



Nutrient Management With Cover Crops

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Nutrient Management and Crop Covers

- Cycle nutrients
 - Surface
 - Subsoil
- Improve nutrient available
 - Root exudates
 - Decomposing biomass
- Nutrient requirements?

Studies to Evaluate Nutrient Management and Cover Crops.

- **Oilseed radish and N rate**
- **Nutrient Cycling**
- **P-K fertilization for cover crops.**
- **Cover Crop x Compost x gypsum**



Nutrient Management Considerations

- Cover crops are expected to capture residual nitrate N.
- What amounts of nutrients will a cover crop accumulate in the top and root biomass?
- How will the accumulated nutrients affect nutrient availability in the soil?
- Are supplemental nutrients beneficial for stimulating growth?

Nitrogen Recovery

Fall Soil Nitrate N after manure

Soil Nitrate N

- No cover 21.3 mg/kg soil
- Oilseed radish 6.5 mg/kg soil

Averages for 7 field sites.

Sundermeir, Ohio State University

Oilseed Radish Biomass Accumulation

- Top Biomass
- Fresh 27 tons/a
- Dry 4.3 tons/a
- D.M. 15.9 %
- Root Biomass
- 17.7 tons/ a
- 5.5 tons/ a
- 31.1 %

Oilseed radish and N rate

- 0, 30, 60, 90, 120 lbs N applied in fall prior to seeding oilseed radish.
- Chlorophyll measurements
- Biomass and nutrient determined.
- Soil nitrogen determined.
- N rates applied in other plots prior to planting cabbage and sweet corn.
- Measure yields.

N Effect on Chlorophyll in Oilseed Radish

N Applied	Chlorophyll Reading
• 0 lbs/a	24.5
• 30	27.9
• 60	27.8
• 90	30.0
• 120	29.3

N Rate Effect on Top Biomass in Oilseed Radish

• N Applied	Fresh	Dry	D.M.
•	- - ton/a	- -	%
• 0	18.7	1.93	10.3
• 30	23.8	1.80	7.6
• 60	23.3	1.86	8.0
• 90	29.1	1.98	6.8
• 120	29.0	2.20	7.6

Oilseed Radish and Soil N

Late Fall, 2006

Oilseed Radish	N Applied lbs/acre	Nitrate -N, lbs/a-ft	Ammonium-N lbs/a-ft
No	0	9.2	13.9
Yes	0	7.7	14.9
Yes	30	10.3	10.8
Yes	60	10.0	11.9
Yes	90	14.4	14.1
Yes	120	11.5	18.5

Oilseed Radish controls winter annual weeds and readily decomposes



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Oilseed Radish and Soil N

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Oilseed Radish	N Applied lbs/acre	Nitrate –N, lbs/a-ft	Ammonium-N lbs/a-ft
No	0	4.5	7.6
Yes	0	7.7	10.3
Yes	30	20.1	9.2
Yes	60	20.6	8.0
Yes	90	31.0	7.0
Yes	120	31.5	8.5

Nutrients are cycled, but is there any net gain in available levels?

- Nutrient uptake reduces available soil levels by uptake, but then replenishes them as the biomass decomposes.
- For there to be an increase in available nutrient levels in the soil there must be a net gain, not just cycling.
- Deep rooting crops bring nutrients from the subsoil to the surface.

N Rate and Oilseed Radish Effect on Soil Test Values, Spring 2007

N Rate lbs/a	P, ppm		•	K, ppm	
	<u>No</u>	<u>OS</u>		<u>No</u>	<u>OS</u>
• 0	60	63	•	125	146
• 30	60	60	•	124	138
• 60	59	63	•	115	145
• 90	58	63	•	116	135
• 120	59	62	•	110	134
• Ave.	59	62	•	118	140

Guidelines for P and K Build up

- On Average.
- 20 lbs P_2O_5/a to increase ST 1 ppm P.
- **Ex.** 3 ppm increase from 60 lbs P_2O_5/a

- 4 to 16 lbs K_2O/a to increase ST 1 ppm K in sandy to clay soils.
- **Ex.** Loam 8:1. 22 ppm increase from 176 lbs K_2O/a

Nutrient Content of Oilseed Radish

	Tops	Roots		Tops	Roots
	%	%		lbs/ acre	
N	3.8	2.5	•	331	272
P	0.7	0.6	•	61	65
K	5.8	5.1	•	505	555

