

Essential Criteria for Conducting N Fertility Testing in Sunflower



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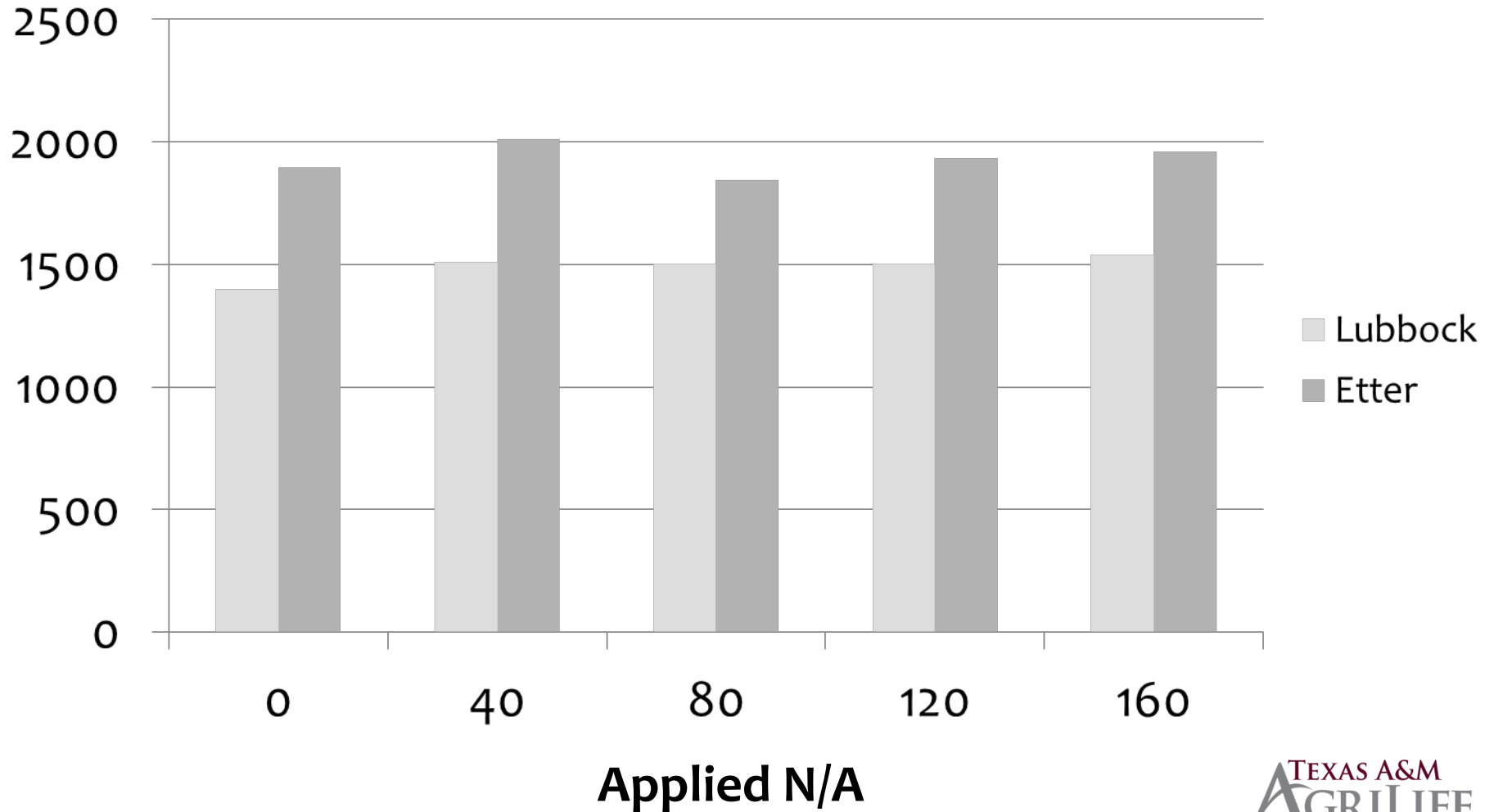
NSA Project: “Gauging Oilseed & Confectionary Sunflower N Response in the TX High Plains (Project 11-P02)”

- ⊙ Deep soil sampling to 6’ if we can get it
- ⊙ Timing for both at-plant and in-season N applications
- ⊙ Confectionary and oilseed
- ⊙ Assessment of yield and quality parameters
- ⊙ Calculation of crop value

NSA Project: “Gauging Oilseed & Confectionary Sunflower N Response in the TX High Plains (Project 11-P02)”

