Crop Establishment Systems and Rotation in Combination

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Background: Why these studies

Sustainability concerns with tillage

- Soils: Organic matter, Structure, Fertility
- GHG emissions
- Disease and Weed control
- Financial sustainability

Suitability for our climate, soils and farms

- Systems evolved in other climates/ farming systems
- Over simplification of systems (e.g. plough vs non-plough)

Research challenges

- Many aspects take decades to show a response.
- 'Systems' always difficult to research
- Conventional trials limited but no simple alternatives

Background: Previous work

Knockbeg: Plough vs Min-till

- Crop Performance (WW and SB)
- Straw incorporation, Soil C changes, Soil Microbiota (WW)
- N dynamics with (WW and SB).
- Soil Flora: Earthworms and beneficials; slugs (WW).

Other

- GHG (NOX and C) of Sp Barley systems
- Leaching on light soil
- Aphids and BYDV
- Machinery Workrates and Costs.

Fortune, Kennedy, Brennan, Lanigan, Van Groningen, Hackett, Murphy, Forristal.

Current research: Cultivations and Rotations

AIMS:

- To compare a range of cultivation systems in combination with rotation.

Cultivations

- Conventional plough: 225mm
- Shallow Plough: <150mm
- Min-till: 75mm
- Strip-Till 330mm spacing: <150mm

Cultivations and Rotations

Rotation – 5 crop

- W. Oilseed rape,
- W. Wheat (R),
- W. Oats,
- W. Wheat(O),
- W. Barley

Monoculture

- W.Wheat (C) - Continuous

Site and plots

Site History

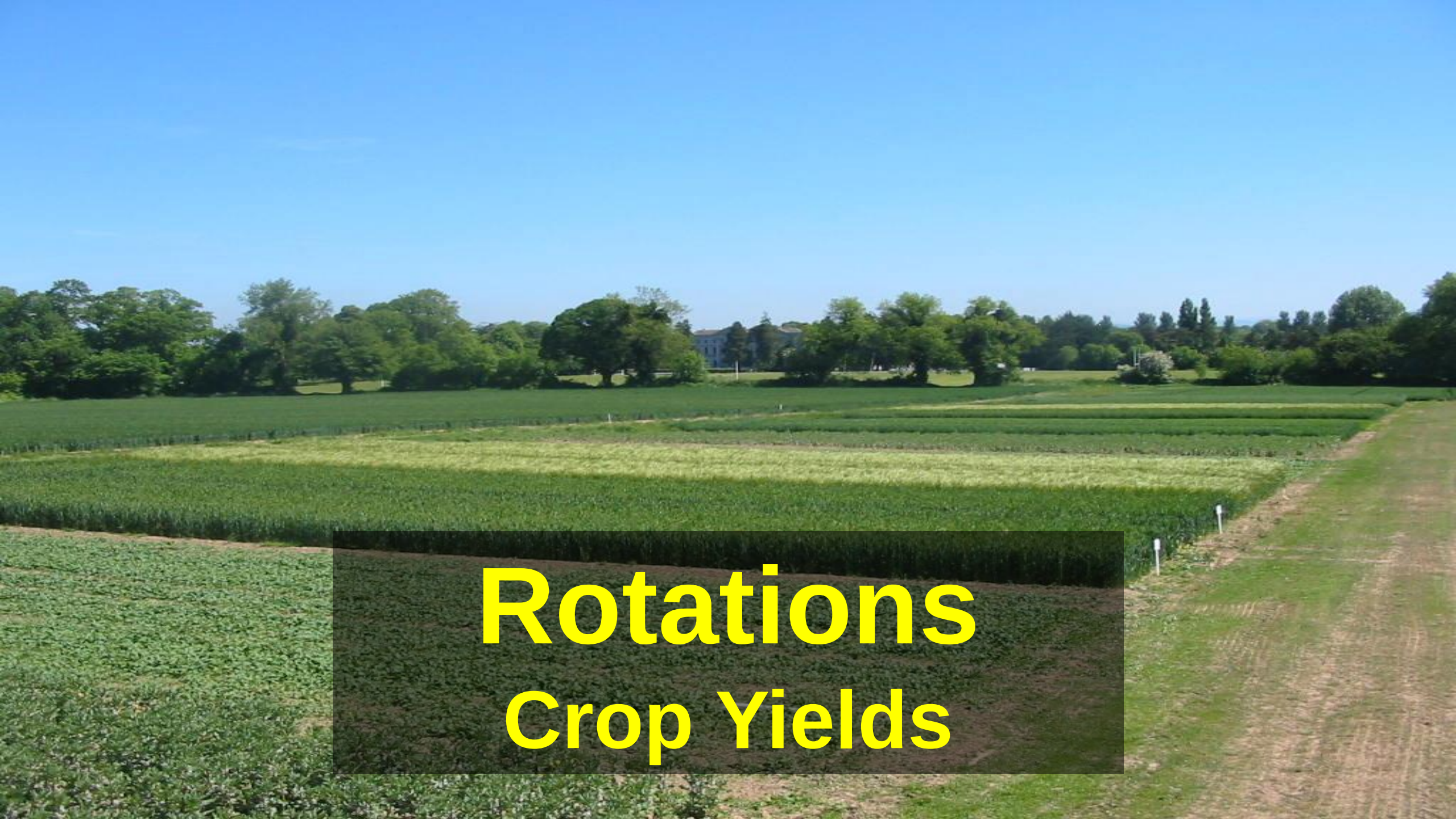
- MT vs Plough since 2001
- Changed 2009 for N studies
- Converted in 2014 for current studies

