BALTIC 21
Phosphorus Recycling and Good Agricultural Management Practice

Thermic digestion of animal meal ash in converter slag

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Thermic digestion of animal meal ash in converter slag

- P solubility and P effect of meat and bone meal
- P solubility and P effect of meat and bone meal ash
- Digestion of animal meal ash in converter slag
  - Process
  - Results from batch trial
- Conclusion and prospects

Meat and bone meal

Prohibition of animal meal use as animal feed since the beginning of the BSE crisis in EU.

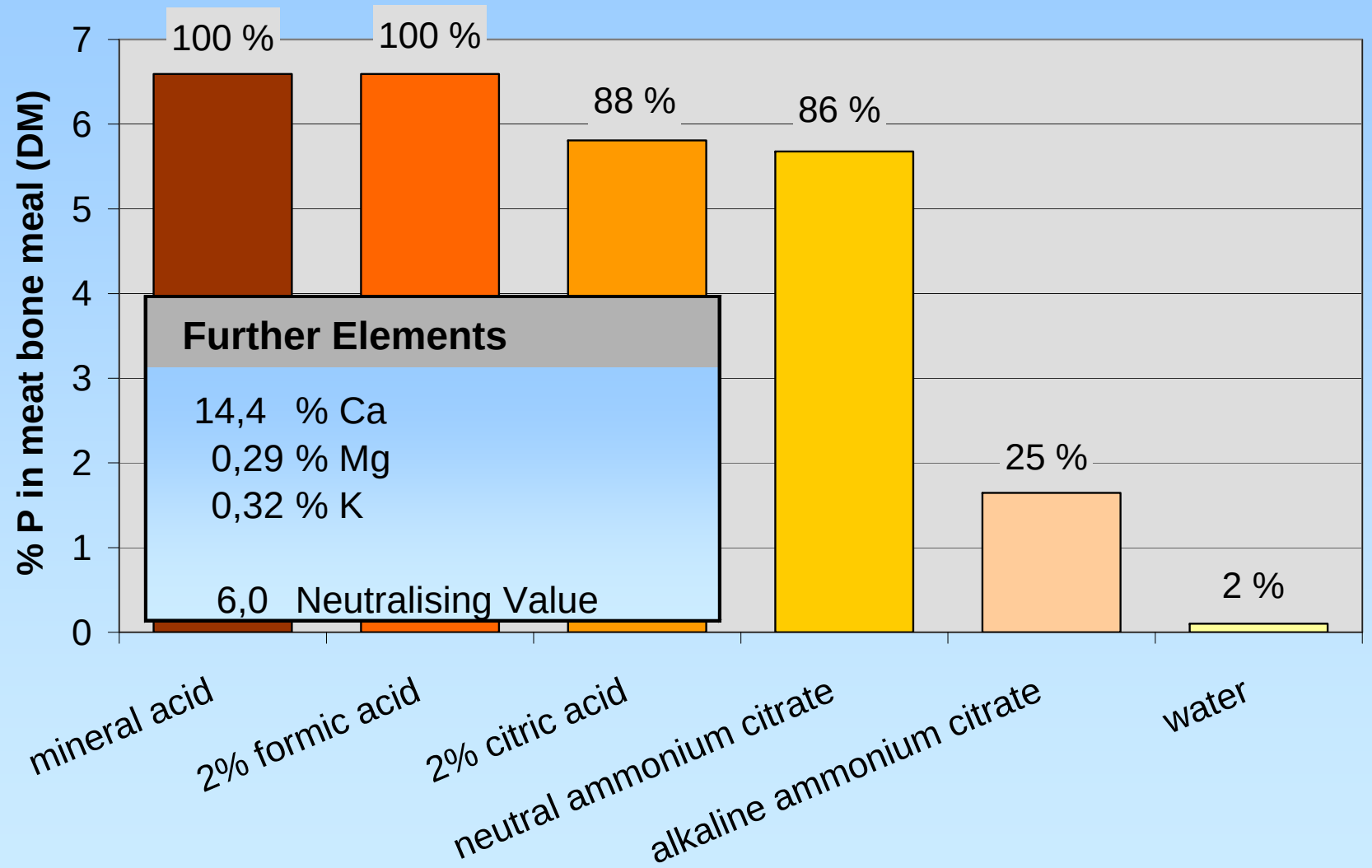
In 2003 approx. 112.000 t meat bone meal (according to 10.000 t P) in Germany. *(Albert, 2005)*

Application as fuel or reasonable organic NP-fertiliser.

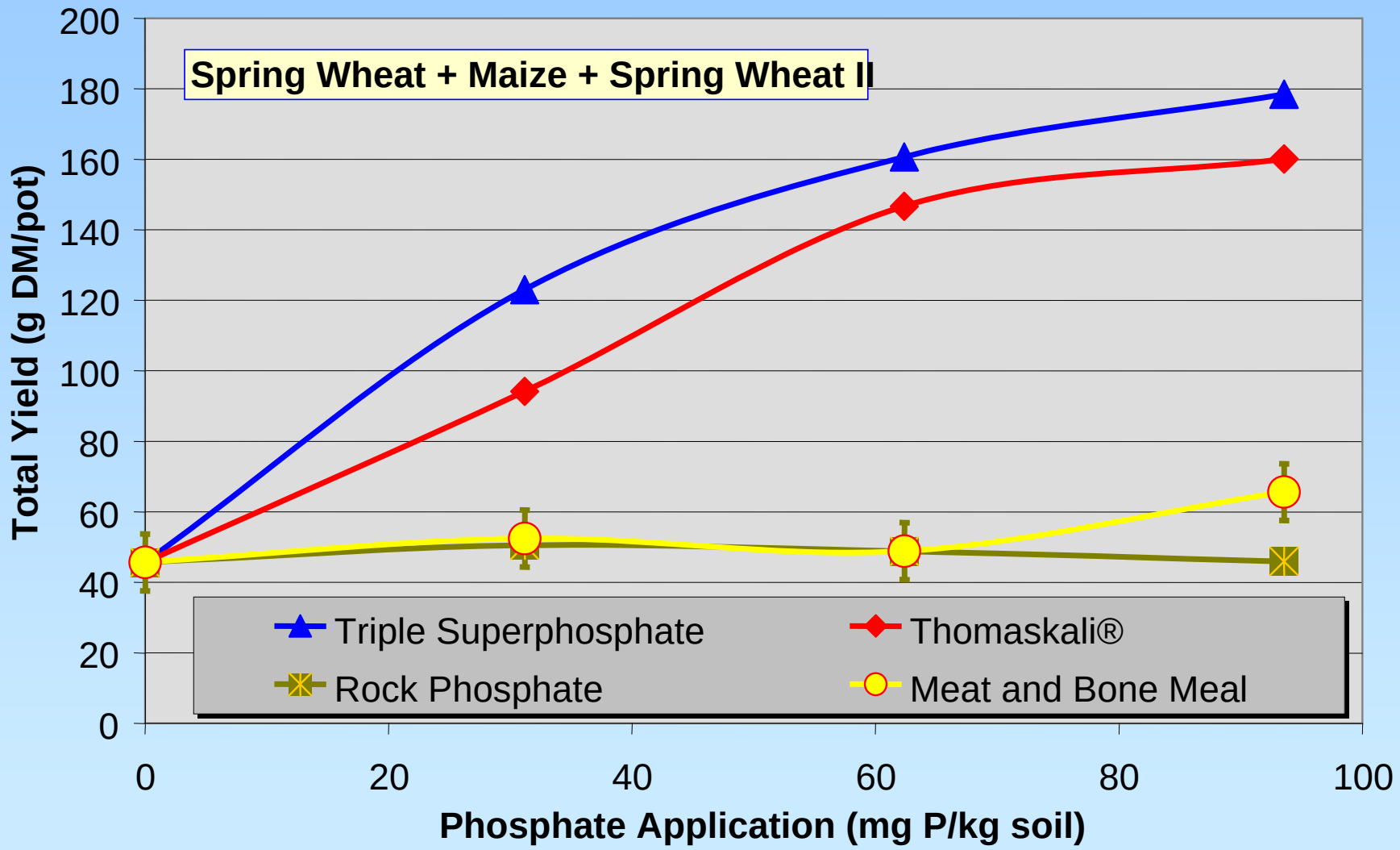
Reports of good experiences with application of meat bone meal in cash crop farms.

Phosphate availability according to *Albert (2005)* between 25% and 50% compared to mineral fertilisers.

