

Soil P Index and P Availability

Kelly Morgan*, Gene McAvoy and Shinjiro Sato



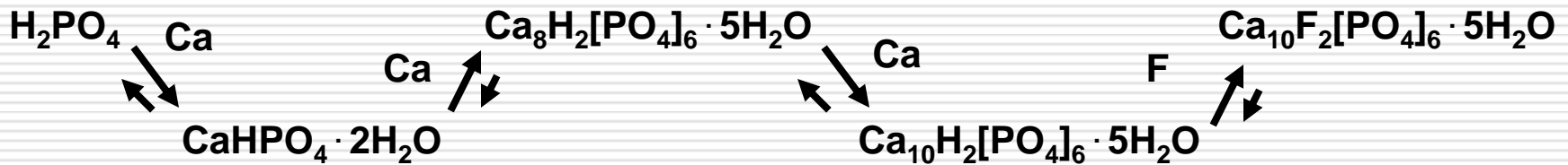
*University of Florida
Soil and Water Sciences
Department
Southwest Florida Research
and Education Center
2686 SR 29N
Immokalee, FL 34142
conserv@ufl.edu



Soil Characteristics and P

- Clay soils “fix” P in clay layers.
- Organic matter “fixes” P on exchange sites.
- Sand holds very little P.
- P precipitates out as Ca compounds in calcareous soils.

Soil Phosphorus



- Reduced Availability (pH = 7.0 to 8.3)
- “Fixed” by soil calcium
- Available to plant for short period of time
- Accumulates over time in-soluble forms
- Soil test measures “extractable” P and not “total” P
- “Extractable” P may contain P not available to the plant

Soil Tests

- Extractable VS Available.
- Effect of pH on Availability.
- Interpretation.
- Recommendation.
- Illustration of P Availability.

Soil Test Recommendations

Table 2. Mehlich-1 (double-acid) interpretations for vegetable crops in Florida.

Element	Very low	Low	Medium	High	Very high
	Parts per million soil				
P	<10	10-15	16-30	31-60	>60
K	<20	20-35	36-60	61-125	>125
Mg ¹	<10	10-20	21-40	41-60	>60
Ca ²	<100	100-200	201-300	301-400	>400

¹ Up to 40 lbs/a may be needed when soil test results are medium or lower
² Ca levels are typically adequate when > 300 ppm

- N not tested, assumed to need 100% N each season
- Mehlich 1 extractant to determine fertilizer rates
- Extracted not Available

Soil Test P

- Soil test results are extractable nutrients
 - ✓ An index of available nutrients
 - ✓ Not a measure of plant-available nutrients
 - ✓ Not be used to calculate available nutrients
- Extractants used in soil test
 - ✓ Water extracts only nutrient in solution (not available)
 - ✓ Mehlich 1 and 3 best results on soils below pH 7.2
 - ✓ Mehlich 3 can be used on higher pH soils
 - ✓ Bray 1 can only be used for soil with pH below 7.4 (not suitable for calcareous soils)
 - ✓ Olsen should only be used for calcareous soils

Availability

- P increasingly available with increased pH.
- P increasingly not available above pH 7.0 in high Ca soils.
- P most available in the pH range of 5.5 to 6.5.
- P soil tests suggest that P can accumulate and remain available for years.

