Dealing with sown pasture run-down

Increasing nitrogen cycling

As the natural process of run-down ties up nitrogen (N) in organic forms that are unavailable to pastures, one of three strategies to address the issue is to increase the rate that N cycles within the pasture system.

Mechanical options such as single cultivations, cultivated short-term fallows and crop–pasture rotations all increase N cycling. Responses to increased N cycling will depend on pasture condition, the level of disturbance and the amount of plant death.

The most commonly used mechanical options are:

- blade plough or cutter bar
- single cultivation—deep rippers, chisel ploughs and disc ploughs
- short fallows using several cultivations.

Economic analysis of different run-down management options over 30 years show that, of the mechanical methods, only cultivated fallows and blade ploughing provide positive returns (see Figure 1). On other less productive country (i.e. lower fertility and/or rainfall), none of the cultivated options provided positive returns.

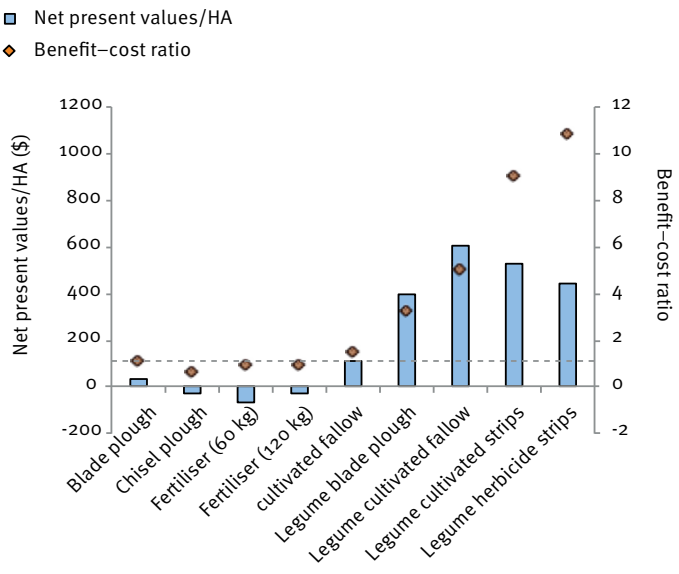

Figure 1: Economic analysis of N-cycling management options—the dotted line represents the break-even point for the benefit-cost ratio

Mechanical options

Mechanical options are typically used for sucker control, with pasture renovation and improved N cycling providing additional benefits. N cycling improvements from cultivation depend on the intensity of the renovation, the relative soil fertility, how rundown the pasture is and seasonal conditions following renovation. With repeated cultivations, the response achieved within a pasture will diminish over time (see Figure 2).

The majority of organic N is located in the top 30 cm of the soil as organic matter, with the highest concentration in the top 10 cm. Disturbance of the top 10 cm of soil and killing the existing plants is essential for cycling this N for future pasture growth.

As N cycling is maximised when all of the existing grass is killed by mechanical renovation, it is necessary to have a good grass seed bank so the pasture can quickly regenerate. If your pasture has not set seed for a long time, seed might need to be added or alternative renovation options may need to be considered.

Blade ploughs and cutter bars

Using a blade plough to control regrowth is often seen as a good opportunity to renovate and establish pastures. However the cost is high, particularly if only done to increase N cycling. Over time, the N again becomes immobilised within the grass organic matter and the run-down process is repeated (Figure 2). Blade plough or cutter bar applications can also leave the soil surface very rough and uneven, which can lead to management difficulties (e.g. mustering).

The rough, cloddy surface resulting from a blade plough or cutter bar is not a good seedbed for sowing pastures, especially small-seeded legumes. Establishment is often unreliable due to seed being buried too deep and poor soil–seed contact.

Using a blade plough or cutter bar can increase infiltration for many years, depending on the soil type. However, if a number of mechanical options are conducted over time, a hard pan can form at the depth of the implement, which may cause future infiltration issues. Plant growth, scalding and erosion issues can also arise if such implements are used on soils with dispersive layers.