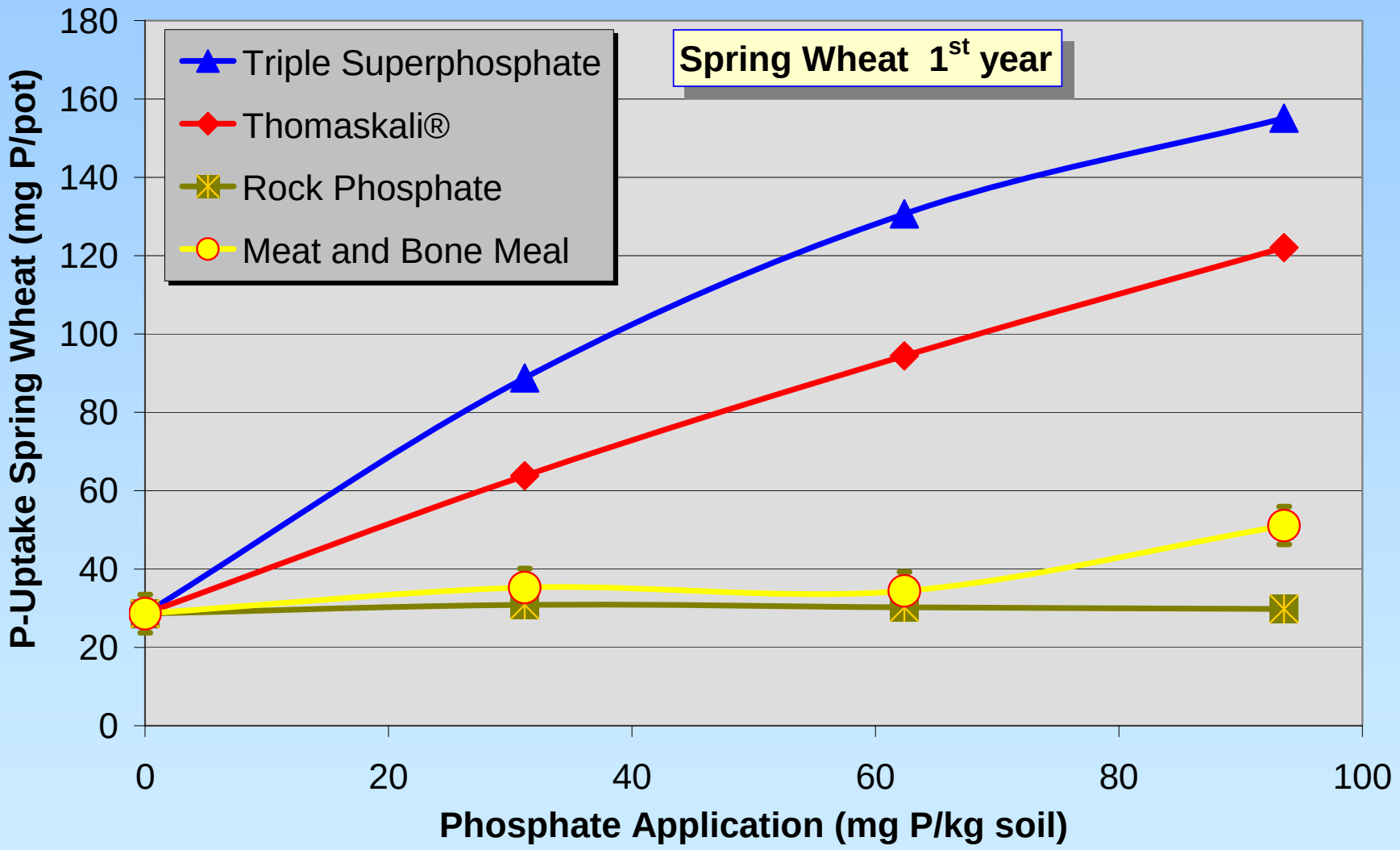
Phosphate solubility of meat bone meal (MBM)



Cumulative yield of 2 x spring wheat and maize in a biennial pot experiment as a function of applied phosphate quantity and form



Cumulative P-uptake of spring wheat in a pot experiment as a function of applied phosphate quantity and form



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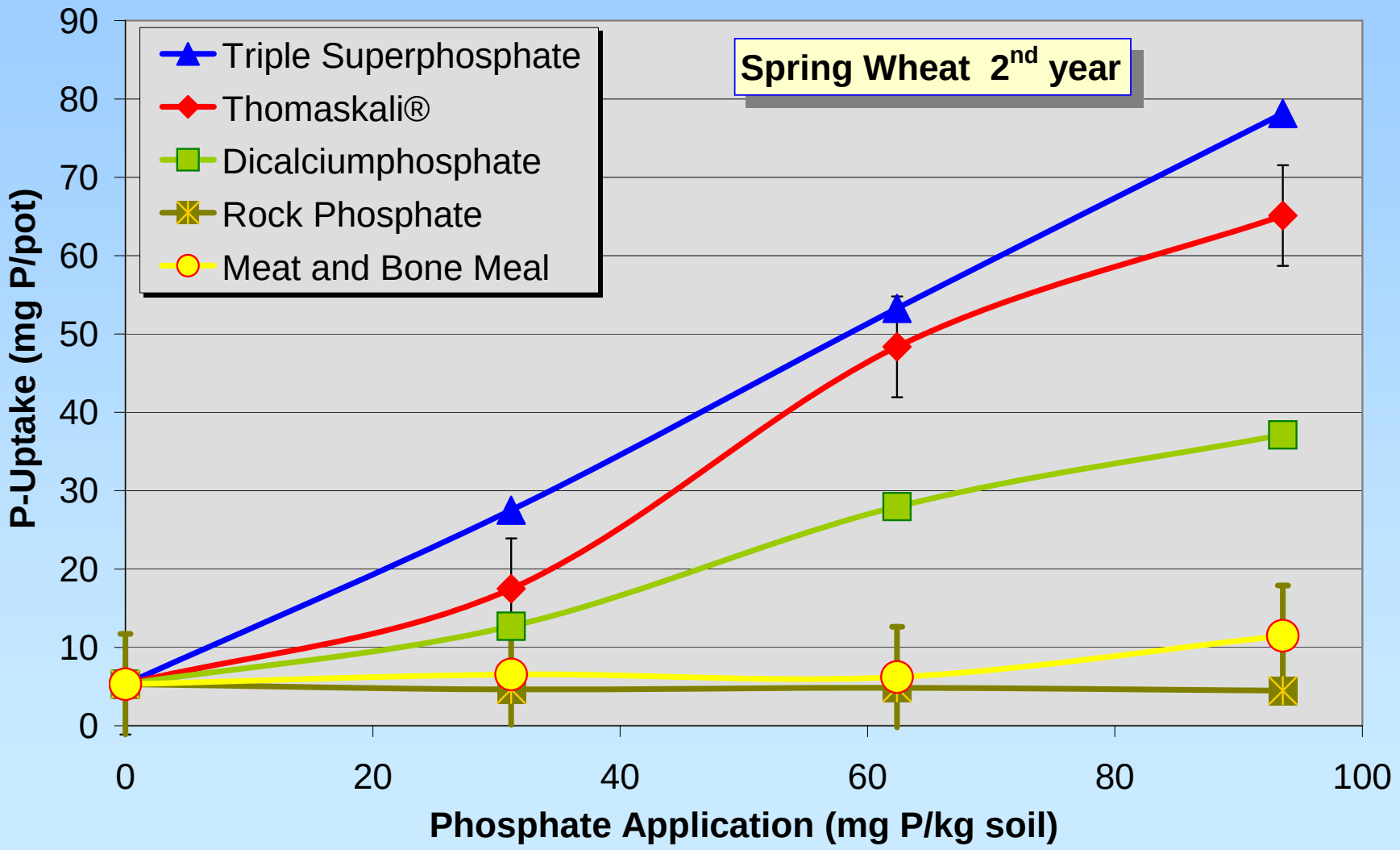

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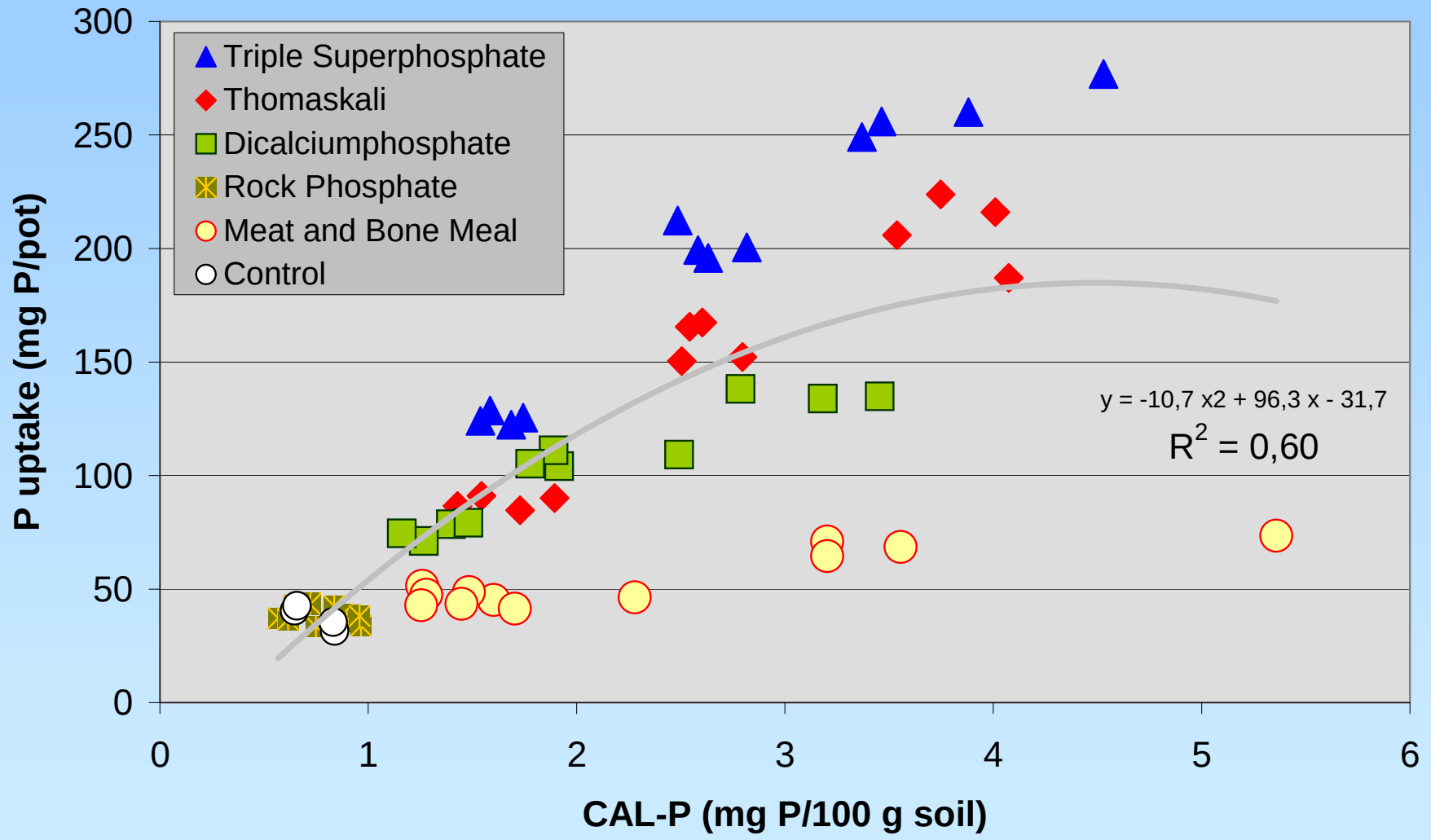
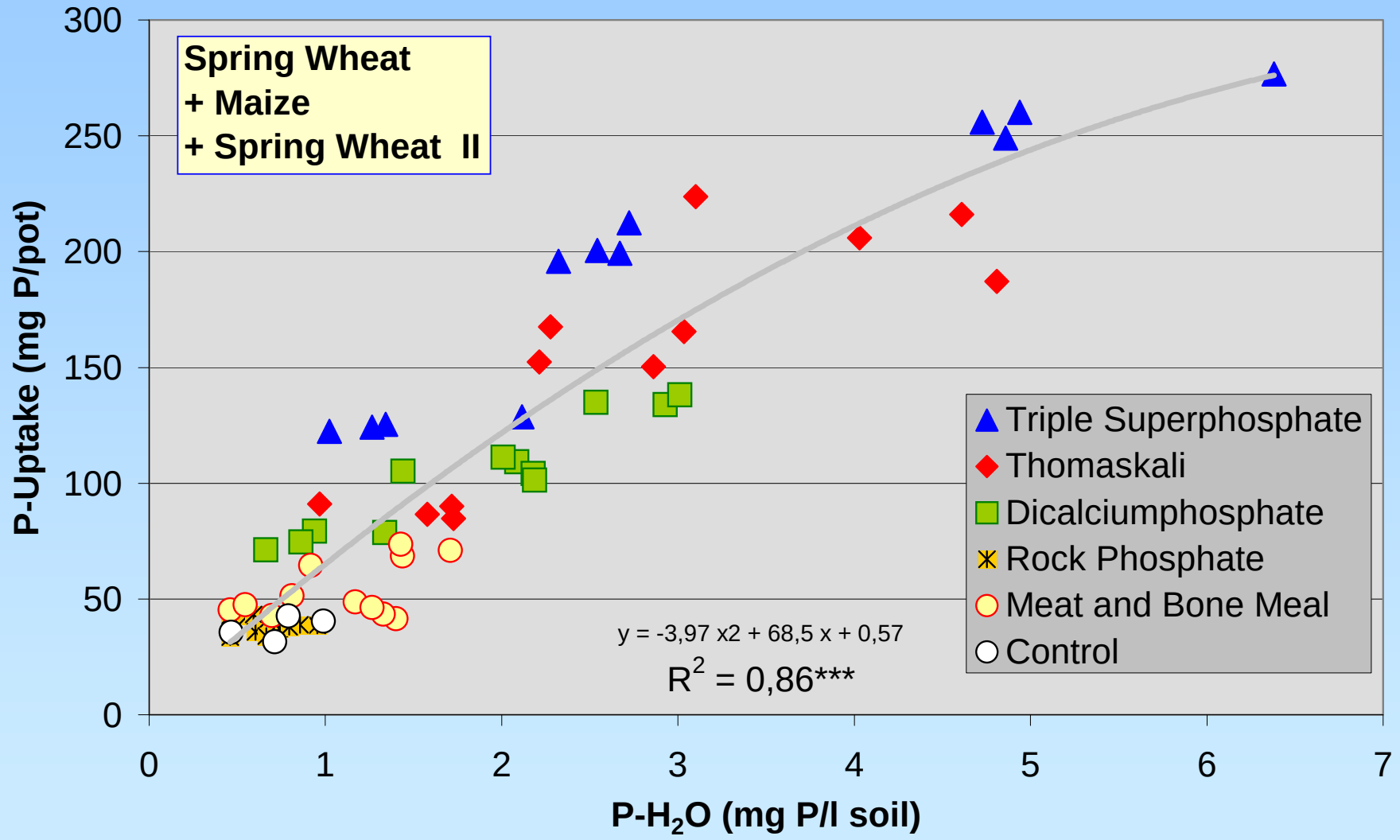


