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Doubling Down with Diversified, Integrated Cropping Systems

Yantai Gan

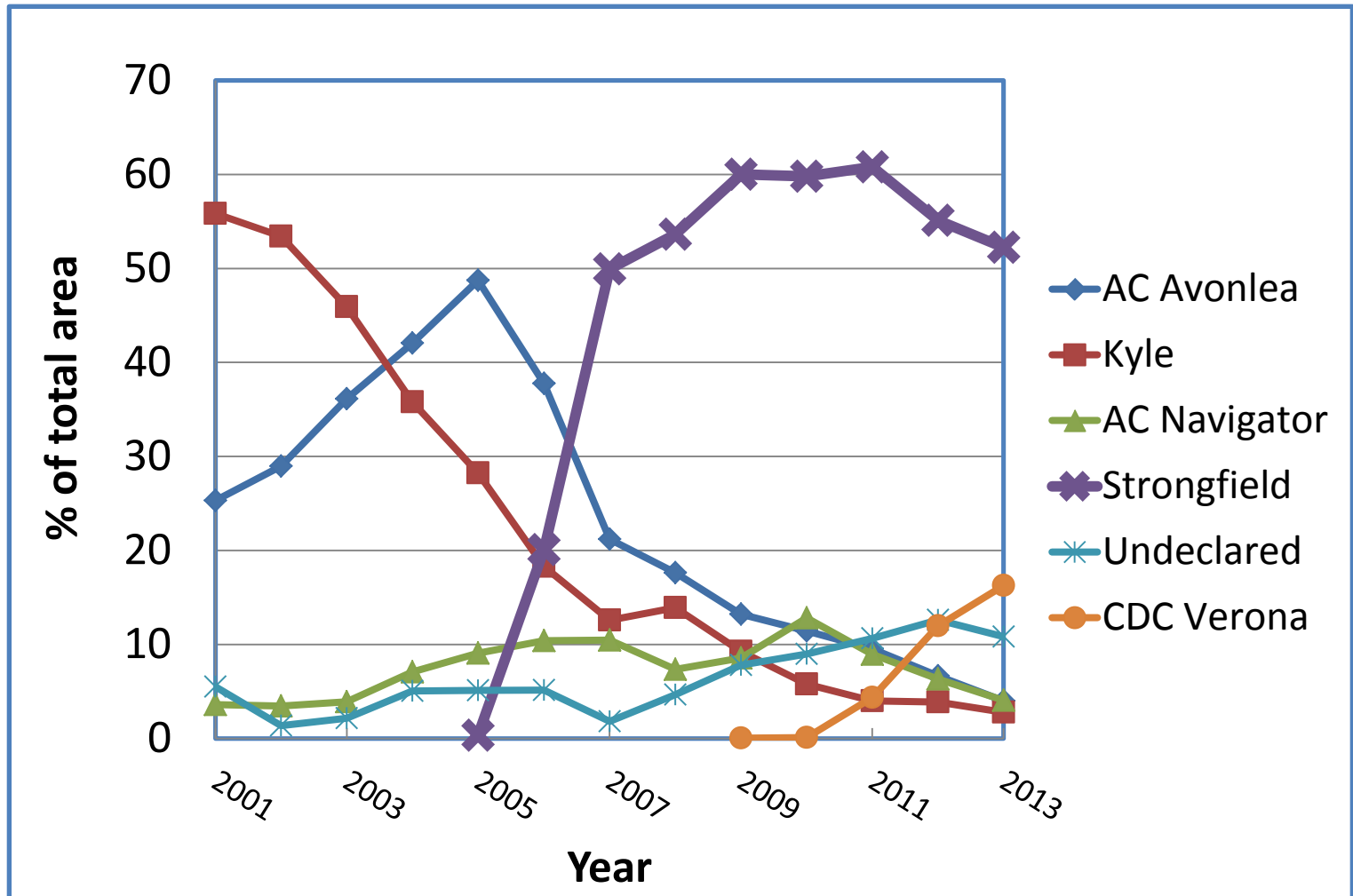
**Agriculture & Agri-Food Canada
Swift Current, Saskatchewan**

Canada



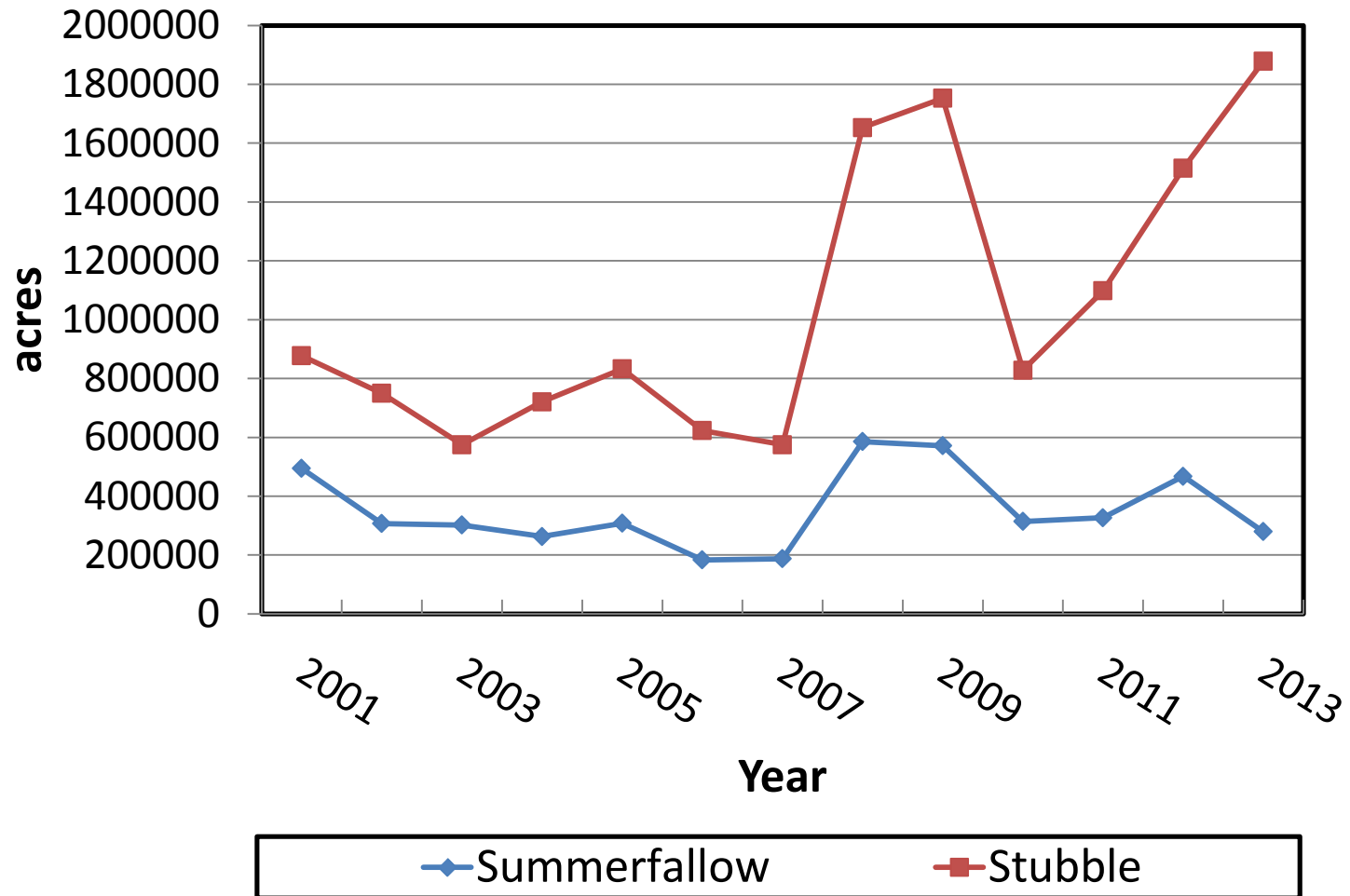
- **General trend of durum production**
- **Choice of cropping systems**
- **Management options for soil N**
- **Productivity vs environ. footprints**
- **Strip cropping possibility?**

