Phosphorus Fertilizer Form, Rate and Application Timing Studies on Head Lettuce

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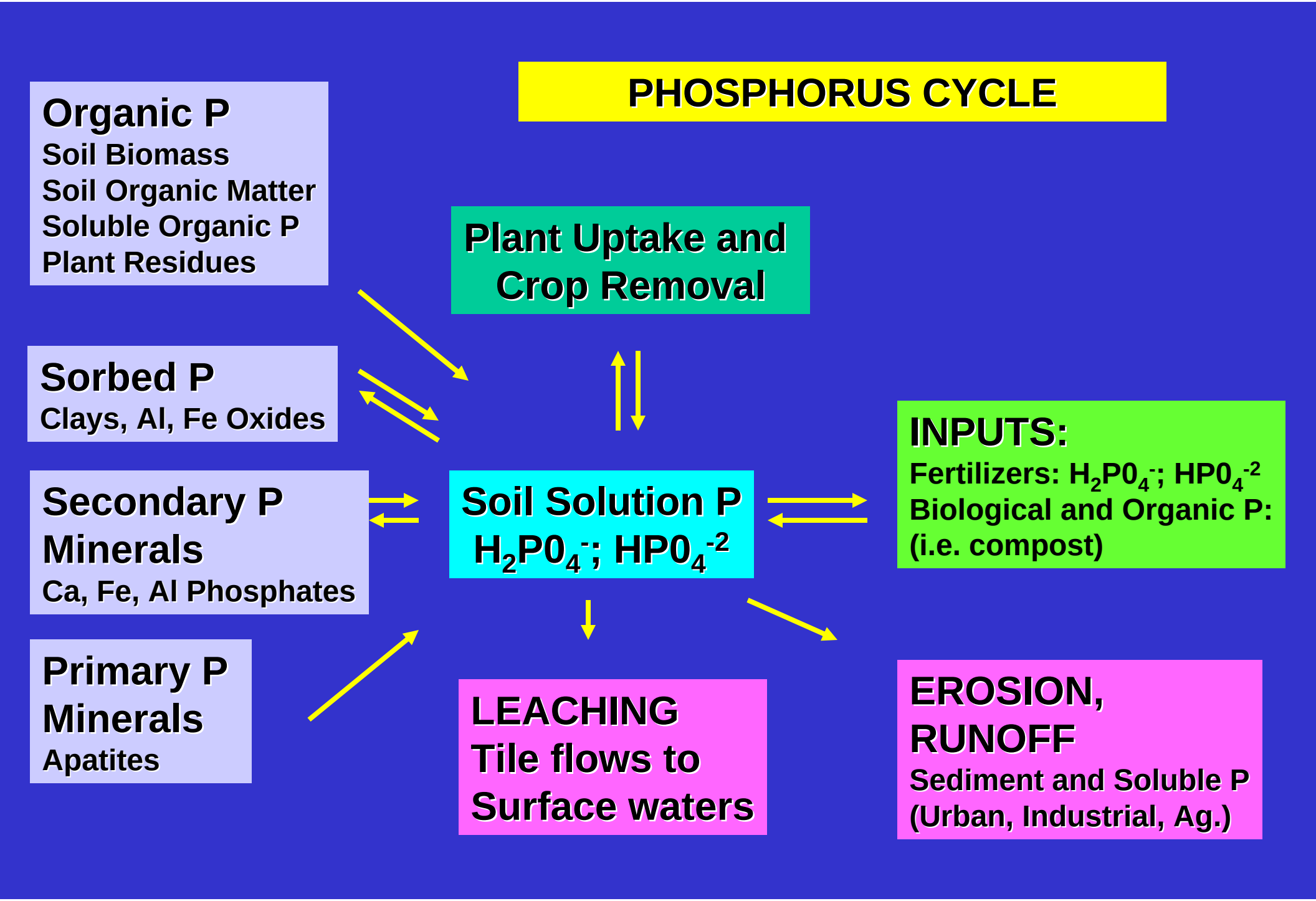
Phosphorus in Salinas Valley Soils

