Interpreting Soil Test Reports and Fertilizer Source Options

Eastern Extension Agent Training, September 25, 2006

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MONTANA STATE UNIVERSITY EXTENSION

Your Questions

- How do I interpret a Soil Test Report?
- What are fertilizer options for small grains?
- What info exists on ESN (Environmentally Sound Nitrogen) and is it worthwhile?
- How are urea applications managed differently than ammonium nitrate applications?

What should you first look for on a soil test report?

- Depth – should have at least a 0-6 in. section
- Nitrate-N – Is it in lb/ac or ppm? If in ppm, you need to convert to lb/ac: 2 x ppm x depth/6 in. and add up separate depths.
- Is phosphorus measured as Olsen P or Bray P? (MSU guidelines are for Olsen P and there are not good conversions between the 2).

AGVISE LABORATORIES

Soil Analysis by Agvise Laboratories
Northwood: (701) 587-6010
Benson: (320) 843-4109

SOIL TEST REPORT

FIELD [redacted] SAMPLE
CNTY
TWP SECTION
QTR ACRES
PREV. CROP

From: Toole Co.

SUBMITTED FOR: [redacted]

SUBMITTED BY: CE2971
CENEX HARVEST STATES
PO BOX 1272
29 NORTH CENTRAL
CUT BANK MT
59427

REF# **6796906**
LAB# **2582**
BOX# **0**

Date Sampled:		Date Received:	2/28/2002	Date Reported:	2/10/2005

NUTRIENT IN THE SOIL		INTERPRETATION VLow	Low	Med	High
Nitrate	0-6" 37 lb/ac 6-24" 36 lb/ac 0-24" 73 lb/ac	****	****		
Olsen Phosphorus	14 ppm	****	****	****	***
Potassium	289 ppm	****	****	****	****
Chloride					
Sulfur	0-6" 8 lb/ac 6-24" 360 +lb/ac	**** ****	** ****	****	****
Boron					
Zinc	0.57 ppm	****	****		
Iron					
Manganese					
Copper					
Magnesium					
Calcium					
Sodium					
Org.Matter	2.5 %	****	***		
Carbonate(CCE)					
Sol. Salts	0-6" 0.44 mmho/cm 6-24" 0.67 mmho/cm	**** ****	*** ****	***	

1ST CROP CHOICE			2ND CROP CHOICE			3RD CROP CHOICE		
Barley-Malting								
YIELD GOAL			YIELD GOAL			YIELD GOAL		
50	BU							
SUGGESTED GUIDELINES			SUGGESTED GUIDELINES			SUGGESTED GUIDELINES		
Band								
LB/ACRE		APPLICATION	LB/ACRE		APPLICATION	LB/ACRE		APPLICATION
N	10		N			N		
P_2O_5	15	Band(Starter)*	P_2O_5			P_2O_5		
K_2O	10	Band(Starter)*	K_2O			K_2O		
Cl			Cl			Cl		
S	5	Band (Trial)	S			S		
B			B			B		
Zn	2	Band	Zn			Zn		
Fe			Fe			Fe		
Mn			Mn			Mn		
Cu			Cu			Cu		
Mg			Mg			Mg		
Lime			Lime			Lime		

