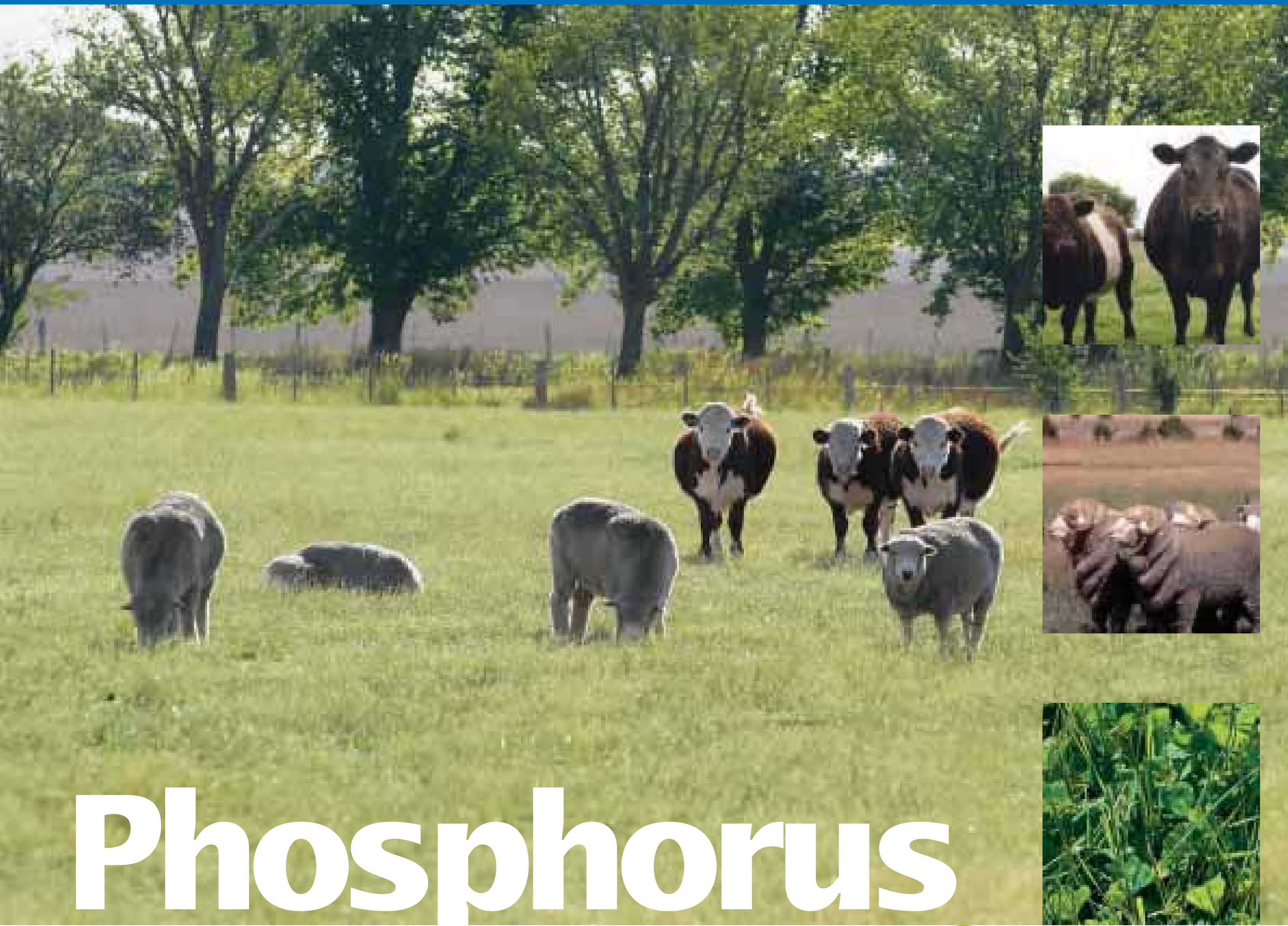

Phosphorus for *sheep and beef* pastures

State Government Victoria
Department of Primary Industries

RURAL SOLUTIONS SA

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Phosphorus for sheep and beef pastures

Farm profitability is linked closely with the correct use of fertiliser.

The key to successful pasture production is the combination of well-fertilised and high-quality pastures, stocked at an appropriate grazing pressure, with livestock of high genetic merit.

