Sentek™
technologies

Sentek SoluSAMPLER™

A Tool for Managing Salt & Nutrient Movement in the Root Zone

Instruction Manual

Version 2.1

Cooperative Research Centre for
IRRIGATION FUTURES

Acknowledgements

The Sentek SoluSAMPLER™ was developed by Dr Tapas Biswas and Dr Gerrit Schrale (SARDI, Adelaide SA) as part of a project funded by the National Program for Sustainable Irrigation, the South Australian Murray Darling Basin Natural Resources Management Board and the Murray Darling Basin Commission to better understand the impact of root zone salinity on horticultural production and the associated river environment.

Dr Tapas Biswas and Dr Gerrit Schrale are researchers with the Cooperative Research Centre for Irrigation Futures and the South Australian Research and Development Institute (SARDI).

Sentek Sensor Technologies has been given exclusive rights to distribute the SARDI soil water extractor (Sentek SoluSAMPLER™). For further product information and pricing on the Sentek SoluSAMPLER™, please contact Sentek on freecall 1800 SENTEK (1800 736 835), email sentek@sentek.com.au or visit www.sentek.com.au.

Copyright

CRC for Irrigation Futures
PO Box 56, Darling Heights Qld 4350
Phone: 07 4631 2046
Fax: 07 4631 1870
Email: enquiries@irrigationfutures.org.au
Web: www.irrigationfutures.org.au

Sentek Pty Ltd
A.C.N. 007 916 672
77 Magill Road
Stepney, South Australia 5069
Phone: +61 8 8366 1900
Facsimile: +61 8 8362 8400
Internet: www.sentek.com.au
Email: sentek@sentek.com.au

Rev 2.1 (2015-05-06)

The Sentek SoluSAMPLER™

The Sentek SoluSAMPLER is a soil solution sampler that draws moisture from the surrounding soil and stores it in an inert ceramic cup, awaiting collection and analysis of soil pore water content.

There are two SoluSAMPLER types:

- Low Flow - suitable for most applications
  (fine grain size ceramic cup, for soil fine particles e.g. Clay)
- High Flow - suitable for light texture and moist soils
  (coarse grain size ceramic cup, for soil coarse particles, and for rapid sampling)

Knowledge of soil water composition is critical for sustainable crop production. Changes in soil water salinity and chemistry under irrigated plantings can be monitored in-situ with the Sentek SoluSAMPLER™. This device gives good results when correctly installed because:

- The inert ceramic cup will not alter the soil solution composition
- It can continuously deliver relatively small volume samples (up to 70 mL)
- The Sentek SoluSAMPLER™ can be permanently installed and can be sampled on demand, and
- It enables soil solution to be extracted over a range of soil moisture conditions.