- ⊙ 32-0-0 applied with a knife rig at 0, 40, 80, 120, and 160 lbs. N/A
- ⊙ Lubbock: 92 lbs. nitrate-N/A in top 5', but only 13 lbs. N at 0-6 (range 58-131 lbs. of nitrate-N; %OM = 0.4%)
 - ⊙ If all N were used, enough for 1,800 lbs./A yield
- ⊙ Etter: 61 lbs. nitrate-N/A in top 5' (range 44-97 lbs. of nitrate-N; %OM = 0.6%)
- ⊙ Goal was testing with < 40 lbs. of nitrate-N/A
- ⊙ Furrow irrigation!

Yield Results, 2012 (Lbs./A)



Not a Suitable Test Situation

- ⊙ Terminate project until low N site can be obtained under sprinkler irrigation
- ⊙ For research we need to isolate sunflower N response to applied N
- ⊙ Furrow irrigation diminishes known contribution/effect—to an unknown degree—of existing N in the field
- ⊙ So what am I left with?—I am not sure!

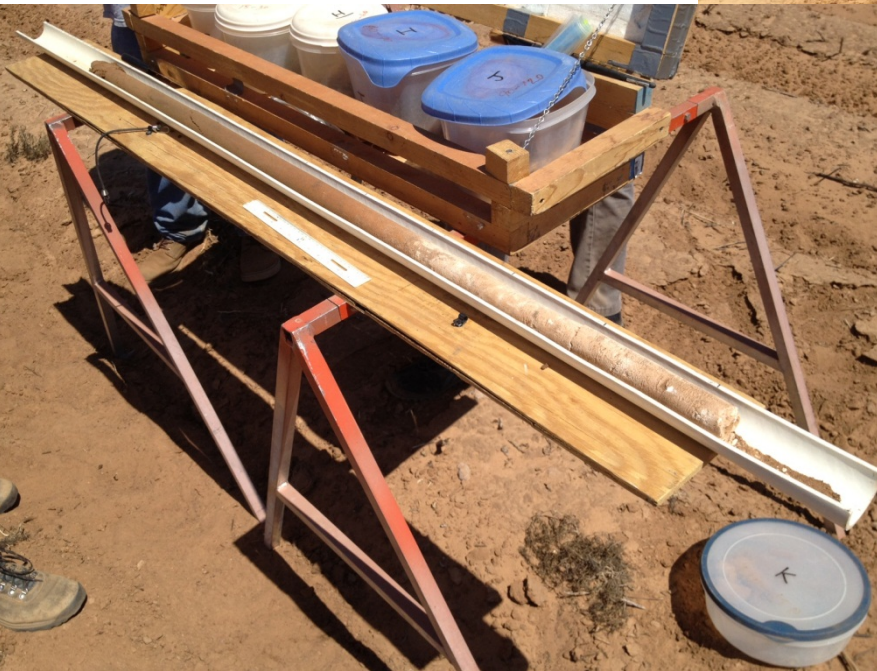
Contributors to Initial Discussion

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Considerations

- ⦿ Significant N research suggests that higher end N applications may not be returning economic value in sunflower
- ⦿ N fertility tests for sunflower are often “flat,” e.g., there is limited response to N
- ⦿ Sunflowers get faulted—or worse—for removal (mining!) of deep soil N to the detriment of the succeeding crop
- ⦿ High N applications can cause an issue with high water tables (Nebraska)...
 - ⦿ ...but might be a solution to removal of deep subsoil nitrate-N that may otherwise reach the water table.

Deep Soil Sampling



The Long-time Standard

- ⊙ Sunflower fertility recommendations of 5 lbs. of nitrogen per 100 lbs. of yield goal
- ⊙ This is not necessarily the sunflower N requirement
- ⊙ Given this Standard, how do we adjust it (if at all) for soil nitrate-N? And to what depth?
 - ⊙ And for soil type, soil organic matter, previous crop?



© *Bradyrhizobium*
nodules

Nitrogen Fertility & Soil Testing

- ⊙ You can't get something from nothing (at least not for very long)
- ⊙ **Sunflower N fertility, ~5 lbs. N per 100 lbs. of yield goal—combined source from soil **and** fertilizer N**
 - ⊙ Soil N value dependent upon depth of soil sample
 - ⊙ Texas A&M lab calculation:
 - ⊙ $N = (\text{yield goal} \times 2) - (2 \times \text{ppm N for 0-6"})$
 - ⊙ $N = (\text{yield goal} \times 2) - (\text{all profile N, 24" deep or more})$
 - ⊙ Subsoil N in Texas is credited a 100%, e.g. for “all practical purposes” deduct it fully from applied N



PROFILE SOIL SAMPLE INFORMATION FORM

Please submit this completed form and payment with samples. Mark each sample bag with your unique sample identification and ensure that it corresponds with the sample identification written on this form. *See sampling and mailing instructions on the back of this form.

