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Review of the effects of water quality on ruminant health and productivity

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Meat and Livestock Australia (MLA) has identified water quality and its effect on ruminant livestock as an important area of concern to producers as well as other livestock industry stakeholders. Water quality of both groundwater and surface water is important for the health and productivity of ruminants. Salinity caused by dissolved salts is a major water quality issue with groundwater in addition to presence (to different concentrations) of some undesirable chemicals of concern.

This book includes a literature review on all aspects of water quality and its impact on the water intake, health, productivity and grazing behaviour of ruminants; a list of water tests suitable for use on-property and laboratory options for north Australian beef producers; case studies and examples of the losses in productivity that have been recorded in beef cattle; maps showing different aspects of underground water quality for northern Australia and recommendations where possible on measures to treat or prevent water quality problems.

This study primarily focuses on the groundwater quality of the northern Australia, starting from northern Western Australia through to northern Queensland.

Palatability of the water is important for water uptake and gaining weight. Odour due to hydrogen sulphide, contamination due to fecal material and salinity can affect the palatability of water.

The effect of water temperature has been found to vary between different breeds of cattle. Brahman cattle have been found to tolerate warmer water, and performed the same level of growth when fed with warm water (32.2^{o}C) as Hereford cattle when fed with cold water at 18^{o}C.

In the case of pH of water, a lower value of less than 5.5 can cause acidosis and reduced feed intake in cattle and a pH greater than 8.5 may result in higher risk of metabolic alkalosis, and may cause digestive upsets, laxative action, poor feed conversion, reduced water and/or feed intake. In northern WA and Northern Territory, the mean pH of groundwater was found to be 7.81 (N = 660) and 7.16 (N= 41,500) whereas for northern Queensland, the mean pH was found to be 5.1 (N=30).

The total dissolved solids (TDS) and high salinity in water may reduce the palatability of water to animals which may decrease feed intake. They can adapt over time to the taste and physiological effects of water with higher salt content, with increased renal excretion of excess salt. The desirable maximum TDS values for dairy cattle, beef cattle and sheep are 2500 mg/L, 4000 mg/Land 5000 mg/L respectively. The mean TDS values in the groundwater of northern WA, NT and northern Queensland are 2705 mg/L (N = 96); 1260 mg/L (N= 35620); and 852 mg/L (N = 51) respectively.

Cattle can tolerate high short-term exposure to high concentrations, up to 4000 mg/L of Sodium, however, it is recommended keeping drinking water sodium concentrations at less than 1000 mg/L. The mean sodium concentration in groundwater in northern WA is 312 mg/L (N = 83) and that of NT of 227 mg/L (N= 37,614). These are well below the maximum limits, but there are locations where sodium level has been found to be well above 5000 mg/L.

One of the most critical salts in water is the sulphate ion, which is commonly found in water. Other forms of sulphur such as sulphides may also be found in some ground water, and although they do not persist for long at the surface, they can contribute to overall poor quality of the water and health problems.

A number of additional groundwater contaminants that can adversely affect the health and productivity have been discussed in the report. These include, Aluminium, Arsenic, nitrate, Calcium, phosphate, Magnesium, Beryllium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, cyanide, Fluoride, Sulphate, Iron, Lead, Manganese, Mercury, Molybdenum, Nickel, and Zinc.

The recommended upper safe values for these contaminants of concern based on The Australian and New Zealand Environment Conservation Council (ANZECC), and other international standards including US-EPA are also provided in the report. Where data of these contaminants in the groundwater in northern WA, NT and northern Queensland are available, the data have been plotted with geo-

reference in the maps. In addition, where applicable, the frequency distributions of the data have also been provided in the report.

The book also provides a short list of water tests suitable for on-property and external laboratories. A list of on-site water quality monitoring kits that are suitable for in-property screening and testing of various chemicals of concern and the level of accuracy of results of such test kits has been provided in the report. The standard procedure for sample collection, storage during delivery to the laboratories is also discussed to help the staff of producers to avoid mistakes that can affect the results of the water quality testing.

Finally the book discusses some of the appropriate technologies and methods suitable for groundwater treatment for northern beef producers. These technologies include air stripping, chlorination, multi-media filter, ultraviolet radiation, ion exchange (softening), slow sand filters, oxidisation & filtration, activated carbon filters, ozonation, biological filters, coagulation, nanofilters, reverse osmosis (RO). A number of these technologies, individually or in combination can reduce considerably or completely eliminate the effect of the identified water quality issues.

Finally the book summarises the treatment costs for water treatment for a 100 and 500 cattle herd. These costs would be indicative only as a number of parameters such as the concentration of the contaminants, economic conditions and the level of controls and monitoring affect the actual costs of the technologies. In addition, these costs can vary significantly with respect to the pre-treatment requirements and the environmental regulations with respect to disposal of rejects and waste streams.

This book is an easily understandable reference material on typical water quality issues in various grazing and feedlot locations in northern Australia and its impact on animal health, water quality testing and treatment opportunities. It will be a useful material for producers, meat industry associations and investors.