Cumulative P-uptake of 3 cultures within a 2-year pot experiment as a function of the water soluble P-content in soil



Conclusions

Meat Bone Meal:

Phosphate effect of meat bone meal on yields and P uptakes is clearly reduced compared to the effects of fully digested phosphate fertilisers.

In biennial pot experiments the yield effects of meat bone meal amount to 50% on spring wheat, 25% on maize and 20% on spring wheat (grain yield 7%) compared to TSP.

P uptake amounted to 33%, 25% and 15% respectively.

An increase of P availability with time did not occur.

Better correlation between P availability of meat bone meal and water extractable P than to CAL-P.

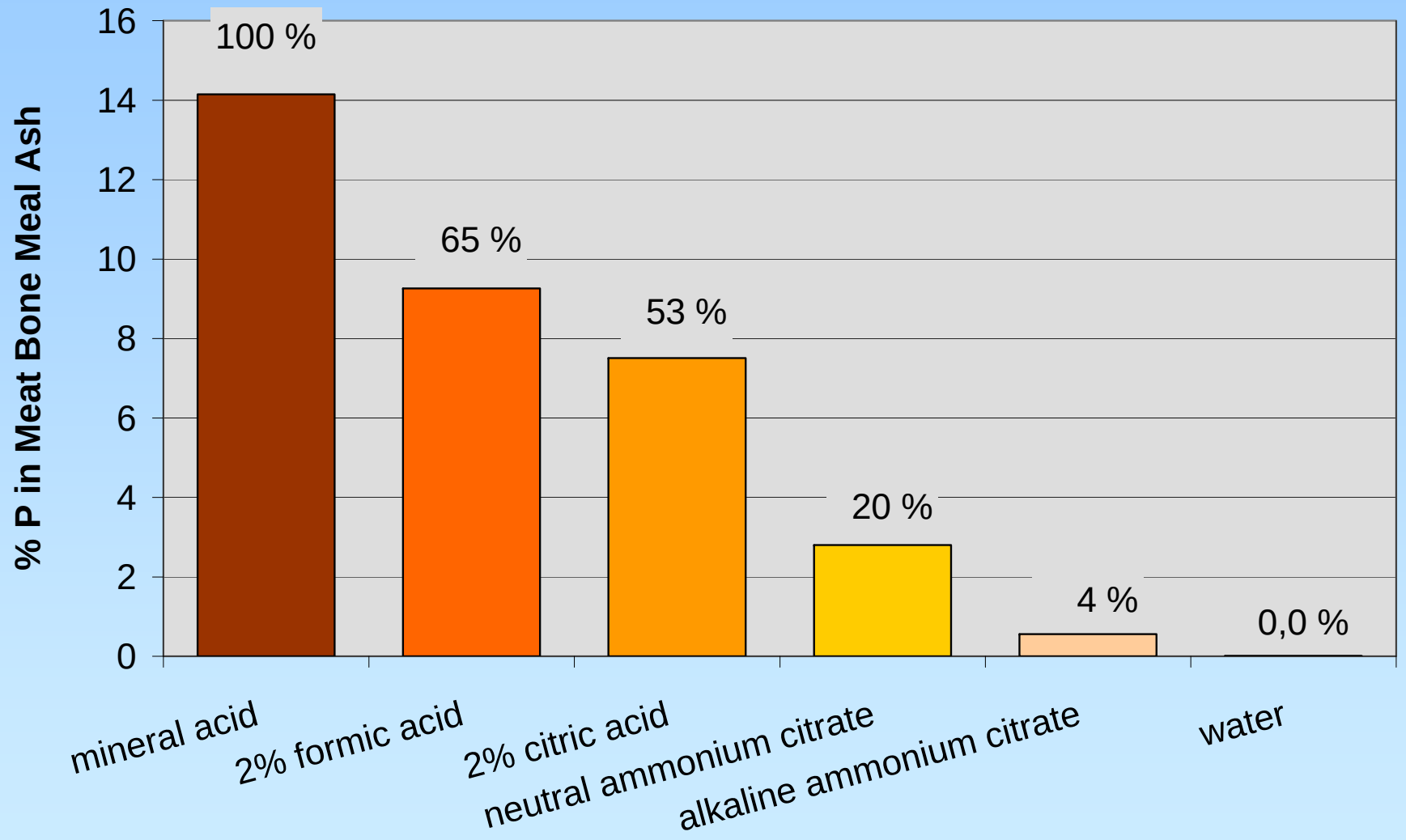
Meat and bone meal ash

Meat and bone meal applicated as fuel for power or cement plants.

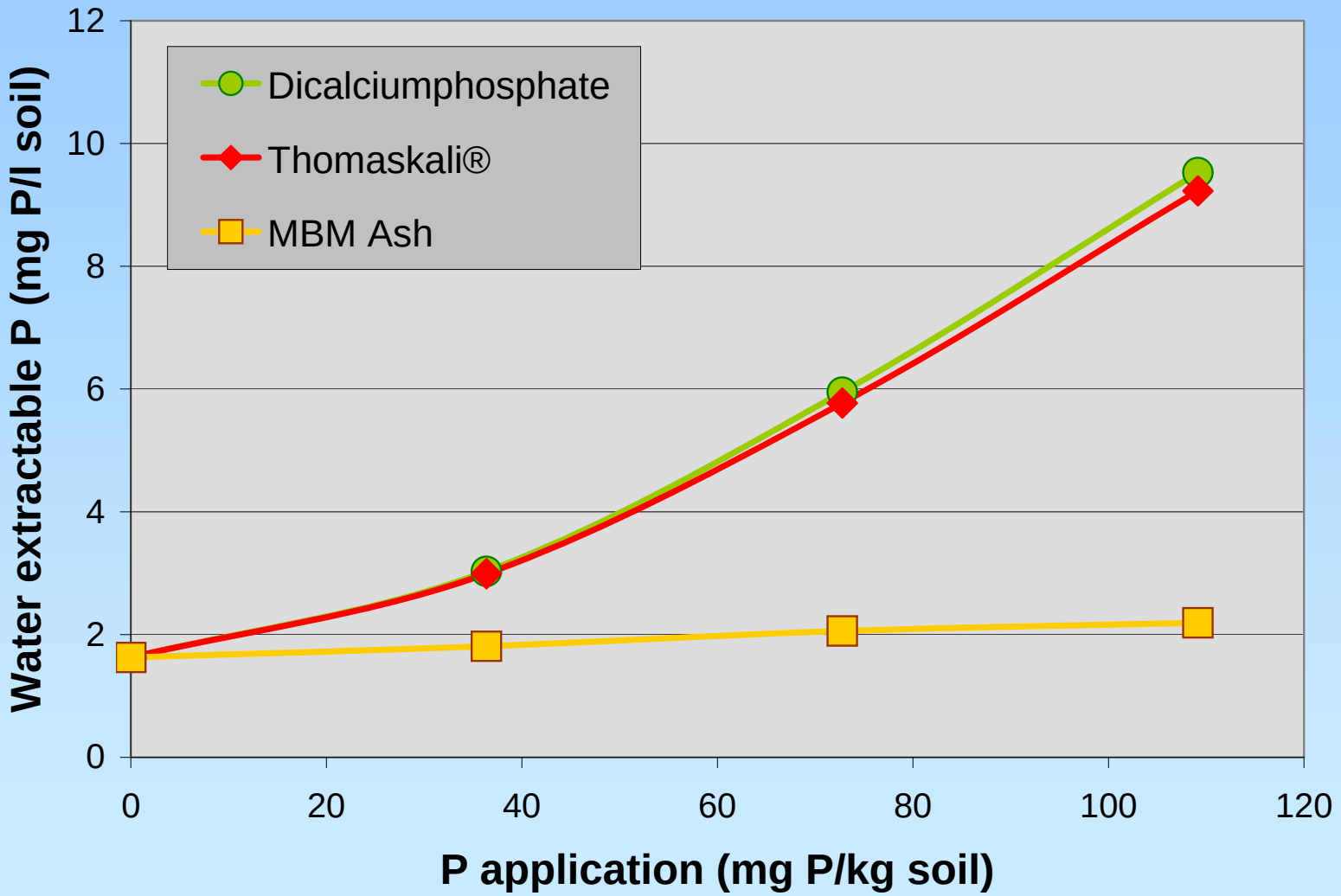
Ashes from mono incineration of MBM might be used as P fertiliser.

