



# Potassium losses and transfers in agricultural and livestock systems

Marta A. Alfaro, Ciro Rosolem, Keith Goulding, Johnny Johnston, Huoyan Wang



Introduction

- Demand and K use

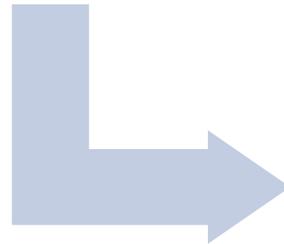
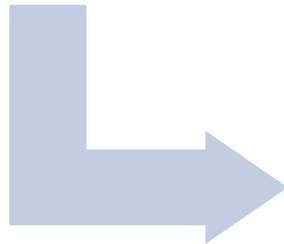
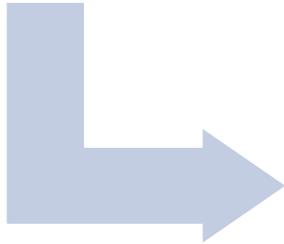
Dynamics of K leaching losses

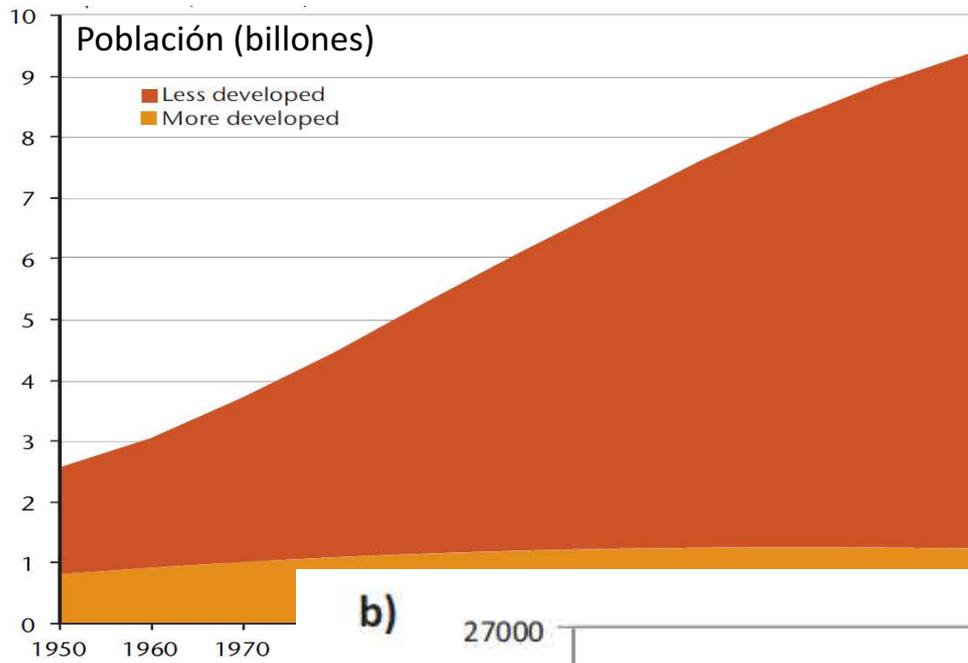
- Flow

Key factors affecting losses

- Climate
- Management

