

# *Nitrogen Uptake by Organic Broccoli from a Legume/Cereal Mix Cover Crop\**

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# Question

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*What is the role of a legume/cereal mix cover crops in supplying nitrogen for organic broccoli in the first season following cover crop incorporation?*

# Two Experiments

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- **Trial 1:** Hartnell East Campus Research Facility in Salinas (April – July, 2006)
- **Trial 2:** Center for Agroecology and Sustainable Food System (CASFS) organic farm in University of California Santa Cruz (June – Sep. 2006)

# Trial 1: Experimental Design

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- Randomized block split design with four replicates.
  - Main plots (n=2): With or without a legume-mixed cover crop
    - 18% 'Cayuse' oats (*Avena sativa*); 38% Bell beans (*Vicia faba*); 20% 'Lana' wooly pod vetch (*Vicia villosa* spp. *dasycarpa*); and 25% 'Magnus' pea (*Pisum sativum*)
  - Split plots (n=4) Feather meal 0, 75, 150, and 225 lbs-N/acre

# Trial 1: Cultural Practices

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- 2/14/06: Cover crops tilled in
- 4/20: Feather meal application
- 4/21: Broccoli cv. Marathon transplanted
- 5/23: Mid growth plant sampling
- 6/30 & 7/05/06: Floret yield survey

# Indicators Measured

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- N in cover crop biomass (lbs-N/acre)
- Soil mineral N (0-12" deep weekly)
- Whole broccoli plant sampling (biomass and N content. 2 times)
- Floret yield (tons/acre)







With Cover Crop



Fert:

