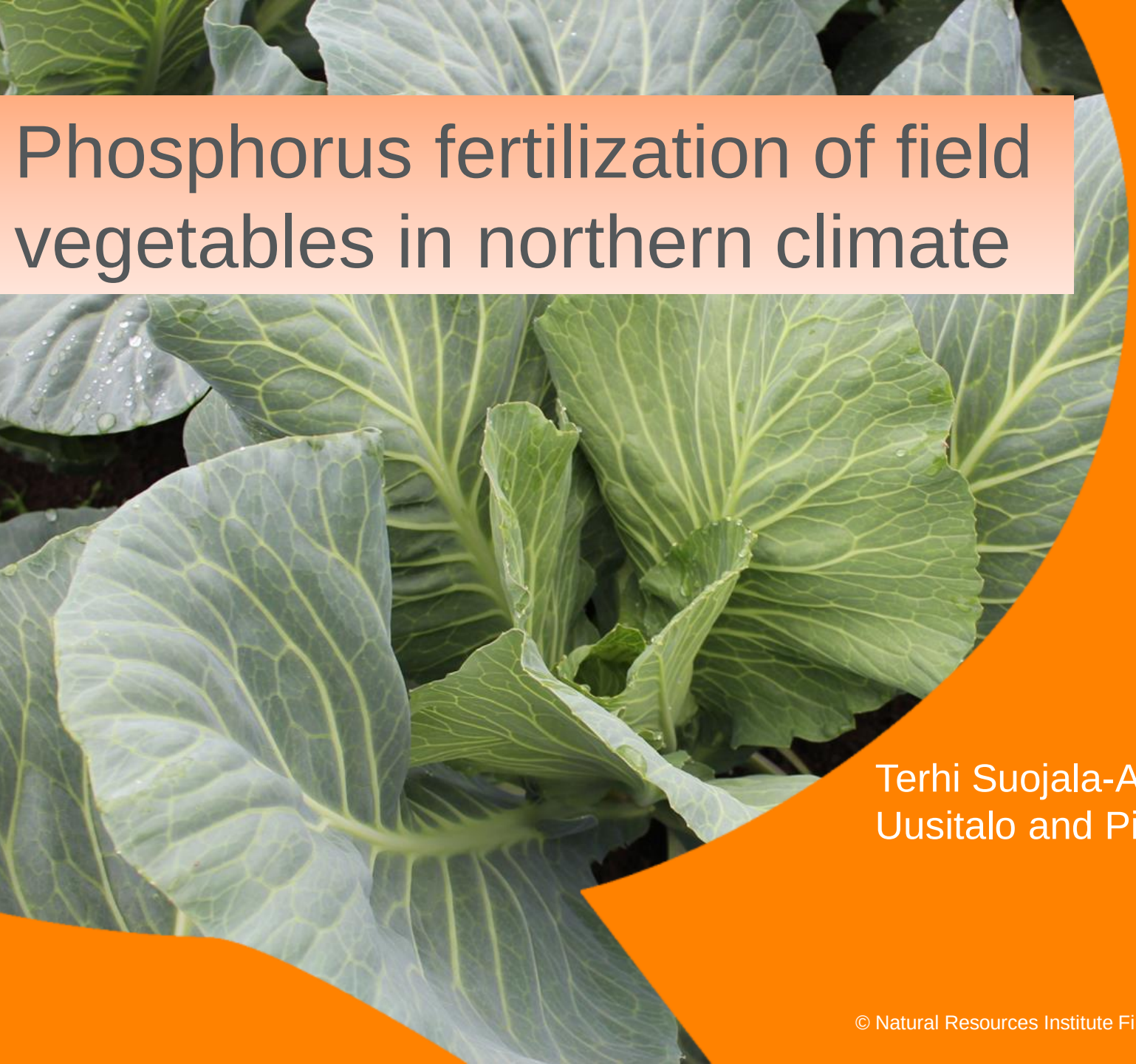
Phosphorus fertilization of field vegetables in northern climate



Terhi Suojala-Ahlfors, Risto Uusitalo and Pirjo Kivijärvi

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Horticultural production and research in Finland

