SITE-SPECIFIC AGRONOMIC SOLUTIONS

NEW COOPERATIVE INC.

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ANTHONY AND RENEE HOLMES

SLINING HOME - ALL - BLA12SW

Summer 2018

6/6/2018

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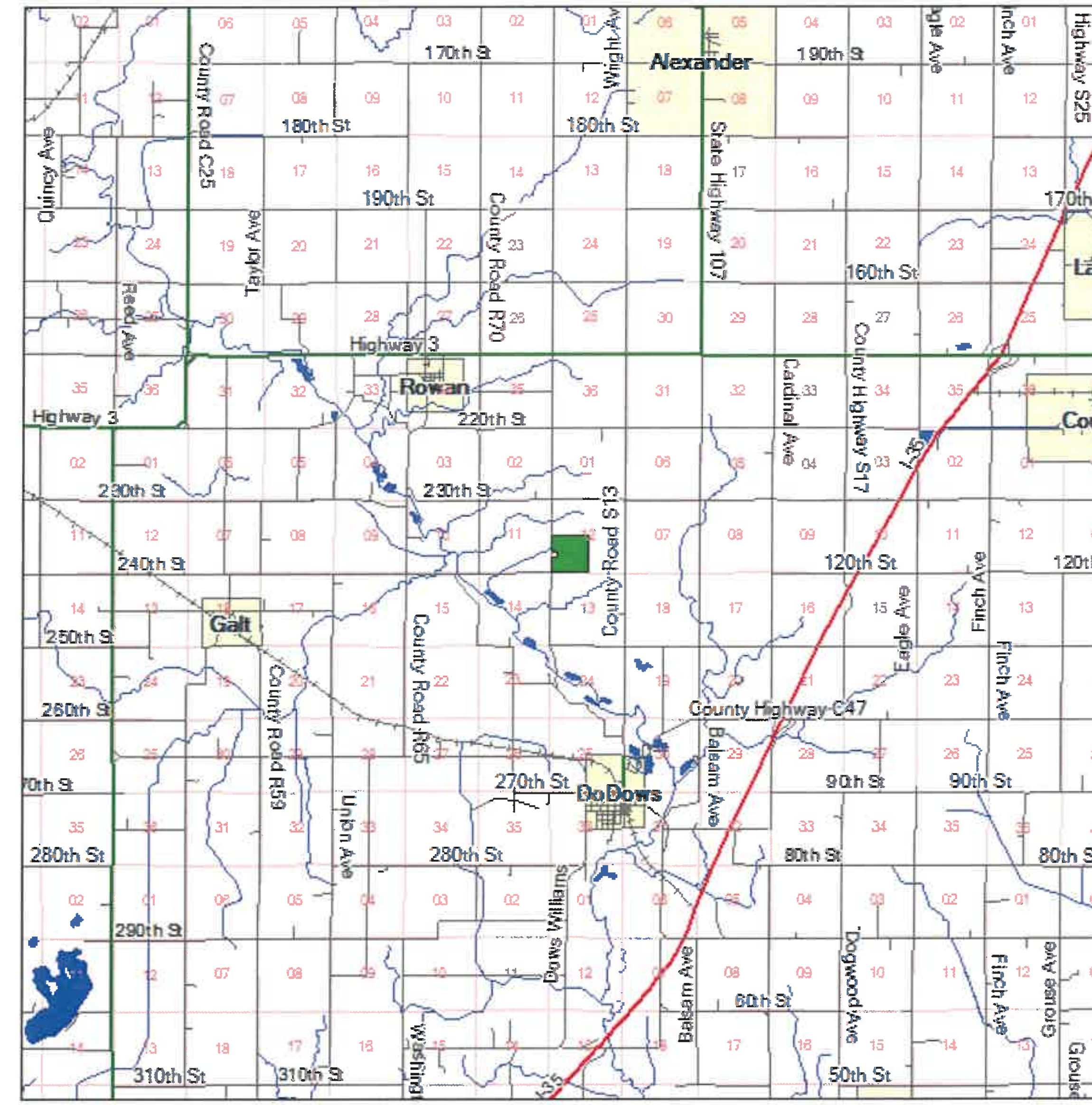
YOUR TECHNOLOGY PARTNER IN THE FIELD

HOLMES, ANTHONY AND RENEE



BLA12SW

Contact

NEW Cooperative
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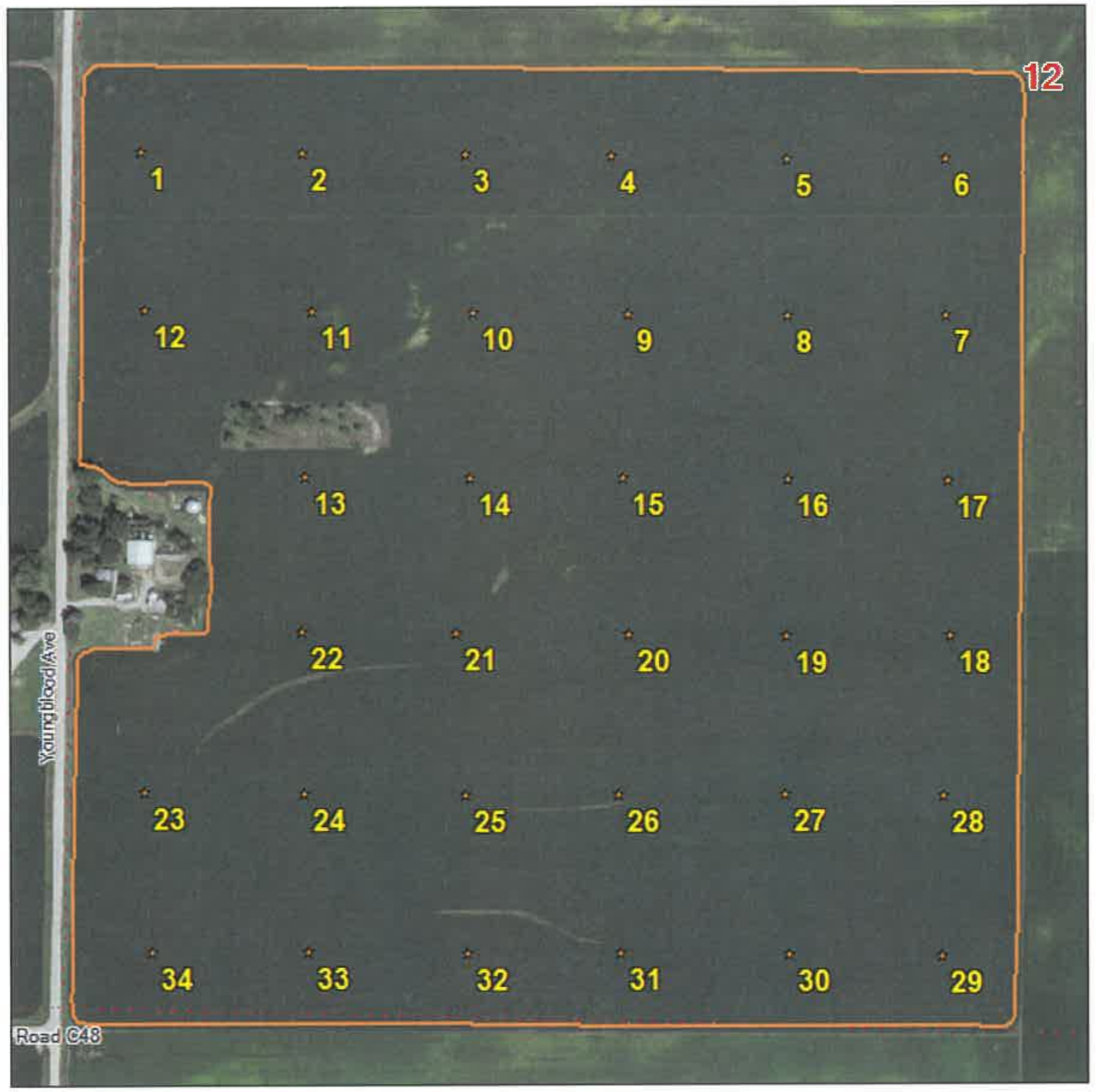
MAPS
MIDWEST AGRONOMIC PROFESSIONAL SERVICES™
NEW COOPERATIVE

Blaine Township of Wright County
Section 12



Customer Name	**HOLMES, ANTHONY AND RENEE**
Farm Name	**SLINING HOME**
Field Name	**ALL**
Field Code	**BLA12SW**
Sampled	**Summer 2018**
Field Acres	**151.68 acres**
Acres per Sample	**4.46**

MAPS Ratings

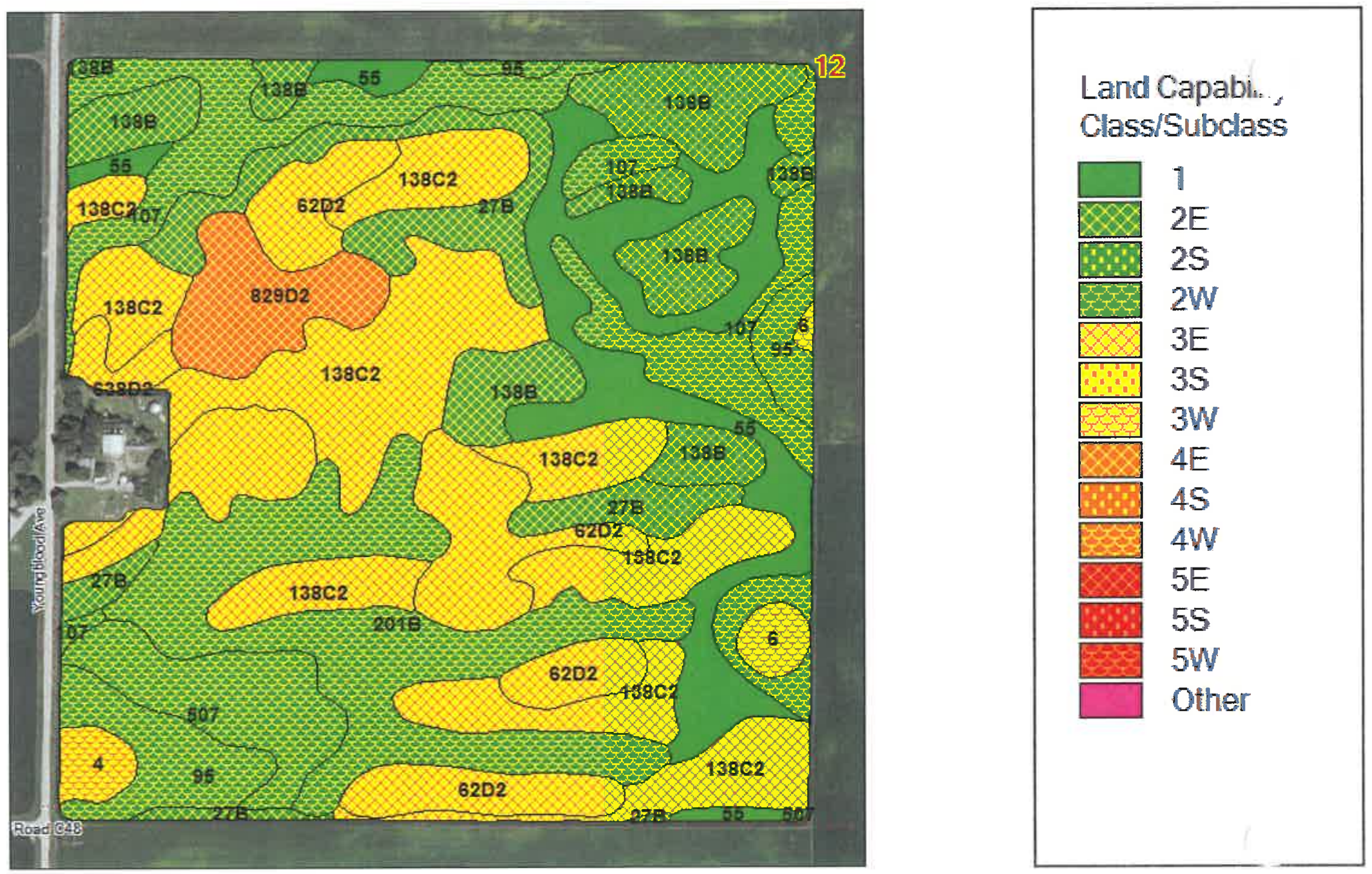
To maintain a given soil fertility level, one needs to apply the amount of nutrients used by the crop. A fertilizer application that is greater than what the crop removes will build soil fertility levels. Conversely, applying less than crop removal will deplete the soil fertility levels.

Throughout the MAPS fertility management book the following color scheme is used.

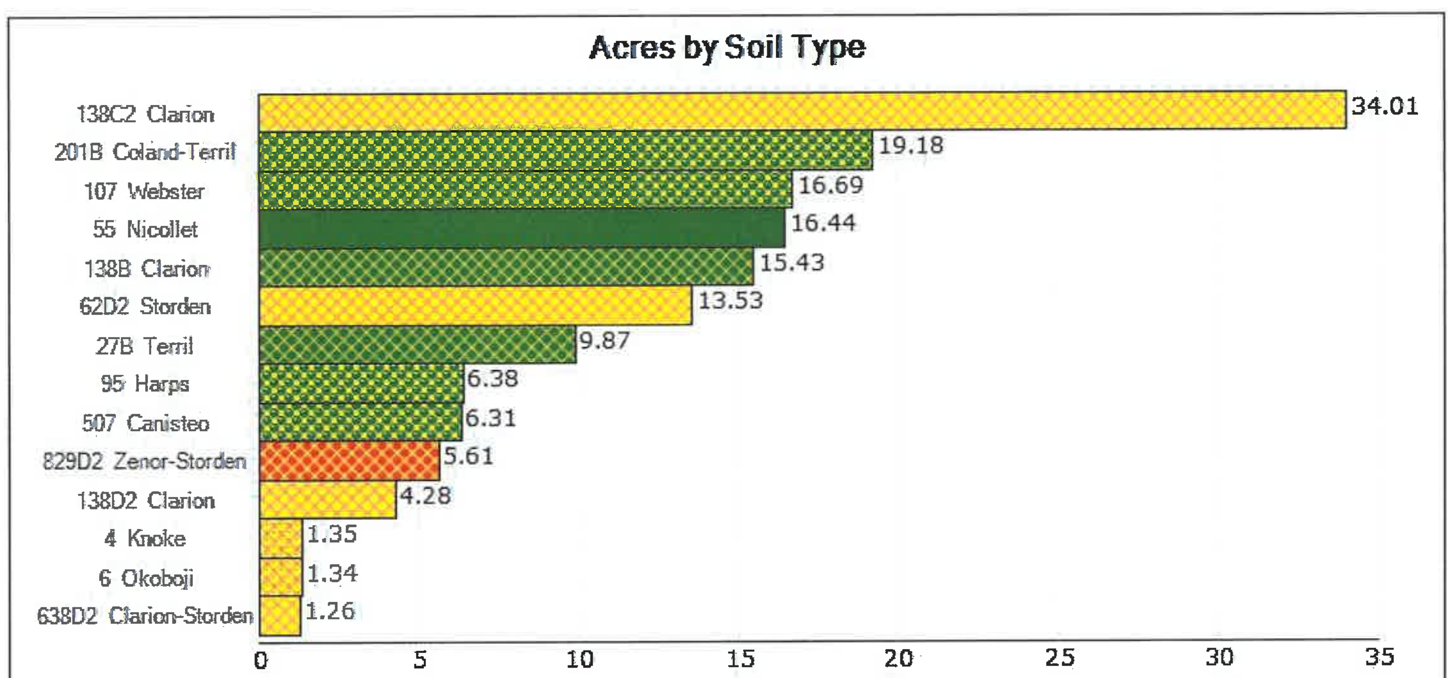
Very Low Red	Yields are usually restricted.
Low Orange	Yields are usually restricted unless conditions are ideal.
Optimum Yellow	Enough nutrients for most conditions for a typical year.
High Green	Enough nutrients for high yield goals under a wide range of conditions.
Very High Blue	It is unlikely to see any economic response to fertilizer applied to these areas.

Disclaimer
The MAPS recommendations included in the book are based on the best information that we currently have available to us. The final decision as to the best methodology to be used rests with the individual producer who is aware of the variables involved in successful crop production. MAPS makes no expressed or implied warranties with the respect to crop yield or successful production with respect to the information contained herein.

Soil Types



BLA12SW



SIGN UP TODAY for the NEW COOP GRID SAMPLING LOYALTY PROGRAM

BENEFITS

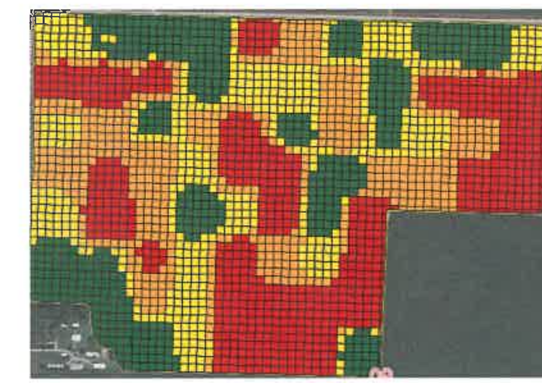
- Auto enrolled to have your fields soil sampled in the 2.5 acre grid sampling loyalty program every four years
- Geo-referenced field boundaries
- Grid sampling with analytical soil sampling results
- Booklet with color coded nutrient maps following sampling
- Annual NEW Coop agronomist planning sessions with field recommendations provided

PROBABLE INCREASE IN YIELDS DUE TO CORRECT PLACEMENT OF NUTRIENTS

GOOD CONSERVATION MANAGEMENT

"Many Iowa producers are choosing to apply the right rate of fertilizer, at the right time." "Using a good soil sampling method and variable-rate technology will help determine the phosphorus and potassium application rate within fields."

- Quote from Antonio Mallarino, ISU Extension Agronomist and Professor of Agronomy



NAME

PHONE

EMAIL

NEW COOP LOCATION

No. of ACRES

If you are interested, please fill out and return to your NEW Cooperative Agronomist or office location.

MAIN OFFICE
2626 1st Avenue South
P.O. Box 818
Fort Dodge, IA 50501

515-955-2040
www.newcoop.com

Soil Types

Soils in Iowa have different inherent capabilities as far as their ability to produce a given crop. The soil type map on the adjoining page was generated using the *Land Capability Classification* that shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their production capabilities for field crops and the way they respond to management. Criteria used in grouping the soils do not include major and generally expensive land forming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects.

The class numbers, 1 through 7, in the legend right of the map indicate progressively greater limitations and narrower choices for practical use. They are defined as follows:

Class I (1) soils have slight limitations that restrict their use.

Class II (2) soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Class III (3) soils have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Class IV (4) soils have very severe limitations that restrict the choice of plants or require very careful management, or both.

