



Contrasting ground cover and establishment techniques for maize production systems

**RESEARCH
WITH
PLYMOUTH
UNIVERSITY**



**John Williams
Soil Scientist
ADAS Boxworth**



Background

- Maize cropping has increased significantly in recent years – 27% increase in 2013 to c.180,000 ha
- Bare soil over winter increases risks of:
 - Nitrate leaching
 - Sediment/phosphorus losses
 - Runoff/flooding risks
- Concern over reduced bio-diversity in maize cropping systems

Previous cover crop research

- Cover crops usually need to be established by late August/ early September to be effective (e.g. mustard, rye)
- Cover crops can be effective at reducing nitrate leaching losses by more than 50% compared with bare ground
- Nitrogen (N) uptake typically 30-50 kg/ha N (depending on growing season)
- May need to adjust SNS index for following crop

Current Defra Funded Research

- Quantify the effects of contrasting cultivation and ground cover management practices on diffuse pollution and maize yields and quality.



Two sites – harvest seasons 2013 and 2014

Fakenham (Norfolk):

- Sandy loam soil
- Gently sloping land,
around 3%



Bow (Devon):

- Sandy silt loam
- Steeply sloping land,
around 13%



Treatments


1. Conventional plough-based cultivation
2. Strip tillage: over-sown perennial ryegrass (June 2012) (sowing rate 35 kg/ha)
3. Strip tillage: over-sown biodiverse seed mix (June 2012)
- 4a. Strip tillage (farm drill): over-sown perennial ryegrass (June 2013 at Fakenham)
- 4b. Conventional plough-based cultivation - with plastic mulch (at Bow)
5. Sub-soil and non-inversion cultivation

Biodiverse Seed Mix Composition

Species	% by wt	Characteristics
Black medick	20	Spring/autumn germinating, annual or perennial, fairly drought tolerant
Sainfoin	25	Spring germinating, perennial, likely to increase in year 2
Alsike clover	20	Spring/summer germinating, annual or short-lived perennial, establishes and flowers well in year 1
Crimson clover	20	Spring/autumn germinating, biennial or short-lived perennial, early flowering
Bird's-foot trefoil	10	Spring germinating, perennial, likely to increase in year 2
Musk mallow	5	Spring germinating, perennial, tolerates drought

Sowing rate: 15 kg/ha

Measurements

- Surface runoff volumes (tipping bucket)
 - Total phosphorus, total dissolved phosphorus, nitrate-N and sediment losses
 - Nitrate leaching losses (Porous pots)
 - Soil mineral N
 - Crop yields and quality
- 

Surface runoff



Fakenham: ryegrass cover (broadcast June 2012)



November 2012



May 2013

Fakenham: Biodiverse mix cover- (broadcast June 2012)



