



Combination of plant-based fertilisers and compost can replace farmyard manure for nitrogen fertilization

- and builds soil fertility in organic vegetable production



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CONCLUSIONS

- Organic vegetables can be grown sustainably
- Plant-based fertilisers and compost can replace animal manure
- On-farm/local production by organic farming practise
- The high N demand of vegetables can be met
- NUE less, but no signs of higher NO_3^- leaching
- Added effect of compost supported – short and long term soil fertility

YES, intensive vegetable production is possible without animal manure and mineral N fertilisers



THE GREAT FOOD TRANSFORMATION: PLANT BASED FOOD IN A GLOBAL PERSPECTIVE

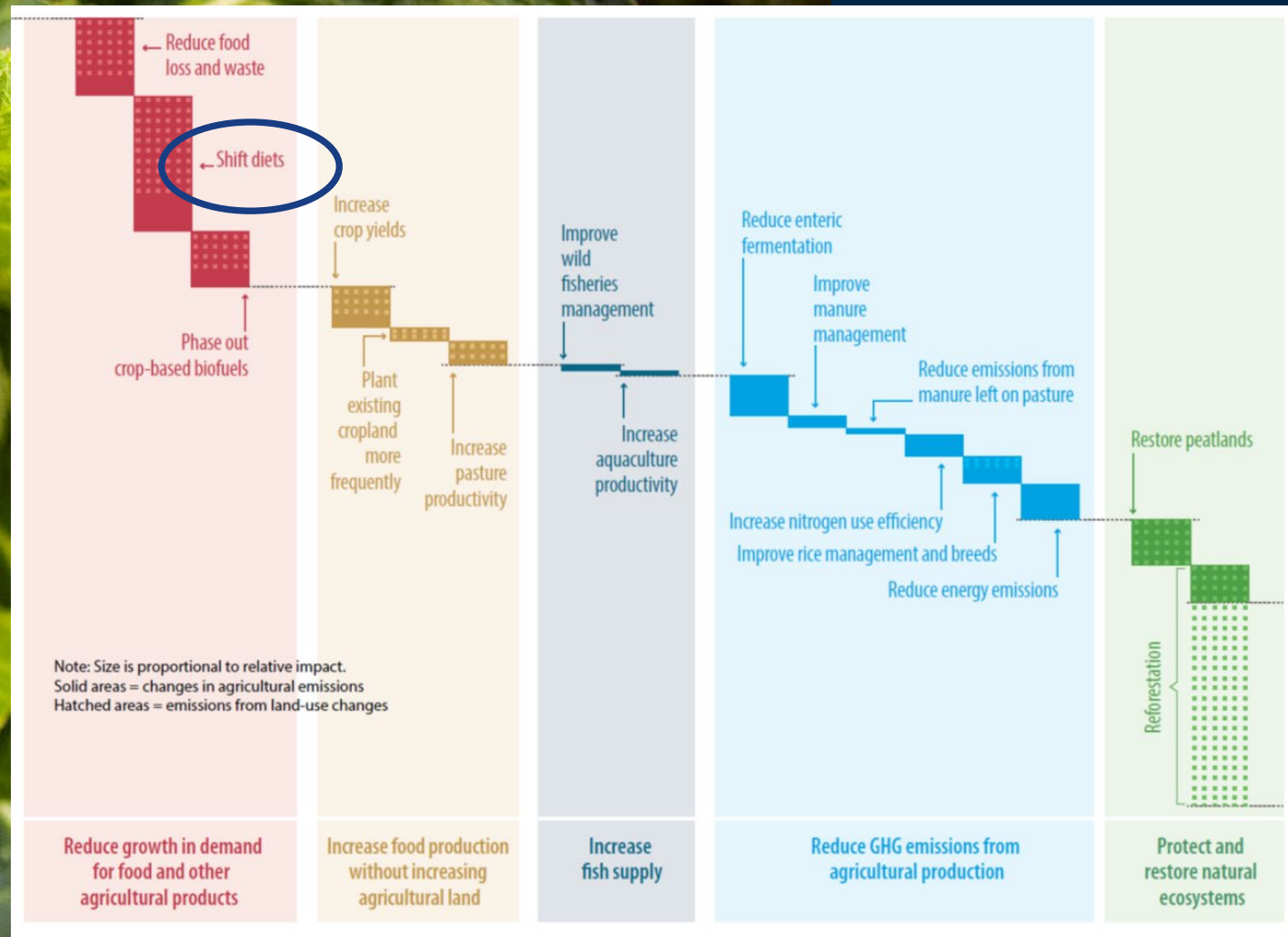
