

Growth Rate of Lettuce: Implications for Nitrogen Fertilization

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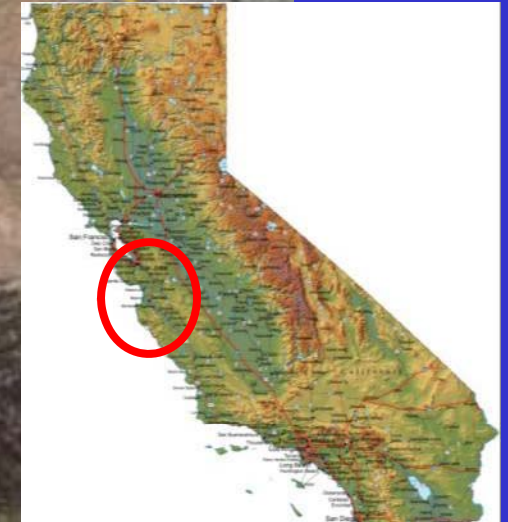
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Salinas Valley

Cool Season Vegetable Production in Summer

Monterey Bay
11-13 °C

Cooler in
the north



Warmer in
the south

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36°23'03.28" N 121°16'25.98" W

elev 207 ft

Eye alt 77.29 mi

Background on Nitrogen Fertilization of Lettuce in the Salinas Valley

- There are typically two crops of lettuce grown during the growing season (January to October/November)



