



ERA-NET **SUSAN**

PEGaSus Phosphorus efficiency in *Gallus gallus* and *Sus scrofa* – Bridging the gaps in the phosphorus value chain

Klaus Wimmers

SusAn virtual project Seminar
16-17 November 2020

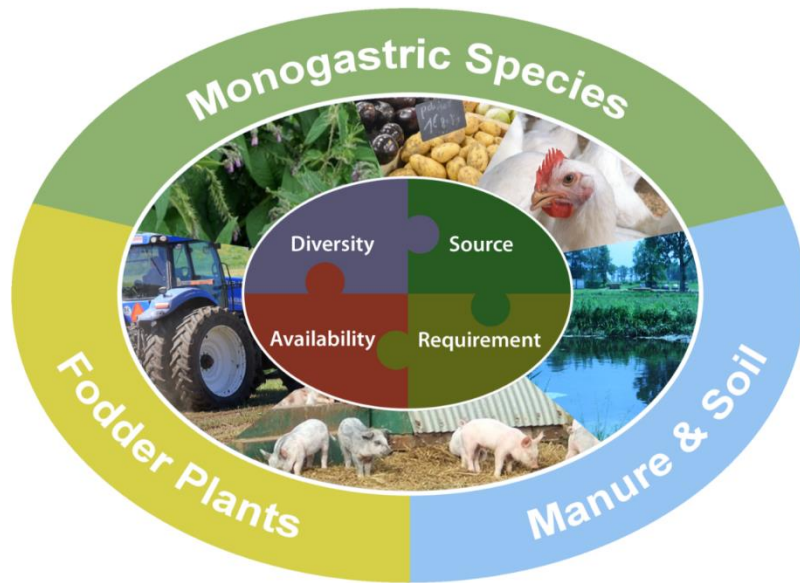


EUROPEAN RESEARCH AREA ON SUSTAINABLE ANIMAL PRODUCTION



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Approaches to achieving P sustainability in pig and poultry



- ▶ WP1: Diets & farm economics
 - P supply, P source
- ▶ WP2: Animals & microbiota
 - Endogenous mechanisms of P utilization
- ▶ WP3: P surplus & legislation
 - Re-cycling, policy options

Effect of a P quota on farm income

- Bio-economic Farm Optimization Model (scenario analysis):
 - Introduction of a quota on P surplus <20 kg P₂O₅/ha per year
 - Potential farm strategy:
 - 1. Reduce herd size (no export scenario)
 - 2. Export manure at 12 euro/ton
 - 3. Export manure at 24 euro/ton

Economic results for Italy: Percentage change of farm income in each scenario compared to the baseline

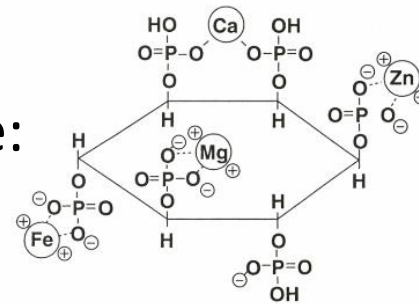
	No manure export		Manure export (price 12 euro/ton)		Manure export (price 24 euro/ton)	
	Vulnerable Zones	Non vulnerable Zones	Vulnerable Zones	Non vulnerable Zones	Vulnerable Zones	Non vulnerable Zones
Sows	-37.1 to -57.7	-59.2 to -75.9	-11.5 to -20.1	-18.8 to -34.9	-22.2 to -30.1	-36.9 to -51.4
Fattening pigs	-27.5	-51.9	-23.6	-44.7	-27.5	-51.9
Laying hens	-42.4	-68.5	-1.1	-1.4	-1.6	-2.3
Broilers	-47.4	-71.4	-0.9	-1.4	-1.2	-2.2



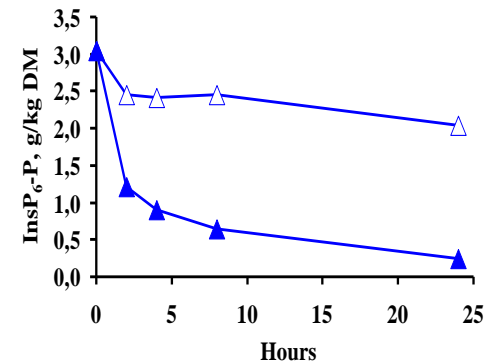
Dietary strategies to reduce P excretion

