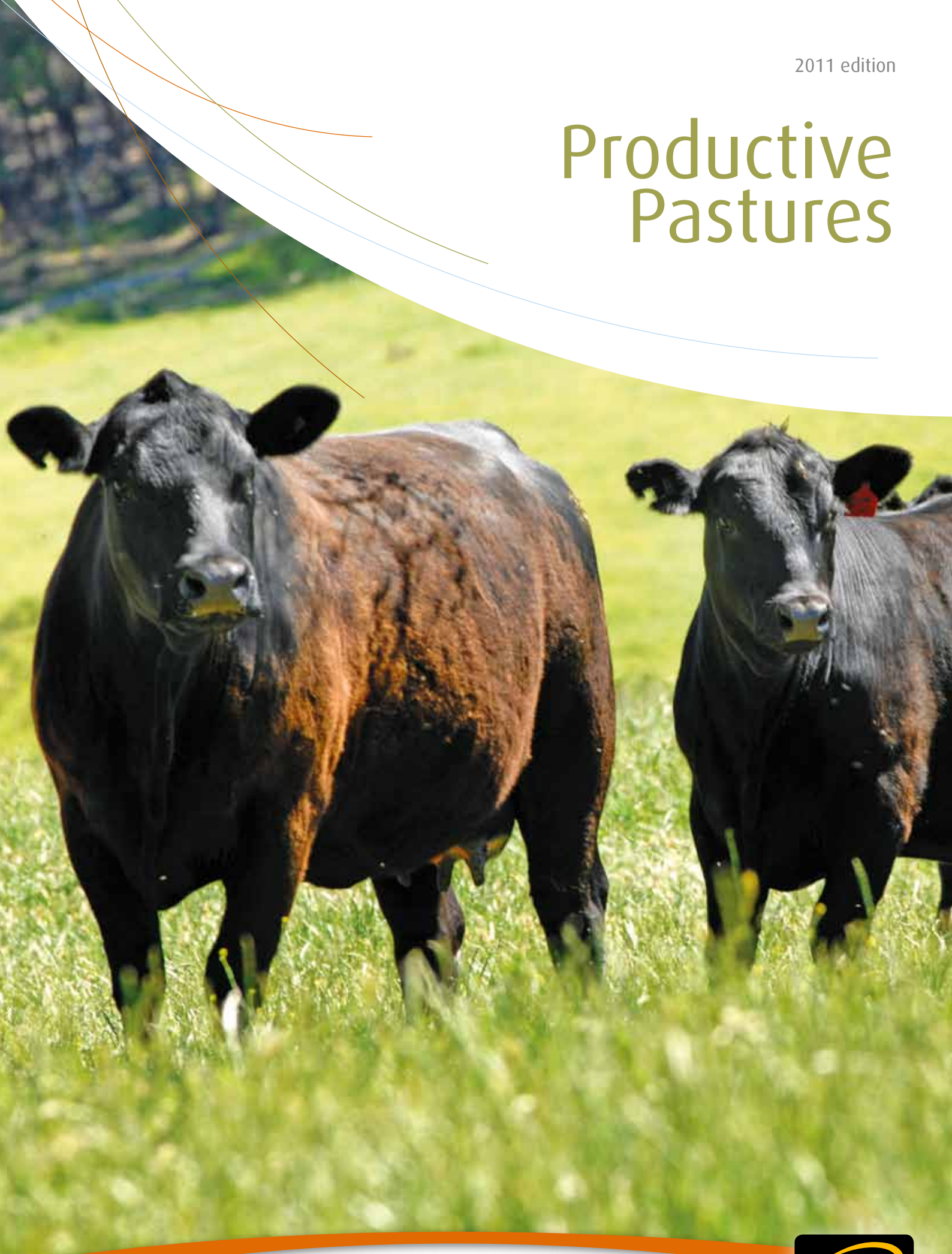
2011 edition

Productive Pastures



Incitec Pivot Fertilisers is Australia's reliable leader in soil and plant nutrition, investing locally in agronomic solutions to help Australian farmers remain globally competitive. **www.incitecpivot.com.au**

Incitec Pivot

CONTENTS

Soil fertility

A balanced soil is needed to grow productive pastures.

The best way to ensure paddocks are fertile and pastures are free from nutrient deficiencies is to soil test.

Soil testing gives graziers and their advisers a better understanding of the nutrient levels in their soils. With this knowledge, they can develop a cost effective fertiliser program that can help meet their production goals.

Soil testing is also used to monitor and assess the suitability of management practices over time and to help diagnose production limiting problems. Records kept over a number of years are valuable for ongoing management.

