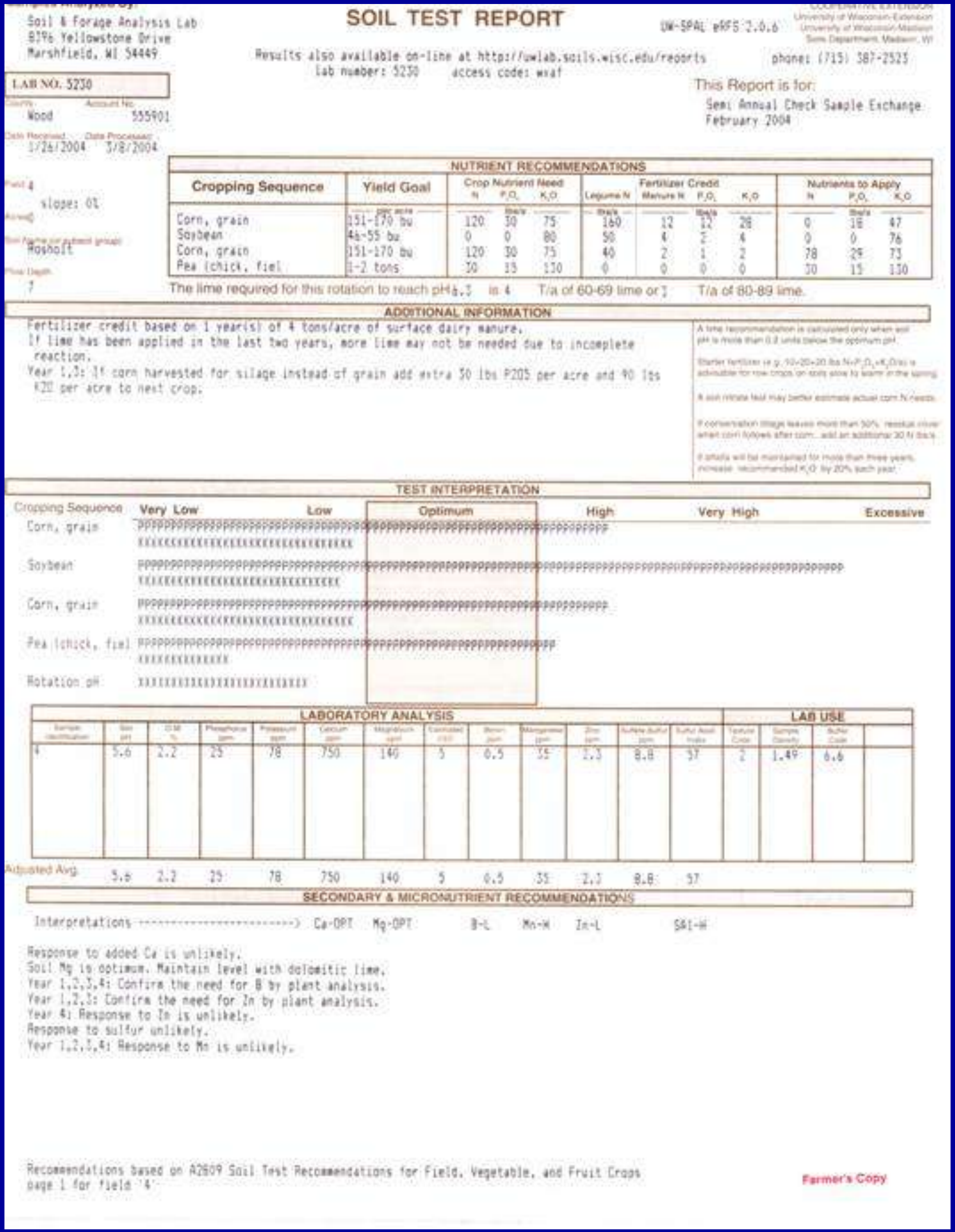
Fertilizer Grade and Calculations

John Peters

UW Soil Science Department

University of Wisconsin Soil Test Report



Soil & Forage Analysis Lab
8396 Yellowstone Drive
Marshfield, WI 54449

SOIL TEST REPORT

UW-SPAL eRFS 2.0.6

Results also available on-line at http://uwlab.soils.wisc.edu/reports
lab number: 5230 access code: wxaf

