PENNSTATE

Green Roof Media Nutrient Testing, Nutrient Management, and Runoff Water Quality

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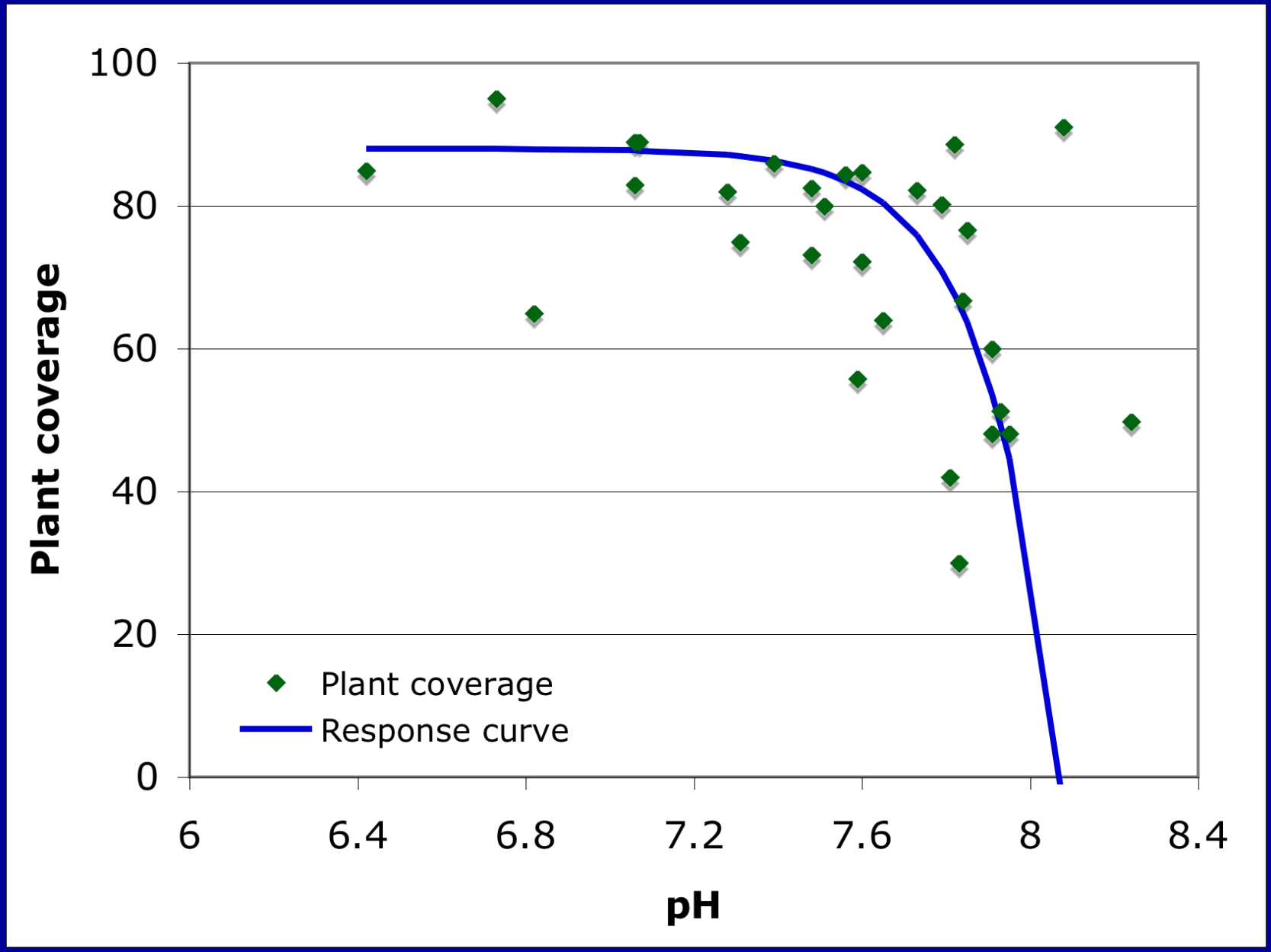
Penn State Center for Green Roof Research

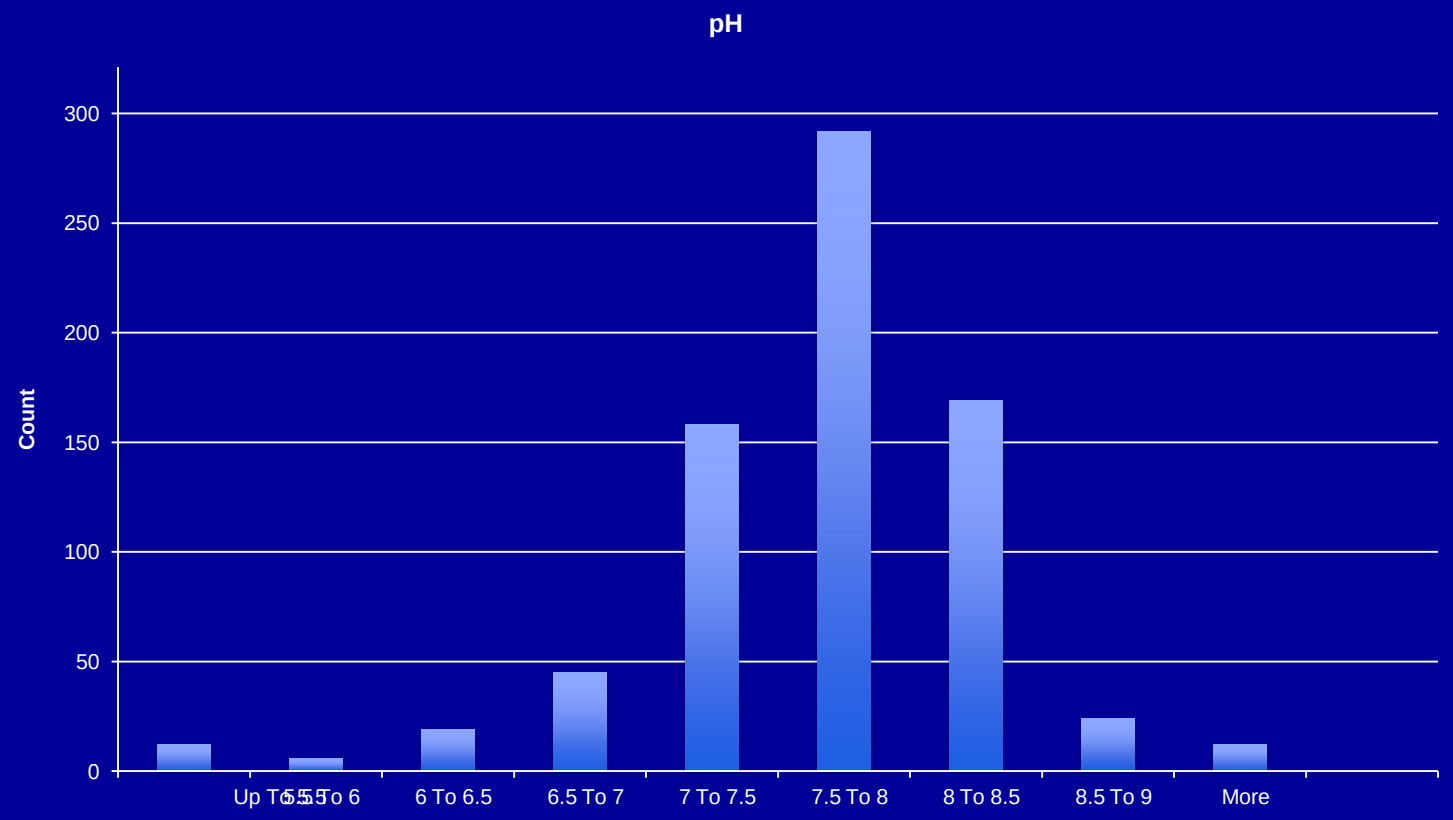
Green roof management –
Healthy plants with good
coverage.

Original study - Sampled 40+ roofs

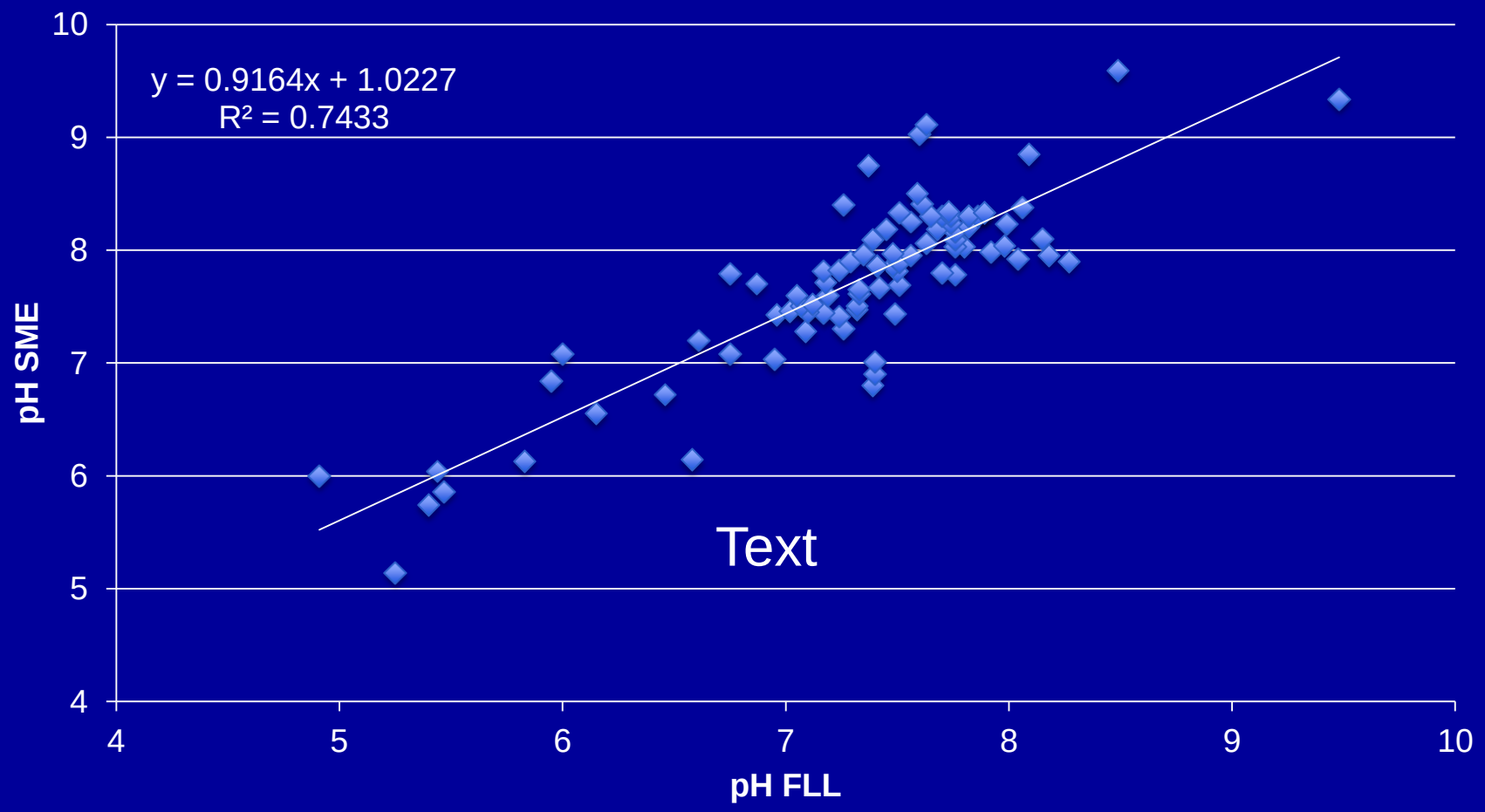
Since the development of the test we have tested over 740 media samples - Many of these also had FLL extracts done



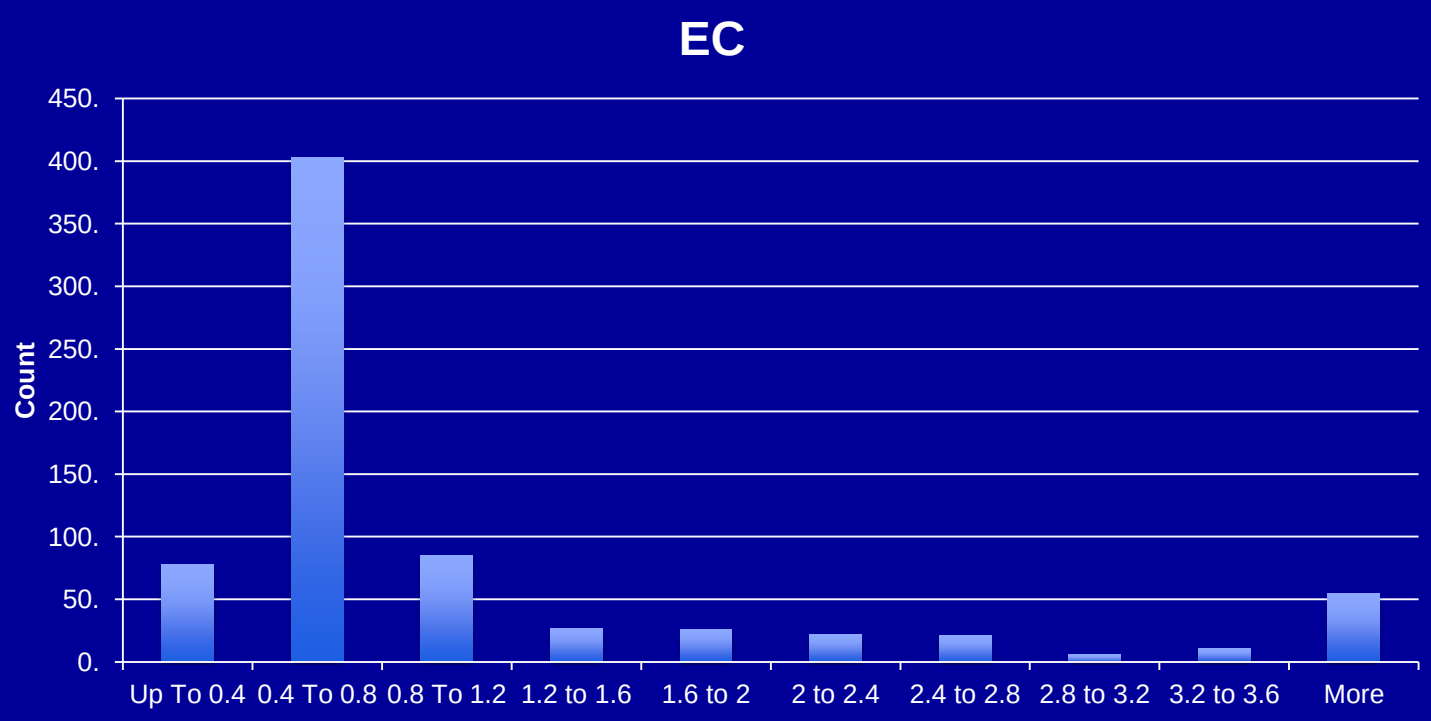
Suggested range 6.5-7.8



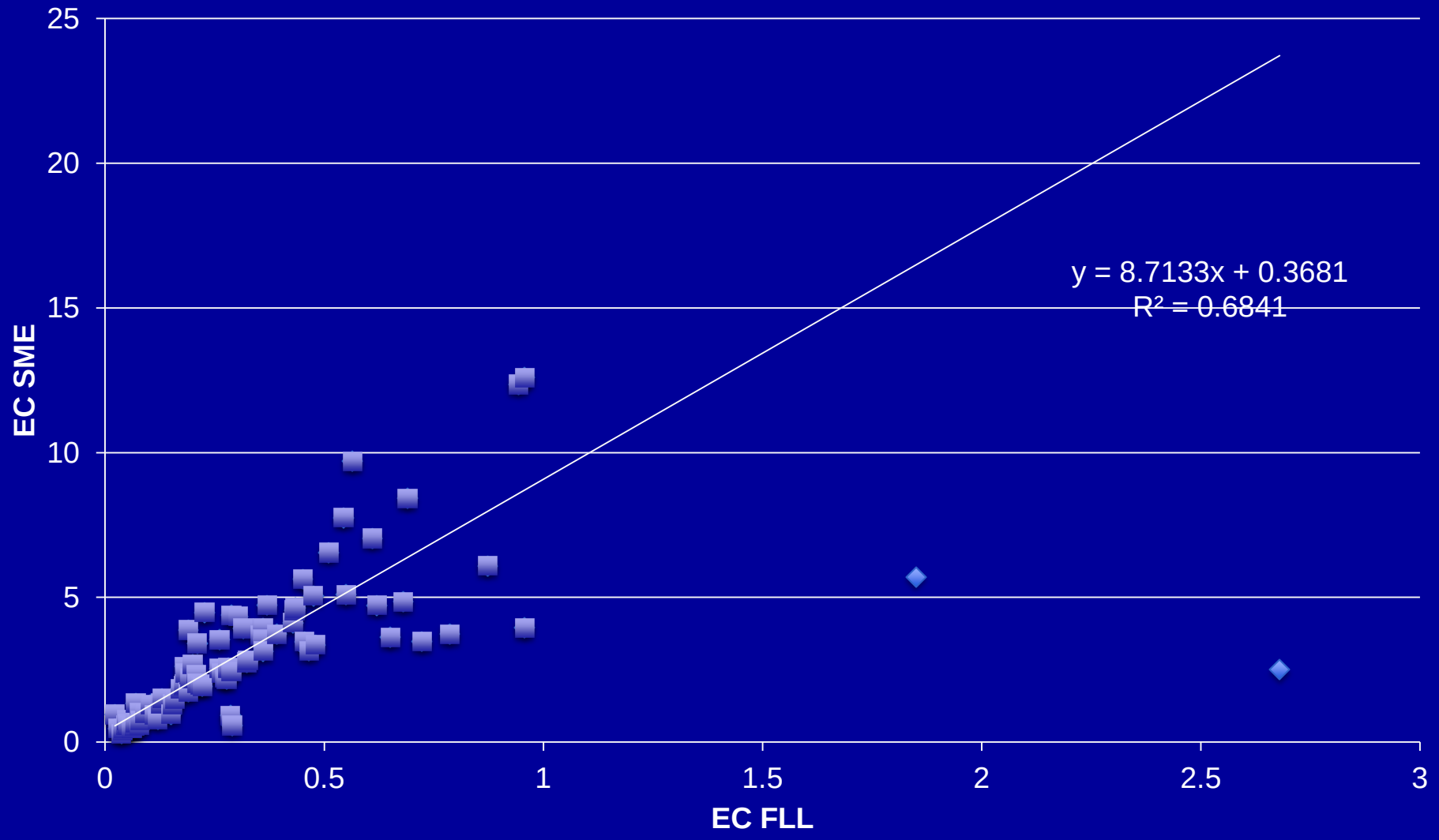
	Unspecified	Single layer	Multicourse	Intensive
Average	7.7	7.5	7.6	7.6
% over 7.8	39%	44%	43%	37%
% under 6.5	3%	14%	4%	6%



