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IPI Conference in Budapest

Nutrient management in a crop rotation for bio energy plants

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Determination of adequate fertilizer supply

1. Nutrient demand of plants
2. +/- Correction of soil nutrient level
3. – Nutrients available from organic fertilizers

   = Nutrient demand from mineral fertilizers
4. – Limitation by the economic optimum
5. – Environmental restrictions

   = Recommended fertilizer supply

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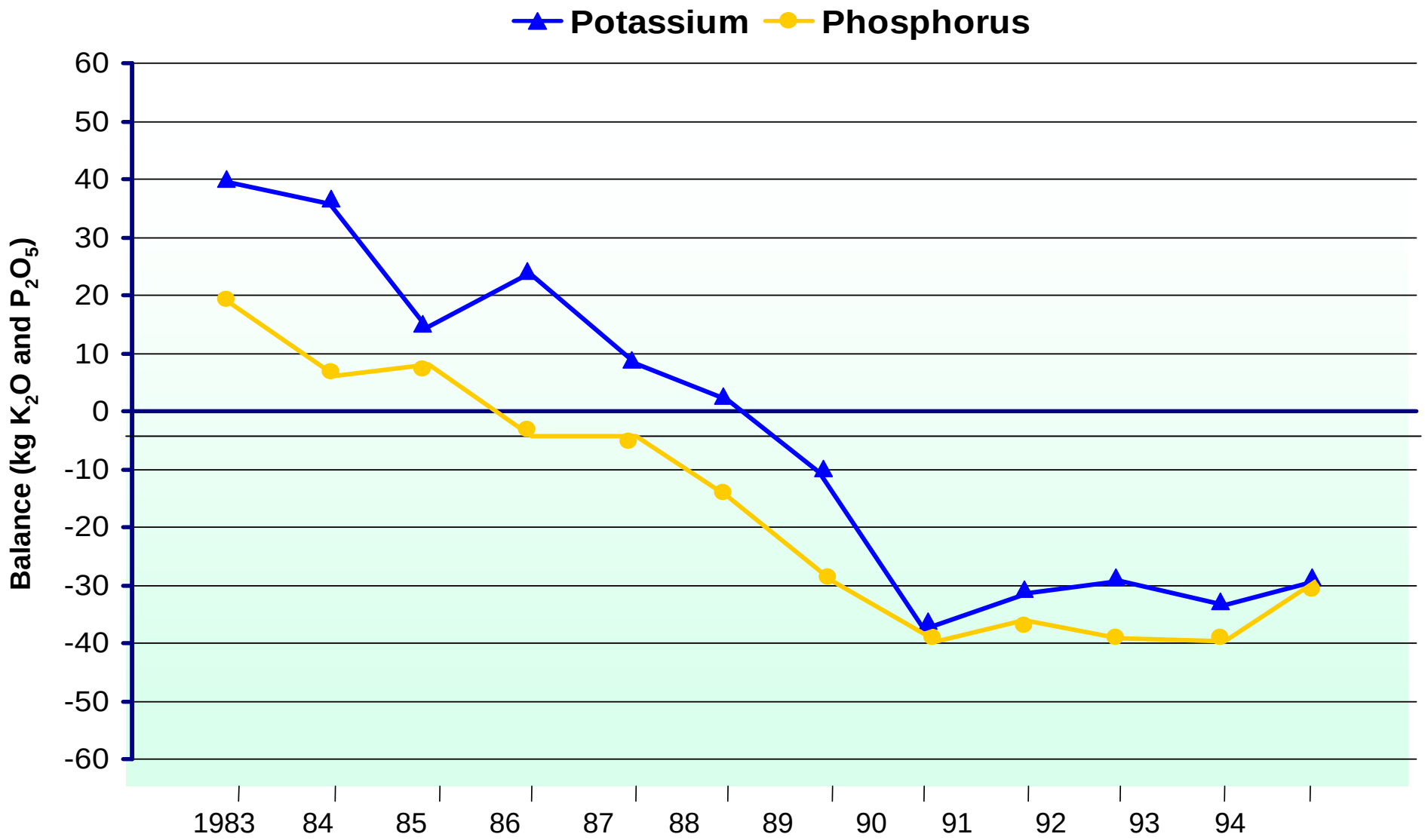
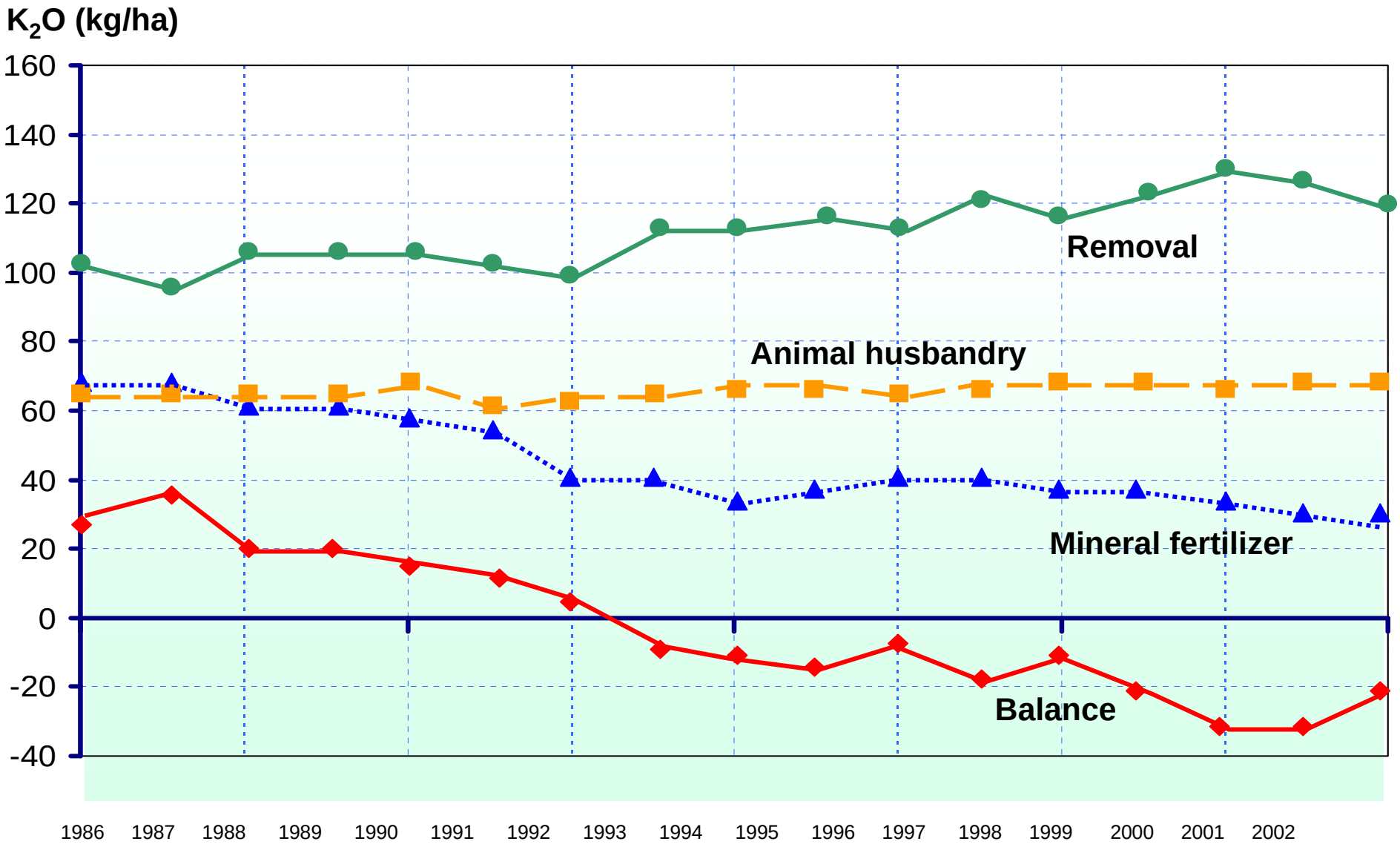
Phosphorus and potassium balances – Crop rotation: sugar beet – winter wheat – winter barley (Lower Saxony; mean of 1983-1994)