Design

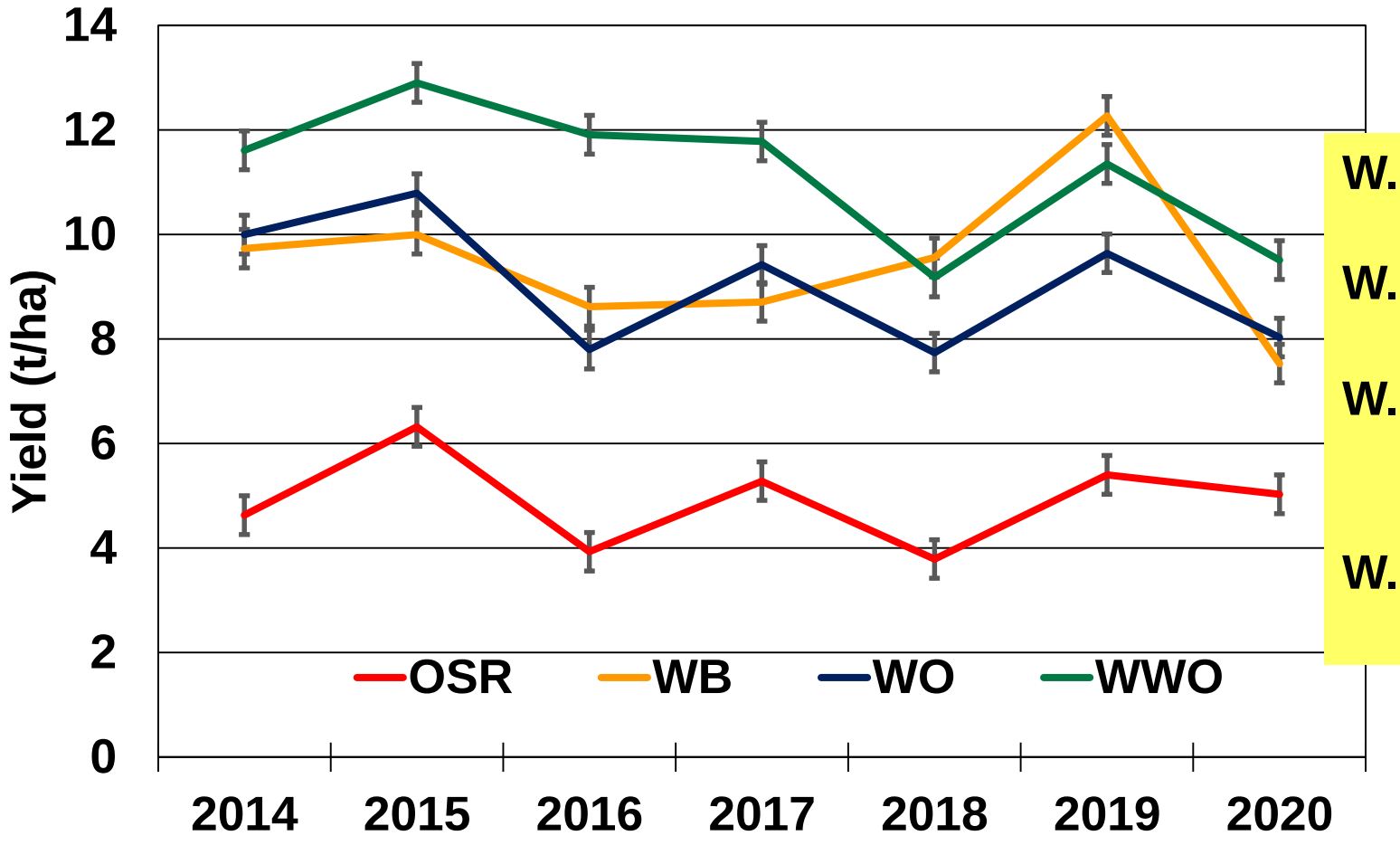
- 30m x 30m Cultivation plots + turning space
- 4 replications
- 5m x 30m Rotation crop plots