November 2012



May 2013

Bow: oversown cover establishment - Autumn 2012

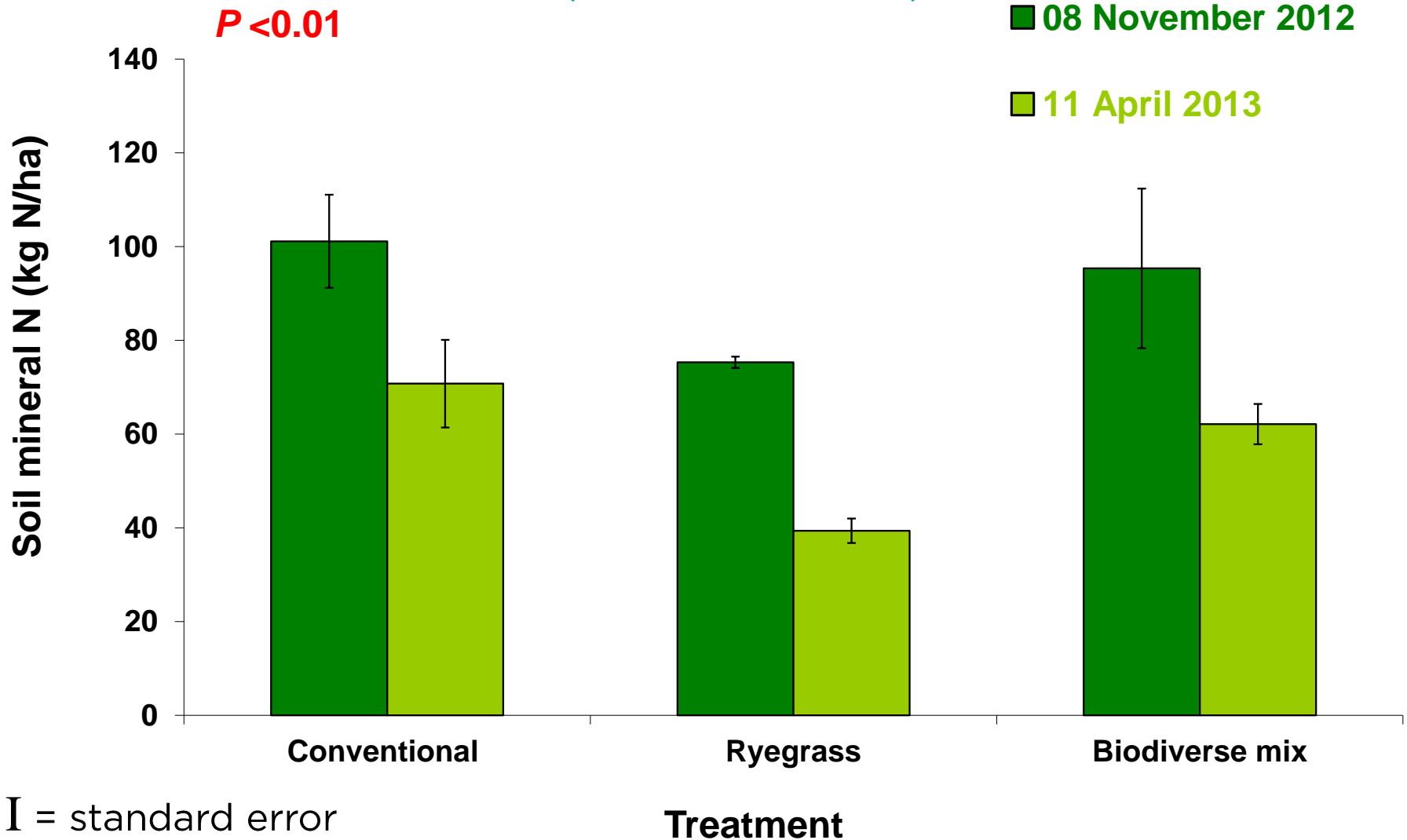


Ryegrass

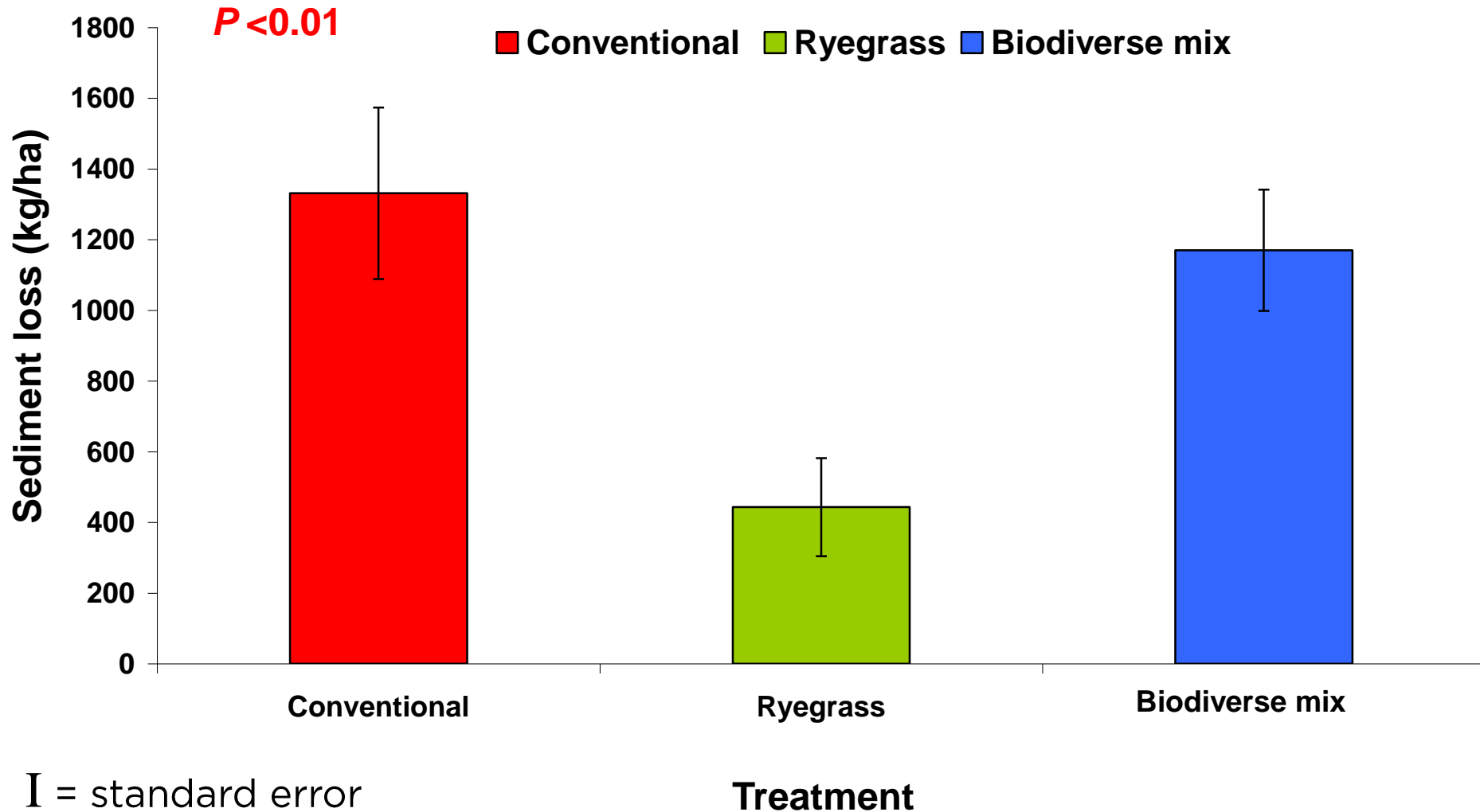


Biodiverse mix

