BEC Feed Solutions

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Nutritional Role of Phosphorus

Phosphorus (P) is present in all cells in the body

- Essential for many digestive and metabolic processes, including conversion of feed into energy and building and repair of body tissues.
- Second most plentiful mineral in the body after Calcium **(Ca)**
- 75-85% of **P** is in the skeleton
  - 7% P @ Birth
  - 9% P @ 1 year
  - 9-12% @ Maturity
  - 6.3g P / kg Lwt
- **Ca** & **P** constantly being drawn from the bone reserves and replaced.
- **P** deficiency results in osteomalacia (Peg Leg)
- **P** transported in the blood stream
- Saliva contributes more **P** to the rumen than the feed eaten.
- Rumen micro organisms have a requirement for **P** distinct from the requirements of the animals tissues.

The Role of Phosphorus in Cattle Growth and Reproduction

- Decreased **P** results in decreased feed intake, without an effect on Dry Matter (DM) digestibility. (not understood why)
- Decreased feed intake results in:-
  - Decreased growth rate
  - Decreased milk yield
  - Decreased reproduction rate
  - Decreased calf growth rate
- **P** absorbed mainly in the small intestine
- **P** absorption depends on:-
  - **P** content of the diet
  - **Ca: P** ratio
  - **P** bioavailability

Phosphorus Loss

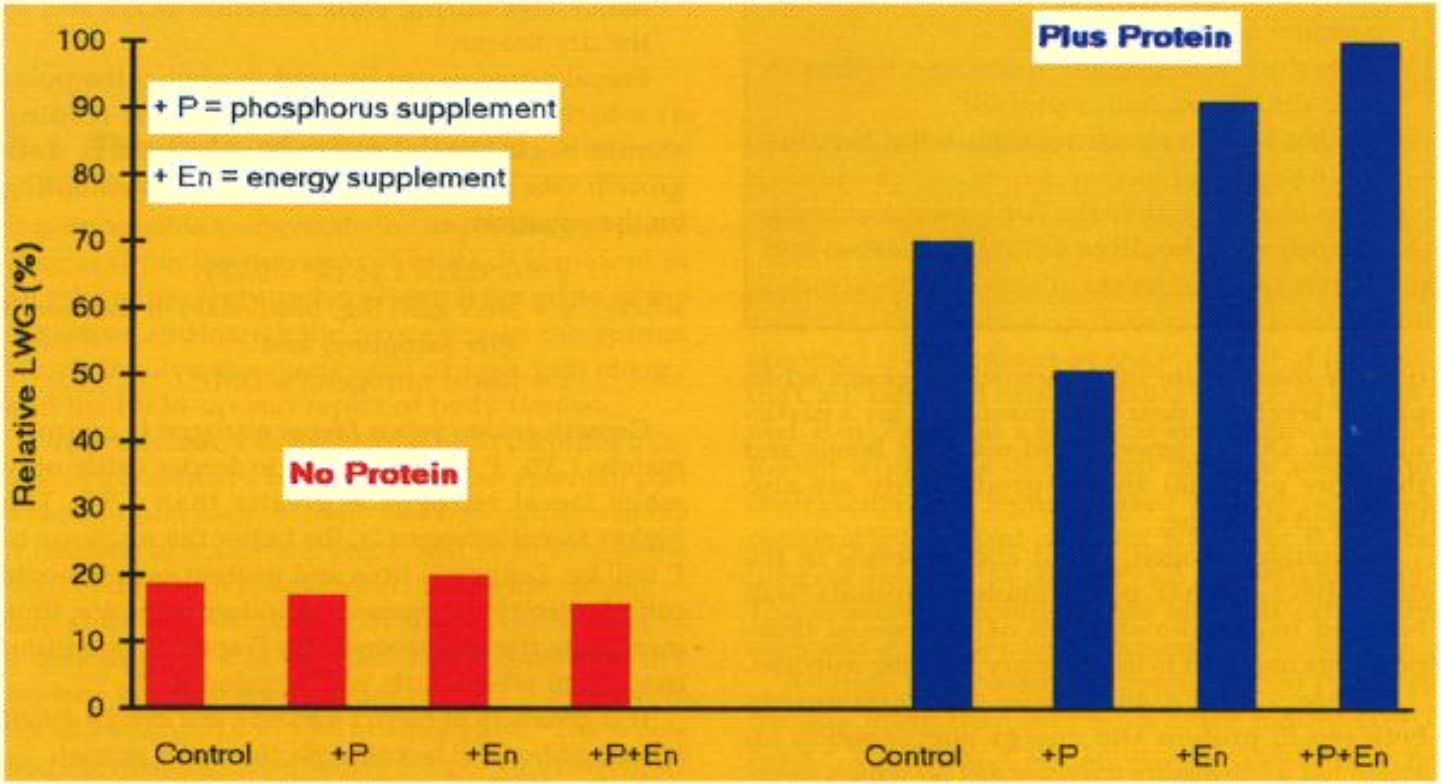
- Faecal, 400kg animal looses 6 – 8g per day.
- Faecal **P** consists of dietary **P** (feed) and endogenous **P** (saliva)
- Milk – 1 litre milk contains 0.95g of **P**
- **P** deficiency leads to decreased milk volume, not decreased P content.