Soil tests should be taken in all paddocks every three to five years. If there are any significant changes to paddock management, it may be worthwhile to test more regularly.

Ensure that soil samples are sent to a reliable, quality assured laboratory. Nutrient Advantage® Laboratory Services is NATA accredited (ISO/IEC 17025), Fertcare accredited and ASPAC certified.

National Association of Testing Authorities (NATA) accreditation means the laboratory has effective quality management systems and is technically competent.

The Australasian Soil and Plant Analysis Council (ASPAC) coordinates inter-laboratory proficiency programs and certifies laboratories on a test-by-test basis.

Informed fertiliser recommendations are just as important. They should include paddock-by-paddock strategies with information on fertiliser and ameliorant products, rates and application times.

Talk to your Nutrient Advantage Advice accredited agronomist or contact Nutrient Advantage on 1800 803 453 to ask about soil analysis today.

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Soil testing makes the difference

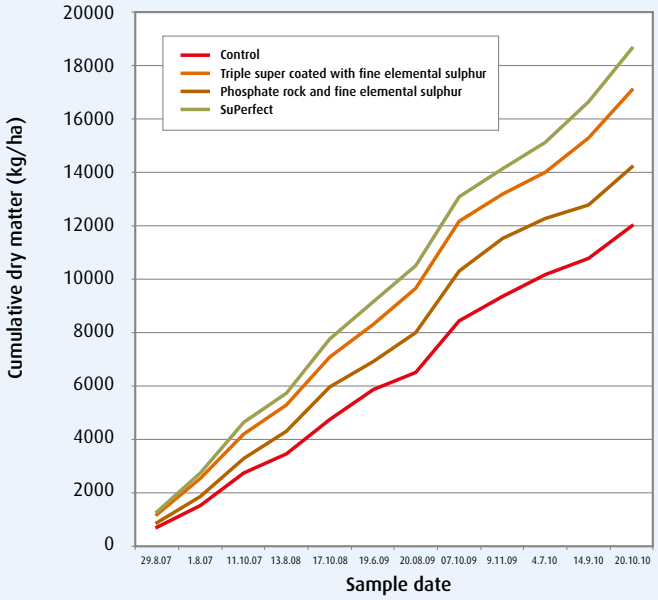
An Incitec Pivot Fertilisers trial at Marcus Hill near Geelong shows the value of soil testing as a basis for fertiliser decisions.

In May 2007, a soil test at the site showed phosphorus levels of 17 mg/kg (Colwell P) with a PBI of 130 and sulphur levels of 18 mg/kg (KCL-40). This suggested that the site would respond to fertilisers with phosphorus, such as SuPerfect® fertiliser.

A range of fertiliser treatments were applied each autumn and results measured by dry matter production.

The application of 170 kg/ha of SuPerfect in 2007, 2008, 2009 and 2010 resulted in the greatest cumulative dry matter response and greatest improvement in soil phosphorus levels, compared with the other products tested.

Cumulative dry matter production, 2007 to 2010



Each fertiliser product was applied at 15 kg P/ha. Source: Incitec Pivot Fertilsers, Marcus Hill, Victoria, 2010.

"Pastures need access to readily available nutrients such as phosphorus and sulphur prior to the autumn break for strong growth."

Topdressing your pastures for autumn

Most graziers topdress their pastures in late summer or early autumn to boost pasture growth and maintain soil fertility.

Pastures need access to readily available nutrients such as phosphorus and sulphur prior to the autumn break for strong growth.

This is an important time of year to lift pasture growth before it naturally slows during the cooler months.

For best responses, pasture fertilisers should be applied before the opening rains and before the clover has germinated, particularly if soil fertility is below optimum levels.

In pastures containing perennial legumes such as lucerne and white clover and in higher rainfall areas, spring topdressing can be just as effective as autumn applications.

The fertilisers needed and the rates required will depend on existing soil fertility and production targets.

Nutrient ratio

The importance of sulphur in pastures is often underestimated.

If a soil test reveals that sulphur fertility is low, it is particularly important to choose a fertiliser that contains at least 30% of its sulphur as plant available sulphate sulphur.

In situations where potassium responses are likely, potassium may be included as a blend ingredient with the autumn topdressing or applied in a spring application.

Concentration and coverage

For best results from pasture topdressing, it is important to ensure optimum distribution of the nutrients to the pasture.

In most soils, phosphorus will only diffuse distances of up to 5 cm from the fertiliser granule. It is only used by plants when their roots contact the soil zone immediately surrounding the fertiliser granule.