BY
SUSTAINABLE INTENSIFICATION
LEGUMES
FRUITS
VEGETABLES
NUTS
WHOLE GRAINS

A bit of animal and fish too



Food in the Anthropocene: the EAT-*Lancet* Commission on healthy diets from sustainable food systems 2019

Global CO₂-emissions from agricultural production



Plant-based food: VEGETABLES

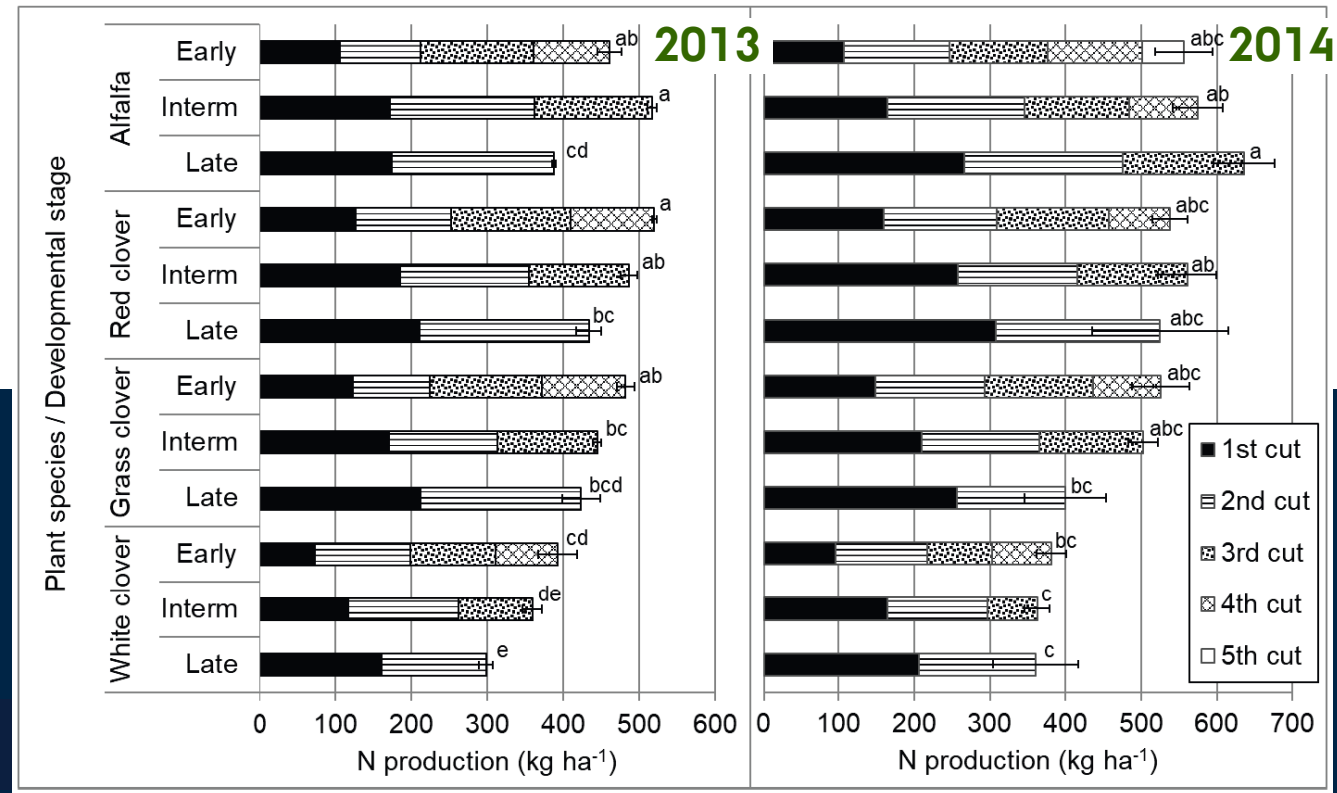
- National food supply – food security
- Sustainably and organically produced (HEU Farm to Fork 25% organic)
- Low energy solutions (organic fertilisers)
- Less nutrients from conventional farming sources (thrust from consumers)
- Vegetables high N and resource demand
- Low N use efficiency, risk of high N losses
- Soil degradation
- **Is intensive vegetable production without animal manure and mineral fertilisers possible?**