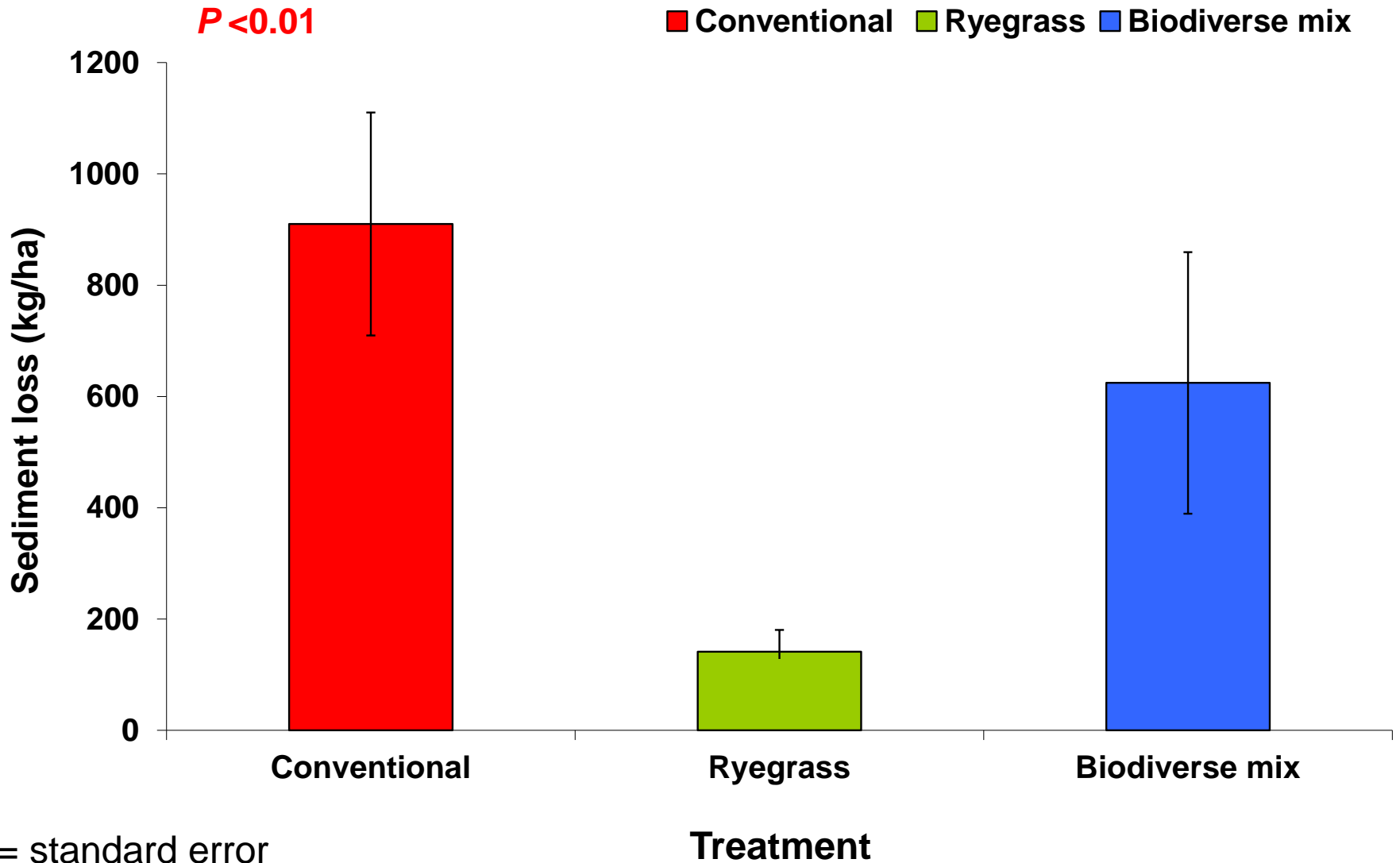
Fakenham: soil mineral nitrogen-N (0-90 cm)