Lower analysis fertilisers, such as SuPerfect, allow graziers to apply more granules per square metre than higher analysis fertilisers, to feed pastures more evenly.

This can be particularly important when phosphorus is applied at low rates and when phosphorus is applied to soils with lower phosphorus fertility.

Fertilisers for autumn

Fertiliser	Analysis	Comments
SuPerfect	8.8% phosphorus, 11% sulphate sulphur, 19% calcium	Single superphosphate in a quality granule. SuPerfect contains a good balance of readily available nutrients to meet the needs of pastures for a quick response.
Prolong®	10% phosphorus, 30% calcium	Prolong is a bioactive, NASAA certified organic phosphate fertiliser. Prolong only contains a small amount of immediately available phosphorus, however will provide a sustained phosphorus release compared with high water soluble phosphorus sources under certain conditions. Consider Prolong where soils are acidic (<pH 6.5 in water), annual average rainfall is >550mm in southern Australia and phosphorus losses are likely due to surface runoff.
Granulock® S	16% nitrogen, 16.7% phosphorus, 12% sulphur	Granulock S is a quality fertiliser where a balance of nitrogen, phosphorus and sulphur is needed.
SuPerfect 26S	7% phosphorus, 26% sulphur, 15% calcium	Contains an extra sulphur boost where high levels of sulphur are required. Only available in NSW.

Building and maintaining soil fertility

As well as addressing any nutrient deficiencies, graziers may need to apply phosphorus and sulphur fertilisers every year to sustain high levels of production.

High performing, improved pasture species require good soil nutrition. Nutrients are removed from the system over time. See table below, which shows typical nutrient removal rates for a range of products.

Nutrient response curves are used to determine the expected production response to fertiliser applications.

They allow farmers to assess whether they have adequate soil nutrient levels to reach their pasture production targets.

For example, consider an extensive sheep/beef enterprise with a Phosphorus Buffering Index of 130 and a current Colwell P of 17 mg/kg. To achieve 95% of potential pasture production would require an increase in the phosphorus status of the soil to around 36 mg/kg. See graph below.

Knowing where each paddock's soil phosphorus level sits in relation to these critical values gives graziers the power to better manage soil fertility, fertiliser applications, pasture productivity and stocking rates.

Your adviser can use this information to determine appropriate maintenance and capital fertiliser applications to meet your targeted stocking rates.

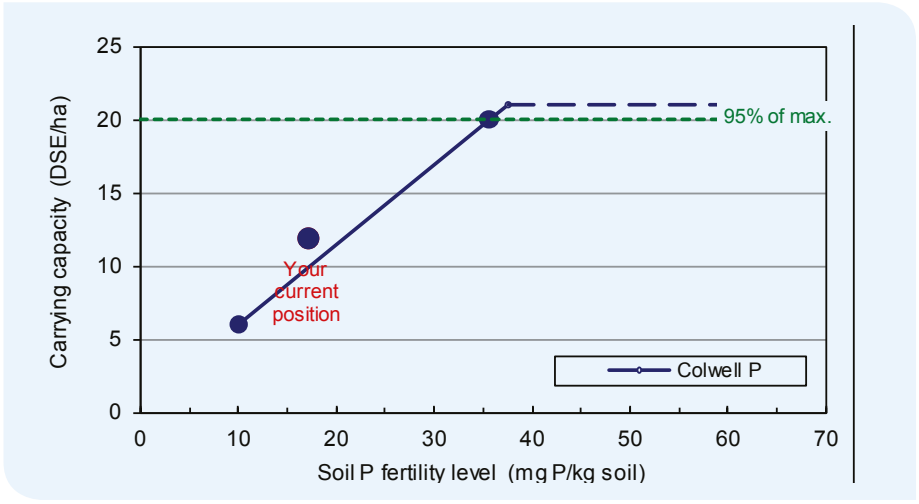
To explore these response curves further, take a look at the handy calculation tool on the Meat and Livestock Australia website called 'Five easy steps to ensure you are making money from superphosphate'.

Typical nutrient removal rates (kg of nutrient per tonne or kilolitre of product)

Product (1 t or kL)	N	P	K	S	Ca	Mg
Mixed pasture/hay	18	1.8	15	1.6	5	1.8
Lucerne hay	28	2	24	2.6	9.9	2.7
Cattle (live ex farm gate)	26	7.2	2	1.4	12	0.4
Sheep (live shorn ex farm gate)	23	5.9	2.1	1.4	11	0.4
Merino, greasy fleece	119	0.3	15	22	1.8	0.59
Milk (cow)	5.3	0.93	1.6	0.3	1.2	0.10

Source: National Land and Water Resources Audit Project, Nutrient Balance in Regional Farming Systems and Soil Nutrient Status, Appendix 6, September 2001.