PRODUCTION: PLANT-BASED FERTILISERS

- Plant-based fertilisers release N fast: Compost improves soil quality
- Plant-based fertilisers are cut-and-carry legumes
- Produce 400-600 kg N ha⁻¹ yr⁻¹
- Perennials better than annuals
- Early-intermediate cuts best
- Alfalfa, red clover, grass-clover best
- Stabilisation for later use: Dry, silage

Lyngé *et al.* (2023)
Journal of Plant Nutrition
and Soil Science DOI:
10.1002/jpln.202200031



PLANT-BASED FERTILISER + COMPOST

Two years field trial: white cabbage and beetroot, sandy loam Aarslev Denmark (n=3)

A combination of fast releasing fertilisers and slow releasing compost can:

- Maintained yields
- Increase early indicators of soil fertility and increase NUE

Treatments fertilisation:



Pig slurry



AF+compost (animal-plant-biofiber)



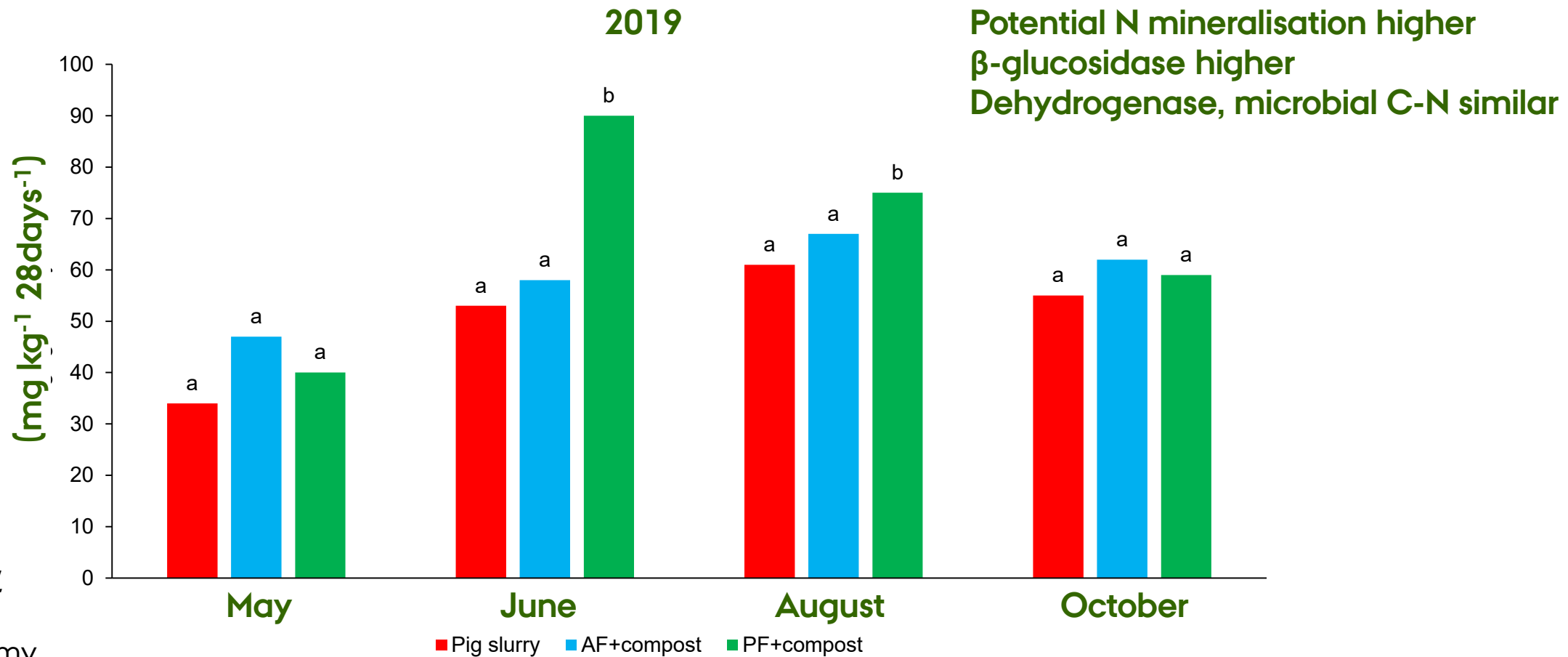
PF+compost (clover fresh/silage, lupin, garden-park compost)



