



Sustainable Intensification and nutrient recycling

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Motivation for sustainable intensification



- **Global food security** in context of continuing population and economic growth and harmful climate change
 - Most growth in food demand will be in developing countries
 - Much world agriculture is economically weak and environmentally damaging, including EU.
 - To avoid unacceptable further destruction of ecosystems the next increment in output must come mostly from existing agricultural land rather than bringing more land into agriculture
 - Hence **sustainable intensification**: more food and conservation outputs from the existing agricultural area, via improved resource efficiency
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Food security to sustainability of agriculture



The argument started with **Global food security** this requires strong action on both:

A. Consumption challenges: waste, diets, health

- *Policy instruments*: targets, information, economic, regulation
- *Policy subjects*: food chain, food service, consumers

and

B. Production challenges: productivity, water, soil, biodiversity, climate and cultural landscape

- *Instruments*: agricultural, environmental & research policy
- *Subjects*: farmers, upstream & downstream industries, researchers/advisers and educators

What role for EU agriculture under Sustainable Intensification?



- Most of the additional global demand will be outside Europe
- EU agriculture is amongst the most intensive in the world
- EU has a high global footprint as it imports feeds and beverages

The developments of the last 50 years in the EU have been based on intensification of agriculture: forest, wetlands and grassland areas increasing and agricultural area is decreasing.

But this was associated with serious environmental damage

Therefore SI in the EU implies

emphasis on sustainability whilst maintaining agricultural productivity growth

Definition of Sustainable Intensification of agriculture



- *Sustainable Intensification means simultaneously improving the productivity & environmental management of agricultural land.*
- Europe is a relatively heavy user of P, and sufferer of phosphate pollution
- Sustainable intensification is a goal or aspiration requiring more knowledge intensive, resource efficient and integrated land management

Deconstructing SI: intensification

- **Intensity** is a ratio. For SI, land is the denominator
- Well defined & measurable but popularly denigrated!
- Applies to conservation outputs/hectare & food/ha
- For recycled inputs, the intensification refers to output per life-cycle unit of nutrient
- **Knowledge per hectare** is key – much is embodied in capital and labour
- Task is to detoxify “intensive”, - eg resource efficient



Deconstructing SI: sustainable

- **Sustainable:** not well defined or measured but universally loved!
- Brundtland (1987) *“meeting the needs of the present generation without compromising the ability of future generations to meet their own needs”*
- Unsustainable systems undermine their indefinite continuation
- 3 dimensions: economic, environmental and social; none pre-eminent, each is multi-dimensional,
- Sustainability is always multi-factorial & location specific
- It implies the existence of limits – thresholds – tipping points – irreversibilities, yet practically no evidence on these



Sustainability of crop nutrient use - N

Nitrogen is, more or less,

- unlimited
- ‘naturally’ cycled
- Unclear if current nutrient surplus threatens future productivity, ie not an obvious threshold/limit
- But very clear damage, and external costs to
 - Habitats, aquatic and marine and biodiversity
 - Climate: directly, CO₂ in manufacture, indirectly N₂O in use

Sustainability of crop nutrient use - P



Phosphorus

- Finite, mined, restricted range of deposits
- No natural cycle
- Serious aquatic pollutant
- Signal of approaching threshold will be price
- Without recovery and recycling it will become a limiting factor

Dealing with nutrient R&R involves complex issues



- Leakages in arable & livestock production & human nutrition
- Technology of nutrient, their application and uptake
- Pollution, habitat destruction
- Waste processing → resource recycling
- Associated depletion of soil organic matter
- Nutrient production and manufacturing issues
- Recovering energy content of waste streams

Dealing with nutrient R&R involves many disciplines and professions



- Plant biology and biochemistry,
- Plant, farm animal & human nutrition
- Soil, crop and livestock science
- Food science, and processing
- Civil , chemical and industrial engineering,
- Water engineering and treatment
- Public administration, health and hygiene regulation
- Environmental policy
- Economics and business

Dealing with nutrient R&R involves multiple stakeholders



- Consumers
- Taxpayers
- Agri - supply industry: fertilisers & mechanisation
- Farmers
- Food processing, food service and food retailing
- Water utilities
- Natural and social scientists and engineers
- Environmental GOs and NGOs
- Legislators and lawyers

Three challenges to be overcome

- **Technical**
 - At farm level: breeding and nutrition of crops & livestock
 - At waste processing level: heavy metals, pathogens, pharmaceuticals
 - Logistics in deal with diffuse, lo value hi bulk materials
- **Cultural/attitudinal and regulatory**
 - What explains the very different levels of use of sewage?
 - How coherent and aligned are environmental, waste, agricultural and energy policies?
- **Economics**
 - of driving more efficient nutrient use
 - Of alternative waste avoidance, collection and processing technologies?



Conclusions

1. Sustainable Intensification *is* a useful, globally-based, concept for better balance between food production & environment.
2. SI in Europe means a **step change in environmental performance** + maintaining agricultural productivity growth.
3. Increasing the **resource efficiency of nutrient use** – and reducing diffuse agricultural pollution is a key component of this
4. Increasing phosphate recovery and recycling demands multi-disciplinary, multi-stakeholder research and debate to motivate action. This conference is a very positive step in this direction.



If you have been . . .
thanks for listening!

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