Managing P and K

Michael Smith

Oklahoma State University

Phosphorus or Potassium Deficiency

OKLAHOMA STATE UNIVERSITY
AGRICULTURE

K and P distribution

mid-season (July); initial shuck split (Oct) and leaf fall (Nov)

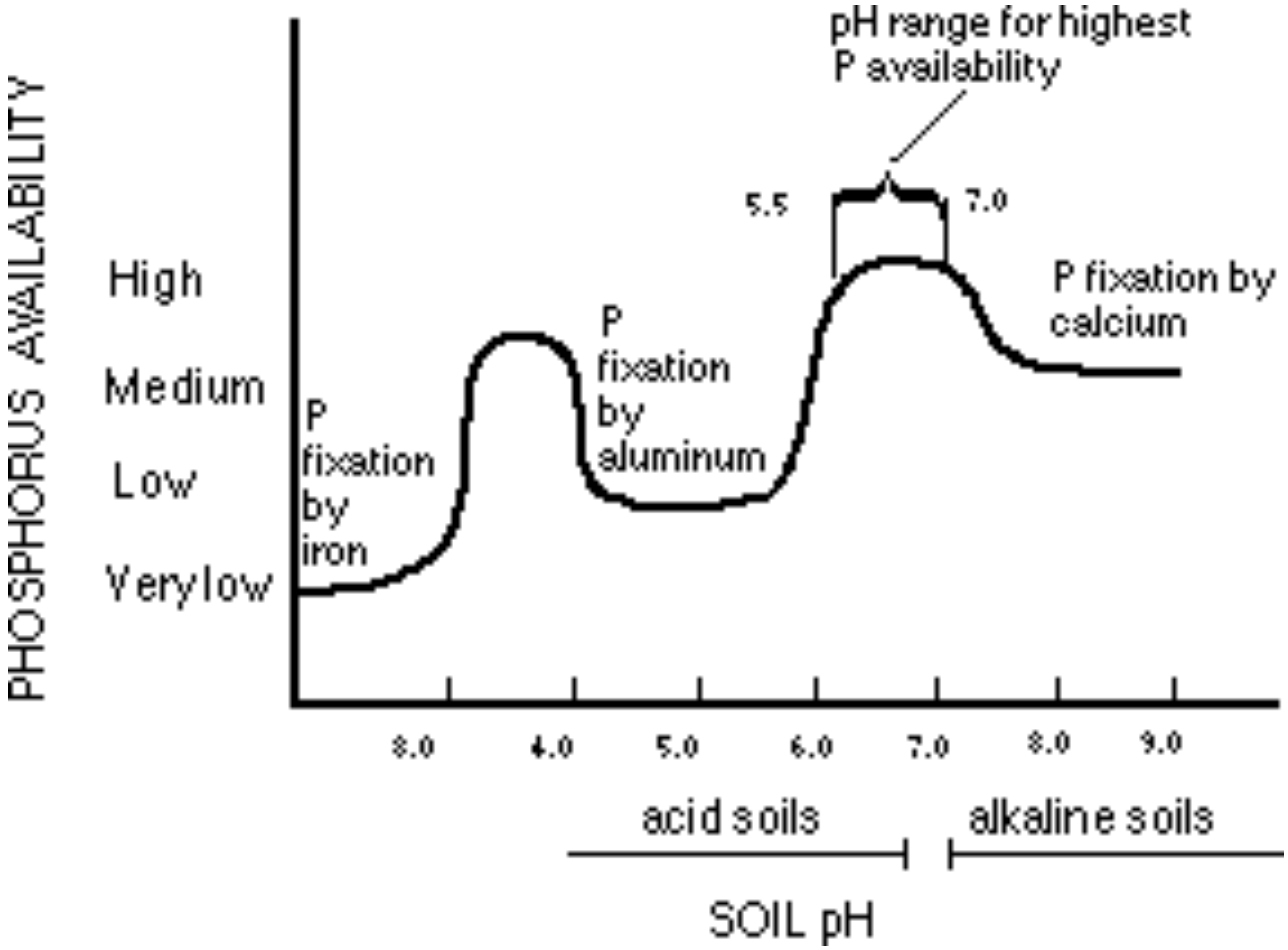
Plant part	K (% of total)			P (% of total)		
	July	Oct	Nov	July	Oct	Nov
Fruit	0.4	8.1	---	0.4	2.1	---
Leaves	19.3	10.5	9.4	17.0	12.8	5.5
Trunk & limbs	45.3	40.4	38.1	35.3	29.5	45.9
Roots	35.0	40.9	52.5	47.3	35.1	48.7

**Movement of K is primarily to the shuck – rapid transport in July and August. Involved in sugar transport and shuck opening.

