Creating Soil Management Zones to Make Variable Rate Technology Profitable

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PRECISION SOIL MANAGEMENT

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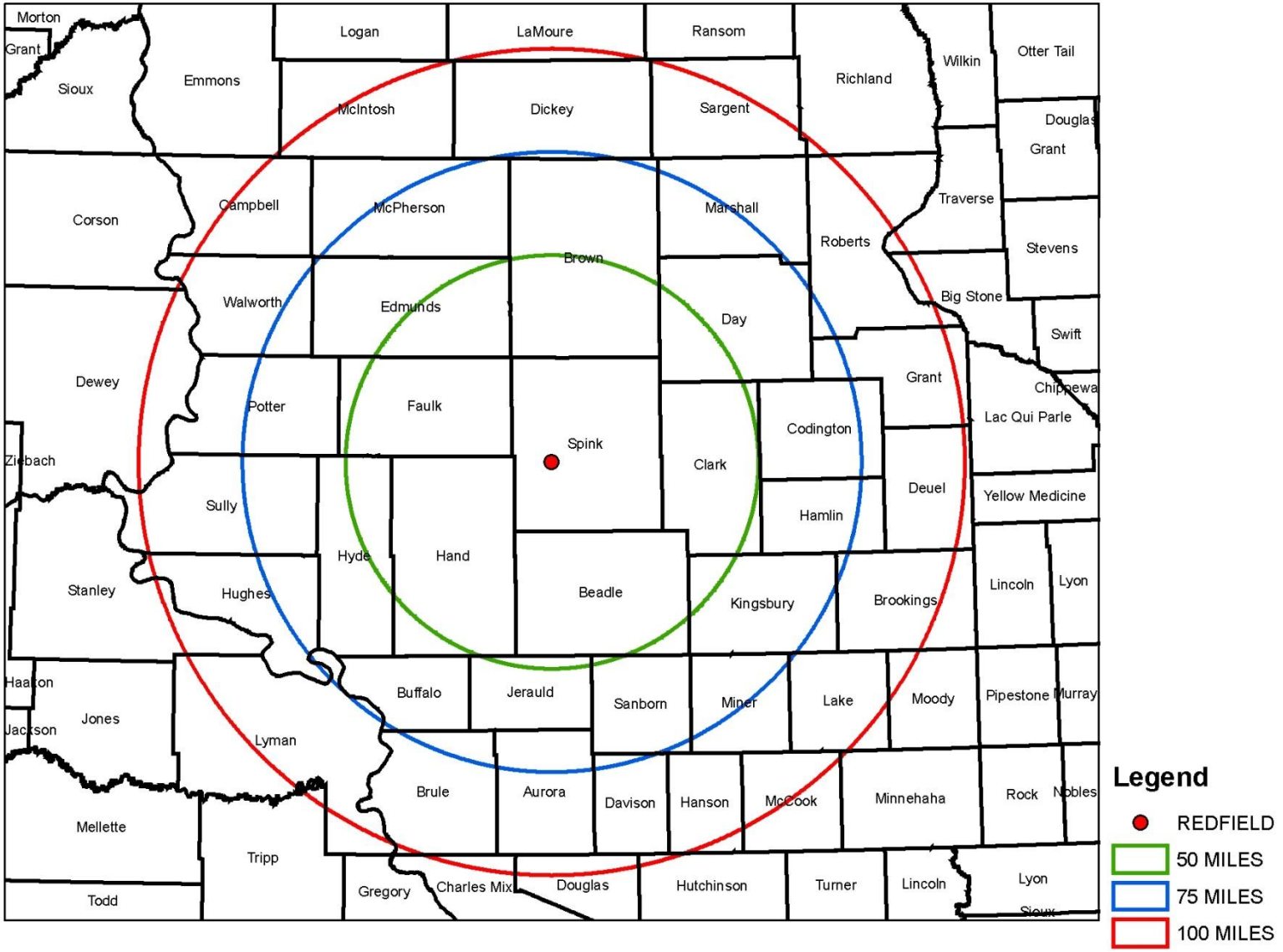
Radius Distance from Redfield, South Dakota



Precision Soil Management

- Create Soil Management Zones
- Geo-referenced Soil Sampling from each Soil Management Zone
- Consult with Producer to Determine Yield Goal and Seeding Rate
- Variable Rate Fertilizer Prescription
- Variable Rate Seeding Prescription

Soil Zones & Descriptions

1. Nearly level, thick topsoil, very high production
2. Nearly level, medium topsoil, high production
3. Gently sloping, medium thin topsoil, medium high production
4. Gently sloping, thin topsoil, medium production
5. Gently to strongly sloping, thin topsoil, low production
6. Swale position, thick topsoil, very high production
7. Floodplain position, thick topsoil, very high production
8. Alkaline soil (calcareous), medium production
9. Strongly saline soil, very low production
10. Saline soil, low production
11. Very shallow claypan soil, low production
12. Shallow claypan soil, medium production
13. Moderately deep claypan soil, high production
14. Deep to gravel soils, medium production
15. Moderately deep to gravel soils, low production
16. Gently sloping, shallow to gravels, very low production
17. Depressional soil, thick topsoil, high production
18. Depressional soil, dense claypan, low production
19. Sandy soil
20. Clayey soil, high production
21. Nearly level to gently sloping, saline subsoil, medium production
22. Shallow claypan soil on floodplain, medium production
23. Somewhat poorly drained clayey depressional soil, high production
24. Gently sloping, thin topsoil, saline topsoil, low production


GIDDINGS
PRECISION
SOIL
MANAGEMENT
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JIM MILLER
F150


PRECISION
SOIL
MANAGEMENT


CAUTION
GIDDINGS


CAUTION

Is Variable Rate Technology Profitable?

DEPENDS

Two Factors Determining Profitability of Variable Rate Technology

1) Soil Variability within a field
2) Accuracy of Soil Management Zones

   - no set rules for creating mngt. zones

The biggest challenge with variable rate technology is not the variable rate equipment, it is creating accurate soil management zones.

Grid Sampling is a good methodology if you know nothing about soils

History of Soil Variability

Matthew 13: 3-8

A sower went out to sow, some seed fell on the path and the birds came and ate it up. Some fell on rocky ground, where it had little soil. It sprang up at once because the soil was not deep, and when the sun rose it was scorched, and it withered for lack of roots. Some seed fell among thorns and the thorns grew up and chocked it. But some seed fell on rich soil, and produced fruit a hundred or sixty or thirty fold.

History of Soil Variability

"South Dakota soils are not all equally fertile. They do not have equal ability to produce crops even with equal amounts of rain. They vary in physical condition ….. And food content …. And do not respond equally well to the same kind of treatment."

Dr. A, N. Hume, SDSC, 1912, Bulletin 139.

Tools for Measuring Soil Variability or Creating Soil Management Zones

1) Aerial Imagery
2) NRCS Soil Survey Maps
3) Yield Maps
4) Satellite Imagery
5) Electrical Conductivity Maps

