Trends in Phosphorus use in Animal Feeds

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ABVista
Feed Ingredients

World Annual Animal Feed Production

- Global Feed Tonnage ~950 million tonnes

- Global monogastric feed ~ 670 million tonnes
  - Asia Pacific 240 m t
  - EMEA 200 m t
  - NAFTA 150 m t
  - LAM 80 m t

- Potential DCP market = 670 x 15 kg/t = 10 m t

Feed Phosphates – P content & digestibility

Source	Phosphorus %	Digestibility of P, % - pigs	Digestibility of P, % - poultry
Monosodium phosphate. $1H_2O$ (MSP)	22.5%	89 %	91 %
Monocalcium phosphate. $1H_2O$ (MCP)	22.6%	83 %	85 %
Dicalcium phosphate. $2H_2O$ (DCP)	18.2%	70 %	78 %

CVB, NL

Feedstuff Phosphorus

Feedstuff	Total P (% DM)	Phytate P (% DM)	Phytate as % of Total
Corn	0.33	0.24	74%
Wheat	0.45	0.33	73%
Soyabean meal	0.76	0.40	52%
Rice bran	1.99	1.62	82%

Leske & Coon, 1999

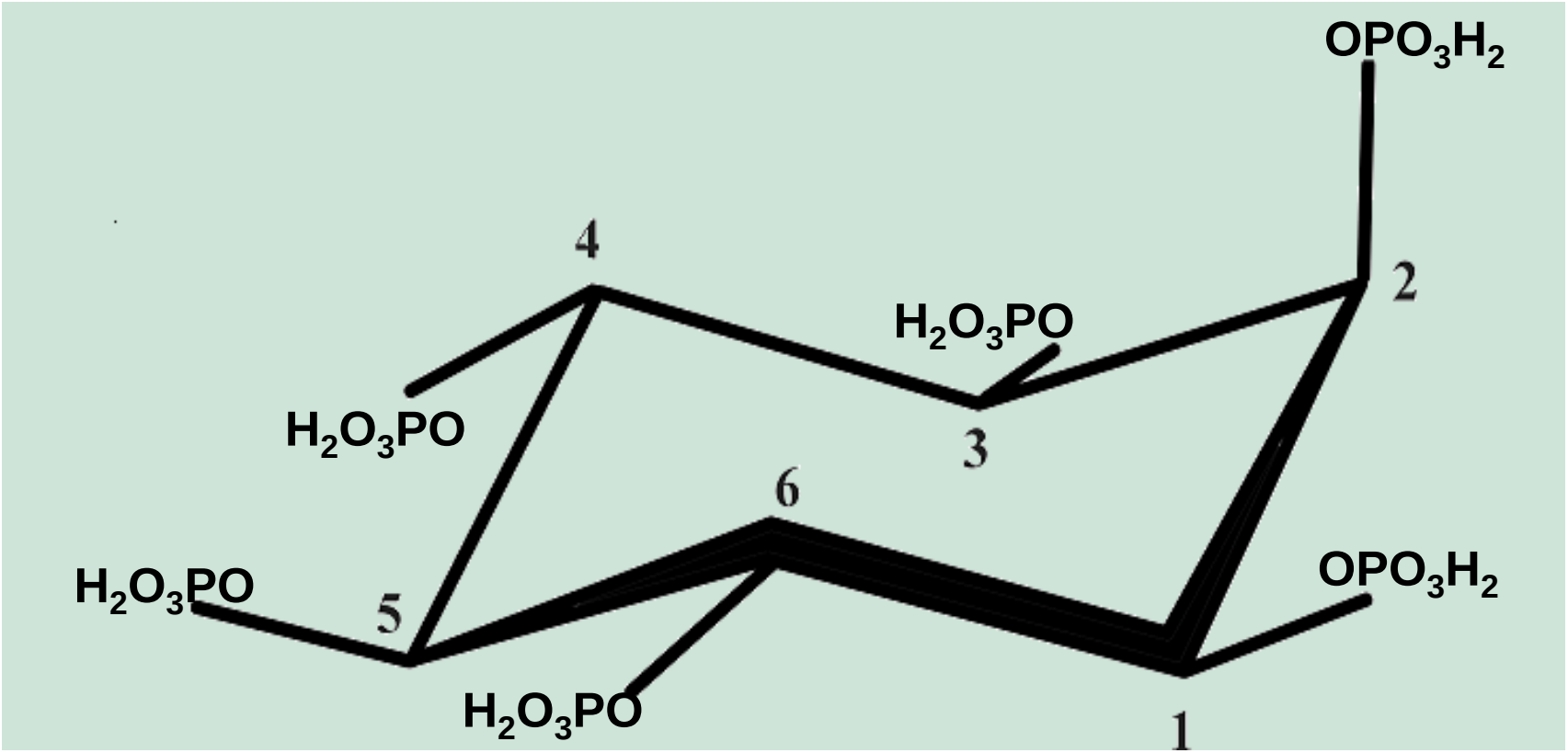
Feedstuff Phosphorus

Feedstuff	Total P (% DM)	Phytate P (% DM)	Phytate as % of Total	P retained (%)
Corn	0.33	0.24	74%	35%
Wheat	0.45	0.33	73%	16%
Soyabean meal	0.76	0.40	52%	27%
Rice bran	1.99	1.62	82%	16%