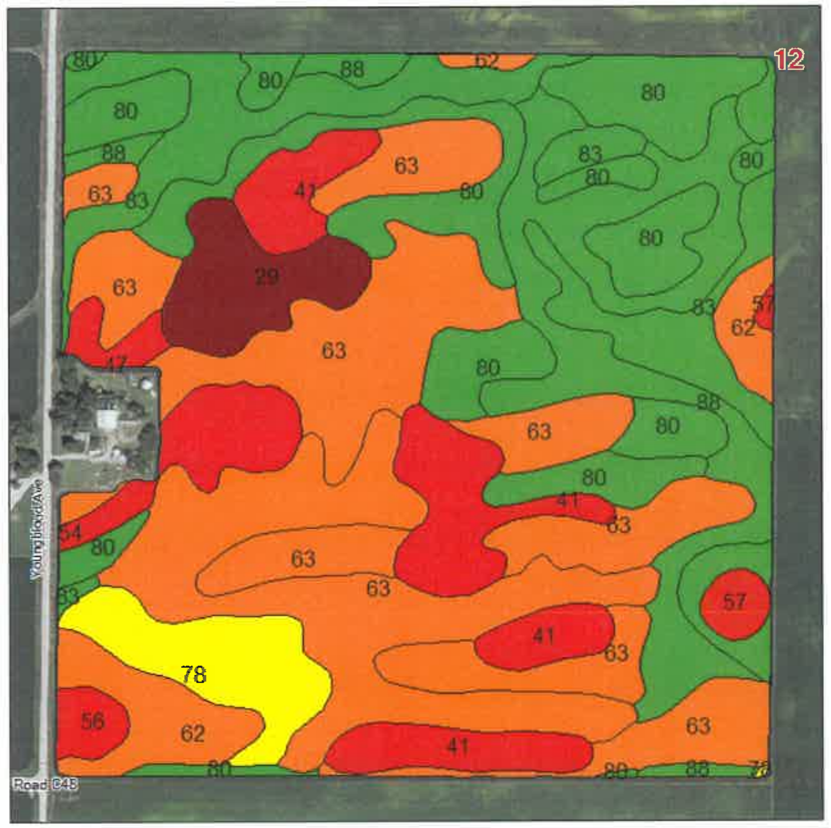
Class V (5) soils have little or no hazard of erosion but have other limitations, impractical to remove, that limit their use mainly to pasture, range, forestland, or wildlife food and cover.

Class VI (6) soils have severe limitations that make them generally unsuited to cultivation and that limit their use mainly to pasture, range, forestland, or wildlife food and cover.

Class VII (7) soils have very severe limitations that make them unsuited to cultivation and that restrict their use mainly to grazing, forestland, or wildlife.

The histogram at the bottom of the soil types page further details the soils by symbol, soil name, slope, and the acres included by each type for the field.

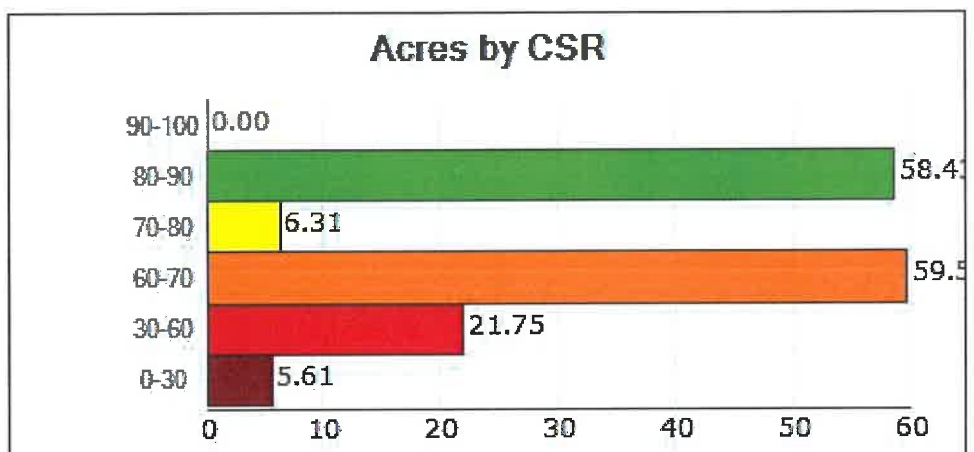
Corn Suitability Rating



BLA12SW

CSR Levels

- 90 - 100
- 80 - 90
- 70 - 80
- 60 - 70
- 30 - 60
- 0 - 30
- All Others



Summary

67.61 is the weighted average CSR value. Field is 151.68 acres in size.

CSRs provide a relative ranking of all soils mapped in the state of Iowa based on their potential to be utilized for row crop production. The CSR is an index that can be used to rate one soils potential yield production against another over a period of time.

Adapted from Miller, Gerald A, 1988. Corn Suitability Ratings - An Index to Soil Productivity, Iowa State Univer. University Extension, Publication Pm-1168. Revised January 2002.

SOIL ANALYSIS

Date Received 4-Jun-2018 | Date Reported 05-Jun-2018 | Information Sheet # 57918

AgSource LABORATORIES

20	6.1	6.7			3.1		91				225	246	2512	8	6	2.9					19.0	20.1	3.0	10.8	66.0	0.2
21	6.4	6.9			2.4		72				191	193	2281	8	6	2.9					15.9	14.7	3.1	10.1	71.9	0.2
22	6.2	6.9			2.2		96				214	138	1703	7	2	2.5					12.8	19.7	4.3	9.0	66.7	0.2
23	6.0	6.7			3.3		39				148	324	3010	9	8	1.5					22.1	17.9	1.7	12.2	68.0	0.2
24	5.8	6.6			3.9		90				203	264	3219	8	7	2.9					24.3	22.5	2.1	9.0	66.2	0.1
25	6.1	6.6			3.9		50				185	371	3628	8	9	2.4					26.4	17.7	1.8	11.7	68.7	0.1
26	5.7	6.5			2.9		24				170	309	2318	9	7	1.0					20.2	27.4	2.2	12.8	57.5	0.2
27	5.5	6.7			2.1		30				113	252	1728	8	6	0.7					14.7	24.9	2.0	14.3	58.6	0.2
28	5.9	6.3			6.2		102				411	351	4090	8	10	3.5					32.7	25.3	3.2	8.9	62.5	0.1
29	5.8	6.8			2.5		89				189	248	2568	8	7	2.3					18.8	17.8	2.6	11.0	68.5	0.2
30	6.3	6.8			3.1		101				242	244	2628	8	8	3.0					18.9	16.3	3.3	10.8	69.5	0.2
31	5.4	6.5			3.0		54				157	282	2721	9	8	2.1					22.2	26.0	1.8	10.6	61.4	0.2
32	6.3	7.1			2.1		67				134	208	1759	8	5	2.0					12.6	13.2	2.7	13.8	70.0	0.3
33	7.8	—			4.5		1		17		228	142	5526	7	14	1.9					29.4		2.0	4.0	93.9	0.1
34	6.8	—			6.5		101				394	418	5615	10	13	3.3					32.6		3.1	10.7	86.1	0.1

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SOIL ANALYSIS

AgSource LABORATORIES

Submitted by 5050110
NEW Cooperative
Attn:A/P 53171
PO Box 818
Fort Dodge, IA 50501-0818

Submitted for
HOLMES

Laboratory Sample #
BG87518 - BG87551

Date Received
4-Jun-2018

Date Reported
05-Jun-2018

Information Sheet #
57918

Field Id: BLA12SW

Sample Id	Soil pH	Buffer pH	Free Lime	Sol. Salt	OM	NO_3	Phosphorus Bray I	Phosphorus Bray II	Phosphorus Olsen	Phosphorus M-3	K	Mg	Ca	Na	S	Zn	Mn	Cu	Fe	B	CEC	% Base Saturation H	% Base Saturation K	% Base Saturation Mg	% Base Saturation Ca	% Base Saturation Na
					%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm		%	%	%	%	%
1	5.9	6.6			2.9		37				153	357	2921	10	9	1.2					22.7	20.6	1.7	13.1	64.4	0.2
2	7.7	---			4.7		42		18		146	349	6413	10	16	2.0					35.4		1.1	8.2	90.6	0.1
3	5.8	6.6			3.5		39				193	427	3655	9	8	2.0					27.8	19.5	1.8	12.8	65.8	0.1
4	5.6	6.5			2.8		34				184	199	1979	8	7	1.5					17.8	32.4	2.6	9.3	55.5	0.2
5	5.5	6.4			3.1		36				168	256	2405	9	7	1.9					21.2	31.2	2.0	10.0	56.6	0.2
6	5.8	6.6			4.0		36				180	368	3397	9	8	2.2					25.7	20.1	1.8	11.9	66.0	0.2
7	5.9	6.7			4.0		69				174	402	3358	9	8	2.6					25.0	17.4	1.8	13.4	67.3	0.2
8	5.7	6.5			3.1		59				202	271	2544	10	7	2.4					21.1	26.4	2.5	10.7	60.3	0.2
9	6.2	6.8			3.1		75				207	301	2896	9	7	2.8					20.3	13.5	2.6	12.4	71.3	0.2
10	7.4	---			2.3		159		65		283	279	2498	7	6	4.5					15.6		4.7	14.9	80.2	0.2
11	6.8	---			2.0		59				122	328	2193	8	7	1.9					14.0		2.2	19.5	78.1	0.2
12	6.3	7.0			2.0		71				151	213	1595	8	4	2.3					12.1	16.3	3.2	14.6	65.6	0.3
13	6.2	7.0			2.1		70				184	258	1857	8	7	2.3					14.0	14.8	3.4	15.3	66.3	0.2
14	5.6	6.6			2.6		82				294	187	1675	7	5	2.2					15.7	31.9	4.8	9.9	53.2	0.2
15	4.8	5.9			3.6		93				398	220	1775	13	8	2.2					24.0	50.8	4.3	7.7	37.0	0.2
16	5.8	6.5			3.8		60				290	347	2982	9	8	2.3					24.8	25.0	3.0	11.7	60.1	0.2
17	7.9	---			3.6		6		16		148	200	5862	7	15	1.9					31.4		1.2	5.3	93.4	0.1
18	5.8	6.7			2.7		67				186	222	2072	10	7	2.1					17.1	25.5	2.8	10.8	60.6	0.3
19	5.8	6.6			3.5		103				259	249	2719	8	7	3.4					20.9	21.6	3.2	9.9	65.1	0.2

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Corn Suitability Rating (CSR)

Corn Suitability Rating (CSR) is an index procedure developed in Iowa to rate each different kind of soil for its potential row-crop productivity. Soil profile properties and weather conditions are the dominant factors that affect productivity. Slope characteristics are major factors that determine how land should be used. Slope gradient and slope length affect potential erosion rates, water infiltration, and ease and efficiency of machine operation.

CSRs provide a relative ranking of all soils mapped in the state of Iowa based on their potential to be utilized for row-crop production. The CSR is an index that can be used to rate one soil's potential yield production against another over a period of time.

The CSR considers average weather conditions as well as the frequency of use of soil for row-crop production. Ratings range from 100 for soils that have no physical limitations, occur on minimal slopes, and can be continuously row-cropped to as low as 5 for soils with severe limitations for row crops.

The CSR assumes:
(a) adequate management
(b) natural weather conditions (no irrigation)
(c) artificial drainage where required
(d) soils lower on the landscape are not affected by frequent floods
(e) no land leveling or terracing

The CSR for a given field or farm can be modified by sandy spots, rock outcroppings, field boundaries, wet spots, and other special soil conditions.

Predicted yields are expected to change with time. CSRs are expected to remain relatively constant in relation to one another. CSRs can be used to quantify the productivity potential for individual fields, farms or larger tracts of land.

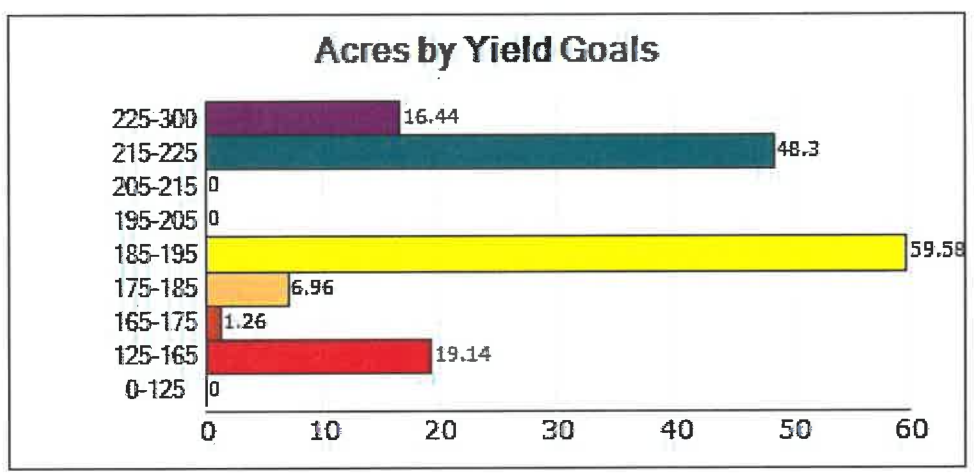
ISU Extension Publication Pm-1168. Revised Jan. 2002

Corn Yield Goals

BLA12SW

CornYld Levels

- 225 - 300
- 215 - 225
- 205 - 215
- 195 - 205
- 185 - 195
- 175 - 185
- 165 - 175
- 125 - 165
- 0 - 125
- All Others



Weighted Average

200.1 bu/acre is the average yield goal set for this field. Due to uncontrollable factors these yields can not be guaranteed. The production goal for this field is 30,346 total bushels of Corn.

Sulfur

HOLMES, ANTHONY AND RENEE
Wright
Blaine 12

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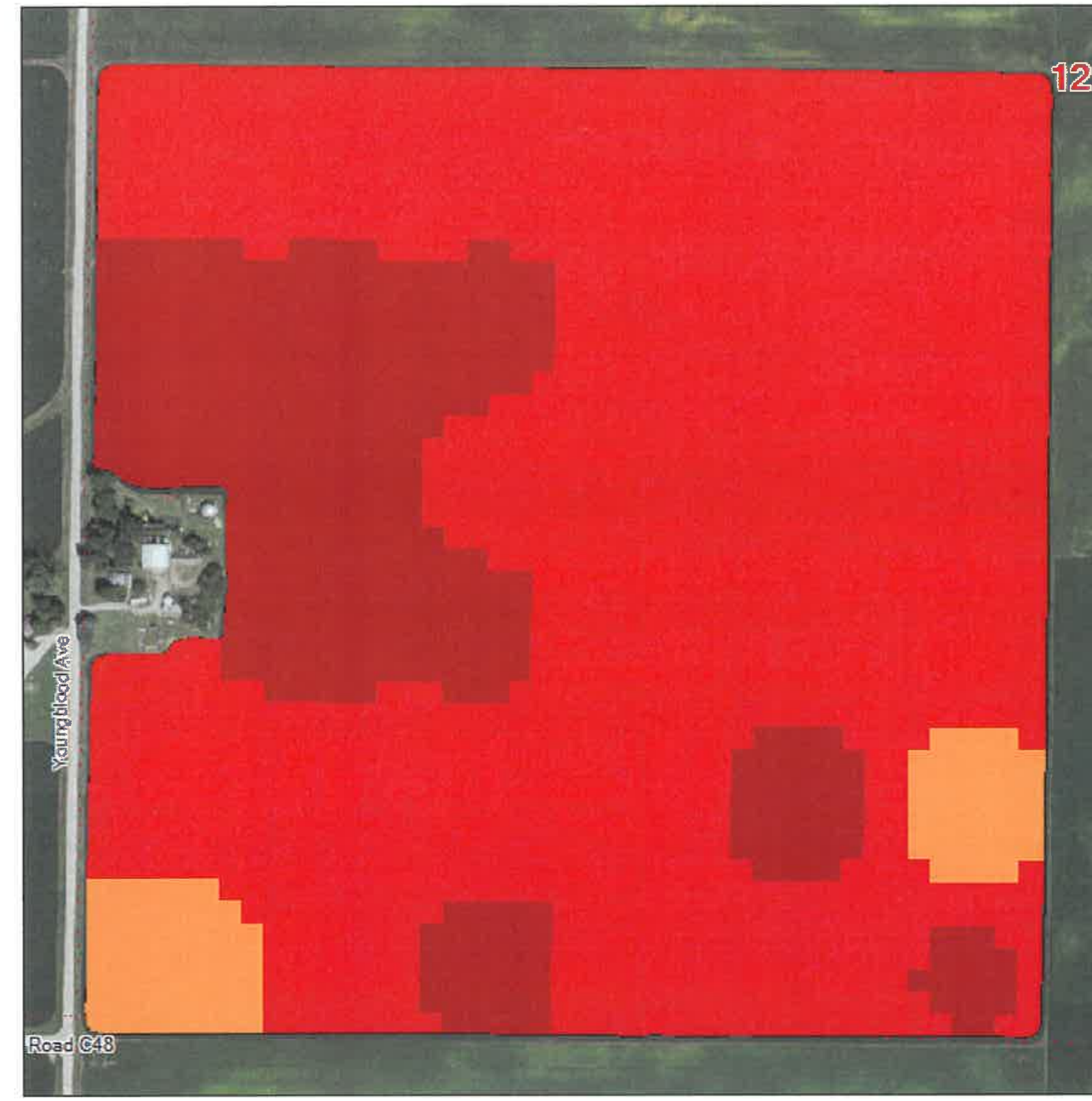
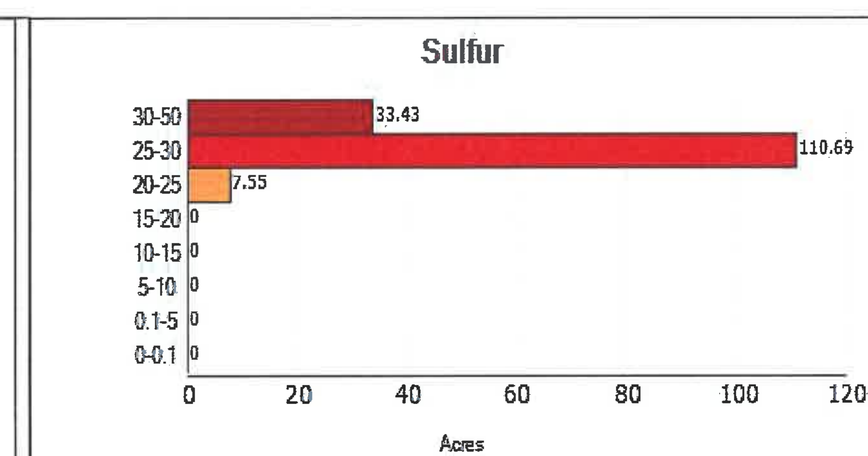


BLA12SW

Sulfur Levels

- 30 - 50
- 25 - 30
- 20 - 25
- 15 - 20
- 10 - 15
- 5 - 10
- 0.1 - 5
- 0 - 0.1
- All Others



