

# **Impact of ThermAer™ ATAD biosolids on biomass yield and quality of three plant species**

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# Materials

Source material	Waste feedstock	ATAD treatment	Location	Fraction used for test
Corn processing waste	Corn processing waste	Full scale plant	Lafayette, IN	Dewatered biosolid
Municipal wastewater	PS, TWAS and SDS	Full scale plant	Three Rivers, MI	Dewatered biosolid
Municipal wastewater	TWAS	Full scale plant	Yorkville, IL	Dewatered biosolid
Municipal wastewater	PS and WAS	Full scale plant	Moorehead, IN	Dewatered biosolid
Municipal wastewater	TWAS	Pilot plant	Ottawa, ON	Dewatered biosolid
Municipal wastewater	TWAS	Pilot plant	Ottawa, ON	Decanted digestate (liquid)
Residential source separated organic solids collection system	Hydropulped organic solids	Pilot plant	Toronto, ON	Dewatered biosolid

# Materials

Material	pH	DM(%)	TP (%)	TK (%)	TNa (%)	OrgC (%)	S (%)	TKN (%)	NH <sub>4</sub> -N (ppm)	NO <sub>3</sub> -N (ppm)
Corn waste	8.4	13.8	1.97	0.23	1.3	31.2	1.75	5.53	11600	12.4
Three Rivers	8.4	21.1	1.48	0	0.06	30.9	0.97	2.73	5750	12.6
Yorkville	6.3	26.1	3.58	0.47	0.06	26.6	0.89	3.97	3780	5.81
Moorehead	7.2	29.4	2.14	0.4	0.06	23.8	1.29	2.34	4360	5.35
Ottawa (decanted digestate)	8.2	1.5	2.98	3.82	5.17	19.7	1.72	5.96	25600	12300
Ottawa (biosolids)	7.9	47.6	2.53	0.73	0.4	19.5	0.53	2.15	1810	98.2
Toronto (separated solids)	6.4	22.2	0.99	0.7	0.5	19.2	0.35	2.29	341	7.33

Plant	Comments
<b>Lettuce</b> , ( <i>Lactuca sativa</i> cultivar Grand Rapids)	C3 plant, Short vegetation period cultivar
<b>Kentucky bluegrass</b> ( <i>Poa pratensis</i> cultivar Mercury)	C4 plant, Fast growing grass
<b>Tall fescue</b> ( <i>Festuca rubra</i> ssp. <i>Rubra</i> , cultivar Jasper)	C4 plant, Slow grower, late establisher



