

Soils & Pasture for Small Farms

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Productive
Landscapes

Soil, pasture and livestock are interrelated and influence each other
Pasture is the major determinant of livestock growth and health
There is a huge amount of freely available research and information on this topic

Soils for pasture

Fertility is very important, up there with rain, pasture species and grazing management in terms of determining pasture growth.

Nitrogen (N), Phosphorus (P), Potassium (K) and Sulphur (S) are the key elements required, plus many others in smaller amounts.

N is very mobile and changes quickly, difficult to test. Pasture legumes, manures and fertiliser will add N. Adding large amounts in single applications is highly inefficient and usually polluting (greenhouse gases, algal blooms). Pasture legumes are the cheapest and most efficient method, but pretty slow during winter.

P is not very mobile and doesn't change quickly, except when soil erodes. Most Australian soils are very low in P. The Olsen P test value of 15-20 is ideal of pasture production. Above that won't help pasture grow (and much higher may cause other problems), below that will slow it down. P can be added with fertiliser or manures.

K is moderately mobile, it can leach out in sandy soil. The

Sand: 126	Medium soil: 143
Sandy loam: 139	Clay: 161

K is added through compost, manures, fertiliser and feed – particularly hay. At very high K levels (500+), livestock health can be compromised. If feeding stock with a lot of hay or straw, ensure it gets spread across the property rather than always in the same paddock – but watch out for weeds in the hay.

S is also moderately mobile, and is usually added as part of other fertilisers such as superphosphate or sulphate of ammonia. Ideal levels vary according to which test is used.

Organic Carbon is very important as it influences many processes like water holding, nutrient recycling, soil biology etc. The amount of carbon that can be stored in soils depends on temperature, rainfall and soil type. Clay soils store more than sand. A healthy pasture is the best way to build and maintain soil carbon. Aim for 3% or higher on sandy soils, 5-7% on clay.

Soil Acidity is a common problem in pastures as many different natural and agronomic processes gradually increase hydrogen ion concentration in the soil. Ideal pH values for pasture are between 6 and 6.5. Below pH 6, nutrient availability for plants changes and problems occur as pH gets lower and lower. Soil acidity is usually resolved by addition of lime. Dolomite and gypsum also work but contain other nutrients as well (magnesium for dolomite and sulphur for gypsum) so these are good options if your soil is also missing those nutrients. If your soil has adequate magnesium already, use lime instead of dolomite.

Testing for soil fertility is quite straightforward. Contact a testing lab or fertiliser company for details and information on sampling procedure. If you intend to manage soil fertility to improve your pastures, testing first is the best way to avoid wasting time and money.

Soil Structure is difficult and expensive to improve, but cheap and easy to damage. The simple way to maintain good soil structure is to keep livestock and tractors off paddocks when they're waterlogged.

Soil Biology is difficult and expensive to measure. Earthworms and dung beetles should be encouraged, but there are plenty of pests as well. Healthy soil with a mixed pasture above it will minimise most problems.

Pasture for livestock

Think about what you want to get out of your pasture, then how to achieve it within your means.

The ideal pasture ***grows quickly all year round, will last forever, and provides a rich and balanced diet for livestock***. This does not happen, but you can aim to get close to it.

⇒ ***Grows Quickly All Year Round***

- Irrigate during dry times if at all possible (except if the water is salty)
- Maintain soil fertility (legumes will help)
- Use a carefully designed mix of pasture species that will grow at different temperatures
- Use perennial species that can take advantage of rain anytime
- Don't overgraze! Really short pastures can't grow as quickly as ones which still have decent leaf and root reserves – aim for minimum 5cm depth of pasture
- Don't undergraze – tall, rank pasture stalks will reduce future growth

⇒ ***Lasts Forever***

- Maintain soil fertility (legumes will help)
- Maintain soil structure – avoid pugging of wet paddocks by livestock
- Don't overgraze! Overgrazed paddocks aren't good at regenerating or competing against weeds
- Use perennial species and rest the pasture at times to allow them to reproduce
- Control pasture pests at times of serious outbreaks

⇒ ***Provides a Rich and Balanced Diet***

- Maintain soil fertility (legumes will help)
- Use a range of pasture species, including legumes and herbs like chicory, so that animals can select what they need and medicate themselves
- Diversity within and between paddocks will help – while pasture is the cheapest feed, it's not always balanced
- The nutritive value of pasture depends on the type of plant and is also influenced by plant growth stage –
 - young grass is rich in protein but low in energy
 - mature green grass is high in energy but lower in protein
 - dry old grass is only high in fibre
- The nutritional needs of livestock can also change –
 - Growing, pregnant and lactating stock have much higher protein and energy needs
 - Smaller animals need richer food than large stock like cattle
 - Protein in excess of what the animal needs is wasted, but also causes energy to be wasted

Pasture Ecology

Pastures are complex ecosystems and a basic understanding of ecology will help you manage them. You can strongly influence key elements like the timing and intensity of grazing, the number and types of animals on the pasture, the soil nutrients and the mix of pasture species.

Consider pasture legumes as an example. Legumes are high quality feed and improve pasture growth by adding nitrogen, but are often absent from smaller pastures. Why?

Well, just imagine you're a clover plant:

"I'm the tastiest thing here in the paddock, but the soil type isn't the best for me, it's too cold most of the year, and there's isn't enough phosphorus for me to grow fast. Worst of all, I never get a rest. Sheep hammer me by day, and I get hunted by possums at night, so I can never build up my reserves and make seeds. The grass all around me is really aggressive and grows roots and leaves too fast for me to keep up and compete. It's hopeless, I don't think I'll make it through the summer."

