

Building soil organic matter - what we know works

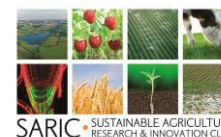
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Rothamsted Research

Chris Watts, Jackie Stroud, Lindsay Todman, Tom Sizmur,
Jim Harris, Karl Ritz, Mark Pawlett, Guy Thallon, Phil Wallace, Renske Hijbeek

Oxford Real Farming Conference 6 January 2016

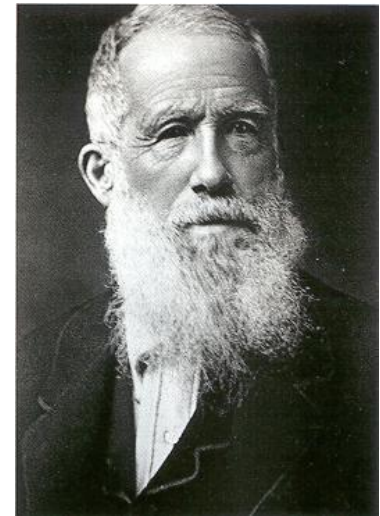
Soil Health without Breaking the Bank



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Broadbalk, Wheat since 1843



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Hoosfield, Spring Barley since 1852



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Park Grass Hay Meadow since 1855



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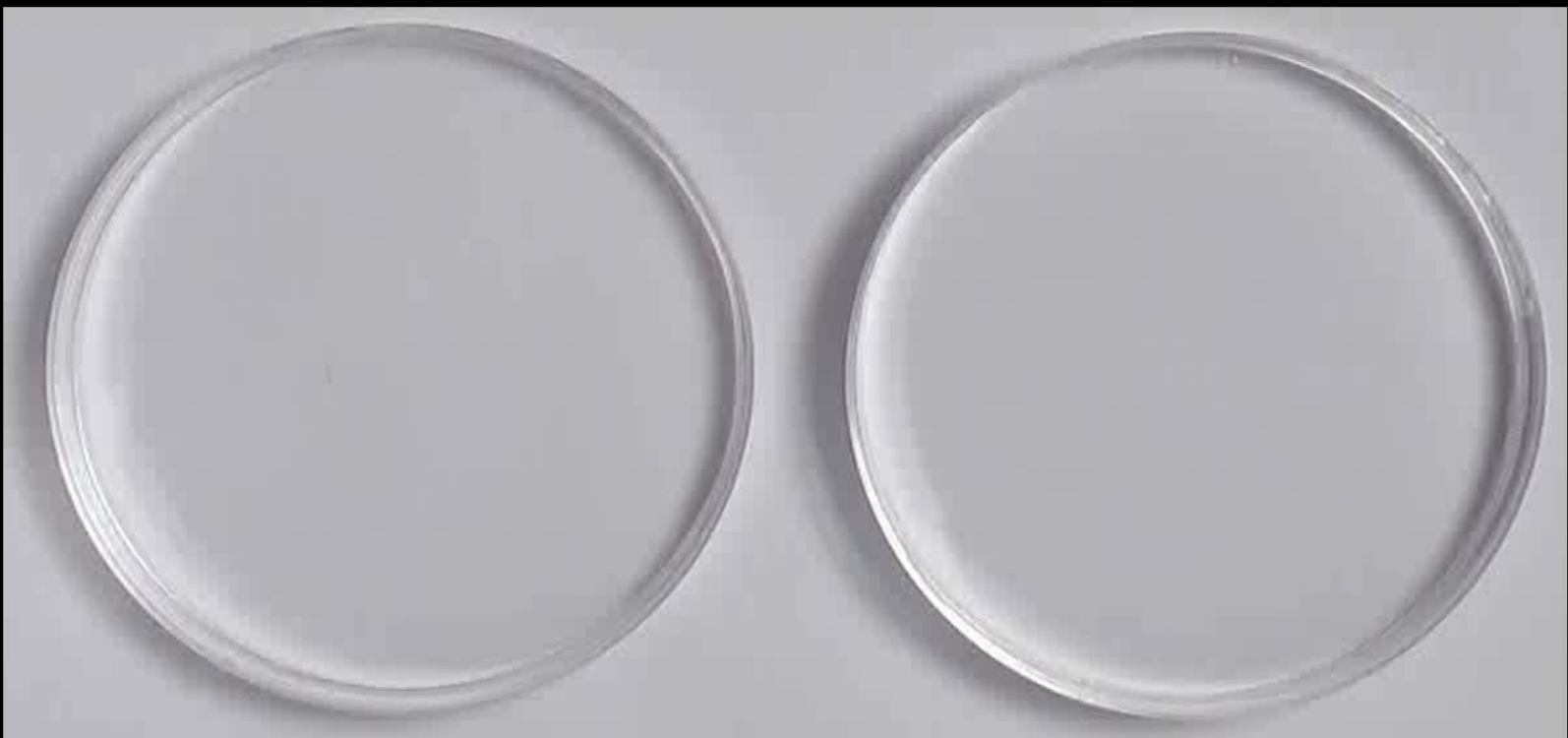
Highfield Arable/Grass Rotation Experiment Rothamsted (Est 1949)

Grassland

Arable (60 years)