Phosphate availability reduced compared to mineral fertilisers.

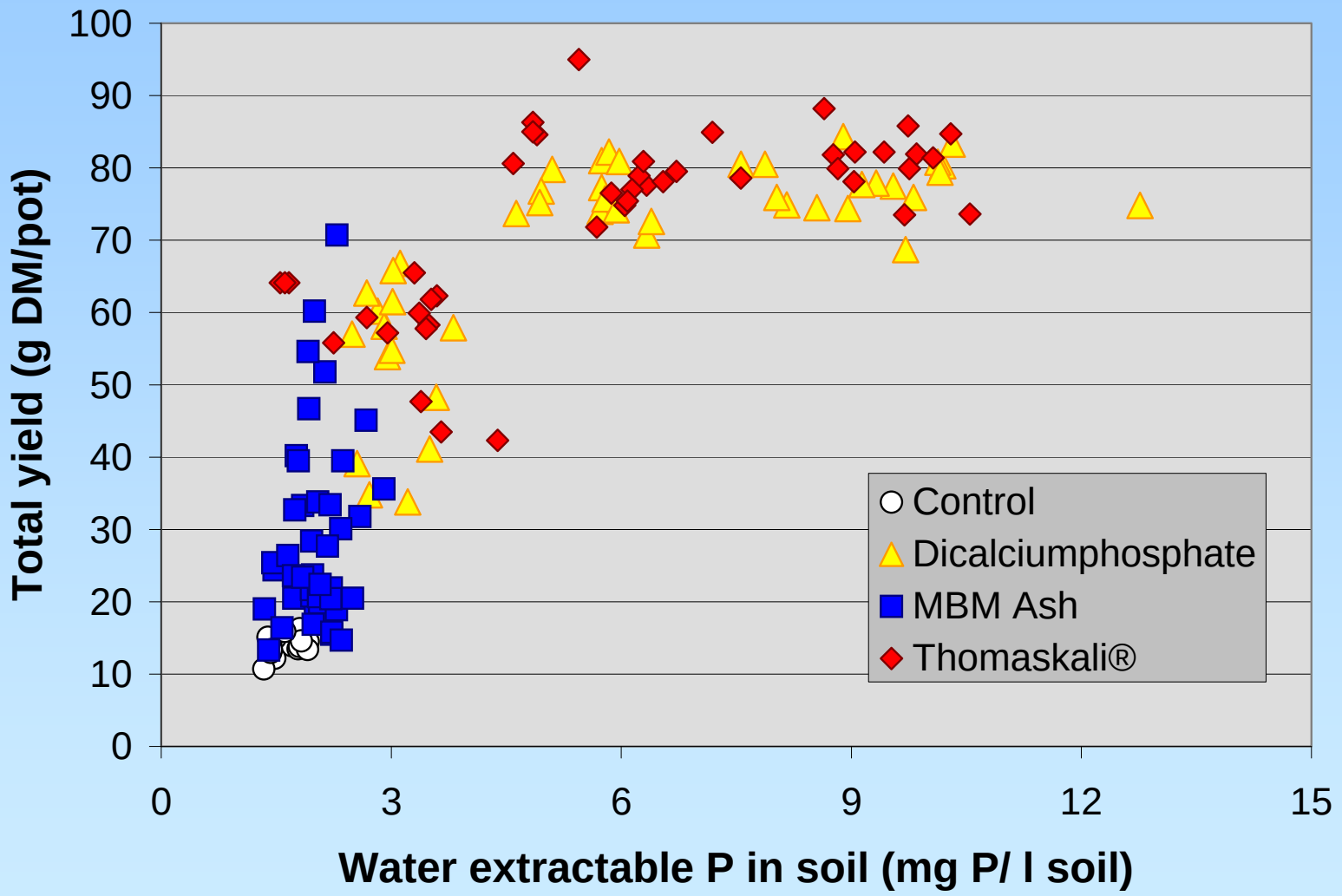
Phosphate solubility of meat bone meal ash (MBMA)



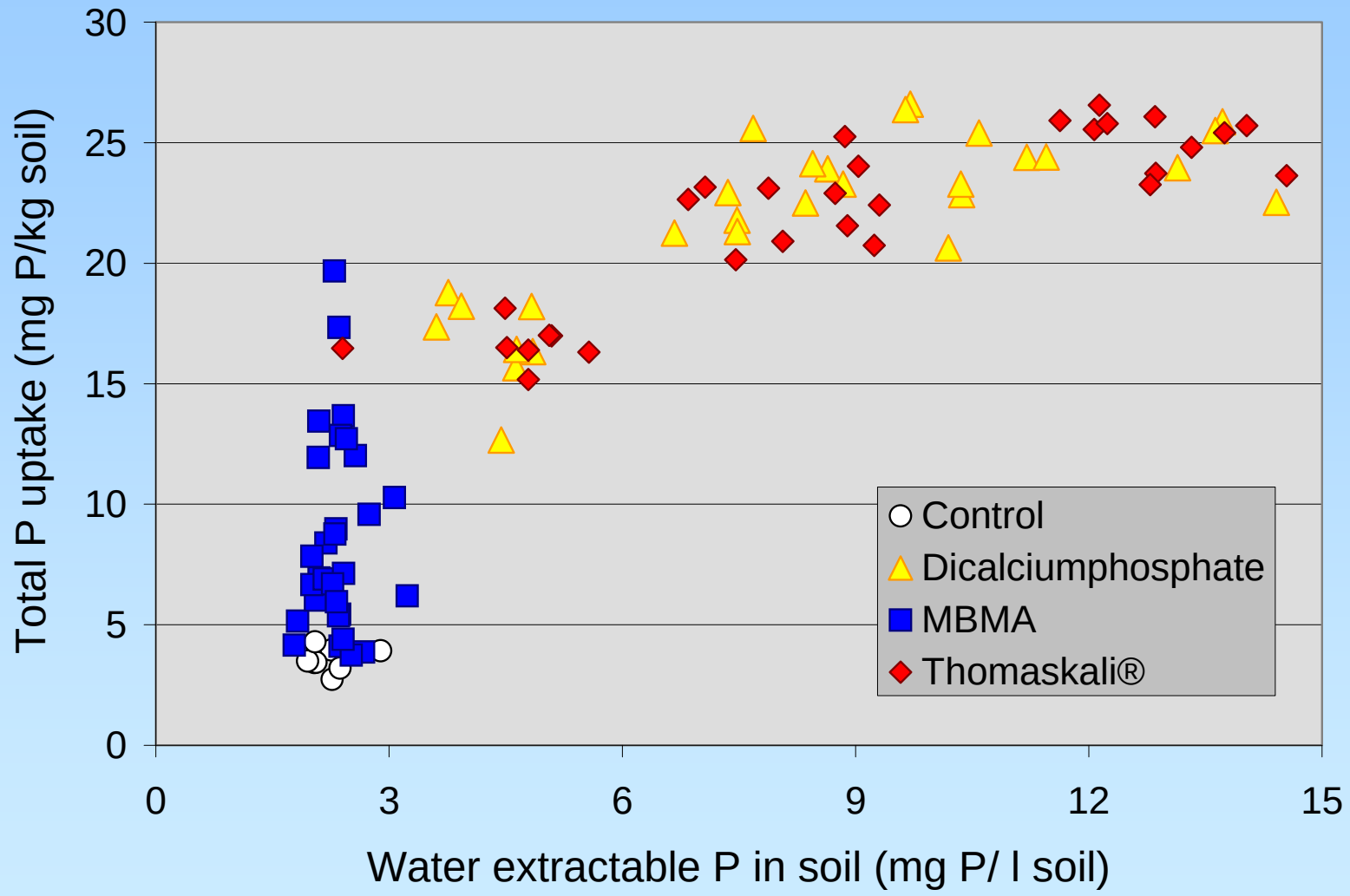
Water extractable phosphate in a pot experiment as a function of applied P quantity and form



