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Soil Health for Water Use and Nutrient Efficiency

VegNet WA Field Day, Carabooda – 05 December 2023

Hort Innovation

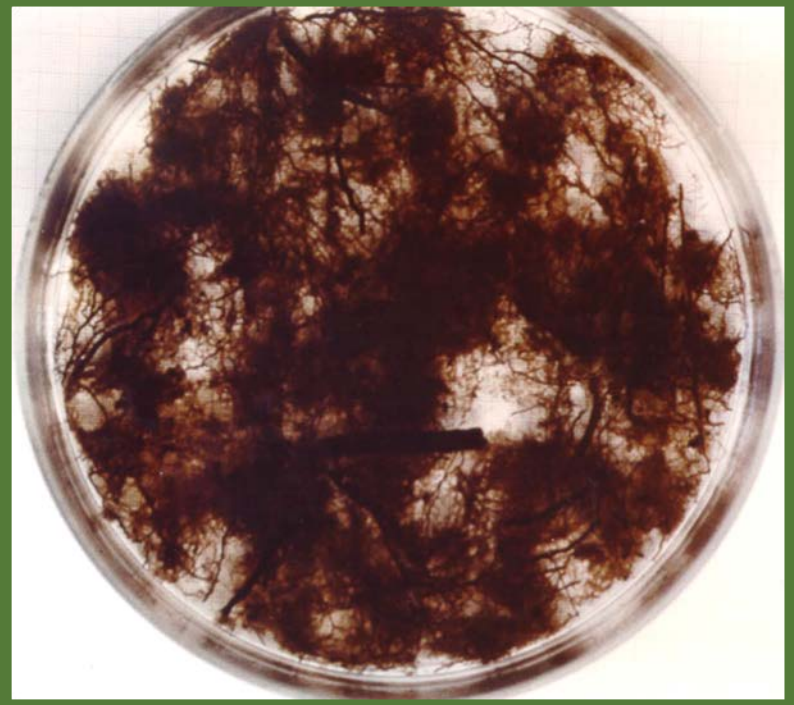
ahr applied horticultural research

RMCG

Introduction

1. Brief overview of the Soil Wealth and Integrated Crop Protection Project
   by Carl Larsen, RMCG
2. How does soil health improve water and nutrient use efficiency?
   by Doris Blaesing, RMCG
3. What to do and how we can assist:
   1. Water and nutrient use efficiency
   2. Farm based emissions

Soil health affects roots



Healthy soil

Ok soil

Unhealthy soil

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So What?

Plants with poor and or shallow root systems access less nutrients and water than plants with good root systems.

Good root systems are required for good water and nutrient use efficiency.

What soil health factors affect nutrient and water use efficiency?

Good root systems are more resistant to pathogens than poor root systems.

Soil health decline – physical & biological

1. Loss of organic matter (carbon)
   - tillage
   - fallow
   - removal of crop/cover crop
2. Low levels or poor diversity of soil life
   - lack of suitable food sources
3. Soil structure decline
   - compaction (machinery, livestock)
   - erosion (wind, water)

1 - Organic Matter (OM) drives soil health

- The organic matter in soil comes from dead plant and animal matter

What is so good about OM?