phone: (715) 387-2523

LAB NO. 5230

County: Wood Account No. 555901

Date Received: 1/26/2004 Date Processed: 3/8/2004

Field: 4 slope: 0%

Soil Name: Rosholt

Plow Depth: 7

This Report is for:
Semi Annual Check Sample Exchange
February 2004

NUTRIENT RECOMMENDATIONS

Cropping Sequence	Yield Goal	Crop Nutrient Need N	P_2O_5	K_2O	Legume N	Fertilizer Credit Manure N	P_2O_5	K_2O	Nutrients to Apply N	P_2O_5	K_2O
	per acre		lb/a		lb/a		lb/a			lb/a	
Corn, grain	151-170 bu	120	30	75	160	12	12	28	0	18	47
Soybean	46-55 bu	0	0	80	50	4	2	4	0	0	76
Corn, grain	151-170 bu	120	30	75	40	2	1	2	78	29	73
Pea (chick, fiel	1-2 tons	30	15	130	0	0	0	0	30	15	130

The lime required for this rotation to reach pH 6.3 is 4 T/a of 60-69 lime or 3 T/a of 80-89 lime.

ADDITIONAL INFORMATION

Fertilizer credit based on 1 year(s) of 4 tons/acre of surface dairy manure.
If lime has been applied in the last two years, more lime may not be needed due to incomplete reaction.
Year 1,3: If corn harvested for silage instead of grain add extra 30 lbs P2O5 per acre and 90 lbs K2O per acre to next crop.

TEST INTERPRETATION

Cropping Sequence: Very Low, Low, Optimum, High, Very High, Excessive

Corn, grain
Soybean
Corn, grain
Pea (chick, fiel
Rotation pH

LABORATORY ANALYSIS

Sample identification	Soil pH	O.M. %	Phosphorus ppm	Potassium ppm	Calcium ppm	Magnesium ppm	Estimated CEC	Boron ppm	Manganese ppm	Zinc ppm	Sulfate-Sulfur ppm	Sulfur Avail. Index	Texture Code	Sample Density	Buffer Code
4	5.6	2.2	25	78	750	140	5	0.5	35	2.3	8.8	37	2	1.49	6.6
Adjusted Avg.	5.6	2.2	25	78	750	140	5	0.5	35	2.3	8.8	37			

LAB USE

SECONDARY & MICRONUTRIENT RECOMMENDATIONS

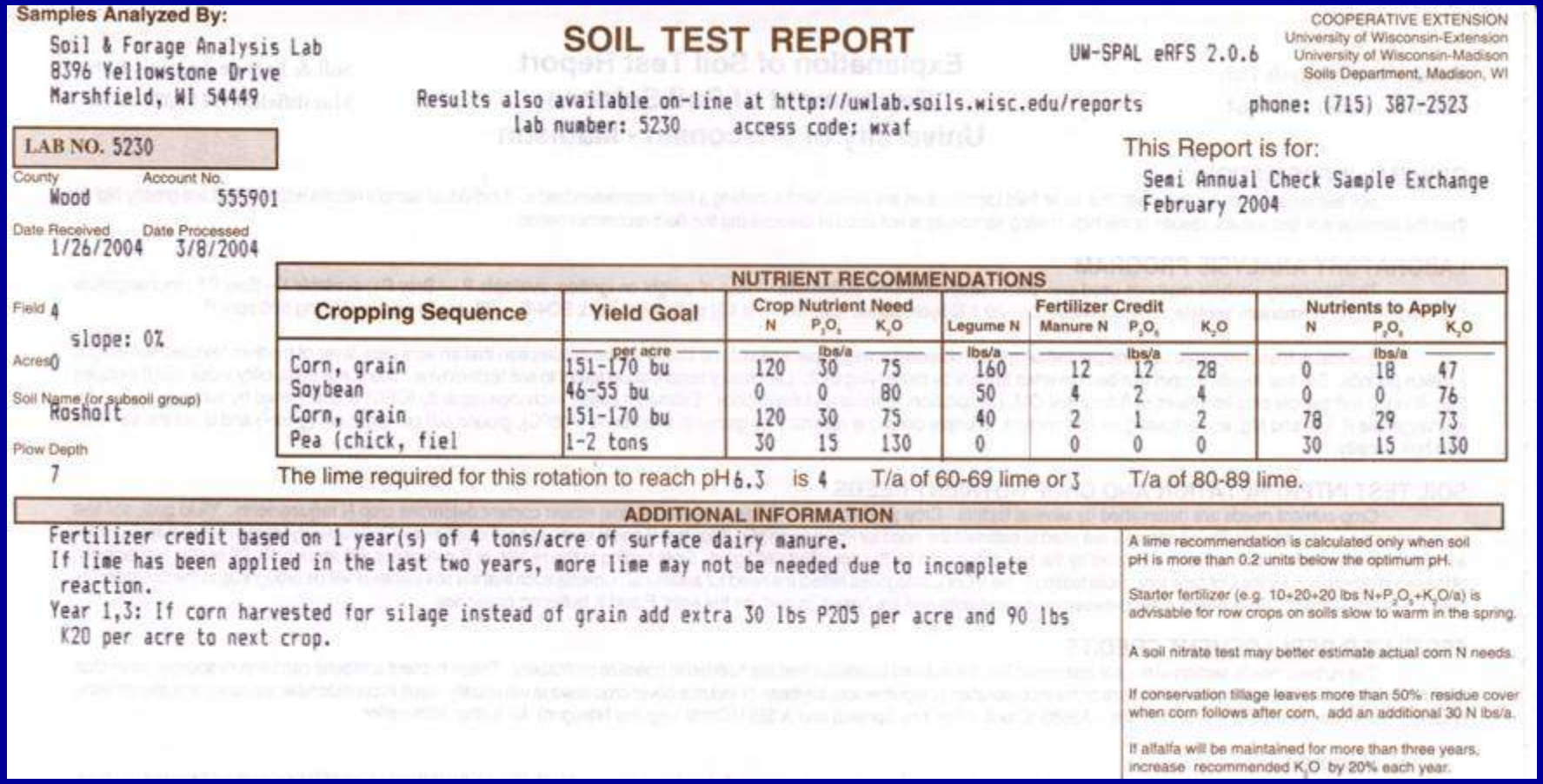
Interpretations ------------------------> Ca-OPT Mg-OPT B-L Mn-H Zn-L SAI-H