Potential carrying capacity



Graziers can use the new Five Easy Steps tool to create a soil fertility and carrying capacity relationship which reflects their farming conditions to see the potential for improvement on their farm. This tool is intended to asssist farmers in determining suitable levels of phosphorus fertilisation of temperate pastures grazed by sheep and beef cattle on acid soils in southern Australia. Source: Five Easy Steps to ensure you are making money from superphosphate, CSIRO and Industry and Investment NSW, 2011.

Micronutrients and your pastures

Plants require micronutrients in very small amounts compared with nitrogen, phosphorus, potassium and sulphur.

However, the micronutrients can be just as important, because a plant's production is limited by the nutrient in shortest supply to its requirements.

Copper, zinc, boron and molybdenum are all critical to pasture growth.

Micronutrient deficiencies may also affect animal health.

Soils usually only have trace levels of these nutrients which makes them difficult to quantify accurately in soil testing.

Leaf tissue testing is the best way to assess micronutrient status.

Molybdenum

Molybdenum is particularly important for legume growth. Pastures grown on acidic soils in higher rainfall areas tend to need more applied molybdenum.

A deficiency in molybdenum in legume pastures will show up as stunted growth and rhizobium nodules will be pale and colourless, rather than a healthy pink colour.

In non-legume plant species, a deficiency in molybdenum blocks the nitrate conversion to amino acids, so visual symptoms will appear similar to a nitrogen deficient crop.

Excess molybdenum in the plants does not affect plant growth, but it can impact on animal health.

Plants high in molybdenum (or low in molybdenum and high in sulphur) can induce copper deficiencies in livestock.

An application of 50 to 100 g/ha of molybdenum every five years is generally adequate, except in rainfall zones higher than 1,000 mm/year or on high phosphorus fixing soils.

Molybdenum can be applied with SuPerfect.

Copper

Because copper is an important animal nutrient, deficiency of copper in pastures may be detrimental to animal health.

There is an important interaction between copper and molybdenum in animal health.

Where a high concentration of molybdenum relative to copper occurs in herbage, an application of molybdenum may induce copper deficiency in animals.

Copper should therefore be applied with molybdenum if the concentration of copper in pastures is marginal.

Copper levels in stock should be monitored with blood tests, particularly in intensive enterprises.

Copper can be applied as a foliar spray or blended with SuPerfect.

Establishing improved pastures

Phosphorus fertiliser should always be used at sowing. When drill sowing, some phosphorus should be placed in the row with the seed.

A failure in early phosphorus nutrition can significantly impact on the pasture's ability to thrive.

An Incitec Pivot Fertilisers trial at the Southern Farming Systems trial site near Dunkeld in Victoria in 2009 showed a significant response to 340 kg/ha of SuPerfect drilled with the seed, compared with the same fertiliser broadcast.

Where the fertiliser was applied with the seed, the pasture produced 4,660 kg DM/ha at first cut.

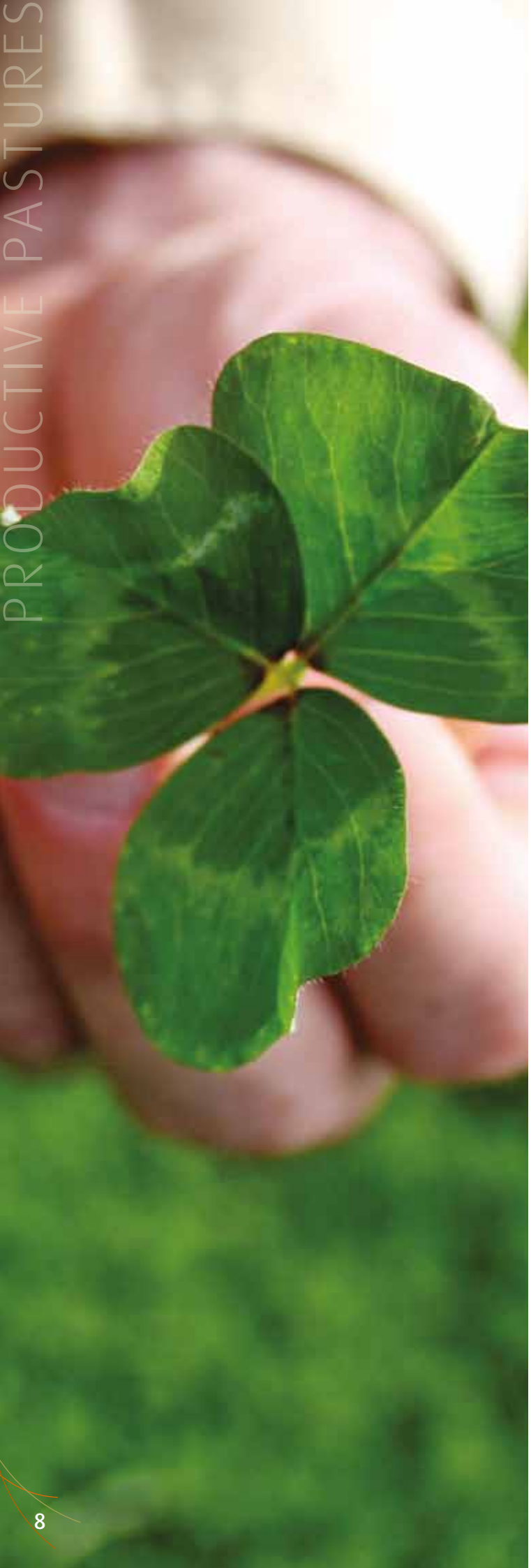
Where it was broadcast, it produced 2,607 kg DM/ha at first cut.