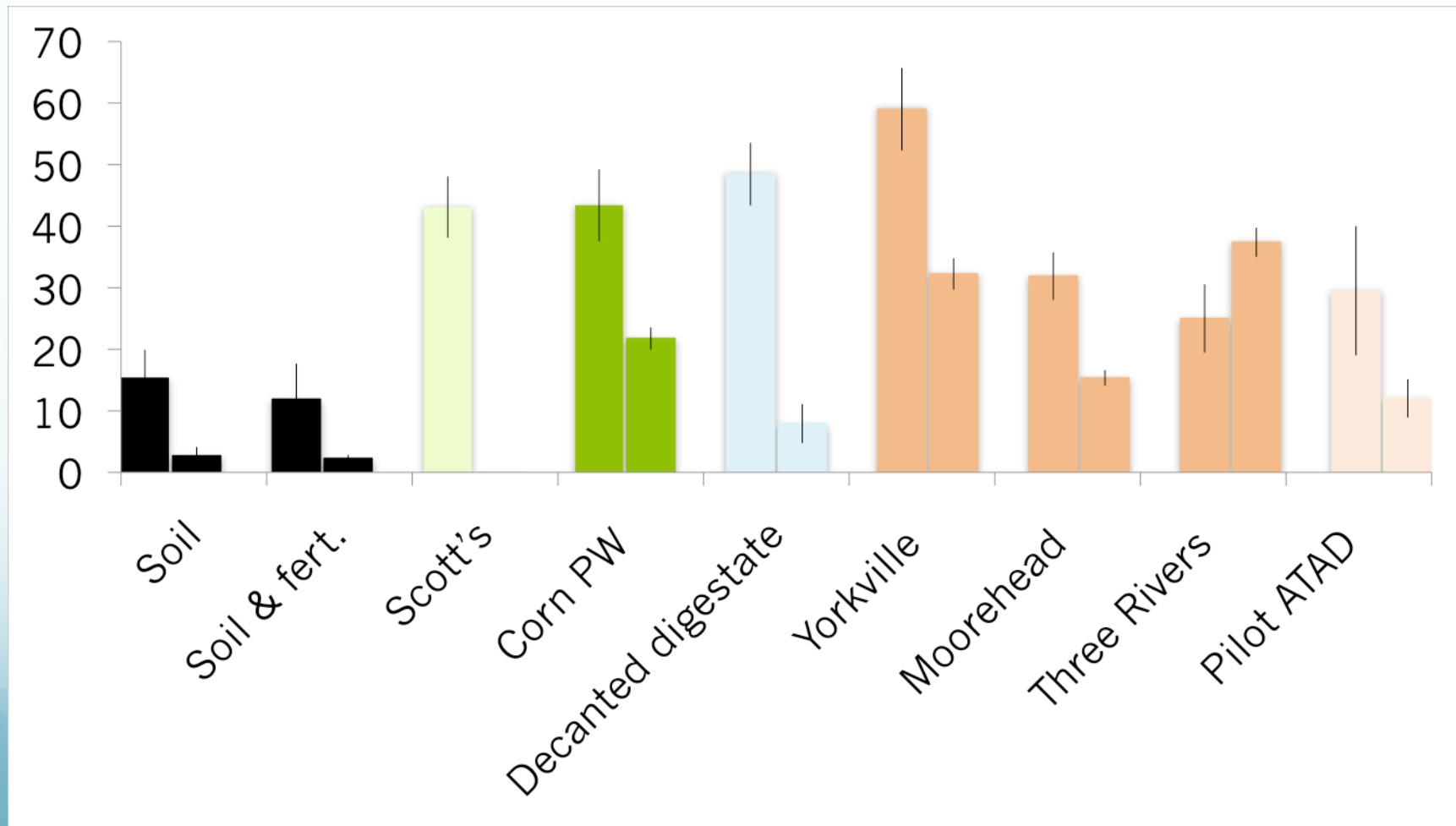
Greenhouse trials

- Rates:
  - To equivalent N or P

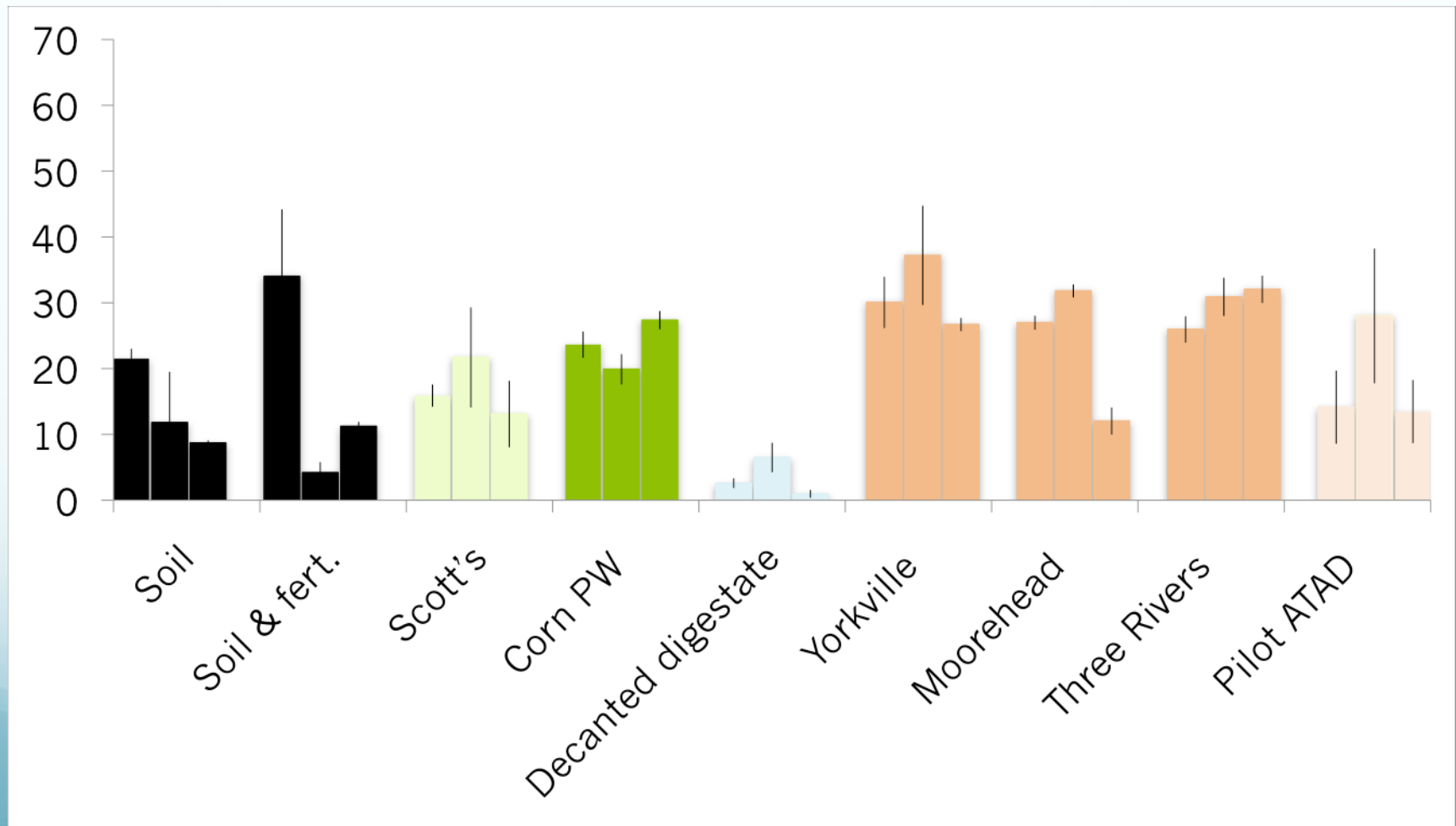
# Results

- Yield?
  - **Daily growth rate?**