0

75 lbs/A

150  
lbs/A

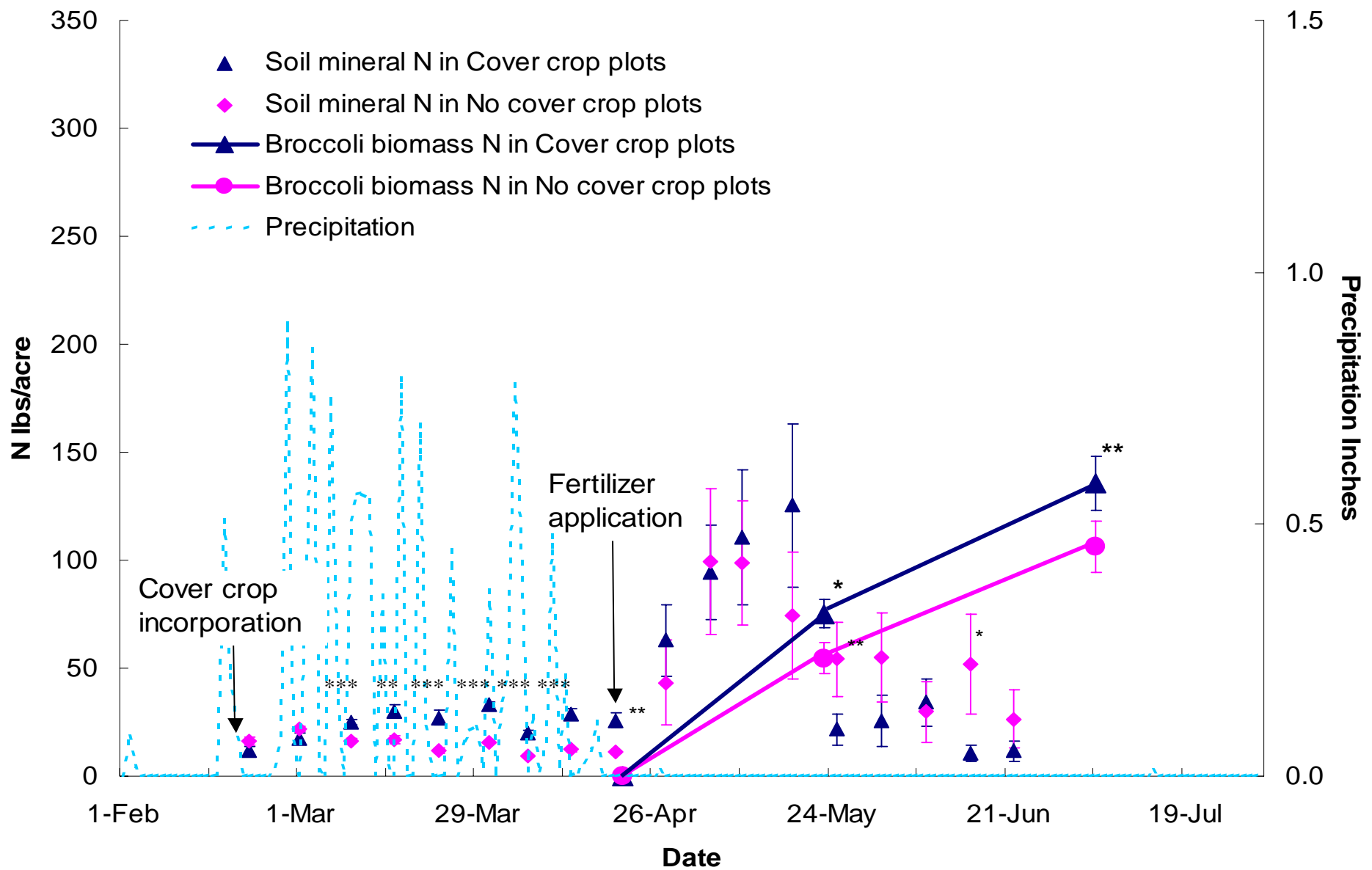
225  
lbs/A



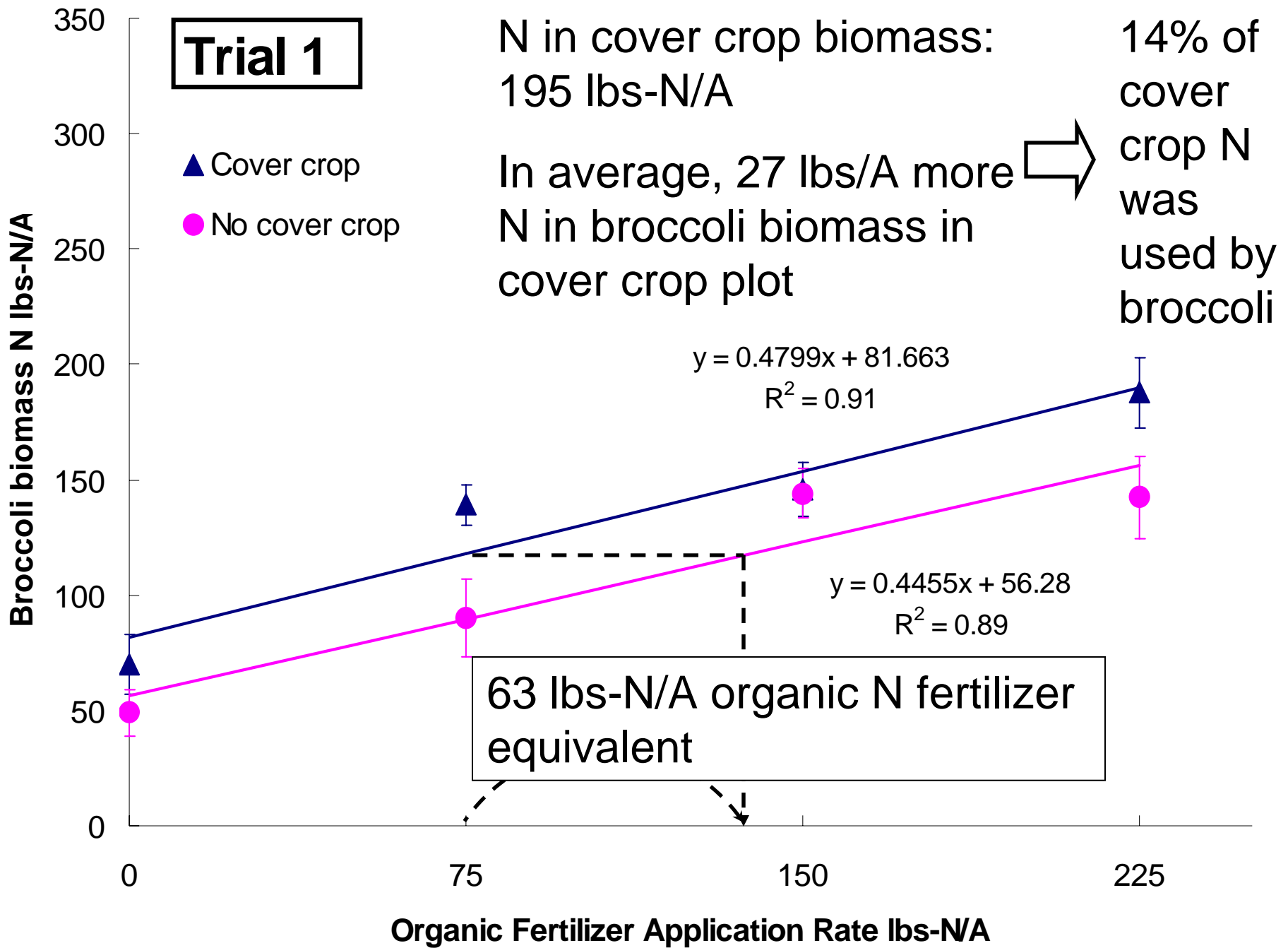
No Cover Crop

## Effects of Main Treatments on Broccoli Yield (Trial 1)

Cover Crop Treatments	Heads No./A	Heads T/A	Mean Head (lb)
No Cover Crop	30,563 a	3.96 a	0.22 a
Cover Crop	39,205 b	5.50 b	0.27 b
<i>ANOVA (P)</i>	<i>0.007**</i>	<i>0.007**</i>	<i>0.052<sup>†</sup></i>
Fertilizer Treatments Lbs-N/A			
0	15,812 a	1.50 a	0.15 a
75	34,990 ab	4.05 a	0.24 ab
150	42,473 b	6.04 b	0.28 b
225	46,262 b	7.34 c	0.32 b
<i>ANOVA (P)</i>	<i>0.001***</i>	<i>0.000***</i>	<i>0.000***</i>



Changes in Soil Mineral N (0-12" deep), Broccoli Biomass N, and Precipitation Amount during the Broccoli Production Cycle (Trial 1)



# Trial 2: Experimental Design

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- Randomized complete block design with four replicates.
  - Cover crop (n=2): With and without a legume mixed cover crops
    - 4% 'Cayuse' oats (*Avena sativa*); 48% Bell beans (*Vicia faba*); and 48% 'Lana' wooly pod vetch (*Vicia villosa* ssp. *dasycarpa*)
  - Organic fertilizer (n=4): 0, 75, 150, and 225 lbs-N/A w/ feather meal (pre-plant; 67%) and blood meal (supplement; 33%)

# Trial 2: Cultural Practices

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- 5/15/06: Cover crops tilled in
- 6/15: Preplant fertilizer application
- 6/21: Broccoli cv. BOS 1095 direct seeded to 3" spacing.
- 7/10: Thinning to 9" spacing
- 7/25 Supplemental organic N fertilizer application
- 9/19/06: Floret yield survey

# Indicators Measured

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- N in cover crop biomass (lbs-N/acre)
- Soil mineral N (0-12" and 12-24" deep weekly)
- Whole broccoli plant sampling (biomass and N content. 3 times)
- Floret yield (tons/acre)







