Nitrogen Management Tools for Wheat

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How to Grow a Wheat Crop

- Soil
- Seed
- Water
- Fertilizer
- Weed control
- Sunshine

Fertilizer: How much and when?

- Recipe based on past experience
- Yield goal
- Appearance of crop
- N management tools

N management tools

Brand	N management tool	Output
N/A	Lower stem nitrate	Nitrate concentration
Minolta	Chlorophyll meter	SPAD (Soil-Plant Analysis Development) unit ~ chlorophyll
Greenseeker	Hand held crop sensor	NDVI (Normalized difference vegetation index)
CropScan	Multispectral radiometer	Reflectance measurements for 16 wavelengths


Lower stem nitrate


Chlorophyll meter
35.9
SPAD
ON
OFF
AVERAGE
ALL DATA CLEAR
1 DATA DELETE
DATA RECALL

Handheld crop sensor

Multispectral radiometer

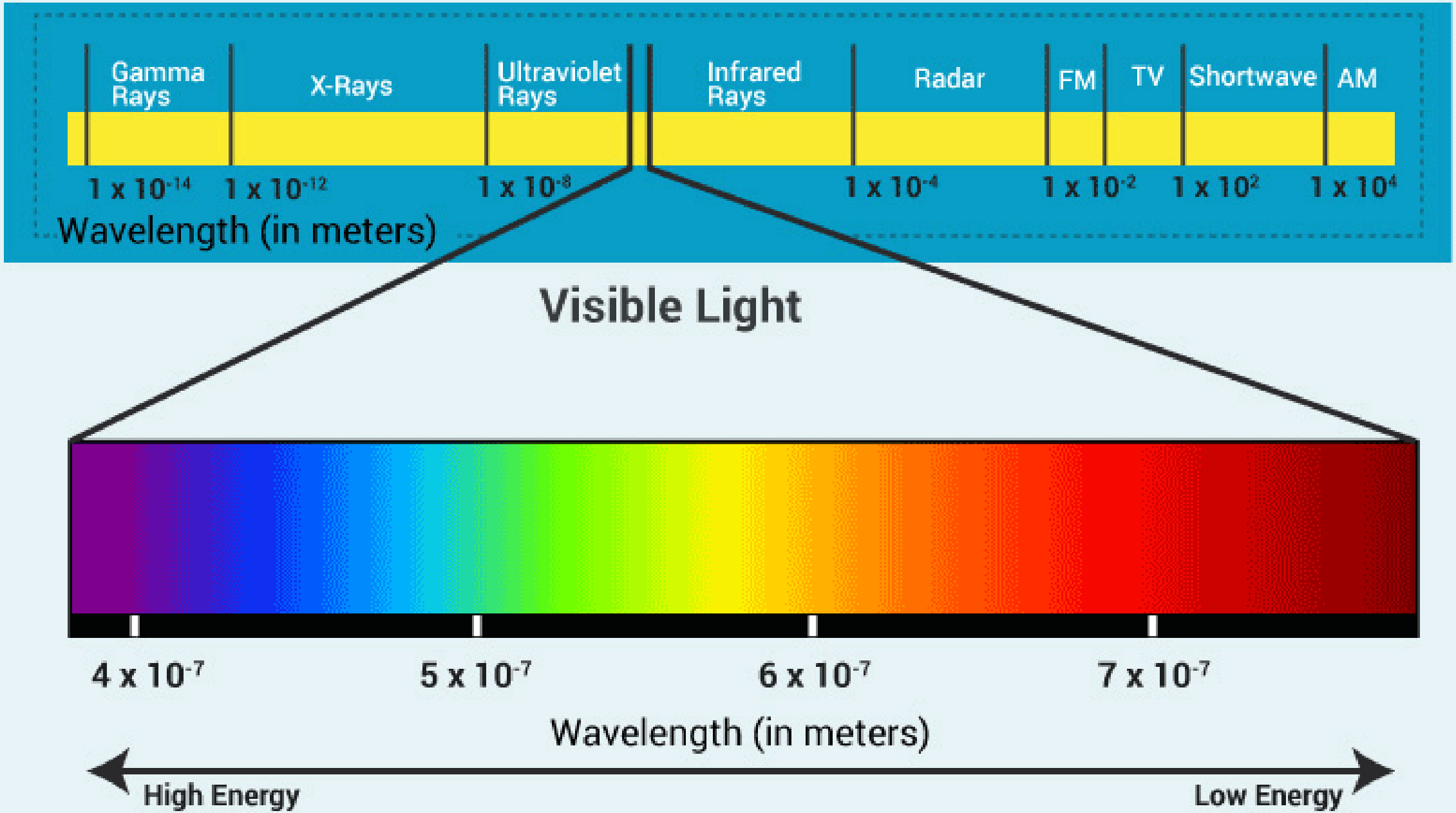
Yuma N management tools studies

- Locations: UA Yuma Valley and Mesa Ag Centers
- Planting date: January 4, 2019
- Seeding rate: 175 lb/acre
- Durum varieties: Powell and Tiburon
- N rates: 0, 50, 100, 150, 200, 250, 300, and 350 lb N/acre
- N application dates: planting, tillering, jointing, boot, heading
- N management tool measurement dates: same as above except planting