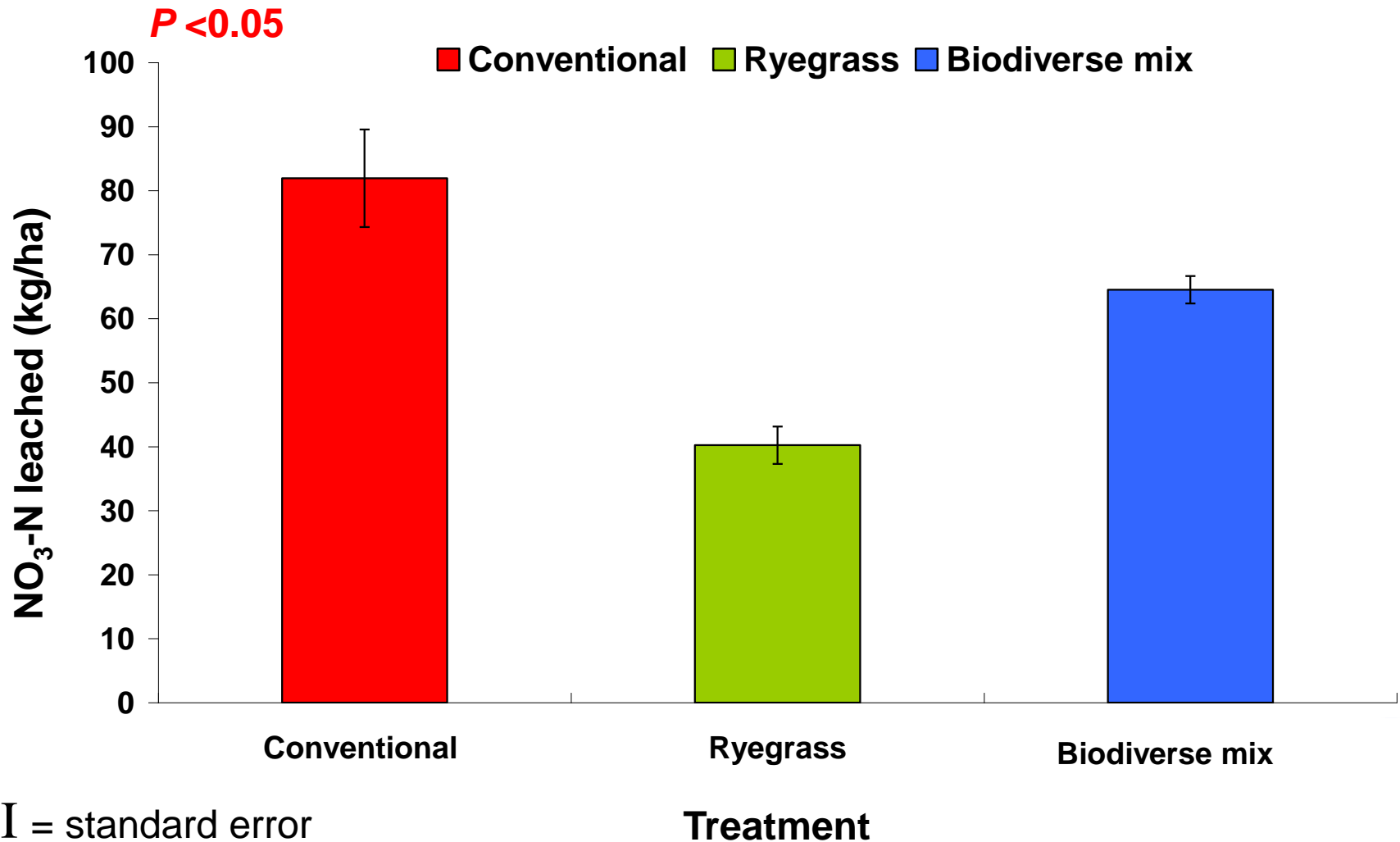
Fakenham: sediment loss (over-winter 2012/13)



Bow: sediment loss (over-winter 2012/13)



Fakenham: nitrate-N leaching losses (over-winter 2012/13)



