

# Nitrogen Release from Cover Crops & Supplemental Fertilizers

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**Application rate**



**Measure biomass**

**Guaranteed analysis**



**Lab analysis**

**Nitrogen mineralization**



**Models and monitoring**

**Soil health**



**Monitoring**



# ESTIMATING PLANT-AVAILABLE NITROGEN RELEASE FROM COVER CROPS

*D.M. Sullivan and N.D. Andrews*



## HIGHLIGHTS

- Legume cover crops provide up to 100 lb PAN/a. To maximize PAN contribution from legumes, kill the cover crop at bud stage (early May).

3080 downloads, about 200/month

- Legume/cereal cover crop mixtures provide a wide range of PAN contributions, depending on legume content. When cover crop dry matter is 75 percent from cereals + 25 percent from legumes, PAN is usually near zero.
- A laboratory analysis for cover crop total N as a percentage in dry matter (DM) is a good predictor of a cover crop's capacity to release PAN for the summer crop.



# Nutrient Management Plan (590) for Organic Systems

## Western State Implementation Guide

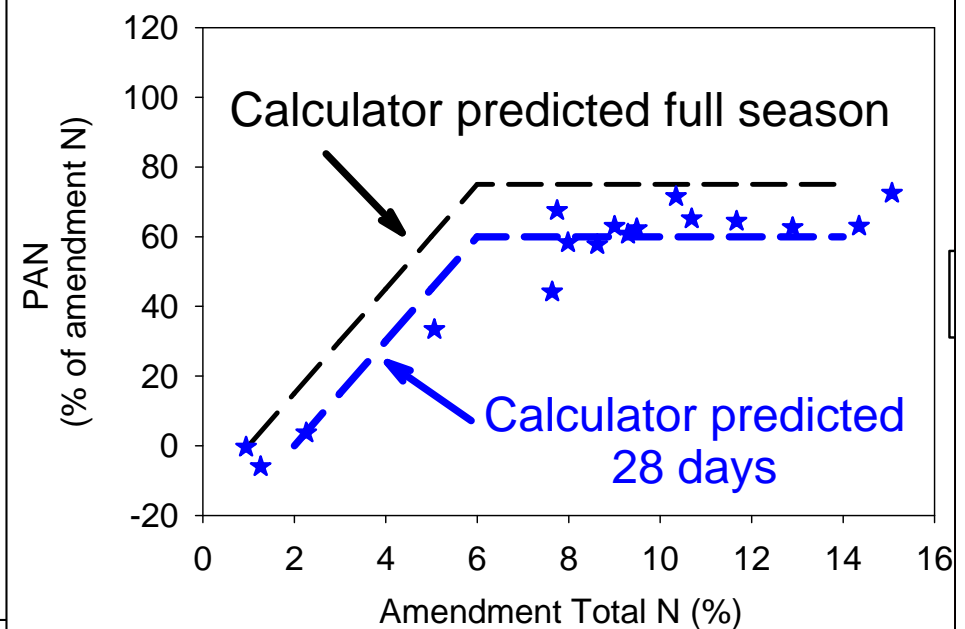
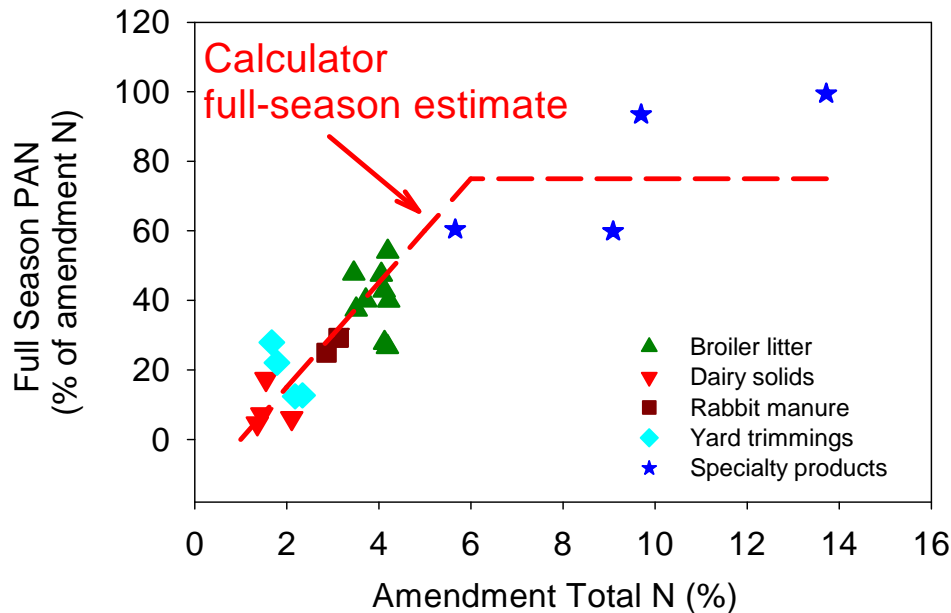


