

# Field view of manure N management in CA forage production: A hypothetical crop N budget

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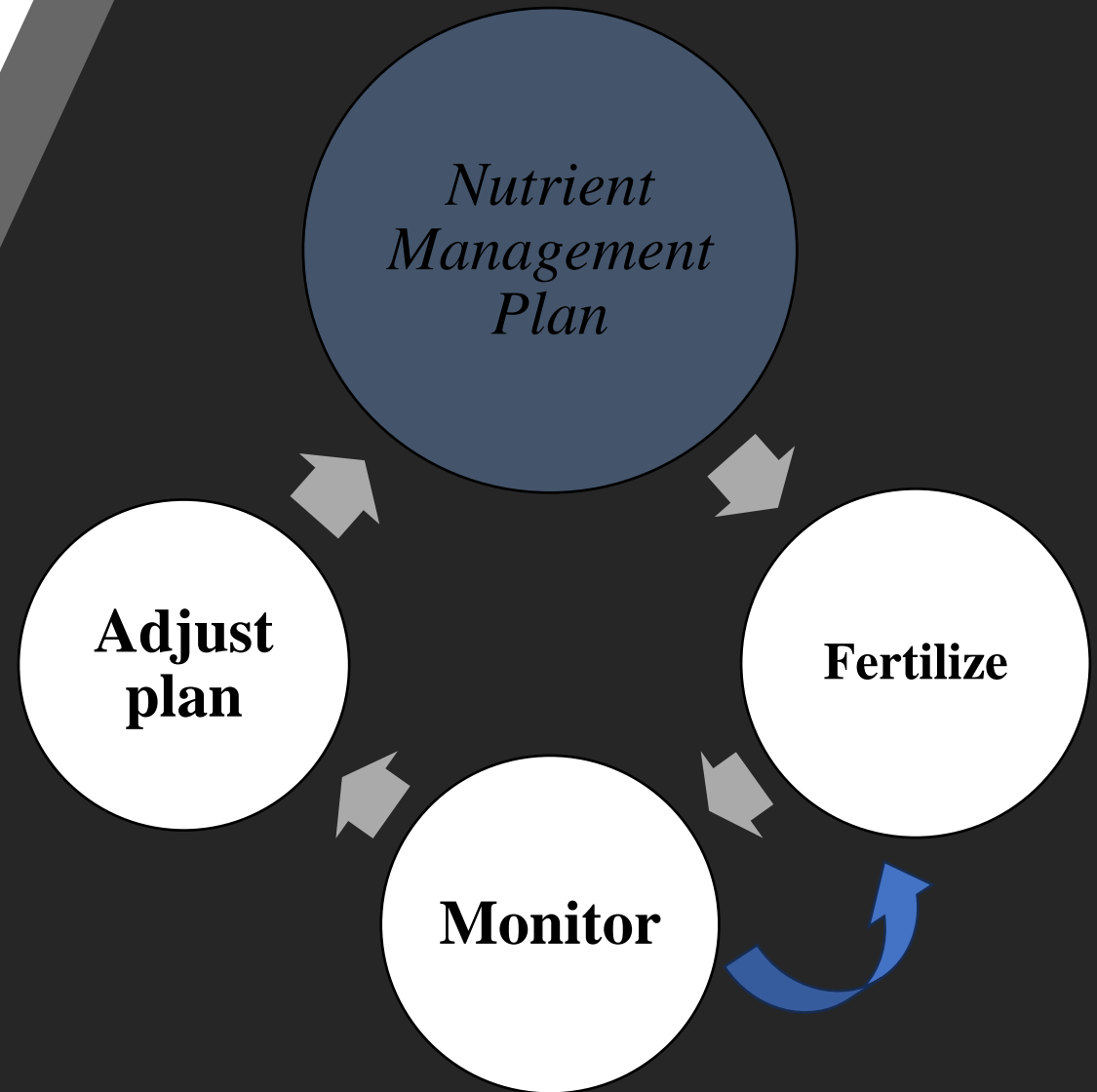
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UC Golden State Dairy Management Conference