(PLEASE DO NOT SEND CASH)

SUBMITTAL AND INVOICE INFORMATION: This information will be used for all official invoicing and communication.

Name _____ County where sampled _____
 Address _____ Phone _____
 City _____ State _____ Zip _____

CLIENT NAME: Client name will only be included with information above on result reports.

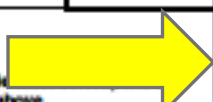
Name _____

This form is only for paired (surface and subsurface) profile sample submittal. All subsurface samples must have a corresponding surface soil. If submitting non-profile samples, use form D-494.

Payment (DO NOT SEND CASH)

- Check
- Money Order (keep your M.O. receipt)
- Credit Card – requires additional form*

Amount Paid \$ _____
 Make Checks Payable to: **Soil Testing Laboratory**
 *Credit card payment forms can be downloaded at <http://soiltesting.tamu.edu>

SAMPLE INFORMATION (Required)					(See options listed below)	
Laboratory # (For Lab Use)	Your Sample I.D.	Acreage Represented	Previous lime/ fertilizer	What are you growing?	Requested analyses	How is forage used?
					<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10	<input type="checkbox"/> Grazing (G) <input type="checkbox"/> G&H <input type="checkbox"/> Hay (H) <input type="checkbox"/> **Min. requirement
	This subsurface sample surface sample listed above. 			Sampling Depth: <input type="checkbox"/> 6-12" <input type="checkbox"/> 6-18" <input type="checkbox"/> 6-24"	<input type="checkbox"/> 11	
					<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10	<input type="checkbox"/> Grazing (G) <input type="checkbox"/> G&H <input type="checkbox"/> Hay (H) <input type="checkbox"/> **Min. requirement



Kansas State University

Department of Agronomy

MF-2586

Soil Test Interpretations and Fertilizer Recommendations

Nutrient Management

Development of sound nutrient management programs involves knowledge of a wide range of information. Soil test records are an important piece of required information, but other factors such as soil moisture conditions, land ownership/tenure, crop and cropping sequence, pest management, cultural prac-

tions are based on surface soil samples collected to a depth of six inches. We suggest collecting a sample from the 0 to 24 inch depth for N, S and Cl recommendations and a separate 0- to 6-inch sample for pH, P, K, Zn, Fe and B soil test determinations.

For lime, the recommended lime rate should be

- ⦿ The results of a 7-year study conducted at the USDA-ARS Central Great Plains Research Station, Akron, Colo., indicated that sunflowers require 6 to 7 pounds of nitrogen for every 100 pounds of production.
- ⦿ An increase from “standard” recommendation of 50 lbs. N per 100 lbs. of yield goal.
- ⦿ Presence of subsoil nitrate may be why producers are getting by with the latter N rate.

Kansas State Soil Test Lab & High Plains Sunflower Production Guide (24" for N)



Sunflower Nitrogen Recommendations

Fertilizer N Required At Various Yield and Soil Organic Matter Levels Assuming Profile N Test Is Not Used (includes 30 Lb N/A residual default)¹

roning

Yield Goal (Lb/A)	Soil Organic Matter Content (%)						
	1.0	1.5	2.0	2.5	3.0	3.5	4.0
	- - - - - Lb N/A - - - - -						
1,000	25	15	5	0	0	0	0
1,500	63	53	43	33	23	13	3
2,000	100	90	80	70	60	50	40
2,500	138	128	118	108	98	88	78
3,000	175	165	155	145	135	125	115

$N\ Rec^2 = (Yield\ Goal \times 0.075) - (\% \text{ SOM} \times 20) - Profile\ N - Manure\ N - Other\ N\ Adjustments + Previous\ Crop\ Adjustments$

¹ Total N requirements presented include only Yield Goal and Soil Organic Matter Adjustments assuming profile N test not used. N rate should include Previous Crop, Manure and Other Appropriate N Rate Adjustments (see N rate adjustments for warm-season crops).

² A minimum fertilizer N application of 30 Lb N/A may be appropriate for early crop growth and development.