Status

- Reporting transition phase (years 1 to 7) here
- Full rotation completed on all plots.


Rotations
Crop Yields

Yield trends: Individual crops (t/ha)



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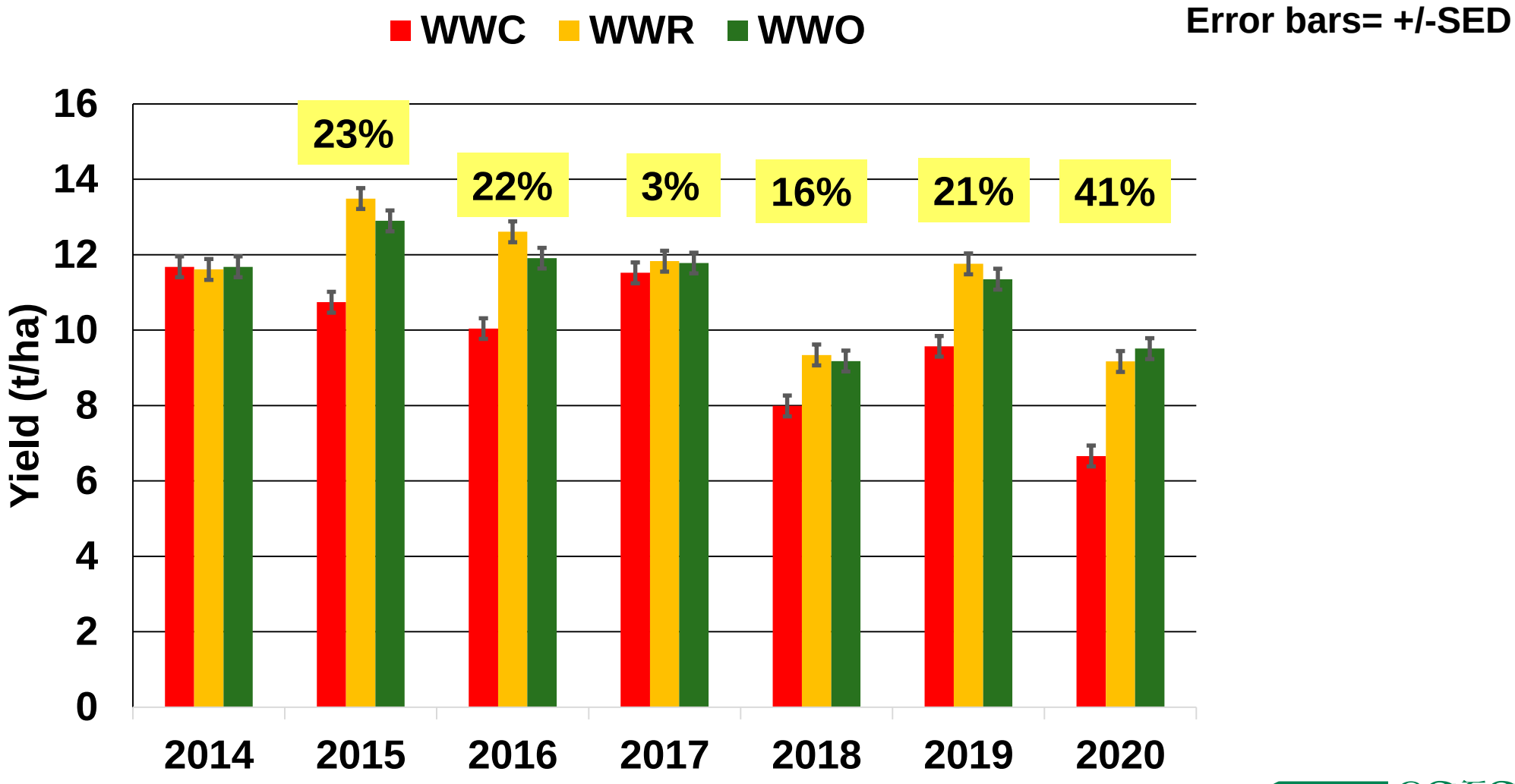
W. Wheat: 11.2

