SoilWealth
NURTURING CROPS

Integrated
Crop Protection
PROTECTING CROPS

Soil biology in Vegetable Production Masterclass 2021

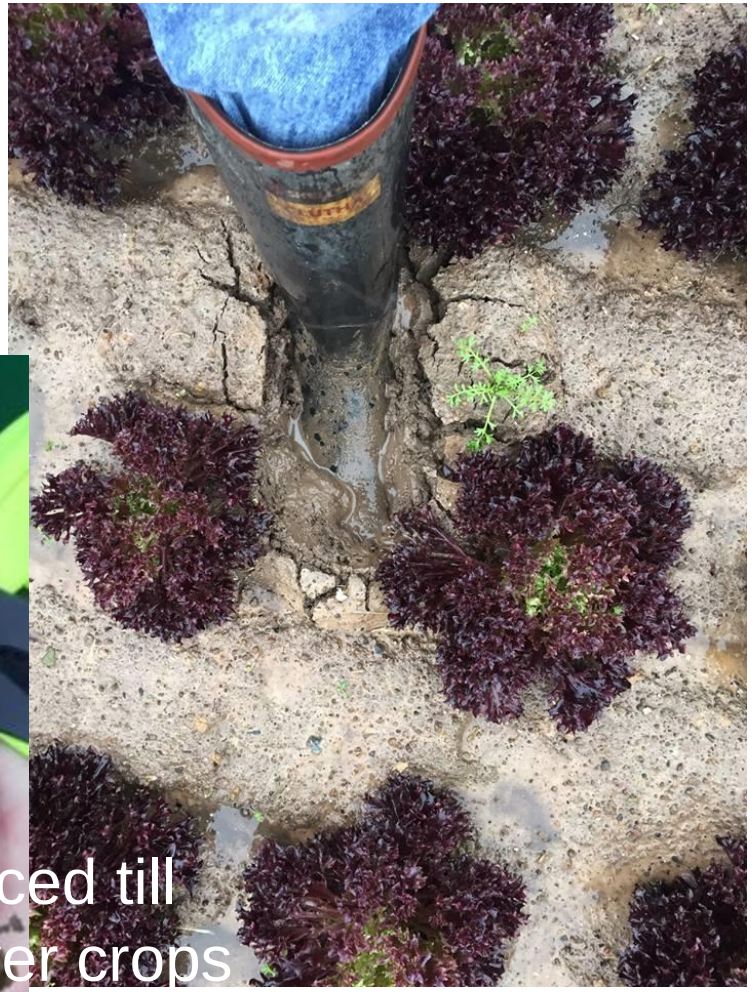
Kelvin Montagu

Soil biology - **Resilient soil**

Steel vs Biology after 120mm

Cultivated
& bare fallow

Reduced till
& cover crops



Soil biology – **long view**

- Reliable production system
  - Long term
  - Leaving the soil in as good or better condition

Soil biology – **Gross margin squeeze**

- Reduced inputs
  - Less fertiliser
  - Less diesel
  - Smaller tractors
  - Irrigation

Soil biology – **Gross margin squeeze**

- Better crops – uniform and reliable
  - Suppress disease
  - Plant growth promoting (PGR bacteria and fungi)
  - Plus all the above

Soil biology – **Net zero emission products**

- Off setting carbon emissions
  - Storage of carbon in soil organic matter
  - Reducing nitrous oxide emissions (greenhouse gas)
  - Reducing emissions via diesel, irrigation, fertiliser

Focus on Function – driven by biology

- Amazing diversity and resilience
- Focus on function
  - Breakdown of biomass and agrichemicals
  - Nitrogen availability
  - Soil structure
  - Fumigation
  - Disease suppression
  - Biological products
- Integration into practices
  - Getting soil biology working for you

Care in generalising from other production systems

Vegetable production intensive

- Aggressive cultivation and sometimes harvest
- High fertility
- High fertiliser input
- Irrigated
- Across all climate zones