FLL CaCl pH	7.3	6.5 - 7.5
SME (Water) pH	7.8	6.5 - 8



	Unspecified	Single layer	Multicourse	Intensive
Average	1.2	1.2	1.2	1.6
% over 1.2	17%	27%	20%	43%
% under 0.4	9%	12%	11%	0%

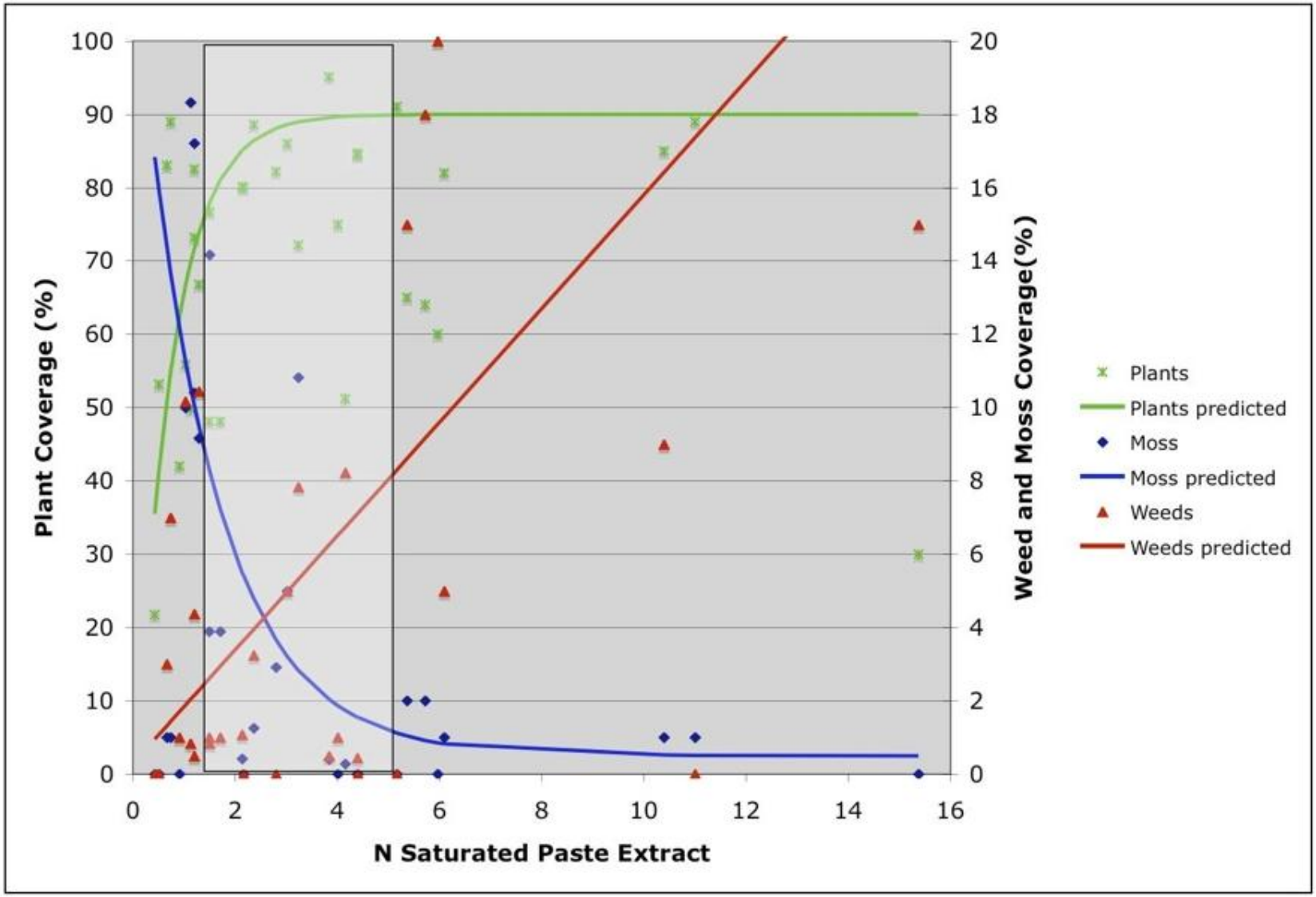


FLL 10:1 EC	0.36
SME (Water) EC	3.0

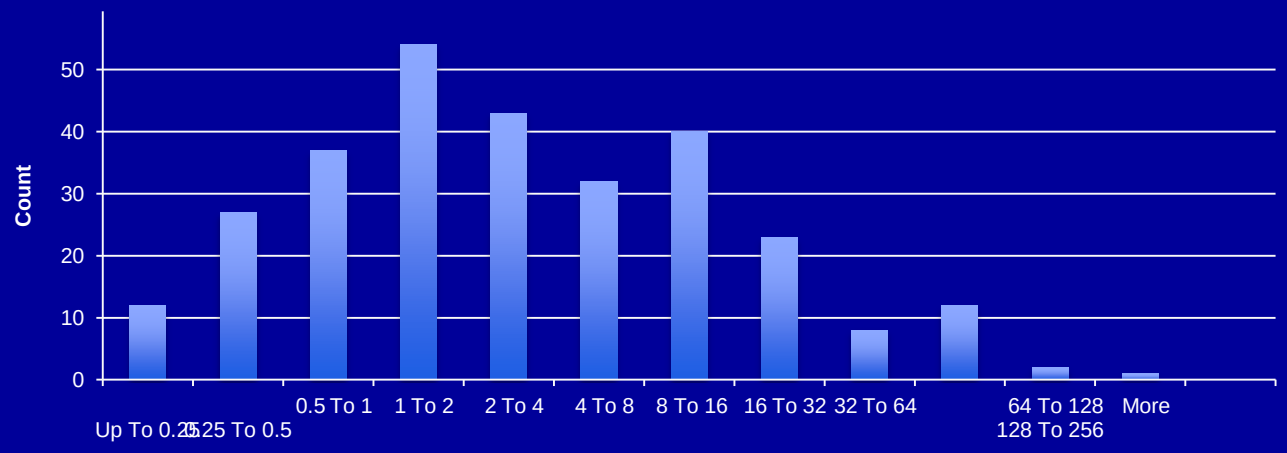
EC ranges

	Extensive		Intensive	
	FLL	SME	FLL	SME
Low	<0.1	<0.4	<0.1	<0.4
Recommended range	0.1-0.16	0.4-1.2		
Normal range	0.1-0.22	0.4-2.0	0.1-0.3	1 - 3
High	0.22-0.3	2.0-3.0		
Excessive	>0.3	>3.0	>0.3	>3

Nitrogen in saturated extracts of green roof media. (1-4 ; 0.4-1.5)

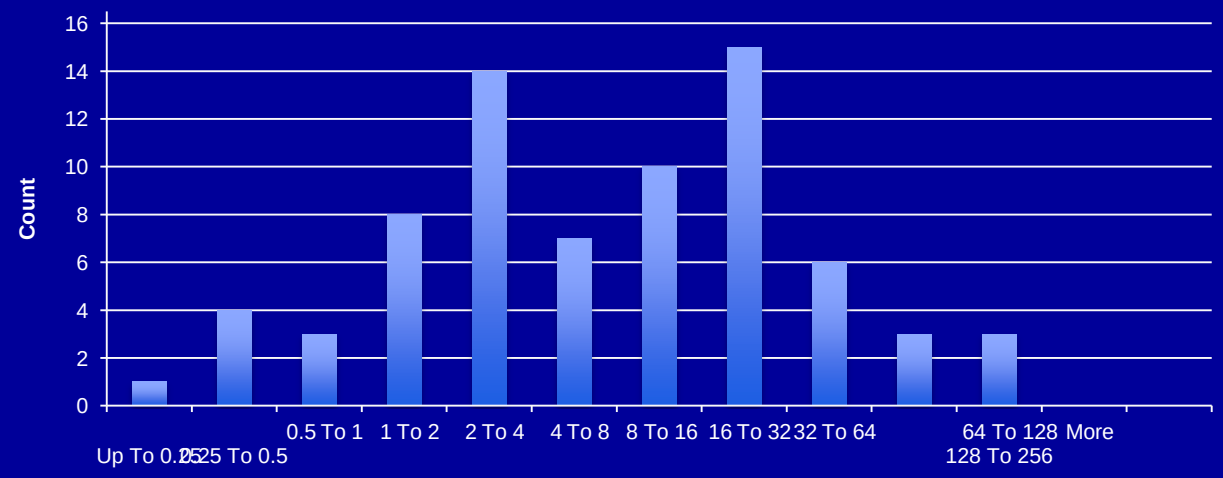


NO3 Extensive

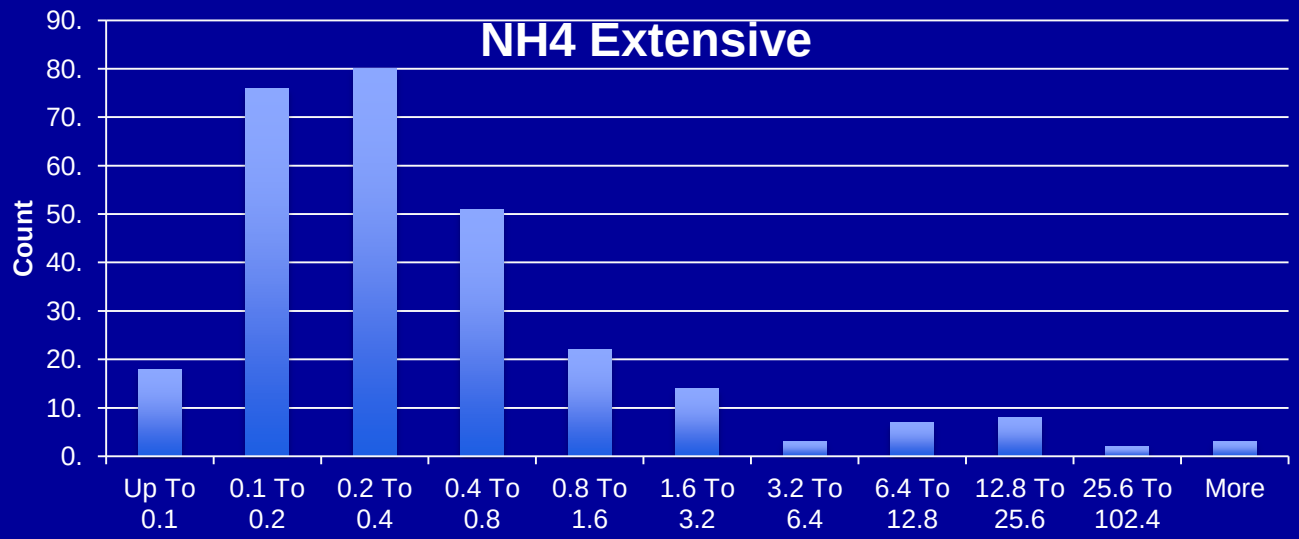


Low	<0.5
Recommended	1-4
Normal range	0.5-32
High	>32

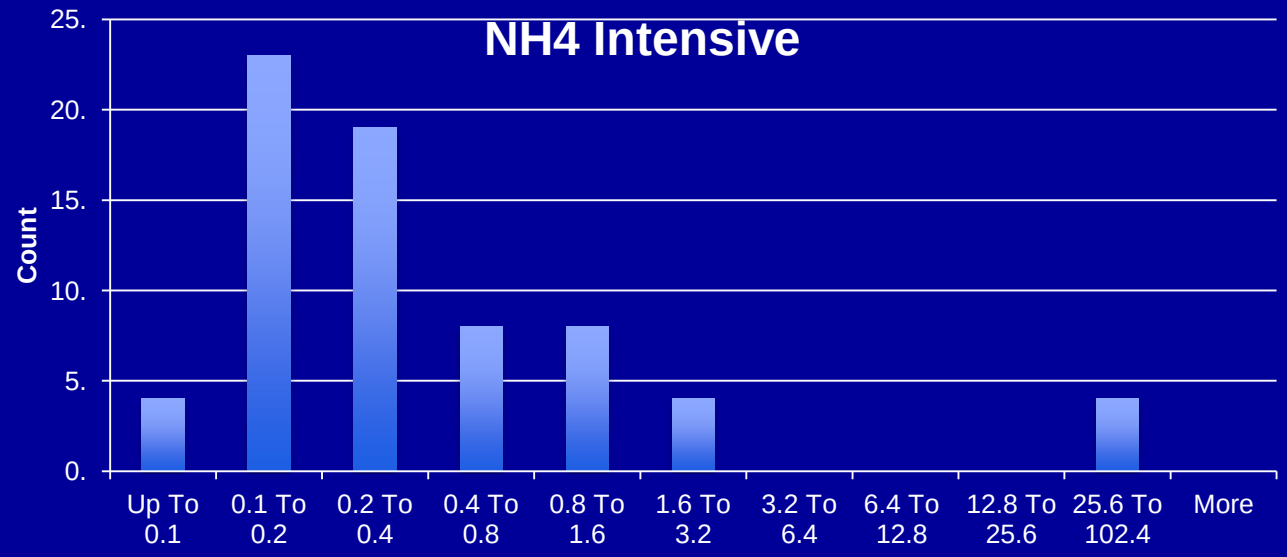
NO3 Intensive



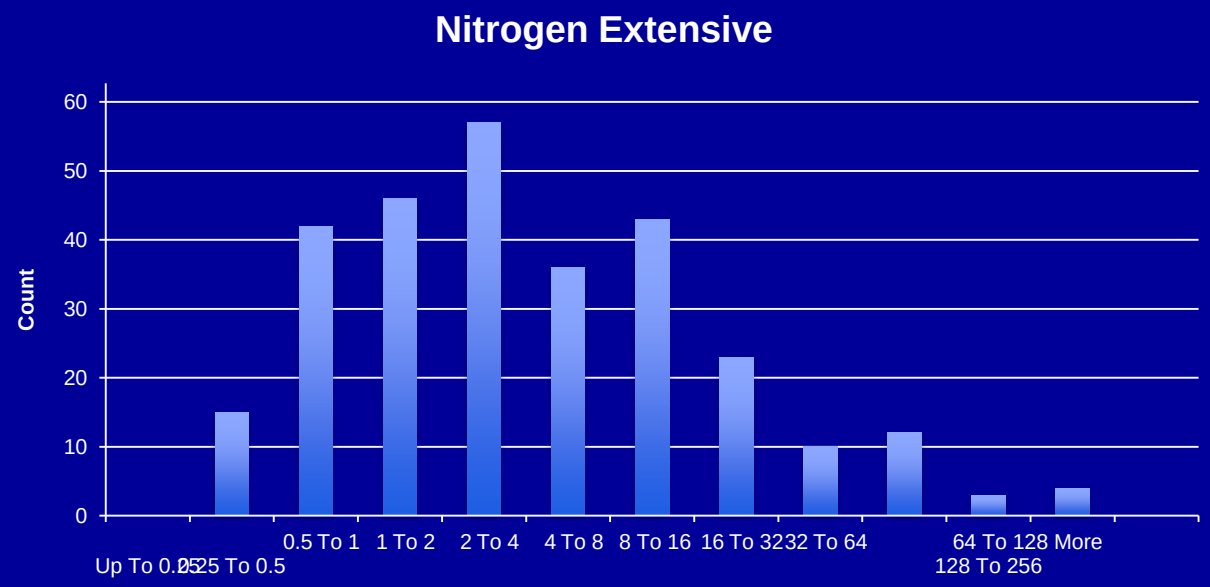
Low	<1
Recommended	2-32
Normal range	1-64
High	>64



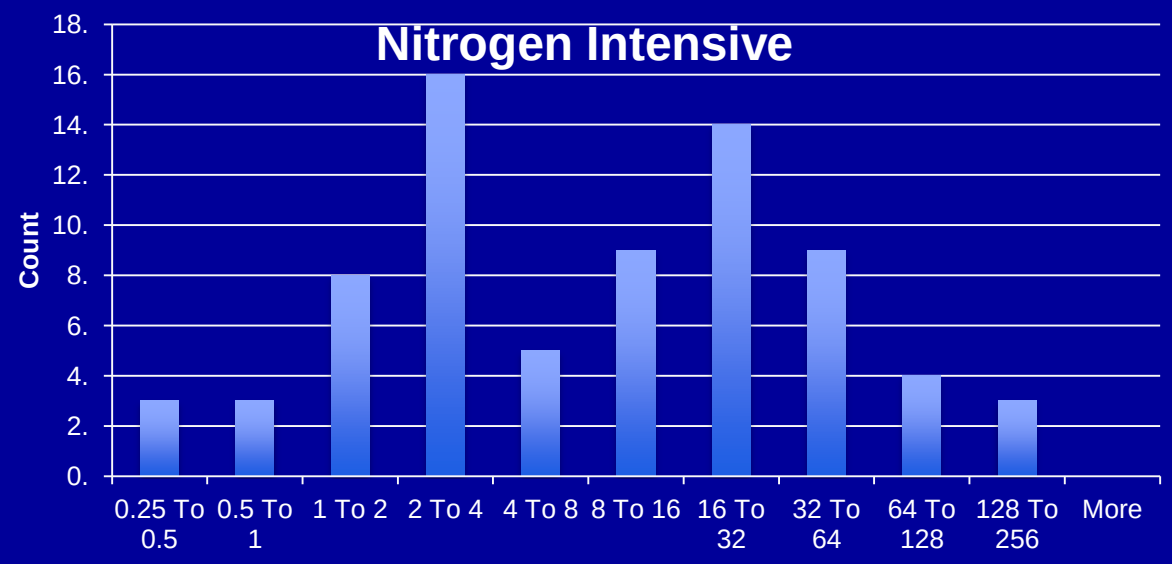
Low	<0.1
Recommended	0.1 - 0.8
Normal range	0.1 - 3.2
High	>3.2



