Soil dispersion and sodicity

Risk factors for dispersion:

1. High exchangeable sodium percent (ESP) **2.** Low salinity (EC) **3.** pH_w above 8.5 **4.** Low OM (OC)

- High levels of exchangeable sodium most commonly cause clay particles to disperse BUT the degree of dispersion is strongly influenced by other soil properties: electrical conductivity (EC, salinity), texture (predominantly clay% and mineralogy), soil pH and organic matter content.
- Clay soils containing large amounts of exchangeable sodium and low levels of soluble salts are predisposed to dispersion. Dispersion is aggravated by working soil when it is moist, e.g. tillage and/or trampling by livestock.
- When dispersive soils are wet, the clay particles break apart and move into suspension, blocking soil pore spaces, which restricts air and water movement into and through the soil. When the soil then dries, it sets hard. This can be seen as a crust on the soil surface or a hard pan in deeper soil.
- This has a significant impact on plant growth and productivity:
  - when soils are wet, infiltration, aeration and water movement within the soil are reduced, leading to waterlogging, erosion and denitrification;
  - as soils dry, they harden and porosity is reduced, resulting in drought stress from restricted root growth, slow movement of water to roots and a lower soil water holding capacity.
- These issues are particularly important for emerging crops and should be addressed before sowing.
- Sodicity may exist in the subsoil only, however it can still significantly impact plant growth.
- When the pH_w of a soil is above 8.5, it amplifies the effects of excess exchangeable sodium, except where the presence of calcium carbonate (often as lime nodules) suppresses dispersion.
- As salinity increases, soil dispersion decreases, regardless of how sodic the soil.
- To manage dispersion, promote soil aggregation (e.g. fibrous roots of pasture), minimise soil disturbance (cultivation) and replace sodium on clays with calcium, where excess sodium occurs.
- Applying an amendment to supply soluble calcium (Ca^{2+}) to replace exchangeable sodium is a common strategy, usually gypsum (calcium sulfate). Lime (calcium carbonate) is far less soluble than gypsum under alkaline conditions and its use to correct sodicity is not advised unless soils are also acidic or neutral. Surface spreading gypsum is effective in treating sodicity in the top 10-15 cm of the profile. Because gypsum is partially soluble it does not need to be incorporated like lime and this avoids disturbing a potentially dispersive soil.
- Treating subsoil sodicity with surface-applied gypsum is difficult because the calcium needs to be flushed through the soil profile to depth. However, it's possible in surface irrigated soils and can be done long term (10+ years) in winter rainfall areas with strategic gypsum application in autumn.
- Deep placement of gypsum and organic amendments have shown promise in the alleviation of subsoil sodicity.
- Reclaiming a dispersive sodic soil is possible, but can be slow, as soil structure takes time to rebuild, and soils often exhibit multiple constraints: sodicity and acidity, or sodicity and salinity. Compaction is another common soil constraint. In these cases, all constraints must be tackled together, with professional guidance from soil science specialists.

This factsheet was written by Abigail Jenkins and Sam North from NSW DPI as part of the **Extension of best practice principles for identifying and managing soil limitations in southern and central NSW** (GRDC Project code FLR1909-001SAX).

NSW GOVERNMENT Department of Primary Industries

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