

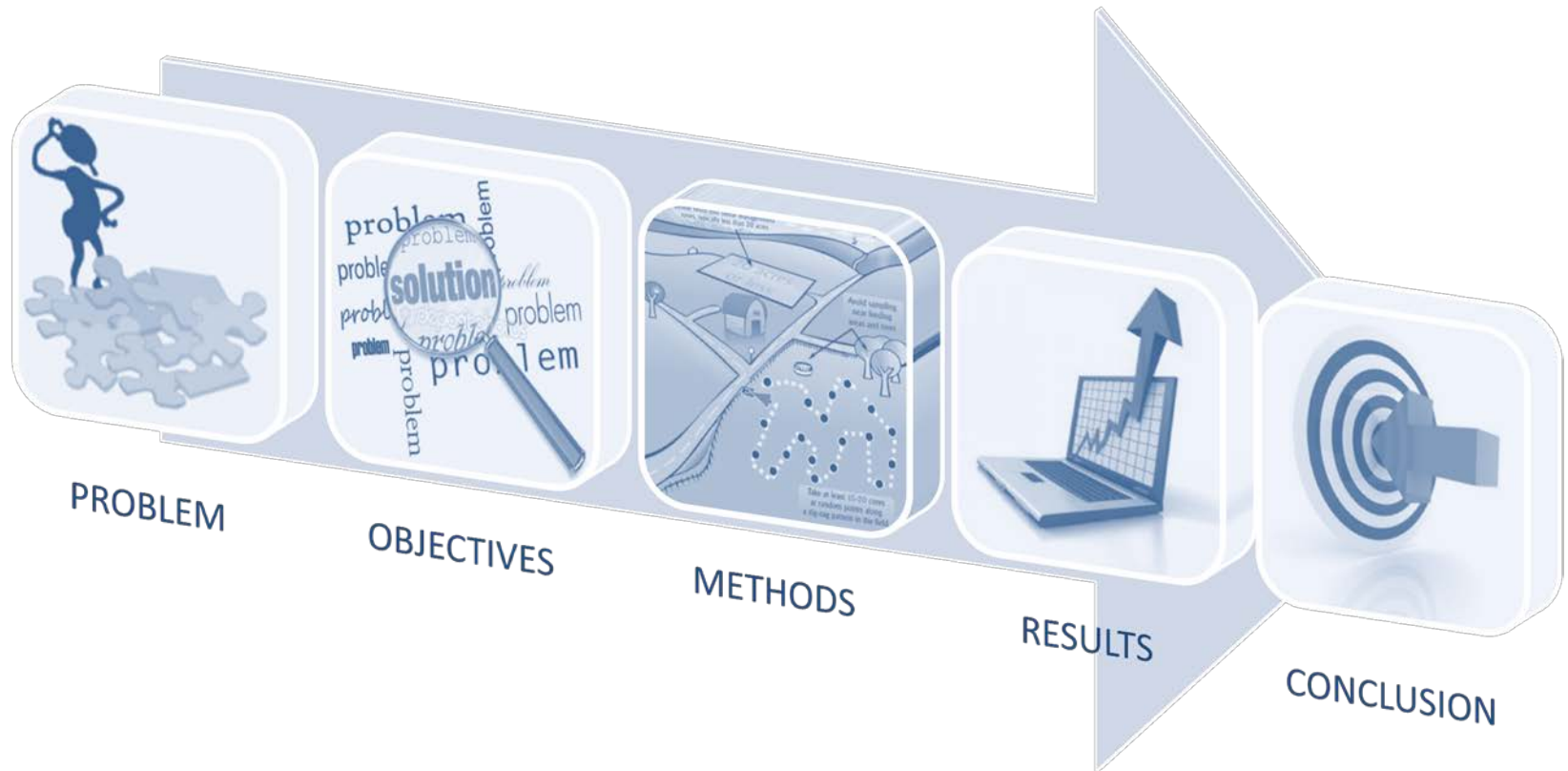
NITROGEN MINERALIZATION POTENTIAL OF BIO-BASED FERTILIZERS

Ivona Sigurnjak, E. Michels, S. De Neve, E. Meers

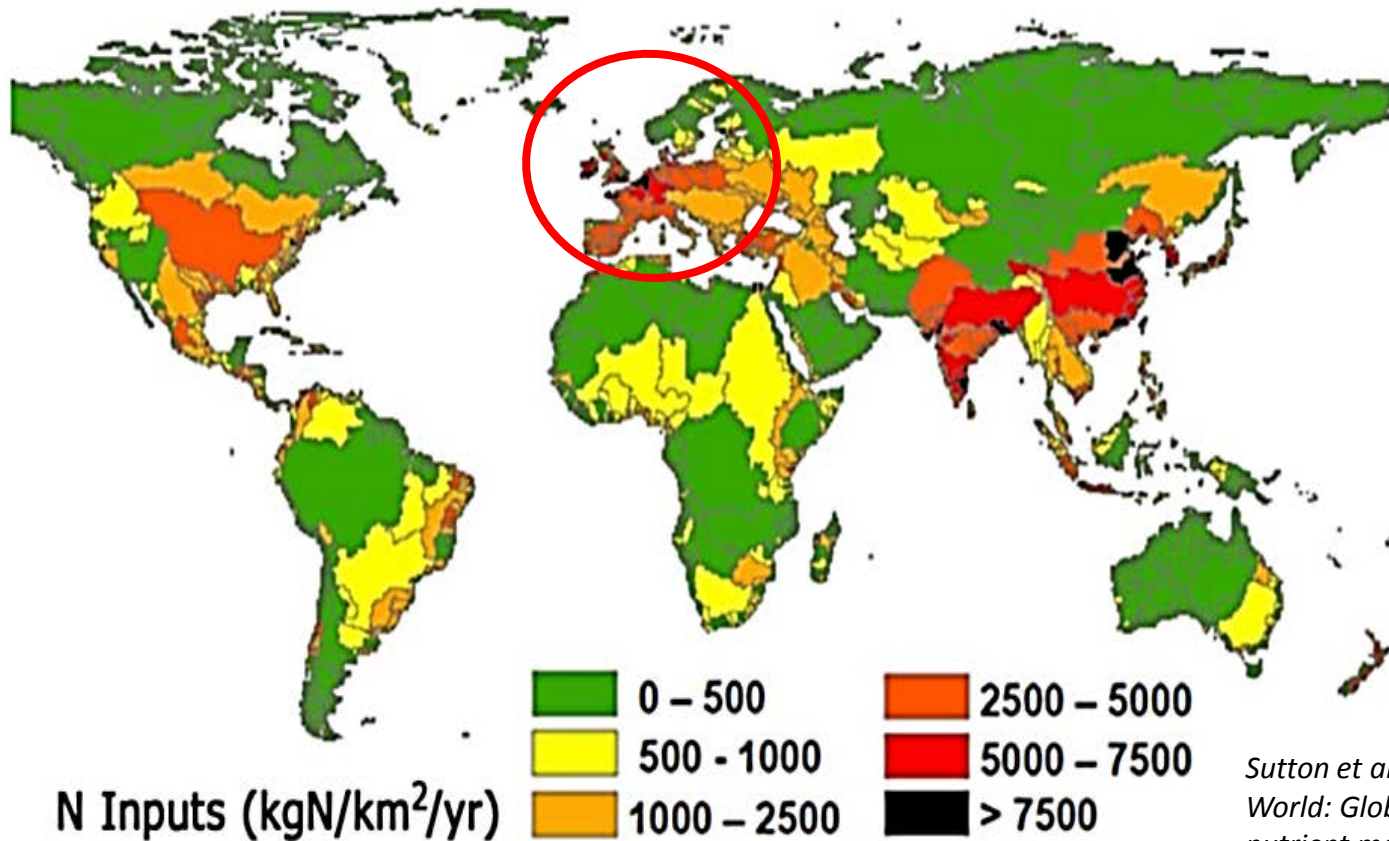
11th International Conference on Renewable Resources & Biorefineries
3 – 4 – 5 2015, York, UK