Response to added Ca is unlikely.
Soil Mg is optimum. Maintain level with dolomitic lime.
Year 1,2,3,4: Confirm the need for B by plant analysis.
Year 1,2,3: Confirm the need for Zn by plant analysis.
Year 4: Response to Zn is unlikely.
Response to sulfur unlikely.
Year 1,2,3,4: Response to Mn is unlikely.

Recommendations based on A2809 Soil Test Recommendations for Field, Vegetable, and Fruit Crops
page 1 for field '4'

Farmer's Copy

Nutrient Recommendations



Samples Analyzed By:
Soil & Forage Analysis Lab
8396 Yellowstone Drive
Marshfield, WI 54449

SOIL TEST REPORT

UW-SPAL eRFS 2.0.6

COOPERATIVE EXTENSION
University of Wisconsin-Extension
University of Wisconsin-Madison
Soils Department, Madison, WI

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lab number: 5230 access code: wxaf

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County: Wood
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Date Received: 1/26/2004
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This Report is for:
Semi Annual Check Sample Exchange
February 2004

Field 4
slope: 0%
Acres 0
Soil Name (or subsoil group) Rosholt
Plow Depth 7

NUTRIENT RECOMMENDATIONS

Cropping Sequence	Yield Goal	Crop Nutrient Need (per acre) N	P_2O_5 lbs/a	K_2O lbs/a	Fertilizer Credit Legume N lbs/a	Manure N	P_2O_5 lbs/a	K_2O lbs/a	Nutrients to Apply N	P_2O_5 lbs/a	K_2O lbs/a
Corn, grain	151-170 bu	120	30	75	160	12	12	28	0	18	47
Soybean	46-55 bu	0	0	80	50	4	2	4	0	0	76
Corn, grain	151-170 bu	120	30	75	40	2	1	2	78	29	73
Pea (chick, fiel	1-2 tons	30	15	130	0	0	0	0	30	15	130

The lime required for this rotation to reach pH 6.3 is 4 T/a of 60-69 lime or 3 T/a of 80-89 lime.

ADDITIONAL INFORMATION

Fertilizer credit based on 1 year(s) of 4 tons/acre of surface dairy manure.
If lime has been applied in the last two years, more lime may not be needed due to incomplete reaction.
Year 1,3: If corn harvested for silage instead of grain add extra 30 lbs P2O5 per acre and 90 lbs K2O per acre to next crop.

A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

Starter fertilizer (e.g. 10+20+20 lbs N+P_2O_5+K_2O/a) is advisable for row crops on soils slow to warm in the spring.