Source: Baumgärtel, Hannover

Potassium balance – Lower Saxony



Source: Baumgärtel, Hannover

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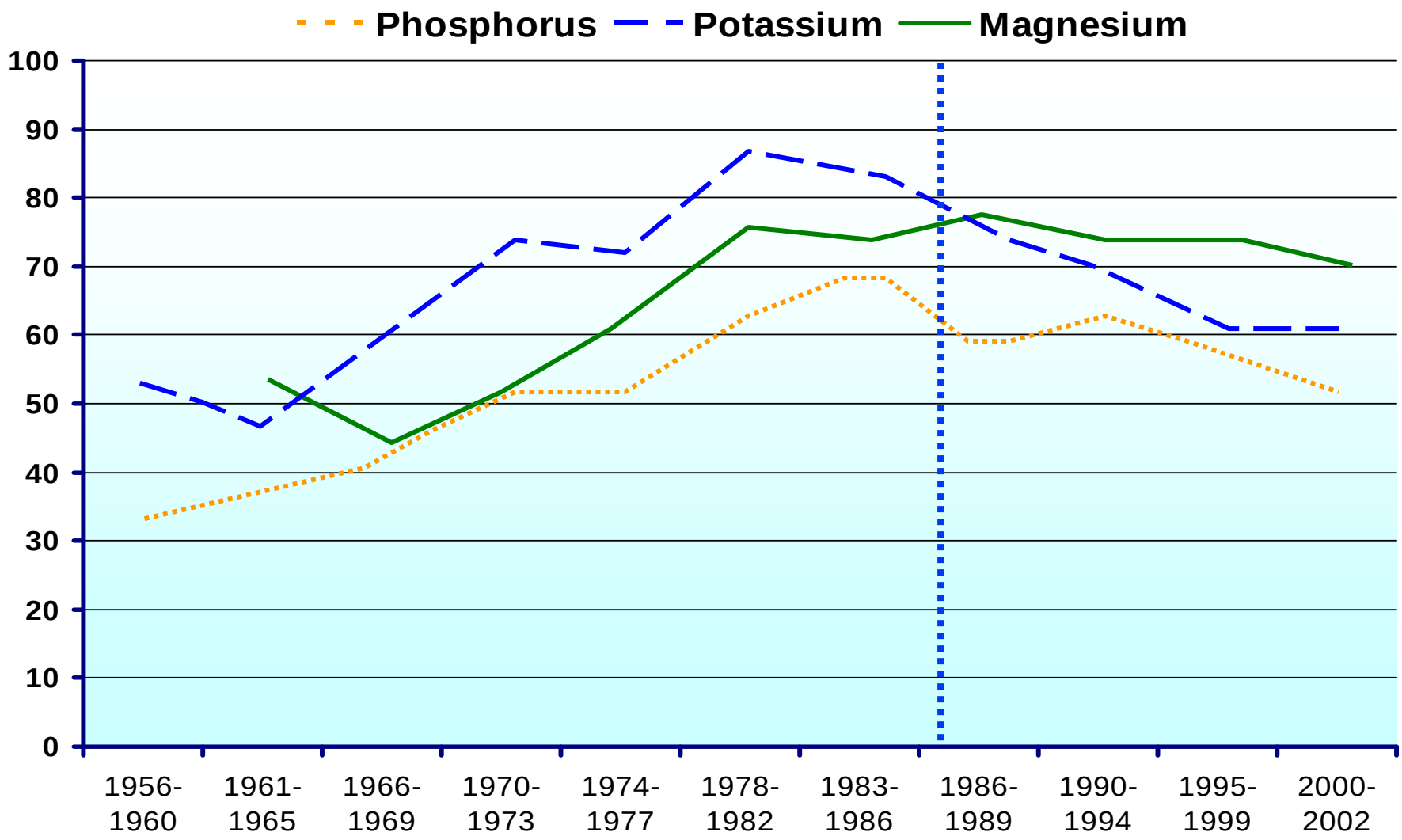
Nutritional status of the arable land in the new federal states of Germany (1956 – 2002) (Nutrition note according to Riem, new valuated after 1987)