Calculated Dry Matter

• 15.9 % 31.1 %

Cover Crop Biomass, Tops + Roots Muck Soil

• Cover Crop	Total Dry Biomass	
	lb/a	tons/a
• Brown Mustard	5480	2.74
• Oriental Mustard	7350	3.67
• Yellow Mustard	6330	3.16
• Oilseed Radish	5590	2.79
• Sorghum Sudangrass	7170	3.58

Wang et al., MSU

Nutrient Content, Tops + Roots Muck Soil

• Cover Crop	N	P ₂ O ₅	K ₂ O
	- - - - -	lb/a	- - - - -
• Brown Mustard	246	62	390
• Oriental Mustard	277	71	449
• Yellow Mustard	277	58	429
• Oilseed Radish	311	87	478
• Sorgh. Sudangrass	235	63	348

Wang et al., MSU

Soil Nutrient Content, Spring Test Values - Muck Soil

• Cover Crop	N	P	K
	- - - - -	ppm-	- - - -
• Brown Mustard	26	43	392
• Oriental Mustard	27	45	436
• Yellow Mustard	27	45	418
• Oilseed Radish	27	50*	431
• Sorgh. Sudangrass	26	45	368
• Control	25	43	387

Wang et al., MSU

Nutrient Content, Tops + Roots Muck Soil

• Cover Crop	Ca	Mg	S
	- - - - -	lb/a	- - - - -
• Brown Mustard	161	14	42
• Oriental Mustard	203	19	47
• Yellow Mustard	178	17	47
• Oilseed Radish	186	21	43
• Sorgh. Sudangrass	82	32	17

Nutrient Content of Soil in Relation to Cover Crops Grown, Muck Soil

• Cover Crop	Ca	Mg
	- - - ppm	- - -
• Brown Mustard	5702	819
• Oriental Mustard	5799	826
• Yellow Mustard	5761	821
• Oilseed Radish	5725	806
• Sorghum Sudangrass	5307	770
• Control	5680	844

Effect of P and K Application on Biomass Production, (tons/a)

	Low P High K	Med P High K	High P High K	High P Med K	High P Low K
Brown	14.7	18.1	21.0	25.4	20.5
Oriental	21.9	23.2	24.78	26.5	20.3
Yellow	13.6	18.7	18.1	17.4	13.8
Daikon OS	33.5	34.8	32.4	37.3	30.3
Defender OS	31.5	32.6	40.6	34.4	32.1
					Fresh Wt.

Cover Crop x Compost x gypsum

- Compost: Yes or No
- Gypsum: Yes or No
- Cereal grain, oilseed radish, mustard, red clover
- Test crop: Sweet corn

Average Nutrient Content of Cover Crops (across years and treatments)

	Wheat	O. Mustard	Oilseed R.
	%	%	%
N	4.32	3.70	3.56
P	0.59	0.55	0.60
K	4.41	4.12	4.98
Ca	0.41	1.87	2.41
Mg	0.18	0.34	0.42

Nutrient Return (NR) in Biomass

Per Each Ton of Fresh Biomass
Assume 10% Dry Matter.

	<u>lbs/ton/a</u>	<u>(% in D.M.)</u>
N	7.5 lbs	(3.75 - N)
P ₂ O ₅	2.8 lbs	(0.60 - P)
K ₂ O	10.5 lbs	(4.40 - K)
Ca	3.6 lbs	(1.80 - Ca)
Mg	0.6 lbs	(0.30 - Mg)

Nutrient Content of Oriental Mustard with Compost and Gypsum, Fall 2005

	Compost	No Comp.		Gypsum	No Gypsum
	%	%		%	%
N	4.39	3.97	N	4.33	4.03
P	0.57a	0.50 b	P	0.55	0.52
K	4.88	4.82	K	5.13	4.57
Ca	2.06	1.84	Ca	2.05	1.85
Mg	0.38	0.40	Mg	0.41	0.37

Nutrient Content of Oriental Mustard with Compost and Gypsum, Fall 2006

	Compost	No Comp.		Gypsum	No Gypsum
	%	%		%	%
N	3.13	3.31	N	3.23	3.20
P	0.56	0.58	P	0.56	0.58
K	3.35	3.44	K	3.35	3.44
Ca	1.85	1.76	Ca	1.83	1.76
Mg	0.26 b	0.30 a	Mg	0.30	0.30

