Valuing nitrogen release from soil organic matter

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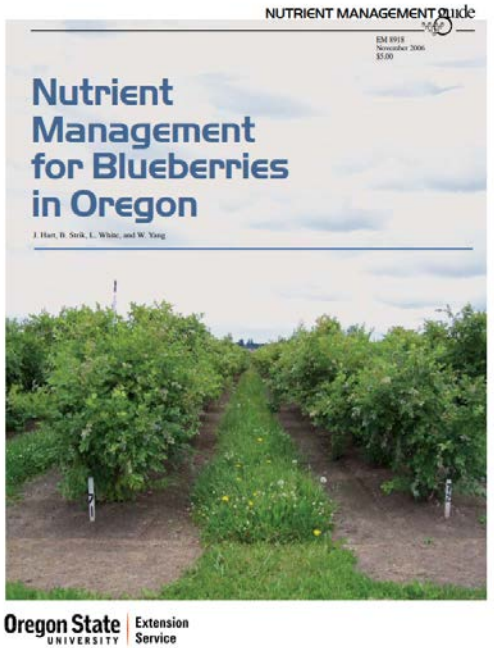
Blueberry N management guidelines

- Nitrogen fertility work in OR and BC has shown:
  - No difference in yield above 50 lbs. acre^{-1} — Strik and Buller, 2014 (Acta Hort.)
  - Yield increases up to 106 lbs. acre^{-1} — Ehret et al., 2014 (Can. J. Plant Sci.)
- OSU Nutrient Management Guide: 165 lbs. acre^{-1} — Hart et al., 2006

This work was mostly done on relatively low organic matter soils (4–5% OM)



How does soil organic matter factor in?

Location of peat soils in Skagit and Whatcom counties (CBI, 2019)

Expected nitrogen release

PAP-Accredited NAPT 2017

soiltest farm consultants, inc.

2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

Soil & Plant Program 2017 NAPT Participating Laboratory

Phosphorus	Bray	mg/kg	86
Potassium	NH4OAc	mg/kg	249
Boron	DTPA	mg/kg	0.54
Zinc	DTPA	mg/kg	5.4
Manganese	DTPA	mg/kg	2.4
Copper	DTPA	mg/kg	7.0
Iron	DTPA	mg/kg	70
Calcium	NH4OAc	meq/100g	7.6
Magnesium	NH4OAc	meq/100g	0.9
Sodium	NH4OAc	meq/100g	0.11
Lime Req		Tons/Acre	0.0
Buffer pH	SMP		6.6
Cation Exchange	CEC	meq/100g	12.1

pH 1:1		6.6	CaCl2 pH 6.2
E.C. 1:1	m.mhos/cm	0.20	
Est Sat Paste E.C.	m.mhos/cm	0.52	
Effervescence			

			Lbs/Acre
Ammonium - N	mg/kg	1.3	4
Organic Matter W.B.	%	3.0	ENR: 59

Depth inches	Nitrate-N mg/kg	Nitrate-N lbs/acre	Sulfate-S mg/kg	Moisture Inches
0 - 12	5.5	18	10	
Totals	**5.5**	**18**	**10**	

Sum of Tested N: 81 lbs/acre N

Expected nitrogen release

A & L WESTERN AGRICULTURAL LABORATORIES

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REPORT NUMBER: 19-086-078

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GROWER:

DATE OF REPORT: 04/01/19

SOIL ANALYSIS REPORT

PAGE: 1

SAMPLE ID	LAB NUMBER	Organic Matter		Phosphorus		Potassium	Magnesium	Calcium	Sodium	pH		Hydrogen	Cation Exchange Capacity	PERCENT CATION SATURATION (COMPUTED)				
		% Rating	ENR lbs/A	P1 (Weak Bray) ppm	$NaHCO_3$-P (Olsen Method) ppm	K ppm	Mg ppm	Ca ppm	Na ppm	Soil pH	Buffer Index	H meq/100g	C.E.C. meq/100g	K %	Mg %	Ca %	H %	Na %
B4N	58766	2.4M	79	61VH	40**	147H	108M	884M	36L	6.1	7.2	0.9	6.8	5.6	13.1	65.1	14.0	2.3
C4S	58767	2.4M	77	80VH	52H	180H	97M	1056H	23L	6.3	6.9	0.8	7.4	6.2	10.7	71.2	10.5	1.4
D5	58768	2.6M	83	76VH	42H	141M	107M	1120H	20L	6.4	7.0	0.7	7.6	4.7	11.6	73.5	9.0	1.1
D4	58769	2.3M	77	66VH	41H	163H	103M	1111H	26L	6.5	7.0	0.6	7.5	5.6	11.3	74.1	7.5	1.5
E4E	58770	2.8M	86	83VH	48VH	134M	119M	1240VH	26L	6.7	7.1	0.4	8.0	4.3	12.2	77.6	4.5	1.4