To make the phosphorus fertiliser decision for South Australian sheep and beef cattle producers easier, we have combined results from the Hamilton Long-term Phosphate Experiment in Victoria and research trials in South Australia, and integrated these with a fertiliser decision method developed in New Zealand.

This package assists producers to:

- decide how much phosphorus to apply to particular paddocks
- decide what type of phosphorus fertiliser to use
- plan a soil phosphorus monitoring program
- prioritise different paddocks for fertiliser application

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The key message of this package is that the old rule of thumb of one kilogram of phosphorus per dry sheep equivalent can be greatly refined to improve profitability, and minimise environmental impacts.

Research indicates that the amount of phosphorus per dry sheep equivalent (kg P/DSE) needed to maintain productivity varies from 0.43 to 1.51 kg P/DSE, depending on rainfall, soil type, pasture species and grazing management.

Adequate amounts of all other soil nutrients need to be present to get the full benefit from phosphorus fertiliser.

Abbreviations

cm	centimetre
DSE	dry sheep equivalent
ha	hectare
kg	kilogram
mg	milligram
K	potassium
N	nitrogen
P	phosphorus
S	sulphur
t	tonne
μm	micron
yr	year

NOTE

The recommendations in this package assume an adequate soil phosphorus status for the intensity of animal production supported by a particular paddock. For productive pasture systems, an adequate soil phosphorus level as measured by the Colwell test should be:

- 25–35 mg/kg for South Australian pasture soils generally
- 35–45 mg/kg for lateritic ironstone soils on Kangaroo Island, and soils of reclaimed swamps on the lower Murray

Phosphorus in grazing systems

Phosphorus is essential for all living things. It is required for respiration, photosynthesis, energy expenditure, cell division and growth, and the uptake and movement of nutrients. In animals, phosphorus is a major constituent of bones, teeth and the central nervous system.

The phosphorus in a grazed paddock moves continuously between the soil, plants and animals (Figure 1).

Some phosphorus may be lost from the grazing system through soil reactions and the movement and management of livestock. If insufficient fertiliser phosphorus is applied to balance these losses, the soil phosphorus status of the paddock will fall. Eventually productivity will also fall.

Soil losses

Phosphorus in dung and plant litter is unavailable to plants until the organic matter is mineralised (broken down) by micro-organisms in the soil.

Phosphorus in the soil will react with iron and aluminium to form insoluble compounds. This phosphorus is known as fixed or sorbed phosphorus. It cannot be used directly by plants but over time may become available through weathering of the soil particles.

Other losses of phosphorus occur by leaching (especially in acid sandy soils), run-off following heavy rain immediately after fertiliser application, and soil erosion.

The amount of phosphorus lost due to soil factors varies with soil type and increases with rainfall.

To maintain an adequate soil phosphorus status, the phosphorus lost from each paddock through soil and animal processes must be replaced

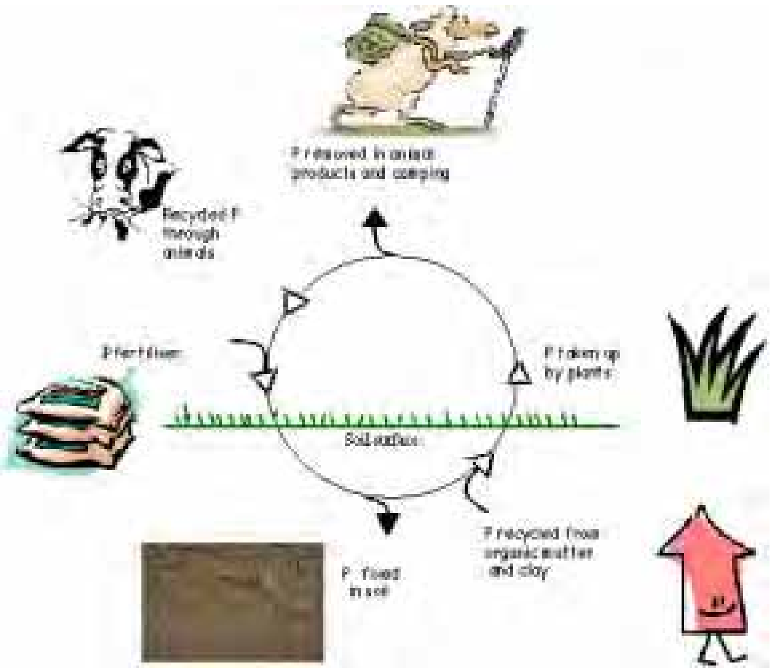
Animal losses

A high proportion of the phosphorus consumed by livestock returns to the soil in dung and urine, but much of it is transferred to stock camps within the paddock, leading to a net loss of phosphorus from the main part of the paddock. Stock camps are more pronounced on hilly terrain and set stocked areas, and less pronounced on flat areas or where paddocks are rotationally grazed.

