Manure Phosphorus Source and Rate Effects on Soil Test Levels and Corn Growth

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In Wisconsin…

- 60% of total P applied as manure is considered to be first year crop available
- Laboratory research has shown this is not always true
- Need to better understand soil test P (STP) changes with respect to P based manure application

Objective

- Determine manure P availability to corn on total P applied basis as compared to fertilizer in a field setting
  - Crop growth
  - Changes in soil test P

Location

- University of Wisconsin Agricultural Research Stations in Arlington and Marshfield

- Soil Characteristics

Location	Soil Series	pH	P	K	Ca	Mg	OM
			——— mg/kg ———				%
Arlington	Plano silt loam	6.5	17	77	1784	535	3.7
Marshfield	Withee silt loam	7.1	14	125	1441	433	2.7

Design

- Plots: 10 ft by 30 ft
- Randomized complete block design
- 4 repetitions
- Adapted corn hybrids

Treatments

- P sources
  - Fertilizer (0-46-0)
  - Dairy slurry
  - Solid dairy manure
  - Swine slurry
  - Poultry pellets
- Three target rates:
  - 80, 160, and 240 lbs P_2O_5/a

Manure characteristics

Manure	Total N	NH_4-N	P_2O_5	K_2O	S	DM†
						%
Arlington						
Dairy Slurry (lbs/1000 gal)	34.3	14.9	12.0	24.2	1.64	10.3
Dairy Solid (lbs/ton)	10.8	3.9	3.7	7.4	0.59	18.9
Swine Slurry (lbs/1000 gal)	22.9	17.6	11.4	13.7	1.08	2.7
Poultry Pellets (lbs/ton)	70.6	8.8	77.1	51.2	3.85	84.0
Marshfield						
Dairy Slurry (lbs/1000 gal)	20.2	10.2	8.8	19.0	1.34	6.1
Dairy Solid (lbs/ton)	9.5	2.7	3.8	12.6	2.68	19.9
Swine Slurry (lbs/1000 gal)	25.2	17.6	10.7	12.5	1.02	2.8

†DM, Dry Matter

Actual P application

	Phosphorus Application Rate		
Source	**Low**	**Medium**	**High**
	lbs P_2O_5/a		
Arlington			
Fertilizer	83	166	248
Dairy Slurry	76	151	227
Dairy Solid	67	134	201
Swine Slurry	62	125	187
Poultry Pellets	77	154	230
Marshfield			
Fertilizer	83	166	248
Dairy Slurry	57	114	171
Dairy Solid	68	137	205
Swine Slurry	59	117	176

Other nutrients

- Manure credits were taken
- Fertilizer applied to achieve rates of:
  - 200 lbs N/a
  - 120 lbs K_2O/a
  - 15 lbs S/a