SOC 30g/kg

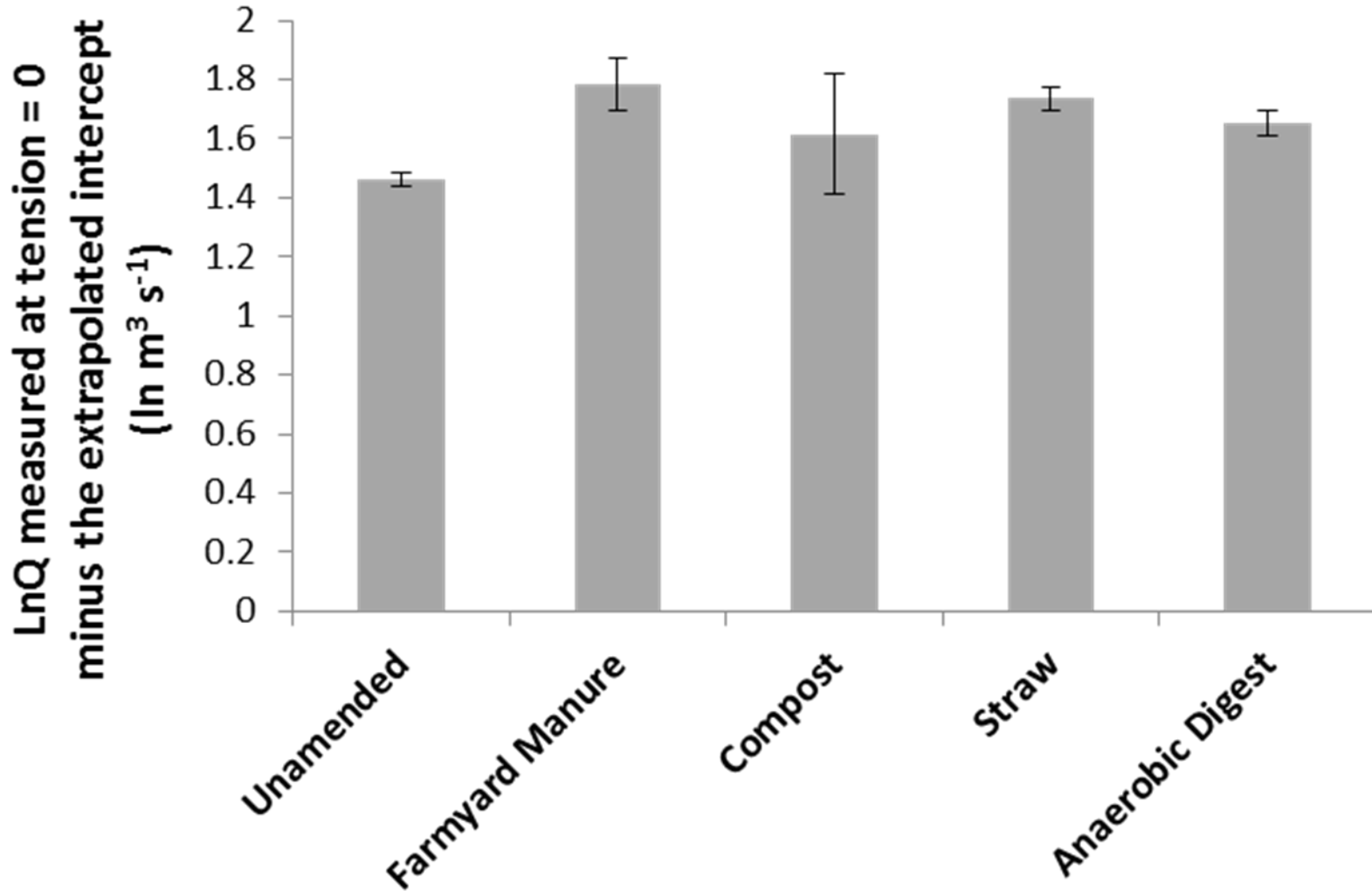
SOC 15g/kg



Infiltration – within one year of amending soil



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Means to increase Soil Organic Matter