GROUND TRUTH
or VALIDATE

Creating Soil Management Zones

Soil Variability

Yield Variability

Soil Variability = Yield Variability

Three Soil Properties Control Soil Variability

1) Soil Texture

2) Soil Organic Matter

3) Soil Salinity

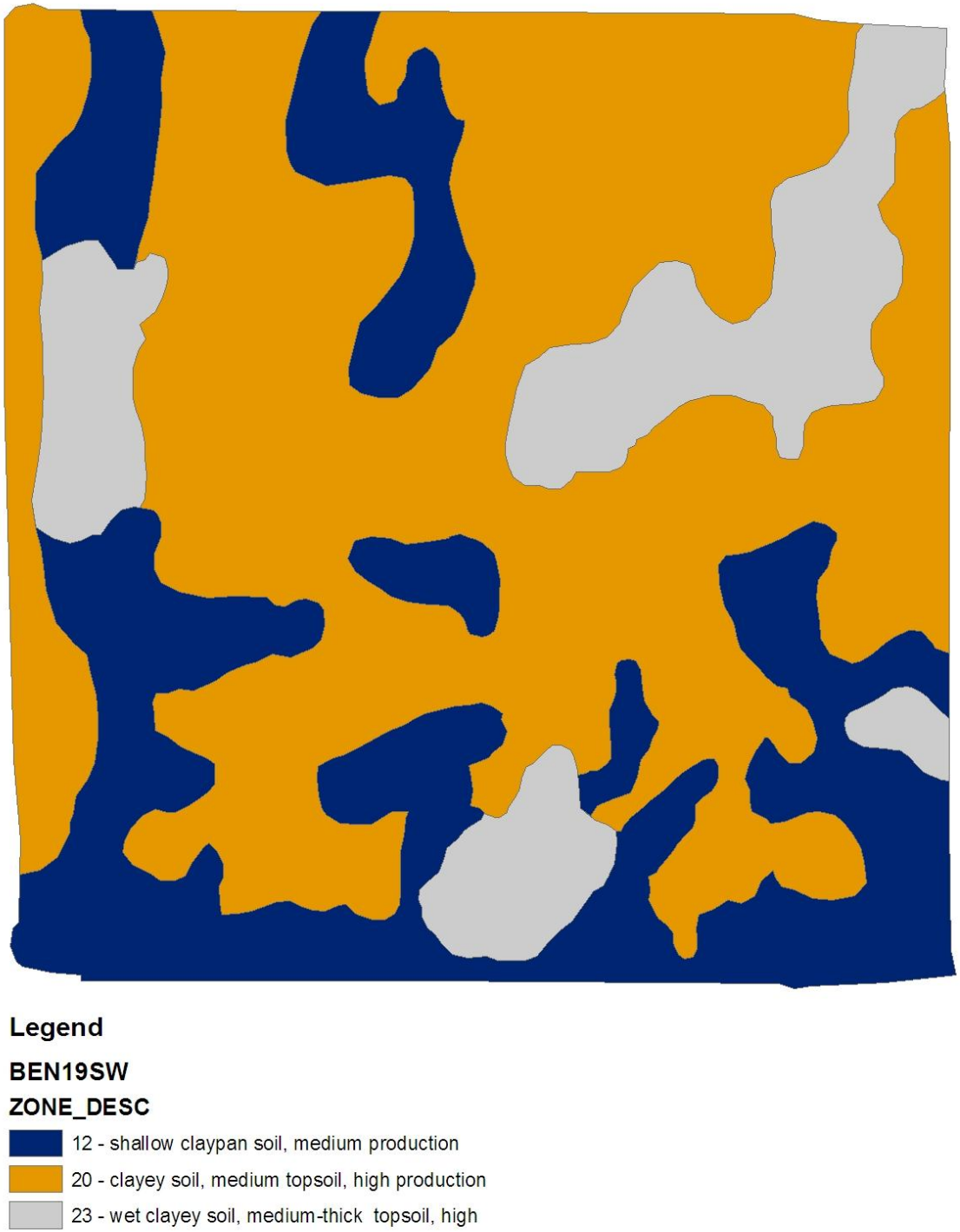
   calcium and sodium salts

Soil Moisture & Soil Nutrients

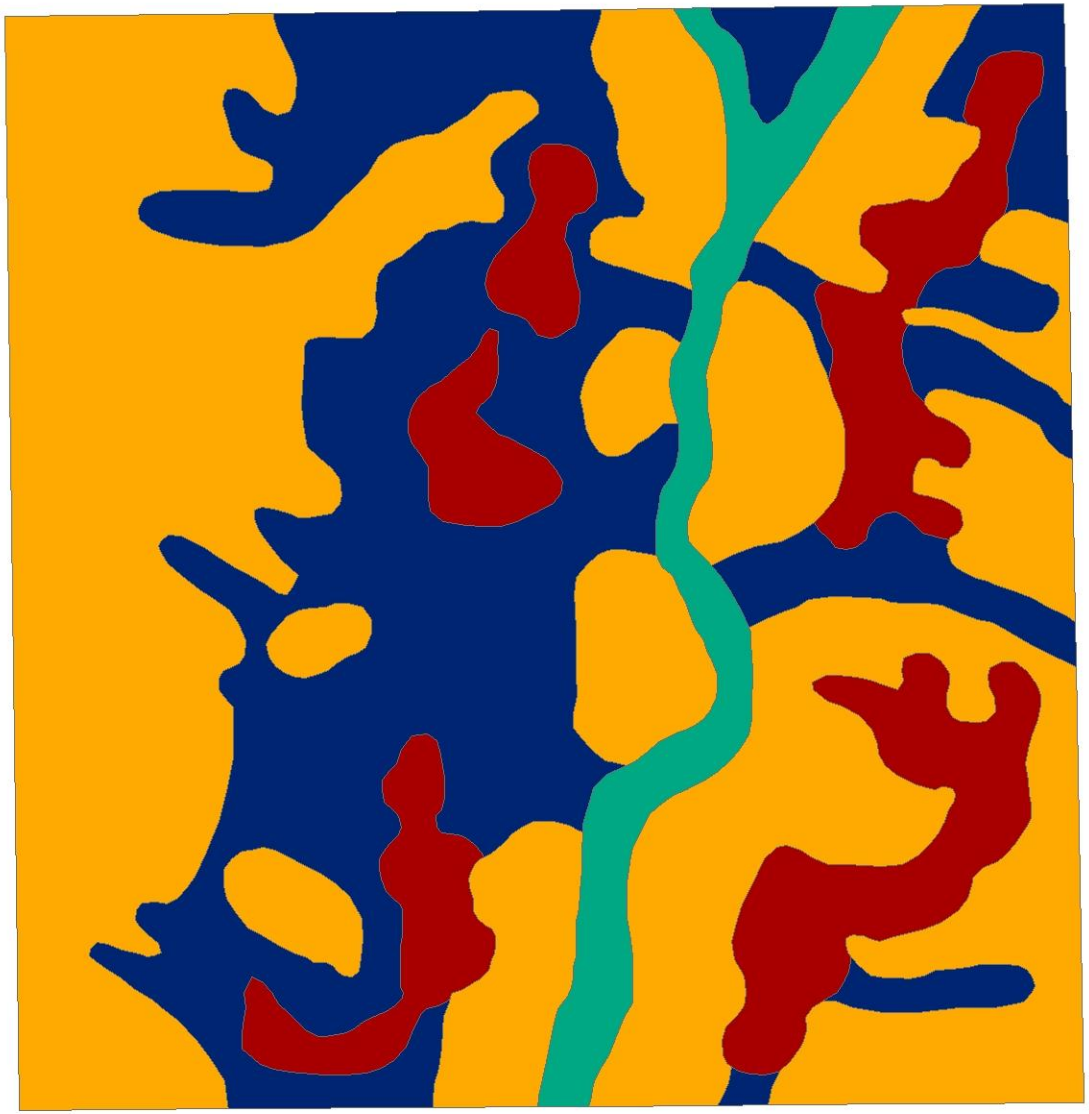
How many Zones in a Field?

How much variability in the field?

How many Zones?

