Salinity – Part 1

Salinity and its effects on crops

Salinity is an excess of salts in the plant, soil and/or water. It is an often- underestimated problem in agriculture, as it can often build up over time and persist with sub-clinical effects before it reaches a level where it is noticeable. It is also often confused with sodicity (sodium problems), but it must be recognised that, while the two do often go hand-in-hand, there can be salinity problems without sodium problems and vice-versa.

Sources of salts

A salt is an inorganic chemical compound made up of an acid and a base. This covers a wide range of substances, and not all salts are necessarily harmful. For example, potassium sulphate is technically a salt, but it provides nutrients to crops, while sodium chloride, another salt, is toxic. Gypsum (calcium sulphate) is another salt, and is often used to remediate sodicity problems.

Salts may already be present in the soil when a crop is planted, or they may be introduced via water, fertilisers or other amendments such as composts and manures. Knowing where the salt is coming from (ie soil/water/fertiliser/other amendments) and what type(s) of salt is present are important factors in being able to address the salinity issue effectively.

The next issue of "Vitality" will look in more detail at sources of salts and various management options.

Effects of salinity on plants

The main problem caused by excess salt is disturbance of the salt-water balance within the plant, which, if left unaddressed, results in dehydration and a concentration of salts in the plant sap and tissues. The salt-water balance is also important for electrochemical functions within the plant. Depending on the type of salts present, there may be toxicity issues and suppression of uptake of particular nutrients through ionic competition (nutrients and toxins "compete" with other nutrients/toxins for uptake – if there are large amounts of one nutrient/toxin, it will be more likely to be taken up than others).

The first-noticed symptoms of salt-overload are wilting plants and/or leaf "burn" or drying of the leaves, which is often caused by sodium and/or chloride toxicity. However, by the time symptoms are seen, the plant has passed its tolerance threshold and is suffering significant losses in vigour and, potentially, yield.

This is where the type of salt present can make an important difference, and will affect how the issue is dealt with. If the excess salt is toxic to plants, then the symptoms shown by the plant will be a combination of salinity stress and toxicity; if the excess salt has a nutritional basis, then water stress and suppression of other nutrients will be more of an issue.

Examples of salt ions and their potential effects:

(An ion is an electrically-charged particle, and is the form that nutrients and toxins are in when taken up by plants. Anions are negatively-charged; cations are positively-charged)

Chloride – competes with anions for uptake, particularly nitrate. Chloride toxicity symptoms include early leaf drop and leaf "burn" or drying of leaves (usually, the *tips* of older leaves are affected before other plant parts).

Sodium – competes with cations for uptake, particularly potassium. Sodium toxicity symptoms include leaf "burn" or drying of leaves (usually, the *margins* of older leaves are affected first).

Potassium – competes with cations for uptake, particularly calcium and magnesium; plant uptake of nitrogen can be suppressed if potassium levels are excessive. Potassium is an important plant nutrient.

Sulphate – competes with anions for uptake, but sulphur toxicity is extremely rare. Sulphur is an important plant nutrient.

Salinity tolerance

How soon a crop will be affected by salinity, and how severely it will be affected, depends on a number of factors. Different crop types have varying tolerance levels to salinity, so some plants will readily grow in soils that more sensitive plants would not grow at all. For example, squash and zucchini tolerate much higher salt levels than potatoes or strawberries, and, as a general rule, grain crops are more tolerant of salts than fruit and vegetable crops. General plant health and the presence of other stresses are also important factors to consider. When water and nutrients are freely available, plants tend to cope better than when something is lacking.

Identifying potential salinity issues

The only way to identify salinity issues before they become a significant problem is through monitoring. Regular crop monitoring of sap levels using NU-test® will show the varying levels of nutrients in plant sap as the plant grows, and provides an early indication of potential issues, including salinity issues if chloride is included in the test (if chloride is not requested it is more difficult to distinguish salinity issues due to relying on other elements, which may be elevated for other reasons). Testing your soils and water will provide an indication of their salinity and can often help in identifying the type of salts present. If a NU-test® sample returns results that suggest salinity issues, it is important to identify the source of salts, and follow up with soil and water tests, particularly if they haven't been done recently. Soil and water testing is also important for identifying potential issues, so that they can be addressed before salinity becomes a problem and before the land becomes unviable.

Testing suspect areas and monitoring of crops and irrigation water are an important part of any crop management strategy, as it allows land managers to deal with issues like salinity before they impact on productivity. ***Next issue of "Vitality" we will bring you Part 2 of our Salinity series, where we will look into the different sources in more detail and management options available for different scenarios.***