The Role of Phosphorus in Cattle Growth and Reproduction

Phosphorus / Energy / Protein

- Nitrogen **(N)**, **P** and Energy levels in pastures generally move in parallel.
- **P** intakes lowest prior to spring storms. When protein and energy are also at their lowest.
- There is a misconception that **P** deficiency is most acute at this time.
- **P** deficiency is most acute in the growing season when plant P levels are at their highest. During this time protein and energy levels are also at their highest.
- Supplementation with **P**, **N**, or **E**nergy will only be positive, if that nutrient is the first limiting nutrient.

The Role of Phosphorus in Cattle Growth and Reproduction



- Low quality diet, protein limits live weight performance.
- Energy without protein has little effect
- Energy and protein are too limiting to get a response from **P**
- **P** actually depressed performance

The Role of Phosphorus in Cattle Growth and Reproduction

- During the growing season on legume based pastures, **P** can be the first limiting nutrient even though **P** levels are at their highest.
- **N** will be the first limiting nutrient on native pastures as early as mid to late summer.
- When faecal **N** drops below 1.3%, growth stops. Therefore never feed **P** when faecal **N** is below 1.3%.
- Necessary to address any **N** and/or Energy deficits before additional **P** supplementation is beneficial.
- **P** supplementation during the dry season leads to decreased growth rate. Thought to be due to the energy expended to metabolize the **P**, with no benefit to offset the loss.

Phosphorus Requirements

- Maintenance requirement for P increases with the size of the animal
- Increased growth leads to increased demand for **P**
  - 3.3g P / 250g/d Lwg
- Lactation 0.95g P / lt milk
  - @ 80% absorption = 1.2g dietary **P** / lt.
  - @ 5lt/day = 6g/day.
- P requirement increase during pregnancy to support growth of foetus and placenta.
  - 30kg calf = 210g **P**
  - Placenta = 10 g **P**
- 90% of this 210g is needed during the last 90 days of pregnancy.
  - 1.5g/day until month 7
  - 4g/day in month 9

The Role of Phosphorus in Cattle Growth and Reproduction

Supplementary phosphorus needs (gP / head / day) without bone demineralization

Liveweight (kg)	Diet quality	'Acute'			Phosphorus status 'Deficient' Rate of gain (g / head / day)				'Marginal'			
		250	500	750	250	500	750	1000	250	500	750	1000
Steers & dry heifers												
300	Average	3	7	11	1	5	8	na	0	3	6	na
300	Good	1	4	7	0	2	5	8	0	0	2	6
500	Average	3	6	10	0	3	7	na	0	0	3	na
500	Good	0	2	6	0	0	1	5	0	0	0	1