Source: Krause and Herold, 2003

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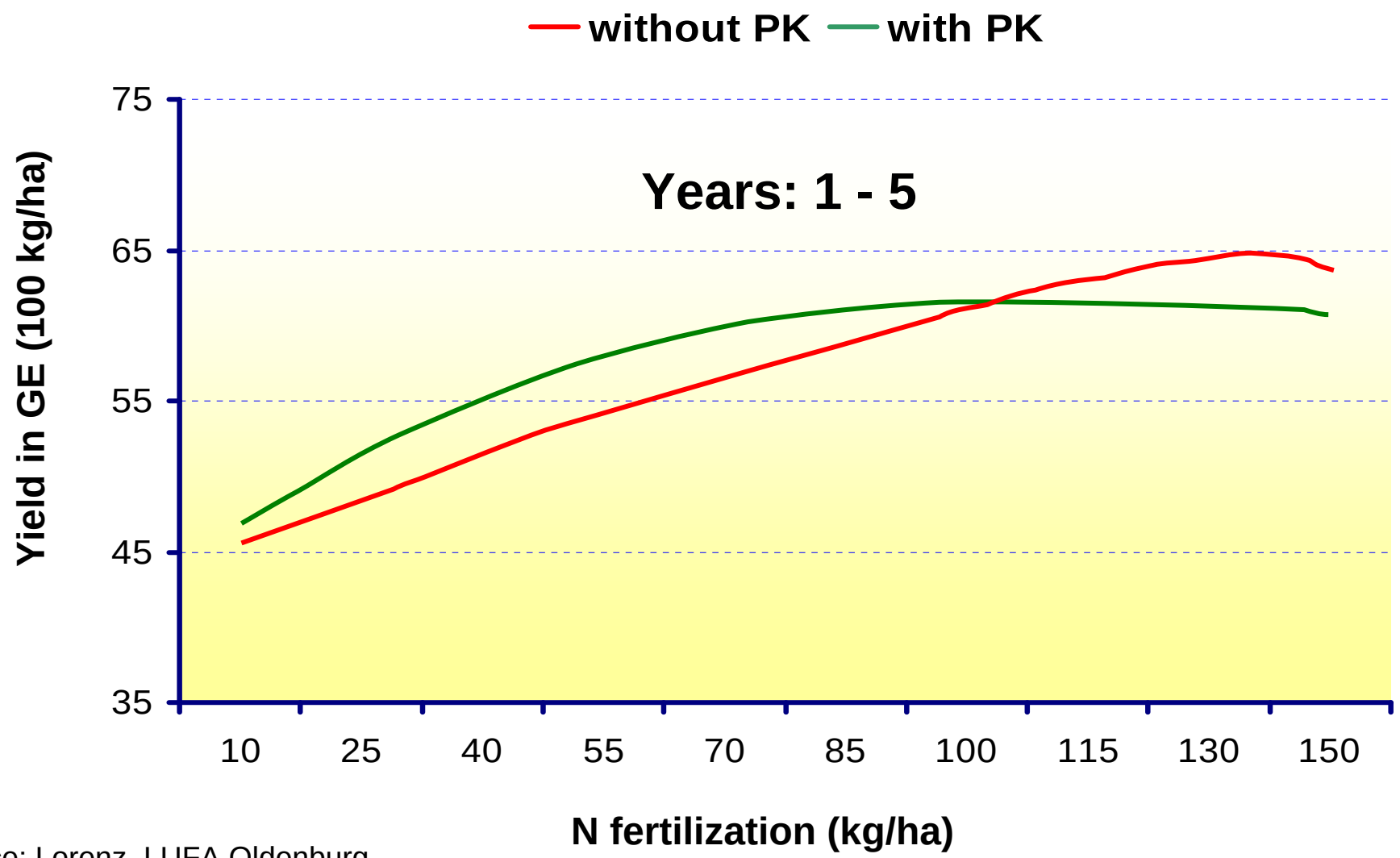
Yield and N demand in two five-year-periods of a long-term fertilization trial of 10 years with and without PK fertilization