Soil Sampling

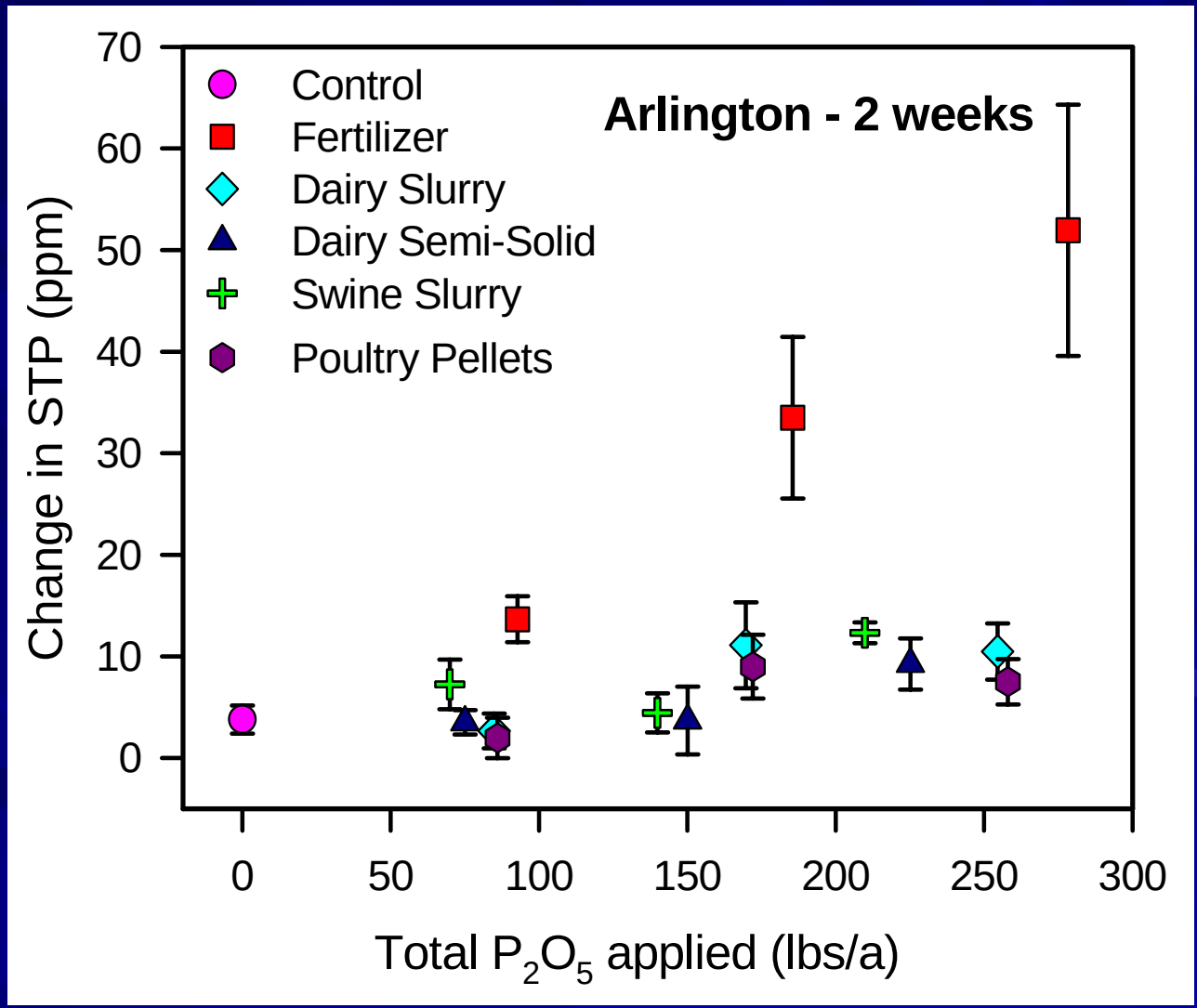
- 0-2, 0-6, and 6-12 in samples
  - Pre-application, 2, 4, 10 weeks, and post harvest
- P extracted with Bray-1 and deionized water