A fertiliser with phosphorus, sulphate sulphur and a lesser amount of nitrogen is ideal for sowing.

Alternatively, nitrogen can be applied four to six weeks following seedling emergence, following the first light grazing.

Tips for pasture establishment

- Start building soil fertility and controlling competitive weeds 12 to 18 months before sowing.
- Sow pastures in autumn or early spring so that the new plants receive adequate warmth and moisture for quick germination and survival.
- Direct drill, sowing into ploughed ground and oversowing are reliable and effective sowing techniques. However, less plant available sulphur is released during sowing by direct drill and oversowing, making a fertiliser with sulphate sulphur particularly valuable when using these methods.
- Band the fertiliser to the side of or below the seed row where it is easily accessible to the new roots.
- Based on 18 cm row spacings, never apply more than 15 kg/ha of nitrogen in close contact with the seed.
- Control weeds and pests before and after sowing.
- Only begin grazing the pasture when plants have begun to tiller out and are at least 10 cm high (use the pull test).
- Keep grazing light at first to promote tillering.



Topdressing your pastures with nitrogen

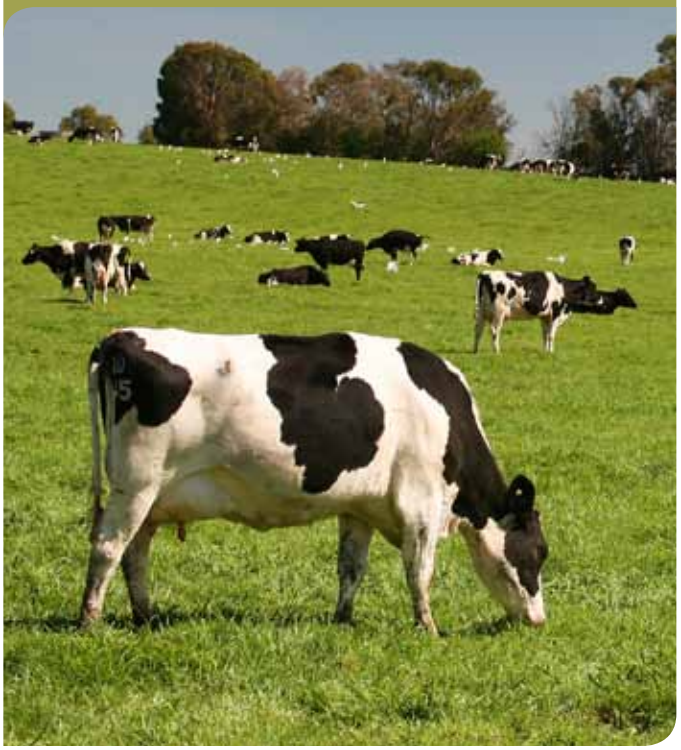
Nitrogen fertilisers can be used to provide additional dry matter responses above normal daily pasture growth rates. Many graziers use nitrogen to boost pasture growth and create a feed wedge coming into winter.

Choose pastures which have good base fertility and good densities of desirable pasture species, with few weeds or insects.

Nitrogen rates should be a minimum of 30 kg/ha to a maximum of 50 kg/ha. Applications should be made immediately following grazing and prior to rainfall or irrigation.