Historical changes of durum varieties on the Canadian prairie

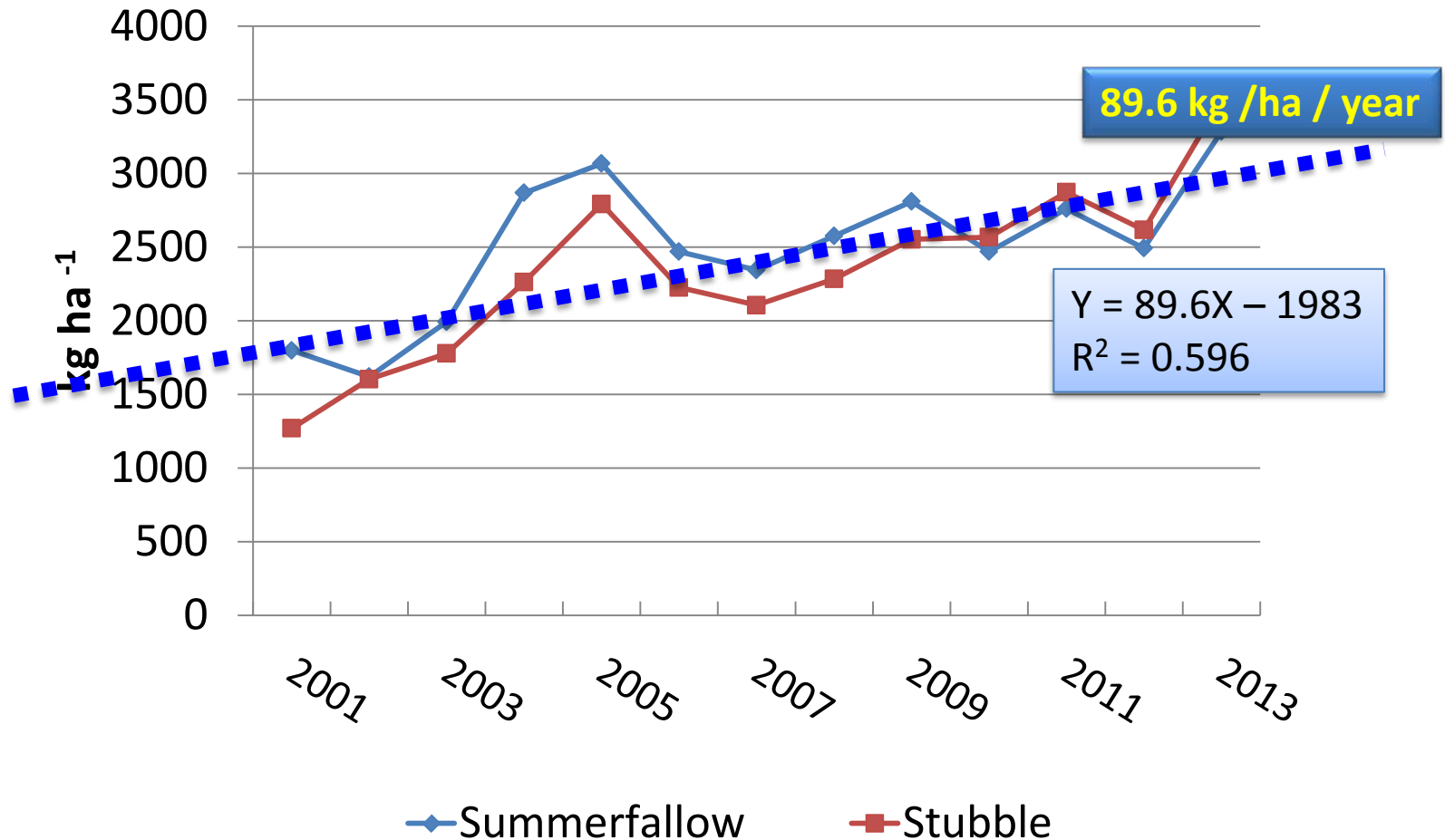


(SCIC, 2014)