W.Barley: 9.5

W.Oats: 9.1

W.OSR: 4.9

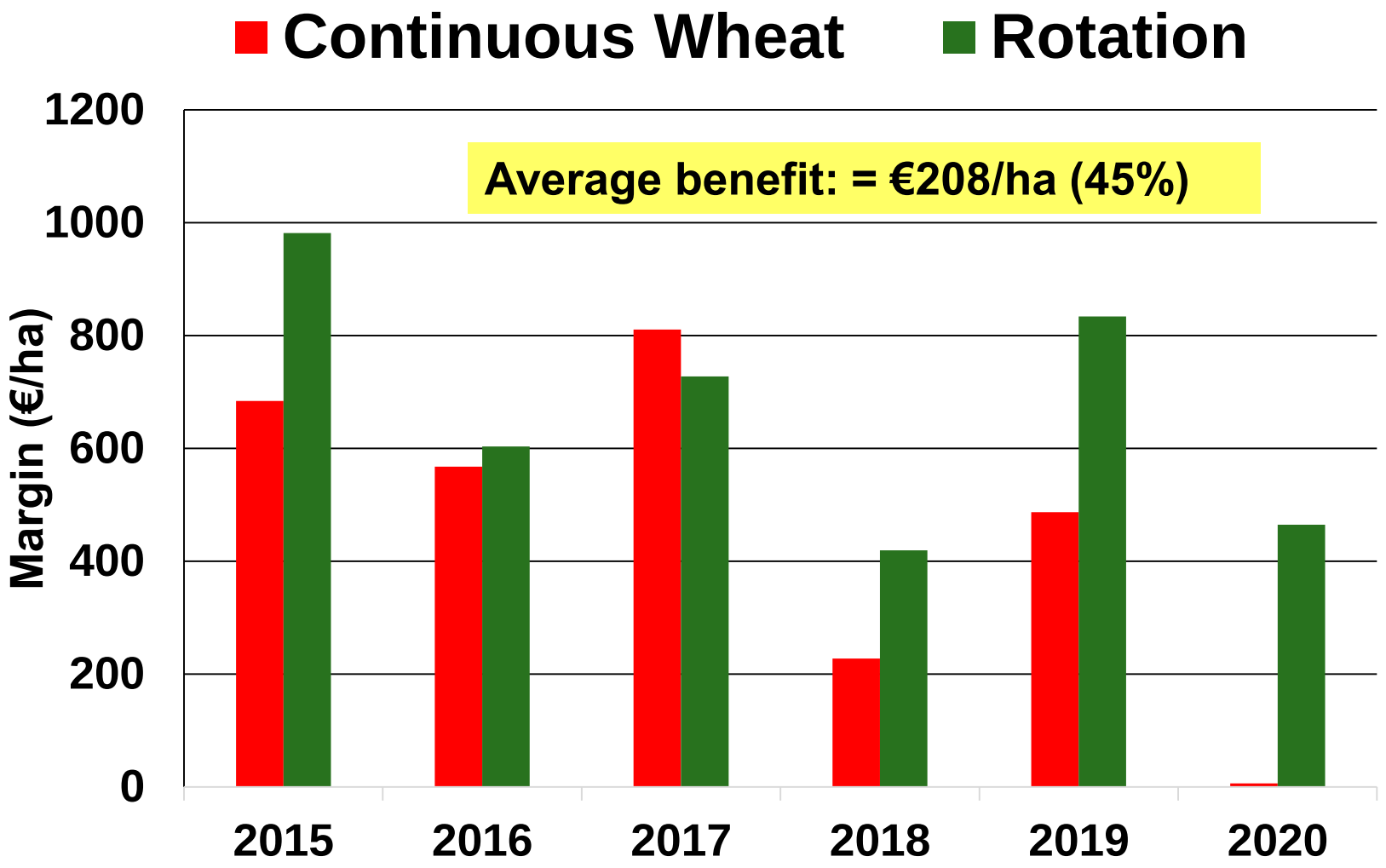
Rotation vs Continuous wheat: Yield



Rotation benefits to next cereal.

- Varies with season: 3% to 41%
  - **Average 19% over these 6 years**
  - Note: 11% in earlier systems trials
- Available from year 2.
- Little difference between Oats and OSR as break crops
  - This and variation indicates that impact on ‘take-all’ is the main cause.
- Little difference in response of different establishment systems to rotation**: no interaction**.
- Huge impact on margins in this period on this site