- 1st period -



Source: Lorenz, LUFA Oldenburg

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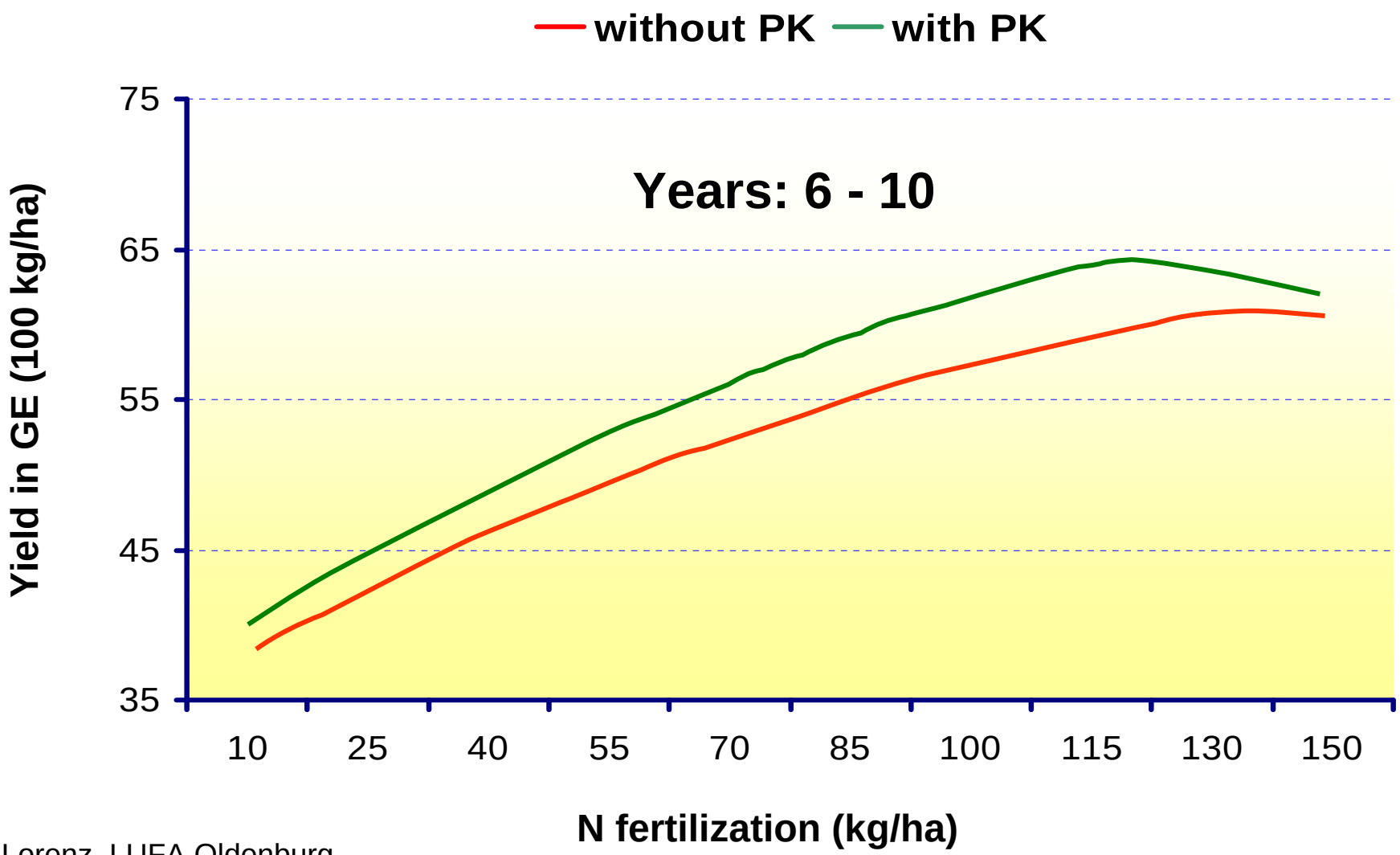
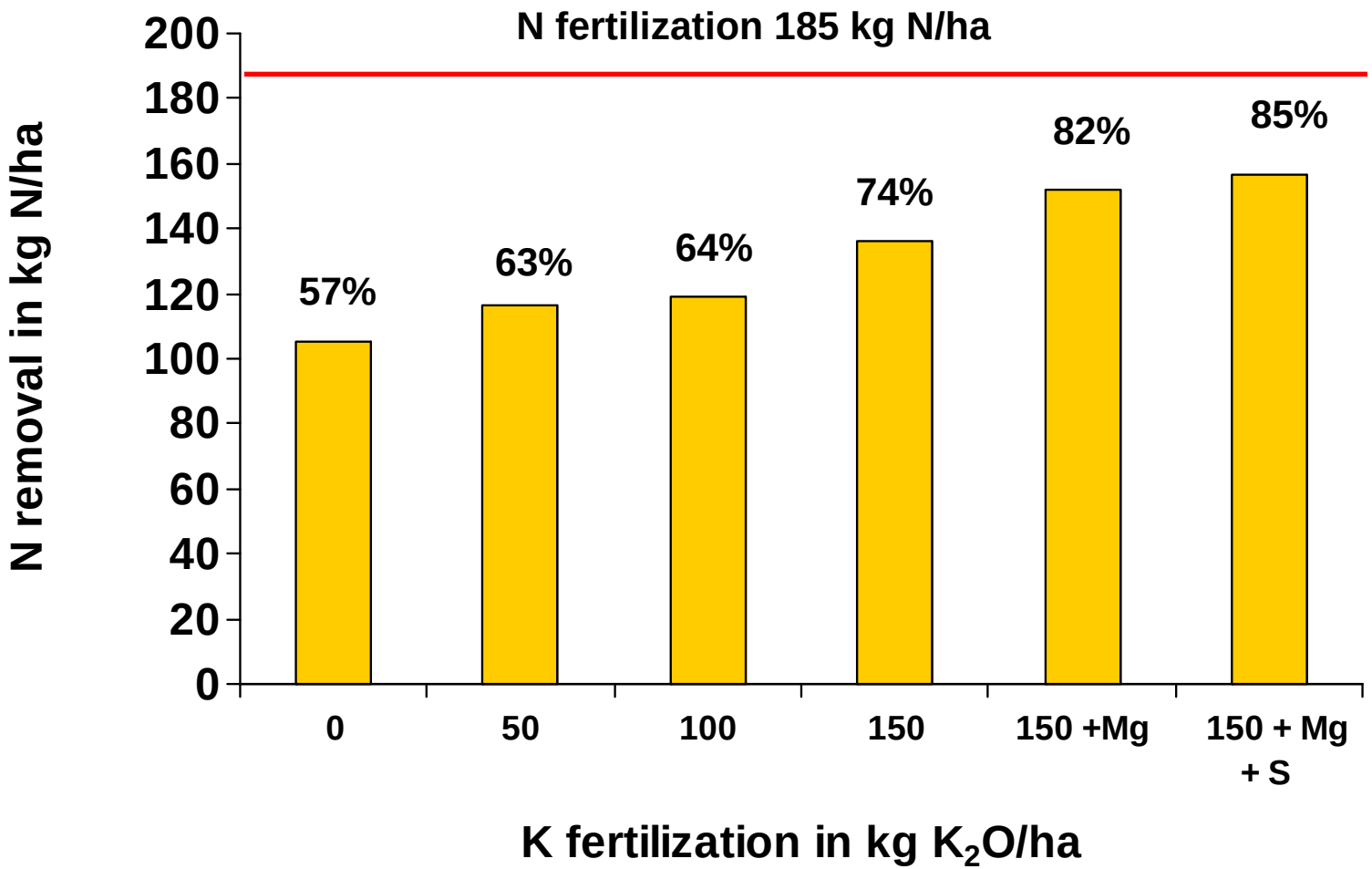
Yield and N demand in two five-year-periods of a long-term fertilization trial of 10 years with and without PK fertilization
- 2nd period -