09.19.2006

No Cover Crop

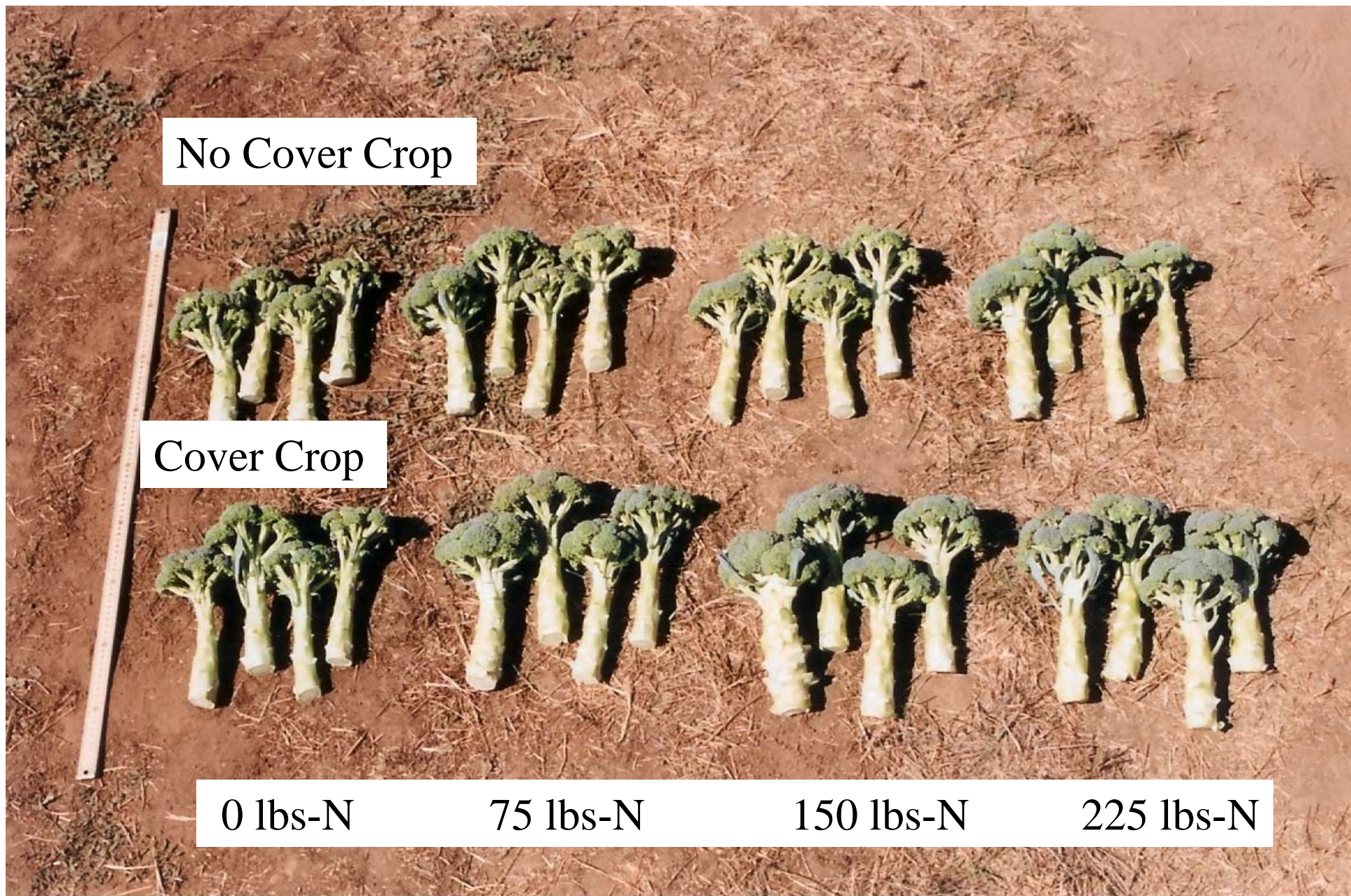
Cover Crop

0 lbs-N

75 lbs-N

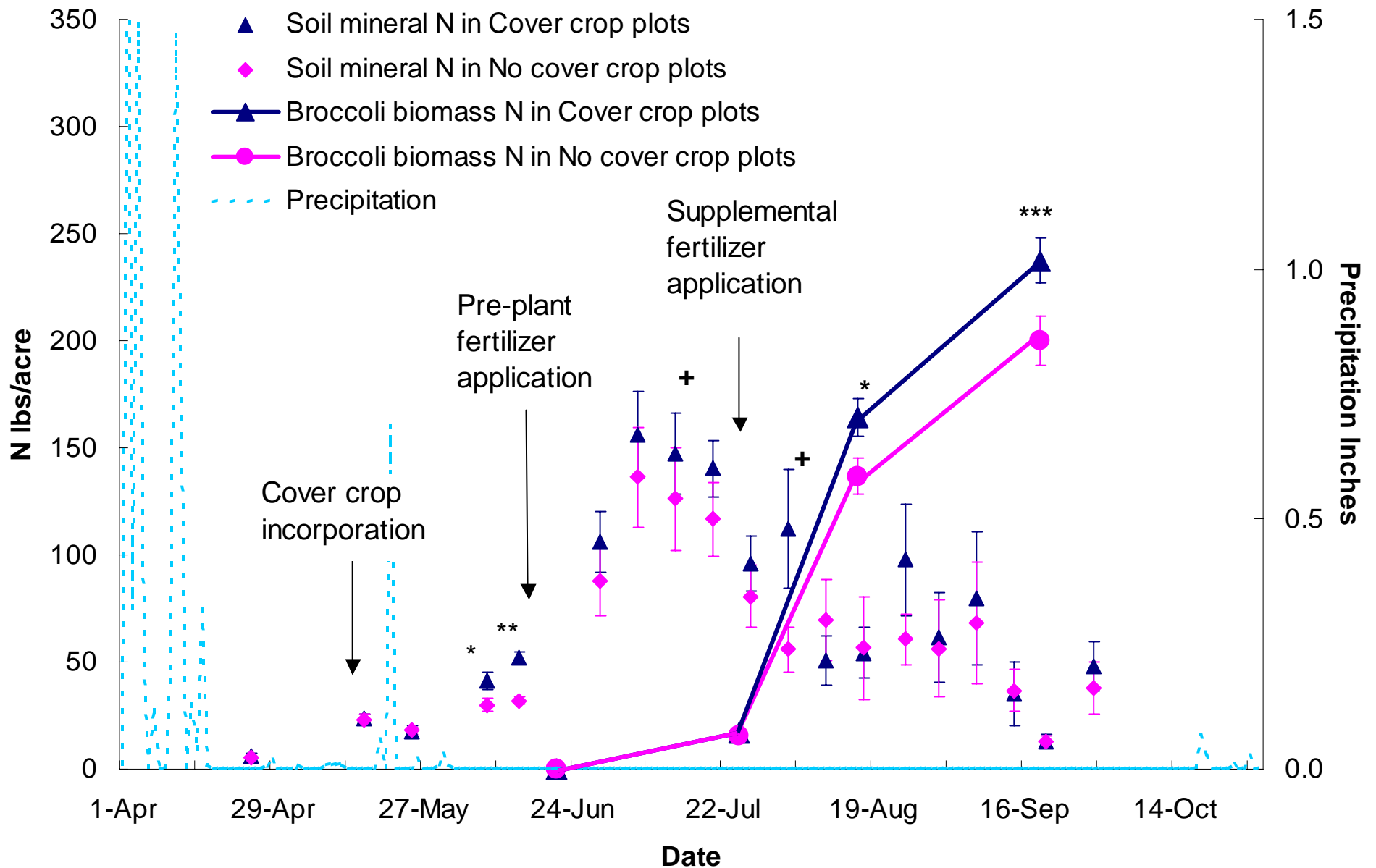
150 lbs-N

225 lbs-N

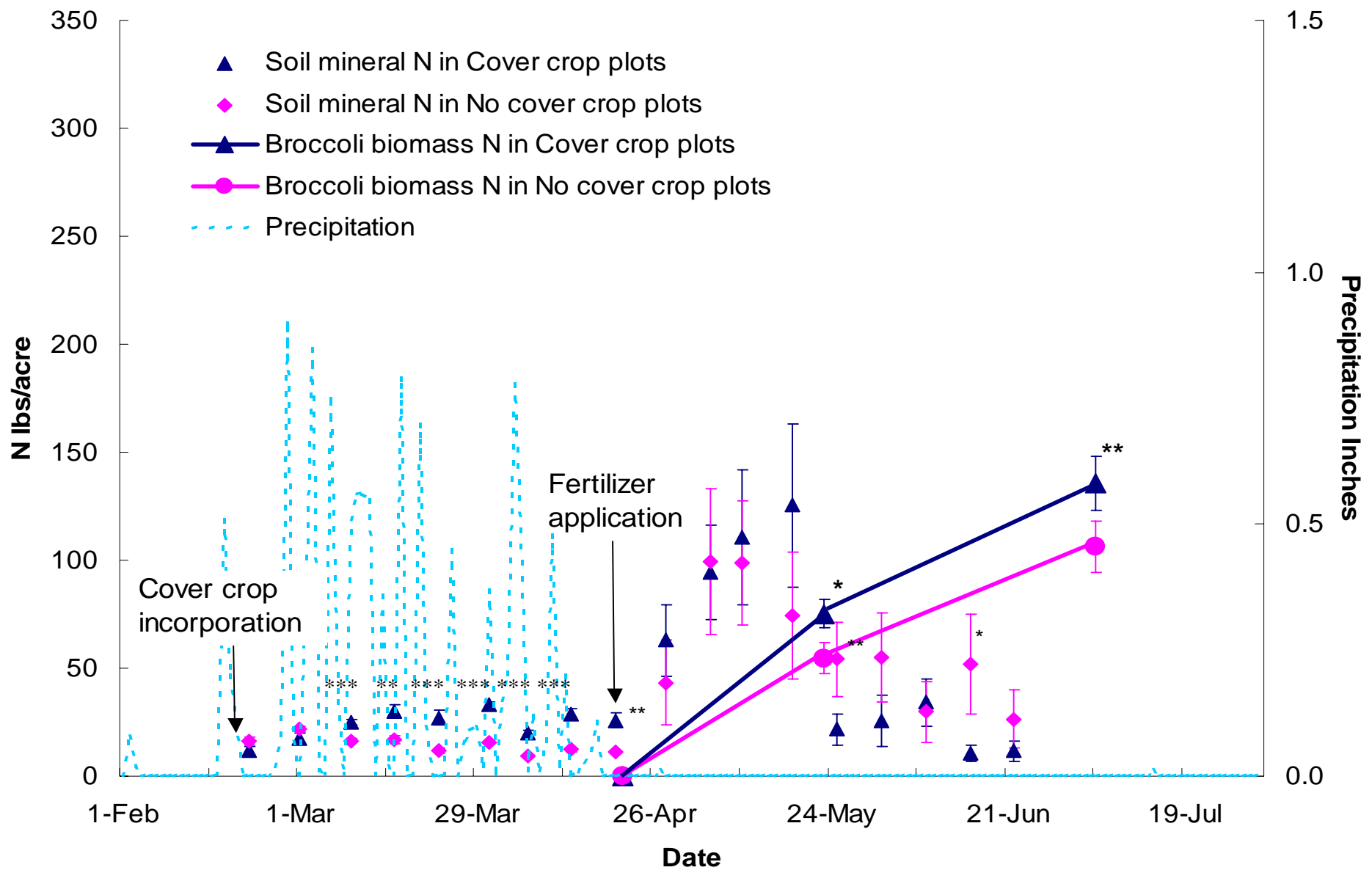