- Biomass Quality?
  - Nutrient concentration?
  - Metal uptake?

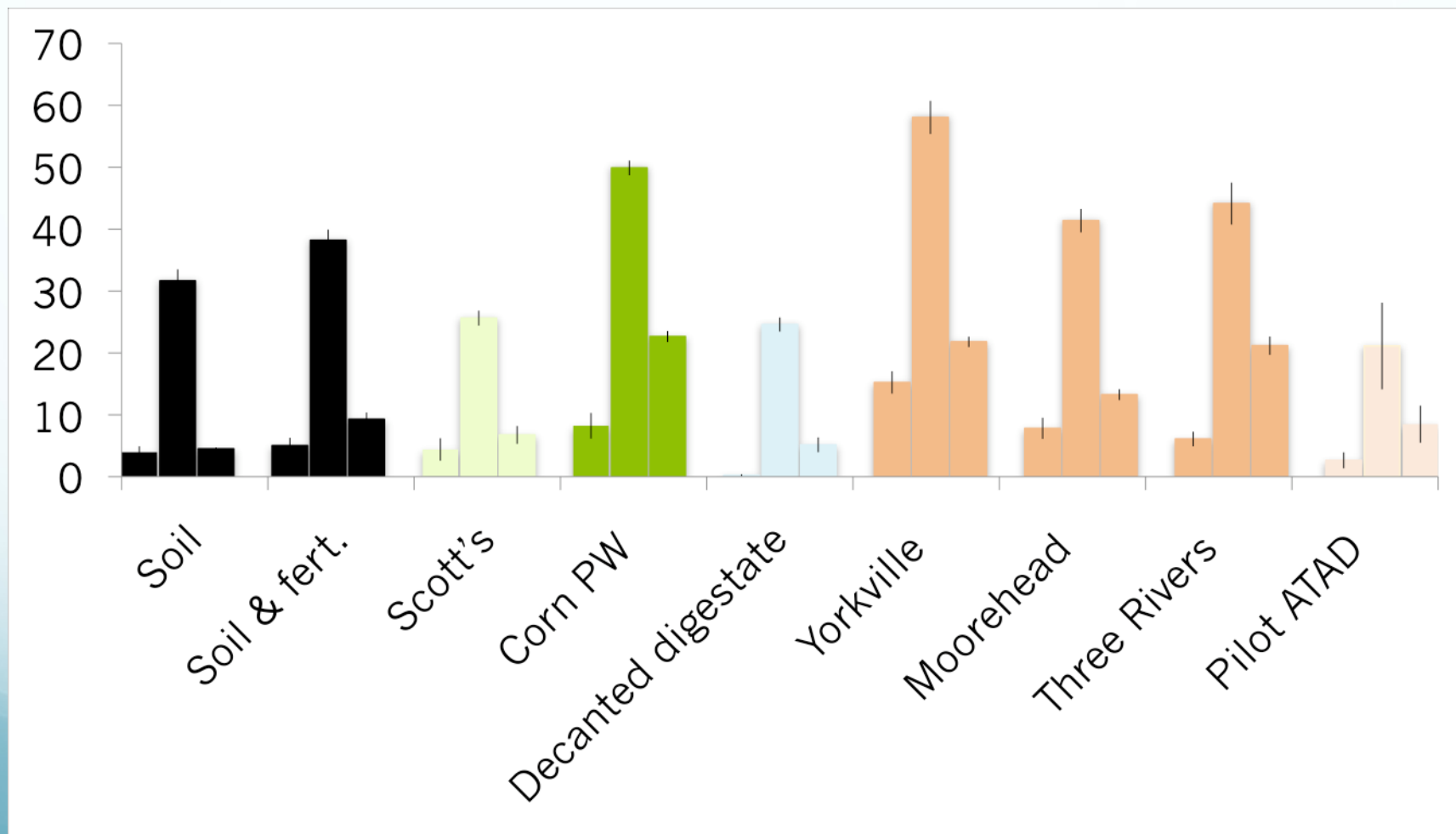
Lettuce:  
Average daily biomass accumulation  
crops 1 & 2  
(kg dry-matter/ha)



