

# How to Use Plant Analysis

Ray Ward

Ward Laboratories, Inc

[www.wardlab.com](http://www.wardlab.com)





# Nutrient Crop Removal, lbs/Bu CORN

<u>Nutrient</u>	<u>lb/bu 200 bu/A</u>	
Nitrogen, N	0.75	150
Phosphorus, P <sub>2</sub> O <sub>5</sub>	0.33	66
Potassium, K <sub>2</sub> O	0.23	46
Sulfur, S	0.09	18
Zinc, Zn	0.001	0.2



# Nutrient Crop Removal, lbs/Bu CORN

<b>Nutrient</b>	<b>lb/bu</b>	<b>200 bu/A</b>
<b>Chloride</b>	<b>0.024</b>	<b>4.8</b>
<b>Manganese</b>	<b>0.0006</b>	<b>0.12</b>
<b>Iron</b>	<b>0.0012</b>	<b>0.24</b>
<b>Copper</b>	<b>0.0004</b>	<b>0.08</b>
<b>Boron</b>	<b>0.0006</b>	<b>0.12</b>
<b>Molybdenum</b>	<b>0.00001</b>	<b>0.002</b>



# Crop Nutrient Removal, lbs/bu

## SOYBEAN

<u>Nutrient</u>	<u>lb/bu</u>	<u>60 bu/A</u>
Nitrogen, N	3.6	216
Phosphorus, P <sub>2</sub> O <sub>5</sub>	0.77	46
Potassium, K <sub>2</sub> O	1.2	72
Sulfur, S	0.18	11
Zinc, Zn	0.003	0.18



# Crop Nutrient Removal, lbs/bu

## SOYBEAN

<u>Nutrient</u>	<u>lb/bu</u>	<u>60 bu/A</u>
Chloride	0.016	1.0
Iron	0.005	0.3
Manganese	0.002	0.12
Copper	0.001	0.06
Boron	0.0006	0.04
Molybdenum	0.00001	0.0006



# Nutrient Crop Removal, lbs/Bu

## WHEAT

<u>Nutrient</u>	<u>lb/bu</u>	<u>60 bu/A</u>
<b>Nitrogen, N</b>	<b>1.2</b>	<b>72</b>
<b>Phosphorus, P2O5</b>	<b>0.52</b>	<b>31</b>
<b>Potassium, K2O</b>	<b>0.26</b>	<b>16</b>
<b>Sulfur, S</b>	<b>0.12</b>	<b>7</b>
<b>Zinc, Zn</b>	<b>0.003</b>	<b>0.18</b>

# Plant Analysis

- Diagnose growth problems within a field
  - Slow crop growth
  - Poor color
- Monitor nutrient level
  - Avoid hidden hunger



# Sampling Plant Tissue

- Corn
  - Top leaf with a collar for early sampling
  - Ear leaf at tassel/pollination stage
- Soybeans
  - Most recently matured trifoliates
- Wheat
  - Whole sample at full tiller up to early heading
- Alfalfa
  - Top 1/3 of the plant at bud stage







Ag Testing - Consulting

Account No. : 90010

Plant Analysis Report

WARD, RAYMOND C  
WARD LABORATORIES  
PO BOX 788  
KEARNEY

NE 68848-0788

Invoice No. : 1062219  
Date Received : 07/16/2009  
Date Reported : 07/17/2009

Lab Number : 2653

Results For : EAST CENTRAL CROP RESIDUE ALLIANCE

Location : CORN

Sample ID : B CLARK

Plant Type : Corn

Stage : Tassel

	Result Dry Basis	Sufficiency Levels			
		Deficient	Low	Sufficient	High
Nitrogen, % N	2.68				
Phosphorus, % P	0.29				
Potassium, % K	2.32				
Calcium, % Ca	0.586				
Magnesium, % Mg	0.242				
Sulfur, % S	0.21				
Zinc, ppm Zn	26				
Iron, ppm Fe	139				
Manganese, ppm Mn	53				
Copper, ppm Cu	9.6				

Brad: N is just slightly low. Added N is not necessary unless yield potential is very good. Then you could apply 20 lbs of N. Ray Ward

# Plant Analysis Interpretation

<u>Range</u>	<u>Yield</u>	<u>Nutrient Comment</u>
Deficient	<80 %	Symptoms present
Low	80-95 %	Hidden Hunger
Sufficient	96-100 %	Normal Yield
High	100-70 %	Abnormally High



