

Deep roots in Controlled traffic farming and intercropping – but not no-tillage systems – increased system's resilience and nitrogen recycling

Any general conclusions to draw on deep roots from the complex effects of cropping systems?

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Organic RDD 3+4

Thanks to funders

InterVeg

SoilVeg

DoubleCrop

ClimateVeg

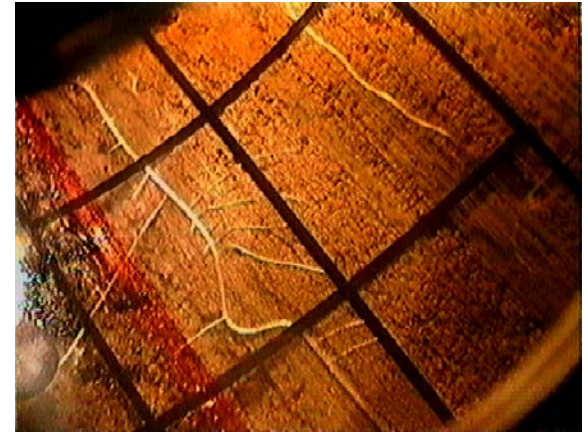


In situ methods to 3 m depth

Dept. Food Science, Aarhus University



Mini video camera for filming



Non-destructive root registration in minirhizotrons



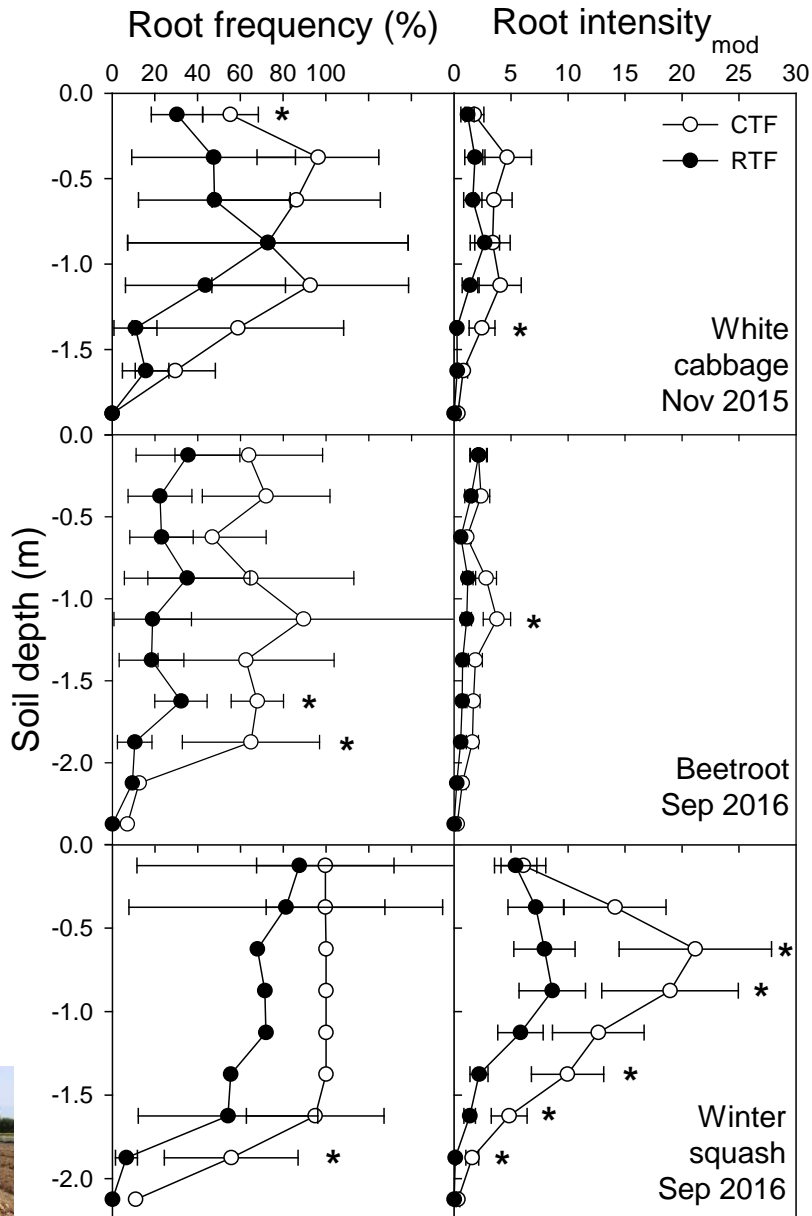
^{15}N injection and soil sampling

Roots of fodder radish in 2 m depth



Photos AU FOOD

Controlled Traffic Farming - roots



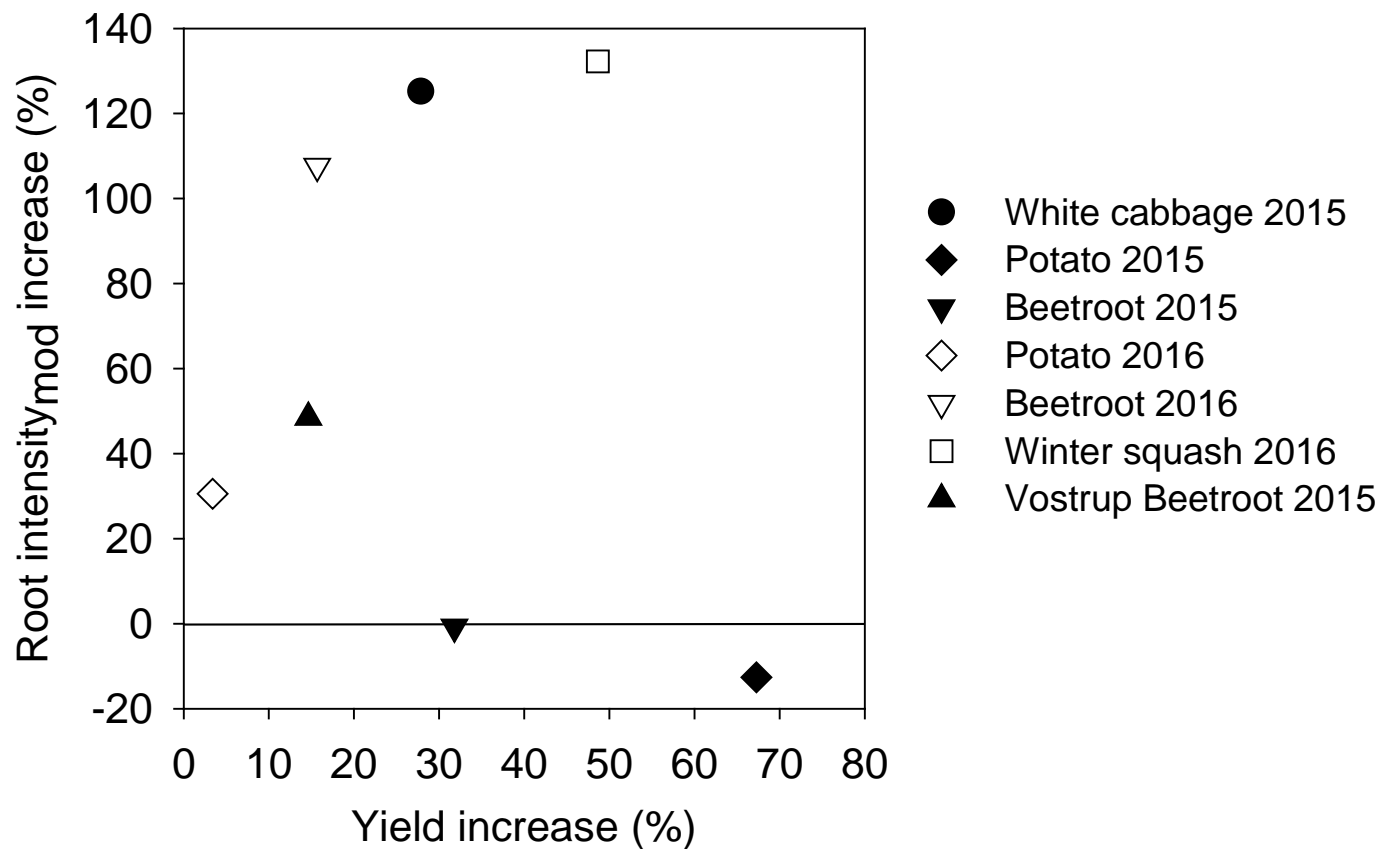
- ↑ Root growth
- ↑ Yields and crop residues
- ↑ Mineralisation
- ↑ N uptake
- No effect on NO₃⁻ leaching