Kentucky bluegrass:  
Average daily biomass accumulation  
cuts 1, 2 & 3  
(kg dry-matter/ha)



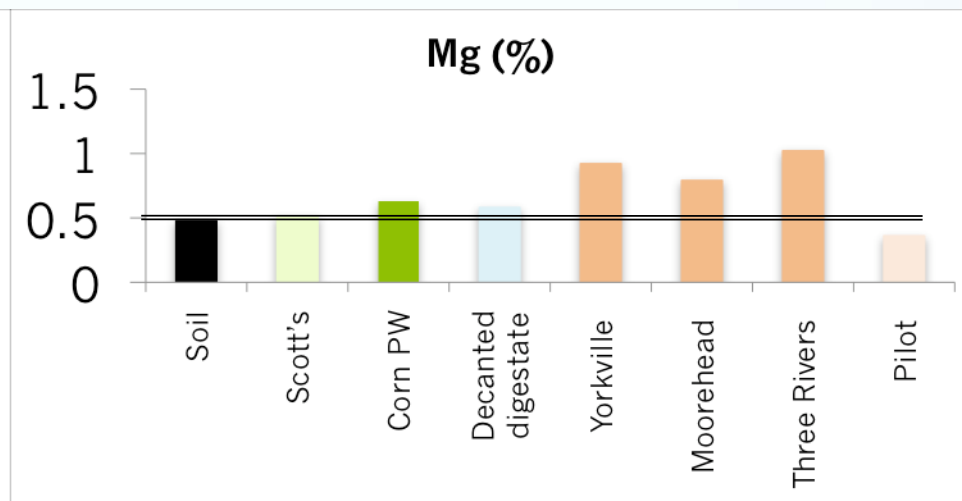
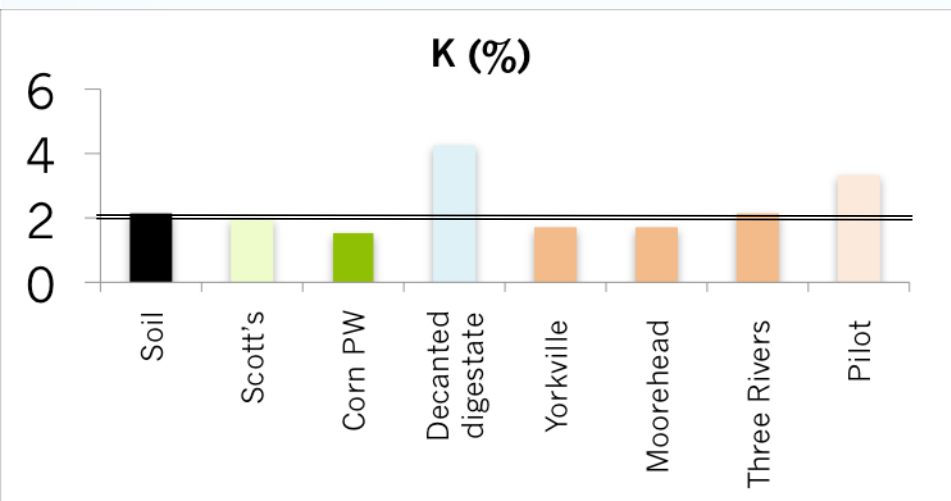
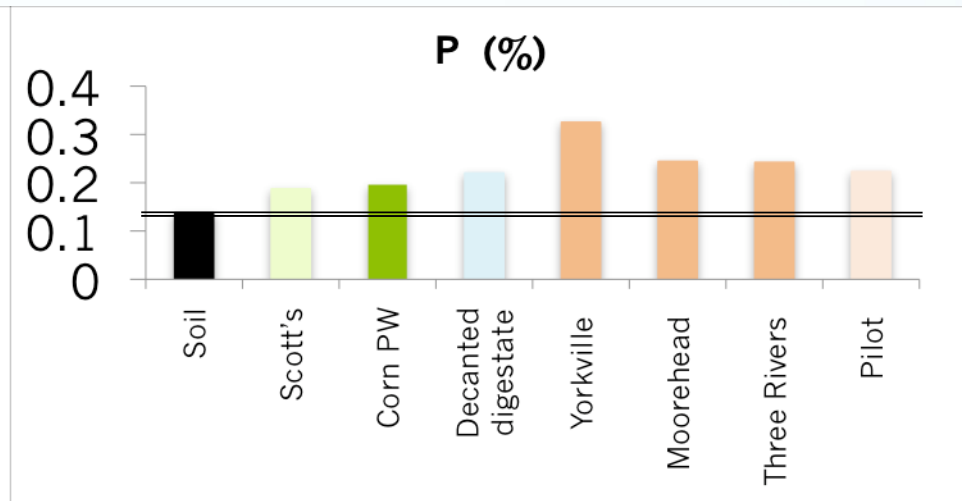
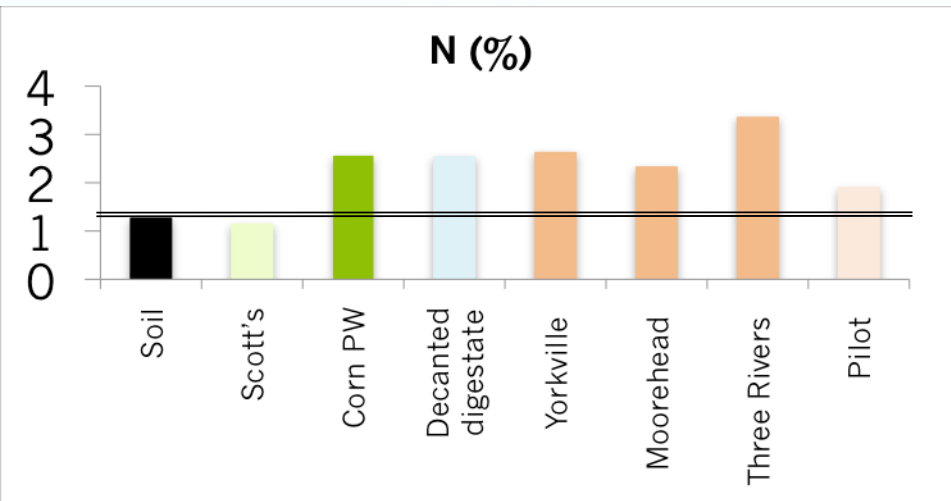
Tall fescue:  
Average daily biomass accumulation  
cuts 1, 2 & 3  
(kg dry-matter/ha)