**Movement of P is primarily to the kernel – rapid transport in late August through shuck split. Constituent of nucleotides, phospholipids (oil synthesis), high-energy phosphate compounds and stored in the kernel.

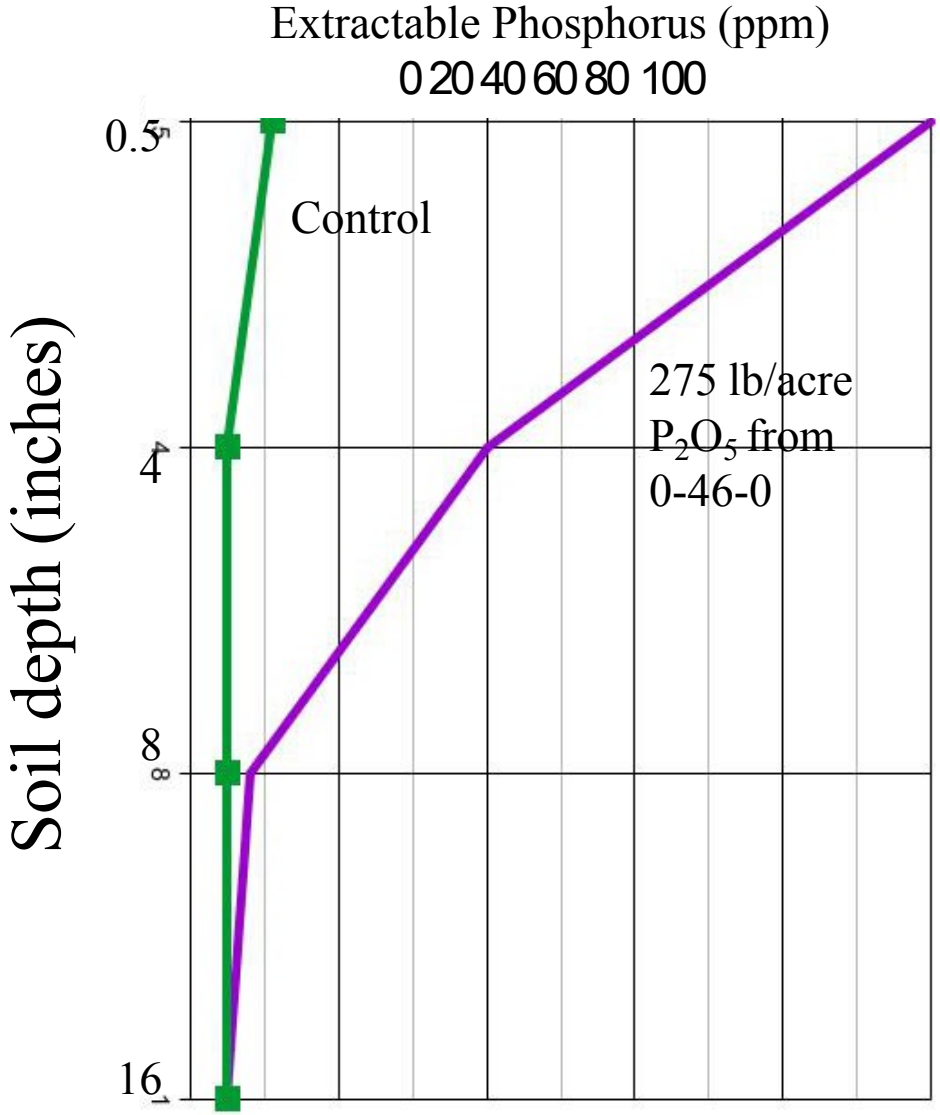
**Pecans loose substantial amounts of K and P in leaves at defoliation.

