Developing Nitrogen Management Tools in Strawberry

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Strawberries important to California…

- *strawberries planted on more than 30,000 acres in key coastal CA counties*
- *harvested value in excess or $1.3 billion*
- *nitrogen (N) management is one of key cultural practices*

Nitrogen and salt management are important

- *nitrogen (N) - important component of yield and quality*
- *salinity can markedly limit strawberry production*
- *manage salinity by leaching of salts – and nitrate?*
- *can strawberries be grown with little off-site N movement?*

N in surface and ground water …

- *excess N leaches or runs off*
- *need to match N availability to crop need*
  N use efficiency
- *but the need to leach salts can put EC management at odds with efficient N management?*
- *manage salts with leaching and nitrate moves*
- *water use implications?*

Strawberries and N management

- *limited applicable research base*
- *strawberry nutrient needs*
- *interaction with other cultural practices*
- *common coastal California strawberry fertility programs*
- *critical determining factors?*

Limited applicable research base…

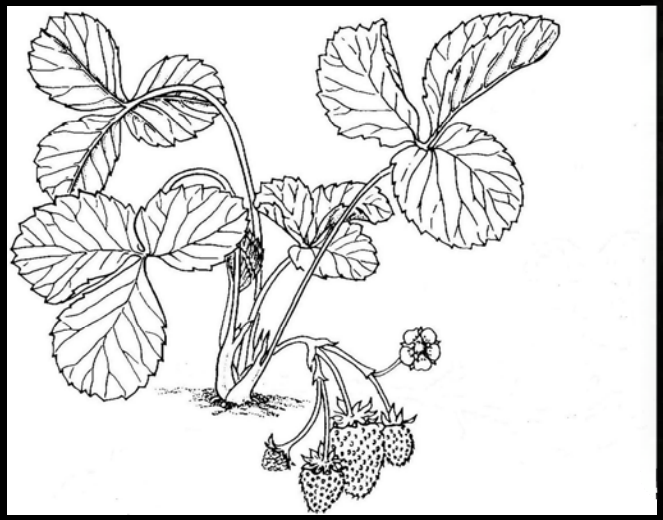
- *Florida N fertility work with strawberry indicates response to 150-200 lb N per acre (~2500 crates per acre)*
- *Florida studies show 75 -80 lb N in the plant and fruit*
  200 day season, warmer / humid
  yields are 30 - 50% of CA yields
- *1996 study from So. Calif shows yield of Chandler and Camarosa increasing with increasing N up to 320 lb / A*
  - Camarosa yes / Chandler no

Other factors affect strawberry N needs

- *key growing districts South to North*
- *range of cultivars, planting and harvest dates Camarosa , Ventana, Diamante, Albion dominate + others, - proprietary*
- *different nursery transplant growing conditions that also affect plant vigor*

Role of N in strawberry development and yield …

- *annual system – need to develop foliar area early and produce over a long season without gaps*
- *high yields of good quality fruit depend on detailed critical management regime or plants fail to meet potential*
- *need to get plant crown branches and foliar area as early as possible >>> then cut back N*
  - - but still maintain vigor.



Role of N in strawberry development and yield

- *If not enough side branches before flowering, flowering competes with vegetative growth*
  > > breaks in production

- *Plant may not respond if limited by cool temps, slower in Northern districts.*

Slide 9

MG1 SHOULD WE HAVE LARSON STUDY EARLY OR AFTER N NEEDS??

Mark Gaskell, 9/28/2008

Interactions with strawberry cultural practices…

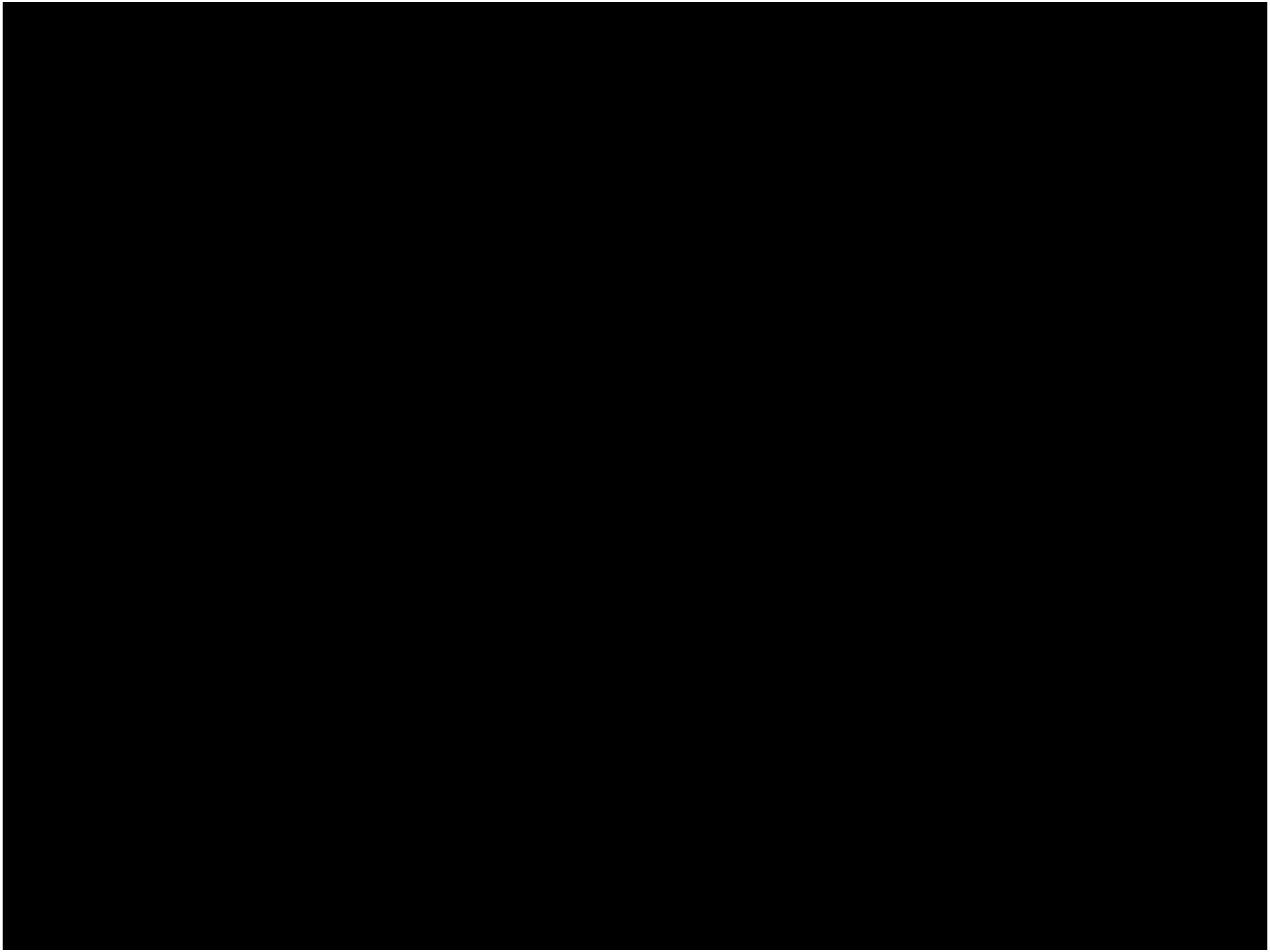
- *variations in cultivars – growth habit, vigor*
  - cultivars respond differently
- *nursery management – N regime, location, planting / digging date all affect early vigor and establishment*
- *soil type, fertility – field to field variation*
- *heat units in growing areas during fall, winter -- in So. Cal, strawberries respond very quickly to applied N – in North districts, slower*