Soil test Interpretations

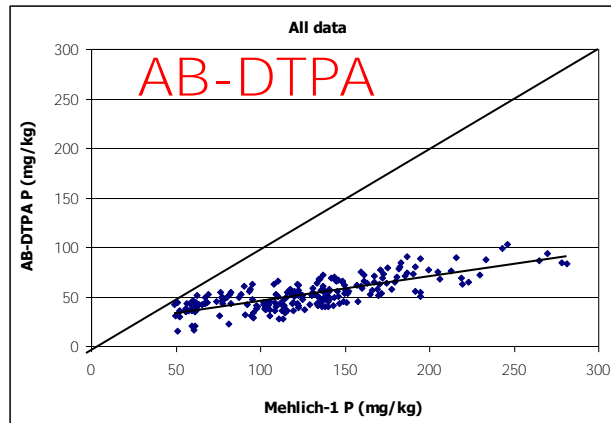
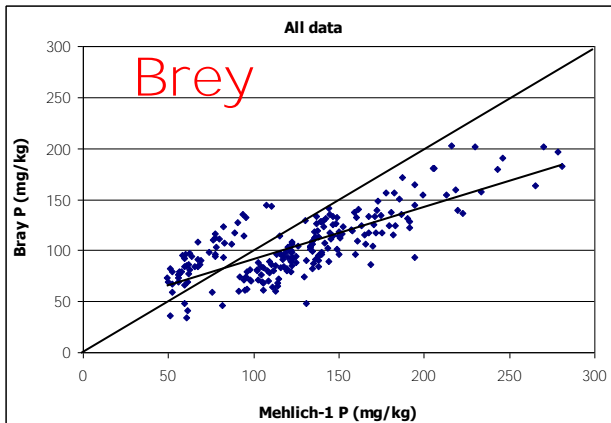
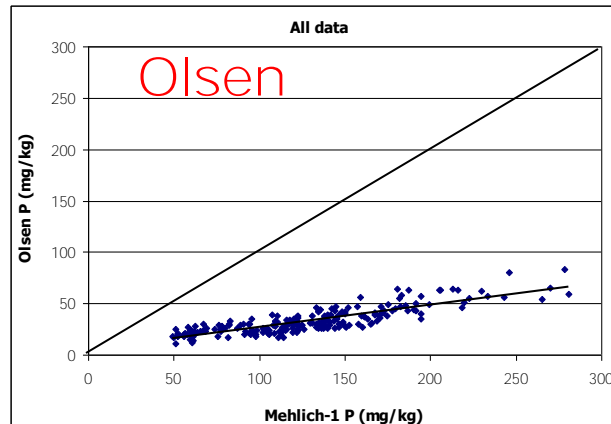
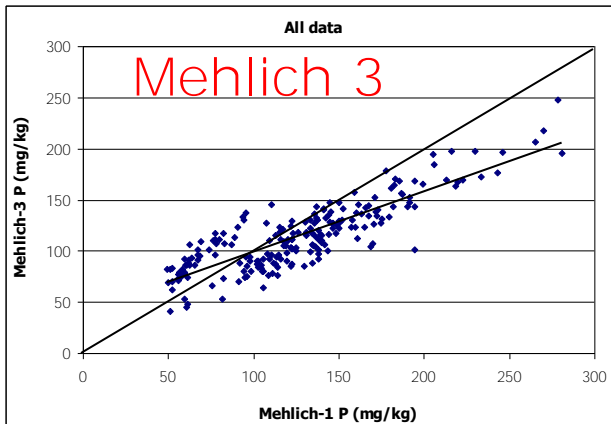
Phosphorus

Soil test rating	M1 Soil-test P (ppm)	Probability that <u>crop will respond</u> to P fertilizer
Very low	< 10	Very good
Low	10 – 15	Good
Medium	16 – 30	It might, it might not
High	31 – 60	About zero
Very high	> 60	No chance