Phosphorus Availability



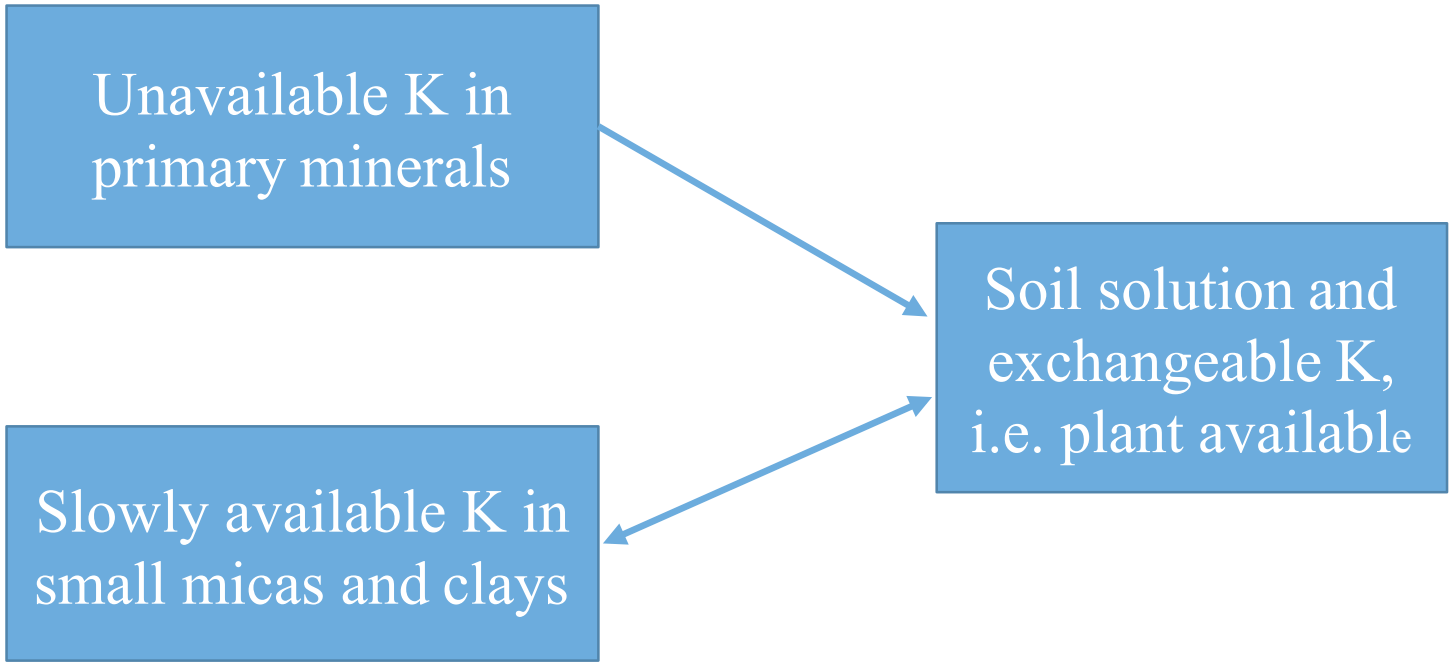
Lowell Busman, John Lamb, Gyles Randall, George Rehm, and Michael Schmitt. 2015. The nature of phosphorus in soils. Univ. of Minn. Extension.

Extractable Phosphorus 6 months after application on a silt loam soil in Wisconsin