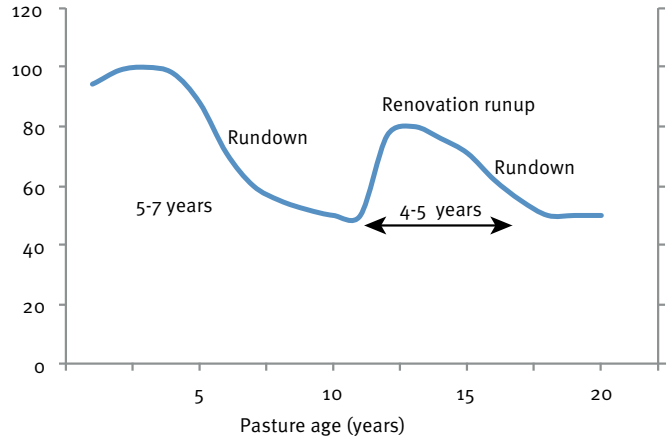

Figure 2: The run-down and run-up of pasture growth over time in response to the repeated use of a blade plough or cutter bar following initial establishment— note the declining level and duration of pasture response over time[1]

Figure 3: Blade ploughs (above) and cutter bars (below) are often used for controlling regrowth and improving infiltration but are not reliable options for sowing pastures.

Figure 4: Cutter bar.

1 Source: Graham, G and Lambert, G 1996, Sown pasture notes—Central Queensland, Department of Primary Industries, Queensland, pp. 94–95.

Figure 5: Previously run-down buffel grass on the left has been rejuvenated with the use of a chisel plough. Photo courtesy of Shaun Salter 'Gaybrielle Downs', Teelbah.

Single cultivations

Responses to single cultivations are variable depending upon pasture condition, the aggressiveness of the cultivation treatment and the seasonal conditions (amount of rain) after treatment. Cultivation treatments can stimulate N mineralisation from soil organic matter, with greater mineralisation occurring when the soil is disturbed extensively and most of the existing plants are killed. Responses reported by graziers and during trials have been variable, with positive responses attained in some instances, no response in others and negative outcomes in some cases.

Responses to single cultivations are more reliable and effective where reduced N availability is also associated with land condition decline (i.e. where the soil has set hard and there is poor infiltration). In these circumstances, cultivation can both mineralise N and improve water infiltration, which leads to better pasture growth. If well managed, improved pasture growth can lead to long-term improvements in ground cover and infiltration. However, N will continue to be tied up in soil organic matter, which will lead to declining pasture growth over time.

This response mirrors that of blade ploughing for regrowth control (Figure 2). Cultivation treatments would need to be repeated in later years to maintain higher levels of pasture growth, which may not provide positive economic returns.

Short fallows

Short-term fallows of three to six months with several cultivations that break up and kill most of the pasture sward effectively renovate run-down pastures and improve pasture growth by approximately 50%.[2] In some situations, fresh seed might need to be applied to re-establish a pasture of your chosen species, especially if undesirable grasses have seeded in recent years. Also, short fallows can provide the opportunity to establish legumes into the pasture, as grass competition is removed, soil moisture is accumulated and a seedbed is generally prepared.

2 Graham, T, Myers, R, Doran, J, Catchpoole, V & Robbins, G 1985, 'Pasture renovation: the effect of cultivation on the productivity and nitrogen cycling of a buffel grass (Cenchrus ciliaris) pasture', in XV International Grassland Congress, Kyoto, Japan, pp. 24–31.

Crop–pasture rotations

Both crops and pastures benefit from crop–pasture rotations (ley farming), as the crop takes advantage of the higher nutrient release from the organic matter accumulated during the pasture phase. The pasture also takes advantage of N released during cultivation.[3]

However, you need to consider the following before implementing a ley farming system:

- Establishment of a new crop phase can be unreliable due to dry soil moisture profiles coming out of a pasture.
- Pasture phases can cause weed problems for following crops.
- Higher management skills are needed as the enterprise is diversified.
- The relative economics of grain compared to grazing animals needs to be considered.

Other options

There are other options that may increase N cycling; however, the amount of N cycled and the effectiveness is either unknown or poor relative to cultivation. These practices include:

- herbicide application
- grazing management
- slashing
- biological treatments
- tree rotations.

The majority of organic N is located on the soil surface as organic matter, making disturbance of soil and killing of plants essential for cycling this N. Therefore, activities like slashing, grazing and spraying will not deliver high levels of N in a form that is available for pasture growth, as there are very low amounts of N within plant tops compared to the amount located in the top 30 cm of the soil.

3 Myers, R & Robbins, G 1991, 'Sustaining productive pastures in the tropics 5: maintaining productive sown grass pastures', Tropical Grasslands, vol. 25, pp.104–110.

More information

This fact sheet is the third in a series of three fact sheets about sown pasture run-down. For more information on other management options, refer to:

fact sheet 1—*Dealing with sown pasture run-down: symptoms, causes and management*

fact sheet 2—*Dealing with sown pasture run-down: increasing nitrogen inputs*

For more information, visit www.futurebeef.com.au or call 13 25 23.

Front page photo courtesy of Sid Cook, Queensland Murray Darling Committee.

CS4288 10/15