Nil Liveweight gain assumed for breeders

Liveweight (kg)	Diet quality	Third term of pregnant	3 L milk / day	6 L milk / day	Third term of pregnant	3 L milk / day	6 L milk / day	Third term of pregnant	3 L milk / day	6 L milk / day
Breeders										
400	Average	4	4	7	1	1	4	0	0	2
400	Good	1	1	5	0	0	1	0	0	0

The Role of Phosphorus in Cattle Growth and Reproduction

Recommendations

- Feed **P** to growing stock during growing season only.
- Feed **N** to breeders in early autumn on native pastures
- Feed **N** to heifers and steers from late autumn on native pastures
- No **P** supplementation for growing stock if they are loosing weight
- Lactating breeders feed **P** in late dry season at half wet season rate

Supplements for Northern Australia

Common Ingredients Utilized in Lick Supplements

- MDCP (Kynofos 21)
- DCP
- TCP
- Rock Phosphate
  - Supply phosphorus
  - Varying bioavailability
  - Varying mixability
  - Huge pricing disparity

Salt

- Supply Sodium and Chloride, needed d for bile production and hydrochloric acid production needed for digestion of fats and carbohydrates and proteins
- Mature cow requires approx 11kg salt per year. inclusive of non supplemental salt
- Commonly used in licks to control intake either up or down
- Can be toxic in extreme cases, at intakes above 3kg/hd/day

Limestone

- Supply calcium **(Ca)**
- If **P** is being supplied from MDCP or DCP additional Ca is not required
- **Ca:P** ratio of between 1.5-2:1 is recommended
- Often added to licks in excess as limestone is cheap

Supplements for Northern Australia

Urea

- Supply Nitrogen **(N)**
- Contrary to common belief Urea is **not** protein. Urea is a simple N compound
- Rumen microorganisms can convert **N** to ammonia which is converted to amino acids and microbial protein.
- Urea can supply up to 1/3 of the total protein requirement of cattle. However at these levels sufficient fermentable energy must be supplied to allow utilization of available **N**

Urea	→	Microbial Urease	→	$NH_3 + CO_2$
Carbohydrates	→	Microbial Enzymes	→	VFA + Keto Acids
Keto Acids + NH_3	→	Microbial Enzymes	→	Amino Acids
Amino Acids	→	Microbial Enzymes	→	Microbial Protein
Microbial Protein	→	Small Intestine Enzyme	→	Free Amino Acids

Free Amino Acids Absorbed

- Toxic dose generally regarded as 0.5grams/kg LWT in a single feeding episode

Supplements for Northern Australia

Sulphate of Ammonia

- Supply **N** as with urea. Contains approx ½ the level of **N** as urea
- Important source of Sulphur **(S)**
- Sulphur required as a precursor to the production amino acids
- **N:S** ratio should be in the range of 12-15:1
- SOA often used to control intake (more bitter than urea)
- More expensive source of **N** than urea

Elemental Sulphur

- Source of **S**.
- Less available source of **S** than SOA.

Protein Meal

- Source of Rumen Escape Protein
- Source of Energy to aid utilization of Urea.
- Used to manipulate intake.
- Commonly used meals include
  - Cotton Seed Meal 43%
  - Copra Meal 20%
  - Canola Meal 35%
  - Soybean meal 48%
  - PKE 15%
- Very important to calculate the input cost of the protein.

Supplements for Northern Australia

Mineral Premix

- Source of Micro minerals generally
  - Copper
  - Zinc
  - Manganese
  - Cobalt
  - Iodine
  - Selenium
- Quite hard to establish micro mineral deficiencies. The inclusion of a mineral premix is very cheap insurance.(1-2c/cow/day)

Premix Manufacture considerations

- Consideration needs to be given to the following criteria.
  - Mixability (Particle size variation)
  - Batch traceability
  - Batch to Batch accuracy
  - Raw material storage and integrity
  - Product consistency from delivery to delivery