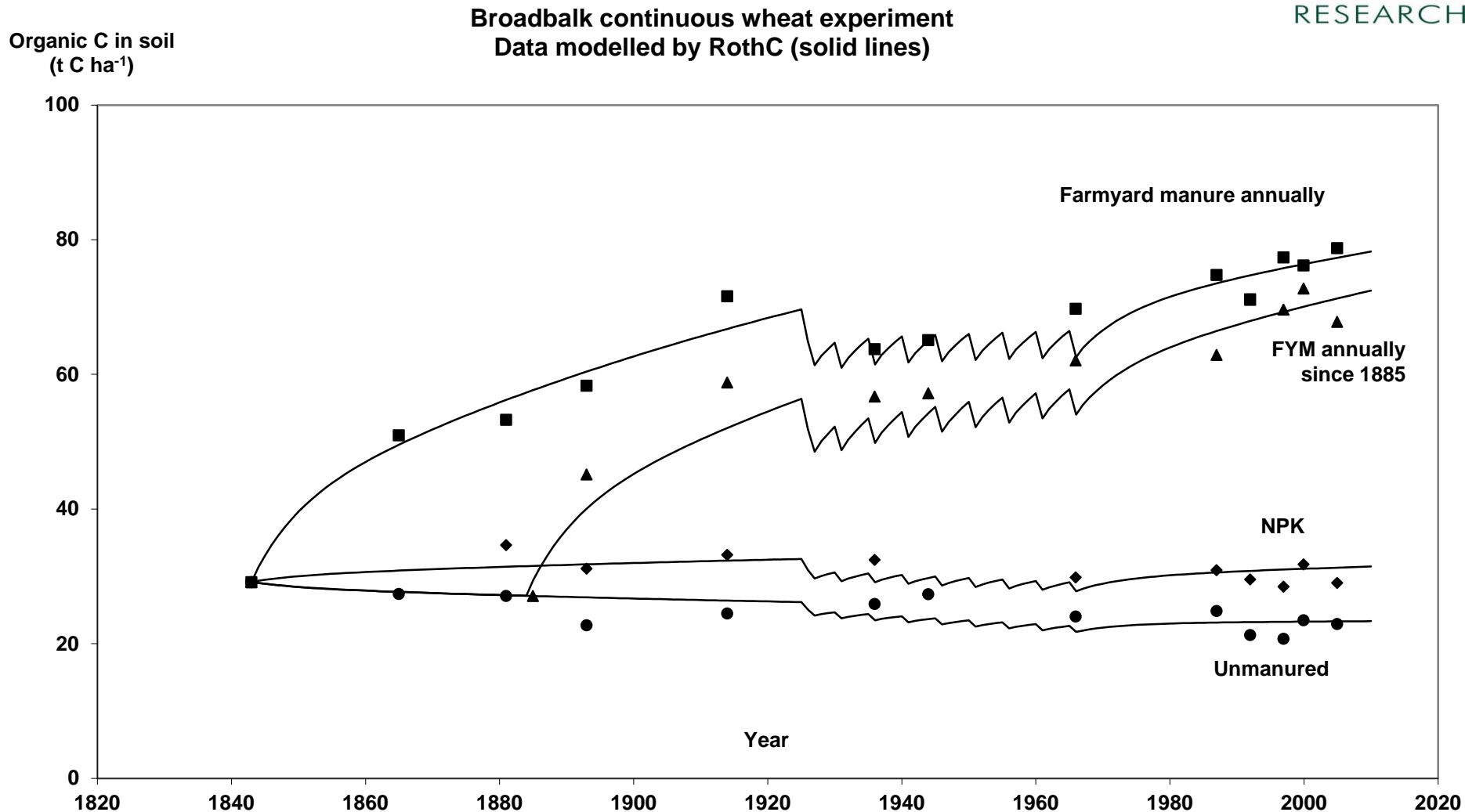
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1. Amend soil – add organic matter
2. Use cover crops, incorporate crop residues
3. Reduced tillage (?) – surface OM
4. (change your soil type or climate !)
5. Work with what you've got
6. Increase soil organic matter – sufficiently, without breaking the bank

Broadbalk – amending soil



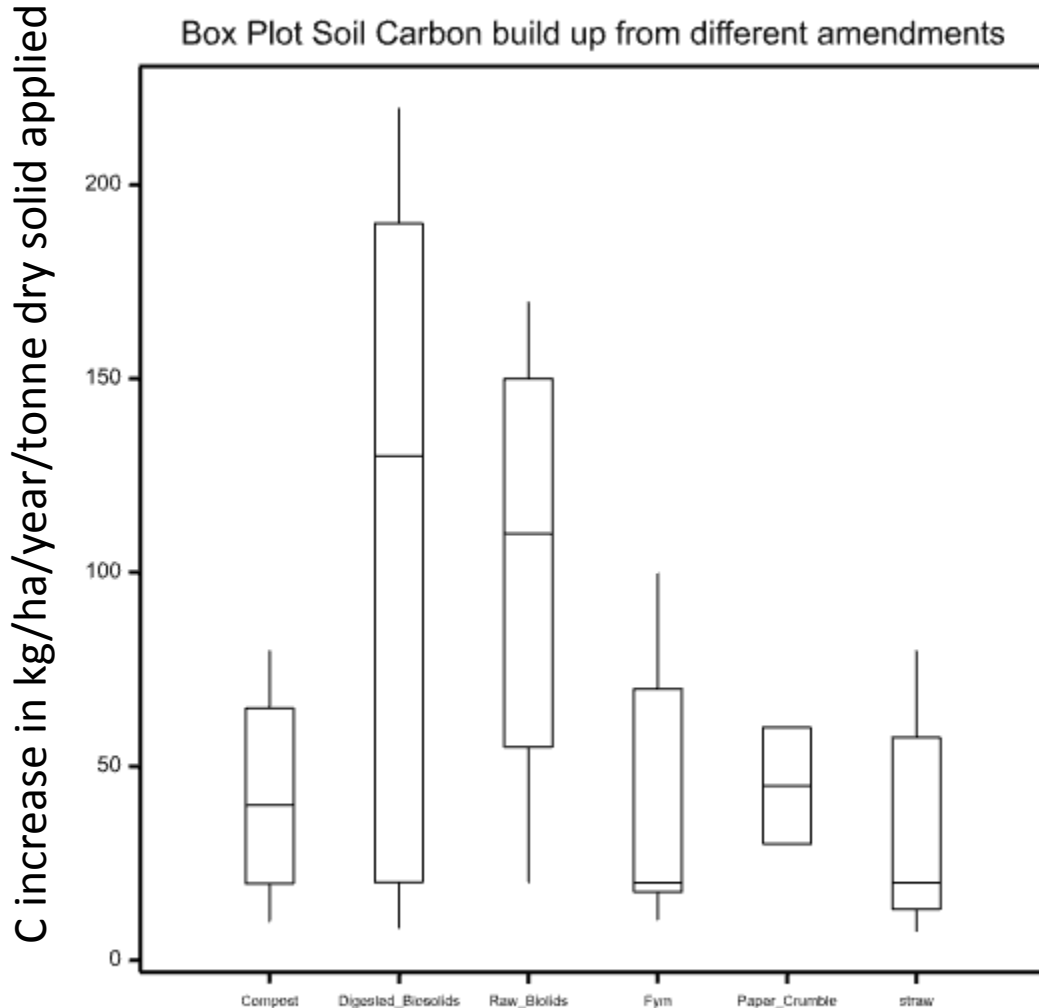
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Build up with various amendments