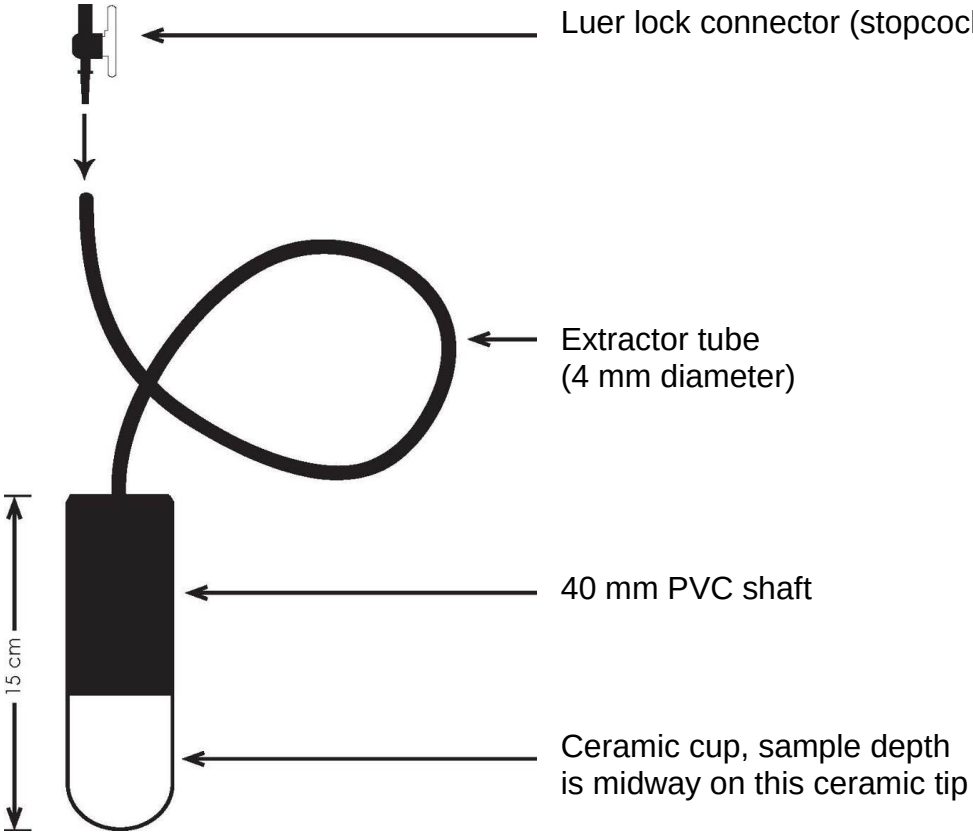

Figure 1. Sentek SoluSAMPLER™

A specially designed ceramic cup is glued to a specific length of PVC housing to form an airtight seal. A hole is drilled through the top of the case to house the vacuum extraction tube. A two-way luer lock connector (stopcock) is attached to the top of the extraction tube.

Sterilisation (skip this step if nutrients are not to be monitored)

Do not touch the ceramic cup with your hands. For sterilisation, soak the Sentek SoluSAMPLER™ for 12 hours in 1% sodium hypochlorite (bleach. Take a Sentek SoluSAMPLER™ and draw up the rest of the bleach solution from the Sentek SoluSAMPLER™ and dispose of it safely. Wash the Sentek SoluSAMPLER™ with clean water at least three times. The sterile and air bubble free Sentek SoluSAMPLER™ is now ready to install.

Equipment required

Before proceeding to the field, make sure you have the following materials with you:

i) 40 mm diameter soil auger
ii) Hand shovel/trowel
iii) Bucket & 2 L of tap water (low EC)
iv) Builders dry sand or fine river sand: Active Gel Bentonite in the ratio of 1:1
v) 60 mL disposable plastic syringe
vi) Kitchen sieve (1-2 mm diameter mesh) to prepare a slurry
vii) Wooden stake/dowel (1 m length) to position the SoluSAMPLER in the augered hole
viii) Plastic twine (15 cm)/cable tie to anchor the extractor tube
ix) Tape measure
x) Permanent marker pen
xi) Electrical tape (to prevent dirt intrusion into extractor tube)

Figure 2. Equipment for installing the Sentek SoluSAMPLER™

Installation

Choosing the location

It is essential that the selected plant, dripper or sprinkler is representative of the whole paddock. The Sentek SoluSAMPLER™ must be placed in the plant root zone. It is recommended to install three Sentek SoluSAMPLERs™ at each site. Common installation depths are 30, 60 and 90 cm.