Plant Sampling

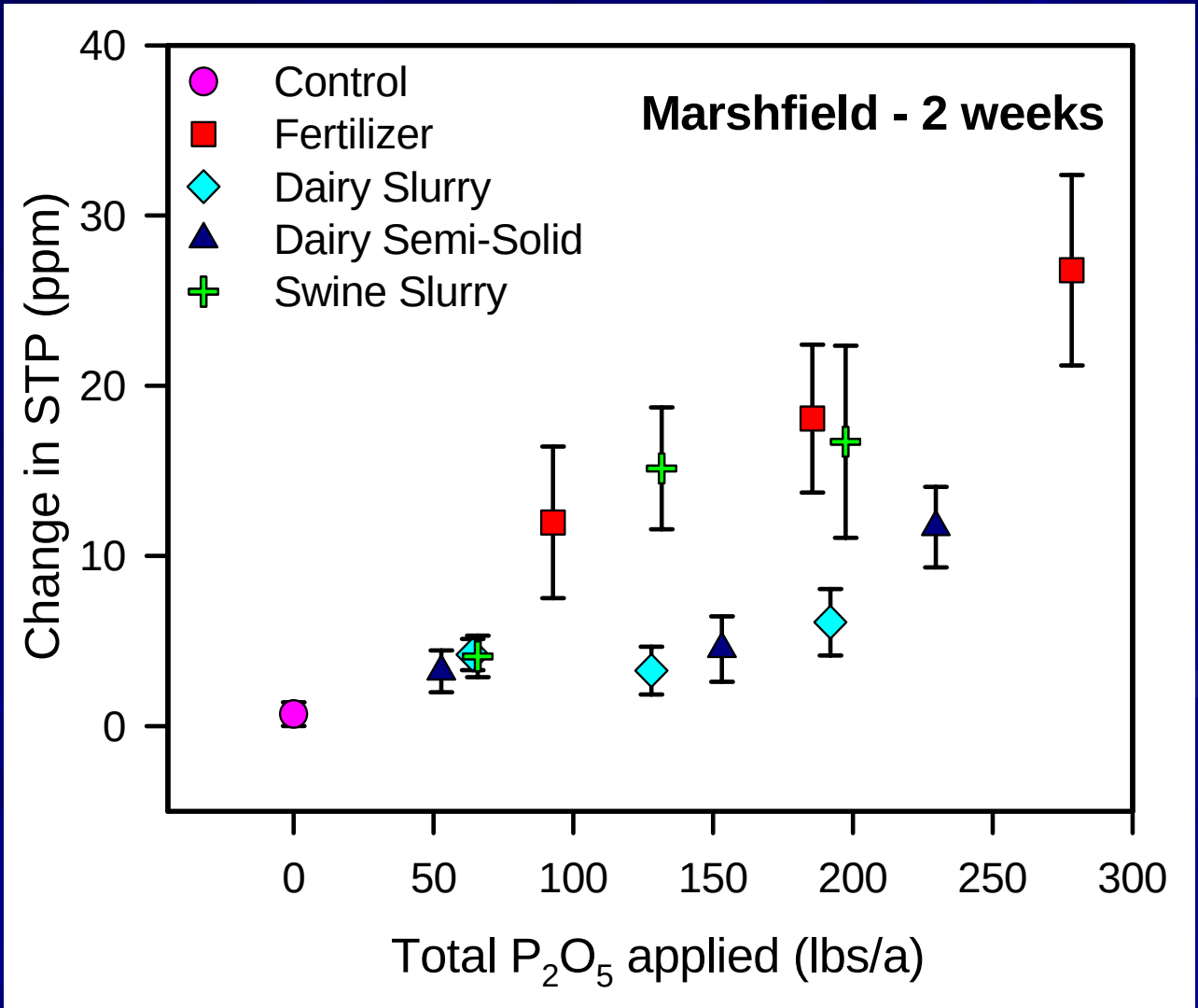
- Whole plant samples
  - V6 growth stage, physiological maturity for silage
- Ear leaf samples at tasseling
- Grain samples at harvest
- Total P measured