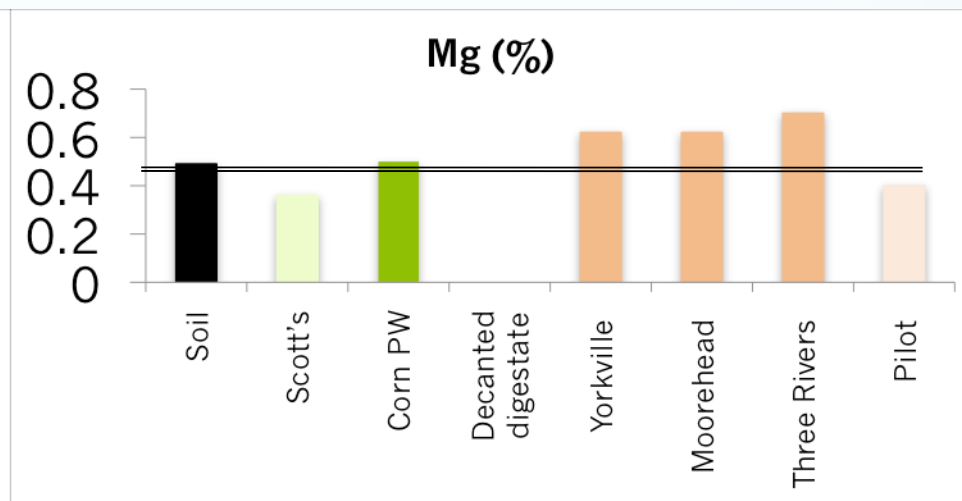
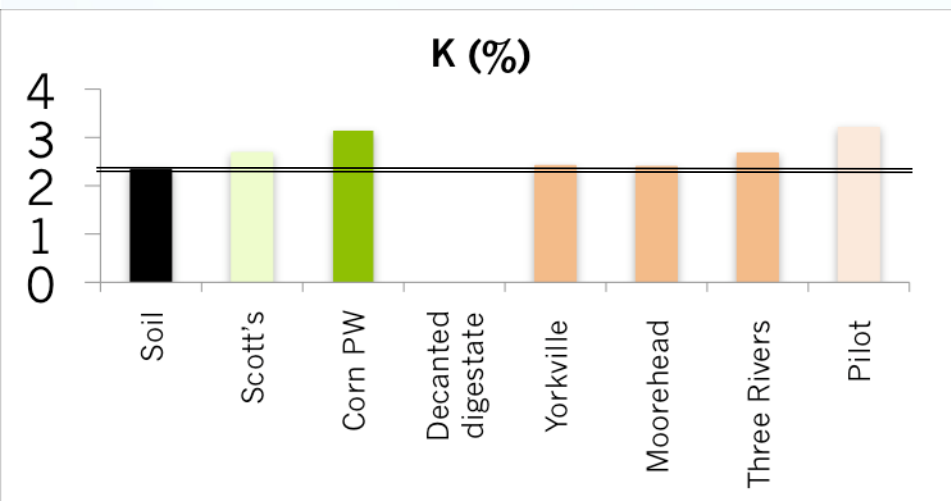
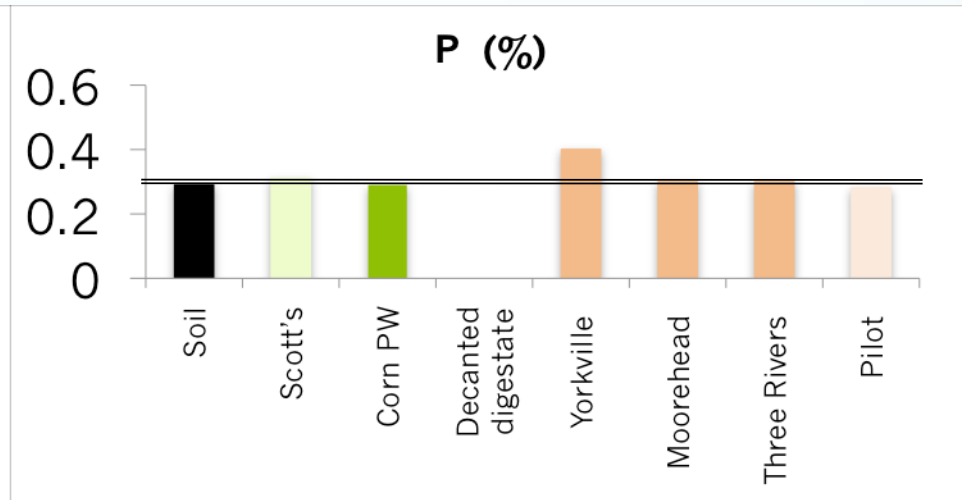
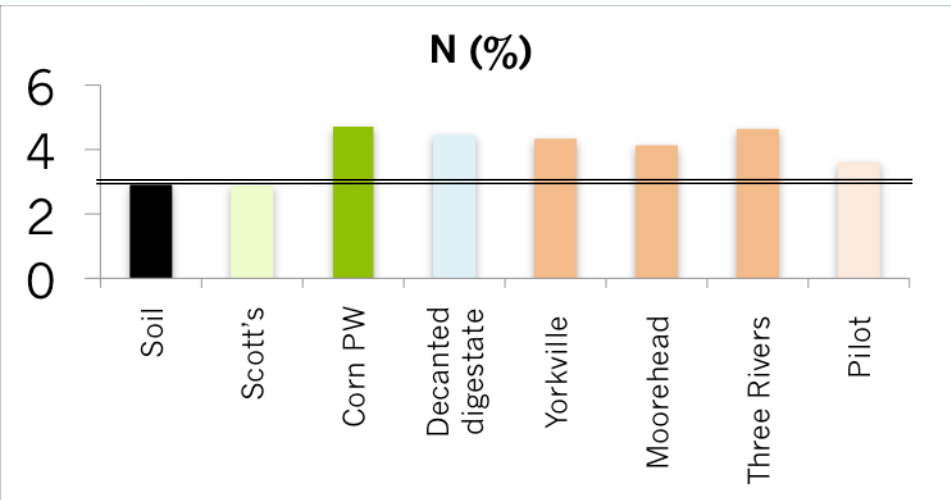
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- Biomass Quality?
  - **Nutrient concentration?**
  - Metal uptake?