UNITS

MIN.	22.0
AVG.	28.50
MAX.	31.0
Acres	151.68
Total	4322.8

Zinc 4yr

HOLMES, ANTHONY AND RENEE
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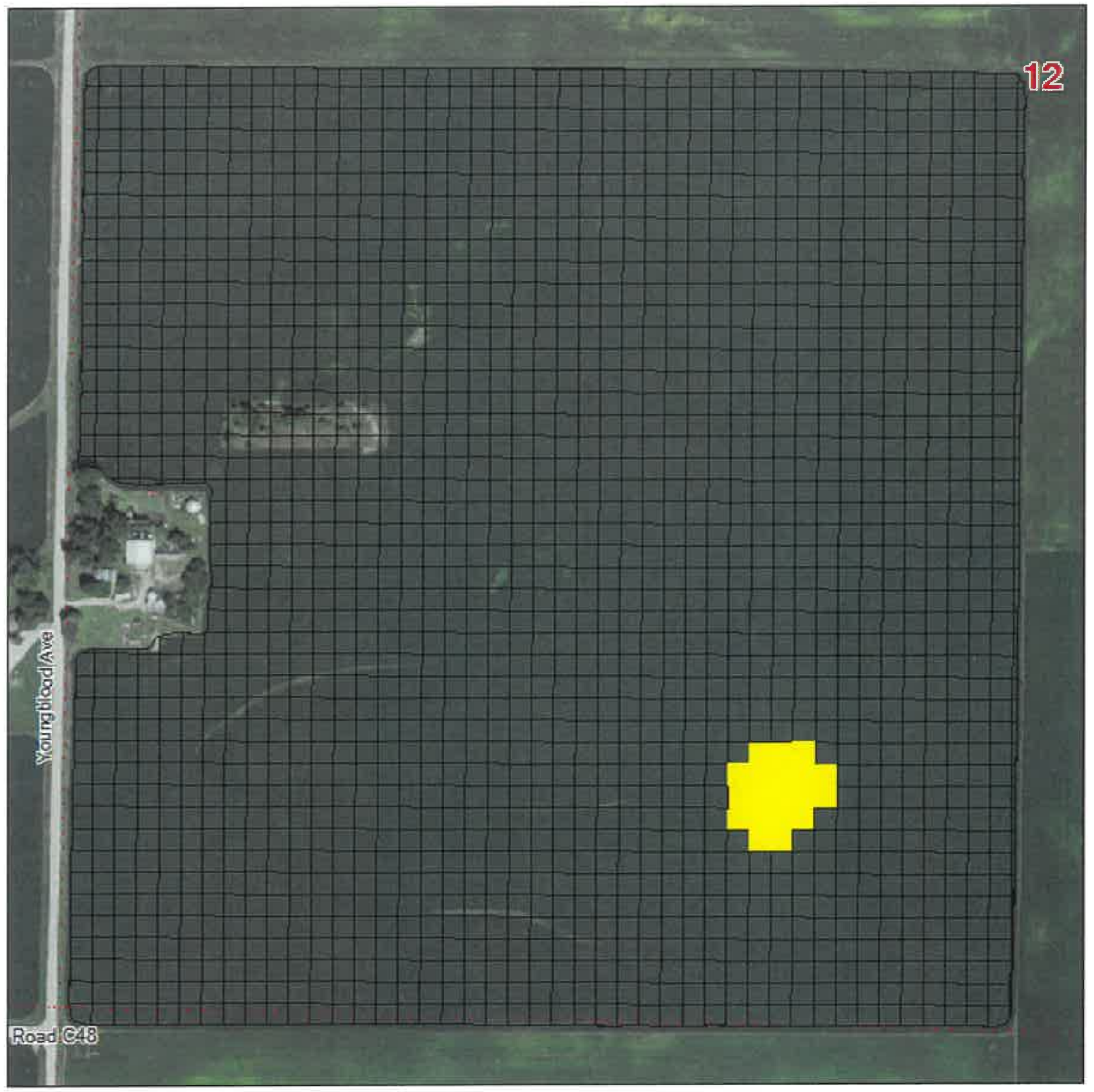
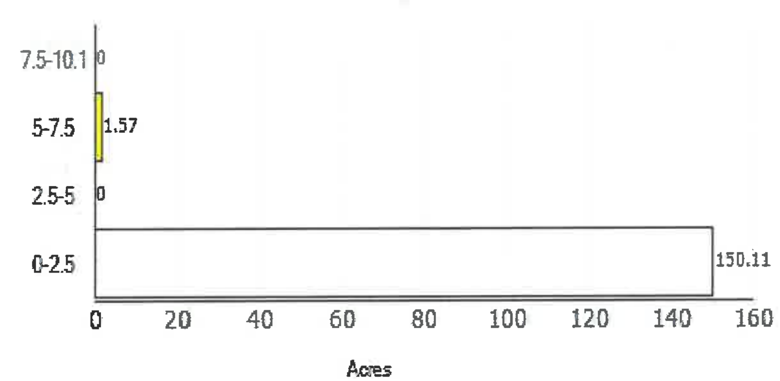


BLA12SW

Zinc4yr Levels

- 7.5 - 10.1
- 5 - 7.5
- 2.5 - 5
- 0 - 2.5
- All Others

Zinc 4yr



UNITS	
MIN.	0.0
AVG.	0.05
MAX.	5.0
Acres	151.68
Total	7.6

Corn Yield Goals

The MAPS program uses soil productivity along with grid sampling to generate the best possible recommendation for nutrient needs. It is obvious that not all areas of a given farm are capable of producing the same yield, therefore yield goals are assigned by productivity and recommendations are made accordingly.

Iowa is fortunate to have most of their soil survey data in digital format allowing it to be used with a Geographic Information System. This digitized data is what is used to predict productivity for each field.

Corn yield is in bushels per acre. The benchmark yield is for weather conditions in a specific area and is based off historical yield. The yield estimate for each soil mapping unit SMU is based on kind of parent material, slope class, erosion class, natural drainage class, and nature of the subsoil in terms of rooting environment to include limiting layers, soil depth, and plant available water capacity. In addition, potential for periodic flooding and weather conditions is included.

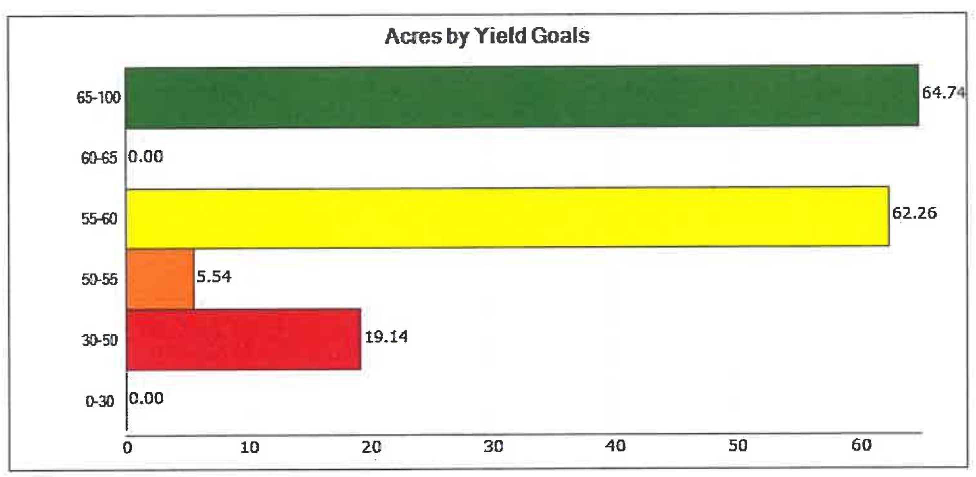
Even though it is difficult to predict yield goals from year to year, long-term averages will give definite trends in productivity. The historical corn yields for each soil type are taken from the newly updated Soil Survey Geographic (SSURGO) Database that is established through NRCS at each county office. With the help of your local agronomist, this yield layer may be edited to meet your specific farm goals. These variable yield goals, defined by soil type, along with any adjustments that you might have made, are the base for productivity for each farm and are used for determining nutrient applications.

It is also important to match specific hybrids to the field situation in which the hybrid will be planted. For example, a quick emerging hybrid with good early season plant vigor may be advantageous for a soil that tends to be wet. A different hybrid may be necessary where a very high soil fertility level exists.

Soybean Yield Goals

BLA12SW

BeanYld Levels
65 - 100
60 - 65
55 - 60
50 - 55
30 - 50
0 - 30
All Others



Weighted Average

60.1 bu/acre is the average yield goal set for this field. Due to uncontrollable factors these yields can not be guaranteed. The production goal for this field is 9,112 total bushels of Soybeans.

HOLMES, ANTHONY AND RENEE
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Bean Green K

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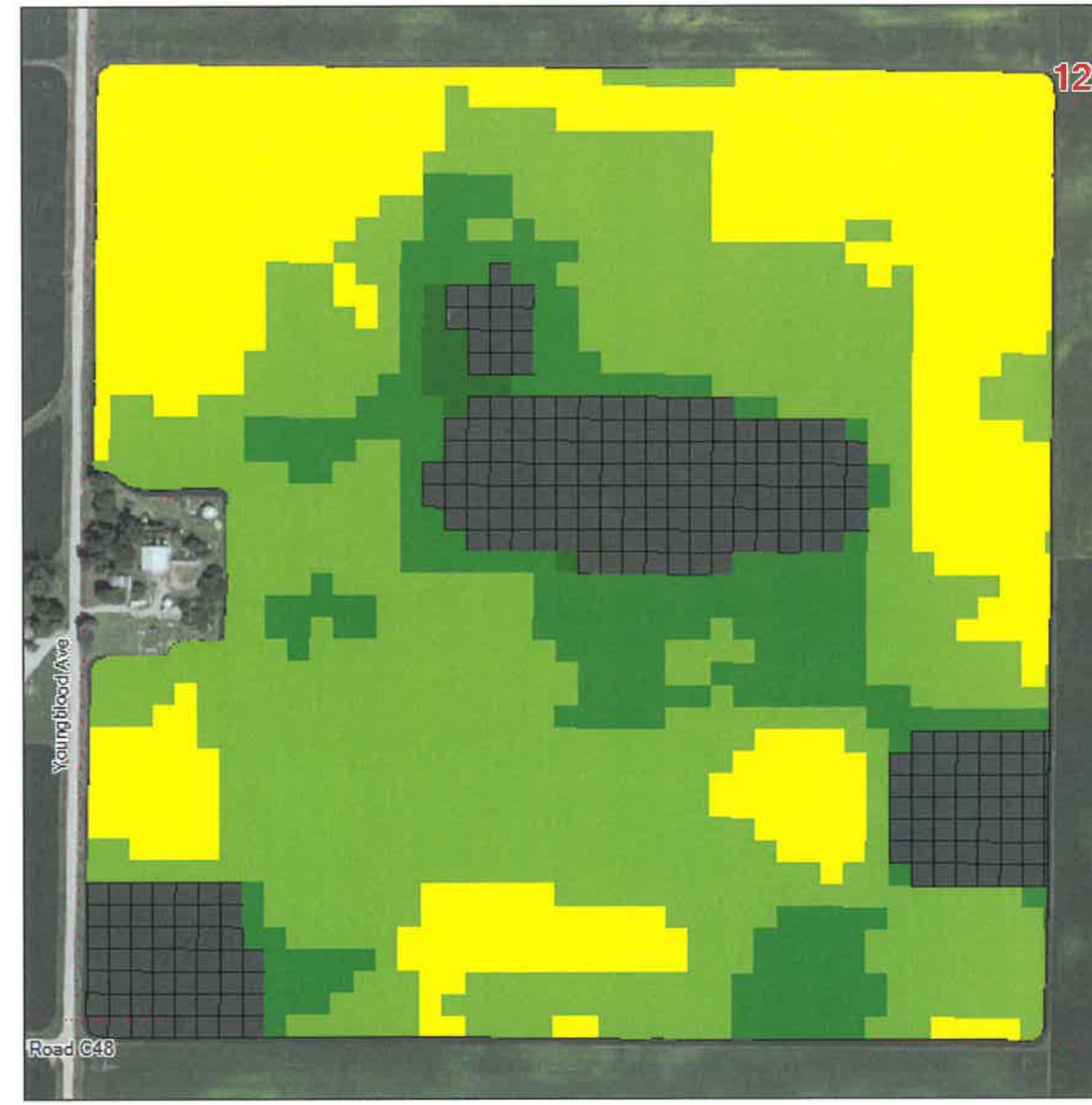
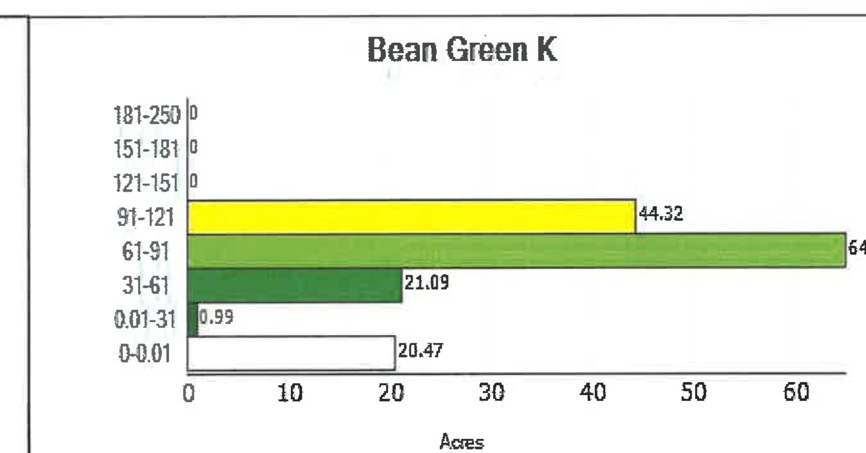


BLA12SW

DGrnKBn Levels
181 - 250
151 - 181
121 - 151
91 - 121
61 - 91
31 - 61
0.01 - 31
0 - 0.01
All Others



UNITS	
MIN.	0.0
AVG.	69.59
MAX.	114.1
Acres	151.68
Total	10554.7

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Bean Green P

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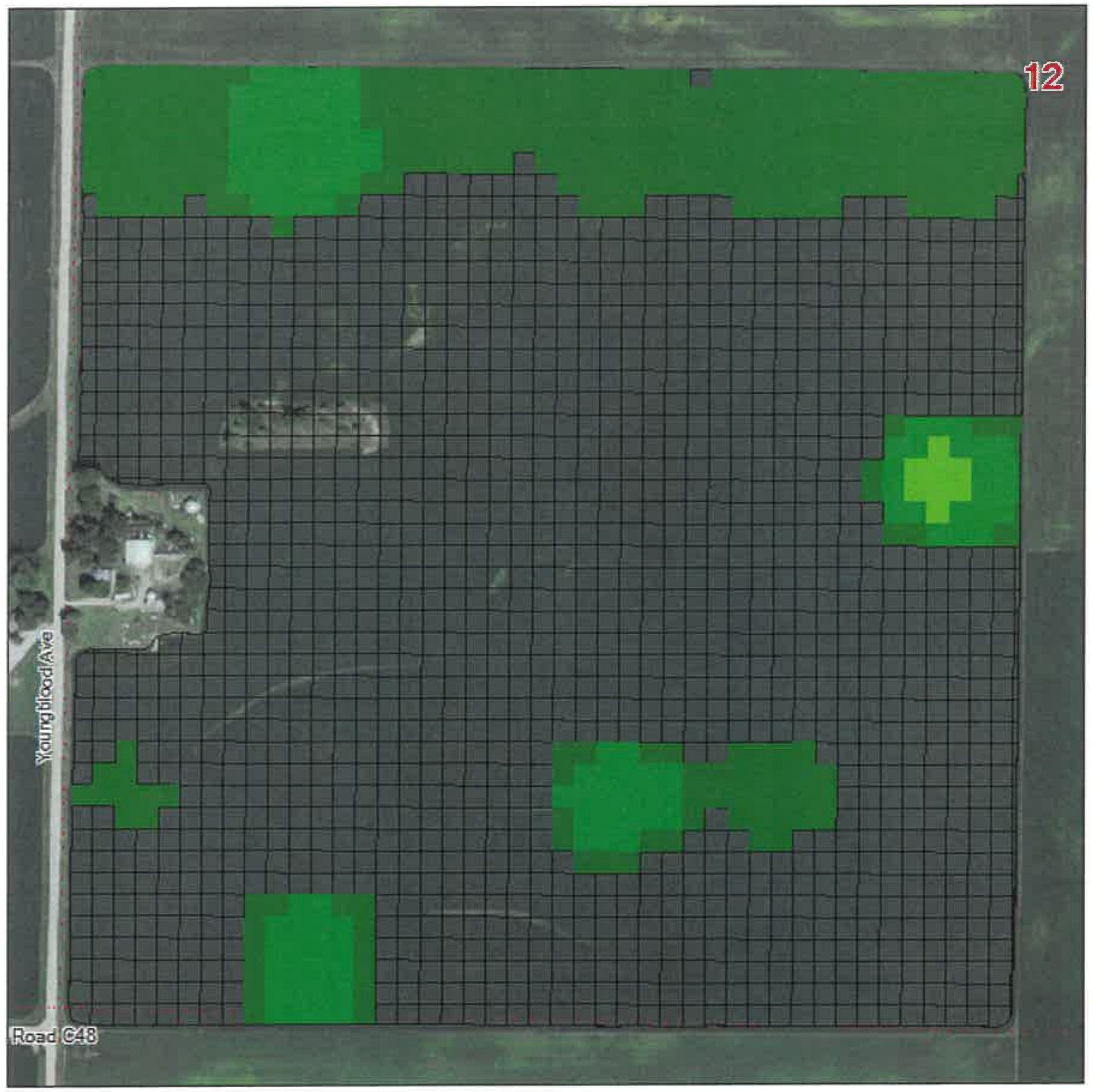
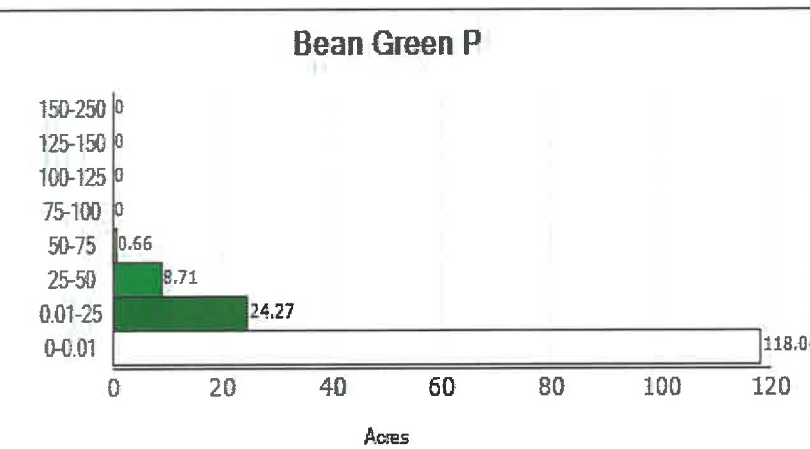


BLA12SW

BnGreenP Levels

Levels
150 - 250
125 - 150
100 - 125
75 - 100
50 - 75
25 - 50
0.01 - 25
0 - 0.01
All Others



UNITS	
MIN.	0.0
AVG.	3.68
MAX.	50.8
Acres	151.68
Total	558.0

Soybean Yield Goals

Soybean yield goals are derived in much the same way as the corn yield potential. However, soybeans tend to be much more sensitive to drainage and high pH issues than corn. The bean yield goals are calculated from a percentage of the estimated corn yield. Location in the state and kind of parent material are considered in these calculations.

It is possible to improve yield in some soils by drainage. Certain soils have properties that cannot practically be improved. Poor internal drainage, high pH subsoil and shallow topsoil are some examples. If the yield goal map for your farm has areas that are rated incorrectly, contact your MAPS representative to make the changes.

