Nitrogen Fertilizer Management In Intensive Cropping Systems

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N Fertility Studies at AVRC to be discussed

- Onion N^{15} Study in 1998
- Corn N^{15} Study in 1999
- Corn N rate study from 2000 – 2003, following watermelon in 1999.
- Chile Pepper (Sonora) N rate study in 2004 following corn.
- Onion N rate study in 2005 following chile pepper.
- Corn N rate study in 2006 and 2007 (recovery of residual N fertilizer by corn following chile pepper and onion in rotation).

- Second N rate study on onion initiated in 2006 following soybean. Corn followed onion in 2007.

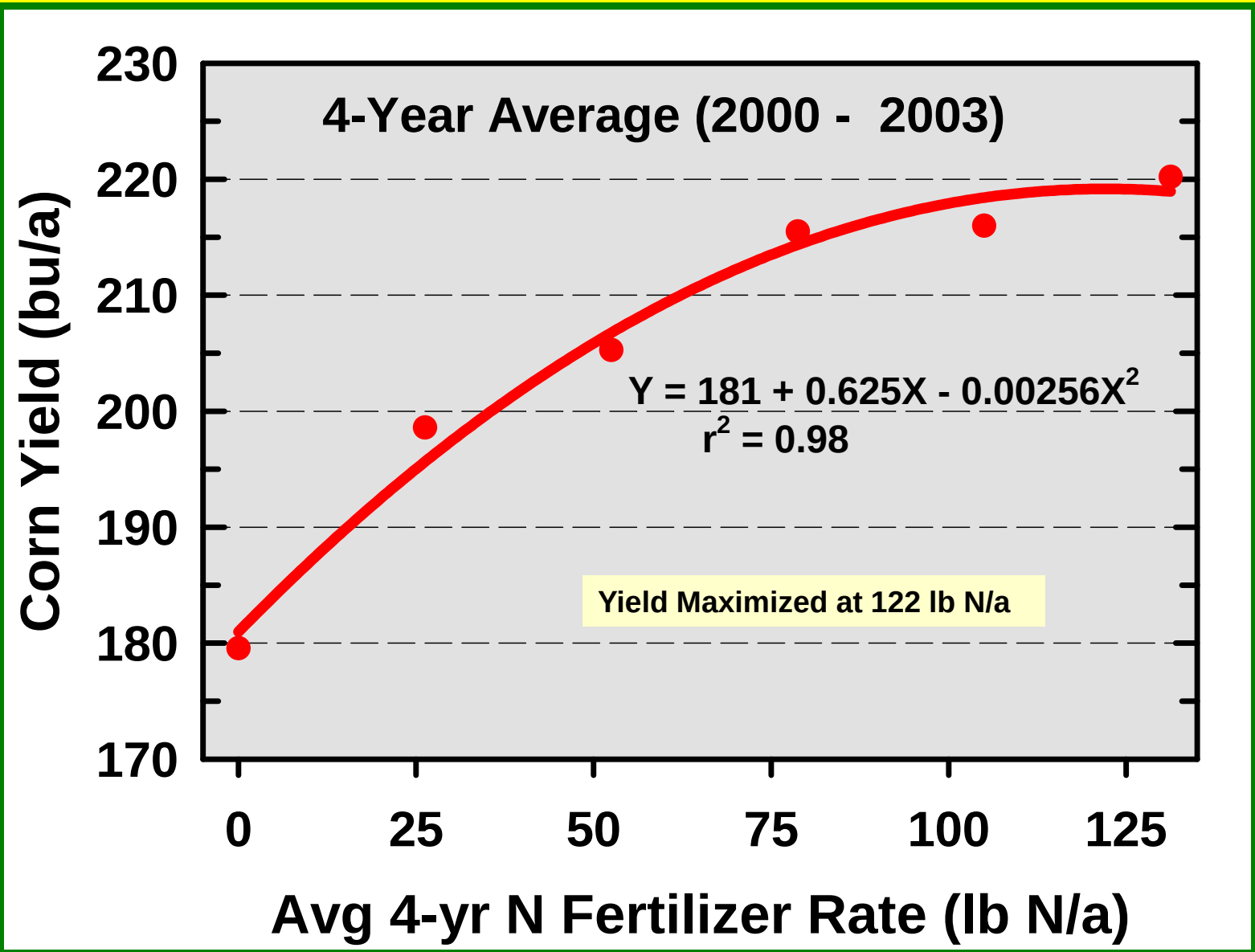
Problem Being Addressed:

- High levels of residual soil NO_3-N in irrigated cropland in Arkansas River Valley.
- High NO_3-N levels in groundwater in Arkansas River Valley of Colorado.
- Contributing factors:
  - High rates of N fertilizer applied to vegetable crops
  - Shallow rooting depths of vegetable crops
  - Inefficient use of applied N fertilizer by crops.
  - Example, N fertilizer use efficiency (NFUE) by onion at AVRC was only 15%.

Results of ^{15}N Study (1998-1999)

- **N Fertilizer use efficiency (NFUE) by onion:**
  - **11% for the fertilizer applied May 20th**
  - **19% for the fertilizer applied June 13th**
  - **Only 15% of the N applied to onion in 1998 was utilized by the onions.**
- **Corn in 1999 used an additional 12% of the fertilizer N applied to onion in 1998.**
- **Total NFUE was about 27% for the two crops.**

Corn N Rate Study following 5 years of alfalfa and watermelon in 1999 (no N applied)



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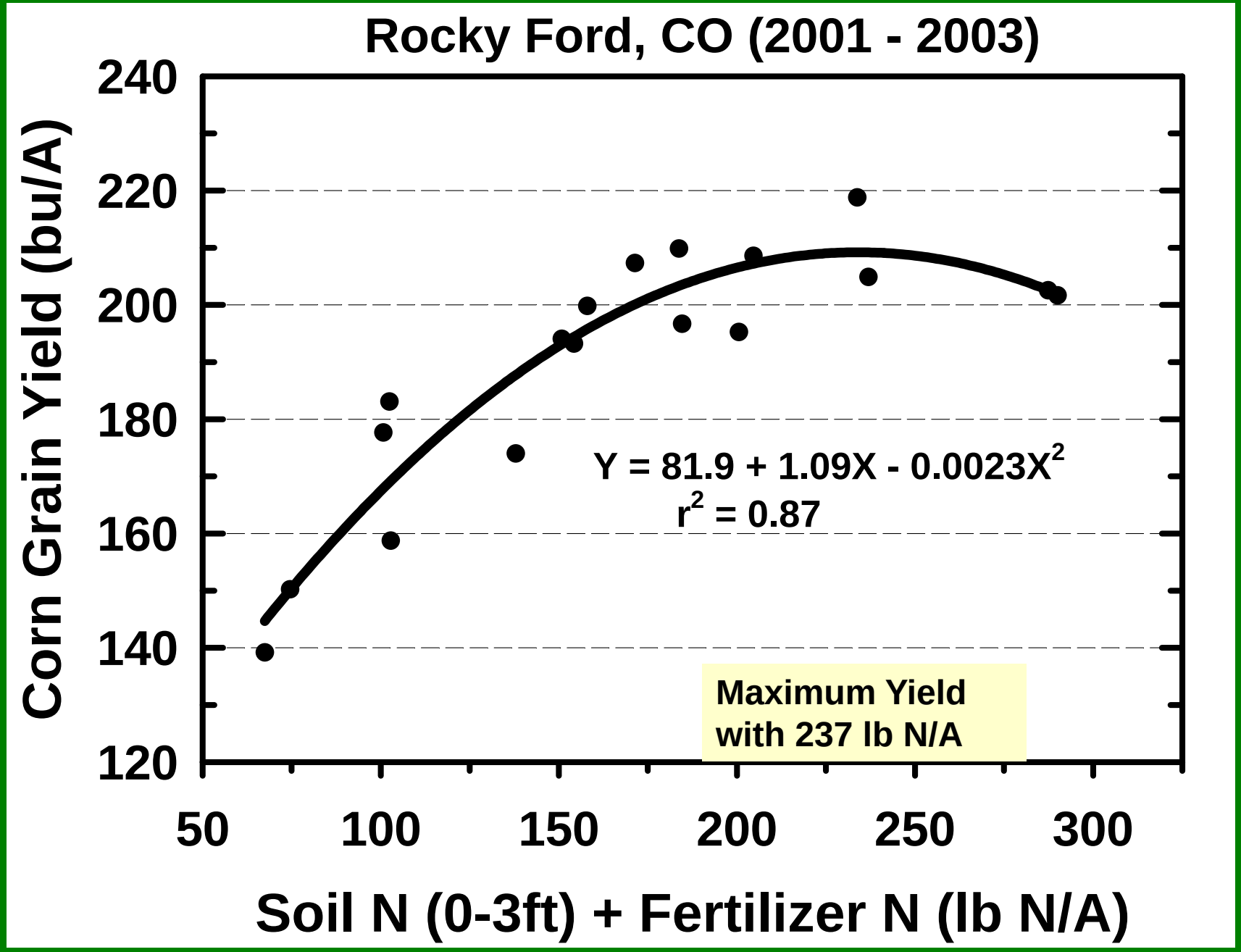

