Nitrogen management of high yielding snap bean

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Objectives:

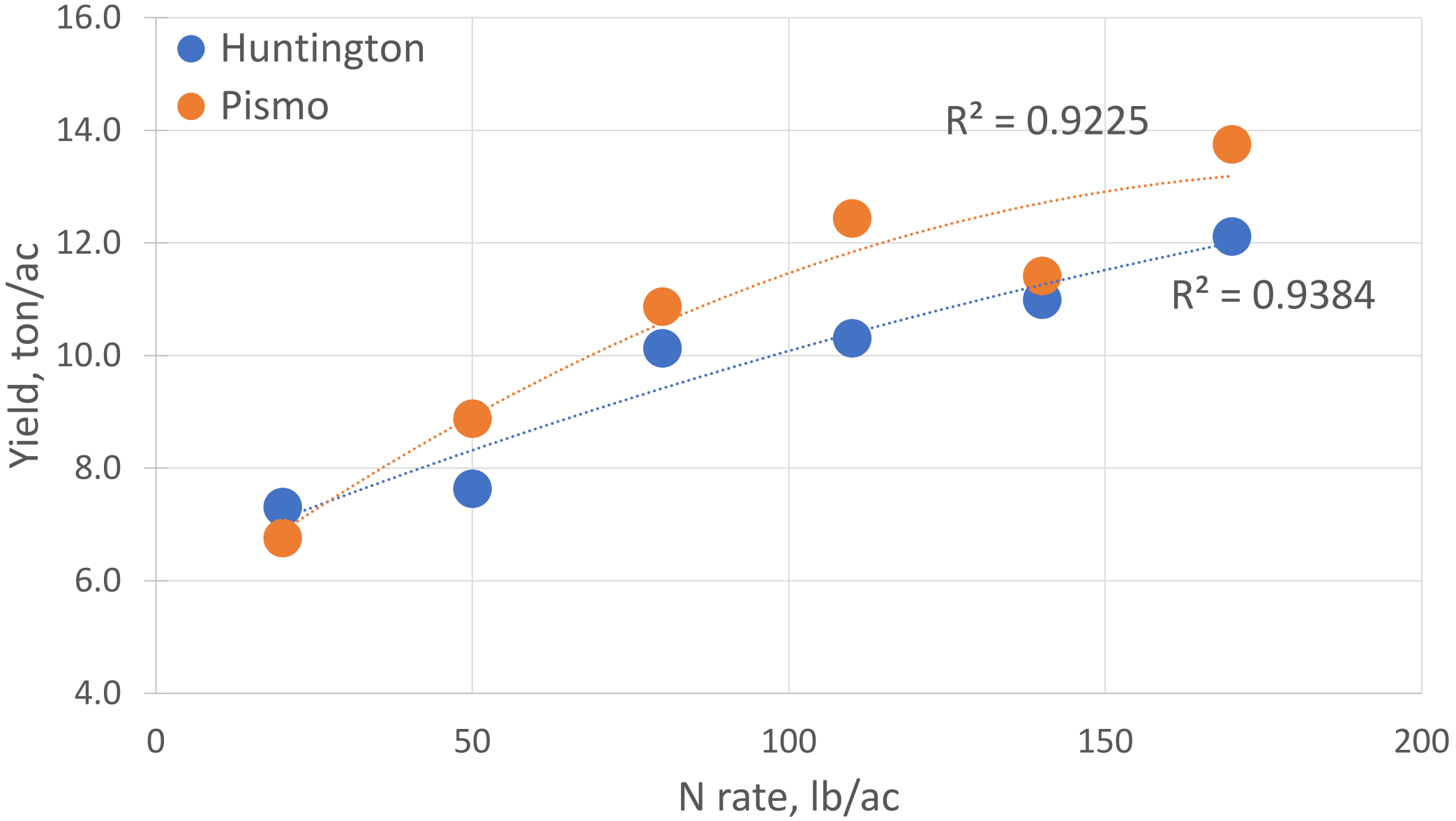
- Determine agronomically optimum N rates for high yielding snap bean.
- Quantify NUE on snap bean
- Removal rates of nutrients – updates to fertilizer recommendations?