OUTLINE

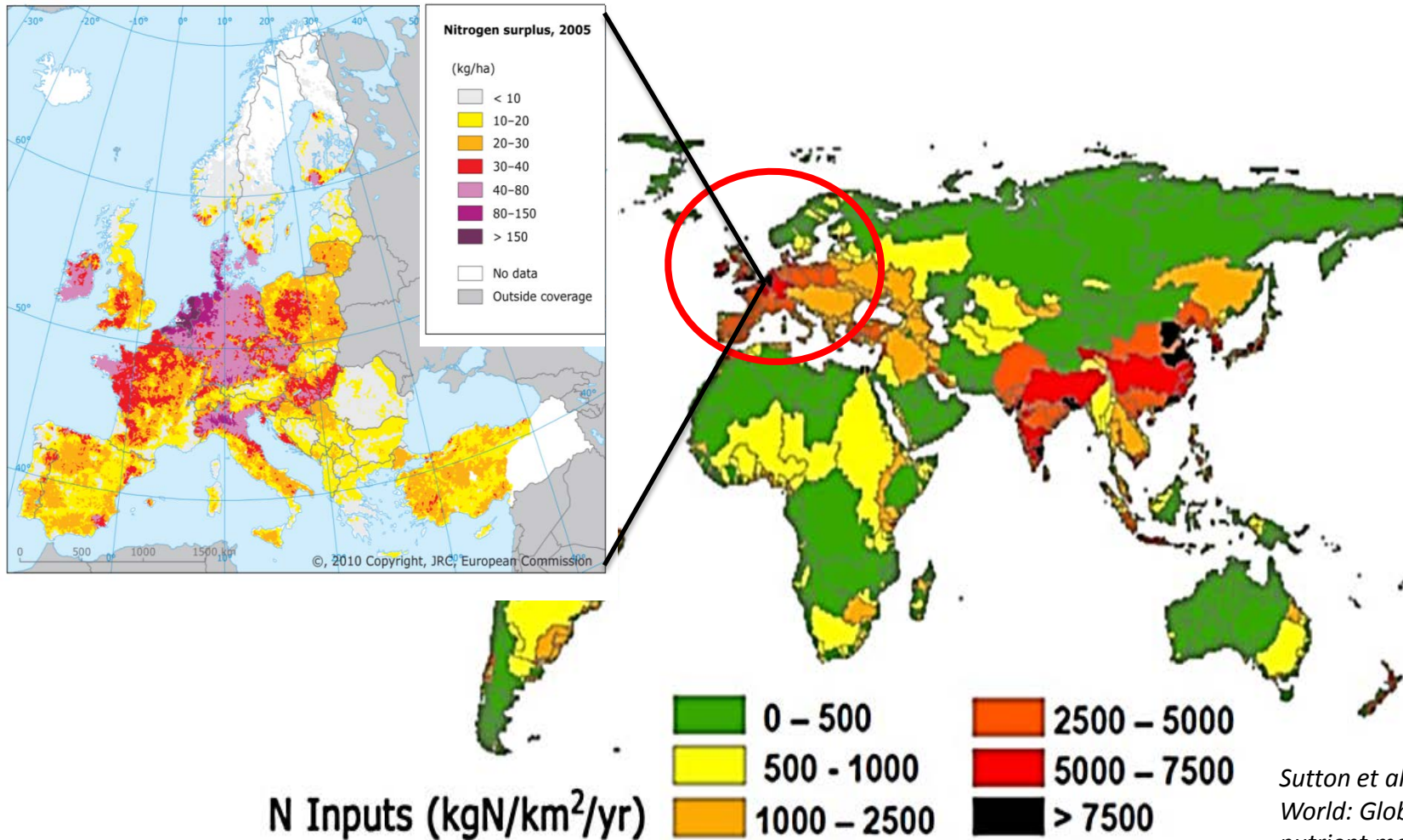


NUTRIENT PARADOX



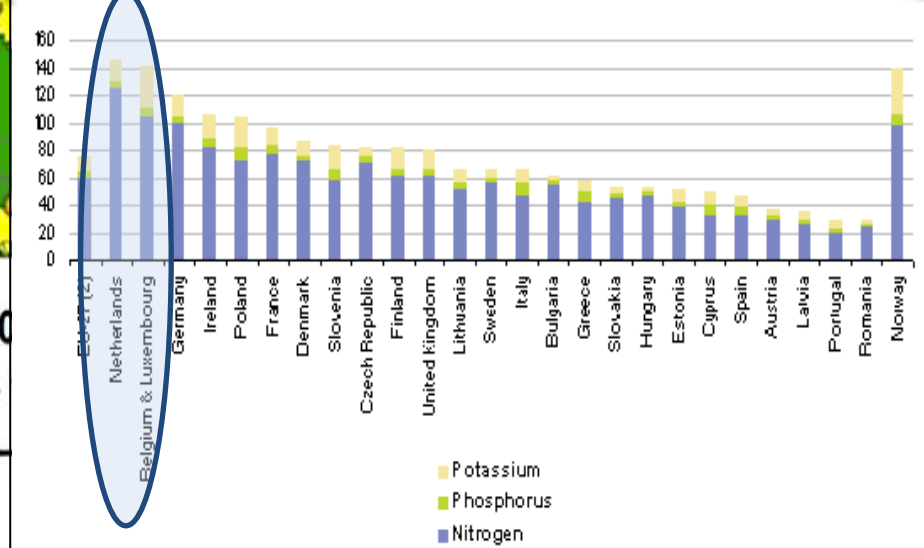
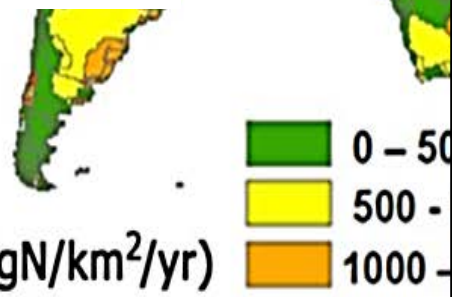
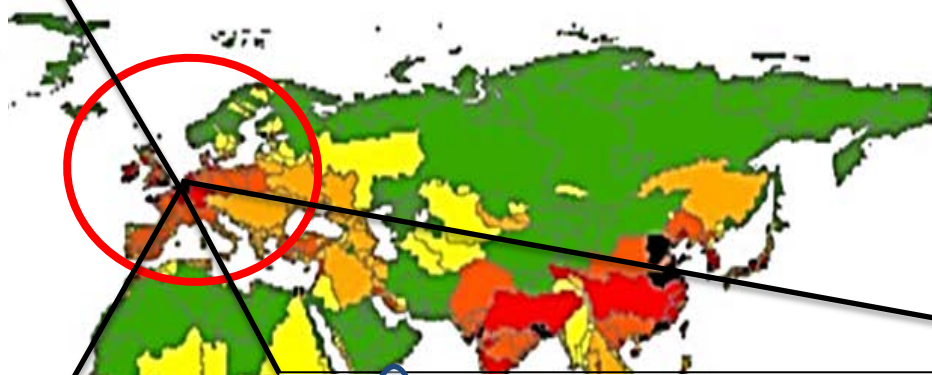
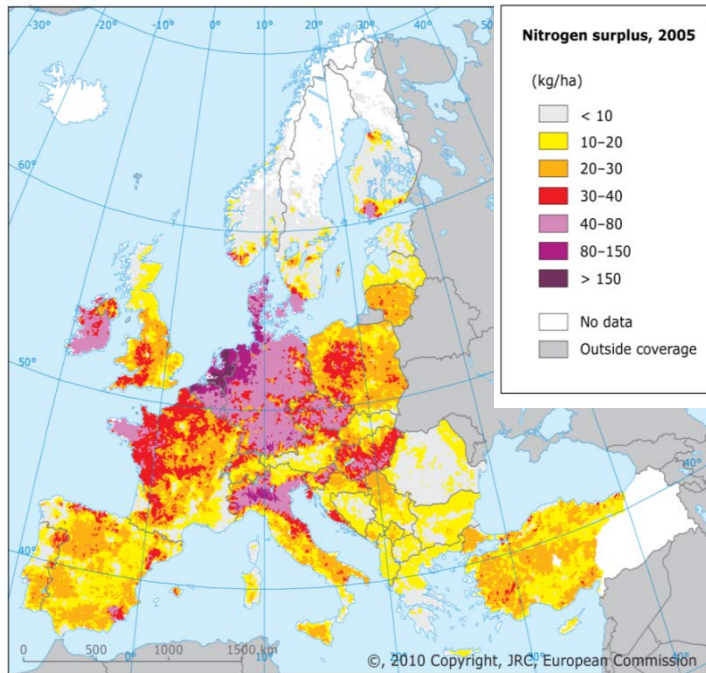
Sutton et al. Our Nutrient World: Global overview on nutrient management (2013)

NUTRIENT PARADOX

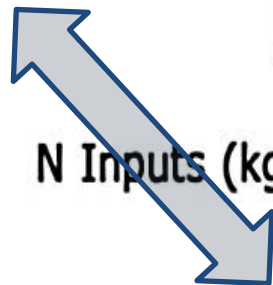


Sutton et al. Our Nutrient World: Global overview on nutrient management (2013)

NUTRIENT PARADOX



NUTRIENT SURPLUS



N Inputs (kgN/km²/yr)