It is economically impractical to lower high pH soils. Proper selection is critical in managing high pH soils. Soybean varieties have a wide range of genetic ability to tolerate high pH soils.

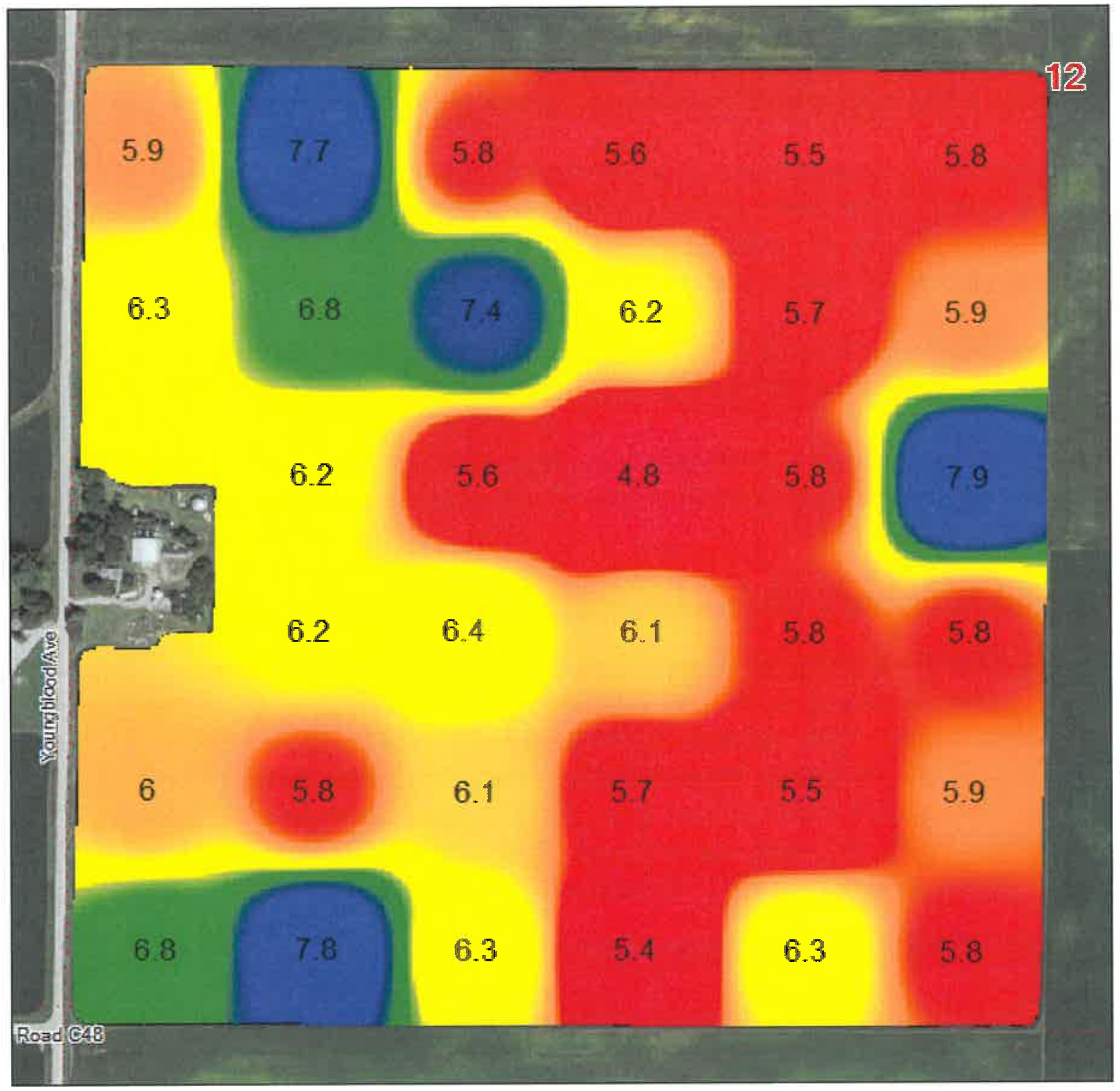
Another important test to consider is a Soybean Cyst Nematode test. It has been proven that Soybean Cyst Nematode is a much bigger factor in limiting soybean yield than earlier realized in our part of the country.

Factors to consider when adding an SCN test include:

- SCN is currently the #1 soybean disease in the United States.
- SCN may cause a 15-30% yield loss without *any* above ground symptoms.
- SCN may take several soybean rotations to build up before it becomes a problem; therefore early detection is key for management.
- Once SCN has infected an area, it can never be completely eradicated. However, you may be able to keep it from spreading from field to field through management practices. Knowing where it is and is not is key to management.

Ask your MAPS representative to explain what we've come to learn about SCN.

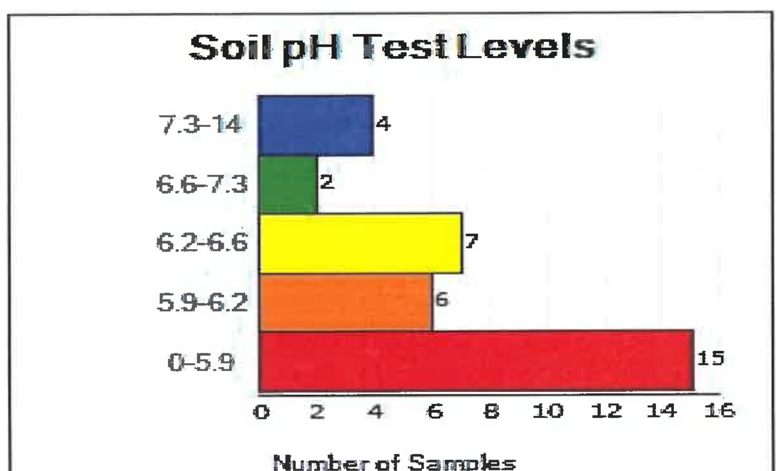
Soil pH Test Levels



BLA12SW **Sampled 2018**

RANGES

- Very High
- High
- Optimum
- Low
- Very Low
- All Others



Statistics

MIN. 4.8

AVG. 6.1

MAX. 7.9

Corn Green K

HOLMES, ANTHONY AND RENEE
Wright
Blaine 12

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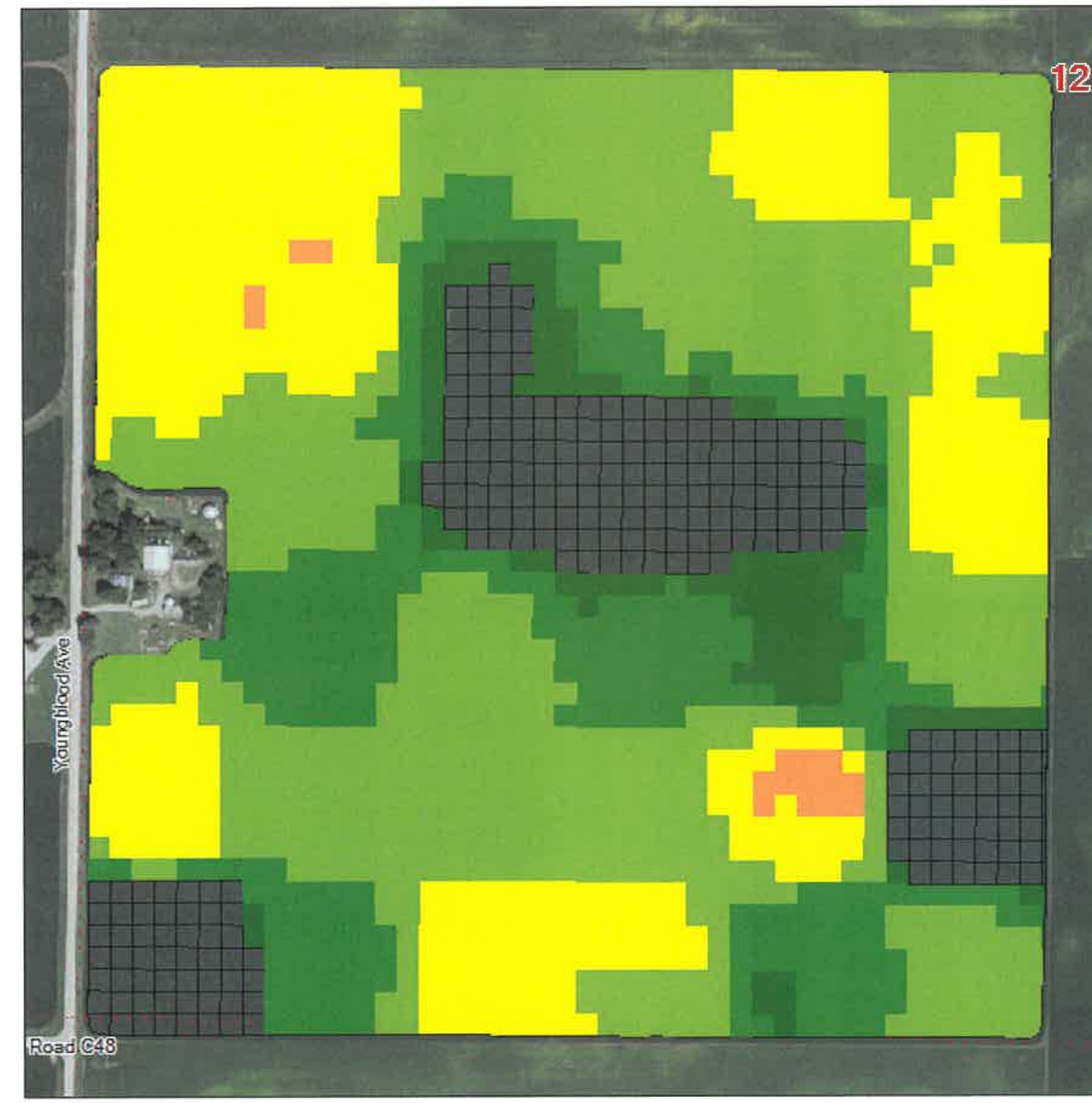
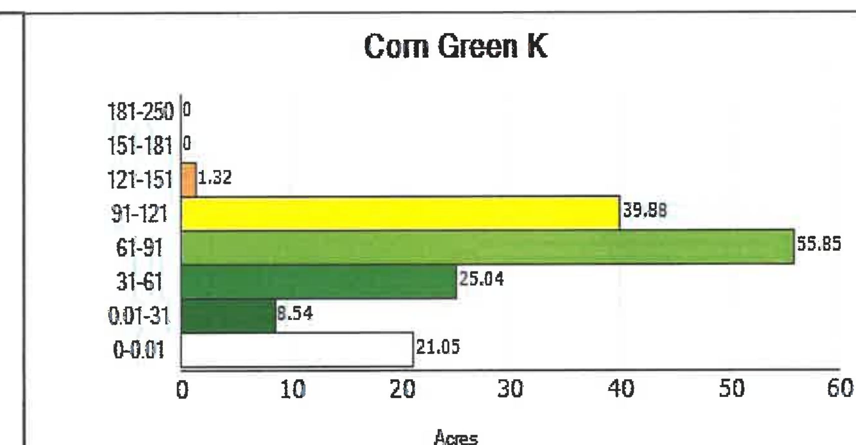


BLA12SW

DrGrnKCrn Levels

- 181 - 250
- 151 - 181
- 121 - 151
- 91 - 121
- 61 - 91
- 31 - 61
- 0.01 - 31
- 0 - 0.01
- All Others



UNITS

MIN. 0.0

AVG. 65.95

MAX. 130.0

Acres 151.68

Total 10003.5

HOLMES, ANTHONY AND RENEE
Wright
Blaine 12

Corn Green P

MIDWEST AGRONOMIC PROFESSIONAL SERVICES
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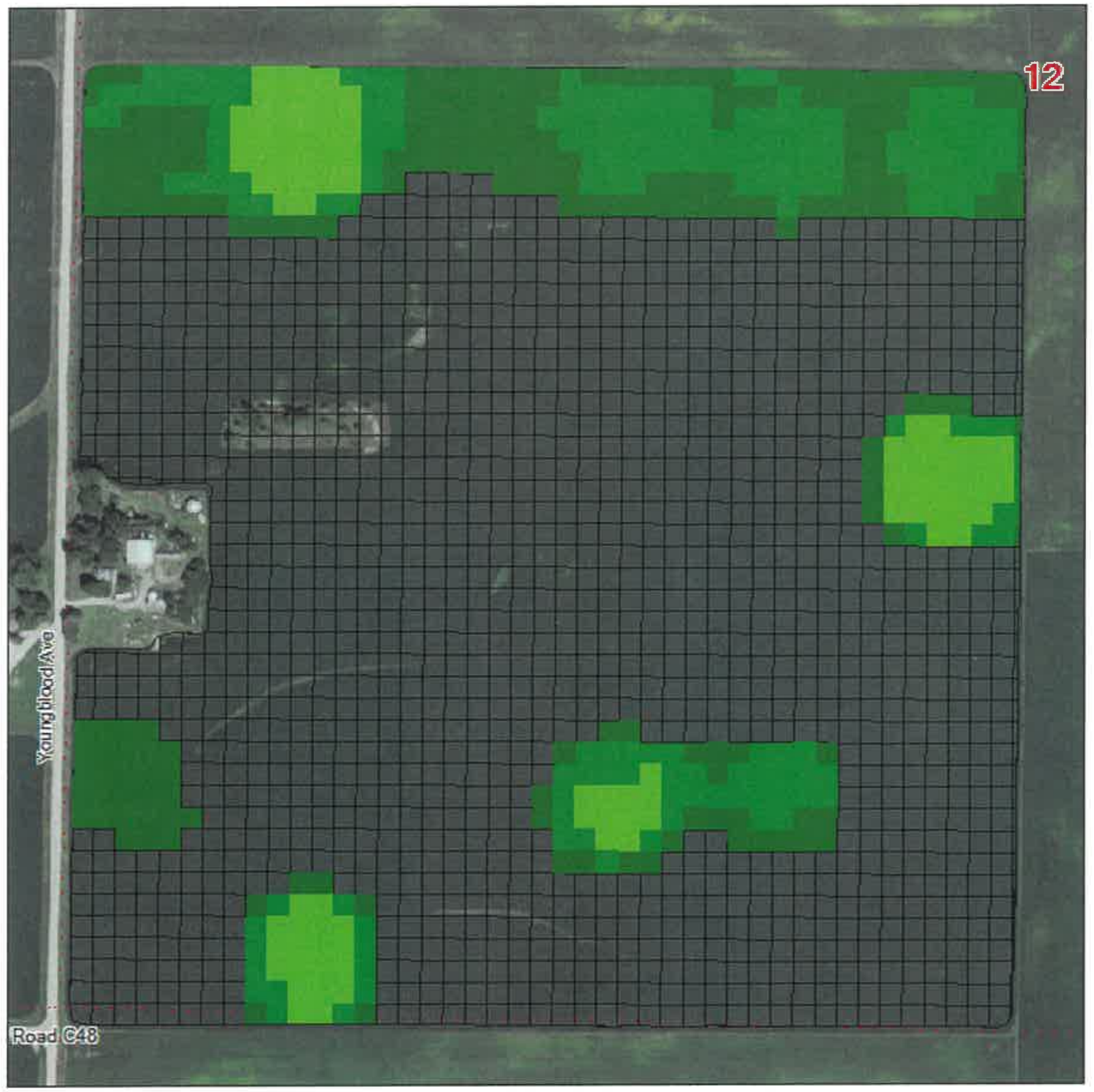
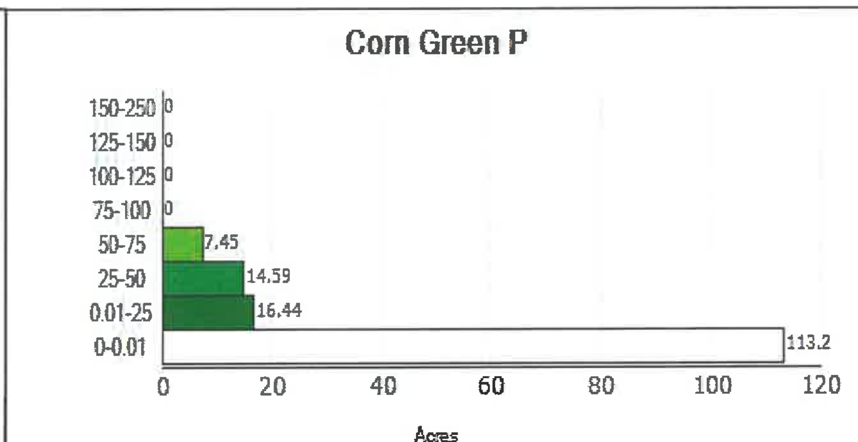


BLA12SW

CrnGreenP Levels

- 150 - 250
- 125 - 150
- 100 - 125
- 75 - 100
- 50 - 75
- 25 - 50
- 0.01 - 25
- 0 - 0.01
- All Others



UNITS	
MIN.	0.0
AVG.	7.97
MAX.	72.6
Acres	151.68
Total	1208.1

Soil pH

Soil pH is a measure of the **degree** of soil acidity or of the **active hydrogen** in the soil solution. This hydrogen is present in the soil solution as positively charged particles or ions.

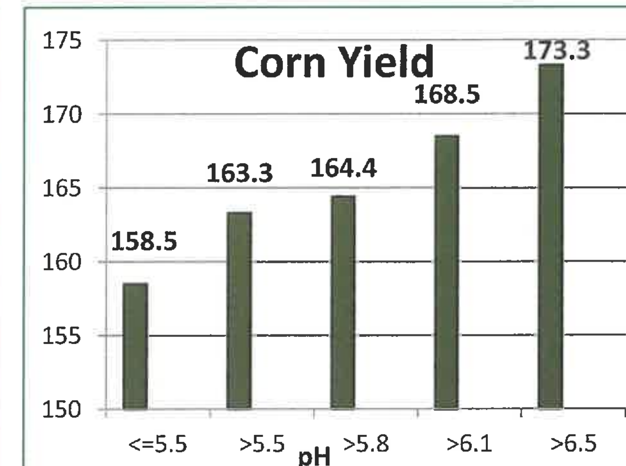
Soil pH can have a dramatic effect on the availability of nutrients as displayed by the chart to the right. Soil pH is the measure of how alkaline or acid a soil is. A pH of slightly below 7 is considered ideal for most crops. A pH <7 is considered acidic and a pH >7 is considered alkaline. Acid soils can be corrected by using aglime. Alkaline soils are very difficult to practically treat. Our soils in this area range anywhere from 5.5 to 8.0 with some exceptions on either side.

