

SUMMARY

AN INVESTIGATION INTO THE QUALITY OF WATER FOR ANIMAL PRODUCTION

by

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The validity of the guidelines presently in use in southern Africa in assessing the quality of water for livestock production has been questioned. International guideline variables and the levels for specific variables differ and highlight the need for each country to have own relevant guidelines. The guidelines in use in South Africa are based largely on international guidelines and have few locally established variable guidelines.

A total of 2293 data sets of borehole water samples from non-hydrogauging stations from the NW & NE Transvaal and NW Cape were reviewed and the variables fluoride (F), total dissolved salts (TDS), chloride (Cl) and sulphate (SO₄) were found to be the variables of major importance to livestock production based on the incidence of potential-toxicity assessed according to international guidelines. High risk areas were identified and selected farms were visited in the NW Cape and NW Transvaal regions. On the basis of the results on the data reviewed and the observations from the interviews conducted, research emphasis was placed on F and the palatability effects of primarily Cl, SO₄ and TDS. Similar results were obtained from a review of data from the Atomic Energy Corporation data base and recent data (1990-1994) from the Department of Water Affairs and Forestry, with nitrate being an addition to the list of water quality variables with high research priority.

The effects of five different levels of F in the drinking water (< 1 mg/l, 6 mg/l, 10 mg/l, 14 mg/l and 20 mg/l) on the growth and health of South African Mutton Merino wethers to market weight was investigated. No significant treatment effects were observed on growth or health. Thyroid gland weight was significantly affected by the treatment in some of the groups with a rise in thyroid gland weight with increasing levels of F in the drinking water. It was concluded that although there were no clinical symptoms or histopathological lesions found that F had a significant physiological impact on the sheep

(hypothyroidism) and fluorosis would have developed with time. It was further concluded that an ingestion of 96 mg F/ sheep/ d of F (25 kg live weight) and 122 mg F/ sheep /d of F (42 kg live weight) could be recommended for SAMM wethers for growth to market weight without any adverse effects on growth or health occurring. A similar finding was concluded in a second trial with a level of 15 mg/l F in the drinking water not resulting in any significant effect on growth or health of SAMM wethers to market weight.

Fluoride levels of up to 20 mg/l in the drinking water or at an ingestion rate of up to 3.206 mgF/bird/day, had no negative effects on production characteristics of Ross broilers.

No significant differences between NaF treatments regarding all major production characteristics were found in Silver Grey Hy-line layers at F levels of up to 20 mg/l or an ingestion rate of up to 4.453 mgF/day/bird over a 74 week period.

Similar findings to those made with SAMM wethers were made with Bonsmara steers exposed to NaF in the drinking water to a level of 20 mg/l F, with a resultant ingestion of 350 mg F/ steer/ /day during the initial growth phase and an ingestion of 600 mg F/ steer/ day during the final growth phase to market weight.

The effect of Cl and SO₄ on the palatability of water was investigated at varying TDS levels and ratios of Cl:TDS and SO₄:TDS. It was found that both variables had a significant adverse effect on the palatability of the water, judged by a decrease in the water intake for both variables and a decrease in the feed intake for the Cl variable. Sulphate appeared to have a negative effect on palatability at a lower level than for Cl. No significant treatment effects were found on growth to market weight or health (clinical observations, and kidney and liver histopathology).

A "zone of preference" in terms of water intake was identified in Friesland steers exposed to various Cl:TDS:SO₄ treatments in the drinking water. The response indicated that water intake may possibly be predicted by establishing the location of a "zone of preference", which aids in assessing the relative importance of water quality variables in terms of toxicological, palatability and adaptation factors. All these factors are important in assessing the effect and thus acceptance of a water source.

Saline water was found to significantly alter the bone [F] in SAMM wethers, compared to fresh water, with a significant negative correlation between salinity and bone [F] being found. A TDS concentration of 3000 - 6000 mg/l appeared to have a beneficial effect on hot carcass weight in Bonsmara steers exposed to F in the drinking water.

A need for an index system to assess the suitability of water for livestock production was identified as the present system does not fulfil this role satisfactorily. The index system should be based on the assessment of water intake for (i) toxic variables - to determine the levels of ingestion of the variable concerned, and (ii) palatability variables - to assess the impact on the variables on water requirement and feed intake. These will then be combined to form a water quality index (WQI).