C-139 Basin Vegetable Demonstration Project

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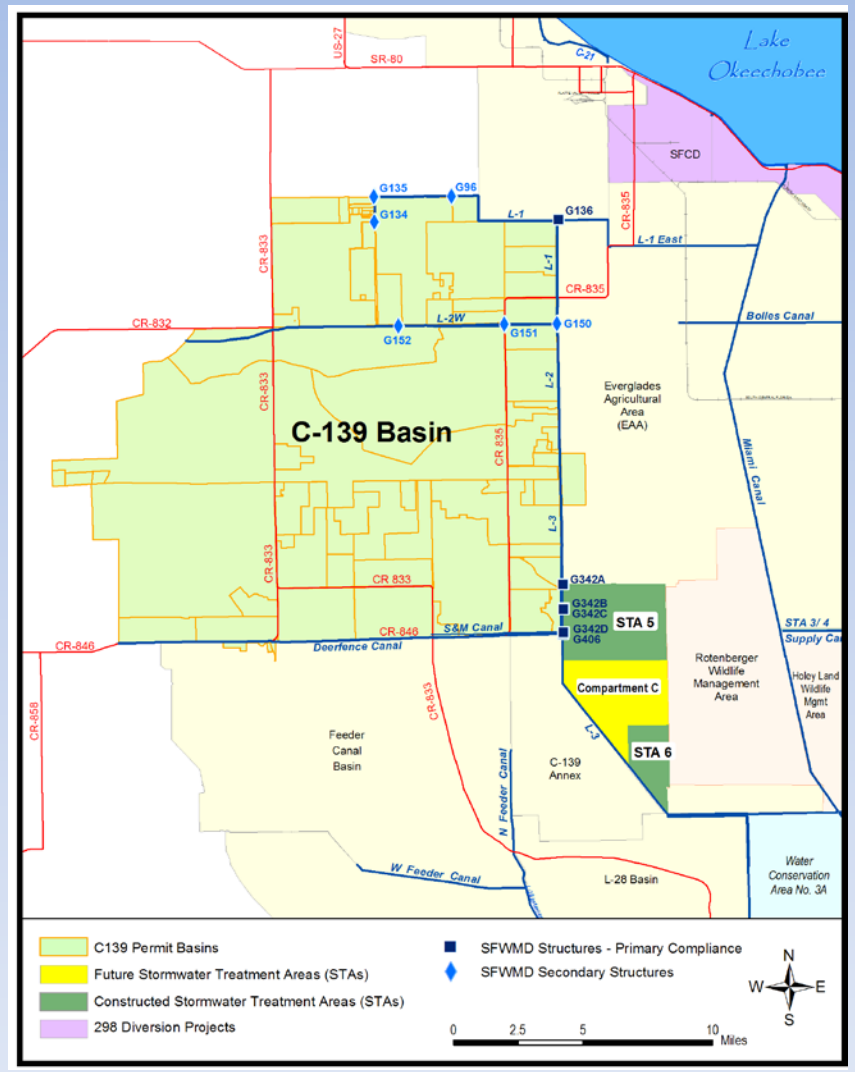
Background

- Partnership among the UF-IFAS, the District, the Florida Department of Agriculture and Consumer Services (FDACS) and 6 volunteer growers
- Six years: Winter 2006 to Spring 2011
- Results based on 25 demonstrations with adequate data.



Objectives

1. Identify soil tests providing a more accurate measurement of “plant available” phosphorus (P) in soils of high pH, Ca and Al content.
2. Evaluate crop response to alternate P application rates.
3. Evaluate the use of soil pH amendments to “mine” unavailable soil P, preventing additional application.
4. Evaluate the use of slow release fertilizers, split (fertigation and foliar) application to provide “just in time” P to the plant, preventing losses in runoff.

Soil Testing and P Rates

- Soil tests are used to determine P requirements for maximum crop production. Soil type, pH and calcium content affect P requirements.