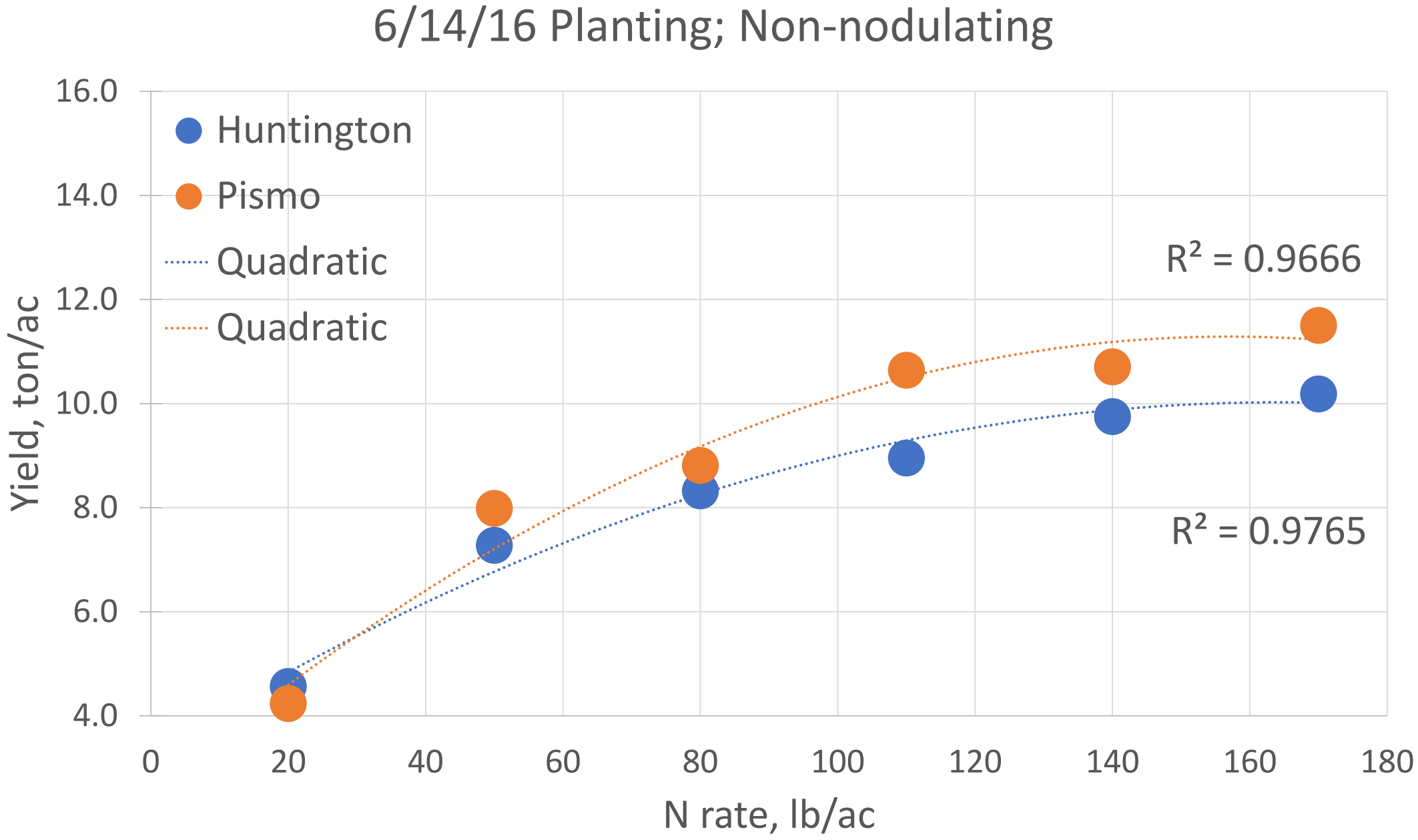
- 2016 and 2017 growing seasons
- Hancock Agricultural Research Station
- Irrigated, sandy soil

Study design

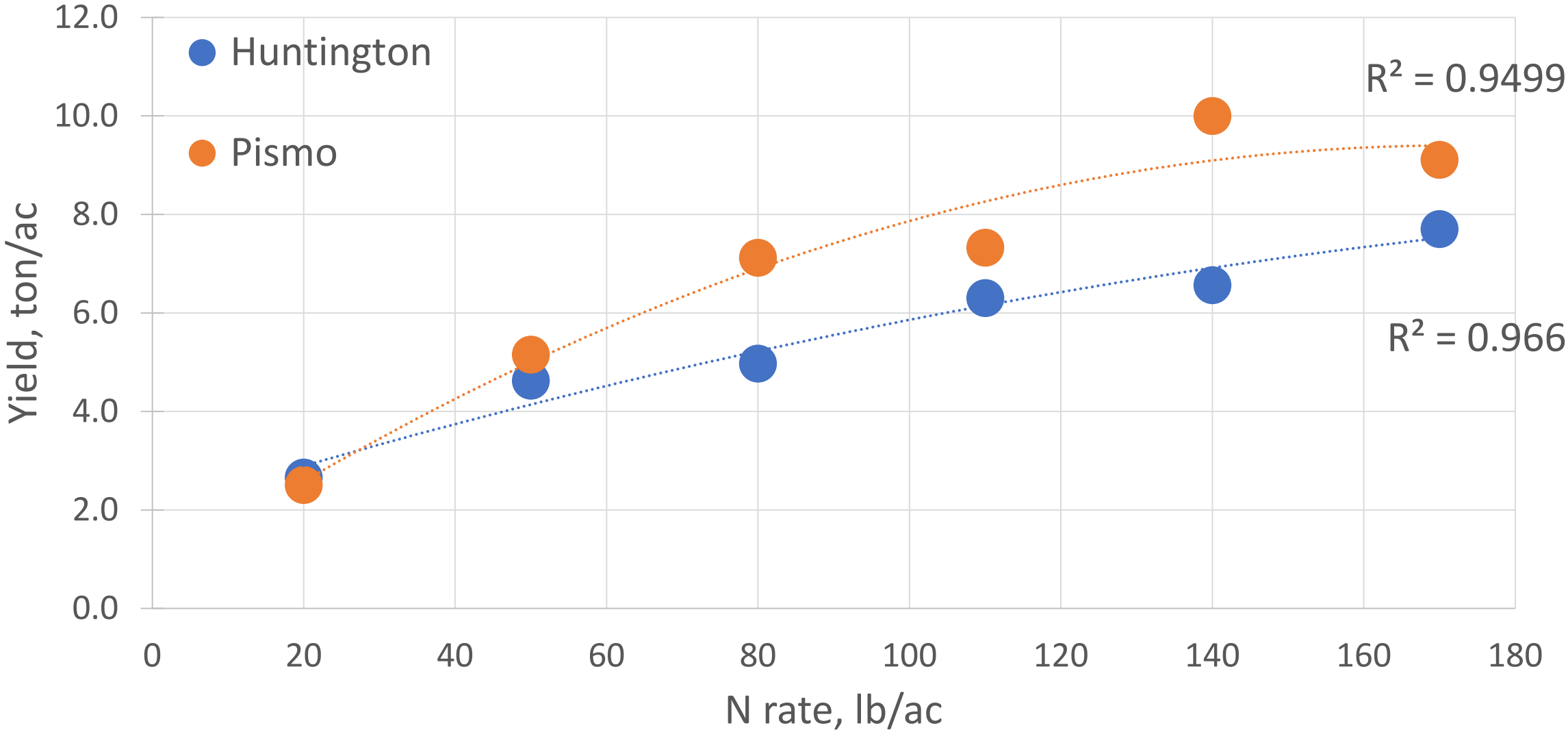
- May or June planting date
- Starter fertilizer with 20 lb-N/ac
- Fertilizer applied in 30 lb-N/ac intervals:
  - 20, 50, 80, 110, 140, 170
  - Applied 50% at V2-V3, 50% 7 to 10 days later
  - In-season N was ammonium nitrate

