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Bradley J. Austin

Dirk Philipp

Mike Daniels

Brian E. Haggard

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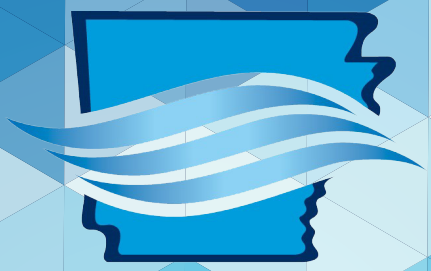

ARKANSAS WATER
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How to Collect Your Water Sample and Interpret the Results for the Livestock Analytical Package

Bradley J. Austin, Dirk Philipp, Mike Daniels, and Brian E. Haggard
Arkansas Water Resources Center
University of Arkansas System Division of Agriculture

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How to Collect Your Water Sample and Interpret the Results for the Livestock Analytical Package

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A plentiful supply of clean water is crucial for livestock health and productivity. To determine the quality of your livestock's water resources, periodic sampling and analysis is needed. The Arkansas Water Resources Center (AWRC) in cooperation with the UA Cooperative Extension Service offers several analytical packages to assess the quality of your water resources. This document is intended to provide guidance to livestock owners on collecting water samples for analysis and understanding the results on your report provided by the AWRC's Water Quality Laboratory (Lab). The information contained within this fact sheet should be used as general guidance, and the reader is encouraged to seek advice from Extension specialists regarding the interpretation of individual reports and water testing results that may be of concern.

Why Should You Have Your Livestock's Water Tested?

- The quality of groundwater sources should not vary much over time, but groundwater may vary between wells, even if they are close in proximity.
- Water quality of surface waters (streams and ponds) can and often do vary seasonally with highest quality in winter and poorest quality in the summer (Gadberry 2013).
- Shallow groundwater and surface waters may be contaminated by agricultural application of fertilizers and pesticides (Gadberry 2013).
- Water resources should be tested if you suspect poor water quality is contributing to decreased livestock production.
- New resources, such as drilling a new well for groundwater, should be tested before use.

Water resources should be tested periodically to ensure good water quality for livestock consumption.

Collecting and Submitting Samples to the AWRC

The AWRC Water Quality Lab requires 0.5 liters (roughly half a quart) to measure all of the parameters included in the livestock analytical package. You should properly label a clean sample bottle with your site information; clean bottles can be obtained from the AWRC Water Quality Lab or from your local extension office, if needed. If your primary water source is a pond, find a sampling location that is devoid of debris, mud, and or algae in surface films, being careful not to stir up the sediments. In streams, water samples should be collected from the area with the fastest moving water; this area is the most thoroughly mixed and representative of the overall stream water quality. Additionally, to avoid potential contamination, water samples should be collected while you're facing upstream, as the water is moving toward you. . Prior to sample collection, the sample bottle should be field-rinsed three times. To do this, fill the sample bottle approximately ¼ full, cap and shake, and then discard the rinse water away from the location that the sample will be collected. Once field-rinsed, the sample bottle should be inverted and then submerged into the water ½ foot below the water surface and then turned upright to allow water to flow into the bottle.

If multiple water sources are used for your livestock, each source should be tested separately. When submitting multiple samples, make sure to properly label each sample bottle so that they can be distinguished from one another. Water samples should be kept cool, preferably on ice and out of the sun, and submitted to the AWRC Water Quality Lab as soon as possible. If possible, reduce delays during shipping and avoid submitting samples at times when they will reach the Lab on a holiday or weekend, as the concentrations of the variables in this analysis package may change over time in unpreserved water samples.

For the most reliable results, water samples should be kept cool, in the dark, and delivered to the AWRC Water Quality Lab as soon as possible.

Interpreting Results

Table 1 provides a list of acceptable concentrations for each of the parameters analyzed in the livestock water quality analytical package. It summarizes data for beef and dairy cattle, and swine. The values listed are acceptable for all ages of each form of livestock. In the descriptions below, specific holding times are listed for each parameter. Many of the parameters are stable for 14 days to 6 months once they have been filtered and preserved by the Lab. A list of holding times or the amount of time the Lab has to analyze the water sample is provided in Table 1. It is recommended that you submit your water samples to the water quality lab as soon as possible and keep them stored on ice until delivery to help ensure accuracy of the variables measured. The AWRC Water Quality Lab generally completes the analysis of your water sample within two weeks, returning results within three to four weeks.

Below are some general guidelines in determining if the parameters tested in your water sample are acceptable for consumption by your livestock. Specific values of maximum acceptable concentrations for daily consumption are provided in Table 1.

Table 1: Recommended limits for the parameters measured in the livestock analytical package based on the primary livestock produced in Arkansas. The listed values represent either the range or the maximum concentration that's safe for daily consumption by livestock.