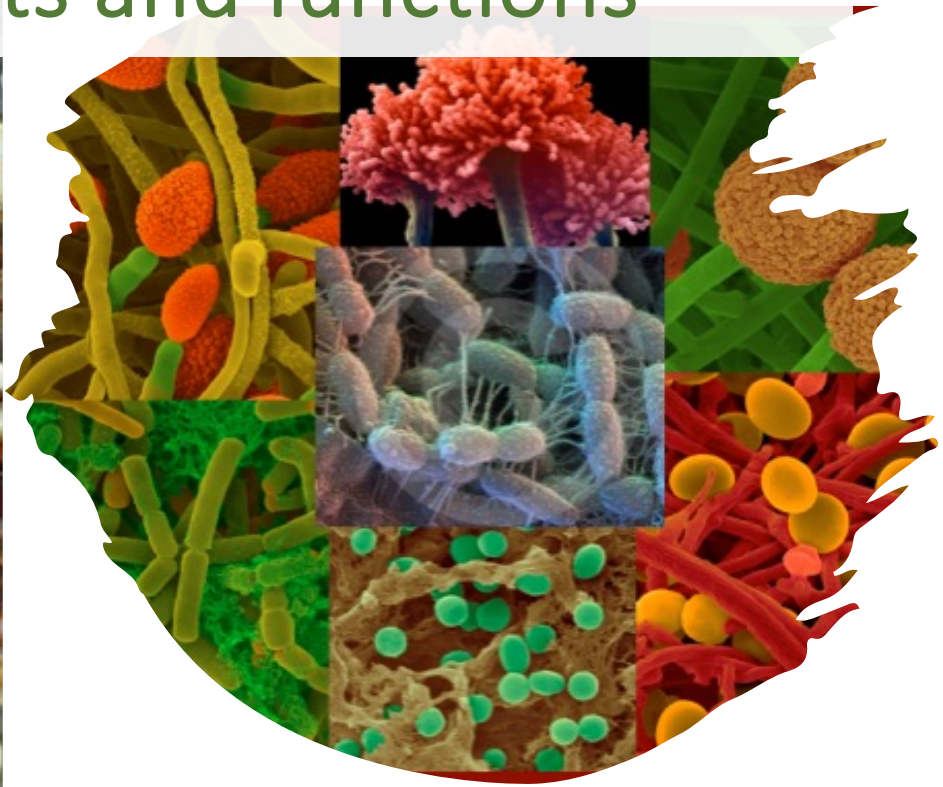
- Food for soil life
- Holds onto nutrients for plants
- ‘Glue’ for soil particles – supports structure
- Improves water infiltration and water holding capacity
- Improves soil air volume

All the above supports good root growth

2 – Soil life has many components and functions

‘**Ecosystem engineers**’ – invertebrates (e.g. ants, earthworms, termites) break down OM and thus alter the physical structure of soil

‘**Litter transformers**’ – small invertebrates (e.g. mites, springtails) further fragment plant residues

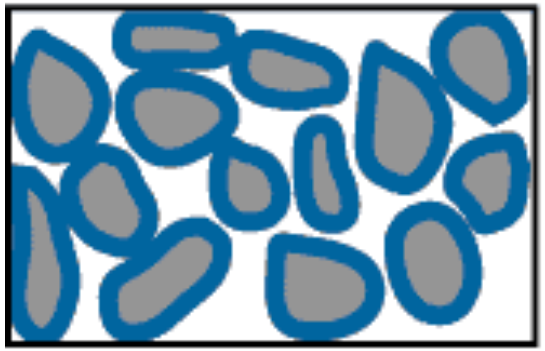


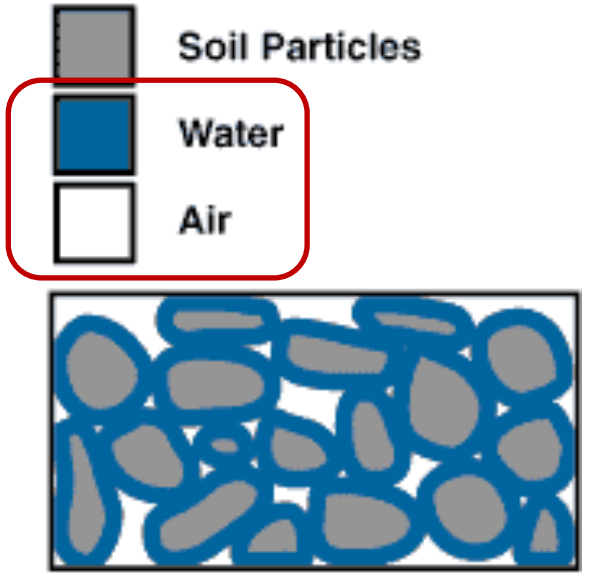
‘**Micro-food web processors** - Soil microbes – cycle nutrients, produce, ‘glue’ for soil structure and combat pathogens

Soil microbes and roots interact

3 – Soil Structure

Poorly structured, **compacted soils hold less <u>water and air</u>** than well-structured soil, they are often low in organic matter