Uptake of Nitrogen

Two Planting Configurations

2 rows on 1-meter beds



112–134 kg N/Ha

5-6 rows on 2-meter beds



134–157 kg N/Ha

Irrigation Impacts on Leaching and Nitrogen Use Efficiency

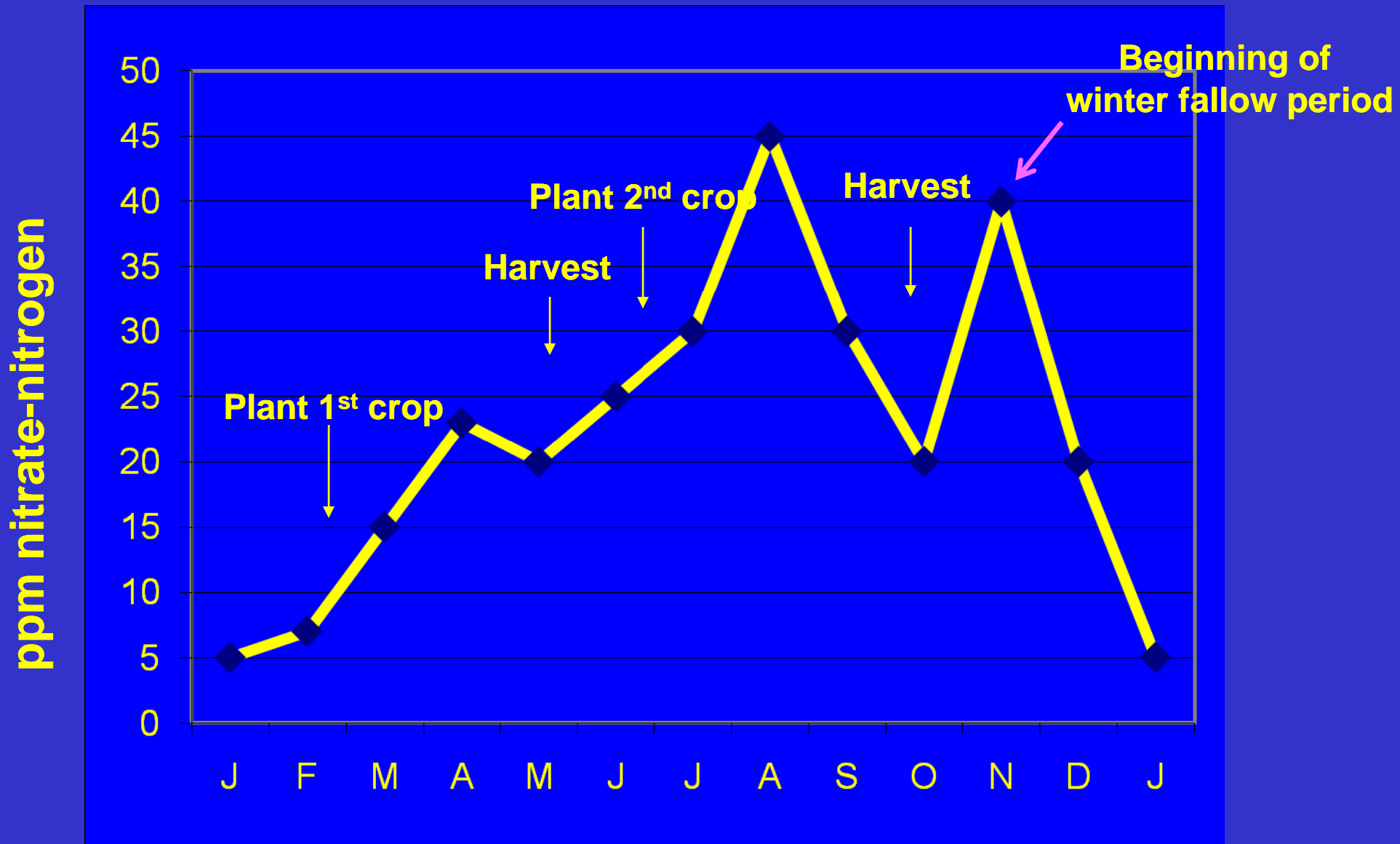
Sprinkler



Drip

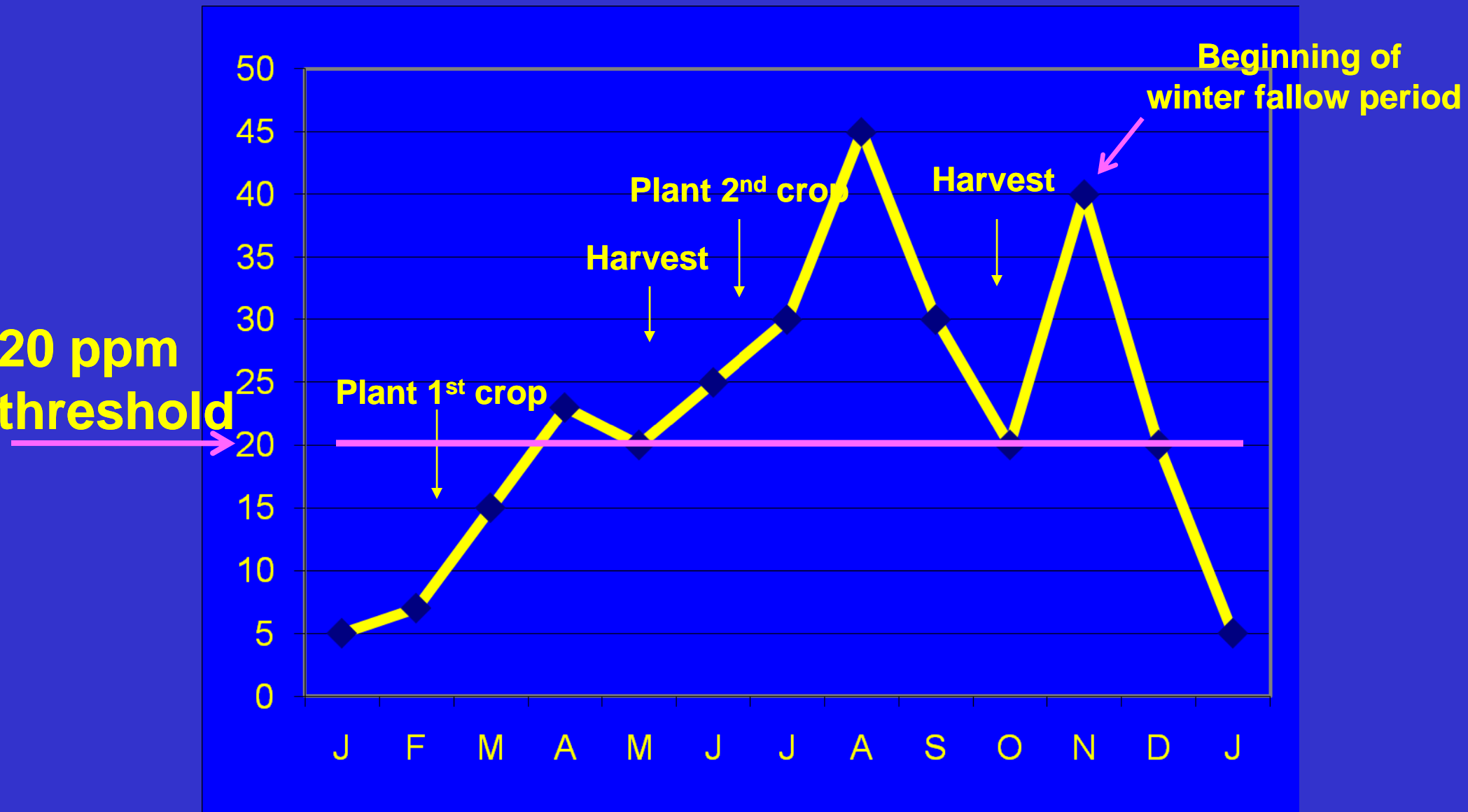


Residual Nitrate-Nitrogen in Soil Over Growing Season (two crops of lettuce)



Smith and Schulbach, 1996

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Smith and Schulbach, 1996

Nitrogen Fertilization of Lettuce

- **Growers are under pressure to reduce off site movement (surface and groundwater) of nitrogen to comply with current and pending water quality regulations**
- **They are also concerned with increasing nitrogen use efficiency to reduce costs of production**

2008 Nutrient and Irrigation Management Trials

- Three trials were conducted in commercial production fields
- Field size ranged from 8.9 to 12.0 ha
- All fields were 2nd crop lettuce
- Treatments were: 1) best management (BMP) and 2) standard grower's practices
 - Three replications of each treatment
 - Soil/plant nitrogen status, water use, nitrate leaching and yield were evaluated
- Results of one of the trials reported today