Installation procedure

i) Place all samplers to be installed in a bucket of RO (reverse osmosis) water to soak for at least 20mins before installation. Undo the stopcocks on the sample tubes to allow the water to travel into the ceramic.

ii) Clear trash away from the site and stake out a place for three Sentek SoluSAMPLERs™ at a radius of 10-15 cm around the dripper as illustrated in Figure 3 or within 75 cm of the sprinkler radius. With sprinklers, place midway within the sprinkling range and not at the edge.

iii) Using a 40 mm diameter auger, dig a hole 30 mm deeper than the required depth. Clearly mark the auger with the correct depths. This ensures that the middle of the 60 mm long ceramic cup will be at the desired depth.

iv) While augering, keep the soil in a heap for back-filling.

v) Before inserting, seal the Sentek SoluSAMPLER™ tube with electrical tape to prevent bedding material entering the tube..

vi) Sieve about 60 g of soil (3 tablespoons full) collected from the bottom of the hole into a plastic cup. Add water to the cup to make a slurry; decant the extra water and pour the slurry into the hole to soften the wall and ensure good contact between soil and Sentek SoluSAMPLER™.

vii) Insert the Sentek SoluSAMPLER™ into the hole and use the blunt end of the wooden stake/dowel to push down on top of the Sentek SoluSAMPLER™.

viii) When the ceramic cup is in contact with the soil push gently on the wooden stake to make strong contact between the tip of ceramic cup and the soil at the bottom of the hole.

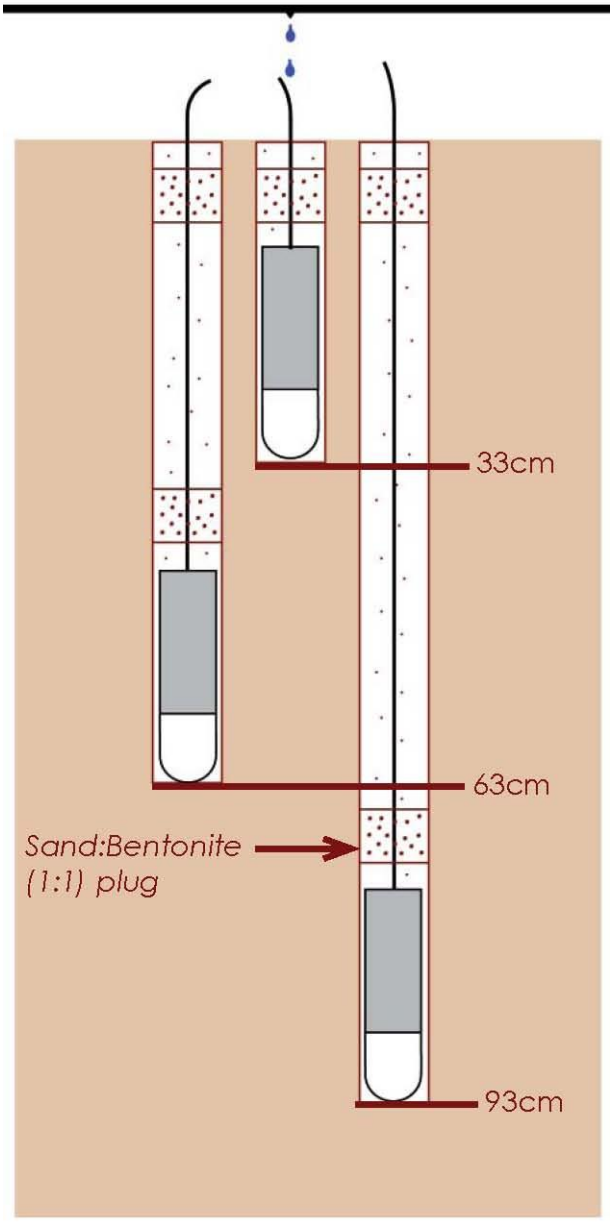

Figure 3. Layout of SWE around a dripper (not to scale)

ix) Remove the wooden stake/dowel and add a handful of soil to the hole. Gently tap down this soil with the blunt end of the stake/dowel. Do not tap it too hard as you are only trying to make the soil return to its natural state, not as a hard compacted layer.

x) Add about 60 mL sand: bentonite mix (or bentonite alone) into the hole and gently tap it again with the stake/dowel. Back-fill the hole with soil and with every few handfuls of soil gently tap it down to try to return it to its natural state. Add soil to the top for the 30 cm Sentek SoluSAMPLER™. For 60 and 90 cm Sentek SoluSAMPLERs™, add two sets of bentonite plugs and top up with soil in between as illustrated in Figure 3.

xi) After installing the Sentek SoluSAMPLER™, remove the electrical tape from the extraction tube and fit the luer lock stopcock. Tie the individual tube to a wooden stake using a 15 cm plastic twine or cable tie and encase the stake and extraction tube with a 50 or 90 mm diameter PVC pipe cut to a 30 cm length. This is to protect the tube from damage by animals and machinery (see Figure 4).