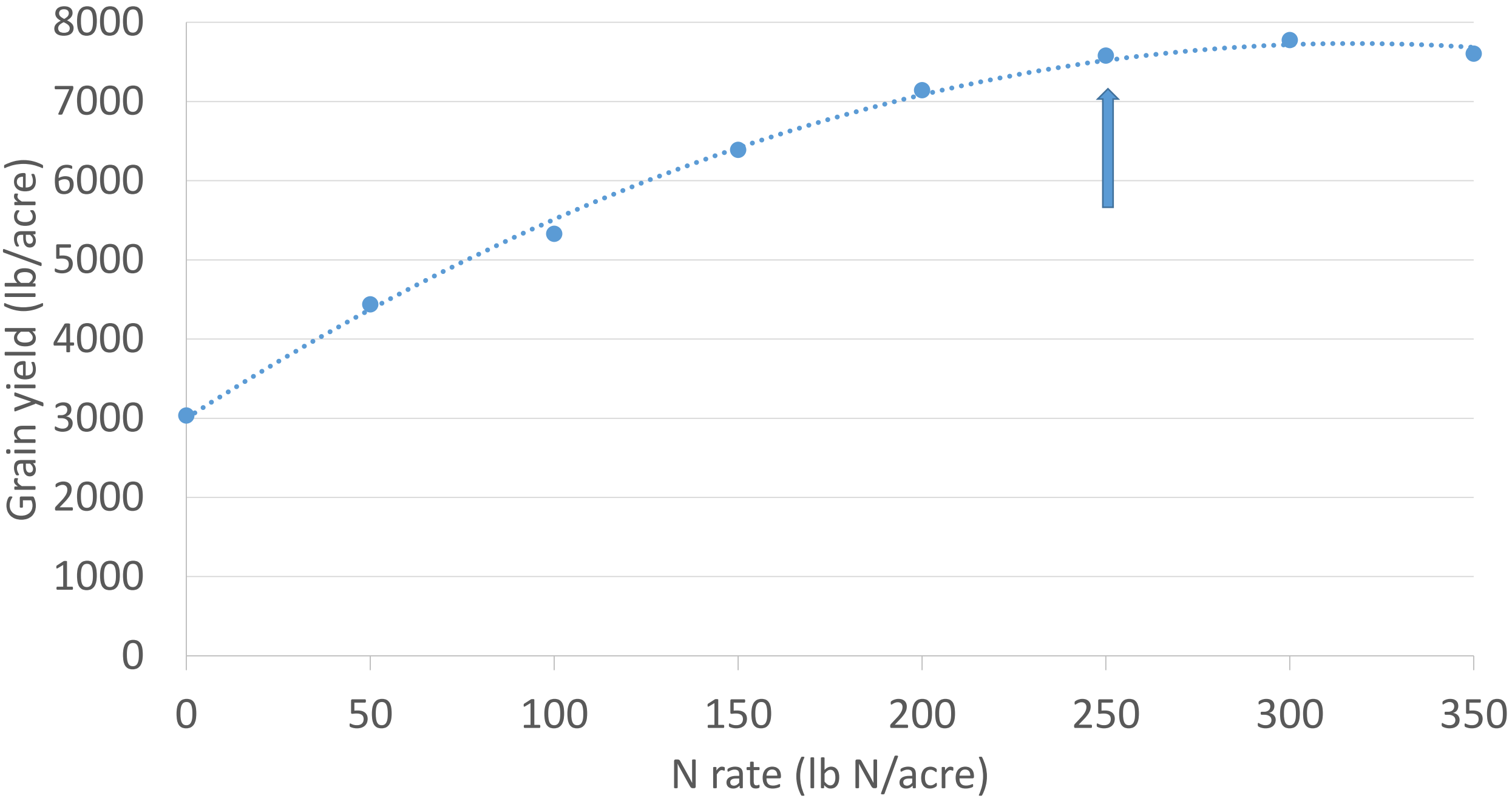
Vegetation indices

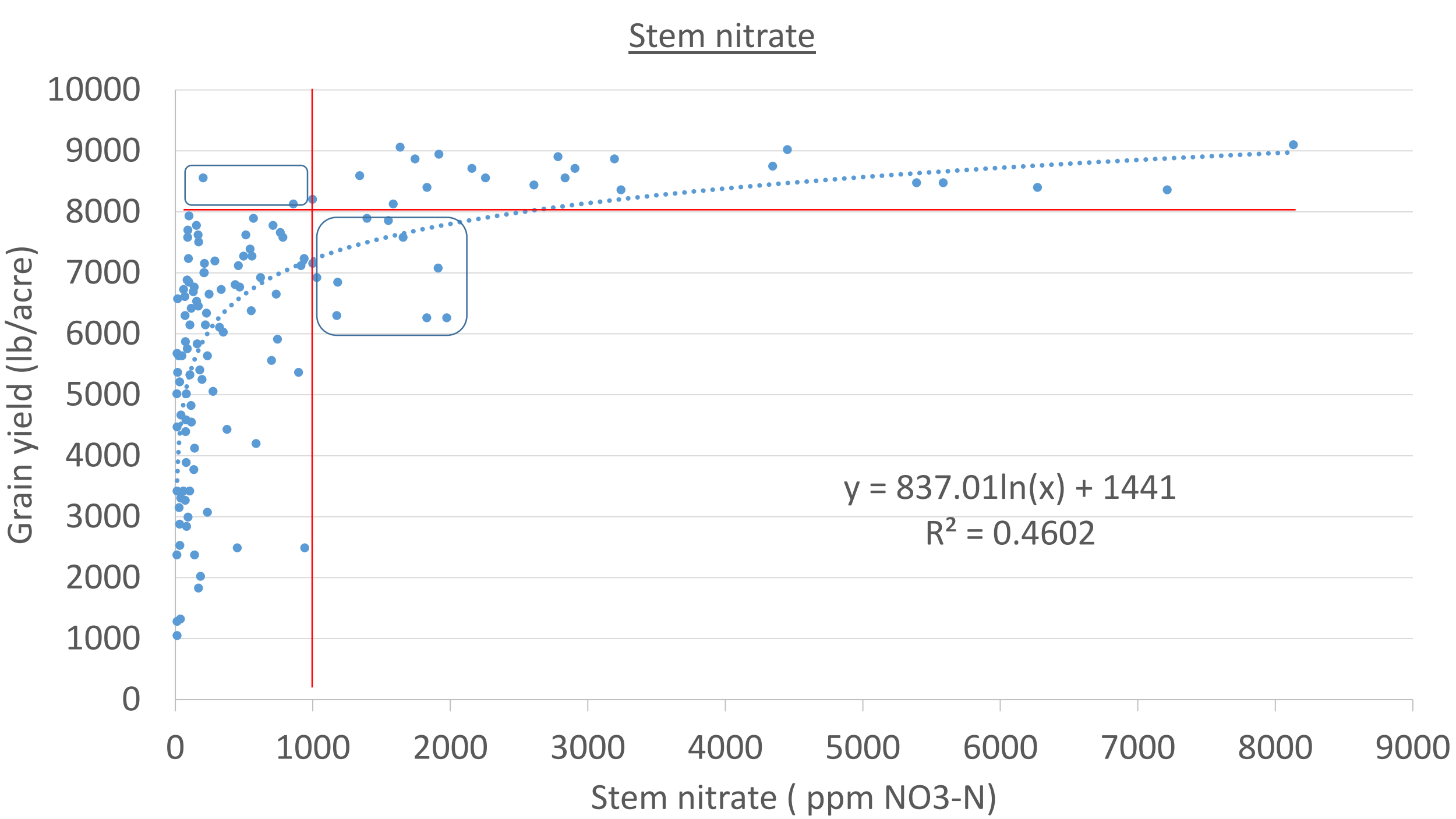
Vegetation index*	Algorithm (wavelength, nm)
NDVI	(690-810)/(690+810)
Green NDVI	(550-810)/(550+810)
Red edge NDVI	(720-750)/(720+750)
Green VI	(690-550)/(690+550)
Difference VI	810-690
CI green	(810/550)-1
CI red edge	(750/720)-1