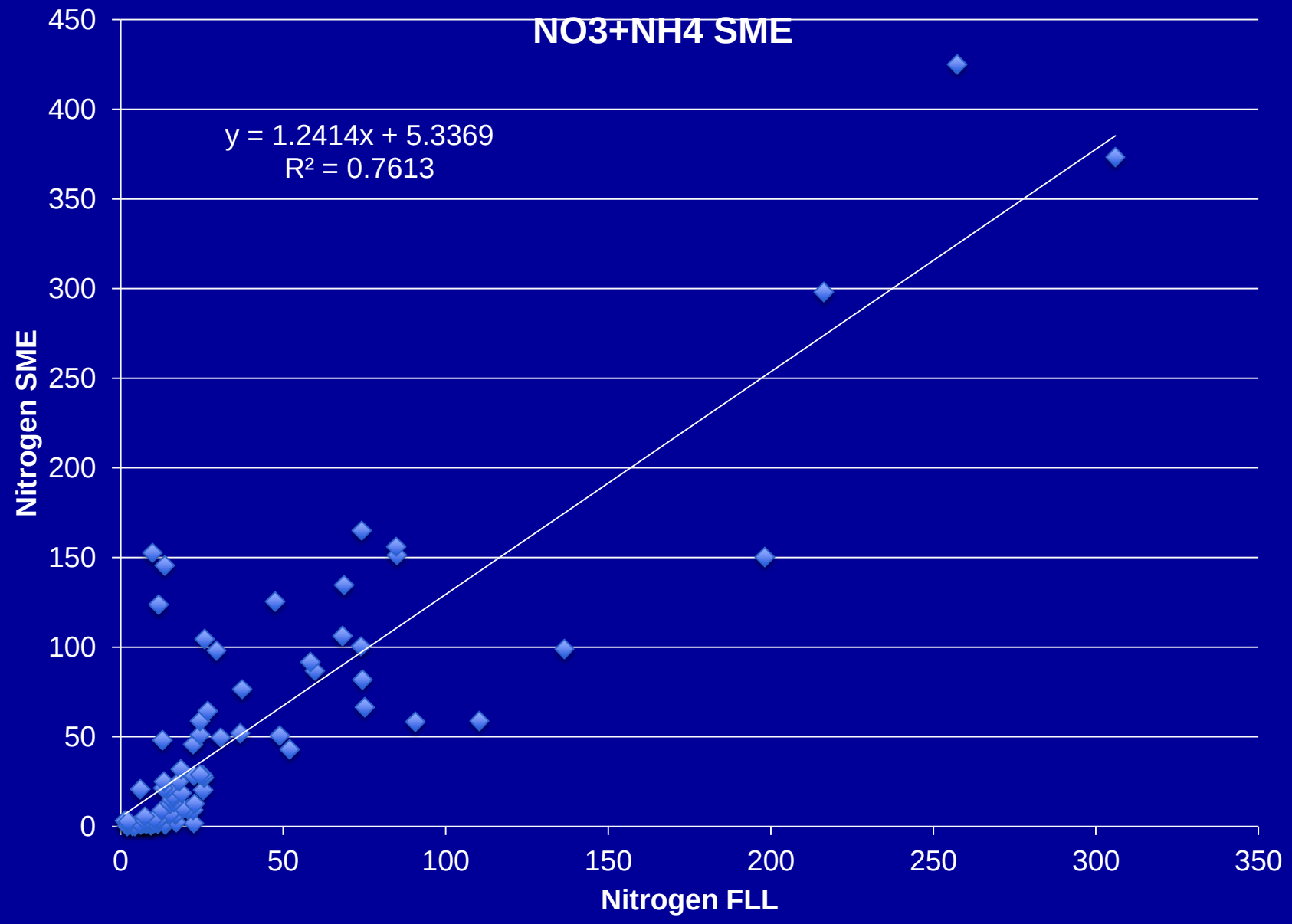
Low	<0.1
Recommended	0.1 - 0.8
Normal range	0.1 - 3.2
High	>3.2



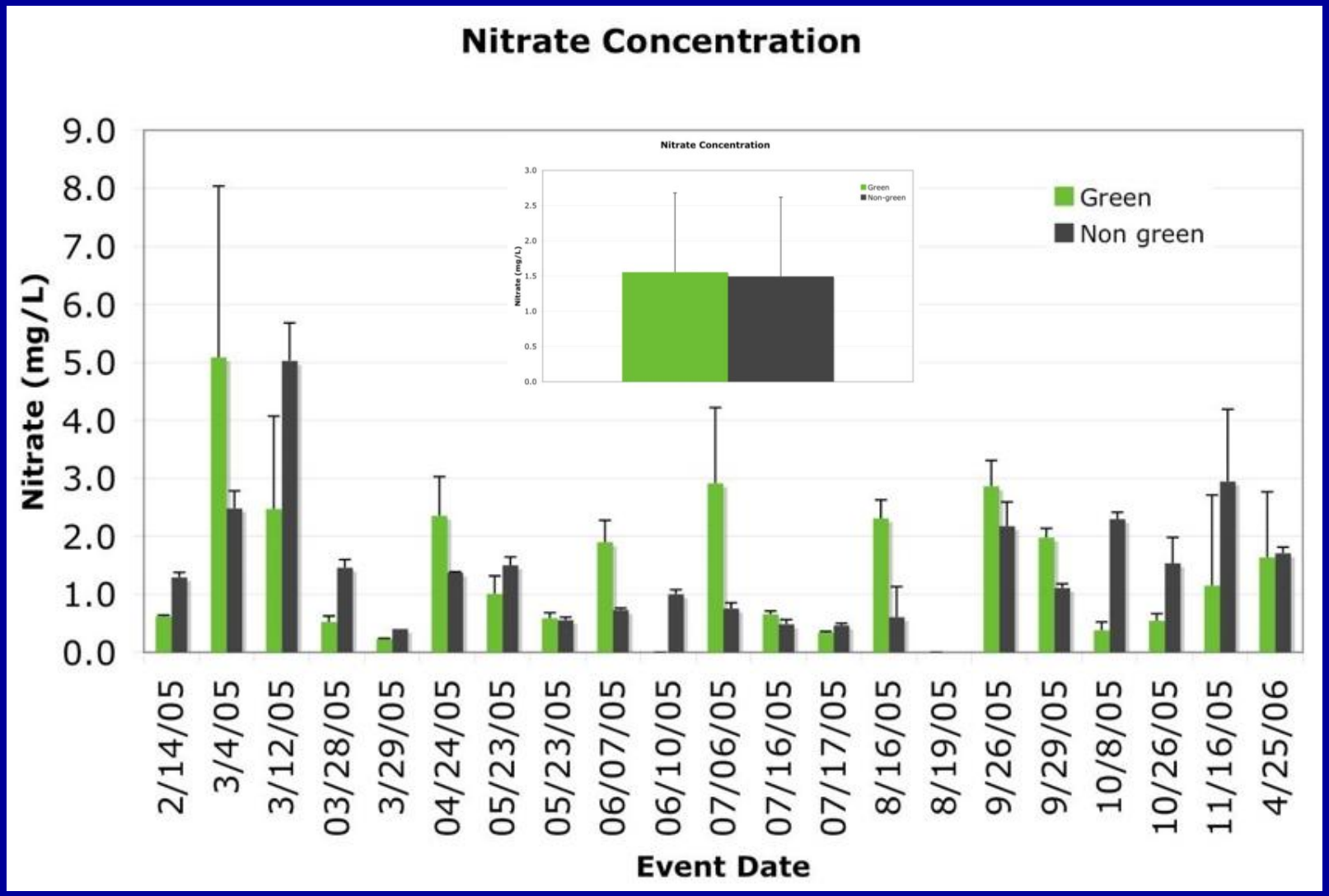
Low	<1
Recommended	2 - 8
Normal range	1 - 32
High	>32

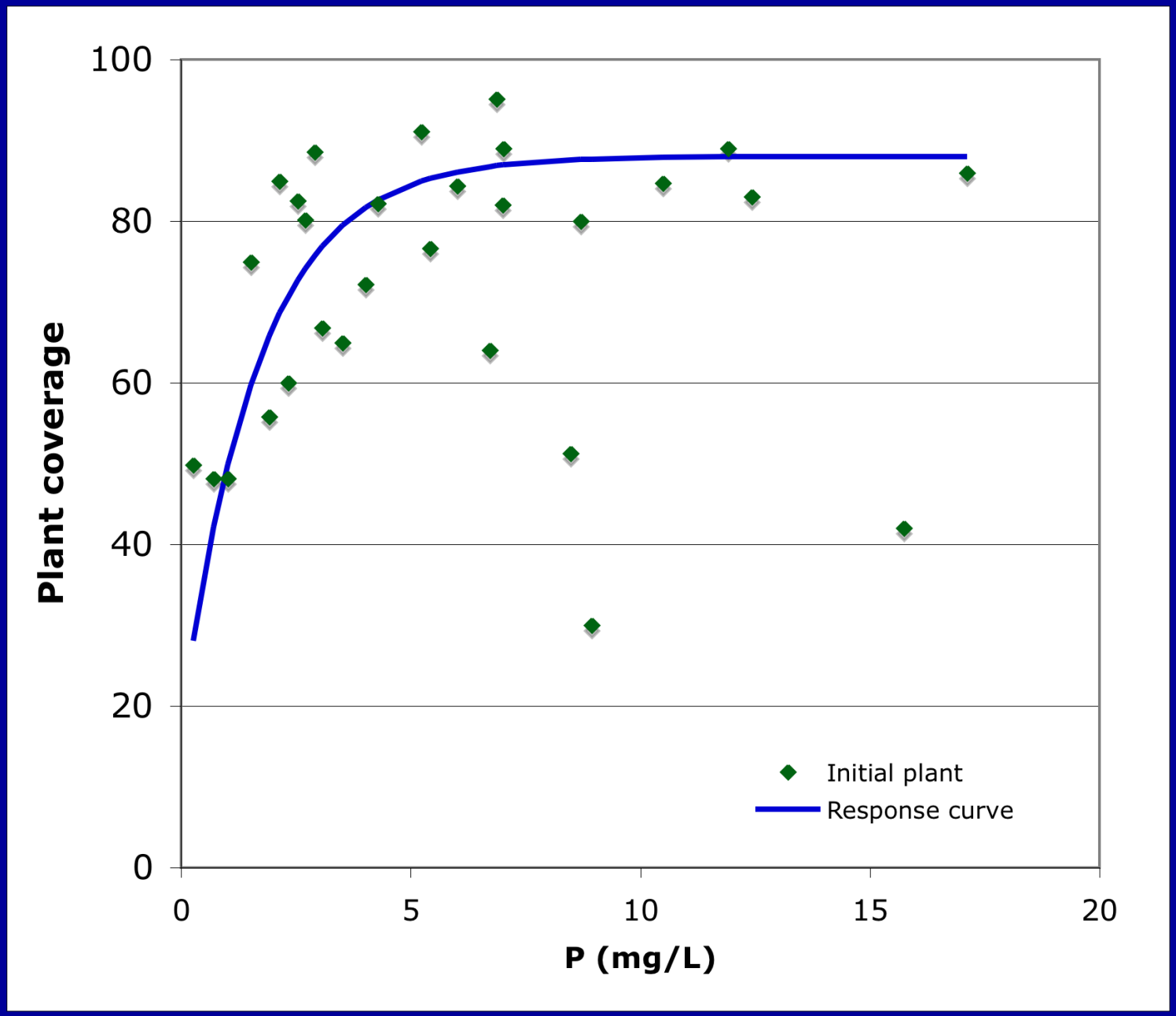


Low	<2
Recommended	2 - 32
Normal range	1 - 64
High	>64

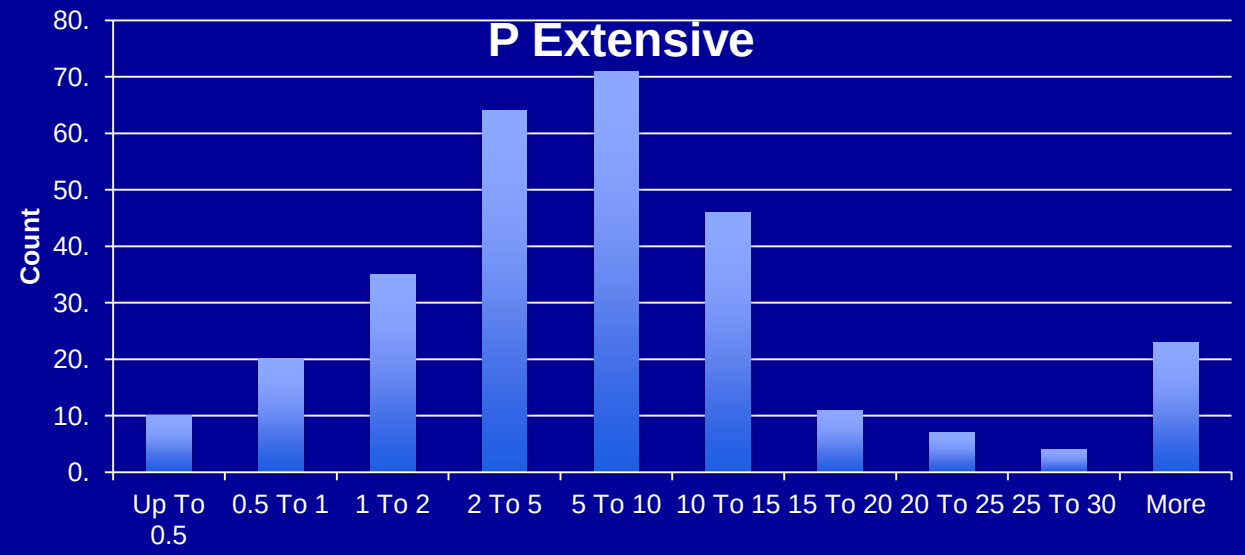

NO3+NH4 SME
y = 1.2414x + 5.3369
R² = 0.7613
Nitrogen SME
Nitrogen FLL
0
50
100
150
200
250
300
350
400
450

Nitrate concentration of runoff from green and non-green roofs.

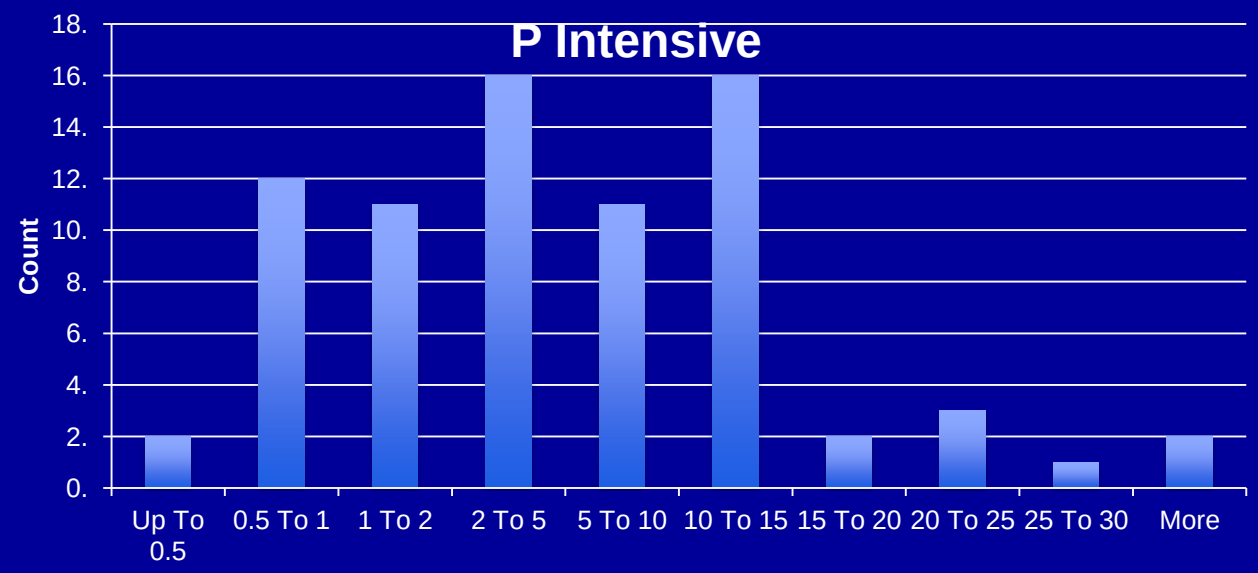



100
80
60
40
20
0
Plant coverage
0
5
10
15
20
P (mg/L)
Initial plant
Response curve