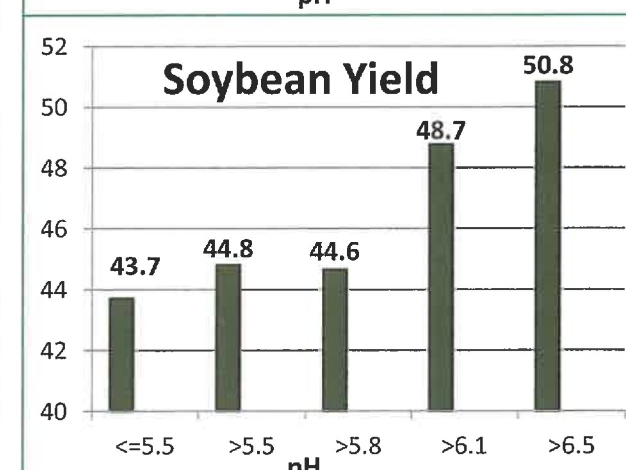
Uniform spreading on the land surface and mixing into the plow layer are assumed when making a limestone recommendation. Because lime moves very slowly in the soil and since uniform mixing is difficult to attain, it may be several years before the lime can be completely effective in neutralizing soil acidity in the plow layer. For any cropping system, apply lime before tilling the soil. Avoid spreading lime when the soil is wet, especially in the spring.

Farmers can do everything right, except one basic step... and lose profitable yields.

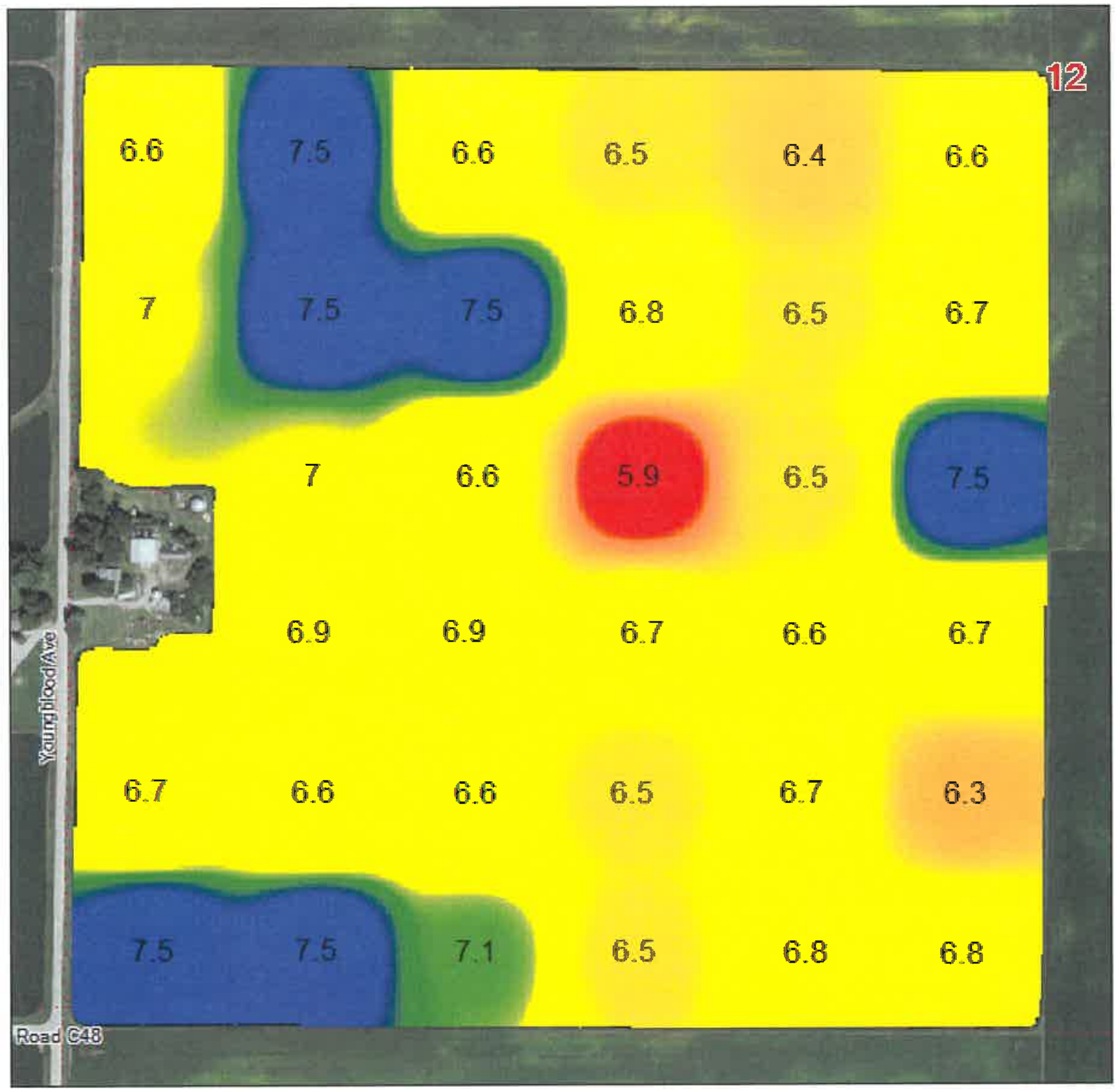
Long-term research has shown that failing to lime acid soils can cause yield losses even with high levels of soil fertility.

The charts to the right are results from research done at Christenson Research Farms near Humboldt, Ia. In these studies, N-P-K was kept at adequate levels so that the increase in yield was the effect of the pH correction.



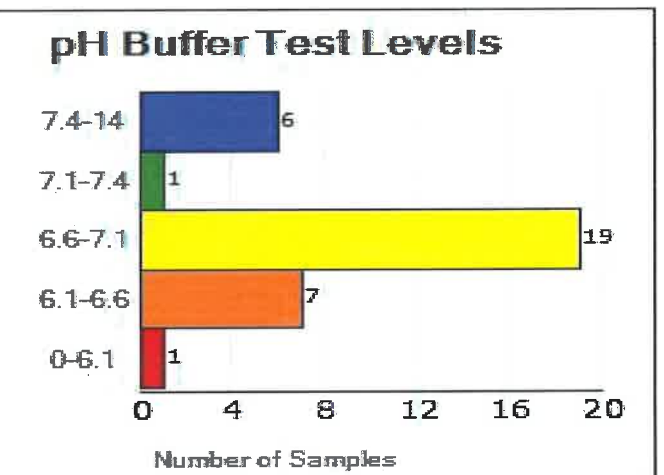


pH Buffer Test Levels



BLA12SW **Sampled 2018**

RANGES	
Very High	
High	
Optimum	
Low	
Very Low	
All Others	



Statistics

MIN. 5.9

AVG. 6.8

MAX. 7.5

SuperCal 98G

HOLMES, ANTHONY AND RENEE
Wright
Blaine 12

MAPS
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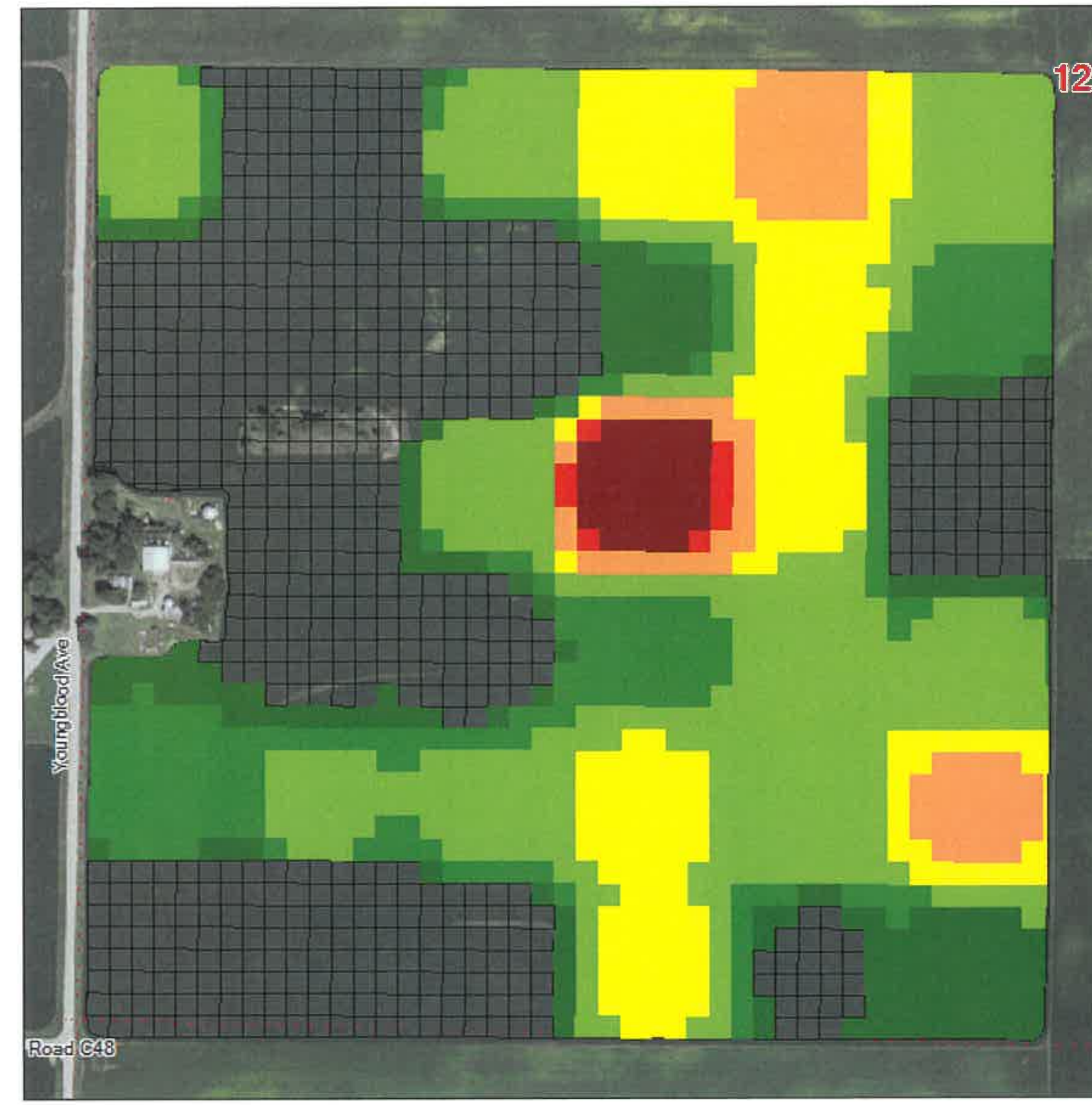
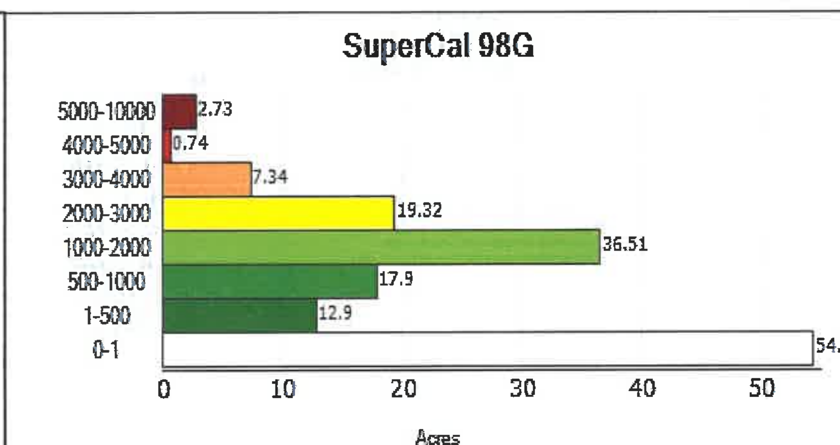


BLA12SW

SCAL98G2 Levels
5000 - 10000
4000 - 5000
3000 - 4000
2000 - 3000
1000 - 2000
500 - 1000
1 - 500
0 - 1
All Others



UNITS

MIN. 0.0

AVG. 1097.42

MAX. 6989.8

Acres 151.68

Total
166457.3

HOLMES, ANTHONY AND RENEE
Wright
Blaine 12

ECCE to 6.5

MAPS
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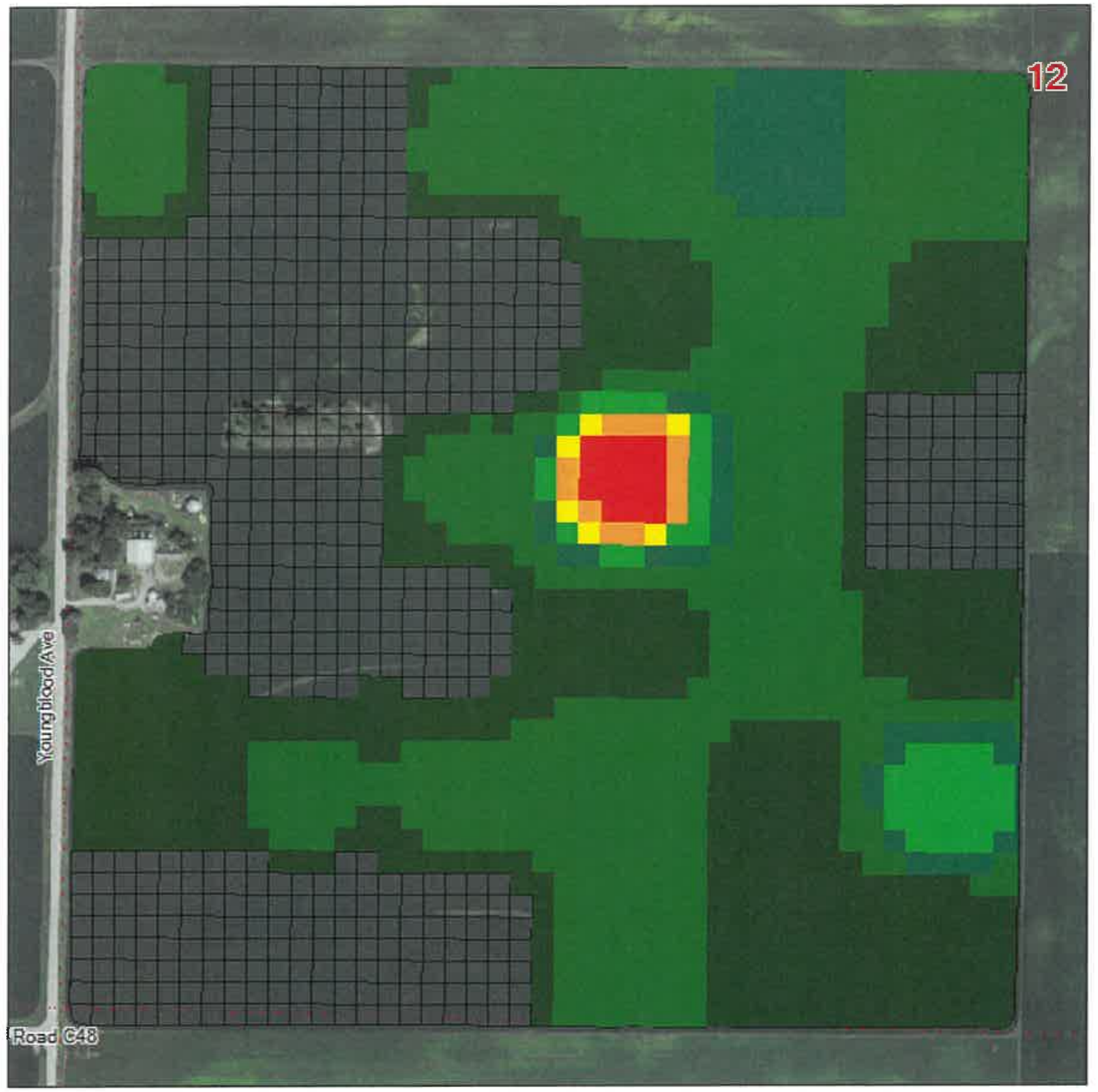
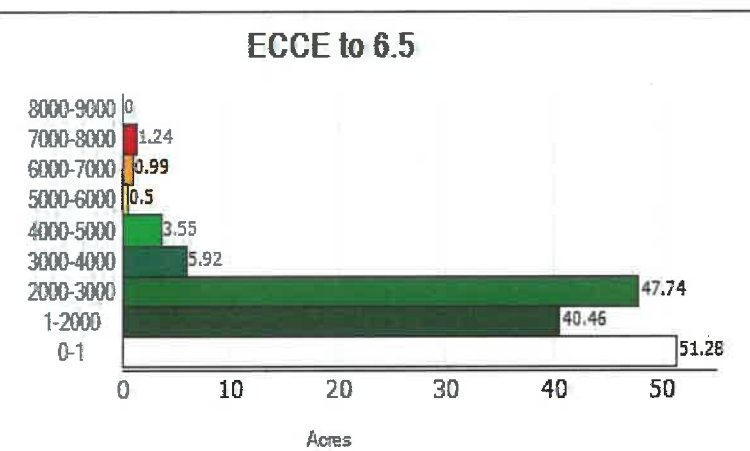


BLA12SW

ECCE65 Levels

- 8000 - 9000
- 7000 - 8000
- 6000 - 7000
- 5000 - 6000
- 4000 - 5000
- 3000 - 4000
- 2000 - 3000
- 1 - 2000
- 0 - 1
- All Others



UNITS	
MIN.	0.0
AVG.	1364.96
MAX.	7143.0
Acres	151.68
Total	207036.9

pH Buffer

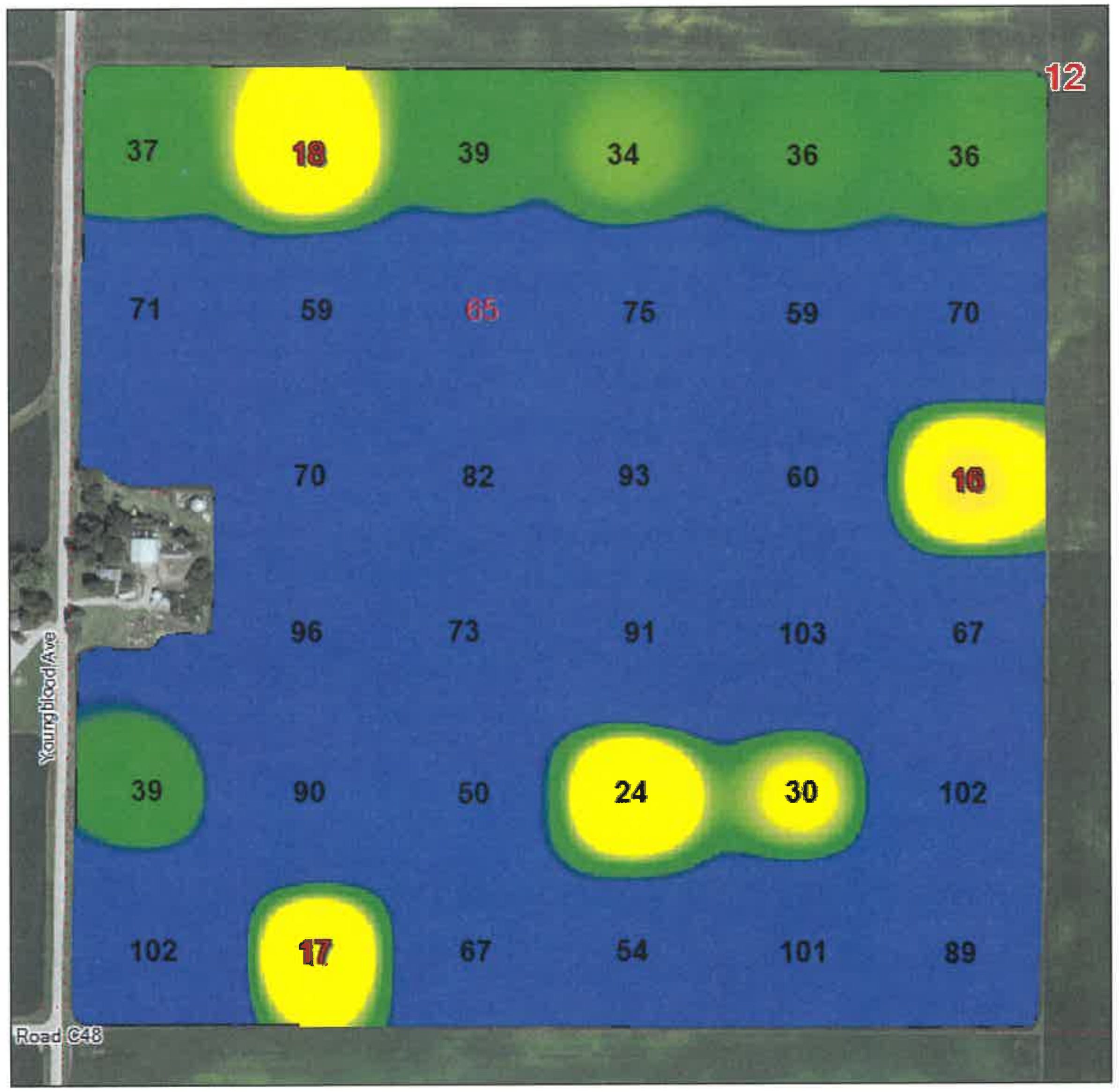
Buffer pH is a measure of the **amount** of soil acidity or of the **potential acidity.** The potential acidity is due to the hydrogen held by the negatively charged soil particles of clay and humus. Hydrogen ions on the surface of these particles are known as exchangeable ions because they can be replaced by other positively charged ions such as calcium, magnesium, or potassium.

