

New approaches to improving the supply of phosphorus

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Range of approaches investigated to make P from phosphate rock (PR) more available to crops

- Biological processes harnessed
 - Using a crop's own ability to liberate P
 - P available to crop directly and/or to following crops
 - Co-composting of PR with organic wastes
 - Microbial processes liberate P into plant available form

- Autumn sown green manures (GM)
 - GM crops chosen for their perceived ability to liberate P
 - GM established in the autumn
 - Incorporated prior to spring crop
- Spring sown crops
 - Crops grown for their perceived ability to liberate P and use it directly themselves
 - Potential P benefits later in the rotation

Autumn sown green manures



GM yield in spring (Dry tonnes / ha)

Crop	+PR	-PR	% Change from -PR
Fallow	0.70	0.46	152
Mixed Brassica	0.78	0.51	152
Field Beans	0.98	0.82	120
Forage Rape	0.58	0.37	157
Forage Rye	0.68	0.48	142

GM P Uptake (kg / ha)

Crop	+PR	-PR	% Change from -PR
Fallow	2.32	1.39	167
Mixed Brassica	2.49	1.57	159
Field Beans	3.39	2.77	122
Forage Rape	1.91	1.14	168
Forage Rye	2.09	1.32	158

Data from Abbey Home Farm site

Biomass effect

Autumn sown green manures: Following year's Spring Wheat



Wheat grain yield (t / ha)

Crop	+PR	-PR	% Change from -PR
Fallow	1.36	1.31	103
Mixed Brassica	1.49	1.40	107
Field Beans	1.50	1.40	108
Forage Rape	1.37	1.29	106
Forage Rye	1.37	1.24	110

- Rotational benefits
 - Brassicas
 - Field beans
 - Forage rye
- N as well as P?