Soil Extractants

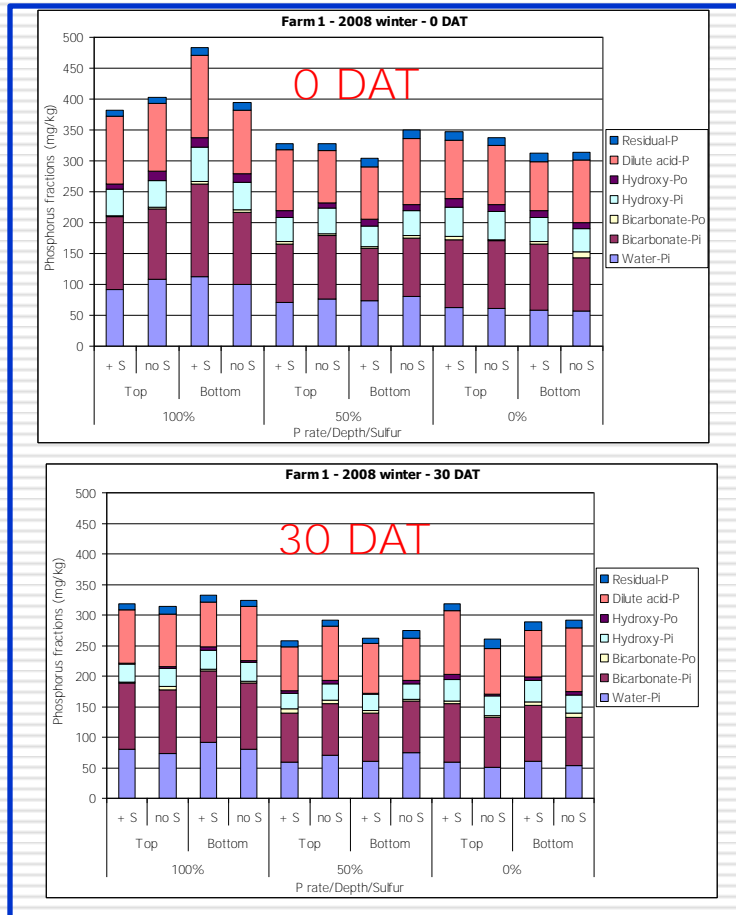
- Mehlich 1 - hydrochloric and sulfuric acids, strongly acidic
- Mehlich 3 - Weaker acid, used on wider range of soil pH
- Bray- Used for soil pH <7.4
- Olsen- Used for soil pH >7.4
- AB-DTPA- Neutral or calcareous soils

Extractants



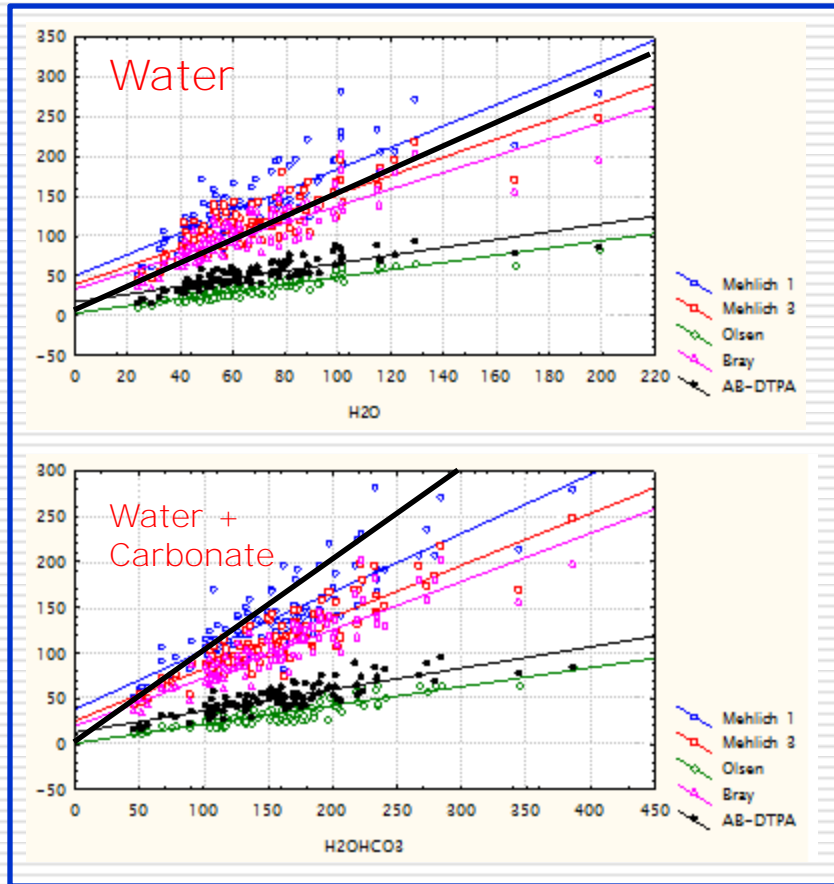
- All extractants remove less soil P compared with mehlich 1 at soil P >100 mg/kg (1:1 line)
- Mehlich 3 nearly identical to Bray
- AB-DTPA extract nearly twice the soil P compared with Olsen
- Olsen considered the best extractant for calcareous soils