The buffer pH is a more useful measurement for determining lime needs. The buffering capacity is the soil's ability to resist change in pH when base-forming materials such as lime are added. The buffer solution added to the soil replaces some of the hydrogen held by the clay and humus. The pH of this soil-buffer solution mixture is the buffer pH. The buffer pH of many Iowa soils has been calibrated with the amount of limestone (pounds of ECCE) needed to change the soil pH to 6.5 and 6.9, and the limestone recommendations are based on this calibration.

A Comparison
The degree of soil acidity (measured by soil pH) compares with the temperature of water, whereas the amount of acidity (measured by buffer pH) compares with the amount of water at a particular temperature. As an example, you may have either a cupful or a pot full of boiling water. The temperature of the water is the same in both containers, but the water in the pail has more total heat and more ice would be required to cool it to the same temperature. Thus, two soils may have the same soil pH, but the soil with the higher amount of clay and organic matter will have the lower buffer pH and thus the higher lime requirement.

	Soil A	**Soil B**
Soil pH	6.0	6.0
Texture of soil	Sandy Loam	Clay Loam
Buffer pH	6.6	6.2
Lime requirement to raise soil pH to 6.5 (lb. ECCE per A)	**2100**	**5000**

Phosphorus Soil Test Levels



(Olsen, Mehlich, Mehlich Icp, or Bray Test)

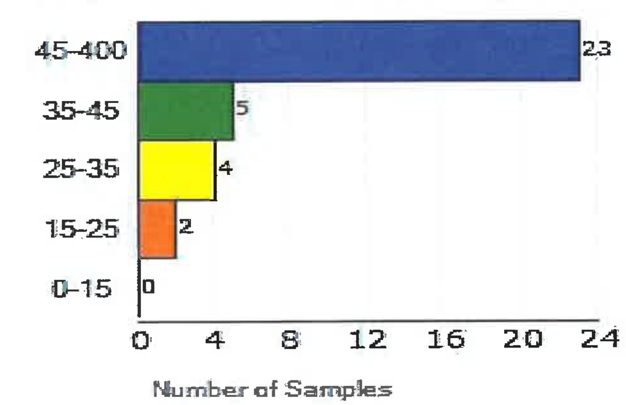
BLA12SW

Sampled 2018

RANGES

- Very High
- High
- Optimum
- Low
- Very Low
- All Others

Normalized P Soil Test Levels



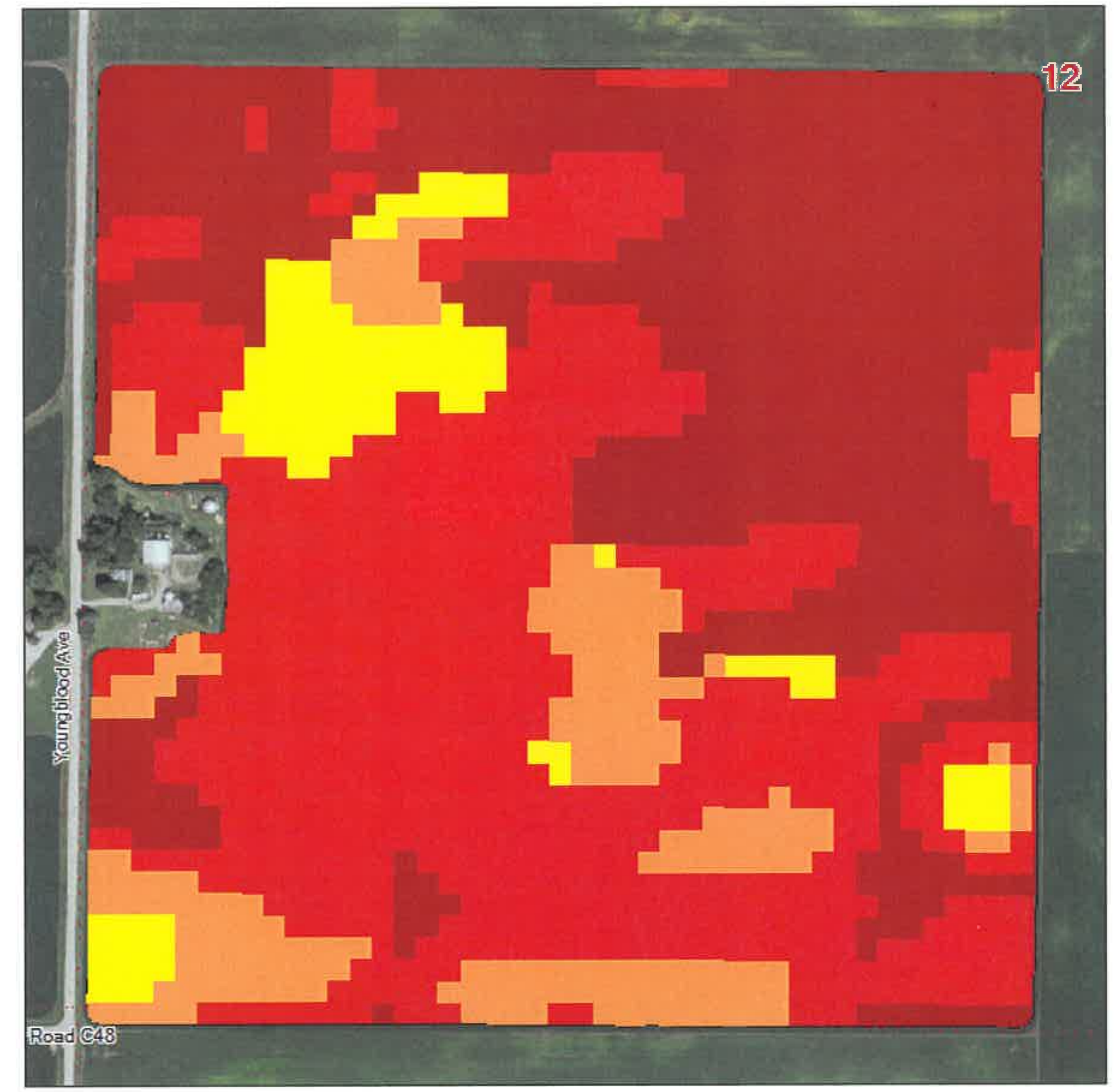
Statistics

MIN.	23.0
AVG.	63.7
MAX.	103.0

Corn N

HOLMES, ANTHONY AND RENEE
Wright
Blaine 12

MAPS MIDWEST AGRONOMIC PROFESSIONAL SERVICES™ NEW COOPERATIVE

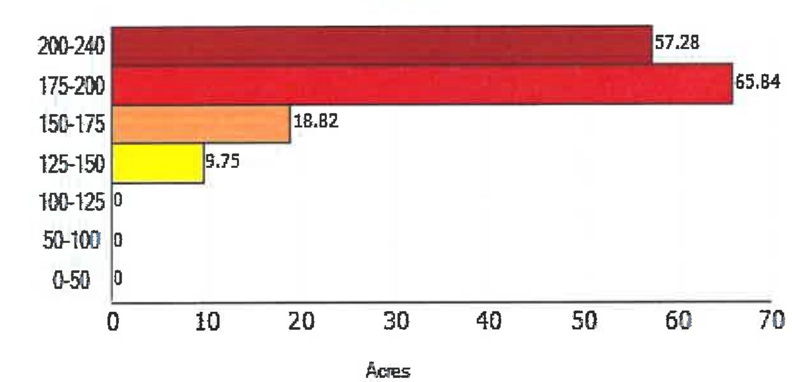


BLA12SW

CrnN Levels

- 200 - 240
- 175 - 200
- 150 - 175
- 125 - 150
- 100 - 125
- 50 - 100
- 0 - 50
- All Others

Corn N



UNITS

MIN.	138.0
AVG.	189.89
MAX.	227.0
Acres	151.68
Total	28802.4

Phosphorus

Phosphorus (P) is essential for crop growth. No other nutrient can be substituted for it. The plant must have P to complete its normal production cycle. It is one of the three major nutrients. The other two are nitrogen (N) and potassium (K).

Phosphorus plays a role in photosynthesis, respiration, energy storage and transfer, cell division, cell enlargement, and several other processes in the living plant. It promotes early root formation and growth. Phosphorus improves the quality of fruit, vegetable, and grain crops and is vital to seed formation. It is involved in the transfer of heredity traits from one generation to the next.

Phosphorus helps roots and seedlings develop more rapidly. It increases water use efficiency, contributes to disease resistance in some plants and hastens maturity important to harvest and crop quality.

Phosphorus is very immobile in the soil. Due to this fact, it is important to maintain adequate levels of phosphorus to ensure maximum yields. It can also become less available to the plant under cold wet conditions and at abnormal pH levels.

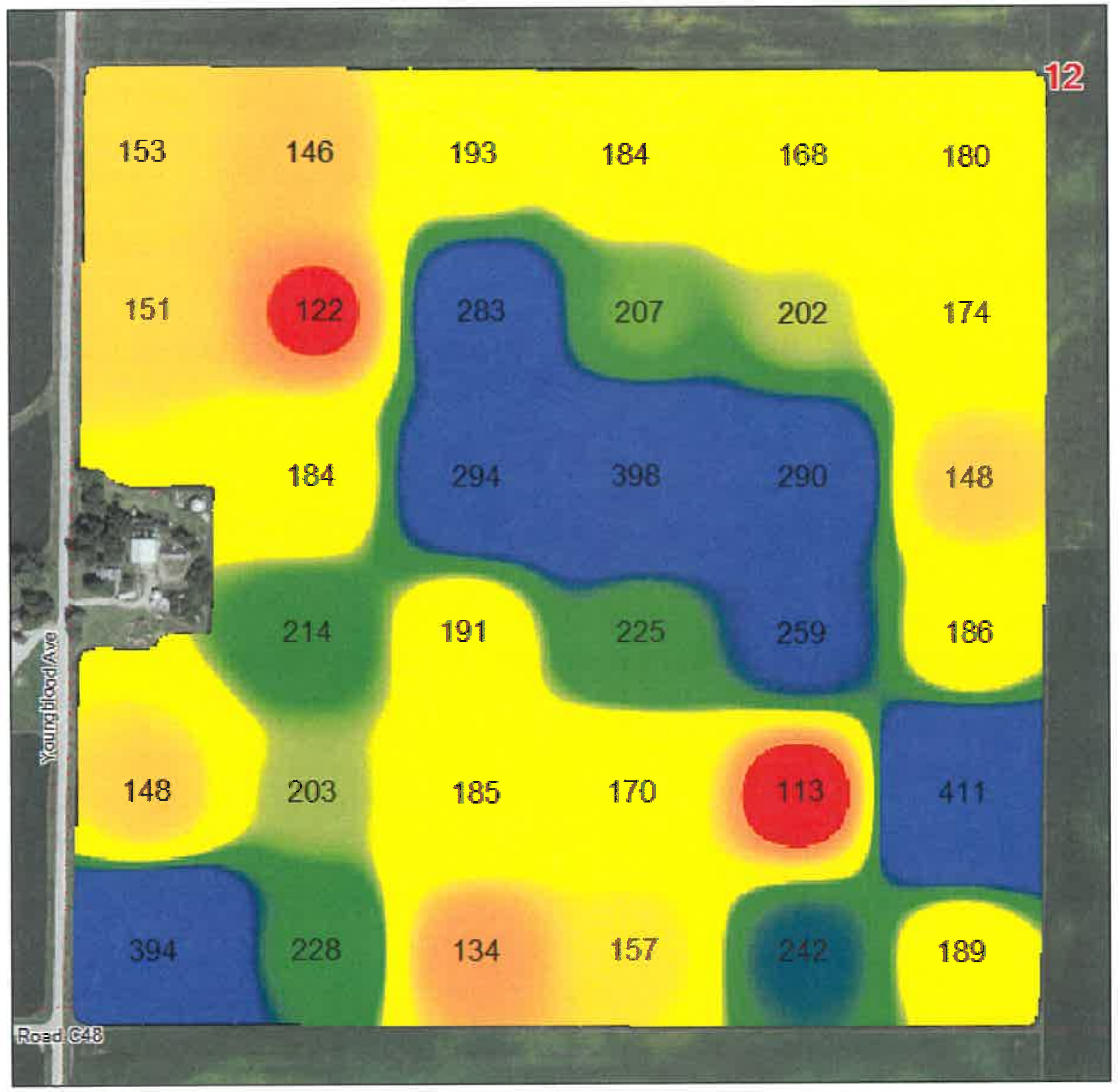
Pure phosphorus does not occur naturally. Commercial fertilizers consist of phosphate rock that has been strip mined at about 15 % P and upgraded for use as fertilizer. Upgrading removes clay and other impurities. The phosphate rock is then treated with ammoniating phosphoric acid to produce what we know as phosphate or MAP.

MAP (11-52-0) represents 11 lbs. nitrogen and 52 lbs. phosphorous for every 100 lbs. material. Corn grain removes .38 lbs. phosphorus per bushel and soybeans remove .8 lbs of phosphorus per bushel. For example, a crop rotation of 200 bushels corn and 60 bushels soybeans removes 124 lbs. of actual phosphorus or 238 lbs. of the product 11-52-0.

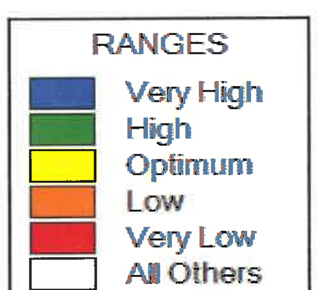
Phosphorus (P) Recommendations		
Corn		
Soil Test Category	**Bray P1 or Mehlich-3 (ppm)**	**Olsen (ppm)**
Very Low	0-14	0-5
Low	15-24	6-10
Optimum	25-34	11-14
High	35-45	15-20
Very High	46+	21+
Soybeans		
Very Low	0-14	0-5
Low	15-24	6-10
Optimum	25-34	11-14
High	35-45	15-20
Very High	46+	21+

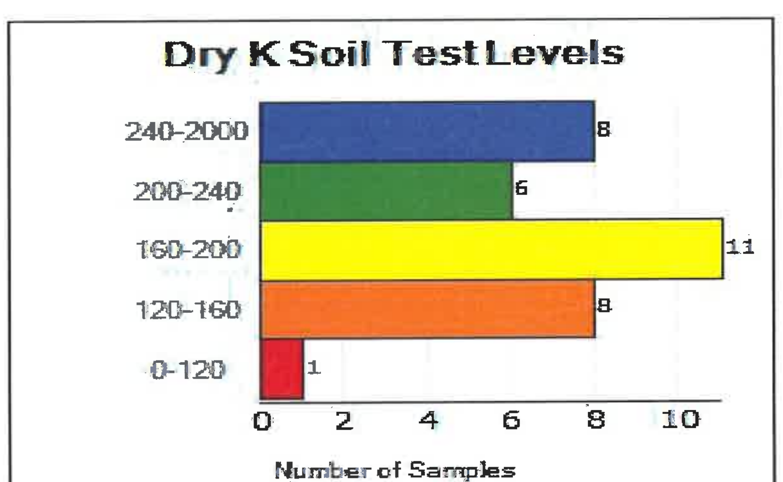
Olsen or Mehlich 3 tests are run on all samples with a ph>7.3
These ranges were determined by averaging out 10 leading corn/bean state universities.

Potassium Soil Test Levels



(Wet or Dry Test) BLA12SW Sampled 2018





Statistics

MIN.	113.0
AVG.	209.6
MAX.	411.0

Nutrient Recommendations

The nutrient recommendations on the following pages are expressed in pounds of **actual** nutrient, not in pounds of material, and have no machine constraints as they will when making an actual application file. Since there are numerous materials that may be used to acquire these nutrient levels, with many different formulations, we've chosen to display what is actually needed and let you and your advisor decide which products will be used to attain the goals.

For example:
Lime recommendations are expressed as 100% ECCE (effective calcium carbonate equivalent). If a field calls for 30,000 total pounds of ECCE, and the lime you are using is 75% effective (1500 ECCE/ton), then take 30,000 / 1500 = 20 tons lime. The lime recommendation is a one-time application for the 4 year life of the samples.

Machine constraints also need to be accounted for depending on the material being applied. Lime applicators usually go no lower than ½ -1 ton per acre, and no higher than 3.5 - 4 tons, in that spread patterns are difficult to maintain with rates outside of these ranges.

Other dry products such as MAP, DAP, and Potash, have constraints as well, in that machines are unable to apply properly at very low rates. Your local agronomic advisor will be able to explain what the machine constraints are for each of these materials.

Nitrogen rates, if recommended, are in pounds of total N required for 1st year corn following soybeans. If multiple products are applied that contain nitrogen, the total of all products applied will equal the total N required if calculated correctly. Make sure you discuss with your advisor all sources intended on being used, such as starter fertilizers or split applications.

Phosphorus and Potassium recommendation pages are for 1 crop year, and if making a multiple year application, need to be added together
(example: 2 year corn/soybean rotation).

Use these pages only as a guideline as to approximately how much nutrient will be required to achieve your goals.

Methods of Fertilization

Phosphorus and Potassium Recommendations

The recommended amounts of P2O5 and K2O are based on research conducted in Iowa over many years. Applying the recommended rates for the very low and low soil test categories will result in profitable crop responses in that year and at the same time increase soil test values after crop harvest because of significant residual effects from the applied P and K. The recommended P and K rates for the optimum soil test category are based on average nutrient removal in harvested grain. The fertilization amounts shown in the following pages reflect the build levels for expected removal based on soil test levels and variable yield goals as defined in the front of this book.