Some phosphorus is exported from the grazing system when animals, meat, milk or wool leave the farm.

If insufficient phosphorus is applied, the phosphorus status of the paddock will fall and eventually productivity will also fall

Figure 1. A simplified phosphorus (P) cycle showing the continuous movement of phosphorus in the animal grazing system and potential loss pathways. After Cornforth and Sinclair (1982).



Research leads to better decision making

A long-term experiment at Hamilton, Victoria, shows that there is a close relationship between inputs of phosphorus and profitability.

The experiment showed that the maximum profit from wool sheep (sale of wool and lambs) at Hamilton occurs when about one kilogram of phosphorus per ewe (about 0.8 kg P/DSE) is applied each year. This figure is relatively insensitive to changes in the cost of fertiliser and the price of wool, and enables reasonably confident recommendations on how much phosphorus fertiliser to use for pastures on the basalt soils in south-western Victoria.

Widespread recommendations across farms and districts of a single kg P/DSE rate are incorrect because the amount of fertiliser required will depend on soil type, the animal enterprise and the potential productivity of individual paddocks.

For high rainfall South Australia, the Hamilton results have been combined with complementary research undertaken in South Australia. The combined results have been integrated with a method developed in New Zealand that is based on replacing the phosphorus lost in the grazing system with fertiliser phosphorus (Figure 1).

The combined approach provides South Australian graziers with a new and better way to make decisions about phosphorus fertiliser. Previously, soil tests alone were used. The new recommendations are based on applying a given amount of phosphorus per DSE, and thus ensuring that paddocks stocked at the highest rates receive the most fertiliser.

Results from the Hamilton Long-term Phosphate Experiment show there is a close relationship between inputs of phosphorus and profitability

How much phosphorus is needed?

This package tailors phosphorus fertiliser recommendations to individual paddocks because soil type, carrying capacity and topography vary between paddocks.

To make decisions on how much phosphorus fertiliser to apply to an individual paddock on your farm, to support the desired production and maintain adequate soil phosphorus status, you will need to know:

- average rainfall
- soil type
- grazing system used
- steepness of the paddock
- pasture species present
- stocking rate expressed as DSE/ha
- phosphorus content of the fertiliser

The value of a phosphorus soil test also helps.

The details from the list above can be used with Table 1, Table 2 or the Phosphorus Ready Reckoner and Table 3 (on page 6) to determine the phosphorus needs of each paddock.

Losses of phosphorus due to soil and animal processes are classified as low, medium or high in New Zealand. This approach has been adapted and described for South Australian conditions (Table 1).

This package presents a method that enables fertiliser rates to be tailored to individual paddocks. It ensures that more fertiliser is used in paddocks with high removal rates, and less is used in paddocks with poor carrying capacity

An example calculation

Your paddock has sandy loam soil, in a 600 mm rainfall zone, growing improved pasture. The paddock supports set stocking on flat to rolling country

➜ *the soil loss factor will be* ***medium*** *(Table 1)*
➜ *the animal loss factor will be* ***low*** *(Table 1)*

Having selected the soil and animal loss factors for your paddock, and taking into account improved pasture, slope and 600 mm rainfall, the appropriate phosphorus rate per DSE is determined from Table 2.

➜ ***0.86 kg P/DSE*** *is recommended*

The next step is to express stocking rate in terms of DSE/ha. Use the average stocking rate for the paddock from the previous year calculated from paddock records. Or use commercially available computer-based farm management programs such as 'Farm Tracker' or 'Paddock Action Manager'. Alternatively, we have developed a computer spreadsheet that does this job. Contact Rural Solutions SA at Snowtown for a copy – see p16 for contact details. If individual paddock information is not available, use an average stocking rate for the farm.

The DSE values for different classes of livestock are shown in Table 3.