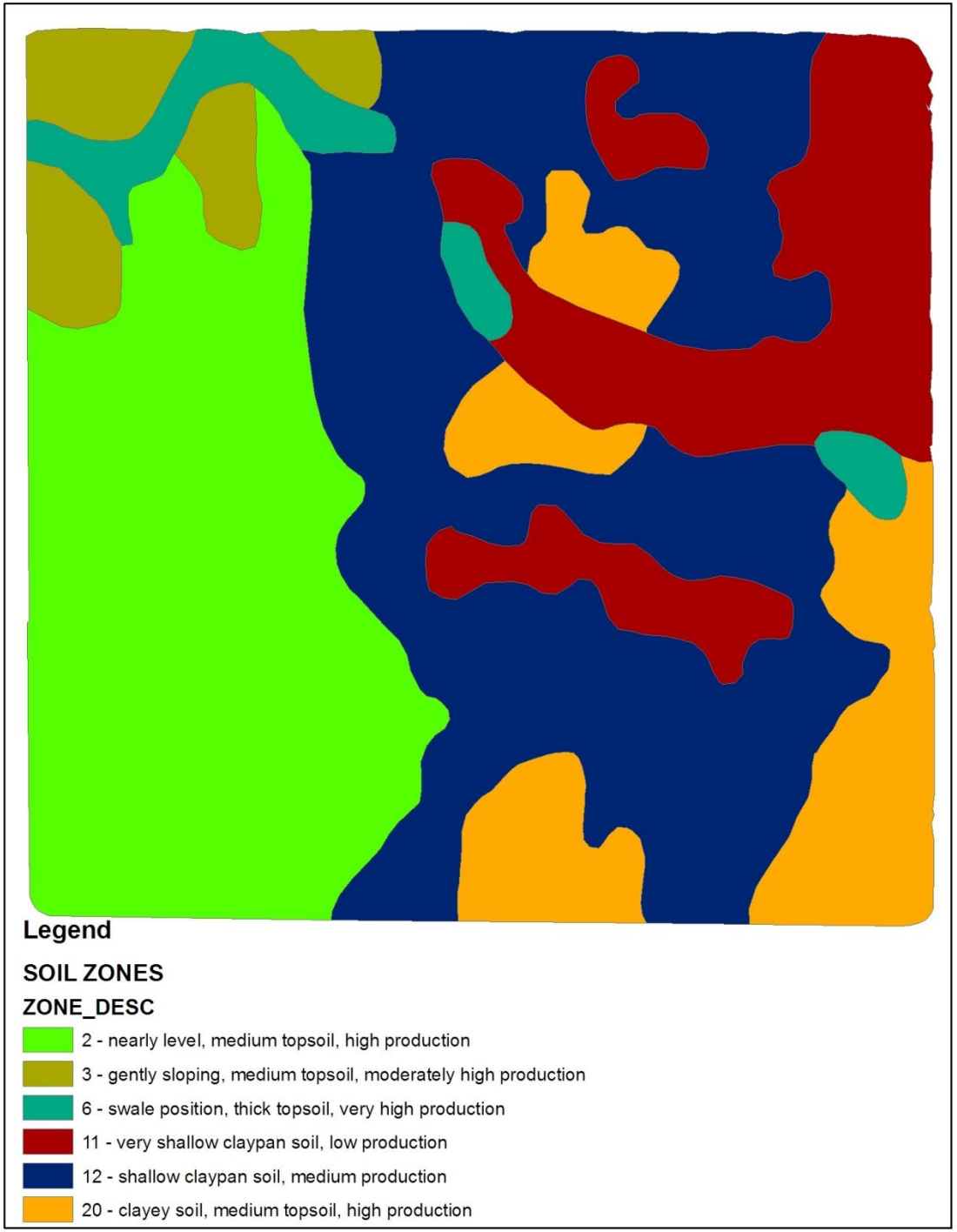


How many Zones?

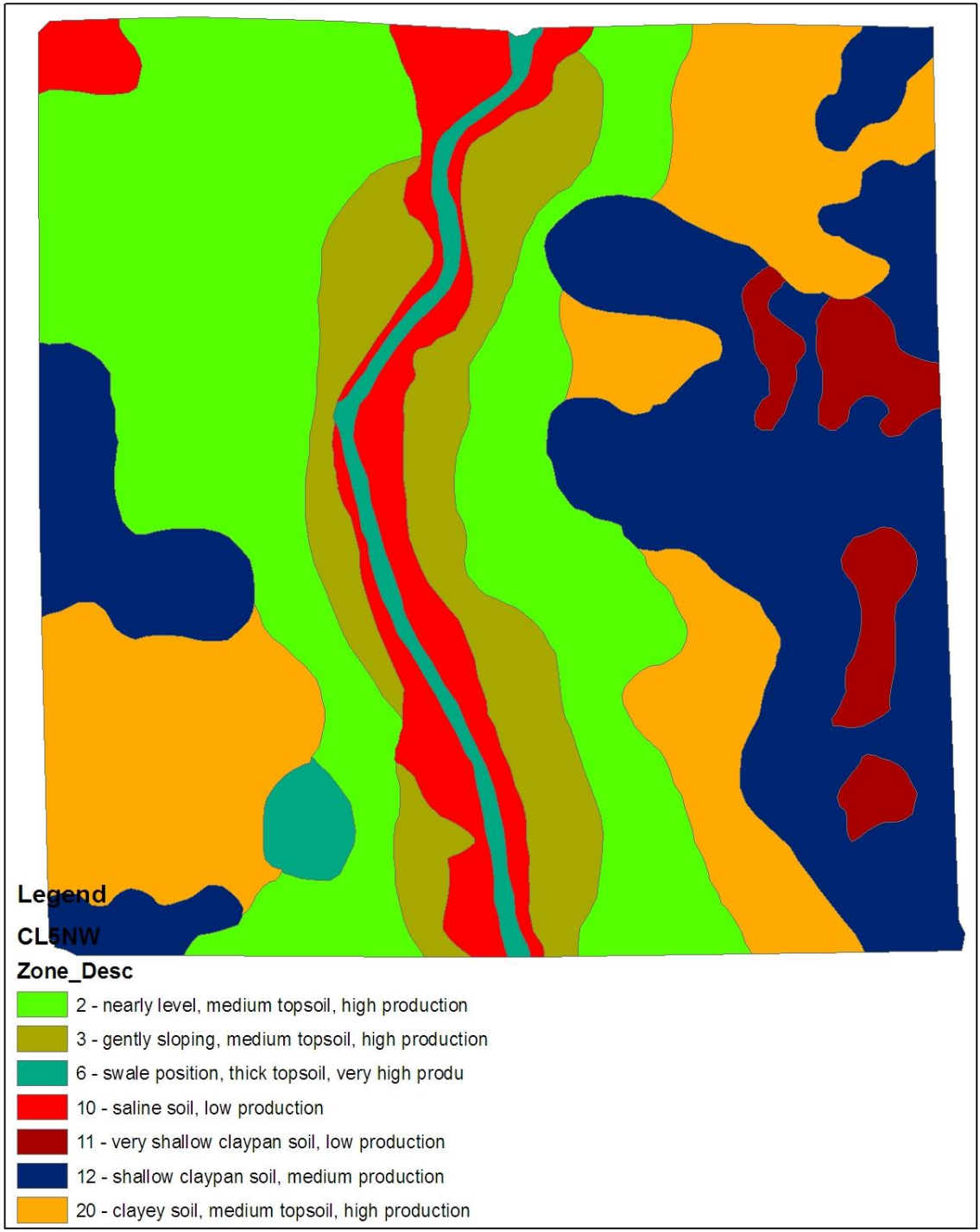


How many Zones?

How many Zones?



How Many Zones?



How do you evaluate the accuracy of the soil management zones?

Soil Fertility Test Results

Soil Fertility Data

Sample	pH	SOM	EC	N	P	K	S	Zn	Ca
Comp	6.9	3.5	0.3	35	9	357	74	0.71	1951
Zone 1	6.8	4.1	0.2	37	17	551	154	1.07	2696
Zone 2	6.4	3.9	0.1	28	12	479	236	1.32	2226
Zone 3	7.4	3.3	0.3	32	8	236	384	0.49	2532
Zone 4	8.1	2.9	0.3	11	5	143	34	0.27	4648
Zone 10	8.0	3.0	3.3	113	26	315	480	0.75	4972
Zone 21	7.8	3.5	1.2	28	19	350	470	0.50	4803

Soil Fertility Data

Sample	Acres	pH	SOM	EC	N	P	K	S	Zn
Zone 1	28.1	5.7	4.3	0.2	27	15	333	16	1.7
Zone 2	94.8	6.1	3.4	0.2	18	7	266	18	0.7
Zone 3	11.0	7.1	2.7	0.4	15	9	229	42	0.4
Zone 10	1.8	7.7	3.2	3.2	97	19	206	120	1.3
Zone 17	17.7	5.6	4.7	0.1	34	52	579	18	2.2

Soil Fertility Data

Sample	Acres	pH	SOM	EC	N	P	K	S	Zn
Zone 6	30.1	6.5	3.4	0.3	30	26	543	18	1.1
Zone 11	18.3	7.3	2.3	1.7	63	34	595	120	1.2
Zone 12	55.6	6.4	2.6	0.2	45	11	495	38	0.9
Zone 17	28.4	6.5	3.8	0.3	36	50	607	42	1.3
Zone 20	27.3	6.8	2.8	0.4	30	8	465	64	1.0