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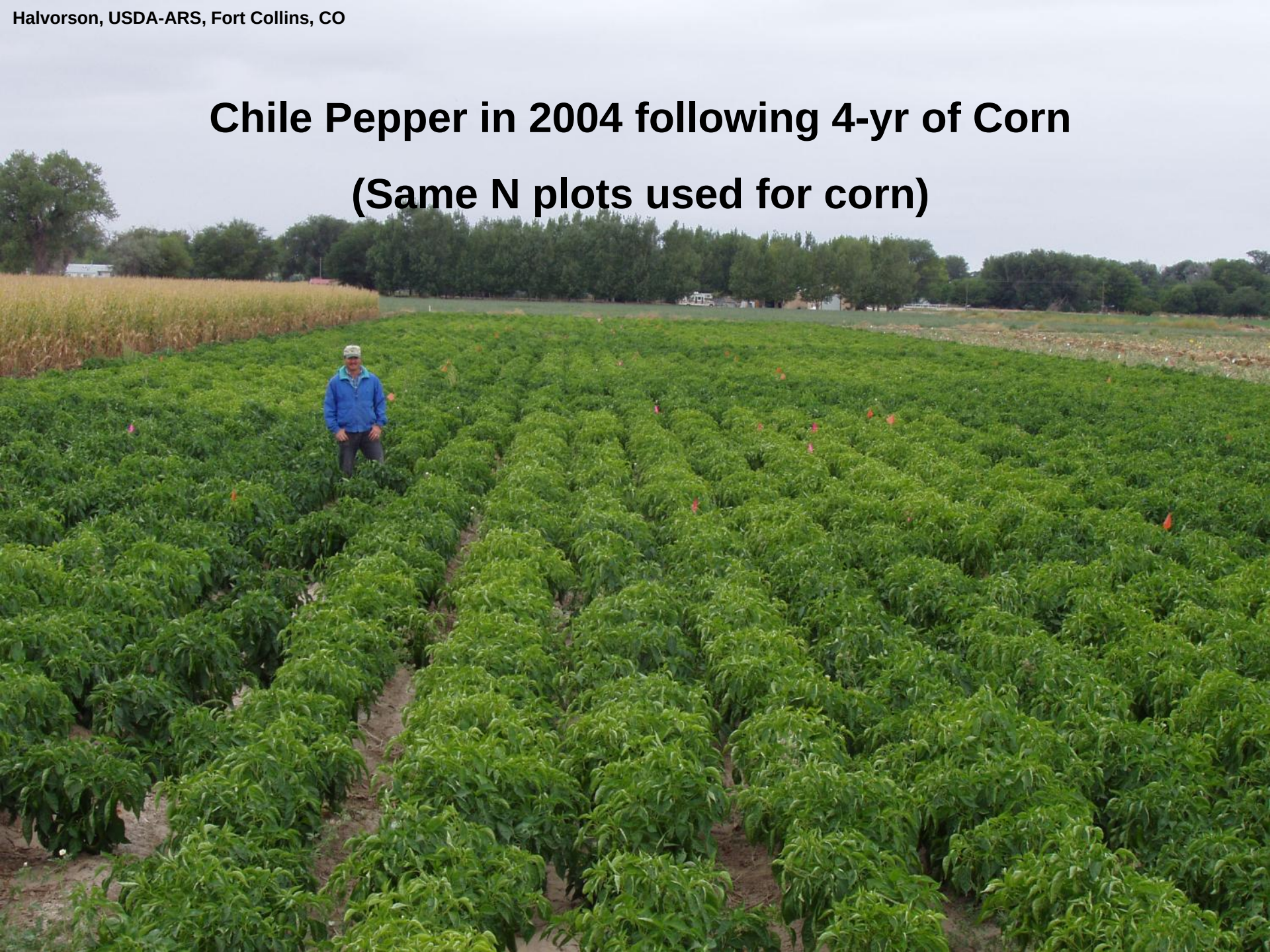
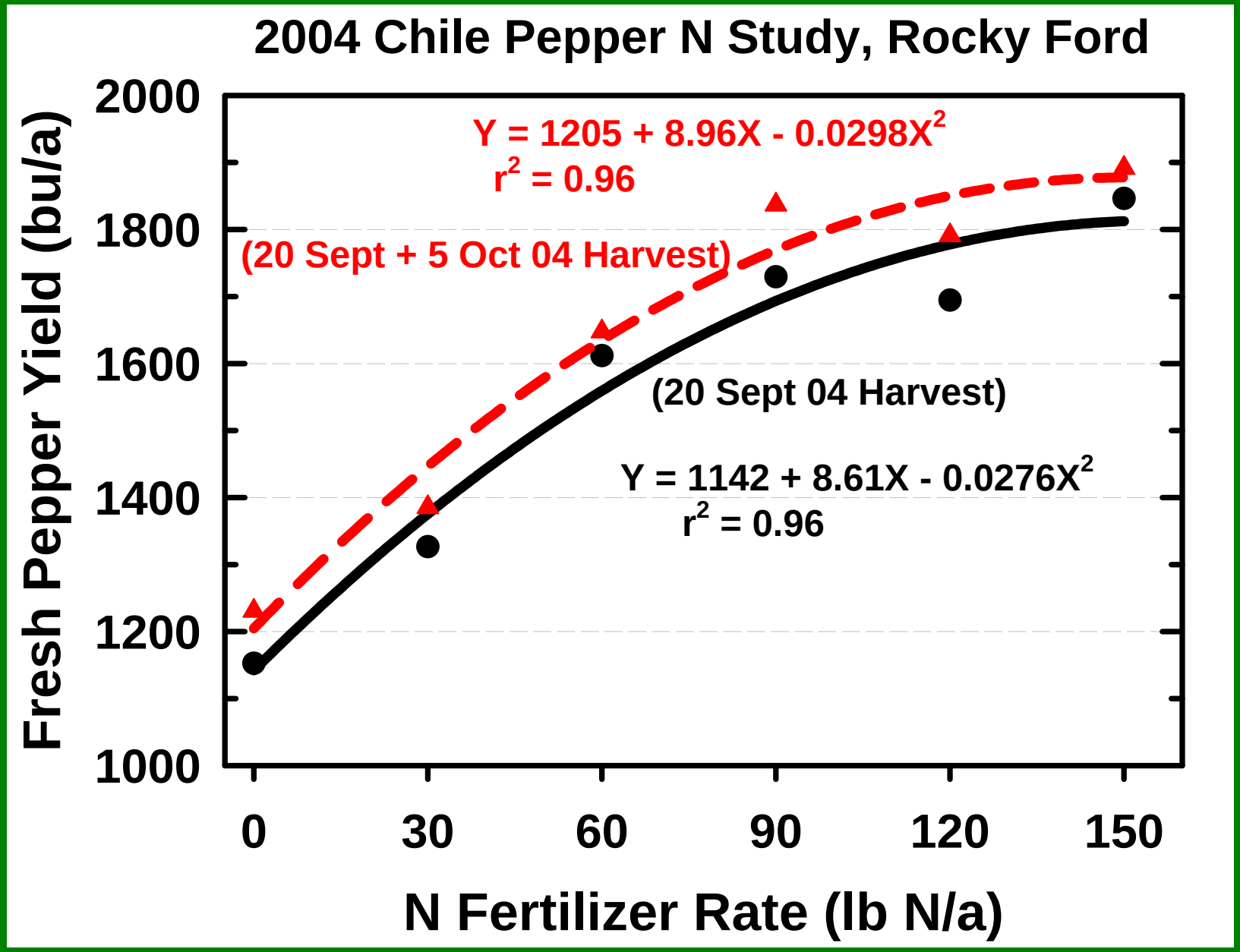
Chile Pepper in 2004 following 4-yr of Corn

(Same N plots used for corn)





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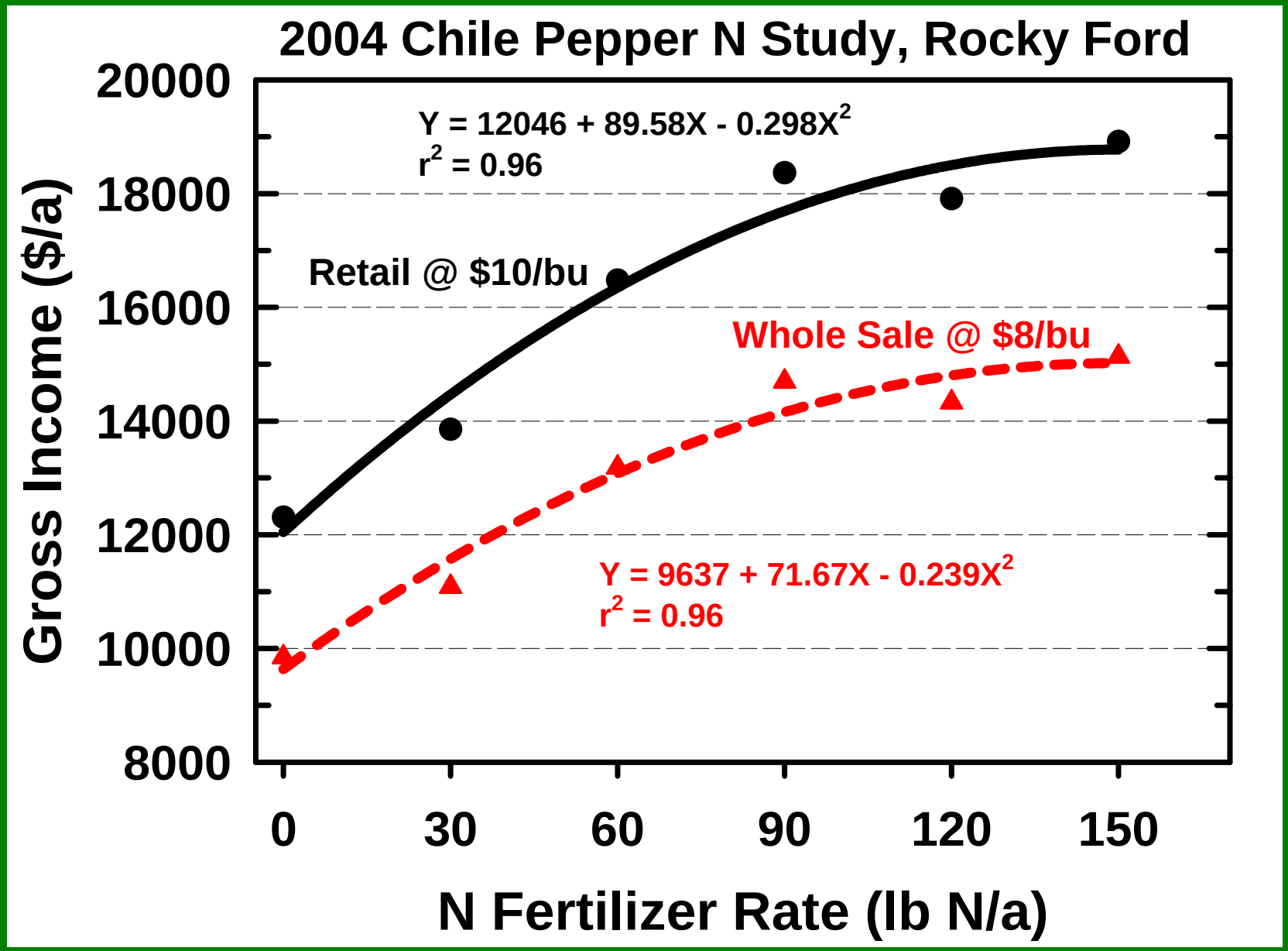