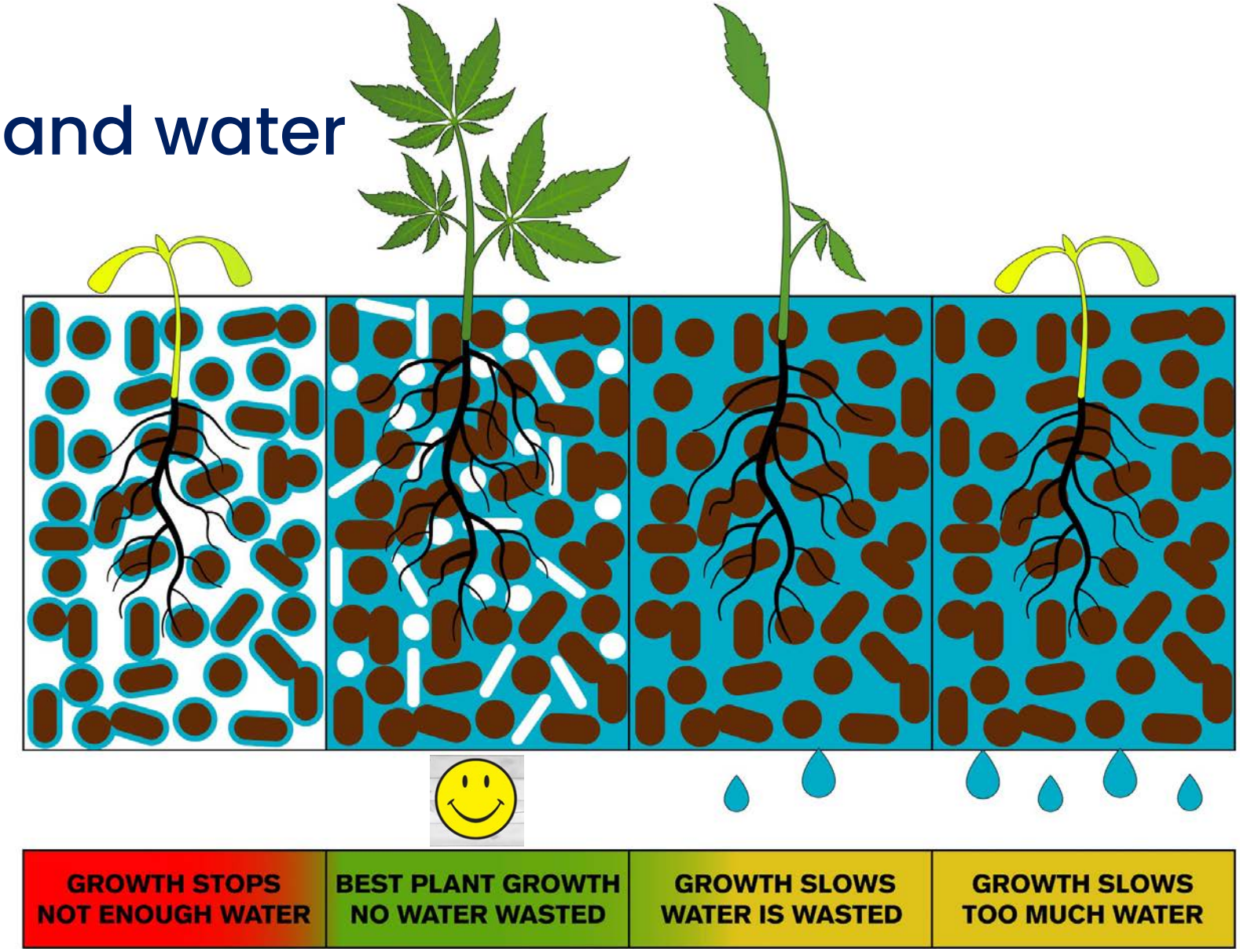
Non-compacted

Compacted

Roots may not be able to penetrate compacted soil

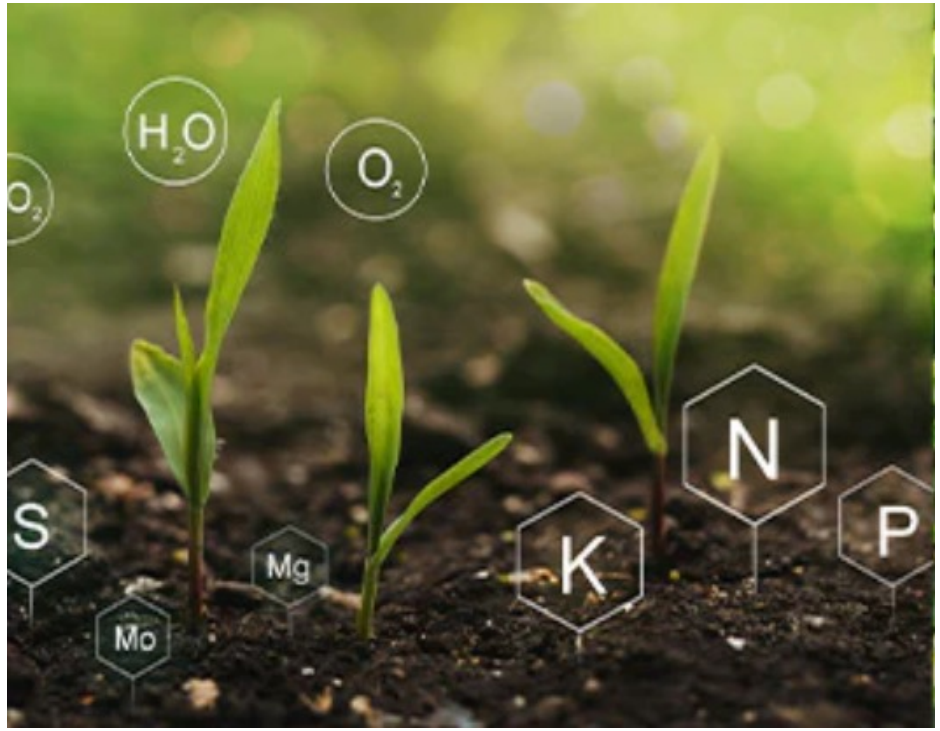
Soil properties and water availability

Soil texture and structure affect the **volume of plant available water - and air**



4 - Soil health decline - chemical

- Salinity - salt in the soil
  - rising groundwater or saltwater incursion
  - salty bore water or recycled water
- Sodicity – high levels of sodium in the soils
- Acidification – drop in soil pH below optimum
- Nutrient imbalance – too much of some, not enough of others
  - imbalanced natural soil properties
  - fertiliser use (e.g. recipes rather than nutrient budgets)
  - subsoil constrains e.g. high boron, salt, sodium, low pH



Above factors affect nutrient use efficiency.

In summary

To achieve good WUE and NUE soils need to provide:

- sufficient water and air for soil life and root growth
- organic matter and nutrients to feed soil life and plants

This can be more difficult to achieve in sandy (light textured) soils compared to loam or clay (heavy) soils.