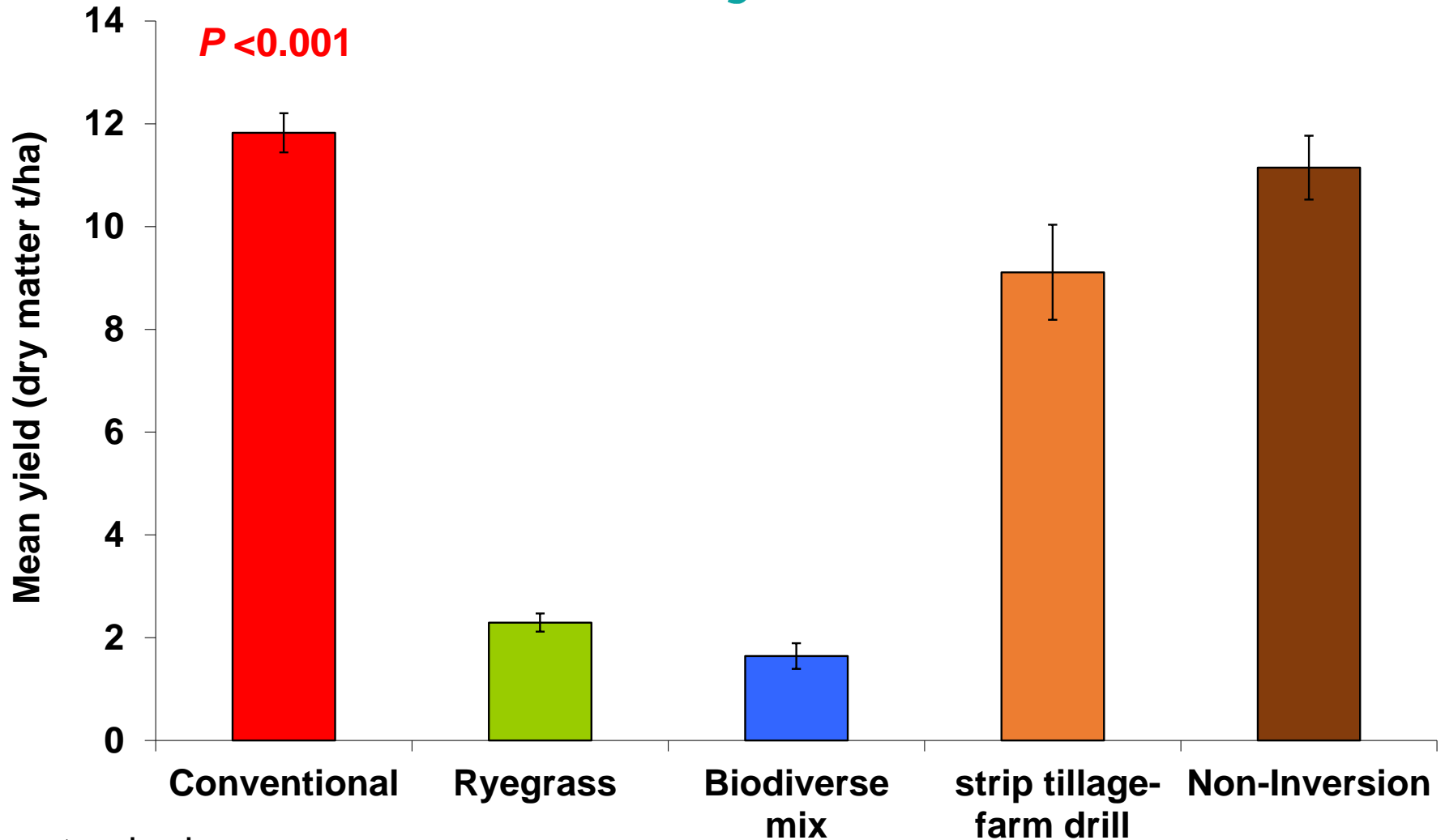
Strip tillage



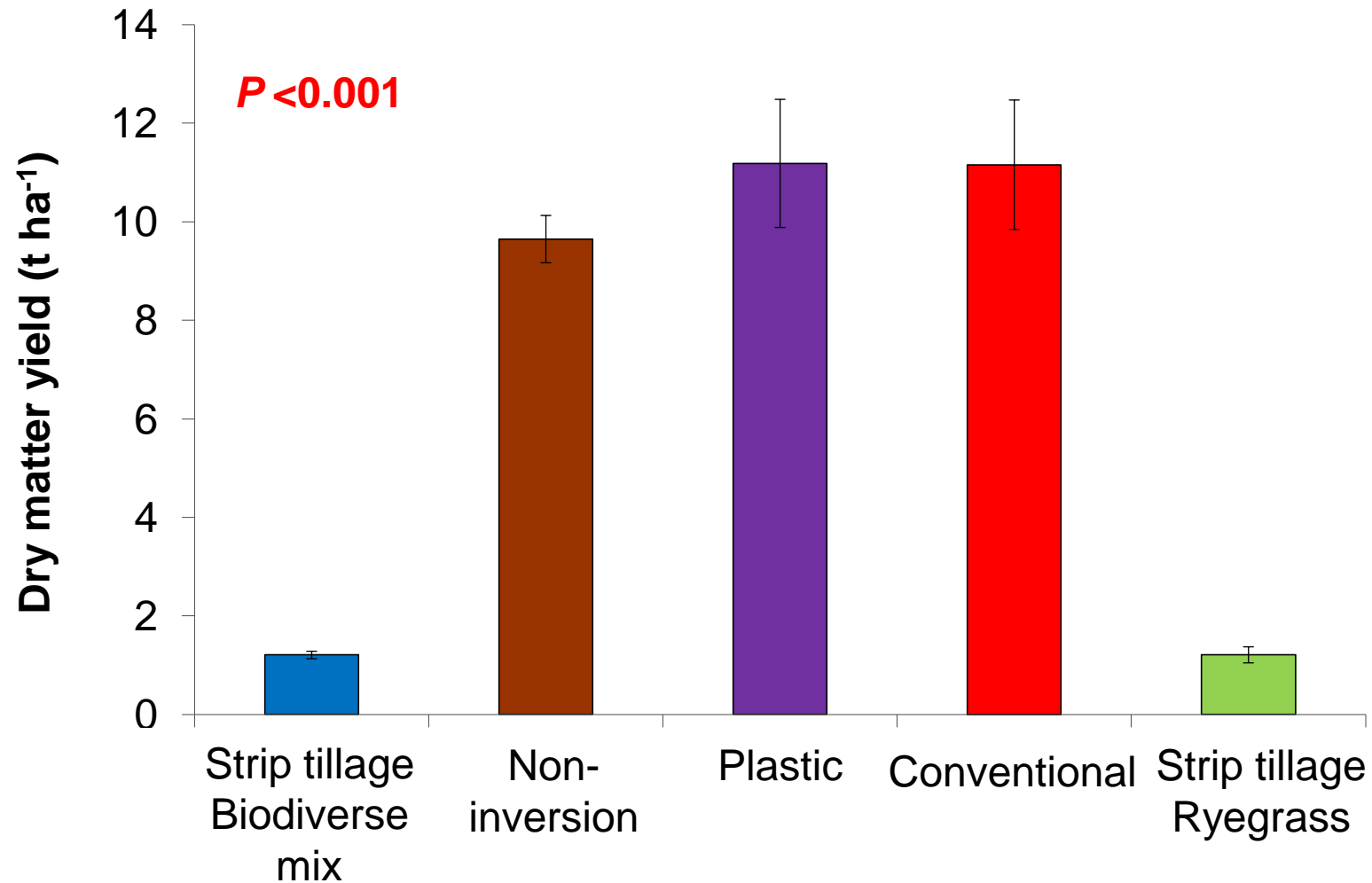
Establishing the cultivation treatments - Spring 2013: strip tillage and over-sown ryegrass