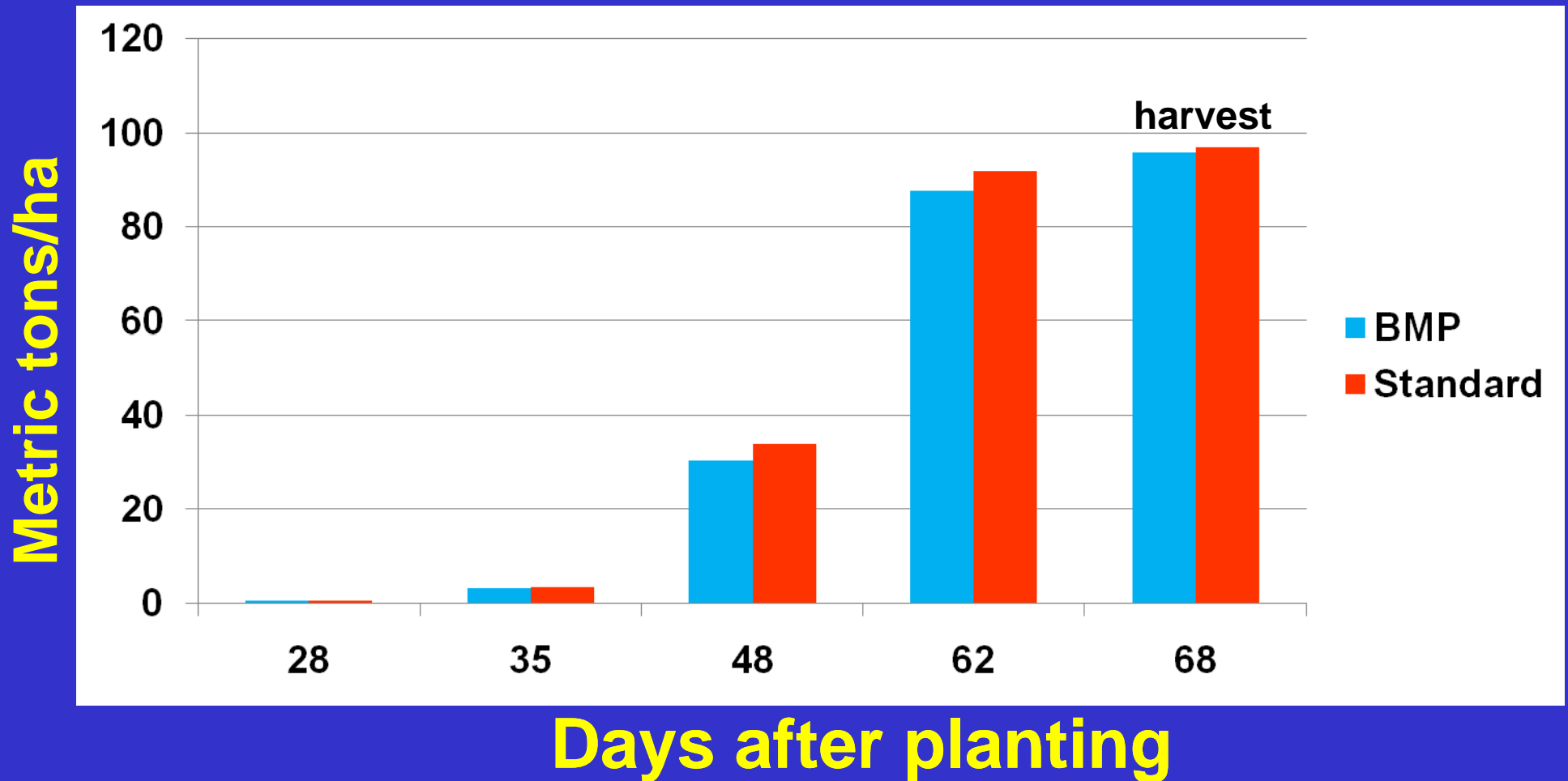
Best Management Practices

Nitrogen fertilization managed by use of monitoring residual soil nitrogen with the nitrate quick test