- Concerns about soil phosphorus came to the attention of the agricultural industry in the Salinas Valley about five years ago
- Enforcement of Total Maximum Daily Load (TMDL) and issues with the Conditional Waiver spurred this interest
- Through careful fertilization of crops in the Salinas Valley we have unwittingly built up phosphorus levels

Accumulation of P in Salinas Valley Soils*

Site Background	Soil P ppm
Pasture	37.3
Research station	53.9
Production field	92.6

* Sites within 0.5 mile of each other


PHOSPHORUS CYCLE
Organic P
Soil Biomass
Soil Organic Matter
Soluble Organic P
Plant Residues
Plant Uptake and Crop Removal
Sorbed P
Clays, Al, Fe Oxides
Secondary P Minerals
Ca, Fe, Al Phosphates
Primary P Minerals
Apatites
Soil Solution P
$H_2P0_4^-$; $HP0_4^{-2}$
INPUTS:
Fertilizers: $H_2P0_4^-$; $HP0_4^{-2}$
Biological and Organic P: (i.e. compost)
LEACHING
Tile flows to Surface waters
EROSION, RUNOFF
Sediment and Soluble P
(Urban, Industrial, Ag.)

Management of Phosphorus Fertilization

- Soil tests provide the best measure of available P for crop growth
- Based on P fertilization trials conducted by Tim Hartz in the Salinas Valley in 2002 – 2003, soils with greater than 55 ppm bicarbonate extractable P (Olsen test) do not respond to additional P fertilization
- Soils with less than this amount, especially in the winter when soils are cold, may need P fertilization

Phosphorus in Salinas Valley Soils

Soil Type	Range of soil P values	Mean Soil P ppm
Sandy Loam	62 - 139	93
Loam	36 - 133	90
Clay Loam	78 - 134	97

Management of Phosphorus Fertilization

If soils are so high in soil P is there any need for P fertilization?

- In most soils, especially in the warm times of the year – no
- There are soils that have levels that may justify P fertilization, especially in the cooler times of the year

Phosphorus Fertilization Trials

- Over the past two years we conducted four field trials on P fertilization of head lettuce
- We examined P fertilizer types and application timing. This article summarizes the results of these studies
- The objective of these trials was to evaluated if P fertilization rates could be reduced without jeopardizing yield

