Alternative Cropping Study (Scott, SK)

Long-term organic vs. conventional management

- **Organic (ORG) management**
  - no synthetic inputs, tillage
- **Reduced input conventional (CON) management**
  - fertilizers and pesticides, no-tillage
- **Diversified crop rotations**
  - annual and perennial

1994 – 2012

Brandt et al. 2010 Eur. J Agron.

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Management system	Crop rotation	Cropping sequence (6 year rotation)
ORG	Annual (ANN)	GM lentil-**wheat**-pea-barley-GM sweet clover-mustard
	Perennial (PER)	Mustard-**wheat**-barley-alfalfa-alfalfa-alfalfa
CON	Annual (ANN)	Canola-fall rye-pea-barley-flax-**wheat**
	Perennial (PER)	Canola-**wheat**-barley-alfalfa-alfalfa-alfalfa

GM=green manure

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Model system

Table 1. Soil properties after 20 years of organic and conventional management

Mgmt	Cropping history	Total C (%)	Total N (%)	Inorganic N (mg kg^{-1} soil)	Available P (mg kg^{-1} soil)	pH
ORG	ANN	2.75	0.246	12.90	21.93	5.4
	PER	2.78	0.255	8.75*	15.63*	5.6
CON	ANN	3.45*	0.307*	29.63	50.98	5.2
	PER	2.98	0.272	21.48	70.50	5.7

ORG, organic management; CON, conventional management

ANN, annual grains cropping history; PER, annual grains-perennial alfalfa cropping history

Alternative Cropping Study (Scott, SK)

Long-term organic vs. conventional management

Dr. Melissa Arcand
Assistant Professor, UofS

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Microbial crop residue decomposition dynamics in organic and conventionally managed soils

Melissa M. Arcand[a], Bobbi L. Helgason[a,b,*], Reynald L. Lemke[b]

frontiers in Microbiology

ORIGINAL RESEARCH
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Resource Legacies of Organic and Conventional Management Differentiate Soil Microbial Carbon Use

*Melissa M. Arcand[1], David J. Levy-Booth[2] and Bobbi L. Helgason[3]**

[1] Department of Soil Science, University of Saskatchewan, Saskatoon, SK, Canada, [2] Department of Microbiology and Immunology, University of British Columbia, Vancouver, BC, Canada, [3] Saskatoon Research Centre, Agriculture and Agri-Food Canada, Saskatoon, SK, Canada