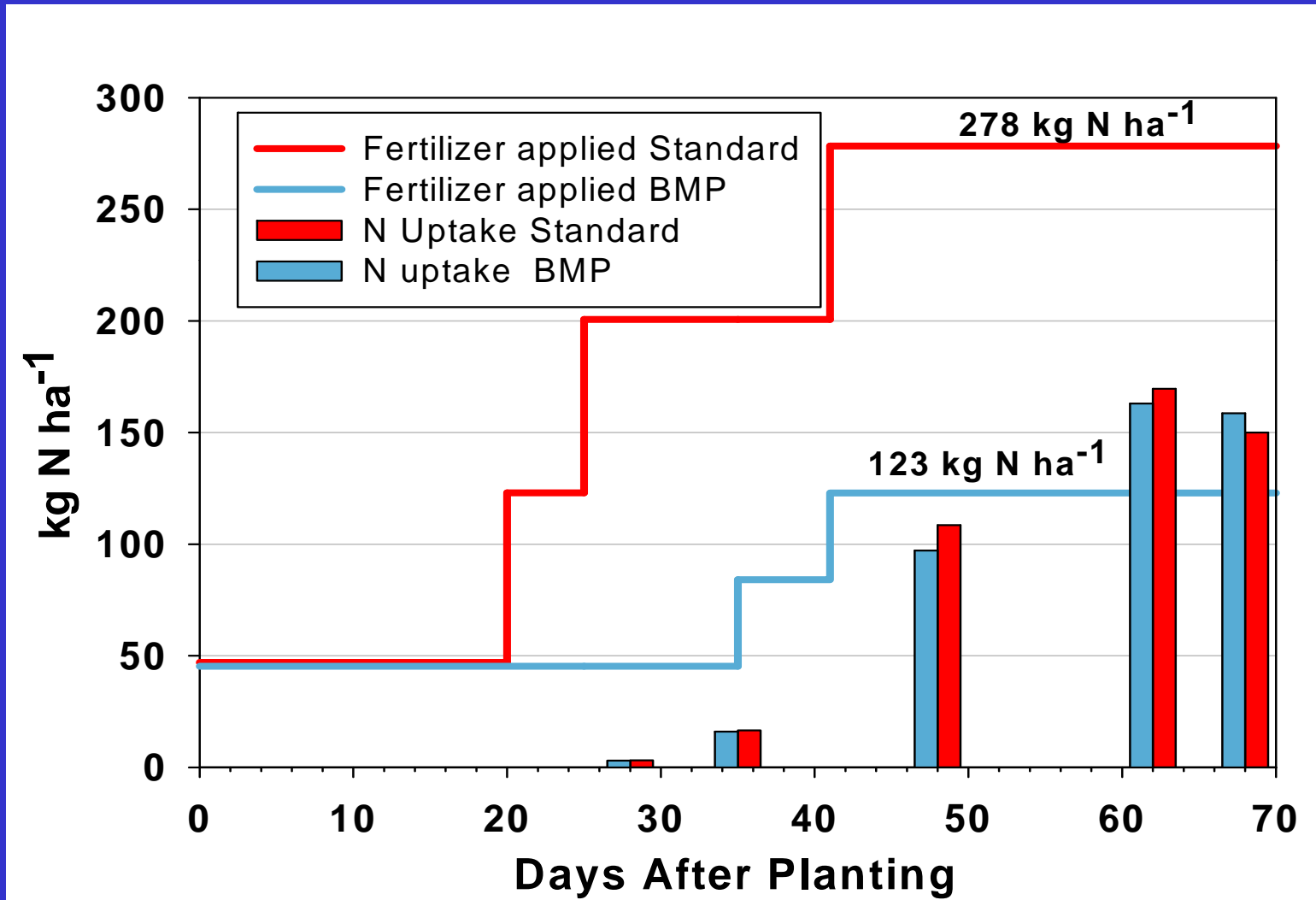
Irrigation managed by use of evapotranspiration information and soil water holding capacity model