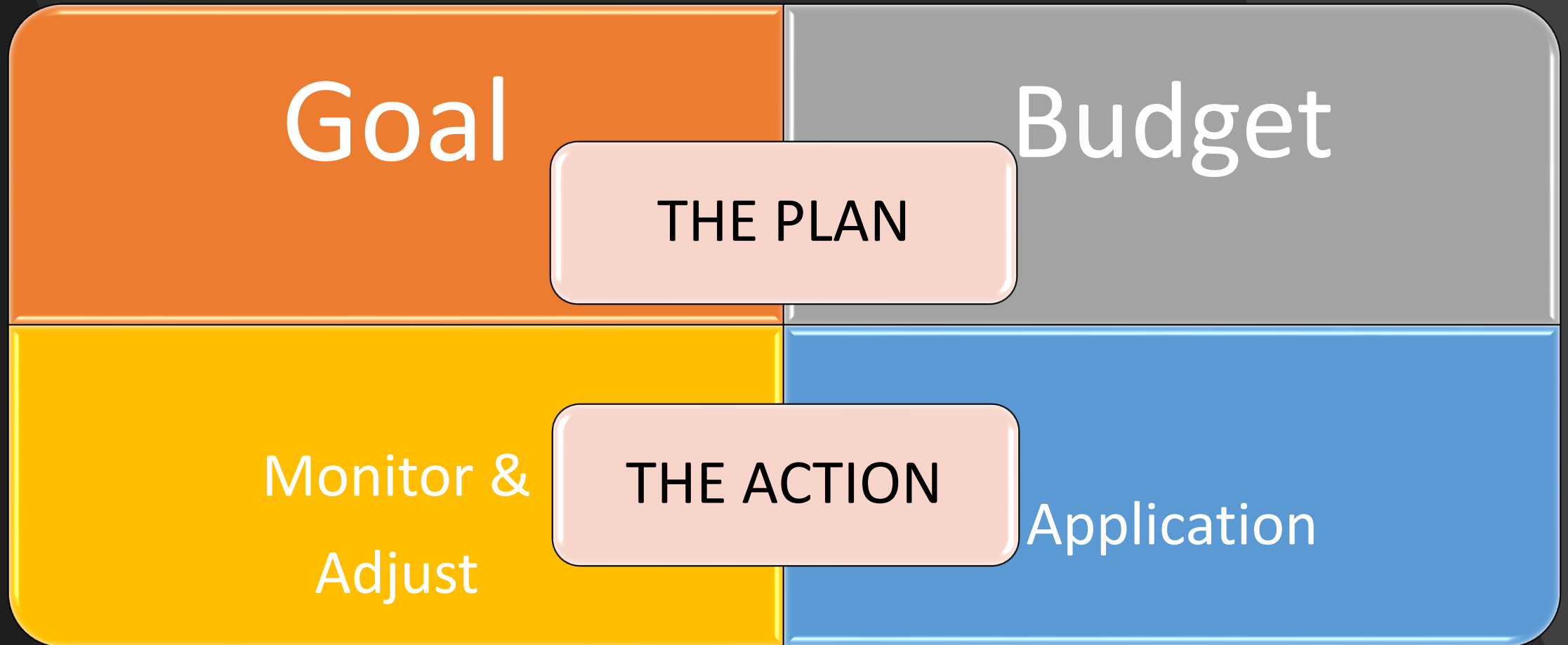
Monday, November 18, 2024

Modesto, CA

# Planned Nitrogen Management Concept

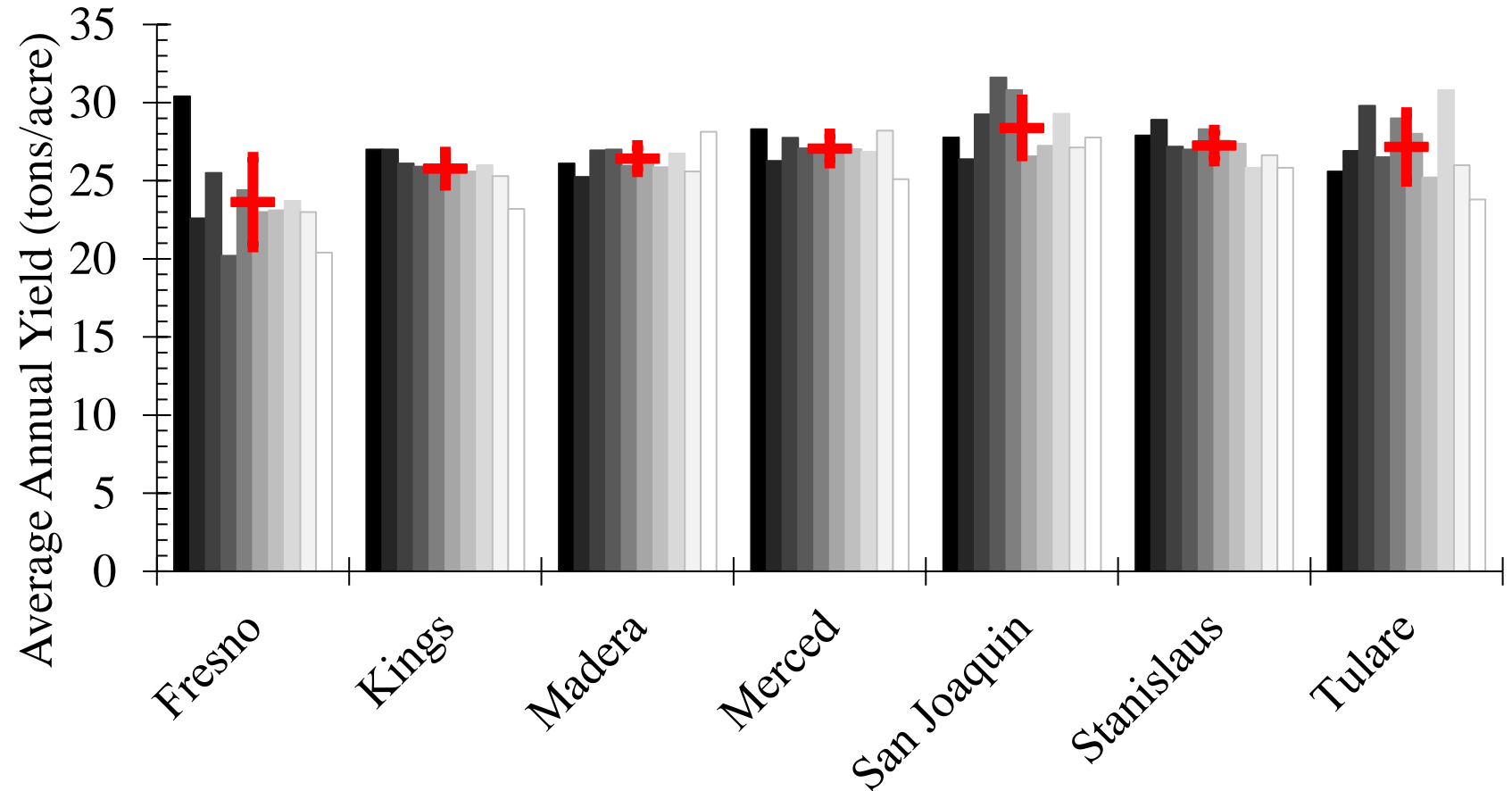


# The Elements of a Nitrogen Management Plan



Identify your expectations;  
set THE GOAL

## SJV Silage Corn Yields (10 yr avg, 2008-17 CAC data)



What are your  
nitrogen  
targets?

**Nitrogen concentrations in harvested  
plant parts - A literature overview**



**Daniel Geisseler**

**2016**

Source material:

<https://plants.usda.gov/npk/main>

<https://www.ipni.net/app/calculator/home>



**University of California**  
Agriculture and Natural Resources

Predict N  
removal with  
harvest:

Simple  
arithmetic  
example

Expected N removed (lbs/acre) with harvested corn silage @ 70% MC			
	---Yield level (tons corn/acre)---		
Info source	1	30	35
Geisseler	7.56	227	265
IPNI	8.8	265	309

# Create THE BUDGET



## Credits

- Residual soil N
- Previous crop residue N
- Irrigation water N
- Soil N mineralization



## Inputs

- Organic amendments
- Fertilizer



## Outputs

- Yield
- Inefficiency

Another way  
to think of  
THE BUDGET

**fertilizer + soil + water =  
harvest + inefficiency**

**environment**



# Nitrogen Management Planning in Action – Silage Corn N Budget Example



# Start with this field:

- 4 years ago corn was 32 Tons/acre
- Coming out of alfalfa
- History of dairy manure
- Soil is uniform, deep, well-drained loam
- Neutral pH, very low salinity, 2% SOM