Data from Abbey Home Farm site

Spring sown crops



Windshiel Farm

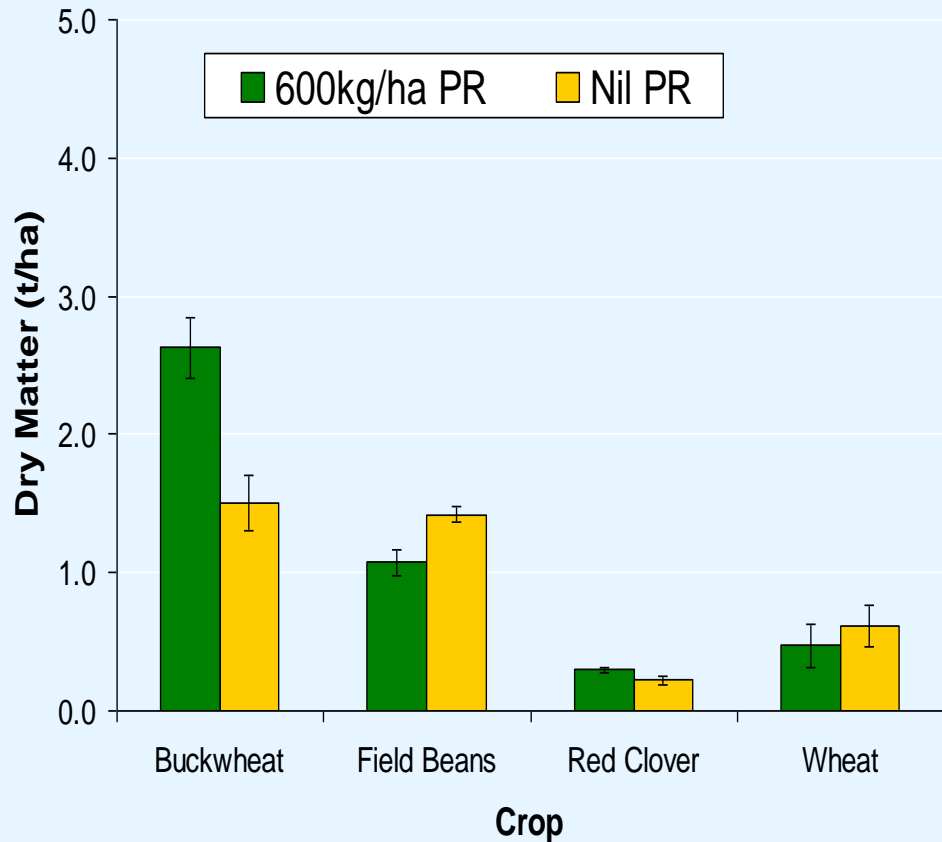


Buckwheat

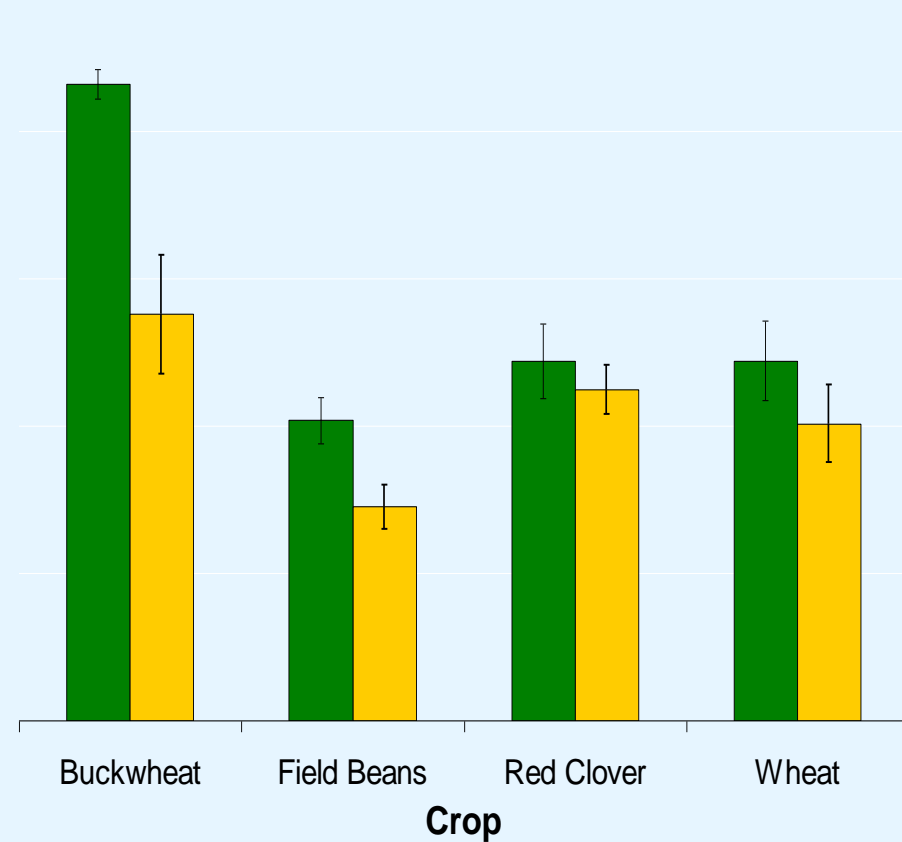
Spring sown crops: Crop biomass



Mid season sample



Pre harvest sample



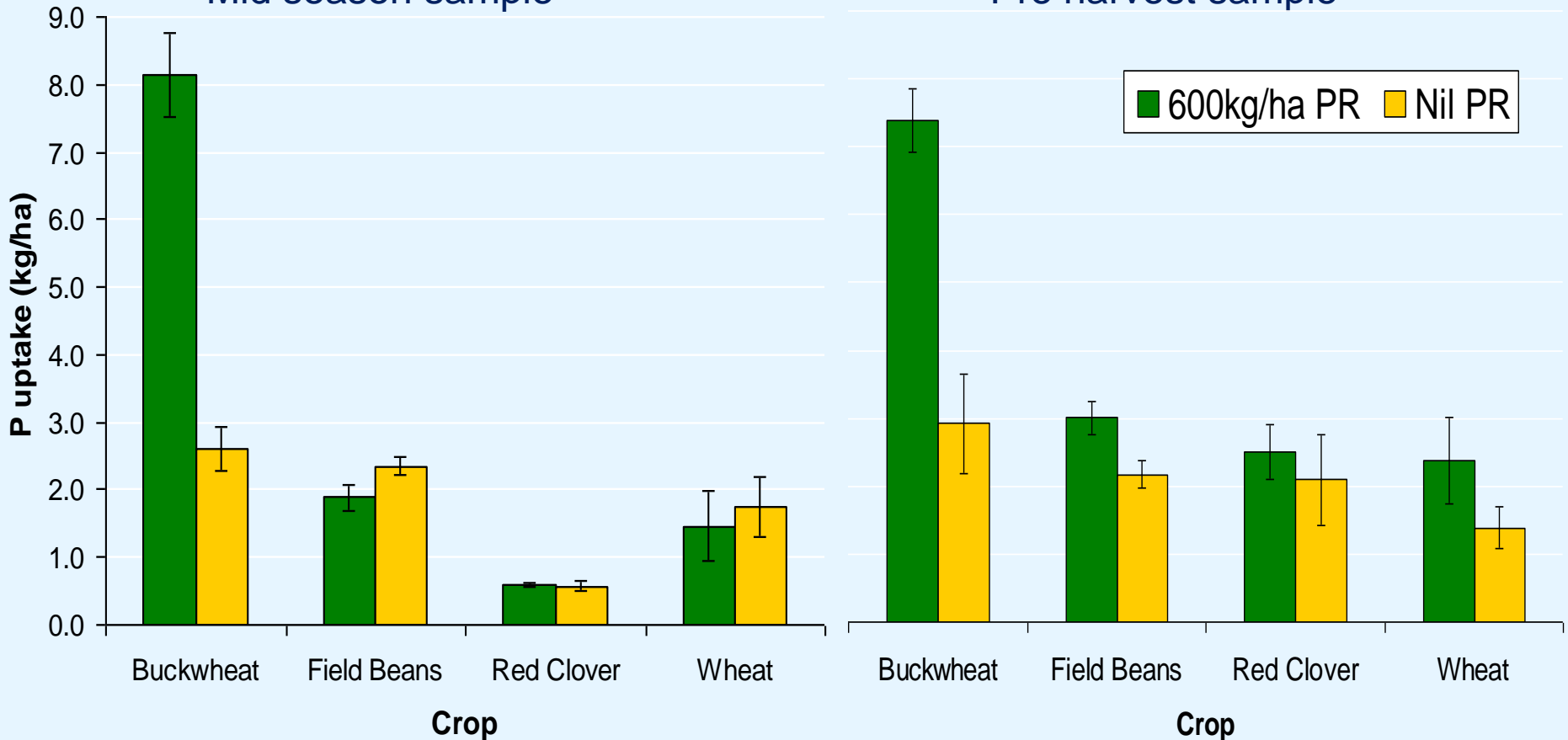
Data from Windshiel Farm

Spring sown crops: P uptake



Mid season sample

Pre harvest sample



Data from Windshiel Farm

Compost field trial 2009



- Composting started 16th January 2009
 - Organic Recycling Limited on concrete pad
 - uncovered
 - PAS100 standard
 - Substrate
 - 2 tonnes wheat straw
 - 6 tonnes cabbage leaf and brussel sprout waste
 - PR treatments (granular formulation)
 - 0 kg (-PR) and 250 kg (+PR)