2005 results

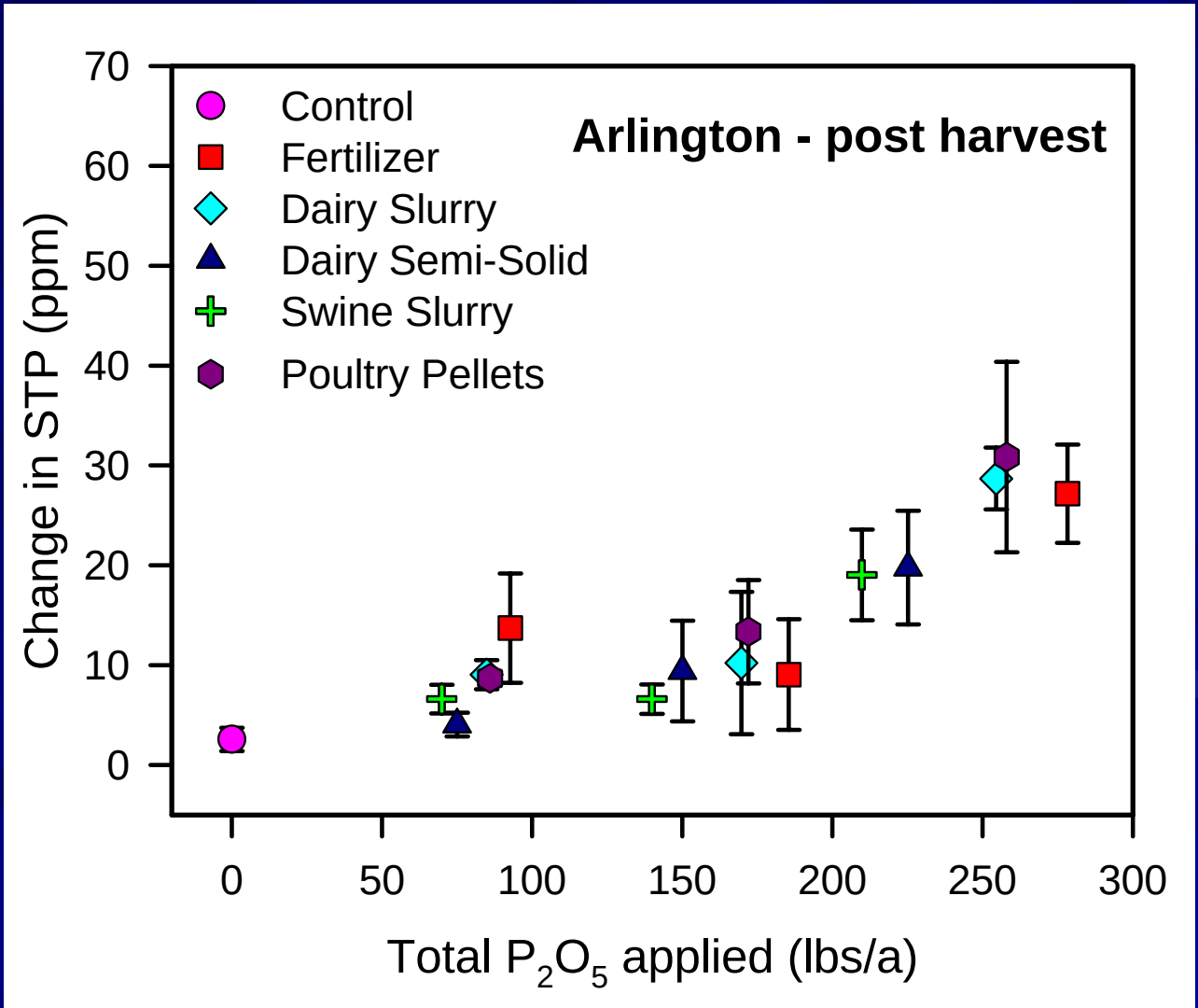
Change in STP with P application: Arlington 2 weeks