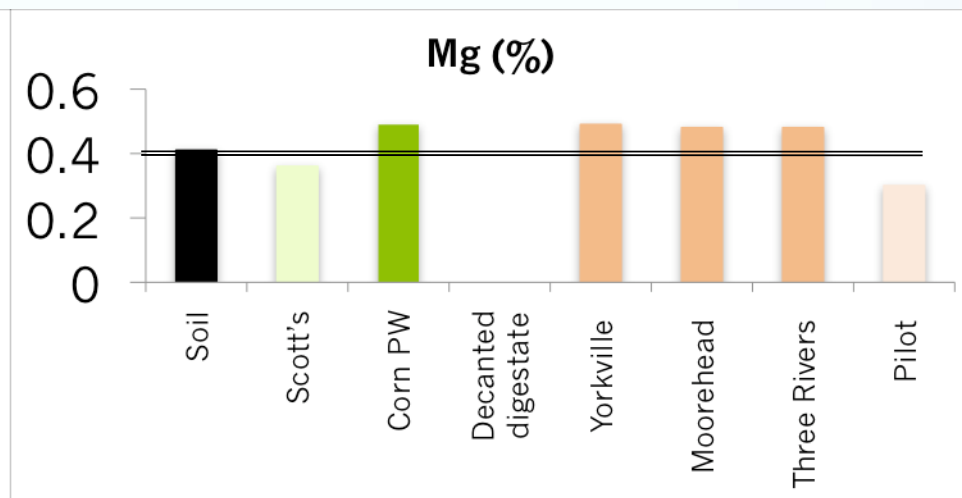
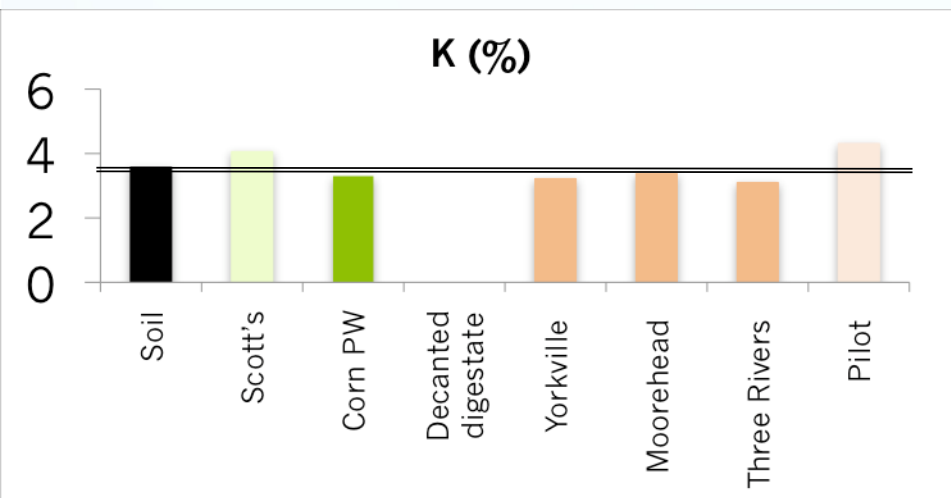
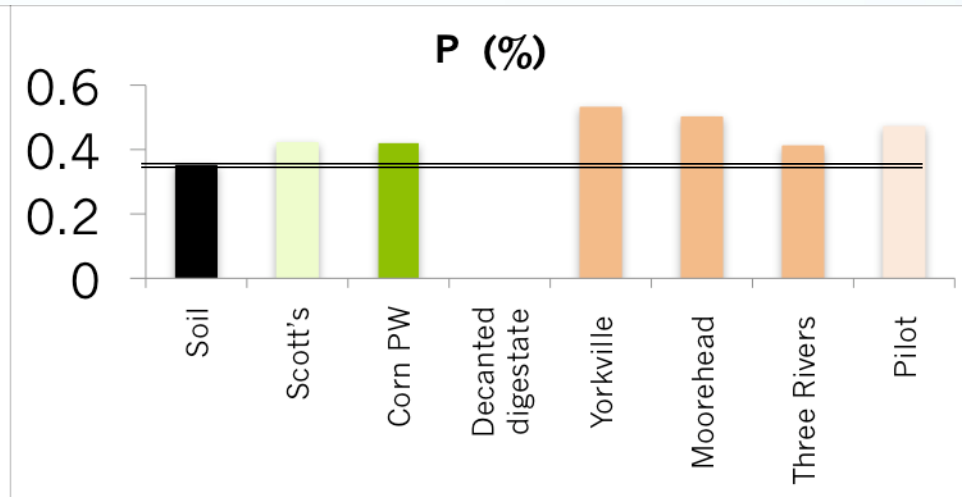
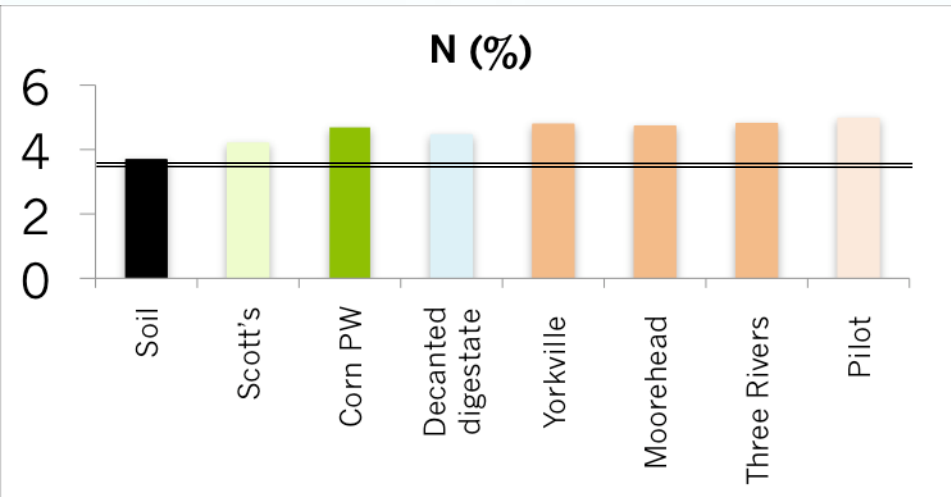
# N, P, K & Mg in Lettuce tissues