The way forward



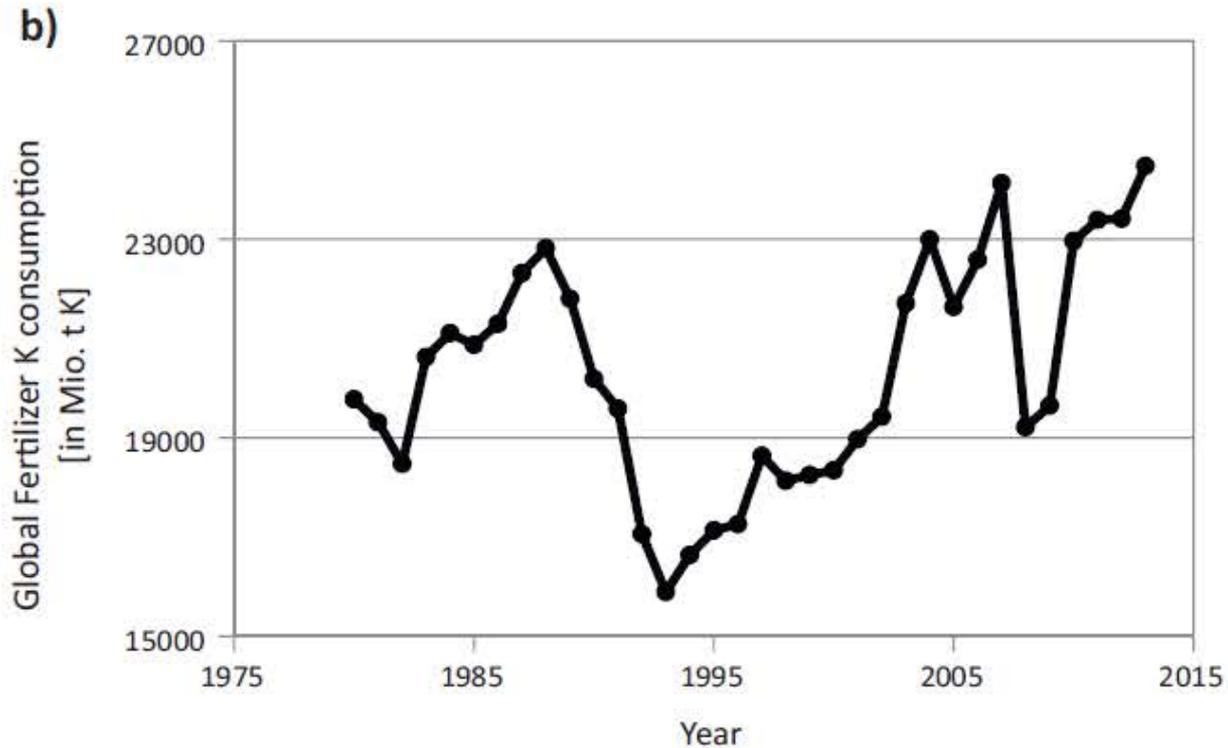


## Current World Population

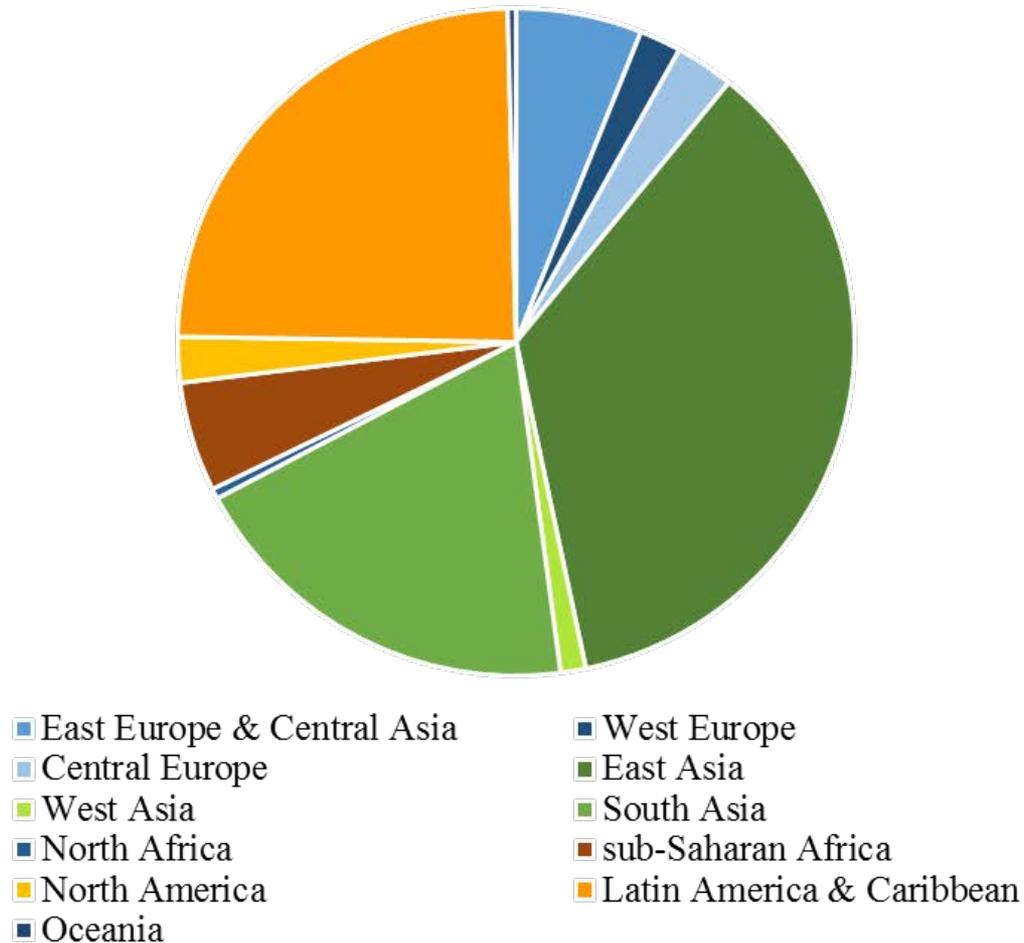
# 7,476,044,900

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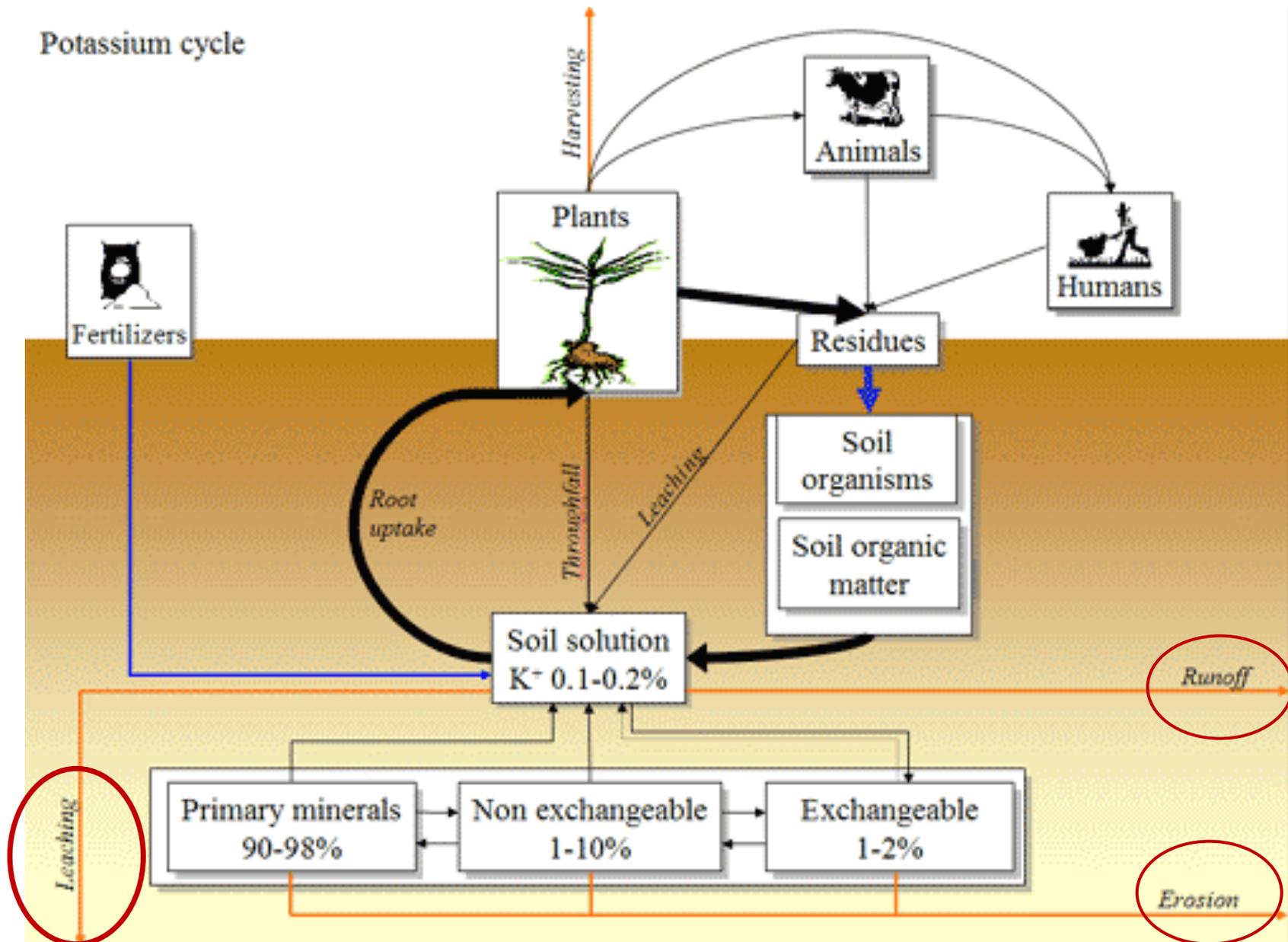
TODAY	THIS YEAR
Births today <b>252,994</b>	Births this year <b>2,952,216</b>
Deaths today <b>104,582</b>	Deaths this year <b>1,220,378</b>
Population Growth today	Population Growth this year