- Statewide standard P recommendations based on the Mehlich 1 extractant exist for typical Florida conditions (sandy soils with low pH and Ca content).

	Pre-plant soil P (ppm)				
	Very Low	Low	Medium	High	Very High
Phosphorus (P)	<10	10-15	16-30	31-60	>60
	P fertilizer Recommendation (lb P_2O_5 ac^{-1})				
Tomatoes	150	120	100	0	0
Green beans	120	100	80	0	0

Source: Hochmuth, G. et. al., UF-IFAS, Phosphorus Management for Vegetable Production (HS105)

C-139 Basin Conditions

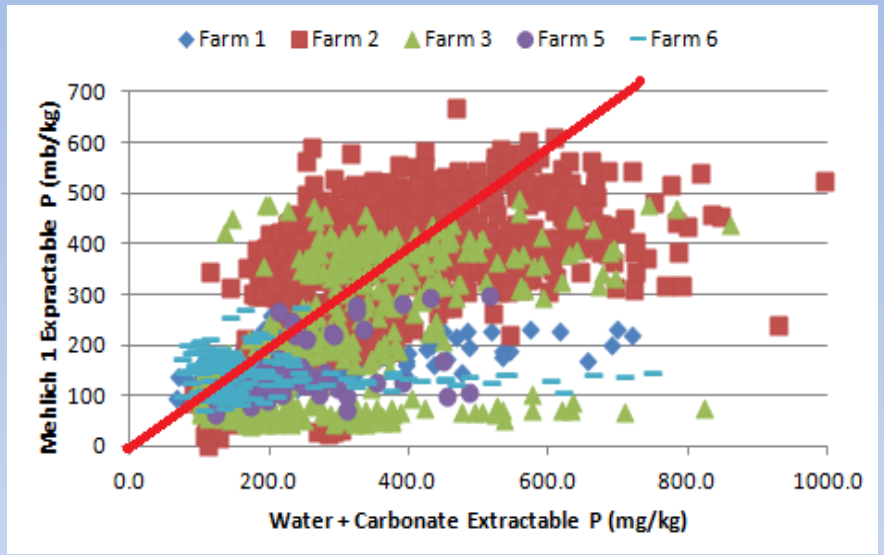
- Soils in C-139 Basin vegetable farms are high in pH (>7.0) and calcium (Ca>1000 ppm). These conditions form insoluble Ca-P precipitates which are unavailable to the plant.
- Growers are aware of the uncertainty of the Mehlich 1 and may develop their own recommendations based on experience.
- Opportunity to develop optimum application rates to maximize production while preventing excess P application by working one-on-one with volunteer growers under production conditions.

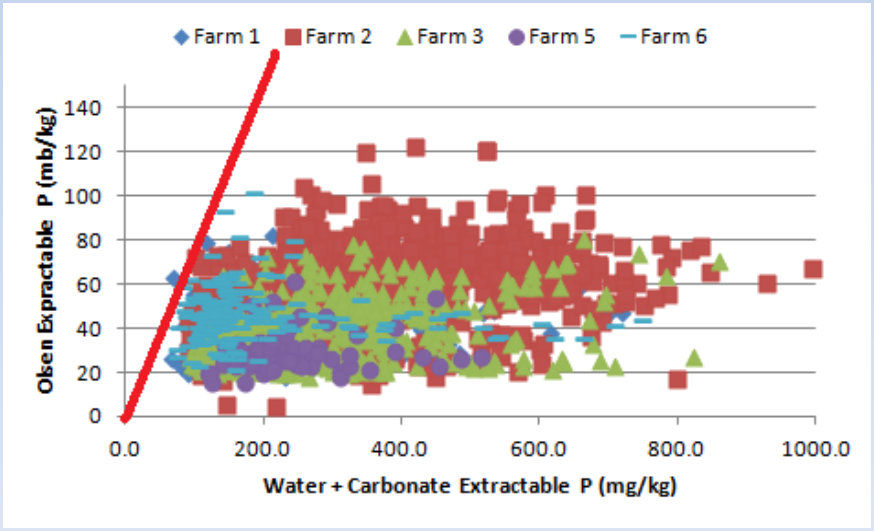
Soil Test P Calibration

Sequential analyses used to determine which extractants best predict plant available P[1]:

- Extractant to soil ratios were revised for Bray, Olsen and AB-DTPA for high P, pH and Ca levels.
- All extractants underestimated plant available P at >250 ppm.
- Mehlich 1 provided the best correlation to plant available P.

