Earthcare TECHNICAL

# P and K budgets

Audrey Litterick

Earthcare Technical Ltd

Earthcare TECHNICAL

## P budgeting – why do it?

- To ensure you apply sufficient P to ensure good yields of quality crops
- To ensure you don't over-apply P in order to avoid:
  - phosphate pollution of water courses and water bodies – a key concern of SEPA and governments of many European countries. We must improve our P use efficiencies if we are to avoid regulations on P use.....
  - wasting money
  - nutrient imbalances (excessive soil P is likely to lead to crop deficiencies in Fe and Zn). Losses in crop quality and yield mean financial losses.

Earthcare TECHNICAL

## P balance – can be done on different scales

- Country basis - tells you whether a country as a whole is likely to have a problem with excessive P applications.
- Catchment basis - tells you whether a river basin district or catchment is likely to have or to develop problems with phosphate pollution.
- Farm basis - tells you whether your farm as a whole is under or over-applying P so that you can work out whether you are likely to develop problems in future.
- Field basis - probably most useful of all
  - Tells you whether you are likely to be building up or running down P over the field

Earthcare TECHNICAL

P balance – can be done on different scales

- Country basis - tells you whether a country as a whole is likely to have a problem with excessive P applications.
- Catchment basis - tells you whether a river basin district or catchment is likely to have or to develop problems with phosphate pollution.
- Farm basis - tells you whether your farm as a whole is under or over-applying P so that you can work out whether you are likely to develop problems in future.
- Field basis - probably most useful of all
  - Tells you whether you are likely to be building up or running down P over the field

Earthcare TECHNICAL

## P balance (or budget)

- Count all inputs (e.g. fertilisers, crop residues such as stubble or straw, dung from grazing animals and bulky organic fertilisers).
- Count all outputs (e.g. grain, straw, silage).
- Subtract outputs from inputs and find whether you have a positive P balance or not.
  - If aiming to build soil P status towards your target, you need to be putting in more than you are taking out.
  - If aiming to reduce soil P status, you need to be putting in less than you are taking out.
  - Once at target, you should aim to address only crop demand, then check through regular soil analysis that you are maintaining soil P at targets.

Earthcare TECHNICAL

## P balance example – 1 year. Manse Hill (WW)

(e.g. crop yields 9 t/ha, grain and straw are removed)

- Soil P status on target (M-)
- Crop P requirement for a 9 t/ha crop is 76 kg/ha for a soil of PSC2 (see SAC TN668)
- Inputs (totalling 80 kg phosphate/ha) might be:
  - Dung (3.2 kg phosphate/fresh tonne @10 t/ha) = 32 kg phosphate/ha
  - Bagged fertiliser = 48 kg phosphate/ha
- Output for a 9 t/ha crop:
  - 9 t/ha WW (9 t x 8.4 kg phosphate/t) = 76 kg phosphate/ha
- Phosphate balance: +4 kg phosphate/ha

Earthcare TECHNICAL

## P balance – best done over a rotation

- Most farms would apply solid organic materials (e.g. dung, compost, biosolids) only one year in 2, 3, 4 or 5.
- Nutrient budgets are best done for single fields over the course of a rotation which includes intermittent organic materials applications.
- It is fine to over-apply P some years, and take "P holidays" in other years.
- The strategy should always be to:
  - increase soil P status until target of moderate is reached (high for P-responsive crops such as potatoes).
  - decrease soil P status if it is higher than target by reducing P applications

Earthcare TECHNICAL

## P balance – best done over a rotation (assume monoculture WW for purposes of exercise)

| Year | Input | P input (kg/ha) | Output | P output (kg/ha) | Balance |
|---|---|---|---|---|---|
| **1** | Bagged fert. | 48 | | | |
| **1** | Dung | 32 | Grain + straw | 76 | +4 |
| **2** | Bagged fert. | 70 | Grain | 70 | 0 |
| **3** | Bagged fert. | 48 | Grain + straw | 76 | +4 |
| **3** | Dung | 32 | | | |
| **4** | Bagged fert. | 72 | Grain + straw | 76 | -4 |
| **Full rotation** | | **302** | | **298** | +4 |

Earthcare TECHNICAL

## Finding your crop P and K requirement

- TN 633 for K (and S and Mg) for arable and potato crops "Phosphorus, potassium, sulphur and magnesium recommendations for cereals, oilseed rape and potatoes"
- TN 688 for P (arable and grass crops) "Managing soil phosphorus"
  - Note is an update on TN633 and includes new information on soil Phosphate Sorption Capacity and new P recommendations which take that into account.

Earthcare TECHNICAL

## Tips to make your P budgets more accurate:

- Use actual values for P in your own organic materials (dungs, slurries, biosolids) rather than average published values.
- Use actual yields of your own crops in each field.
- Consider having your own crops tested for P and K content
- Know your soil PSC (1, 2 or 3) in order to determine accurate, up-to-date crop P requirement (see TN 668)
- Track any trends in your soil P content by looking at the actual values in mg/l rather than just the status (mod, high etc.). Are the values rising or declining over time?

Earthcare TECHNICAL

## Sometimes it is fine to add lots of P!

- New guidance has come out (RB209 latest edition) that it is acceptable to add much higher amounts of phosphate than that required by crops in a single year, where the intention is to build soil P rapidly from low or very low.
- As a rough guide, application of around 400 kg phosphate/ha is likely to result in an increase of around 10 mg/l in Olsen extractable P.
- Care should be taken in doing this so that extractable soil P concentrations to not become too high.
- More frequent testing of fields to which high P applications have been made is recommended.

Earthcare TECHNICAL

## K budgeting

- Also very much worth doing and done in the same way as for P.
- K is not a nutrient of concern in terms of diffuse pollution.
- But - still important to ensure adequate but not excessive K applications in order to avoid:
  - wasting money
  - nutrient imbalances (excessive soil K is likely to lead to crop deficiencies in other nutrients, esp. Mg which can cause problems in both crops and livestock).

Earthcare
TECHNICAL

# THANKYOU!

Audrey Litterick
audrey@earthcaretechnical.co.uk