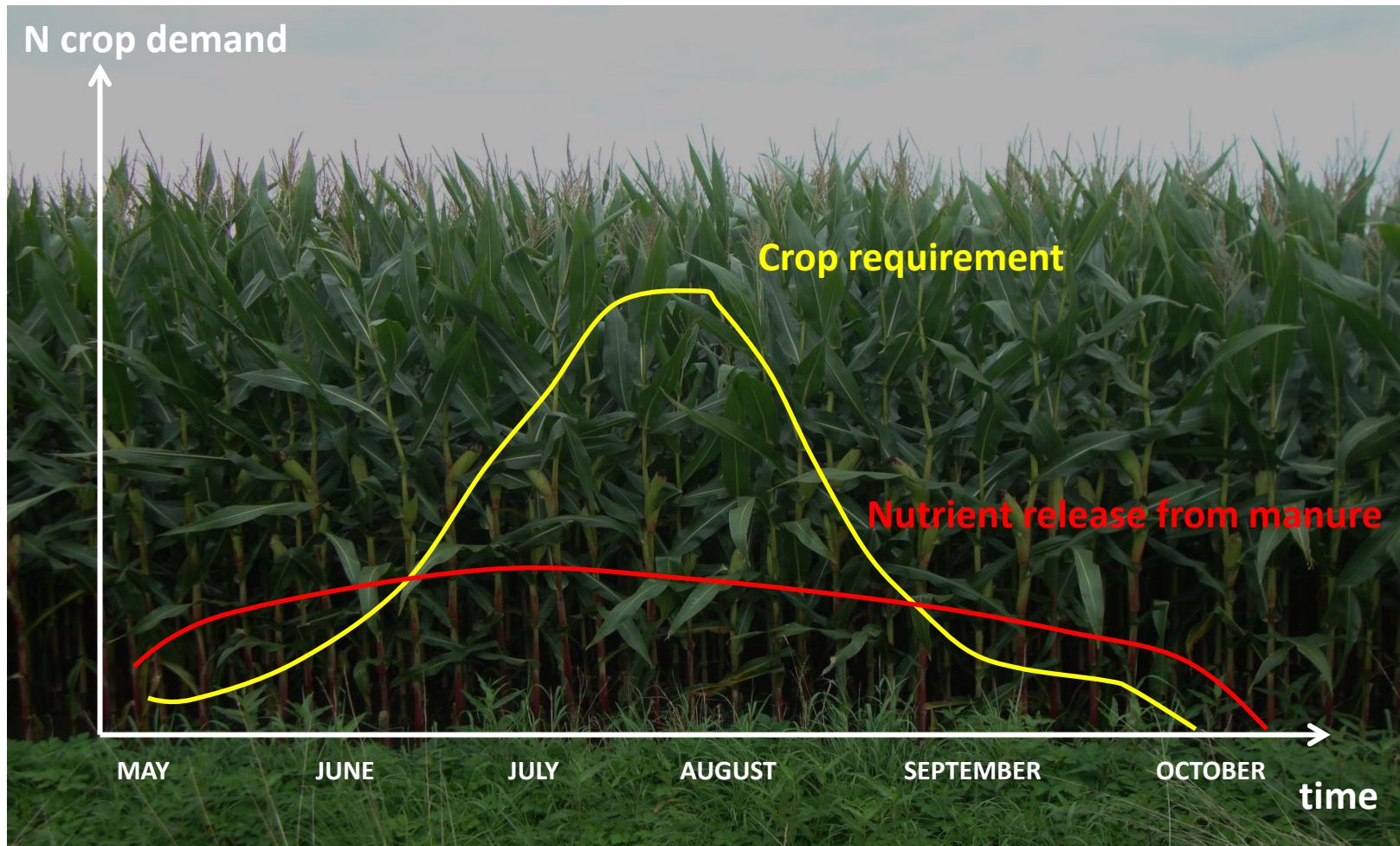
NUTRIENT IMPORT

(1) Utilised agricultural area, 2007; Malta, not available.

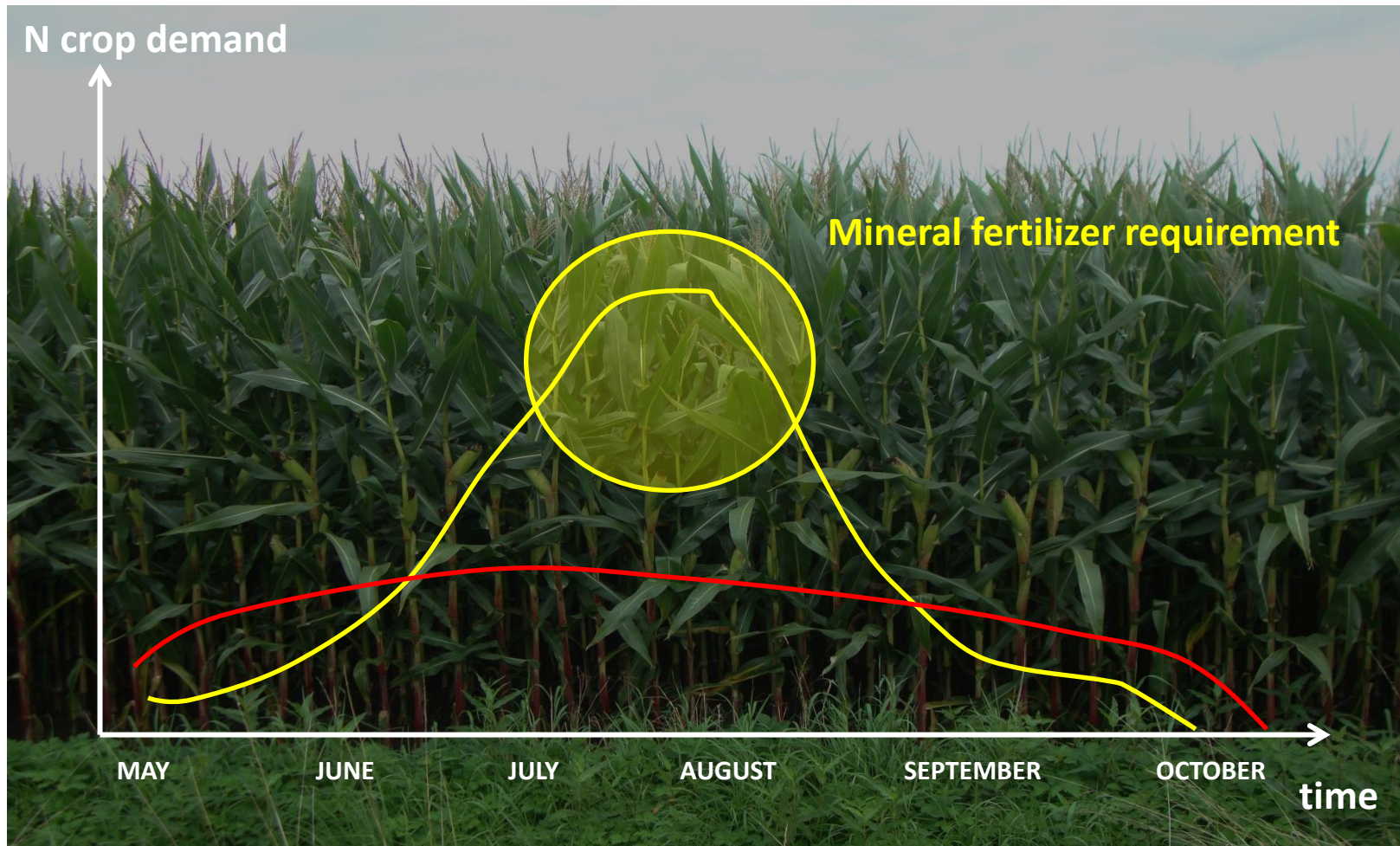
(2) Excluding Malta.

Source: Eurostat (online data codes: ae_fm_manfert and ef_lu_ovcroppa) and Fertilizers Europe