- Horticultural production in Finland is an important sector of agriculture
  - Field vegetables (carrots, onion, cabbages, garden pea etc.)
  - Berries (strawberry, currants, raspberry etc.)
  - Apple
  - Greenhouse production (cucumber, tomato, lettuce, herbs, pot plants)
- Luke (Natural Resources Institute Finland) is the state research centre on agriculture, forestry, game and fisheries
  - Altogether 1300 employ
  - Horticultural research is conducted in different sites of Luke

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Background of the research on P

- Leaching of P from agricultural fields is one cause to eutrophication of lakes and sea
- P fertilization is limited in the Finnish environmental programme
  - P fertilization limits are given in relation to soil P status
  - In horticultural production higher P fertilization is allowed than in other field crops
  - On horticultural farms, soil P status is often quite high
- Very few research data on the yield effects of P on field vegetables

Research project in 2014-2017

- Funded by the Ministry of Agriculture and Forestry and Yara Finland
- Aims:
  - to determine the yield responses of field vegetables and strawberry to P fertilization
  - to provide growers with the information on the economical opimization of P fertilization
  - to evaluate the relevance of the prevailing P fertilization limits in the Finnish environmental programme

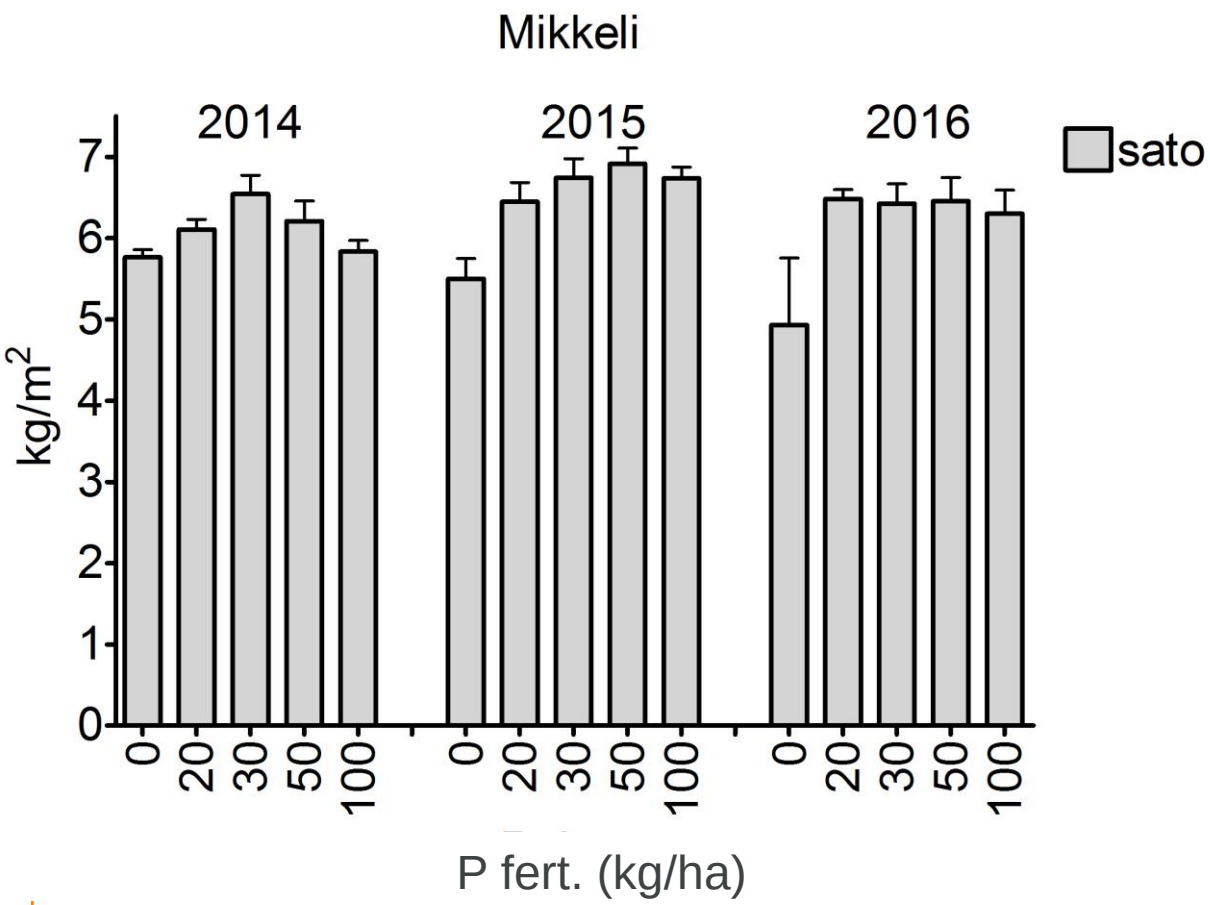
Field experiments in Luke in 2014-2016

Crop	Site	Soil P status	P fertilization rates (kg/ha)				
Onion	Piikkiö	Low	0	20	50	100	20 + 10 (starter)*
Onion	Piikkiö	High	0	5	15	30	
Onion	Mikkeli	Low	0	20	50	100	20 + 10 (starter)
White cabb.	Piikkiö	Low	0	20	50	100	20 + 10 (starter)*
White cabb.	Piikkiö	High	0	5	15	30	
White cabb.	Mikkeli	Low	0	20	50	100	20 + 10 (starter)

Also 14 farm experiments with carrot, white cabbage and celeriac

Yield results, Luke Mikkeli
WHITE CABBAGE ’Lennox’

P fertilization gave statistically significant effect each year



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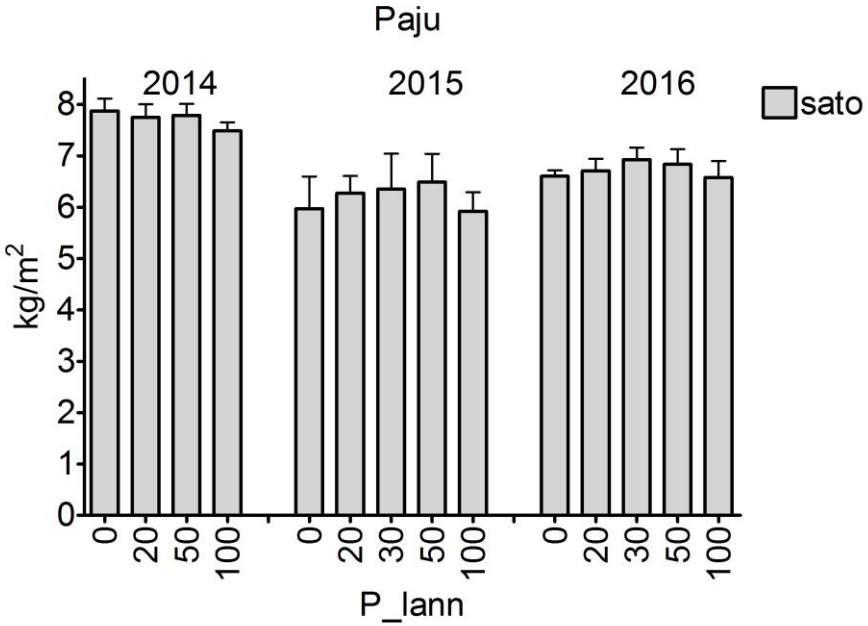
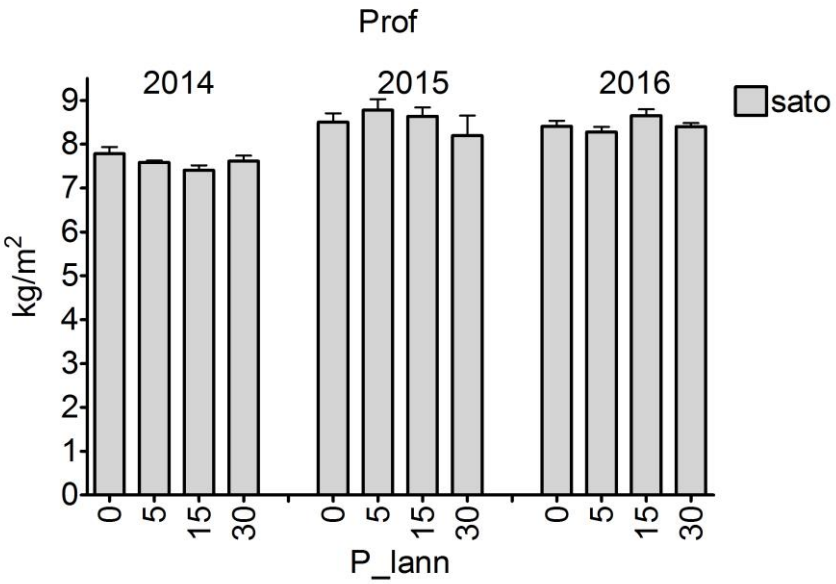
Yield results, Luke Piikkiö
WHITE CABBAGE ’Lennox’