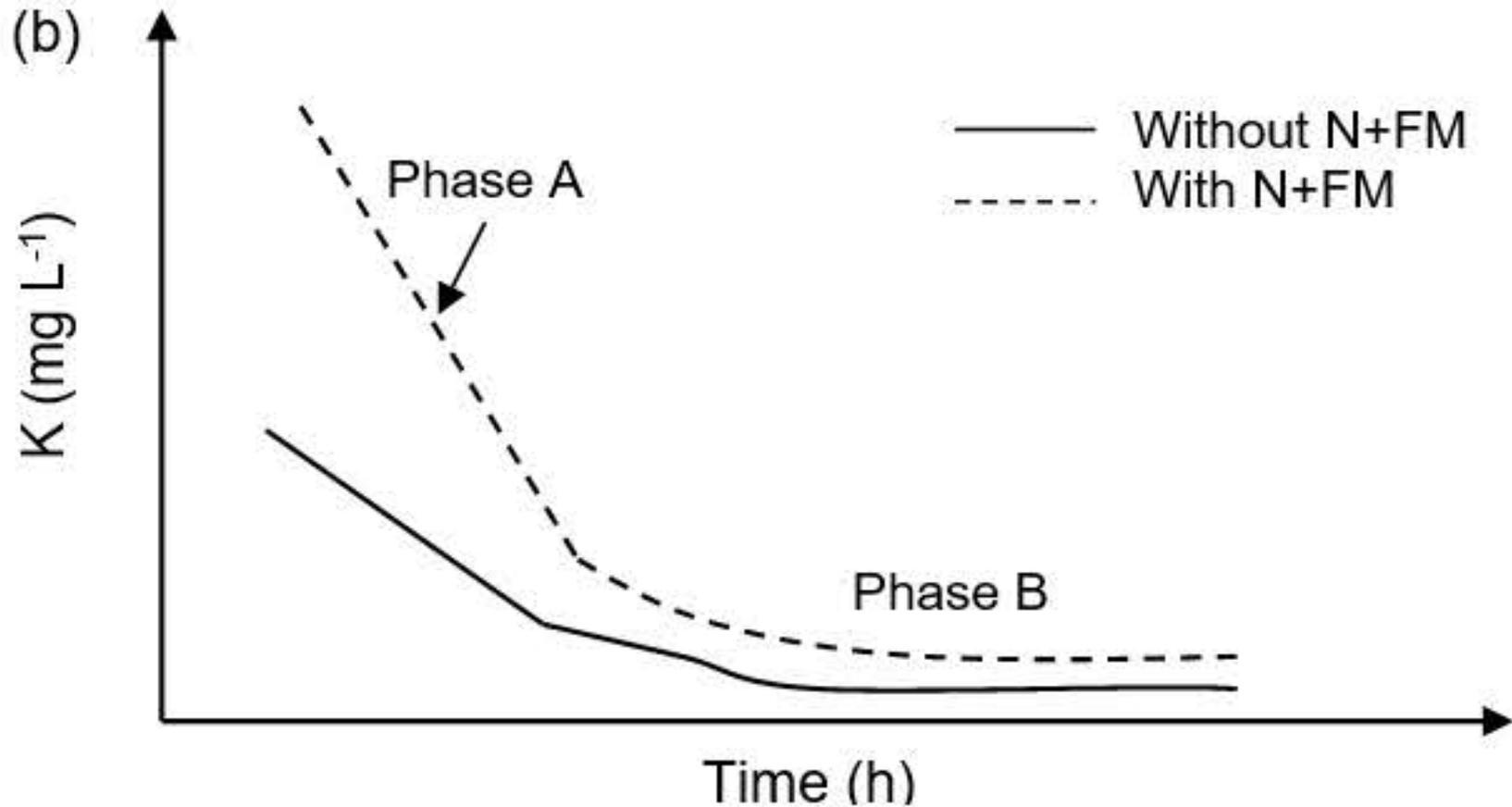
# Regional and subregional share of world increase in potash fertilizer consumption, 2014-2018



