Farm Water Futures

MANAGING SALTS IN THE CROP ROOT ZONE

All water contains some salts. When water is taken up by crops, much of the salt is left behind in the root zone. If this salt is not removed, then the salt concentration in the root zone will build up and affect crop growth and production.

Introduction

Salt is present in many irrigation areas throughout Queensland, particularly those that rely on groundwater supplies. Effective salinity management is crucial to ensure both environmental and economic sustainability.

There are two situations that change the approach to estimate and manage salts in the crop root zone:

1. No infiltration from rainfall such as during dry periods or under plastic mulch, or
2. Infiltration from rainfall is present

No rainfall infiltration

To prevent crop damage, the salt in the root zone must be removed by leaching (i.e. flushing) with either natural rainfall or irrigation. During periods of little rainfall, or in farming systems where infiltration from rainfall is excluded (e.g. under plastic mulch), additional irrigation may be needed to maintain the soil salinity below a concentration which impacts on the crop. In these cases, the amount of additional irrigation needed can be estimated if the irrigation water quality is known. In general, the higher the concentration of salts in the irrigation, the more water that needs to be applied to leach the excess salt out of the root zone. This additional water is called the leaching requirement.

Identifying the additional water required for leaching

1. For your crop, identify the tolerance ECse allowable in the crop root zone before the salts start to affect yields (Figure 1 or other sources).
2. Measure the electrical conductivity of your irrigation water (ECw).
3. Calculate the leaching requirement using the following equation

$$\mathbf{LR = ECw \div ((5 \times ECse) - ECw)}$$

LR = ECw_______________dS/m ÷
((5 × ECse_______________dS/m)- ECw_______________dS/m)

LR=_______________

The answer will be a fraction, multiply this by 100 to get the additional % of water required.

Example
Growing capsicums using water with an ECw of 1.25 dS/m.

From the chart, the approximate ECse of capsicums is 1.5dS/m. Using the equation above:

LR = ECw ÷(((5 x ECse) - ECw)
LR =1.25÷((5×1.5)-1.25)
LR =0.2 or 20%

The capsicums will need an extra 20% irrigation to effectively leach the salts and prevent impacts to the crop. The additional water will reduce the efficiency of irrigation application but can be applied either with each irrigation event or as larger applications routinely applied throughout the season.

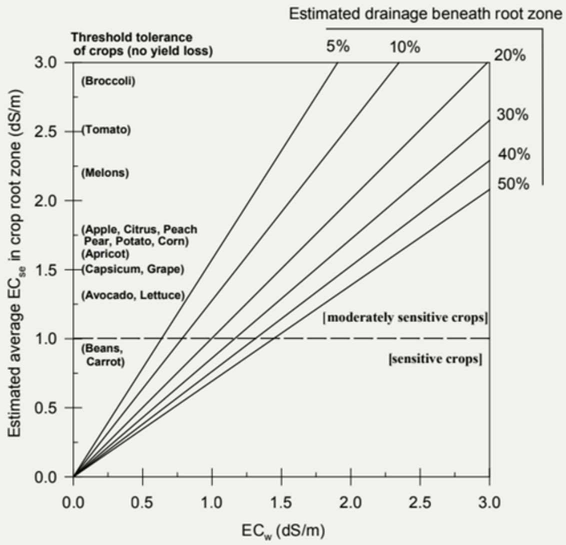

Figure 1: Additional water needed to ensure that salts do not build up in root zone

With rainfall infiltration

The potential long-term damage caused by poor quality irrigation water can be estimated if both the quality and quantity of the water entering and draining out of the bottom of the root zone are known.

Calculating the average water quality entering the soil

In the long term, both rain and irrigation will infiltrate into the soil and contribute to the root zone salinity. The electrical conductivity of the water entering the soil (ECw) should be calculated using the infiltrated rainfall and irrigation volumes. Where there is no substantial surface runoff or evaporative losses from irrigation (e.g. drip or micro-sprinklers), the applied irrigation can be assumed to completely infiltrate (100%). Similarly, in the long term the proportion of infiltrated rainfall is commonly assumed to be 80% of the total rainfall. Hence, if you normally apply approximately 700mm/y of irrigation water with an ECw of 2.6 dS/m, and the field also normally receives approximately 1000mm/y of rainfall (assume an EC of 0.04 dS/m), then the average ECw would be equal to the below:

Total water infiltrated = $700 + 0.8 \times 1000$
$= 1500\text{mm}$

Average water quality = (Irrigation water salinity + Rain water salinity) / Total water infiltrated
$= (700\text{mm} \times 2.6\text{dS/m} + 0.8 \times 1000\text{mm} \times 0.04\text{ dS/m}) \div 1500\text{mm}$
$= 1.2\text{dS/m}$

Calculating the amount of drainage beneath the crop root zone

The amount of drainage beneath the crop root zone can be calculated as the difference between the total infiltrated amount and the estimated crop water use during the period. For example, if the typical crop water use is 900 mm/y and the total amount of water infiltrated into the soil was 1500 mm/y, then the proportion of the infiltrated water which ends up as deep drainage can be calculated as per below:

Crop Root Zone Drainage = (Total water infiltrated - Crop water use) ÷ Total water infiltrated
$= (1500 - 900) \div 1500$
$= 0.4$ or 40%

Estimating the long-term salinity level in the crop root zone

Using the average water quality (i.e. weighted average of rainfall and irrigation water) entering the soil, the estimated drainage beneath the root zone and Figure 1, it is possible to estimate the average long-term salinity level in the crop root zone. Compare the estimated long term ECse with the 'no yield reduction' threshold for your crop. If the long term estimated ECse is greater than the threshold for the crop, then it is time to reconsider the use of poor-quality irrigation water and/or irrigation management practices being used.

Note: This information is provided only as a general guide. Growers using poor quality irrigation water should ensure that they routinely monitor salt levels within their crop root zone to ensure that adequate leaching is occurring and seek professional advice.

For more details contact Growcom on 07 3620 3844.

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