent diarrhea
4. more liver damage
5. increased infections

D. Keep drinking cups, bowls, and tanks relatively clean

1. clean out and sanitize them weekly
2. use a raised base around bowls or tanks to reduce manure contamination

Blue-green algae

At least six species may be toxic, especially if exposed to the sun in tanks or ponds in shallow areas.

Checking quality

See the next section (by clicking on **Go forward**, below,) for recommended testing options for water. Water testing is available tlirough numerous public and private laboratories.

Expected levels for various items in farm water supplies and values associated with problems may be found in Table 2.

Watering devices

A. Drinking cups for dairy cows in stall barns; use types and valves that are relatively trouble-free.

B. In free-stall or loose housing, use sufficient tanks, troughs, or fountains to enable most cows to drink relatively soon after milking or eating.

1. generally need one sizable tank per 40 cows

2. use valves that permit 15 gal/min of flow at 20 lbs. pressure

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RECOMMENDED TESTING OPTIONS FOR WATER

Introduction

This information is provided to indicate types of tests that may be run on water samples for routine checking and in problem-solving situations when water may be suspect. When tests are performed to provide a history of water quality in areas subject to pollution from mining or other industries, a combination of options 1 and 3 should be used. Sometimes options 4 and 5 should also be included, depending upon the type of industries in the area.

It's preferable to have background or historical samples taken periodically by a professional third party, and have them tested at a laboratory certified for the tests involved by EPA and DER.

Further help with testing choices and the interpretation or test results and the alleviation and elimination of water problems is available from County Agricultural Extension Offices and specialists in Agricultural Engineering, Forest Resources (Land and Water Institute) and the Departments of Dairy and Animal Science and Veterinary Science at Penn State. Publications are available on most aspects of water use, problems, and treatment. If you need help that is not covered in this publication, mail us and describe a specific need. We can respond with information.

Option 1. Initial, or, standard tests

This option is designed for a starter in problem-solving and for routine testing one to three times yearly, preferably during different seasons or rainfall situations. Suggested tests include:

- total bacteria
- total coliform
- pH
- nitrate

Request definitive counts via dilution techniques to obtain quantitative results.

Option 2. Bacterial sources and differentiation

This option determines if animal or human wastes may be primarily responsible for pollution of water with bacteria, as may be found in Option 1. These tests must be run on fresh, iced samples taken in sterile containers provided by the laboratory. Suggested tests are:

- fecal coliform
- fecal strep

Option 3. Intermediate chemical tests

This option is designed to determine if any of the usual chemical entities beyond those in Option 1 may be responsible for a water quality problem. Tests include:

- specific conductance or total dissolved solids (TDS)
- calcium
- iron
- total acidity
- magnesium
- copper
- total hardness
- sodium
- manganese
- saturation index
- sulfate
- chloride

Option 4. Toxic metals

This package is designed to determine if some of the unusual and toxic elements may be present in a suspected water supply when tests in Option 1 or 3 do not indicate possible problems, or if certain types of industrial pollution may be present. These elements include the following:

- arsenic
- chromium
- mercury
- barium
- fluoride
- molybdenum
- cadmium
- lead
- strontium

Option 5. Organic scan

This test is designed to determine if organic compounds such as pesticides, herbicides, or solvents are present in appreciable amounts in a suspected water sample.

- halides
- pesticides and PCBs
- herbicides
- purgeable aromatics
- fuel

Testing services

Testing services are available from many laboratories in most areas. The federal EPA periodically publishes updated lists of laboratories certified to perform various tests. Some laboratories may be found in the yellow pages section of the phone book. Contact your County Agricultural Extension office or appropriate departments in the College of Agricultural Sciences at Penn State if help is needed in locating laboratories. Laboratories provide directions and special containers for use in sampling for various tests.

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