Application of compost to trials

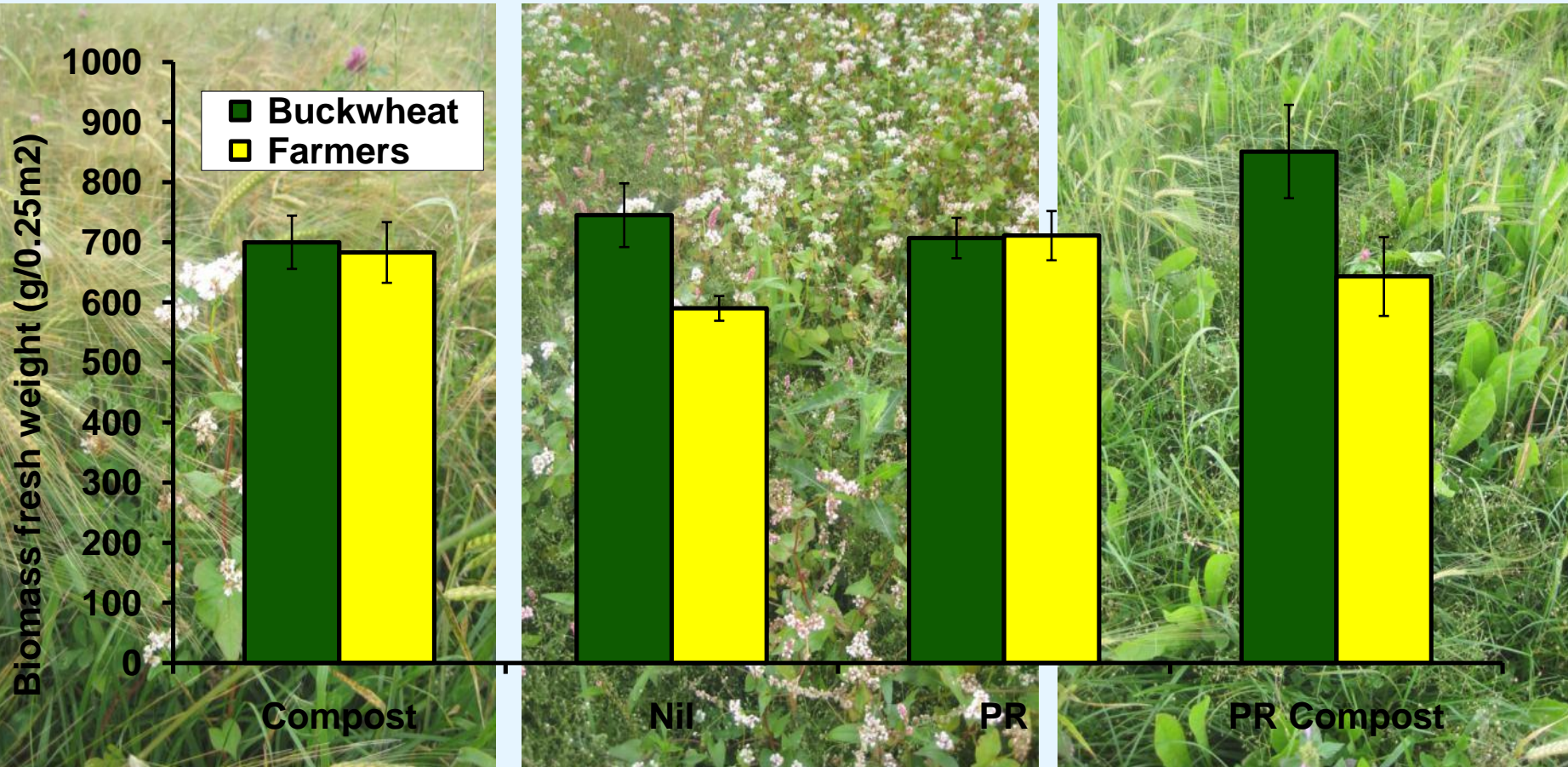


- Plot size 120 m²
- 96 kg compost applied per plot
 - Based on 8 t/ha application rate
 - Estimated to supply 100 kg P per ha (+PR) and 20 kg P per ha (-PR) based on previous data
- Total P actually applied (kg P per ha)
 - From compost
 - Around 50% of expected amount (due to losses)
 - From PR ~ 72 kg P per ha

- Predicted P in compost not as high in reality
 - variability shown between batches sent to each site, although all from same compost
 - Total P as well as AEM P
- Factors that influenced P?
 - Environment
 - Temperature
 - Rainfall
 - Chemistry
 - Ca / P interactions