January 2014

National Center for  
Appropriate Technology (NCAT)  
[www.ncat.org](http://www.ncat.org)

Oregon Tilth  
[www.tilth.org](http://www.tilth.org)

# Fertilizer N Mineralization

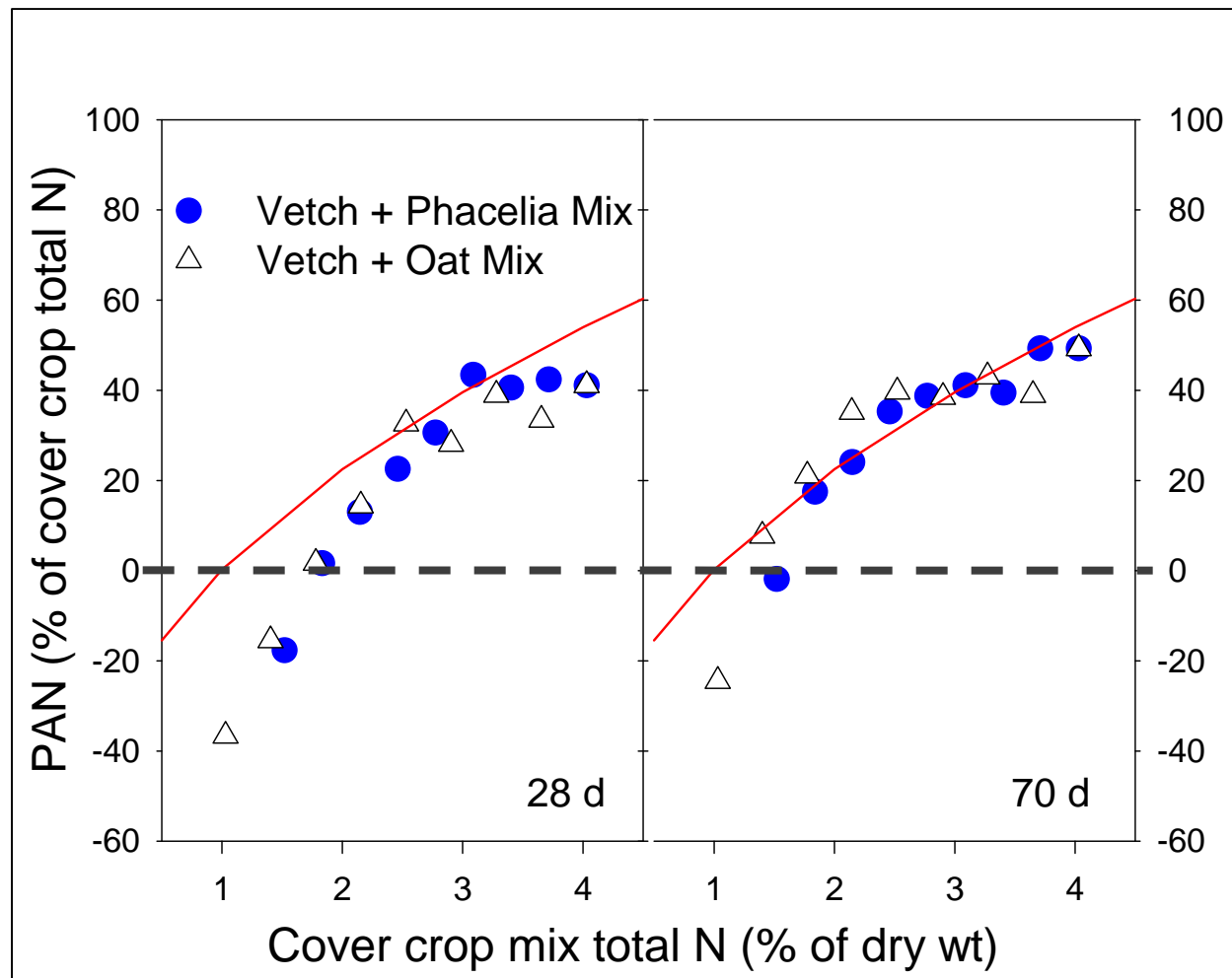


Gale et al. (2006). J Env Qual 35:2321-2332