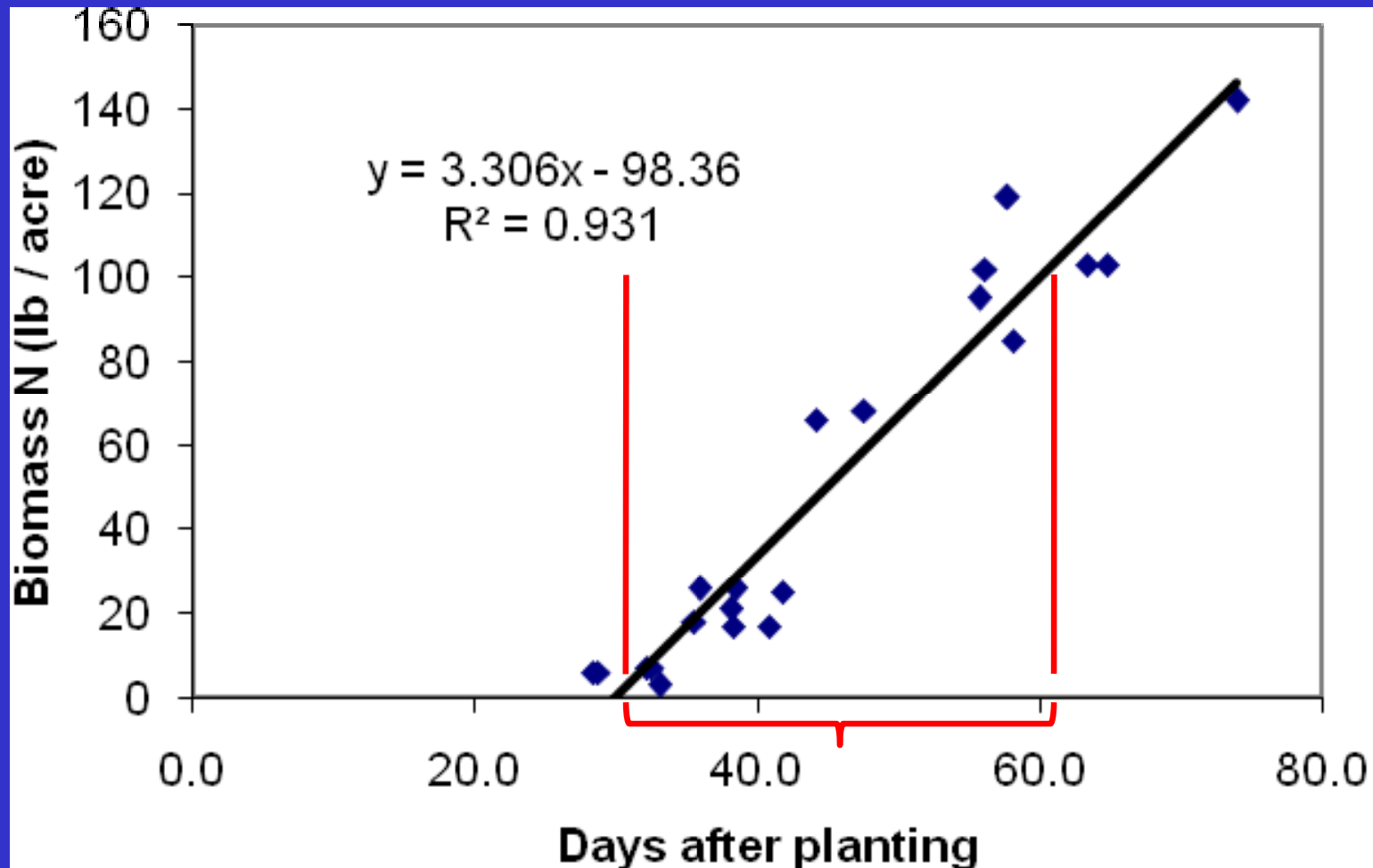
Head Lettuce Biomass Accumulation Over Growing Season Mt/ha