Sequential Soil P Analysis



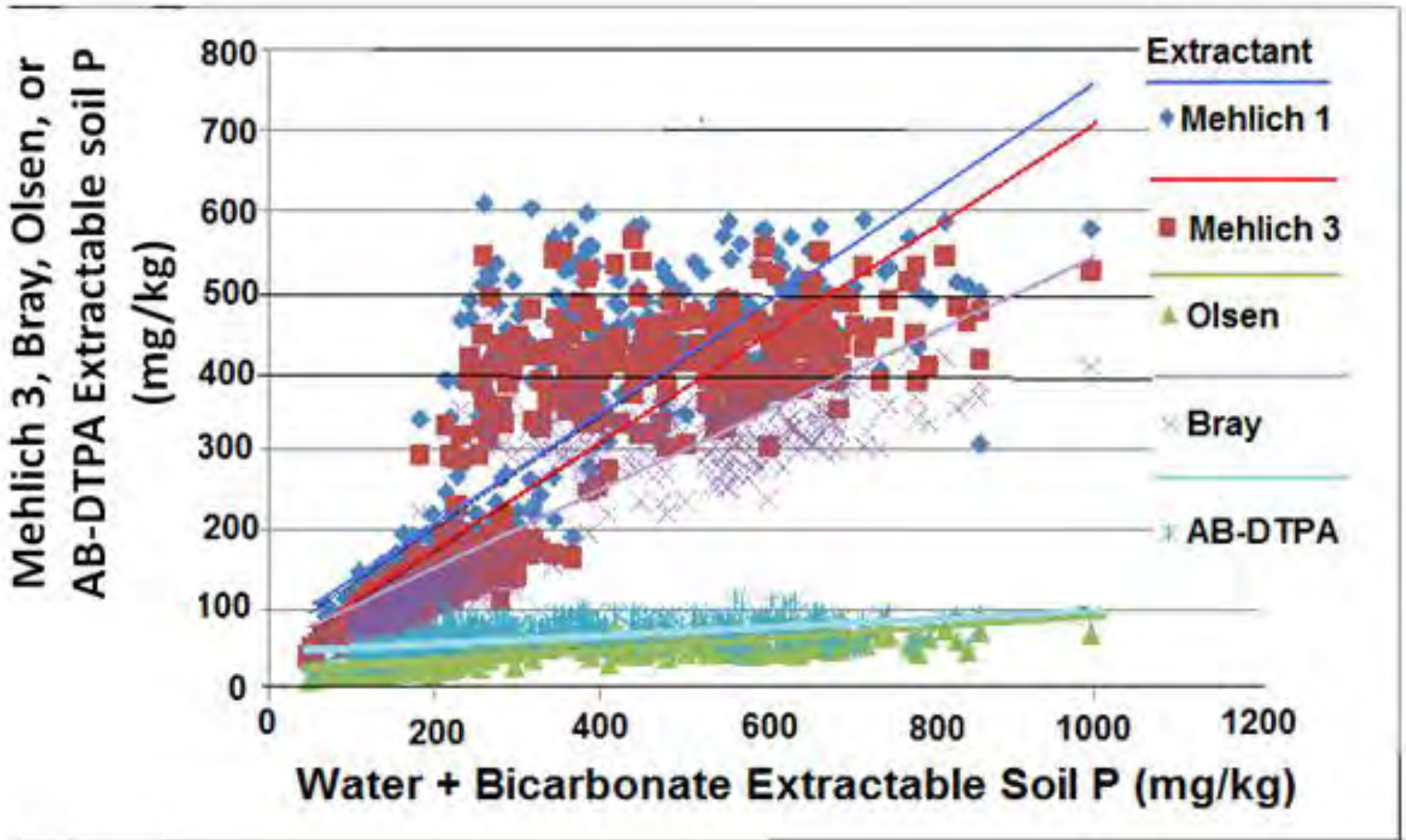
- Approximately 25 and 50 mg/kg applied at the 100 and 50% P rates
- Nearly all added P in water soluble fraction at planting (0DAT)
- Reduction water soluble P and increase in Carbonate extractable P at 30 DAT
- Little change in other soil (nonavailable) P fractions