Long-term organic management affects residue decomposition and fertility

Dr. Melissa Arcand
Assistant Professor, UofS

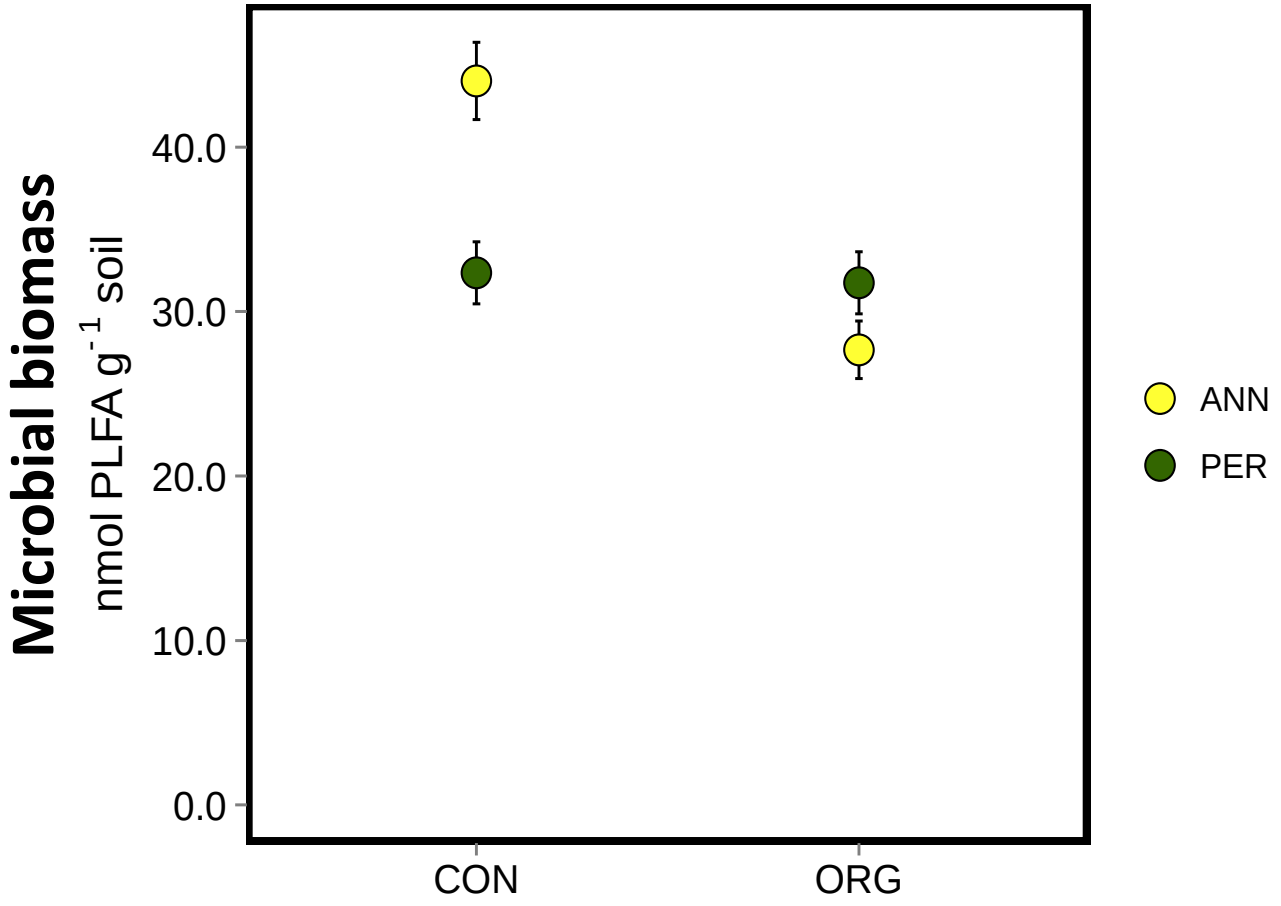
Controls (no residue)