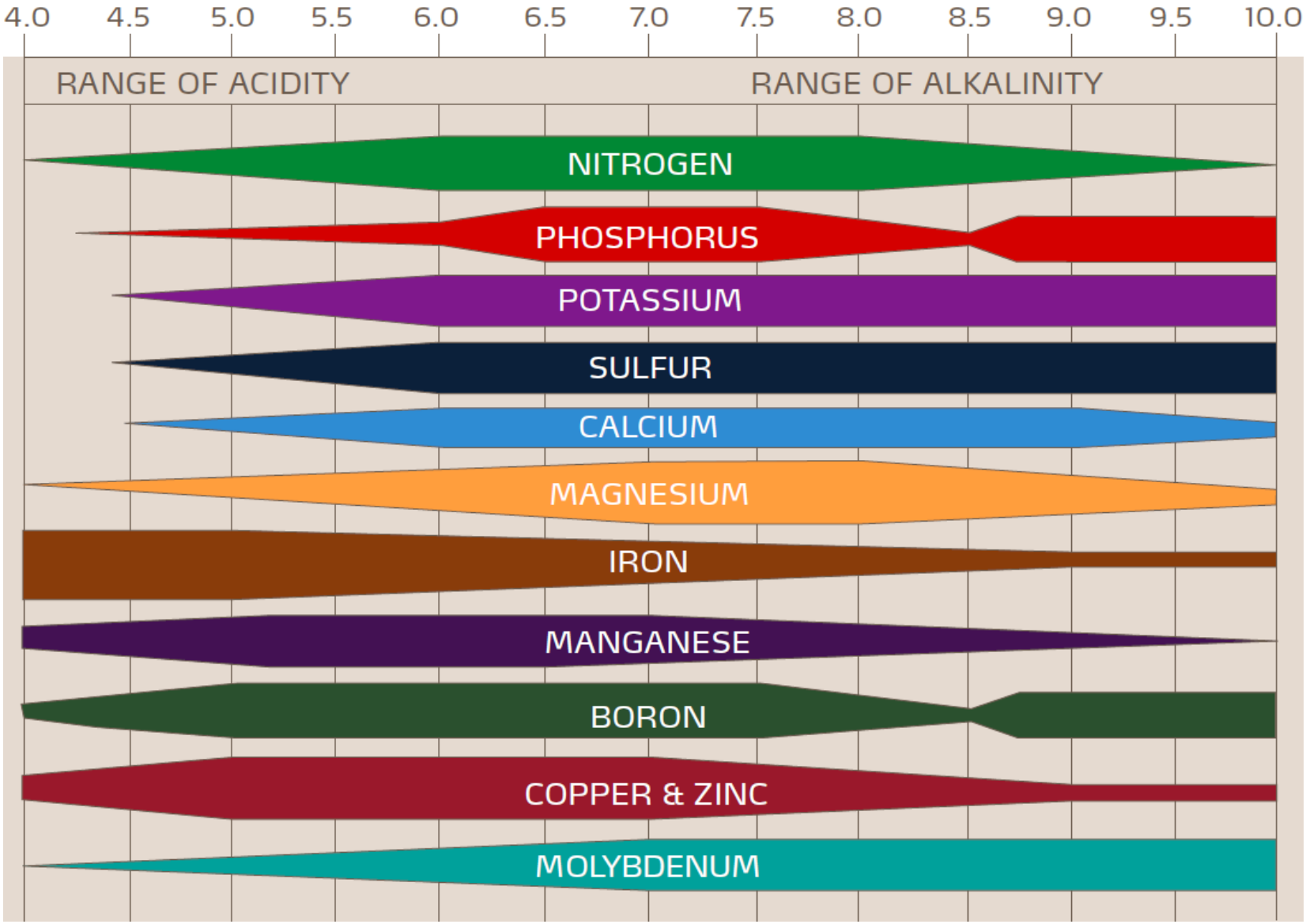


Midgley. 1931. J. Amer. Soc. Agron.