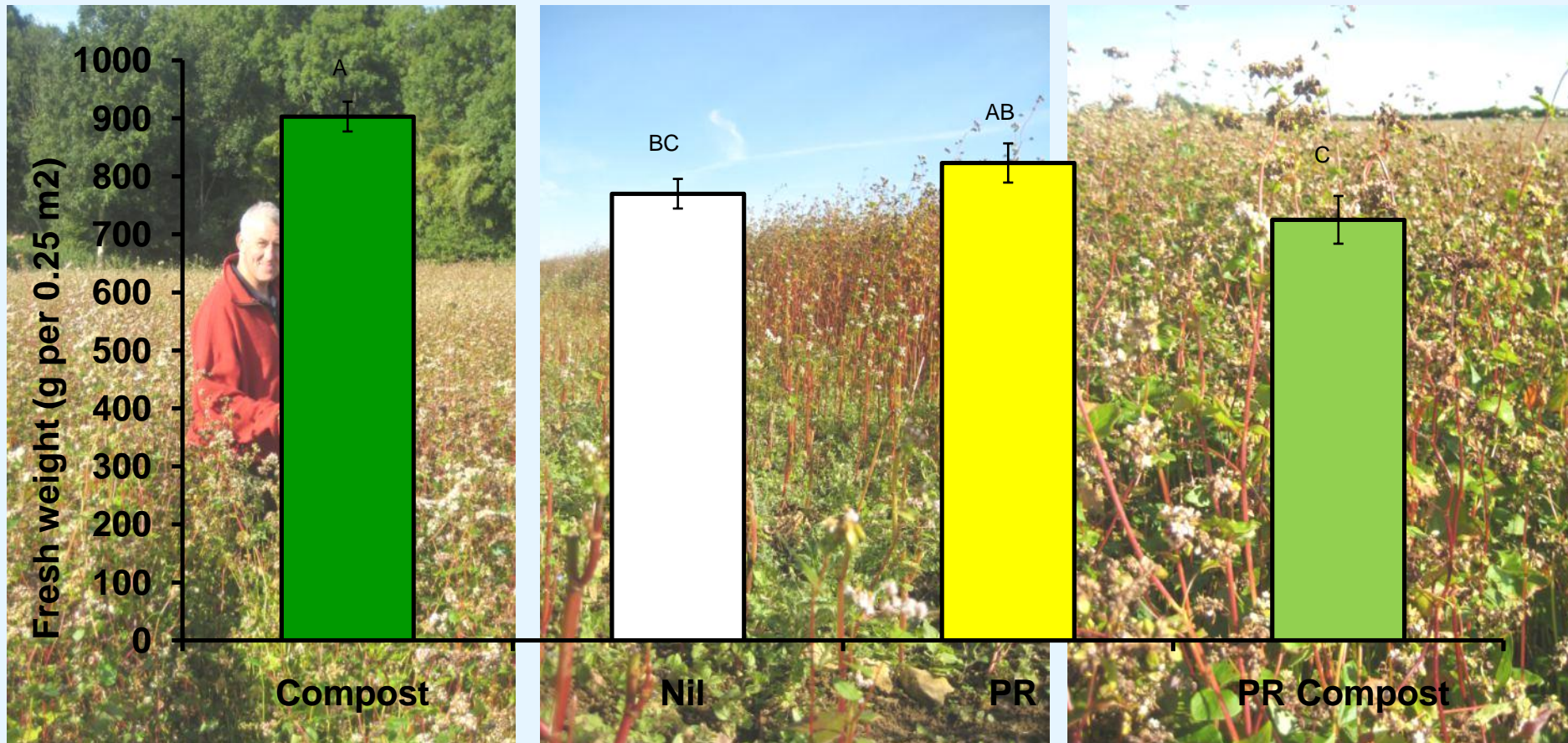
Compost field trial

- Windshiel
 - Farmer's crop: Barley silage mixture



Compost field trial

- Abbey Home Farm
 - Farmer's crop was buckwheat



Summary: Rotations



- Some crops better at accessing P from PR
 - Buckwheat
 - Brassica species
- Rotational effects can be positive
 - P availability (and N)
 - Brassicas
 - Field Beans
 - Forage rye
 - Buckwheat?

Summary: Compost



- Co-composting can have beneficial effects on P availability
 - Results not always consistent
 - Longer term benefits may be possible
- Adding more PR to compost does not always increase P availability
 - AEM-P affected by citric acid levels
 - High CA levels can reduce AEM-P
 - Importance of Ca?
 - Still being investigated

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