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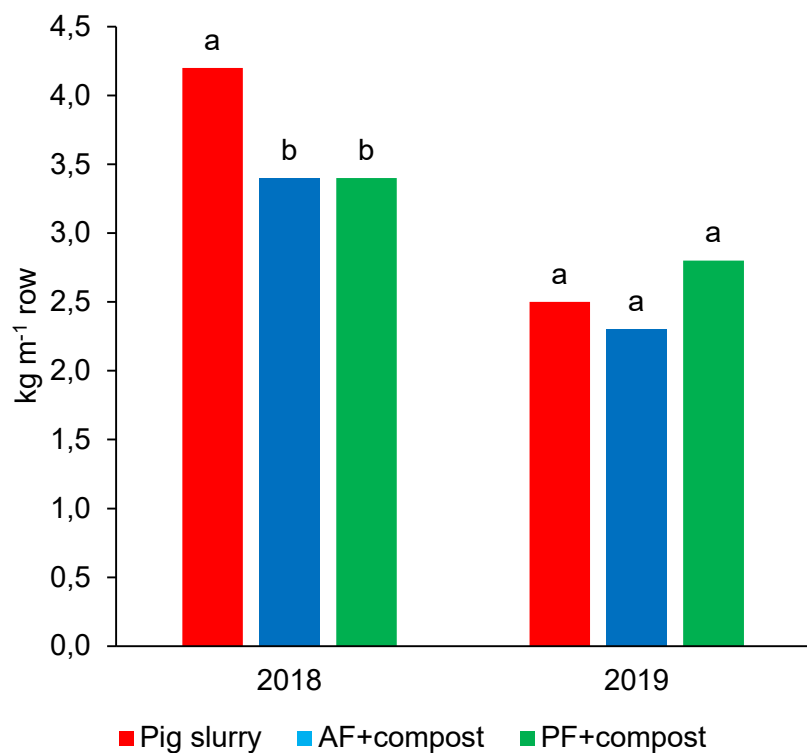
POTENTIAL SOIL N MINERALISATION



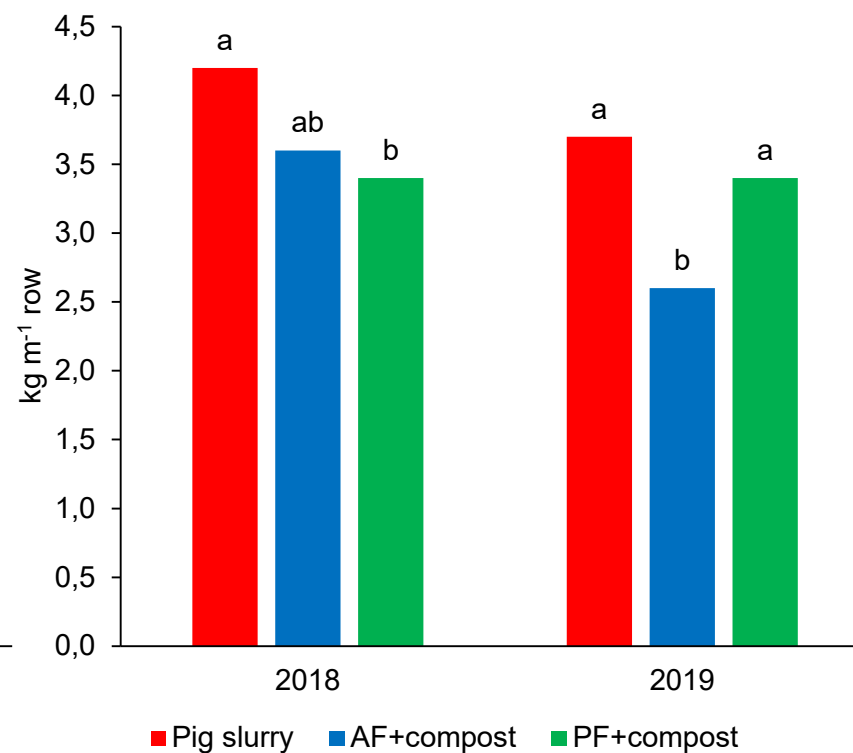
Shanmugam *et al.*
(2022) European
Journal of Agronomy

