



Reducing the productivity gap – nutrients

Organic Producers' Conference workshop

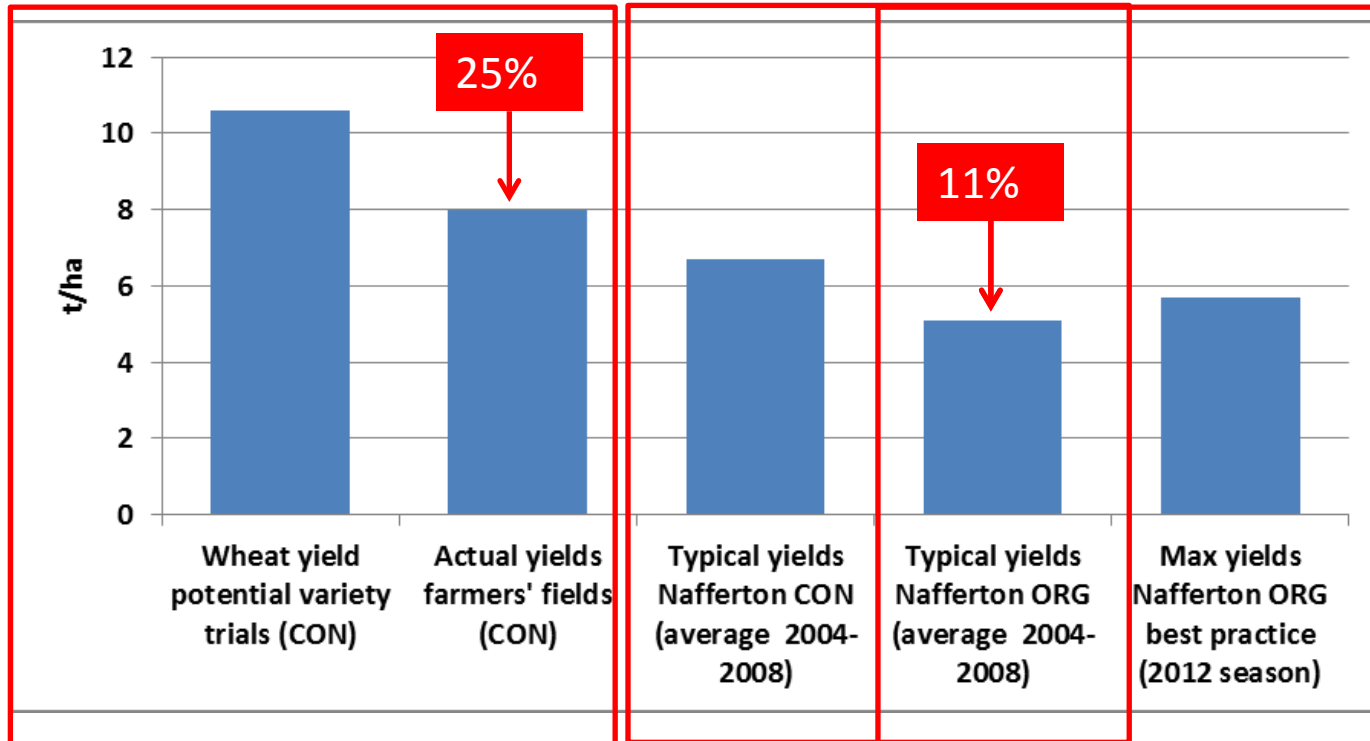
23 January 2014

Julia Cooper, Kate Gascoyne & Eleanor Swain

Nafferton Ecological Farming Group, Newcastle University



What do we mean by the productivity gap?

