Getting water to roots in berry production:
the challenges of poor soil wettability and root proliferation

B.M. McKenzie[1], P.D. Hallett[1] and S.N. Jennings[2]

[1]Scottish Crop Research Institute, Invergowrie, Dundee DD2 5DA.
[2]Mylnefield Research Services, Invergowrie, Dundee DD2 5DA.

- Can we improve soil management in berry production?
- Hard soil (>2MPa penetrometer resistance) limits root growth.
- Soft stable soils that accept and tramsmit water are needed to deliver water applied as irrigation to roots.
- Poor soil wettability leads to uneven water distribution.
- We studied the soil and roots under long established raspberry (cv Glen Ample) plants grown in raised beds, under protected cropping at SCRI

Soil strength

Soil strength measured as penetrometer resistance on soil cores equilibrated to 10kPa matric suction (field capacity). Red indicates strength greater than 2MPa, sufficient to severely restrict root growth. Strength is less in paler squares. Grid units are10x10cm.

Root distribution

Root number measured as visible roots in each 10x10cm grid unit. Dark green indicates more than 10 roots, paler squares have fewer roots. In white squares no roots were visible.

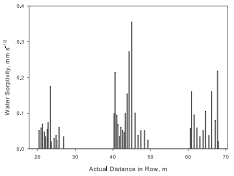
Methodology

Sorptivity and hydraulic conductivity were determined with mini disk infiltrometers.

Miniature TDR probes and data loggers to measure the pattern of water entry.

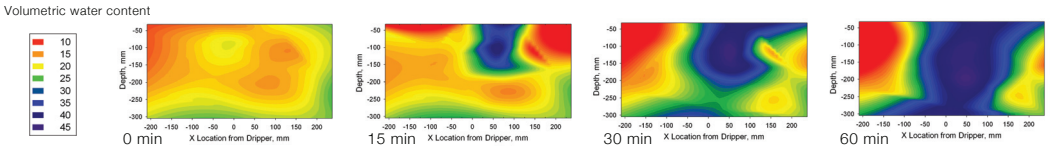
Wettability along the row

Water sorptivity is highly variable along the raspberry row, leading to uneven wetting. Soil management should create an environment where values are consistent and greater than 0.1mms$^{-1/2}$. Low water sorptivities are caused by water repellency and poor connectivity of soil pores.



Wetting pattern

Patterns of water entry under a dripper after 0, 15, 30 and 60 minutes of water application. Note that much of the soil remains dry.



Conclusions

- Hard soil is negatively correlated with root number. Only part of the soil profile is being used for crop production.
- We have quantified the extent of poor wettability and found decreases in wetting rates of up to 20-fold. Water spread from dripper outlets is typically less than 6cm. These factors create inefficient irrigation as water is lost to by-pass flow.
- Research is necessary to develop management to create and maintain soft, stable and wettable soil to support berry production.

References

Wheaton AD, McKenzie BM & Tisdall JM (2008) Soil & Tillage Research 98: 68-80.
Hallett, PD, Gordon, D. & Bengough, A.G. (2003). New Phytologist 157: 597-603.

Acknowledgements

The Scottish Crop Research Insititute receives grant-in-aid support from the Scottish Government Rural and Environment Research Analysis Directorate.