Comparing Extractable P with P Fractional Analysis Results

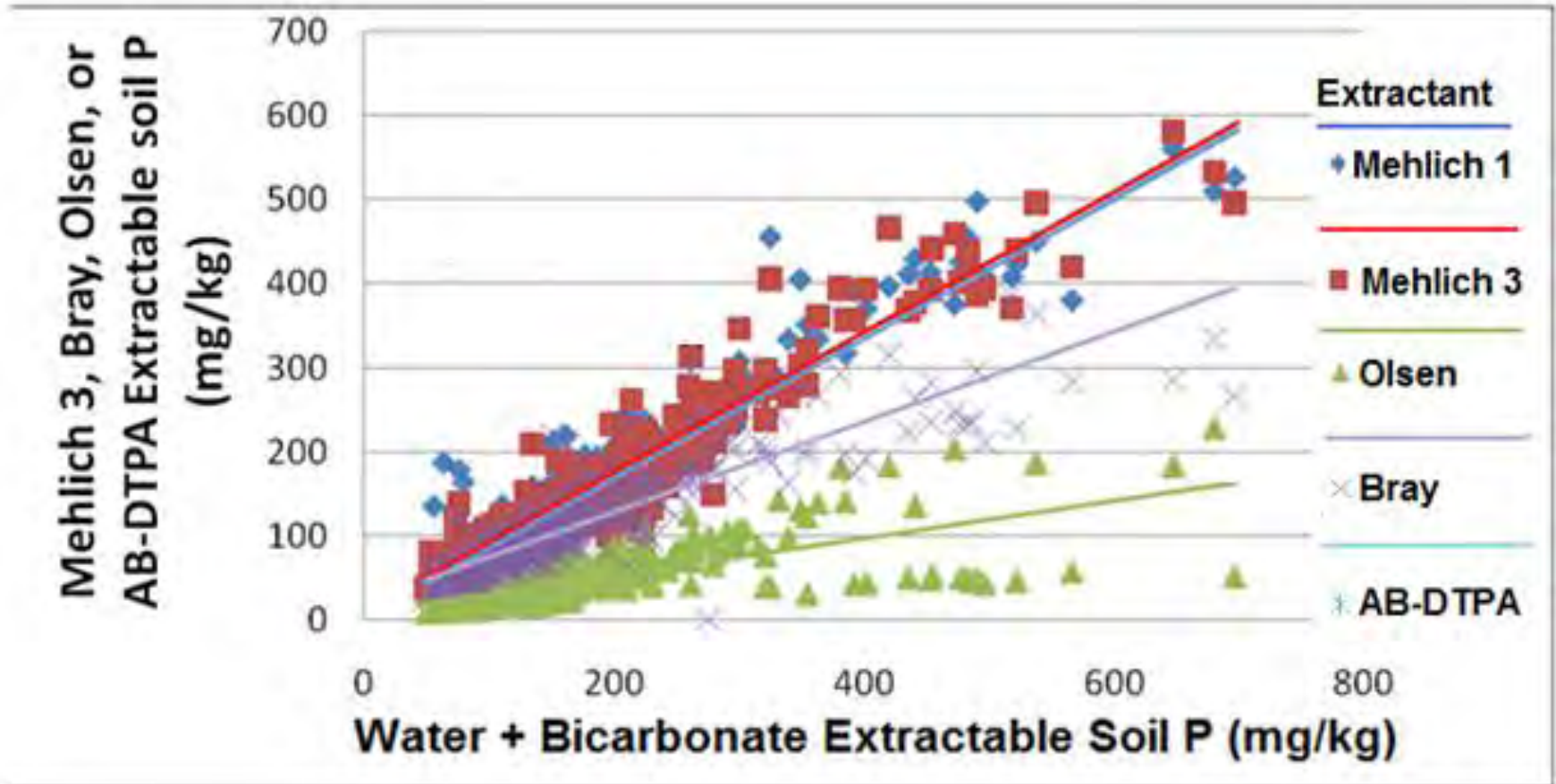


- Mehlich 1 extracts more P than in the water soluble fraction and nearly all the P in the water and carbonate fractions
- Mehlich 3 and Bray extracts nearly all of the water soluble fraction and approximately half of the carbonate fraction
- Olsen and AB-DTPA extracts only the water soluble P fraction