# Plant Analysis - Corn

<u>Nutrient</u>	<u>4 to 6 leaf</u>	<u>Ear leaf silk</u>
Nitrogen, %	3.4 - 5.0	2.7 – 3.5
Phosphorus, %	.35 - .80	.25 - .40
Potassium, %	2.7 - 5.0	2.0 – 2.5
Sulfur, %	.16 - .35	.14 - .25
Magnesium, %	.16 - .50	.13 - .35

# Plant Analysis - Corn

<u>Nutrient, ppm</u>	<u>4 to 6 leaf</u>	<u>Ear leaf silk</u>
Zinc	20 - 60	18 - 60
Iron	30 - 300	30 - 300
Manganese	30 - 160	20 - 150
Copper	5 - 20	4 - 20
Boron	7 - 25	4 - 25
Chloride, %	.30 - 1.00	.25 - .60
Molybdenum	.21 - 4.0	.21 - 4.0







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Plant Analysis Report

WARD, RAYMOND C  
WARD LABORATORIES  
PO BOX 788  
KEARNEY

NE 68848-0788

Invoice No. : 1062220  
Date Received : 07/20/2009  
Date Reported : 07/21/2009

Lab Number : 2742

Results For : G & G FARMS  
Location : LIVINGSTONS  
Sample ID : 1-STUNTED SOYBEANS

Plant Type : Soybean  
Stage : Flower

	Result Dry Basis	Sufficiency Levels			
		Deficient	Low	Sufficient	High
Nitrogen, % N	4.15				
Phosphorus, % P	0.44				
Potassium, % K	2.81				
Calcium, % Ca	1.237				
Magnesium, % Mg	0.458				
Sulfur, % S	0.26				
Zinc, ppm Zn	54				
Iron, ppm Fe	186				
Manganese, ppm Mn	239				
Copper, ppm Cu	8.4				

Two things look off. Low N and High manganese. To to apply 15 to 20 lbs of N per acre. The high manganese may be due to wet soil. As soil dries, manganese should decrease. Ray Ward

Reviewed By : Raymond Ward

1/11/2010

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web site  
www.wardlab.com

4007 Cherry Ave., P.O. Box 788  
Kearney, Nebraska 68848-0788





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Account No. : 90013

Plant Analysis Report

WARD, RAYMOND & JOLENE  
FARM ACCOUNT  
2545 E 92ND ST  
KEARNEY NE 68847

Invoice No. : 1017510  
Date Received : 07/09/2007  
Date Reported : 07/10/2007  
Lab Number : 927

Results For : RAY WARD

Location :

Sample ID : HOME

Plant Type : Soybean

Stage : Flower

	Result Dry Basis	Sufficiency Levels			
		Deficient	Low	Sufficient	High
Nitrogen , % N	4.07				
Phosphorus, % P	0.37				
Potassium, % K	3.53				
Calcium, % Ca	1.04				
Magnesium, % Mg	0.39				
Sulfur, % S	0.19				
Zinc, ppm Zn	35				
Iron, ppm Fe	171				
Manganese, ppm Mn	86				
Copper, ppm Cu	9.0				
Boron, ppm B	31				
Chloride, % Cl	0.04				
Molybdenum, ppm Mo	0.01				

# Plant Analysis - Soybean

<u>Nutrient, %</u>	<u>Flowering Stage</u>
Nitrogen	4.26-5.50
Phosphorus	.26 - .50
Potassium	2.00 – 2.80
Sulfur	.18 - .30
Chloride	.20 - .60



# Plant Analysis - Soybean

<u>Nutrient, ppm</u>	<u>Flowering Stage</u>
Zinc	20-50
Iron	50 – 350
Manganese	25 – 200
Copper	6 – 30
Boron	21 – 60
Molybdenum	0.21 – 4.0





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Plant Analysis Report

WARD, RAYMOND & JOLENE  
 FARM ACCOUNT  
 2545 E 92ND ST  
 KEARNEY NE 68847

Invoice No. : 1050524  
 Date Received : 05/11/2009  
 Date Reported : 05/12/2009  
 Lab Number : 1206