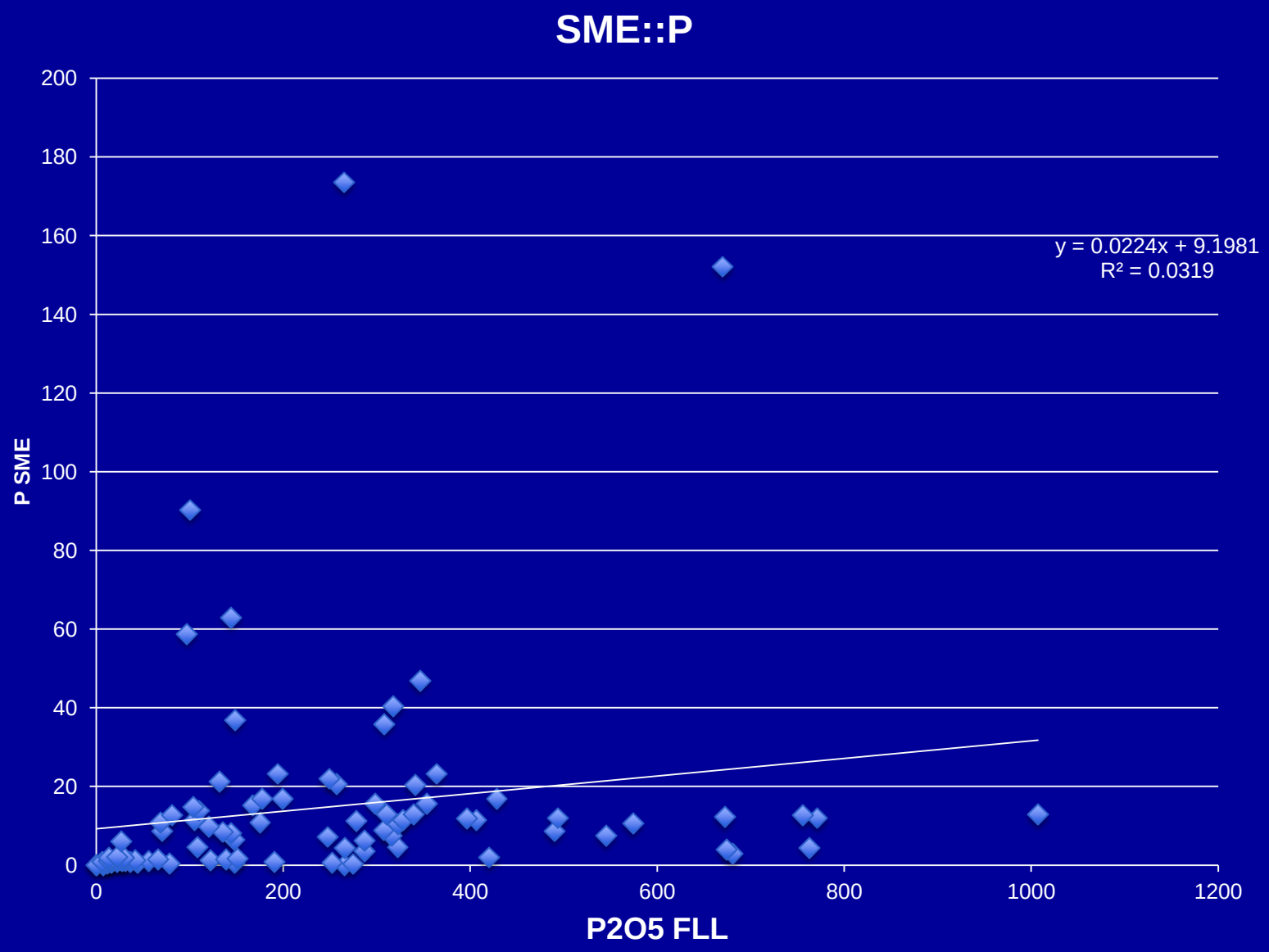
2.2-5+



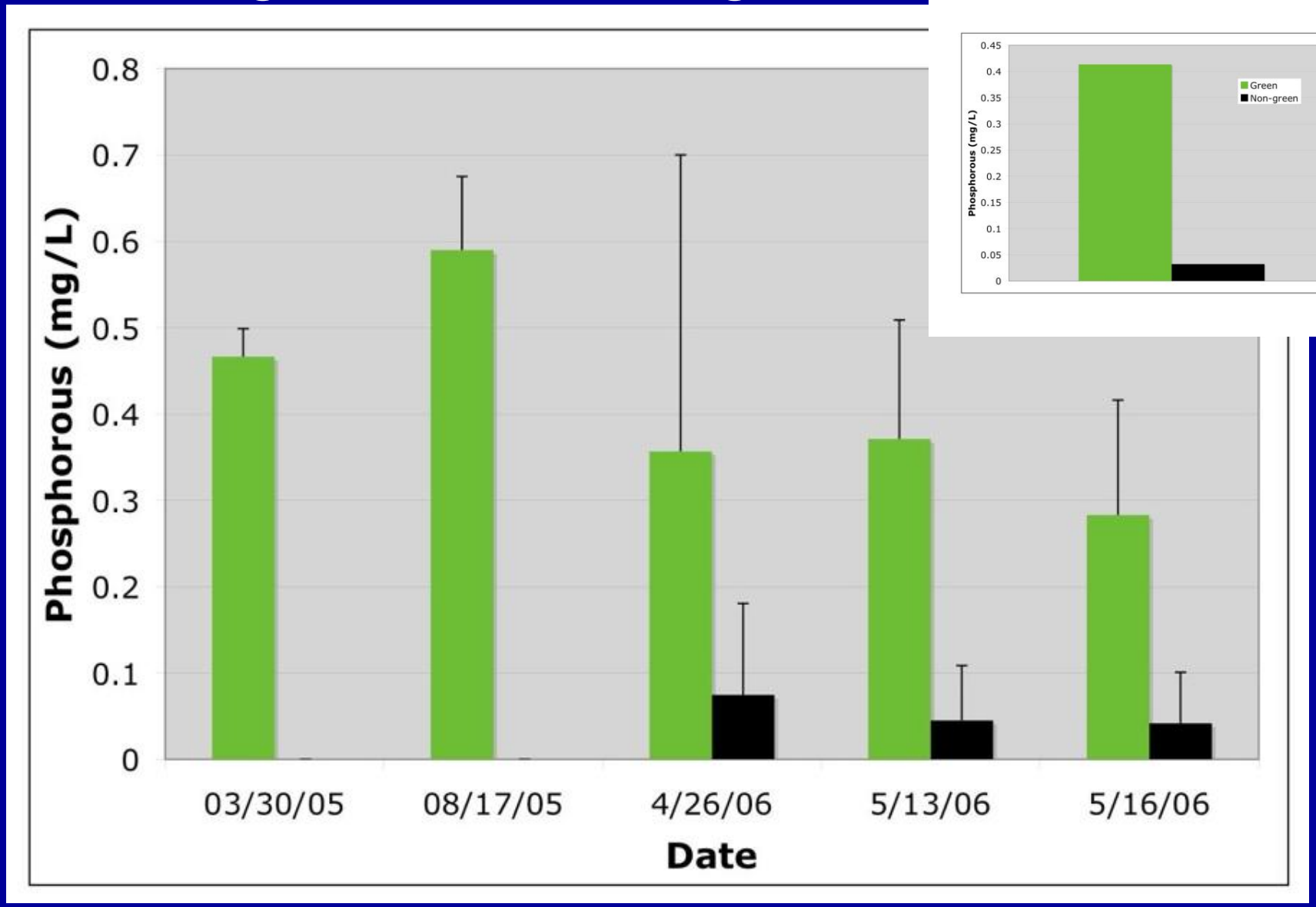
Low	<2
Recommended	2 - 10
Normal range	0.5 - 20
High	>20



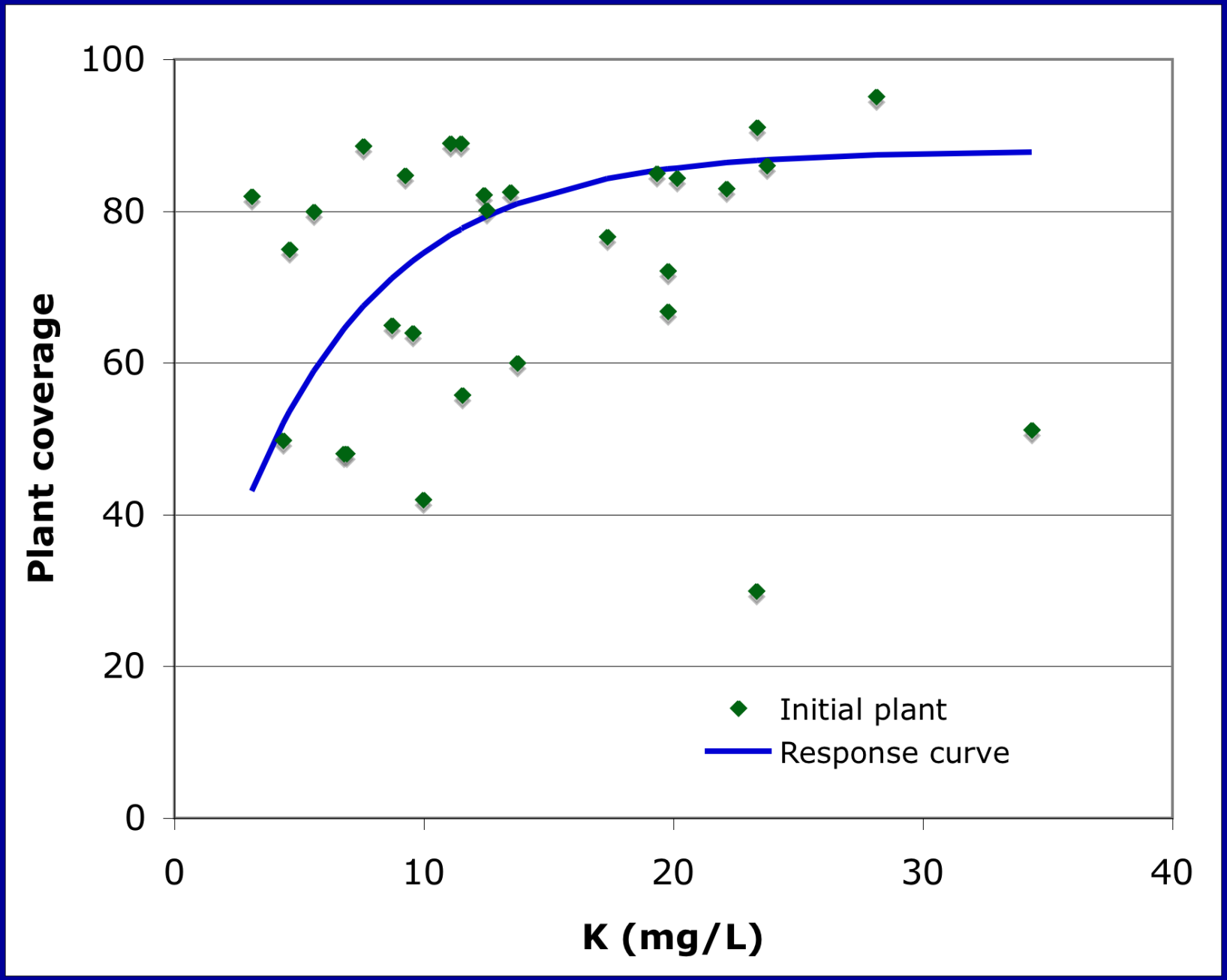
Low	<2
Recommended	2 - 15
Normal range	0.5 - 20
High	>20

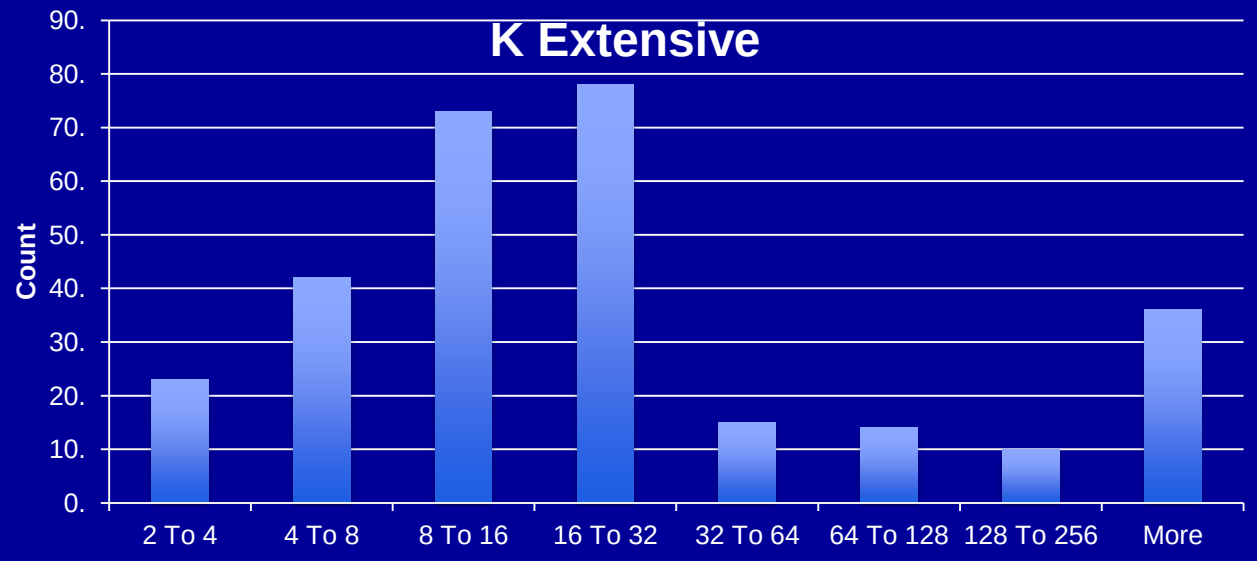

SME::P
y = 0.0224x + 9.1981
R² = 0.0319
P SME
P2O5 FLL
0
20
40
60
80
100
120
140
160
180
200
0
200
400
600
800
1000
1200

Phosphorous concentration of runoff from green and non-green roofs.

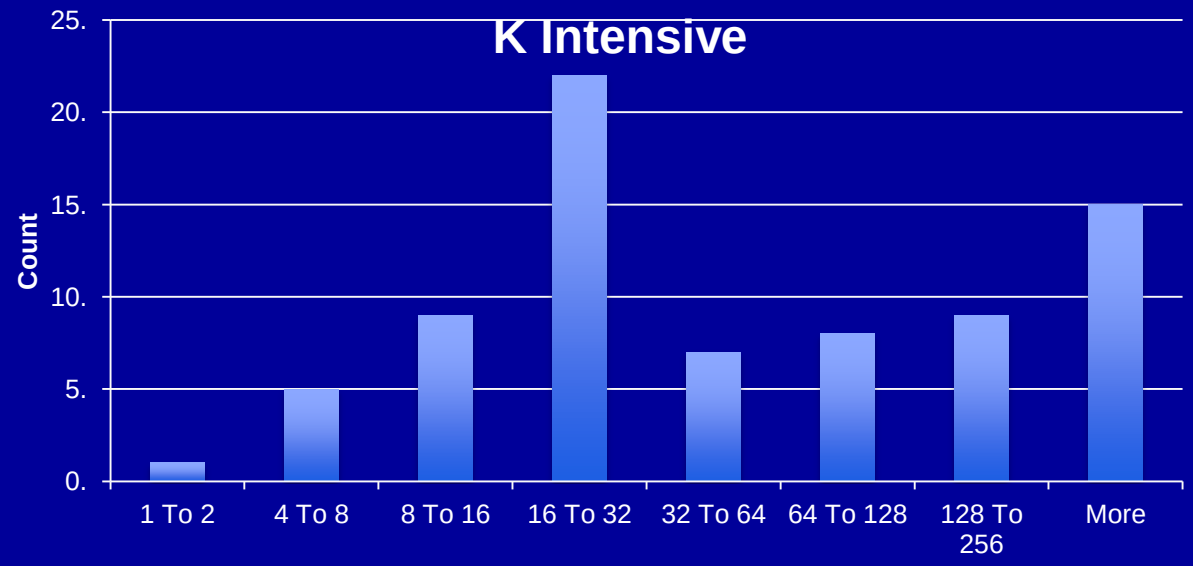


Recommended 7.5 – 20+

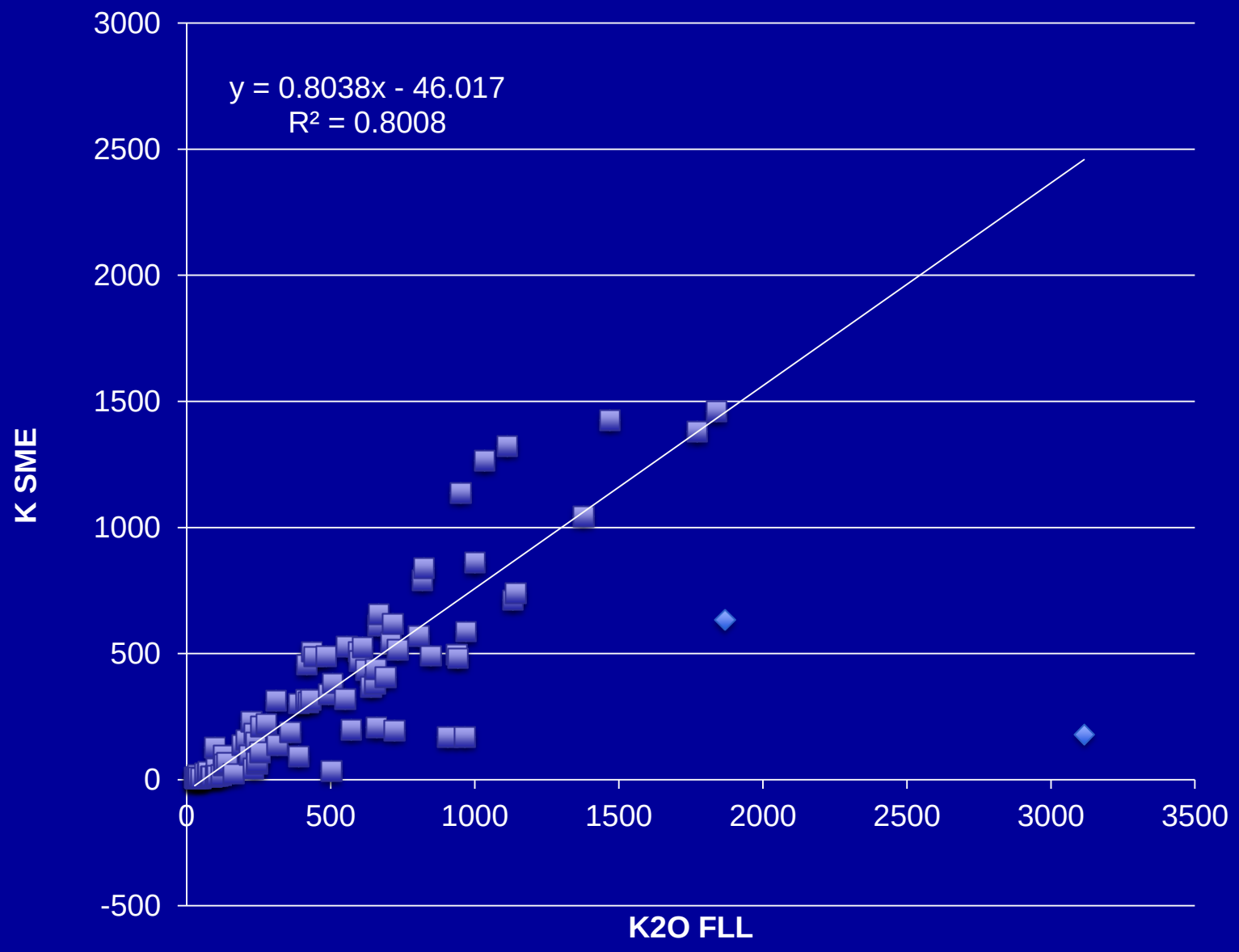




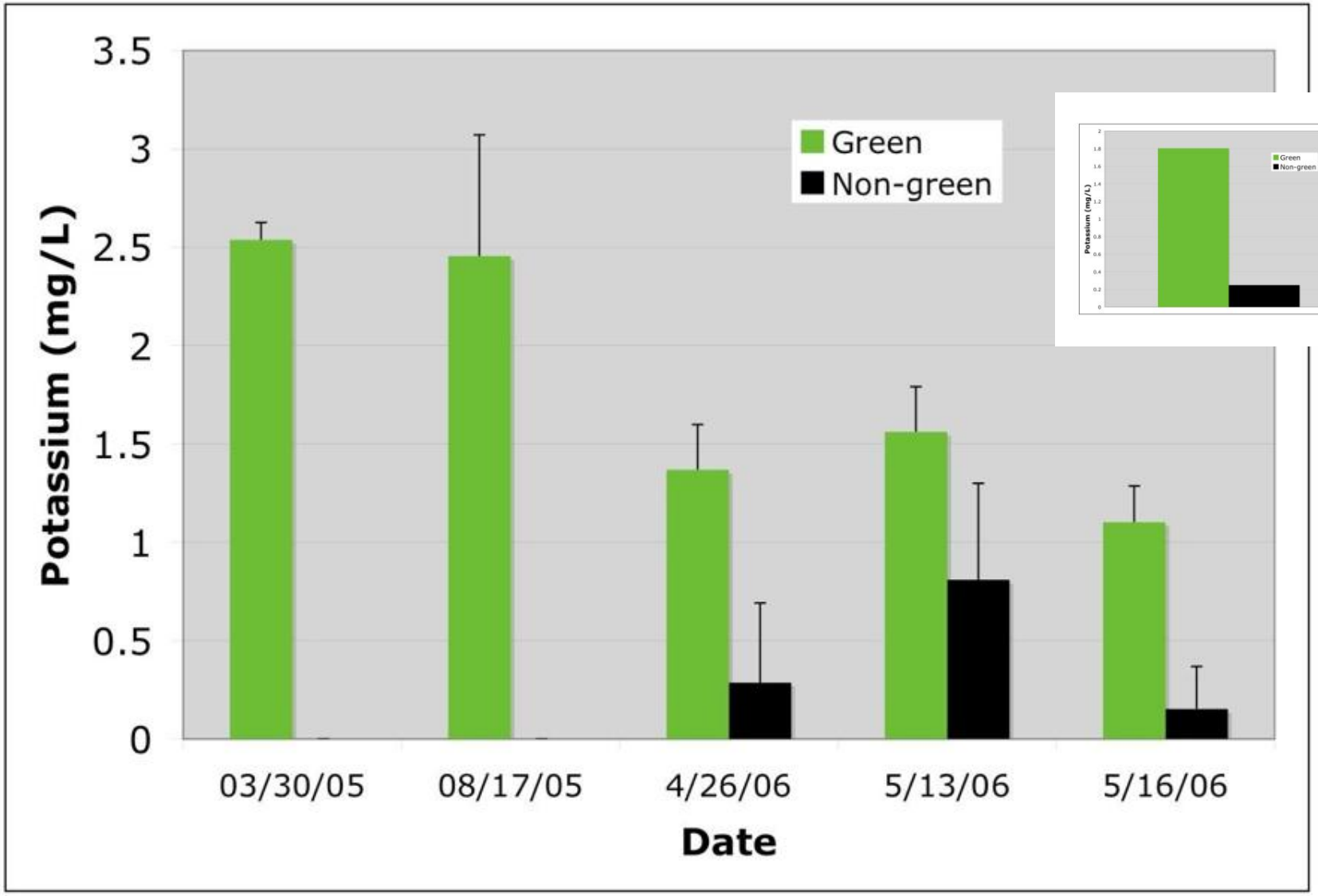
Low	<8
Recommended	8 - 32
Normal range	4 - 128
High	>128