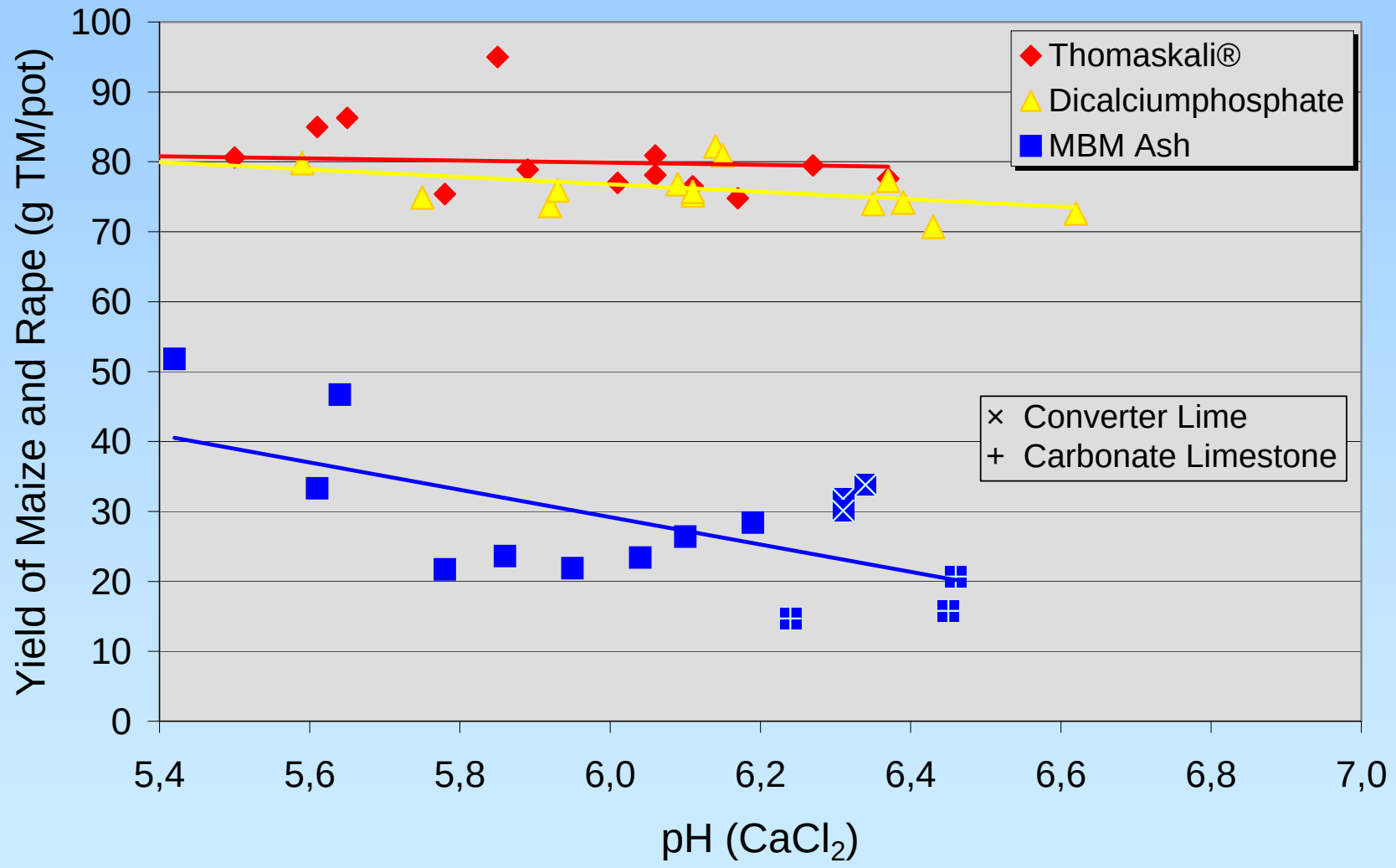
Cumulative yield of maize and rape in a pot experiment as a function of the water extractable P-content in soil



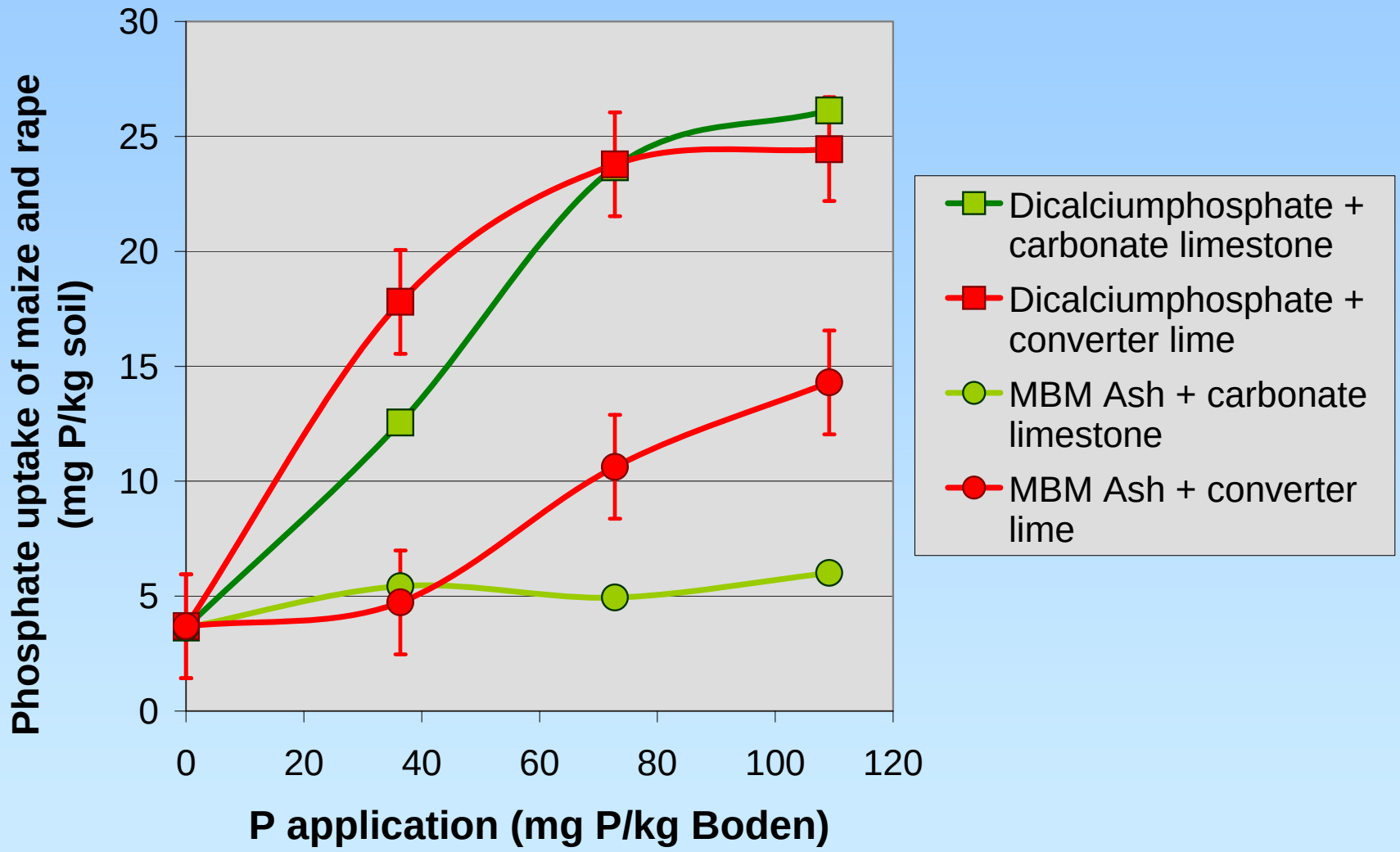
Cumulative P-Uptake of maize and rape in a pot experiment as a function of the water extractable P-content in soil



Cumulative yield of maize and rape in a pot experiment related to the pH value in the soil and the phosphate form



Cumulative P uptake of maize and rape in a pot experiment as a function of phosphate and lime form



Conclusions

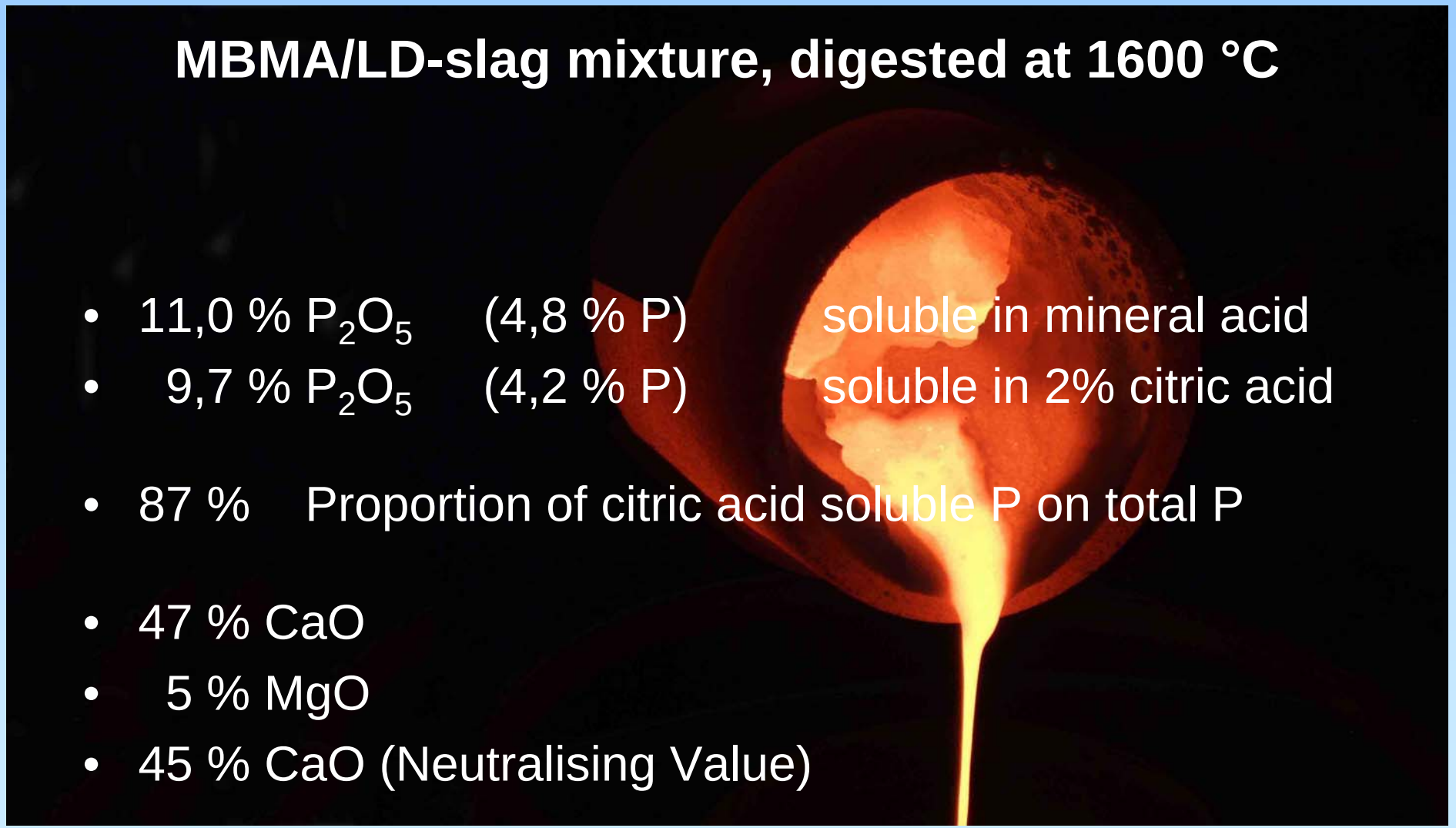
Meat Bone Meal Ash:

Phosphate effect of meat bone meal ash on yields and P uptakes of plants is clearly reduced compared to the effects of fully digested phosphate fertilisers, especially on soils with neutral and light acid soil reaction.