In our example, the paddock is stocked with 60 kg wethers, running at 10 head/ha. A 60 kg wether has a DSE value of 1.2, so the stocking rate of the paddock is 10 x 1.2

➜ ***12 DSE/ha***

The amount of fertiliser to apply per hectare can be determined using the following equation:

$$\frac{100 \times \text{kg P/DSE} \times \text{DSE/ha}}{\%P}$$

If single super (9% phosphorus) is used, the fertiliser application rate will be:

➜ $$\frac{100 \times 0.86 \times 12}{9} = 115 \text{ kg single super/ha}$$

Table 1. A description and rating of phosphorus loss factors in sheep and beef cattle grazing systems based on soil type, grazing management and landscape.

Soil loss factors	
Soil type (soil types are described on page 7)	Loss Factor
Loam (rainfall less than 500 mm), recent alluvial soil, red brown earth, rendzina, cracking clay	Low
Loam and sandy loam (rainfall over 500 mm), solodised solonetz and solodic soil, red or brown podzolic	Medium
Podosol (acid sand), lateritic podzolic (ironstone), krasnozem (red clay) and red loam, organic soil	High

Animal loss factors		
Grazing management	Landscape	Loss Factor
Intensive rotational grazing	Flat and rolling (mostly less than 10° slope)	Very Low
	Easy hills (mostly less than 25°)	Low
	Steep hills (1/3 of paddock greater than 35°)	Medium
Set stocked or intermittent grazing	Flat and rolling	Low
	Easy hills	Medium
	Steep hills	High

Table 2. Recommended phosphorus rate (kg P/DSE) for maximum profit, according to loss factors, pasture type and rainfall.

Soil loss factor	**Animal loss factor**	**Undeveloped pasture** *Annual rainfall (mm)* *400*	*600*	*800*	**Improved pasture** *Annual rainfall (mm)* *400*	*600*	*800*
Low	Very low	0.43	0.47	0.50	0.45	0.50	0.55
	Low	0.55	0.60	0.64	0.57	0.64	0.71
	Medium	0.67	0.73	0.78	0.70	0.78	0.86
	High	0.79	0.86	0.92	0.82	0.92	1.02
Medium	Very low	0.63	0.67	0.72	0.65	0. 72	0.80
	Low	0.75	0.81	0.86	0.77	0. 86	0.96
	Medium	0.87	0.94	1.00	0.90	1.00	1.11
	High	0.99	1.07	1.14	1.02	1. 14	1.27
High	Very low	0.82	0.88	0.95	0.85	0.95	1.05
	Low	0.94	1.01	1.09	0.97	1.09	1.20
	Medium	1.06	1.15	1.23	1.10	1.23	1.36
	High	1.18	1.28	1.37	1.22	1.37	1.51

Table 3. Dry sheep equivalent (DSE) values for different classes of livestock, at different live weights

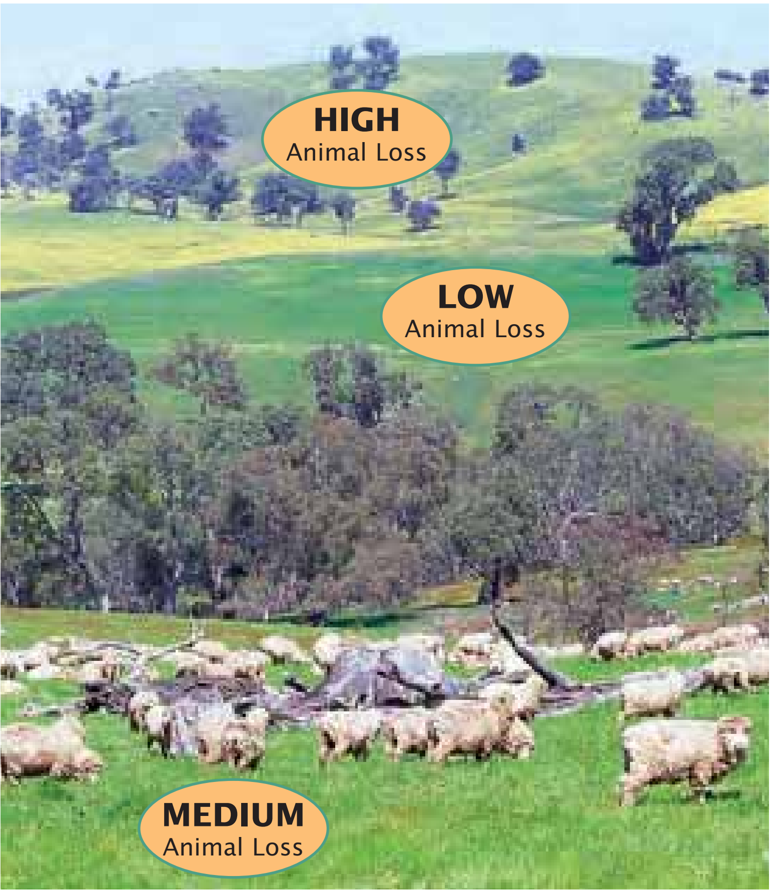
Sheep	**30 kg**	**40 kg**	**50 kg**	**60 kg**
Dry ewes or wethers (maintaining weight)	-	0.9	1.0	1.2
Last month of pregnancy (singles / twins)	-	1.2 / 1.4	1.4 / 1.6	1.6 / 1.9
Lactation (singles / twins)	-	2.6 / 3.7	2.7 / 3.9	2.9 / 4.4
Weaners (growth rate 100 g/day)	1.1	1.3	-	-
Average (year) ewe	-	1.5	1.6	1.8

