# Optimizing nutrient management for high productivity and environmental protection



## Nutrient management and water quality :

- 303(d) listings for nutrients, algae, ammonia, dissolved oxygen and pH are all conected to fertilizer management

- Compliance with future regulations will likely require better control of field runoff and drainage, and fertilizer application in closer balance with crop removal

# Typical nutrient balance in pepper production :

| | lbs / acre | |
|---|---|---|
| | N | $P_2O_5$ |
| Fertilizer application | 150 - ? | 40 - 120 |
| Crop uptake | 160 - 200 | 30 - 40 |
| Removal in fruit | 50 - 70 | 15-20 |

# Agronomic P requirement :

| Olsen P level (PPM) | Lettuce response likely? |
|---|---|
| < 50 PPM | Reasonable chance of + response, particularly in cold soil |
| > 50 PPM | Response unlikely |

**Pepper certainly no higher than lettuce**

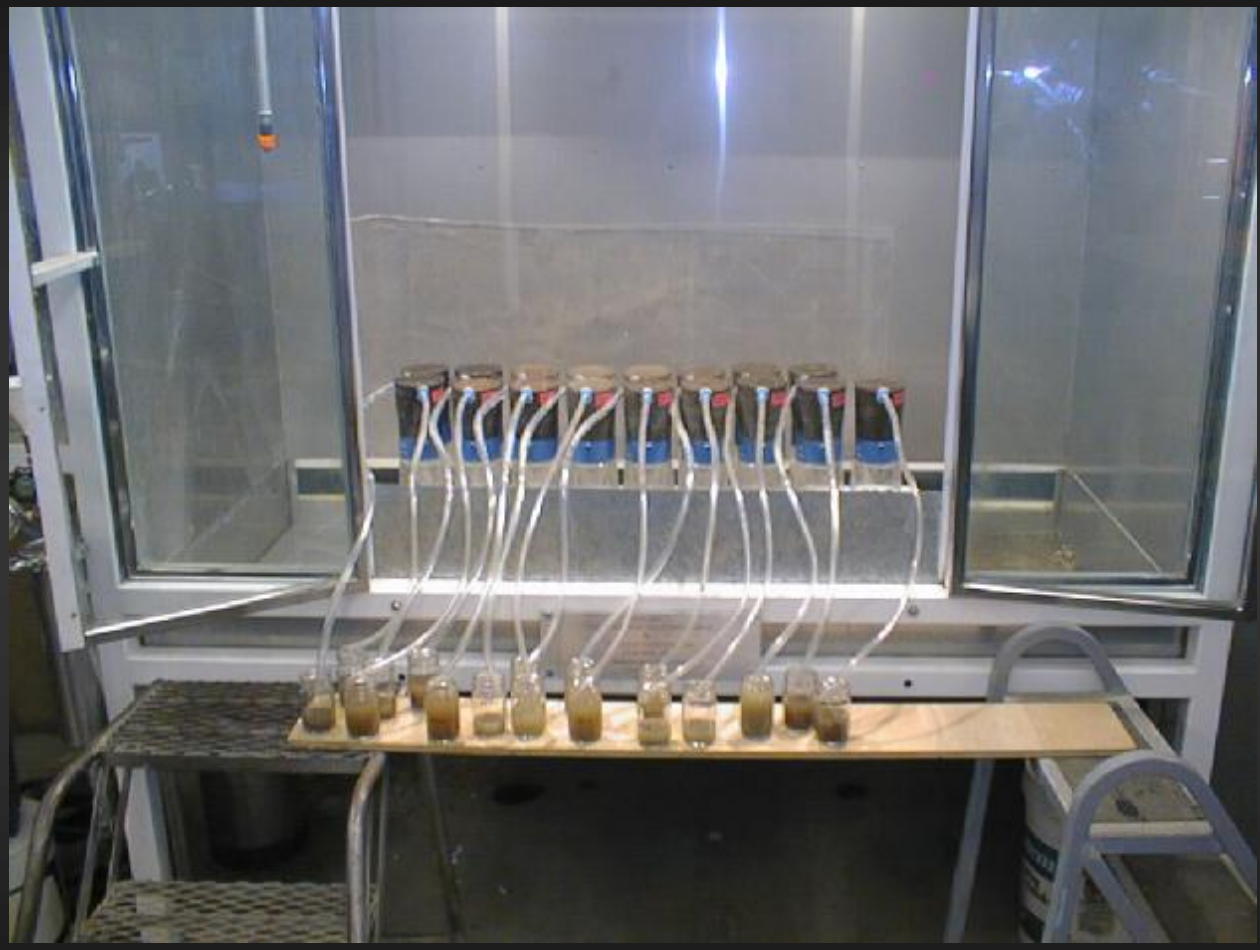
# Does P runoff or leaching potential correlate with soil test P ?