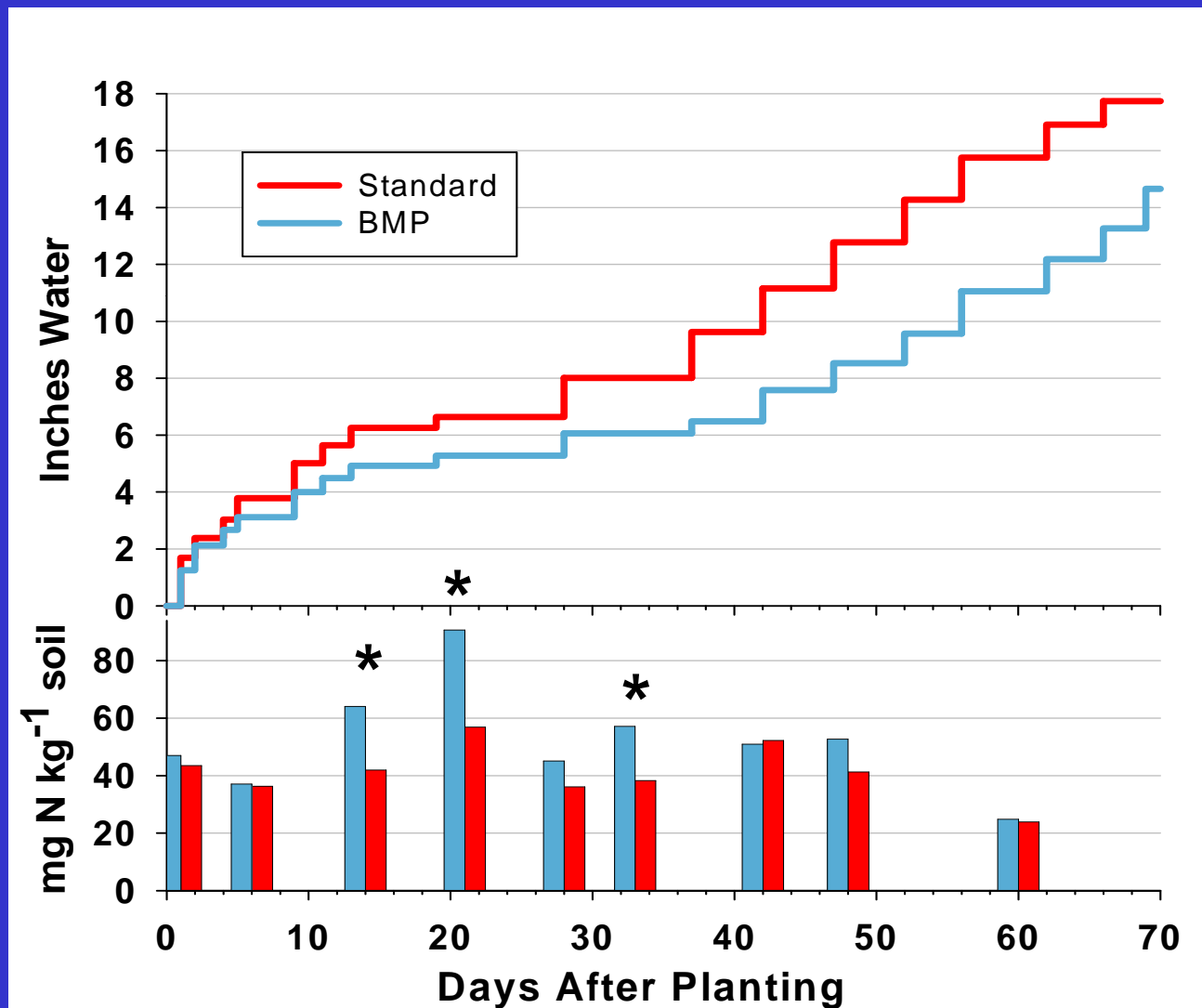
Nitrogen Uptake by Lettuce and Fertilizer N Applied over Growing Cycle



Head Lettuce Nitrogen Uptake 3.7-4.5 kg/ha/day



Irrigation Applications and Soil Mineral Nitrogen over Growing Cycle



Lysimeter

2 feet deep

Collection
bottle

Hose to
vacuum
pump

Lysimeters were installed and maintained at suctions that approximated the flow of gravitational water. Samples of this water were analyzed for nitrate content. From the concentration of nitrate in this water and estimations of movement of water through the soil we could estimate nitrate loss