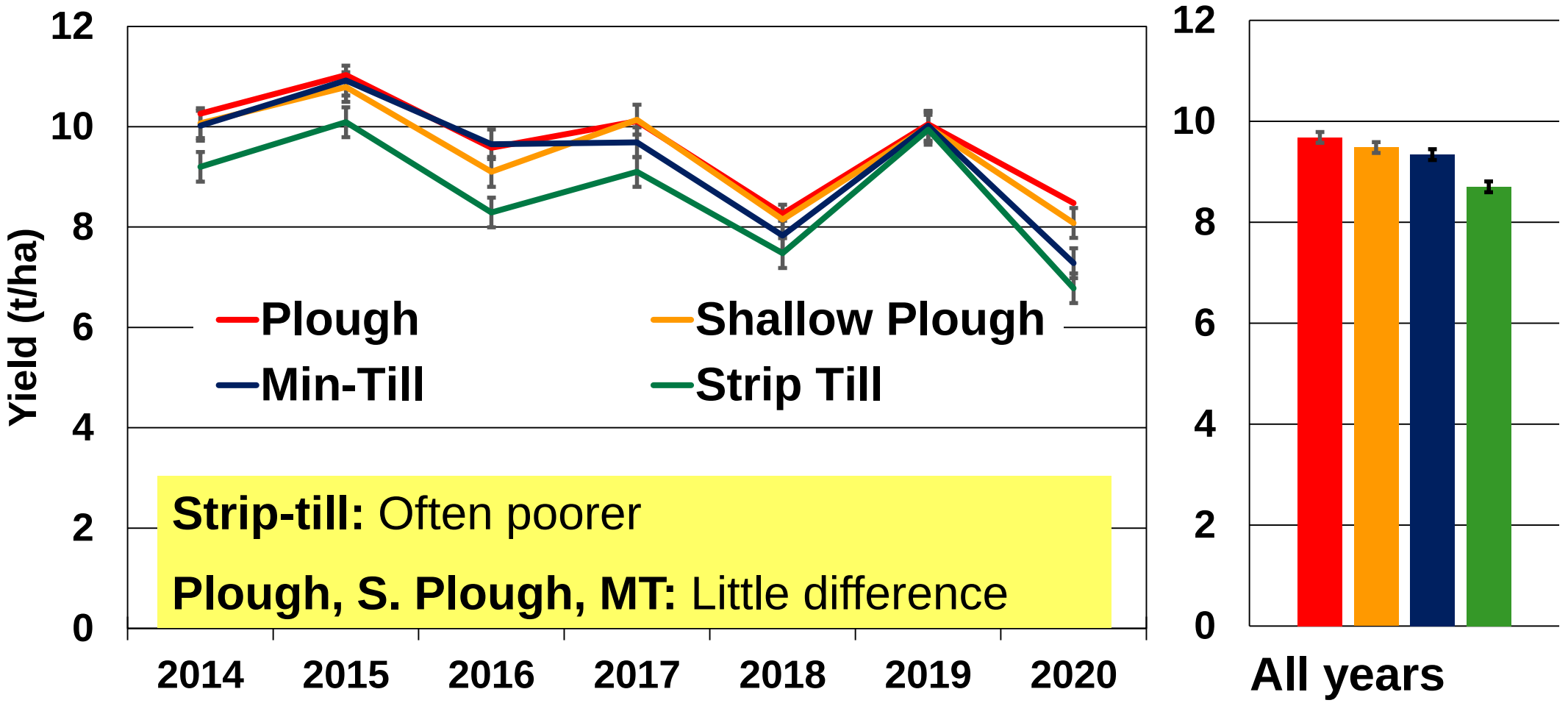
Margins: Rotation vs Wheat monoculture



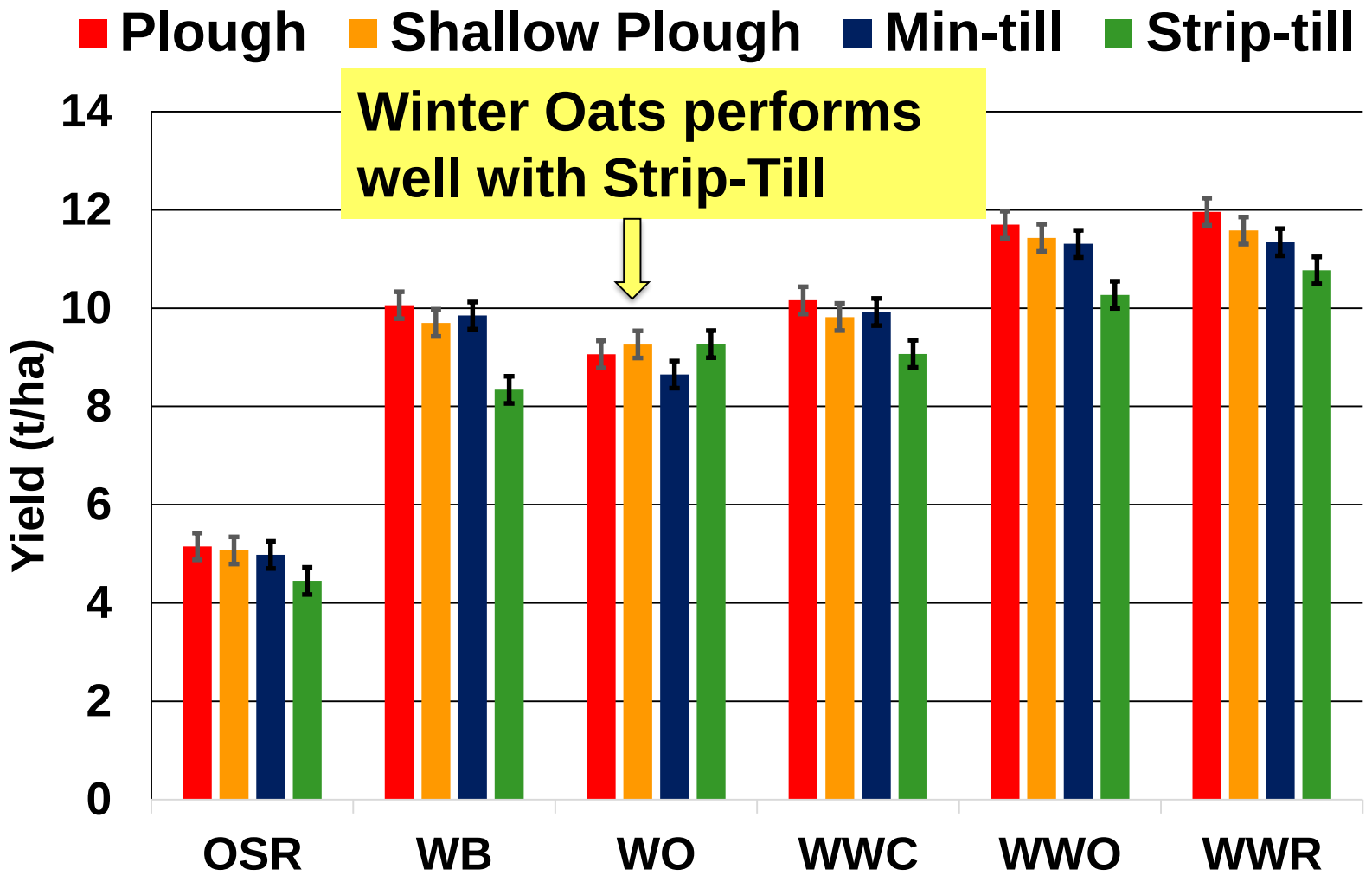
Crop Establishment

Crop Yields

Cultivations: All crops 7 years



But Crop type matters!



Establishment system impacts.

- Plough, Shallow Plough and MT all capable of supporting high yields.
- Strip- Till, as we practiced it, had a small yield penalty, but not with oats.
  - **We had grass weed challenges with ST**
  - Different management may have overcome this.
- Shallow <150mm ploughing had no yield penalty


New On- Farm Studies
Oct 20 ➡

The adoption of non-inversion Systems

Jack Jameson (Post Grad)

Focus Study
21 farms – on site
Plough, MT, Direct Drill
Crop performance
Soil assessment
Env. indicators

Perception Survey
100 farms – phone
Growers expectations
Knowledge sources
Knowledge acquisition
Adoption practice

Field trials
Tillage system impacts on Crops and Soils in a controlled experiment.

Conclusions

Rotation

- Break-crops impact on following yields (+19%)
- No interaction with crop establishment systems.

Use Rotations (particularly with winter cropping)

Crop Establishment / Cultivations

- Plough, Shallow plough and Min-till: Similar yields
- Strip-till: some yield loss – not Oats (grass weed management vital).

Manage Non-Inversion well; Plough less deep

On Farm data collection will augment field trials