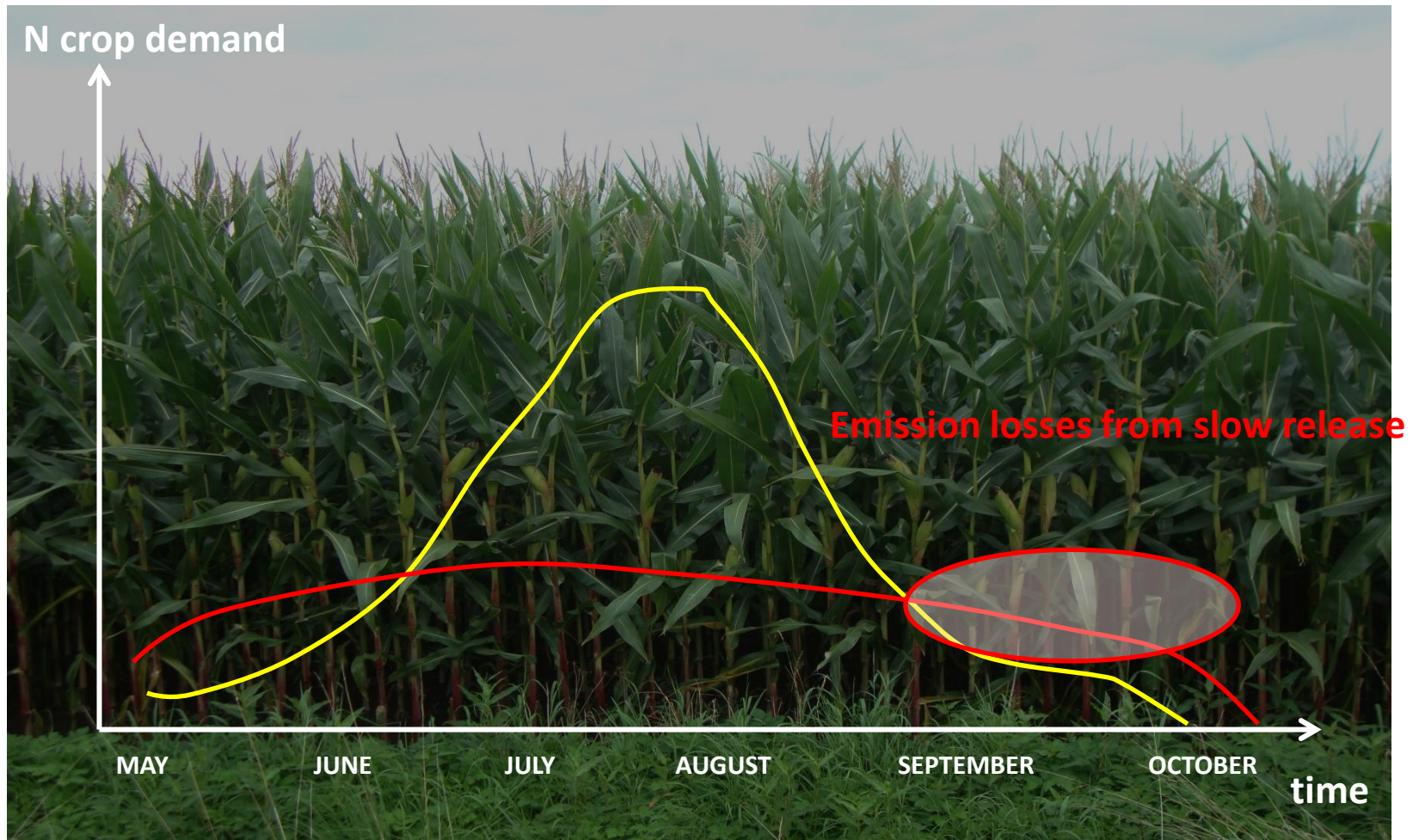
NITROGEN AVAILABILITY



NITROGEN AVAILABILITY

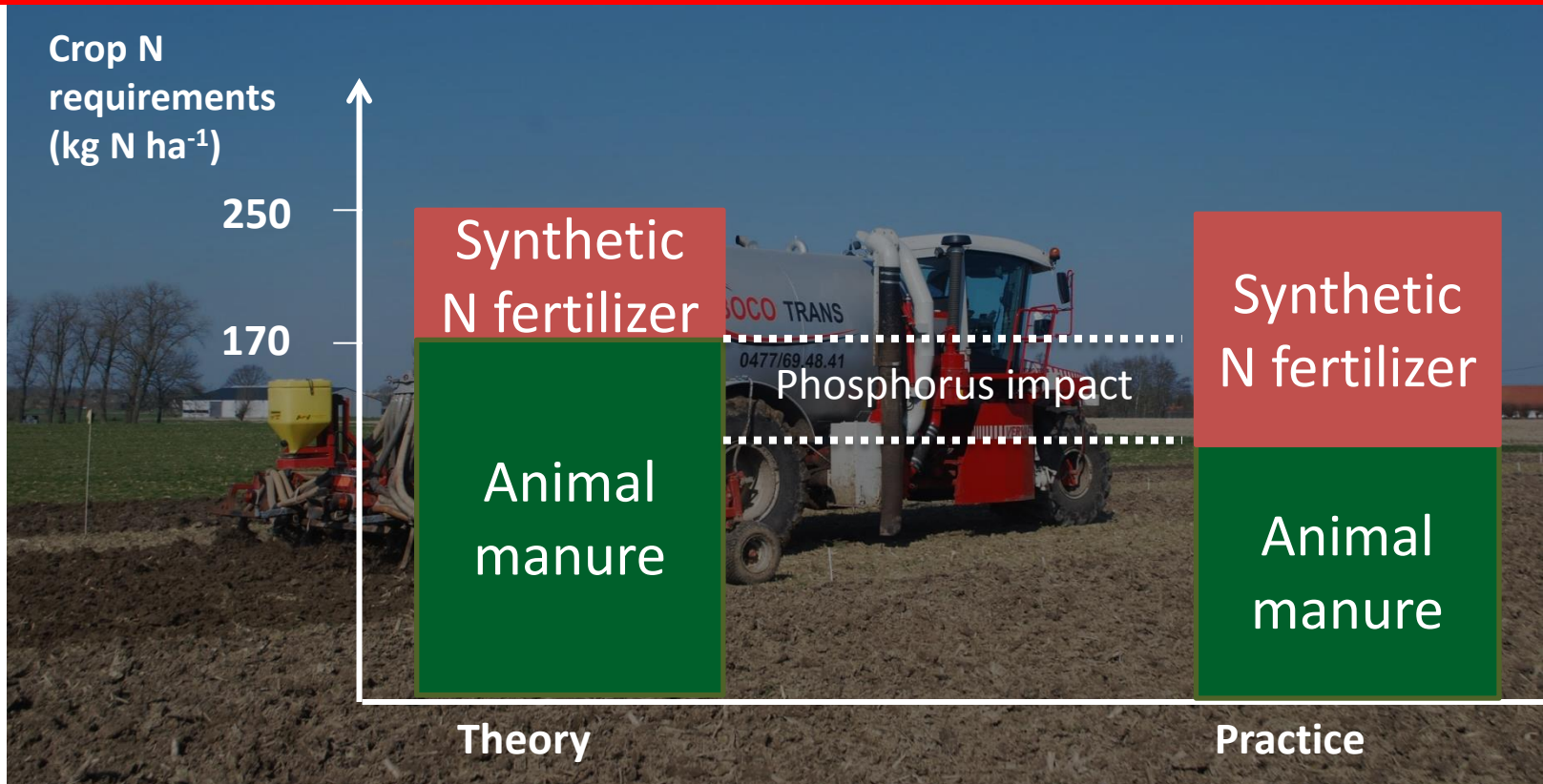


NITROGEN AVAILABILITY



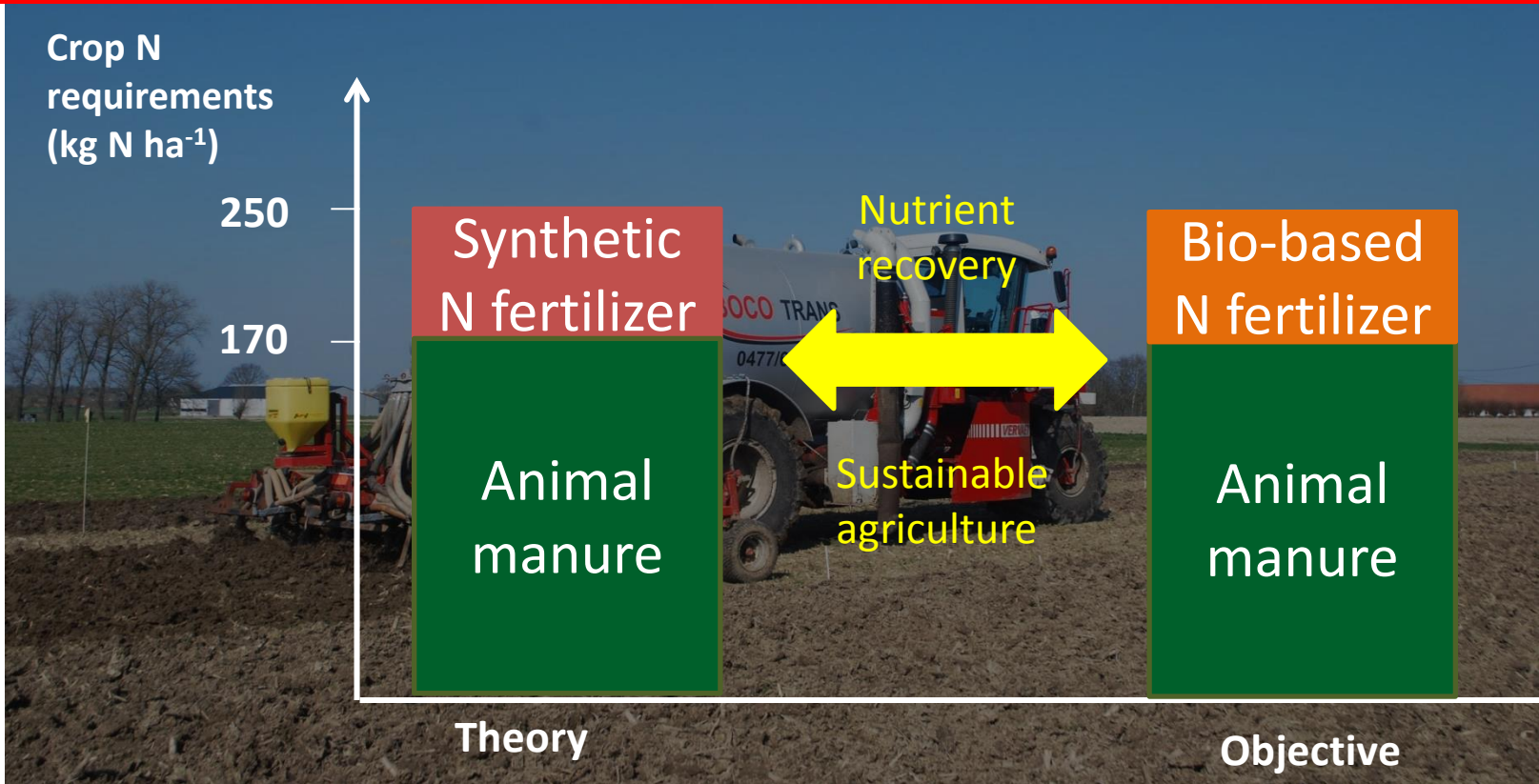
LEGAL ASPECTS

Manure application in NVZ limited up to maximum of 170 kg N ha⁻¹ (Nitrates Directive 91/676/EC)