Typical Crop Uptake and Removal of Phosphorus in Lettuce

Crop	Crop Uptake Lbs P/A	Removal in Harvest lbs P/A
Lettuce	15 – 20	10 – 15

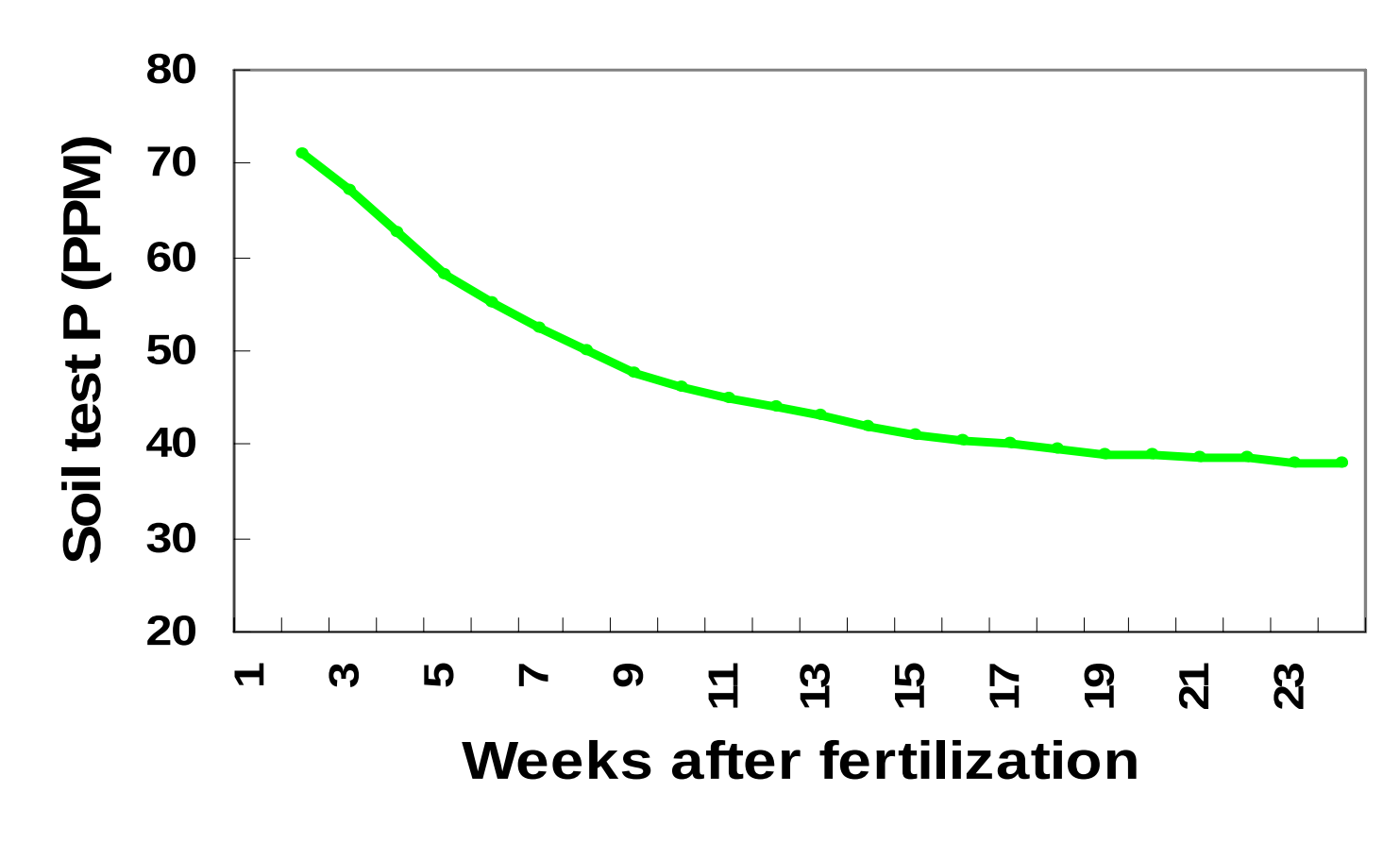
Trial Summaries

Trial	Soil P ppm	Planting Date	Yield response
1	47	Jan 27	No
2	68	April 18	No
3	30	April 29	Yes
4	45	June 2	No

Details of Trial No. 3

Treatment	P/acre lbs	P_2O_5/acre lbs	Application
Untreated	----	----	----
Actagro 7-21-0	9	20	at planting
Ortho Phos 12-58-0	9	20	at planting
10-34-0 + 1% Avail	9	20	at planting
7-7-0-7[2]	9	20	at planting
15-15-15	27	60	Preplant

Timing of application of P makes a difference



@ 77 ºF at field capacity

P uptake and Yield

Treatment	Crop P Uptake (Lbs/Acre)	Mean Head Wt. (Lbs)	Mean Wt./Acre (Tons)
Untreated	11.3	1.09	29.5
Actagro 7-21-0	12.1	1.18	32.9
Ortho Phos 12-58-0	11.8	1.10	30.3
10-34-0 + 1% Avail	11.9	1.20	32.7
7-7-0-7	11.9	1.17	32.2
15-15-15	10.7	1.04	28.9

Recommendations

- Fertilization of head lettuce with P can be justified on sites with less than 55 ppm soil P in the winter
- Once soils warm in the late spring, however, these sites do not respond to P fertilization

Recommendations

- In situations where P fertilization is justified, low at-planting treatments applied in a band over the seedlines provides a useful technique to maximize yields
- The low P fertilization rates will help reduce further loading of P in Salinas Valley soils


Thank you for your attention