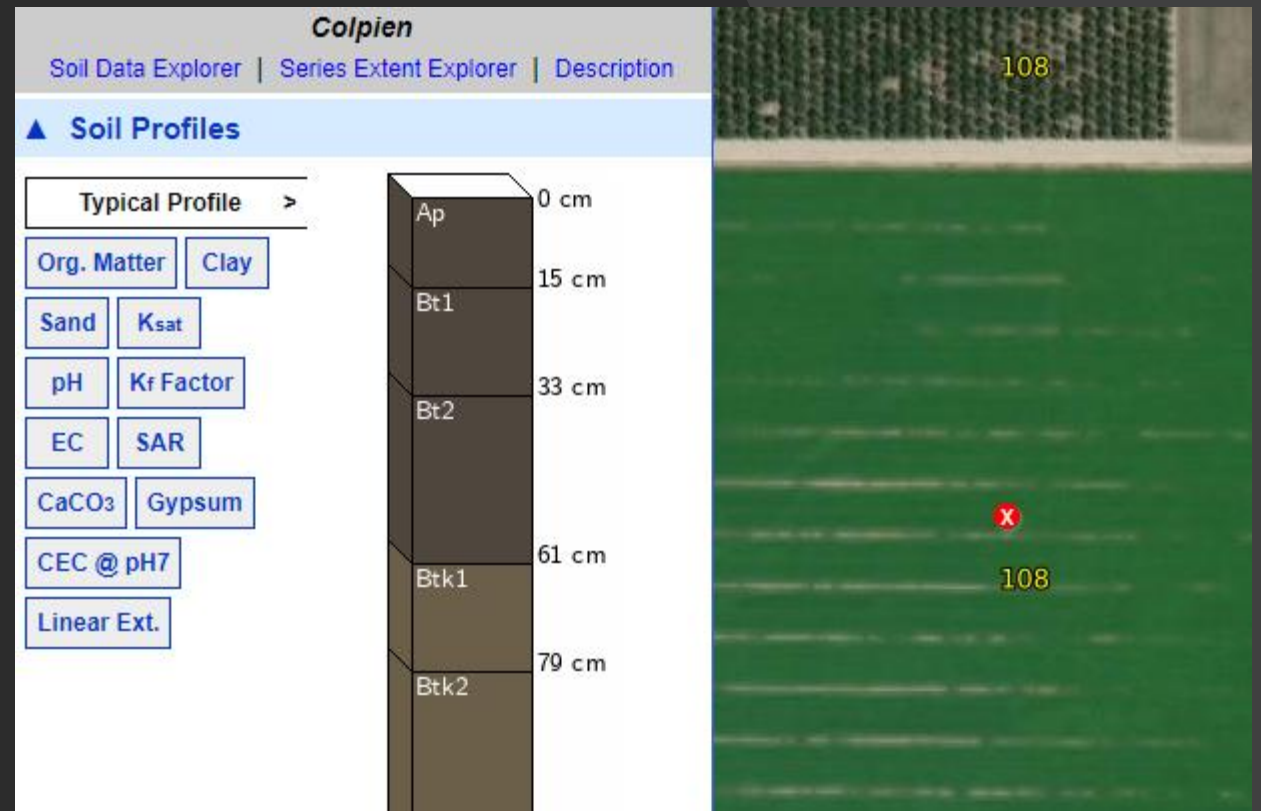


Image generated using:  
<https://casoilresource.lawr.ucdavis.edu/>

Translate yield to  
seasonal crop N  
requirement

### Nitrogen Removed in Silage Corn Harvest\*

Yield (tons)	N (lbs)
1	8.3
<b>32</b>	<b>266</b>

\*WFH 9<sup>th</sup> ed.

# Budgeting with a set goal

Start with the end-point: Yield, or N yield

266 lbs N/acre



Credits



Inputs



Outputs

- Yield

# Determine your credits, start with pre-plant soil

## Output:

Yield: 266 lbs N/acre

Calculate the soil fertilizer equivalent:

$10 \text{ ppm} \times 4 \times 2 \text{ ft} = 80 \text{ lbs N/acre}$

Multiply by a conservative efficiency factor, 70%

$80 \text{ lbs N/acre} * 0.7 = \underline{\underline{56 \text{ lbs N/acre}}}$



Credits

- 10 ppm NO<sub>3</sub>- two ft soil



Inputs



Outputs



# What about soil N mineralization?

## Outputs:

Yield: 266 lbs N/acre

## Credits:

Soil nitrate: 56 lbs N/acre

Estimate contribution from SOM:  
80 lbs N/acre/yr  $\neq$  N mineralized  
from April 15 – August 15  
growing season. Assume 40 lbs  
N/acre\*