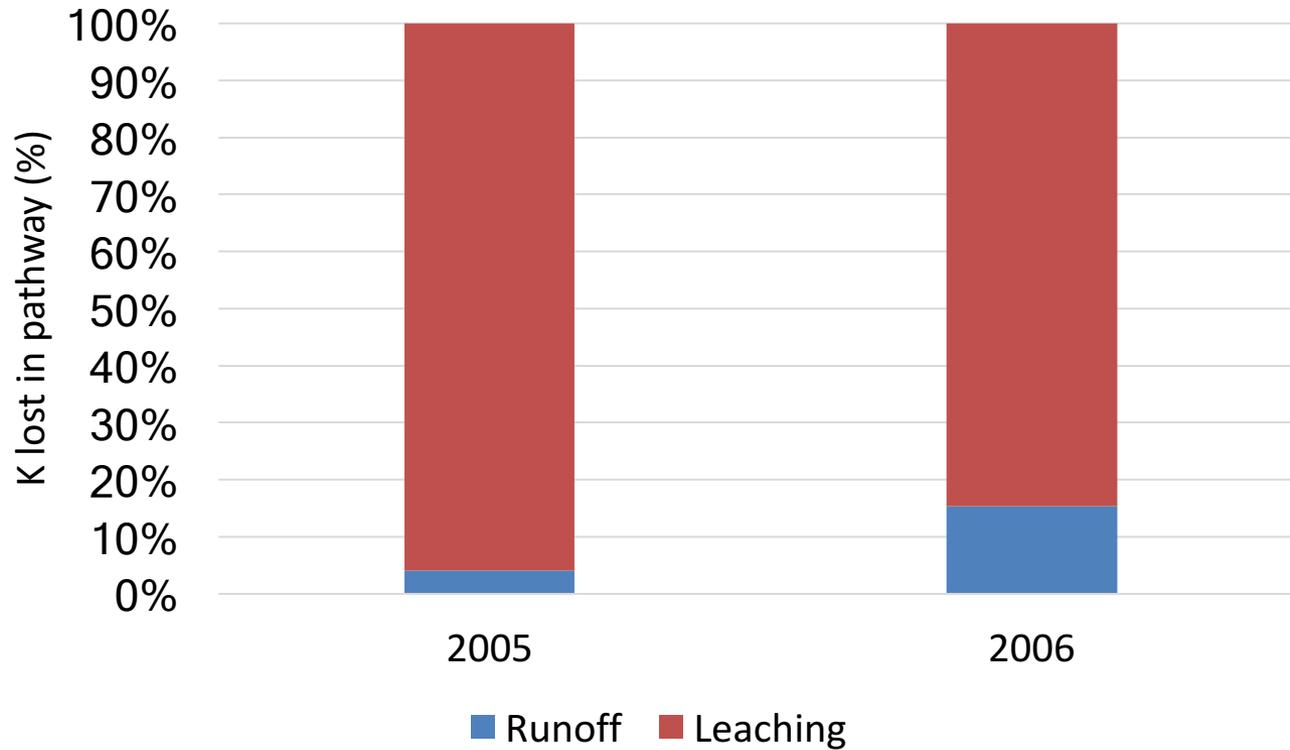
# Potassium cycle



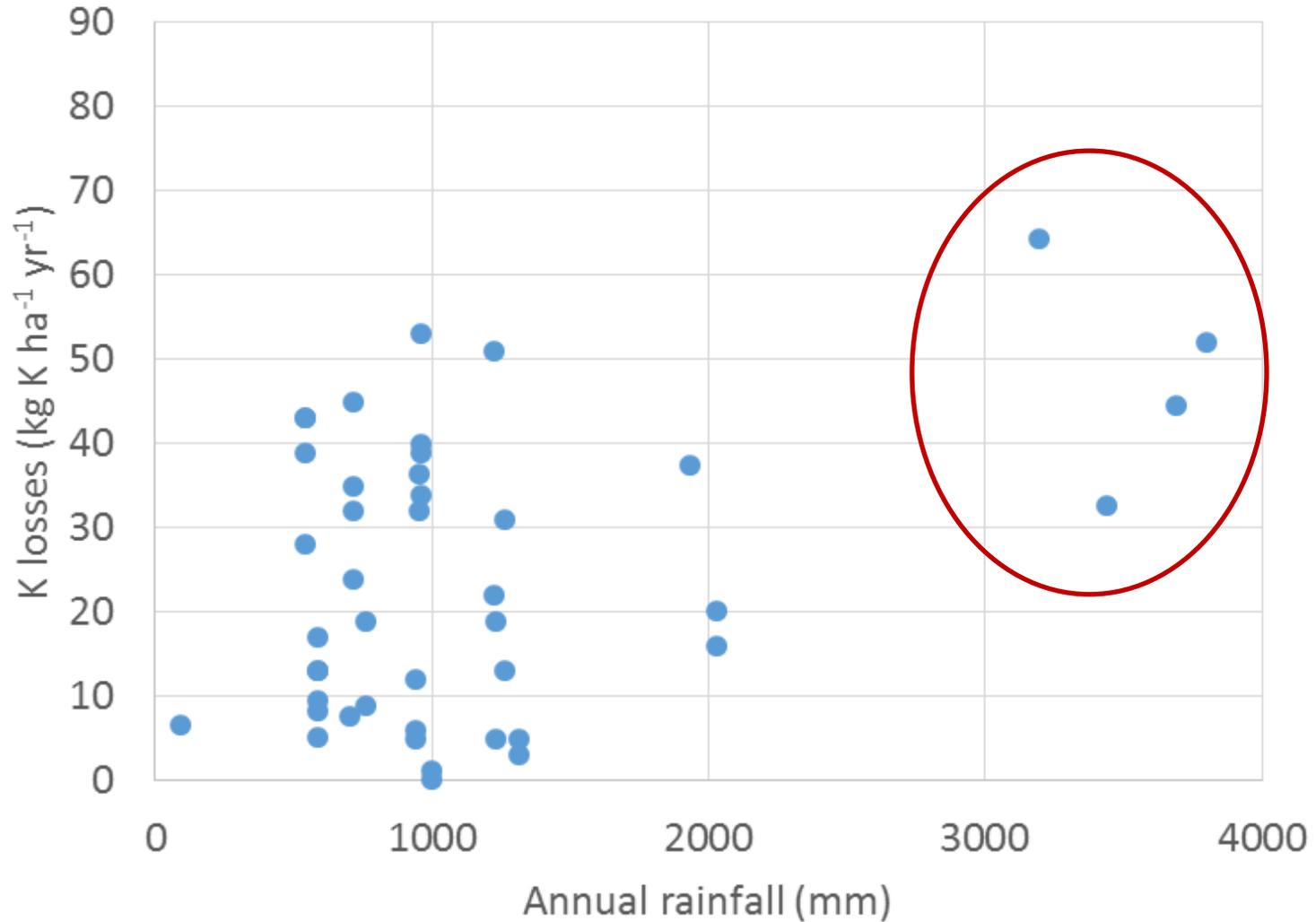
# Dynamics of K losses in water



# Proportion of K lost in runoff or leaching