# N, P, K & Mg in Kentucky bluegrass tissues



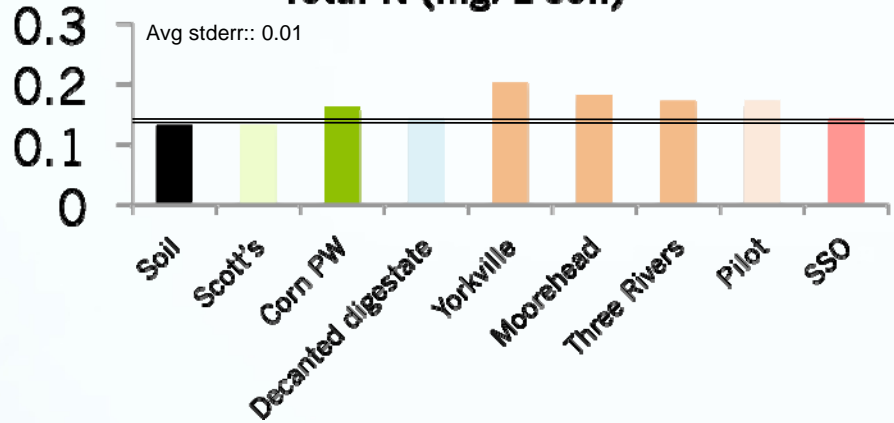
# N, P, K & Mg in Tall fescue tissues



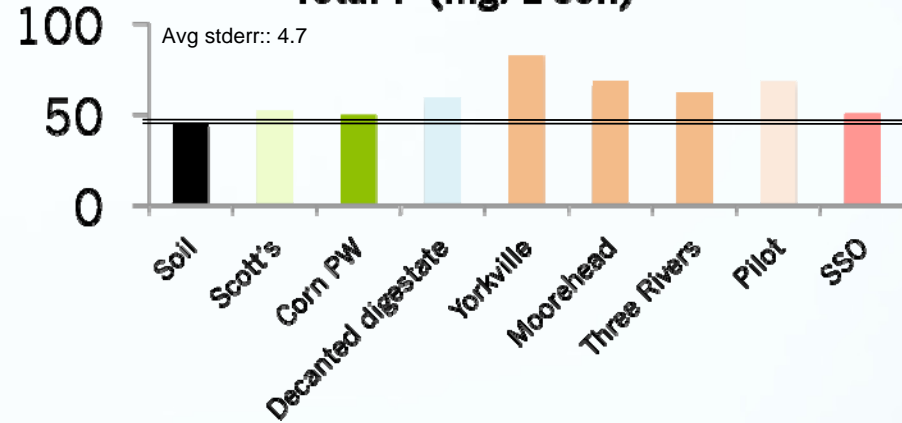
# Soil Residual N, P, K

## - cross treatment averages -

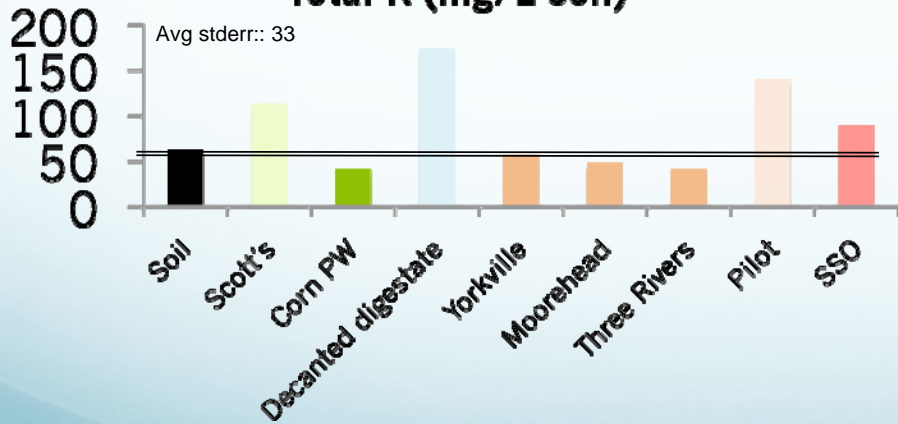
**Total N (mg/L soil)**



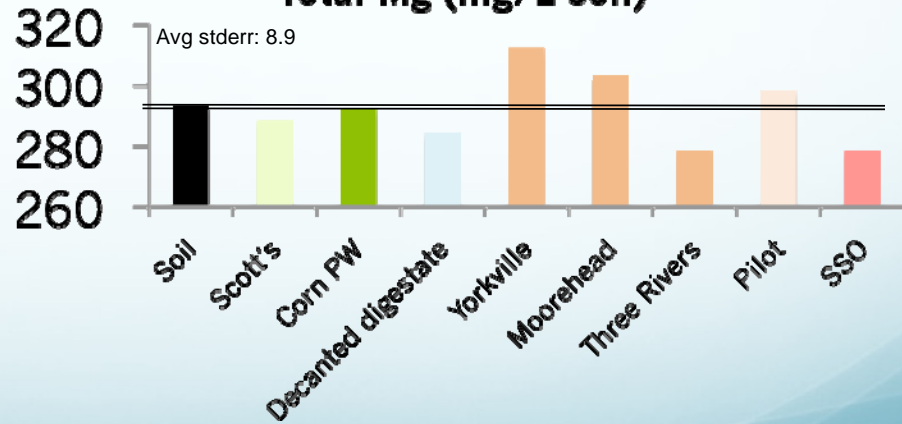
**Total P (mg/L soil)**



**Total K (mg/L soil)**



**Total Mg (mg/L soil)**

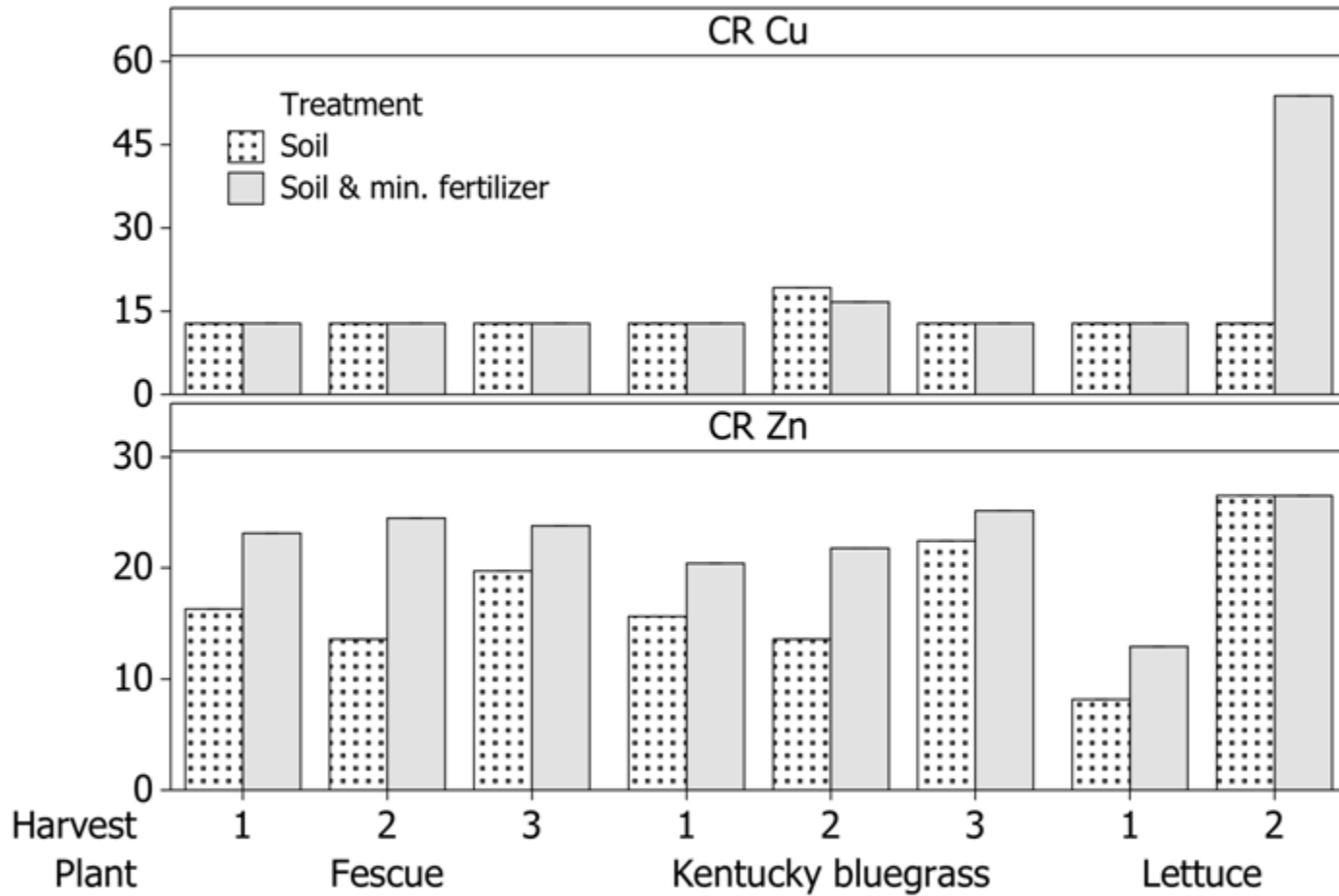


# Results

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  - Daily growth rate
  
- Biomass Quality?
  - Nutrient concentration?
  - **Metal uptake?**

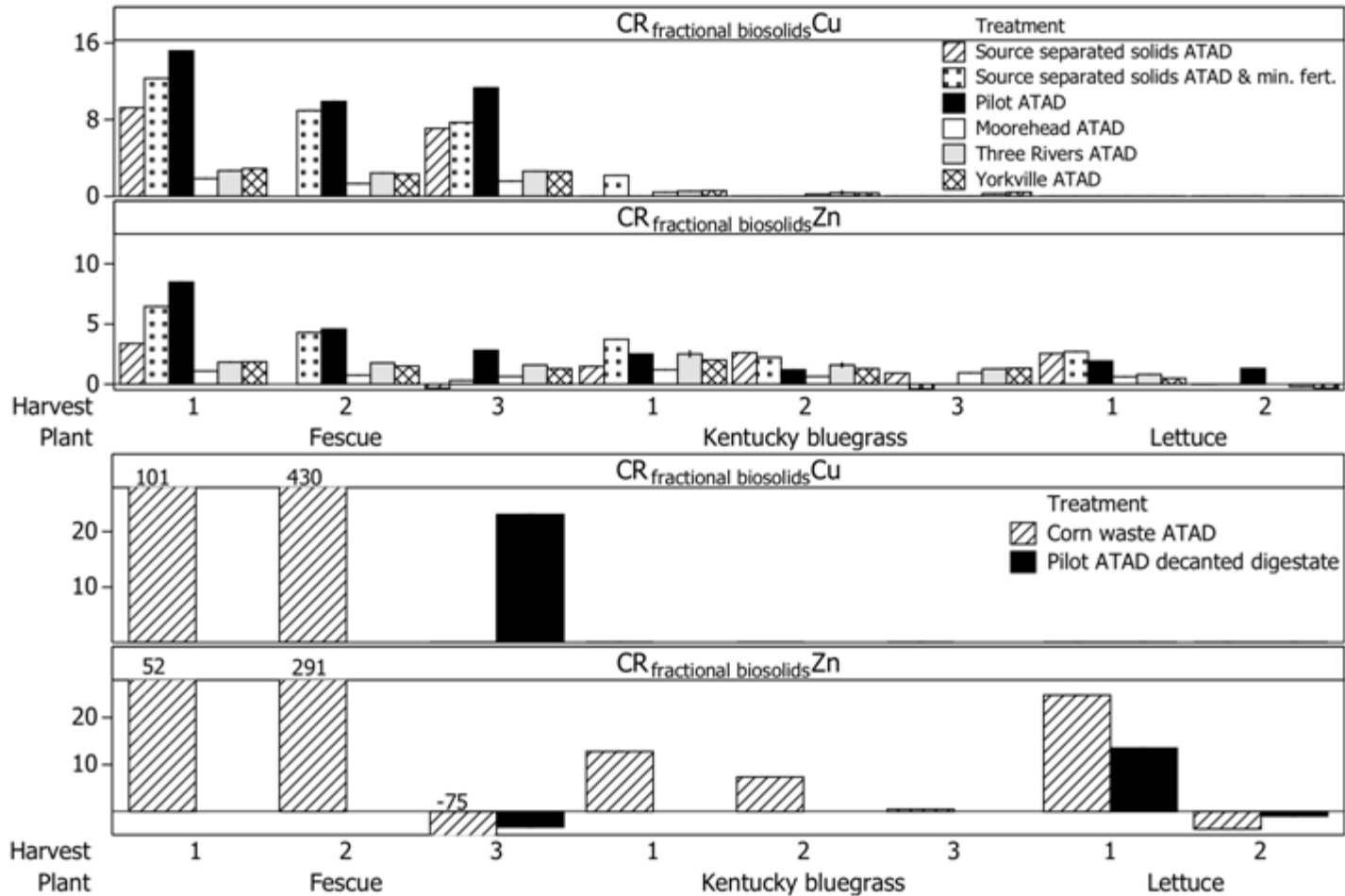