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Bar: mean

Box: standard error

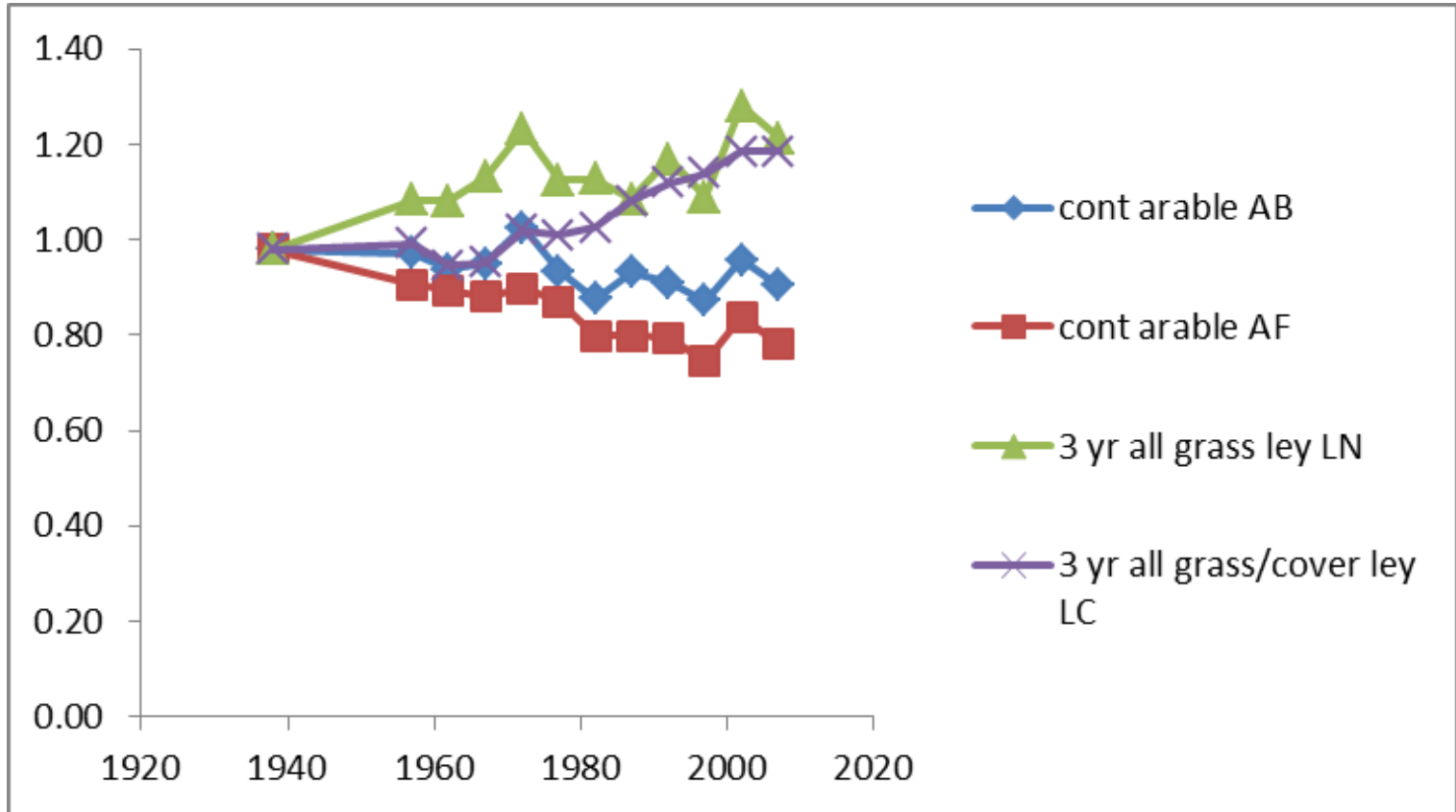
Whiskers: 95% Confidence Intervals

Compost, **Digested Biosolids**, Raw Biosolids, **FYM**, Paper Crumble, **Straw**