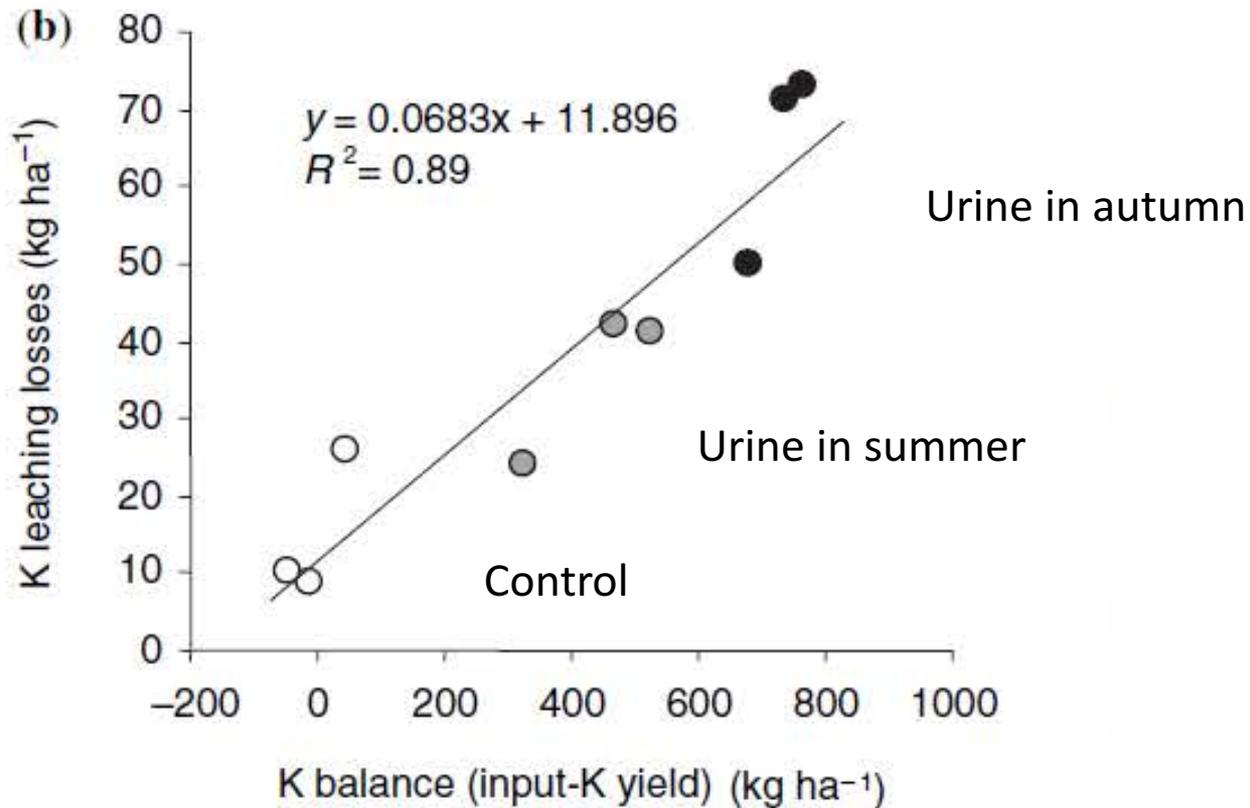


# Role of anual rainfall on K losses (n=20; 1984-2016)

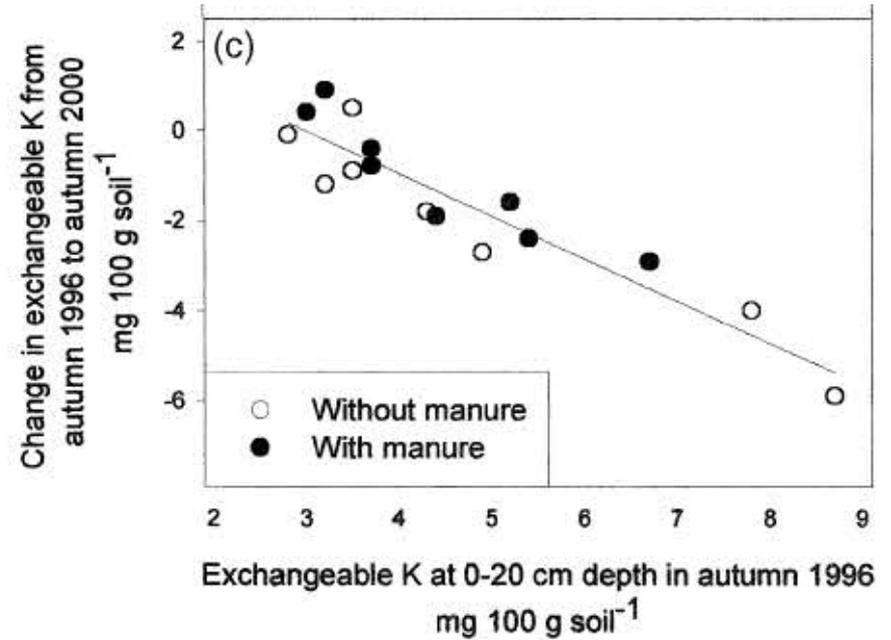
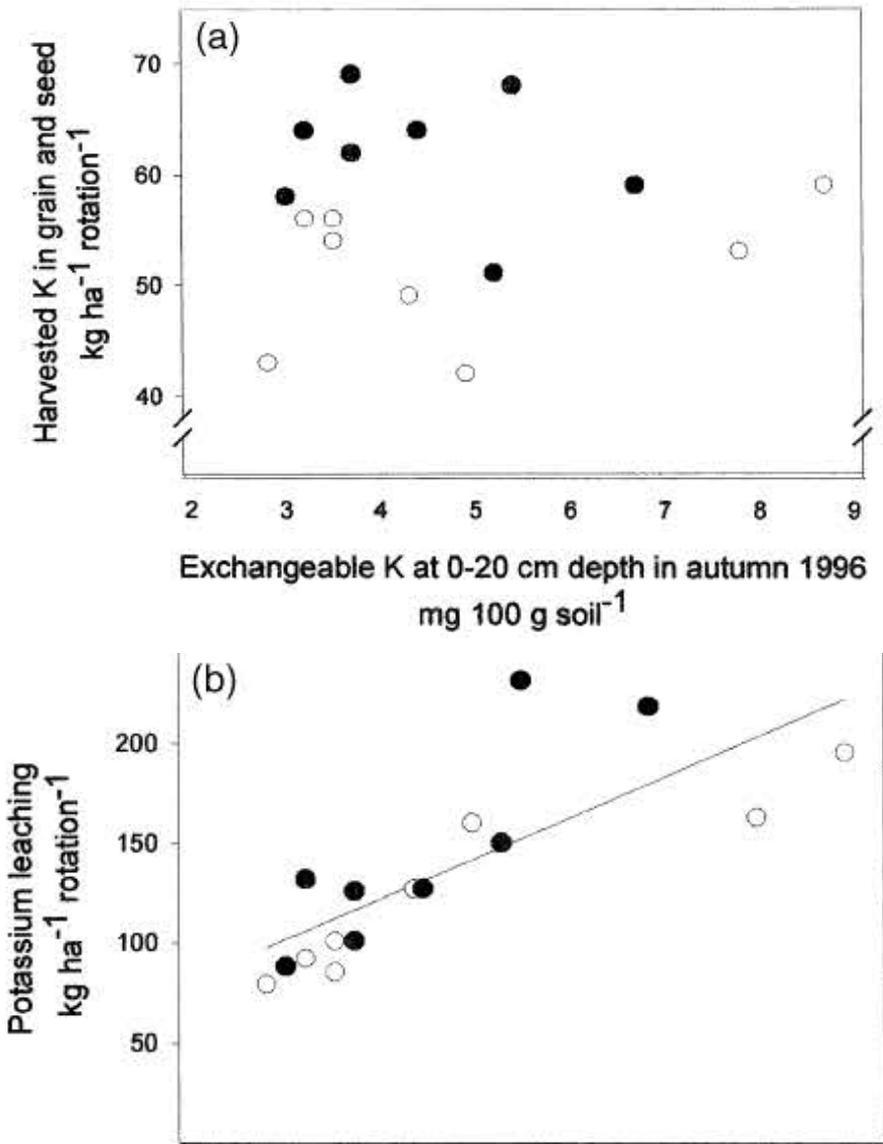