Seeded acres of durum wheat in Saskatchewan



Grain yield of durum wheat in the recent 14 years



Choice of Cropping Systems for Durum



**Conventional
wheat monoculture**



Pulse-intensified systems



Diversified systems

Growing N₂-fixing pulses in rotation prior to durum wheat



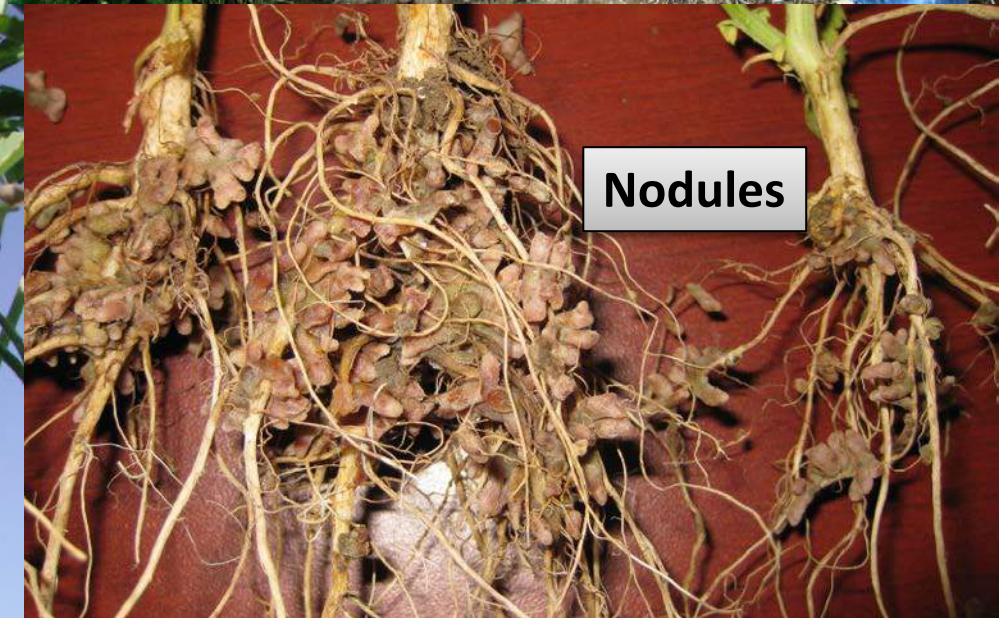
Lentil



Pea



Chickpea