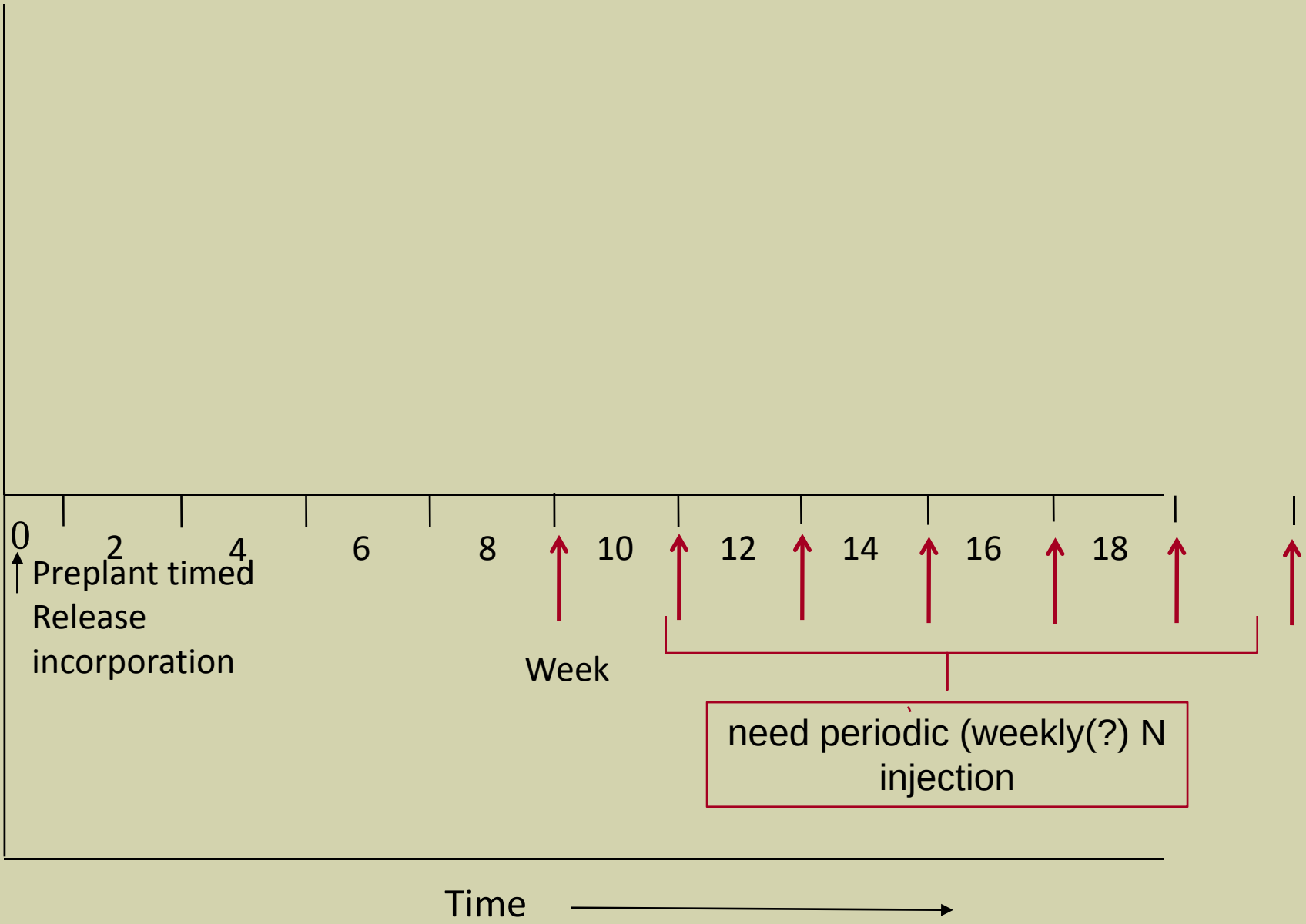
Interactions with strawberry cultural practices…

- *in-season climate – rainfall? + rainfall X temp?*
- *bed height, mulch color orientation, planting density, irrigation management*
- *fruit growers must integrate N management into this mix of interacting factors - no easy task*
- *observations of plant growth and vigor also important*