Source: Lorenz, LUFA Oldenburg

Effect of different rates of K and Mg on the uptake of N in triticale



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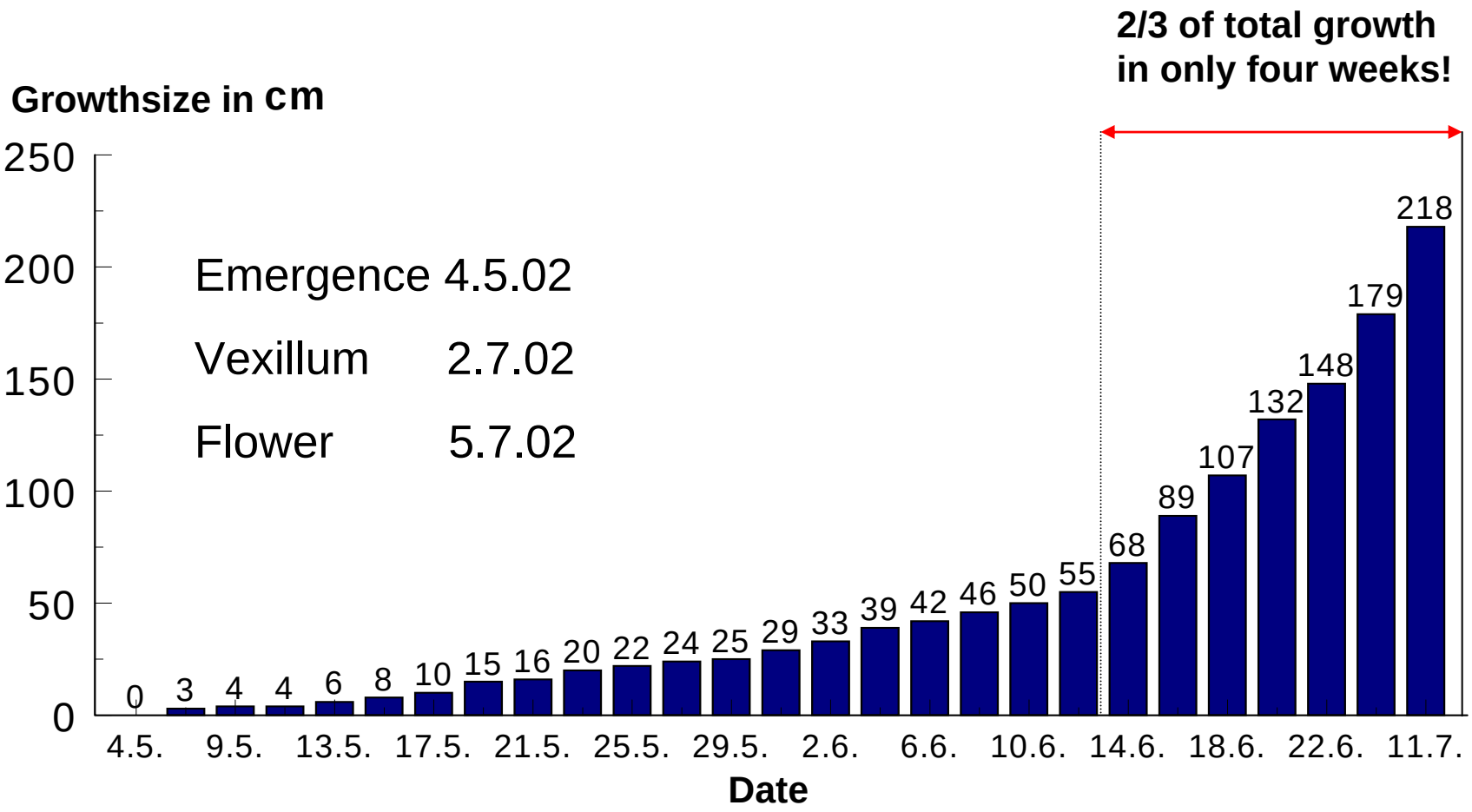
Nutrient balances on supply/withdrawal basis of Potassium

		Organic farming	Conventional farming
INPUT			
Farmyard manure	**kg**	**141.8**	**179.6**
Mineral fertilizer	**kg**	**10.8**	**-**
∑ *INPUT*	*kg*	*152.6*	*179.6*
OUTPUT			
Removal	**kg**	**165.3**	**213.6**
∑ *Output*	*kg*	*165.3*	*213.6*
Field/stable balance	*kg*	*-12.8*	*-33.9*

Source: Gruber et al., Austria, 2001

Growth of maize



Sorte Nicco, Fa. KWS

Nutrient uptake:
170 kg/ha K_20, 40 kg/ha MgO
on 100 dt/ha yield of grain maize

Nutrient removal of maize

(total removal, total plant)

Green matter t/ha	**N – removal** kg/ha	**P_2O_5 – removal** kg/ha	**K_2O- removal** kg/ha	**MgO – Entzug** kg/ha
50	190	80	225	45
60	228	96	270	54
70	266	112	315	63

Nutrient removal of grain maize

Grain yield dt/ha TM	**N – removal** kg/ha	**P_2O_5 – removal** kg/ha	**K_2O- removal** kg/ha	**MgO – Entzug** kg/ha
80	192	80	200	48
100	240	100	250	60
120	288	120	300	72
140	336	140	350	84

Because of breeding development of 14.8 dt/ha grain yield (TM) within 10 years, the nutrient removals increase:

36 kg N/ha, 15 kg P_2O_5/ha, 37 kg K_2O/ha and 9 kg MgO/ha !