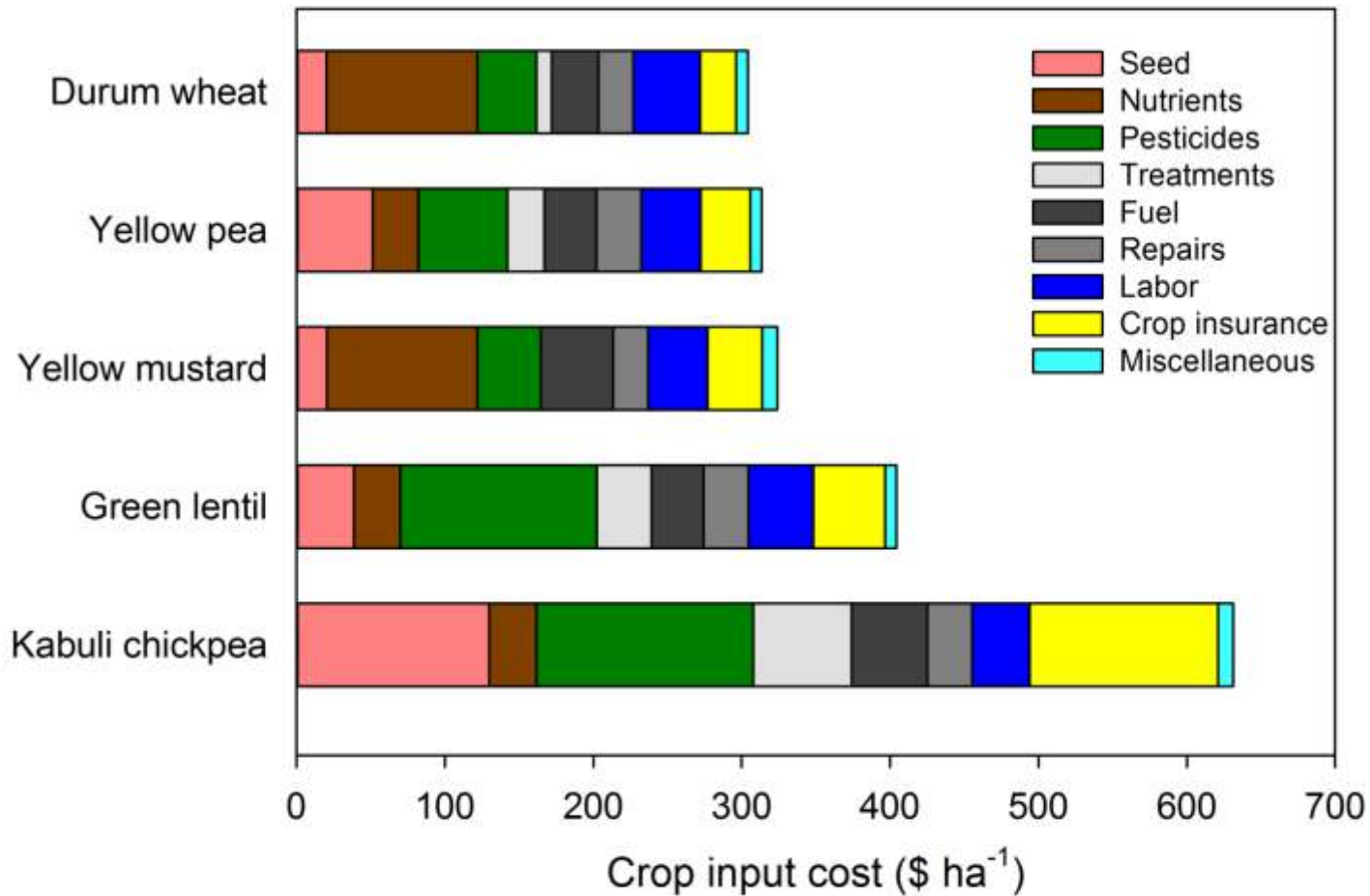


Nodules

Direct-seeding pulses in standing wheat stubble in rotation

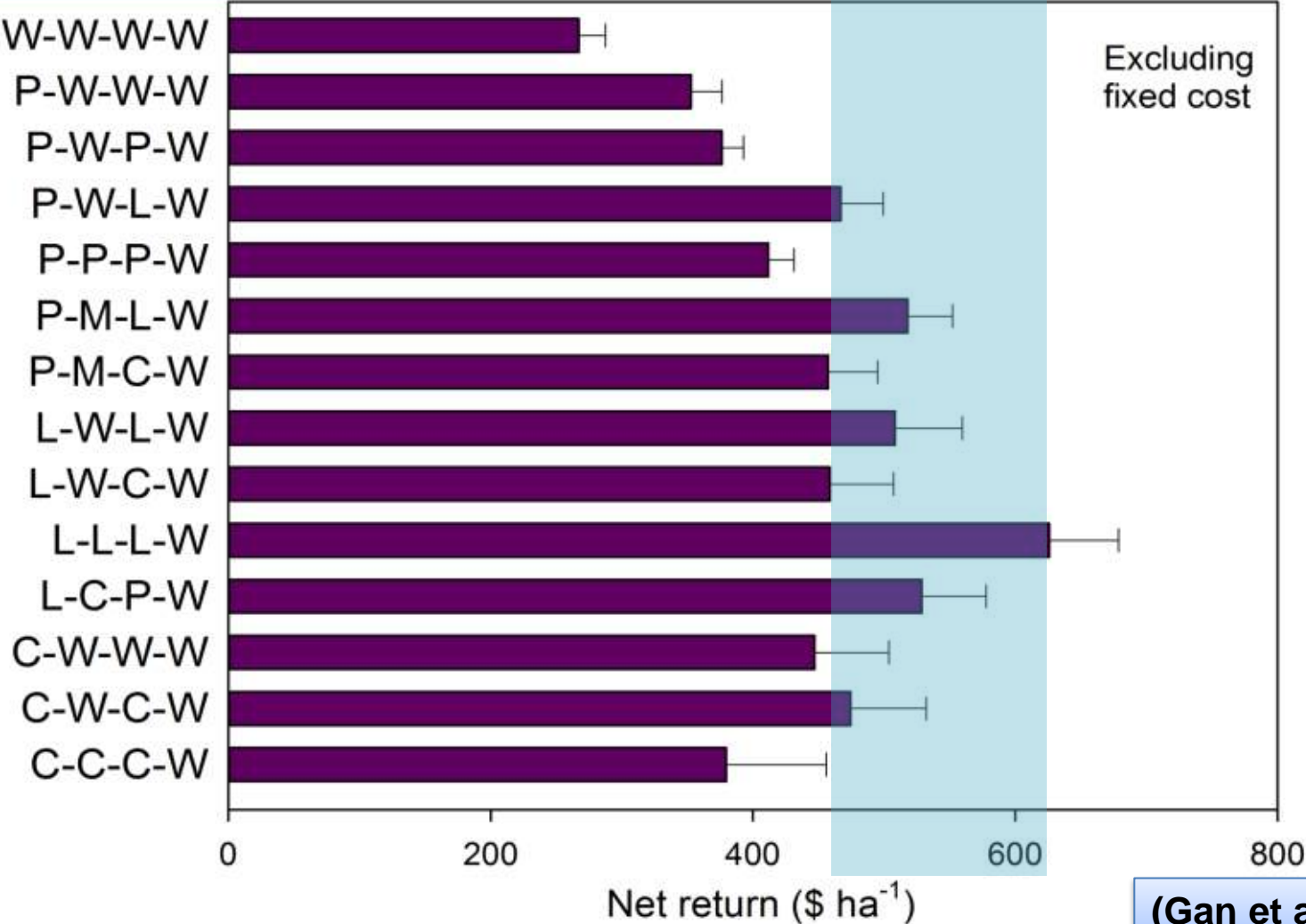


Variable cost of growing crops in 2015

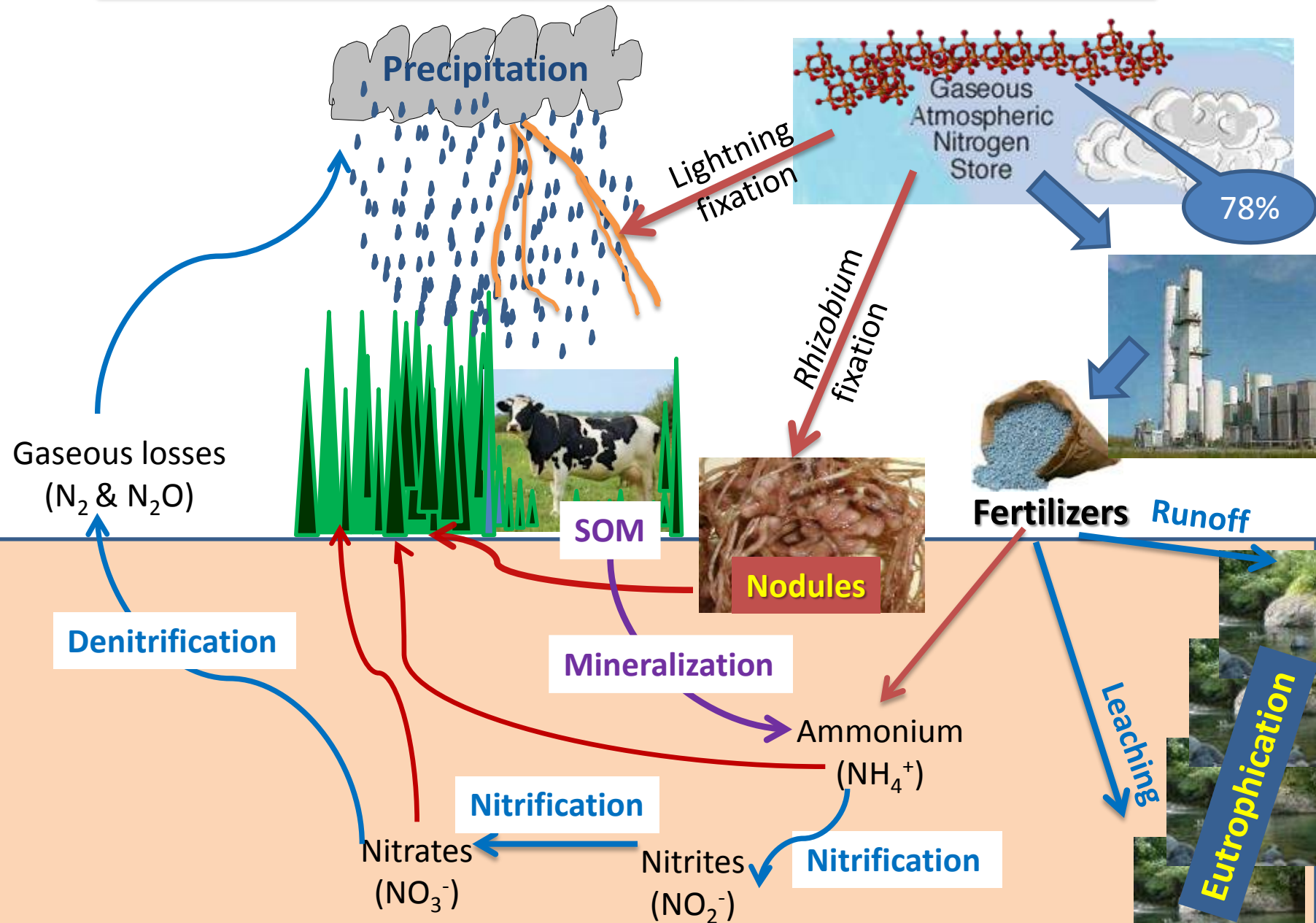


Net incomes of various 4-yr rotations

yr1-yr2-yr3-yr4

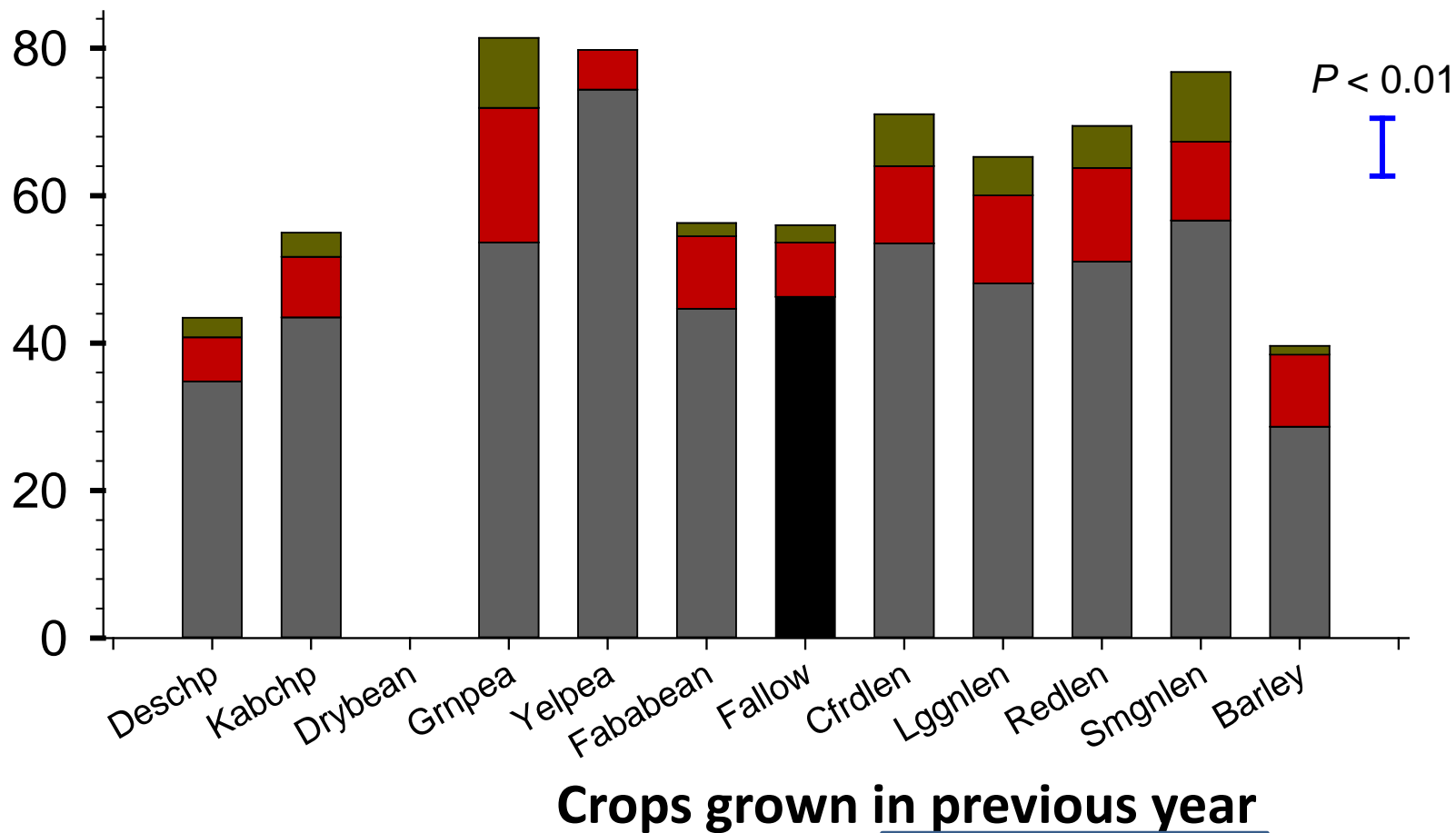
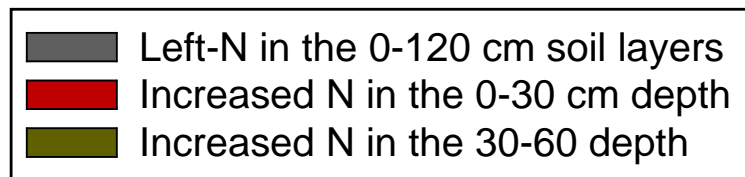