Kansas State Adjustments

- ⊙ Numerous adjustments for N recommendations for all crops
- ⊙ Subsoil Nitrate-N from down to 24" and deeper credited at 90%+ to sunflower N requirement
- ⊙ Soil test lab uses 50 lbs. N per 100 lbs. of yield goal

$$N \text{ Rec} = \{ [YG \times 0.065 \text{ pounds nitrogen per pound of yield}] \times \text{STA} \} - \text{PCA} - \text{PYM} - \text{PSNT} - (\text{Nmin})$$

N Rec Fertilizer nitrogen recommended in pounds per acre

YG A realistic yield goal in pounds per acre

STA Soil texture adjustment (1.1 for sandy soils less than 1.0 percent organic matter, 1.0 for other soils)

PCA Previous crop adjustment [use Table 2 for previous legumes, 20 pounds for fallow (if no profile N test) and 0 for all other previous crops]

PYM Previous years manure (50 pounds for last year, 20 pounds for 2 years ago and 0 for no manure history)

PSNT Profile nitrogen soil test results where:

Surface:

ppm nitrogen \times 0.3 \times depth, inches = pounds per acre

Subsoil:

ppm nitrogen \times 0.3 \times depth, inches = pounds per acre

Total Profile nitrogen = pounds per acre

Note: If profile nitrogen test is not run, use 30 pounds per acre as a default value for PSNT.

Nmin Estimate of nitrogen mineralized from soil organic matter. Credit 30 pounds of nitrogen for every 1 percent of soil organic matter in the top 6 inches of soil.

NDSU

A-1121 (10-21 Revised)

Sunflower Production

SF-882 (Revised)

North Dakota Fertilizer Recommendation Tables and Equations

D.W. Franzen
NDSU Extension Soil Specialist

The following soil test recommendation tables are based on field research data obtained in North Dakota, South Dakota, western Minnesota

region. Recent research has shown that more productive areas of fields require less fertilizer, particularly N, than less productive areas of the field because they tend to be higher in organic matter and have a higher seasonal moisture content. The exception to this would be saline

NDSU

NDSU Extension Service
NDS Agricultural Experiment Station
4460 13th Ave S, Grand Forks, ND 58202

SEPTEMBER 2007

NDSU Soil Test Form N Suggestions

Depths to sample – Opposite each test (see below) are the depths required to make a recommendation for that nutrient. For example, a phosphorus recommendation requires a 0-6" sample, while a nitrogen recommendation requires at least a 0-6" and a 6-24" or a 0-24" sample. Place each 0-6", 6-24" 0-24" or 24-48" composite sample in a separate container.

Check tests requested

- | Check tests requested | Depths required for a recommendation |
|---|--|
| <input type="checkbox"/> Nitrogen | 0-6" and 6-24" or 0-24" and 24-48" if interested in deep N |
| <input type="checkbox"/> Phosphorus | 0-6" |
| <input type="checkbox"/> Potassium | 0-6" |
| <input type="checkbox"/> pH | 0-6" |