Nitrogen and salt management …

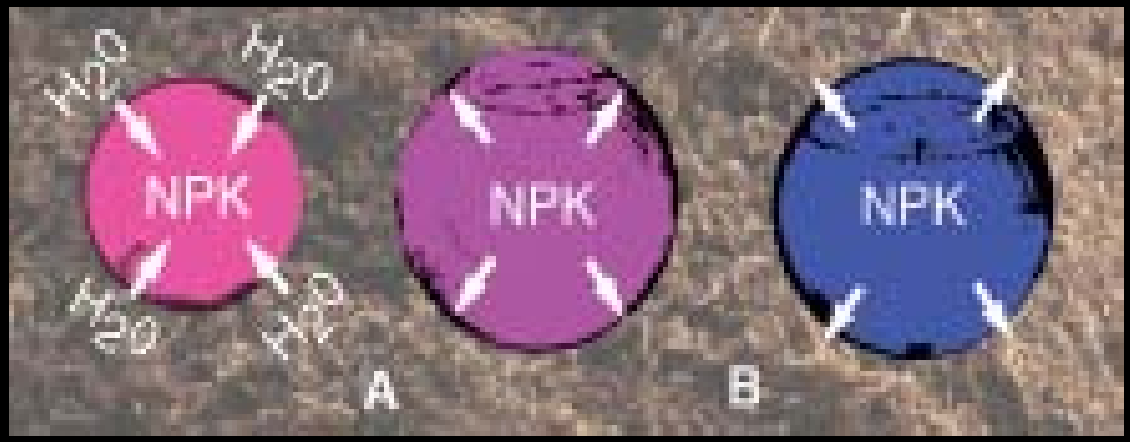
- *back to balancing plant N need with EC management*
- *strawberries are sensitive to salts and also specific ion detrimental effects with Cl^- that need to be considered*
- *some data shows that we may lose %30 of yield going from ECe of 1-2 – not uncommon in Santa Maria strawberry fields*
- *conflict between optimizing N and leaching salts?*

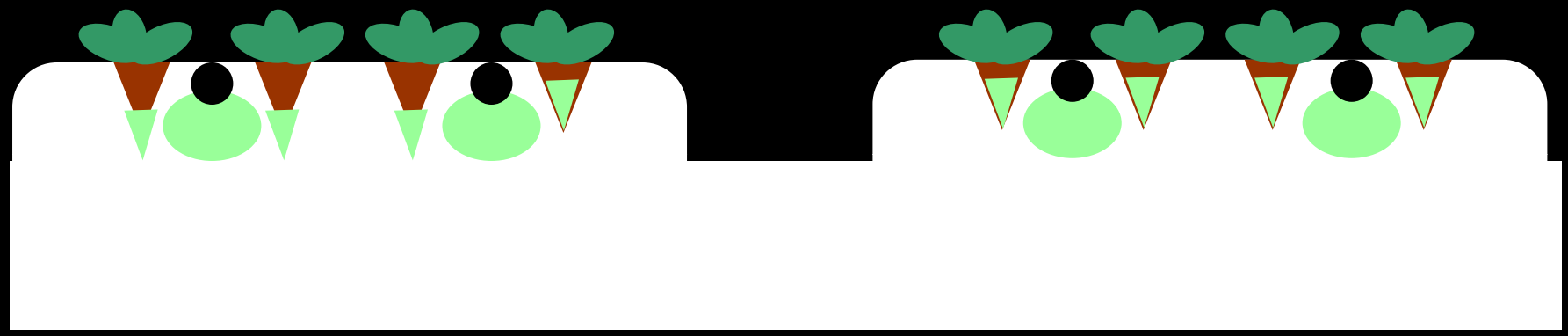



0
2
4
6
8
10
12
14
16
18
Preplant timed
Release
incorporation
Week
need periodic (weekly(?) N
injection
Time

Controlled release fertilizers…

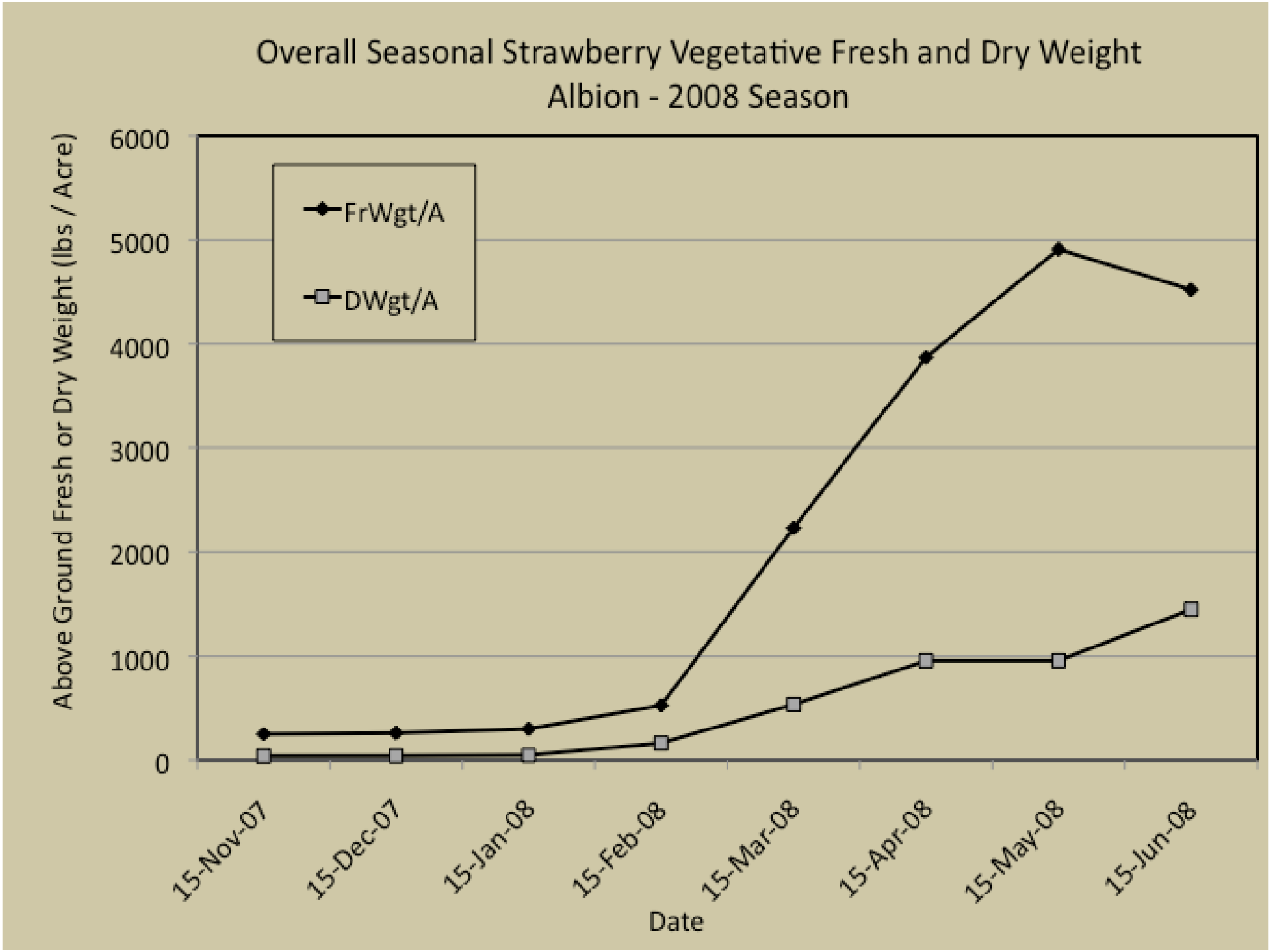
- *Industry has gone to more controlled released fertilizers over time for pre-plant fertilization*
- *Relatively pricey but can be very effective*
- *Release of N may not always meet needs of strawberry plant – need some flexibility*