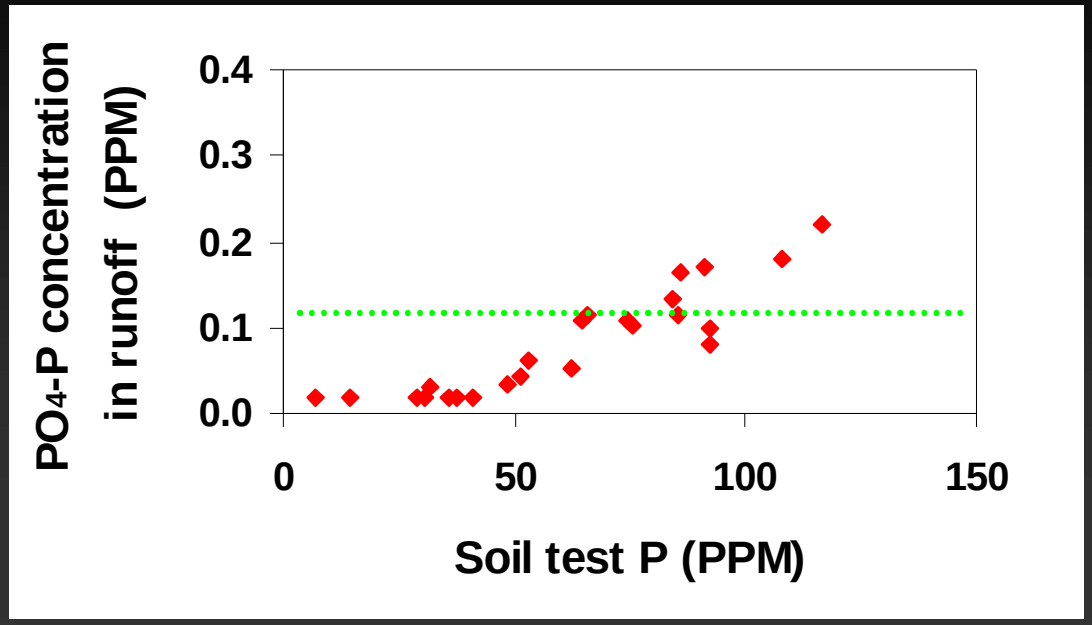
**Representative coastal vegetable soils collected :**

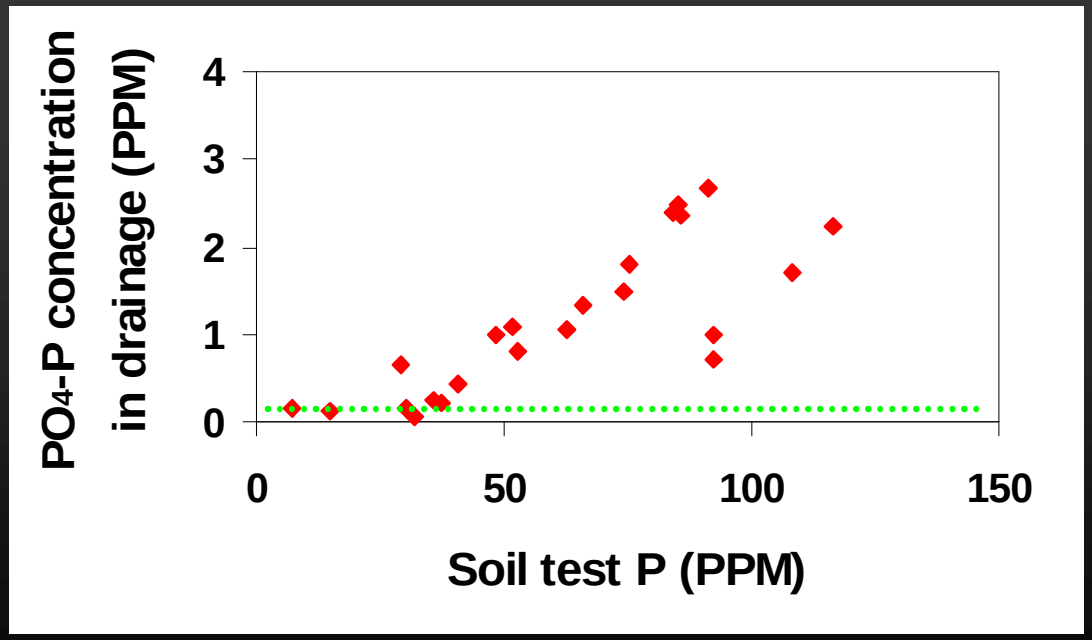
| | Number of fields | |
|---|---|---|
| Olsen P (PPM) | Conventional | Organic |
| < 40 | 8 | 3 |
| 40 - 80 | 8 | 1 |
| > 80 | 8 | 3 |

