

Uptake and effect studies with foliar applied or fertigated phosphorus on soils with and without calcium carbonate

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Context

- 90% of Dutch orchards soils contain calcium carbonate
- Soil applied phosphorus increases extractable soil-P but does not increase P-leaf-content of apple on rootstock M.9 or pear on rootstock Kwee on these soils
- An efficient P-fertilization method on calcium carbonate containing soils is needed:
 - Determination of the P-leaf-requirement
 - A maximum input of 60 kg P_2O_5 /ha/year



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P-leaf-requirement in the Netherlands

- Full grown basal leaves of long shoots in august
- 0.16% is the present lower limit of classification "good"
- 90% of all leaf analyses results between 0.16 - 0.19%P
(Source: Fruitconsult)

It all started with the Niensens

	3 years 5 varieties	2 years 2 varieties	1 years 5 varieties
P leaf %	Watercore %	Membrane leackage	Anti- oxidant (ug/mL)
0.18	26 a	0.29 a	1.25 a
0.24	20 b	0.19 b	1.71 b

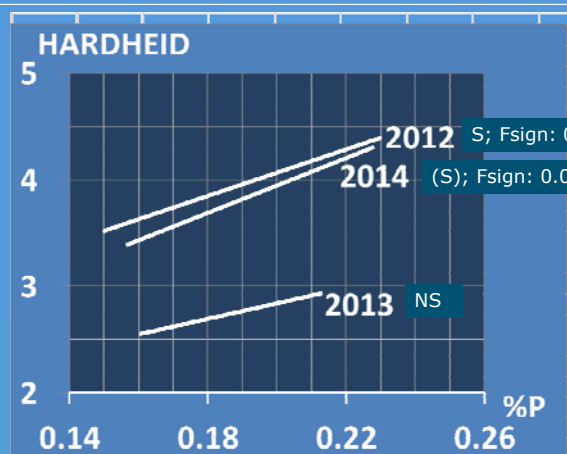
Nielsen et al., HortScience 43(3):885-890, 2008

Foliar P-application on pear; 8x(MAP+MKP)

P ₂ O ₅ kg/ha	Period	2012	2013	2014	Average
0		0.16 a	0.17 a	0.18 a	0.168 a
28	May- 15 July	0.17 b	0.18 a	0.21 b	0.187 b
56	May- 15 July	0.20 c	0.20 b	0.23 c	0.210 c
26	July onwards	0.22 d	0.18 a	0.21 b	0.202 c

Correlation P-leaf and fruit firmness

firmness (hardheid): kg/cm²; after 10 months storage



Effect found at average firmness of 4 kg/cm²; (at 5 and 3 no effect)

P-leaf and fruit firmness (2)

firmness (kg/cm²); after 10 months storage

2015	kg P ₂ O ₅ /ha	P leaf %
Control	0	0.15
8x (8kgMKP + 8kgMAP) in July and Augustus	65	0.31

Average firmness after storage: 3.3 kg/cm²

No effect of P application

Sandy soil (D50: 180 um, pH 5.9), apple

Fertigation	2016			2012-2016		
	P-leaf (%dm)	#fr /tree	kg /tree	P-leaf (%dm)	#fr /tree	kg /tree
Standard	0.23a	110a	16.7a	0.22a	413a	68.0a
+ P	0.32b	120b	18.9b	0.28b	432b	71.4b



open gutter
drained
120 L soil/tree



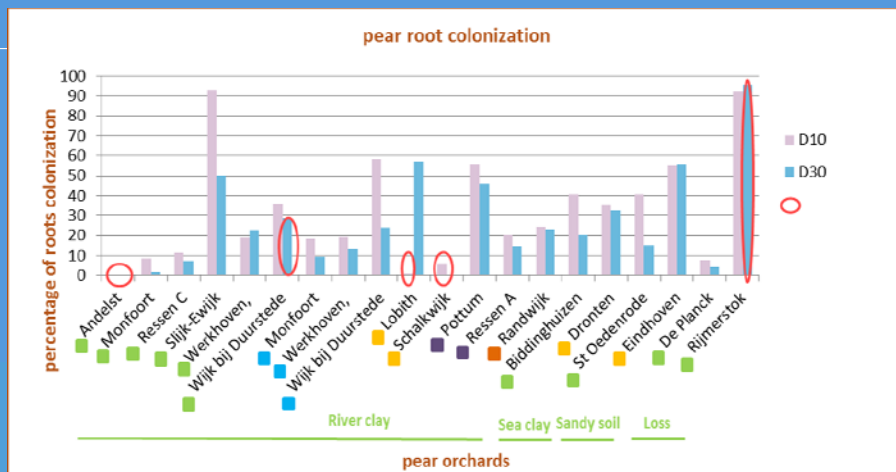
Main conclusions and recommendations

- Foliar P-applications increase leaf P-content of pear (consistent with early season applications; not consistent, but potentially more efficient, with late season applications)
- The minimal P-leaf-requirement of apple under Dutch growing conditions is higher than 0.16%P.
- More research is needed:
 - Effectiveness of late P-foliar-applications
 - Level of the minimum P-leaf requirement for apple and pear

Thanks you for
your attention



Inventory mycorrhiza's Dutch pear orchards



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