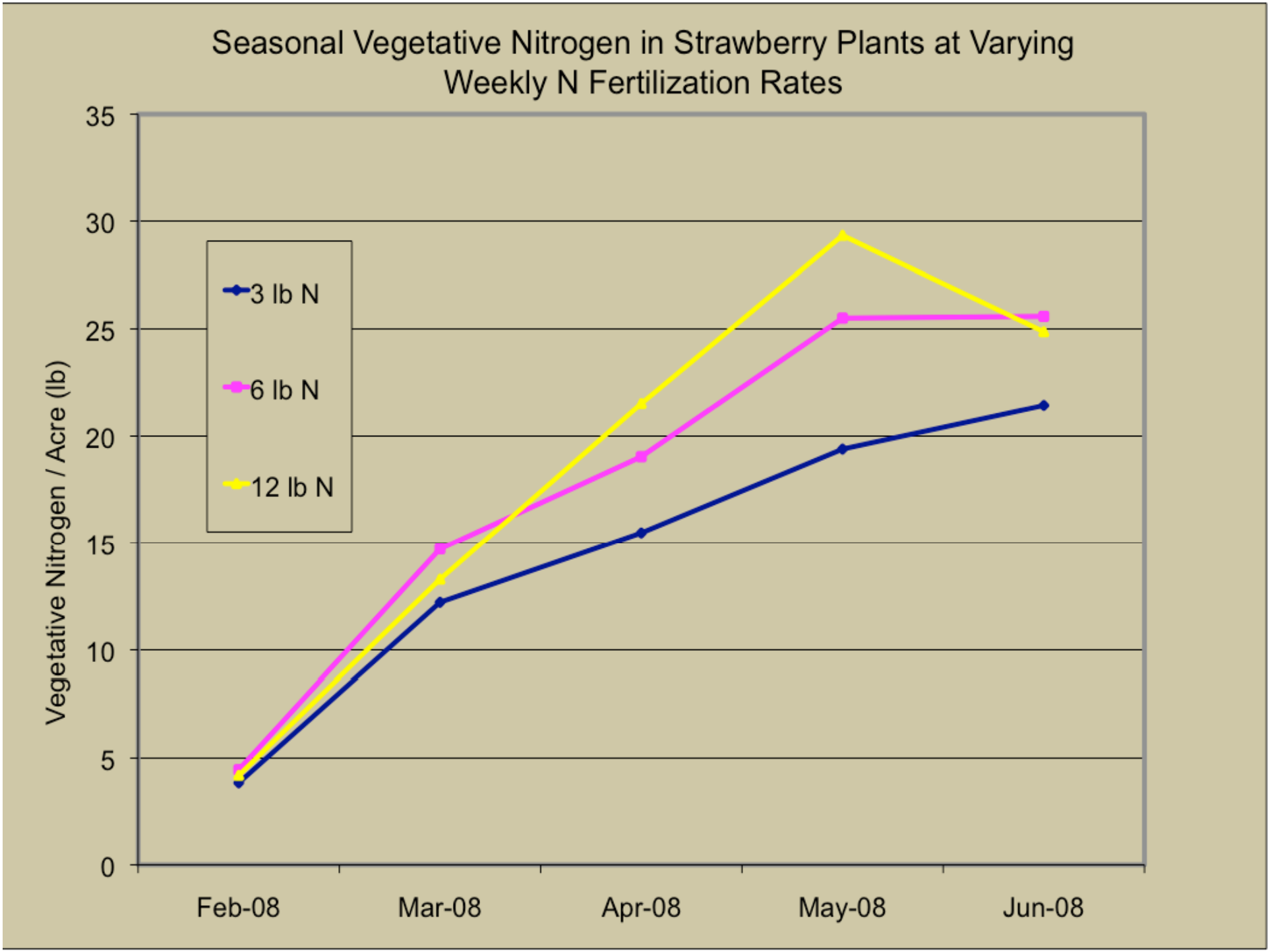


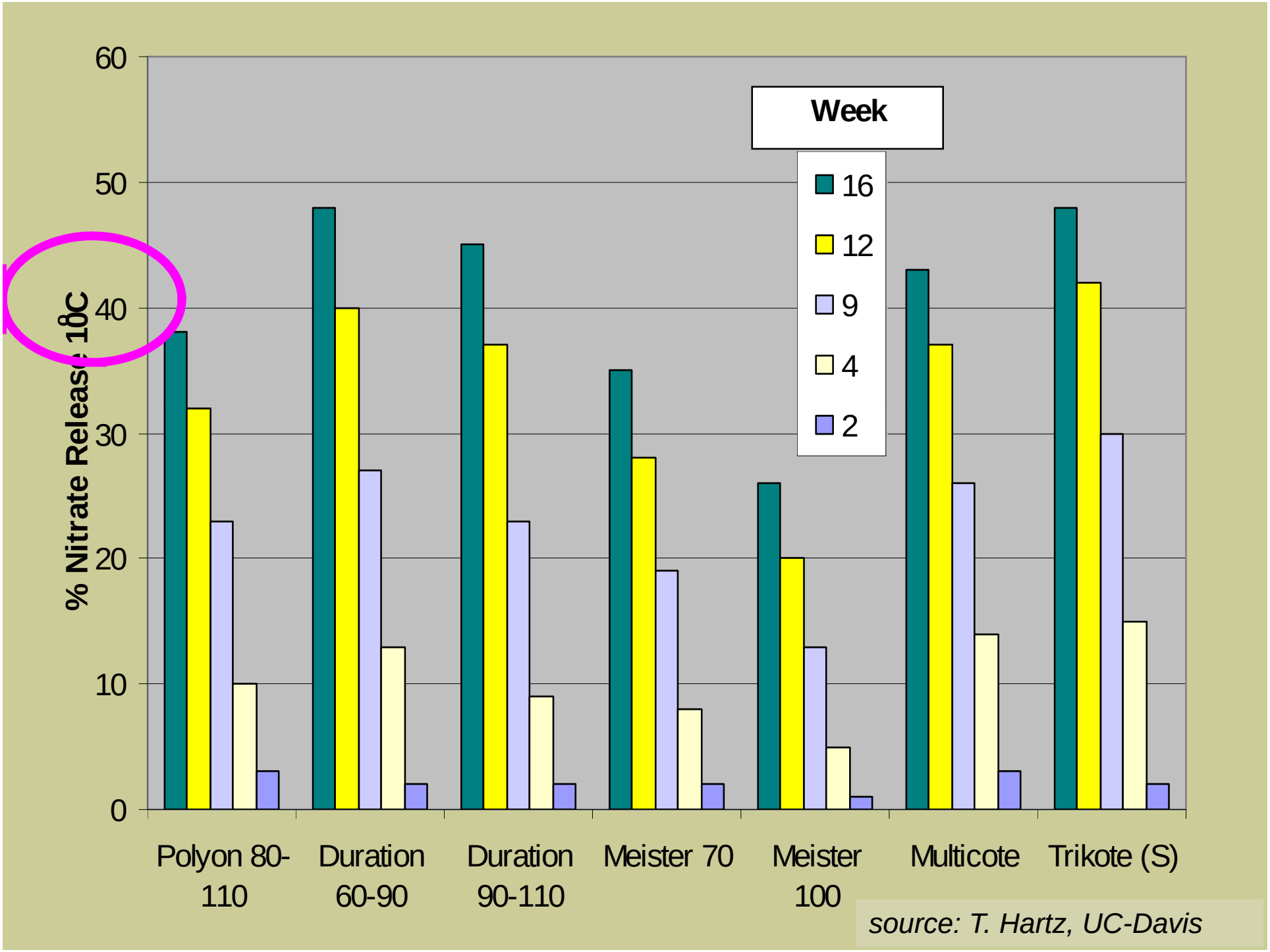