Tool used:

[http://geisseler.ucdavis.edu/Tomato\\_N\\_Calculator.html](http://geisseler.ucdavis.edu/Tomato_N_Calculator.html)

Literature cited:

<https://access.onlinelibrary.wiley.com/doi/abs/10.2136/sssaj2018.12.0473>



Credits

- CV mineral soils mineralize ~ 80 lbs N/acre/yr



Inputs



Outputs

# Remember N in irrigation water

## Outputs:

Yield: 266 lbs N/acre

## Credits:

Soil nitrate: 56 lbs N/acre

SOM mineralization: 40 lbs N/acre

Calculate contribution from 46 in. applied IW:

$2 \text{ ppm NO}_3\text{-N} * 0.23 = 0.46 \text{ lbs NO}_3\text{-N/acre*in. IW}$

Only count ETc: corn silage ETc  $\approx 1 \text{ acre*in./ton corn silage}$

$32 \text{ tons} * 1 \text{ acre*in.} * 0.46 \text{ lbs NO}_3\text{-N} \approx \underline{\underline{15 \text{ lbs NO}_3\text{-N/acre}}}$



Credits

- Irrigation water = 2 ppm NO<sub>3</sub>-N



Inputs



Outputs

Extra reading:

<https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=9361>

$$N \text{ inputs} = (\text{Outputs} - \text{Credits})^*$$

### Outputs:

Yield: 266 lbs N/acre

### Credits:

Soil nitrate: 56 lbs N/acre

SOM mineralization: 40 lbs N/acre

Irrigation: 15 lbs N/acre

Calculate remaining crop N requirement:

$$\text{Inputs} = 266 - (56 + 40 + 15) = 155 \text{ lbs N/acre...}^*$$

\*Still need to account for NUE of inputs



Credits



Inputs

- Manure, corral scrapings
- UN-32 sidedress
- Anhydrous NH<sub>4</sub><sup>+</sup> waterrun



Outputs



# N Use Efficiency, corral scraped manure

Calculate manure application & efficiency

## Application:

10 tons/acre of 1% N at 60% moisture (as is) =

$10 \text{ tons} * 0.01 = 200 \text{ lbs N/acre}$

## Efficiency:

25% availability, year 1 =

$200 \text{ lbs N} * 0.25 = \underline{50 \text{ lbs N/acre}}$



Credits



Inputs

- 10 tons manure / acre, corral scrapings, 1% N at applied at 60% moisture, incorporated preplant



Outputs

Extra reading:

[http://manuremanagement.ucdavis.edu/Resources/Manure\\_Technical\\_Guidance/](http://manuremanagement.ucdavis.edu/Resources/Manure_Technical_Guidance/)

# The remainder made up by in-season fertilizer\*

## Outputs:

Yield: 266 lbs N/acre

## Credits:

Soil nitrate: 56 lbs N/acre

SOM-N mineralization: 40 lbs N/acre

Irrigation  $\text{NO}_3^-$ : 15 lbs N/acre

## Inputs:

Manure: 50 lbs N/acre

Calculate remaining N requirement

$266 - (111 + 50) = 105 \text{ lbs N/acre}$

Efficiency: 70% fertilizer NUE

$105 \text{ lbs N/acre} / 0.7 = \underline{150 \text{ lbs N/acre}}$



Credits



Inputs

- UN-32 knee-high side-dress
- Pre-tassel  $\text{NH}_4^+$  water-run



Outputs

\*Applications should be made based on soil and tissue testing levels

Extra reading:

<https://www.cdffa.ca.gov/is/ffldrs/frep/FertilizationGuidelines/Corn.html>

# Compare what the crop sees vs. what you applied

## Example Corn N Budget

<u>CATEGORY</u>	<u>ITEM</u>	<u>In the crop (lbs N/acre)</u>	<u>Applied (lbs N/acre)</u>
Outputs (goal)			
	Yield	266	
Credits			
	Soil Residual Nitrate	56	
	SOM Nitrogen Mineralized	40	
	Irrigation Water	15	21
Inputs			
	Manure	50	200
	Fertilizer	105	150
		A/R	<u>1.39</u>

Extra viewing:

<http://lecture.ucanr.edu/Mediasite/Play/fbda32cb894e4757a05648aadcd0ba1d>