Beef cattle	**400 kg**	**500 kg**	**600 kg**
Dry cows or store steers (maintaining weight)	6	7	8
Dry cows or store steers (growth rate 0.5 kg/day)	8	11	12
Dry cows or store steers (growth rate 1.0 kg/day)	11	13	15
Last 3 months of pregnancy	8	9	11
Cows with 0-3 month calves	13	14	17
Cows with 3-9 month calves	19	21	24
Average (year) cow and calf	15	16	19

Table 4. Descriptions of soil types listed in Table 1.

Alluvial soil	Formed by deposits from river activity, usually well drained and more fertile than soils derived in situ from underlying rock
Loam	A medium textured soil that when moist, can be worked into a ball, but cannot be rolled out into a ribbon; sand grains cannot be felt
Sandy Loam	A medium textured soil that when moist, can be worked into a ball, but cannot be rolled out into a ribbon, sand grains can be felt
Clay	A heavy textured soil that is hard to work in a ball; but is plastic and can be rolled into a long ribbon when just dry enough not to be sticky
Organic soil	Soil in reclaimed swamps containing mixed inorganic (clay) and organic (peat) constituents
Solodised solonetz	Acid sandy or sandy clay topsoil over a light brown to yellow clay or sandy clay subsoil
Solodic soil	A solodised solonetz that sets hard upon drying in the topsoil and subsurface layers
Lateritic podzol (ironstone)	Sandy to sandy loam top soil containing ironstone gravel over a yellow or white clay
Podosol	Acid loamy sand with no change in texture with depth – containing coffee rock
Red or brown podzolic	Acid sandy loam or loam over brown, yellowish brown or red clay derived from weathered rocks
Red brown earth	Reddish brown sandy loam to loam over a calcareous clay subsoil
Rendzina	Black to grey friable clay over limestone, neutral to alkaline, with a uniform profile
Krasnozem & red loam	Dark red-brown clay with very friable crumb structure; subsoil is a red clay, friable and very porous

Figure 2: A landscape that illustrates the different animal loss factors for phosphorus based on landscape features, as described in Table 1. The landscape features are easy hill country in the foreground, flat and rolling country behind the tree line, and steep hills in the background.



Fodder conservation

Large quantities of nutrients are removed when hay or silage is made. Pasture hay contains about 0.25% phosphorus and 2% potassium, so a 2.5 t/ha hay crop removes about 6 kg P/ha and 50 kg K/ha.

If the fodder is not fed back onto the paddocks from which it was made, the nutrient status of the paddock will decline.

A fertiliser program on hay and silage paddocks should aim to replace the phosphorus and potassium in the hay or silage, *in addition* to phosphorus removed through livestock (kg P/ha) and *in addition* to any phosphorus required to bring the soil phosphorus up to maintenance levels.

Regular soil tests should be taken in summer to monitor fertility of hay and silage paddocks.

Removing hay and not feeding it back will also gradually acidify the soil. About 75 kg/ha of lime is required to compensate for the effect of removing a 2.5 t/ha hay crop.

Increasing stocking rates

Improving pasture quality and grazing management may enable an increase in stocking rate. This will necessarily require more phosphorus fertiliser in order to replace the extra phosphorus removed through the increased production. However, the investment in extra phosphorus should be profitable.

Reworking the calculations outlined in this package, using the increased stocking rate target, will enable you to determine the new phosphorus rate.

Testing and monitoring soil phosphorus

Soil tests for phosphorus are used to assess the level of phosphorus available to plants.