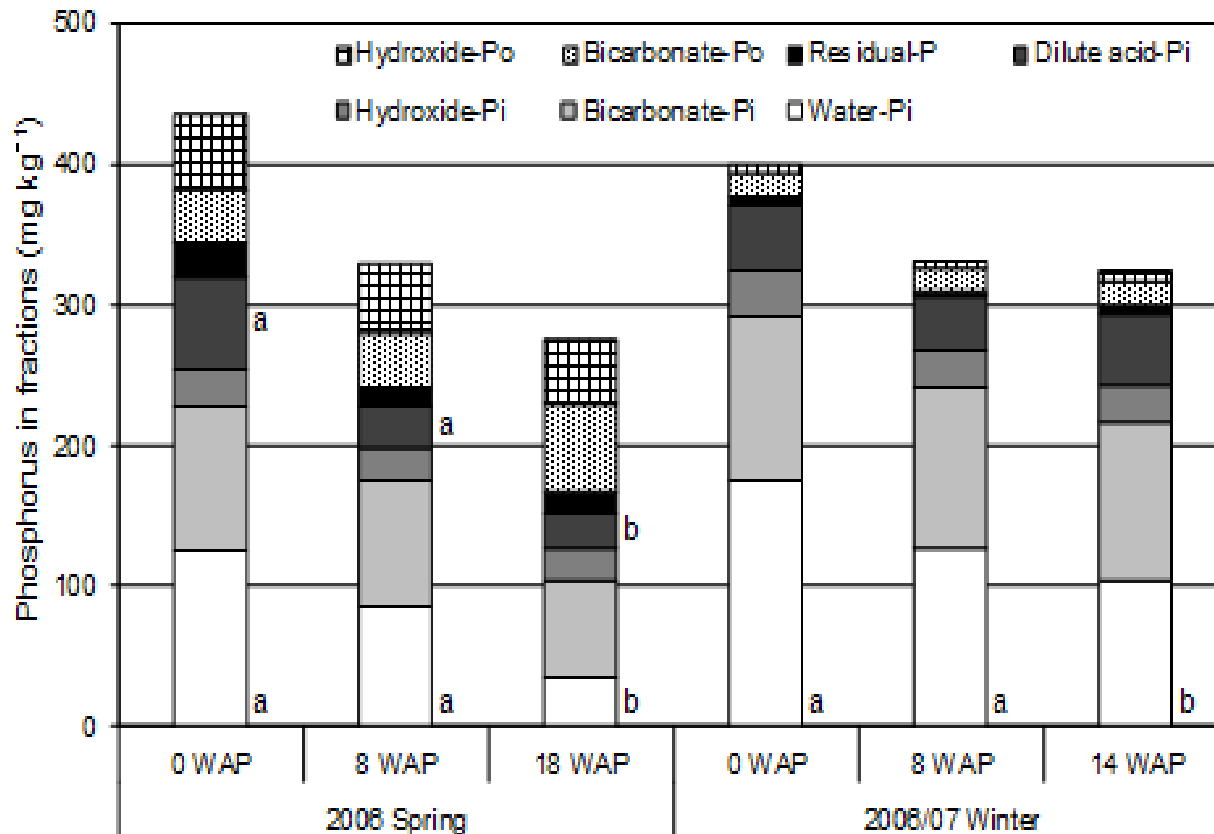
Standard Extractant to Soil Ratio – on High Ca Soils