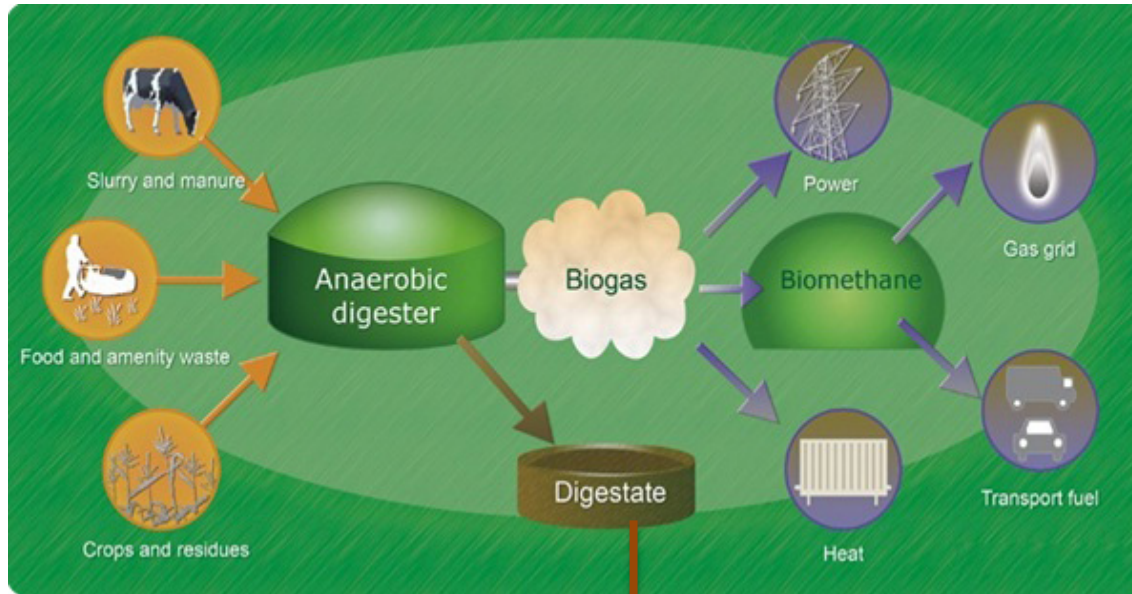


OBJECTIVE

Manure application in NVZ limited up to maximum of 170 kg N ha⁻¹ (Nitrates Directive 91/676/EC)



MATERIAL AND METHODS



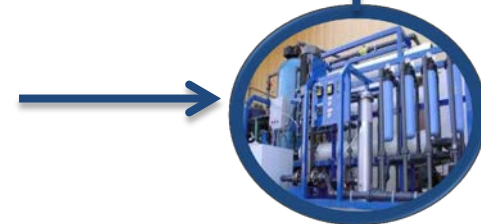
Mineral concentrate (NK-rich)

Solid fraction
of digestate
(P-rich)



Separation

Liquid fraction
of digestate
(NK-rich)



MATERIAL AND METHODS

Parameters	Animal manure	Digestate	LF digestate		Mineral Concentrate	
	AM	DIG	LFDnon-animal	LFDanimal	MCA	MCH
DM (%)	8.5	7	6.3	2.3	4.9	3.5
OM (%)	5.8	4.83	3.5	1.3	3.1	1.7
C/N	5.7	6.2	2.9	1.5	4.3	1.3
N _{tot} (g kg ⁻¹ FW)	5.6	4.3	6.6	4.7	4.0	7.3
NH ₄ -N (g kg ⁻¹ FW)	3.3	2.2	4.1	3.6	3.8	5.9
P ₂ O ₅ (g kg ⁻¹ FW)	4.8	2.4	2.7	0.064	0.049	0.71
K ₂ O (g kg ⁻¹ FW)	4.0	2.6	5.3	3.6	4.1	8.8
NH ₄ -N/N	0.59	0.51	0.62	0.76	0.95	0.80

N-K fertilizer with lower P



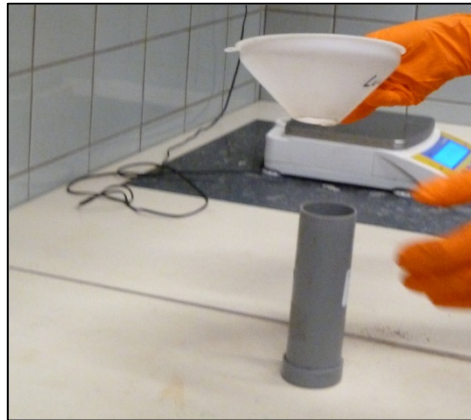
MATERIAL AND METHODS

- Fertilization advice for maize cultivation on sand - loam soil:
 - N effective = 150 kg ha⁻¹
 - P₂O₅ = 80 kg ha⁻¹

According to effective N	MCA	MCH	Animal manure	Digestate	LFD animal	LFD non-animal	Synthetic N
ton/ha of product	37,50	20,55	44,64	58,14	31,91	22,73	0,56
P ₂ O ₅ added in kg/ha	1,84	14,59	214,29	139,53	2,04	61,36	0,00

Corrections for P2O5	MCA	MCH	Animal manure	Digestate	LFD animal	LFD non-animal	Synthetic N
ton/ha of product	37,50	20,55	16,66	33,33	31,91	22,73	0,56
P ₂ O ₅ added in kg/ha	1,84	14,59	79,97	79,99	2,04	61,36	0,00

MATERIAL AND METHODS



MATERIAL AND METHODS

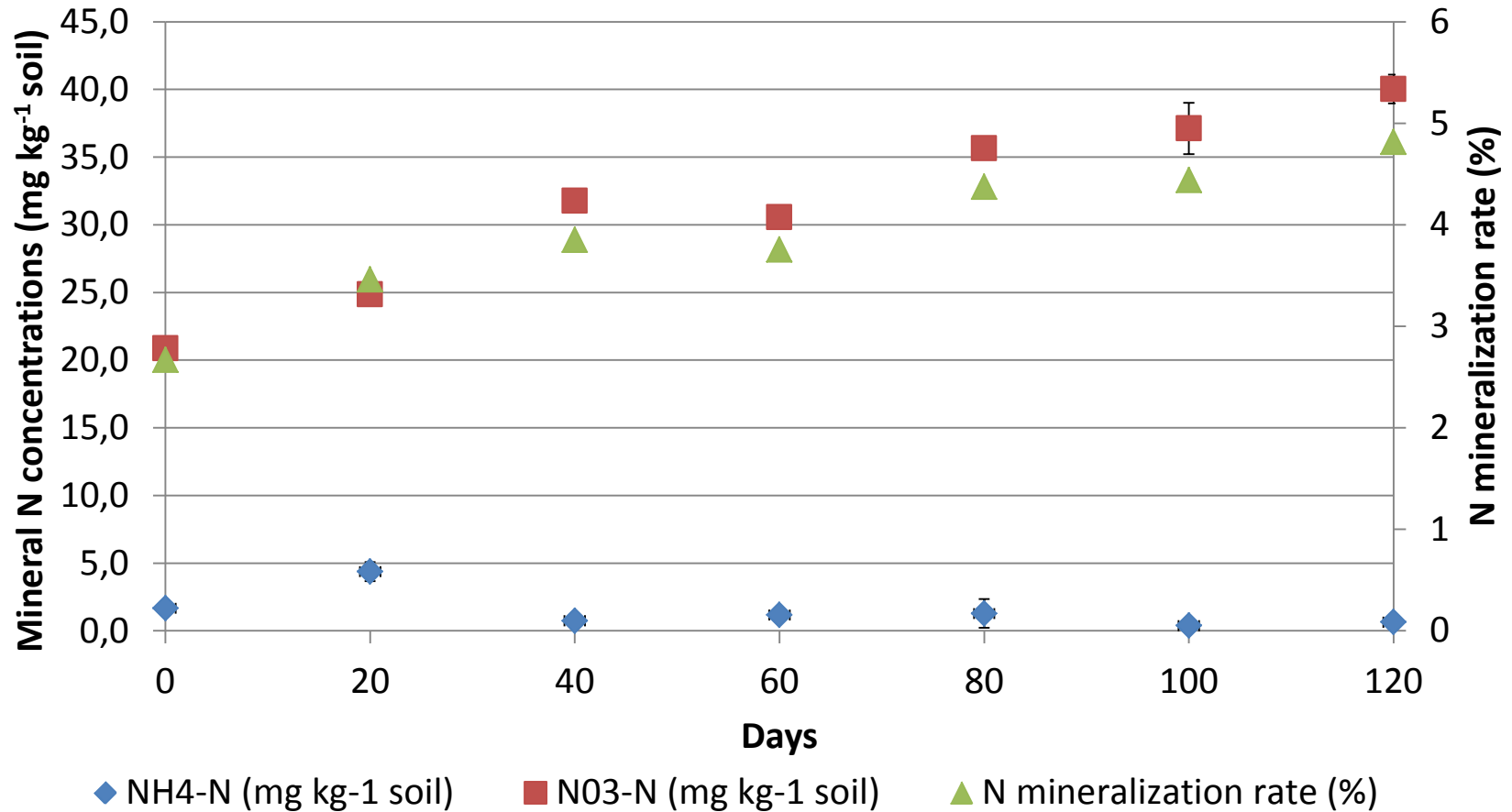
- ❑ Experiment duration: **120 days**
- ❑ **8 treatments (n=4)**: in total 192 tubes
- ❑ **every 20 days sampling** took place
- ❑ **Aim**: evolution of N mineralization rate (%)

$$\% \text{ N mineralization} = \frac{([\text{NO}_{3,\text{mixture}}] - [\text{NO}_{3,\text{soil}}]) + ([\text{NH}_{4,\text{mixture}}] - [\text{NH}_{4,\text{soil}}])}{\text{N}_{\text{product}}}$$