Parameter	Beef€	Dairy¥	Swine¤	Sample Preservation	Holding Time (days)
pH	5.5 – 8.0	6.0 – 8.0	6.5 – 8.5	None	2
Arsenic (mg/L)	<0.2	<0.05	<0.2*	Filter/Acidify	180
Calcium (mg/L)	< 500	<500€	< 1000	Filter/Acidify	180
Magnesium (mg/L)	< 250	<250€	<250	Filter/Acidify	180
Sodium (mg/L)	< 1000	<1000€	< 1000	Filter/Acidify	180
Copper (mg/L)	<1.0¥	< 1.0	< 0.5	Filter/Acidify	180
Iron (mg/L)	<2.0	<2.0	<0.2	Filter/Acidify	180
Manganese (mg/L)	<0.05	<0.05	<1.0	Filter/Acidify	180
Total Dissolved Solids (mg/L)	< 2500	< 1000	< 3000	None	7
Conductivity (µS/cm)	< 1500	< 1500	< 1500	None	28
Fluoride (mg/L)	< 2.0	< 2.0	2.0 – 3.0	None	28
Chloride (mg/L)	< 1500	<1500€	< 250	None	28
Sulfate (mg/L)	< 500	< 500	< 1000	None	28
Nitrate-Nitrogen (mg/L)	< 68*	< 22	< 68*	None	2

Symbols next to specific headers denote primary source for values listed under that category of livestock, symbols next to individual values denotes the source for that specific value.

€: Gadberry 2013, FAS3021; ¥: Looper 2013, FAS4021; ¤: van Heugten, ANS00-811s; *: CAST 1974, Report No. 26
: Spectrum Analytic (access date 11-16-2015)

1 **pH:** This is a measure of how acidic (values less than 7) or basic (values greater than 7) a water sample is. The acceptable range for most livestock is between 5.5 and 8.5. Several problems may arise when the pH is outside of this range. Excessively low pH may corrode water delivery systems leading to contamination of the water with metals such as iron, copper, and lead. Waters with a pH outside of the desirable range may also result in digestive upset, diarrhea, and decreased feed and water intake. Samples should be analyzed within 48 hours of collection for the most accurate results (Table 1).

2 **Arsenic (As):** Arsenic enters water bodies through the erosion and weathering of soil, minerals, and ores, and atmospheric deposition through the burning of fossil fuels. Drinking water concentrations less than 0.2 mg/L are generally acceptable for most livestock. However, total intake of arsenic from all dietary sources should be taken into consideration. Once your water sample is processed and preserved in the laboratory it is stable for 6 months.

3 **Calcium (Ca):** Calcium is naturally occurring in most water sources and it can come from dissolved rock such as limestone and gypsum. High concentrations of calcium along with magnesium relate to "hard water" which can result in scale formation in your water delivery system, thereby decreasing function. Calcium concentrations less than 500 mg/L are acceptable for cattle, while swine can handle concentrations up to 1000 mg/L. Once your water sample is processed and preserved in the laboratory it is stable for 6 months.

4 **Magnesium (Mg):** Similar to calcium, magnesium is naturally occurring in most water sources and comes from dissolved rock such as dolomite. Magnesium also relates to "hard water" which can result in scale formation in water delivery systems. Concentrations less than 125 mg/L are generally safe for your livestock; however, concentrations as low as 50 mg/L may cause diarrhea if sulfate is high. Once your sample is processed and preserved in the laboratory it is stable for 6 months.

5 **Sodium (Na):** Usually found in association with chloride, sodium occurs in water from the dissolving of rock and salts. Concentrations of less than 1000 mg/L are acceptable for both cattle and swine. Lower concentrations may be needed if both chloride and sulfate are also present in higher concentrations. Once your sample is processed and preserved in the laboratory it is stable for 6 months.

6 **Copper (Cu):** Acceptable concentrations for copper in the water supply for livestock range from less than 0.5 mg/L for swine to as high as 1 mg/L for cattle. Higher concentrations may produce a bitter flavor which can reduce water intake and decrease animal production. One potential source of elevated copper is from the water delivery system if copper pipe is used and the water source has a low pH. Once your sample is processed and preserved in the laboratory it is stable for 6 months.

7 **Iron (Fe):** The water sample is analyzed for concentrations of total dissolved iron and will not distinguish between unoxidized (ferrous) and oxidized (ferric) forms. Iron concentrations of up to 2.0 mg/L for beef and dairy cattle and 0.2 mg/L for other livestock should not be harmful for consumption. Once the water sample is processed and preserved by the laboratory, the holding time for analysis is 6 months.

8 **Manganese (Mn):** Concentrations of total dissolved manganese less than 0.05 mg/L are not harmful to livestock. Once the water sample is processed and preserved by the laboratory, the holding time for analysis is 6 months.

9 **Total Dissolved Solids (TDS):** This is a general term defining the sum of all inorganic matter dissolved in water. The acceptable level of TDS for all livestock is less than 1000 mg/L, though maximum safe concentrations vary between cattle and swine. Concentrations above 3000 mg/L can cause diarrhea, and above 7000 mg/L water becomes unsuitable for animal consumption over extended periods of time. TDS should be analyzed in water samples within 7 days after collection.