^{13}C-labelled barley residues mixed with soil

10 atom% ^{13}C

Long-term Organic vs. Conventional

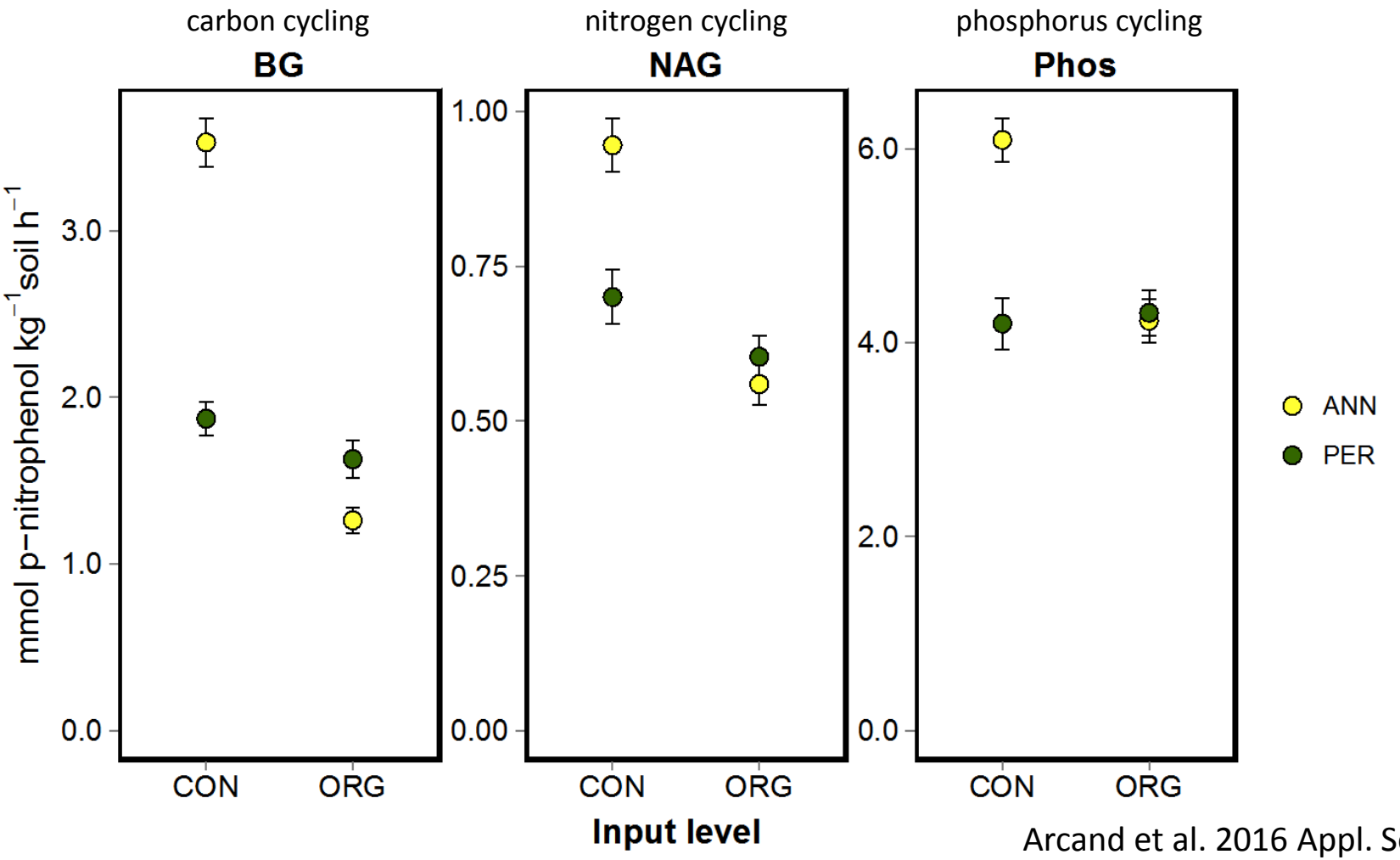
microbial biomass is reduced in the organic system



Arcand et al. 2016 Appl. Soil Ecol.

Long-term Organic vs. Conventional

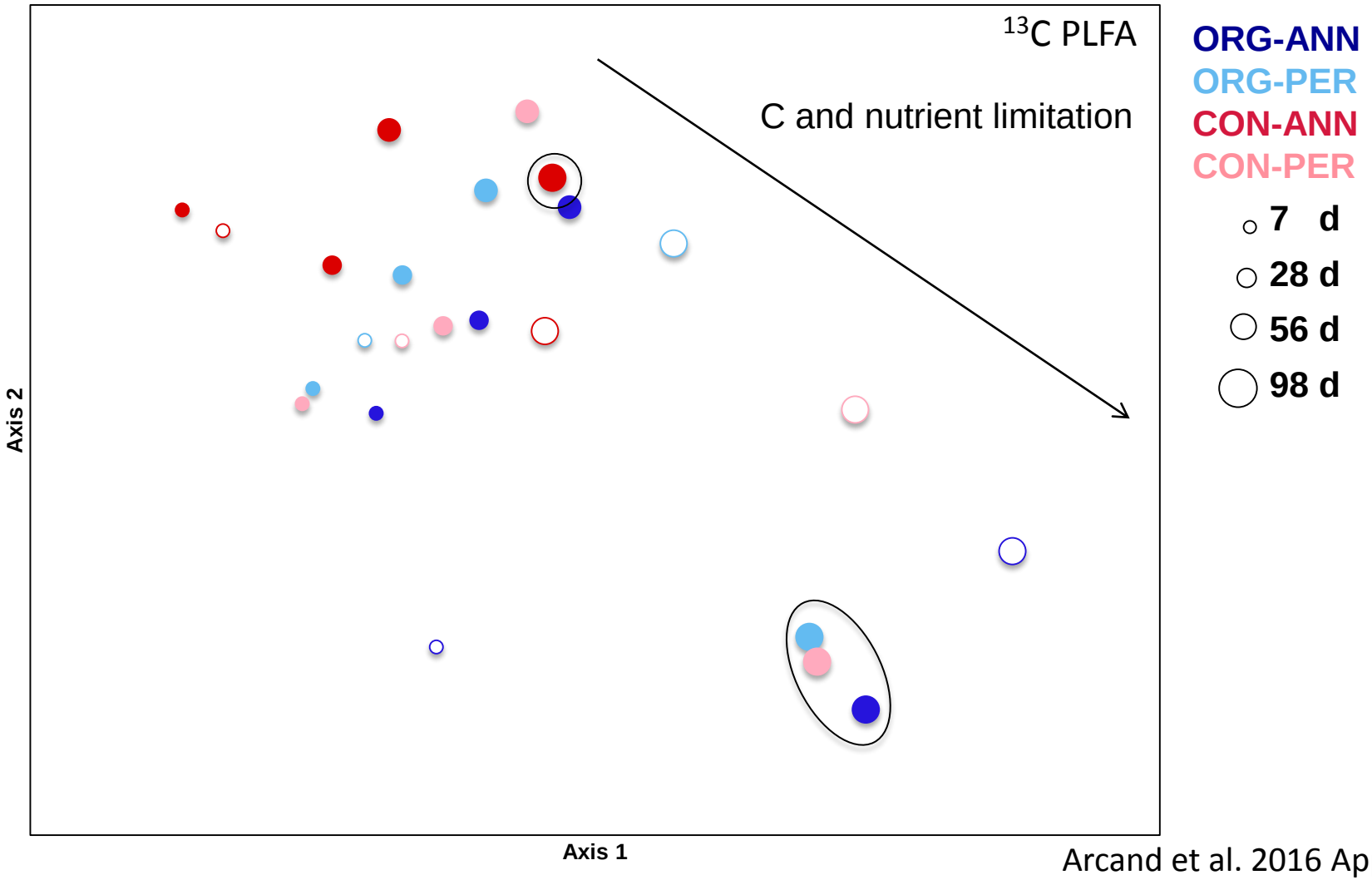
microbial function (soil enzyme activities) are reduced