Water need of different crops

to produce 1 kg dry matter, crop plants need:

Crop	Water use **in liter/kg TS**	Crop	Water use **in liter/kg TS**
Potato	**250 - 500**	Maize	200 - 300
Sugar beet	**350 - 450**	Wheat	**250 - 500**
Lucerne	**800 - 1000**	Rye	**400 - 700**
Oats	**400 - 600**		

with 100 mmNS, 14 – 25 dt TS/ha rye can be produced, but 33 – 50 dt TS/ha maize!

Water need of energy maize (1)

Maize needs 200 to 300 l water (depending on potassium supply) to produce 1kg dry matter.

1 mm precipitation (NS)/m² = 1 l/m² = 10 000 l/ha

TS-production	Water need	
	good potash supply	**bad potash supply**
10 t/ha	2.000.000l **= 200 mmNS**	3.000.000l **= 300 mmNS**
20 t/ha	4.000.000l **= 400 mmNS**	6.000.000l **= 600 mmNS**

→ 34% Difference of water need!

Potassium fertilisation trial on energy maize 2006

Trial Haag	Without fertilisation 20 – 25 mg K_2O/100g soil	With fertilisation ca. 40 mg K_2O/100g soil
	t/ha TS	t/ha TS
K 240	20.20	20.82
K 360	19.95	20.10
K360 + Kieserite	20.58	21.89

Sorte 5241 KWS

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Phosphorus deficiency at high pH

Zinc deficiency after high liming in maize

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The effect of foliar fertilisation in high zinc deficiency

