Potash Helps Prevent Soil Salinity

By Brian J. Leach and John S. Glendinning

ONE OF THE ADVERSE EFFECTS of the clearing of forest, woodland and scrub for farming in southwest Australia has been the development of large areas of soils affected by salinity. Most of the clearing was carried out in the last 20 to 80 years.

The area has a Mediterranean or winter rainfall climate and so farming is based on annual crop and pasture plants. These annual plants have used less of the total rainfall than the original native trees and shrubs. This in turn, has led to a general rise in the saline ground water table. Where it is near the surface, soils have become or are becoming salty.

In medium rainfall areas (400 to 600 mm per annum) most of the saline and potentially saline areas are on the valley floors. These areas retain soil moisture until later in the spring and so used to carry the most productive clover based pastures.

The soils are mainly acid sands overlaying clay. The development of agriculture in the area was based on a cereal pasture rotation, with sheep production from the pasture phase. The pastures are annual, based almost wholly on subterranean clover, with various naturalized species such as "Cape Weed" (*Artotheca calendula*, Fam. Asteraceae) and "Guildford grass" (*Romulea rosea*, Fam. Iridaceae), and several species of *Erodium* (Fam. Geraniaceae). Although these species are regarded as weeds, they do make a contribution to pasture and animal production. Annual grass species include ryegrass (*Lolium*), brome (*Bromus*), barley grass (*Hordeum*) and silver grass (*Vulpia*). Climatic conditions do not allow perennial grasses to survive the hot, dry summers.

For all practical purposes the only fertilizer used for many years was single superphosphate. With the lengthening of the cropping phase in more recent times, nitrogen (N) is being more commonly used on wheat, barley and oats at rates of around 20 kg N/ha. In the more intensive dairying areas with rainfall around 1,000 mm, potassium (K) is also an important part of fertilizer programmes.

Micronutrients, particularly copper (Cu), zinc (Zn) and molybdenum (Mo), must also be applied in many situations in Western Australia agriculture to ensure profitable crop and pasture production. Manganese (Mn) is required in some situations.

Soil Salinity

Under the traditional farming and fertilizer practices that were developed, productivity in some areas gradually declined. The first species to be affected were the clovers. Eventually, in some of the low-lying areas the growth of all species declined to a very low level. Many farms have low lying parts where there now is virtually no useful grazing. As time goes by, these non-productive areas of the farm gradually extend farther up the slopes.

Many farmers now admit to having patches on their farms, extending from 5 ha up to 100 ha, which are affected in this way. These patches normally adjoin bare, salt-scald areas near stream courses where

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the grass on their fringes is dominantly "sea barley grass" (*Hordeum maritimum*). This is a salt-tolerant species, but of very low productivity and palatability. Farmers consider that such areas of barley grass are already slightly saline and will become more so.

Potash Deficiency - The Real Cause

It is now known that the real, underlying cause of the development of these bare, scalded areas is a deficiency of K. Soil tests show high salinity levels only near or in the scalds, but most parts are severely deficient in K. The barley grass can apparently tolerate low K supply as well as high salt.

The deficiency of K leads to reduced seed-set and growth of pasture legumes and thus lack of soil N to support other useful pasture species. But salinity appears to be spreading. This is partly due to low water use resulting from the lack of pasture growth. In other words, the increased soil salinity which has taken place is an effect, and not a cause, of the loss of the pastures.

CSBP Chief Agronomist Brian Leach inspects a stand of Balansa clover on a site that is waterlogged and slightly saline. Potash application is effective in treating the condition in areas of Western Australia.

Field research and soil testing by the agricultural staff of CSBP, the major fertilizer company in Western Australia, showed K deficiency to be a significant problem. They also showed that the trend in these areas . . . of rising water tables, increased soil salinity and loss of pasture growth . . . can be reversed by the use of K fertilizer.

Extensive areas farther upslope and not threatened by salt have also been found to be highly responsive to K, although they are not as deficient as the low lying areas. Greater pasture production and hence water use in these areas should also lead to less surplus water in the valleys, less waterlogging and, consequently, less salinity.

The use of K fertilizer, together with superphosphate, has enabled reestablishment of legume pasture species, especially Balansa clover (*Trifolium balabsae*).

This has also resulted in greatly improved pasture (quantity and quality) and animal production, plus increased palatability and consumption of non-legume pasture species. It can be expected to lead to an improvement in soil N supply for cereal crops in the rotation.

The highly saline areas which are bare, or nearly so, are being reclaimed by planting saltbush (*Atriplex* spp) for autumn browsing. Annual legumes such as Balansa clover cannot survive in these areas, but with adequate K and other nutrients can again make soil bordering the highly saline areas more productive and prevent further encroachment of salt.

Conclusion

Soil salinity has spread in Western Australia primarily due to reduced water use by plants following agricultural development. The increasing incidence of K deficiency has aggravated the problem, especially in low lying areas of the southwest. Treatment with K fertilizer (and superphosphate) is returning pastures to high productivity and helping to stop the spread of salt. ■