Depths required for a recommendation

1-11

For lab use only

Fee paid _____

NDSU

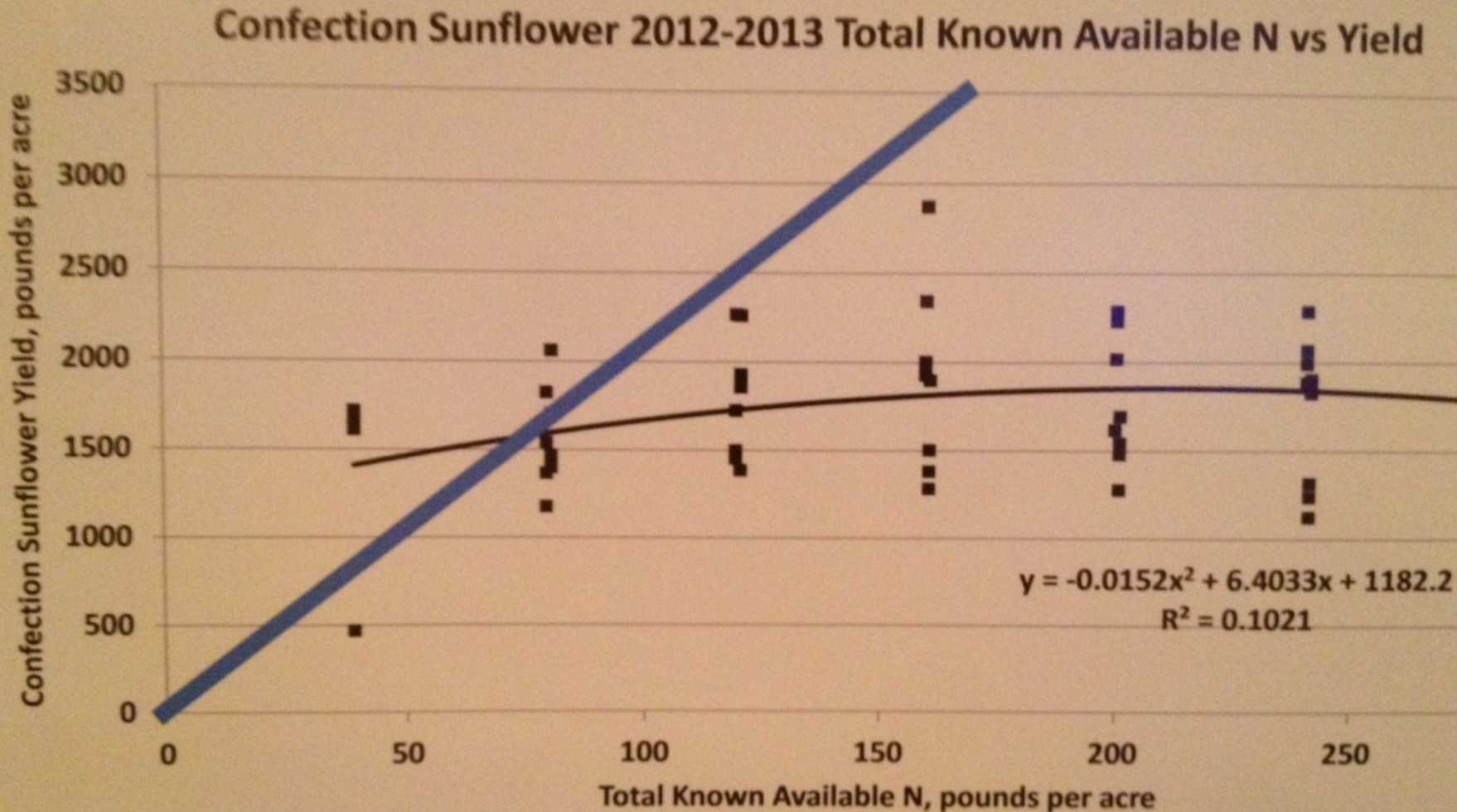
- ⊙ If deeper sampling is conducted to refine recommendations for ... sunflower..., the following adjustments would apply:
- ⊙ If the amount of Nitrate-N in the 2-4' depth is more than 30 lbs. Nitrate-N/A, reduce the N recommendation by 80% of the amount > 30 lbs. Nitrate-N/A.

- ⊙ Nitrogen rec. =
 - ⊙ $0.05 \times \text{yield} - \text{Soil Test N} - \text{Prev Crop Credit}$

Table 26. Sunflower.

Yield potential	Soil N plus fertilizer N required	Bray-1 Olsen
lb/a	lb/acre-2'	
1,000	50	
1,500	75	
2,000	100	
2,500	125	

Franzen et al., NSA 2014



Blue line represents the present sunflower N recommendation of $N \text{ rec} = \text{Yield} \times 0.05$.

Essential Criteria for Conducting N Fertility Testing in Sunflower

- ⦿ Subsoil N testing to a minimum of 4', and preferably 5' and even 6'
 - ⦿ Post-crop re-testing of soil N?
 - ⦿ Measurement of organic matter contribution
 - ⦿ Measurement of in-season NH_4^+ exchange?
- ⦿ A decision on when to time the applications
- ⦿ Couple sunflower N fertility testing with at least one external validation technique
 - ⦿ GreenSeeker, chlorophyll SPAD meter, NDVI reflectance, etc.

Consensus for N Recs for Sunflower

- ⦿ Emphasis on soil N testing to the extent possible/practical.
- ⦿ It is incumbent on researchers & extension personnel to derive a recommendation that will do the best job of compensating for the lack of soil test N, especially below 24", but even for no soil N data below 6".
 - ⦿ This will involve predictive assumptions to get sunflower producers "in the ballpark" for their sunflower crop when they don't have soil test N data, no reason info. on potential soil organic matter N contribution, etc.
- ⦿ Soil N recommendations for sunflower may need to be "regrettably simple" in order aid producers.