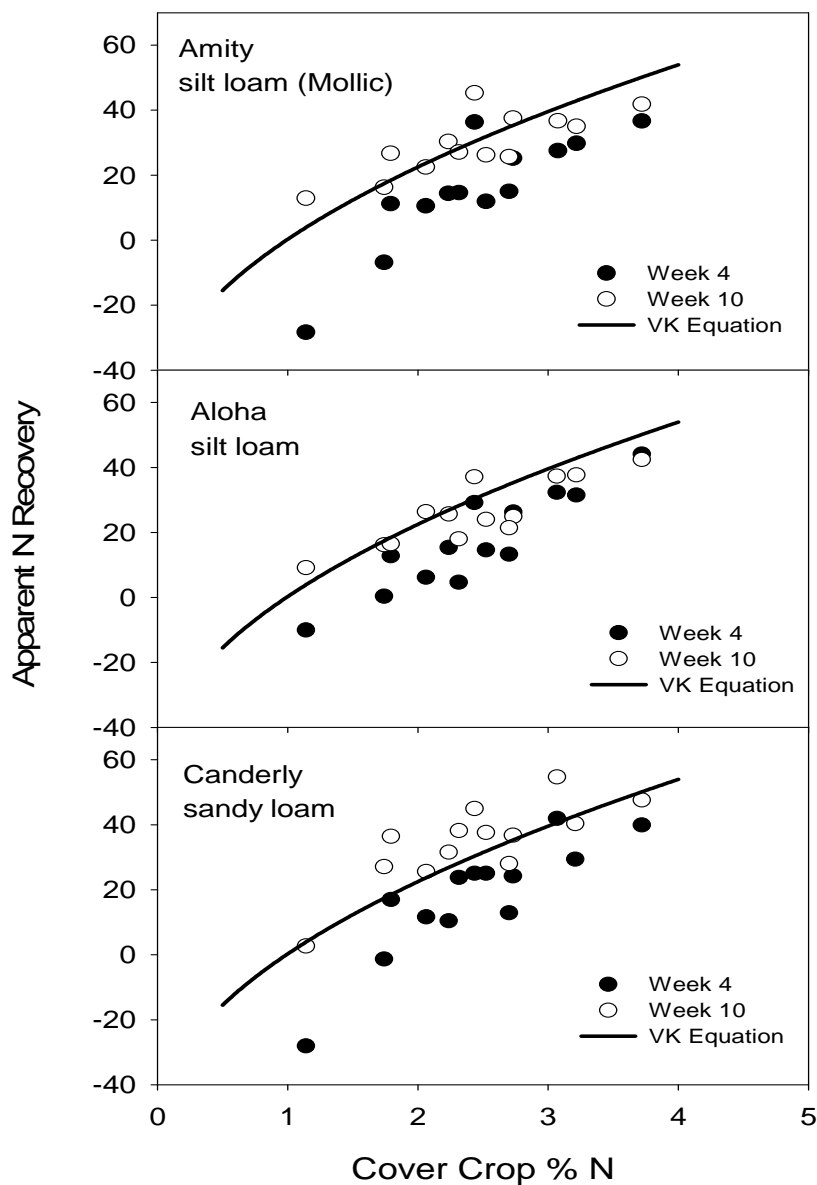
## Specialty Products include

Fish meals	Alfalfa meal	Fish bone meal
Soybean meal	Blood meal	Meat & bone meal
Corn gluten meal	Kelp meal	Bone meal
Feather meal	Sol. Seaweed Extract	Seabird guano