Potassium in soils

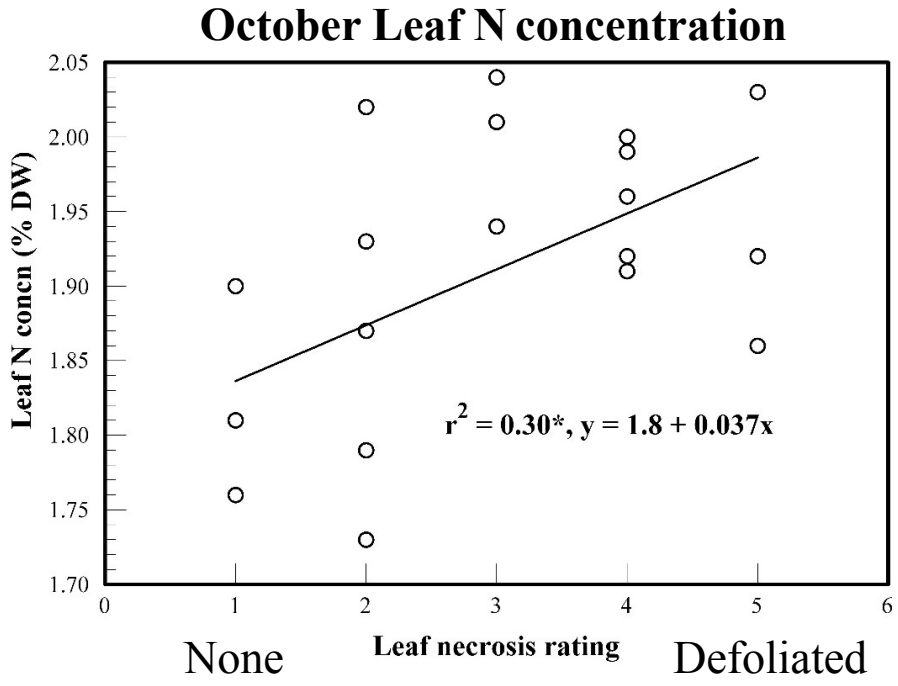


The Influence of Soil pH on Nutrient Availability

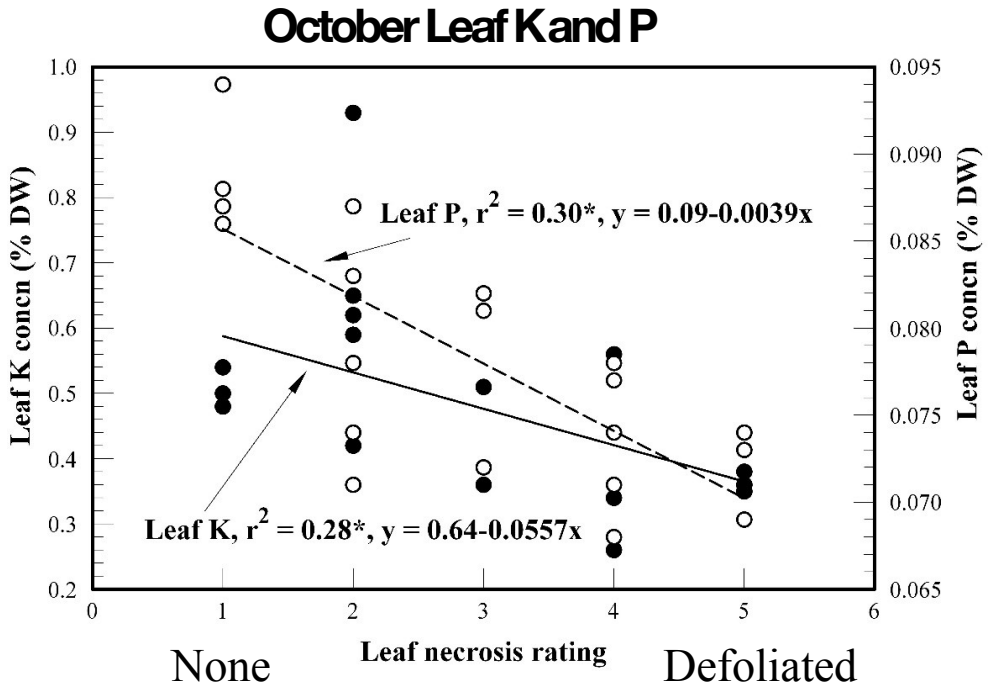


12-year-old Pawnee trees bearing large crop

Nitrogen Increases Symptoms



Increased P or K Decreased Symptoms



Banded P and K annually on 1 side of tree over irrigation drip line

- Rate 260 lb/field acre P_2O_5 applied as a band mid way between the trunk and canopy drip line, i.e. about 7 lb/tree
- Rate 140 lb/field acre K_2O
- P and K were applied alone or together plus a control

Pdeficiency symptom in July

Leaf symptoms after annual banding P & K

Element applied	Trees with any necrotic leaf symptoms 29 Aug. 2009 (%)	Tree necrosis rating 4 Oct. 2010	Tree necrosis rating 31 Aug. 2012
None	66	3.7a	4.0a
P	33	1.5b	1.7b
K	100	3.3a	4.3a
P + K	17	1.3b	1.5b