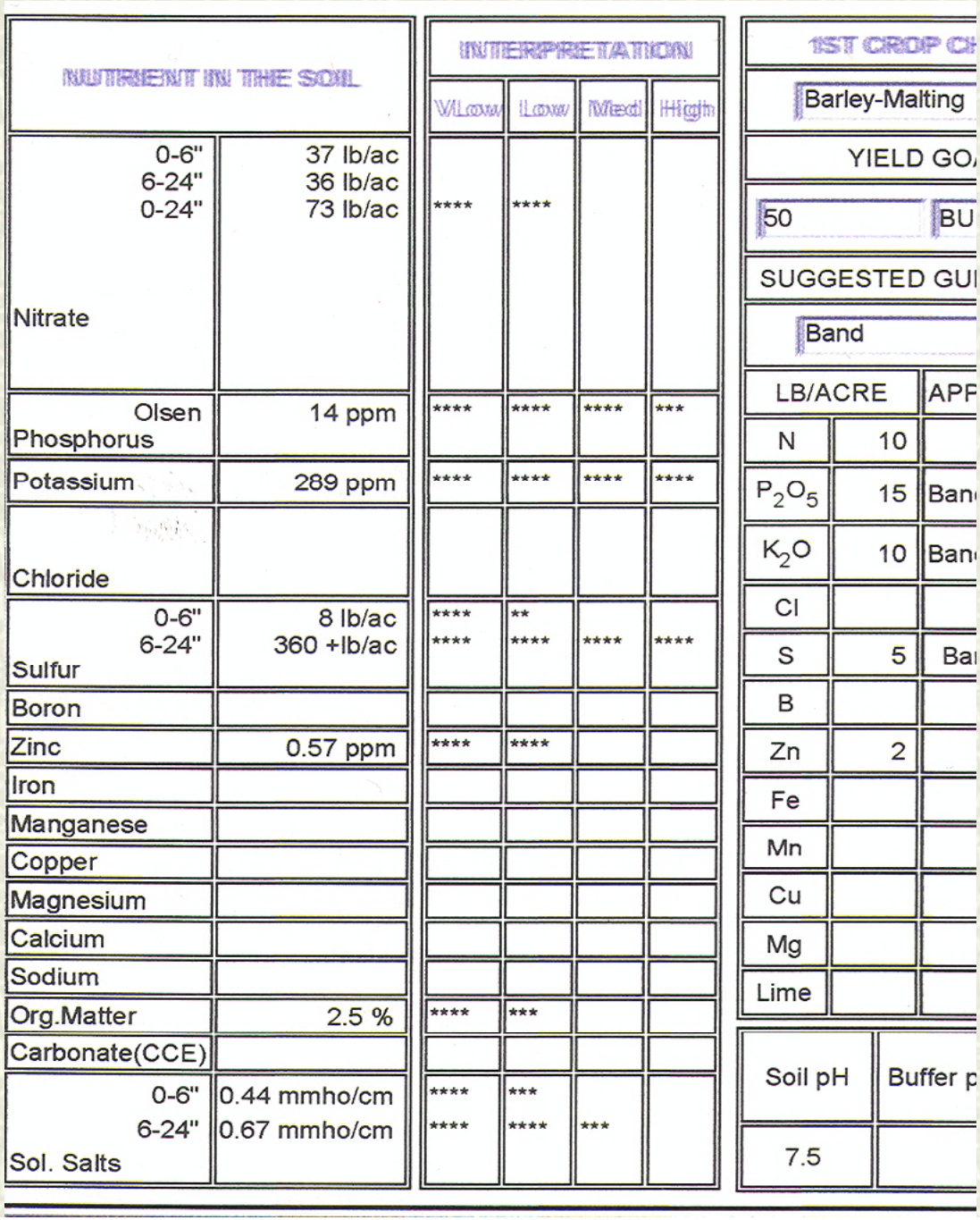
Soil pH	Buffer pH	Cation Exchange Capacity	% Base Saturation (Typical Range) % Ca	% Mg	% K	% Na	% H
7.5							

Crop 1: * Caution: Seed Placed Fertilizer Can Cause Injury * Crop Removal: P2O5 = 24 K2O = 25 AGVISE Band guidelines will build P & K test levels to the medium range over many years.

What else should I look for?

Test	"Good" range	Possible problem
Soil pH	6-8	Low-poor nodulation; High-can indicate high Na. Either high or low-can tie up P
Organic Matter (O.M.)	2-8%	Low-poor water holding capacity, low nutrient release; High-Cu deficiency, salts if from manure
"EC" or salts	< 4 mmho/cm	Poor water uptake, decreased yields
Nitrate-N	10-100 ppm	Low-chlorosis; High-'burn' if hot, dry
Olsen Phosphorus (P)	16-60 ppm	Low-poor energy storage, root growth High-possible Zn deficiency or P losses
Potassium (K)	250-700 ppm	Low-chlorosis, short internodes High-possible Ca deficiency
Zinc (Zn)	> 0.5 ppm	Low-stunted growth, interveinal chlorosis

Any red flags here?



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SUGGESTED GUI	
Band	

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P_2O_5	15	Ban
K_2O	10	Ban
Cl		
S	5	Ba
B		
Zn	2	
Fe		
Mn		
Cu		
Mg		
Lime		

Soil pH	Buffer p
7.5	

What else do you see on soil test reports?

