



# Effects of P-fertilizer placement to grain maize at different tillage systems

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## Site conditions

- Bernburg, Saxony-Anhalt, 80 m over sea level
- Loess chernozem over lime stone
- Annual precipitation 511 mm, annual average temperature 9.7 °C (1981-2010)
- Soil pH April 2012/2013: 7.4/7.5 (high/very high)
- CAL-soluble P 2012/2013: 55/73 mg kg<sup>-1</sup> (optimal/high)

## Experimental design

- Plot (1.2 ha) within a crop rotation after winter wheat
- Tillage treatments (since 1992):
  - Mouldboard ploughing (MP), Conservation tillage (CT)**
- Basic fertilization every second year 60 kg P ha<sup>-1</sup> as TSP, 75 kg K ha<sup>-1</sup> as KCl (autumn before tillage 2010+2012)
- Additional P placement near the root: 20 kg P as DAP **(+P)**, compensation of N supply (120 kg N ha<sup>-1</sup> in all treatments)



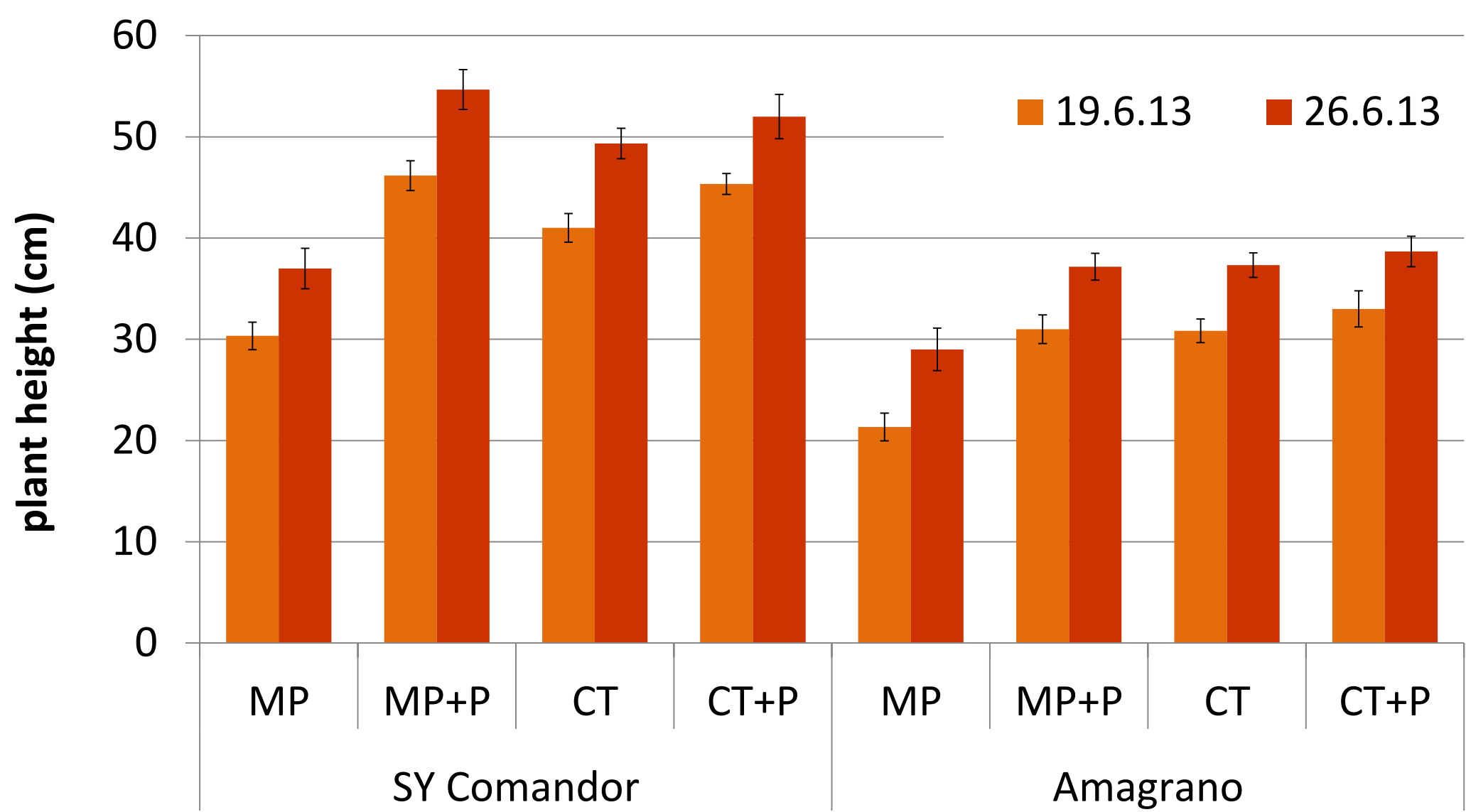
Plant development

- P deficiency symptoms, especially after mouldboard ploughing
- Strong enhancement of early development by additional P placement
  - Higher P uptake
  - Increased biomass
  - Faster generative development
  - Improved stress resistance

Effects of additional DAP placement on early development (maize variety SY Comandor, 2. July 2014)