Increasing OM with leys – sandy soil



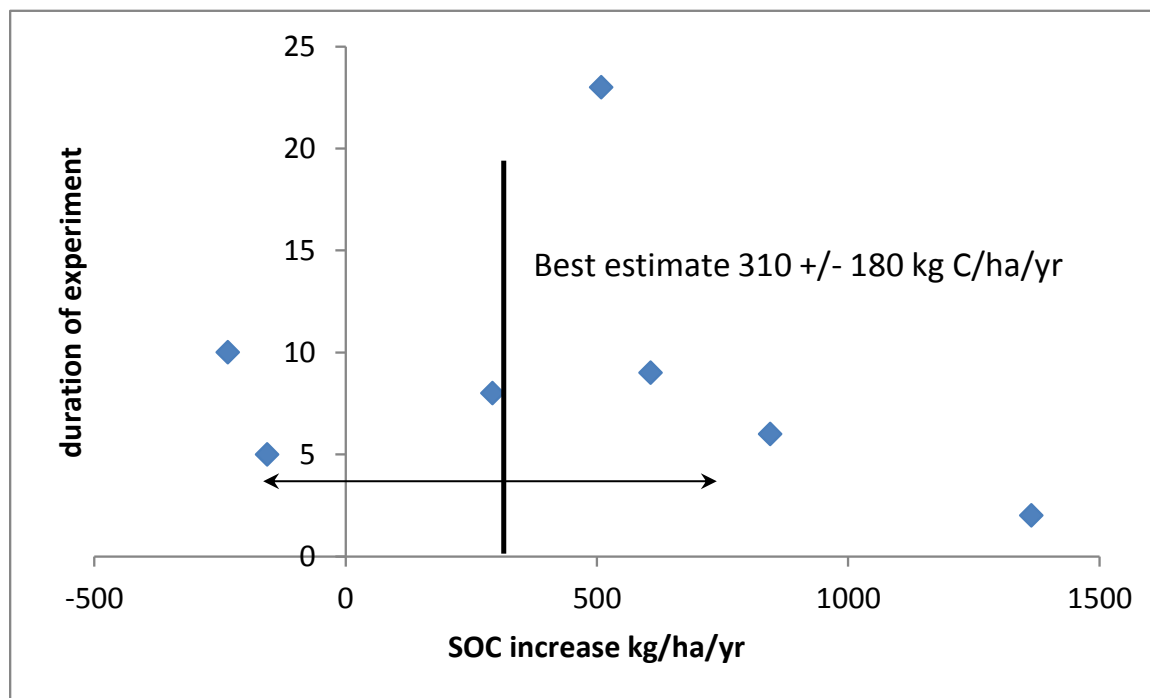
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Reduced Tillage, small, but not large increase in SOM



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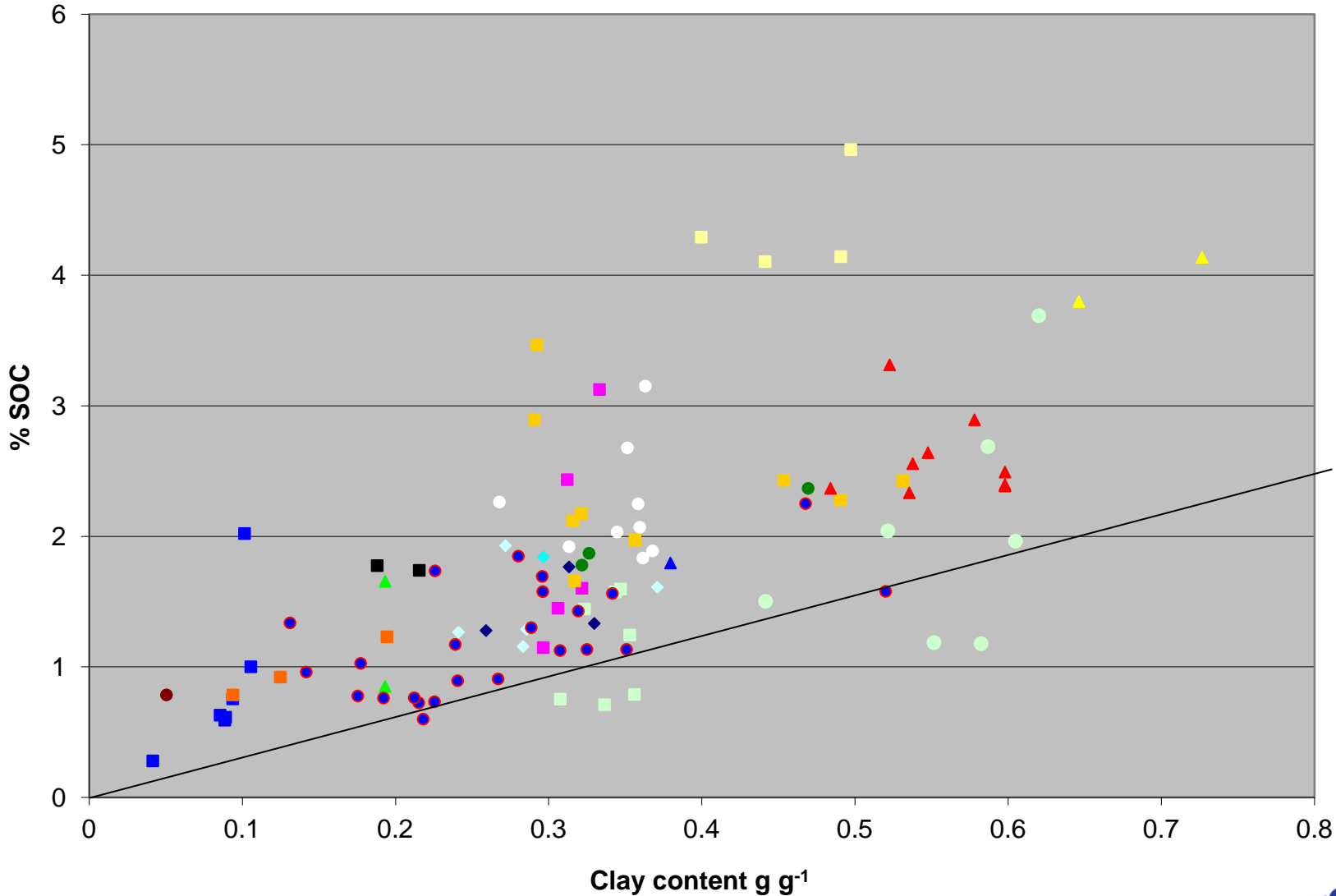