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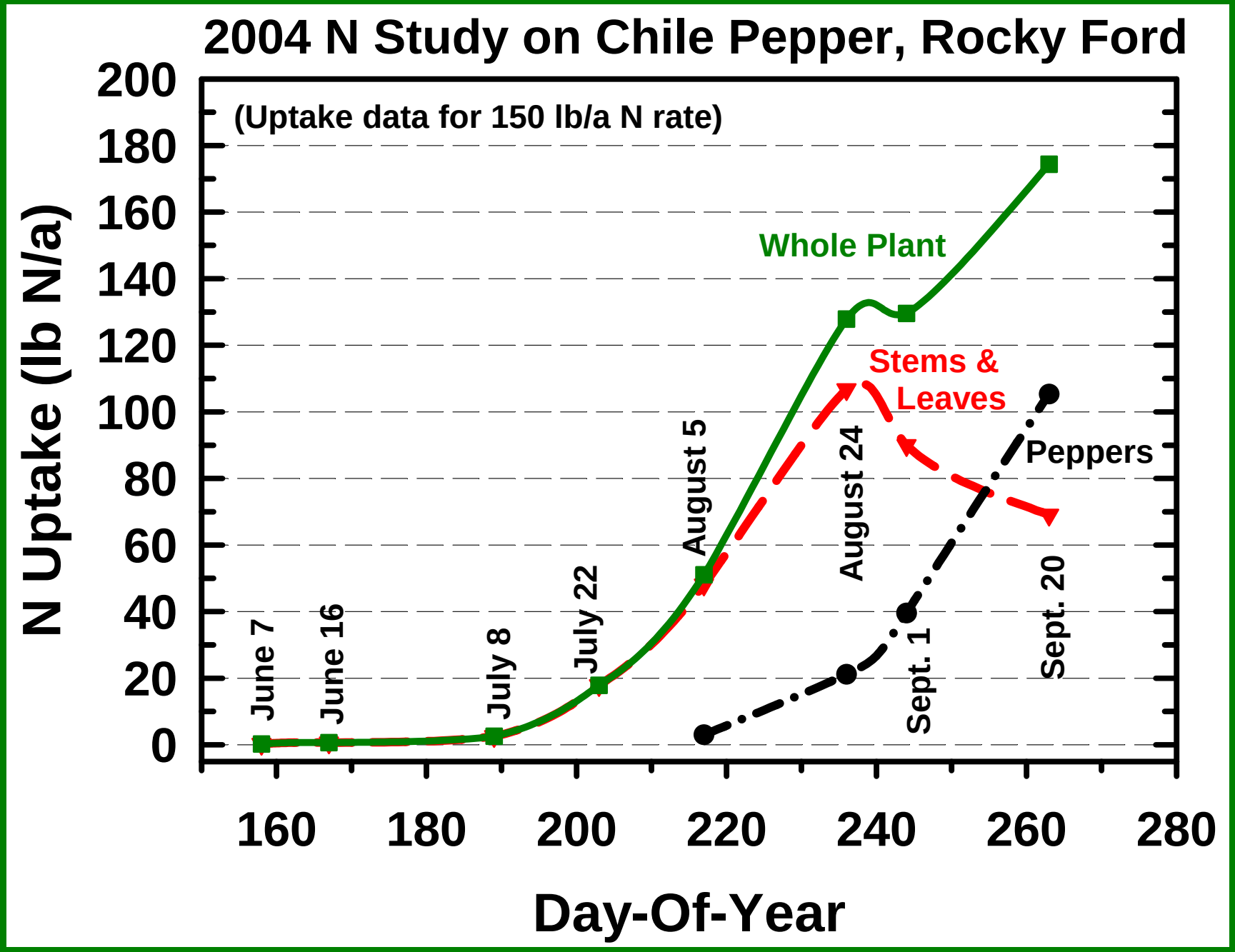

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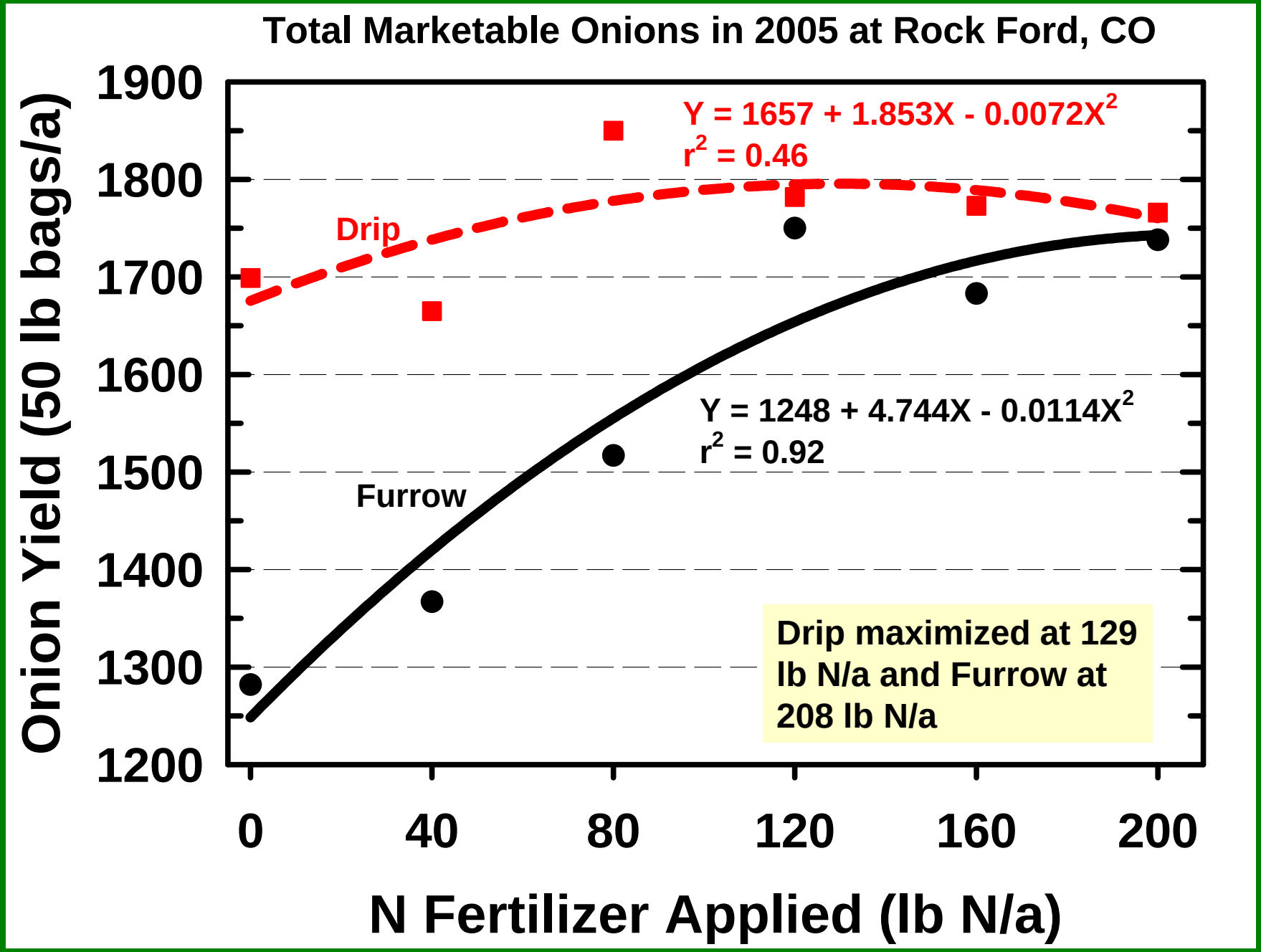
Onion in 2005 following Chile Pepper in 2004

2005 Nitrogen & Irrigation Study on Onion

- N rates: 0, 40, 80, 120, 160, 200 (lb N/a)
- N Source: Polymer-coated urea (Duration Type III fertilizer with a 120 day release period; provided by Agrium)
- Applied February 22, 2005

Irrigation Methods Used

- **Furrow Irrigation (normal practice)**
- **Drip Irrigation (alternative practice)**
- **Water Applied to Onions:**
  - **Furrow Irrigation = 96 inches**
  - **Drip Irrigation = 27 inches**



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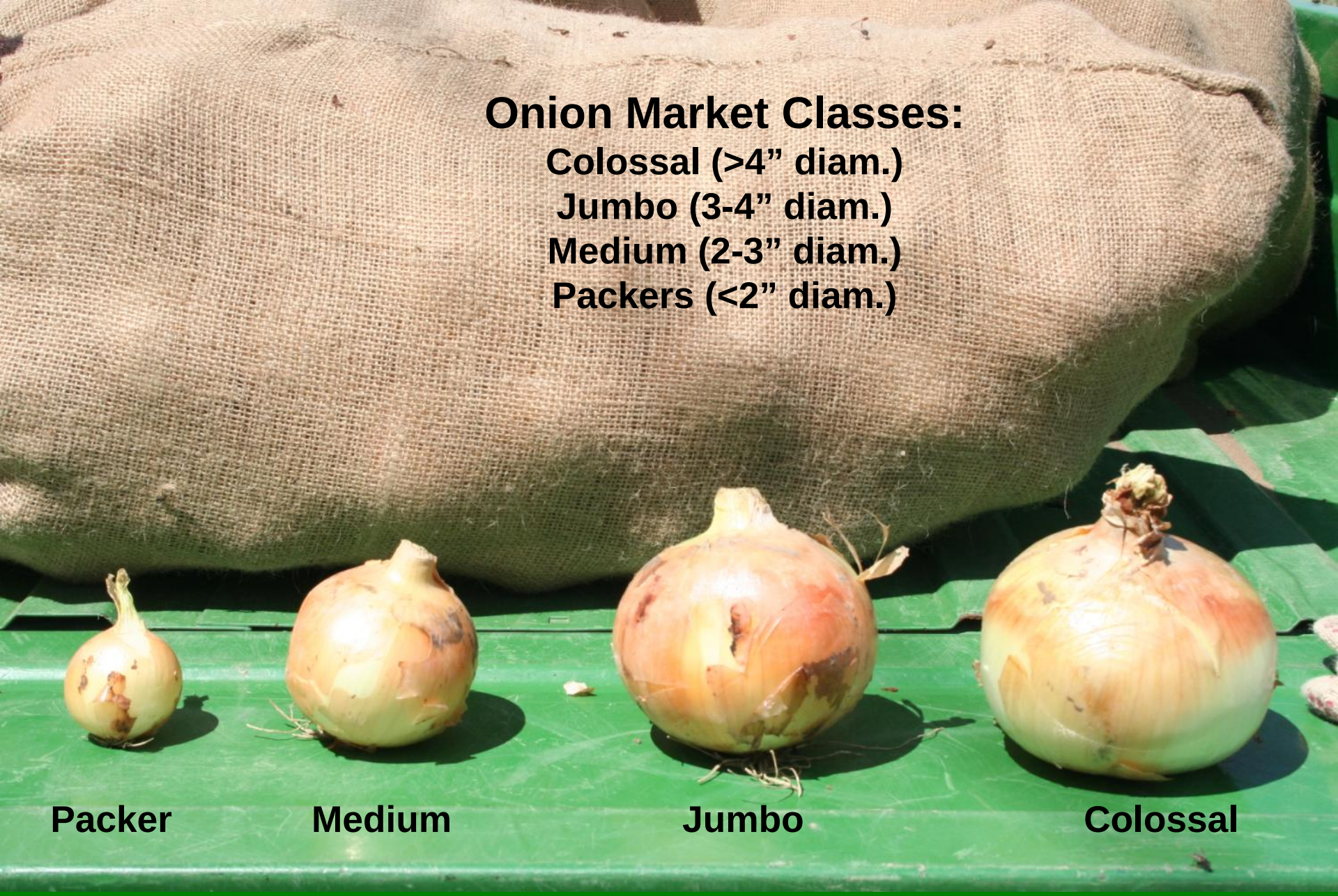