Leske & Coon, 1999; 3 wk old broiler chicks

Phytate – myo-inositol-hexaphosphate

Phosphorus storage in plants
Poorly digested by monogastric animals



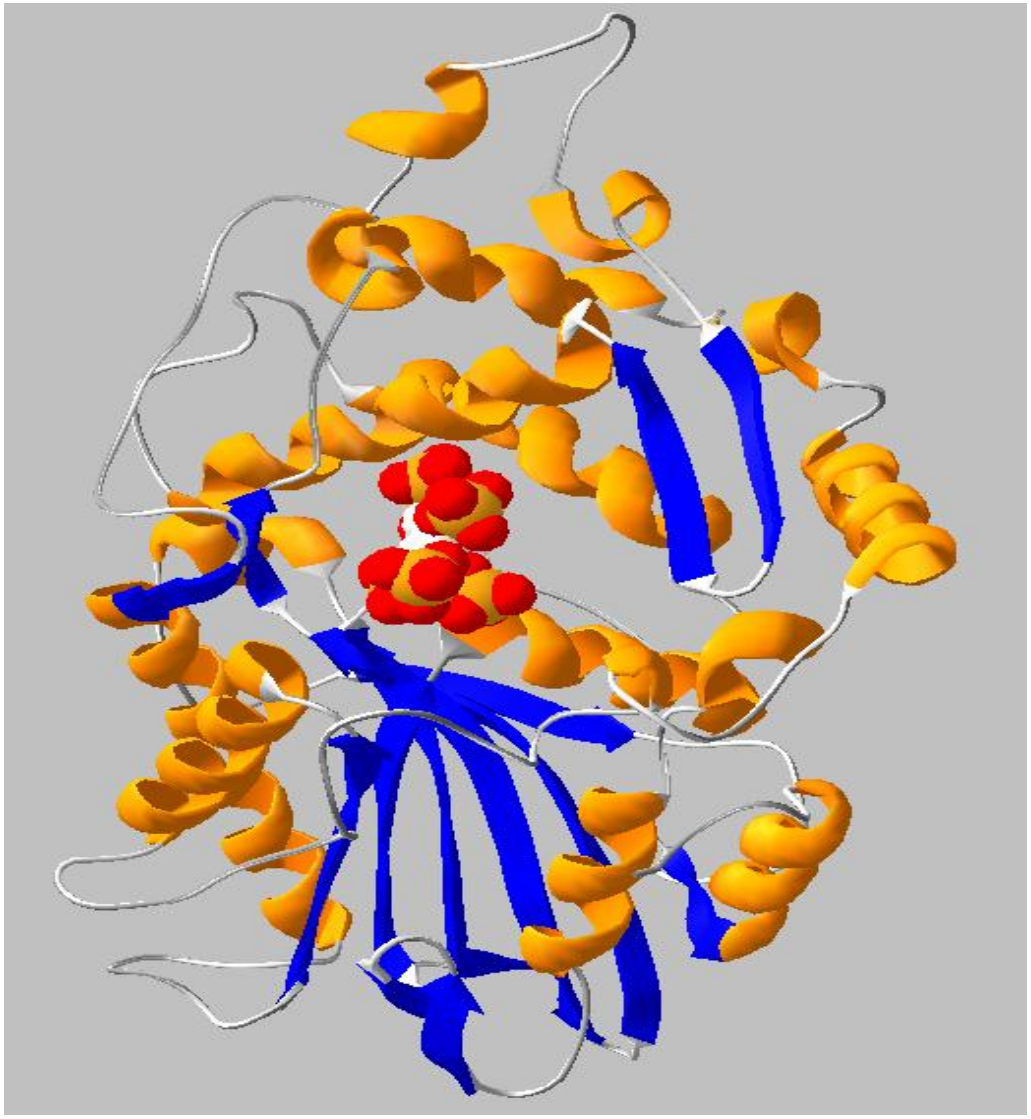
Can be degraded by microbial phytases

Feedstuff Phosphorus

Feedstuff	Total P (% DM)	Phytate P (% DM)	Phytate as % of Total	P retained (%)	P retained with Phytase (%)
Corn	0.33	0.24	74%	35%	41%
Wheat	0.45	0.33	73%	16%	34%
Soyabean meal	0.76	0.40	52%	27%	58%
Rice bran	1.99	1.62	82%	16%	27%

Leske & Coon, 1999; 3 wk old broiler chicks, 600 U/kg Aspergillus phytase

Feed Phytases



- First used in NL in early-1990
- Can release inositol + up to 6 free phosphates
- P release from 500 U/kg:
  - 1991 – 1.0 kg/t
  - 2006 – 1.2 kg/t
  - 2012 – 1.5 kg/t
- Also increases availability of Ca, Na, energy & amino acids

Adding Phytases to Feeds

Feed Ingredient (kg/t)	Standard feed	+Phytase* (P, Ca & Na only)
Wheat	628	645
Soyabean meal	223	220
Oil	23.6	18.9
Limestone	5.1	6.4
Salt & bicarbonate	4.7	3.5
Dicalcium phosphate	14.1	5.3
Phytase	-	0.1
Amino acids, micro-minerals, vitamins	to 1000	to 1000
Total Cost	€ 263.3	€ 257.3
Cost savings		€ 6.0

UK broiler finisher
*500 U/kg Quantum Blue

Adding Phytases to Feeds

Feed Ingredient (kg/t)	Standard feed	+Phytase* (P, Ca & Na only)	+Phytase* (all nutrients)
Wheat	628	645	669
Soyabean meal	223	220	205
Oil	23.6	18.9	10.0
Limestone	5.1	6.4	6.7