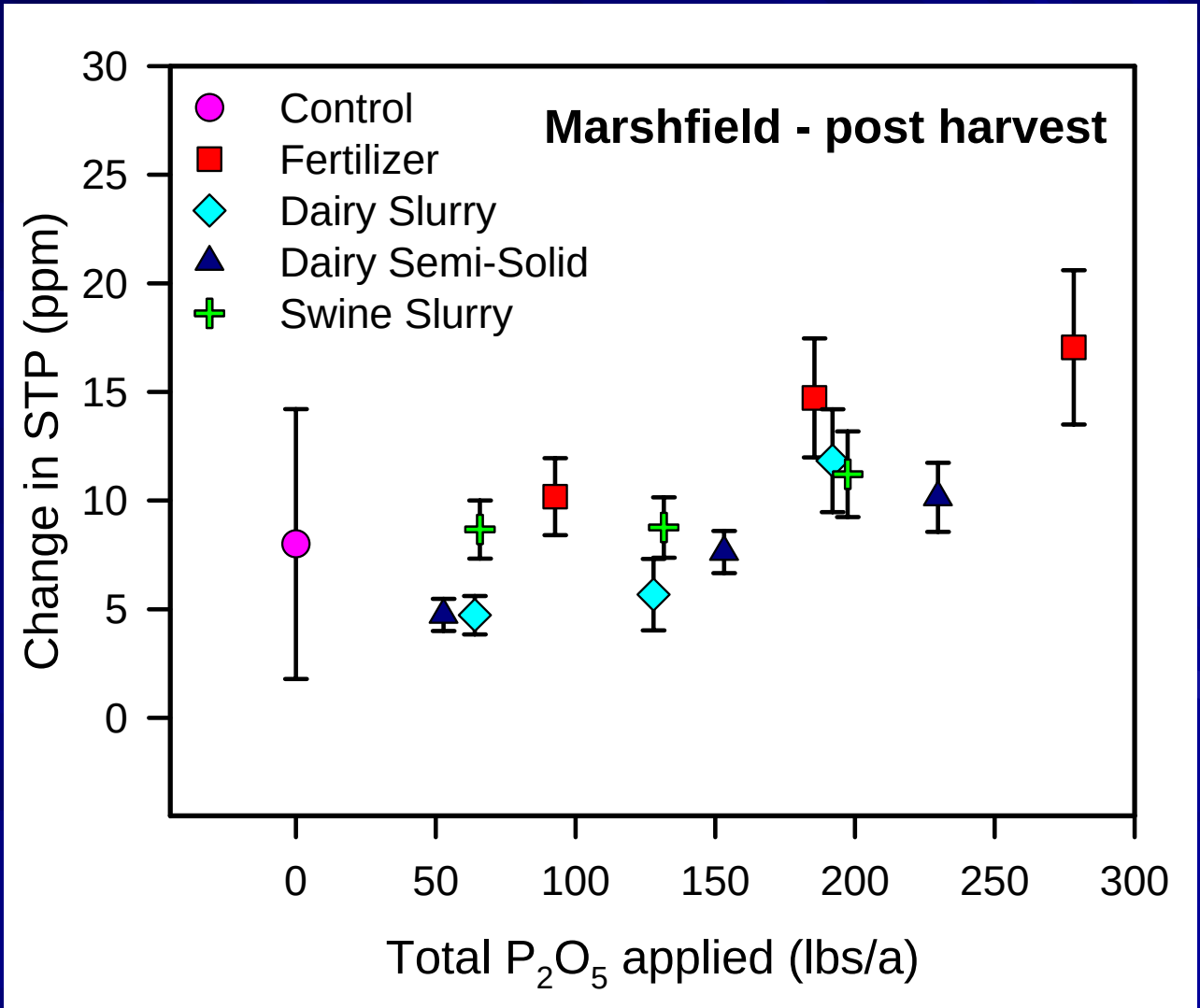
Change in STP with P application: Marshfield 2 weeks