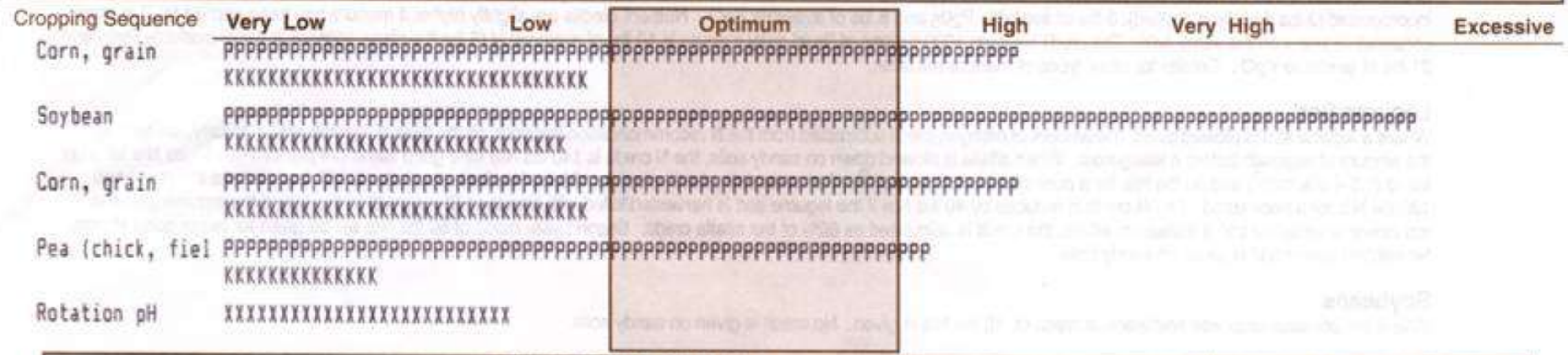
A soil nitrate test may better estimate actual corn N needs.

If conservation tillage leaves more than 50% residue cover when corn follows after corn, add an additional 30 N lbs/a.

If alfalfa will be maintained for more than three years, increase recommended K_2O by 20% each year.

Graphic Interpretation and Lab Results

TEST INTERPRETATION



LABORATORY ANALYSIS													LAB USE			
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4	5.6	2.2	25	78	750	140	5	0.5	35	2.3	8.8	57	2	1.49	6.6	
Adjusted Avg.	5.6	2.2	25	78	750	140	5	0.5	35	2.3	8.8	57				

Secondary and Micronutrient Recommendations

SECONDARY & MICRONUTRIENT RECOMMENDATIONS

Interpretations ---------->	Ca-OPT	Mg-OPT	B-L	Mn-H	Zn-L	SAI-H

Response to added Ca is unlikely.
Soil Mg is optimum. Maintain level with dolomitic lime.
Year 1,2,3,4: Confirm the need for B by plant analysis.
Year 1,2,3: Confirm the need for Zn by plant analysis.
Year 4: Response to Zn is unlikely.
Response to sulfur unlikely.
Year 1,2,3,4: Response to Mn is unlikely.

Recommendations based on A2809 Soil Test Recommendations for Field, Vegetable, and Fruit Crops
page 1 for field '4'

Farmer's Copy

Key steps to obtaining a proper fertilizer recommendation

- Take a good soil sample, (publicationA2100)

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- Use a Wisconsin Certified Laboratory

A & L Great Lakes Laboratories, Inc.
3505 Conestoga Drive
Fort Wayne, IN 46808
260-483-4759

AgSource Cooperative Services
106 N. Cecil Street
Bonduel, WI 54107
715-758-2178

Dairyland Laboratories
217 E. Main Street
Arcadia, WI 54612
608-323-2123

Mowers Soil Testing Plus, Inc.
117 East Main Street
Toulan, IL 61483
309-286-2761

Rock River Laboratory
P. O. Box 169
Watertown, WI 53094
920-261-0446

UW Soil & Plant Analysis Lab
5711 Mineral Point Road
Madison, WI 53705
608-262-4364

UW Soil & Forage Analysis Lab
8396 Yellowstone Drive
Marshfield, WI 54449
715-387-2523

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- Take the appropriate nutrient credits for manure or previous legume crops

Key steps to obtaining a proper fertilizer recommendation

- Take a good soil sample, (publicationA2100)
- Use a Wisconsin Certified Laboratory
- Take the appropriate nutrient credits for manure or previous legume crops
- Follow the guidelines listed on the report

What is Needed?