Higher Extractant to Soil Ratios

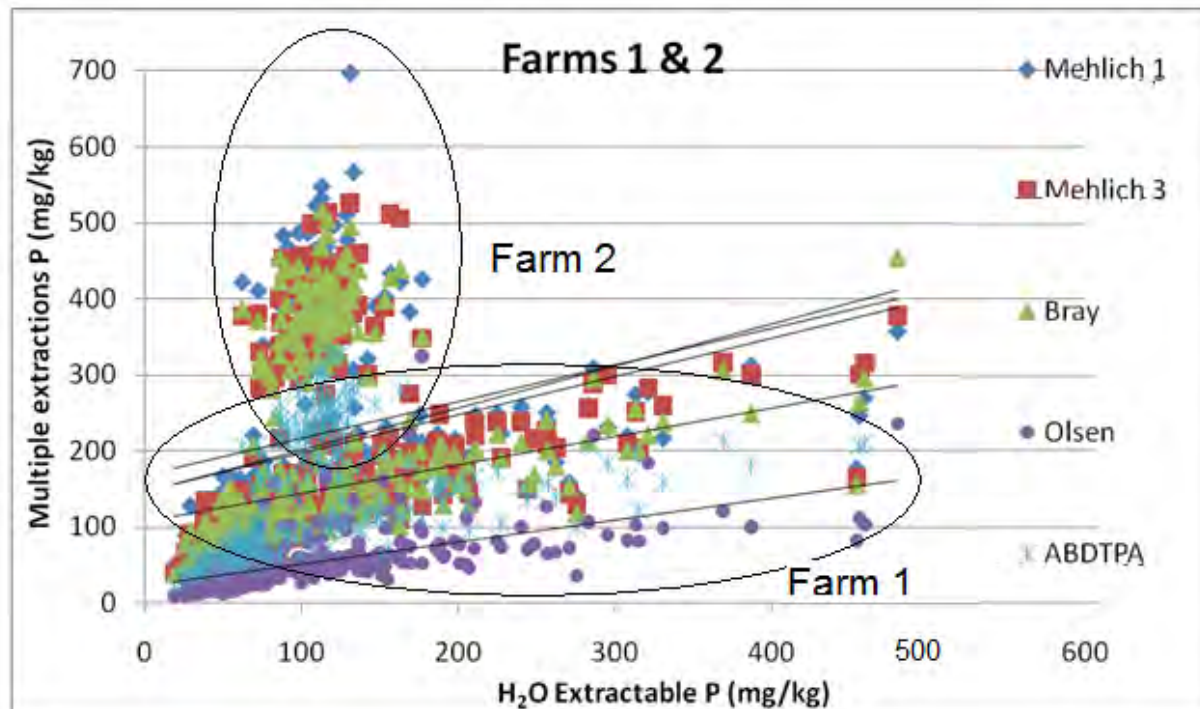


Changes in P Forms with Time



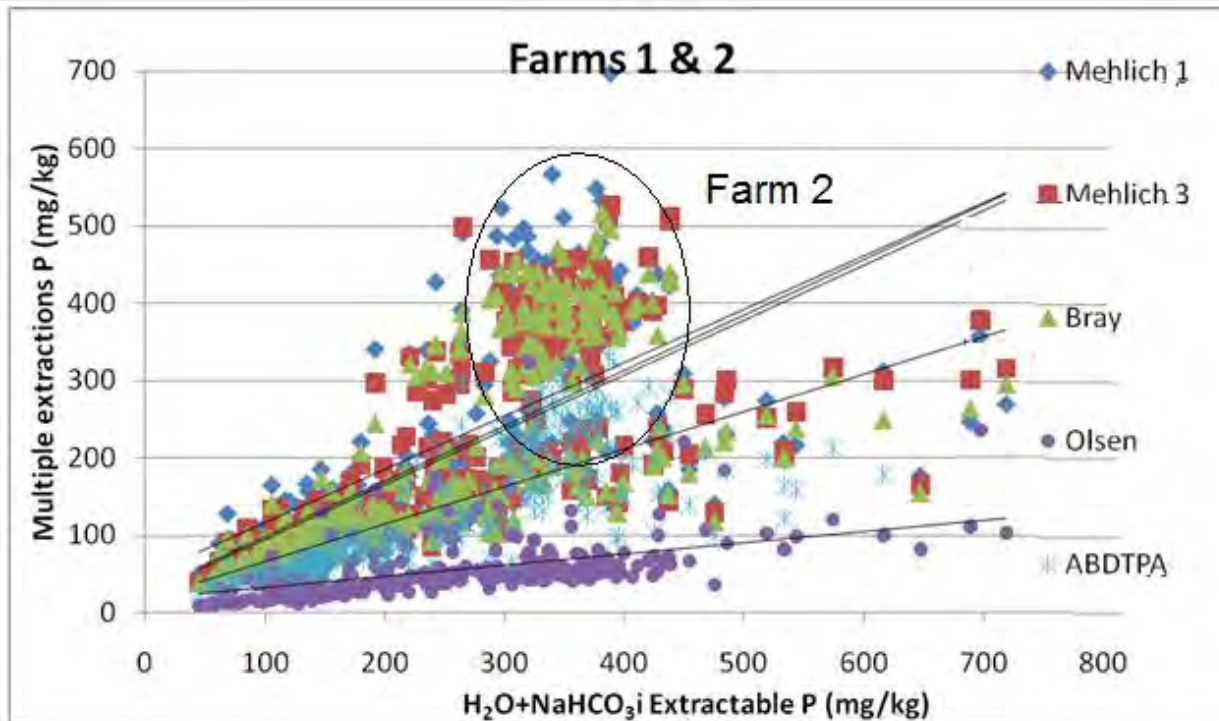
- Water and bicarbonate forms change with uptake
- Acid extractable forms do not change