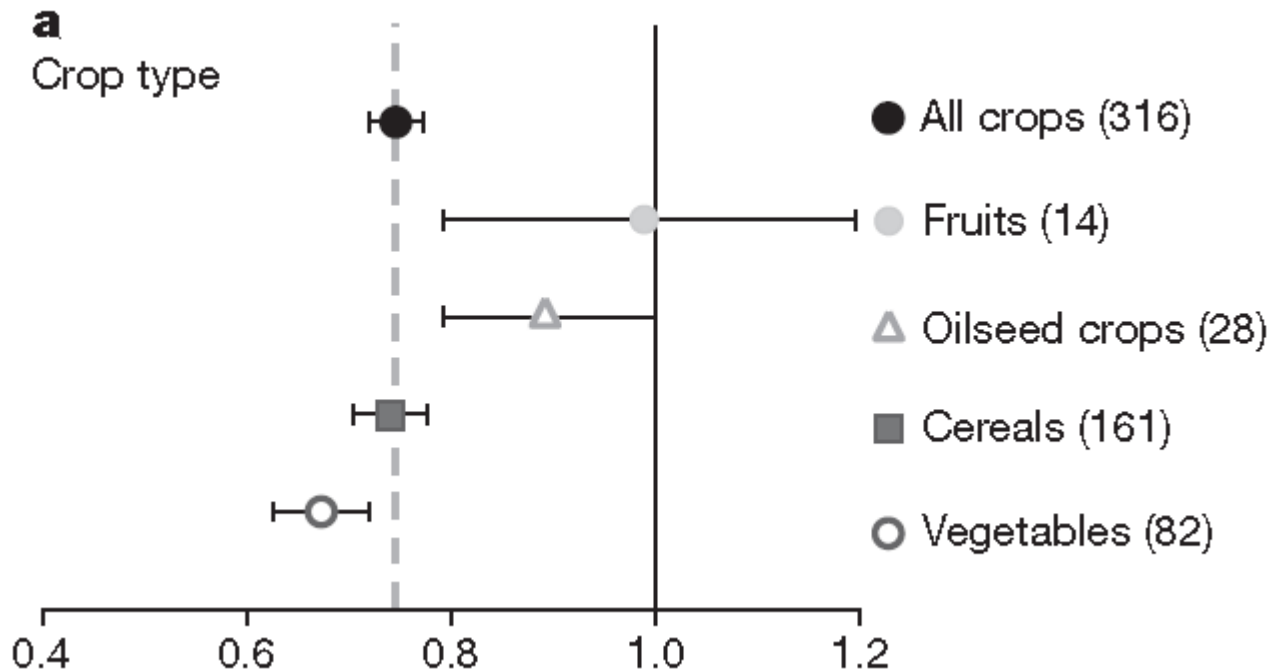


Key factors:
N nutrition
Disease
Minimum tillage (subsoil compaction)
Weather

Knight et al. (2012) Desk study to evaluate contributory causes of the current 'yield plateau' in wheat and oilseed rape. Project Report No. 502. Agriculture and Horticulture Development Board.

Bilsborrow et al. (2013) The effect of organic and conventional management on the yield and quality of wheat grown in a long-term field trial. Eur J Agron 51:71-80

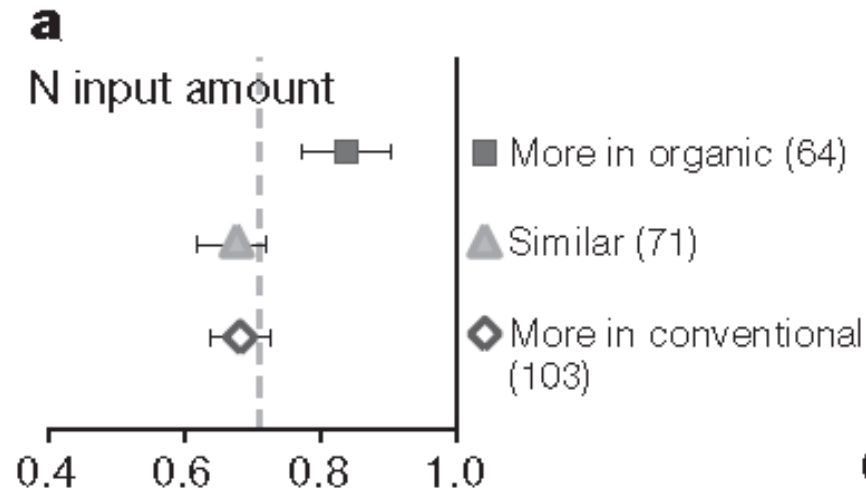
Global data – organic versus conventional



- About 25% lower yields for cereals in organic crops
- Only about 10% lower for oilseeds

Seufert et al. (2012) Comparing the yields of organic and conventional agriculture. *Nature advance online publication*. doi:<http://www.nature.com/nature/journal/vaop/ncurrent/abs/nature11069.html#supplementary-information>

Is N the problem?



- Yield gap is reduced by supplying more N to the organic system than the conventional

Seufert et al. (2012) Comparing the yields of organic and conventional agriculture. Nature advance online publication. doi:<http://www.nature.com/nature/journal/vaop/ncurrent/abs/nature11069.html#supplementary-information>

Improving N supply with legume leys – results from Nafferton Winter Wheat 2012



Three year legume ley meets N supply

- No difference in yield between organic and conventional fertility treatments following three years of grass/clover ley
- A two year ley organic fertility yields slightly depressed
- Wheat following potatoes or cabbages has significantly lower yields

Ruminants are essential to make this system economic



N supply from legumes

- Most farms with legume leys and/or permanent pastures have an N surplus
- Annual inputs
 - Temp leys – 50-300 kg N/ha/y
 - Permanent pastures – 50-150 kg N/ha/y