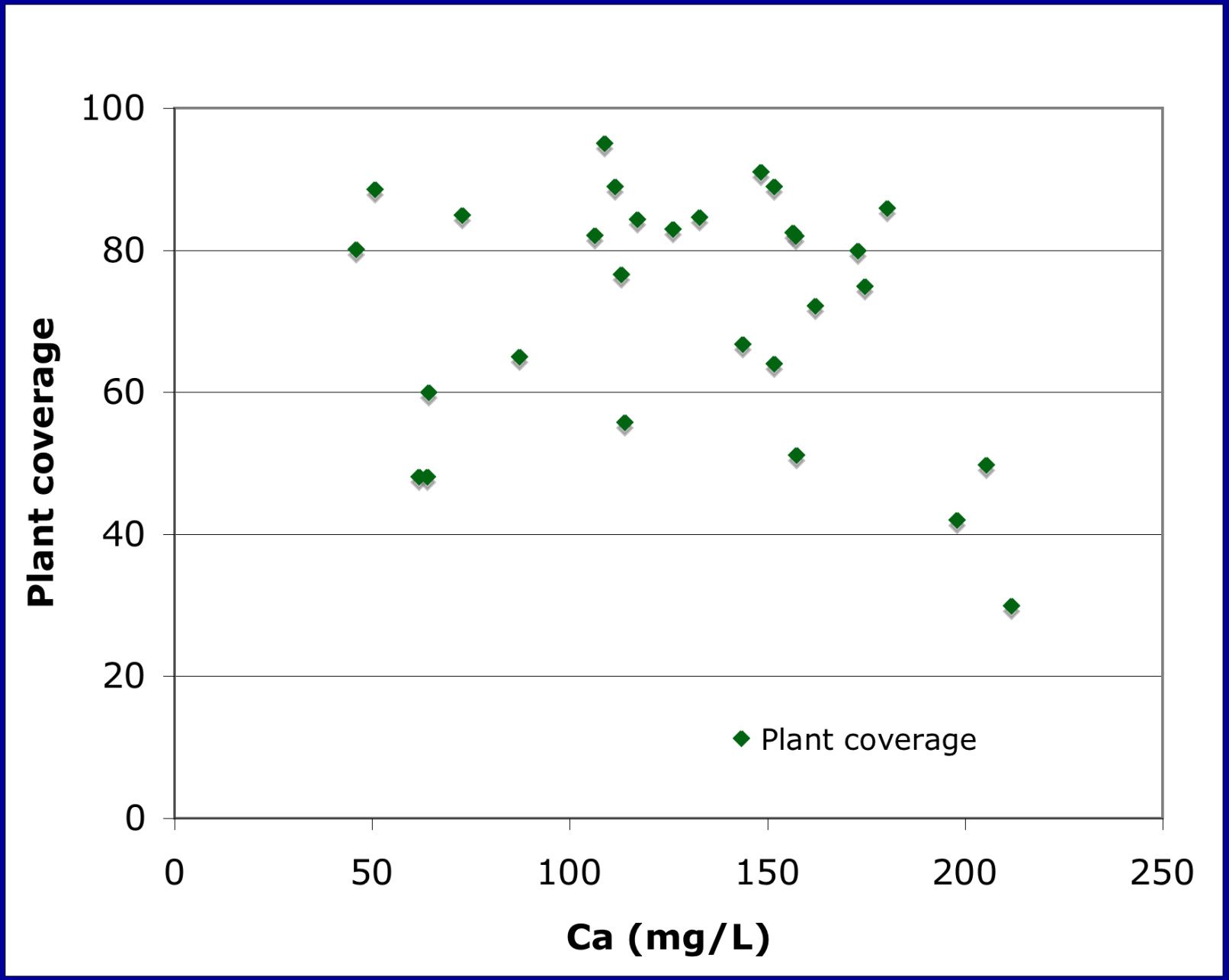
Low	<8
Recommended	8 - 64
Normal range	8 - 256
High	>256

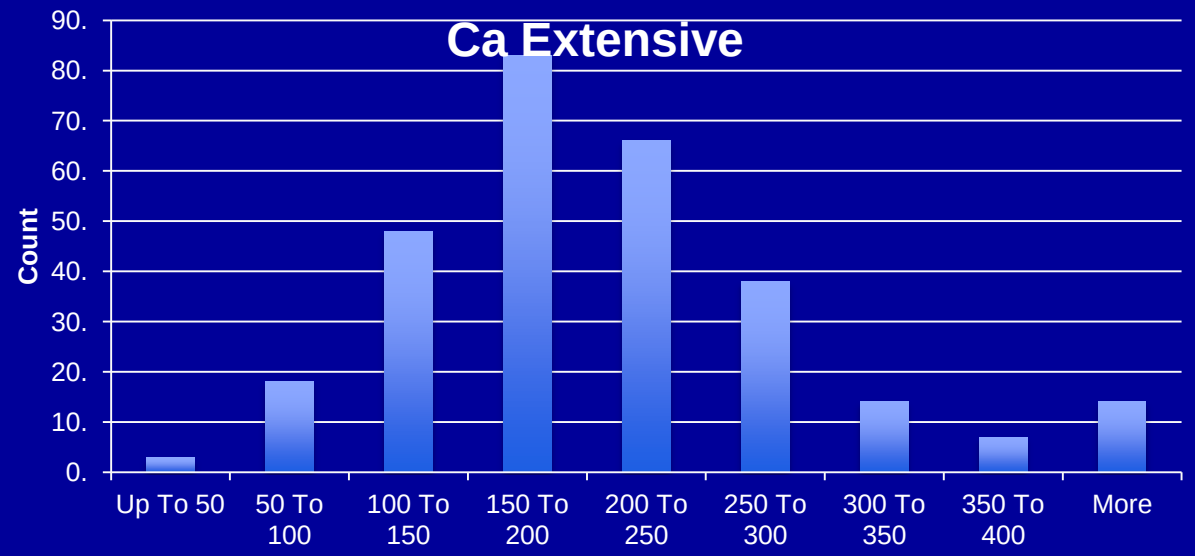

y = 0.8038x - 46.017
R² = 0.8008
3000
2500
2000
1500
1000
500
0
-500
0
500
1000
1500
2000
2500
3000
3500
K SME
K2O FLL

Potassium concentration of runoff from green and non-green roofs.

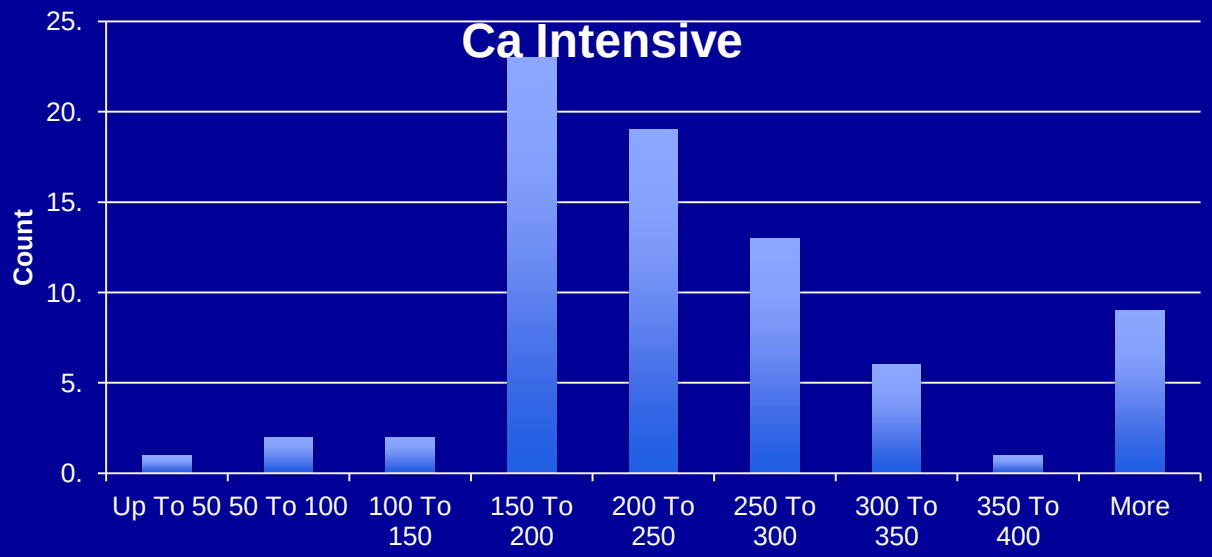


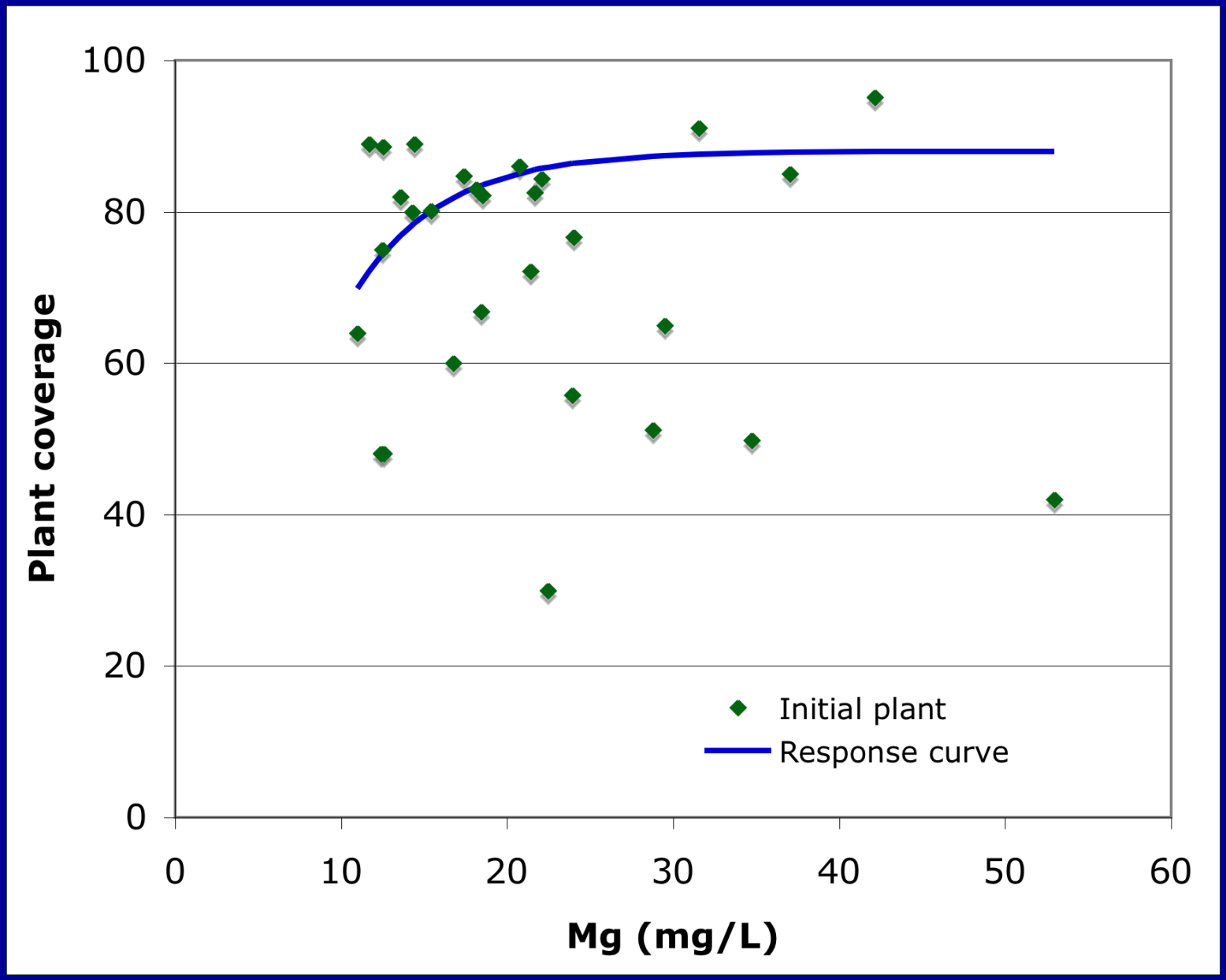
40-180

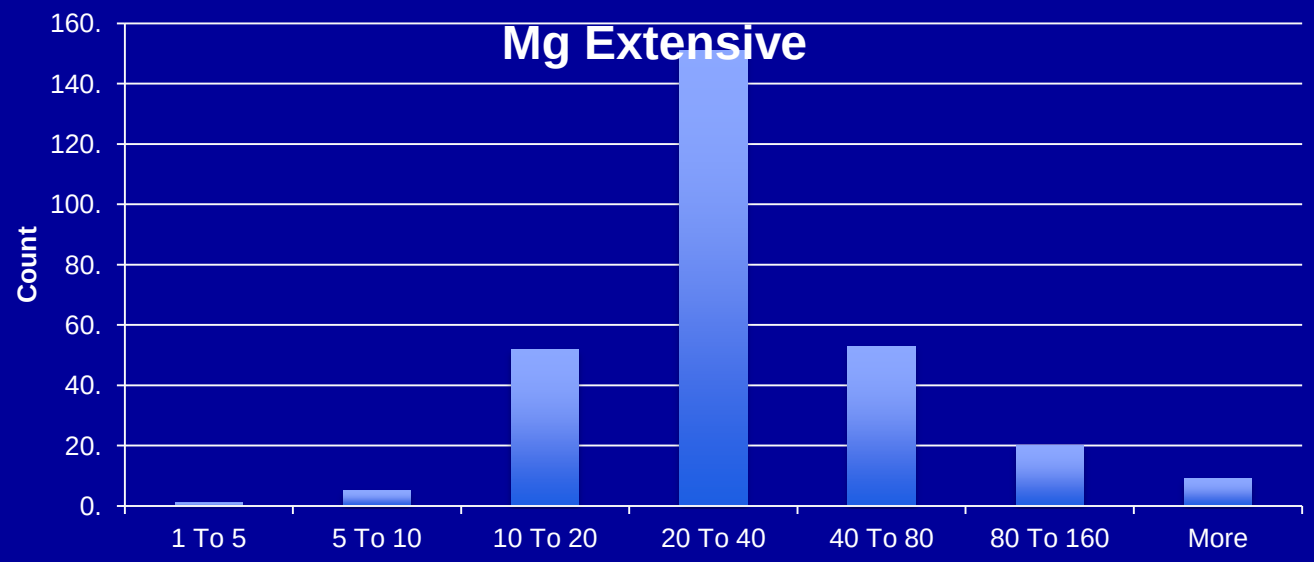

100
80
60
40
20
0
Plant coverage
0
50
100
150
200
250
Ca (mg/L)
Plant coverage



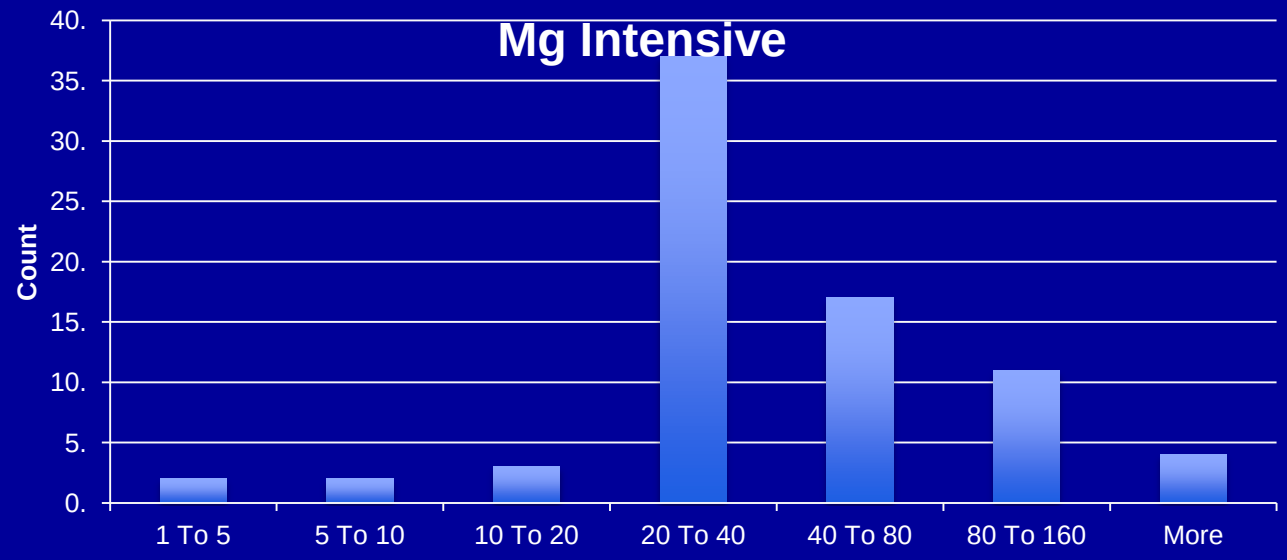
Low	<50
Recommended	100 - 300
Normal range	50 - 350
High	>350