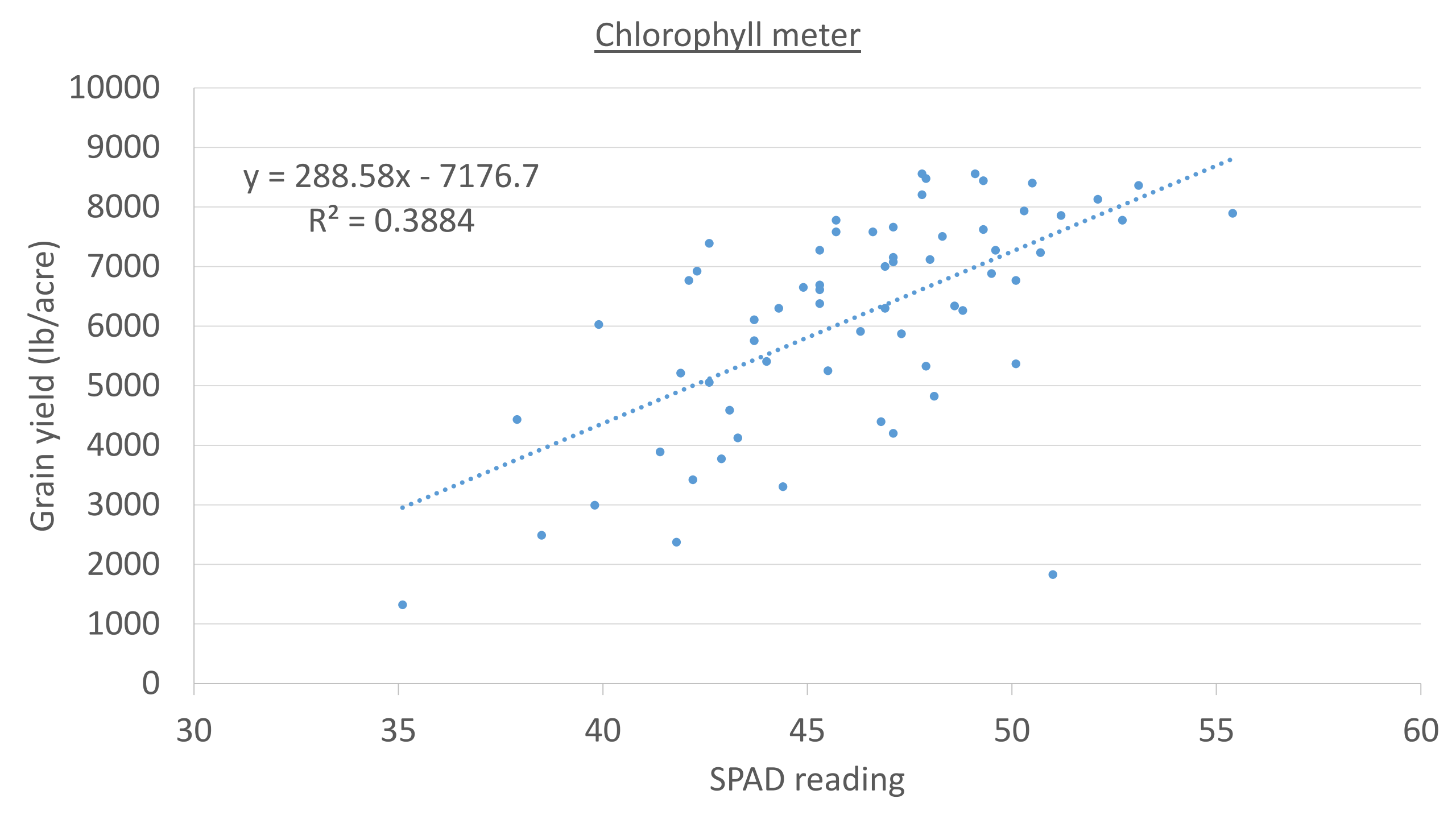
*NDVI = normalized difference vegetation index, VI = vegetation index, CI = chlorophyll index.