Salinity and sodicity bring further challenges.

So, what can you do?

‘Grow’ or add organic matter

Reduce bare soil

Irrigate well

Add lime or dolomite or gypsum as required

Reduce tillage

Ensure a balanced, site and crop specific nutrition program

How do you know how you are going?

- Soil and plant tests and assessments
- Productivity indicators
  - Healthy, resilient crops
  - Good yield and quality
  - Efficient harvest, grading/packing – high % of 1st grade

Indicators the SoilWealth/ICP team can help with:

1. Water Use Efficiency - yield (t/ha) per (ML) water
2. Nutrient Use Efficiency – e.g. yield (t/ha) per unit of nitrogen (or other nutrients)

Thank you

- For more information or to get involved, contact:

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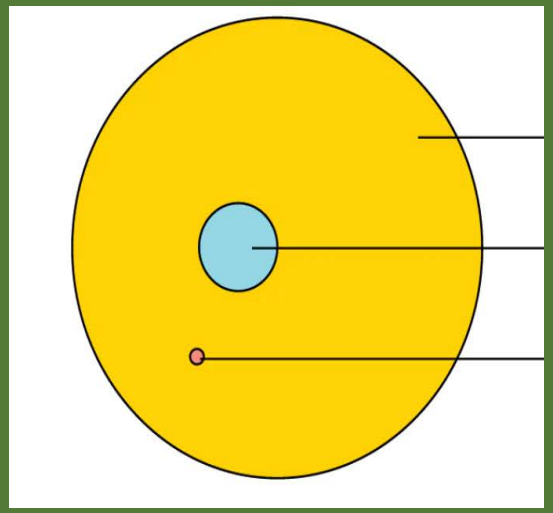
Soil and WUE

Soil texture influences plant available water (PAW)



texture	[mm] of PAW per [m] of soil depth
coarse sand	21-63
fine sand	63-83
loamy sand	91-100
sandy loam	104-117
fine sandy loam	125-167
silt loam	167-208
silty clay loam	150-167
silty clay	125-142
clay	100-125