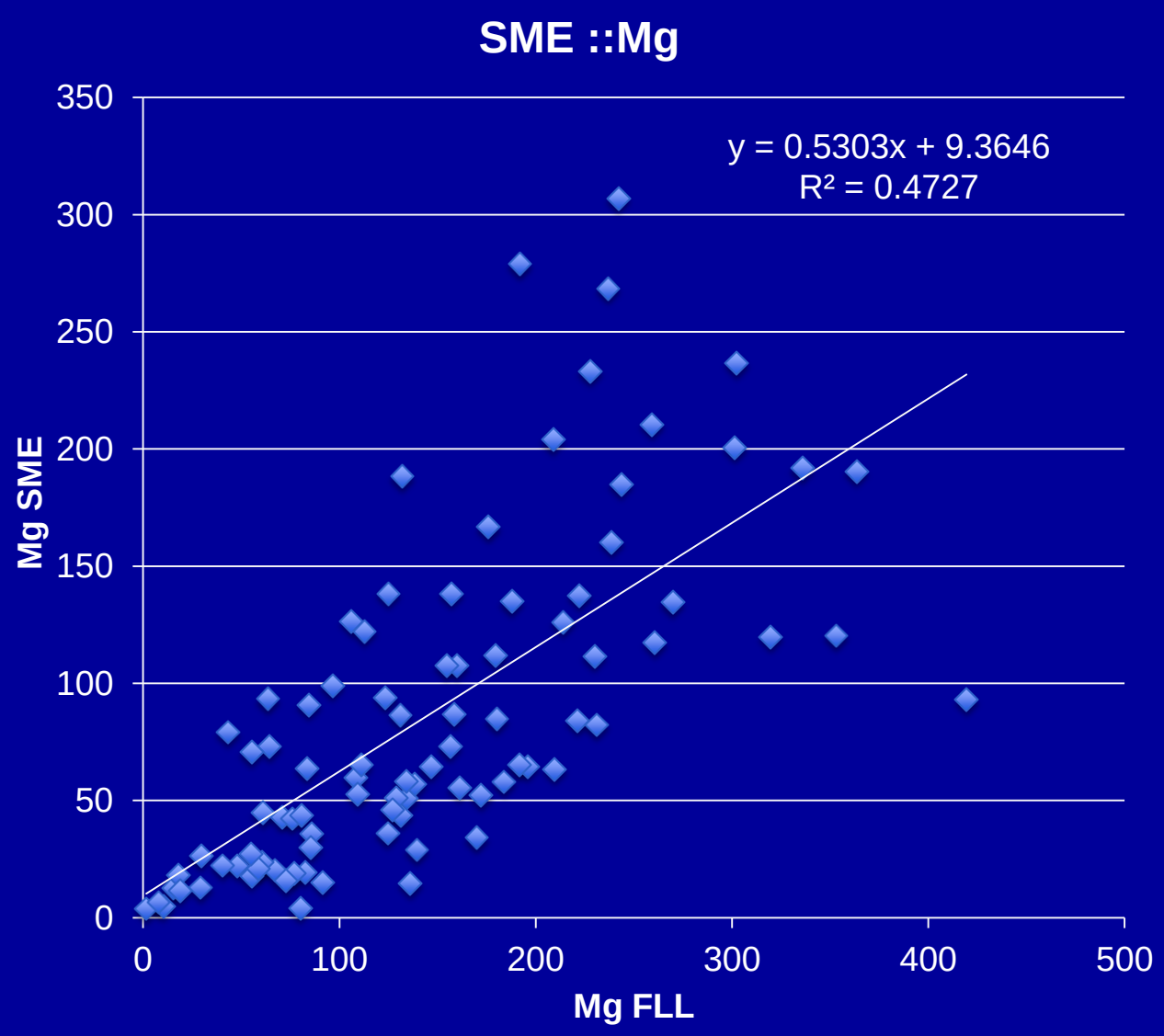



100
80
60
40
20
0
Plant coverage
0
10
20
30
40
50
60
Mg (mg/L)
Initial plant
Response curve



Low	<10
Recommended	10 - 80
Normal range	10 - 160
High	>160

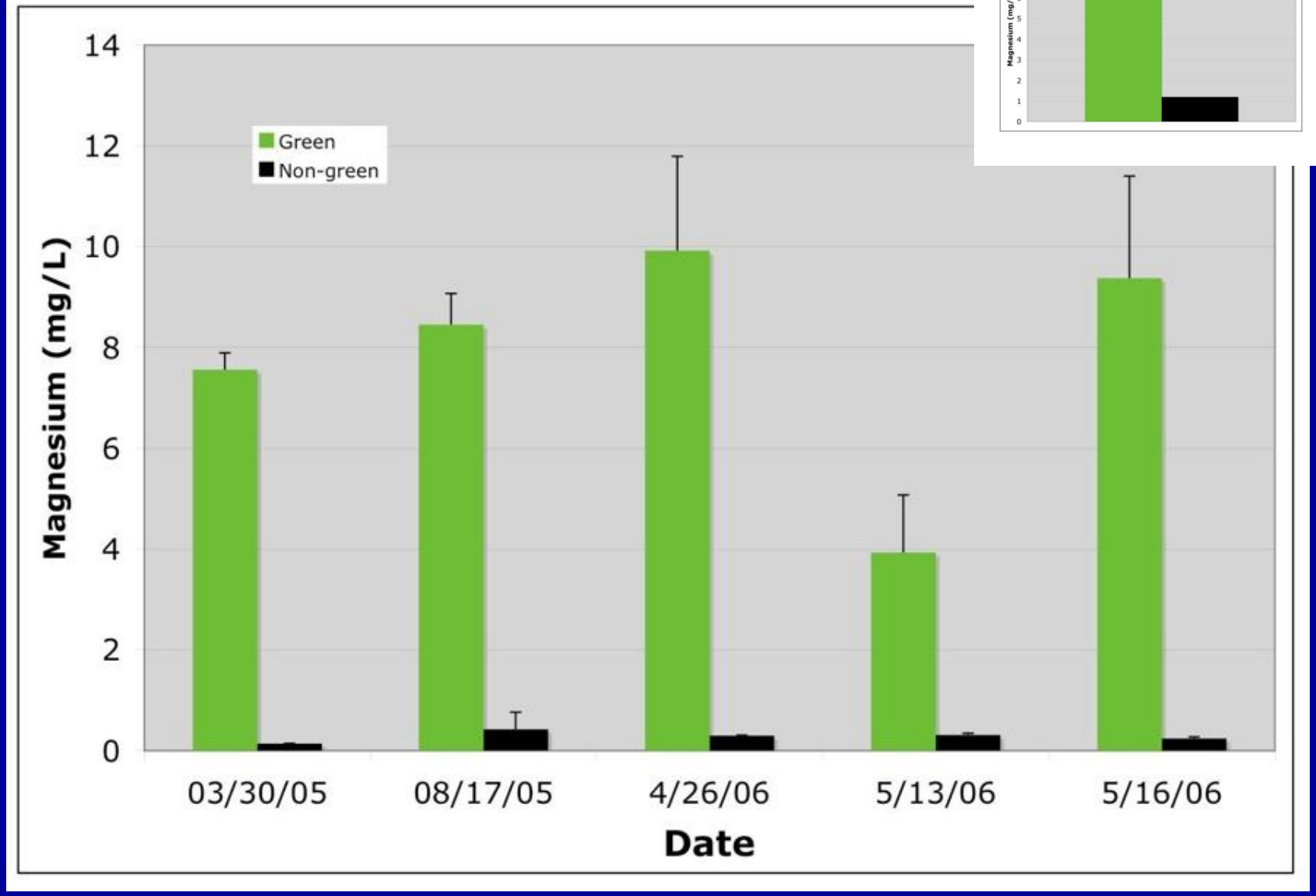


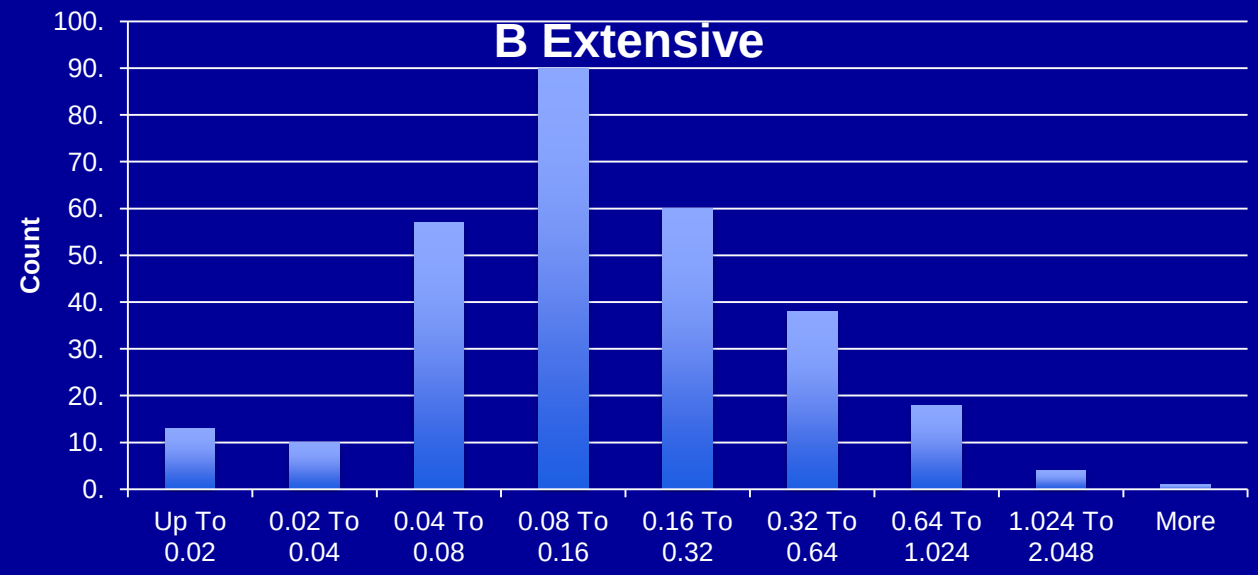


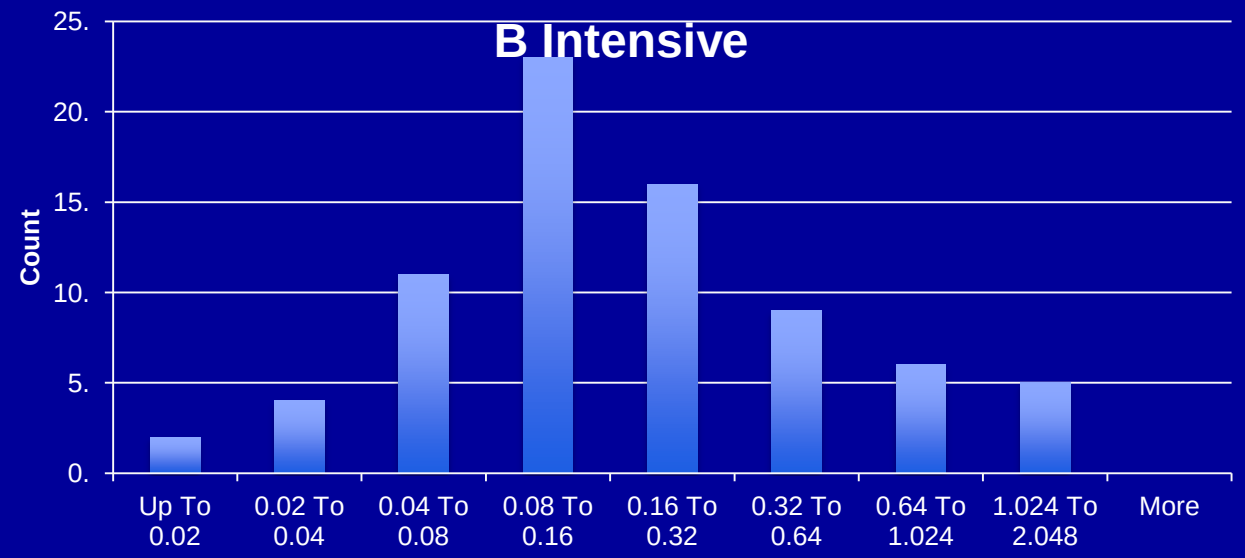
SME	
Low	<50
Recommended	100 - 300
Normal range	50 - 350
High	>350

FLL	
Low	<100
Recommended	150-330
Normal range	75 - 380
High	>380

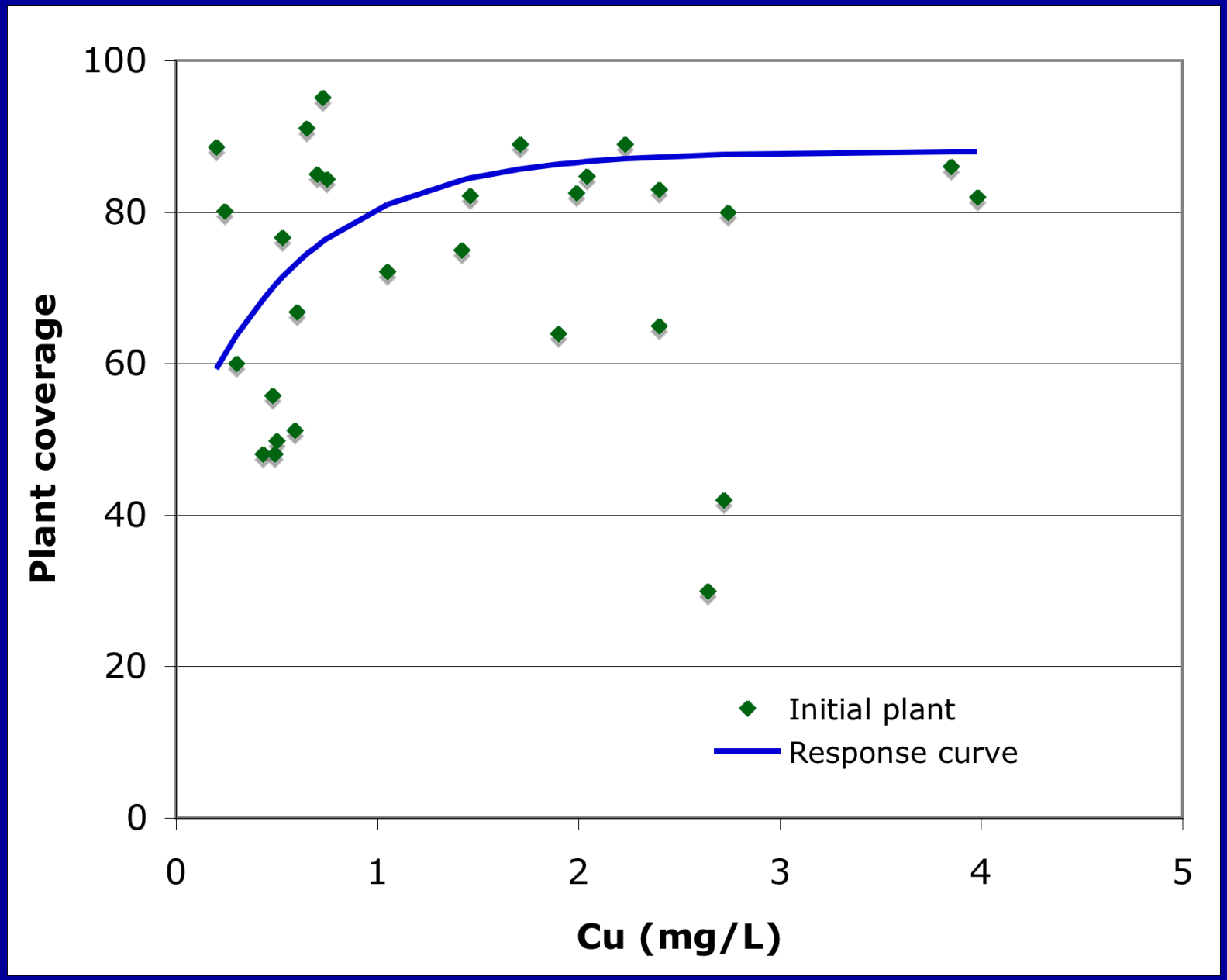
Magnesium concentration of runoff from green and non-green ro



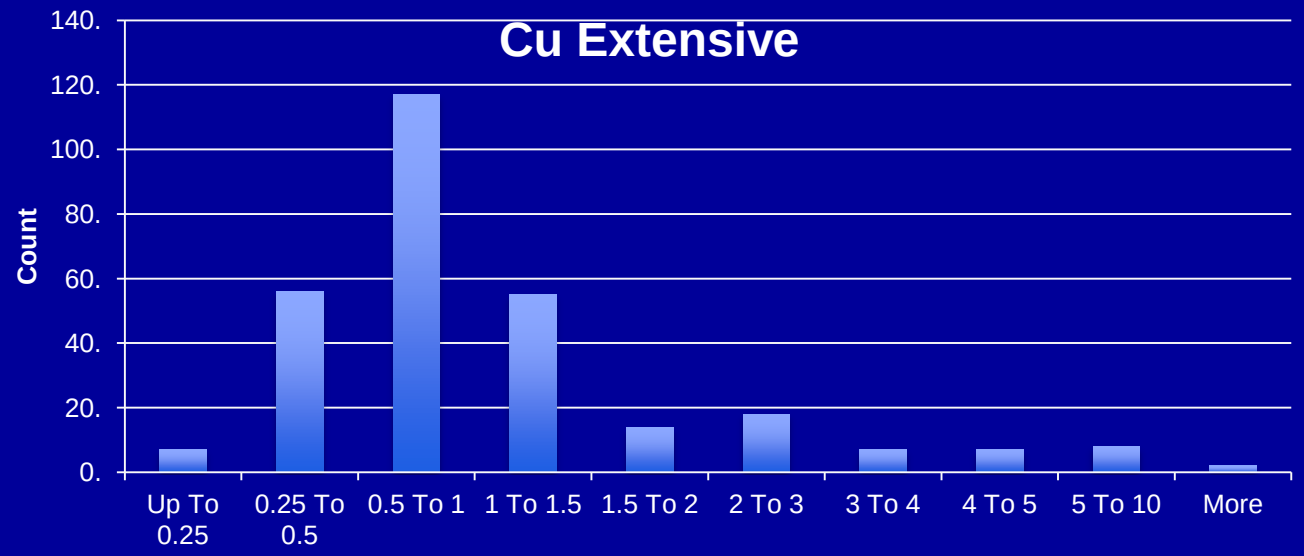




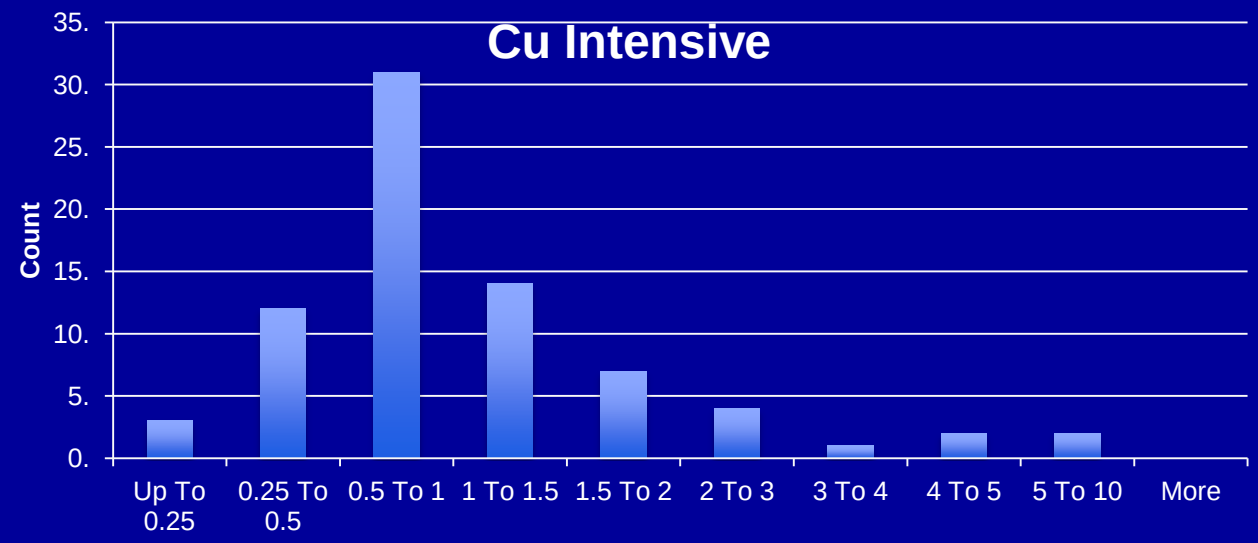
Low	<0.04
Recommended	0.04 - 0.6
Normal range	0.04 - 1.2
High	1.2 - 2
Excessive	>2