Production intensity

Vegetable **>** broadacre cropping **>** pasture **>** perennial tree crops

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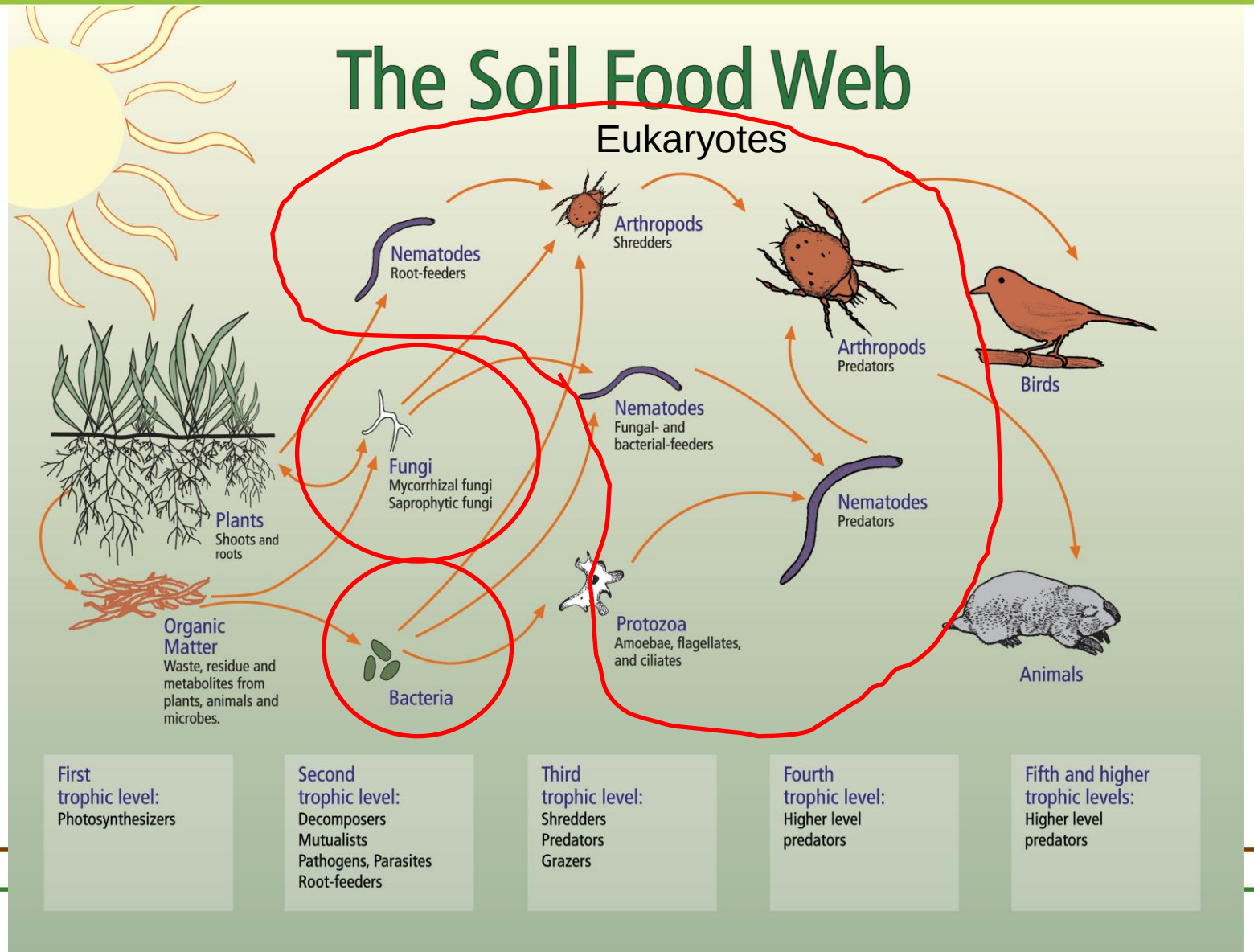
Soil biology – what are we talking about



The Diversity in vegetable growing soil is Amazing

	Forthside	Gatton	Cowra	South Tas
Bacteria (~species)	540	340	336	989
Fungi (~species)	207	71	288	165
Eukaryotes (phyla)	56	37	47	47