YIELD AND N ACCUMULATION

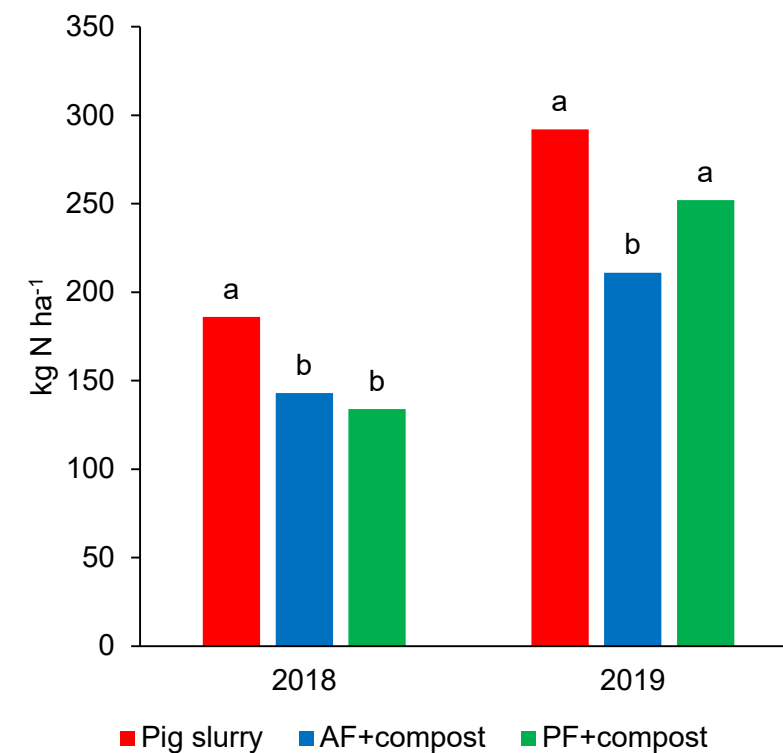
Cabbage yield



Beetroot yield