Arcand et al. 2016 Appl. Soil Ecol.

Long-term Organic vs. Conventional

microbial community structure is altered



Arcand et al. 2016 Appl. Soil Ecol.

Alternative Cropping Study (Scott, SK)

Restoring fertility

What macro-nutrient is most limiting crop growth in soil managed under long-term organic production?

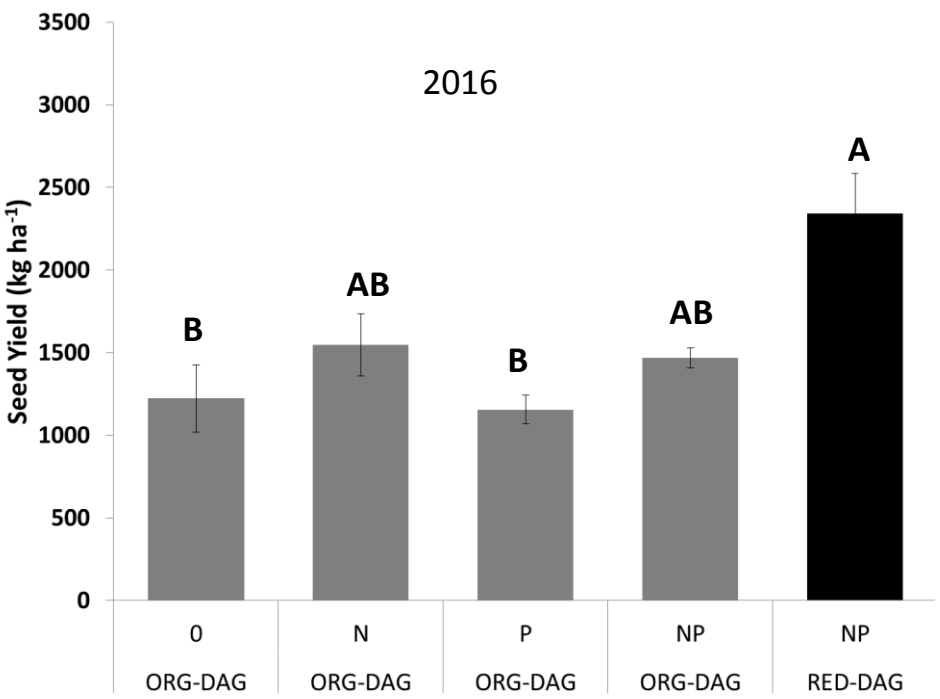
How can we best enhance nitrogen and phosphorus availability in organic dryland systems?

