



North Central Water Quality Survey¹

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Summary

This survey was conducted to determine the water quality in north central South Dakota. Twenty-one water sources from 16 different livestock operations were surveyed for this project. The water sources included five runoff-fed dugouts, 6 spring-fed dugouts, 4 deep wells (> 1000 ft), 3 medium-depth wells (100 to 500 ft) and 3 shallow wells (< 100 ft). Each water sample was initially tested with a hand-held Hanna Dist WP4 electroconductivity (EC) meter and the readings were recorded. Samples were then shipped to Servi-Tech Laboratories in Hastings, NE, where they were tested for EC, total dissolved solids (TDS), hardness, pH, calcium (Ca), chloride (Cl), magnesium (Mg), potassium (K), sulfate (SO₄), sulfate-sulfur (SO₄-S), and sodium (Na). Water quality indicators and mineral concentrations were not different over time when analyzed across all water sources or within each water source independently. Water from runoff-fed dugouts was lower ($P < 0.05$) in pH than water from spring-fed dugouts or wells. Well water contained greater ($P < 0.05$) concentrations of Cl than water from either runoff-fed or spring-fed dugouts. Potassium concentrations were greater ($P < 0.05$) in water from runoff-fed dugouts than in water from spring-fed dugouts or well water. Estimation of water quality without testing is highly inaccurate and variable. Livestock producers should obtain water samples for determination of water quality and adjust management to account for poor-quality water sources.

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Introduction

Water quality is a major concern for livestock operations in South Dakota. For most livestock operations, poor-quality water is that which contains high concentrations of sulfates. High-sulfate water is common in certain regions of western South Dakota, but has also been identified sporadically in eastern South Dakota. This survey was conducted to determine the water quality in north central South Dakota.

Materials and Methods

Twenty-one water sources from 16 different livestock operations were surveyed for this project. Producers were asked to cost share in the project at a rate of \$5.00 per sample and provide information and access to the water sources in question. The water sources included five runoff-fed dugouts, 6 spring-fed dugouts, 4 deep wells (> 1000 ft), 3 medium-depth wells (100 to 500 ft) and 3 shallow wells (< 100 ft). Sampling dates were on or near May 24, July 8, August 24, October 4, 2005. Dugout samples were collected on each of the dates listed above and well water samples were sampled twice, once at the initial sampling date and again on the final sampling date. Each water sample was initially tested with a hand-held Hanna Dist WP4 electroconductivity (EC) meter and the readings were recorded. Samples were then shipped to Servi-Tech Laboratories in Hastings, NE, where they were tested for EC, total dissolved solids (TDS), hardness, pH, calcium (Ca), chloride (Cl), magnesium (Mg), potassium (K), sulfate (SO₄), sulfate-sulfur (SO₄-S), and sodium (Na). Data were analyzed using the GLM and MIXED procedures of SAS.

Results and Discussion

Water quality indicators or mineral concentrations were not different over time when analyzed across all water sources or within each

water source independently. As such, only the main effect of source is presented in Tables 1 and 2. With the exception of pH, water quality indicators were not different between water sources. Water from runoff-fed dugouts was lower ($P < 0.05$) in pH than water from spring-fed dugouts or wells. Well water contained greater ($P < 0.05$) concentrations of Cl than

water from either runoff-fed or spring-fed dugouts. Potassium concentrations were greater ($P < 0.05$) in water from runoff-fed dugouts than in water from spring-fed dugouts or well water

Table 1. Water quality indicators for water from different sources

Item	Runoff-fed dugout	Spring-fed dugout	Well	SEM
Number of locations	4	6	11	
Number of samples per location	4	4	2	
Handheld electroconductivity, mmho/cm ^a	0.88	1.75	1.99	0.20
Lab electroconductivity, mmho/cm	0.93	1.91	2.09	0.21
Total dissolved solids, ppm ^b	698	1432	1347	230
Hardness, mg CaCO ₃ /L	414	722	536	84
pH	7.76 ^c	8.00 ^d	7.87 ^d	0.04

^ammho/cm = millimhos per centimeter

^bppm = parts per million.

^{c,d}Means within a row lacking common superscripts differ ($P < 0.05$).

Table 2. Mineral concentrations in water from different sources

Item	Runoff-fed dugout	Spring-fed dugout	Well	SEM
	----- ppm ^a -----			
Number of locations	4	6	11	
Number of samples per location	4	4	2	
Calcium	78	110	143	11
Chloride	22 ^b	84 ^b	201 ^c	22
Magnesium	53	108	43	16
Potassium	22 ^b	15 ^c	12 ^c	1
Sodium	76	256	326	52
Sulfate	347	849	568	168

^appm = parts per million.

^{b,c}Means within a row lacking common superscripts differ ($P < 0.05$).

Many of the parameters tested did not change over time and were not affected by water source. This is perhaps not unexpected given the relatively small sample size and high degree of variability. Analysis of a larger sample might help elucidate indicators or trends to aid in

prediction of water quality. In the mean time, livestock producers, managers, nutritionists, and veterinarians should be cautious in making assumptions on water quality. Testing the quality of the water directly is, without question, the most

accurate means of determining water quality.

Implications

Due to the variability in the quality of water within various sources, the lack of a clear correlation between water source and water quality, and the lack of clear patterns relative to changes in water quality following environmental events, it is recommended that water be tested prior to utilization by livestock. A simple hand held EC meter can be utilized as a screening tool to determine if further testing may be necessary. All county extension offices in South Dakota have an EC meter available to help screen livestock water at no charge to the producer.

If a high EC reading occurs (> 2000), it is recommended that further testing be conducted to determine the cause for the high EC reading.

Frequency of testing is up to the discretion of the producer. However, it is suggested that a test be conducted at the start of the grazing season to determine initial water quality. That test may also be suggestive of the need for further or more frequent testing. Subsequent testing may be necessary depending on environmental conditions. Also, if producers notice a change in animal health – cattle that are gaunt or cattle that are at the dugout but refuse to drink – it may be an indication of a water quality issue and testing is needed.