Nitrogen Cycling



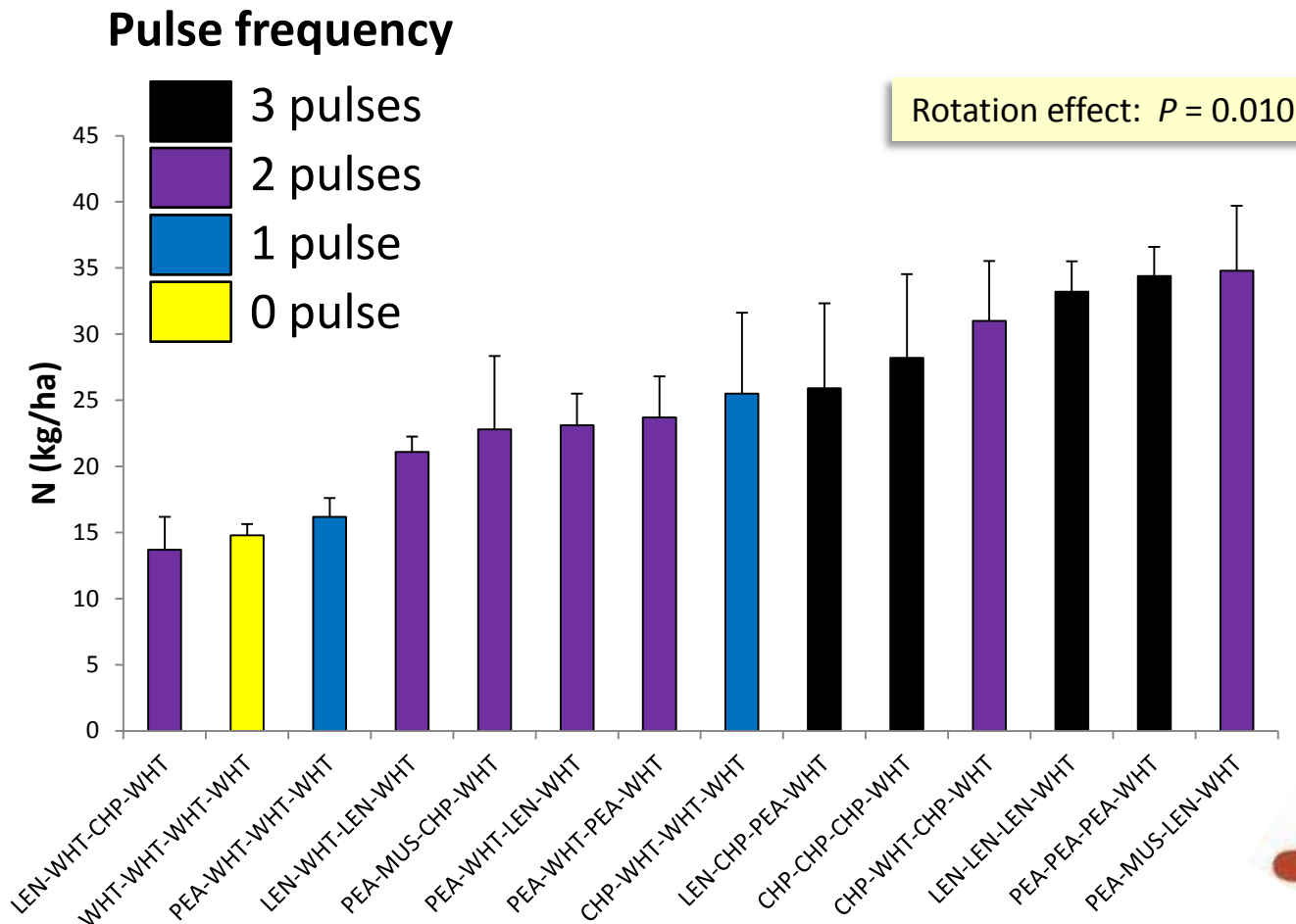
Available Soil-N at Spring Seeding

Soil mineral N
(kg N ha⁻¹)