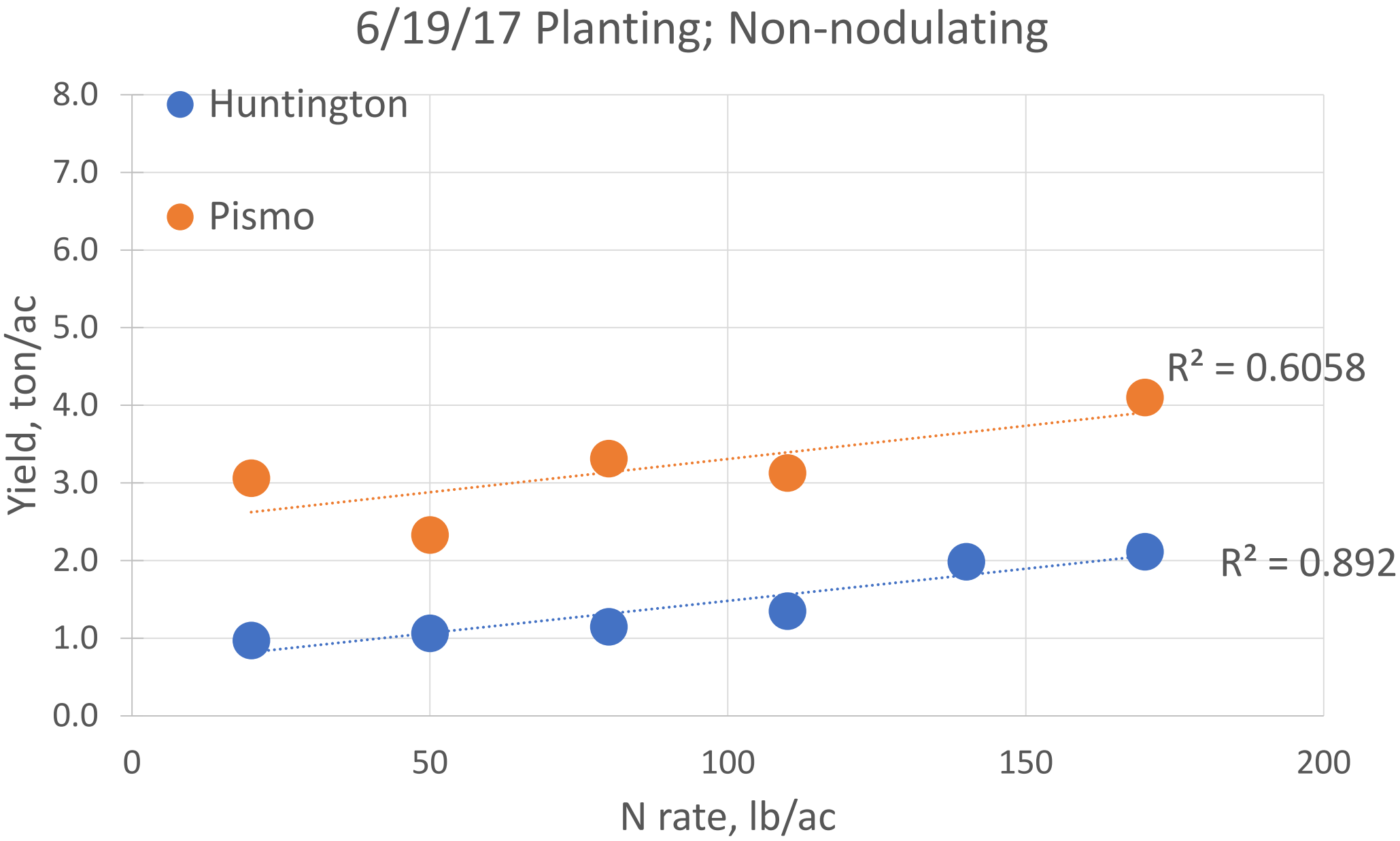
5/26/16 Planting; Non-nodulating

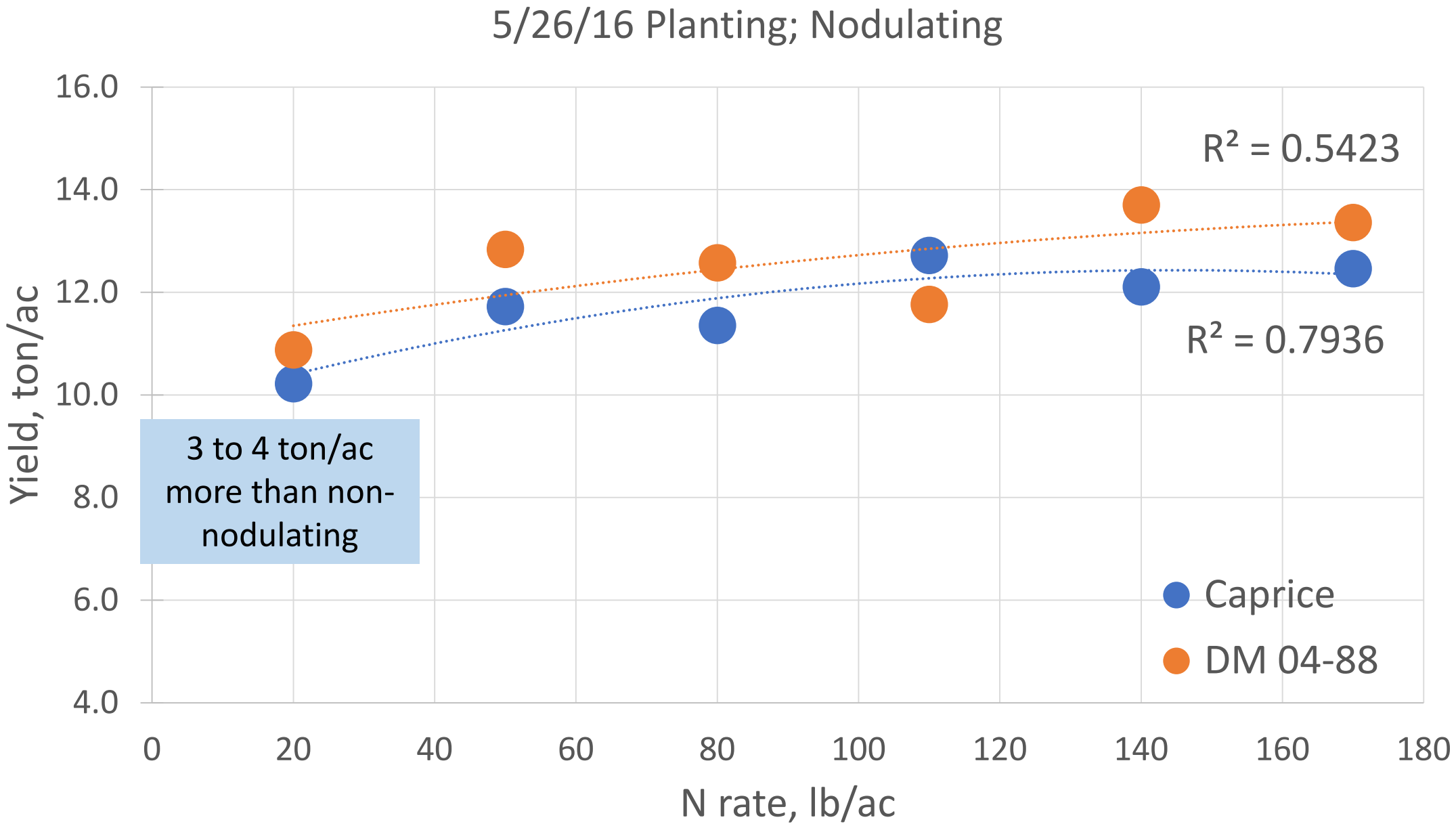


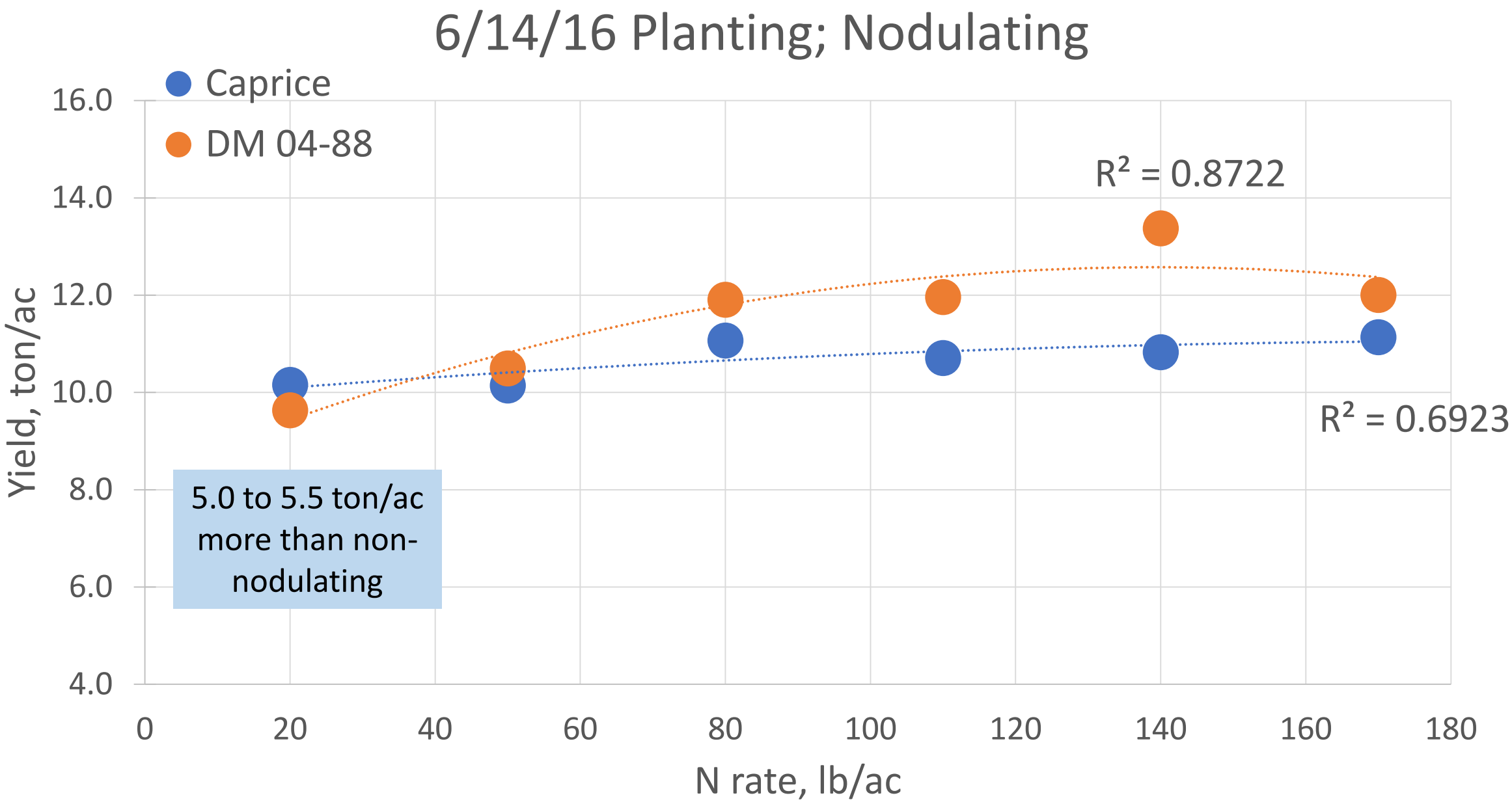

6/14/16 Planting; Non-nodulating
Huntington
Pismo
Quadratic
Quadratic
R² = 0.9666
R² = 0.9765
Yield, ton/ac
16.0
14.0
12.0
10.0
8.0
6.0
4.0
0
20
40
60
80
100
120
140
160
180
N rate, lb/ac