Minimum soil carbon increases with clay



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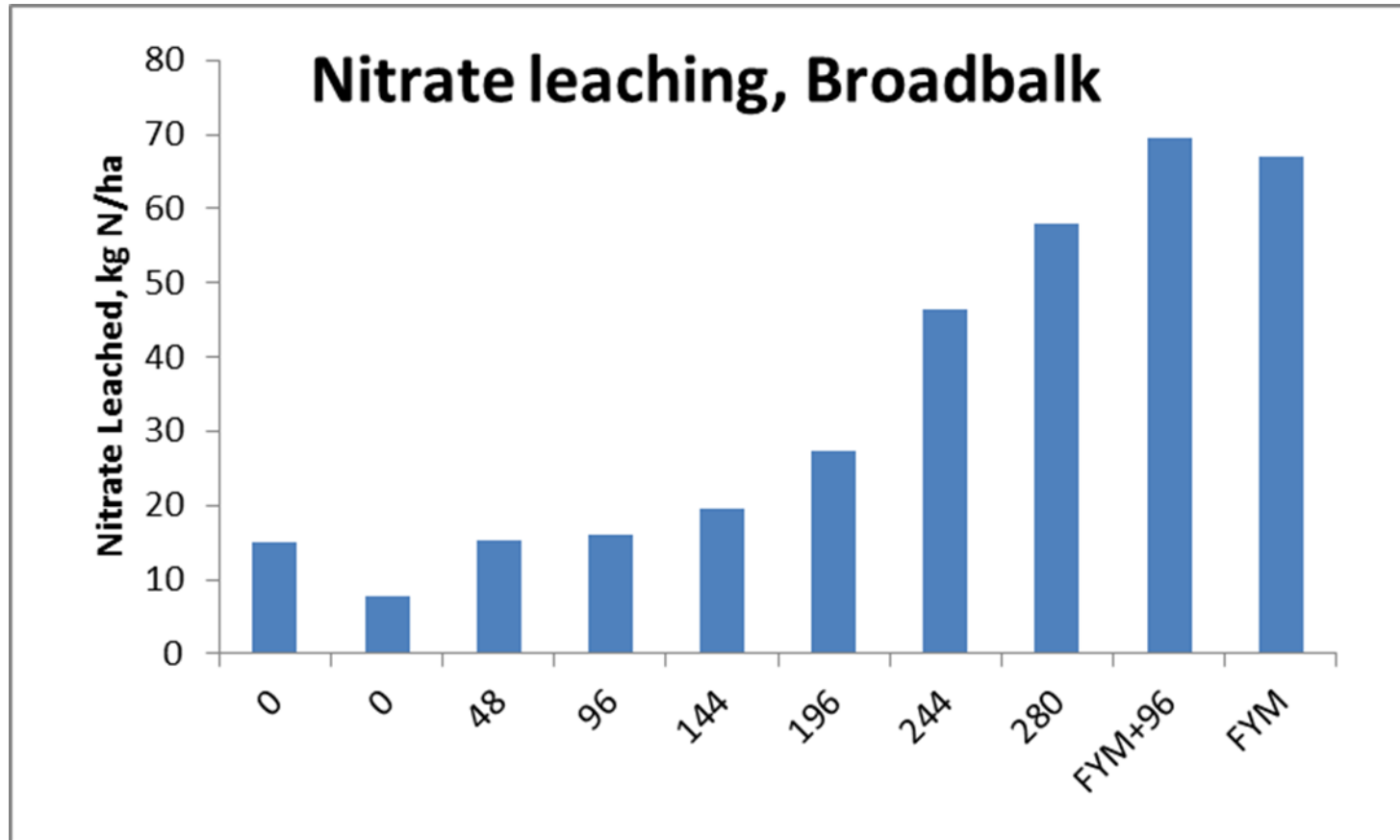
- ◆ Fosters
- Highfield
- ▲ Boot
- ▲ Bypass
- ◆ Roundhill
- Garden Gate
- ▲ Silsoe Farm
- Cockayne
- Gleadthorpe
- ◆ Rosemaund
- TErrington
- Iger NW 1
- Iger NW 2
- Gleadthorpe
- Leicester
- Malvern
- ▲ Boxworth
- Tollesbury
- others
- horticulture



Is there anything wrong with OM?



