PHOSPHORUS DEFICIENCY

PHOSPHORUS IN NZ DAIRY

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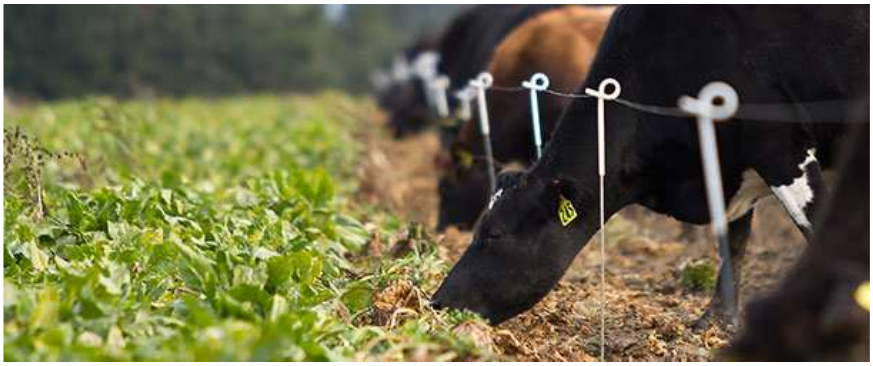

Photo: Courtesy NZ Farmsource

Deficiency

Phosphorus (P) is the mineral most frequently associated with infertility in dairy cows.

Under normal conditions, a P deficiency in dairy cows will result in:

- Poor appetite
- Poor production,
- Pica (craving /eating of abnormal materials)
- Reproductive disturbances/ infertility.

A moderate deficiency in P may be associated with cows not conceiving when mated, while a more severe deficiency can extend postpartum anestrus (non-cycling activity post calving) due to inactive ovaries.

- Studies showed 2.8-3.7 services per conception for heifers on a P deficient diet, this reduced to 1.3 with P supplementation.

Phosphorus is the second most abundant mineral in the animal body

- 80% stored in bones/ teeth
  - Key role is bone maintenance and mineralisation
  - Stored 2:1 -Ca: P in the bones
  - Think bricks and mortar, one will not be stored without the other
  - Therefore needs to be in the diet at a minimum 2:1, Ca:P. Up to 8:1 Ca:P is acceptable.
- 20% in tissues and fluids where it is critical for
  - Energy utilization
  - DNA Structure
  - Protein synthesis
  - Fatty acid transfer

(Beede, 2003; Brooks Hv, 1984; Council, 2001; Group, 2015; Horst, 1986; Kincaid, Hillers, & Cronrath, 1981; Manston, 1967; McGrath, 2015; Moellers & Riese, 1988; Suttle, 2010)

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LOW PHOSPHORUS FODDER BEET

PHOSPHORUS IN NZ DAIRY

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Photo Courtesy: Seedforce

Issues becoming more apparent

New Zealand dairy farms are seeing an anecdotal increase in empty rates, and poor 6 week in calf rates on farms that are feeding an increasing amount of fodder beet as their winter feed.

Absorption and Availability

Absorption and availability of P are affected by many dietary factors, most importantly the Ca:P ratio consumed by the cow. Less than 2:1 is deleterious to the cow, not only hindering P and Ca absorption, but is associated with reduced performance and reproductive problems in cows. A high Ca:P ratio will have negative effects too.

Iron will combine with P to form insoluble complexes which is very concerning with the amount of high iron soil that the cows will eat when consuming fodder beet.

Phosphorus in Fodder beet

- Low mineral concentration
  - Especially Phosphorus
  - 50-70% less when compared with Kale or Pasture
  - Well below NRC recommendations, even for dry stock
- Dry period and late lactation is traditionally when cows will replenish P stores
  - If cows have been restricted then P supplementation must start earlier than dry period to rectify previous winters "mining".

Other negative interactions

- Potassium and nitrates will negatively affect P absorption
- Magnesium, Ca, Fe, and Aluminum will form insoluble complexes with P
- Lack of strong sunlight (deficient in NZ winter) to create vitamin D, as vitamin D regulates active P and Ca absorption

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PHOSPHORUS SUPPLEMENTATION

PHOSPHORUS IN NZ DAIRY

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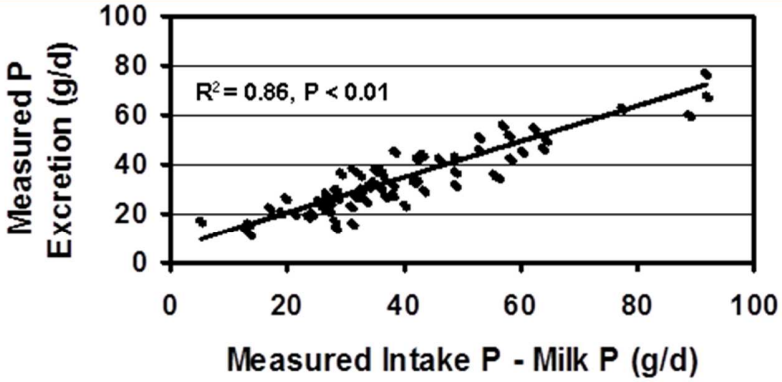

Figure 1. Measured phosphorus excretion versus P intake minus milk P secretion from research results from the scientific literature (Beede and Davidson, 1999).

Phosphorus Absorption Rate has a Limit

As P intake increases beyond requirement, excess P is excreted (above). Therefore, cows that need to build bone stores of P from previous winters on fodder beet will not be able to "make up for lost time" by supplementing with large quantities of P in the coming winter.

Supplementation needs to start earlier to rebuild bone stores before winter.

MilkMap Recommendations

- Feed a high P mineral source when on fodderbeet
- Ensure that P supplementation high enough (recommended dose rates may not be enough)
- If beet is fed at high rates (>4 kg) or long periods (>21 days) then some additional mineral supplementation should be given throughout the season to replace mobilized reserves
- DCP alone will not supply the right ratio of Ca
    - Negative mineral interactions can occur that will limit P absorption
- Continue feeding minerals post calving to minimize further bone depletion from milk production

NZ winter on fodder beet

- Low P in beet
- Poor Ca:P ratio for bone mineralisation
- Available P can be low with soil iron consumption
- Short period for Ca + P supplementation as Ca should be pulled out prior to calving
- Increasing P requirement from calf fetus (890 g P in the last trimester)

P supplementation must start earlier than the cows going onto fodder beet, and needs to continue through early lactation to minimise further depletion

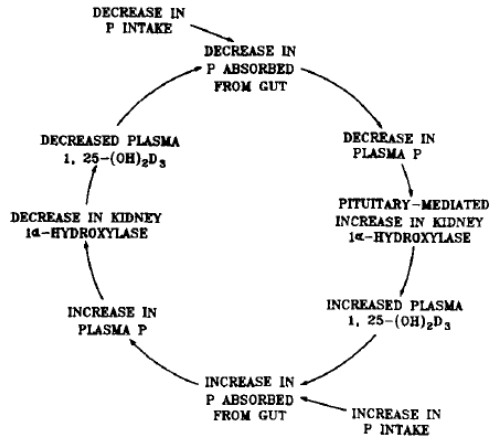

Figure 4. Mechanism of adaptation to alterations in dietary phosphorus (P). $(OH)_2$ = Dihydroxyvitamin. (Horst, 1986)

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