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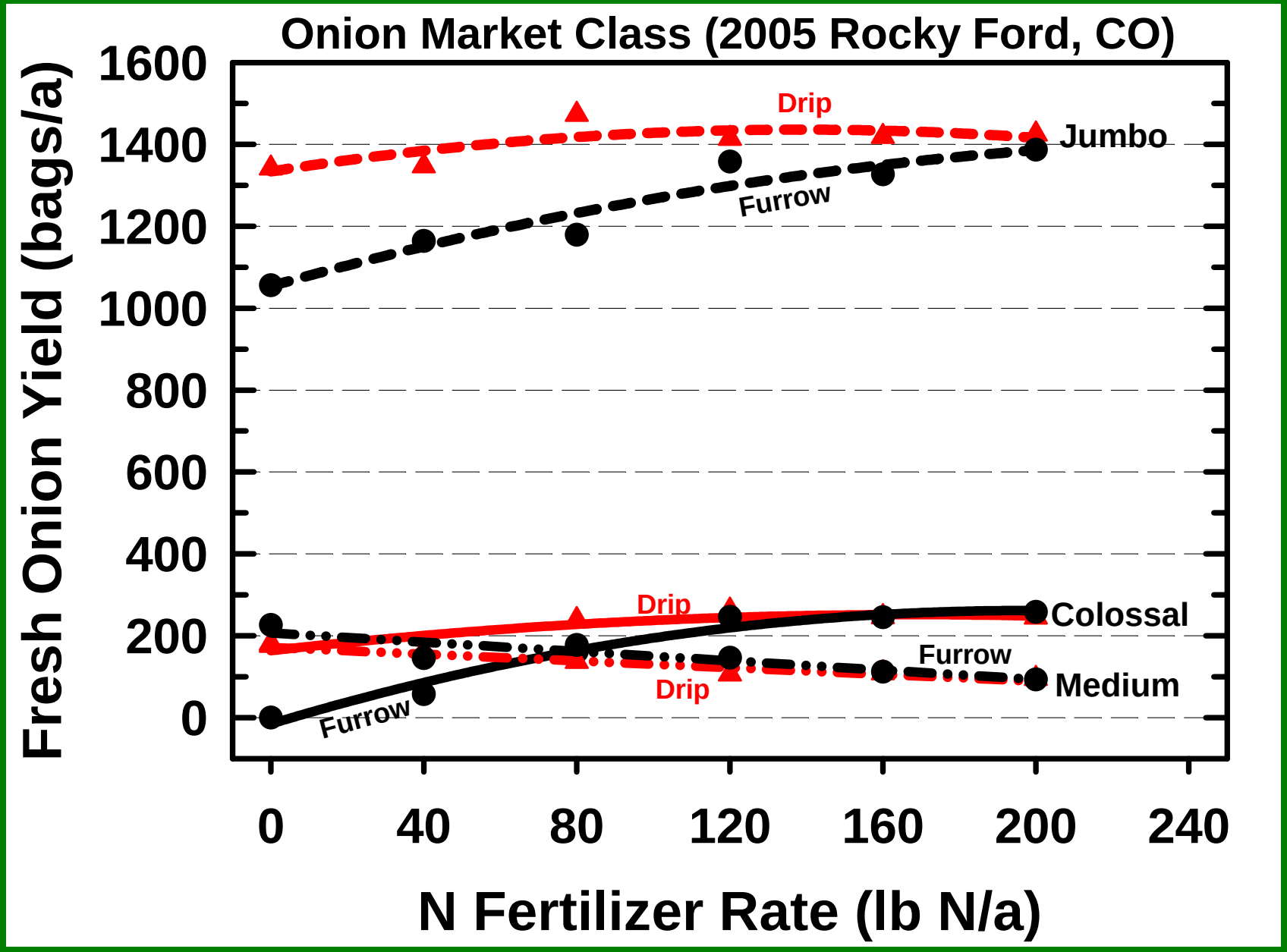

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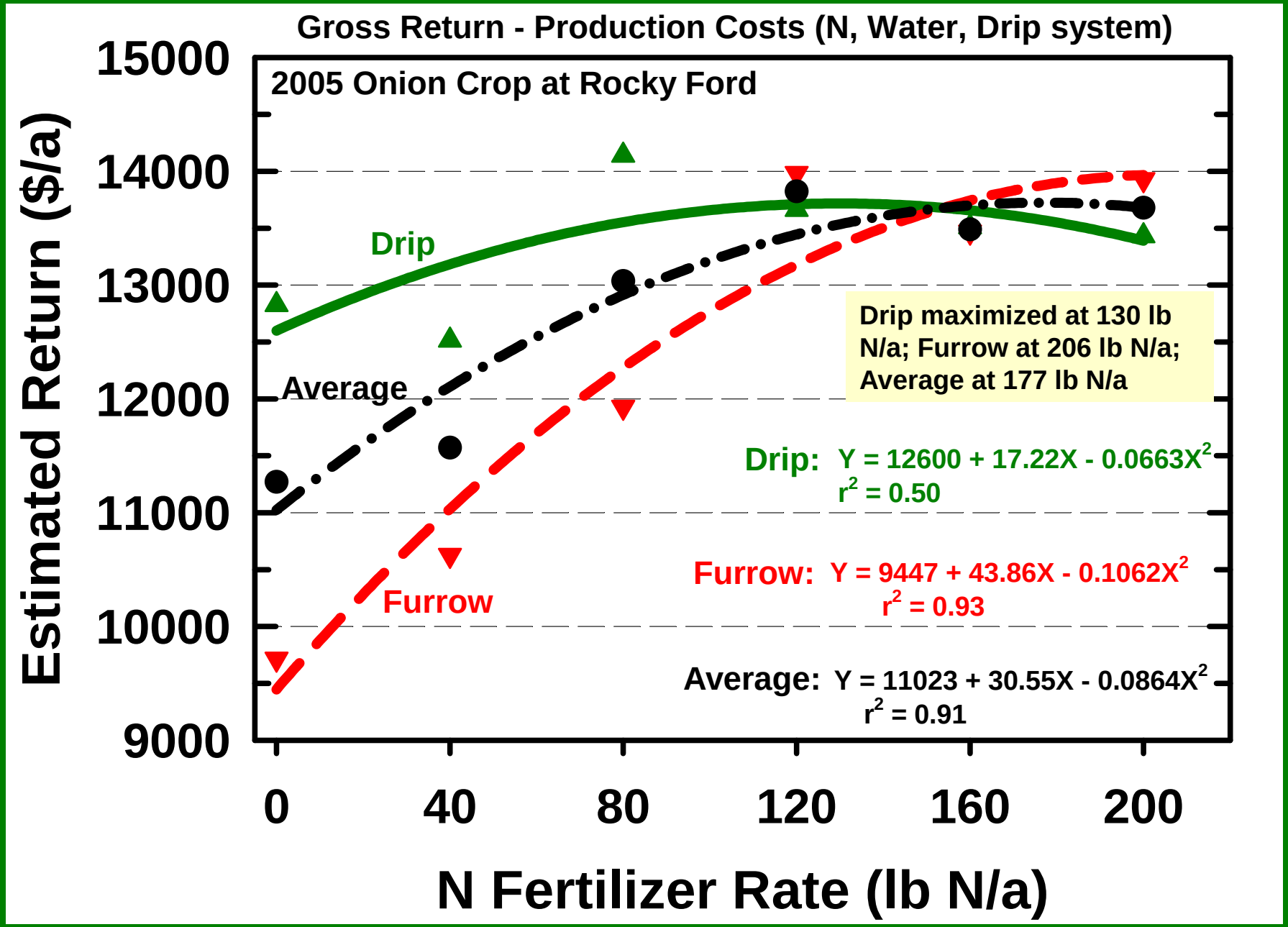

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2006 Nitrogen & Irrigation Onion Study at Rocky Ford (new plot area, soybean in 2005)

No significant response to N fertilization or N *x* irrigation interactions

Yield and Economics	Drip	Furrow	Difference Drip-Furrow
Total Marketable Onion Fresh Yield (cwt/a)	722.00	648.71	73.29
Colossal size onion (cwt/a)	8.92	0.77	8.15
Jumbo size onion (cwt/a)	603.61	394.83	208.78
Medium size onion (cwt/a)	159.47	253.11	- 93.64
Packers (discards) (cwt/a)	4.86	9.08	- 4.22
Total Gross Market Value ($/a)	$17,288	$13,547	$3,741
Colossal value ($/a) @$28/cwt	$ 250	$ 22	$ 228
Jumbo value ($/a) @$24/cwt	$14,487	$ 9,476	$5,011
Medium size value ($/a) @$16/cwt	$ 2,552	$ 4,050	-$1,498