Nutrients to Apply		
N	P_2O_5	K_2O
lbs/a		
0	18	47
0	0	76
78	29	73
30	15	130

P_2O_5 & K_2O or P & K

- Grades for P and K are expressed as oxides, rather than on elemental basis
- Fertilizer recommendations are also given on oxide basis
  - lbs P_2O_5 / acre
  - lbs K_2O / acre
- P and K in fertilizer not actual present as P_2O_5 or K_2O
  - Plants do not actually use P_2O_5 or K_2O
  - Oxide forms are used only to indicate amounts of P and K in fertilizer

Nutrient Forms

Elemental Name	Elemental Symbol	Oxide Name	Oxide Symbol	Plants Use
Phosphorus	P	Phosphate	P_2O_5	$H_2PO_4^-$
Potassium	K	Potash	K_2O	K^+

Can I just apply 150 – 10 – 55?

- NO
- Certain decisions and calculations must be done first
- Crop, soil, source and price considerations
- Make the best choice after considering the whole picture

Fertilizer Types

- Mixed Fertilizer – contains more than one of the three major nutrients (ie 18-46-0)
- Complete Fertilizer – contains all three of the major nutrients (ie 6-24-24)
- Straight Fertilizer – contains only one of the three major nutrients (ie 46-0-0)

Fertilizer Grades

- Useful in determining application rates
- Minimum guaranteed amounts of available N, P_2O_5 and K_2O in fertilizer

5 – 10 – 30

N – P_2O_5 – K_2O

Calculated on a % of total weight basis

What is Needed?

Nutrients to Apply		
N	P_2O_5	K_2O
lbs/a		
0	18	47
0	0	76
78	29	73
30	15	130

Example 150 – 10 – 55

$N – P_2O_5 – K_2O$

- 150 lbs N/a
- 150 lbs N x 100 lbs urea/45 lbs N = 333 lbs urea (45-0-0)
- Or
- 150 lbs N x 100 lbs ammonium sulfate/21 lbs N = 714 lbs ammonium sulfate (21-0-0-24)

Material considerations

- Cost per pound of nutrients for urea
  - Example urea at $200/ton,
  - Contains .45 lbs N/lb urea x 2000 = 900 lbs N
  - $200/900 lbs N = $0.22/lb N
- Cost per pound of nutrients for AMS
  - Example ammonium sulfate at $200/ton
  - Contains .21 lbs N/lab AMS x 2000 = 420 lbs N
  - $200/420 lbs N = $0.48/lb N

Other considerations

- Availability – NH_4 vs. NO_3
- Additional nutrients – Sulfur in AMS

Example 150 – 10 – 55

$N – P_2O_5 – K_2O$

- 10 lbs P_2O_5/a
- 10 lbs P_2O_5 x 100 lbs TSP/46 lbs P_2O_5 = 22 lbs triple super phosphate (0-46-0)
- Or
- 10 lbs P_2O_5 x 100 lbs (9-23-30)/23 lbs P_2O_5 = 43 lbs fertilizer

Example 150 – 10 – 55

$N – P_2O_5 – K_2O$

- 55 lbs K_2O/a
- 55 lbs K_2O x 100 lbs potash (KCl)/60 lbs 55 lbs K_2O = 92 lbs potash (0-0-60)
- Or
- 55 lbs K_2O x 100 lbs potassium sulfate /50 lbs 55 lbs K_2O = 110 lbs fertilizer (0-0-50)

Fertilizer Ratio

- Relative proportion of N, P_2O_5 and K_2O in a fertilizer

Grade	Ratio
6-24-24	1:4:4
5-10-30	1:2:6
9-9-9	1:1:1

Conversions between elemental and oxide forms

1 lb of P_2O_5	=	0.44 lbs P
1 lb of P	=	2.29 lbs P_2O_5
1 lb of K_2O	=	0.83 lbs K
1 lb of K	=	1.20 lbs of K_2O

Nutrient amounts in liquid fertilizers

- Calculation of nutrient content of liquid fertilizers requires information on weight per gallon of the liquid fertilizer

Material	Weight (lbs/gal)
10-34-0	11.7
9-18-9	11.7
28-0-0	10.7

Nutrient amounts in liquid fertilizers

- 10.7 lbs x 28lbs N/100 lbs. Material = 3.0 lbs N per gallon of 28-0-0
- Therefore, if you need to apply 50 lbs of N per acre, how many gallons should you apply
- 50lbs N x one gallon/3.0 lbs = 16.7 gallons per acre