Results For : FARM ACCOUNT  
 Location : WHEAT  
 Sample ID : HOME

Plant Type : Wheat  
 Stage : FEEKES8

	Result Dry Basis	Sufficiency Levels			
		Deficient	Low	Sufficient	High
Nitrogen, % N	4.11				
Phosphorus, % P	0.33				
Potassium, % K	4.86				
Calcium, % Ca	0.443				
Magnesium, % Mg	0.167				
Sulfur, % S	0.37				
Zinc, ppm Zn	33				
Iron, ppm Fe	195				
Manganese, ppm Mn	98				
Copper, ppm Cu	6.4				
Boron, ppm B	7				
Chloride, % Cl	0.11				
Molybdenum, ppm Mo	0.95				

Reviewed By : Raymond Ward

1/6/2010

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 Kearney, Nebraska 68848-0788





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Account No. : 90013

Plant Analysis Report

WARD, RAYMOND & JOLENE  
FARM ACCOUNT  
2545 E 92ND ST  
KEARNEY NE 68847

Invoice No. : 1046303  
Date Received : 03/05/2008  
Date Reported : 03/06/2008

Lab Number : 1044

Results For : GOODSON RANCH LP  
Location : NORTH B GOOD  
Sample ID : WINTER WHEAT

Plant Type : Wheat  
Stage : FEEKES4

	Result Dry Basis	Sufficiency Levels			
		Deficient	Low	Sufficient	High
Nitrogen, % N	4.59				
Phosphorus, % P	0.41				
Potassium, % K	3.02				
Calcium, % Ca	0.44				
Magnesium, % Mg	0.13				
Sulfur, % S	0.35				
Zinc, ppm Zn	32				
Iron, ppm Fe	615				
Manganese, ppm Mn	101				
Copper, ppm Cu	6.0				
Boron, ppm B	14				
Chloride, % Cl	0.73				
Molybdenum, ppm Mo	1.38				

This sample is low in Magnesium. I am not sure if foliar will help. Epsom salts is magnesium sulfate. Apply 2 to 4 lbs of epsom salts per acre as a trial.

# Micro-Nutrients

Micronutrient Availability is partially based on  
Soil Forming Factors

- Parent Material
- Vegetation
- Climate
- Time
- Topography

# Micro-Nutrients

- Availability of Micronutrients Based on Cultural Practices
  - No Till seems to reduce some micronutrients
  - Slower mineralization of organic matter
  - Chelation of “metals”
  - Root channels and other macro pores
    - Must have different root patterns
  - Higher yields



# Deficiency Symptoms

## Nitrogen

Older leaves turn light green to yellow color and spindly growth.

## Phosphorus

Blue-green color, stiff, stunted and erect growth. Leaflets often fold together, and the undersides and stems may be red or purplish.

## Potassium

Light green to yellow color and spindly growth.

## Magnesium

Older leaves turn yellow at the edge, similar to K

## Sulfur

Sulfur Deficiency: Light green, similar to N deficiency, spindly stems and weak growth.

# Deficiency Symptoms

- Copper
  - Leaves are dark green, plant is stunted
- Iron
  - Yellowing occurs between the veins of young leaves
- Manganese
  - Yellowing pattern is not as distinct as with iron
- Nickel
  - Firing of upper leaves
- Zinc
  - Shortened internodes, yellowing on mid-leaves across veins

# Deficiency Symptoms

- Boron
  - Terminal buds die, lower leaves misshapen, shortened internodes
- Chloride
  - Wilting and reduced leaf growth
- Molybdenum
  - Appear as N deficiency, stunted growth, and chlorosis











# Phosphorus deficiency



# Phosphorus Deficiency and Response





# Phosphorus Deficiency





# Potassium deficiency







# Potassium deficiency







# Sulfur Deficiency - Corn





# Sulfur Deficiency - Corn





# Sulfur Deficiency in Wheat



# Indicators of Possible S Deficiency

- 1) No-Till Farming
- 2) Organic Matter Content
- 3) Soil Texture
- 4) Soil Test Level
- 5) Irrigation Water Sulfate Concentration



# Magnesium Deficiency







Zinc Deficiency



# Zinc Deficiency Iowa State U



# Zinc Deficiency - Soybeans









# Zinc Deficiency Wheat



# Zinc and 10-34-0

- Do not mix more than 1 pound of Zn with 30 lbs of P<sub>2</sub>O<sub>5</sub>.
- Or 1 pound of Zn with 7 gallons of 10-34-0.
- Polyphosphate sequesters zinc, so ammoniated zinc or chelated zinc will react the same in the soil.