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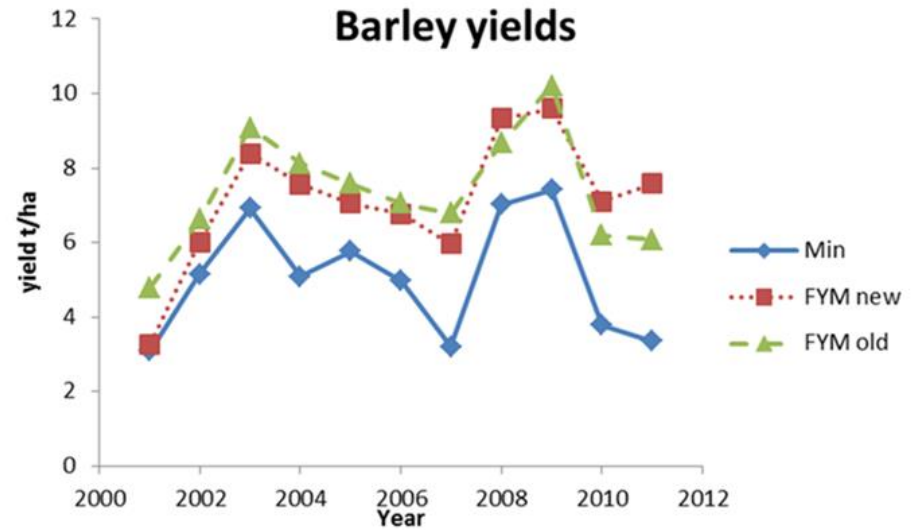
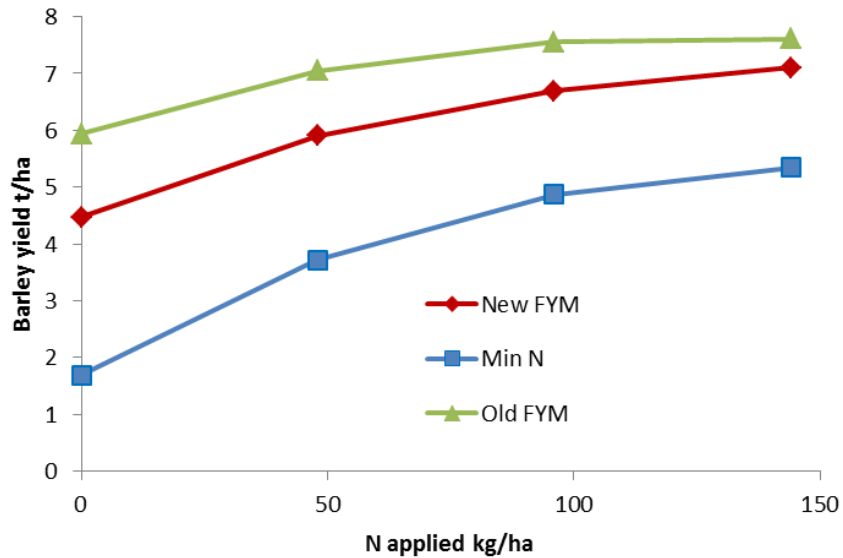
OM releases nutrients such as N. If it does this at the wrong time nitrate may leach
Or denitrify to nitrous oxide gas (N₂O) a potent contributor to global warming

Hoos barley yields with or without OM



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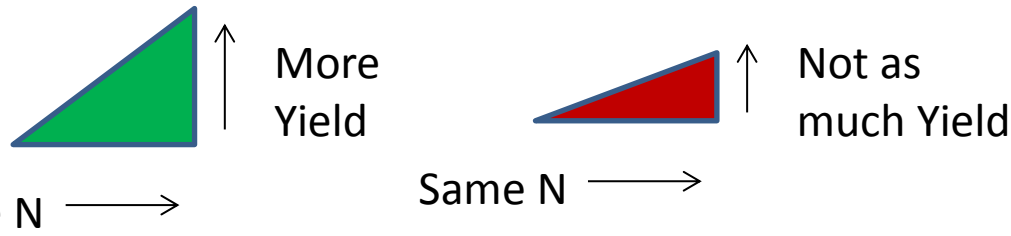
Average response curves 2001-2009



The Break Even Ratio (BER) is the extra amount of produce needed to pay for the extra amount of fertiliser