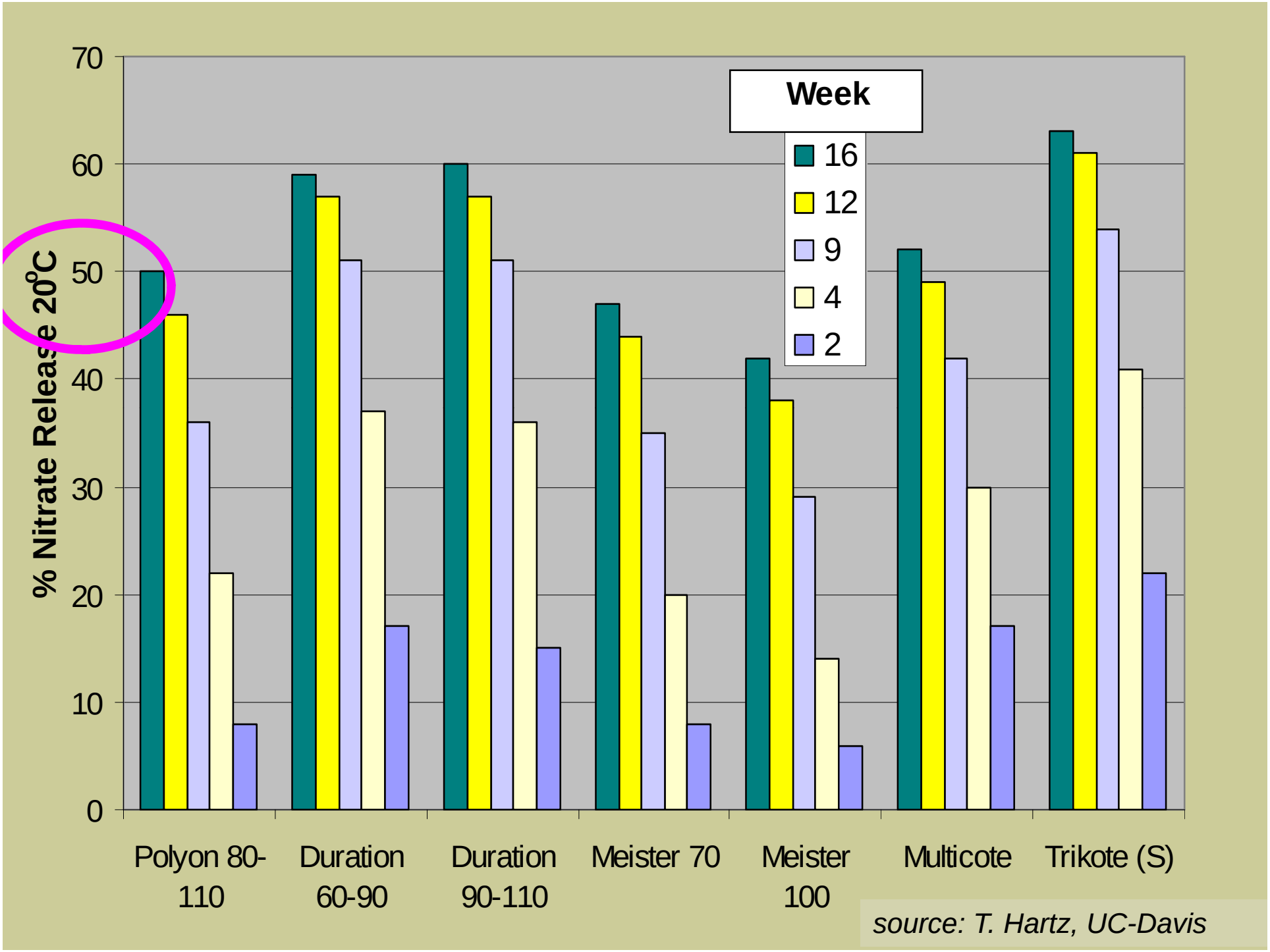
"Typical" Fertilization Program?