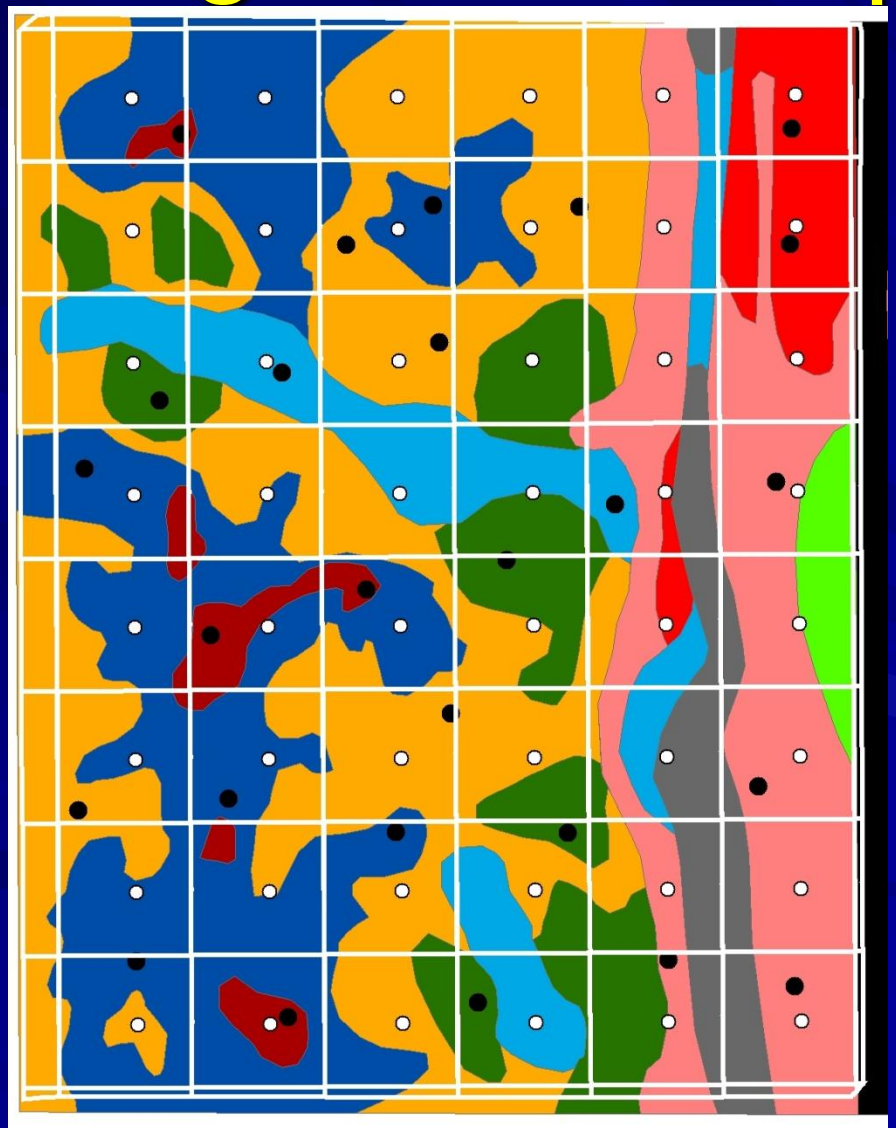
Zones & Soil Fertility Data

Zone	pH	SOM	EC 0-6	N	P	K	S 0-6	S 6-24	Zn
			mmhos/cm	lbs/ac	ppm	ppm	lbs/ac	lbs/ac	ppm
1	6.8	3.5	0.5	39	11	435	44	360	0.9
2	6.8	3.4	0.5	43	8	428	22	72	0.9
3	6.4	3.2	0.5	46	28	705	24	60	1.2
4	6.7	3.1	2.9	65	22	435	120	360	1.1
5	6.5	3.5	0.9	71	38	690	40	198	1.5
6	6.8	3.4	0.4	40	18	459	34	114	1.7
7	6.5	3.2	0.4	177	18	401	34	360	1.0
8	6.3	3.4	0.3	51	10	383	24	360	1.1
9	6.6	4.0	0.4	53	39	1033	14	222	2.7

Zones & Soil Fertility Data

Zone	pH	SOM	EC 0-6	N	P	K	S 0-6	S 6-24	Zn
			mmhos/cm	lbs/ac	ppm	ppm	lbs/ac	lbs/ac	ppm
1	6.8	3.5	0.5	39	11	435	44	360	0.9
2	6.8	3.4	0.5	43	8	428	22	72	0.9
3	6.4	3.2	0.5	46	28	705	24	60	1.2
4	6.7	3.1	2.9	65	22	435	120	360	1.1
5	6.5	3.5	0.9	71	38	690	40	198	1.5
6	6.8	3.4	0.4	40	18	459	34	114	1.7
7	6.5	3.2	0.4	177	18	401	34	360	1.0
8	6.3	3.4	0.3	51	10	383	24	360	1.1
9	6.6	4.0	0.4	53	39	1033	14	222	2.7

Gird Sampling vs Soil Mngt Zone Sampling



SOIL TEST RESULTS

	pH	SOM	EC1	EC2	N	P	K	S1	Zn
ZONE	8.2	3.2	0.6	0.4	18	8	345	98	0.6
AVG	8.2	3.1	0.7	0.6	50	8	388	105	0.7
STD	0.4	0.2	0.1	0.3	42	3.1	88	29	0.3

ALKALINE SOIL - 12 Grid Samples

SOIL TEST RESULTS

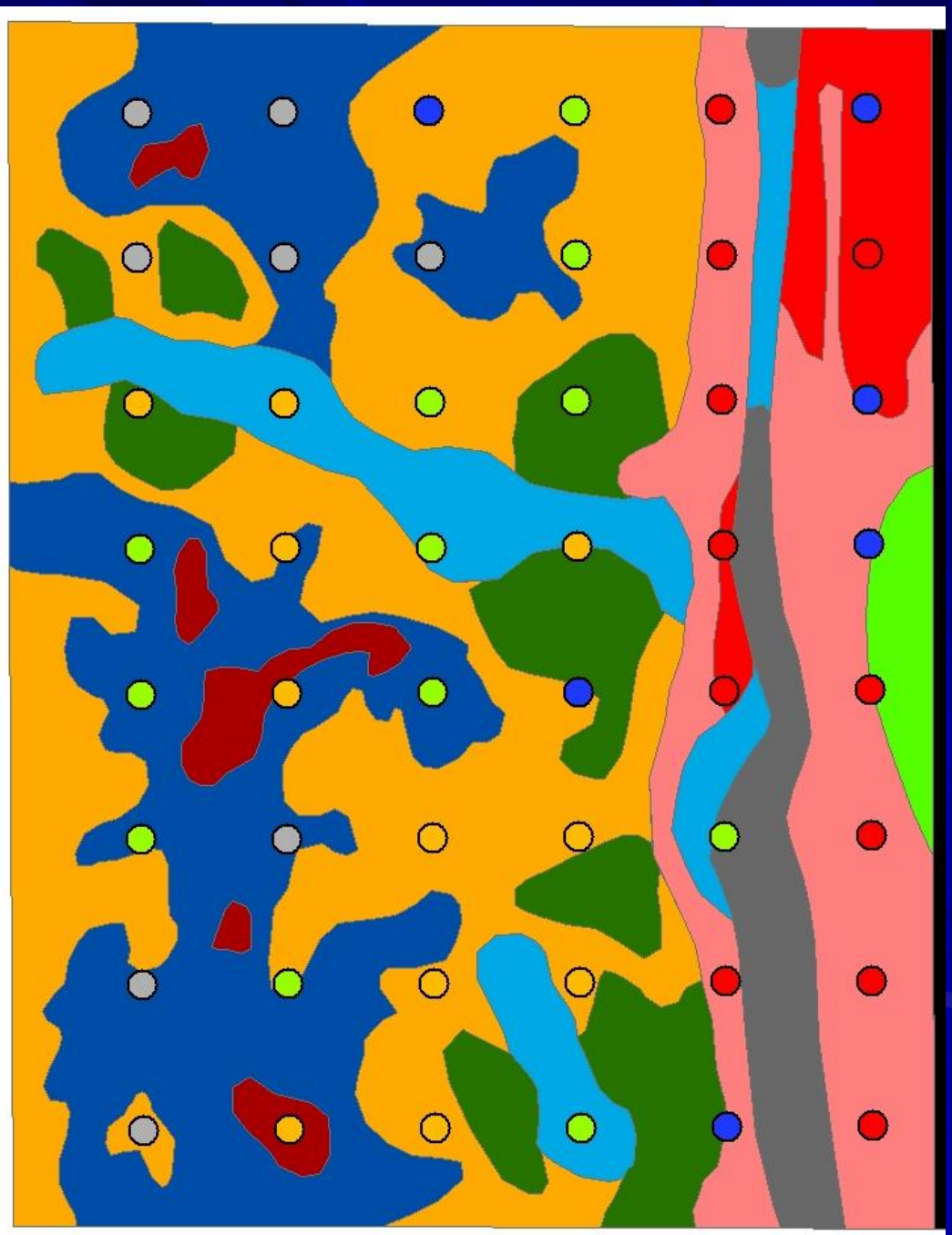
	pH	SOM	EC1	EC2	N	P	K	S1	Zn
ZONE	6.8	4.4	0.5	1.9	37	33	547	120	1.7
AVG	6.3	4.4	0.5	1.5	48	34	558	78	1.8
STD	0.4	0.4	0.2	0.9	21	8.5	82	44	0.3