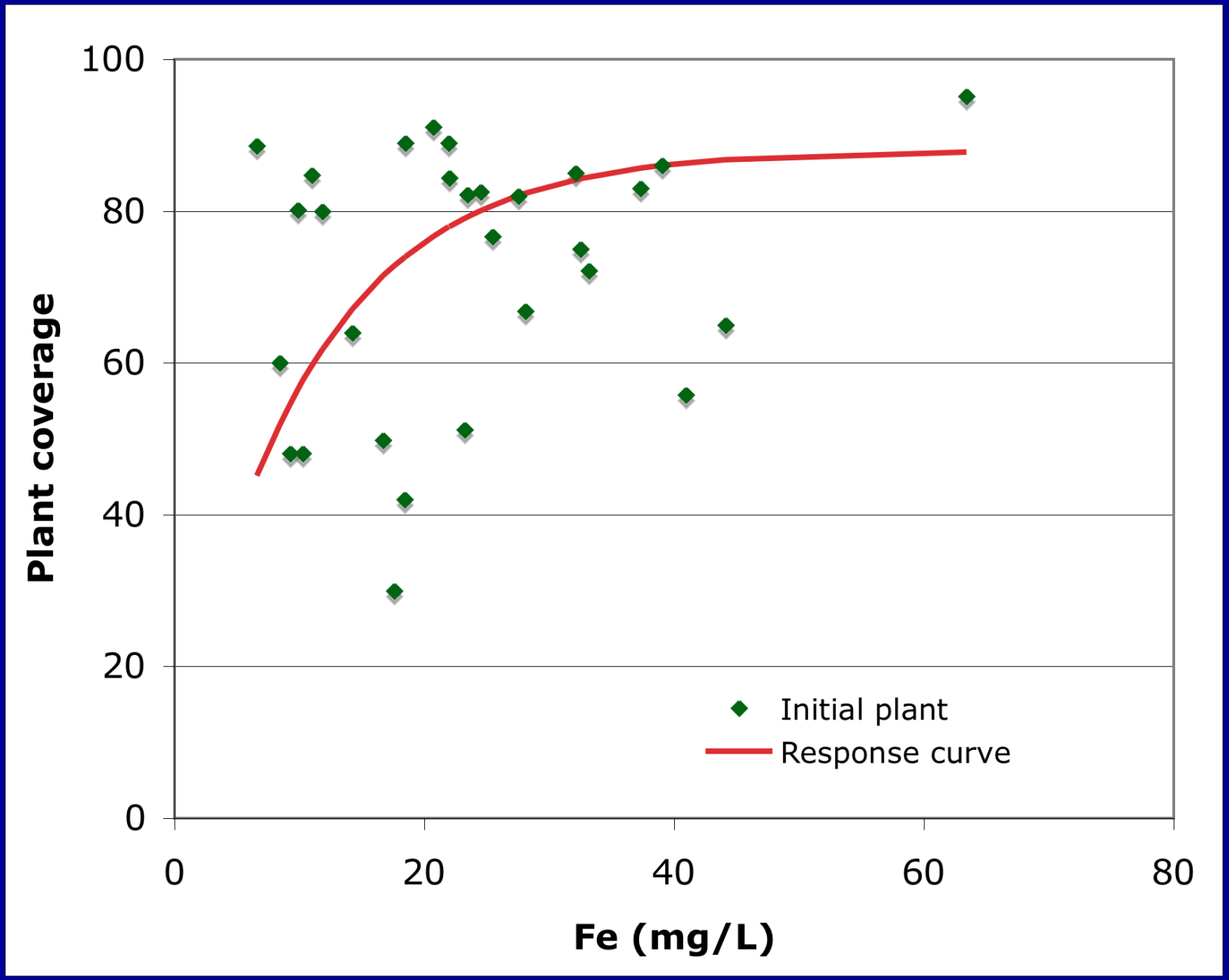

100
80
60
40
20
0
Plant coverage
0
1
2
3
4
5
Cu (mg/L)
Initial plant
Response curve

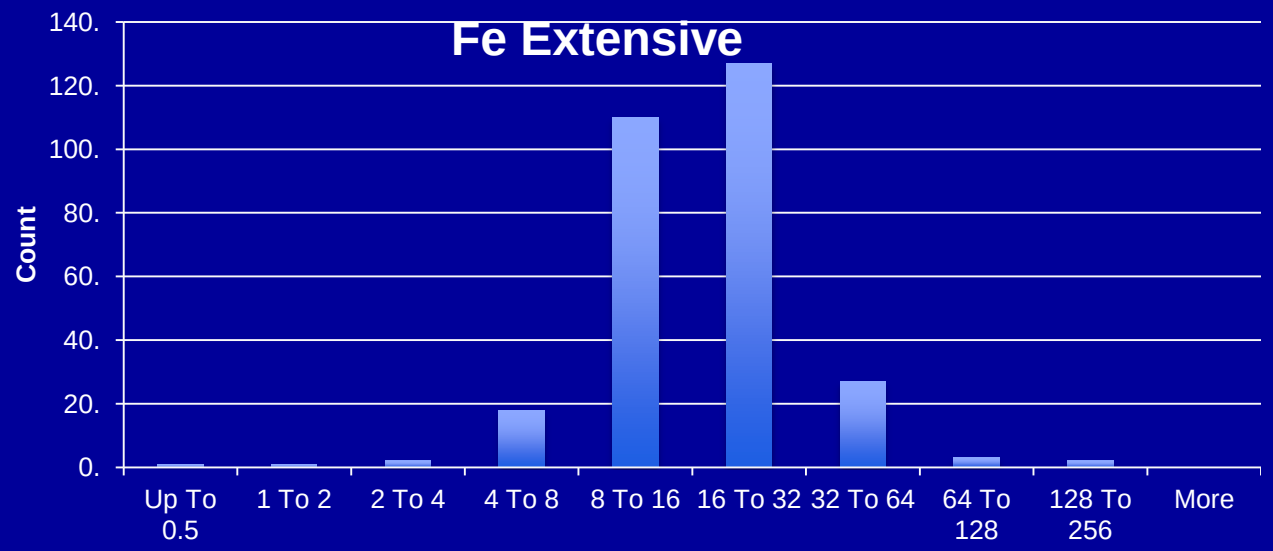
0.5 – 3.0



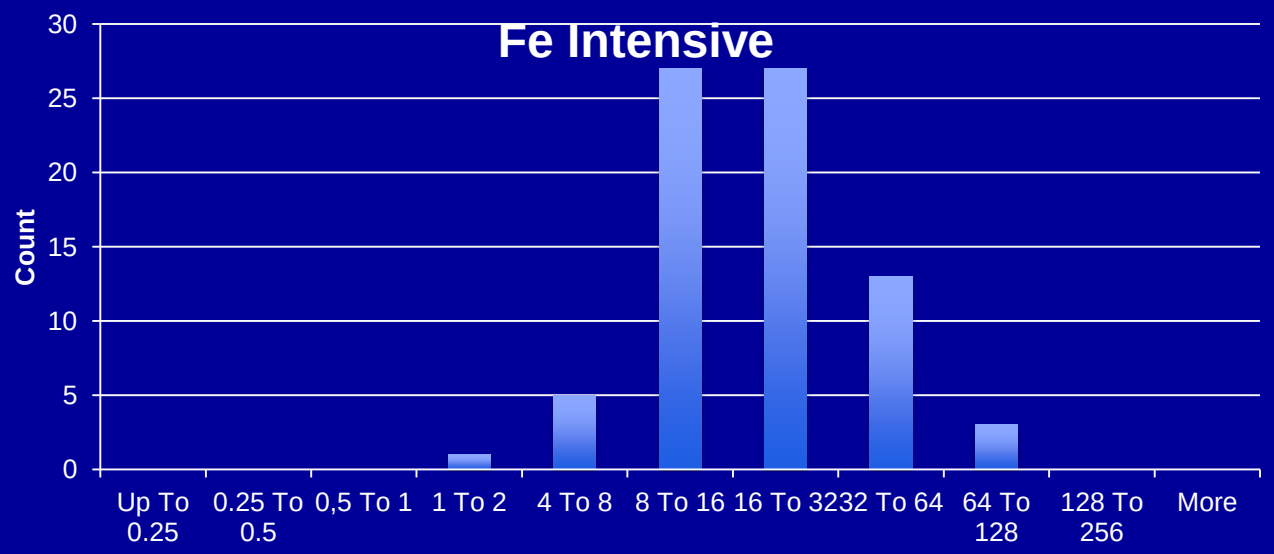
Low	<0.25
Recommended	0.5 - 1.5
Normal range	0.25 - 3
High	<3

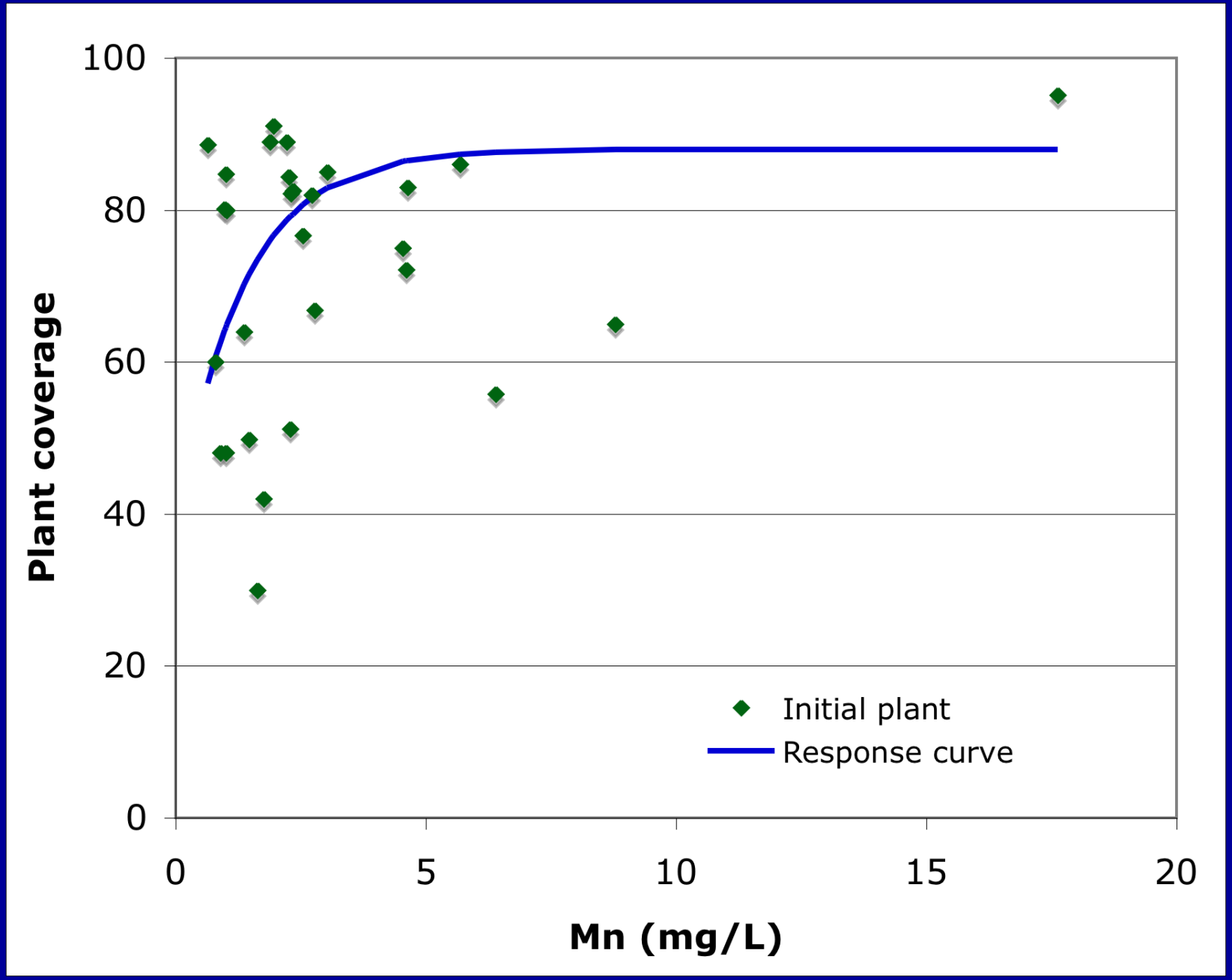


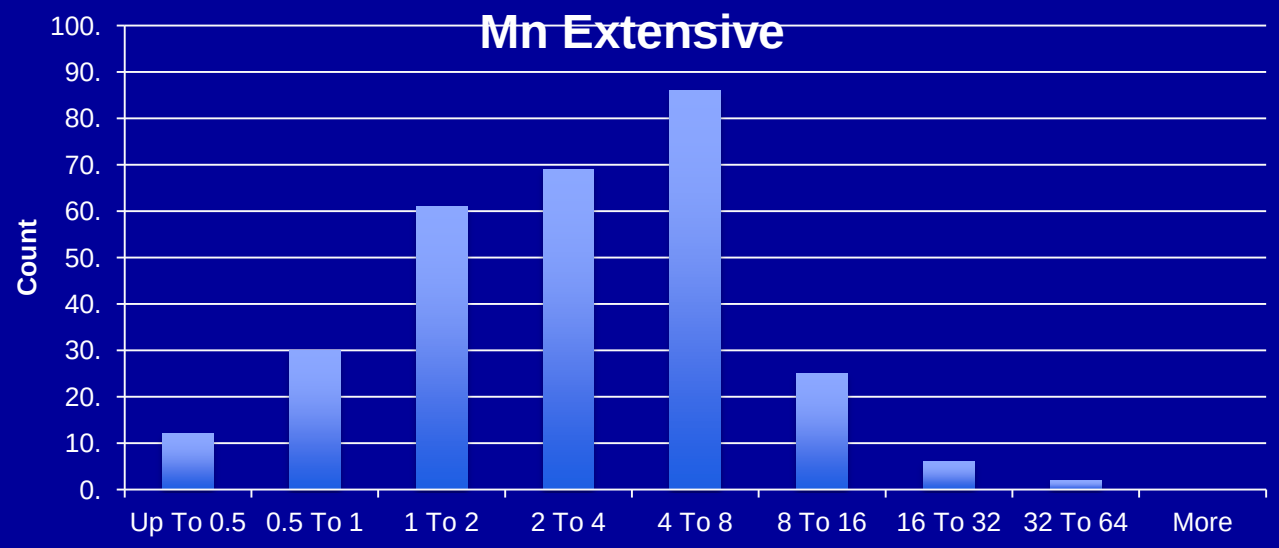

100
80
60
40
20
0
Plant coverage
0
20
40
60
80
Fe (mg/L)
Initial plant
Response curve



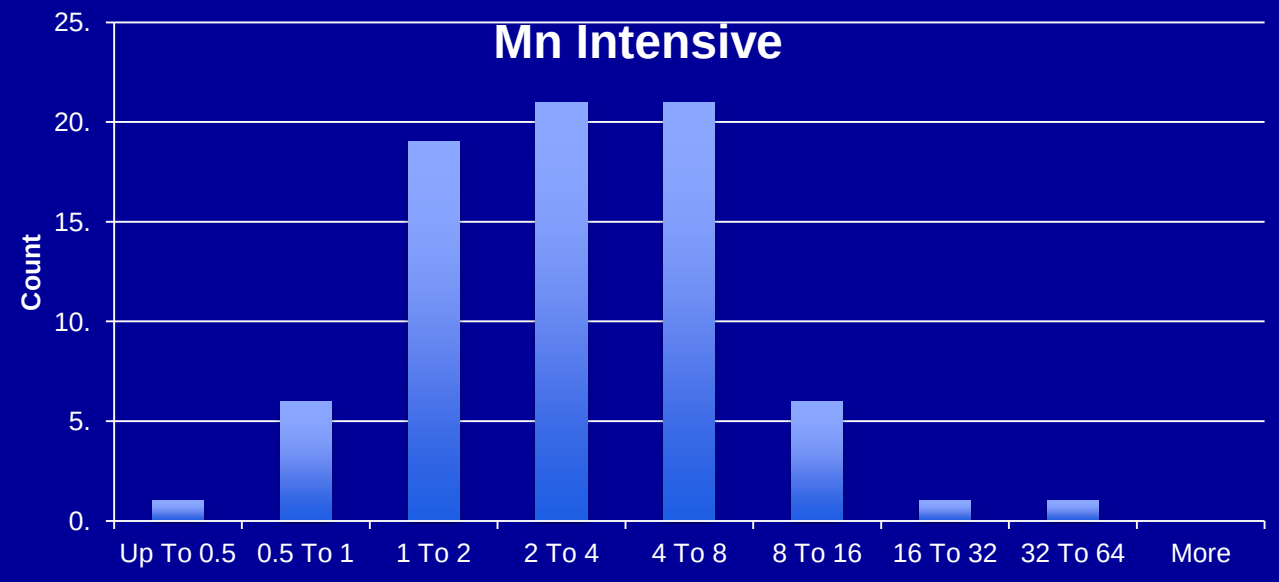
Low	<8
Recommended	8 - 32
Normal range	4 - 64
High	>64