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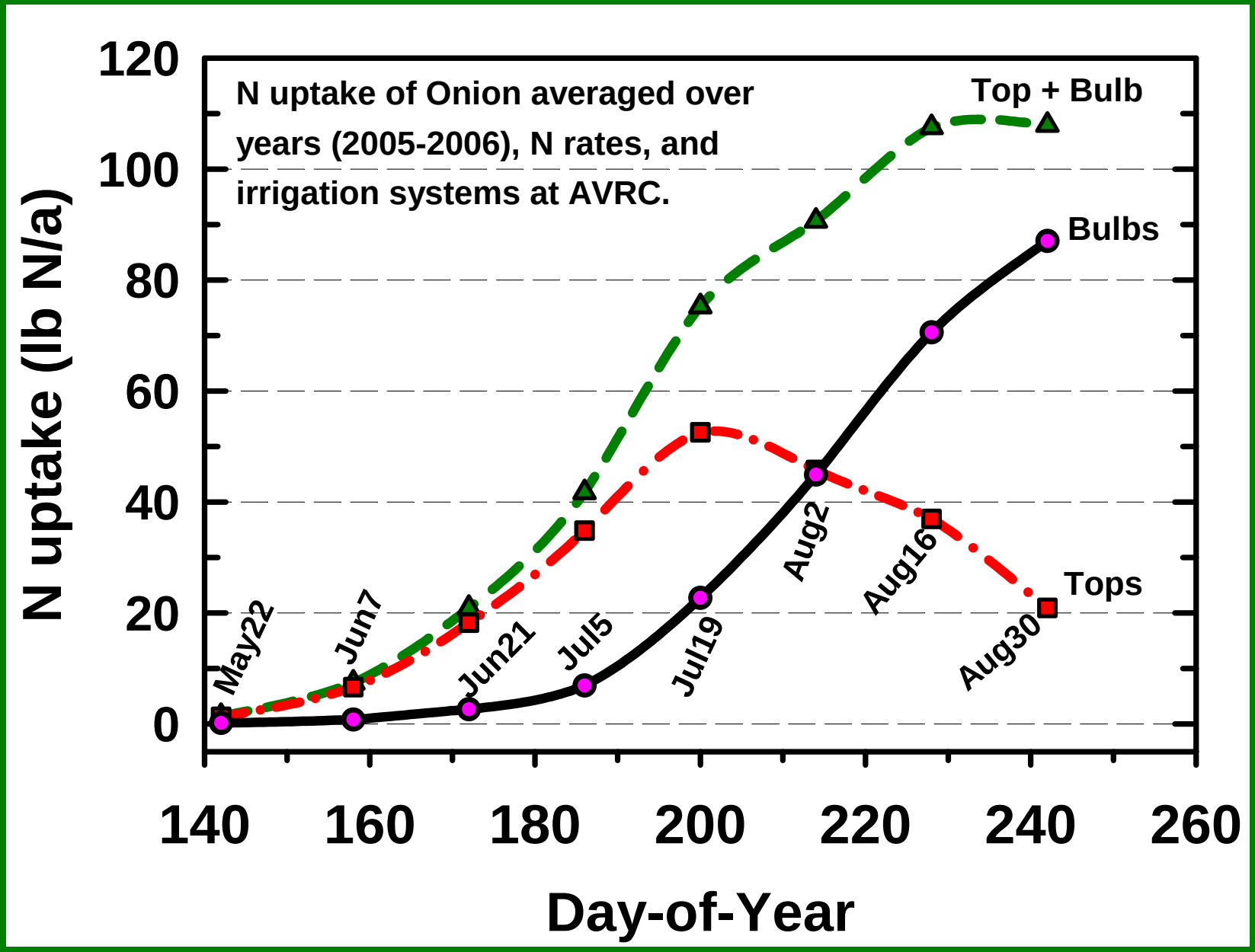

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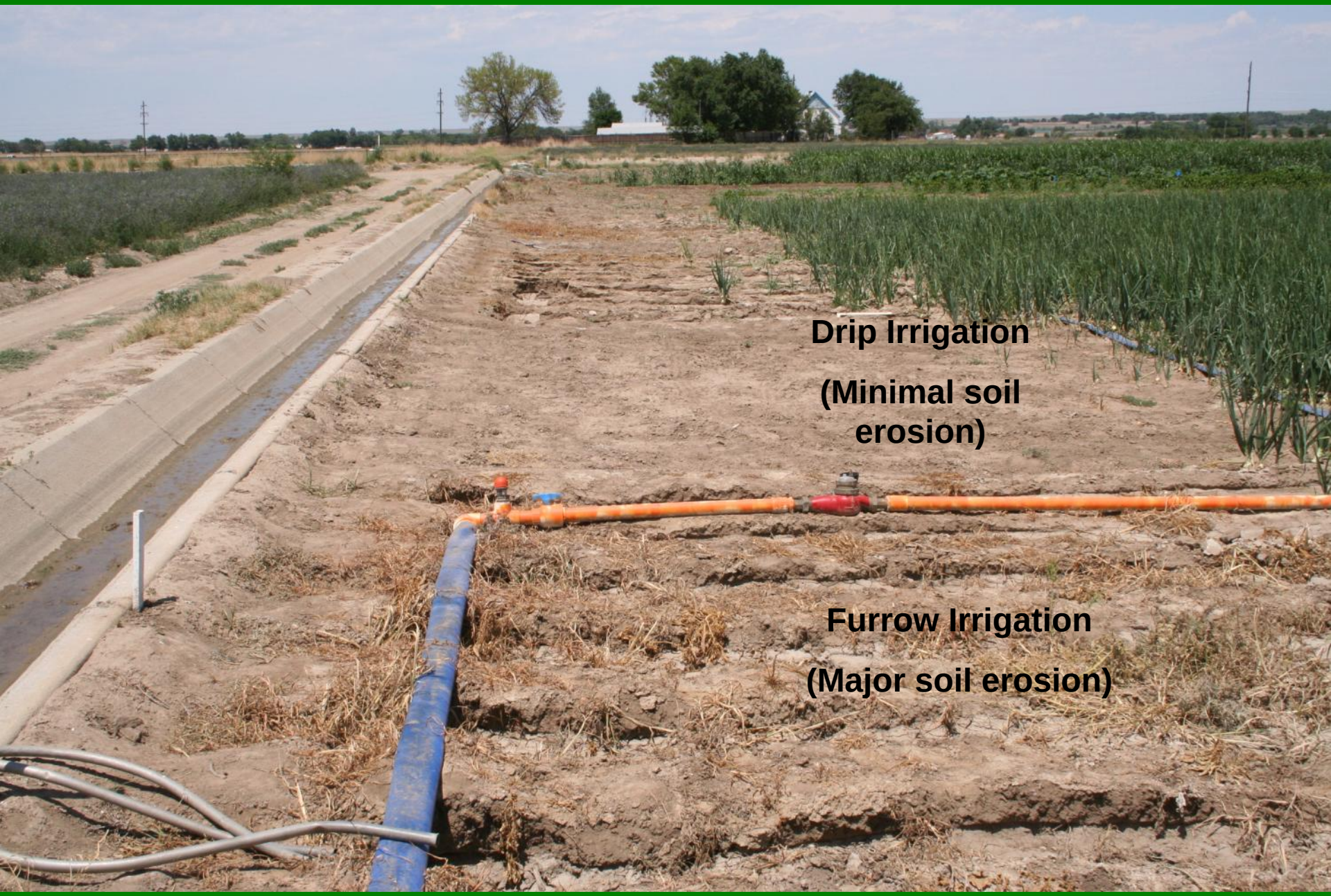

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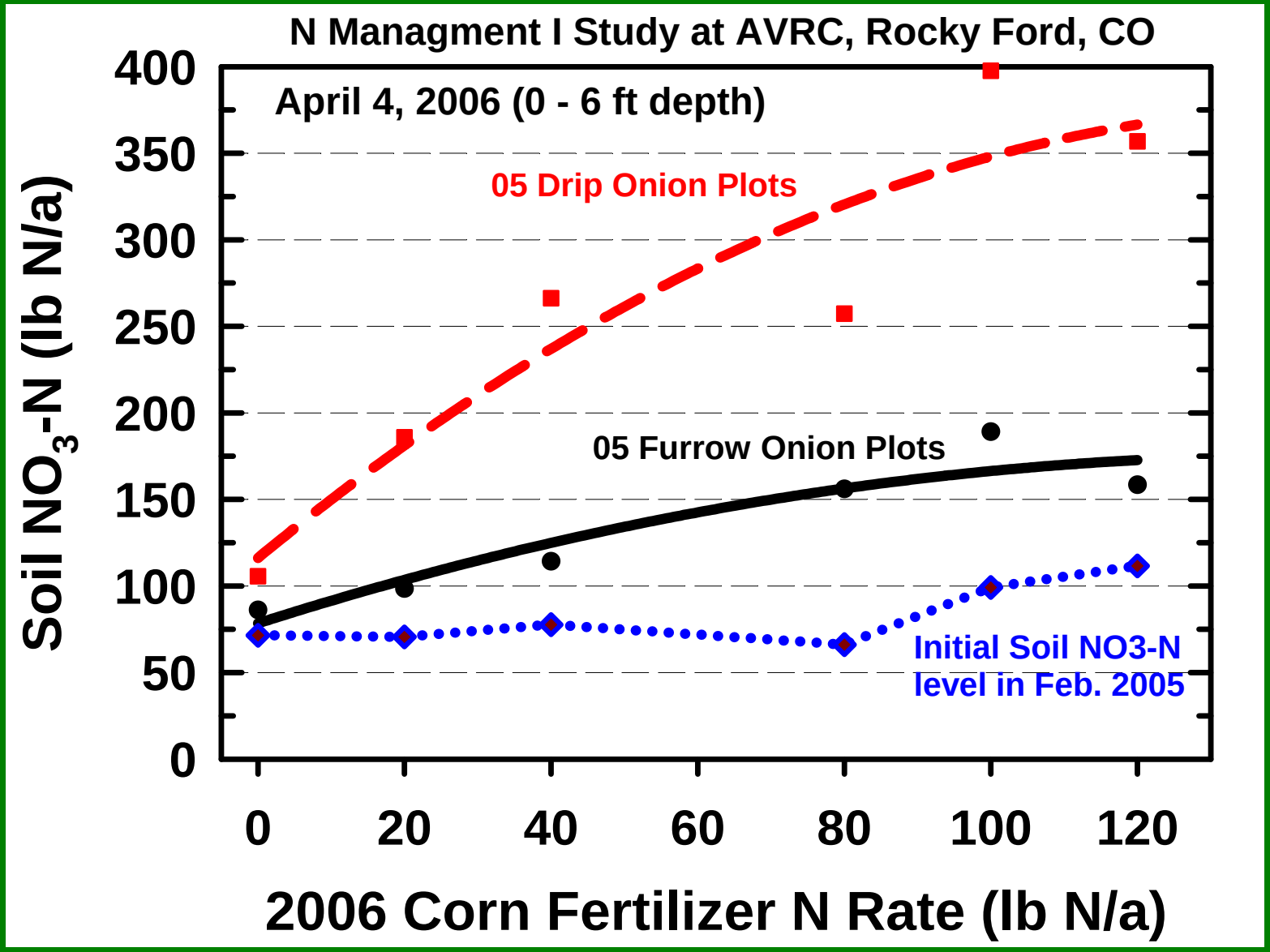
Corn in 2006 following 2005 Onion Study