There are a wide range of pasture legumes available in Tasmania. They vary in preferred soil type, water needs, vigour and growth habit. There are annual and perennial options. Some clover species have really long roots to survive droughts. Others spread and partially grow underground to resist overgrazing. And some types of legumes grow quickly to compete with grass.



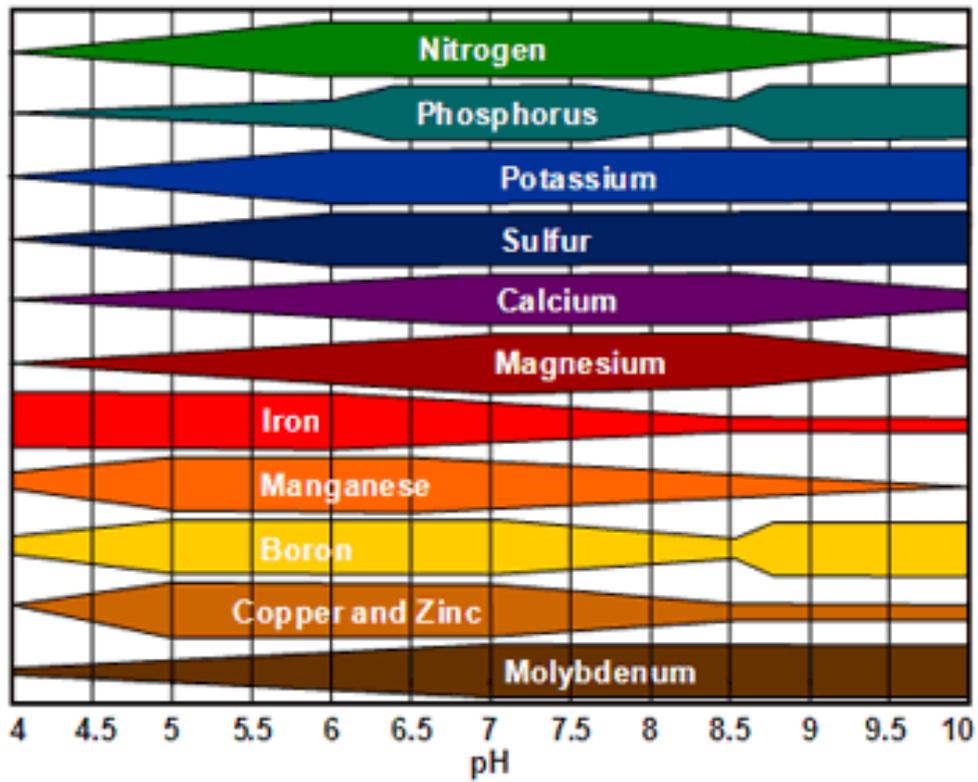
Choose the right kind of pasture plants for your situation, ensure adequate soil fertility, and control both domestic and wild grazing.

- Remember that wallabies and possums will overgraze and ruin your pastures if in high numbers!
- Parasitic worm problems can be minimised through rotational grazing, including chicory in the pasture, and by using different animals together
- Pasture weeds thrive in poorly-performing and badly managed pasture, but they have a hard time competing against a thick, vigorous pasture – and goats

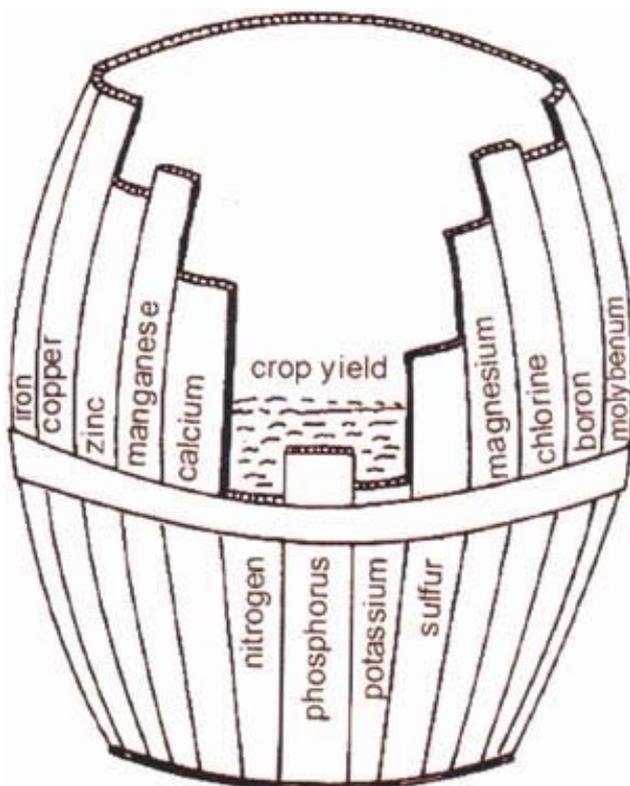
There are 2 main methods for improving pasture:

- ⇒ ***Kill the pasture and start again (\$\$\$ and risk); or***
- ⇒ ***Manage the pasture ecology to give desirable plants a competitive advantage (slow)***

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Above: relative plant availability of soil nutrients according to soil pH



Left: leaky barrel image symbolising plant growth rates limited by most significant nutrient deficiency. In this image, adding phosphorous fertiliser will not improve plant performance as it is currently limited by nitrogen deficiency