Plant N accumulation

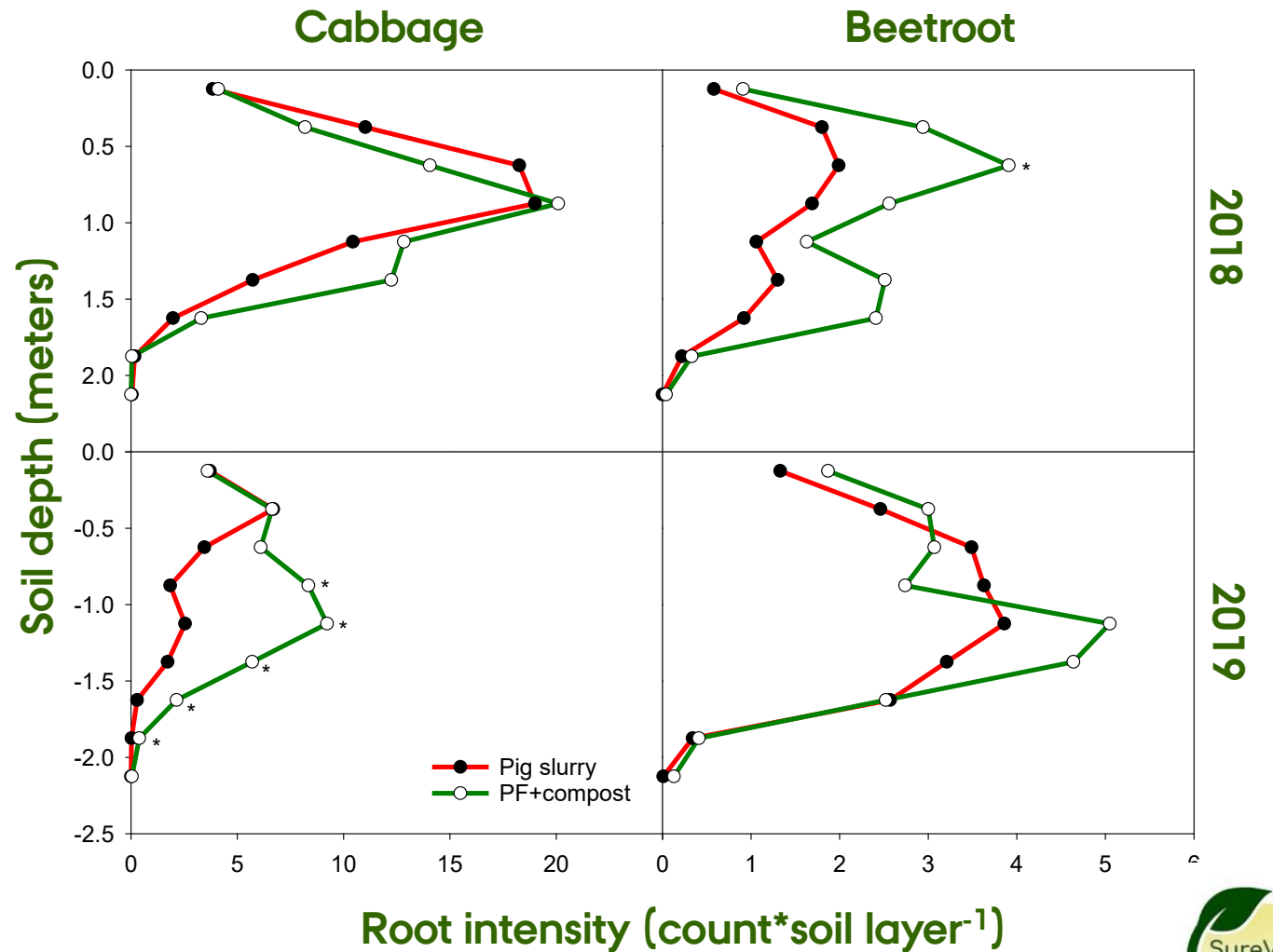
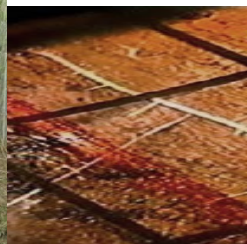