In South Australia soil phosphorus is tested using the Cowell method. The result is often referred to as "Colwell P". Other methods may be used but regardless of the method used, results are expressed in terms of milligrams of phosphorus per kilogram of soil (mg/kg).

Experience at Hamilton indicates that when Colwell P falls below 20 mg/kg, perennial ryegrass fails to persist, and the proportion of poor quality grasses and broadleaved weeds, such as Guildford grass, fog grass, bent grass and cat's-ear increases.

For productive pasture systems in South Australia, the Colwell P level should be at least:

- 25–30 mg/kg, generally
- 35–45 mg/kg for lateritic ironstone soils on Kangaroo Island, and soils of reclaimed swamps on the lower Murray.

Soil testing can be used to monitor soil acidity, and to identify other deficiencies that may arise, such as a lack of potassium or sulphur.

In addition to phosphorus, the nutrients most likely to be deficient in South Australia are sulphur, potassium and trace elements – copper, molybdenum and zinc.

For productive pasture systems, Colwell P should be 25–35 mg/kg generally, or 35–45 mg/kg for lateritic ironstone soils on Kangaroo Island and soils of reclaimed swamps on the lower Murray

Soil tests should be used to assess the status of phosphorus, potassium and sulphur; and to monitor changes over time. A tissue test will confirm sulphur status, as well as assess and monitor trace element status

Monitoring soil phosphorus

Soil test results over several years provide valuable information on trends in nutrient levels. The trend will show if the phosphorus status is increasing, decreasing or remaining stable. The trend then helps verify the need for maintenance or build-up fertiliser applications.

To detect a trend in the soil test, follow the steps as listed:

- Take soil samples from the same places in the paddock at the same time of the year – sampling is best done in early summer.
- Mark your sampling path across the paddock by painting fence posts white, or by marking a landmark. Take at least 30 sub-samples along the sampling path at regular intervals (say each 10–15 paces).
- Take samples from representative parts of the paddock. Do not take samples from stock camps, watering points, under trees or along headlands.
- Samples are best taken with a sampling tool which removes a 10 cm deep core of soil. The concentration of phosphorus in the soil falls off rapidly with depth, so it is vital to collect all samples at the same depth, and make sure that the bottom end of the sample doesn't fall out of the sampler as it is removed from the soil.

More instructions on soil sampling are given in the soil sample kits available from Rural Solutions SA offices.

Designate 10–20% of paddocks as monitoring paddocks and test every two years. Monitoring paddocks should represent a cross section of hay or silage, high stocking rate and low stocking rate paddocks on the farm. Other paddocks can be tested every 5–10 years.

Regular soil testing will prevent excessive quantities of fertiliser being used in future years. Trends in soil phosphorus values should be used to revise the soil loss factors you have chosen in Table 1. For example, if a medium soil loss factor has been used, and the soil test falls with time, try using a high soil loss factor for that paddock or soil type.

Increasing soil phosphorus levels

If the levels of phosphorus in the soil are too low, **capital applications** (i.e. phosphorus in excess of the maintenance application) will be required.

At Hamilton, on a clay loam soil derived from basalt, a capital application of about 5 kg P/ha (i.e. phosphorus in excess of the kg P/DSE shown in Table 2) is required to increase the Colwell P by 1 mg/kg.

Some soils, such as krasnozems (red clays), fix large amounts of phosphorus and require capital applications as much as 7 kg P/ha to increase Colwell P by 1 mg/kg.

In the Adelaide Hills and Kangaroo Island, research has shown a capital application of about 4 kg P/ha will increase Colwell P by 1 mg/kg.

A soil test for the phosphorus buffering index will be available soon to measure phosphorus fixing capacity of soils. This test will provide a more accurate measure of the amount of phosphorus fertiliser required to increase phosphorus availability in different soils.

The following generalisations apply to all soils:

- The higher the phosphorus status of a soil, the greater is the amount of fertiliser phosphorus required to maintain that status.
- The higher the phosphorus status of a soil, the bigger will be the drop in phosphorus if no fertiliser is applied.
- For well-utilised paddocks with a high phosphorus status, omitting fertiliser can lead to shortages of feed in winter if a high stocking rate is maintained.

An example calculation

If you require 0.8 kg P/DSE, and your stocking rate is 10 DSE/ha, the maintenance application of phosphorus required will be 8 kg P/ha.

If however, your soil phosphorus levels are only 20 mg/kg, a capital application is required to lift soil phosphorus to an adequate level, say 25 mg/kg.