CLAYPAN SOIL - 12 Grid Samples

SOIL TEST RESULTS

	pH	SOM	EC1	EC2	N	P	K	S1	Zn
ZONE	6.4	4.4	0.6	0.7	66	19	481	120	1.4
AVG	6.6	4.4	0.5	0.9	48	21	542	67	1.5
STD	0.5	0.5	0.3	0.6	18	6.1	95	44	0.5

HIGH PRODUCING SOIL - 13 Grid Samples

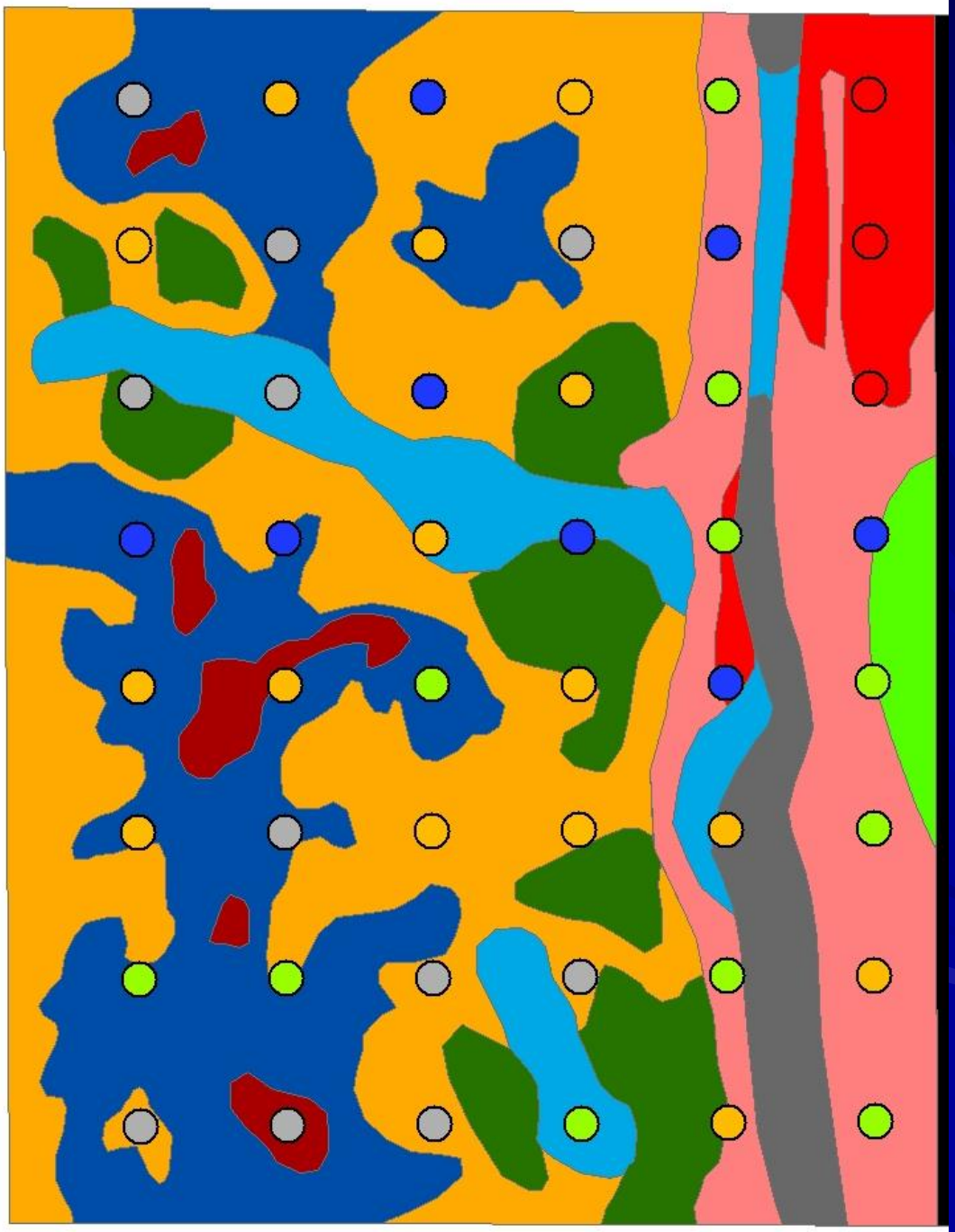

Legend
Grid Data pH
pH
5.700 - 6.100
6.101 - 6.600
6.601 - 7.200
7.201 - 7.900
7.901 - 8.800