Loss of Nitrate-N by Leaching

One Irrigation Event 27 Days After Planting

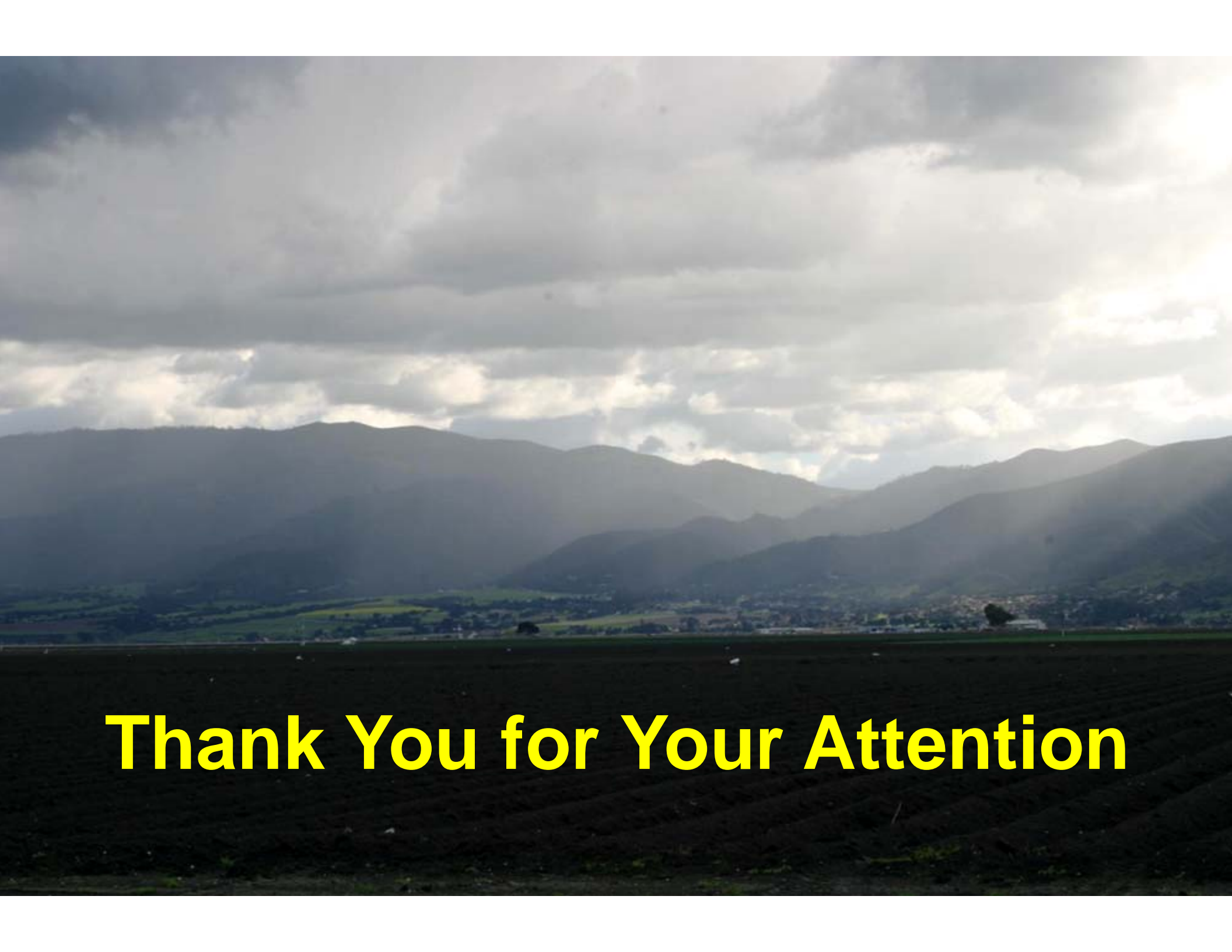
Treatment	Applied water cm	ET cm	Percolation cm	Nitrate-N Concentration in Leachate - ppm	Nitrogen loss Kg N/ha
Standard	8.9	3.1	5.3	104.9	41.8
BMP	6.1	3.1	3.1	116.4	12.6

Yield, Nitrogen and Irrigation Summary of 2008 Trial

Trial	Yield Mt/ha	N application Kg/ha	Irrigation cm
Standard	48.5	278	44.9
BMP	48.0	123	37.3
Difference	-0.9	-155	-7.6

Summary of Nitrogen Fertilization of Lettuce

- **Regulations and economics are motivating growers to manage nitrogen fertilization more carefully**
- **Accounting for residual soil nitrate and adjusting timing and rates of application to more carefully match the needs of the crop are essential to improve N use efficiency**
- **Matching irrigation applications to crop needs is critical to maintaining nitrate in the root zone**



Thank You for Your Attention