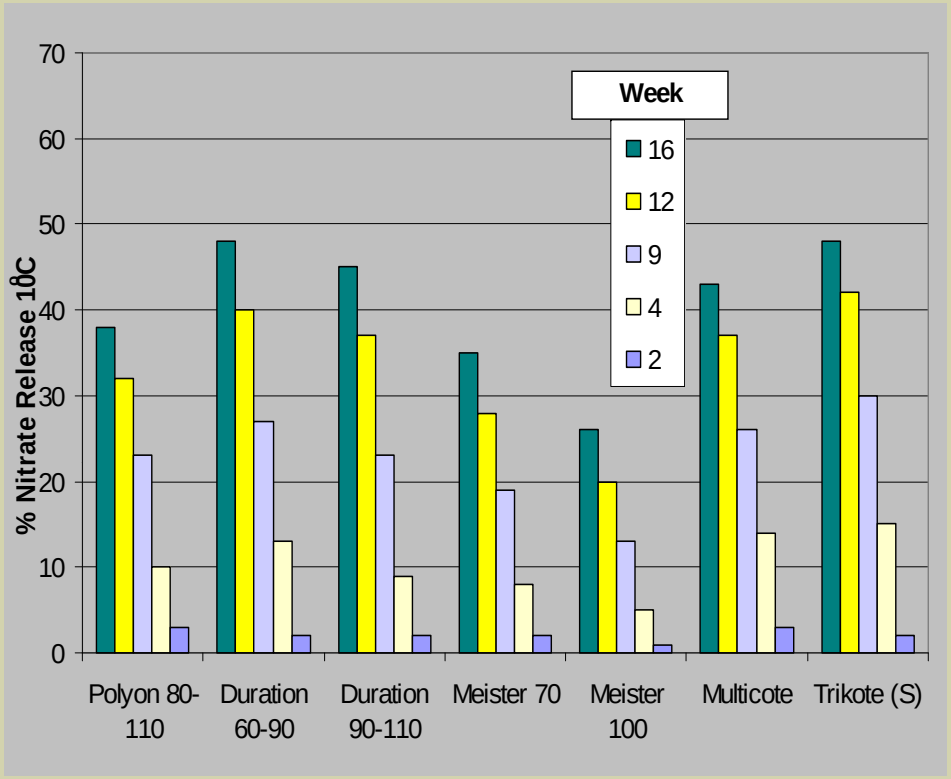
- *Some variation among districts –*
  slower in North and less early N or
- *Lower N analysis materials in North districts*
- *Some variations with varieties – vigor?*
- *Some growers use little or no CR fertilizers with excellent results*
  - more careful, intensive fertigation mgmt
- *In warmer So., plants more responsive to early N;*
  in North, establish more slowly


Overall Seasonal Strawberry Vegetative Fresh and Dry Weight
Albion - 2008 Season
Above Ground Fresh or Dry Weight (lbs / Acre)
6000
5000
4000
3000
2000
1000
0
FrWgt/A
DWgt/A
15-Nov-07
15-Dec-07
15-Jan-08
15-Feb-08
15-Mar-08
15-Apr-08
15-May-08
15-Jun-08
Date

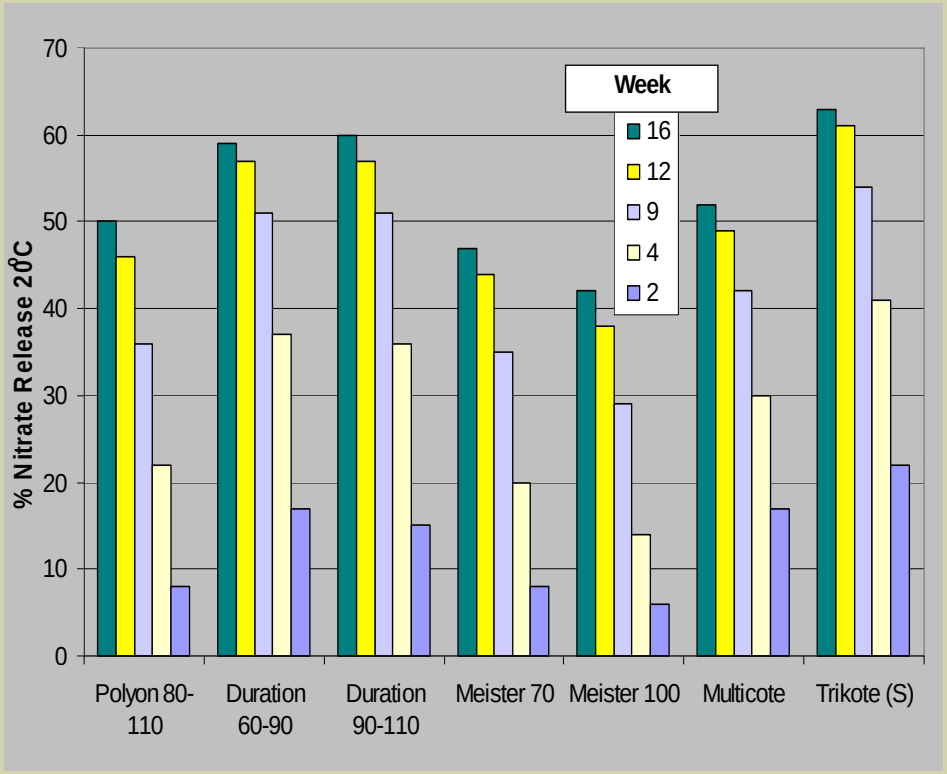

Seasonal Vegetative Nitrogen in Strawberry Plants at Varying Weekly N Fertilization Rates
Vegetative Nitrogen / Acre (lb)
35
30
25
20
15
10
5
0
3 lb N
6 lb N
12 lb N
Feb-08
Mar-08
Apr-08
May-08
Jun-08


60
50
40
30
20
10
0
% Nitrate Release 10C
Week
16
12
9
4
2
Polyon 80-110
Duration 60-90
Duration 90-110
Meister 70
Meister 100
Multicote
Trikote (S)
source: T. Hartz, UC-Davis


% Nitrate Release 20°C
70
60
50
40
30
20
10
0
Week
16
12
9
4
2
Polyon 80-110
Duration 60-90
Duration 90-110
Meister 70
Meister 100
Multicote
Trikote (S)
source: T. Hartz, UC-Davis