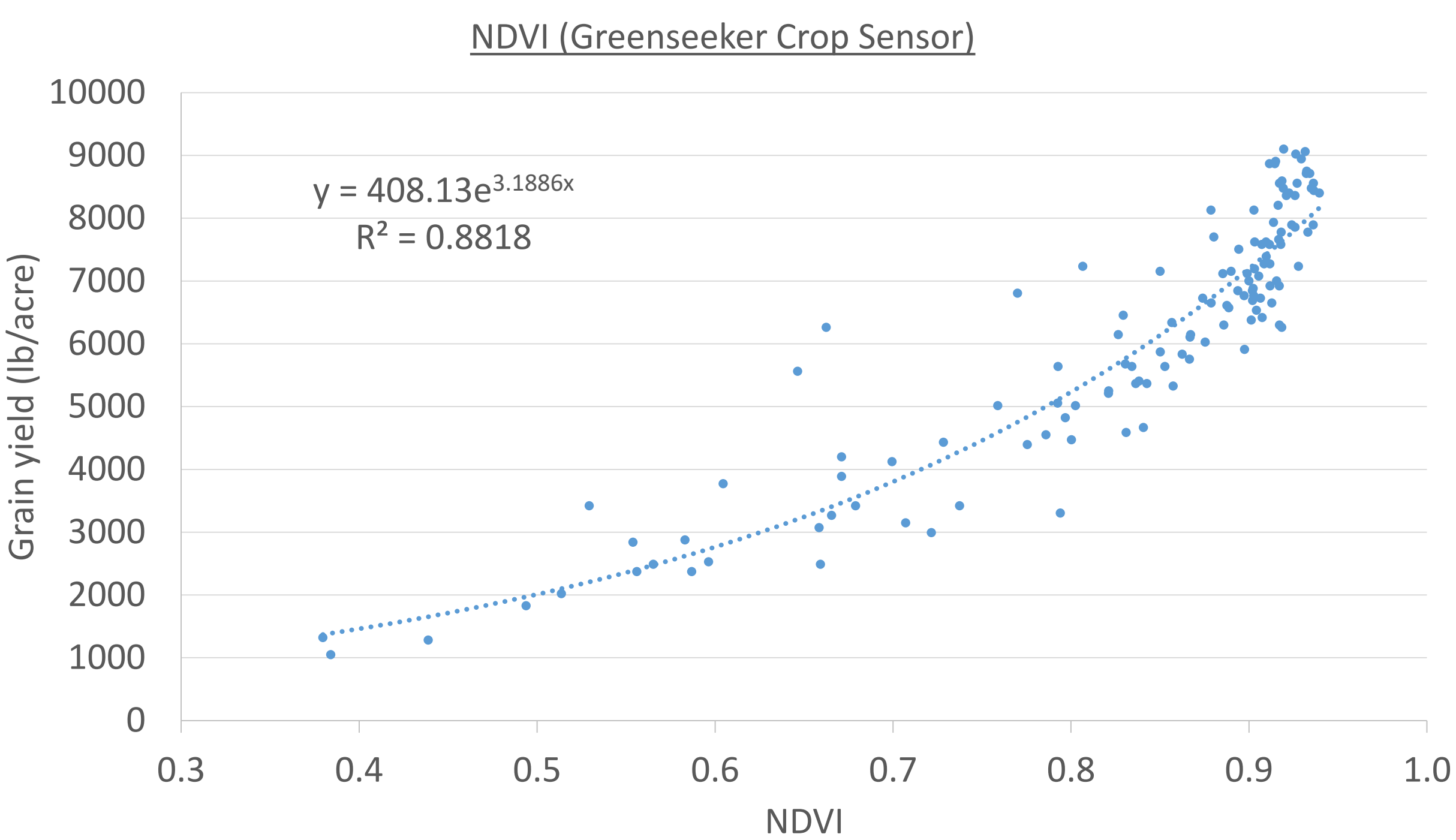

Gamma Rays
X-Rays
Ultraviolet Rays
Infrared Rays
Radar
FM
TV
Shortwave
AM
1 x 10-14
1 x 10-12
1 x 10-8
1 x 10-4
1 x 10-2
1 x 102
1 x 104
Wavelength (in meters)
Visible Light
4 x 10-7
5 x 10-7
6 x 10-7
7 x 10-7
Wavelength (in meters)
High Energy
Low Energy