Shanmugam *et al.* (2022) European Journal of Agronomy

ROOTS: CABBAGE AND BEETROOT



Minirhizotron
method



2018

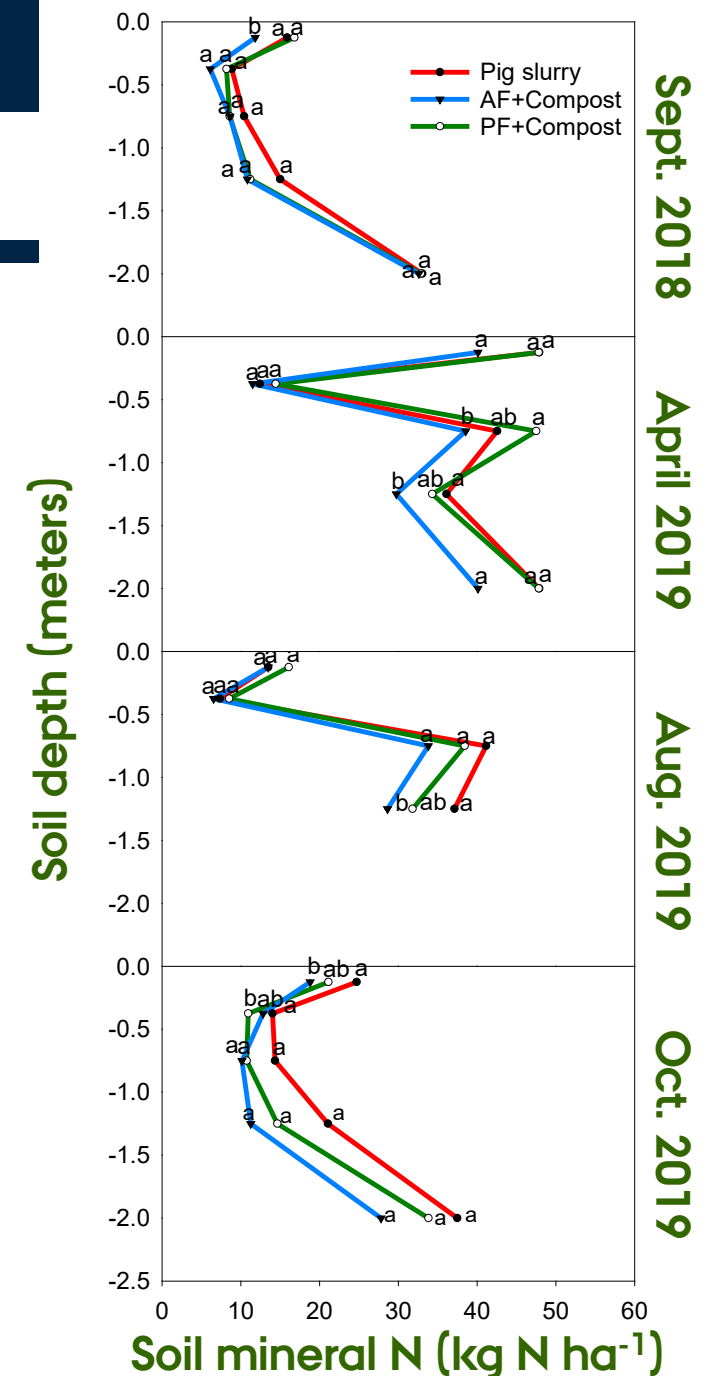
2019

SOIL MINERAL N

- All some deep N
- Soil fertility increased – long term perspective
- Yields and N accumulation maintained
- Root growth stimulated
- N use efficiency lower