Nutrient Content of Oilseed Radish with Compost and Gypsum, Fall 2005

	Compost	No Comp.		Gypsum	No Gypsum
	%	%		%	%
N	4.61	4.43	N	4.50	4.42
P	0.64 a	0.57 b	P	0.60	0.56
K	5.60	6.0	K	6.05	5.65
Ca	2.71	2.70	Ca	3.00	2.40
Mg	0.47	0.54	Mg	0.54	0.47

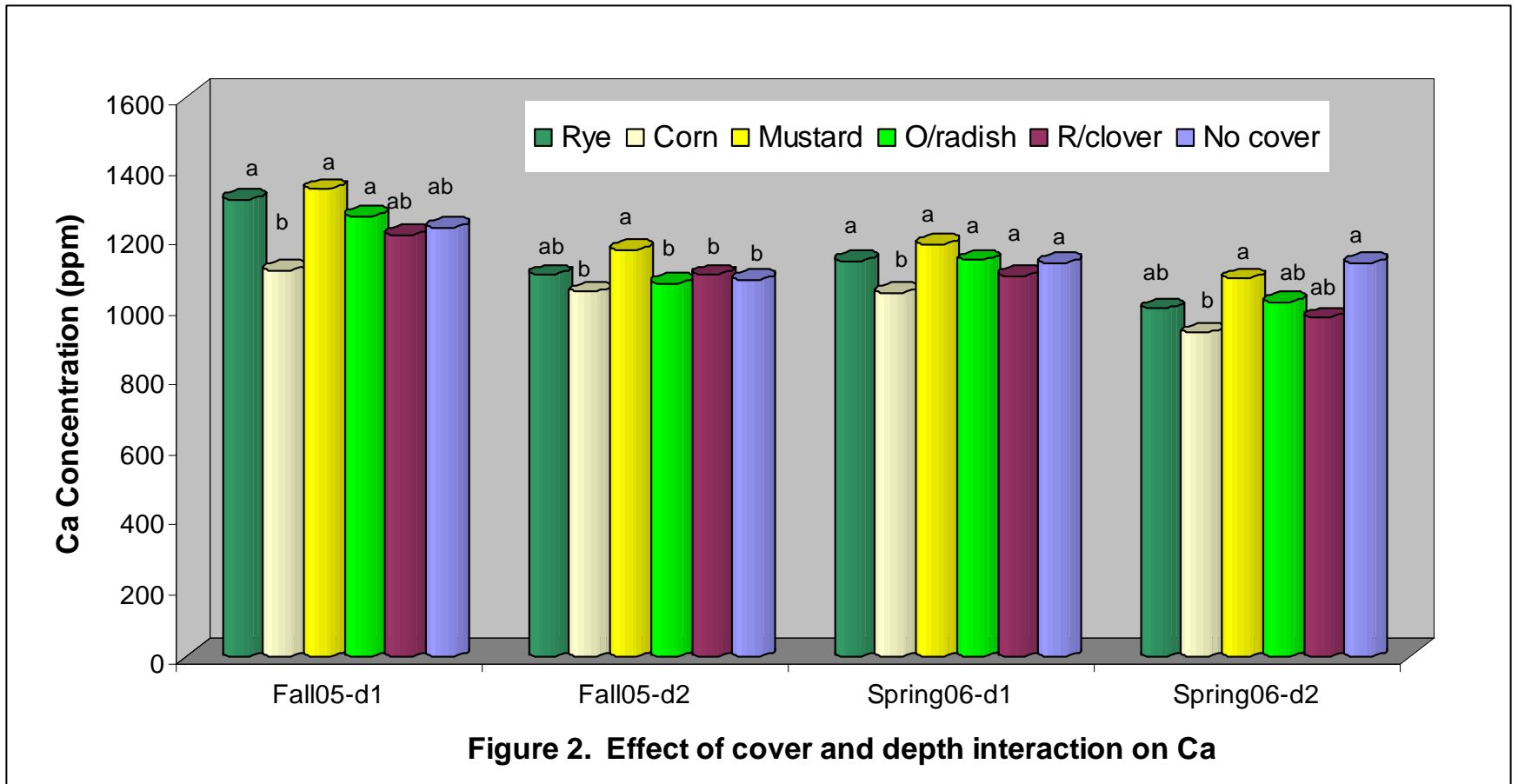
Nutrient Content of Oilseed Radish with Compost and Gypsum, Fall 2006