# Cover Crop N Mineralization



Equation: Vigil and Kissel (1991) SSSAJ 55:757



## Cover Crops tested at mid vegetative and flowering GS

Oats

Cereal Rye

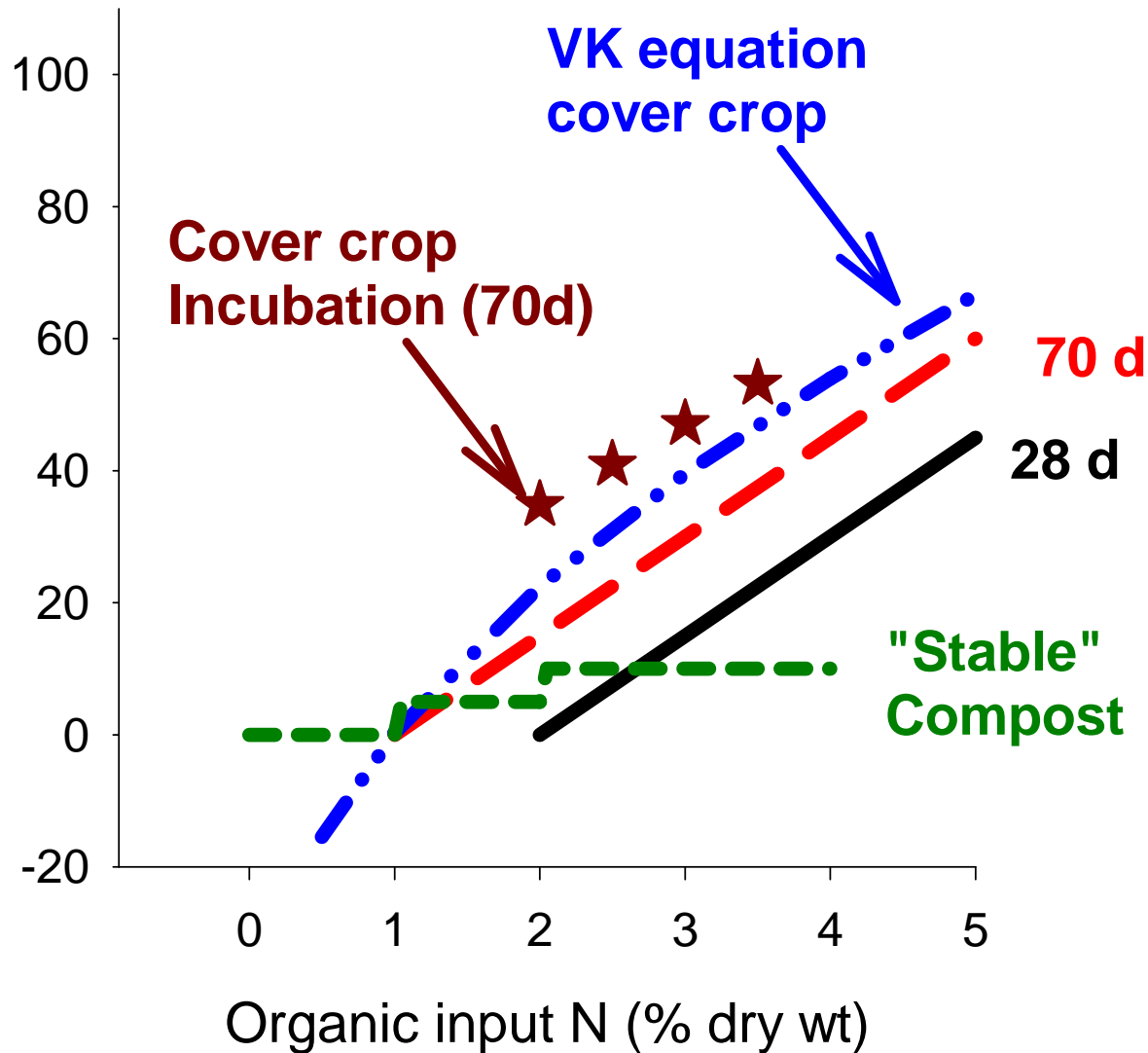
Phacelia

Common Vetch

Crimson Clover

# OSU Calculator Equations

PAN estimate  
(% of fertilizer N)













# Handling Samples



1. Mix, remove soil and tear apart large plants.
2. Weigh field sample
3. Select  $\approx 1$  lb (fresh wt.) subsample
4. Package to avoid wilting or molding
5. Send sub-sample to lab that will:
  - a. Dry and grind full sample
  - b. Report total %N and % dry matter



# smallfarms.oregonstate.edu/calculator

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## Organic Fertilizer and Cover Crop Calculator

This free online tool compares the nutrient value and cost of cover crops, organic and synthetic fertilizers and compost. Use this Excel Calculator to develop well balanced and cost effective nutrient management programs for your farm. Developed by Nick Andrews, Dan Sullivan, Jim Julian and Kristin Pool.