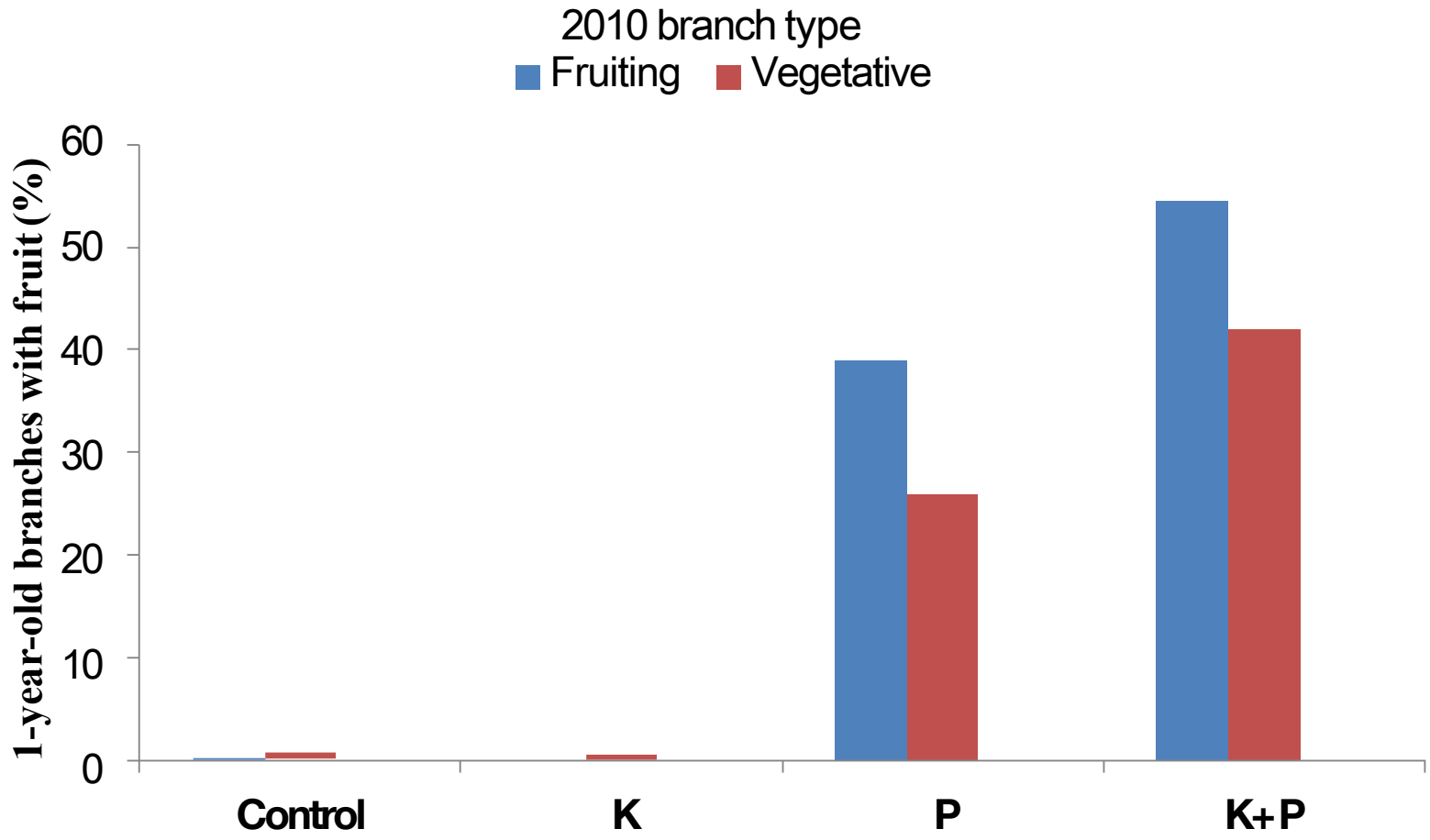
Symptoms appear closely linked to P shortage, even in July.

Rating 1

Rating 3

Rating 5

2011 1–year–old branches with fruit



Summary

- Banded P improved return bloom substantially and marginally improved kernel %
- Banded K improved kernel %
- Banding P and K together was effective in alleviating shortages.
- Either applied alone resulted in greater absorption than applied together.

Leaf P concentration

14-year-old 'Pawnee', All trees received same N rate, N-P-K applied dry in March, 28% N solution applied 4 times between 2 wk after budbreak to mid-June.

- Treatments
  - None
  - P on drip side
  - K on drip side
  - P& K on drip side
  - P& K on dry side
  - Pon drip side, K on dry side
  - K on drip side, Pon dry side
- 10 Replications
- Rates
  - 150 lb/a P_2O_5 from 18-46-0
  - 150 lb/a K_2O from 0-0-60
  - Balanced N with urea

- Results 2014 No differences
- P Results 2015, Leaf % DW
  - None vs P***: 0.117 vs 0.124
  - P drip vs P dry^{NS}: 0.125 vs 0.123
  - P& K together vs opposite sides of tree**: 0.122 vs 0.127
  - P only vs P & K^{NS}: 0.124 vs 0.124