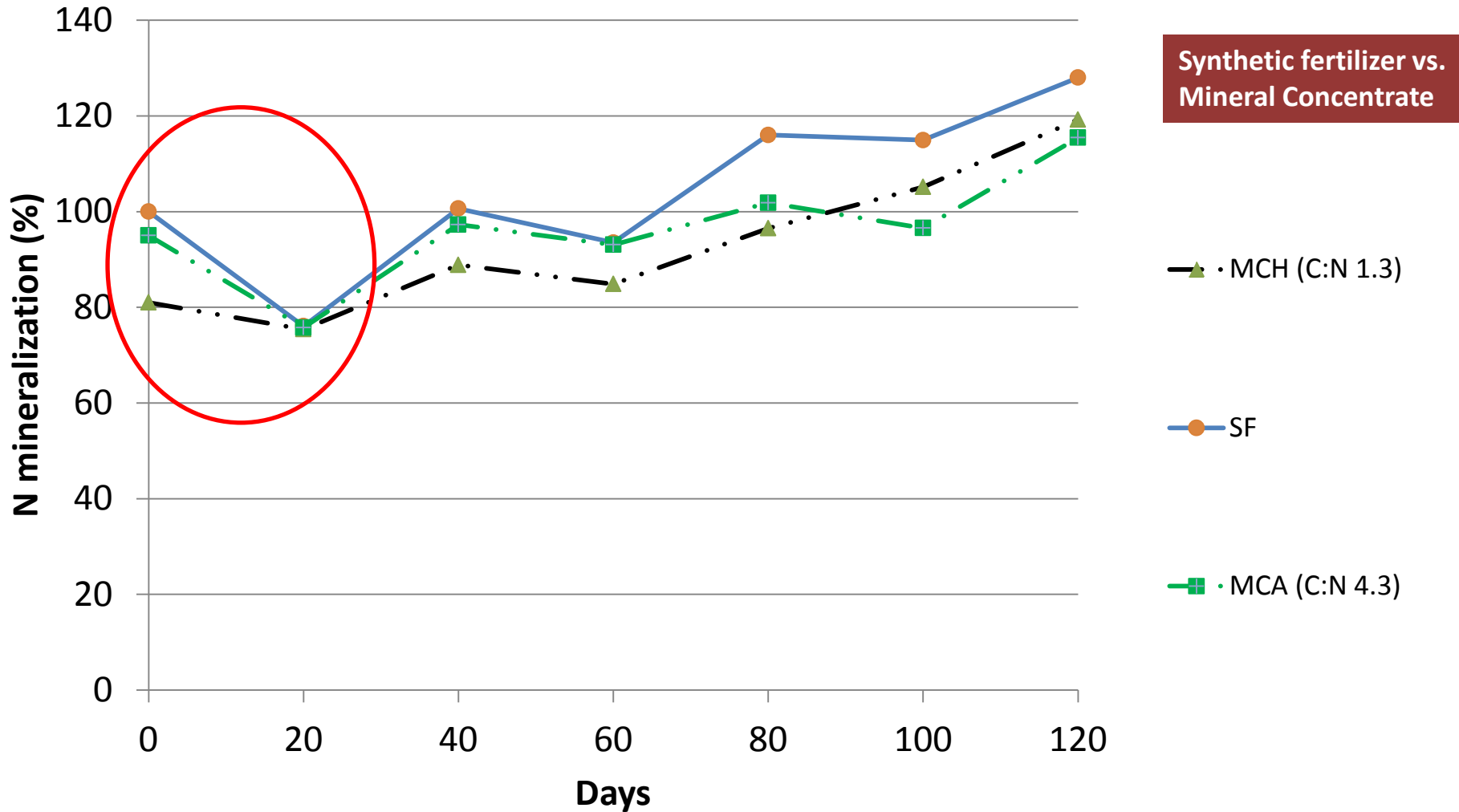


RESULTS

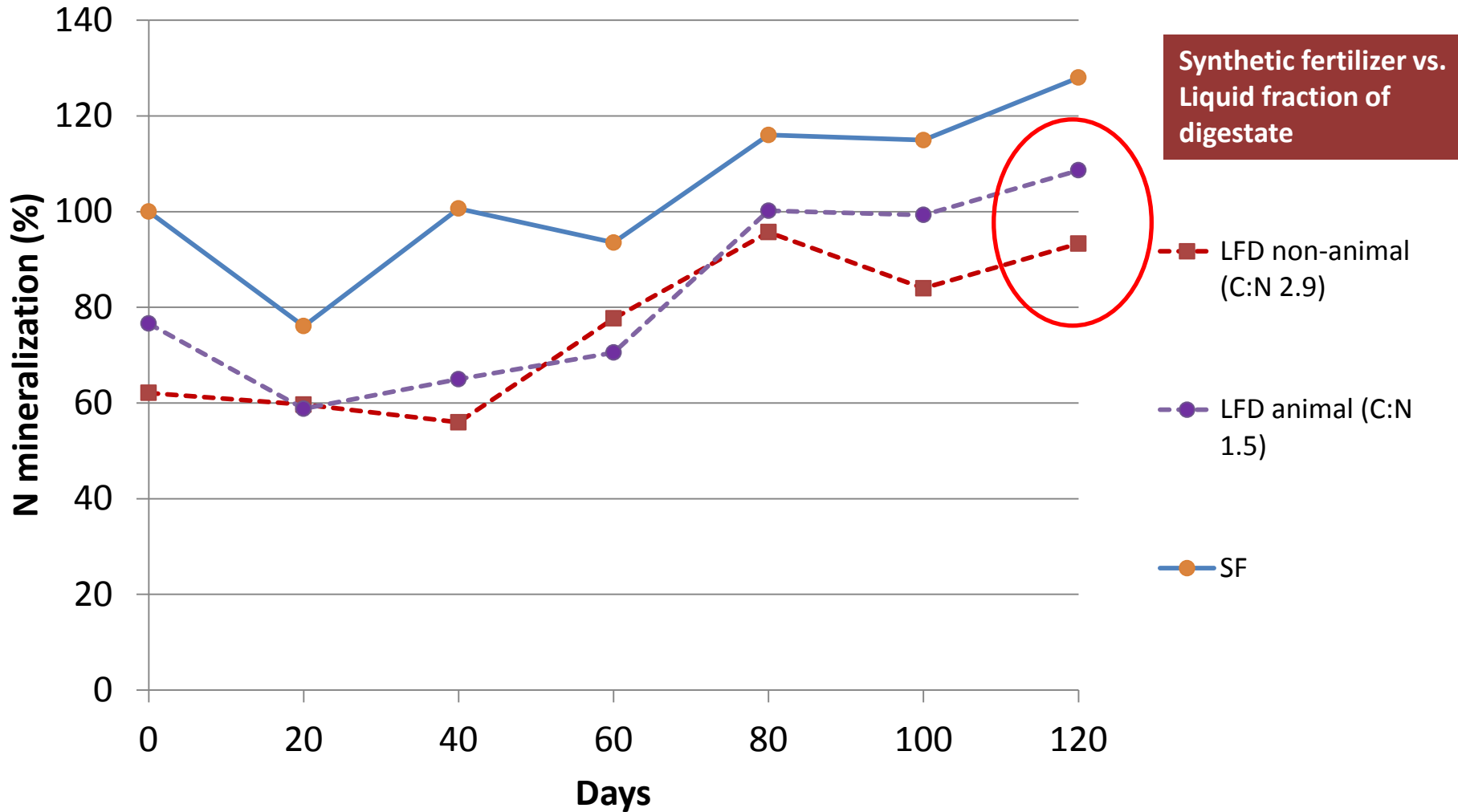
Mineral N concentrations in unamended soil