The effect is comparable to rock phosphate.

A still insufficient but slight better P effect occurs in combination with silicate liming materials.

Digestion of meat and bone meal ash (MBMA) in converter slag



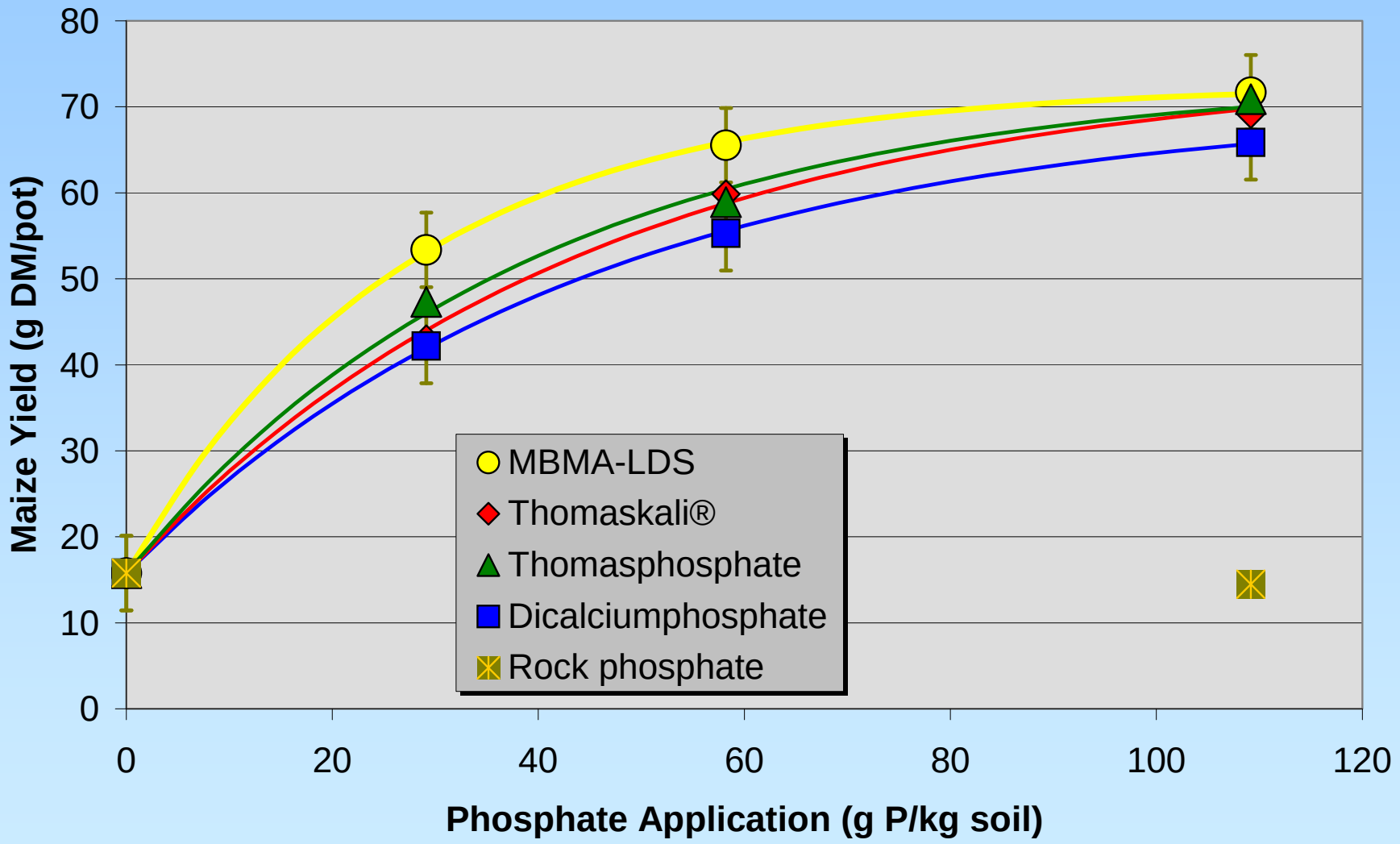
MBMA/LD-slag mixture, digested at 1600 °C

- 11,0 % P_2O_5 (4,8 % P) soluble in mineral acid
- 9,7 % P_2O_5 (4,2 % P) soluble in 2% citric acid

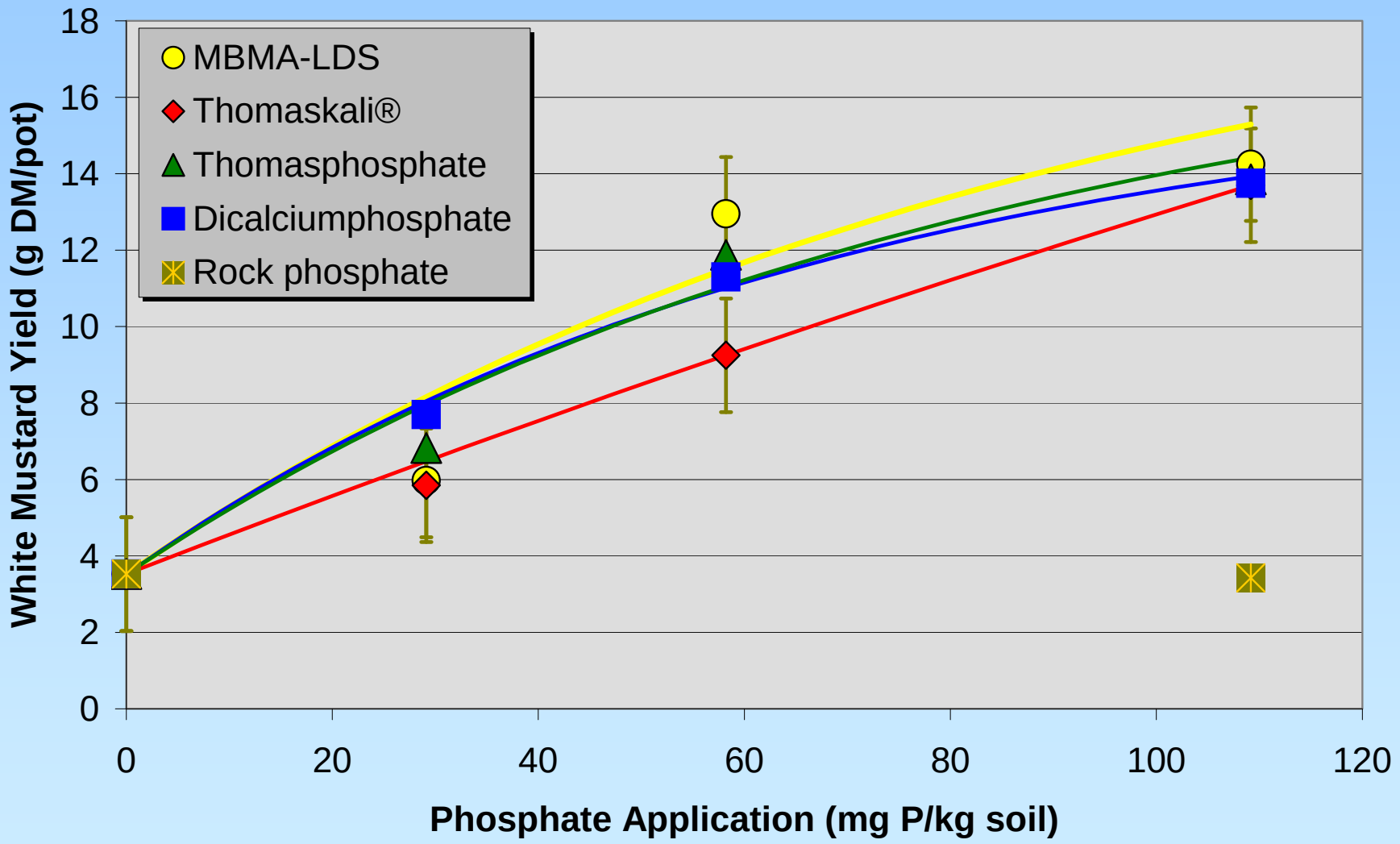
- 87 % Proportion of citric acid soluble P on total P

- 47 % CaO
- 5 % MgO
- 45 % CaO (Neutralising Value)

Yield of Maize (Zea mays) in a pot experiment as a function of applied phosphate quantity and form



Yield of White Mustard (Sinapis alba) in a pot experiment as a function of applied phosphate quantity and form