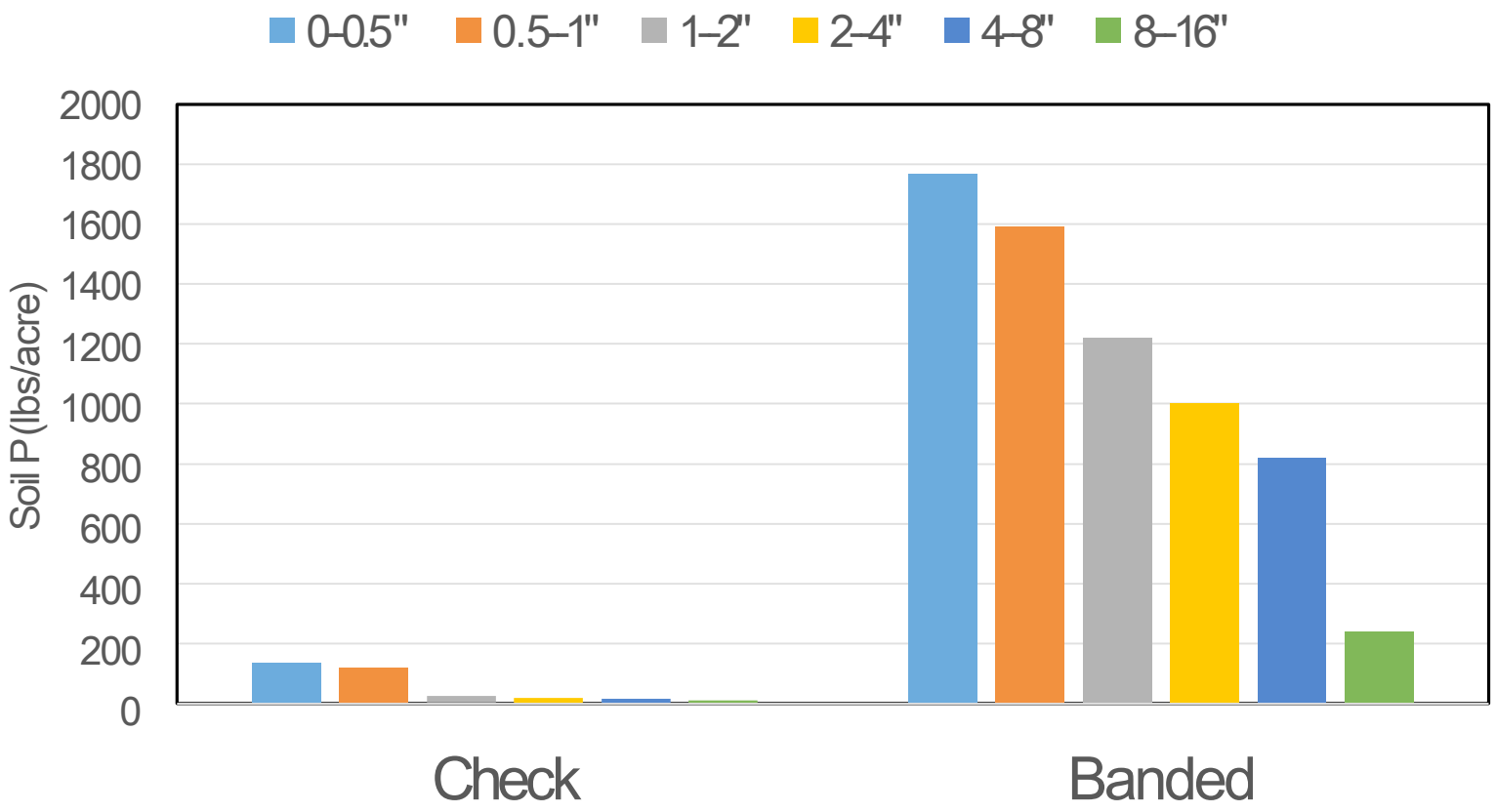
Leaf P & K distribution in July following banding on 1 side in March with 9-24-24 at 400 lb/acre