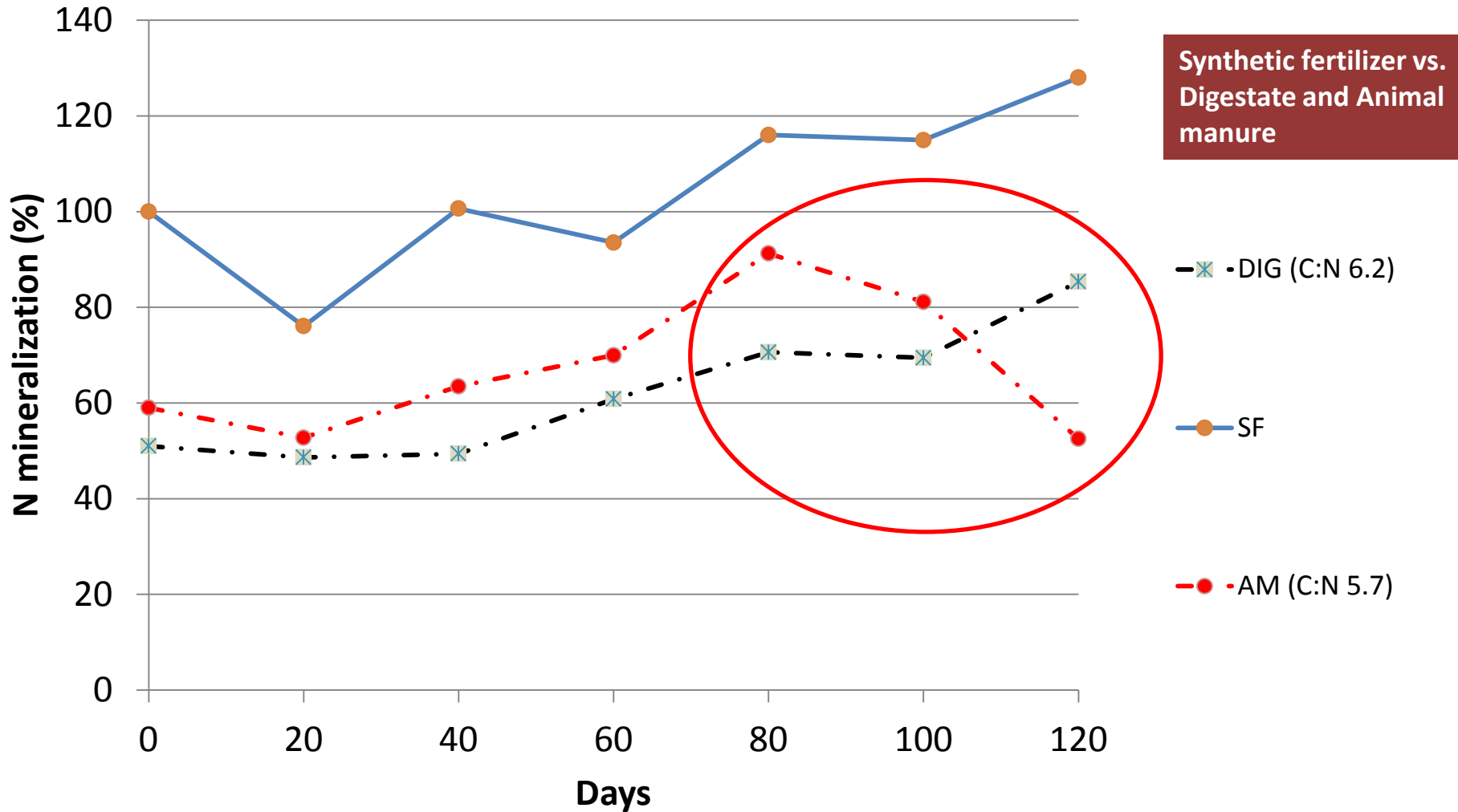
RESULTS



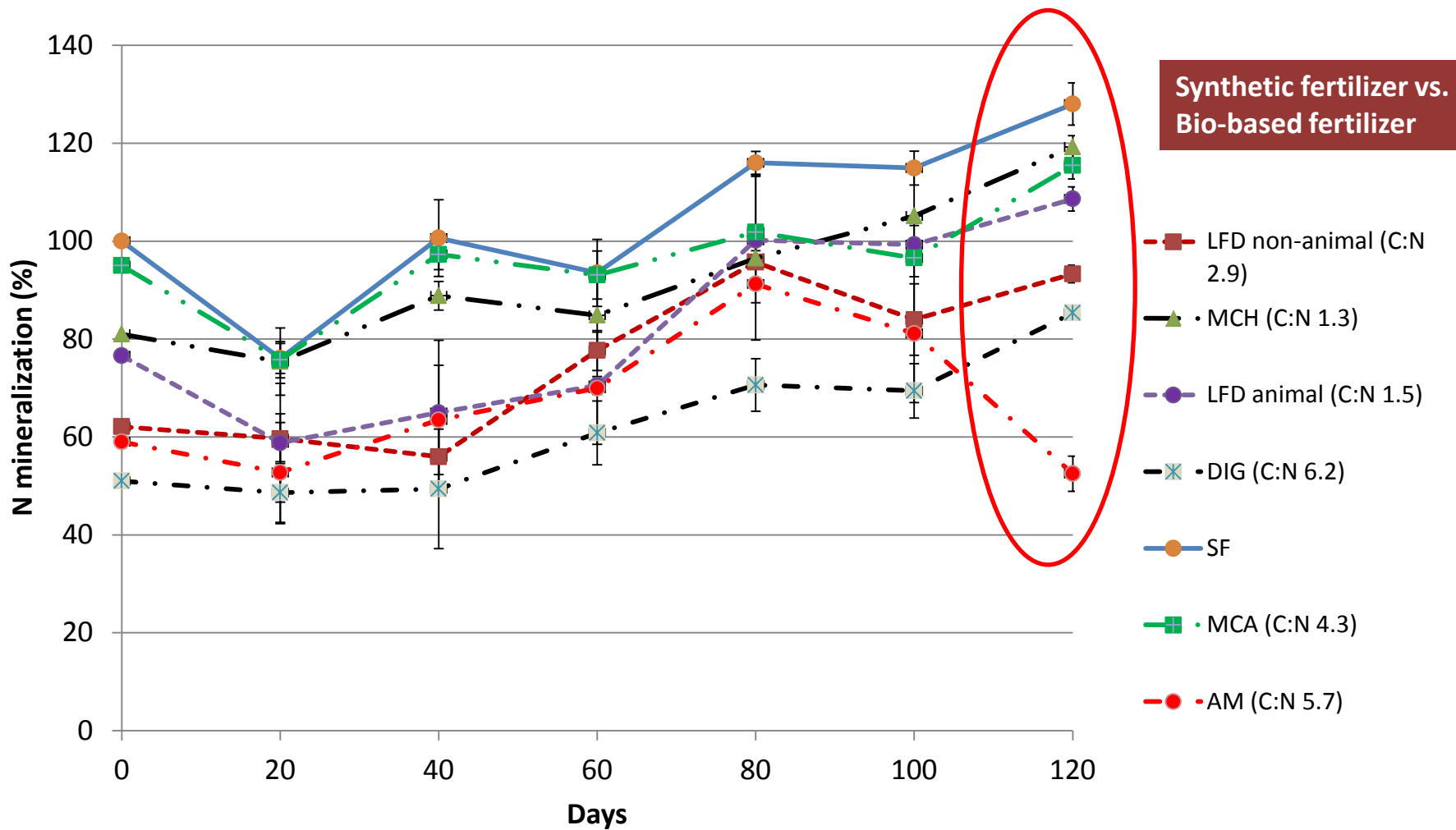
RESULTS



RESULTS

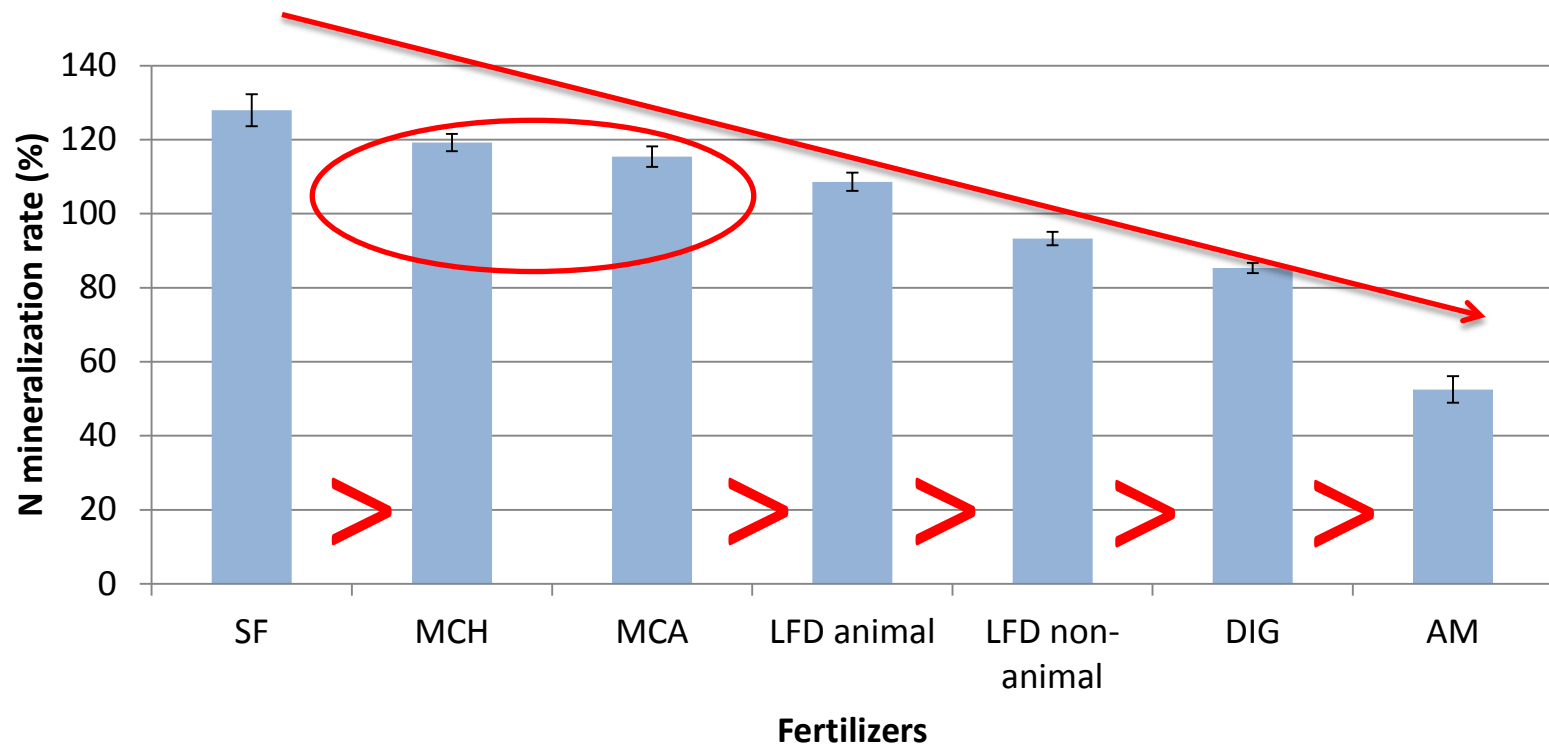


RESULTS



RESULTS

Incubation day 120

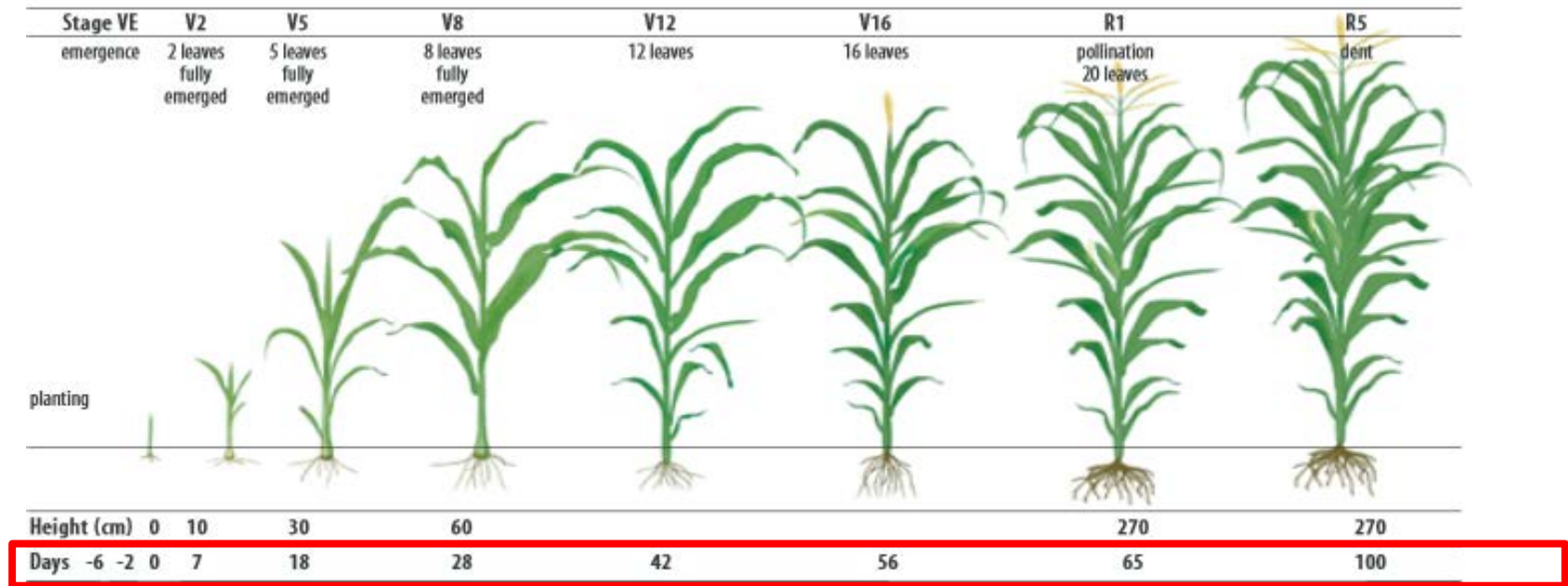


CONCLUSION

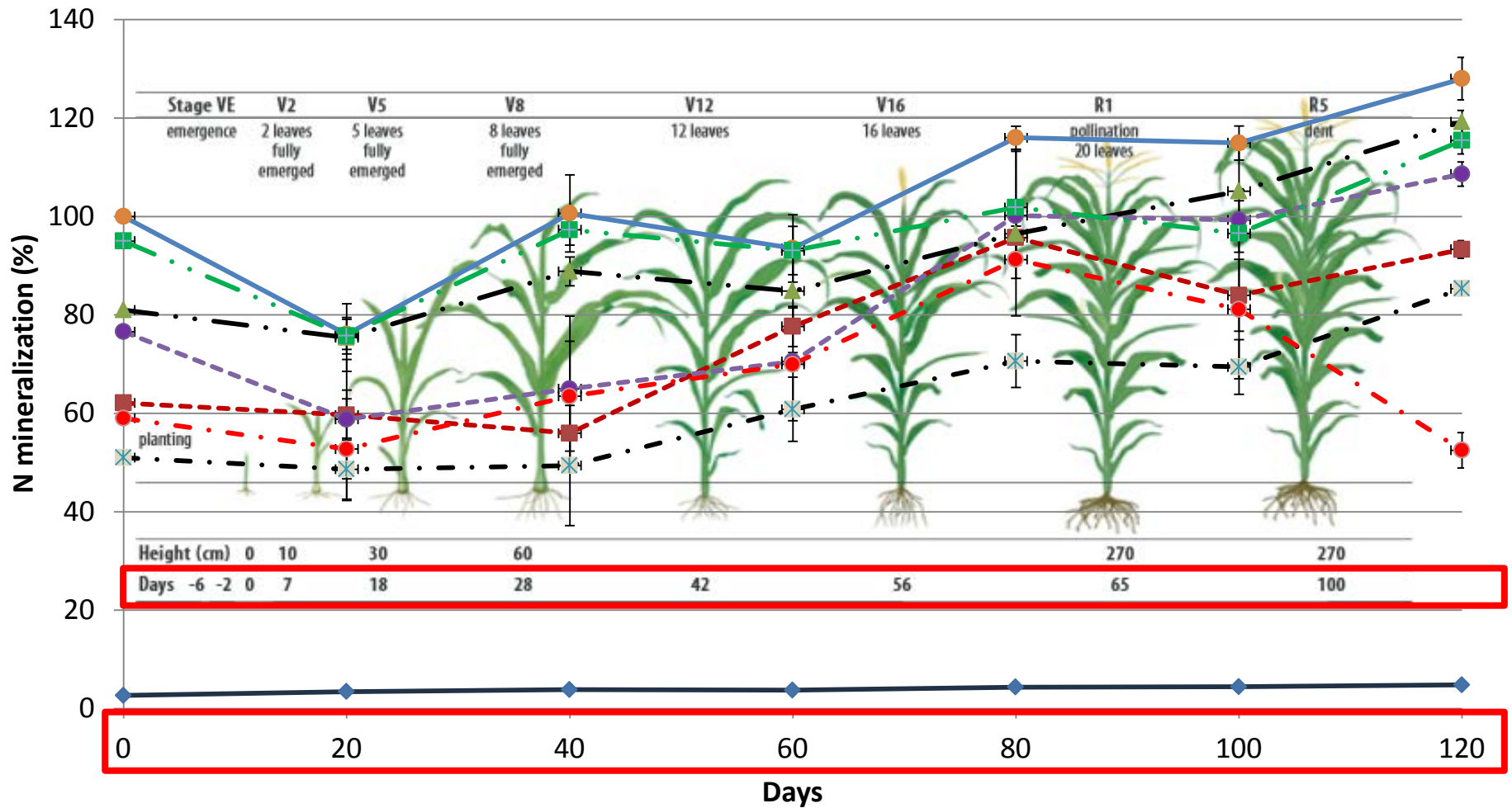
- ❑ The use of mineral concentrate and LF of digestate exhibited similar mineralization patterns and could therefore be considered as worthy substitutes for mineral nitrogen originating from synthetic fertilizers
- ❑ Characteristics of bio-based fertilizers (eg. LF of digestate) can vary greatly depending on the raw materials used for co-digestion
- ❑ Recommendations on the bio-based fertilizer use should be type specific and reflect the C/N, N/P and $\text{NH}_4\text{-N/N}$ ratios



FUTURE PERSPECTIVES



FUTURE PERSPECTIVES





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