# Metal concentration ratios

(plant vs. soil conc.)

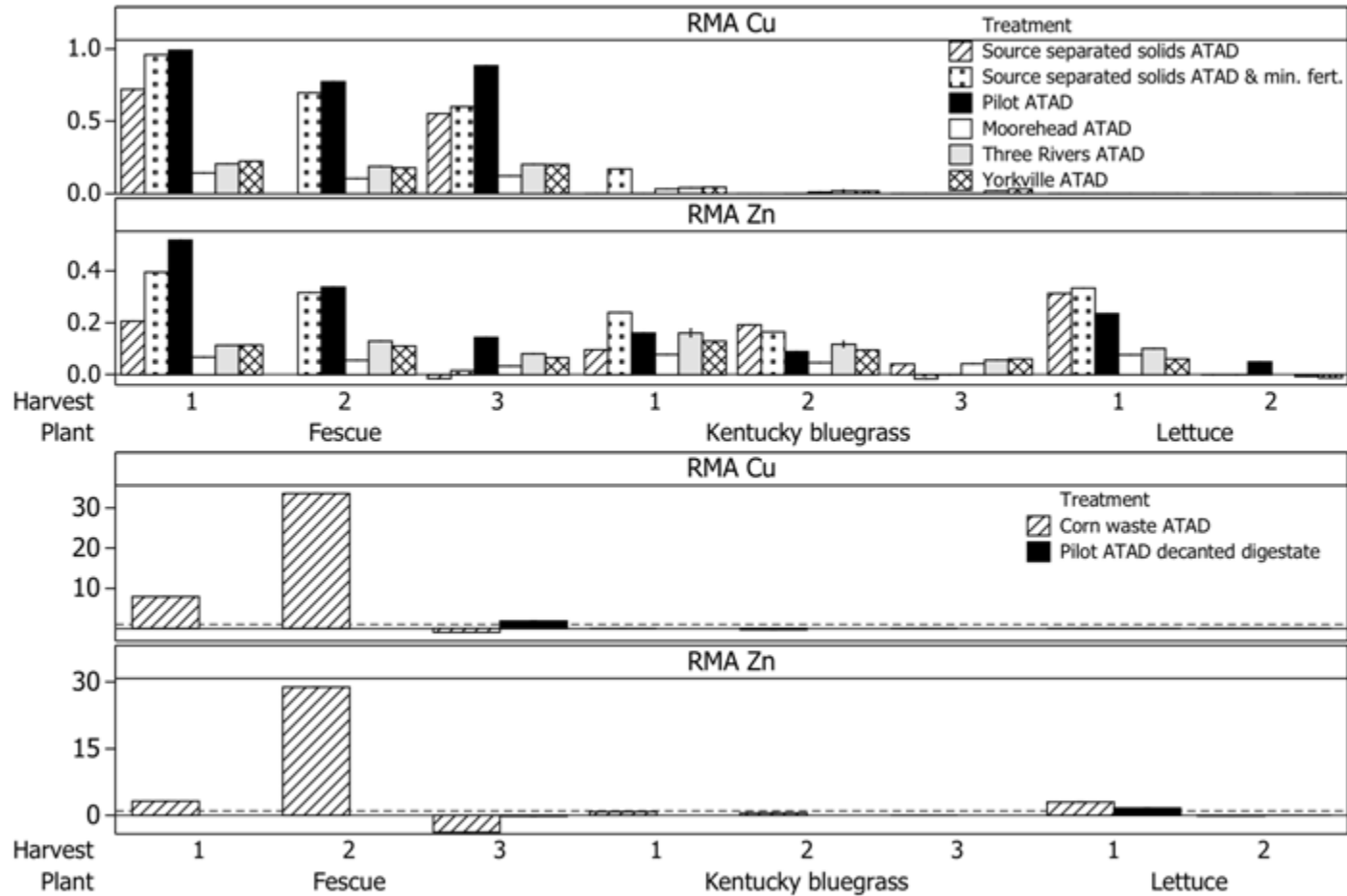


# Fractional metal concentration ratios

(plant vs. soil conc.)



# Relative metal availability



# Summary

- Variable nutrient availability kinetic (i.e. mineralization patterns) not clearly related to source type
- Yields of long vegetation period crops on ATAD products outperform fertilizers including commercial organic fertilizers
- Improved biomass quality (N, P, Mg conc. in tissues) after ATAD biosolids as expressed by N, P and Mg
- Lower metal availability for complex source biosolids; metal availability linked to mineralization rates