Different Reactions for Soils with Higher Ca Content



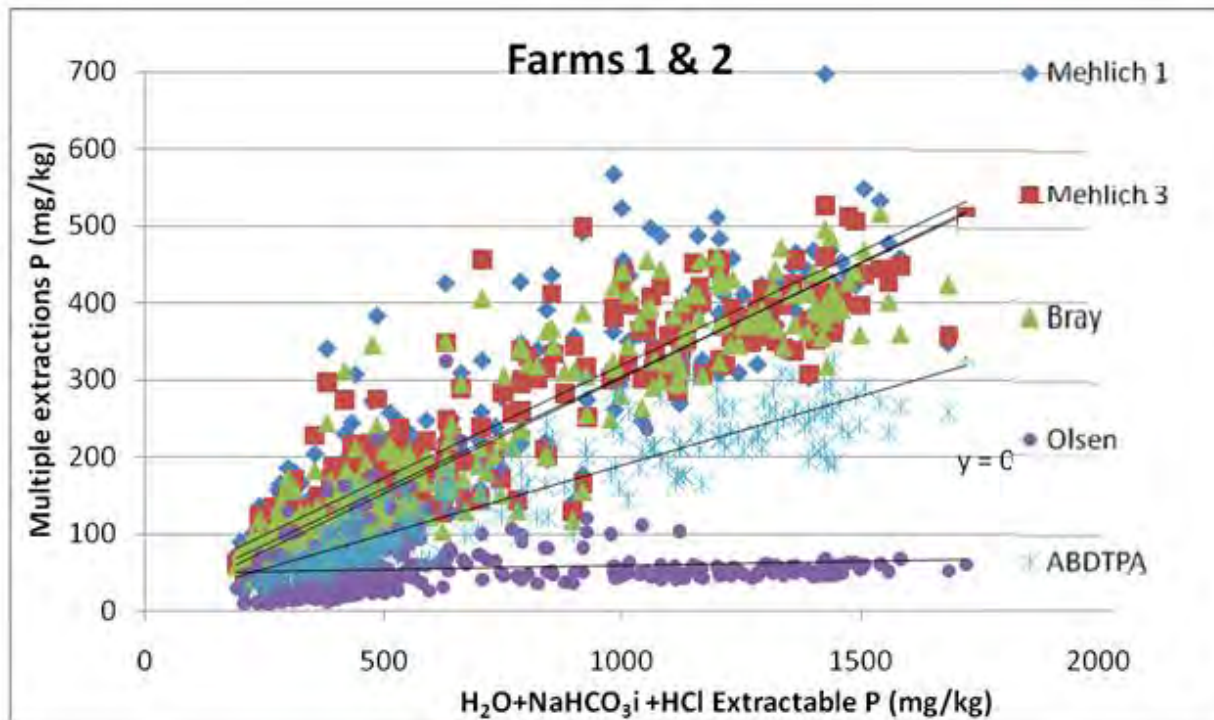
- Farm 1 less than 1200 ppm Ca
- Farm 2 greater than 2000 ppm Ca

Comparing Extractants



- Adding Bicarbonate extractable P explains some of the differences in Acid extractants

Comparing Extractants



- Adding Acid extractable P explains all the differences

Summary

- ❑ Plant P content is about 1/10th that of N or K.
- ❑ P soil tests suggest that P can accumulate and remain available for years
- ❑ Under S. Florida soil conditions (high Ca and high pH) P availability varies
- ❑ Soil tests should be counted on to guide P fertilization. New Index for high Ca and high pH soils need to be evaluated for S. Florida
- ❑ Soil amendments that affect soil P availability should be evaluated

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