Fakenham: maize dry matter yields - harvest year 2013

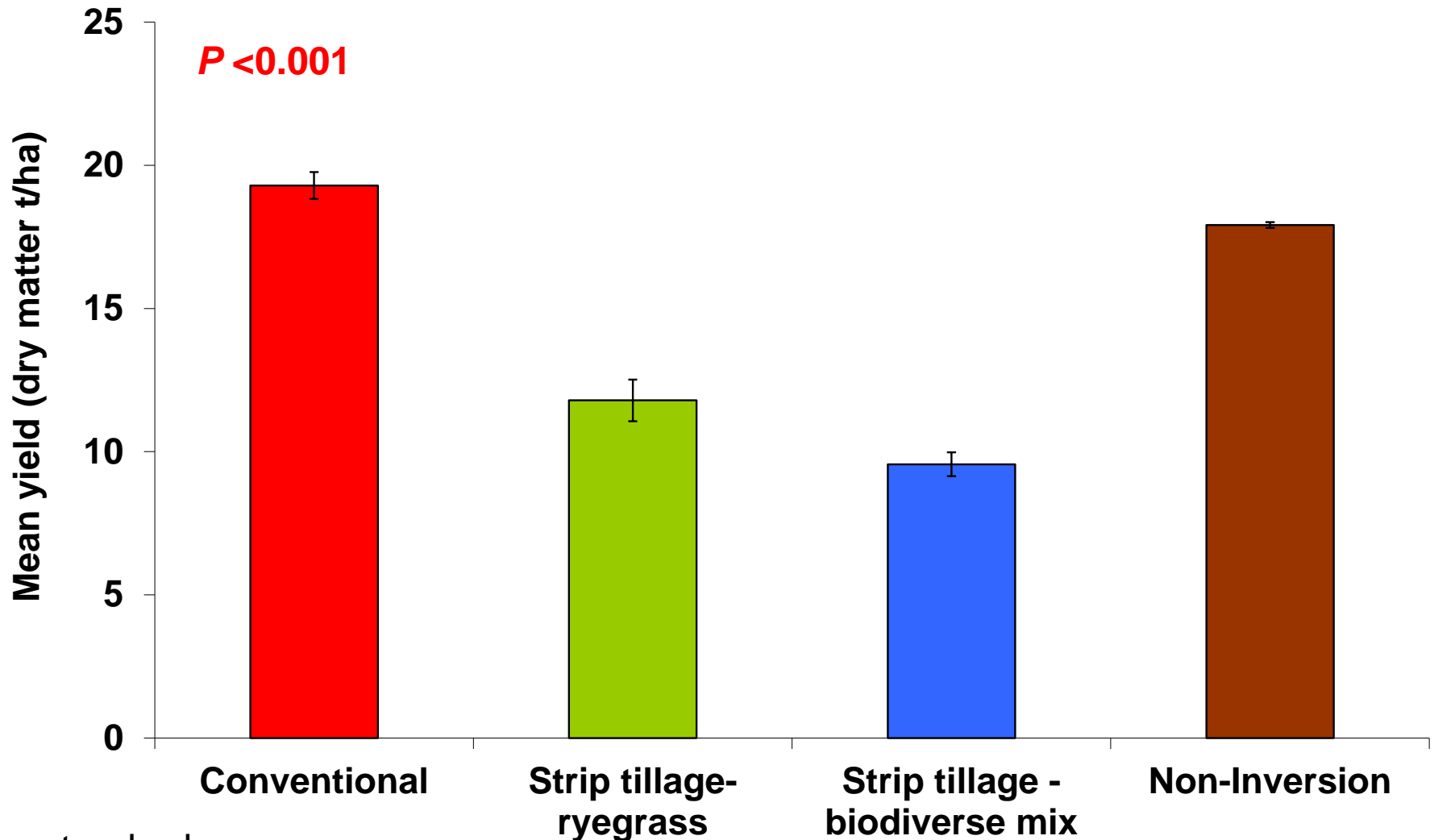


Bow: maize dry yields - harvest year 2013



I = standard error

Fakenham, maize dry yields - harvest year 2014



I = standard error

Conclusions

- Over-sown ryegrass and biodiverse mixture established 'well', in moist soil conditions
- Ryegrass *reduced* (compared with the conventional treatment):
 - *Soil mineral-N* (November and April)
 - Overwinter *sediment* losses (c. 70-85%)
 - Overwinter NO_3 -N losses (c. 50%)
- Maize yields reduced - when strip tilled into well established growing cover crop

Thank you - Questions

This research was completed as
part of the Defra funded project WQ0140

**RESEARCH
WITH
PLYMOUTH
UNIVERSITY**