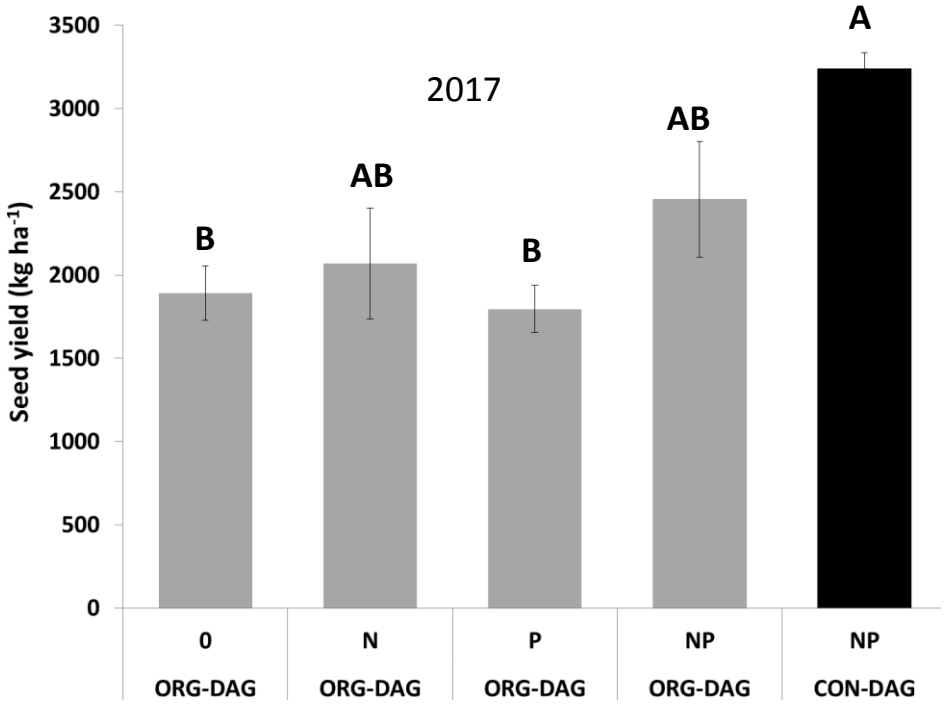
Sask Wheat DEVELOPMENT COMMISSION

Alternative Cropping Study (Scott, SK)

Field Assay: N and P fertilizer addition (2016-2018)

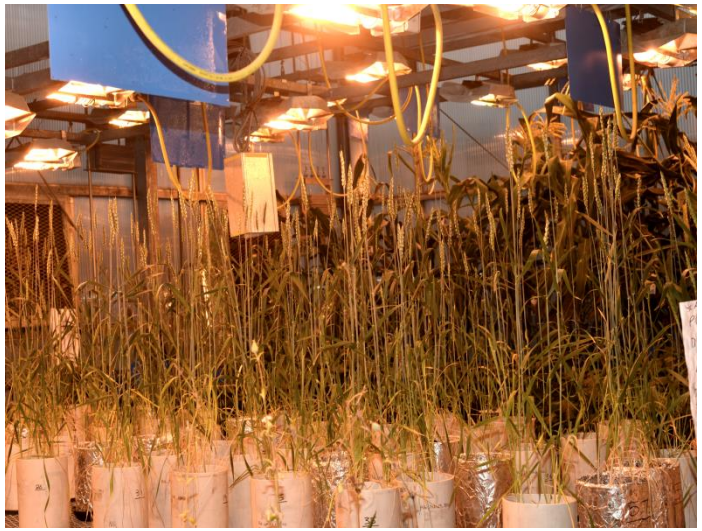
Wheat yield - annual grains history





Alternative Cropping Study (Scott, SK)

Greenhouse bioassay



1) Check
2) P
3) N
4) NP
5) Wheat residue (C) + NP
6) Wheat residue (C)