## Nutrient supply at early shooting stage (7. July 2012, 26. June 2013)

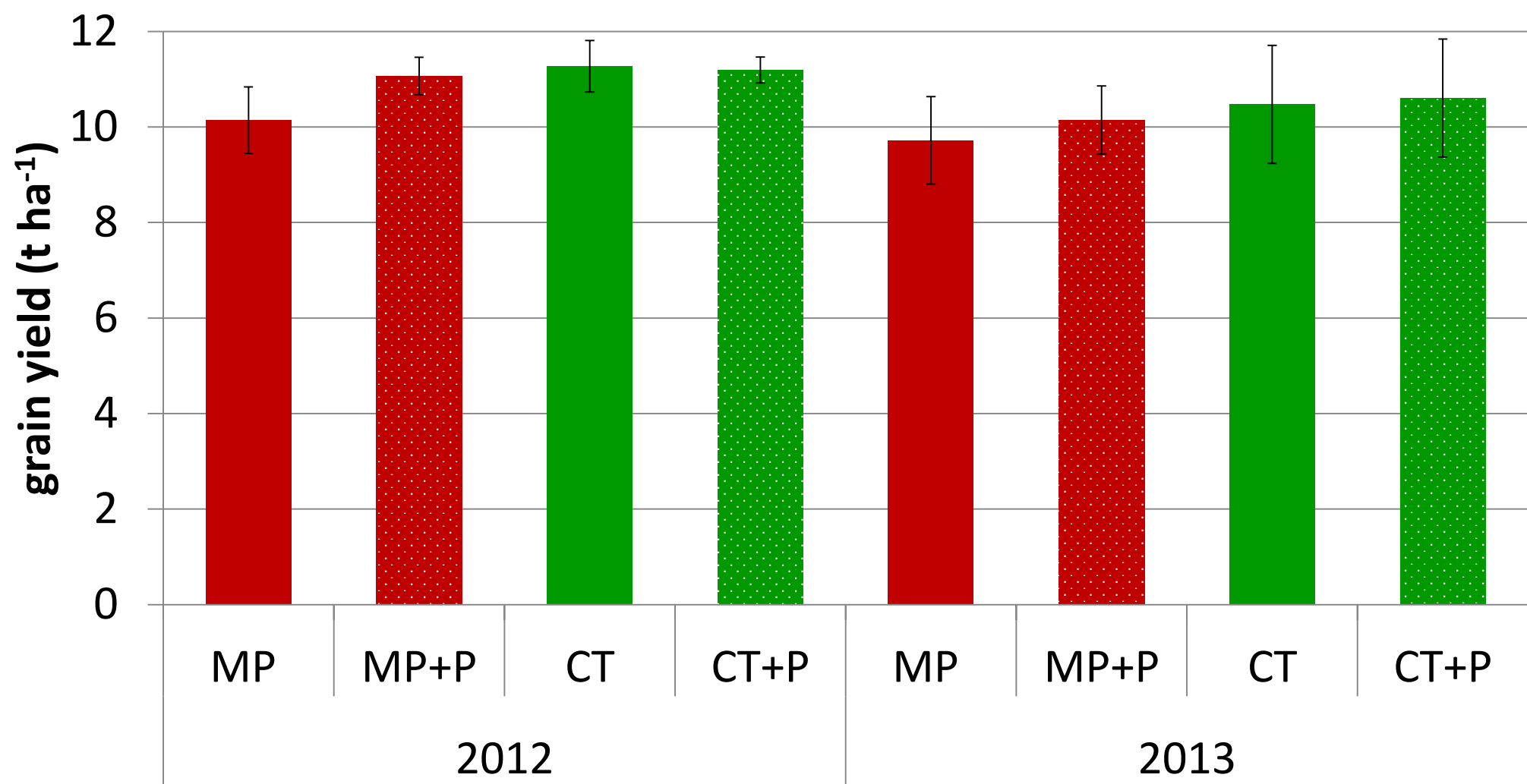
	% N	% P	% K	% Mg	mg kg <sup>-1</sup> Mn	mg kg <sup>-1</sup> Cu	mg kg <sup>-1</sup> Zn
2012							
MP	4.02	0.21	1.89	0.16	93.61	11.84	15.70
MP+P	3.72	0.24	1.98	0.13	77.61	10.18	15.54
CT	3.78	0.27	2.43	0.12	64.53	10.62	17.03
CT+P	3.69	0.33	2.21	0.12	65.44	12.78	19.21
2013							
MP	3.40	0.28	1.85	0.12	138.28	11.63	31.09
MP+P	3.31	0.31	1.73	0.12	109.51	11.94	29.13
CT	3.44	0.31	1.76	0.13	96.87	12.48	33.66
CT+P	3.38	0.32	1.70	0.12	91.61	14.66	38.43
recommended	3.5-5.0	0.3-0.5	3.1-5.0	0.16-0.50	40-160	6.0-17.0	22-70



Plant height depending on variety, tillage treatment and P placement

## Effects of additional P fertilization on grain dry matter at harvest, grain quality and nutrient concentration

	2012				2013			
	MP	MP+P	CT	CT+P	MP	MP+P	CT	CT+P
grain dry matter (%)	63.5	66.0	66.8	66.2	66.6	67.1	66.7	66.9
crude protein (%)	8.5	8.9	9.6	9.5	9.5	9.6	9.7	9.8
starch (%)	73.7	73.8	72.8	72.9	71.4	71.5	71.9	71.5
P concentration (%)	2.3	2.3	2.3	2.3	2.3	2.3	2.2	2.2
K concentration (%)	1.9	2.1	2.0	2.1	2.2	2.0	1.9	2.0
Mg concentration (%)	0.7	0.7	0.7	0.8	0.9	0.9	0.9	0.9



Effect of additional P placement on maize grain yield (86% dry matter) depending on tillage

## Yield effects of P placement

- Significant yield increase only in ploughed plots 2012 (no fresh basic fertilization, dry conditions in spring)
- Maturation more homogeneous in ploughed plots
- No effects on grain quality and nutrient concentration of grains

## Conclusions

- In early growth stages, higher P uptake at conservation tillage
- Low efficiency of autumn P fertilization in maize because of high soil pH, improved plant development by P placement
- P fertilization higher than P uptake only profitable at strong deficiency