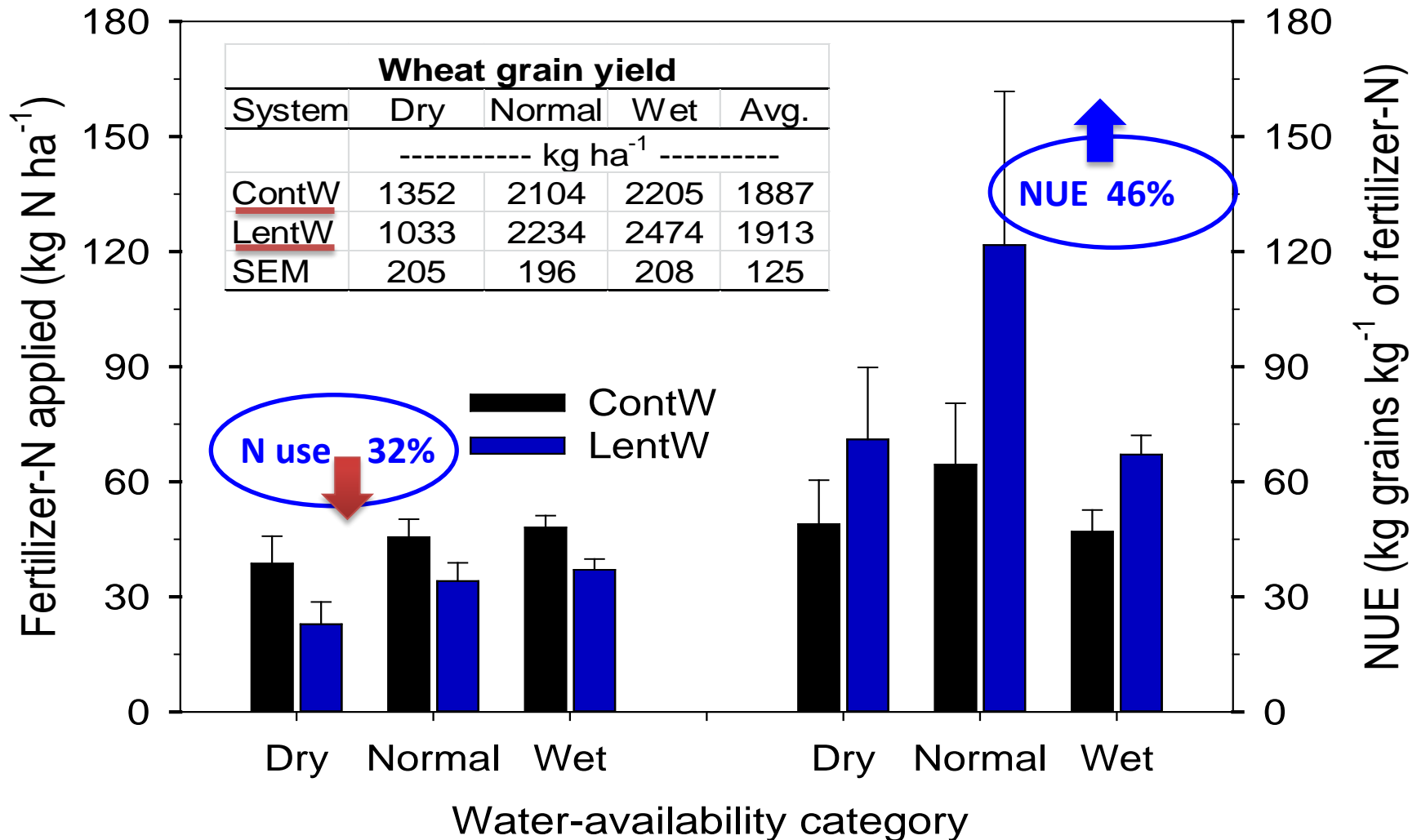


Soil residual N after 4-years of rotations

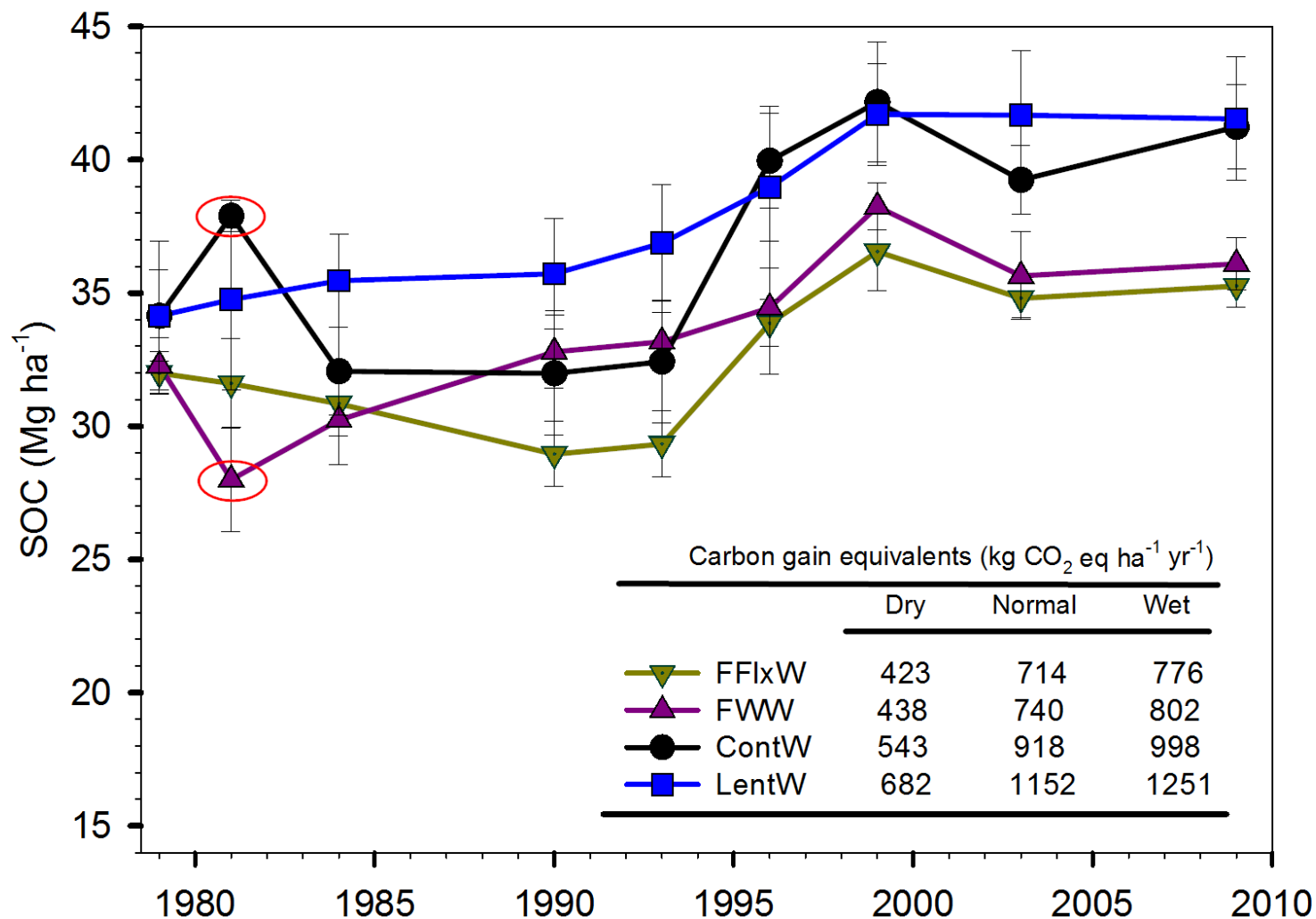
(in the 0-120 cm depth)



Wheat grain yield, N use, and NUE in the different rotation systems



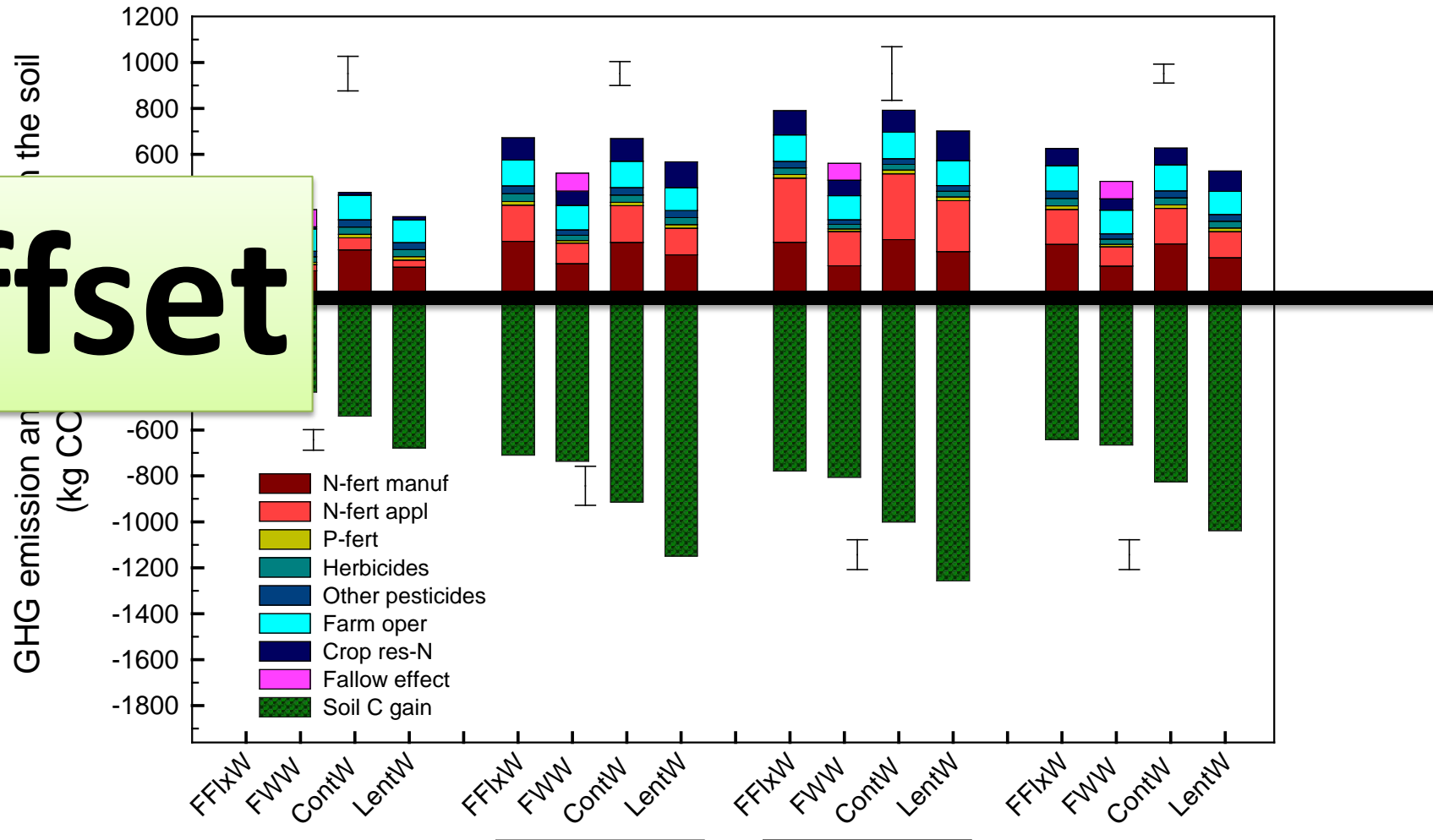
Soil C changes during the 25-yr (1985-2009) in different cropping systems