# Urine application and K leaching losses Mini-lysimeters

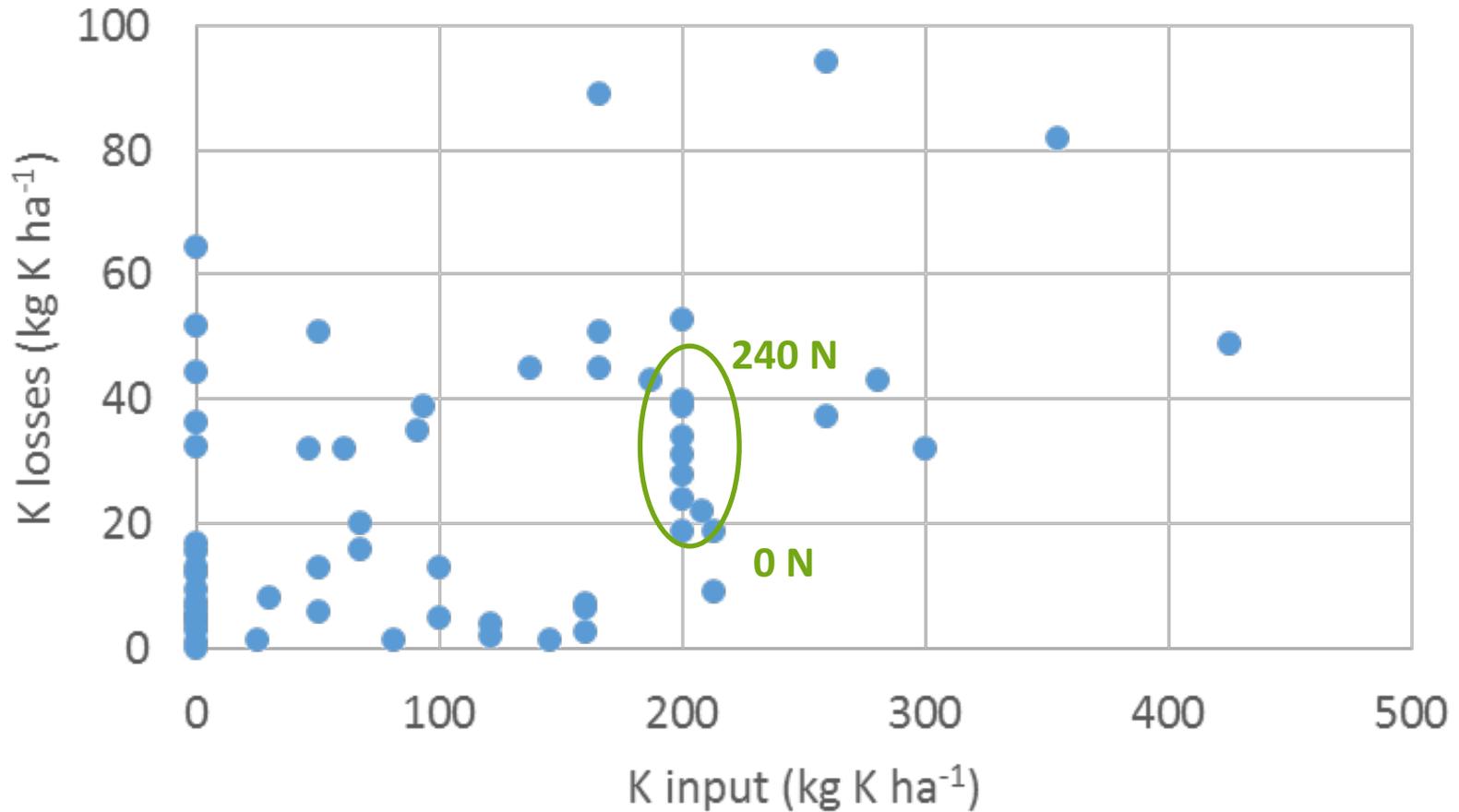




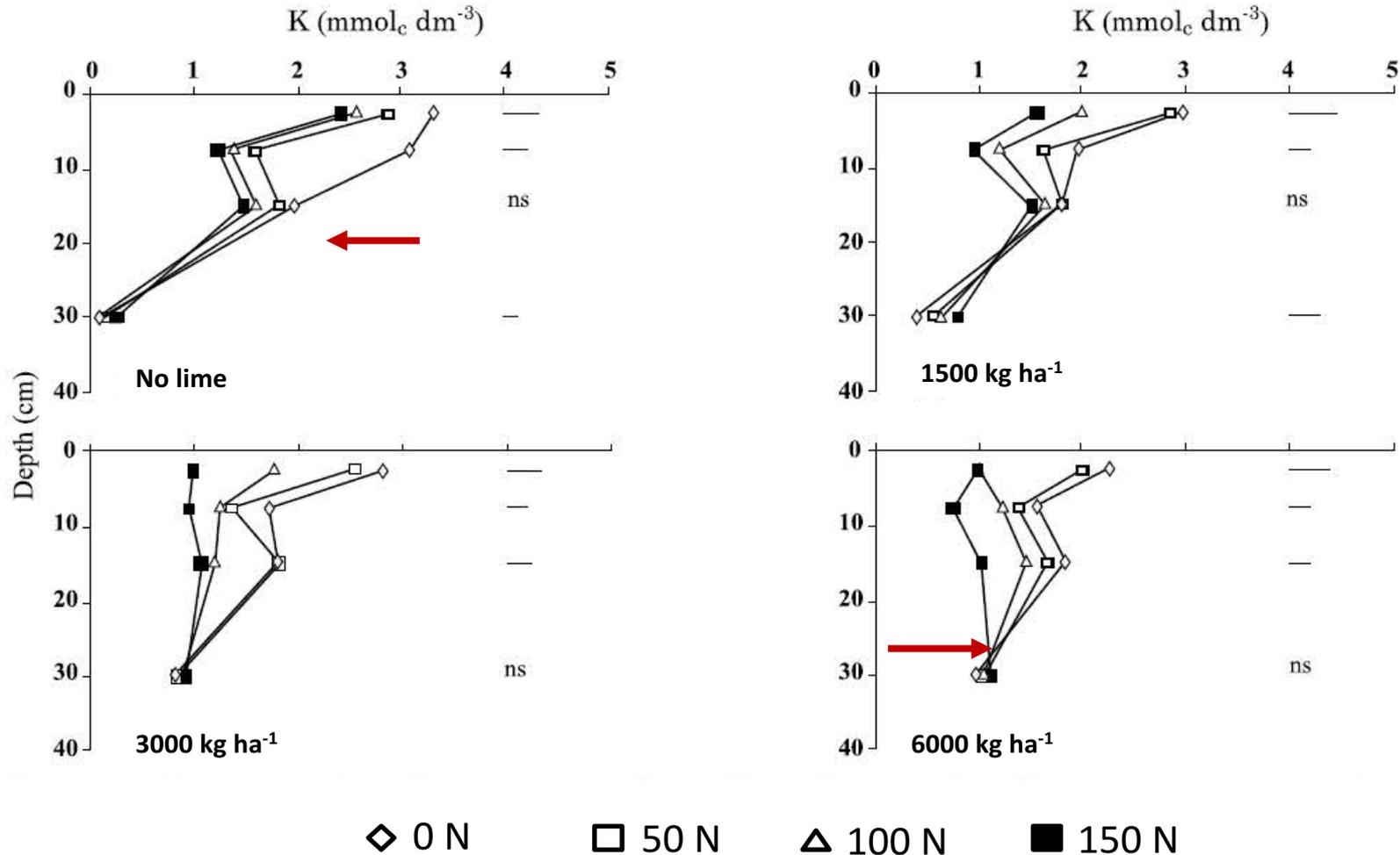


Askegaard et al. (2003); sand soil; two rotations (cereal-grass/clover-lupin-cereal); manure N from pig or daily slurry applied to cereals ( $50 \text{ kg N-NH}_4 \text{ ha}^{-1}$ ); ceramic cups at 0.8 m

# Potassium and nitrogen interaction and effects on K leaching losses (n=20; 1984-2016)



# Potassium concentration in the soil due to N fertilizer and lime application (maize-upland rice)



Crusciol et al. (2011); N (kg ha<sup>-1</sup>) as urea; Lime as dolomite. Results from 18 months after liming; no till; lime and nitrification; 1515 mm rainfall