	Compost	No Comp.		Gypsum	No Gypsum
	%	%		%	%
N	2.72	2.56	N	2.5	2.78
P	0.65 a	0.55 b	P	0.59	0.61
K	4.33	3.97	K	3.97	4.30
Ca	2.22	2.02	Ca	2.04	2.20
Mg	0.31	0.37	Mg	0.31	0.37

Nutrient Content of Wheat with Compost and Gypsum, Fall 2006

	Compost	No Comp.		Gypsum	No Gypsum
	%	%		%	%
N	4.56	4.08	N	4.43	4.21
P	0.63 a	0.57 b	P	0.60	0.56
K	4.53	4.31	K	4.31	4.50
Ca	0.39	0.44	Ca	0.44	0.39
Mg	0.17	0.19	Mg	0.18	0.17

Effect of Cover Crop on Soil Calcium Level



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Effect of Cover Crop on Soil Magnesium Level

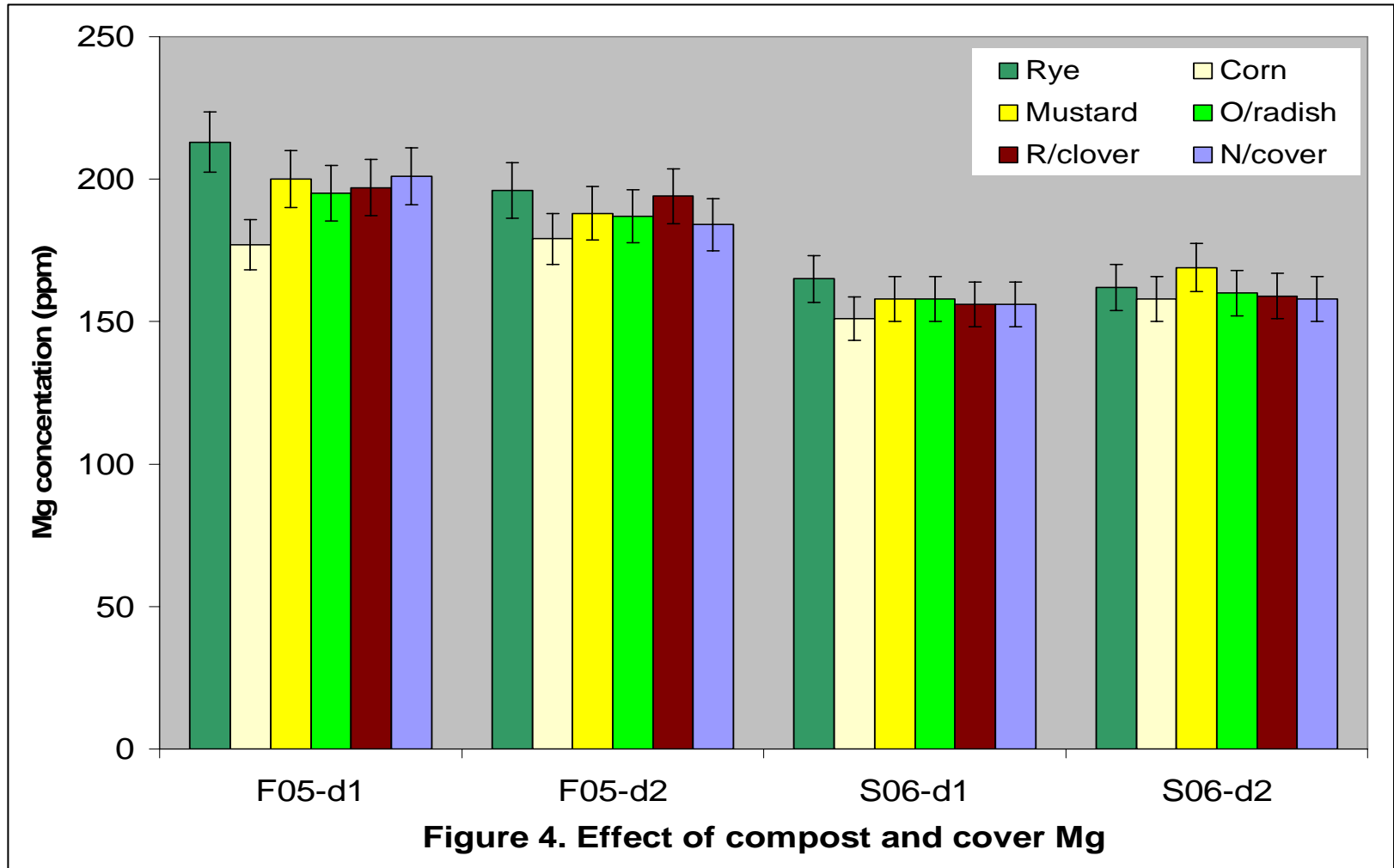


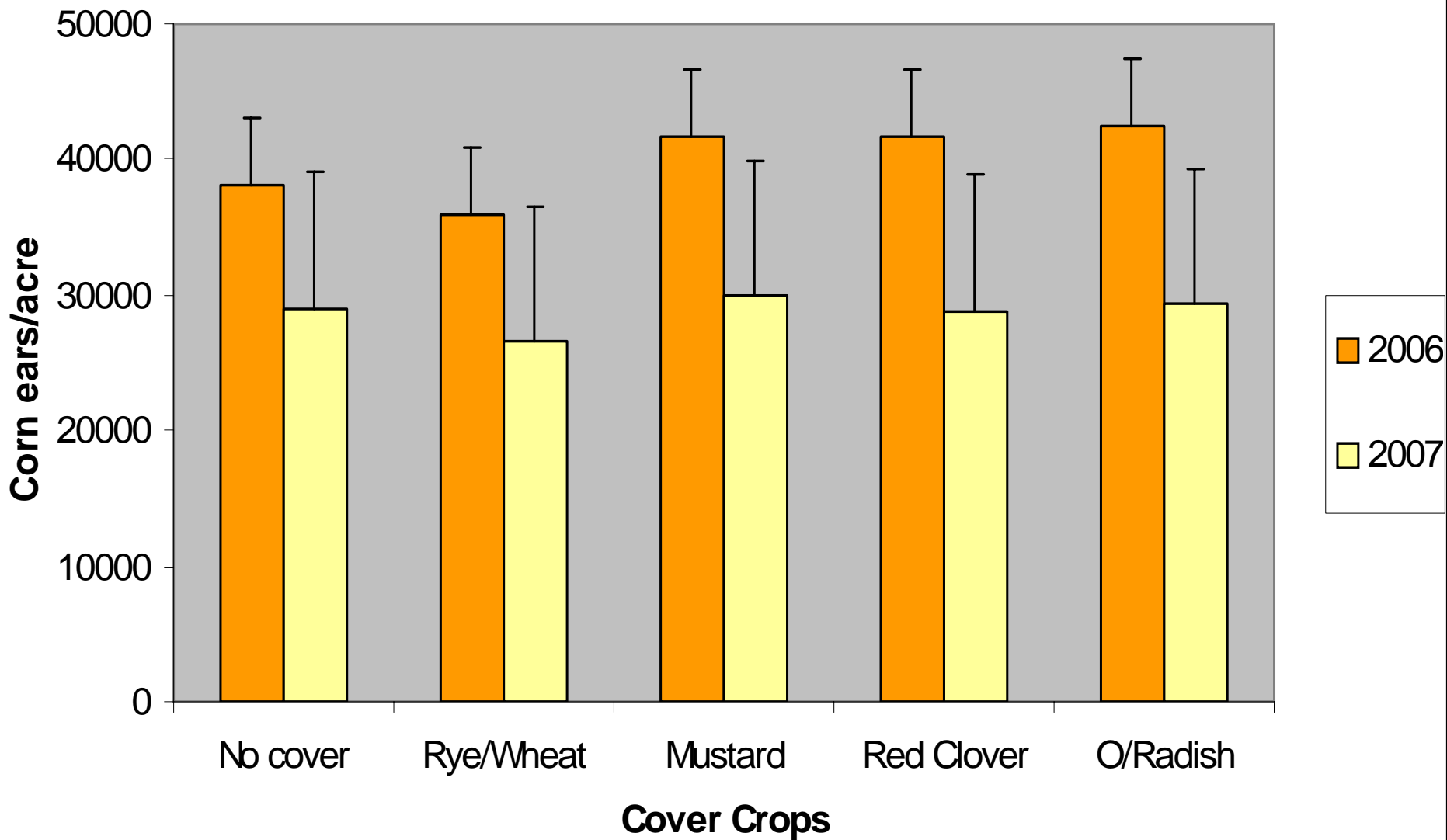
Figure 4. Effect of compost and cover Mg