- P-conditioning
- Super phytase
- Phytate-depleted cereals
- Digestibility studies
- Liquid feeding
- Regional feed: Legumes
- Local feed: Comfrey

➤ Phytate:

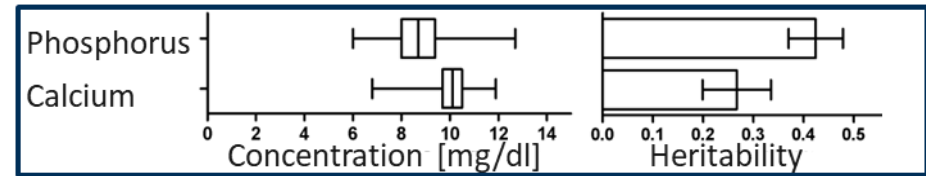


- Low supply of mineral P triggers intestinal mobilization of phytate P
- Follow-up of phytate cleavage products (InsP_x) in diets, excreta & soil



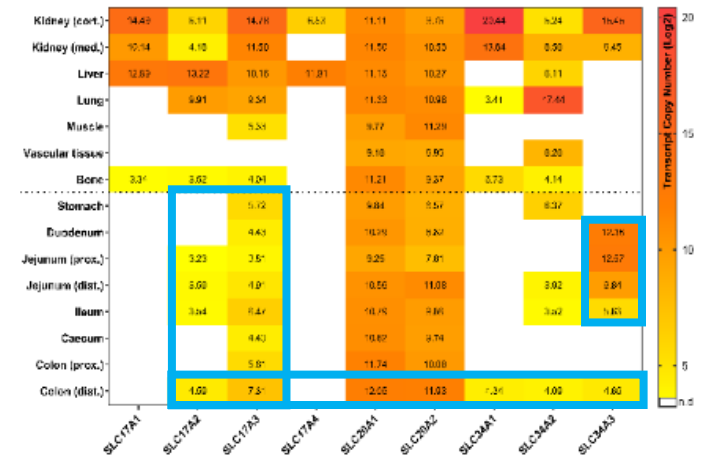
Genetics and physiology in pigs

- Nearly half of the variation in blood P levels in pigs is thought to be due to genetic factors



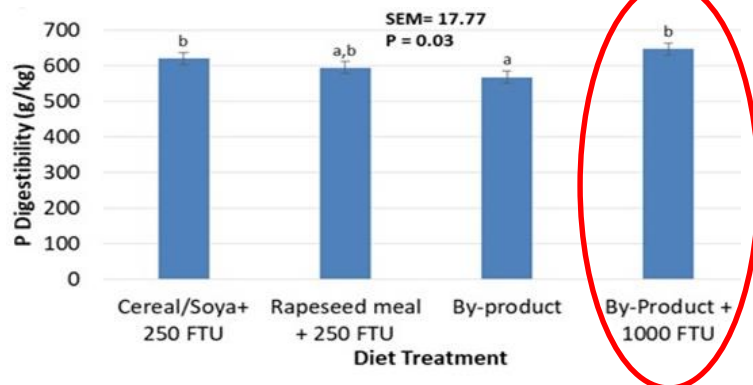
Reyer et al., *Front Genet*, 2019, 10, 590

- Adaptation to variable P supplies in tissues and systemic level (utilization, absorption, excretion)