Residual Soil N levels following Onion



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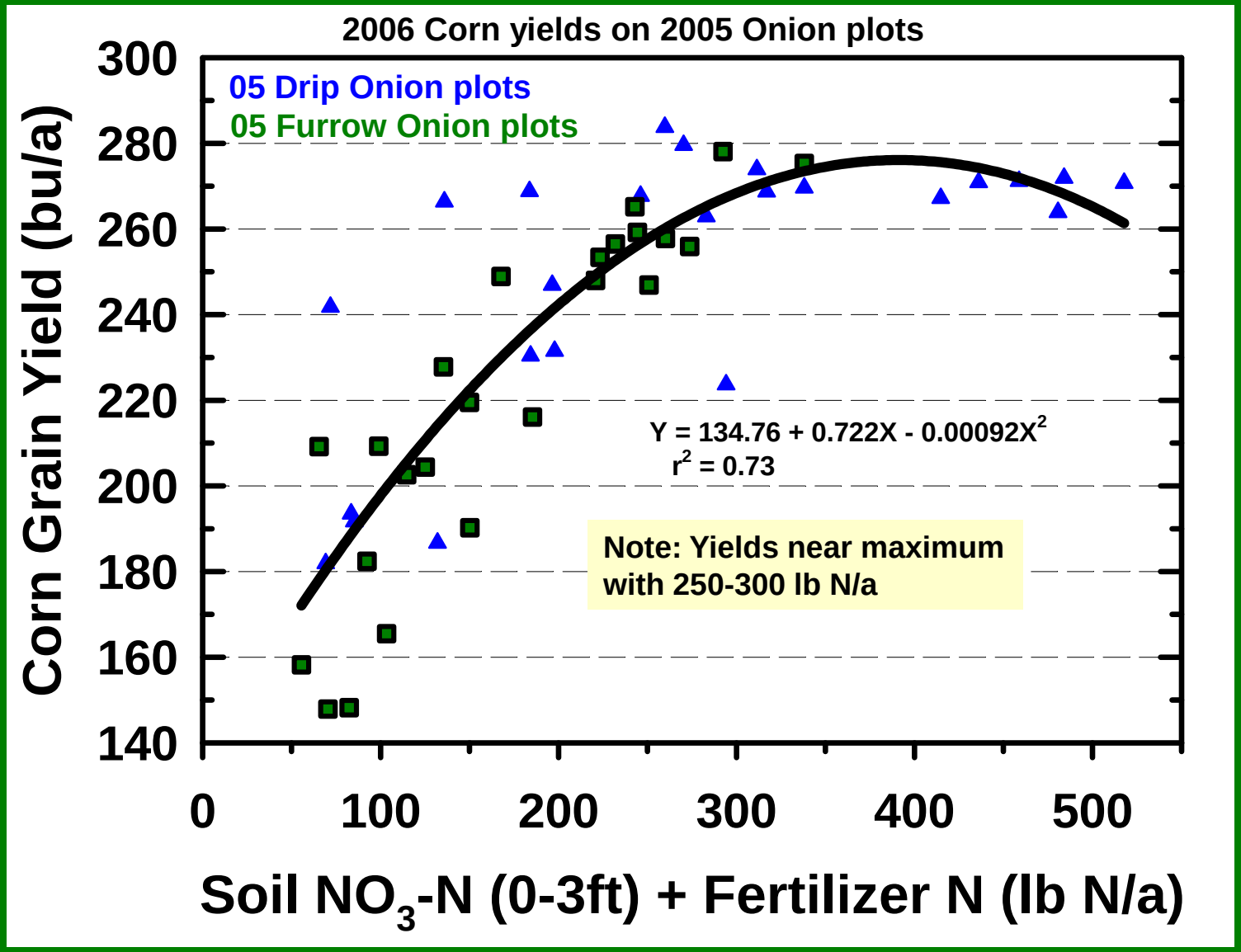

Corn was furrow irrigated in 2006

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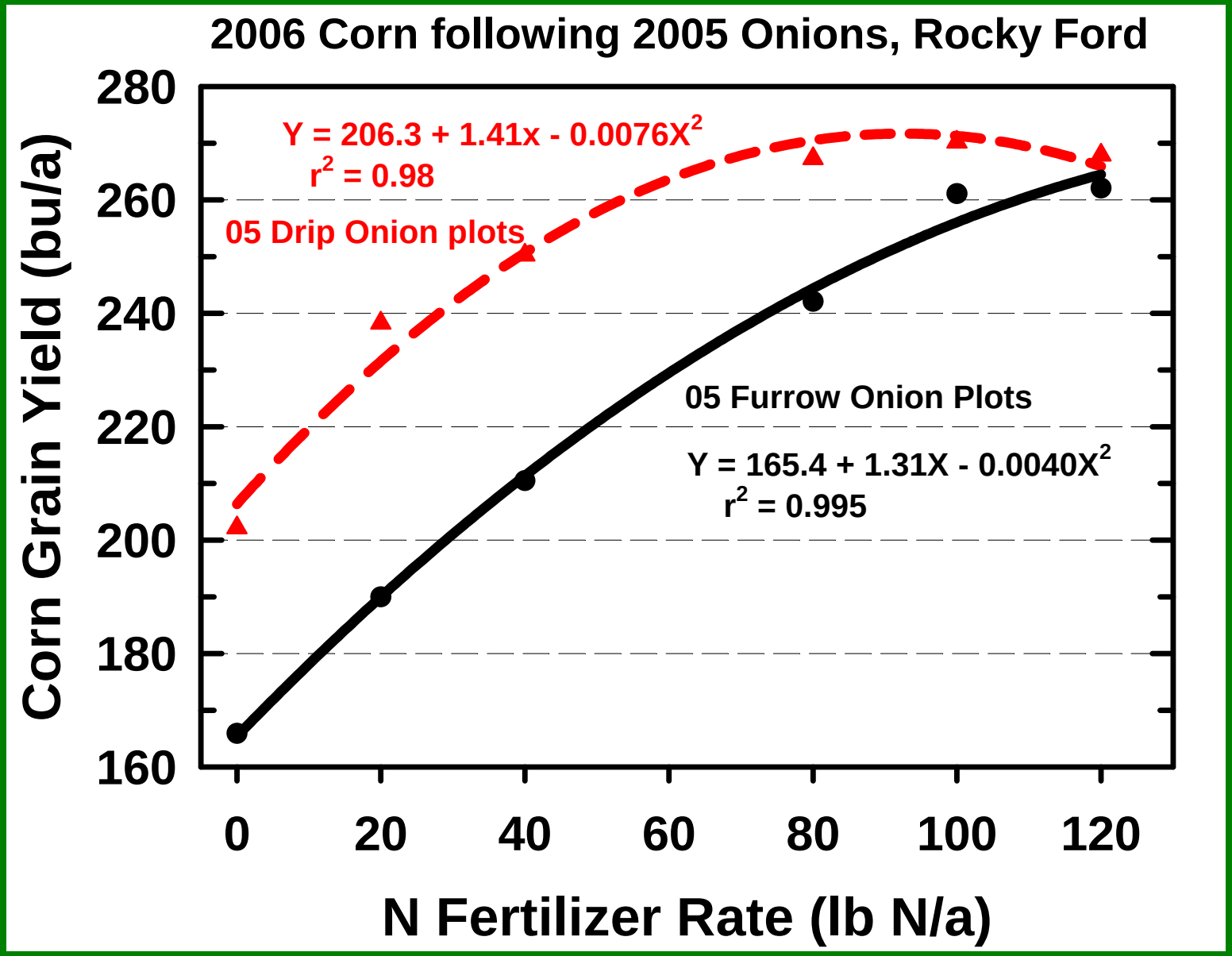

Note: 2006 Corn crop was furrow irrigated

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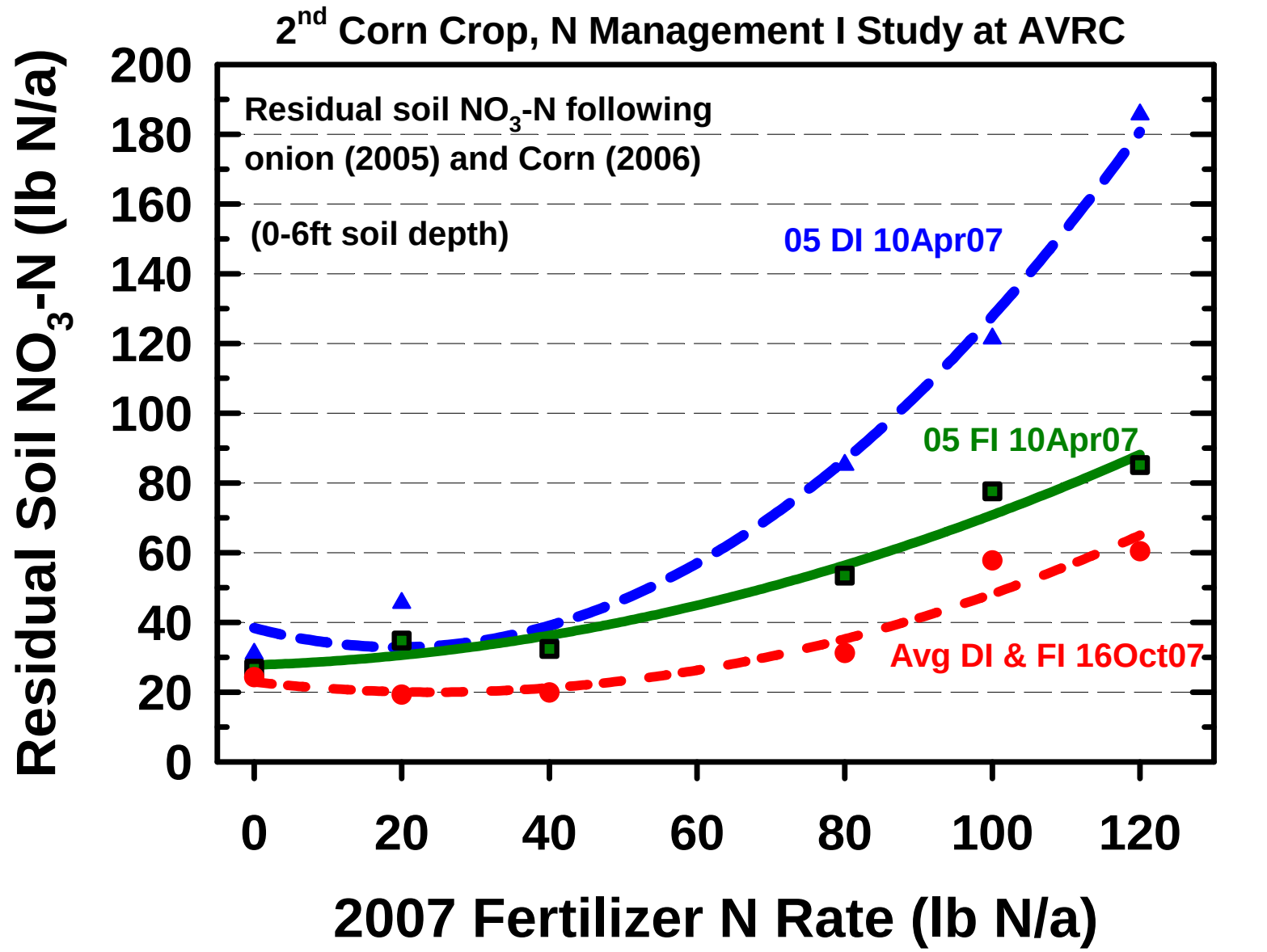
Residual Soil N following 2006 Corn crop and before fertilizing the 2007 corn crop and after harvest