Research questions and hypotheses

- **Question 1:** What is the contribution of soil organic matter (SOM) to plant available nitrogen across a range of SOM?
  - **Hypothesis 1b:** Nitrogen release from soils can be predicted by soil organic matter
  - **Hypothesis 1a:** Equations to predict nitrogen release developed in low SOM soils don't work well for high SOM soils

- **Question 2:** Does the nitrogen fertilizer requirement for optimal yield differ predictably based on SOM?
  - **Hypothesis 2:** Higher nitrogen rates will be required to maximize yield in lower SOM soils

Methods

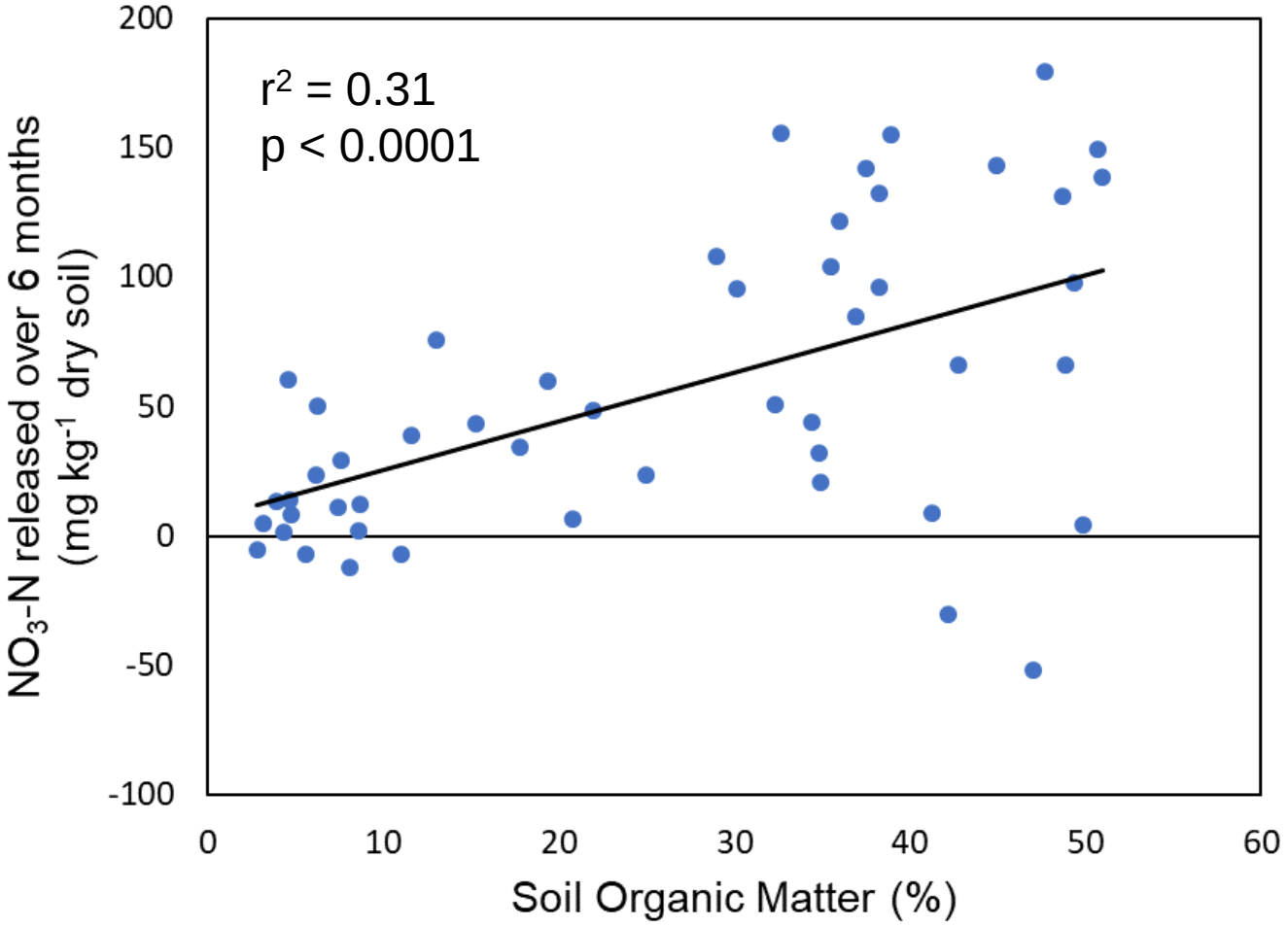
- Laboratory incubation: Determine N release from soils
  - Collected soil samples from 5 locations each in 10 fields with SOM contents ranging from 3–53%
  - Incubated soil samples at soil temperatures representative of those for April – September
  - Measured plant available nitrogen (in progress)

