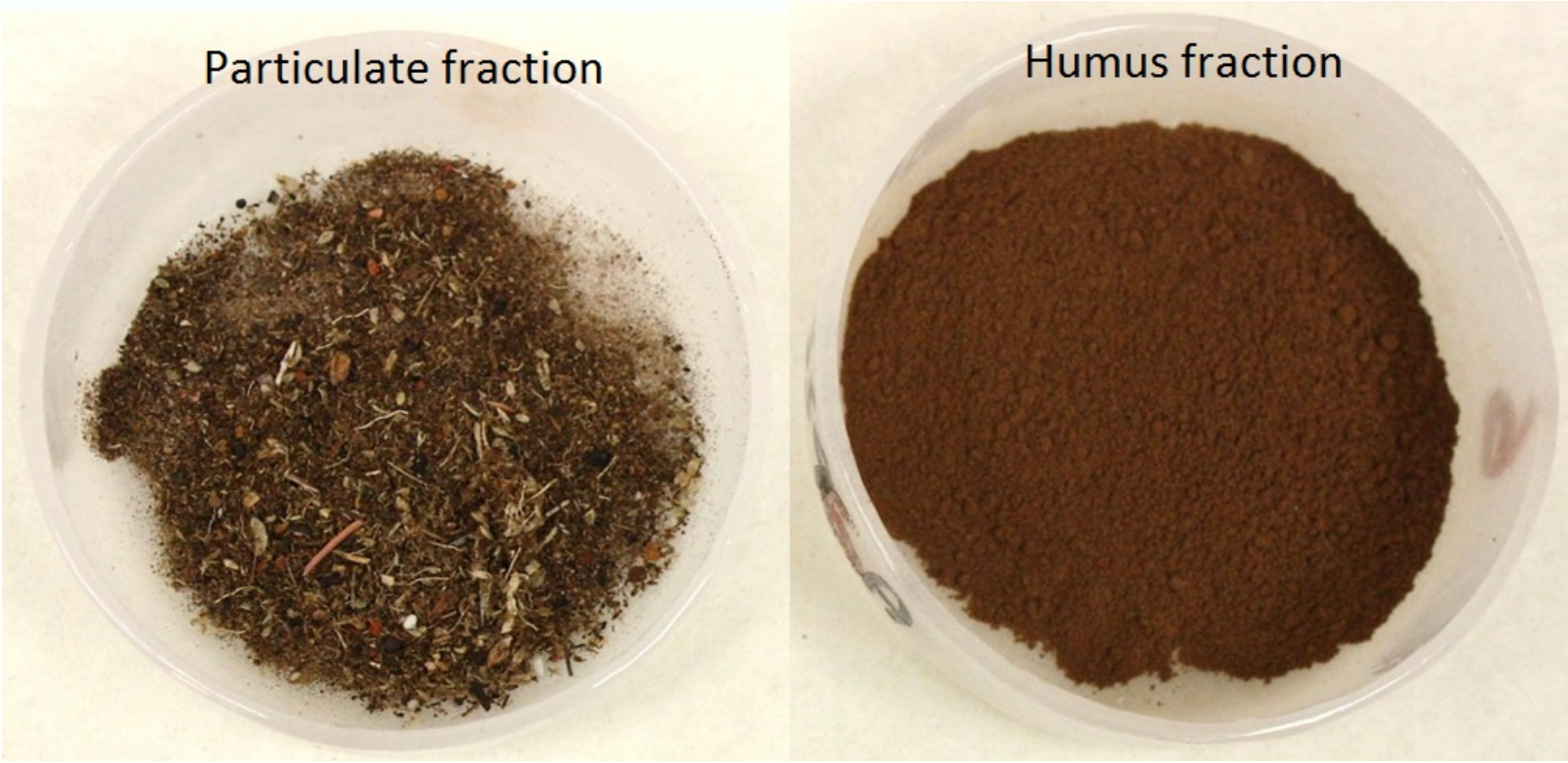
Soil Organic Matter
"what is it good for?"

Harm van Rees
Cropfacts P/L

Two fractions influenced by management



- **Decomposing plant and animal material**
- **Unstable (months to years)**
- **0.05 to 2mm**

- **Decomposed material attached to soil particles**
- **Stable (decades)**
- **<0.05mm**

Third fraction Charcoal

Functions of SOM

Measurable Functions	Particulate Organic C	Humus Organic C
Plant available water	**x**	**√**
Bulk density	**√√**	**√**
Soil structure	**√√√**	**√**
Cation Exch Cap	**x**	**√√√**
Mineralisation N	**√**	**√√√**
Buffering soil acidity	**x**	**√√√**
Microbial activity	**√√√**	**√√√**

What value can we put on SOC?