Legend

Grid Data Salt1

Salt1

- 0.190 - 0.330
- 0.331 - 0.540
- 0.541 - 0.790
- 0.791 - 1.490
- 1.491 - 3.560

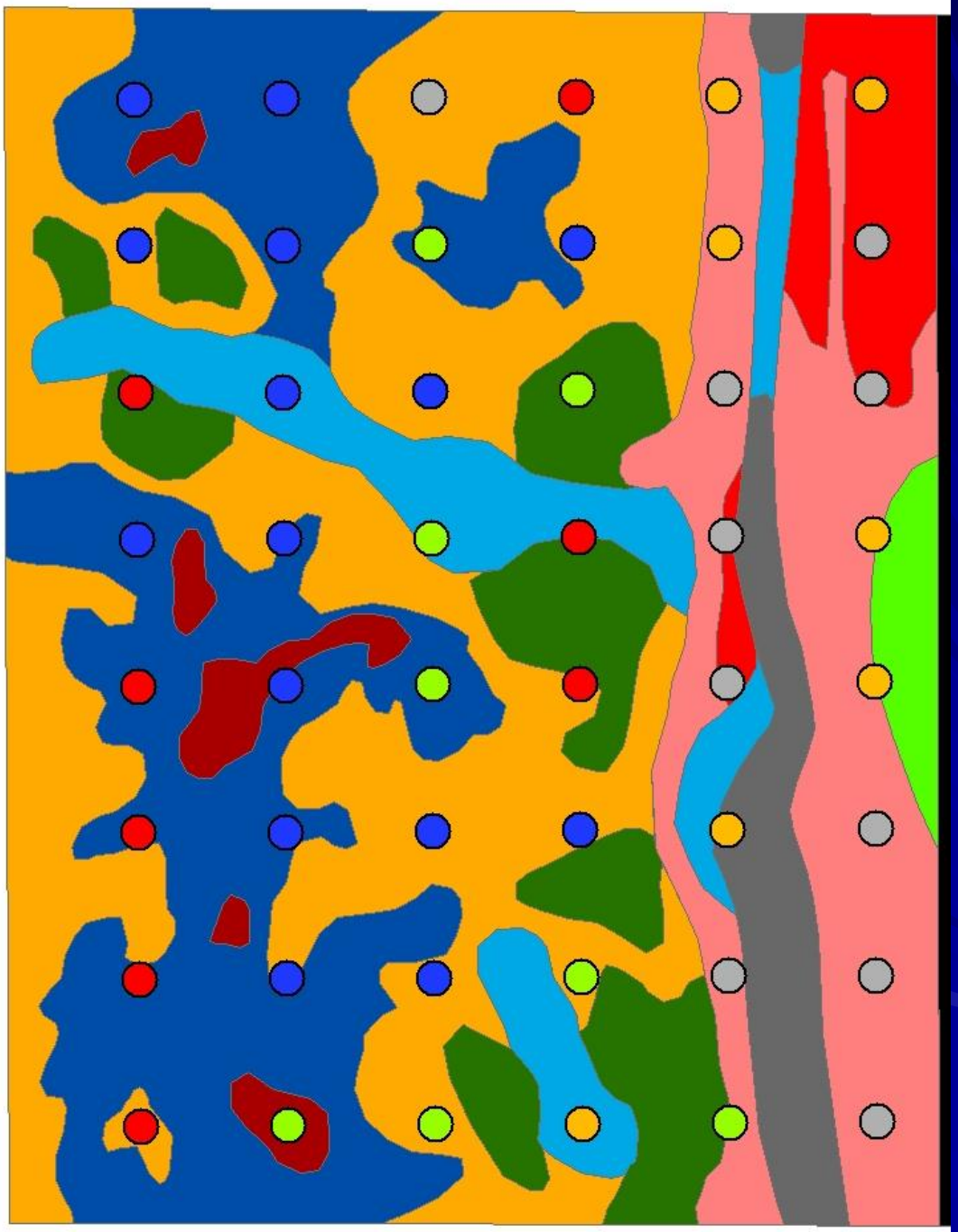


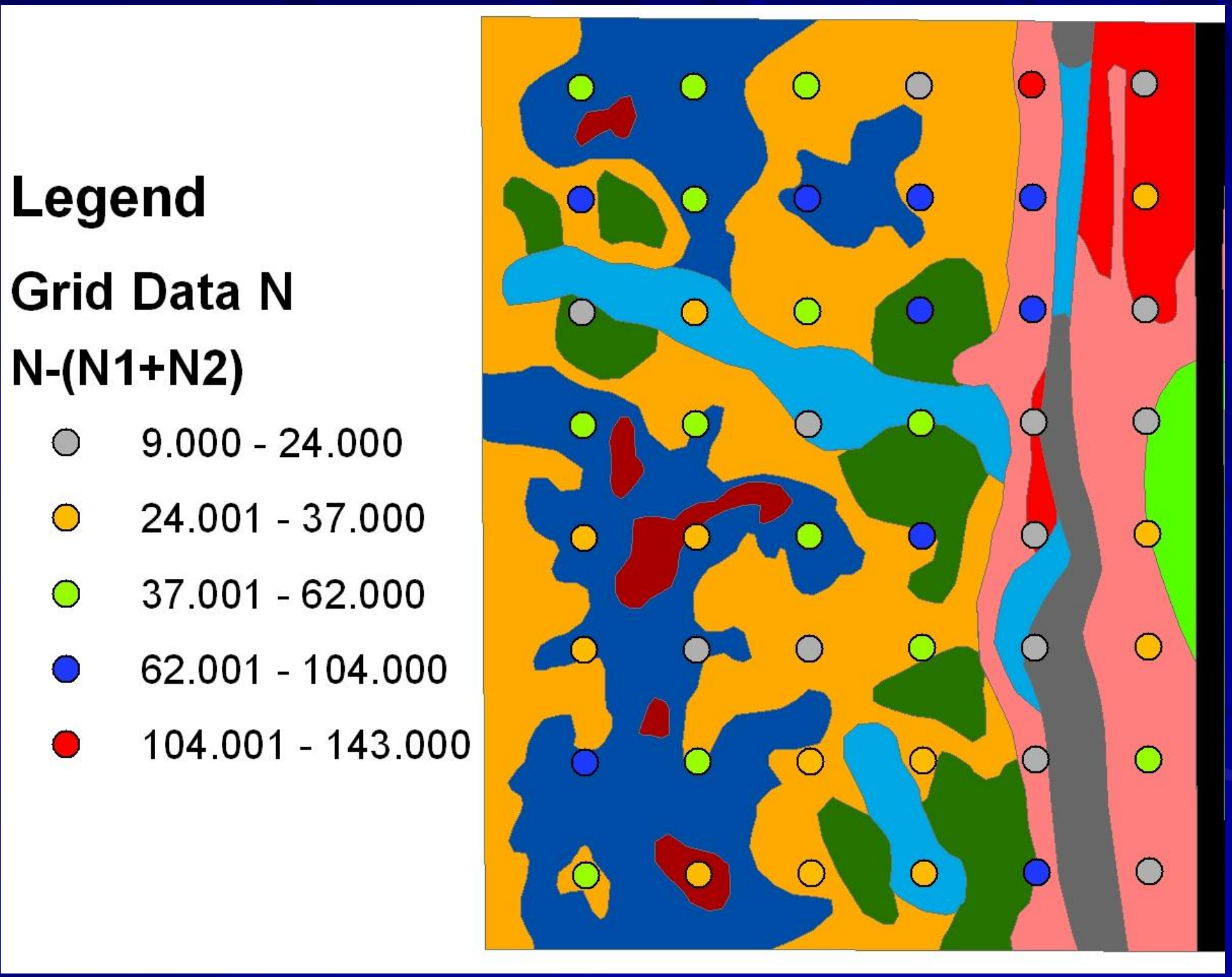
Legend

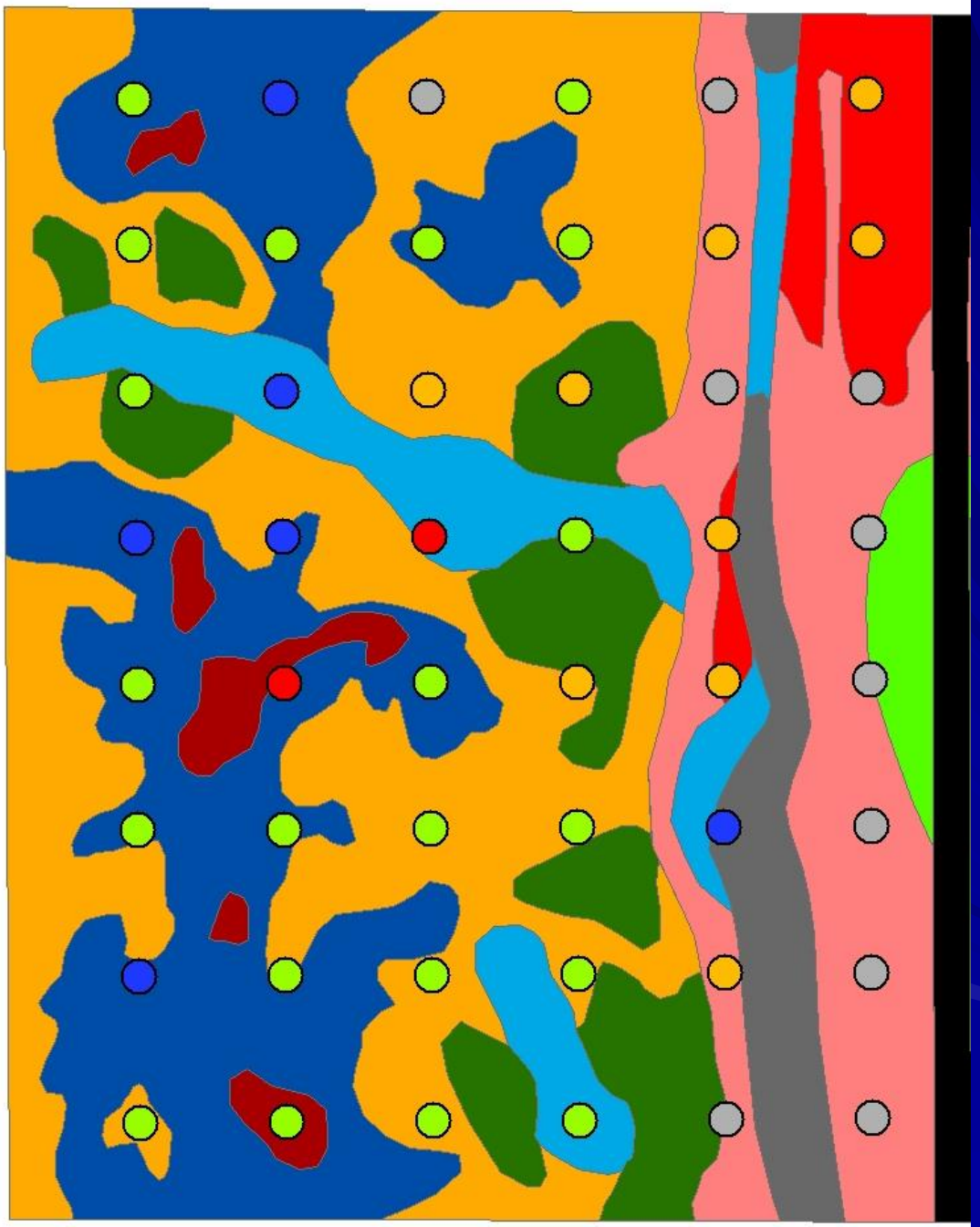
Grid Data SOM

OM

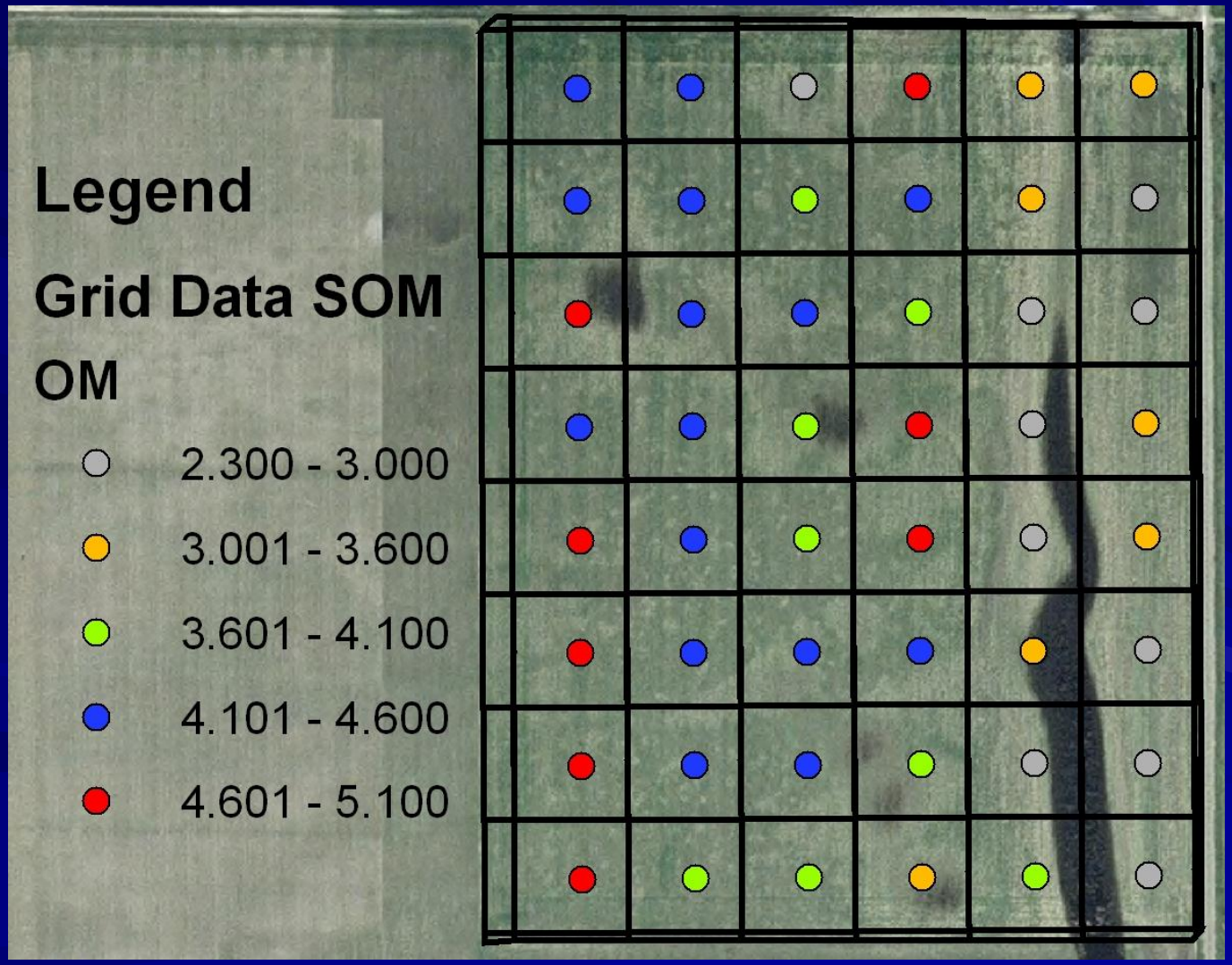
- 2.300 - 3.000
- 3.001 - 3.600
- 3.601 - 4.100
- 4.101 - 4.600
- 4.601 - 5.100




Legend
Grid Data N
N-(N1+N2)
9.000 - 24.000
24.001 - 37.000
37.001 - 62.000
62.001 - 104.000
104.001 - 143.000


Legend
Grid Data P
P-O_ppm
4.000 - 8.000
8.001 - 18.000
18.001 - 31.000
31.001 - 43.000
43.001 - 61.000

How do you write a seeding prescription from a grid map?