To lift the Colwell P by 5 mg/kg in the Adelaide Hills and on Kangaroo Island, a capital application of 20 kg P/ha, in excess of the maintenance application of 8 kg P/ha, is required. The economics of this decision may mean that the capital investment of phosphorus occurs over several years.

Phosphorus fertilisers

Phosphate rock is the main source of phosphorus used in the manufacture of fertilisers in Australia and overseas. This material is insoluble in water, and therefore its phosphorus is unavailable to plants.

Superphosphates are the most common fertilisers used to supply phosphorus to sheep and beef pastures. Superphosphates are produced by reacting phosphate rock with acids, changing the phosphorus in the rock to a form that is water soluble and available to plants.

Some types of phosphate rock, called reactive phosphate rock (RPR), given adequate rainfall and acid soils, will release the phosphorus in a form that plants can use. More information on for the use of RPR on Australian pastures is available on the Internet at: **http://www.latrobe.edu.au/rpr**

The type of phosphorus fertiliser to use depends on the phosphorus and sulphur status of the soil, and to some extent soil type.

Phosphorus status

The most efficient phosphorus fertiliser to increase soil phosphorus levels (as indicated by the Colwell P test) is triple superphosphate.

Reactive phosphate rock releases its phosphorus slowly over several seasons and in most situations is not suitable for increasing soil phosphorus levels (i.e. as capital applications) or where stocking rates are above average.

Reactive phosphate rock used with gypsum as a source of sulphur may be suitable maintenance fertilisers, provided annual rainfall exceeds 700 mm, the growing season is longer than 9 months and the soil pH ($CaCl_2$) is less than 5.2. These conditions are rare in South Australia.

Reactive phosphate rock may be superior to the soluble phosphorus fertilisers for acid sandy soils, as the slower release of phosphorus leads to less phosphorus being leached – provided there is enough growing season rainfall to make the phosphorus available before winter.

Sulphur status

Where a soil test indicates a high level of available sulphur, the use of low sulphur fertilisers such as triple superphosphate is warranted, especially if these are the cheapest source of phosphorus.

Annual sulphur applications are required on pastures in high rainfall South Australia except for on rendzina soils. A soil test from dry soil over summer will indicate the amount of sulphur required. Typical application rates of single superphosphate and sulphur-enriched high analysis fertilisers also apply 10–15 kg S/ha which is generally adequate to maintain sulphur status.

Type of sulphur

Sulphur can be applied as either sulphate sulphur (soluble) or as elemental sulphur (slow release). Single superphosphate contains soluble sulphur (as does gypsum), whilst sulphur-enriched high-analysis fertilisers contain elemental sulphur. Paddocks with a very low sulphur soil test (less than 5–7 mg/kg) should have sulphate sulphur applied. Elemental sulphur is acceptable where soil sulphur levels are above 10 mg/kg. Between 5 and 10 mg/kg, a mix of sulphate and elemental sulphur would be appropriate.

Likelihood of acidification

Phosphorus fertiliser will not directly cause acidification but its increased use will promote acidifying factors such as nitrogen fixation and subsequent nitrate leaching, and product removal. For soils prone to acidification, particularly those with a light-textured topsoil and organic carbon less than 2.5%, the pH of the soil must be monitored. The pH balance is restored with applications of lime. See the "Further reading" list for information about the management of soil acidity.

Priorities for phosphorus fertiliser use

The phosphorus application program over the whole property will be a staged process taking into consideration logistics and economics.

The values in Table 2 will help decide the optimum amount of phosphorus to apply to different paddocks, or major soil types within the farm, thereby maximising the investment for each kilogram of phosphorus applied.

It is possible to further prioritise phosphorus applications based on paddock use, pasture composition and soil tests.

The information below is based on practical experience of factors that drive responses to phosphorus fertiliser.

Proposed use

Paddocks with the greatest need for phosphorus are those that run pregnant, lactating or fattening stock, or where hay or silage is to be made. Phosphorus fertiliser improves pasture quality, as well as pasture production, and stock will respond profitably to high quality herbage.

Anticipated stocking rate

The need for phosphorus fertiliser increases as the stocking rate increases and more pasture production is required.

If available pasture contains more than 10% old pasture (on a dry matter basis) in August, the pasture is under-used or over-fertilised. Alternatively, poor quality pasture may be preventing stock eating all that is available.