Methods

- Field experiment: How do optimal N rates vary with SOM?
  - Applied 20, 50, or 80 lbs. acre^{-1} at 4 field sites with soils ranging from 5–44% SOM
  - Measured fruit yield, fruit size, firmness, leaf tissue N, and vegetative growth
  - Fruit quality (ºBrix, pH), soil nitrate and ammonium, and cold-hardiness measurements in progress

Preliminary results: N mineralization

Lab Incubation

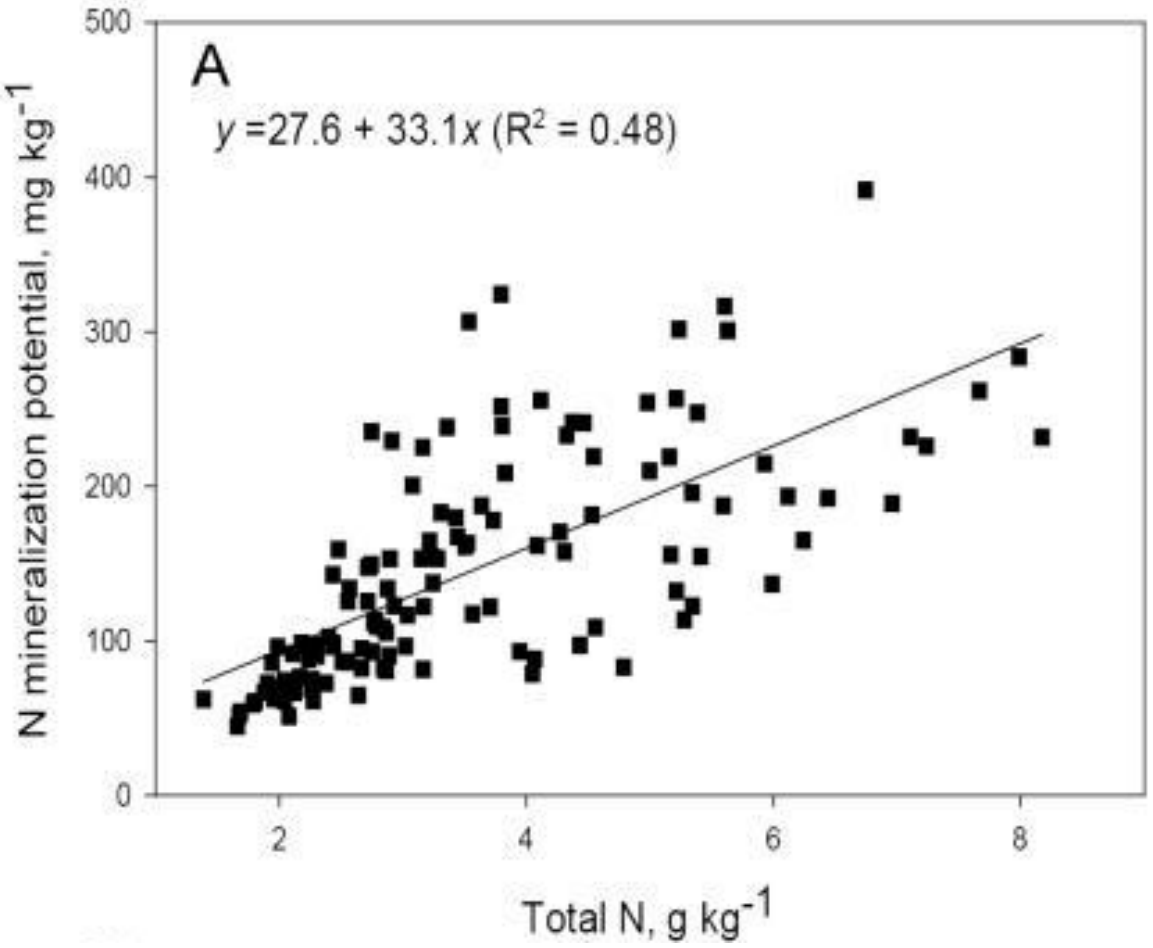


Significant relationship between NO_3 mineralized and SOM

Not strong enough to be useful (yet) to adjust N rates

Preliminary results: N mineralization

Lab Incubation

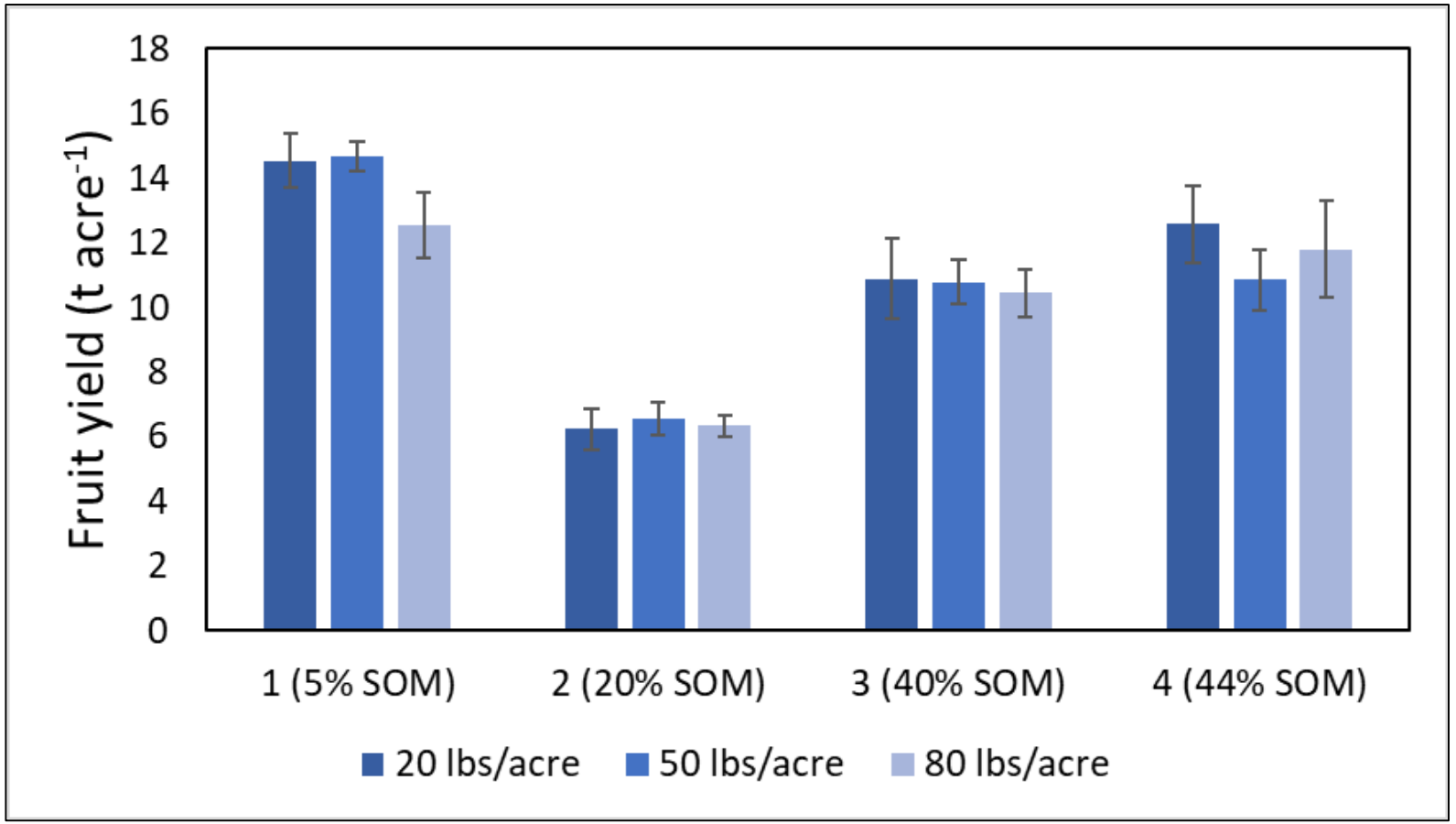


Results similar to other studies …
even those that exclude peat soils

Curtin et al. 2017 (SSSAJ)