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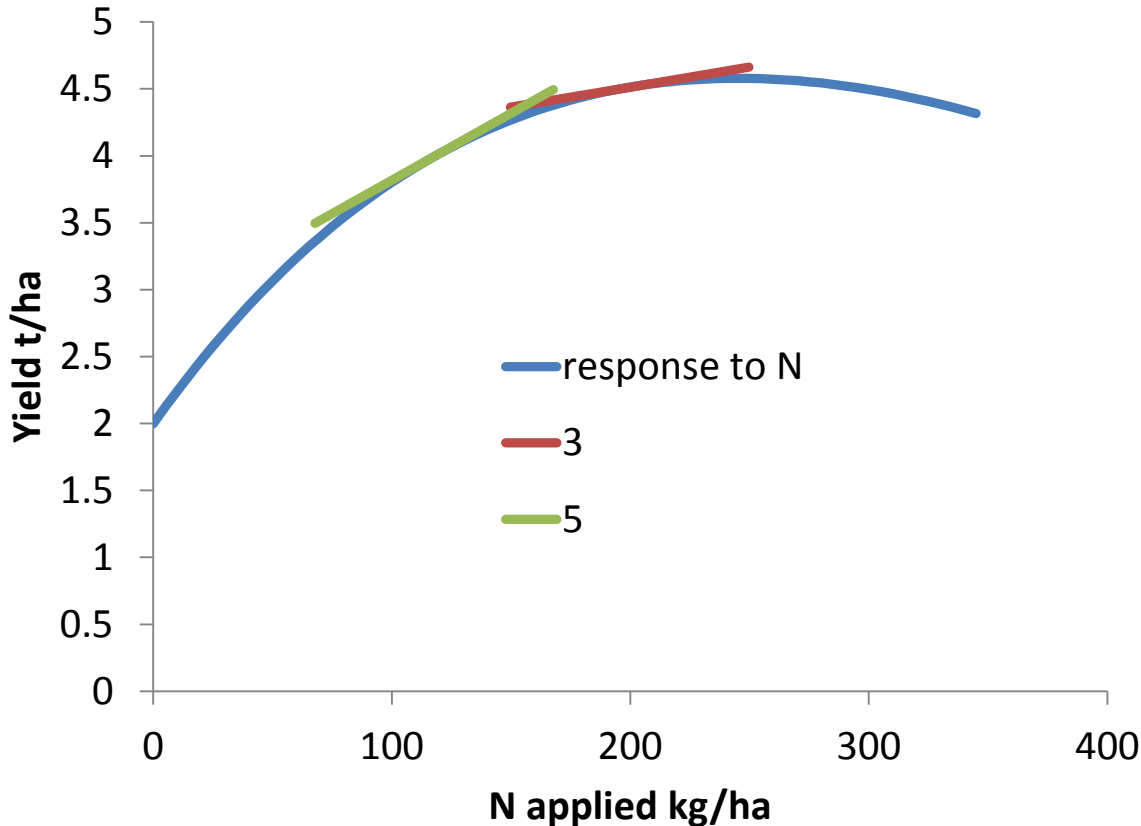


$$\frac{\text{kg N} * \text{£price}}{\text{Kg Yield} * \text{£value}}$$

e.g.

$$\frac{\text{£1}}{\text{£200/1000}} = 5:1$$

Slope of response curve is obtained by differentiating the formula for the curve

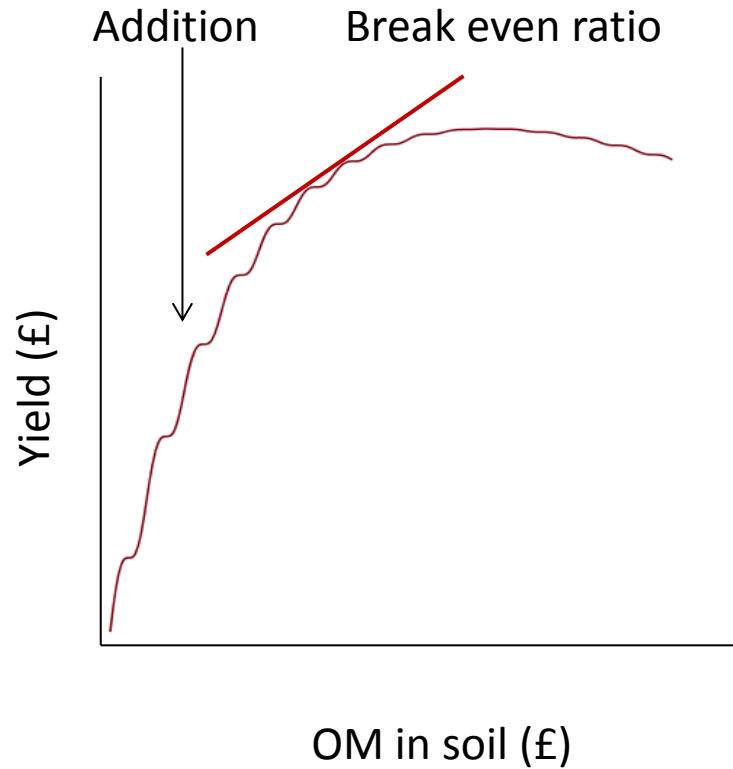


Fertilizer Manual Defra (was RB209)

Break-even ratio for OM over time



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Conclusions



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- Multiple benefits of increasing organic matter in soils
- Benefits do not increase without end
- There is a cost benefit to consider
- In degraded soils (and this includes many arable soils), there may be benefits of adding relatively little organic matter
- It may not be necessary – indeed it may be harmful – to increase organic matter levels hugely.
- Physical benefits derive from OM that remains in soil, Fertility (Chemical) from OM that breaks down, Biology from the energy in OM. All of this results from the consumption of OM by soil organisms