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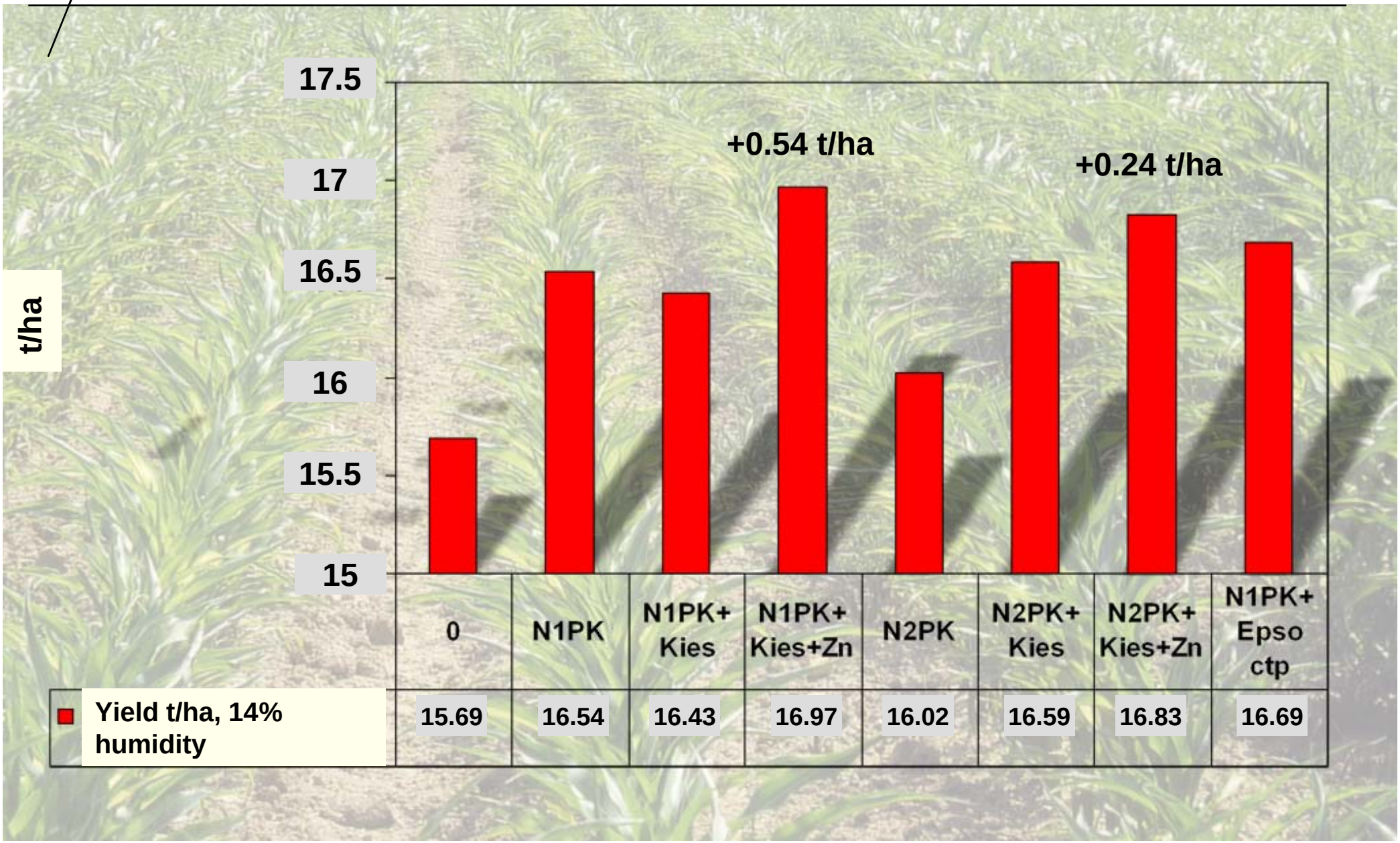
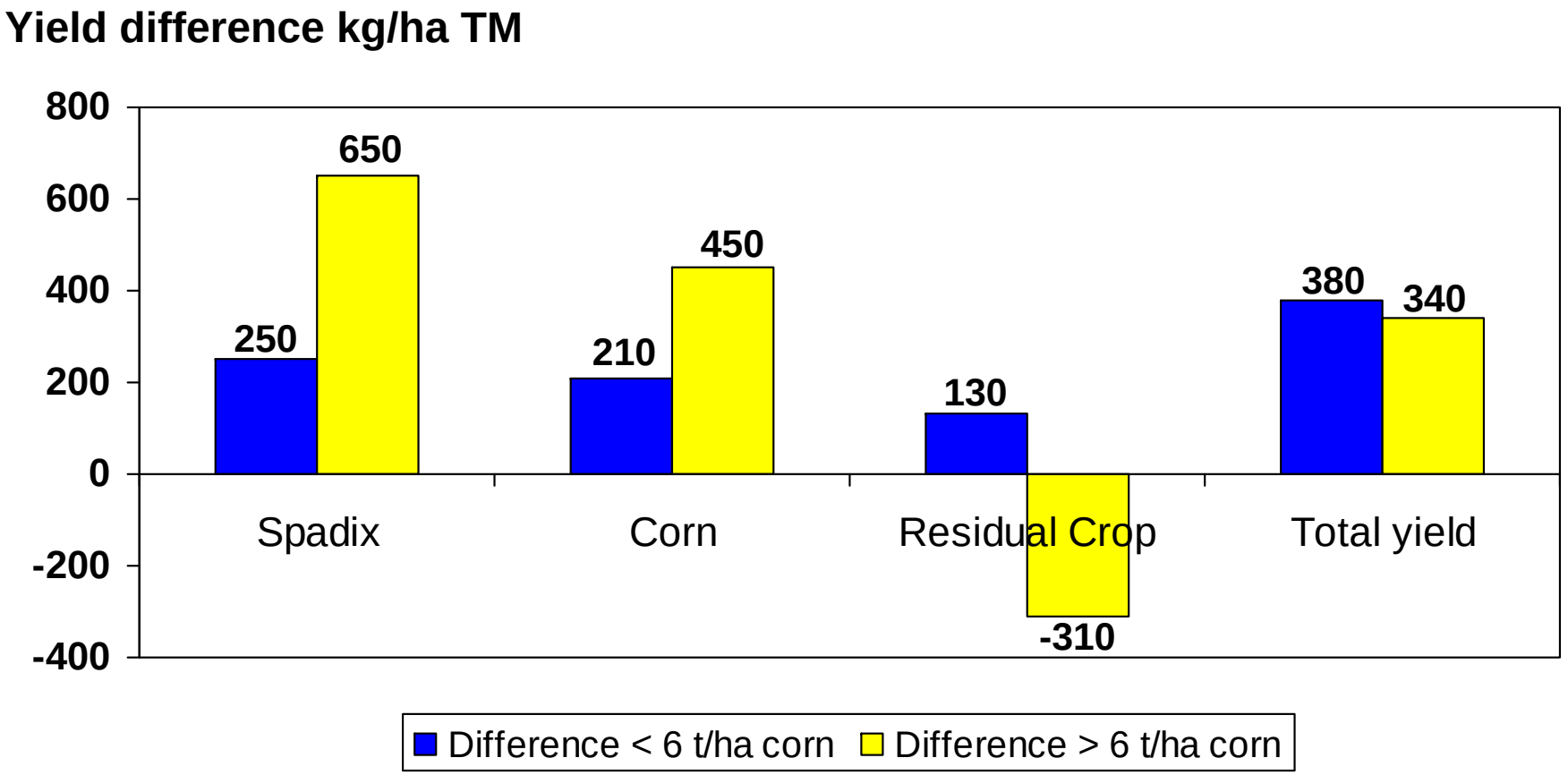
Zinc-Kieserite trial



Effect of boron fertilisation on maize yield

Result of 24 multi-year trials, LWK Weser-Ems 1997



Thank you for your attention!