Change in STP with P application: Arlington post harvest



Change in STP with P application: Marshfield post harvest



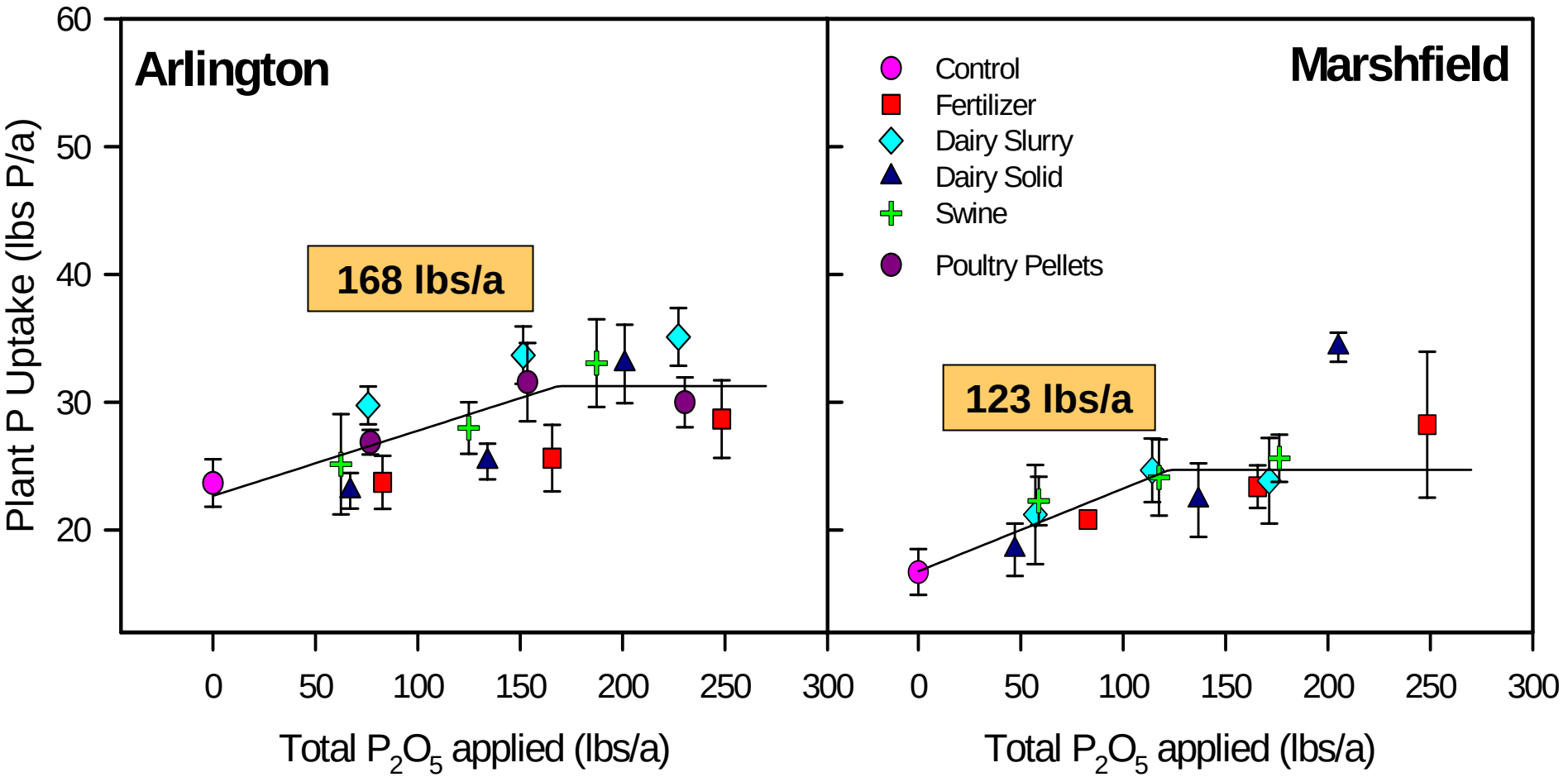
Relative availability (RA) of manure P compared to fertilizer at 2 weeks

Source	RA
Arlington	
Dairy slurry	0.22***
Dairy solid	0.19***
Swine slurry	0.16***
Poultry pellets	0.18***
Marshfield	
Dairy slurry	0.19**
Dairy solid	0.58*
Swine slurry	1.20^{NS}