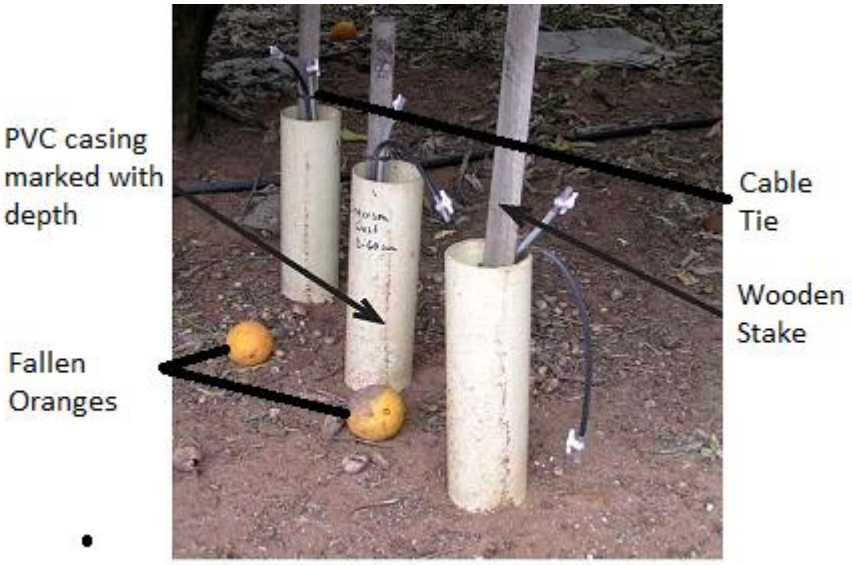

Figure 4. Wooden pegs and PVC casing.

Priming the Sentek SoluSAMPLER™ for sampling

Never operate the Sentek SoluSAMPLER™ before irrigation water reaches the tip of the ceramic cup because suction can never be achieved while the ceramic cup is dry.

Air needs to be sucked out of the tube to form negative pressure so that soil water can move into the tube over a period ranging from minutes to overnight.

i) Allow one day after the irrigation event before commencing the sample extraction.

ii) Connect the 60 mL syringe to the luer lock and open the valve.

iii) Put one hand below the syringe wings and with your other hand draw the syringe piston all the way back (60 mL).

iv) Keep holding the piston tightly and close the luer lock connector 90º with your other hand.

v) Disconnect the syringe from the luer lock.

vi) Repeat applying suction by using steps (ii) to (v) to create 60-70 kPa suction (approximately 2 - 3 draws on the syringe).

Generally it requires a fortnight before the SoluSAMPLER will yield a representative soil water sample after installation. During this fortnight, discard two extracted samples to avoid non-representative samples.

Maintenance (for nutrient sampling only)

Collecting the soil water sample from the Sentek SoluSAMPLER™

i) Allow 30 minutes to four hours after applying the suction before drawing the soil water sample. In clay soils a day or two might be required to get enough soil water volume in the sample.

ii) Open the luer lock at the time of sampling. Connect the syringe to the luer lock valve and pull the syringe piston all the way back (60 mL) as shown in Figure 5.

iii) Within a few seconds the syringe will be filled with soil water. Disconnect the syringe from the transparent nozzle and leave the valve open. At least 4 mL of sample is required to conduct an EC test using a portable/hand held EC meter. If an inadequate sample volume is obtained, repeat the procedure at the next irrigation and allow for more time for the primed device to extract soil water. For nutrient analysis a 20 mL sample is required.

iv) Immediately measure the salinity by using a portable electrical conductivity meter (EC) or salinity meter, or label and chill the sample for later laboratory analysis.