10 **Conductivity:** Conductivity is related to the salt content or the amount of dissolved ions in the water sample and it is a measure of how well water conducts electricity. In general conductivity less than 1500 µS/cm is relatively high quality for most livestock. Increasing above this point may cause diarrhea until the animals become accustomed to the change. With even higher values (> 8000 µS/cm), water becomes unsuitable for animal consumption over extended periods of time. Conductivity is stable in water sample for up to 28 days after collection.

11 **Fluoride (F):** Fluoride is a naturally occurring trace element found in surface and ground waters, generally occurring in concentrations ranging from 0.1 – 1.5 mg/L. Acceptable concentrations for livestock range from less than 2.0 mg/L to 3.0 mg/L. Fluoride concentrations are stable in your water sample for up to 28 days after collection.

12 **Chloride (Cl):** Chloride should not be confused with chlorine (Cl_2) which is a highly reactive compound, often used by drinking water treatment plants as a disinfectant. Chloride is part of common salt (sodium chloride) and occurs naturally in surface and ground water sources due to the dissolving of rock. Acceptable concentrations of chloride in water sources for livestock ranges from less than 250 mg/L for swine to as high as 1500 mg/L for cattle. Chloride concentrations are stable in water samples for up to 28 days after collection.

13 **Sulfate (SO_4):** Sulfate is a naturally occurring compound in surface and ground waters ranging in concentration from 0 – 1000 mg/L. Cattle and swine can handle concentrations between 500 – 1000 mg/L. Higher concentrations for all livestock will have a laxative effect;

14 **Nitrate-Nitrogen (NO_3-N):** Nitrate is presented in the report as NO_3-N which is the concentration of nitrogen in the sample in the form of nitrate. Nitrate is not in itself very toxic to animals; however, excessively high nitrate concentrations (>68 mg/L NO_3-N) tend to co-occur with an accumulation of nitrite (NO_2) which is toxic to livestock. Nitrite decreases the blood's ability to carry oxygen. Healthy adult cattle and swine can handle concentrations as high as 68 mg/L of NO_3-N, while for juvenile animals concentrations should be less than 10 mg/L of NO_3-N. Nitrate should be analyzed within 48 hours of water sample(s) being collected.

Protecting Water Quality For Livestock Consumption

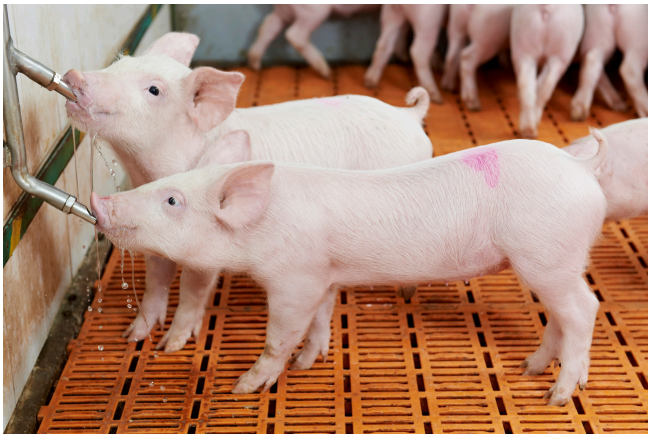
While the intended purpose of this fact sheet is to provide guidance in understanding the livestock water quality report there are some simple precautions you can take to help maintain good water quality for your livestock.

If ponds and streams are used as a water source for your livestock, keep the animals out of their water source (Gadberry 2013).

- Animals can contaminate their water source with manure and urine.
- Fence off ponds and streams and use a secondary watering tank that is filled by the water source.

Don't over-apply fertilizers and pesticides to your pastures.

- Over application or improper application of fertilizers and pesticides can result in an increase of nutrients and harmful chemicals running off into nearby streams and seeping into shallow groundwater sources. This may alter the quality of water available for livestock's consumption.
- Avoid using water supplies that drain adjacent crop agricultural fields, especially if over application of fertilizers and pesticides is an issue.



Keeping livestock out of their water source will help maintain good water quality.

Summary

Having a reliable water source with good water quality is integral for livestock health and production. Testing water resources regularly can help ensure that you are providing your livestock with clean water and can help detect problems before they negatively impact your animals. This fact sheet is intended to provide information on acceptable concentrations of various elements and compounds for livestock consumption. If the water is being used for additional purposes, such as crop irrigation, it is important to take into consideration the recommended concentrations for the other intended purposes when managing your water resources. If you have specific questions regarding how your water quality may influence your livestock please contact either Dr. Mike Daniels or Dr. Dirk Philipp, with the University Of Arkansas Cooperative Extension Service (mdaniels@uaex.edu or dphilipp@uark.edu).

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ARKANSAS WATER RESOURCES CENTER

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

UNIVERSITY OF ARKANSAS

Arkansas Water Resources Center
479.575.4430
awrc@uark.edu
College of Engineering
203 Engineering Hall
University of Arkansas
Fayetteville, AR 72701