Fertilizer Recommendations

- Use EB 161. Point out 'Guidelines'

- Nitrogen: Need yield potential.
  - Spring wheat – 3.3 lb N/bu
  - Winter wheat – 2.6 lb N/bu
  - Malt barley – 1.2 lb N/bu
  - Grass – 25 lb N/ton

WHEAT - WINTER	
Yield Potential (bu/a)*	Available N (lbs/a) **
30	78
40	104
50	130
60	156
70	182
80	208
90	234

- Fertilizer N =

  Available N (from table)

  - spring soil N (lb N/ac) (-25 lb N/ac if fall soil N)

  - 10 lb N/ac if previous crop was an annual legume, 40 lb N/ac if previous crop was alfalfa

  - 20 lb N/ac if > 3% O.M.

  + 10 lb N/ac per 1000 lb of residue/ac if N will be topdressed on stubble (up to 40 lb N/ac)

How estimate straw residue?

- Need previous yield (bu/ac) and test weight (lb/bu)
- Grain yield (lb/ac) = Yield x test weight
- Straw yield (lb/ac) = Grain yield x 1.67 (ww)
  Grain yield x 1.33 (sw)
- Residue = straw yield – straw baled

Need help? Call or email me.

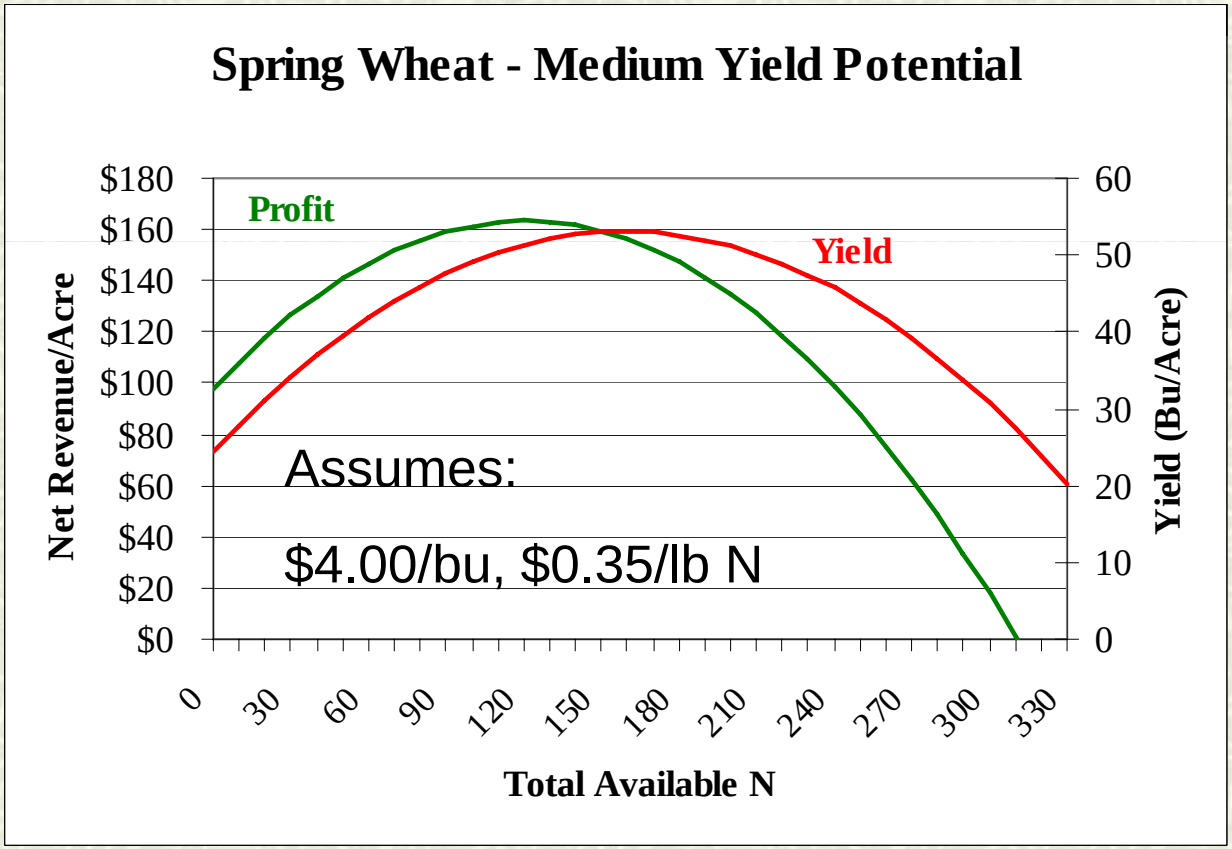
Questions for you:

- Why might more N be needed this coming year in recrop areas that received good moisture in ’06?
- Why might less N be needed this coming year for crops being seeded into fallow that received good moisture?