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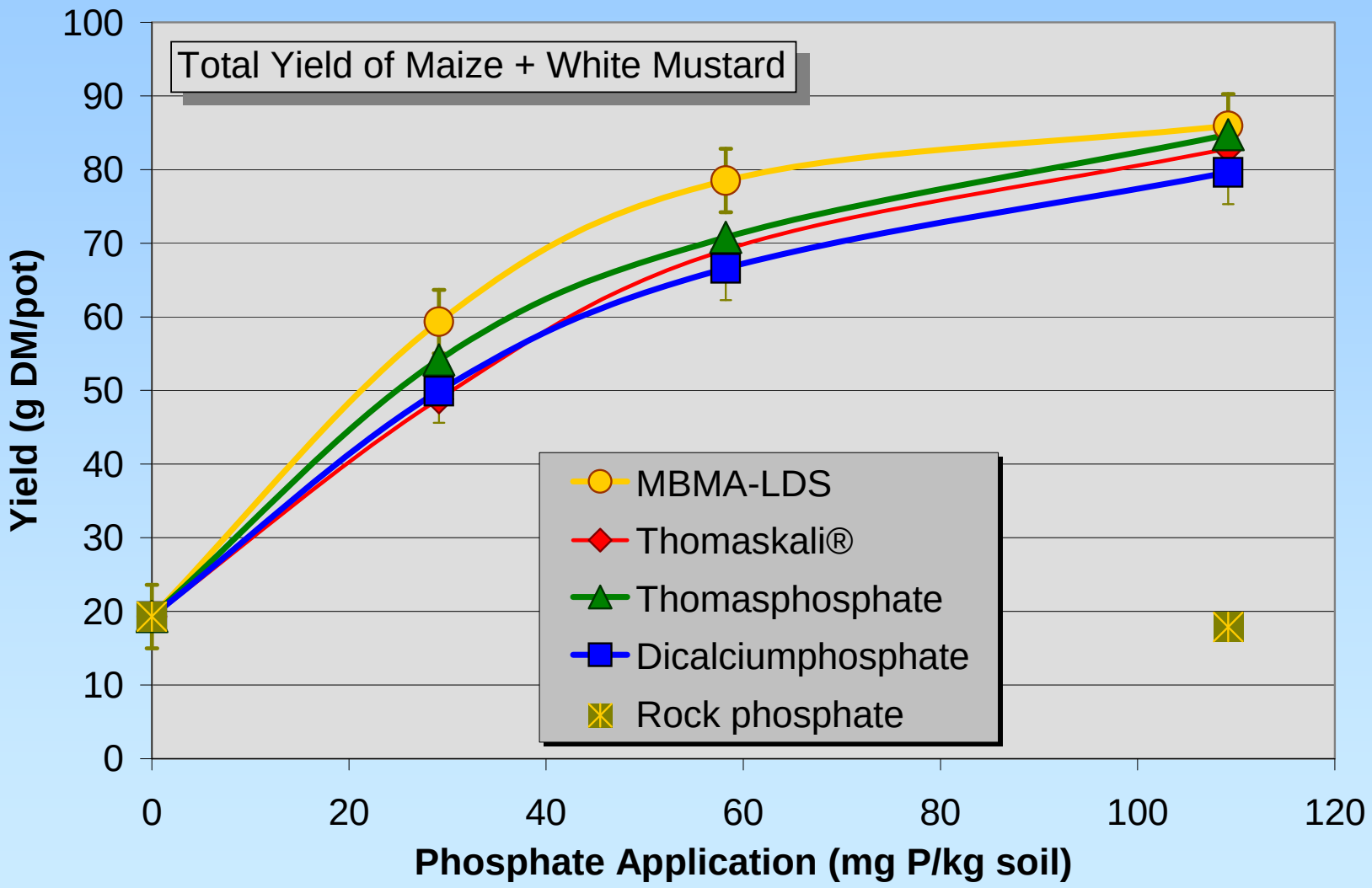
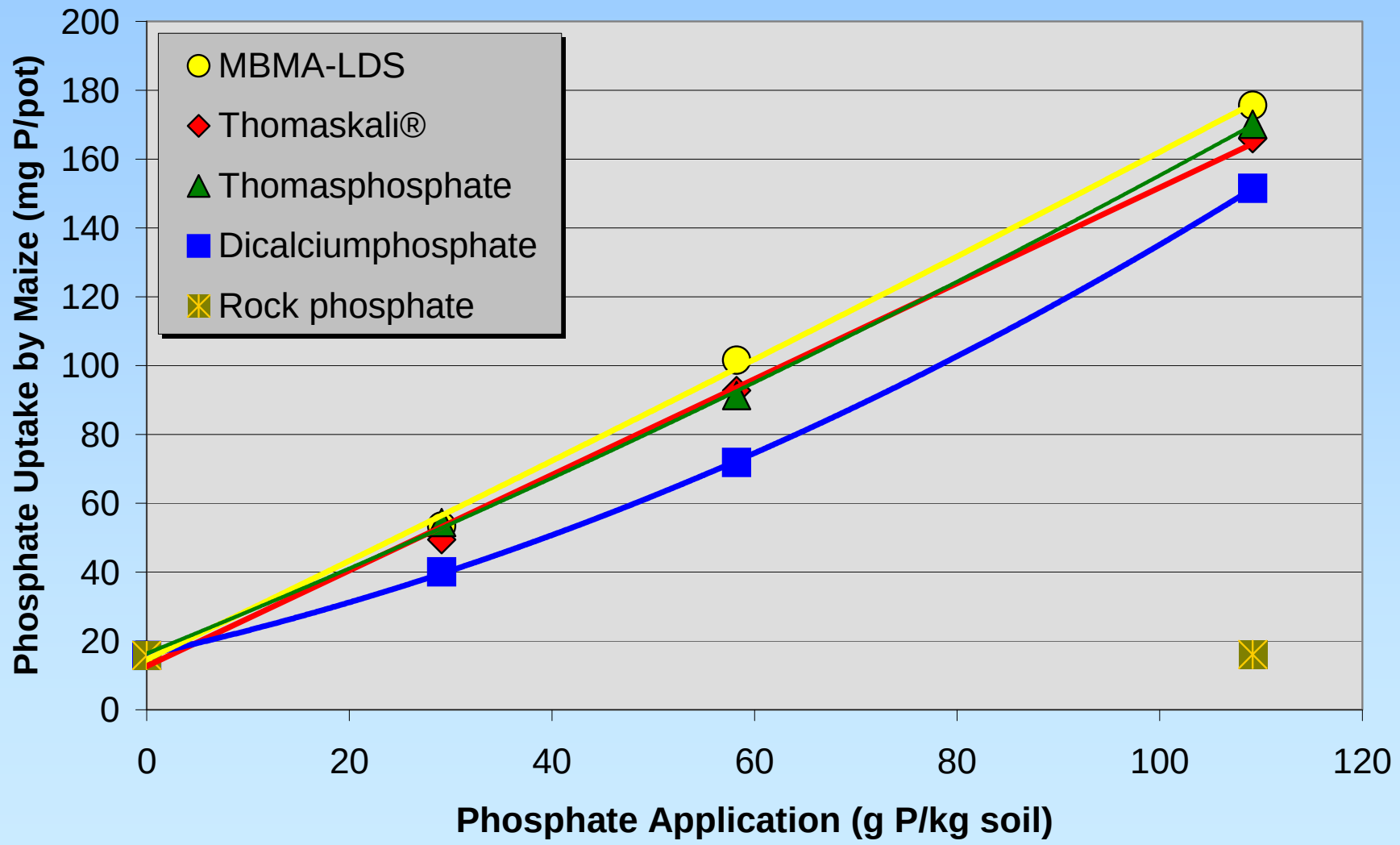


P-Uptake of Maize (Zea mays) in a pot experiment as a function of applied phosphate quantity and form



