Update on Nitrogen Management Field Studies with Strawberries and Leafy Vegetables

Mark Gaskell, Farm Advisor
UCCE – Santa Maria

CAPCA Central Coast Meeting
Nipomo, CA
December 2, 2009
Nitrogen has a major effect on vigor, production and harvest quality of fruits and vegetables.

Historically, rates of application and need for high N utilization efficiency not important because of low cost.

Cheap insurance and ample application considered inexpensive insurance.
Background / Overview

• *N considered a contaminant in ground and surface waters*

• *Spikes in N costs – closely tied to energy cost*

• *Organic N sources for organic production are always expensive and uncertain.*
Situation

• Negatively charged nitrate molecule most abundant in agricultural fields and moves freely with water to manage N need to manage fertilization and water

• Measure 15 ppm soil nitrate N on a dry soil basis = 3 – 5 TIMES that amount in solution – so root zone and effluent concentration is much higher than measure of soil N

• Need to match N application to crop need total and timing of application
Managing Nitrogen Efficiency?

- Optimize N loading at the field end
- Minimize water leaving the root zone
Strawberry Study -2008- 09

Albion Variety

Three Pre plant CR N rates
0
65 lb N (350 lb / A 18-4-8)
130 lb N (700 lb / A 18-4-8)

Weekly Applications of 2.5, 5, 10 lb N

Measures:
Weekly soil residual nitrate-N
Seasonal plant growth and N uptake
Yield
Conventional Strawberry Trial – 2008-09
Residual Soil Nitrate at different Fertilization

Sample Date

Nitrate-N Residual (ppm)

0 lb Pre

- 2.5 lb N / Week
- 5 lb N / week
- 10 lb N / week

Nitrato-N Residual (ppm)
Conventional Strawberry Trial – 2008-09
Residual Soil Nitrate at different Fertilization

Residual Soil Nitrate-N (ppm)

Sample Date

1/12/05 1/26/05 2/9/05 2/23/05 3/9/05 3/23/05 4/6/05 4/20/05 5/4/05 5/18/05 6/1/05 6/15/05 6/29/05

68 lb Pre

2.5 lb N / Week
5 lb N / week
10 lb N / week
Conventional Strawberry Trial – 2008-09
Residual Soil Nitrate at different Fertilization

Residual Soil Nitrate-N (ppm)

Sample Date

1.12/05 1.26/05 2.9/05 2.23/05 3.9/05 3.23/05 4.6/05 4.20/05 5.4/05 5.18/05 6.1/05 6.15/05 6.29/05

2.5 lb N / Week
5 lb N / week
10 lb N / week

135 lb N Pre
Strawberry Nitrogen Accumulation

Some N important
Total Strawberry Yield at Varying Preplant and In-Season N Rates

Total fruit yield to 7/17

Preplant Applied N
Organic Strawberry Study -2008- 09

Albion Variety

Three organic N sources
True Organic (started with Agrilizer)
Neptune’s Harvest (started with Nitriboost)
Phytamin 801

Weekly Applications of 6, 12, 18 lb N

Measures:
Weekly soil residual nitrate-N
Seasonal plant growth and N uptake
Yield
Weekly Residual Soil Nitrate Nitrogen
Manzanita Farms – Santa Maria, 2008-09 Season

Residual Soil Nitrate-N (ppm)

- 6 lbsN/A/wk
- 12 lbsN/A/wk
- 18 lbsN/A/wk

1/4/05 1/19/05 2/3/05 2/18/05 3/5/05 3/20/05 4/4/05 4/19/05 5/4/05 5/19/05 6/3/05 6/18/05 7/3/05
Total strawberry yield from plots receiving varying types of organic fertilizer as weekly N fertigation
Santa Maria, CA – 2008-09 Season

low soil nitrate suggests problems with N availability
Seasonal Fresh Weight Accumulation by Organic Strawberry Plant and Fruit
Manzanita Farms – Santa Maria, 2008-09 Season
Seasonal Nitrogen Accumulation by Organic Strawberry Plant and Fruit
Manzanita Farms – Santa Maria, 2008-09 Season
Lettuce and Napa N use -2008- 09

Use of soil quick test to reduce N applications

3 treatments
  if \( \geq 25 \) ppm nitrate- N:
  1) 0 application
  2) \( \frac{1}{2} \) normal side dress
  3) normal side dress

Preliminary conclusions:
  N uptake is very different from strawberry
  Can eliminate pre plant
  Normal N needed for at least last side-dress
Lettuce N Uptake
Morro Bay, CA - 2009

Nitrogen Accumulation (lb N/A)

Date: 9-Apr, 16-Apr, 23-Apr, 30-Apr, 7-May, 14-May, 21-May, 28-May
Nappa Cabbage
Morro Bay, CA - 2009 season

Nitrogen Accumulation (lb N/A)
Match N availability to crop need- strawberries

- Transplanted strawberry N uptake about 4 lb – 10 lb N/acre - first 90 days. – rainy winter period

- During the next 20 weeks of growth, N uptake approaches 70 to 90 percent of seasonal total ~ 130-150 lb N/acre

- N uptake is steady and continuous for the entire period

- Current strawberry fertigation reccs for FL = 0.3 lb – 0.75 lb N /acre/day
Summary

• Many fields have excessive N in top foot and application rates often unrelated to yield.

• Opportunities exist to improve N use efficiency
  - some growers are much more efficient

• Need to match N application to plant uptake

• Water management also plays a role
  - nitrate moves with water
Acknowledgements

Cachuma Resource Conservation District, Santa Maria

Dave Peck, Manzanita Berry Farm, Santa Maria

USDA 2501 Program, FREP, CDFA Specialty Crop Block Grant

Additional Information

Vegetable Research and Information Center (VRIC), UC Davis - Educational Modules
http://groups.ucanr.org/nutrientmanagement/index.cfm