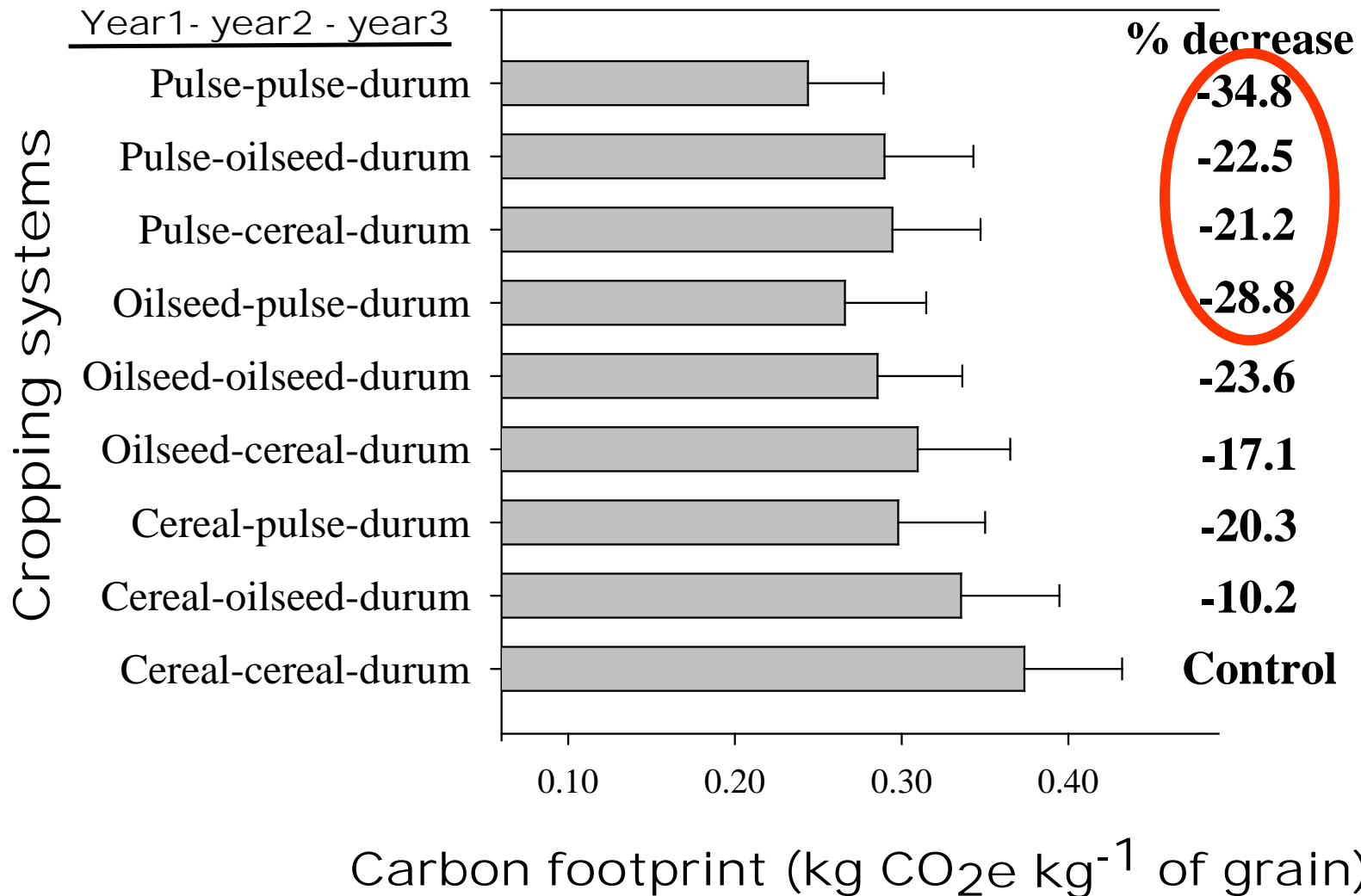
(Campbell et al. 2011)

GHG emissions (top) and carbon sequestered to soil (bottom) in different cropping systems (1985-2009)

offset



Carbon footprints of different cropping systems



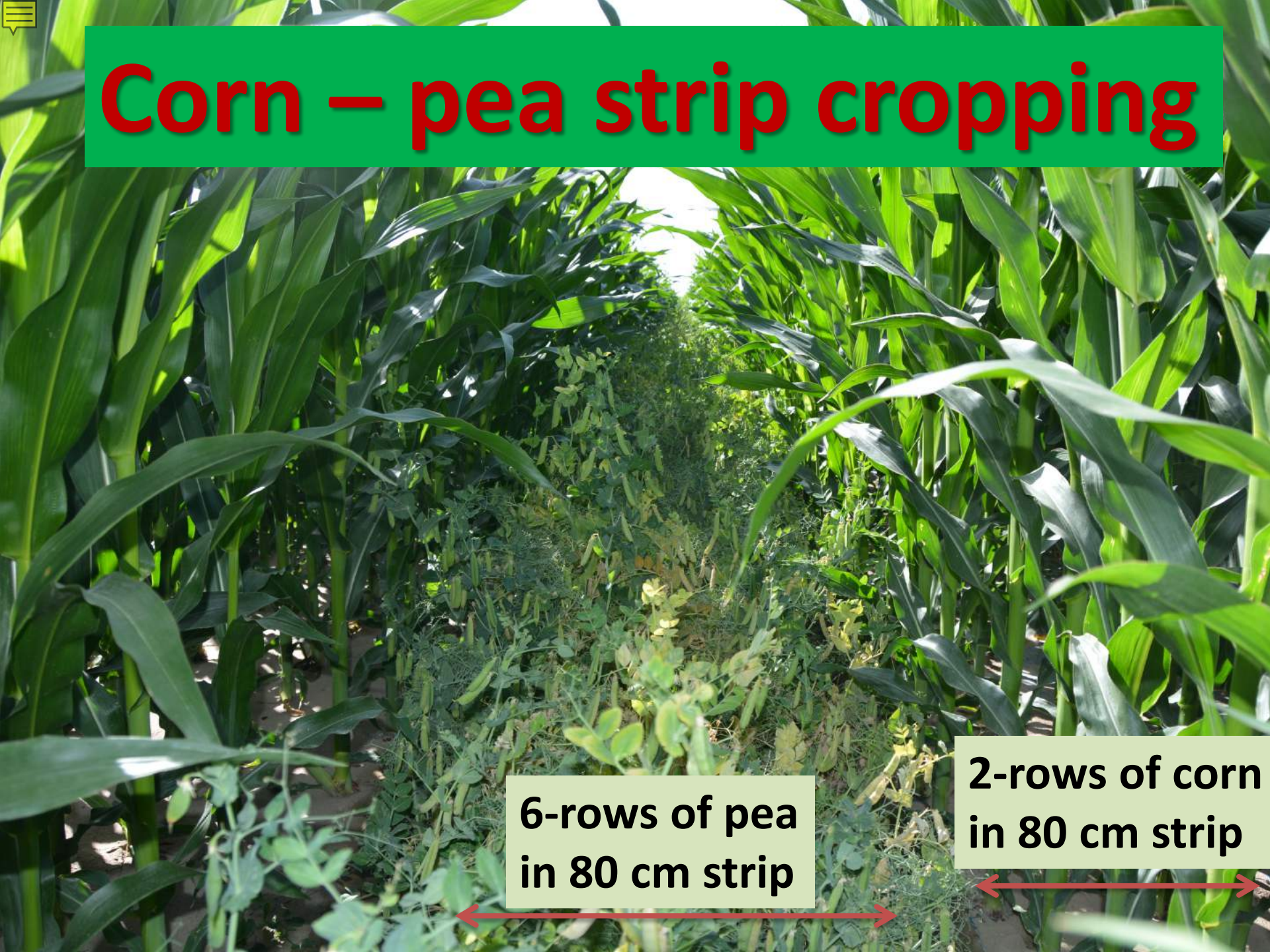


Integrated Cropping Systems allows to:

- ✓ Increase crop productivity
- ✓ Improve N use efficiency
- ✓ Increase SOC
- ✓ Reduce carbon footprint
- ✓ Improve soil health
- ✓ Enhance long-term sustainability

Gan et al. (2014) *Nature Communications* 5:5012, doi:10.1038/ncomms6012;
Gan et al. (2015) *Nature Scientific Reports* 5:14625, doi:10.1038/srep14625.