# Iron Deficiency





# Iron Deficiency



# Manganese Deficiency



# Manganese Deficiency

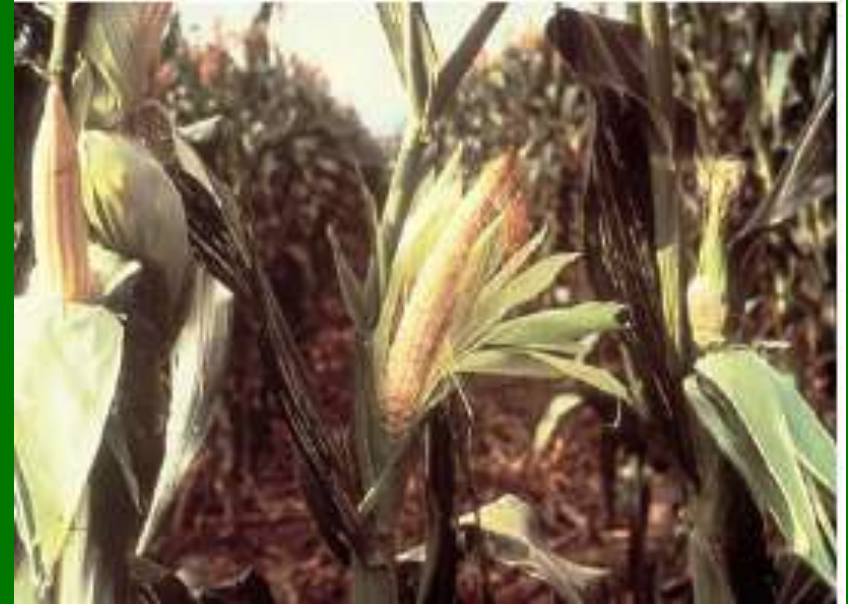




# Copper Deficiency Wheat



# Boron Deficiency in Corn



# Molybdenum Deficiency





# Molybdenum Application

- Foliar Treatment
  - 2 ounces of Sodium Molybdate per acre in 30 gallons of water as a foliar
- Seed Treatment
  - 1/2 ounce of Sodium Molybdate per bushel

# Chloride Deficiency



# Chloride Deficiency





# Magnesium Deficiency



# Calcium:Magnesium Ratio

In summary, the Ca:Mg ratio concept is unproven and should not be used as a basis for fertilization or liming practices.

Having sufficient levels of Ca and Mg is the proper method of evaluation, rather than trying to manipulate ratios.



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Account No. : 90013

**Plant Analysis Report**

WARD, RAYMOND & JOLENE  
FARM ACCOUNT  
2545 E 92ND ST  
KEARNEY NE 68847

Invoice No. : 1034433  
Date Received : 06/30/2008  
Date Reported : 07/01/2008  
Lab Number : 1734

Results For : RAY WARD  
Location : N OF B  
Sample ID : CORN

Plant Type : Corn  
Stage : 10-14 L

	Result Dry Basis	Sufficiency Levels			
		Deficient	Low	Sufficient	High
Nitrogen, % N	3.00				
Phosphorus, % P	0.39				
Potassium, % K	2.66				
Calcium, % Ca	0.34				
Magnesium, % Mg	0.11				
Sulfur, % S	0.20				
Zinc, ppm Zn	16				
Iron, ppm Fe	111				
Manganese, ppm Mn	100				
Copper, ppm Cu	9.2				



# Factors in Addition to Soil pH Which Influence the Frequency of Liming

- **Soil texture**
- **Rate of N fertilization**
- **Rate of crop removal of Ca and Mg**
- **Amount of lime applied**
- **pH range desired**

# The Best Placement Method

Minimizing  
Fertilizer  
reaction with  
soil



Balance

Maximizing  
contact with  
roots

# Carbon/Organic Matter

- Organic Matter is about 58 % C
- Ratio becomes 170 OM : 8 N : 1 S
- 1 % OM in 8 inches of Soil is 24,000 lbs/A
- This Quantity of OM Holds About 1100 lbs of N and 140 lbs of S per Acre.
- This is true for other plant nutrients



Thank You