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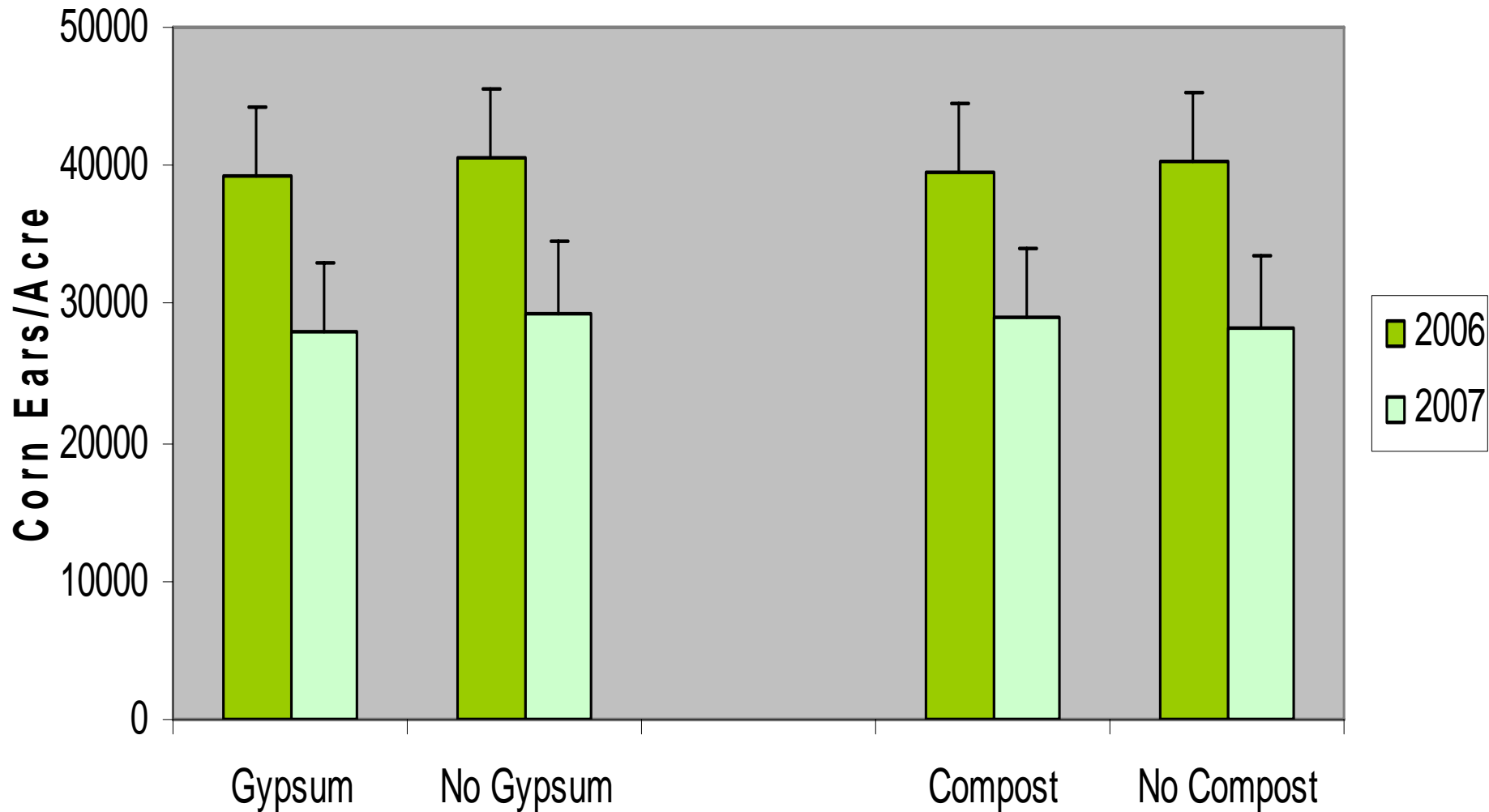
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Effect of Various Covers on Corn Yield



Effect of Gypsum and Compost on corn Yield



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Gypsum and Compost (different years)

Mean weights (lbs) of 10 husked ears from Cover Crops treatments

2006

Cover Crops	No Cover	Cereal rye	Oriental mustard	Oilseed radish	Red clover
Mean (lbs)	4.2a	4.7b	4.3a	4.4a	4.2a