### Download the Calculator

- ▶ [Quick Guide & Records Sheet](#) - the quick guide illustrates the main steps used to use the calculator, the records sheet identifies all the information needed to use the calculator.
- ▶ [Cover Crop Sampling Instructions](#) - these instructions explain how to sample cover crops in your field.
- ▶ [Estimating plant available nitrogen release from cover crops \(PNW 636\)](#) - this PNW Extension Publication introduces a shortcut method for estimating cover crop plant-available nitrogen (PAN) release, describes the science behind cover crop PAN estimates, and uses on-farm case studies to address other frequently asked questions about cover crop PAN.
- ▶ [Research Background](#) - these papers and eOrganic webinar provide more information about the research supporting the PAN estimates provided in the calculator.



# Cover Crop Analysis & PAN

	A	B	C	D	E	F	G	H	I	J
1	<b>ENTER YOUR COVER CROP INFORMATION FROM THE FIELD AND THE LAB</b>									
2	<i>Enter your information in yellow cells. Results are in green cells.</i>									
3		Area sampled (ft <sup>2</sup> )	Fraction of acre sampled	Fresh weight of field sample (x.x lb)	% N from lab (x.x%)	% dry matter from lab (xx.x%)	fresh weight (lbs/A)	Total dry weight (lb/A)	Total N (lb/A)	PAN (lb/A)
4	<b>COVER CROPS</b>									
5	Common vetch	16	0.000367	8.0	3.5	22.0	21780	4792	168	79
6	Rye vetch	16	0.000367	8.0	2.5	22.0	21780	4792	120	38
7	Common vetch (seed only)	16	0.000367	8.0	3.5	22.0	21780	4792	168	79
8	Comments to: <a href="mailto:nick.andrews@oregonstate.edu">nick.andrews@oregonstate.edu</a>									

[Fertilizer Analysis](#) / 
 [Cover Crop Analysis](#) / 
 [Your Costs](#) / 
 [Cost Comparisons](#) / 
 [Nutrients Provided](#)





# Cost Comparisons

	A	B	C	D	E	F	G	
1	COMPARE THE COSTS OF DIFFERENT FERTILIZERS, COMPO							
2	Enter your information in yellow cells. Results are in green cells							
3	MATERIAL							
4			Product price (\$/lb)	Cost (\$/A)	Total N (\$/lb)	Total dry matter (\$/lb)	28-day PAN (\$/lb)	full-season PAN (\$/lb)
5	ORGANIC FERTILIZERS							
6	Blood meal (12.5-1.5-0.6)		\$0.65	\$0.00	5.20	0.71	8.67	6.93
7	Bone meal (3-20-0.5)		\$0.50	\$0.00	16.67	0.53	95.96	51.49
8	Chicken manure - dried (3.5-2-2)		\$0.12	\$0.00	3.43	0.14	10.79	7.33
9	Feather meal (granulated) (13-0-0)		\$0.55	\$0.00	4.23	0.57	7.05	5.64
10	Fish meal (10-6-2)		\$0.75	\$0.00	7.50	0.82	12.50	10.00
11	Meat and bone meal (7-8-0)		\$0.50	\$0.00	7.14	0.54	11.90	9.52
12	Muriate of potash (KCl) (0-0-60)		\$0.60	\$0.00	0.00	0.60	0.00	0.00
13	Soy meal (6.5-1.5-2.4)		\$0.55	\$0.00	8.46	0.61	14.10	11.28
14	Sulfate of potash (0-0-50)		\$0.60	\$0.00	0.00	0.61	0.00	0.00
15	Sulfate of potash magnesia (0-0-22)		\$0.35	\$0.00	0.00	0.35	0.00	0.00
16	New fertilizer (5-3-3)		\$0.25	\$0.00	5.00	0.26	10.22	7.82
17	0			\$0.00	0.00	0.00	0.00	0.00
18	SYNTHETIC FERTILIZERS							
19	Triple super phosphate (0-40-0)			\$0.00	0.00	N/A	0.00	0.00
20	Urea (46-0-0)		\$0.40	\$0.00	0.87	N/A	0.87	0.87
21	0			\$0.00	0.00	N/A	0.00	0.00
22	0			\$0.00	0.00	N/A	0.00	0.00
23	Fertilizer application cost			\$2.69				
24	Total cost of fertilizer and application			\$2.69				
32	COVER CROPS							70 day PAN
33	Common vetch			\$105.71	0.63	0.02		1.34
34	Rye vetch			\$107.71	0.90	0.02		2.86
35	Common vetch (seed only)			\$51.00	0.30	0.01		0.65
36								
Fertilizer Analysis / Cover Crop Analysis / Your Costs / Cost Comparisons / Nutrients Provided								



