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MANAGEMENT OF SOIL SALINITY IN SOUTH-EAST AUSTRALIA: IMPRESSIONS OF A VISITOR

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Officers of the Riverina Branch of the Australian Society of Soil Science Inc. are to be complimented for the fine conference programme and field trip. It brought together a "critical mass" of individuals and disciplines involved in the salinity problems of the area. This kind of gathering needs to be promoted every four to six years. The interactions between disciplines was very stimulating to all those involved. The following comments are not meant as criticisms, but rather as the perceptions of an outsider and newcomer, of topics that appear to warrant more thought and investigation.

A conference such as this usually exhibits the need for uniformity of units. This was emphasized directly and indirectly during the presentations and in the texts of the conference papers. Electrical conductivity (EC) units should be dS/m corrected to 25°C for irrigation and drainage waters and soil extracts. Soil salinity also needs to be expressed on the saturation extract basis. The need is obvious in terms of being able to compare data from different studies. A less obvious reason to use saturation extract EC, sodium adsorption ratio (SAR) and pH data, is that these were the standards for developing soil salinity and sodicity plant response tables (Bresler <u>et al</u>. 1982; U.S. Salinity Lab. Staff 1954). These data also allow comparison of salinity and sodicity effects, among soils of differing textures, for each plant variety. Dividing "EC units" (μS/cm or μmhos/cm)by 1000 gives dS/m. Approximate dS/m values can also be calculated by dividing PPM data by 640. Saturation extract EC's (EC_e) can be approximated from 1:5 extract EC data using the equation,

$$EC_e = EC_{1:5} * 500/\text{Saturation Percentage},$$

and saturation extract SAR values can be approximated from 1:5 extract SAR data using the equation

$$SAR_e = SAR_{1:5} * (500/\text{Saturation Percentage})^{1/2}.$$

A great deal of water table depth and EC data has been generated for the basin, and some very good papers were presented on the interactions among SAR, exchangeable sodium percentage (ESP), water movement and physical properties of soils. It appears, however, that the data base for irrigation and drainage water SAR, and for soil and subsoil ESP, is generally lacking. It also seems that the scientific and agricultural communities need to develop a stronger understanding of the consequences of high SAR and ESP in the various management schemes. The rice industry seems to have started recognizing these interactions, but not all others involved in irrigation, drainage and hydrology have come to grips with these complex interactions.

The comparison of lime ($CaCO_3$) and gypsum ($CaSO_4 \cdot 2H_2O$) effects on low pH (less than 6.5) sodic soils should be a very productive research area. These soils appear, from the literature, to have lower infiltration and hydraulic conductivity rates at a given ESP than would be predicted using data from sodic soils with pH values above 8.2. These low pH soils are only partially base saturated. The exchangeable Na^+ appears to be more detrimental to soil physical properties in these soils than an equivalent exchangeable Na^+ concentration in base saturated soils. Lime treatment would be expected to produce a greater degree of amelioration than gypsum, since gypsum adds a strong acid anion while lime would not. With the addition of lime, part of the exchangeable H^+ or Al^{3+} would be neutralized, thus allowing a greater exchange of Ca^{2+} onto the exchange sites. The chemistry differences of these two treatments should produce differing effects in soil pH, SAR and ESP, infiltration and hydraulic conductivity rates, phosphorus and micro nutrient availability to plants, soil strength and structural stability, gaseous exchange rates, shrinkage and swelling, root penetration, available water holding capacity, and drainage characteristics. These kinds of information would be valuable to irrigation and drainage planners and operators.

One of the conference speakers suggested that the lower reaches of the Murray River system contained sufficient plant nutrients to produce algal blooms, but that the blooms had not developed because high sediment concentrations kept sunlight from penetrating the water to a significant depth. The salinity status of the system is changing as a whole and to a greater degree in localized areas. Research on other soils suggests that, over the range of 0.2 to 1.0 dS/m, the soluble salt concentration and SAR can greatly affect the settling rate of fine clay particles (Robbins and

Brockway 1978). It would be worthwhile to determine the effects of EC and SAR changes on sedimentation rates, light penetration, and algal blooms in this drainage system.

Another question that came to mind during the field trip was: "What are the interactions between soil fertility and recharge in the highland areas?" How much can water use be increased by optimizing soil fertility in tree plantings, lucerne or improved pastures? Could water use be increased by rotating grazing areas, allowing the forage to grow to 0.4 to 0.6 m tall before grazing, grazing the forage off rapidly by a high concentration of animals, and then allowing regrowth before the next grazing? Could better management packages be developed that are economically attractive to the land owner and at the same time increase water use in the recharge areas? The system would likely include improved plant species, fertilizer or amendment recommendations and improved harvesting methods. Little was said during the conference about fertility or amendment effects on increasing water use by various crops.

On a more socio-economic note, public works such as the Wakool subsurface drainage-evaporation pond complex do not seem to be an acceptable answer to the problem. Even though such a system helps keep salt out of the river system, the irrigator does not have anything to gain by improving water use efficiency nor anything to loose by continuing to use poor irrigation methods as long as someone else provides the drainage. By some means, the irrigator needs to feel a pressure to become a better manager of available resources. This may be done by better record keeping of water onto and off of the property. Most irrigators know how to economically improve their irrigation efficiency. Many a scientist or engineer has set out to measure irrigation efficiency in an irrigation project, only to find that as soon as the irrigator realizes that records are being kept, the irrigation management improves and the on farm efficiency increases. Increasing water costs and then using the additional revenue to keep surface drainage separate from saline water, to reuse the surface runoff, to pay the cost of proper subsurface drainage water disposal or to subsidize land forming or water measurement equipment may stimulate onfarm improvements, especially when the irrigator realizes his or her inefficacy is being penalized and someone else is benefiting from it. Another possibility would be to impose a charge on excessive irrigation surface water runoff and ponding, as long as rain fall was not included. These decisions are seldom popular, but somehow, the irrigator who is not attempting to improve unacceptable irrigation methods and systems needs to "feel the heat", socially or economically.

Hopefully these thoughts will stimulate research or management activities that will partially help defer the salinization of the Murray Darling Basin.

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