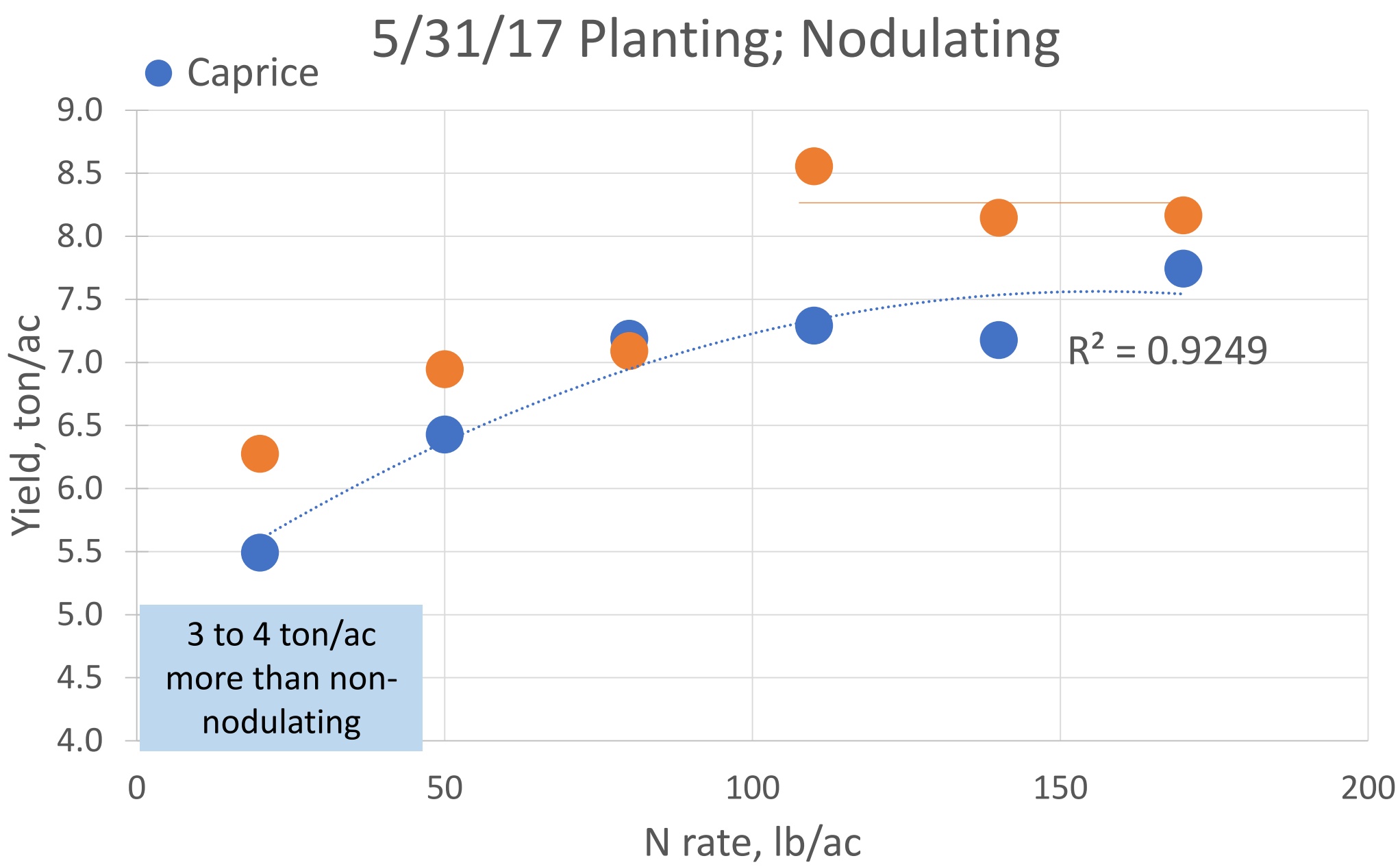
5/31/17 Planting; Non-nodulating

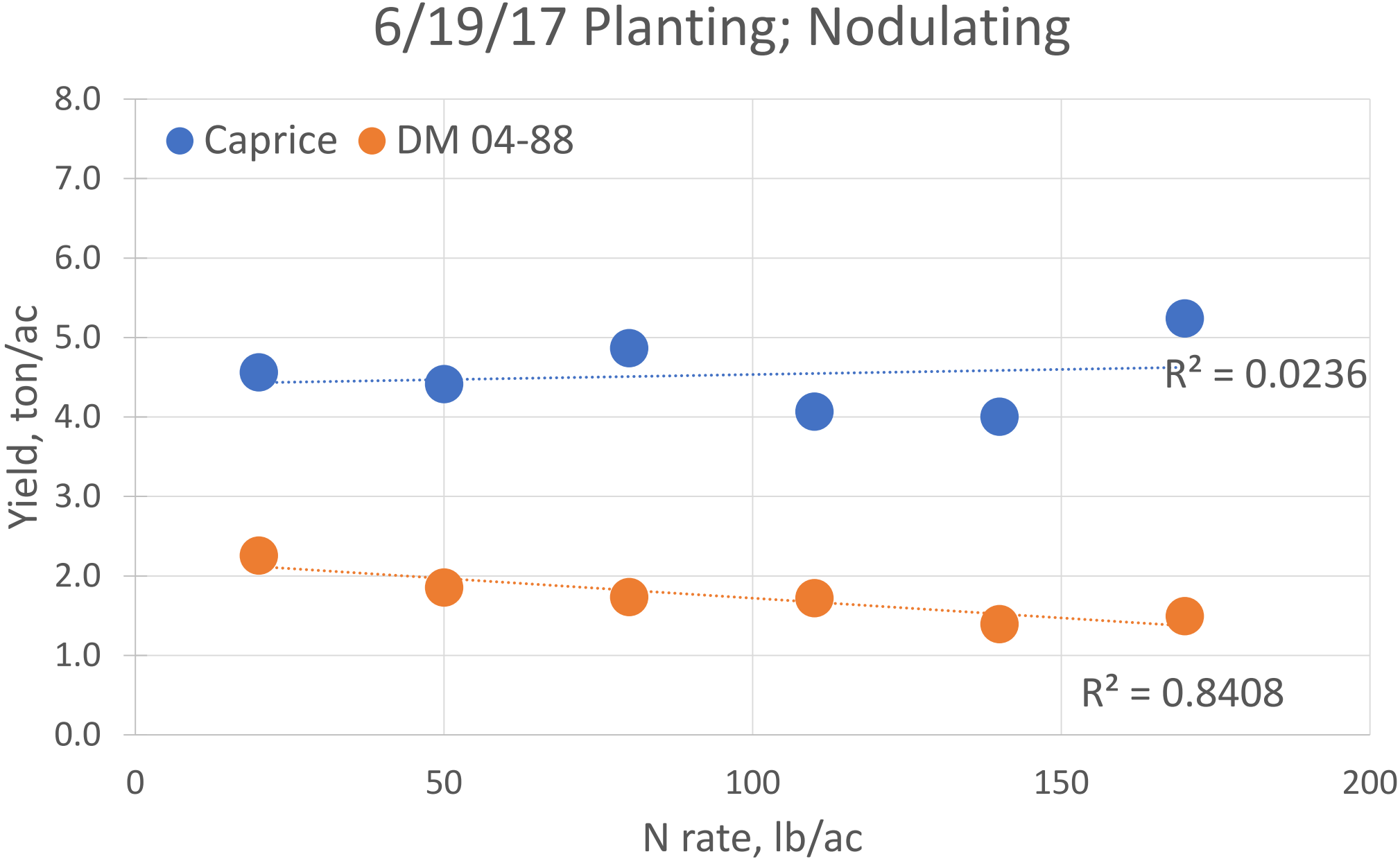



6/19/17 Planting; Non-nodulating
Huntington
Pismo
Yield, ton/ac
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
50
100
150
200
N rate, lb/ac
R² = 0.6058
R² = 0.892


5/26/16 Planting; Nodulating
16.0
14.0
12.0
10.0
8.0
6.0
4.0
Yield, ton/ac
0
20
40
60
80
100
120
140
160
180
N rate, lb/ac
R² = 0.5423
R² = 0.7936
3 to 4 ton/ac more than non-nodulating
Caprice
DM 04-88


6/14/16 Planting; Nodulating
Caprice
DM 04-88
R² = 0.8722
R² = 0.6923
5.0 to 5.5 ton/ac more than non-nodulating
Yield, ton/ac
16.0
14.0
12.0
10.0
8.0
6.0
4.0
0
20
40
60
80
100
120
140
160
180
N rate, lb/ac


5/31/17 Planting; Nodulating
Caprice
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
Yield, ton/ac
0
50
100
150
200
N rate, lb/ac
R² = 0.9249
3 to 4 ton/ac more than non-nodulating