Recovering the Cost of Variable Rate Technology

1) Fertilizer
   - Phosphorus
   - Nitrogen
   - Sulfur
   -Potassium

2) Seed

Nitrogen Variability & Nitrogen Recommendations

Nitrogen is a Mobile Nutrient in the Soil

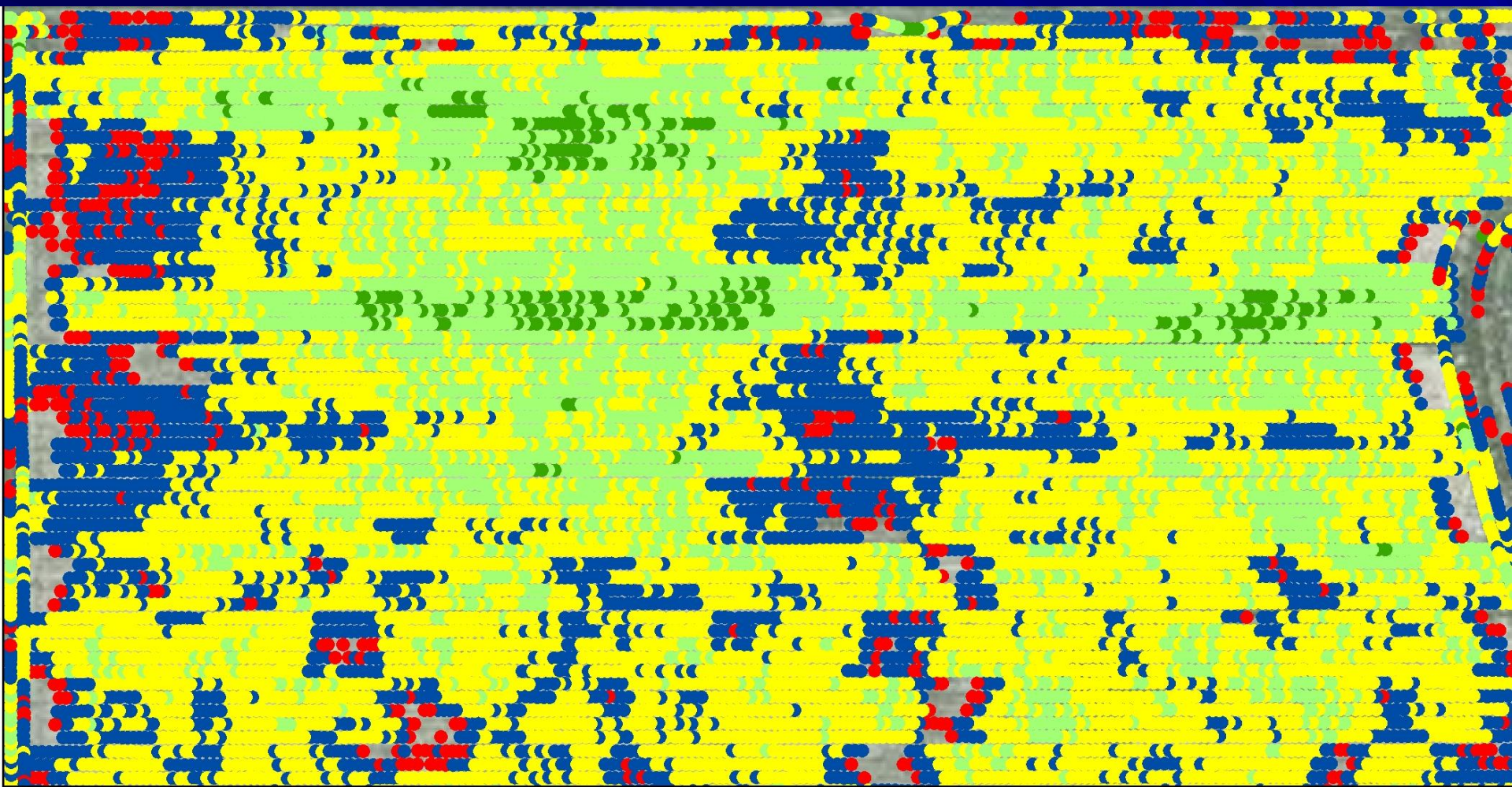
Treat Nitrogen like a checking account

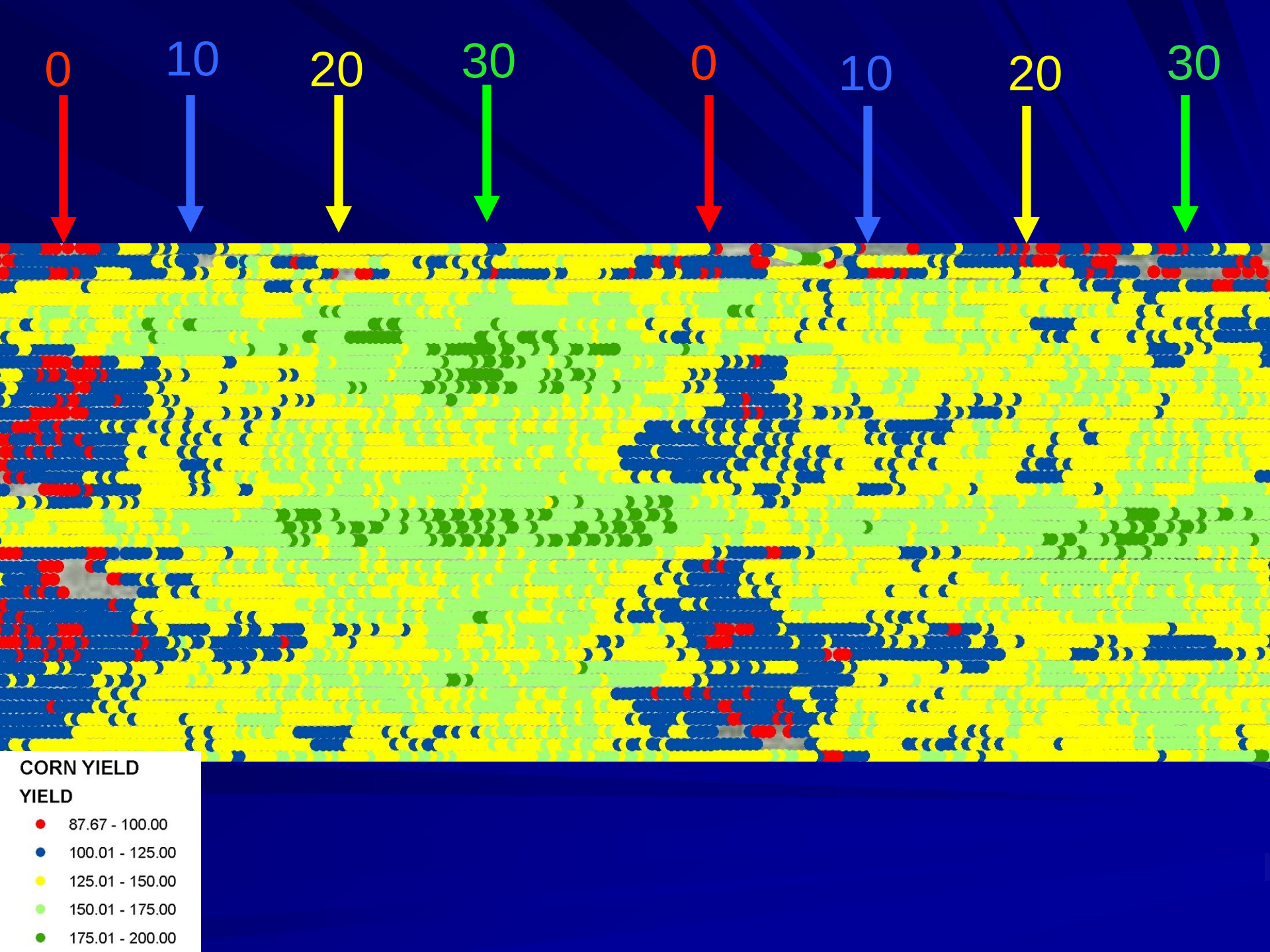
N Management

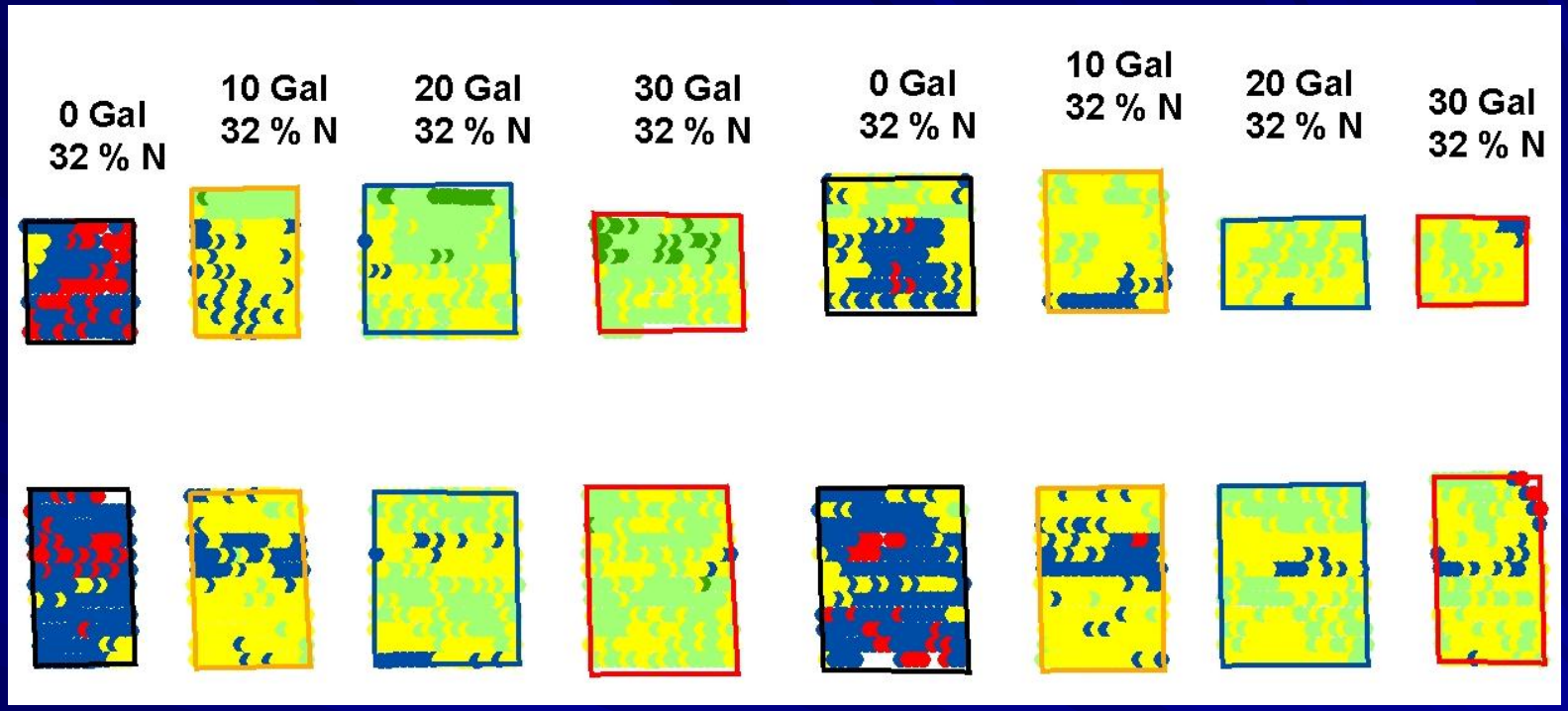
SOM	N release per year
1	26
2	52
3	78
4	104
5	132

assuming 2 percent rate of breakdown

NITROGEN USE EFFICIENCY




0
10
20
30
0
10
20
30
CORN YIELD
YIELD
87.67 - 100.00
100.01 - 125.00
125.01 - 150.00
150.01 - 175.00
175.01 - 200.00



N	Yield	Total N	NUE
0 gal	147.7	105	0.7
10 gal	154.7	135	0.9
20 gal	169.1	165	1.0
30 gal	169.3	195	1.15

Phosphorus Variability & Phosphorus Recommendations

Phosphorus is a non mobile Nutrient in the Soil

Treat Phosphorus like a Savings Account

Two Version of Phosphorus Variability

1) Natural Variability Based on Landscape
   - P levels increase as you move down the slope

2) Man-Made Variability
   - Old building sites or fields with manure history
   - Highest P levels on the poorest producing soils

Landscape and Phosphorus

Sample	pH	SOM	EC	N	P	K	S	Zn	Ca
			mmhos/cm	lbs/ac	ppm	ppm	lbs/ac	ppm	ppm
Upland	6.4	3.9	0.1	28	12	479	236	1.32	2226
Eroded	8.1	2.9	0.3	11	5	143	34	0.27	4648
Swale	6.8	4.1	0.2	37	17	551	154	1.07	2696
Saline	8.0	3.0	3.3	113	26	315	480	0.75	4972

Landscape and Phosphorus

Landscape	pH	SOM	N	P	K
eroded knob	8.0	2.7	23	07	186
sloping upland	6.7	3.3	26	11	198
swale	6.4	4.3	39	30	288
depression	6.1	4.6	73	73	547

Variable Rate Seeding

Corn

Soybeans

Wheat

Cover Crops and Variable Rate Technology

WINTER CANOLA, RADISH, & LENTILS

	9-16-08			11-04-08		
	NITROGEN			NITROGEN		
	0-6	6-24	T	0-6	6-24	T
MW12	8	15	23	2	3	5
MW20	15	27	42	2	6	8
MW23	7	12	19	3	6	9
KF12	37	57	94	3	3	6
KF20	20	24	44	2	3	5

ANY QUESTIONS?

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