Autumn and winter responses to nitrogen fertiliser are usually in the order of 10 kg of dry matter per kg of nitrogen applied or 250 to 500 kgDM/ha above normal growth rates.

While urea is still the most commonly used nitrogen fertiliser, there are other nitrogen fertilisers suitable for boosting pasture growth.



Nitrogen fertilisers

Fertiliser	Analysis	Comments
Green Urea™	46% nitrogen	Urea enhanced with a urease inhibitor to help protect the fertiliser from volatilisation losses.
Urea	46% nitrogen	The most common nitrogen fertiliser. Can be topdressed to pastures closely after grazing and before rain or irrigation.
EASY N®	42.5% nitrogen (w/v) – 21.5% as urea (w/v), 10.5% as ammonium (w/v), 10.5% as nitrate (w/v)	Ideal for small, repeat applications. EASY N contains plant available nitrate nitrogen which can provide quicker responses on cold soils compared with urea.
Cal-Gran®	23.9% nitrogen – 16.5% as ammonium, 7.4% as nitrate – 10.8% sulphur, 4.4% calcium	Cal-Gran contains immediately plant available nitrate nitrogen which can provide quicker responses on cold soils compared with urea. Can be blended with other fertilisers.

Green Urea

Green Urea™ fertiliser offers the same benefits as urea with the added security of a urease inhibitor.

This helps protect the fertiliser from volatilisation losses, allowing more time for the urea to be incorporated into the soil, helping more applied nitrogen to be available for your pastures.

This is a good option if follow-up rainfall or irrigation is unlikely within a few days of application.

EASY N

EASY N® fertiliser is a liquid nitrogen fertiliser which can be sprayed on to pastures to boost growth.

It is ideal for small, repeat applications, such as applying 50 L/ha of EASY N after each grazing with a boomspray. EASY N can cause foliage burn, so applications with flat fan nozzles should be applied immediately post grazing to minimise leaf area contact. Streaming nozzles can also assist in minimising leaf burn. EASY N can also be applied through centre pivots and with other irrigation systems.

Because EASY N contains one quarter of its nitrogen as plant available nitrate nitrogen, it can provide quicker responses on cold soils than urea.

While follow-up rain or irrigation is needed to carry the fertiliser into the soil, EASY N has a lower volatilisation loss potential than urea.