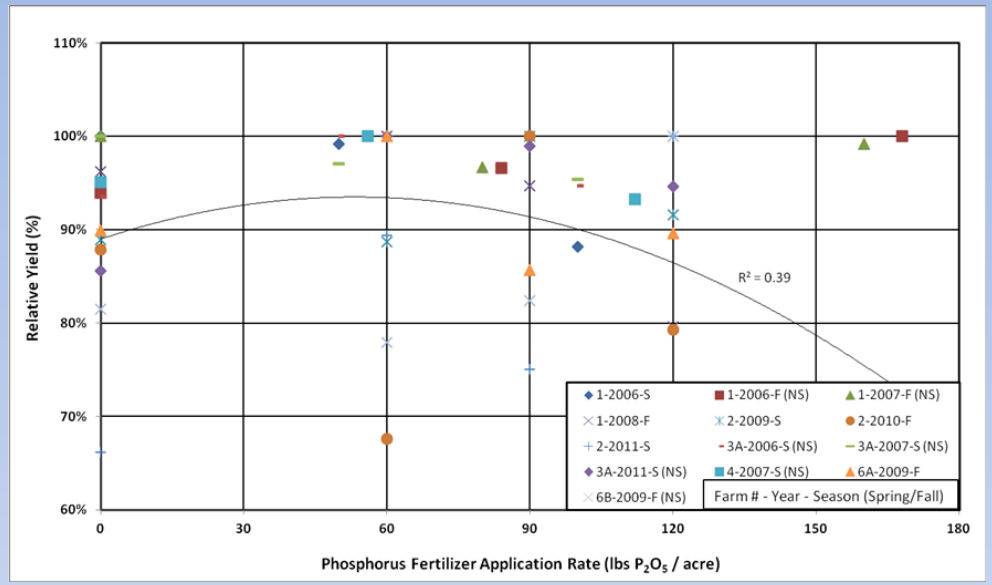
[1] Water + Carbonate Extractable P



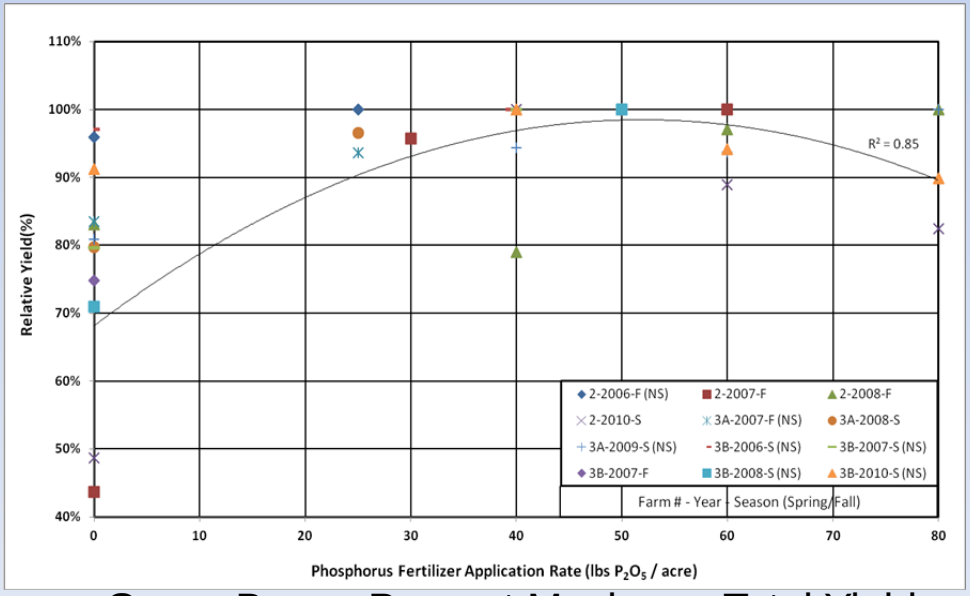


Effect of P Rates

- Pre-plant soil P were in the "High" level for all demonstrations.
- On average, rates resulting in highest yields were between the standard recommendation and the grower rates.
- Optimum rates varied from site to site, and season to season.



Tomato Percent Maximum Total Yield



Green Beans Percent Maximum Total Yield

Soil pH Amendments

- Soil pH moderation (lowering) by adding sulfur (S) to the soil during planting is an industry practice.
- Hypothesis: Lower pH delays the formation of P-Ca precipitates potentially reducing P application needs.
- Results from two tomato demonstrations and one green bean demonstration:
  - Lowering soil pH increased tomato biomass initially (30 days). However, yields nor biomass at harvest increased with amended soils.
  - P rates for the highest tomato yields were the same.
  - In contrast for green beans, the zero P rate was associated with the highest yield when the soil was amended.
  - Higher Ortho P levels in runoff were observed in amended soils. S levels in runoff were lower in mulched beds.

Slow Release Fertilizers

- Coated fertilizers provide slow-release of nutrients into the soil to improve plant uptake and reduce leaching.
- Sulfur coated and polymer coated fertilizers were used. Nitrogen, phosphorus and potassium were coated.
- Results from three tomato demonstrations on two farms:
- For the farm with two demonstrations, the highest yield and biomass were obtained with polymer coated fertilizer at the zero P rate, in contrast with rates of 90 and 120 lbs/acre when uncoated fertilizers were used.

Slow Release Fertilizers (continues)

- For the farm with one tomato demonstration, there were no statistical differences among the yields. However, the highest biomass was obtained with uncoated fertilizers at the zero P rate.