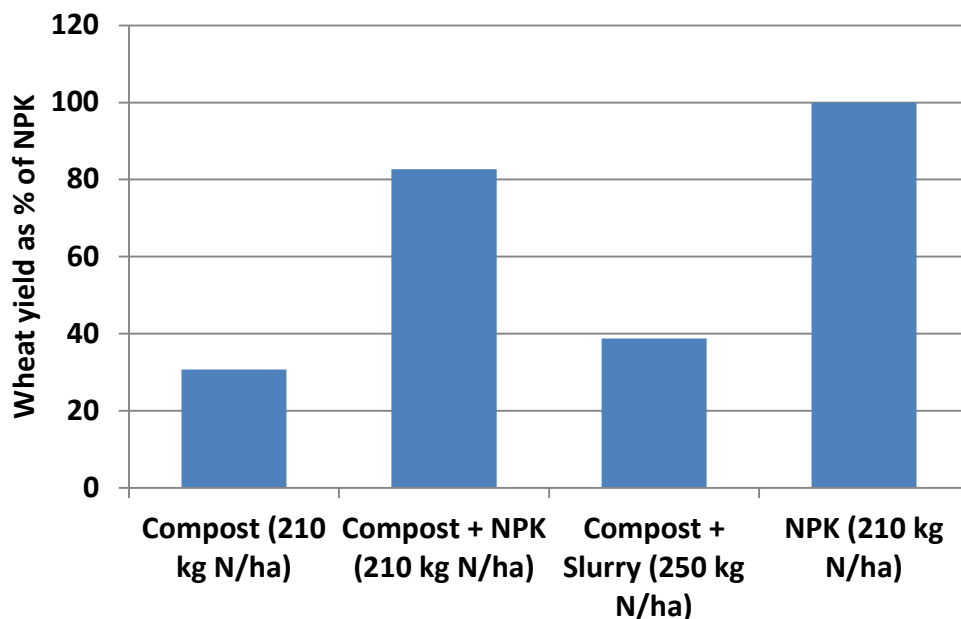


North Yorkshire case study

- Mixed farm with 42 ha permanent pasture, 48 ha arable rotation (18 ha/y in temporary ley)
- Total inputs by N fixation – 11,500 kg N/year fixed (128 kg N/ha/year)
- N challenge for most organic farms with legumes is not quantity, but distribution



Can N supply be met with slurry?



2nd wheat yields, Nafferton 2013



But its not all about N...

- For P inputs and outputs must be balanced
- And we must “close the P loop”



Closing the P loop

SOCIETY

- Recycle human waste
- Recycle food & food processing waste
- Reduce food wastage

THE FARM

- Prevent losses
- Recycle on-farm waste
- Improve crop uptake



Preventing losses from farms – reducing soil erosion

- 8 MT/y lost from soil erosion



Recycling organic wastes produced on-farm



Buckwheat – the P mobiliser



Closing the loop – recycling P from society

“Science, after having long groped about, now knows that the most fecundating and the most efficacious of fertilizers is human manure...A great city is the most mighty of dung-makers.” *Les Miserables*, Victor Hugo, 1862



Exciting news from Slough!

New reactor at sewage works turning human excrement from people of Slough into high-quality fertiliser that could be key to securing future global food supplies

Published: 7 Nov 2013 06:30

1 comment

WASTE from the people of Slough is at the centre of a new invention touted as the key to securing future global food supplies.

Thames Water has set up a £2m

nutri

of its

Sew

phos

and waste from residents and businesses.

Phosphorous is a key ingredient in fertiliser - which is used to improve wheat crop yields - but is non-renewable and currently mined from dwindling reserve supplies.

Experts say the reserves could run out in two generations and have hailed the technology as a



The BIG question... will this be acceptable in the organic industry??



Phosphorate expert Rosanna Cleeman in



QUALITY
ER 3STR
footstool, c
2000, sell f
(Growthom

Tel: 013447



Check out the story [here](#)

Last but not least...K

- Minimize losses due to leaching – catch crops
- Minimize losses from manure and compost
- Replace losses with allowable inputs supplements



Reducing the productivity gap - nutrients

N	improve capture (fixation), distribution and timing of release on farm
P	improve on-farm recycling, crop efficiency of uptake, societal recycling
K	minimise losses on-farm, replace offtake with allowable K sources

Thanks to...

- Technical staff at Nafferton Ecological Farming Group especially Gavin Hall & Rachel Chapman
- IMPROVE-P CORE ORGANIC II project
- European Community Seventh Framework Programme for Research, Technological Development and Demonstration Activities, for the Integrated Project NUE CROPS EU-FP7 222-645