Even worn-out intensive baby leaf production soils

Integrated Crop Protection
PROTECTING CROPS

SoilWealth
NURTURING CROPS

- Root grow into a biological zoo
- BYO microbes – endophytes IN seed
- Soil microbes stimulates/attracted by roots
- Added in inoculant

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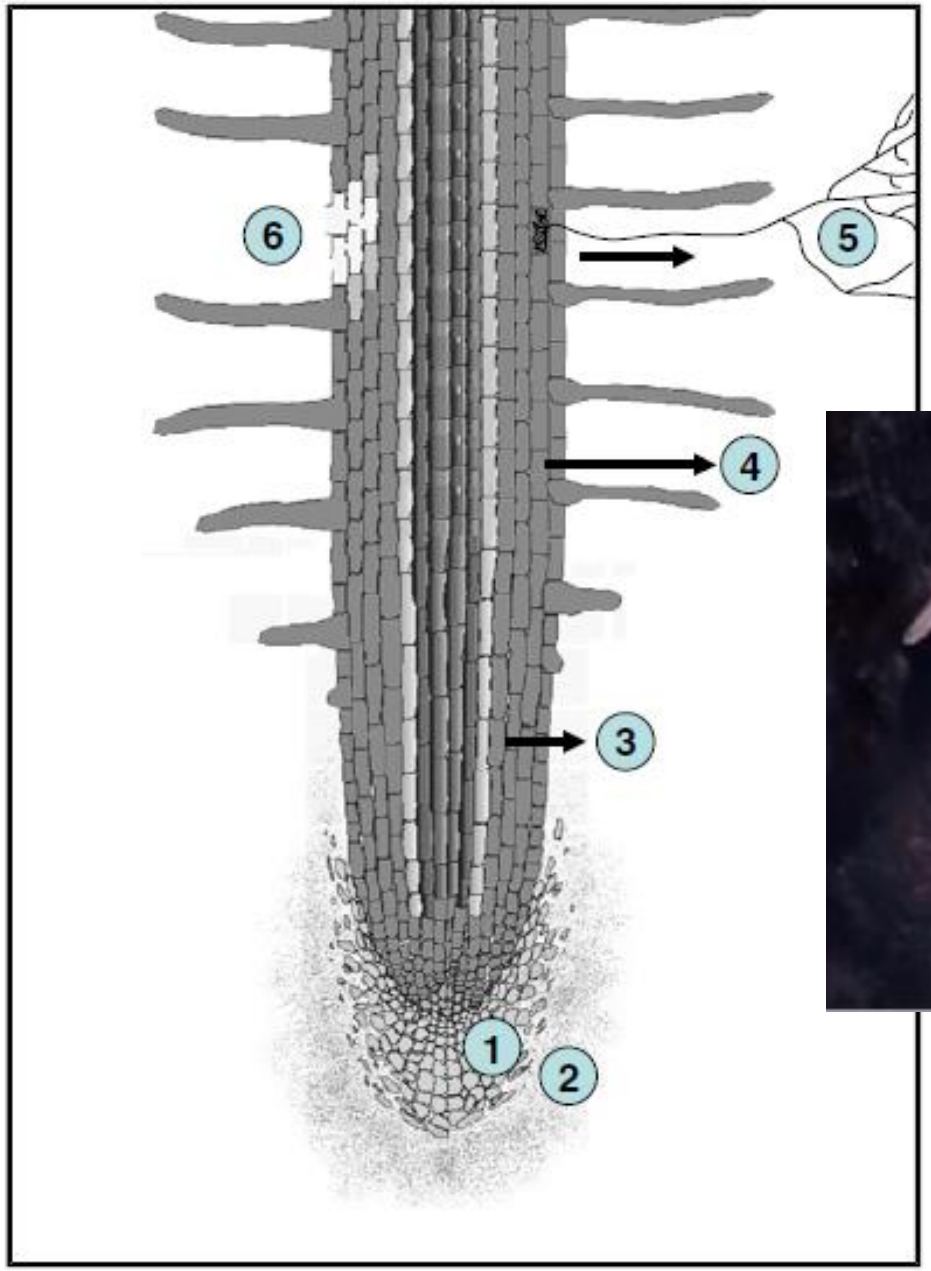
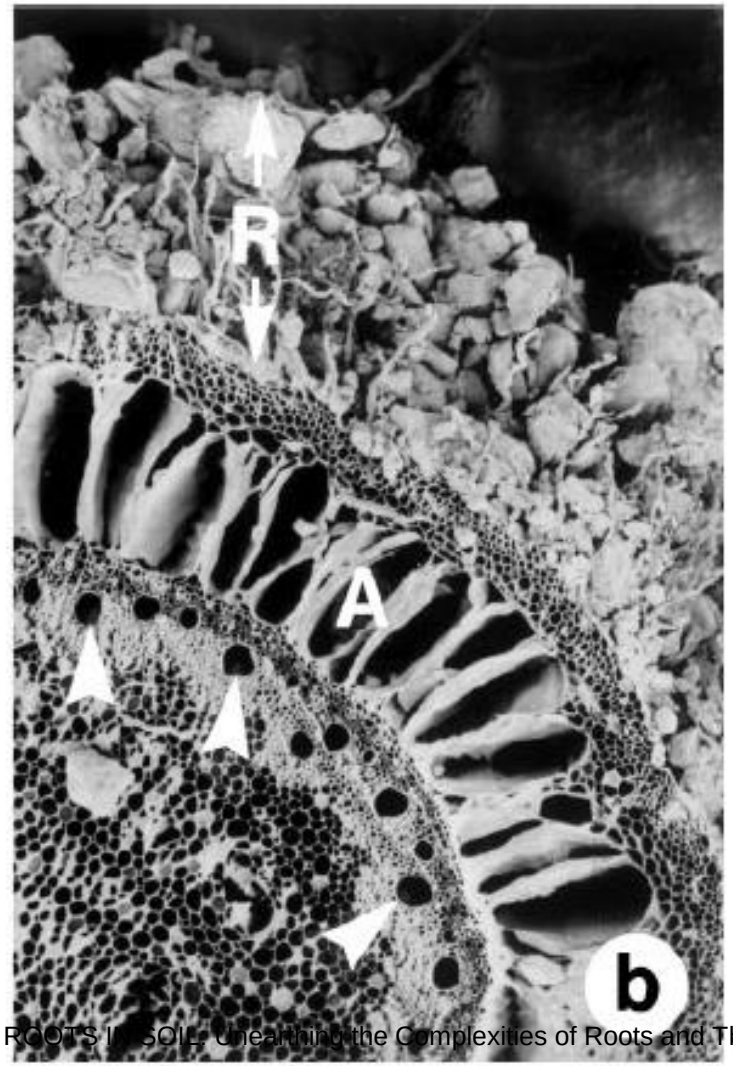
Exudates and others

Stimulation and attraction
1 & 2 Root cap and Mucilage
- mainly fresh food (days)
3 Exudates
- amino acids, proteins (30-60 minutes)
4 Volatile organic carbon (30-60 minutes)
allopathy, isothiocyanates
5. Mycorrhizae association (months)
6. Sealing of the root (months)
- pipe phase



Roots and the rhizoshealth – biological hot spot



Margaret E. McCully. 1999. ROOTS IN SOIL: Unearthing the Complexities of Roots and Thei
Plant Mol. Biol. 50:695–718.

100% Photosynthesis – Adding food to the system

70%

40% - Shoot biomass

30%- *Shoot (respiration)*

30%

15% - Root biomass

5% - Soil organic matter and microbial biomass

10% - *Root & microbes (respiration)*

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Principles of Soil Biology

- Drive most of the key functions in the soil
- There is amazing diversity and resilience in vegetable soils
- Its highly competitive down there
- Plants feed soil biology
- Soil organic matter are important indicators of soil health
- No one soil microbial community = Soil health
- Everything you do to the soil alters soil biology