**Native condition of coastal soils < 25 PPM Olsen P**

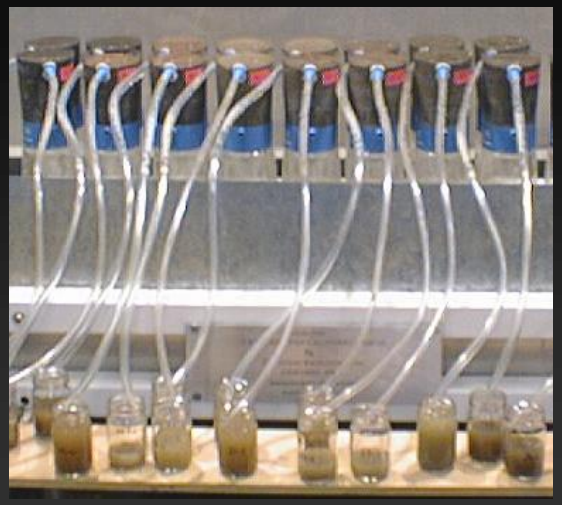
# Measuring P runoff and leachate potential:



## What about P content in sediment ?



- Soluble P ($PO_4$-P) typically represents only 10-30% of total P content of surface water; the remainder is P bound to soil particles

- Control of P loss requires control of soil erosion

# Efficient P management :

- Ø Apply P fertilizer only when soil test shows the need

- Ø Minimize P loss to the environment :
  - tailwater containment or elimination
  - minimize drainage volume
  - erosion control

- Ø Target remediation efforts on fields with high Olsen P level, particularly if location and drainage characteristics favor runoff and drainage flow to surface water

# Nitrogen management for pepper :

- Ø Modest crop uptake requirement for high yield (160 – 220 lb N / acre)
- Ø With efficient irrigation, seasonal fertilizer requirement should not exceed this range, and may be even less
- Ø Excessive N application can lower fruit yield and increase blossom end rot
- Ø Excessive N application can be a serious pollution problem

## Nitrogen management and environmental risk :

- Ø Environmental targets for N concentration in both surface and groundwater are *very low;* any water that escapes a pepper field is likely to exceed desirable N concentration
- Ø N management strategy should be:
  - minimize water volume leaving the field (runoff or drainage)
  - minimize unnecessary N application

# Nitrogen management:

- In field trials in California and Florida, pepper yield and quality usually maximized at seasonal N rates < 200 lb N / acre; higher rates can be detrimental
- Fertigation is the most efficient application technique
- Fertigation rate should reflect crop growth rate
- fertilizer N source is of little importance in most field conditions

# General pepper N fertigation schedule *

| Growth stage | lb N / acre / week |
|---|---|
| establishment / early growth | 5 - 10 |
| early flowering / fruiting | 10 - 20 |
| fruit set / bulking | 15 - 25 |
| after first harvest | 5 - 10 |

* to be adjusted for field-specific conditions

## Controlling blossom end rot (BER) :

- Fruit most susceptible to BER during rapid expansion phase

- While BER results from a calcium deficiency in the fruit, the cause is usually water stress or excessive use of $NH_4$ or urea-based fertilizers

- Controlling BER with Ca application is unlikely; the key is eliminating water stress and minimizing $NH_4^+$ application

**Pepper spot – STIP**

- **Calcium disorder, aggravated by high N or K fertilizer rates**
- **Susceptibility varies greatly by variety**
- **Control by Ca foliar spray or soil amendment only partially effective**

# K management :

- Ø Pepper has  a moderate K requirement (< 200 lb K uptake/acre)
- Ø Soils vary widely in K supply:
  - exchangeable K
  - K as a % of base Exchange (meq K / (meq Ca + Mg + Na + K))
  - rooting density

# K management :

**Fields > 200 PPM exchangeable K, with more than 2.5% of base exchange, require minimal K application**

- **Where K is required, fertigation is the most efficient technique**
- **K uptake peaks during early fruit bulking, so should fertigation**

## In summary :

- Pepper production and environmental stewardship can coexist
- Environmental impact can be minimized by:
  - efficiently using drip irrigation
  - eliminating unnecessary fertilizer application
  - using crop rotation and conservation practices to control erosion and ‘soak up’ excess soil N