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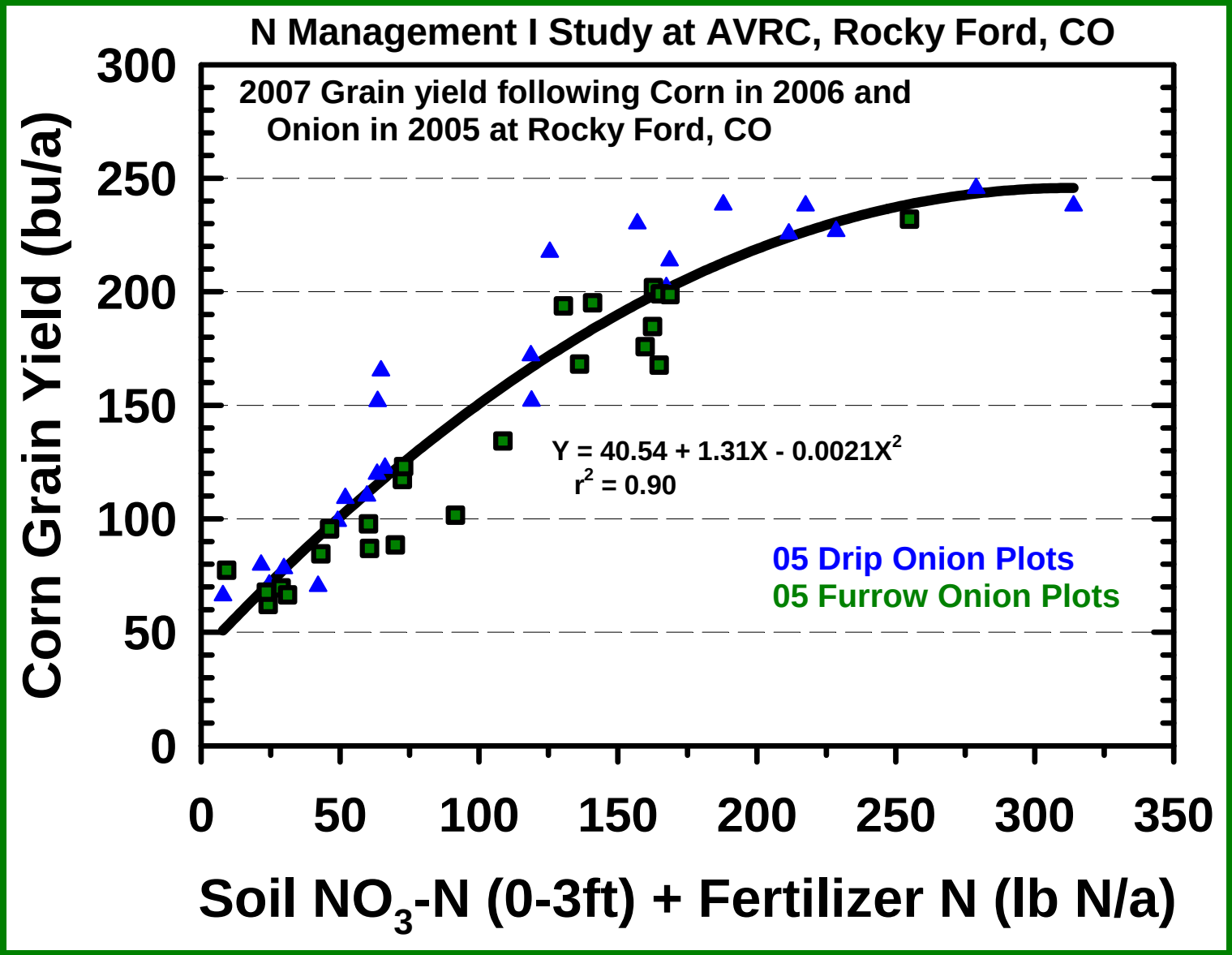

Corn was furrow irrigated in 2007

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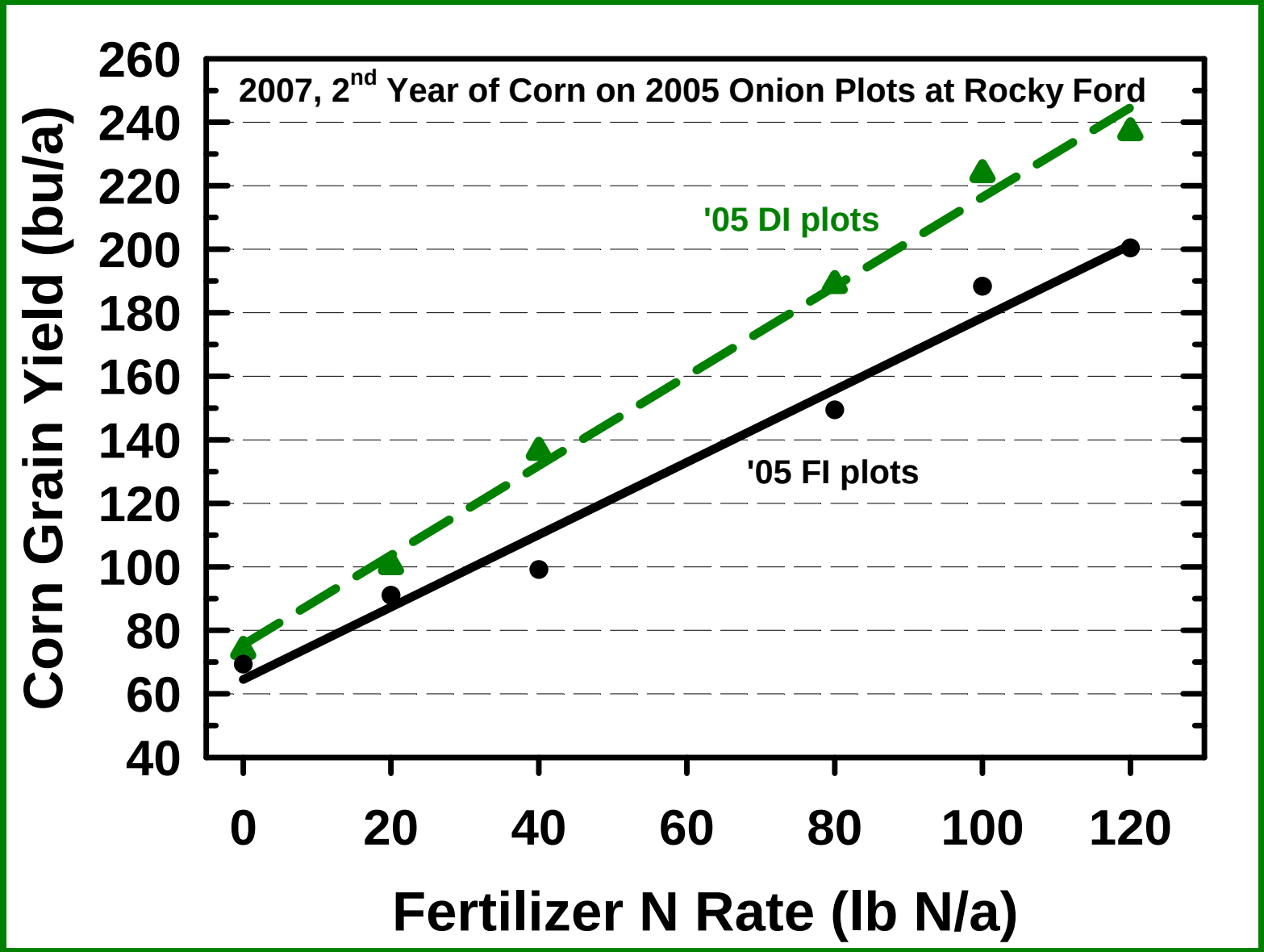
Grain yield of 2007 Corn crop (furrow irrigated)



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N Management I Study at AVRC, Rocky Ford, CO

		N Fertilizer Treatment					
Year	Crop	N1	N2	N3	N4	N5	N6
		N Removed in Harvested Portion of Crop, lb N/a					
2000	Corn	149.1	158.3	140.8	145.2	156.5	156.6
2001	Corn	95.2	107.7	111.9	118.3	123.9	124.7
2002	Corn	68.6	84.3	91.2	104.8	108.7	116.3
2003	Corn	72.9	92.9	118.2	125.9	129.2	143.3
2004	Chile Pepper	62.6	69.8	98.1	90.9	106.7	105.3
2005	Onion	90.3	87.4	100.6	116.9	111.6	117.3
2006	Corn	76.4	94.4	108.0	122.9	129.5	130.7
2007	Corn	48.8	65.4	72.8	112.18	151.18	165.2
Total N removed (8 crops)		663.9	760.2	830.6	937.3	1017.3	1059.4
Total N added, lb N/a		0	215	430	685	900	1115
N Fert. Use Efficiency			45%	39%	40%	39%	35%
Avg N Rate, lb N/a		0	26.9	53.8	85.6	112.5	139.4