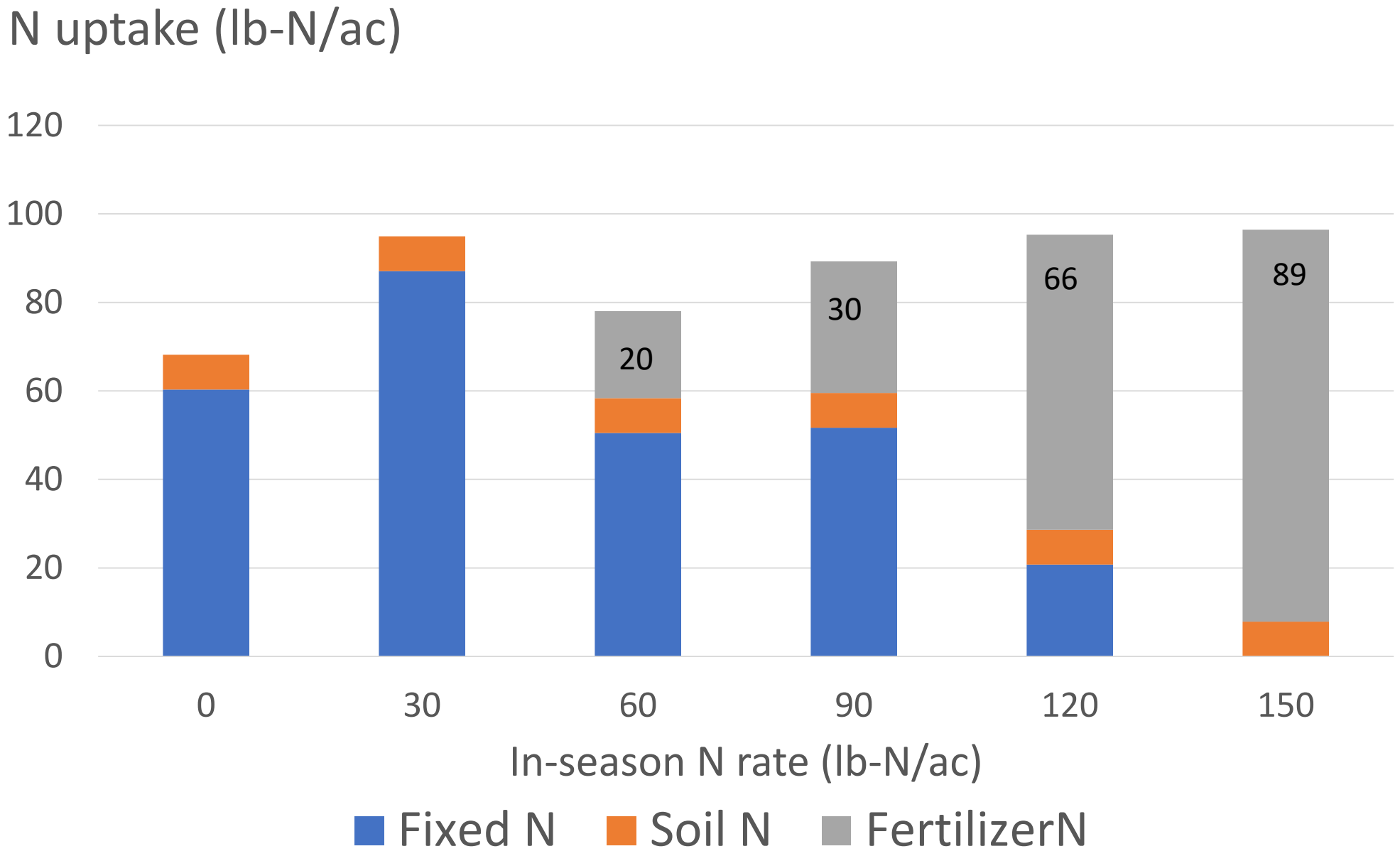

6/19/17 Planting; Nodulating
Caprice
DM 04-88
Yield, ton/ac
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
50
100
150
200
N rate, lb/ac
R² = 0.0236
R² = 0.8408