Corn – pea strip cropping



6-rows of pea
in 80 cm strip

2-rows of corn
in 80 cm strip

Corn – pea strip cropping



**3-rows of corn
in 80 cm strip**




**4-rows of pea
in 80 cm strip**



Corn – soybean strip cropping

**4-rows of soybean
in 80 cm strip**



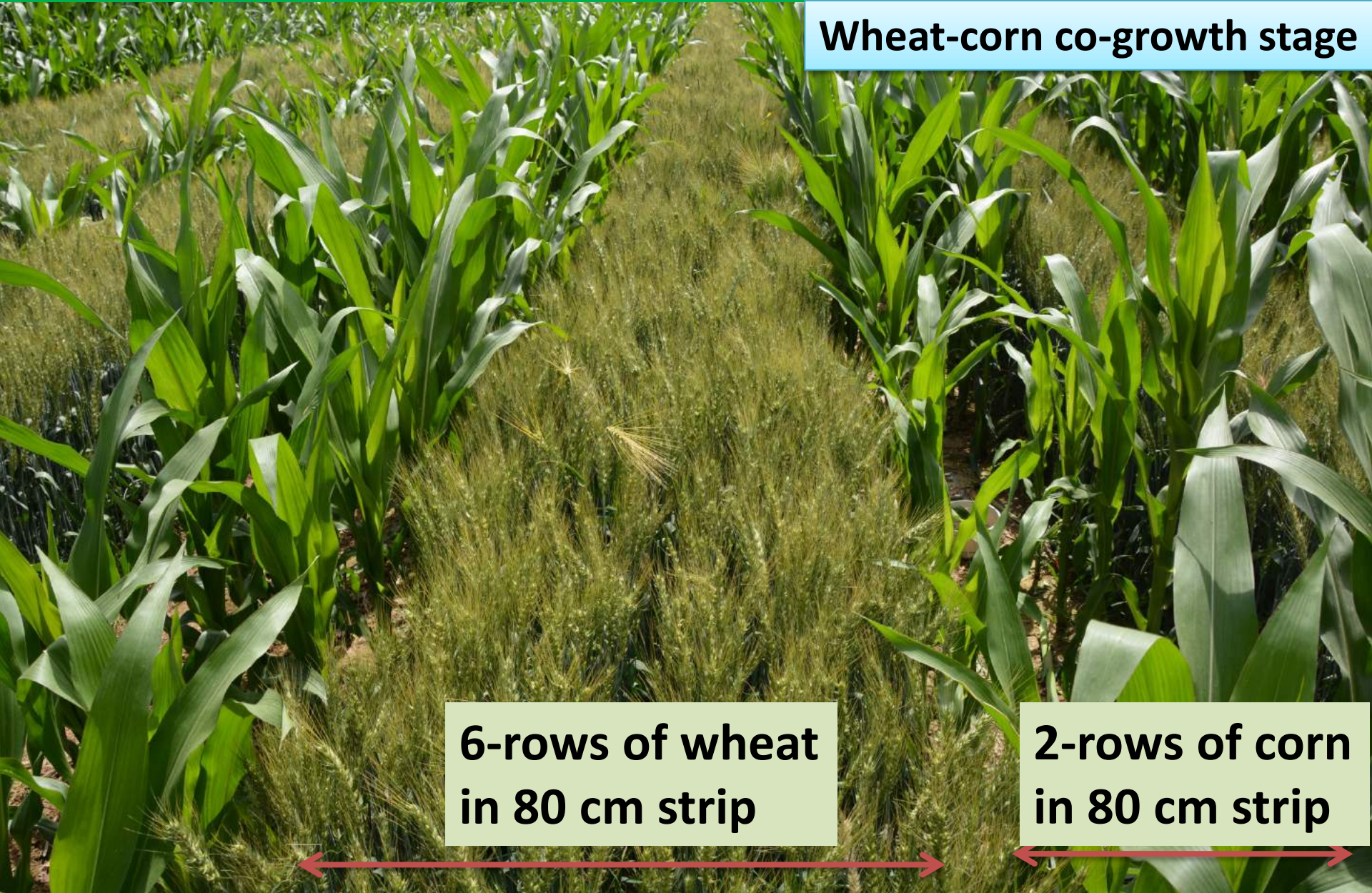
**2-rows of corn
in 80 cm strip**

Wheat – corn strip cropping

Wheat-corn co-growth stage

6-rows of wheat
in 80 cm strip

2-rows of corn
in 80 cm strip



Wheat – corn strip cropping

Wheat grain-fulling stage

6-rows of corn
in 80 cm strip

6-rows of wheat
in 80 cm strip



Corn is grown under plastic film

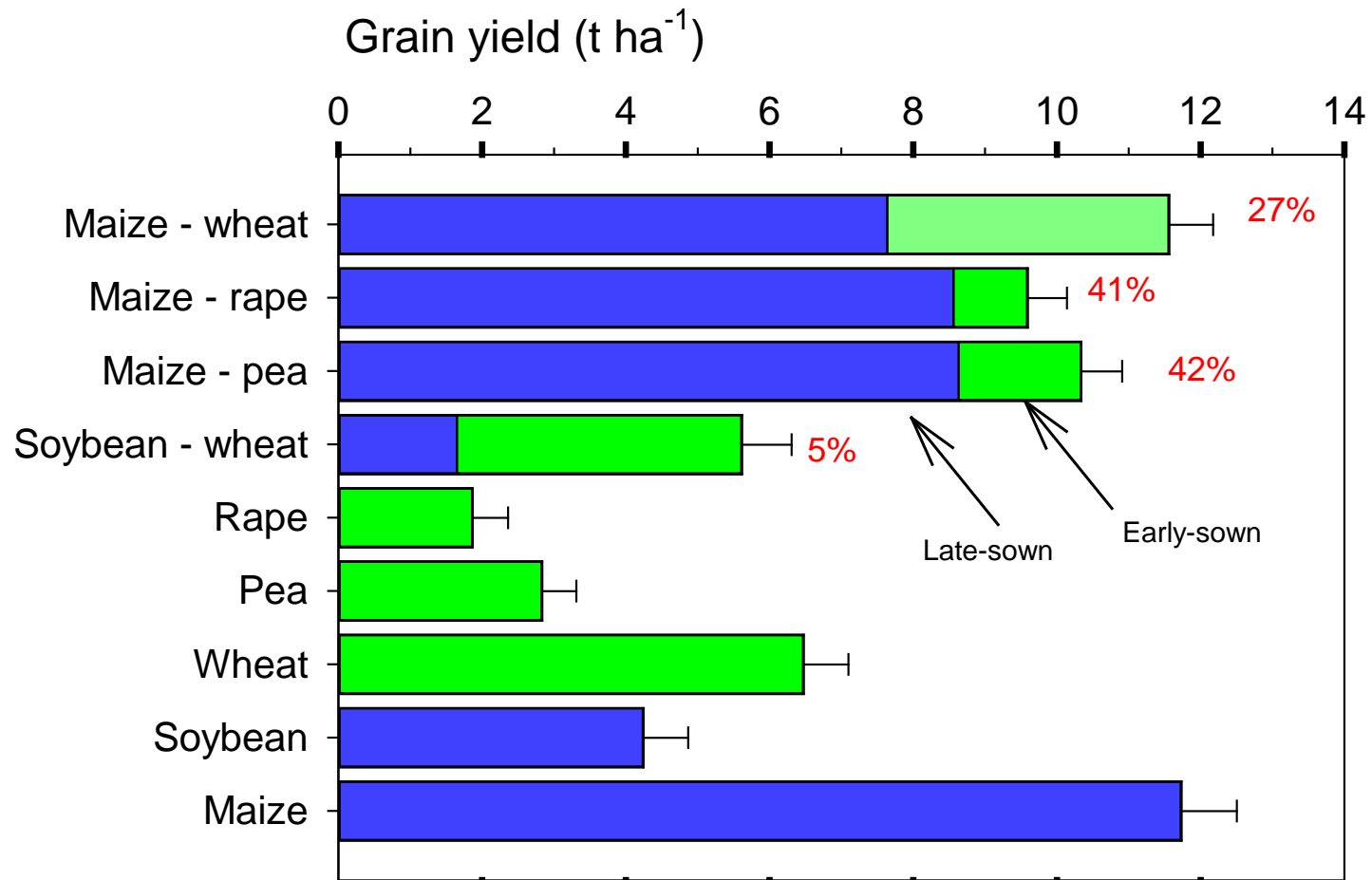




Film cover helps reduce soil evaporation during the entire growing season

Weeds are blocked under the plastic film cover physically





***** Land Equivalent Ratio: 1.21 to 1.43**

Research support



AAFC Cluster



Growing Forward



Agriculture and
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Agroalimentaire Canada



Graduates and Post-Doc fellows



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Lobna Abdellatif



Adriana
Navarro-Borrell



Ahmad Taheri



Walid Ellouze



Mulan Dai



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Bazghaleh



Zakir Hossain



Yining Niu