## Effects of Main Treatments on Broccoli Yield (Trial 2)

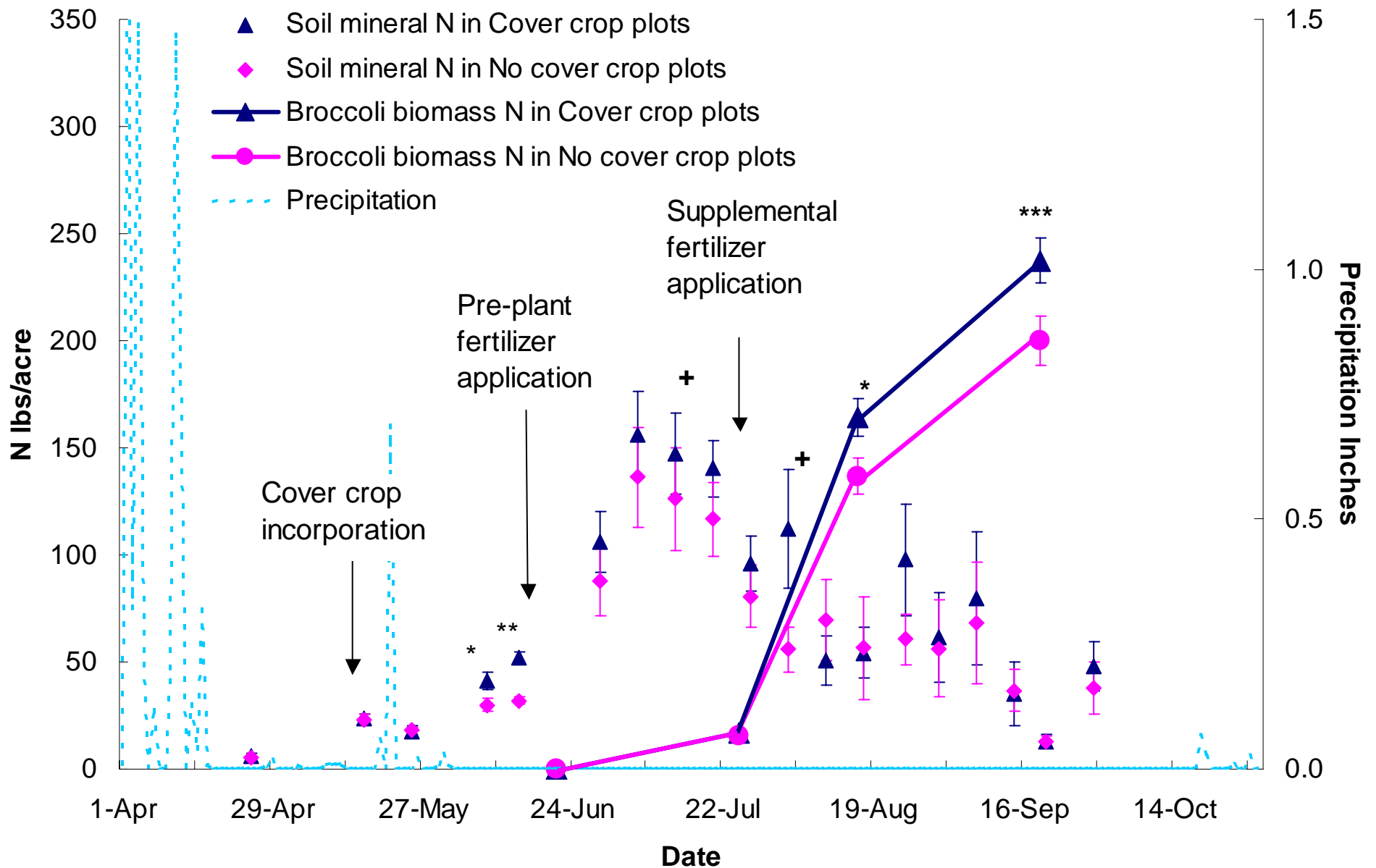
Cover Crop Treatments	Heads No./A	Heads T/A	Mean Head (lb)
No Cover Crop	32,740	8.25 a	0.56 a
Cover Crop	32,556	9.31 b	0.63 b
<i>ANOVA (P)</i>	<i>0.88</i>	<i>0.0036**</i>	<i>0.011*</i>
Fertilizer Treatments Lbs-N/A			
0	32,095	6.90 a	0.48 a
75	31,726	8.24 b	0.58 b
150	32,463	9.57 c	0.65 b
225	34,308	10.4 c	0.67 b
<i>ANOVA (P)</i>	<i>0.47</i>	<i>0.0000***</i>	<i>0.0001***</i>