# Nutrients Provided

	A	B	C	D	E	F	G	H
1	<b>COMPARE THE NUTRIENT VALUE OF DIFFERENT FERTILIZERS, CO.</b>							
2	<b>Enter your information in yellow cells. Results are in green cells.</b>							
3	<b>MATERIAL</b>	<b>APP'N RATE</b>	<b>POUNDS OF EACH</b>					
4	 	App'n rate "as-is" basis (lb/ac)	Total N applied (lb/ac)	Total dry matter applied (lb/ac)	Estimated PAN after 28 days (lb/ac)	Estimated PAN after full season (lb/ac)	P <sub>2</sub> O <sub>5</sub> (lb/ac)	K <sub>2</sub> O (lb/ac)
5	<b>ORGANIC FERTILIZERS</b>							
6	Blood meal (12.5-1.5-0.6)		0	0	0	0	0	0
7	Bone meal (3-20-0.5)		0	0	0	0	0	0
8	Chicken manure - dried (3.5-2-2)	2500	88	2125	28	41	50	50
9	Feather meal (granulated) (13-0-0)		0	0	0	0	0	0
10	Fish meal (10-6-2)		0	0	0	0	0	0
11	Meat and bone meal (7-8-0)		0	0	0	0	0	0
12	Muriate of potash (KCl) (0-0-60)		0	0	0	0	0	0
13	Soy meal (6.5-1.5-2.4)		0	0	0	0	0	0
14	Sulfate of potash (0-0-50)		0	0	0	0	0	0
15	Sulfate of potash magnesia (0-0-22)		0	0	0	0	0	0
16	New fertilizer (5-3-3)		0	0	0	0	0	0
17	0		0	0	0	0	0	0
27	<b>COVER CROP FIELD</b>							
28	Common vetch	21780	168	4792		79		
29								
30	<b>Total applied</b>		255	6917	28	120	50	50
31								
32	<b>Fertilizer recommendation</b>					100	50	50
33								
34	<b>Balance</b>		255	6917	28	20	0	0
35								

# Idaho



Amber Moore UI  
Irrigated farms in  
semi-arid regions

Location-Cover Crop	<input type="text"/>	
Area Sampled	<input type="text" value="0"/>	Sq. Ft.
Fraction of Acre Sampled	<input type="text" value="0.000000"/>	%
Fresh Weight of Field Sample	<input type="text" value="0.00"/>	lb
% Nitrogen From Lab	<input type="text" value="0"/>	%
% Dry Matter From Lab	<input type="text" value="0"/>	%
Fresh Weight	<input type="text" value="NaN"/>	lb/Acre
Total Dry Weight	<input type="text" value="NaN"/>	lb/Acre
Total Nitrogen	<input type="text" value="NaN"/>	lb N/Acre
Plant Available Nitrogen (PAN)	<input type="text" value="NaN"/>	lb N/Acre

[extension.uidaho.edu/nutrient/CC\\_Calculator/CC\\_page.htm](http://extension.uidaho.edu/nutrient/CC_Calculator/CC_page.htm)

# Hawaii

- Ted Radovich and Archana Pant, UH
- Collecting data from low and high elevation tropical climates
- Planning to incorporate models into a calculator for HI





# David Brown: Mustard Seed Farms

## 80 ac organic fresh vegetables



“This year I reduced my fertilizer bill about 60% by working with Nick and Dan and still got great yields”

“This project helps me evaluate my cover cropping program”