Figure 5. Drawing soil pore water

After drawing out the soil water, the Sentek SoluSAMPLER™ should not remain at vacuum conditions until the next time of operation.

The ceramic cup must be sterilised in-situ against bacteria every six months if nutrient measurement of the soil water is to be included. Fill the syringe with the sterilising 30 mL bleach solution. Open the luer lock and inject the bleach solution into the Sentek SoluSAMPLER™ slowly. Allow 5 minutes before drawing up the rest of the solution from the Sentek SoluSAMPLER™ and dispose of it. Discard the first 2-3 soil water samples following the sterilisation process.

Additional information

Using an EC meter to measure salinity in soil water

It is important to calibrate the EC meter prior to measurement of salinity. Once calibrated the EC meter can measure several samples. Both the standard solution for EC and the calibration manual can be obtained from the place of purchase of the EC meter.

i) Before using the EC meter (see Figure 6) rinse the electrode and the sample container with distilled water or rainwater.
ii) Pour the extracted sample into the container and immerse the EC meter into the sample.
iii) Wait for the EC meter reading to stabilize then record the EC reading
iv) For further analysis (nutrients) store the sample in a clean 60 mL plastic container and chill before dispatch to the laboratory.
v) Rinse the EC meter with distilled water or rainwater before measuring the next sample.

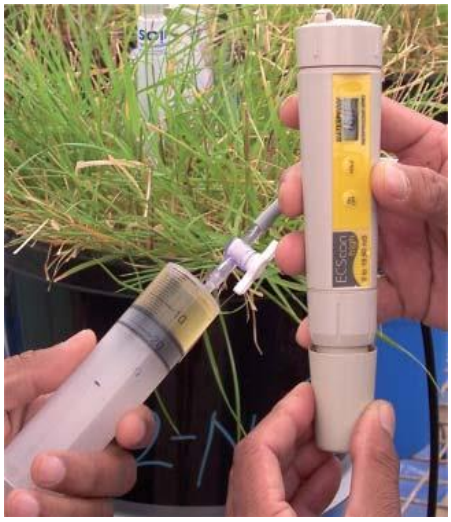

Figure 6 Extracting sample and reading the EC meter

What the soil water salinity means to your horticultural crops

Salt tolerance levels shown in the Table below should be used as a guide. They may require adjustment depending on management, irrigation water salinity, soil salinity and leaching efficiency.

Table 1. Average rootzone salinity threshold

Tree crops	Varieties	Threshold salinity at which yield decline starts
		ECsw[a]
Almond	All	**3**
Apricot	All	**3.2**
Grape[b] – Sensitive to moderately sensitive	Own roots (Vitis vinifera): eg. Sultana, Shiraz, Chardonnay Rootstocks: 1202C, Kober 5BB, Teleki 5C, S04	**3.6**
Grape – Moderately tolerant to tolerant	Rootstocks: eg. Ramsey, 1103 Paulsen, Ruggeri 140, Schwarzmann, 101-14, Rupestris St. George	**6.6**
Orange	All	**3.4**
Peach	All	**3.4**
Plum	All	**3.0**
Pear	All	**2.0**
Potato	All	**3.5**

[a]Soil water salinity was found to be twice the salinity of saturated paste extract of a sandy loam soil.
[b] Zhang et al. (2002). Australia Grape and Wine Res 8: 150-156; Walker, R and Stevens, R. (2004). In Salinity Impacts on Lower Murray Horticulture - Milestone 1 Report (DEP15 Project). Eds G Schrale and TK Biswas. pp. 1-16. Water Resources & Irrigation, SARDI, Adelaide 5001.