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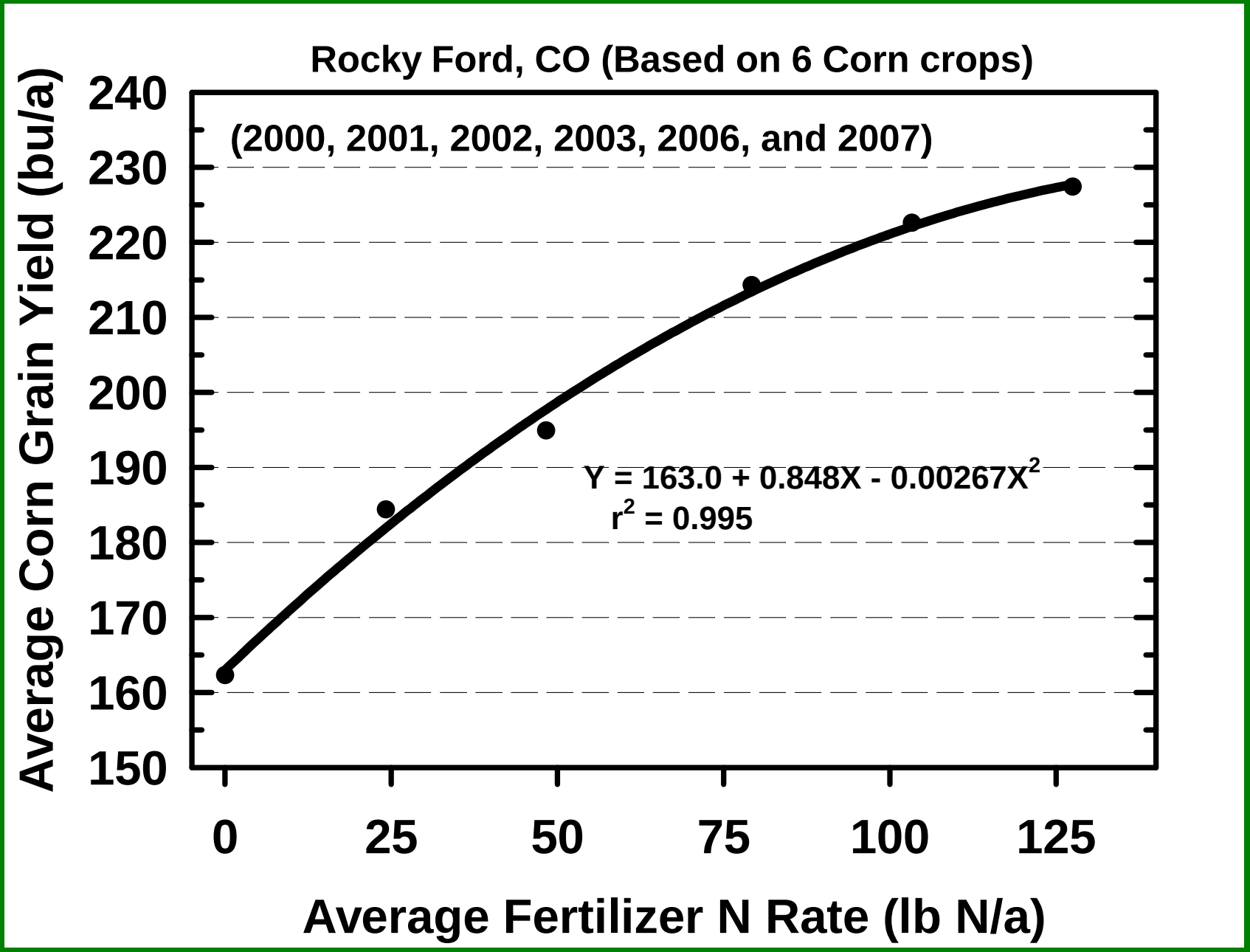

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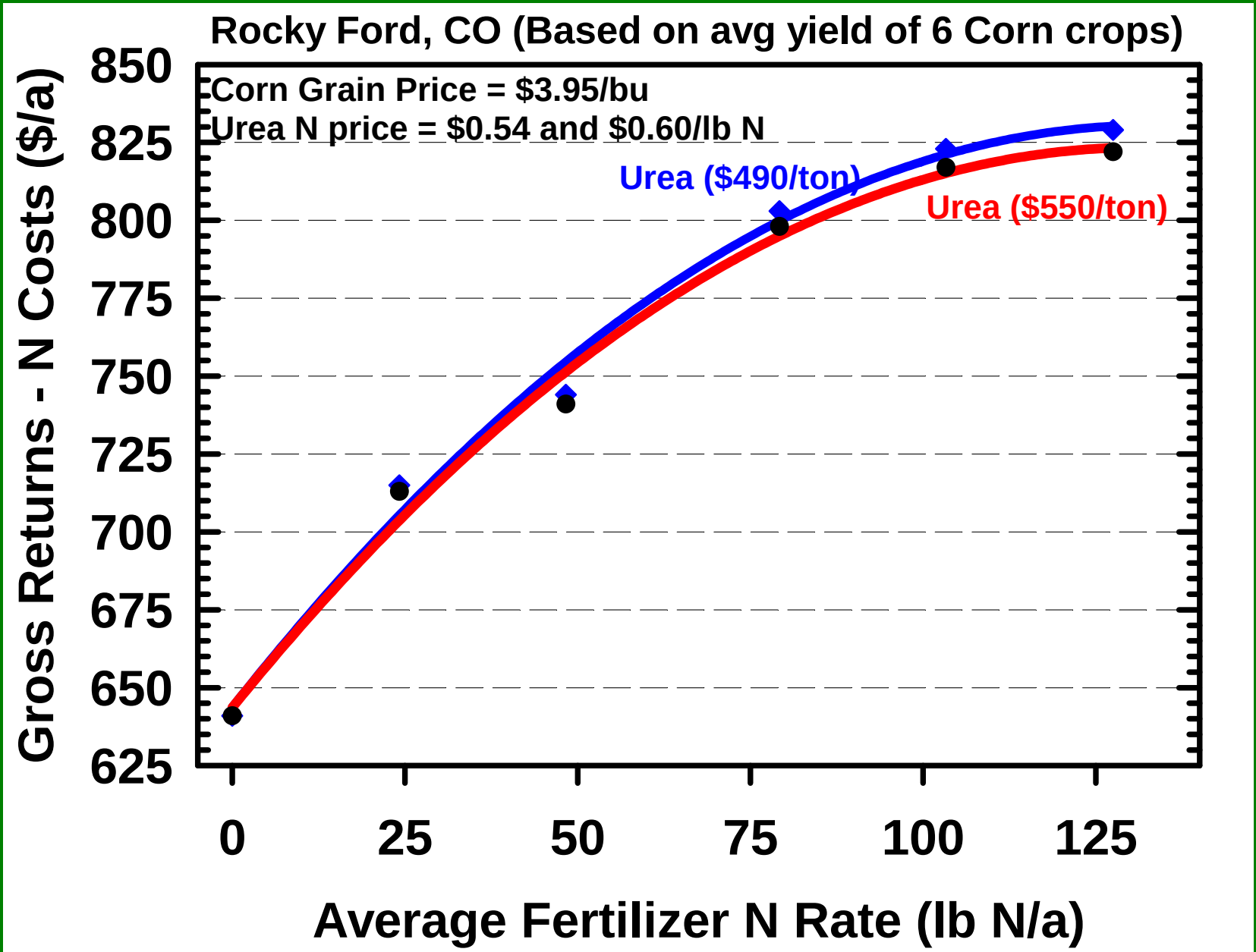

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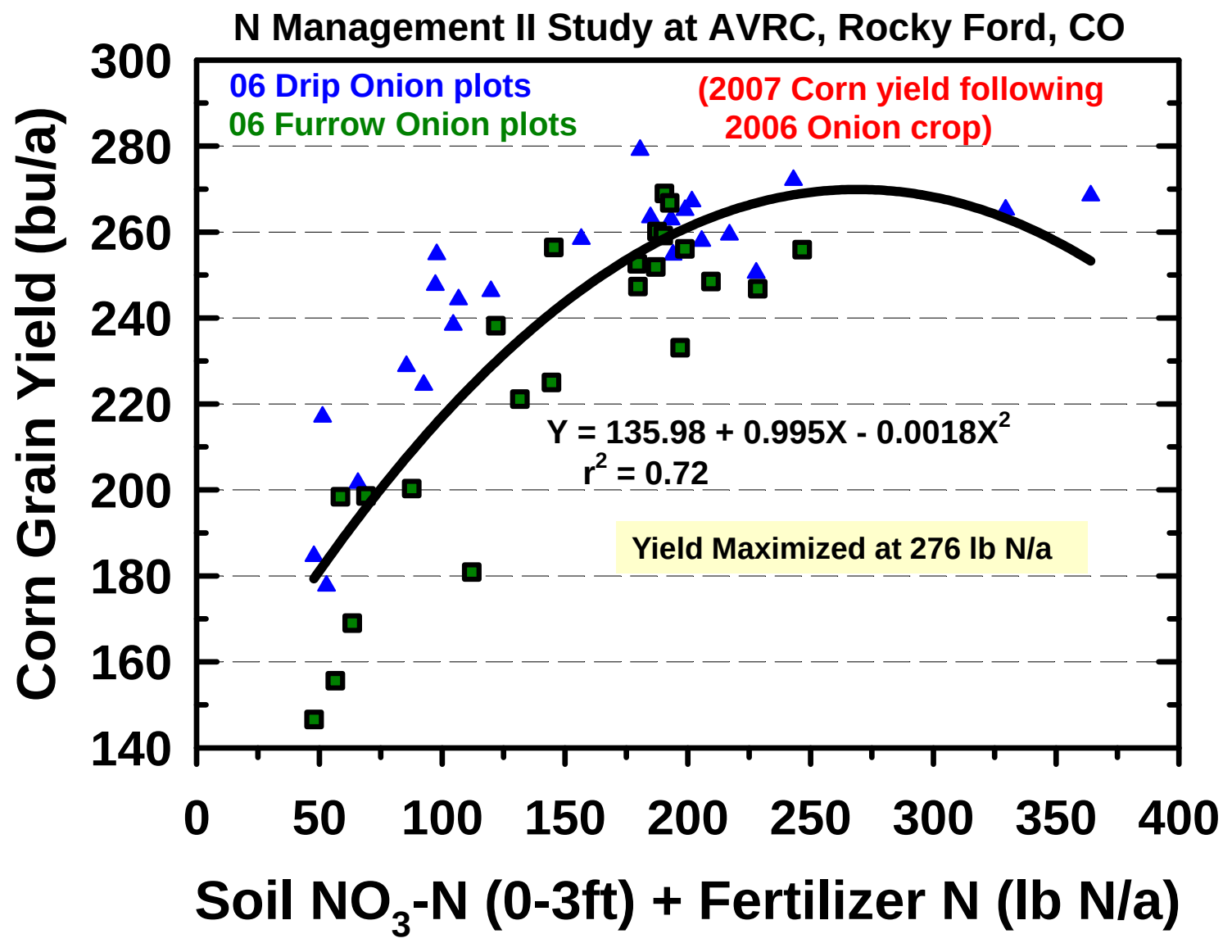
2007 Corn yields following 2006 Onion crop
(new N study initiated in 2006)



Corn was furrow irrigated in 2007

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Total N Needs of Corn:
Avg = 1.14 lb N/bu

Grain N Removal by Corn:
Avg = 0.69 lb N/bu

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Conclusions from Onion Studies

- Onion response to N fertilization was minimal following soybean.
- Drip Irrigation resulted in greater marketable onion yields and more large sized onions at lower N rates than the normal furrow irrigation system.
- Drip required less irrigation water.
- Drip irrigation appears to have an economic advantage over furrow irrigation.
- Drip irrigation resulted in less soil erosion.

Strategy Tips for N Management

- Use corn as a scavenger to recover unused fertilizer N applied to vegetable crops.
- Corn can reduce residual soil NO_3-N levels.
- Reduce N fertilizer rates applied to corn following onion based on soil test.
- Reduce rates of N applied to Onion.
- Delay N application to Onion crop until late-May and Chile Pepper until mid-June.
- Use polymer-coated urea (controlled release N fertilizers).
- Use drip irrigation on onion and other high cash value vegetable crops to get more efficient use of N by reducing N rates, and a reduction in water application.
- Soil Test for residual soil N before fertilizing.



Collecting Corn and Soil Samples from N Management Study at Rocky Ford


Thanks for Listening!!

Questions???

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