As nutrient levels increase, there is a decreasing probability of an *economic* yield response to applied nutrients. The percentage of P and K applications expected on average to produce a yield response within each category is *80% for very low, 65% for low, 25 % for optimum, 5% for high, and <1% for very high*, according to Iowa State University.

Listed below is the target level for the Green recommendation.

Green (High) P target level = 35ppm, K target level = 200ppm

This method applies the amount of fertilizer that will build soil test levels to the High range. Additional amounts are applied to low testing fields or parts of the field so that in time the soil test rises to a high level. Less than maintenance amounts are applied to very high testing parts of the field so in time the soil test level falls to a high level. When soil tests are maintained at a high level, fertility is removed as a yield-limiting factor no matter how favorable or unfavorable other agronomic conditions are. No matter where soil tests are maintained, (low, medium or high), the same amount of nutrients are required to product a specified number of bushels of corn, soybeans or other crop. Therefore, once the ideal agronomic level of soil fertility is reached, there is no additional cost over maintenance to retain that level.

**Recommendations in book represent individual crop year needs.*

Potassium

The chemical symbol for potassium is K, which is derived from the German word, Kalium. Potassium is another one of the major plant nutrients including nitrogen and phosphorus. No other nutrient can replace it.

Potassium has a great impact on crop quality, including increased kernel weight and kernels per ear in corn and improved oil and protein content in soybeans.

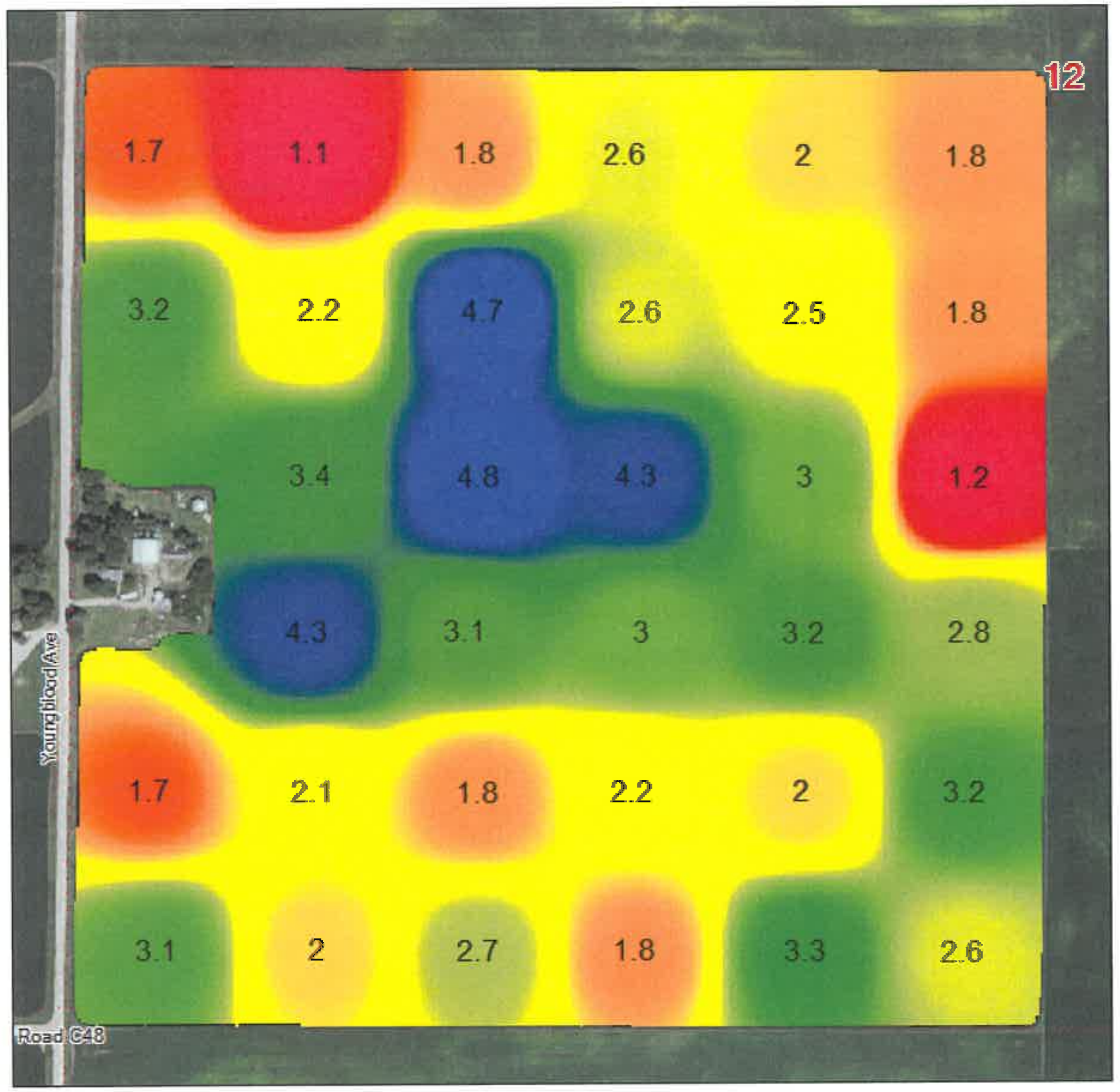
Potassium is vital to photosynthesis. High K levels help increase crop tolerance to drought stress. When K is deficient, photosynthesis declines, and the plant's respiration increases. Potassium is critical to maintaining favorable plant water status. If K becomes deficient, stomates do not function properly, inhibiting photosynthesis and interfering with plant water relations. K in the cell water allows the cells to maintain high internal water pressure. More K permits the maintenance of this pressure as the plant's environment gets drier and drier. With sufficient K, plants can continue to photosynthesize and to grow through periods of dry conditions. Sufficient levels of potassium also **improve seedling vigor, plant health**, and **stalk strength**.

Potassium's importance in disease suppression cannot be overstated. Many trials have shown potash as a key element in reducing leaf blight and stalk rot in corn as well as mold and mildew in soybeans. When K helps a plant resist disease, it doesn't do it as a direct agent of control, but by strengthening the natural resistance mechanisms of the plant.

Potash (0-0-60) represents 60 lbs. K2O for every 100 lbs. material. Corn grain removes .3 lbs. K2O per bushel and soybeans remove 1.5 lbs. of K2O per bushel. For example, a crop rotation of 200 bushels corn and 60 bushels soybeans removes 150 lbs. of actual potassium or 250 lbs. of the product 0-0-60.

Potassium (K) Recommendations	
	Corn
Soil Test Category	**(ppm)**
	Dried/Ground
Very Low	0-120
Low	120-160
Optimum	160-200
High	200-240
Very High	240+
	Soybeans
Very Low	0-120
Low	120-160
Optimum	160-200
High	200-240
Very High	240+
These ranges were determined by averaging out 10 leading corn/bean state universities.	

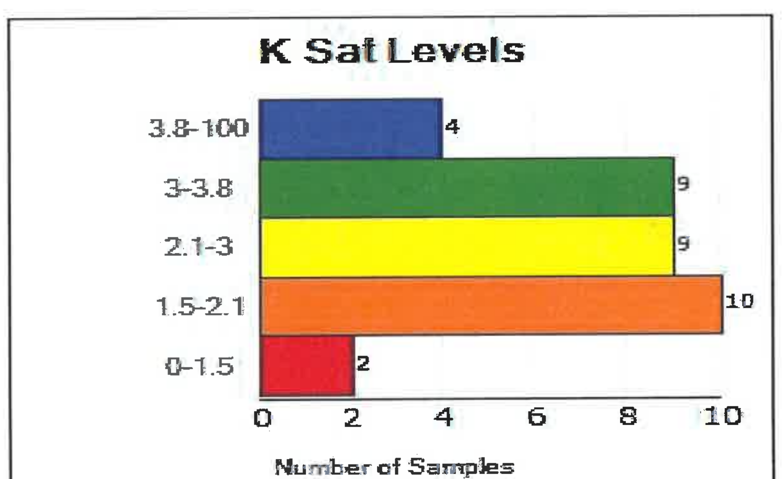
K Base Saturation



BLA12SW **Sampled 2018**

RANGES

- 3.8 - 100
- 3 - 3.8
- 2.1 - 3
- 1.5 - 2.1
- 0 - 1.5
- All Others



Statistics

MIN.	1.1
AVG.	2.6
MAX.	4.8

Cation Exchange Capacity

The total number of exchangeable cations a soil can hold (the amount of its negative charge) is called its **cation exchange capacity**. Cations held by soils can be replaced by other cations. This means they are exchangeable.

For example, Ca++ can be exchanged for H+ and/or K+ and vice versa. The higher a soil's CEC, the more cations it can retain. Soils differ in their capacities to hold exchangeable K+ and other cations. The CEC depends on amounts and kinds of clay and organic matter present. A high-clay soil can hold more exchangeable cations than a low-clay soil. Also, CEC increases as organic matter increases.

Where soils are highly weathered and organic matter levels are low, CEC values are low. Where less weathering has occurred and organic matter levels are usually higher, CEC values can be quite high. Clay soils with high CEC can retain large amounts of cations against potential loss by leaching. Sandy soils, with low CEC, retain smaller quantities. This makes timing and application rates important in planning a fertilizer program. For example, it may not be wise to apply K on very sandy soils in the middle of a monsoon, where rainfall can be high and intense. Fertilizer application should be split to prevent leaching and erosion, especially in the humid tropics. Also, splitting N applications, using nitrification inhibitors and timing application to meet peak crop demands, are important to reduce the potential for nitrate leaching on sandy soils as well as finer-textured soils.

The CEC of a soil is expressed as milligram equivalents per 100 grams of soil (meq/100g). A rule of thumb for estimating CEC is:

(% organic matter X 2) + (%clay X 0.5) = CEC

Example:
A soil with 5% organic matter and 30% clay would have a CEC of 25 meq/100 grams.

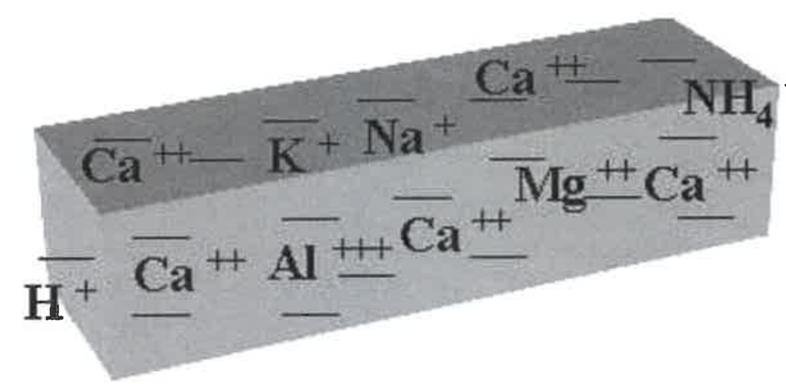
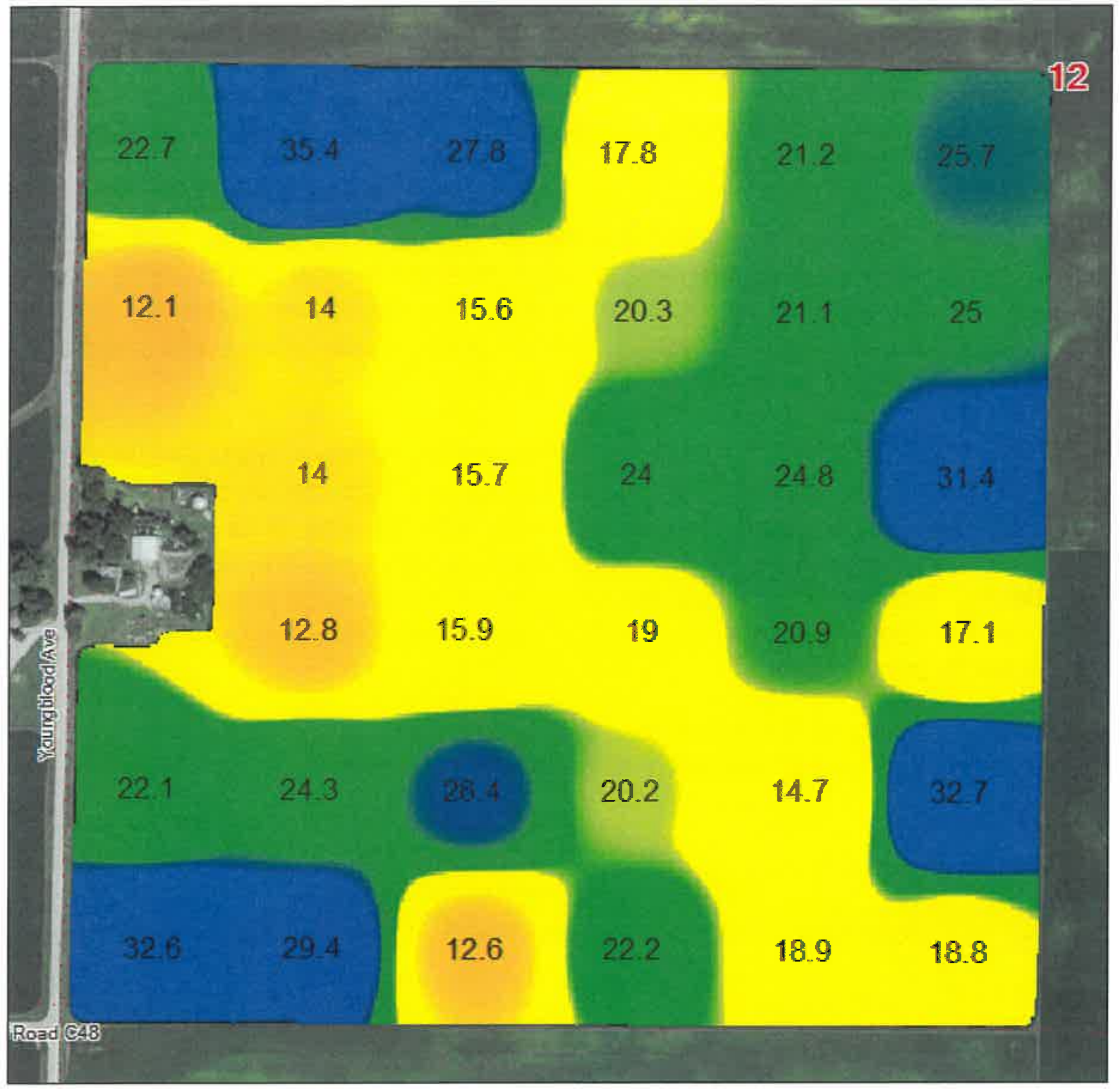


Figure 1: Schematic of a clay particle with negative charges on the surface attracting various cations.

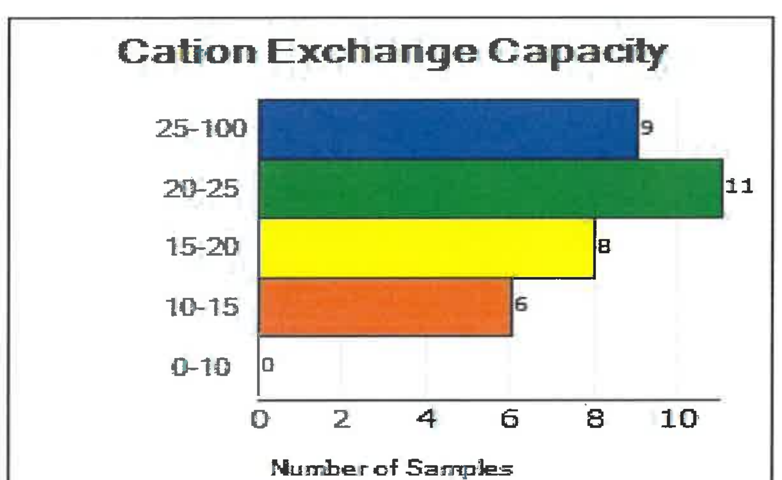
Cation Exchange Capacity



BLA12SW **Sampled 2018**

RANGES

- Very High
- High
- Optimum
- Low
- Very Low
- All Others



Statistics

MIN. 12.1

AVG. 21.4

MAX. 35.4

Base Saturation

The term base saturation is used to characterize how completely occupied are the adsorbing (surface held) sites of soil mineral and organic particles with basic cations. The basic cations commonly found in the soil are calcium (Ca), magnesium (Mg), potassium (K), and sodium (Na). The acidic cations are aluminum (Al) and hydrogen (H). So, base saturation describes how completely the soil particle surface is filled with the basic cations (Ca, Mg, K, and Na).

When all the soil particle exchange sites are occupied with bases, we have 100% saturation. This happens when the soil pH is well above 7 (alkaline). However, at lower pH values, some H and Al find their way onto the surface of the soil mineral and organic particles and that drops the base saturation to less than 100. So, base saturation is:

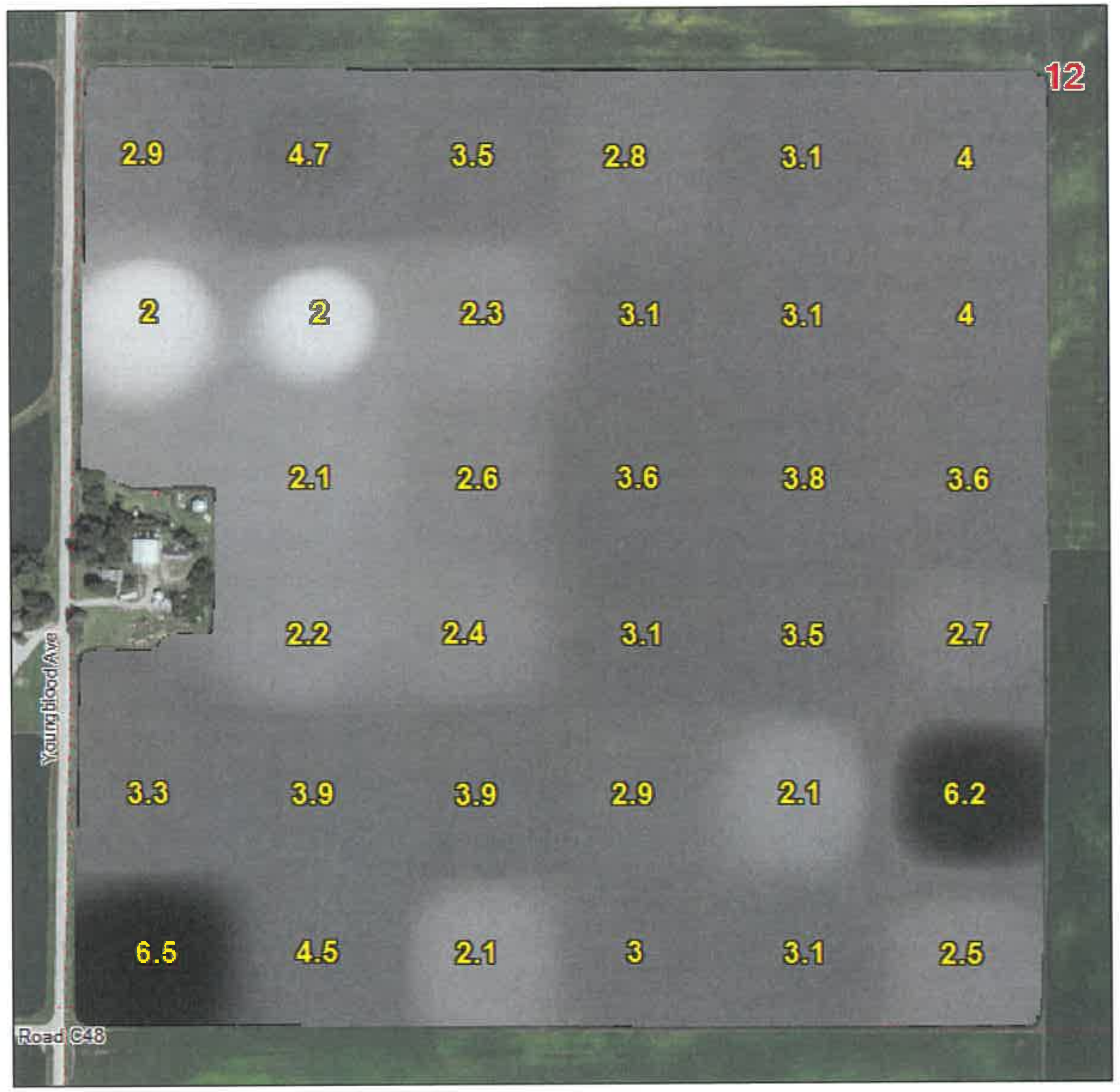
$$\% \text{ K BS} = \frac{\text{ppm K}}{390} \div \text{CEC} \times 100$$

Base saturation has been used to make decisions on whether a soil should be limited or not, along with a number of other tools. It is not a soil testing index and does not necessarily imply nutrient fertility of a soil. Although there might be adequate ppm of a specific cation, if it is not available on the soil colloid in correct proportion to the other cations, it may not be as plant available as the ppm suggests.