QUESTIONS?

What else should you and the grower consider in selecting N rate?

- Cost of fertilizer
- Expected price/bu
- Expected size of discounts



http://www.montana.edu/extensionecon/software/FertilizerCostBenefit.xls

Phosphorus and Potassium Fertilization Strategies

1. Sufficiency Approach – Do you want to apply minimum necessary to maximize yield in most years? *If so*, use Table 18 (P) and Table 19 (K).
2. Maintenance Approach – Do you want to replace the nutrients removed at harvest? *If so*, use Table 21.
3. Build Approach – Do you want to build your soil P and K, to minimize yield losses and save on fertilizer in future years? *If so*, add amounts from 1 and 2.

What might grower's answer depend upon?

From Table 18

Crop	Olsen P Soil Test Level (ppm)				
	0	4	8	12	16*
	P Fertilizer Rate (lbs P_2O_5/a)				
Wheat-Spring	50	45	35	30	20
Wheat-Winter	55	50	45	40	35

If want to see specific example, go to http://landresources.montana.edu/soilfertility

Go to ‘Soil Fertility 101-Wheat Focus’ under ‘Presentations’

QUESTIONS?

N Source Options

- Urea (46-0-0)
- UAN liquid (28-0-0)
- Anhydrous ammonia (82-0-0)
- Ammonium nitrate (limited supplies)
- Ammonium sulfate (21-0-0-24). Expensive per lb of N, but S can increase protein, esp. in dry years.
- CRNs - Controlled release nitrogen, such as ESN.
- Urease inhibitors –Applied to urea to decrease volatilization, such as Agrotain.

Controlled Release N

- Made with polymer coatings to:
  - –Decrease leaching
  - –Decrease volatilization

  Ex: In 124 studies, ESN increased corn yield an average of 7 bu/ac over urea (Blaylock and Tindall, 2006). Increase likely due to decreased volatilization.

  ESN Cost? $50 -$70 more per ton. Net economic gain on corn (mainly Midwest)

  Worth of CRNs and Agrotain on small grains and forages in Montana? Not enough research yet to say, but benefits likely less due to smaller revenues here and less potential for volatilization.

Differences between urea and ammonium nitrate

- Urea is more damaging to seed germination

  Implications:
  1. MSU recommends < 30 lb N/ac of AN with seed, but < 15 lb N/ac of UR (crop dependent).
  2. Recommend a spreader (or wider spreader) so that more UR can be placed near seed.

- Urea has higher potential to volatilize

  Implications:
  1. Urea application should be done during period with cool temperatures, especially when on moist, sandy soils with residue.
  2. Urea should be irrigated (>0.5 inches) or tilled in if possible.

- Urea is not immediately available for plant uptake

  Implication: For same effect, urea needs to be applied earlier in season, especially if Fall soil test N levels are low (<20-30 lb N/ac).

P Source options

- Monoammonium P (MAP)
- Diammonium P (DAP)
- Liquids (generally more expensive than MAP and DAP)

Generally no yield differences between sources.
Exception: Liquids produce higher yields on highly calcareous soils (> 20% $CaCO_3$)

Placement: Need roughly 3 times more P if broadcast than if placed near the seed at Olsen P levels < 8 ppm, and 2 times more P when Olsen P = 8-12 ppm. MSU guidelines assume P will be banded with the seed.

Conclusions

- Given some criteria, soil test reports can be quickly evaluated for potential problems.
- N, P, and K recommendations can be made by knowing how to use EB 161 AND giving the grower some options (e.g. sufficiency vs. build)
- Different N and P sources generally don’t produce large yield differences. However, good management of volatile N sources can reduce yield losses in some situations.

QUESTIONS?

For more information on N cycling, fertilizer sources, placement and timing see:
http://landresources.montana.edu/nm

For more information on urea volatilization and management, see:
http://www.oznet.ksu.edu/library/crpsl2/NCR326.pdf

MSU Soil Fertility webpage:
http://landresources.montana.edu/soilfertility