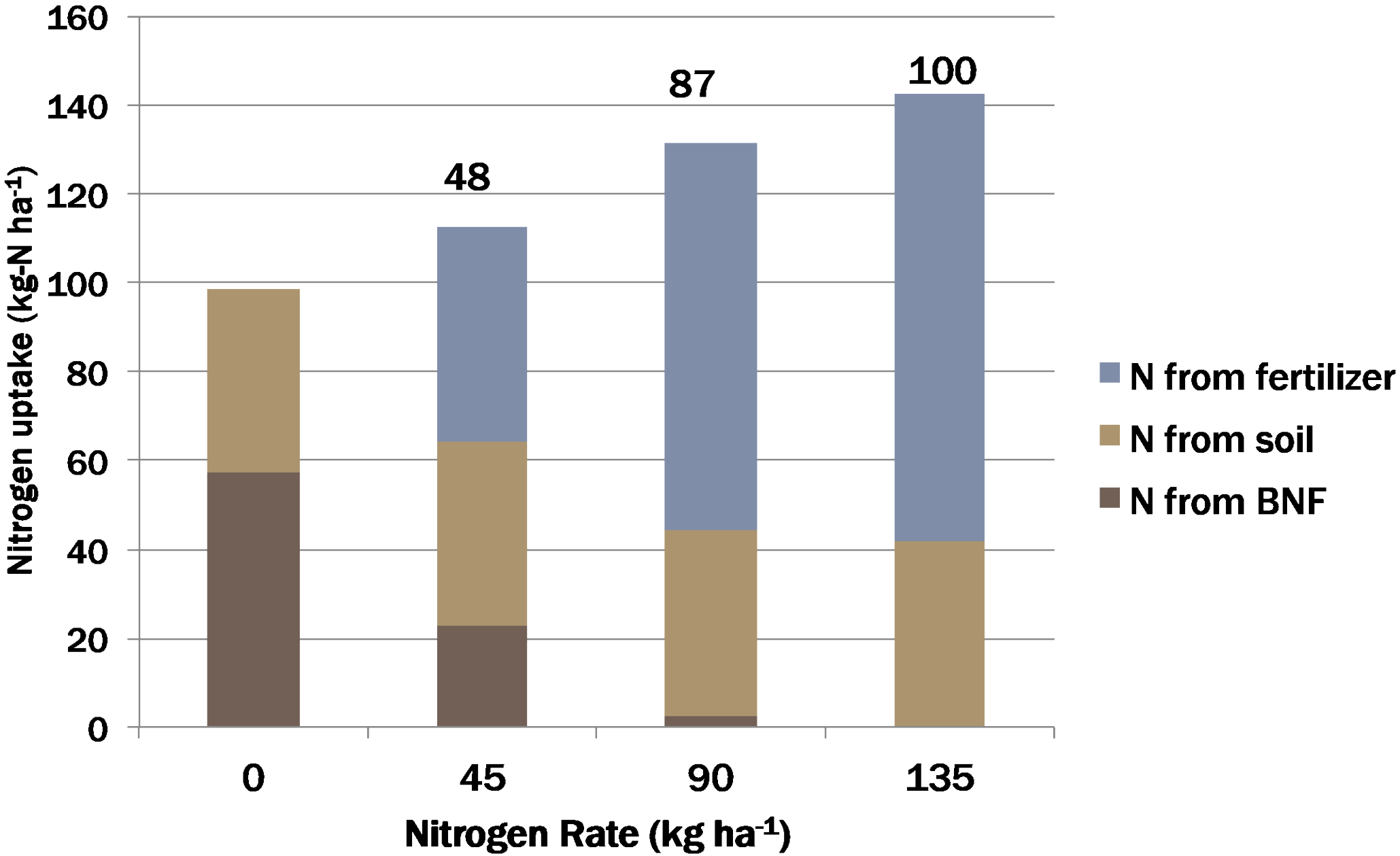
Recap of response

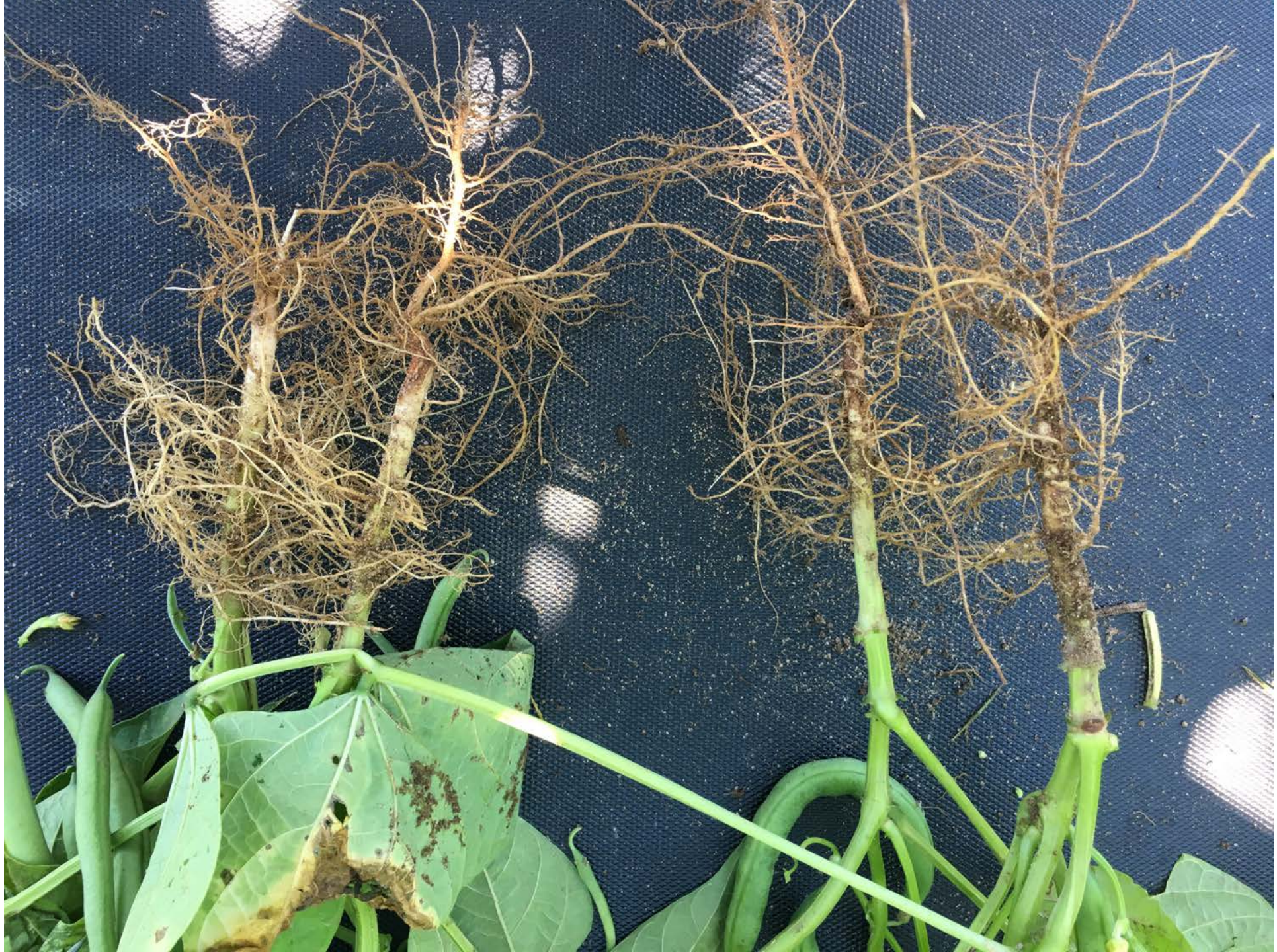
- Non-nodulating - Quadratic response function, yields keep going up
  - A2809 Guidelines suggest 60 lb-N/ac (1.5 to 6.5 ton/ac range)
- Nodulating – N fixation is supplying a lot of N!
  - But technically, yields still tick up about 2 ton/ac with 50 to 110 lb-N/ac

- Statewide average is 5.5 ton/ac

- 60, 57, 57, & 58 days between planting and harvest in these studies


N uptake (lb-N/ac)
120
100
80
60
40
20
0
20
30
66
89
0
30
60
90
120
150
In-season N rate (lb-N/ac)
Fixed N
Soil N
FertilizerN


160
140
120
100
80
60
40
20
0
Nitrogen uptake (kg-N ha-1)
48
87
100
0
45
90
135
Nitrogen Rate (kg ha-1)
N from fertilizer
N from soil
N from BNF




102


105


107


124

Removal rates of P, K, and S were not very different among varieties in 2016