Hefner et al. (2019) Soil & Tillage Research 191: 117-130



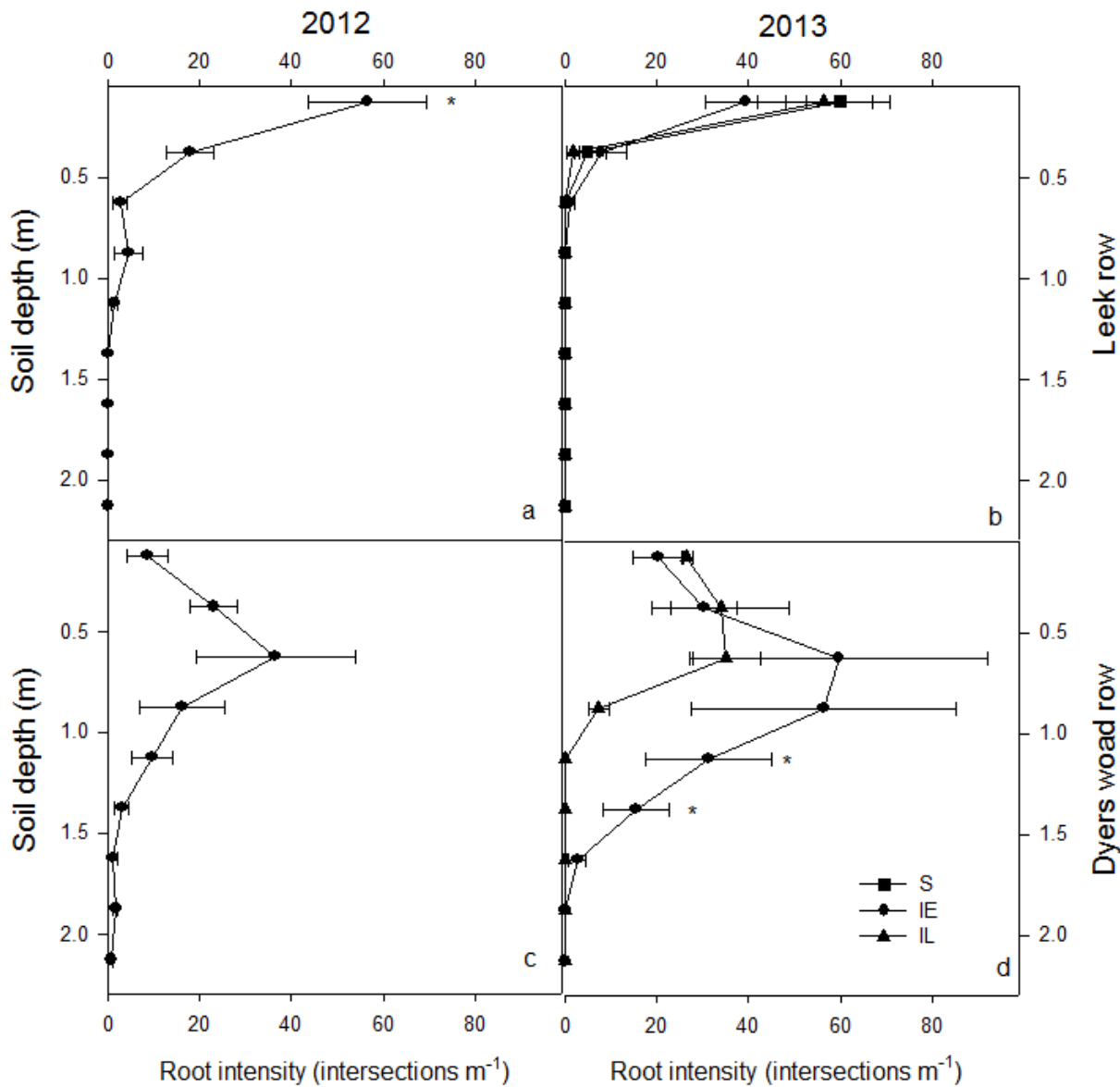
Controlled Traffic Farming – increase of system's resilience