Salt & bicarbonate	4.7	3.5	3.5
Dicalcium phosphate	14.1	5.3	5.4
Phytase	-	0.1	0.1
Amino acids, micro-minerals, vitamins	to 1000	to 1000	to 1000
Total Cost	€ 263.3	€ 257.3	€ 249.1
Cost savings		€ 6.0	€ 14.2

UK broiler finisher
*500 U/kg Quantum Blue

Current Phytase Market Worldwide

- Market penetration (2014):
  - Poultry ~94%
  - Swine ~90%
- Annual Phytase Market >€300 million
- Current savings to the feed industry >€2 billion

Limits to Phytase use in Feeds

- Chicken grower feed (64% corn, 28% soyabean meal) contains 0.25% potentially degradable phytate-P

- Assuming 80% maximum degradation gives 0.20% additional P release with phytase

  = 15.7 kg/t DCP

- At 500 U/kg, an enhanced *E. coli* phytase can release 0.15% phytate P

  = 11.8 kg/t DCP

Consequences of Phytase Use in Feeds

- Use of phytase in all monogastric feeds could:
  - Reduce dietary DCP from ~15 kg/t to 8 kg/t
    - Drop feed DCP use from 10 to 5.5 m t/annum
  - Reduce manure P by up to 30%
    - From 1.5 m t to 1.0 m t/annum
  - Save the feed industry over €10/ton
    - Worth ~€7 billion/annum!

Conclusions

- Phytases are almost universally used in monogastric animal feeds worldwide, and this will continue
- Future phytase developments will have marginal effects on inorganic P use
- Greater use of food/energy co-products (meat & bone meal, distillers grains…) could reduce inorganic P use