- For the one green bean demonstration, the highest yield and biomass were obtained with sulfur coated fertilizer at the zero P rate, in contrast with a rate of 40 lbs/acre when uncoated fertilizers were used.
- In some instances during the growing season, Ortho P levels were higher in runoff from blocks were coated fertilizers were used.
- There were no significant differences in soil P at harvest from coated and uncoated demonstration blocks.

Fertigation and Foliar Application

Two foliar vs. fertigation demonstrations for tomatoes were conducted in greenhouses:

- Spring 2011: the highest yields were observed at a P rate of 90 lbs/acre with fertigation and at 60 lbs/acre with foliar application.
- Fall 2011: the interaction between P rate and application method was not significant. The highest yields were recorded at 120 lbs/acre regardless of the application method.

Conclusions

1. The study verified that the Mehlich 1 extractant can overestimate plant available P in high pH, Ca, and Al soils. However, it showed that it provided a closer prediction than other extractants.
2. Crop response varied from site to site. Yields of half of the tomato demonstrations and ¼ of the green beans increased with P application despite high P soils.
3. On average, optimum rates were between the standard recommendation and grower rates:
   - For tomatoes, 60 – 90 lb/acre.
   - For green beans, 40 – 60 lb/acre.

Conclusions (continues)

4. Based on four demonstrations of soil pH amendments, reduced P rates were only observed for the single green bean demonstration.
5. Based on four demonstrations of slow release fertilizers, reduced P rates were observed for a farm with two tomato demonstrations, and for sulfur coated fertilizer for the single green bean site.
6. The fertigation and foliar application demonstrations offered contrasting results, while lower fertigation rates resulted in higher yields in the spring. No differences were observed in the fall.

Questions?

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