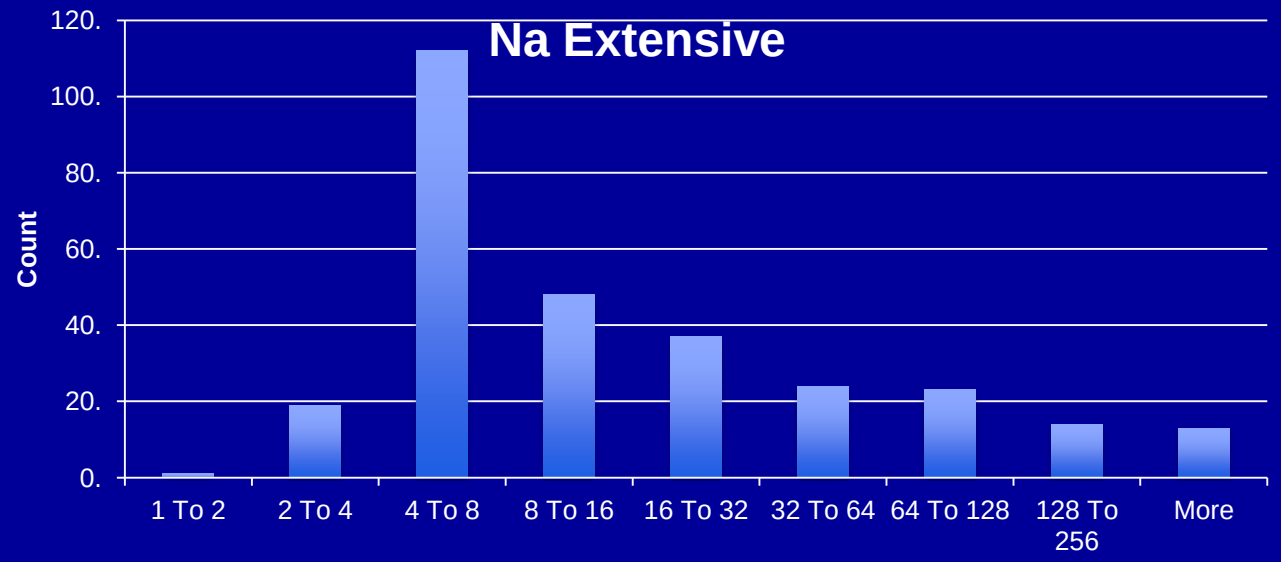



100
80
60
40
20
0
Plant coverage
0
5
10
15
20
Mn (mg/L)
Initial plant
Response curve

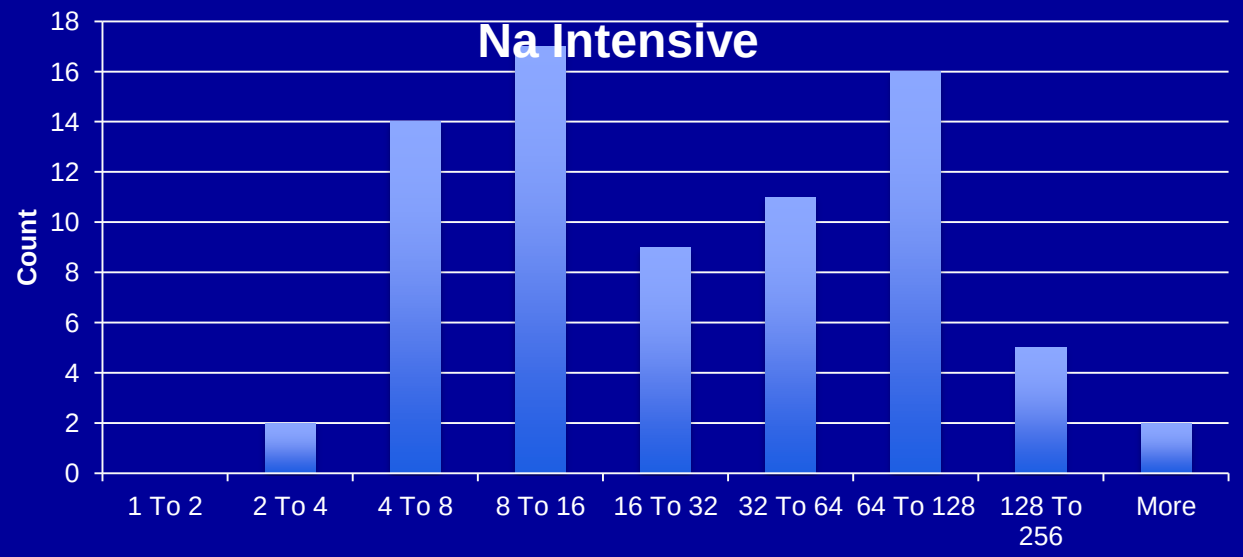


Low	<0.5
Recommended	1 - 8
Normal range	0.5 - 16
High	>16

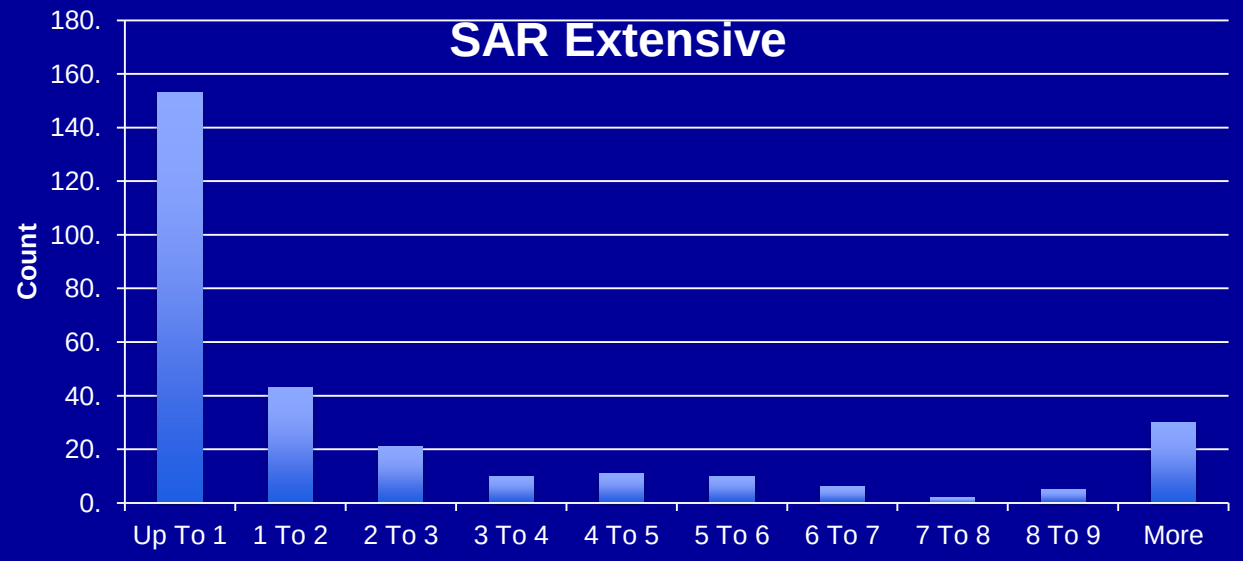


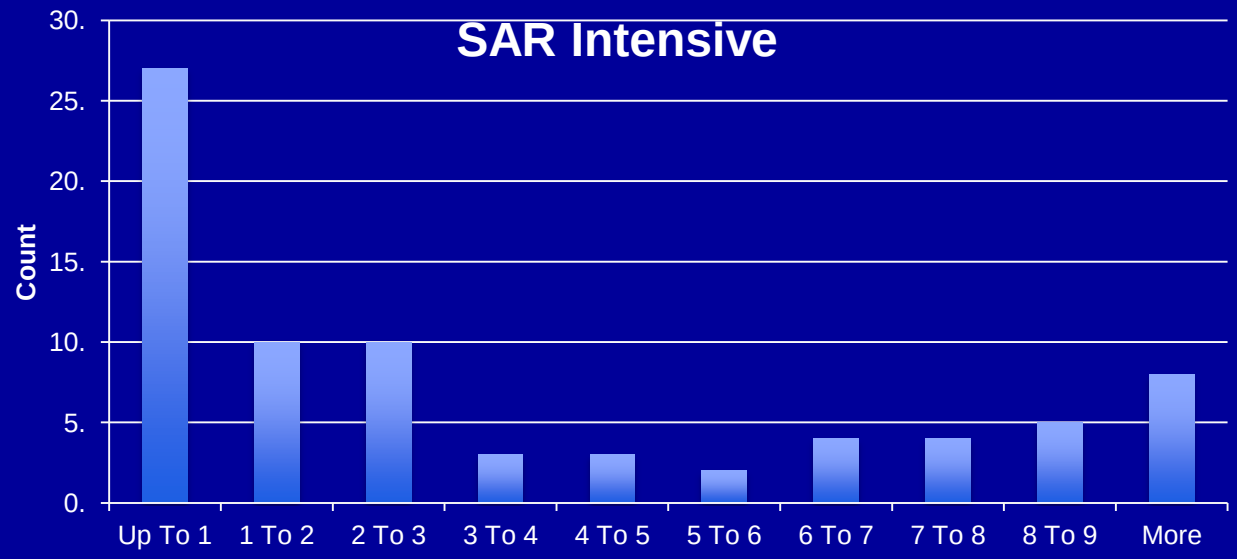


Low	
Recommended	<20
Normal range	2 - 32
High	>64

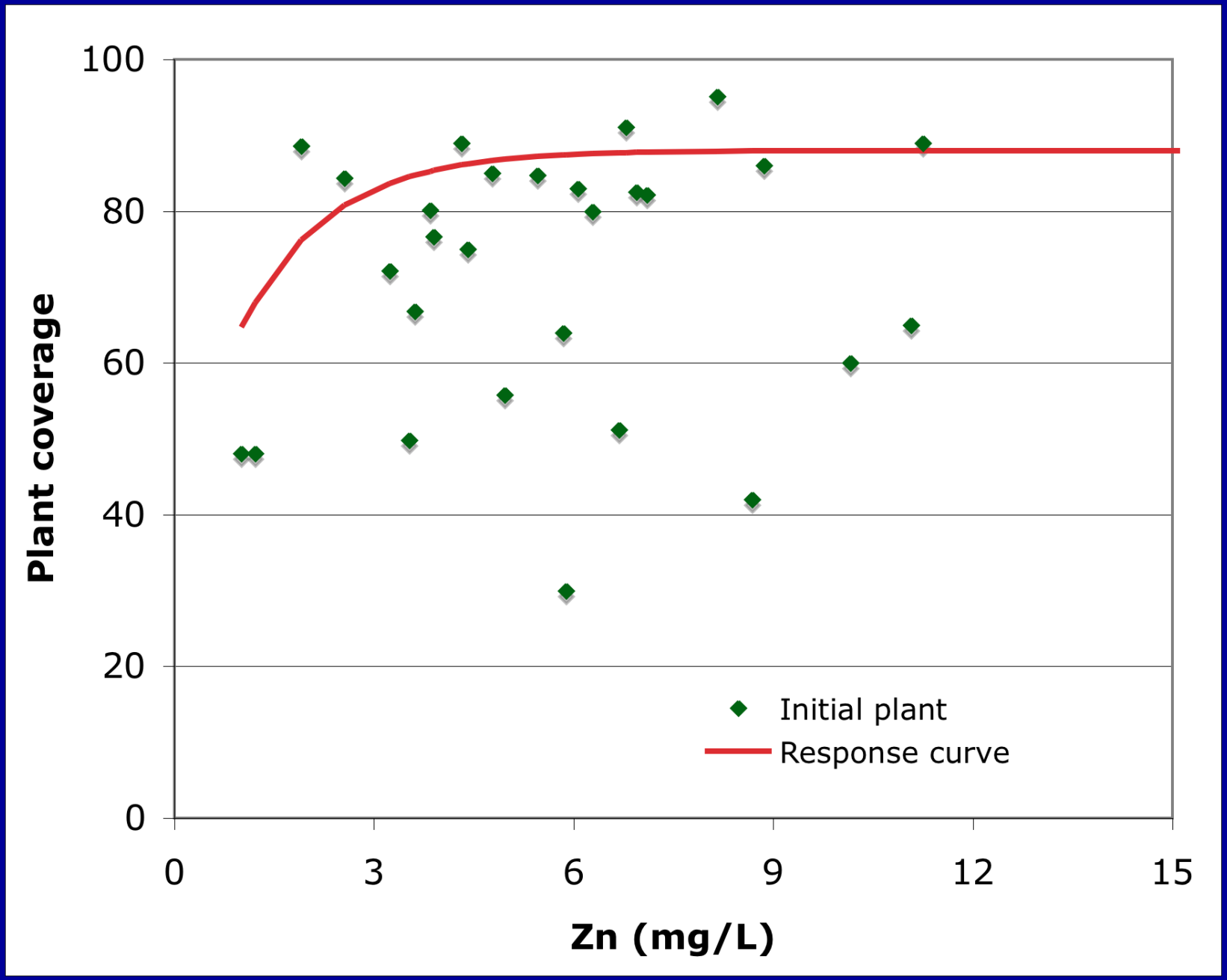


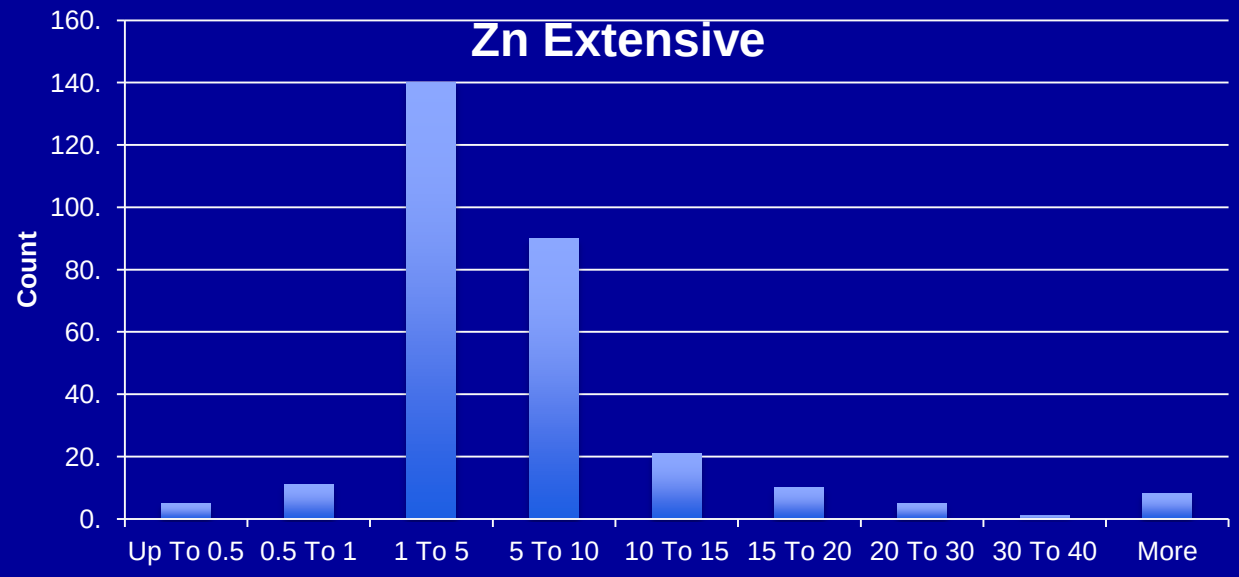
Low	
Recommended	<20
Normal range	2 - 128
High	>64



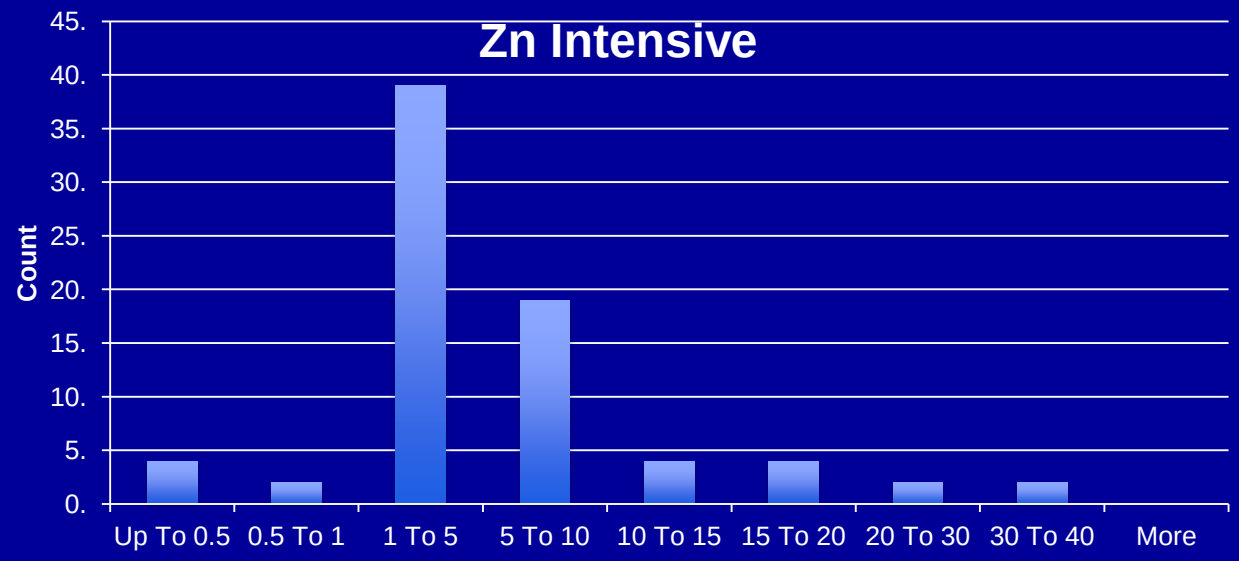


Low	
Recommended	<2
Normal range	0 - 3
High	>3
Excessive	>9


100
80
60
40
20
0
Plant coverage
0
3
6
9
12
15
Zn (mg/L)
Initial plant
Response curve



Low	<1
Recommended	1 - 10
Normal range	1 - 15
High	>15



What does it mean?

- Annual media samples as a part of an ongoing management program to optimize plant growth and reduce fertilizer use and runoff.
- A diagnostic tool to evaluate the nutrient status of problem roofs

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