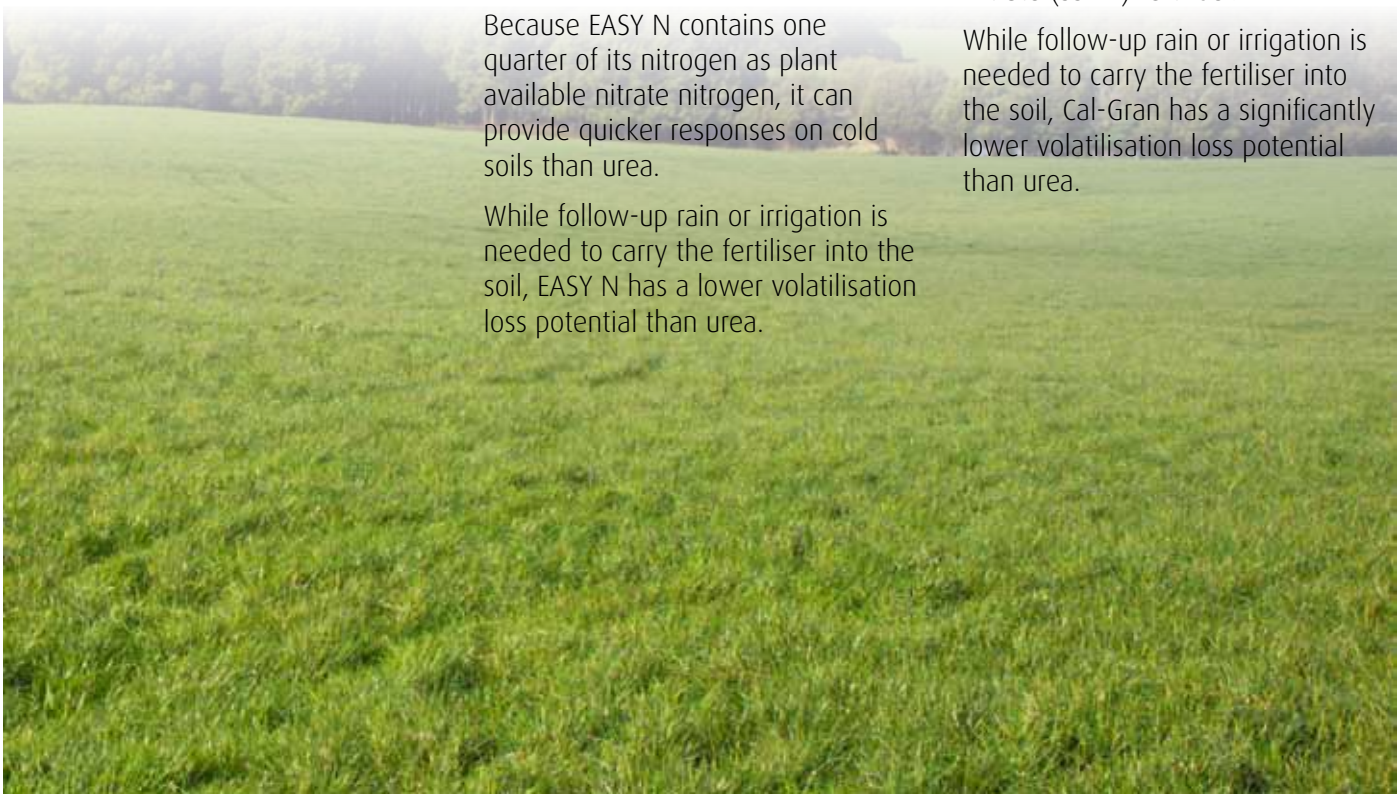
Cal-Gran

Cal-Gran® fertiliser contains immediately plant available nitrate nitrogen for quicker responses in pastures than urea, particularly from late autumn to early spring when soil temperatures are cooler.

It contains 23.9% nitrogen, with 7.4% as nitrate nitrogen and 16.5% ammonium nitrogen. It also contains 10.8% sulphur and 4.4% calcium.

Cal-Gran can be blended with other fertilisers to match specific nutrient requirements and is not classified as a Security Sensitive Ammonium Nitrate (SSAN) fertiliser.

While follow-up rain or irrigation is needed to carry the fertiliser into the soil, Cal-Gran has a significantly lower volatilisation loss potential than urea.



Making the most of spring

Nitrogen, phosphorus and potassium applied leading into spring can improve the quantity and quality of silage and hay.

The first consideration in selecting a fertiliser to bring spring forward or boost hay and silage growth should be the nutrient requirements of the paddock, based on paddock history or previous soil test results.

Spring pasture growth rates naturally increase in response to more favourable growing conditions. Nitrogen applications can further accelerate fodder growth, but other nutrients may be required to make the most of nitrogen fertiliser applications.

Potassium is a key nutrient for hay and silage production, as large amounts can be removed at cutting.

Paddocks with a long history of hay and silage production and soils where potassium levels are known to be below critical values should respond best to potassium fertilisers. Where potassium levels are close to critical values, maintenance applications can be made.

Be aware that applying excess potassium is not only an unnecessary expense, it could lead to animal health problems such as hypomagnesia (grass tetany), which is due to the imbalance between the luxury plant consumption of potassium at the expense of magnesium.

Soil testing is the best way to determine whether potassium fertiliser is needed.

Where possible, avoid grazing pastures where spring pasture fertilisers have been applied for at least three weeks.

Avoid grazing fodder crops for six to eight weeks.

Fodder harvest quality can be adversely affected if left too long between closing the paddock to grazing and harvesting the fodder.

Good grazing management and fodder harvesting management is essential to maximise the benefits of applying nitrogen.

Aim to graze ryegrass at the three leaf stage, except in spring when ryegrass can be grazed as early as the two to two and half leaf stage. Aim to graze phalaris and fescue grasses at the four to five leaf stage.

Fertilisers for spring

Fertiliser	Analysis	Comments
GrassBoosta™	29.9% nitrogen, 15% sulphur	Excellent for applying to pastures coming out of winter, because of the combination of nitrogen and sulphate sulphur.
PastureBoosta®	23.8% nitrogen, 3.7% phosphorus, 13% potassium, 4.1% sulphur	A balanced NPKS fertiliser that is ideal for pastures with a higher percentage of grass than clover.
HayBoosta®	11.7% nitrogen, 4.7% phosphorus, 23.9% potassium, 4.6% sulphur	A specially blended fertiliser for hay paddocks and pastures with a higher legume content. It is best applied when closing up paddocks to bulk up the pasture quickly and grow better quality hay.
FodderBoosta®	11.5% nitrogen, 7.6% phosphorus, 19.5% potassium, 6.1% sulphur	Great for fodder crops and in situations where soil phosphorus and potassium levels need a boost.
SuPerfect	8.8% phosphorus, 11% sulphate sulphur, 19% calcium	SuPerfect contains the right balance of readily available nutrients to meet the needs of legume based pastures. Can be blended with Muriate of Potash.
Muriate of Potash	50% potassium	A high analysis potassium fertiliser that can be blended with other fertilisers or used alone.
Granulock S	16% nitrogen, 16.7% phosphorus, 12% sulphur	Granulock S is a quality fertiliser with a balance of nitrogen, phosphorus and sulphur. It can be blended with Muriate of Potash.

