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EFFECTS OF WATER QUALITY ON COW/CALF PRODUCTION

NON-TECHNICAL SUMMARY: Water high in TDS and sulfates can kill livestock, however the effects of moderate concentrations are poorly understood. This project examines the effects of water with moderate TDS and sulfates on cow/calf performance and the effect of thiamine additions to steer diets in moderating the effects of poor quality water.

OBJECTIVES: The objectives of this study are to 1) determine the relationship between water quality (TDS and sulfates) and the production and health of cow/calf pairs, 2) determine the effect of thiamine addition to feed on the health and production of cattle receiving poor quality water, 3) compare the environmental conditions between confinement and pasture cattle, and 4) determine the economic impacts of water quality on production costs and sale value of livestock and land.

APPROACH: This project will involve 2 studies. In Study 1, approximately 20 mature cows with calves, 5 first-calf heifers with calves, plus one bull will graze each of six native pastures for three months in summer 2003 and summer 2004. Pastures will provide similar quantities and qualities of forage, and will be stocked to assure forage quantity does not become limiting. Three pastures will be randomly assigned to receive poor quality water (5000 mg/L TDS, 3000 mg/L sulfates) and the remaining three pastures will receive good quality water (1000 mg/L TDS, 400 mg/L sulfates). Data to be collected include cow weights and body condition scores, calf weights, health assessments, water consumption, milk production, pregnancy rates, forage moisture content, and environmental temperatures. In Study 2, 72 steers will be stratified by weight and randomly assigned to one of nine pens in a feedlot. Six of the pens will be randomly assigned to a poor quality water treatment and the remaining three pens will be provided good quality water. Steers in both treatments will be fed a growing ration. Thiamine will be included in the ration in only half of the poor quality water pens. Good quality water for Study 2 will be the same as for Study 1 and poor

quality water will be approximately 7000 mg/L TDS. Data to be collected in this study include weights, health assessments, feed consumption, water consumption, moisture content of feed, and environmental temperatures. The amount of forage available to cattle grazing pastures in Study 1 will be monitored throughout the growing season in permanent plots. Utilization will be determined using caged plots randomly located throughout each pasture. Consumption of feed by cattle in Study 2 will be measured daily. Cattle in both studies will be weighed monthly and health of animals assessed daily. Any sickness will be treated promptly according to established protocol. Daily water consumption will be determined for all pastures and pens. Samples of the feed provided to confined steers and the forage available to cattle on pasture will be collected weekly and percent moisture content determined. The heat experienced by cattle in each of the two studies will be assessed in two ways: 1) using an infrared thermometer to measure the surface temperature of feedlot pens and pastures in mid-afternoon and 2) using ear thermometers. Production of milk by cows on the pastures will be assessed at least twice each year in Study 1 using a weigh-suckle-weigh procedure. Data on production costs will be collected on livestock in each treatment to determine any significant differences in production costs. Comparisons will be made between cattle in the different treatments to determine the total dollar value of beef produced in each treatment, the value of cattle available for sale, and the estimated gross and net returns for each treatment group. The data will be used to develop representative production budgets for each group of cattle. Data will also be collected to evaluate the value of land (sale, lease) and the expense of rangeland improvement practices to provide higher quality water.

PROGRESS: 2002/12 TO 2004/09

This project was designed to evaluate the impacts of high sulfate water on cow-calf performance while grazing rangeland. Previous work with steers grazing rangeland indicated that average daily gain (ADG) for steers provided low sulfate water was greater than for steers provided high sulfate water. The current study was also conducted at the Cottonwood Range and Livestock Research Station in both 2003 and 2004. In both years, low sulfate (LS) water (400 mg/l sulfate in both years) and high sulfate (HS) water (2700 mg/l sulfate in 2003 and 3000 mg/l sulfate in 2004) were each provided to cow-calf pairs grazing in 3 separate pastures (6 herds and pastures total, 3 reps per water treatment) during the growing season. Data collected on the livestock included beginning and ending weight and body condition score (BCS), 12-hour milk production, and pregnancy rates. In 2003, sulfate levels in drinking water affected cow weight change ($P=0.04$) with LS cows gaining 6.8 kg and HS cows losing 16.34 kg. Cow body condition score change was also significant ($P=0.10$) with LS cows having a smaller decrease (-0.27) than HS cows (-0.48). Sulfate levels did not affect 12-hour milk production ($P=0.33$ for July 2 and $P=0.48$ for July 29), calf ADG ($P=0.71$), or pregnancy rates ($P=0.36$). In 2004, cow weight change was not significant ($P=0.18$) with LS cows gaining 11.8 kg and HS cows gaining 3.6 kg. Cow BCS change was also nonsignificant ($P=0.93$, a BCS of -0.09 and -0.08 for

LS and HS cows, respectively). Twelve-hour milk production was, however affected by water sulfate level ($P=0.02$) with LS cows producing 4.1 kg and HS cows producing 2.0 kg. Calf ADG was not different between LS and HS ($P=0.14$, ADG of 1.16 kg/d and 1.12 kg/d for LS and HS, respectively). Pregnancy rates in 2004 were not statistically significant ($P=0.2$, 91.7% and 83% for LS and HS cows, respectively), however the percent of cows that bred in the first 25 days of the breeding season was greater ($P=0.06$) for LS cows (81.3%) than for HS cows (63.8%). This can significantly impact the likelihood of a cow remaining in a breeding herd. While the specific impacts differed between years, in both years important cow-calf production parameters were affected by high levels of sulfate in water. In 2003, cow weight change and body condition score change were both negatively impacted by HS water, whereas in 2004, 12-hour milk production and percent of cows that bred in the first 25 days of the breeding season were lower in HS cows.

IMPACT: 2002/12 TO 2004/09

Sulfate levels in water in western South Dakota range from minimal to extremely high. The sulfate levels in drinking water available to livestock on many pastures in the region often exceed the levels of sulfate used in this study (2700 mg/l sulfates in 2003 and 3000 mg/l sulfates in 2004). Our study shows very clearly that water sulfate levels of 2700 mg/l or greater can have detrimental effects on cow-calf herds. Alternative sources or management to avoid water when salts are most concentrated need to be considered in these situations.

PUBLICATIONS: 2002/12 TO 2004/09

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