Application side	P %	K %
No	0.122	0.77
Yes	0.123	0.76

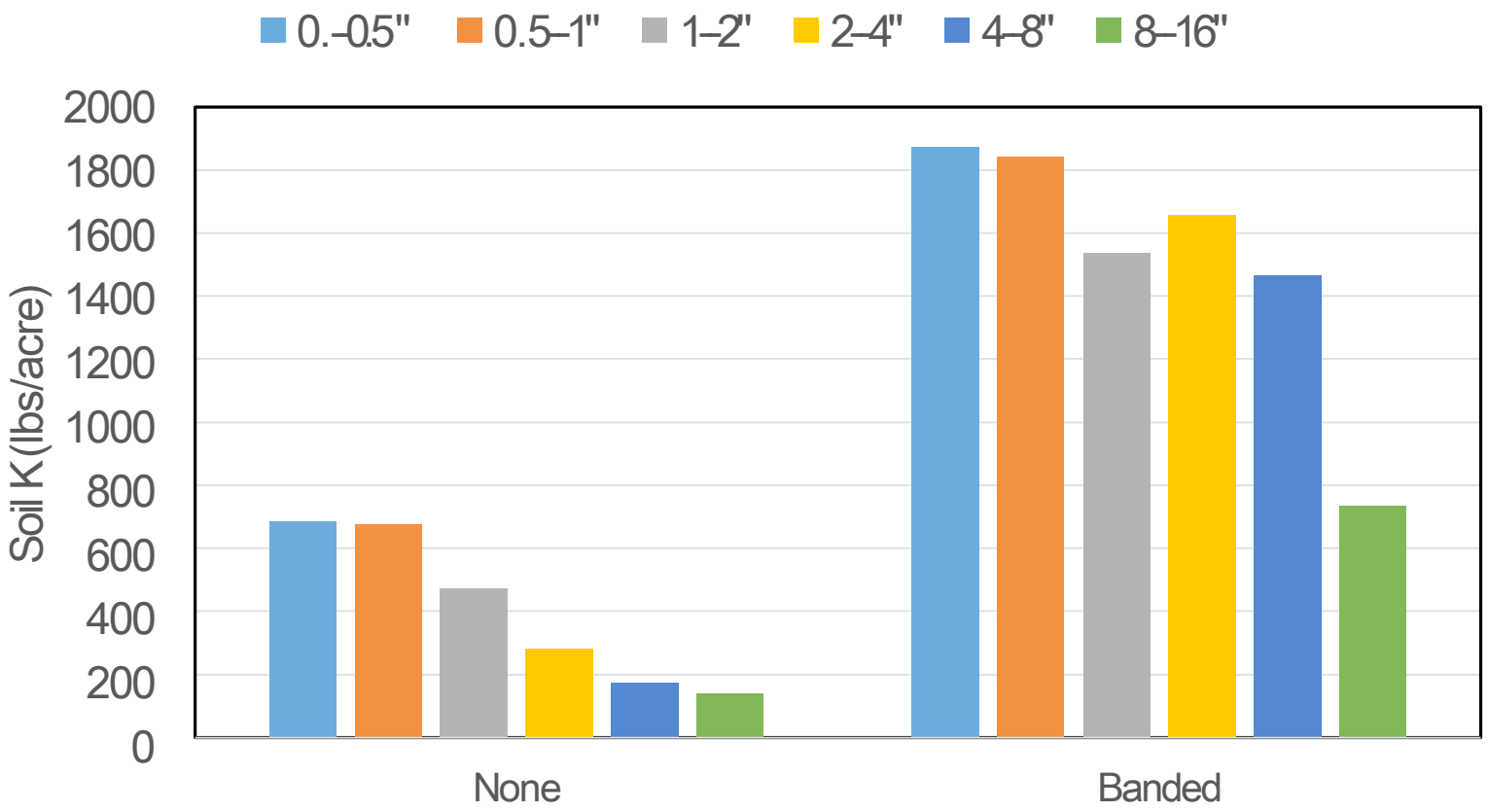
Effect of 400 lb/a 9-24-24 application time on leaf P & K concentration

Time of application	2014	2015
	P %	
Pre budbreak March	0.122	0.135
Water stage August	0.123	0.133
	K%	
Pre budbreak March	0.77	0.91
Water stage August	0.75	0.92

Soil P (lbs/acre) under the band or on the opposite of the tree. Trees banded for 5 years. Sample collection December.



Soil K (lbs/acre) under the band or on the opposite of the tree. Trees banded for 5 years. Sample collec:on December.




Applied with spinner off

Conclusions

- Target leaf concentrations are 0.14% P and 1.0% K.
  - When those concentrations are met the fertilizer can be withheld, except Desirable K target is 1.25%.
  - Maintaining a 6.2–7.0 pH benefits availability and uptake.
- P and K can be applied together with negligible affects on uptake.
- P or K should be applied on 1 side of the tree for maximum availability. Application should be to the same location annually.
- P or K applicaNon can be effective when applied pre budbreak and through the latter part of the growing season.
- Nut quality if very sensitive to K shortage, although low K will affect many tree responses.
- Return bloom appears to be especially sensitive to P deficiency, but P shortage will affect several other tree responses.