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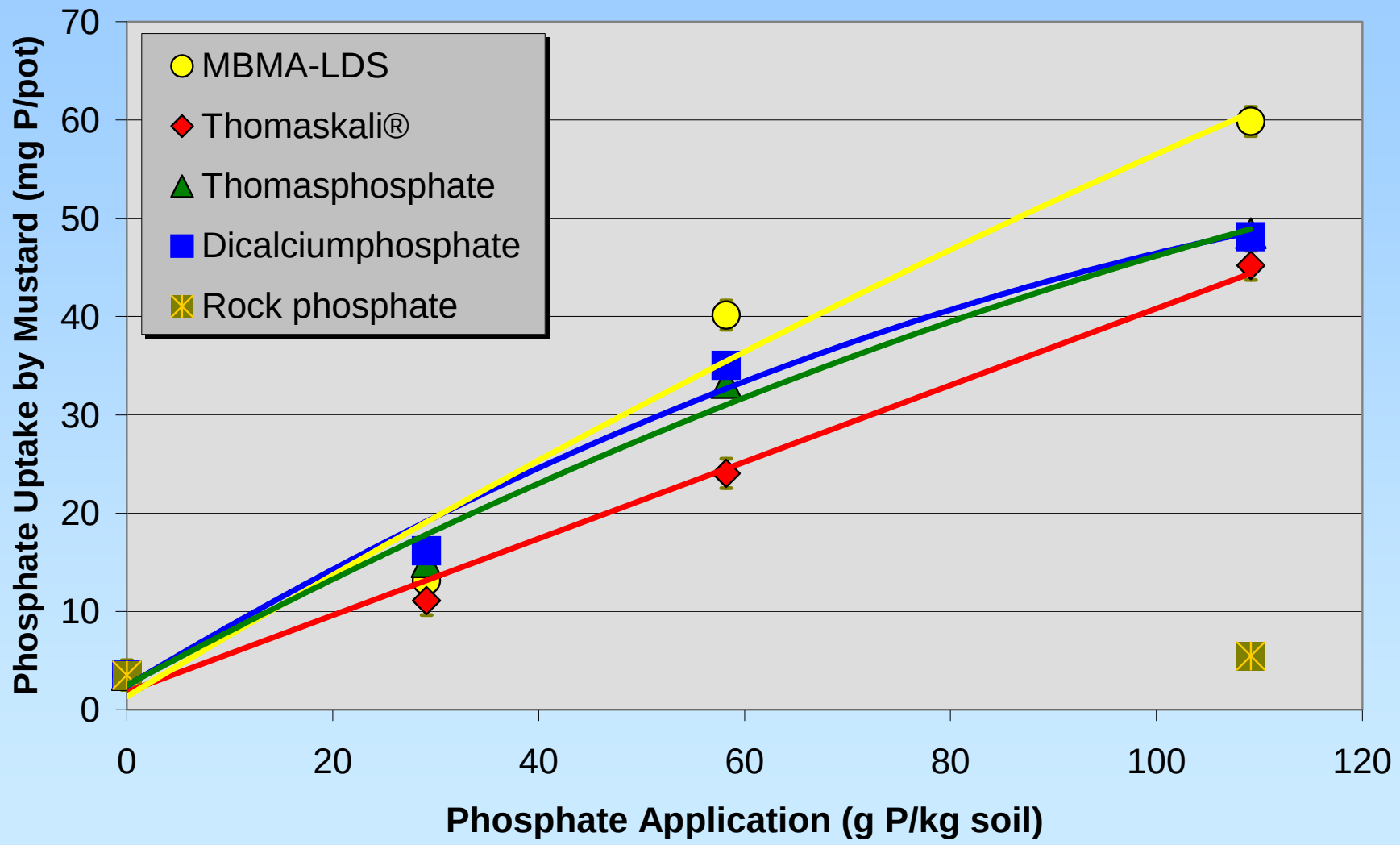
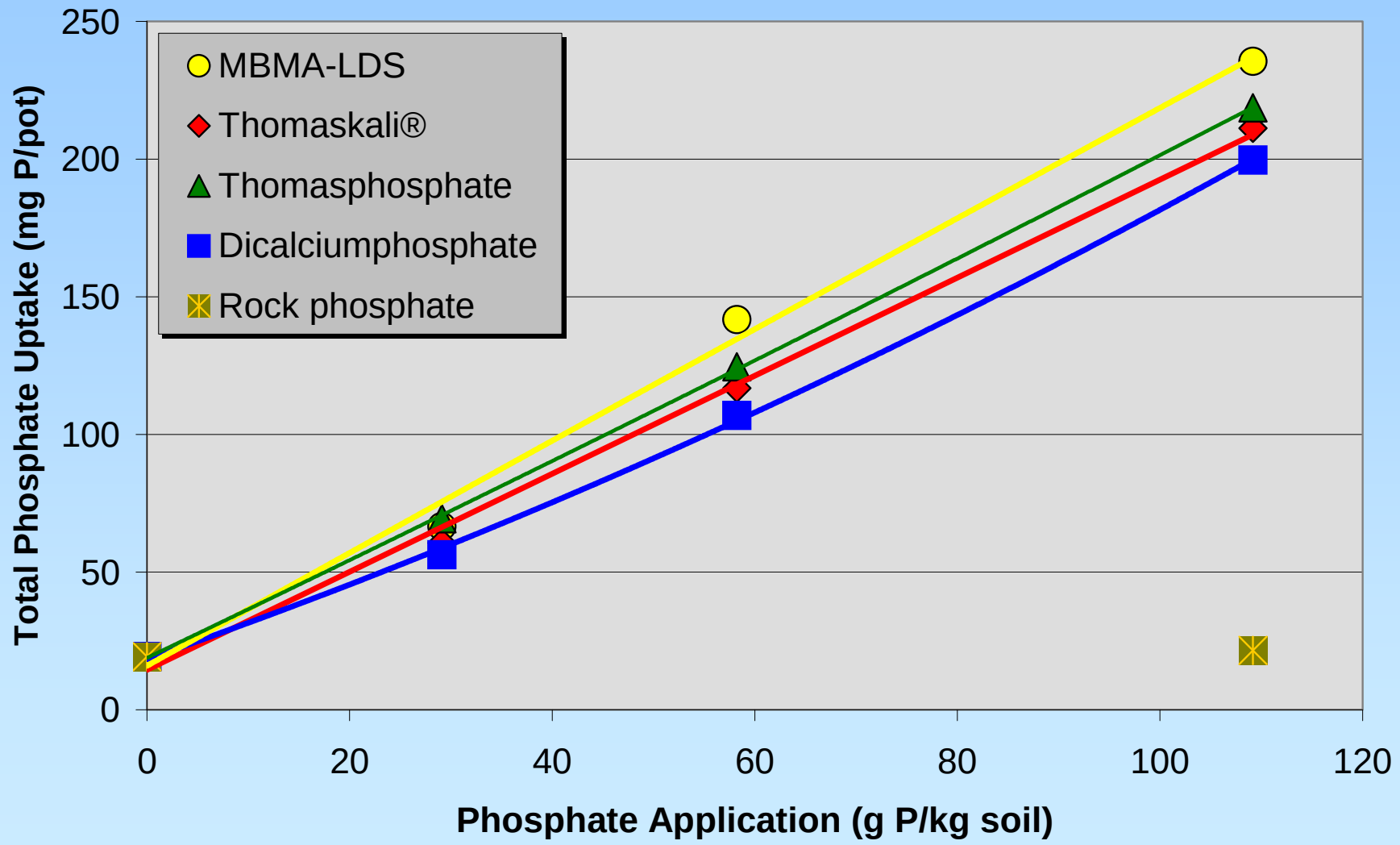


Cumulative P-Uptake of Maize and White Mustard in a pot experiment as a function of applied phosphate quantity and form



Conclusions

Meat Bone Meal Ash/LD-Slag:

Digestion of MBM Ash in liquid converter slag at 1600 °C increases the phosphate solubility in citric acid up to 87 % of total P.

Vegetation pot experiments showed a high P effect of the converter slag enriched with MBM Ash.

P availability of MBMAsh/LD-Slag was directly comparable to the effects of Thomasphosphate and other fully digested P fertilisers.

These experiences will be investigated on an industrial stage.

BMBF – Research Project

Innovative Technologien für Ressourceneffizienz - Rohstoffintensive Produktionsprozesse

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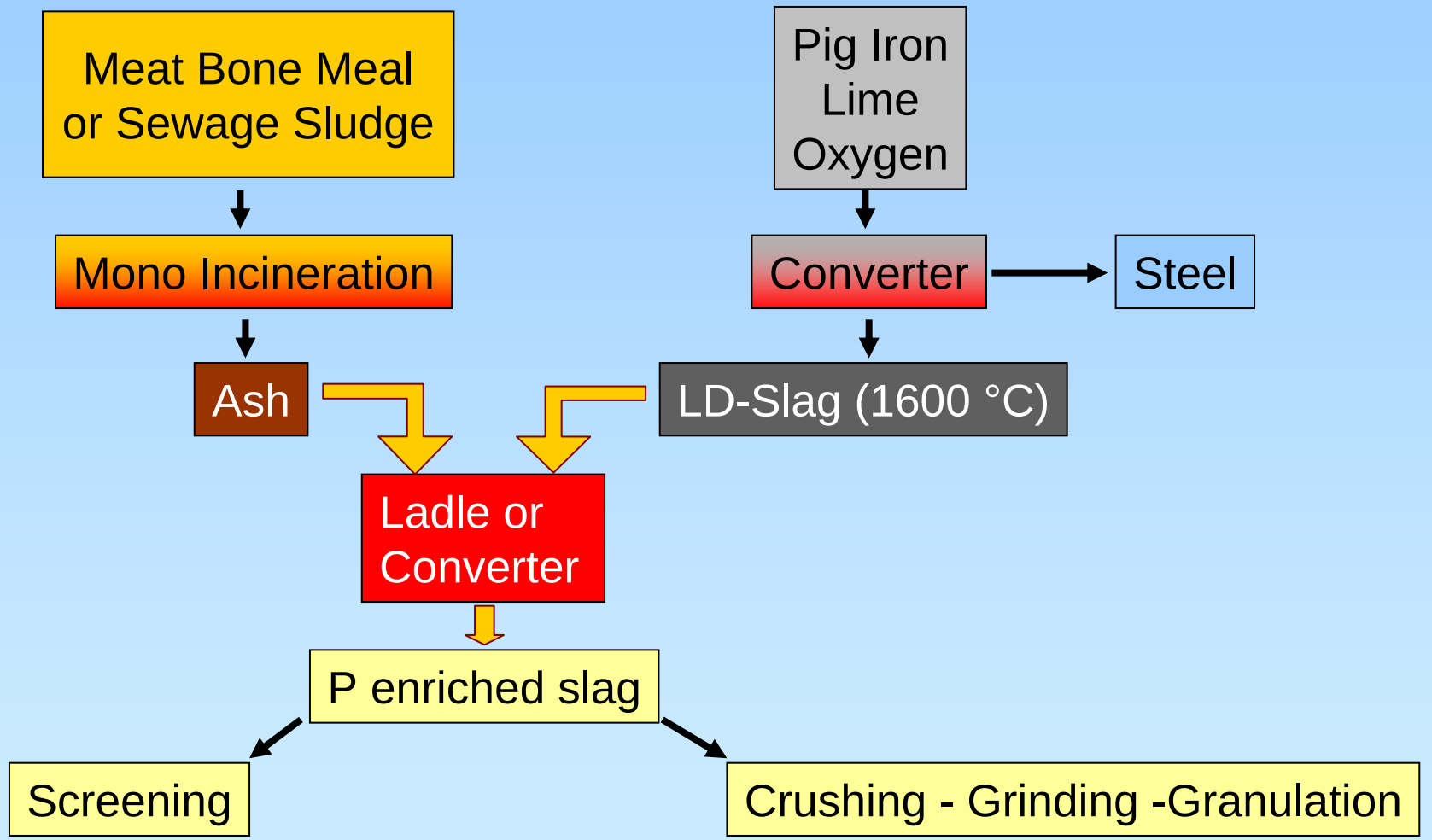
Schematic draft of P enrichment of steel slag



Treatment of BOF slag in a ladle

Phosphor Containing Residues

- Animal Remains Burning Ashes
  - P contents approx. 36 % P_2O_5
  - P Recycling Potential: 23.000 t P_2O_5/a

- Sewage Sludge Ashes
  - P contents 15 - 25 % P_2O_5
  - P-Recycling Potential: 100.000 t P_2O_5/a

Phosphor Enrichment of Basic Oxygen Furnace Slag

Proportion of P containing residues for a slag amount of 20 t

P content (P_2O_5) in „Thomas Lime“	3%	5%	7%
Animal Meal Ash (36 % P_2O_5)	0,9 t	2,3 t	3,8 t
Sewage Sludge Ash (22 % P_2O_5)	1,6 t	4,2 t	7,4 t

Loading of a converter

Tilting of slag

Thank you for your attention!