Hefner et al. (2019) Soil & Tillage
Research 191: 117-130

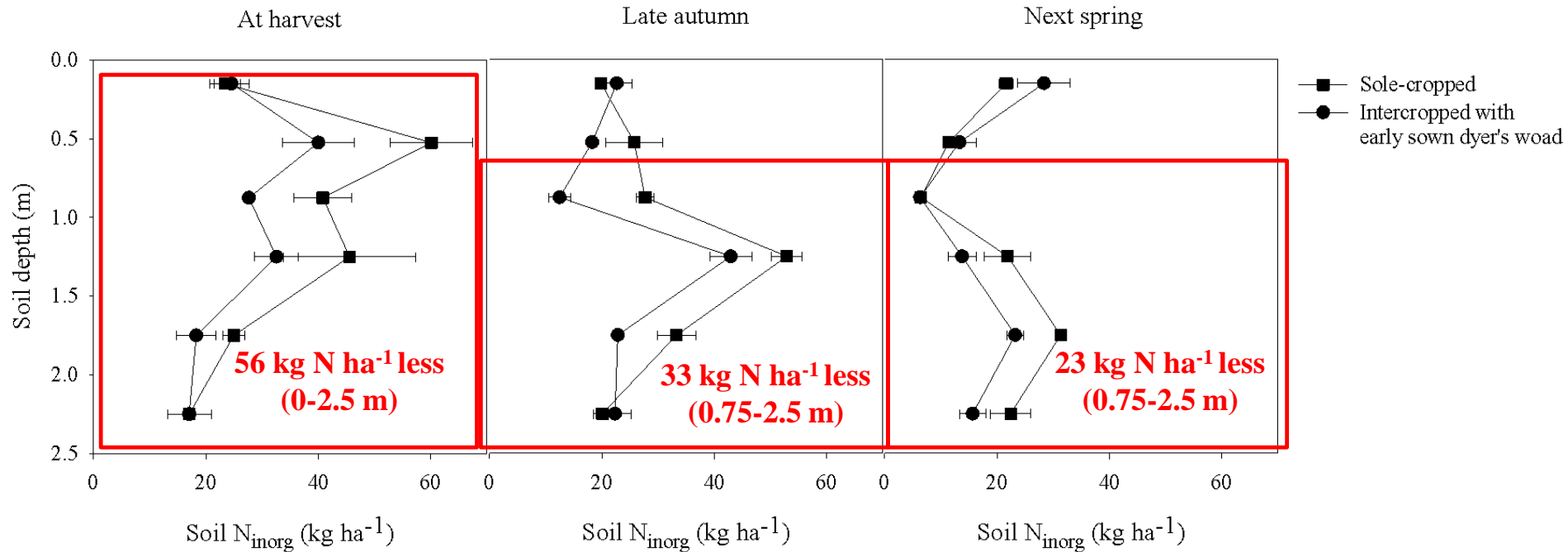


Intercropping – more roots at harvest



Xie & Kristensen (2017)
 European Journal of
 Agronomy 82: 21-32

Intercropping – decrease of soil N_{\min}



Xie & Kristensen (2017)
European Journal of
Agronomy 82: 21-32



More deep roots – system’s sustainability?



System/Management	Soil type	Crop	Yields	Deep roots	N exploitation	Cause	Reference
Controlled Traffic Farming vs Random TF	Sandy loam	Many vegetables	+	+	(+)		Hefner et al. 2019 Soil & Tillage Research
CTF vs RTF	Sand	Beetroot	+	+	(+)		
Intercropping vs sole cropping	Sandy loam	Leek Dyer's woad	+	+	+		Xie & Kristensen 2017
Winter legumes vs legume-rye mix	Sandy loam	Cabbage	+	+	-	N limited	Hefner et al. Accepted. Agriculture, Ecosystems & Environment
No-tillage vs full incorporation	Sandy loam	Cabbage	+	+	-	N limited	
High sowing density vs low	Coarse sand	Rucola	+	+	(+)		Kristensen & Stavridou 2017. Soil Use & Management
Low late season N fertilisation vs high	Coarse sand	Rucola	+	-	-	N saturated	
Low top soil N vs high	Sandy loam	Fodder radish	+	+	+		Xie et al. Submitted
Farmyard manure vs plant-based fertiliser	Sandy loam	Beetroot Cabbage	+	+	(+)		Shanmugam et al. In prep.

Key message for discussion

Session 3: Enhancing resource use through deep rooting – What is the potential for water and nutrient uptake by deep rooted crops?’

Yes – more deep roots increase
system’s sustainability
Unless crop N status interferes