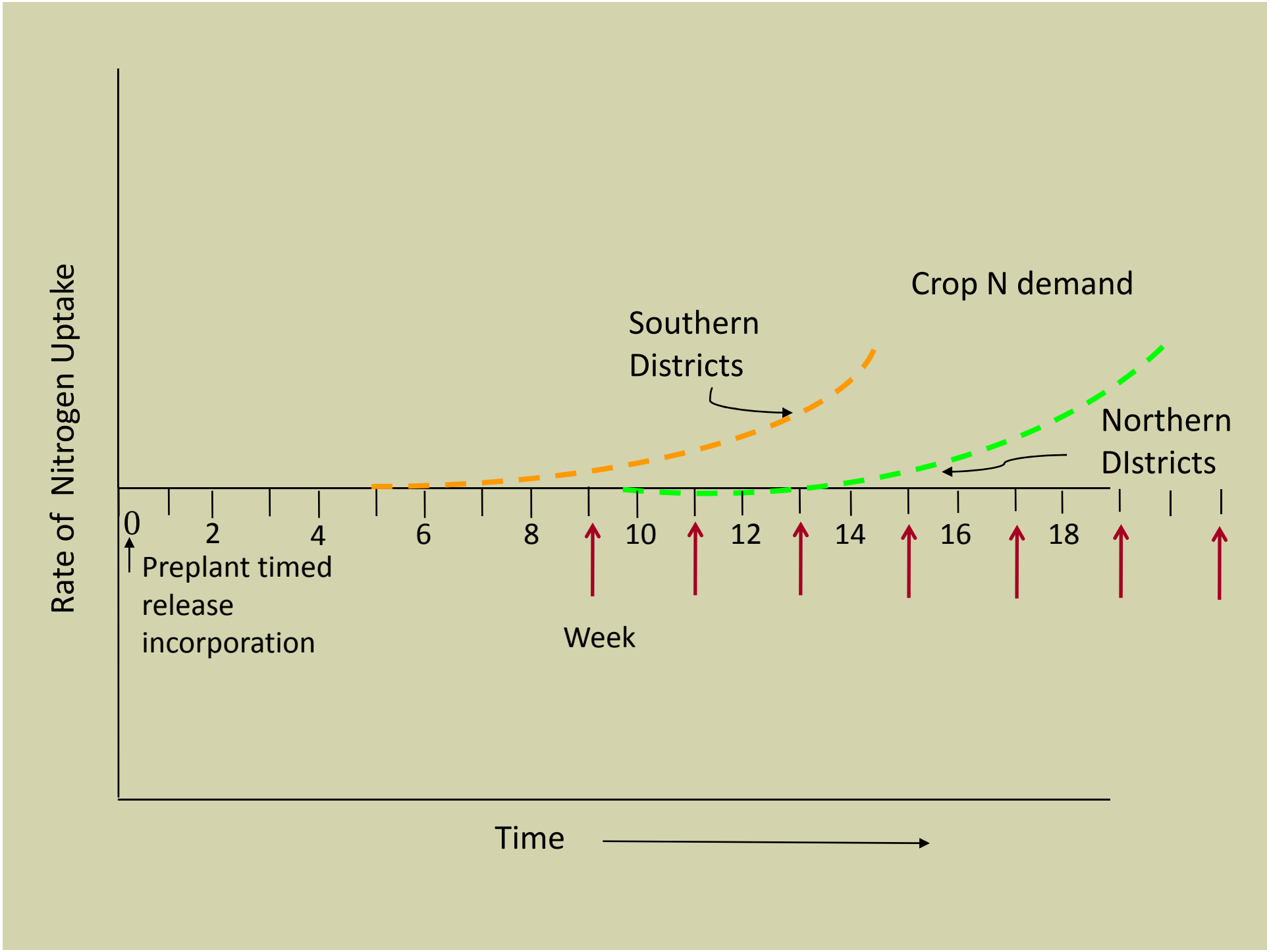


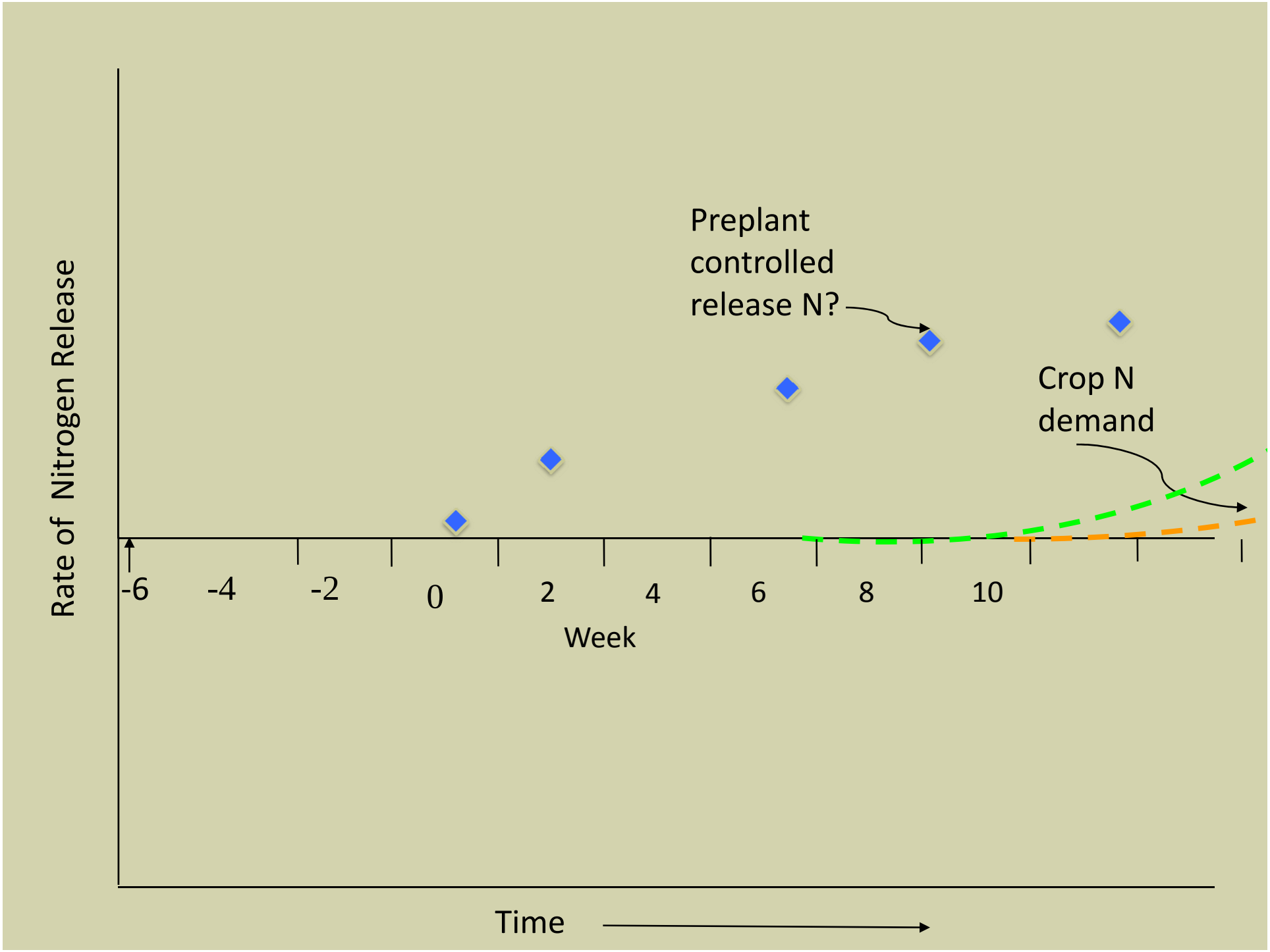
10º C (50º F)