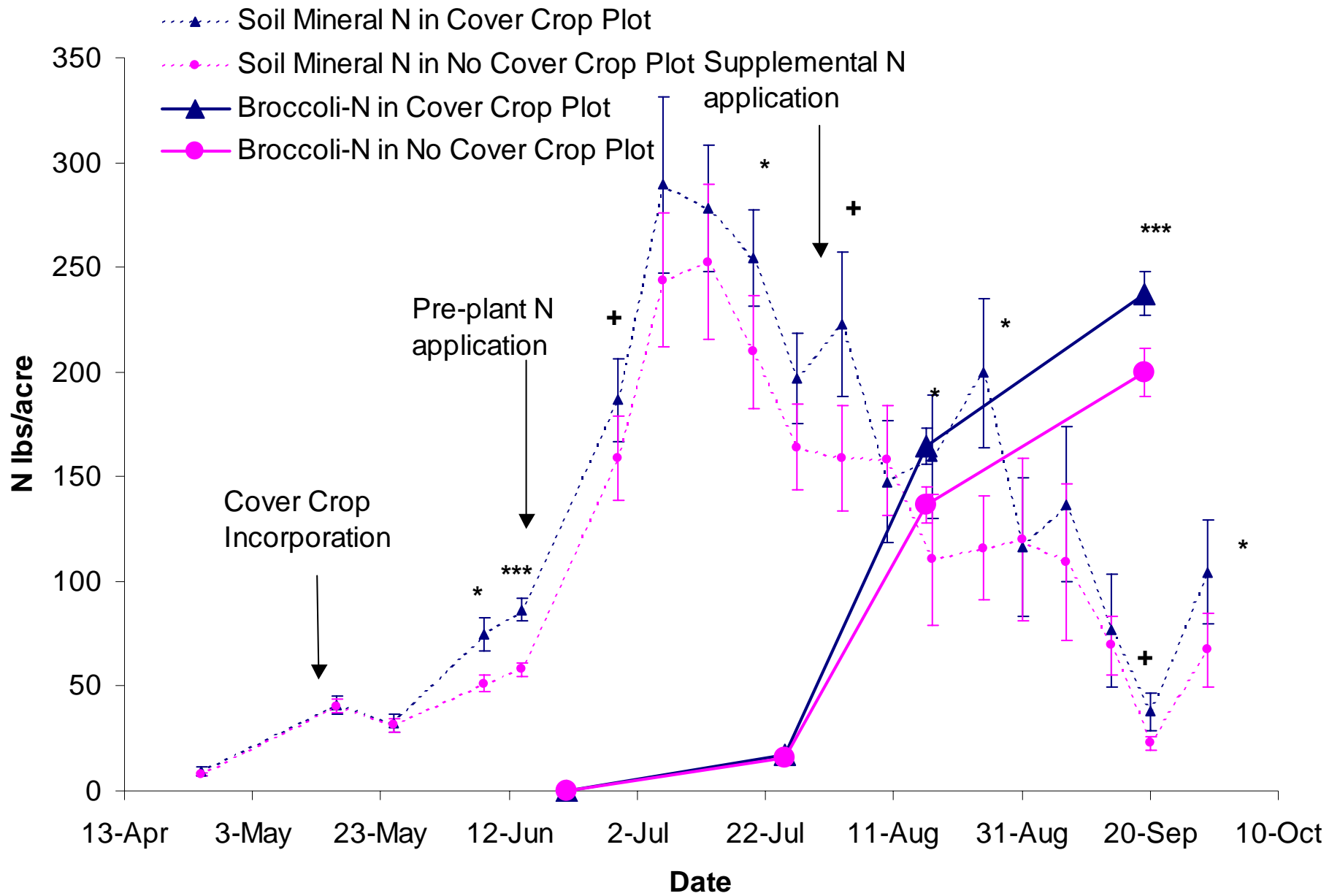
Changes in Soil Mineral N (0-12" deep), Broccoli Biomass N, and Precipitation Amount during the Broccoli Production Cycle (Trial 2)



Changes in Soil Mineral N (0-12" deep), Broccoli Biomass N, and Precipitation Amount during the Broccoli Production Cycle (Trial 1)