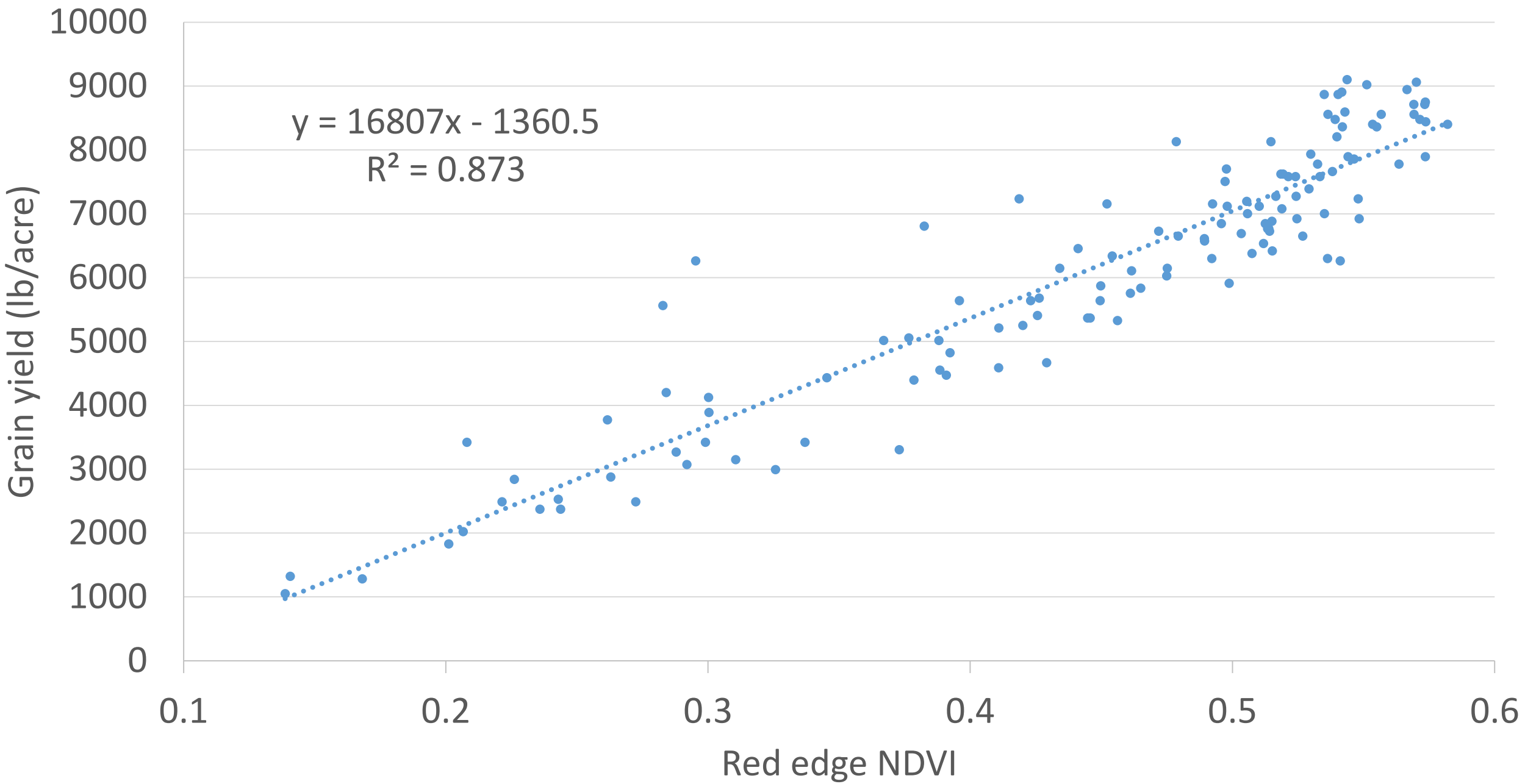

Wheat N Tools Study
Yuma Valley
March 28, 2019


8000
7000
6000
5000
4000
3000
2000
1000
0
Grain yield (lb/acre)
0
50
100
150
200
250
300
350
N rate (lb N/acre)


Stem nitrate
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Grain yield (lb/acre)
y = 837.01ln(x) + 1441
R² = 0.4602
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
Stem nitrate (ppm NO3-N)


Chlorophyll meter
y = 288.58x - 7176.7
R² = 0.3884
Grain yield (lb/acre)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
30
35
40
45
50
55
60
SPAD reading


NDVI (Greenseeker Crop Sensor)
y = 408.13e3.1886x
R² = 0.8818
Grain yield (lb/acre)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
NDVI


Red edge NDVI (Multispectral radiometer)
y = 16807x - 1360.5
R² = 0.873
Grain yield (lb/acre)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0.1
0.2
0.3
0.4
0.5
0.6
Red edge NDVI

Conclusion

- Vegetation indices are promising nitrogen management tools for wheat