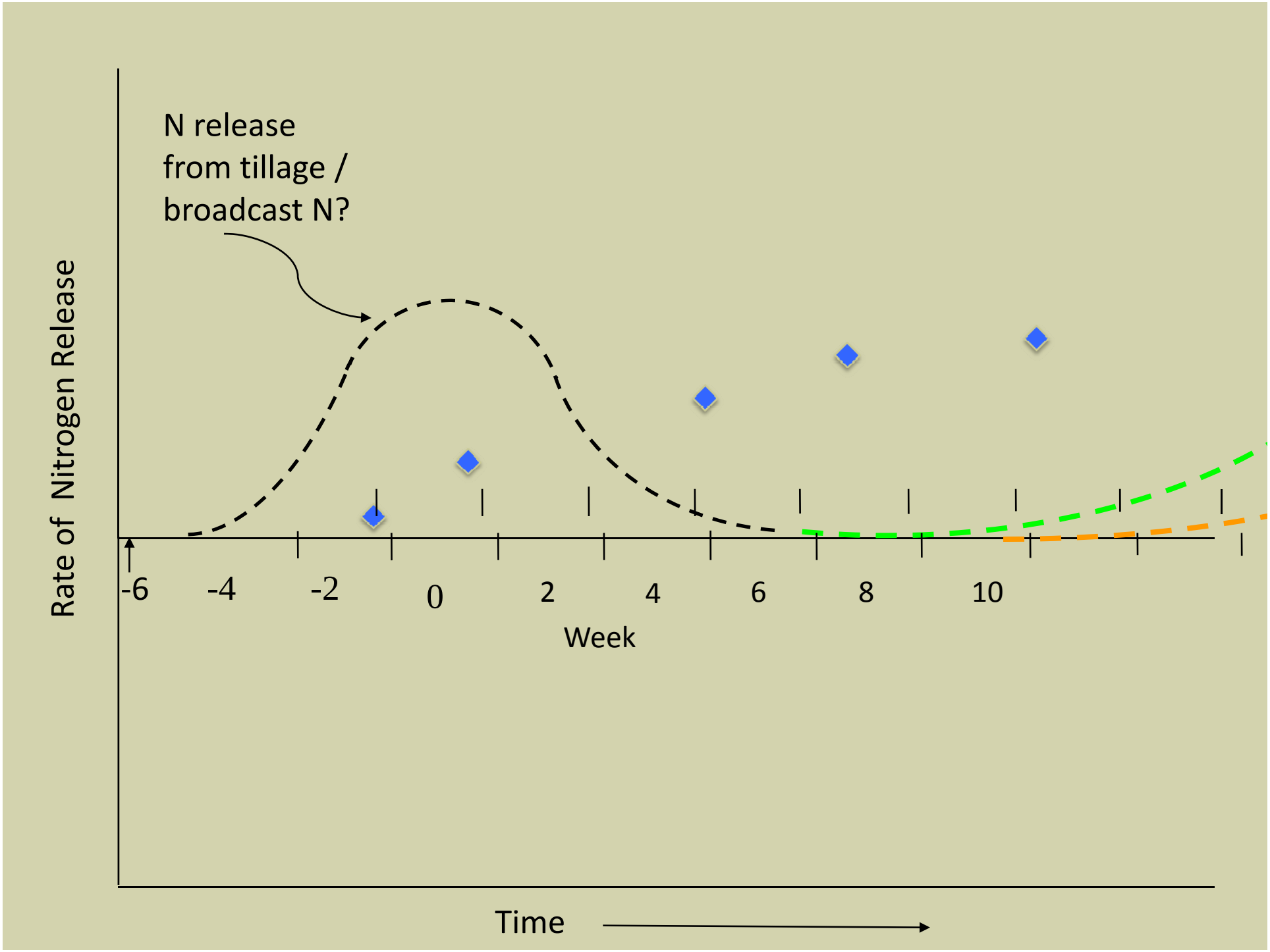


20º C (68º F)

source: T. Hartz, UC-Davis


Rate of Nitrogen Uptake
Crop N demand
Southern Districts
Northern DIstricts
0
2
4
6
8
10
12
14
16
18
Preplant timed release incorporation
Week
Time


Rate of Nitrogen Release
Preplant
controlled
release N?
Crop N
demand
-6
-4
-2
0
2
4
6
8
10
Week
Time


N release
from tillage /
broadcast N?
Rate of Nitrogen Release
-6
-4
-2
0
2
4
6
8
10
Week
Time

Controlled Release VS drip applied N?

- *drip-applied N*
  most flexibility and efficiency - management?
- *wet years ?*
  may be difficult getting into field and applying sufficient N without damaging beds, aggravating other problems - but this would be brief -
- *improve control over off-site movement?*

Strawberries and N management

- *time N availability to crop need*
  - high preplant application may not allow needed control
  - time-released materials are more costly, less efficient

- *manage irrigation for EC and nitrate?*
  - more research needed > plant response, variables, timing, conditions, etc.

- *can more targeted periodic N injection can avoid off site N movement?*

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