	P	K	S
Variety	Average	Average	Average
	---------- lb/ac ----------		
Non-nodulating #1	9.1	51	4.1
Non-nodulating #2	9.3	55	4.3
Nodulating #1	9.2	53	3.9
Nodulating #2	11.5	56	5.3

10 lb-P = 23 lb P_2O_5

55 lb-K = 66 lb K_2O

Crop name	Yield goal (per acre)	P_2O_5 rate guidelines					K_2O rate guidelines					
		VL	L	O	H	EH	VL	L	O	H	VH	EH
		lb P_2O_5/a to apply[a]					lb K_2O/a to apply[b]					
Bean, snap	1.5–2.5 ton	50	40	10	5	0	95	80	40	20	10	0
	2.6–3.5 ton	55	45	15	10	0	115	100	60	30	15	0
	3.6–4.5 ton	60	50	20	10	0	135	120	80	40	20	0
	4.6–5.5 ton	65	55	25	15	0	155	140	100	50	25	0
	5.6–6.5 ton	70	60	30	15	0	175	160	120	60	30	0

10 lb-P = 23 lb P2O5

55 lb-K = 66 lb K2O

STP = 100 ppm (26-37 optimum)

STK = 122 ppm (80-121 optimum)

We are applying (starter) 10-20-20 @ 200 lb/ac


QUESTIONS?
COMMENTS?
CONCERNS?