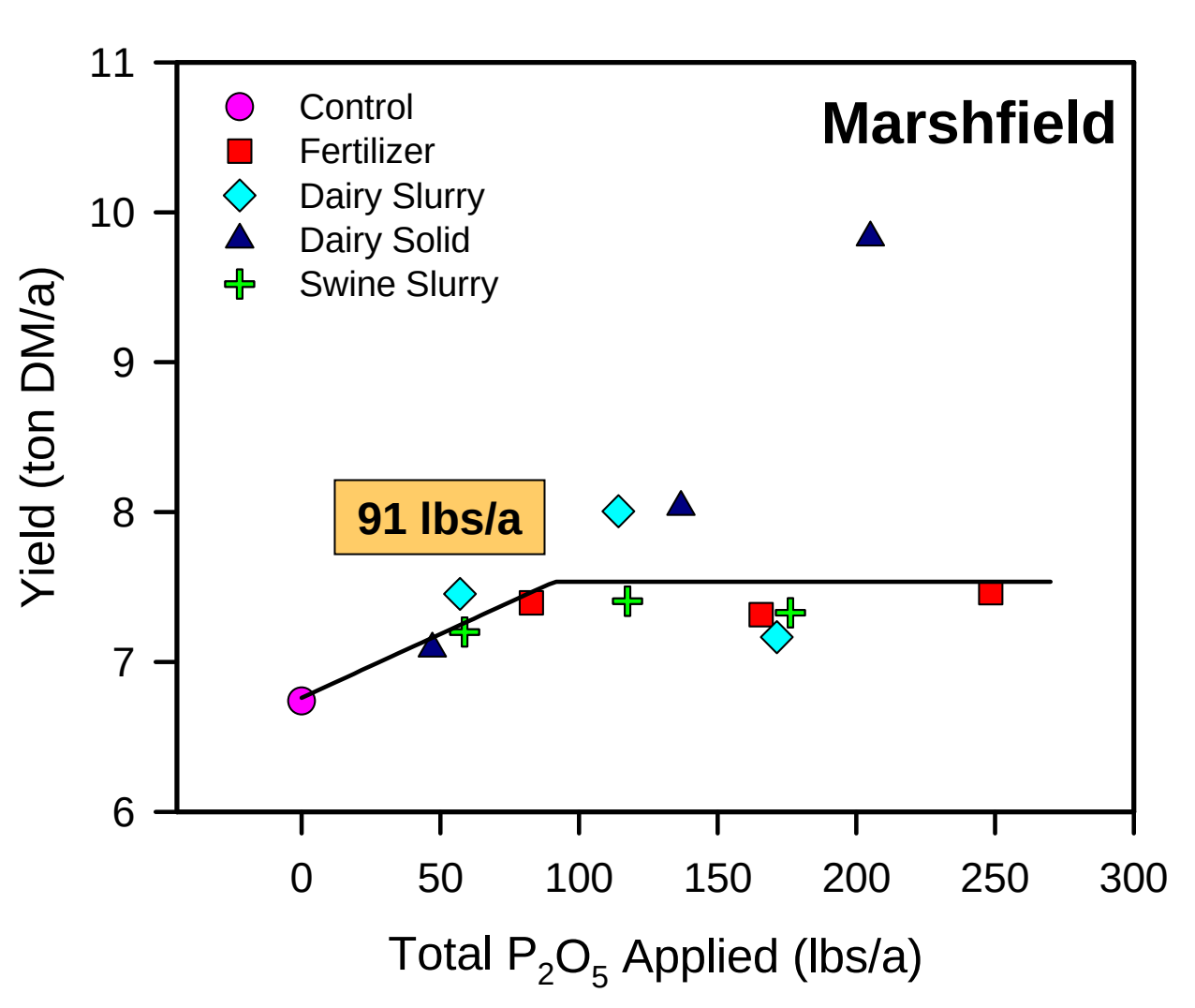
NS = not significant, *Significant at 0.1, **Significant at 0.05, ***Significant at 0.001

- Post harvest
  - RA: not significantly different than fertilizer

Silage P Uptake



Silage yield at Marshfield



Conclusions

- Change in STP varied by soil, manure type, and sampling date
- No significant manure source effect on silage P uptake and yield
- Manure and fertilizer are equivalent P sources
  - In terms of P availability to crop growth

Conclusions

- Treating all manures the same may not be the most effective way to account for manure P
- Manure effects on STP more important for environmental concerns rather than crop response

Questions?

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  - Wisconsin Fertilizer Research Program
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  - The “Poo” Crew