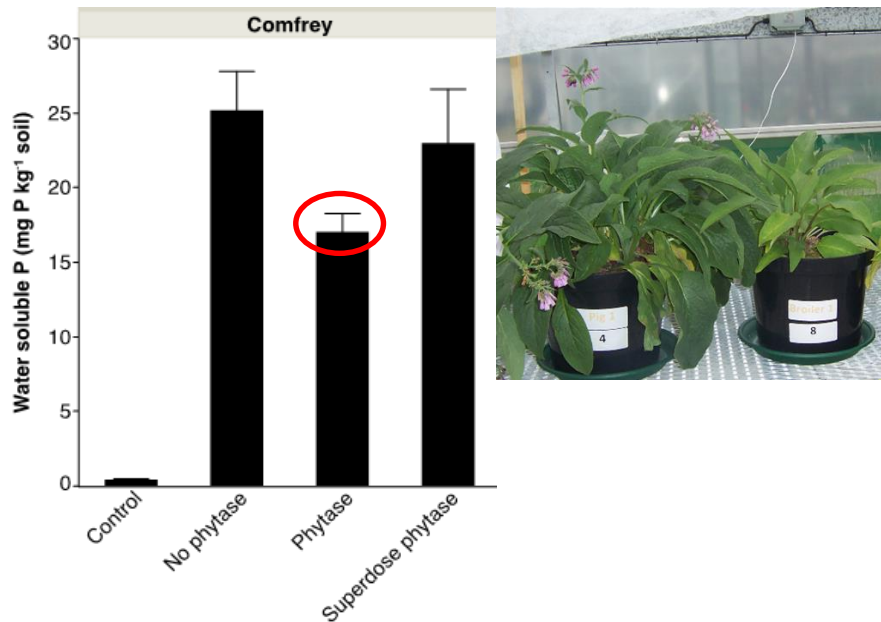
Wubuli et al., *Int J Mol Sci* 2019, 20, 5576

- Phytase super-dose improved P digestibility in pigs

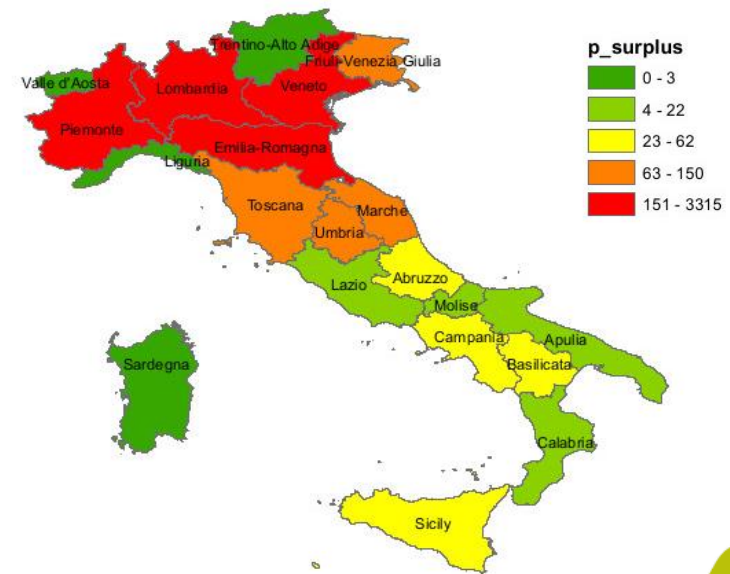


P surplus in European regions

- P balance surpluses in croplands linked to intensive animal farms running from 15-40 kg P/ha/yr
- Typical P levels in manure (g P/kg DM) → poultry: 14; pig: 32
- Manure applications: High P surpluses to soil in Lombardy (Italy), Brittany (France), Flanders (Belgium), Netherlands, Denmark



Medium usage of phytase
→ lower P leakage in soils



P surplus for pig fattening farms (tons P per region)



Current status on P legislation

- Focusing mainly on N content by following the Nitrates Directive (170 kg N /ha/yr), results in **excessive P from manure** applied to soil.
- Only a **few countries have national norms** to control P overloading from manure: Belgium, Netherlands, Sweden, Denmark, Estonia, Ireland, Finland, and Germany, while Lithuania and Poland have recommendations.
- In the areas where soil-P is high, legacy P will remain a problem for several decades.
- These areas should not be receiving manure or fertilizer containing P.



Future research needs for sustainable animal production systems



- Integrated nutrient management
 - Cover N, P, and C across areas (e.g. water, air, food, fertilizers, waste, climate change)
 - Integrate existing policies (both N and P surpluses)
 - Market price of nutrients
- Improve knowledge on nutrient flows
 - Emissions & re-cycling potential
 - Integrate existing data (re-use, application in agriculture)
- Improve animal genetics and physiology
 - Breeding programs covering P traits
 - Fully exploit endogenous mechanisms in P utilization
 - Usage of local crop plants



Thanks to all the PEGaSus team

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