Preliminary results: Fruit yield

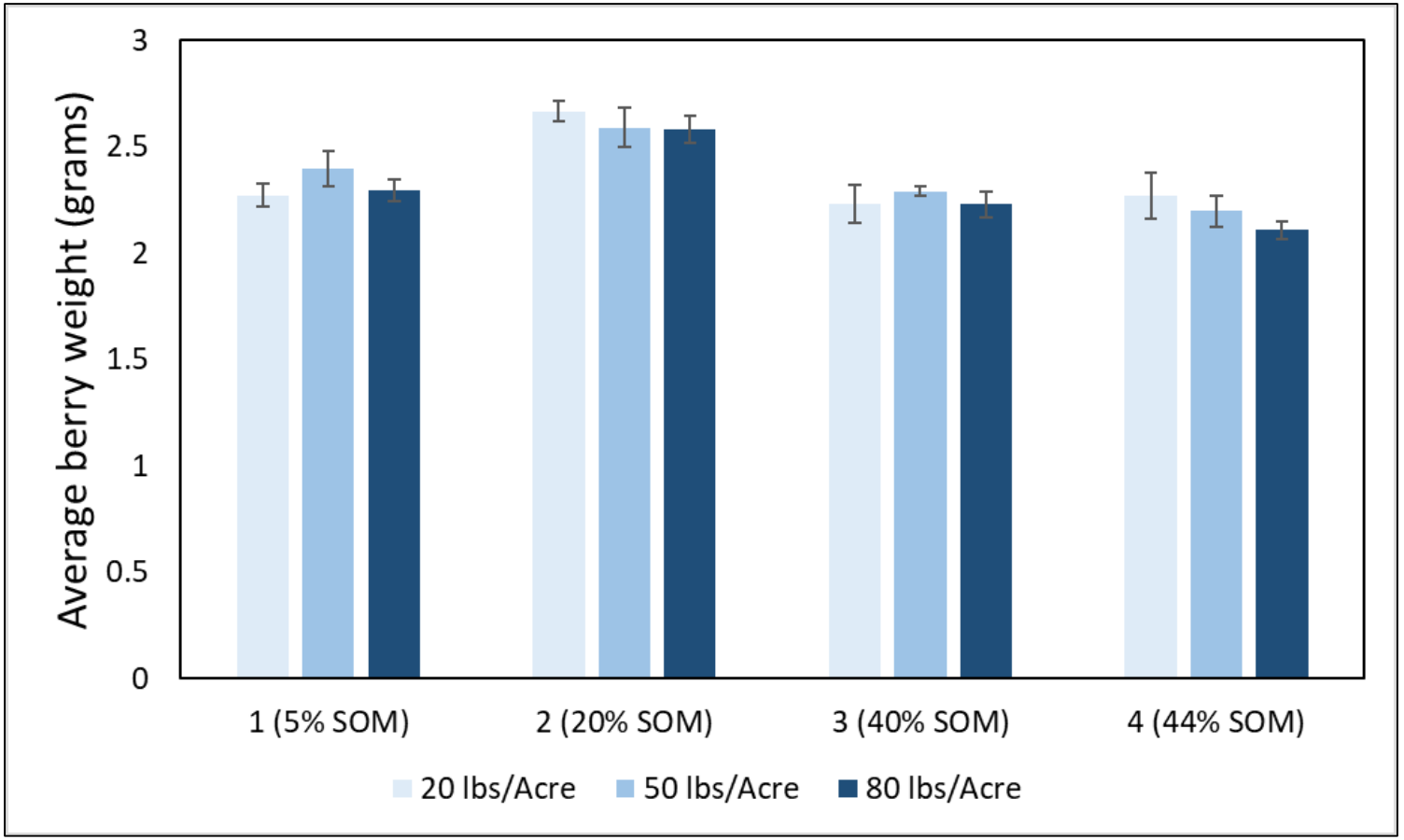
Field Experiment



No clear differences after one year

Preliminary results: Fruit size

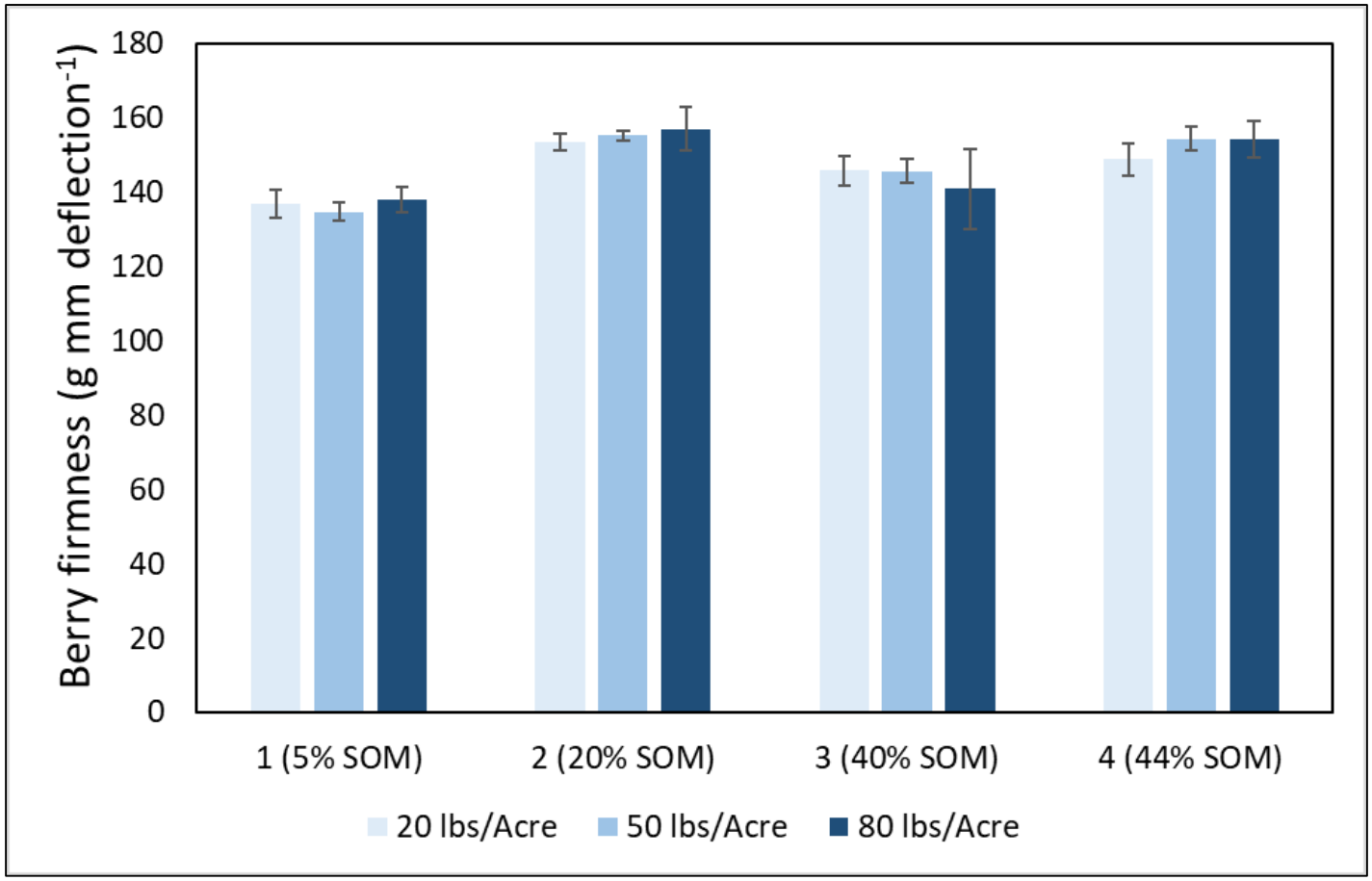
Field Experiment



No clear differences after one year

Preliminary results: Fruit firmness

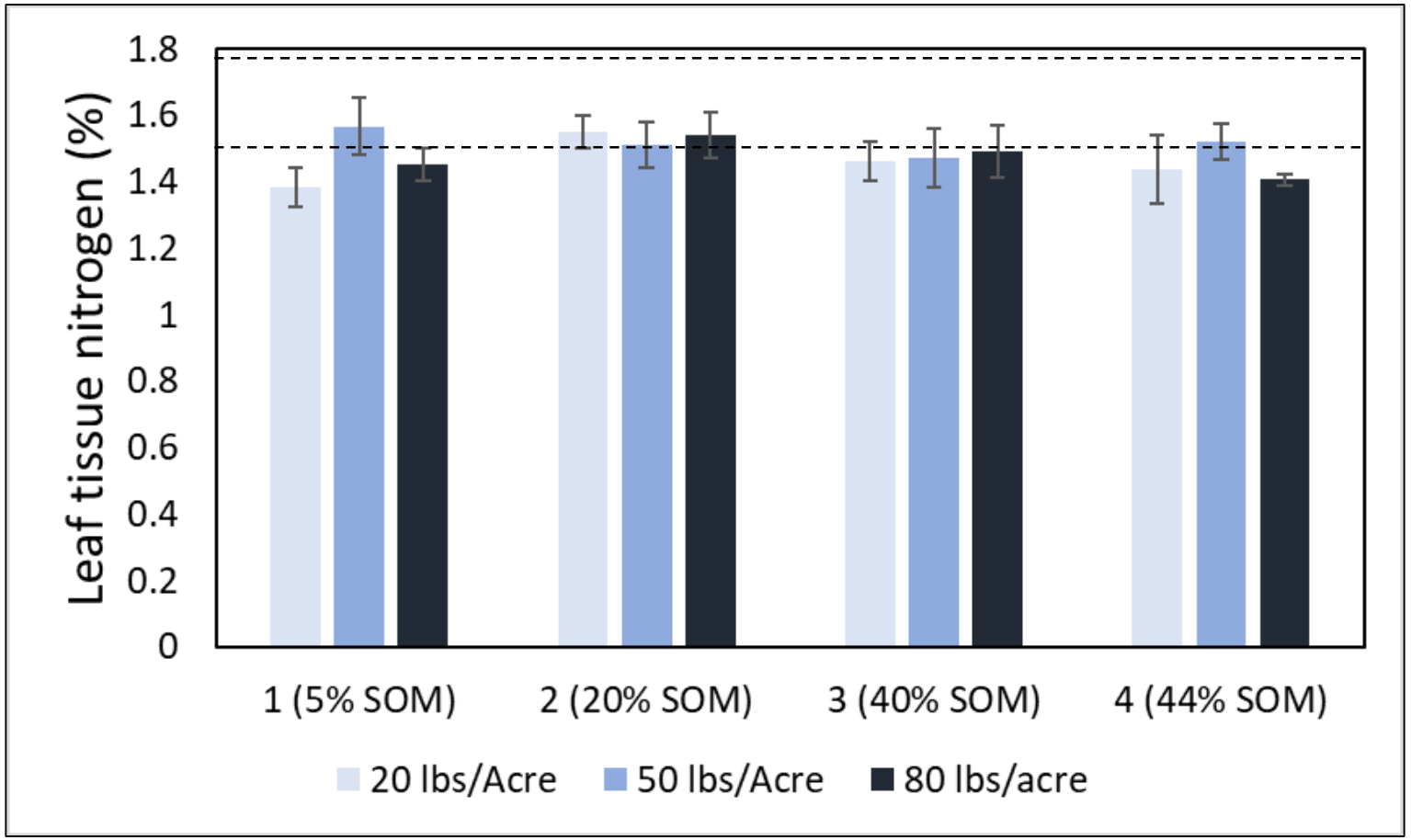
Field Experiment