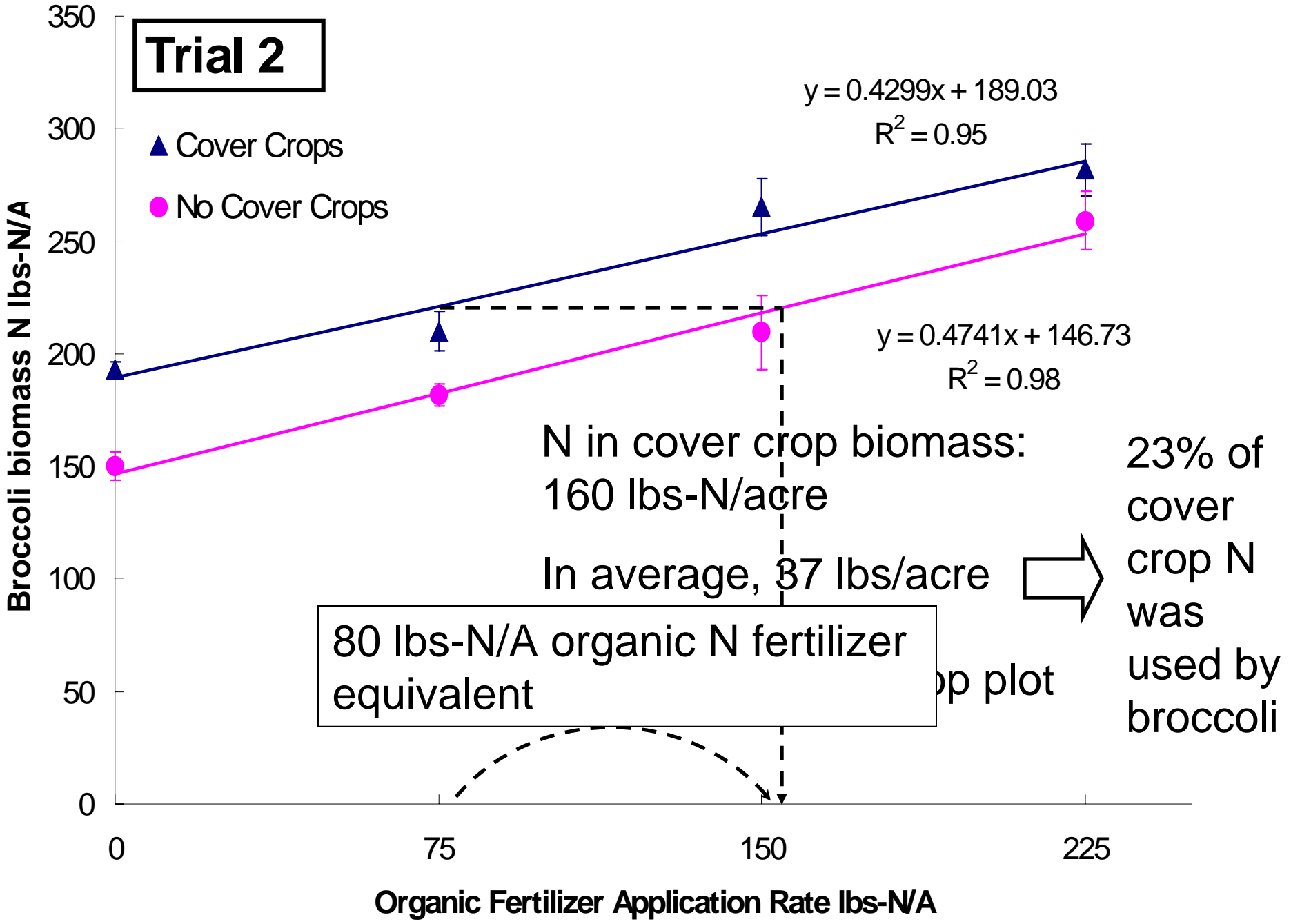


Changes in Soil Mineral N (0-12" deep), Broccoli Biomass N, and Precipitation Amount during the Broccoli Production Cycle (Trial 2)



Changes in Soil Mineral N (0-24" deep) and Broccoli Biomass N (Trial 2)

# Trial 2





# Conclusions

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- The yield of broccoli was higher in the cover crop treatment in both trials.
- In the Salinas trial (Trial 1), due to high rainfall between cover crop incorporation and transplanting broccoli, a sizeable proportion of cover crop nitrogen was probably lost due to leaching.

# Conclusions

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- In the UCSC trial (Trial 2), there was generally higher mineral nitrogen in the soil in cover crop vs. no cover crop plots in the 0 - 24 inch depth following incorporation throughout the broccoli production cycle.

# Conclusions

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- A 14-23% of cover crop N was utilized by the successive broccoli crop in two trials.
- Overall, the cover crop increased the nitrogen content of the broccoli crop at harvest by 27 to 37 lbs-N/A, which was the equivalent of 60 to 80 lbs/A of applied organic nitrogen fertilizer across two trials.