Spreading the same amount of fertiliser per hectare over the whole farm is unlikely to give the best return for the money invested

Pasture type

Paddocks can be classified into different categories depending on their potential response to phosphorus fertiliser. For a given soil test value, it is likely that the paddocks with the best pasture composition will give the highest response to phosphorus fertiliser.

Four different pasture types are listed in order of priority for phosphorus fertiliser applications:

1. **Re-sown pasture:** applying fertiliser on re-sown pasture protects the investment already made. It is essential to apply adequate nutrients following pasture renovation.
2. **Good pasture:** pasture that consists mainly of sown perennial grasses and annual or perennial legume.
3. **Moderate pasture:** sown perennial grass and clover is present, but there is also Guildford grass, bent grass or silver grass. Capeweed and barley grass may also be present.
4. **Poor pasture:** run-down pasture where sown species are inconspicuous, and the sward is dominated by Guildford grass, silver grass and cat's-ear. Clover, if present, is stunted with small dark-green leaves indicating nutrient deficiency.

Phosphorus status of paddock

The lower the soil phosphorus status, the greater is the likely response to phosphorus fertiliser, provided other nutrients are non-limiting and the pasture is not run down.

If the soil phosphorus level is not known, consider the amount of phosphorus applied in the last four years or the soil test results from similar paddocks. It is best, however, to soil test the paddock.

Other soil-related factors

Excessive salinity, high aluminium, excessive acidity, waterlogging or a lack of water-holding capacity will limit the extent to which pastures will respond to phosphorus.

Responsible fertiliser use

A well-fertilised and well-managed improved pasture is responsible land management. The benefits from dense, perennial grass based pastures on fertile soils are:

- improved ground cover
- reduced water run-off
- higher water use compared to annual grass based pastures

Most soils readily 'fix' applied phosphorus, where it remains in the top few centimetres of soil. Research into phosphorus run-off at the Hamilton Long-term Phosphate Experiment has shown losses of applied phosphorus to be, at most, 0.3% – even at high application rates (more than 20 kg P/ha every year for 20 years). However, even small amounts of phosphorus can contribute to environmental problems in waterways, impact on flora and fauna habitat and ultimately affect the marine environment.

Best practice in applying phosphorus fertiliser can minimise nutrient loss and reduce any impact on the environment.

Current best practices for phosphorus fertiliser application are:

- Avoid applying fertiliser when ground cover is less than 70%, or land is over-grazed, or affected by drought or flood.
- Prevent fertiliser entering waterways and water storages during application.
- Do not apply fertiliser if heavy rain is forecast within four days.
- Avoid applying fertiliser to waterlogged soils or soils likely to flood soon after application.
- Locate fertiliser storage areas away from potential run-off areas.

Best practice in applying phosphorus fertiliser can minimise nutrient loss and reduce any impact on the environment

Phosphorus fertiliser is best applied in autumn to paddocks with at least 70% ground cover

Further reading

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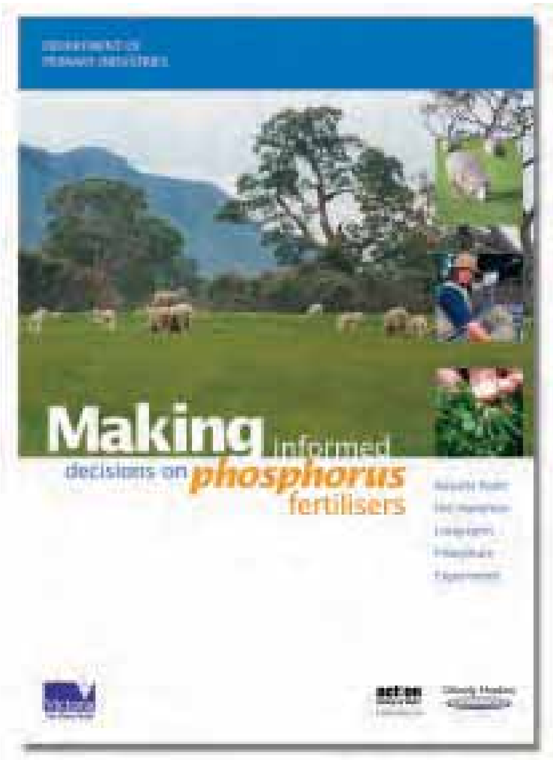

A summary of the results from the Hamilton Long-term Phosphate Experiment is reported in the publication: *Making informed decisions on phosphorus fertilisers* and is available from:

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