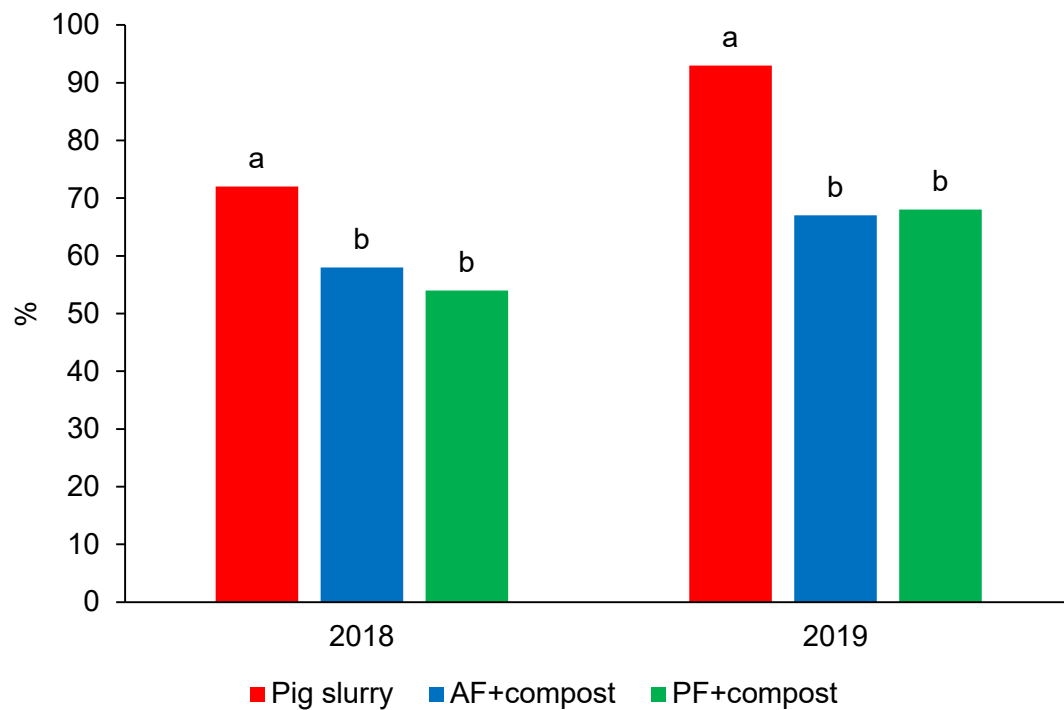


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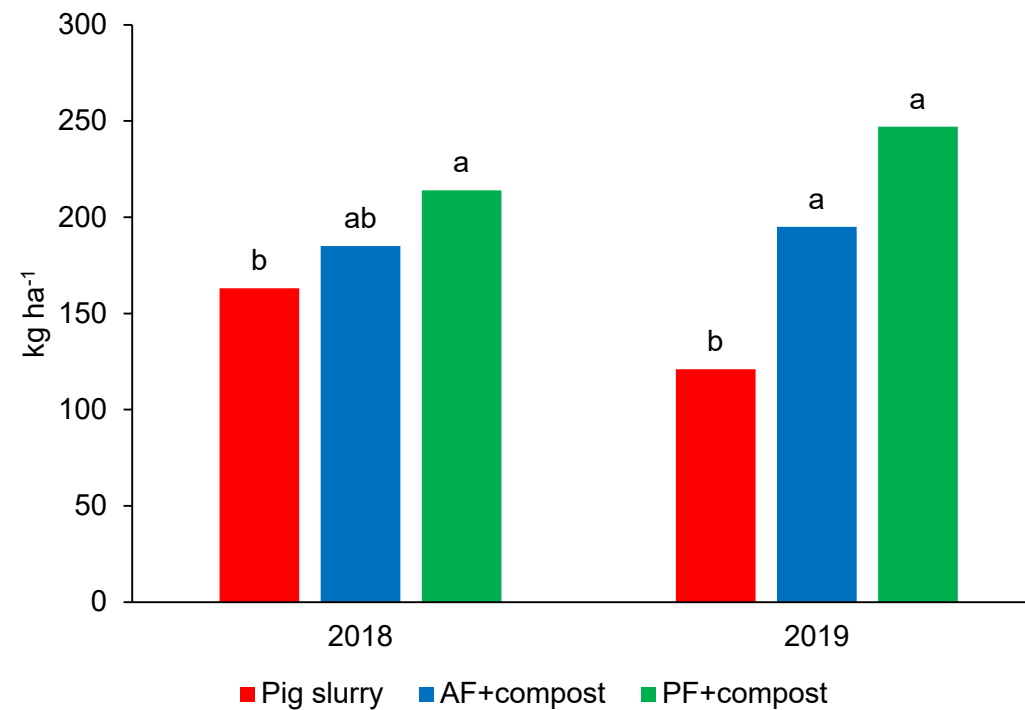


N USE EFFICIENCY

N uptake efficiency



N balance



Shanmugam *et al.* (2022) European Journal of Agronomy

PARSLEY POT TRIAL **PRELIMINARY:** PLANT-BASED FERTILISERS + COMPOST

NC: No compost
C: Compost
NF: No N fertiliser
MN: mineral N fertiliser
DC: Dried clover
SC: Silaged clover
SW: Seaweed
GP: Gas protein byproduct



Shanmugam *et al.* (in preparation)

PARSLEY POT TRIAL **PRELIMINARY:** PLANT-BASED FERTILISERS + COMPOST

- Effect of plant-based fertilisers on soil microbial enzyme
- Additive effect of compost
- Additive effect on yields for 1/2 of treatments
- Increased N uptake efficiency for 1/2 of treatments

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Unpublished results removed

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<https://doi.org/10.1007/s11104-021-04982-1>

Interreg
North Sea Region
SOILCOM

European Regional Development Fund



EUROPEAN UNION



Thank you!



DoubleCrop
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