# Brian & Jason Montecucco

## 600 ac (15 COG) fresh vegetables

Jason Montecucco

Dan Sullivan

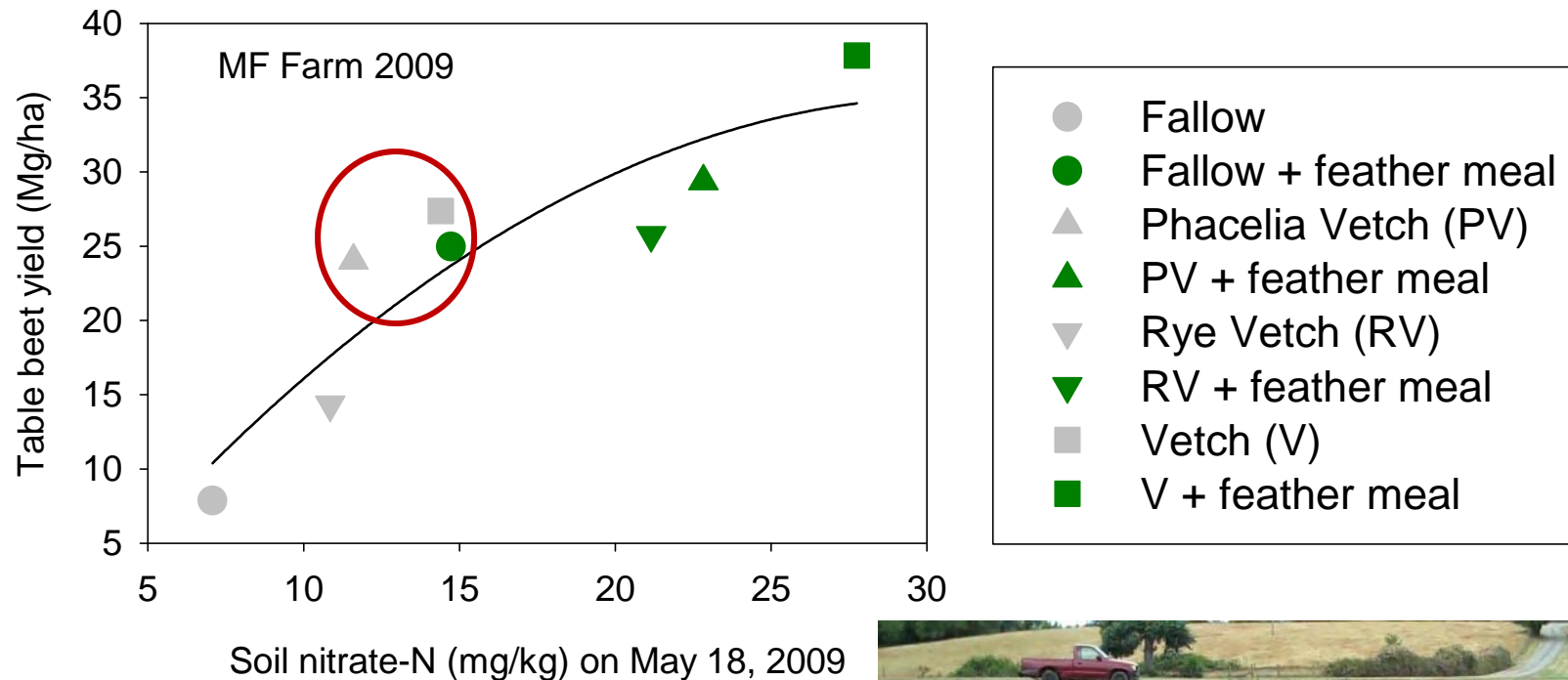


“We have areas on our farm that need organic matter to rebuild the soil from years of intensive farming.”

“We want to use cover crops to prevent nutrients from leaching and capture nutrients essential to plant growth.”



# Soil nitrate-N vs. table beet yield





# Sauvie Island Organics

## 20 ac organic fresh vegetables

### ~400 CSA members, 25 restaurants



Kristin Pool

Scott Latham

"We didn't give our cover crops enough N-credit. The Calculator showed us we were getting twice the N we thought. Now, no N is applied to our head lettuce, we get the same yield and save \$275/ac on fertilizer"

"We invest our savings in additional N to our broccoli field and get higher broccoli yields."

# Organic Fertilizer and Cover Crop Calculator Impacts



- >2,400 registered users from every US state and 47 countries
  - 36% farmers
  - 39% other ag professionals
  - 17% students
  - 7% gardeners
- Estimated \$2 million annual economic impact





# Future work?

## Outreach and Extension

- Conferences and workshops
- Improve Extension & NRCS technical information about cover crops and nutrient management
- Improve cover crop establishment in marginal conditions (i.e. relay seeding, compost applied with seed, etc.)
- Cover crop variety trials
- Increase communication between ARS and Extension & farmers

## Research

- Degree-day sensitive N-mineralization models
- Regional predictions of cover crop N-mineralization
- Cover crop breeding

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