Soil pH and nutrient availability

Soil pH is a measure of a soil's acidity or alkalinity on a scale of 0 to 14.

A pH of 7 is neutral, with acidity increasing with every number down the scale and alkalinity increasing with every number up the scale.

The pH scale is exponential, which means a pH of 6 is 10 times more acidic than 7 and a pH of 5 is 100 times more acidic than 7.

The best way to understand your soil pH is to conduct a soil test.

It is important to know the pH of soils because it can affect the availability of nutrients to plants. See figure below.

In very acidic soils, the availability of some nutrients such as phosphorus, calcium, magnesium and molybdenum is very low.

The rhizobium bacteria in the nodules of legumes that fix atmospheric nitrogen are less effective in strongly acidic conditions. Molybdenum, required by these rhizobia, is less available at pH ($CaCl_2$) levels below 5.0.

In strongly acidic soils, aluminium and manganese, which are usually insoluble in the soil, become more soluble to the point where they can become toxic. Plants which prefer more alkaline conditions, such as lucerne, are very susceptible to aluminium toxicity.

Soil acidity is corrected by applying liming products.

Lime, or calcium carbonate, is made from pulverising limestone, marble, shells or coral to create a product that can be spread. If lime contains more than 8% magnesium, it is called dolomite.

Lime works by neutralising hydrogen ions in the soil, which leads to the soil's pH increasing.

How much lime?

Soil test CEC (meq /100g)	Lime required (t/ha) to lift the pH of the top 10 cm			
	From 4.0 to 5.2	From 4.3 to 5.2	From 4.7 to 5.2	From 5.2 to 5.5
1	1.6	0.8*	0.3*	0.2*
2	2.4	1.2	0.5*	0.4*
3	3.5	1.7	0.7	0.5*
4	3.9	2.1	0.9	0.6
5	4.7	2.5	1.1	0.7
6	5.5	3.0	1.2	0.8
7	6.3	3.3	1.4	1.0
8	7.1	3.8	1.6	1.1
9	7.9	4.2	1.8	1.2
10	8.7	4.6	1.9	1.3
15	12.5	6.7	2.8	1.9

This table shows the limestone required (fine and NV>95) to lift the pH of the top 10 cm of soil. *Low rates of lime are impractical to apply, but over-liming can cause nutrient imbalances, particularly in light soils. Do not apply more than 4 t/ha in a single application. Source: AgFacts 'Soil acidity and liming', NSW DPI, B.Upjohn, G.Fenton, M. Conyers, 1995.

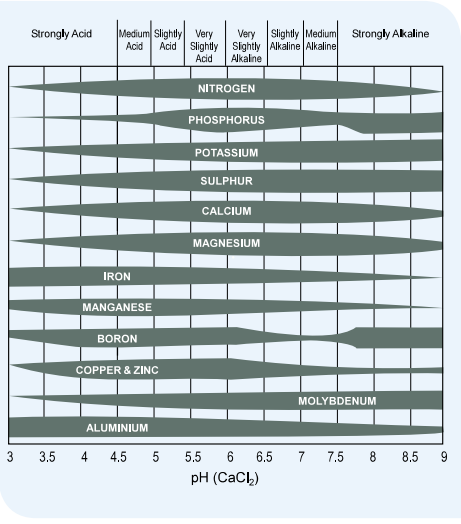
By applying a liming product, the availability of phosphorus, calcium, magnesium and molybdenum can increase, while reducing the availability of aluminium, manganese and iron.

Gypsum

Gypsum does not alter soil pH, but can be used to address the breakdown of soil structure, in particular, sodic soils. Excess sodium disperses the soil particles, limiting movement of air and water, so water tends to pond on the soil surface.

To better understand your soil's lime or gypsum requirements, conduct a soil test and consult your agronomist.

Influence of pH on nutrient availability



Source: Australian Soil Fertility Manual, J.S. Glendinning, Fertilizer Industry Federation of Australia and CSIRO, 1999.

For further information and advice on fertilisers for your farm, see your local Incitec Pivot Fertilisers Distributor.

Contact Incitec Pivot Fertilisers on 1800 009 832
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