Summary

- Know what nutrients are needed and in what amount of N, P_2O_5 and K_20
- Consider soil type, additional crop nutrient needs, price and availability
- Make the best choice of ready mixed product or order custom blended material

1. Calculate the pounds of N, P_2O_5 and K_2O in 1 ton (2000 lbs) of 9-18-30.

9-18-30 means there is 9 lbs of N, 18 lbs of P_2O_5 and 30 lbs of K_2O in every 100 lbs of material

Since there is 20 x 100 lbs in a ton

Multiply 9 x 20 = 180 lbs of N

18 x 20 = 360 lbs of P_2O_5

30 x 20 = 600 lbs of K_2O

2. Which is a cheaper source of N?
82-0-0 @ $245/ton or
46-0-0 @ $160/ton

82-0-0 contains:

82 x 20 = 1640 units of N for $245/ton

$$\frac{\$245}{164 \text{ units}} = 14.9¢ \text{ / unit of N}$$

46-0-0 contains:

46 x 20 = 920 units of N for $160/ton

$$\frac{\$245}{164 \text{ units}} = 17.4¢ \text{ / unit of N}$$

3. Sven of Sven and Ole's super nifty fertilizer company, says that 3 gal/a of his liquid fish emulsion (3-2-3) is equivalent to 6 gal/a of a 7-21-7 liquid fertilizer from the local coop. The fish emulsion weight 8.7 lb/gal and the 7-21-7 weighs 10.8 lb/gal

How much N, P_2O_5 and K_2O would be applied per acre with each material?

3. How much N, P_2O_5 and K_2O would be applied per acre with each material?

Fish emulsion: 3 gal x $\frac{8.7 \text{ lb}}{\text{gal}}$ = 26.1 lbs

N $\frac{3 \text{ lbs N}}{100 \text{ lbs}}$ x 26.1 lbs = 0.783 lbs N

P_2O_5 $\frac{2 \text{ lbs } P_2O_5}{100 \text{ lbs}}$ x 26.1 lbs = 0.522 lbs P_2O_5

K_2O $\frac{3 \text{ lbs } K_2O}{100 \text{ lbs}}$ x 26.1 lbs = 0.783 lbs K_2O

Liquid fertilizer: 6 gal x $\frac{10.8 \text{ lb}}{\text{gal}}$ = 64.8 lbs

N $\frac{7 \text{ lbs N}}{100 \text{ lbs}}$ x 64.8 lbs = 4.53 lbs N

P_2O_5 $\frac{21 \text{ lbs } P_2O_5}{100 \text{ lbs}}$ x 64.8 lbs = 13.61 lbs P_2O_5

K_2O $\frac{7 \text{ lbs } K_2O}{100 \text{ lbs}}$ x 64.8 lbs = 4.53 lbs K_2O

4. If a fertilizer recommendation for corn calls for 160 lb N/a, 50 lb P_2O_5/a, and 50 lb K_2O/a, how many pounds of the following fertilizer materials will be needed to supply the recommended amounts of nutrients on a per acre basis?

46-0-0 0-46-0 0-0-50

4. Recommendation - 160 lb N/a, 50 lb P_2O_5/a, and 50 lb K_2O/a

<u>46-0-0</u> <u>0-46-0</u> <u>0-0-50</u>

$$\frac{160 \text{ lbs N}}{0.46 \text{ N}} = 348 \text{ lbs of 46-0-0}$$

$$\frac{50 \text{ lbs } P_2O_5}{0.46 \ P_2O_5} = 109 \text{ lbs of 0-46-0}$$

$$\frac{50 \text{ lbs } K_2O}{0.50 \ K_2O} = 100 \text{ lbs of 0-0-50}$$

5. If 600 lb of 34-0-0, 800 lb of 18-46-0, and 600 lb of 0-0-60 are mixed, what is the grade of the resulting fertilizer blend?

600 x 0.34 = 204 units of N

800 x 0.18 = 144 units of N

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348 total units of N

800 x 0.46 = **368** units of P_2O_5

---

600 x 0.60 = **360** units of K_2O

5. If 600 lb of 34-0-0, 800 lb of 18-46-0, and 600 lb of 0-0-60 are mixed, what is the grade of the resulting fertilizer blend?

$$\frac{\textbf{348} \text{ units N, } \textbf{368} \text{ units } P_2O_5, \textbf{360} \text{ units } K_2O}{2000 \text{ lbs}}$$

20 = 17.4 – 18.4 – 18.0