Base Saturation Recommendations

Cation	Target %
Potassium (K^+)	4% - 8%
Calcium (Ca^{++})	65% - 70%
Magnesium (Mg^{++})	12% - 18%
Sodium (Na^+)	< 1%
Hydrogen (H^+)	< 10%

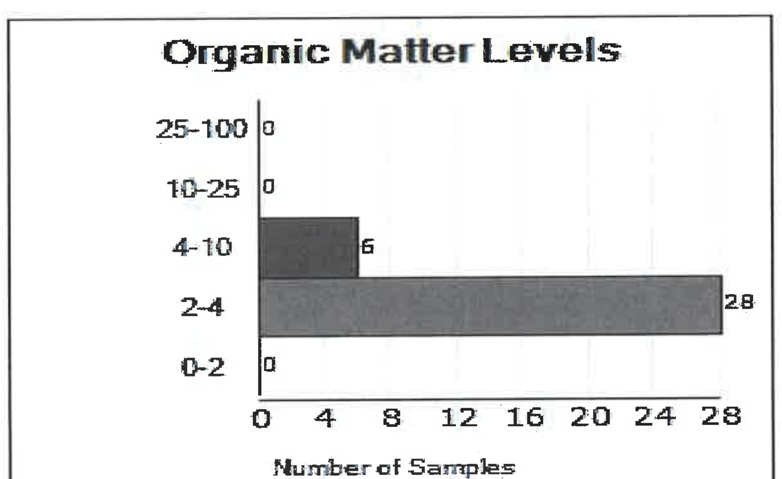
Organic Matter Levels



BLA12SW Sampled 2018

RANGES

- Peat
- Muck
- Heavy
- Medium
- Light
- All Others



Statistics

MIN. 2.0

AVG. 3.3

MAX. 6.5

Sulfur

Sulfur is an essential plant nutrient and is used as a component for several amino acids, the building blocks of proteins. Sulfur is present in the atmosphere as sulfur dioxide (SO_2) that can be absorbed directly by plants.

Sulfate is an anion, therefore, not attracted to cation exchange sites in the soil, and therefore is subject to leaching.

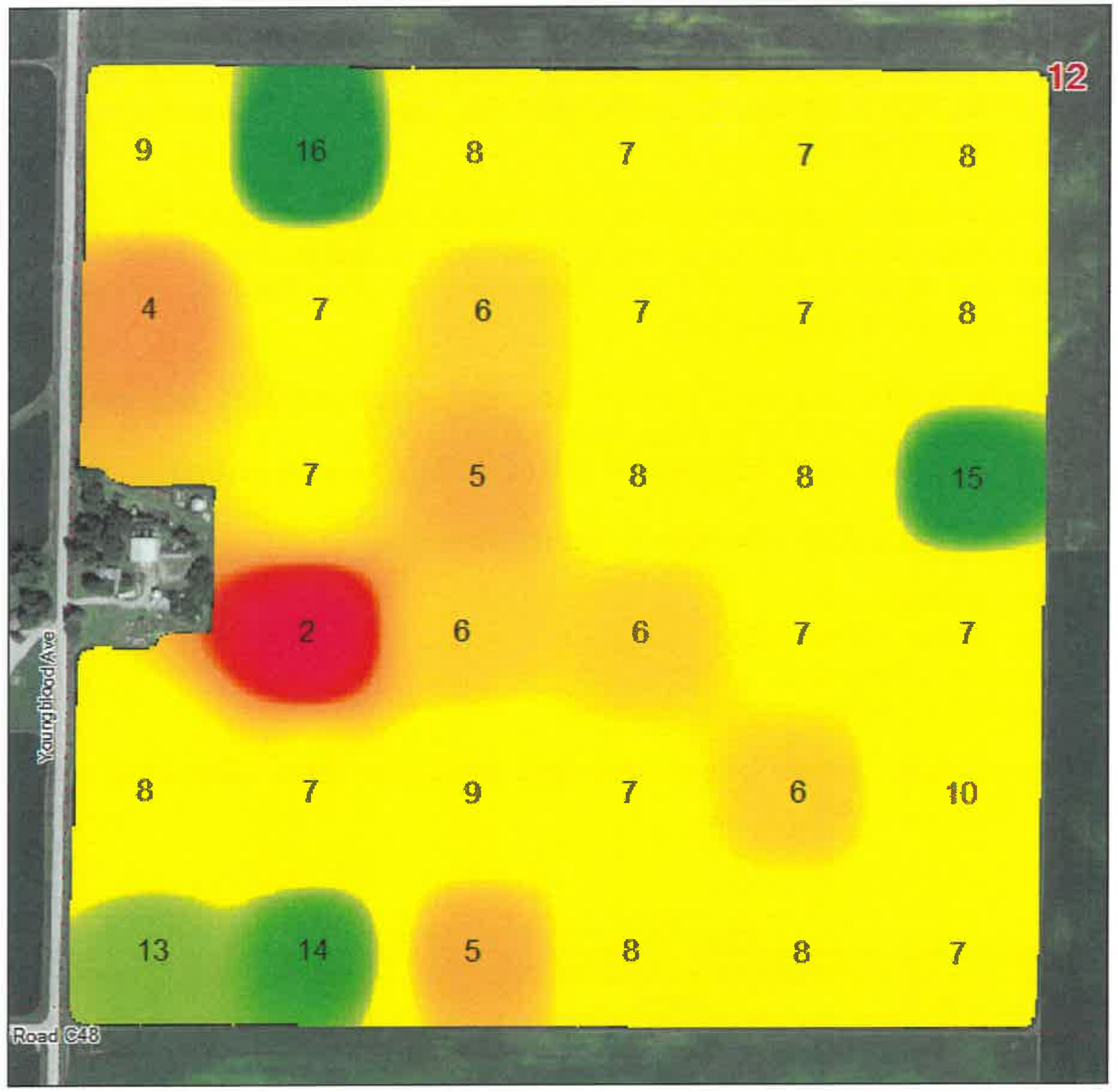
Sulfur deficiency symptoms appear similar to nitrogen deficiency; light green to yellowish leaves, with even lighter yellow veins, stunted growth and delayed maturity, and spindly plants with short, slender stalks. The distinction between S and N deficiencies is that yellowing appears first on the young upper leaves with S deficiency, while most N deficiency symptoms appear on the older, bottom leaves.

The soil test for sulfur, which measures sulfate sulfur, is not a good predictor of the need for fertilizer sulfur. Because of this, it is suggested that the nitrogen, phosphorus, and potassium needs be taken care of first. The best chances for a yield response to fertilizer sulfur would probably be with alfalfa because its needs are higher than for corn and soybeans. The soils that would be expected to give a yield response first are the coarse-textured sandy soils low in organic matter and severely eroded soils, which would be low in organic matter.

Research is continuing on the sulfur provided by soils and on the sulfur provided by the atmosphere through rainfall and direct absorption by plants.

Sulfur (S Recommendations)		
Corn		
Soil Test Category:	**(ppm)**	**Sulfur to apply**
Very Low	0-3	25
Low	4-6	20
Medium	7-12	10
High	13+	0

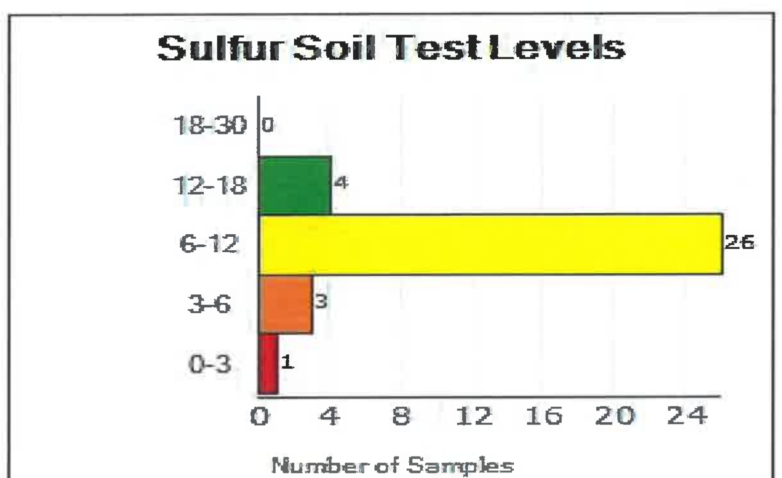
Sulfur Soil Test Levels



BLA12SW **Sampled 2018**

RANGES

- Very High
- High
- Optimum
- Low
- Very Low
- All Others



Statistics

MIN.	2.0
AVG.	7.9
MAX.	16.0

Organic Matter

Organic matter (OM) is the partially decomposed residue of plants, animals, and other organisms. Initially plant residue requires nitrogen to decompose. As OM decays, it will release nitrogen for future crops. Under favorable conditions, one to three percent of the soils' OM can decompose annually.

Organic matter acts as a sponge. High organic matter soils have the capacity to hold more nutrients, chemicals and water. Conversely, sandy soils, low in organic matter, cannot hold a lot of nutrients. Sandy soils must be fertilized more frequently with lower amounts.

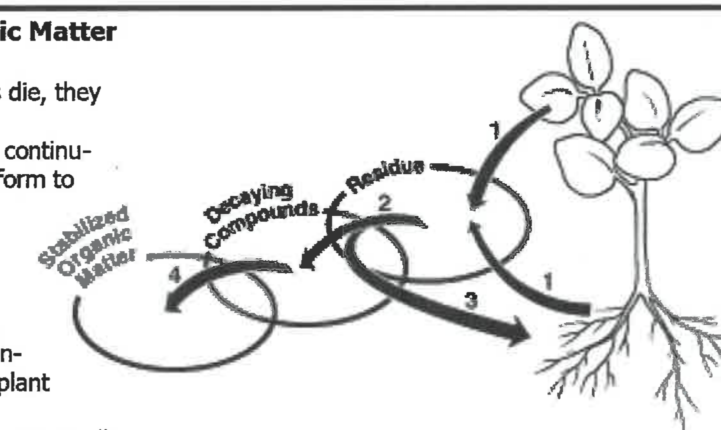
Organic matter benefits include:

- ✓ Reduces compaction
- ✓ Promotes water movement
- ✓ Promotes healthy roots
- ✓ Prevents soil erosion
- ✓ Holds fertilizer and chemicals

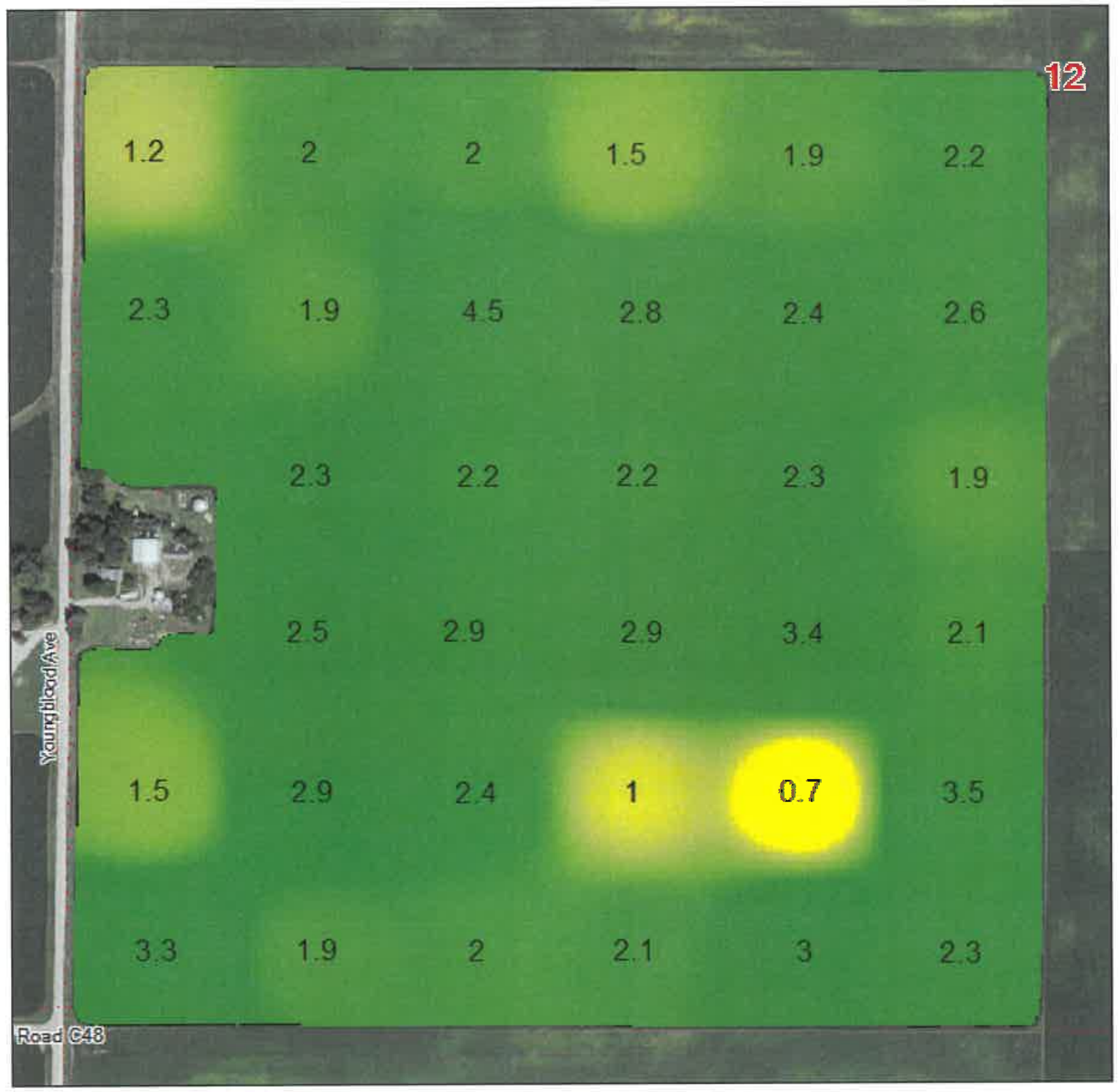
Organic matter results are used in recommendations for nitrogen rates on corn and also many times are the determining factor on the correct rate of pre-plant incorporated herbicides.

The Changing Forms of Soil Organic Matter

1. **Additions.** When roots and leaves die, they become part of the soil organic matter.
2. **Transformations.** Soil organisms continually change organic compounds from one form to another. They consume plant residue and other organic matter, and then create by-products, wastes, and cell tissue.
3. **Microbes feed plants.** Some of the wastes released by soil organisms are nutrients that can be used by plants. Organisms release other compounds that affect plant growth.
4. **Stabilization of organic matter.** Eventually, soil organic compounds become stabilized and resistant to further changes.

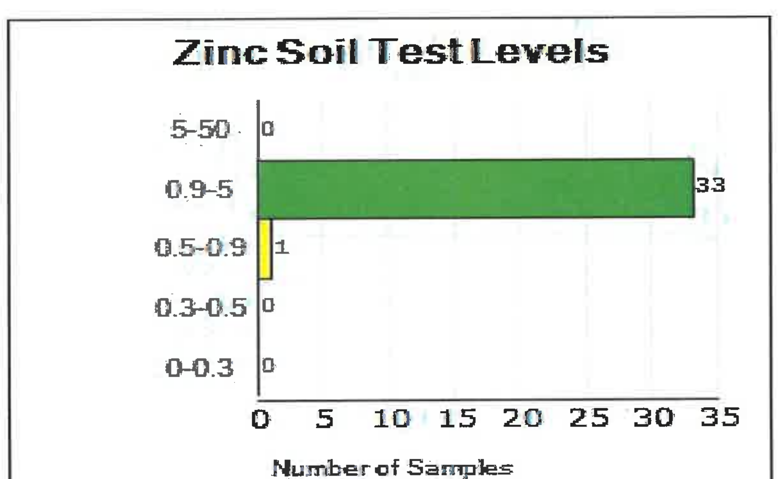


Zinc Soil Test Levels



BLA12SW **Sampled 2018**

RANGES
- Very High
- High
- Optimum
- Low
- Very Low
- All Others



Statistics

MIN. 0.7

AVG. 2.3

MAX. 4.5

Zinc

There are seven essential nutrients required by plants in small amounts. These are referred to as micronutrients. Zinc was one of the first micronutrients recognized as essential for plants and one most commonly limiting yields. Although it is required in small amounts, high yields are impossible without it. Corn and soybeans are among the crops most responsive to zinc.

Most micronutrients are adequate in this area with the exception of zinc. The symptoms of zinc deficiency include decreased yields, dead spots on leaves and chlorosis between leaf veins. Zinc in not translocated within the plant, so symptoms first appear on the younger leaves and other plant parts.

Excess levels of phosphorus can tie up zinc and excess levels of zinc can tie up phosphorus. It is important to manage these nutrients in conjunction with each other. High soil pH also tends to reduce the availability of zinc.

Some typical areas that zinc may be needed on are:

- ✓ High pH Soils
- ✓ Low organic matter soils
- ✓ High Phosphorus soils
- ✓ Wet or cold soils

Zinc has excellent residual effects and high application rates (10#/acre) may be sufficient for 3 to 4 years.

Zinc (ZN Recommendations)		
Corn		
Soil Test Category:	(ppm)	Zinc to apply
Low	0-0.4	10
Marginal	0.4-0.8	5
Adequate	0.9+	0