No statistically significant effects found, either in low P soil (left) or in high P soil (right)





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Conclusions on yield responses

- In all crops, **statistically significant effects** of P fertilization on yield was found **in less than one third** of the experiments (altogether 32 exps)
- The maximum yield increase obtained by P fertilization was usually 10-20 %
- Crop P concentrations were affected more than the yield, but only in some experiments
- The challenge is to distinguish the conditions in which P fertilization is needed
- The P fertilization recommendations can be reduced to some extent

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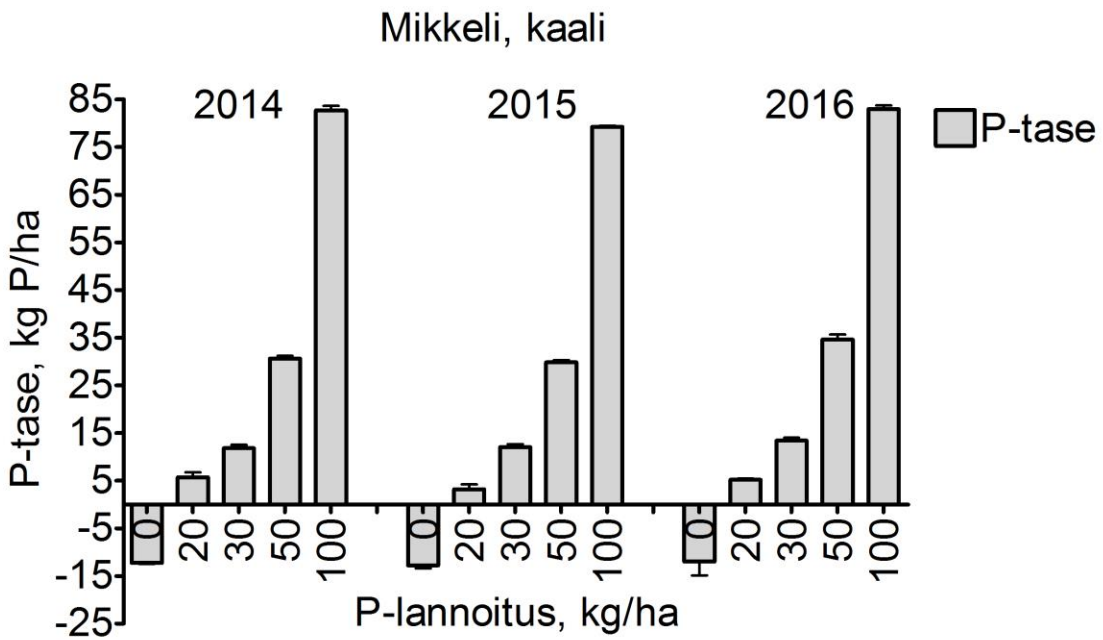
Effect of P fertilization on P balance

- High P fertilization results in very positive P balance -> risk for leaching and accumulation of P in soil
- Positive P balance in one year does not cause a great risk but continuous positive balance is a risky business!
- Growers should think P fertilization in the whole crop rotation, not just in one year



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Research on P fertilization is continuing

- Report of the project will be published in Luke report series in June 2017 (in Finnish)
- Some new experiments are being conducted, using liquid fertilizers in comparison to granular fertilizers
- Also interest in the better utilization of nutrient analyses of plant and soil
  - To understand the relation between fertilization rates and yield quantity and quality
  - To adjust the fertilization programmes

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Thank you!

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