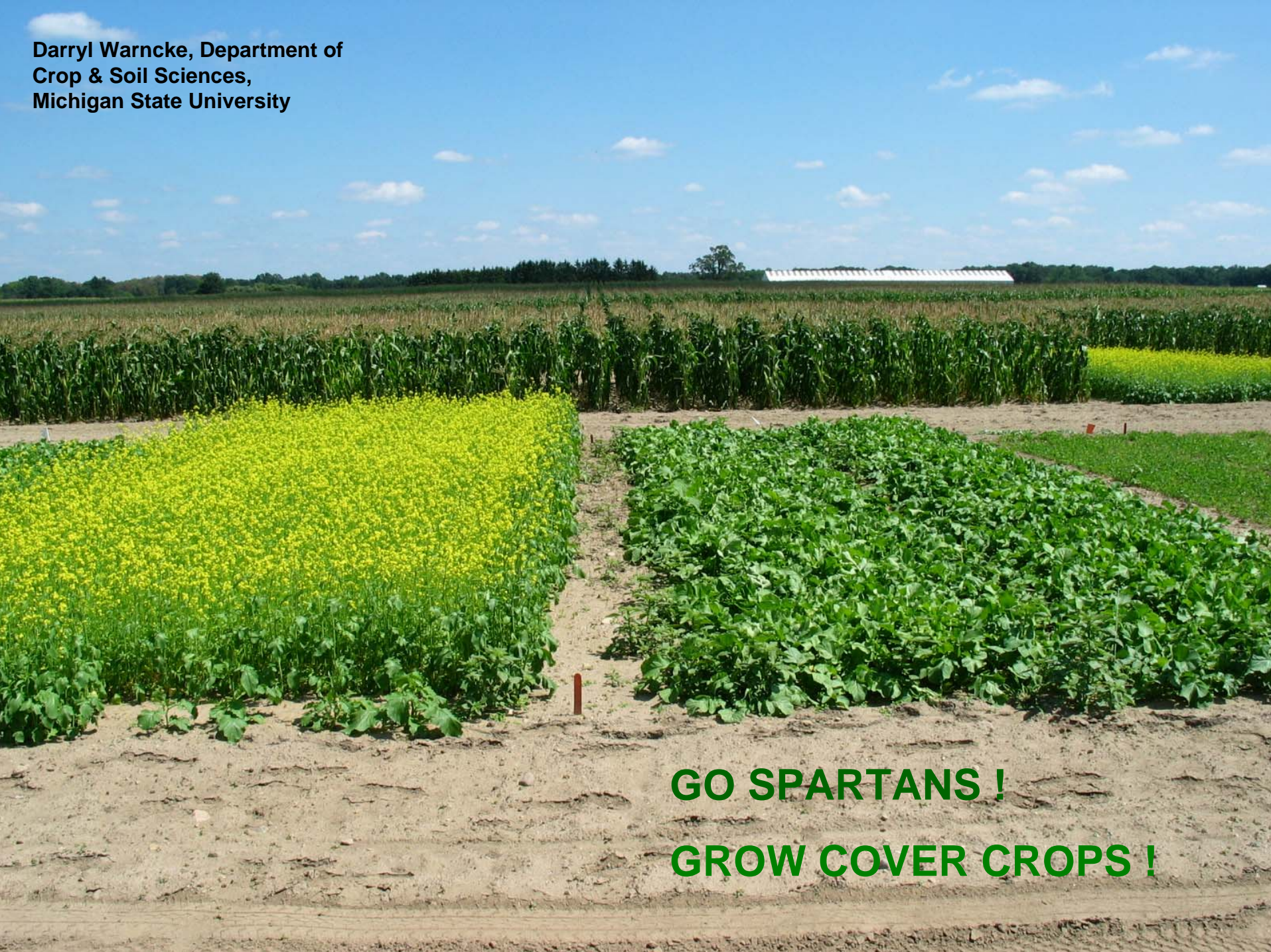
2007

Cover Crops	No Cover	Wheat	Oriental mustard	Oilseed radish	Red clover
Mean (lbs)	4.3b	4.1a	4.4b	4.4b	4.2a

Summary

- **Cover crops provide a mechanism for:**
 - - Recovering residual nutrients
 - - Cycling nutrients in the surface soil
 - - Moving nutrients from the subsoil to the surface soil.
- ** With adequate soil nutrient levels adding supplemental nutrients provides limited benefit.

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GO SPARTANS !
GROW COVER CROPS !

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Thanks for your Interest !