# Potassium leaching losses and N fertilizer application (mown grass, total of 6 years, kg K ha<sup>-1</sup>)

	K input	K surplus	K leaching	Kex
Control	1014	279 b	45 b	62 b
WCL	1014	-334 c	89 b	27 c
MIN320	1818	236 b	32 b	32 c
SLR320	2580	955 a	149 a	212 a

P<0.05,

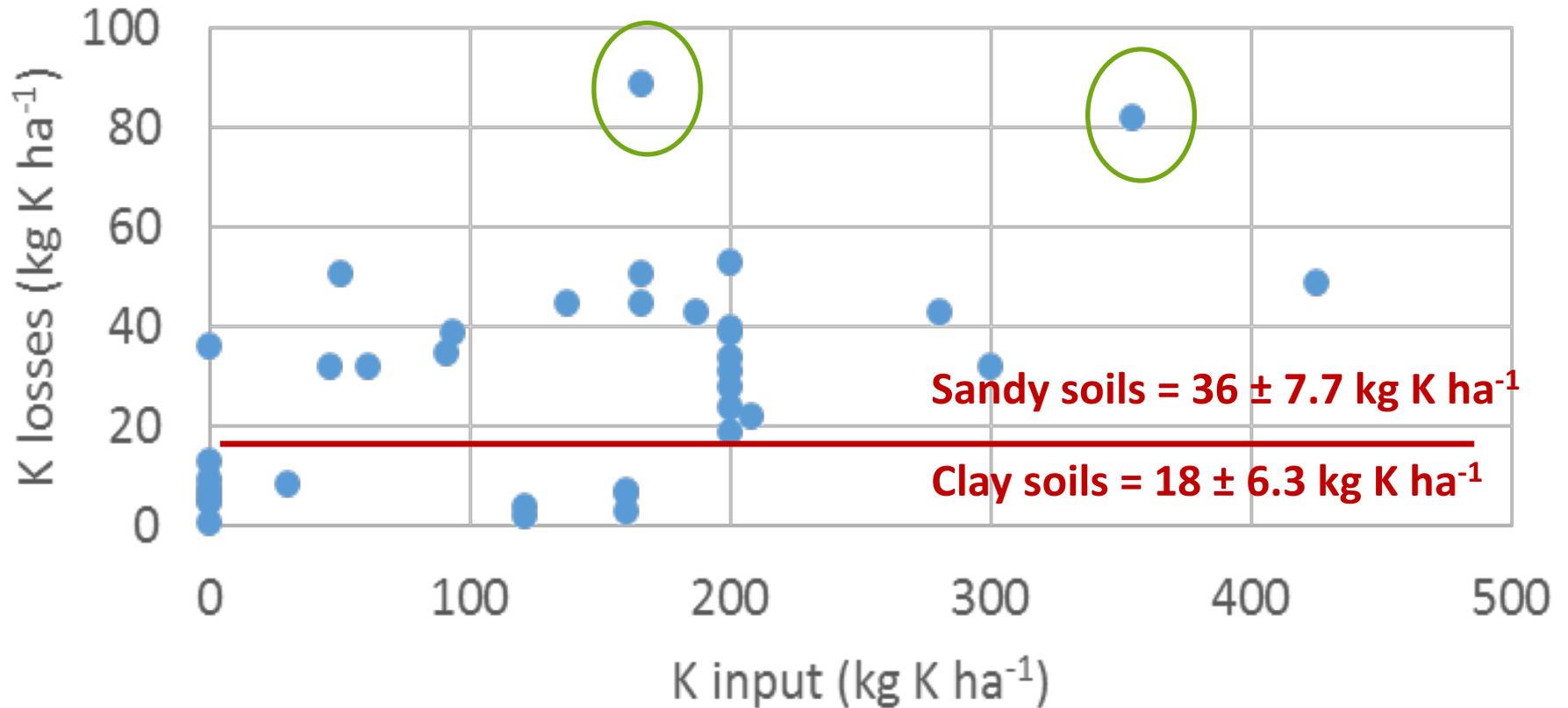
Control: grass, 0 N-166 kg K ha<sup>-1</sup>

WCL: grass-clover, 152 kg N-166 kg K ha<sup>-1</sup>

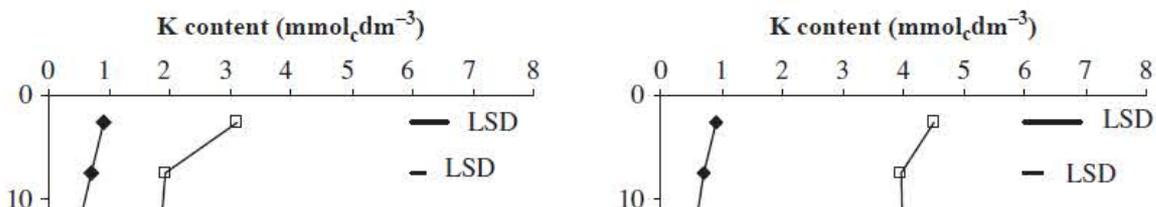
MIN320: grass, 320 kg N-300 kg K ha<sup>-1</sup>

SLR320: cattle slurry, grass 320 kg N-425 kg K ha<sup>-1</sup>

# Soil texture and K leaching losses (n=20; 1984-2016)

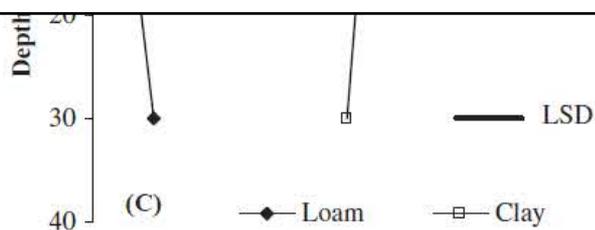


# Soil texture and K leaching losses

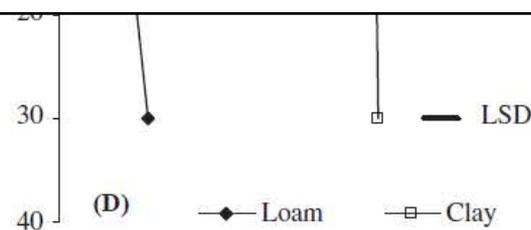


Soil series	Total K losses (kg ha <sup>-1</sup> )	K in leachates (mg L <sup>-1</sup> )	Flow (L)
Loam (Radyr)	1 ± 0.01 b	0.2 ± 0.02 b	385 ± 7.4 a
Loam over chalk (Frilsham)	4 ± 0.01 b	0.6 ± 0.07 b	371 ± 9.8 a
Sand (Newport)	19 ± 0.08 a	2.4 ± 0.14 b	404 ± 7.2 a