No clear differences after one year

Preliminary results: Leaf tissue nitrogen

Field Experiment

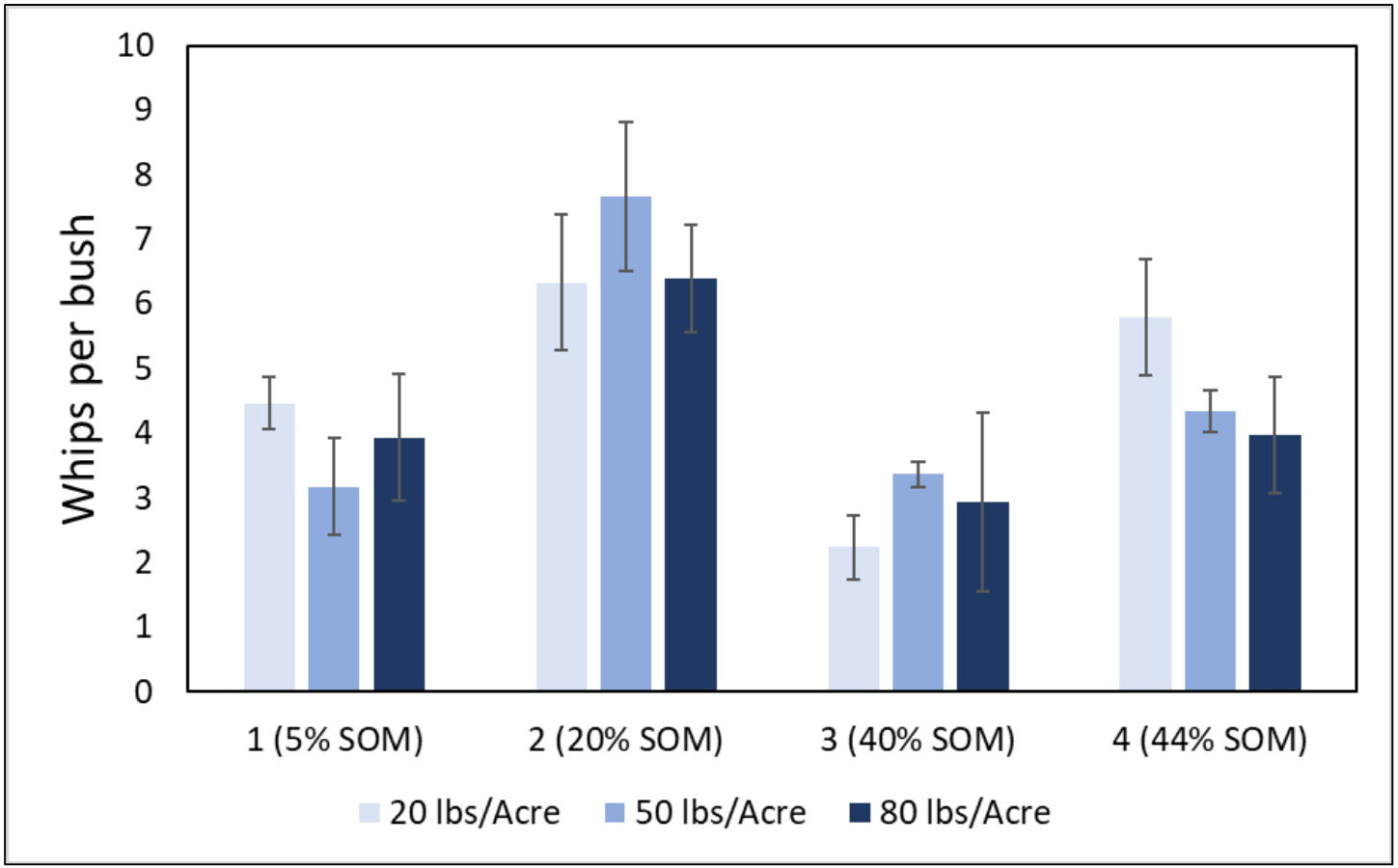


Late July to mid-August is recommended for sampling (leaves sampled on August 16th)

Hart et al. 2006, Strik and Vance 2015

Preliminary results: Vegetative growth

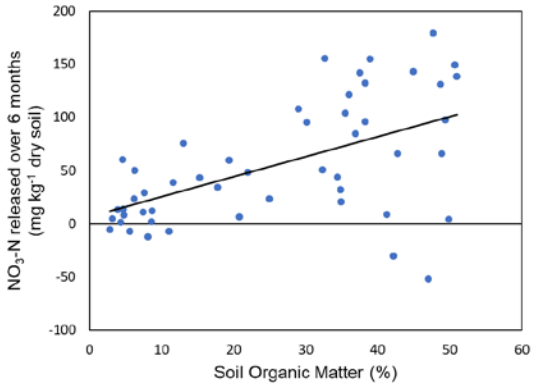
Field Experiment



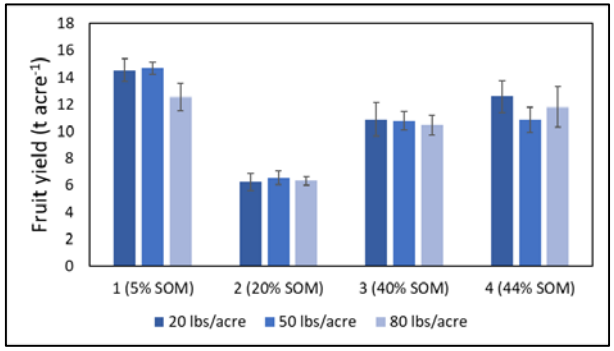
No clear differences after one year

Preliminary conclusions and future steps

- Nitrogen release from soil increases with increasing soil organic matter, but the relationship is too weak to be useful
  - Next step: Evaluate other easily measured indicators (mineralizable C, hot-water extractable organic N)



- No differences in fruit yield or quality among N application rates at any site
  - Expected for first couple years
  - Next step: Continue field experiment for at least 3 years



Acknowledgements

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Washington Blueberry Commission

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Questions?