- Soil Water: 1% SOC in the topsoil (0-10cm) can retain 5 to 6mm of water

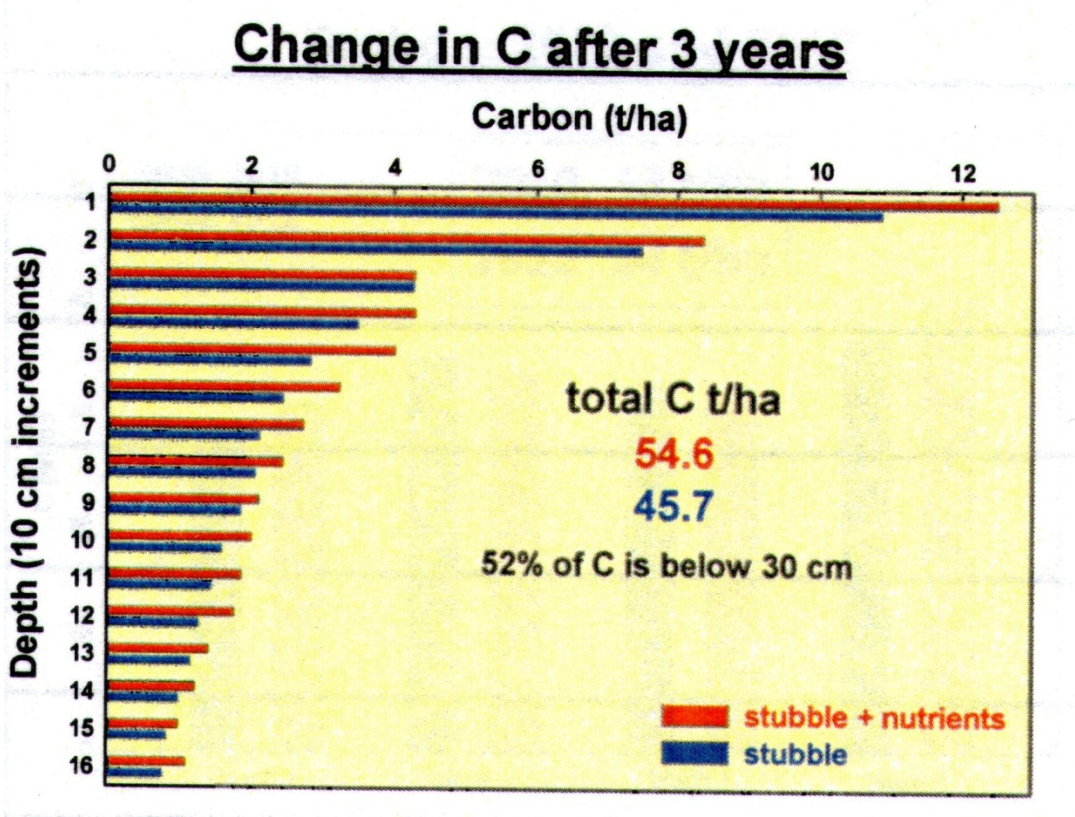
- Soil nitrogen: around 3% of SOM is turned over every year. A soil with a SOC level of 1% would release around 40kg N per year.

How to increase Soil C levels

- No-Till stubble retention trials (world wide) have not demonstrated an increase in humus content
- To break down stubble (C) microbes need Nitrogen, Phosphorus and Sulphur
- 

  Stubble + Nutrients (N P S) results in increased humus levels
- Legume pastures – do increase Soil C

CSIRO work has demonstrated an increase in soil C with No-Till ONLY when additional nutrients are applied. For every tonne of stubble to breakdown to humus you need: 5kg N, 2kg P, 1kg S



from Clive Kirkby, CSIRO

Benefits of legume based pasture

Legume pastures fix atmospheric N

N is the main nutrient required for soil microbes

Providing there is P and S available – legume pastures build SOM

Doing the maths (unfortunately….)

Q. how much biomass do you need to increase SOC (0-10cm) from 1 to 2%?

- 1% SOC in the topsoil is equivalent to 15t Carbon/ha
  soil volume: 100 x 100 x 0.1m = 1000m^3 ;
  Bulk density = 1.5; soil mass: 1000 x 1.5 = 1500t,
  and 1% of 1500t = 15t)
- Vegetative material (ie. stubble) consists of 45% C
  Hence need 15t x 100/45 = 33t vegetative material however
- Microbial efficiency is only 30% (the rest, 70%, is lost as CO_2)
  33t x 100/30 = **110t of stubble**
- Even over a 10 year period that is a lot of stubble!

How much would it cost to convert 110t of stubble to Soil Carbon?

- For every 1 t wheat stubble you need 5kg N, 2kg P, 1kg S to convert it to soil C
- As fertiliser that would cost $9/tonne stubble
- To increase SOC from 1 to 2% requires 110 tonne of stubble
- Which would cost **$1000/ha** (110 t stubble x $9/t stubble) (assuming all nutrients came out of a bag)

Summary

- **Three fractions** – Particulate, Humus, Resistant
- Different beneficial attributes - dependent on **soil type**
- Increasing SOM - **small increase** in Plant Available Water (**PAW**)
- The **greatest benefit** of increasing SOM is from **increased N (Humus fraction)**
- **SOM slow to increase under crop** (and requires additional N, P and S fertiliser)
- **SOM faster to increase under pasture** (may require P, S)
- **Continued research to quantify the benefits of SOM is** funded by GRDC and the Federal Dept. of Agriculture