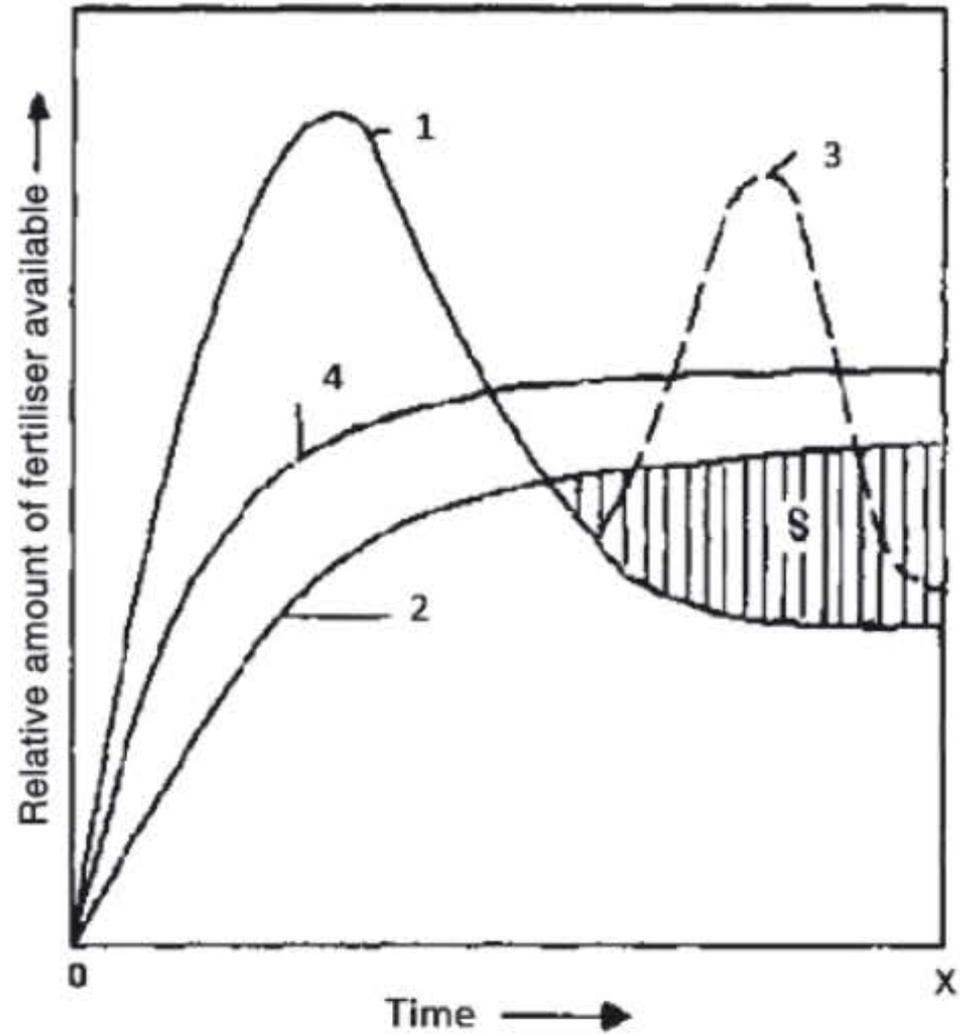
120 kg K<sub>2</sub>O ha<sup>-1</sup>



180 kg K<sub>2</sub>O ha<sup>-1</sup>



# What can we expect for the coming years?



Timilsena et al. (2015); 1, soluble fertilizer supply; 2, enhanced fertilizer supply; 3, second dressing contribution; 4, plant uptake

# Potassium release rate and cumulate release of PCPC (Polymer Coated Potassium Chloride)

Yield (kg ha <sup>-1</sup> )	Seed cotton	Lint
K 180 PS	2795 c	1243 c
K 90 PS + K 90 PCPS	3183 b	1423 b
K 54 PS + K 126 PCPS	3516 a	1584 a

# Annual leaching losses of K<sup>+</sup> (kg K ha<sup>-1</sup> yr<sup>-1</sup>) directly measured from lysimeters and impacts in a grazed paddock receiveing 200 kg N ha<sup>-1</sup> (urea) (25% as urine patches)

Treatment	K <sup>+</sup>
Control	15.5 (3.3)
Urea 200	4.1 (0.5)
Urea 200/urine 1000	185 (24.7)
Urea 200/urine 1000/DCD	47.9 (11.3)



Cation	Leaching losses (kg ha <sup>-1</sup> yr <sup>-1</sup> )		% decrease due to DCD
	- DCD	+ DCD	
K <sup>+</sup>	48.1	17.0	65%
NO <sub>3</sub> -N	118.0	46.0	61%

Adapted from Di and Cameron (2004); DCD, dicyandiamide

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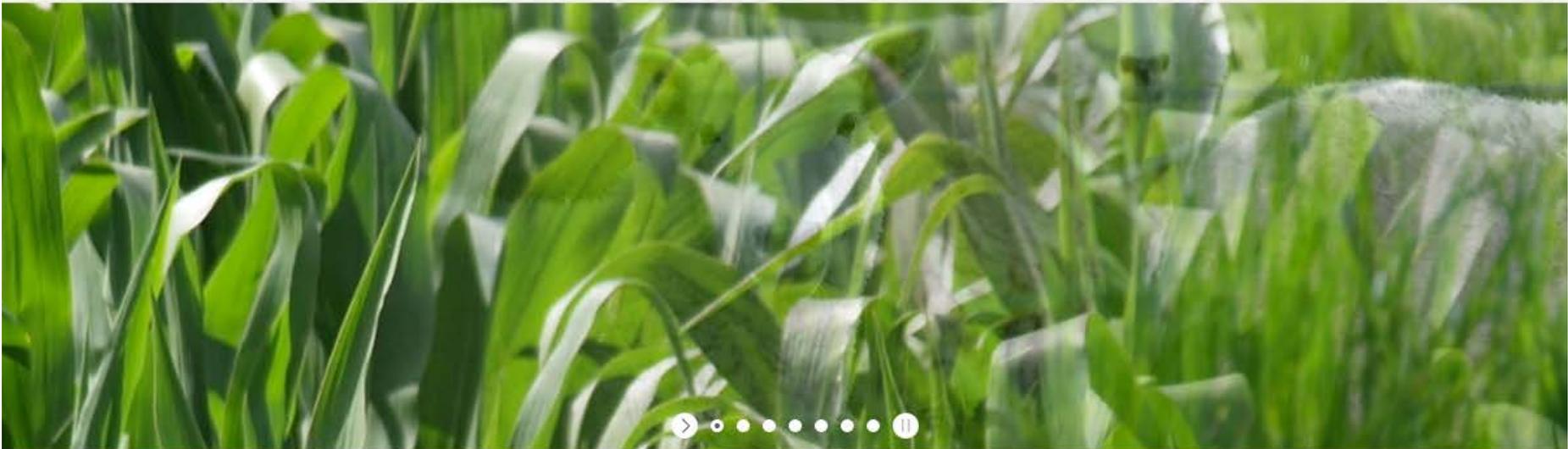
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Nicholson et al. (2013), Wheeler et al. (2008)





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**[malfaro@inia.cl](mailto:malfaro@inia.cl)**

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