

R&D BRIEF 127: USING SUBTERRANEAN CLOVER

This R&D brief presents current knowledge on how to manage subterranean clover to maximise stock production and farm profitability. Subterranean clover should be considered where white clover performs poorly due to summer dry conditions. Other annual clovers such as balansa, cluster and suckling are mentioned in R&D Brief 125: Annual legumes enhance animal production from summer dry pastures

WHY SUBTERRANEAN CLOVER IS USEFUL ON DRYLAND FARMS

SUBTERRANEAN CLOVER GROWS MORE IN SPRING

Annual legumes produce more in early spring than perennial legumes. This is because annuals have lower optimum temperatures for germination and growth than perennial legumes ((10-15°C compared to 20-25°C). Subterranean clover starts rapid growth at least a month earlier than lucerne and white and Caucasian clovers. Well-managed dryland pastures can get 50 per cent clover on offer in the late spring.

SUBTERRANEAN CLOVER HAS HIGHER FEED VALUE THAN GRASSES

Grazing animals, when given the choice, prefer a diet that is 70 per cent clover and 30 per cent

grass. Quality herbage from August to November helps lactating ewes milk well, ensuring rapid lamb growth rates.

Table: Legumes have impressive energy value (MJME/kg dry matter) and lose less of this energy value over time than grasses

Clover	12
Lucerne pre-flower	12.2
Young grass leaf	11.5 (declines 0.03/day)
Dead grass	8

SUBTERRANEAN CLOVER IMPROVES GRASS PALATABILITY

Grasses in the sward become more palatable through nitrogen fixation by legumes. Legumes fix about 25kg nitrogen per tonne of dry matter grown. For example, four tonnes dry matter of sub-clover grown over a year would fix at least 100kg of nitrogen per hectare.

SUBTERRANEAN CLOVER SURVIVES ON DRIER SITES WHERE WHITE CLOVER CAN'T

With the exception of lucerne, most perennial legumes are unproductive on drier sites like sunny hill faces and stony soils. Some, such as white clover, may not survive summer drought. Annual clovers can survive from year to year as they set large amounts of seed before dying, ensuring a seed bank and rapid regeneration of seedlings with autumn rains.

ABOUT SUBTERRANEAN CLOVER



Mid-flowering cultivar Woogenellup 18 August when air temperature was 7.6°C at 8am

BIOLOGY OF THE PLANT

Subterranean clover is an annual – the seed germinates in autumn, flourishes and flowers in spring, and then dies off as soils dry in summer. As plants mature in late spring and early summer, seed burrs are buried in the soil.

HARD SEED PROTECTS AGAINST FALSE STRIKES

Part of the seed set contains hard seeds. Some of these seeds will germinate one or two years later than most. This helps protect the plant from 'false strikes' where early germination is followed by drought and loss of seedlings.

Sub clover cultivars which have a lower percentage of hard seed by the end of February are more susceptible to false strike than cultivars with a higher hard seed rating. For example, Woogennellup is 'soft-seeded' and Goulburn 'hard'. Woogennellup can exploit a wet autumn better than Goulburn but it is more prone to false strikes.

Hard seeds 'soften' faster in hot dry conditions with wide day/night temperature fluctuations. These conditions crack the seed coat. This creates 'soft' seed that is then permeable to water and can germinate with the next rain event.

Hardseededness is a quality that is valued in Australia where soil surface temperatures are greater than generally experienced here. Hence some Australian cultivars with a high hardseededness rating may be less suited to New Zealand conditions. Sunny hill faces with a high proportion of bare ground in summer will require cultivars with greater hardseededness than shady faces which tend to have denser grass swards and more litter on the soil surface.

PRODUCTION

Pure swards of sub clover produce four to ten tonnes of dry matter per hectare a year, depending on rainfall. This is similar to mixed grass and clover pastures at the same site. However, clover content is likely to be only 20 per cent of the total production in mixed pastures. Given that clover herbage has a higher feeding value than grass, a strong case can be made for farming for legumes rather than grass when wanting to maximise lamb growth during spring ewe lactation.

Strategies to fit pure stands of clover into farming systems need to be devised so that faster lamb growth rates can be achieved.

The Max Clover grazing experiment showed that superior clover content in sub/ocksfoot pastures gave greater liveweight gain per hectare from August to October than white clover/ryegrass or white clover/ocksfoot pastures. For more see R&D Brief 126: Clover and nitrogen to improve cocksfoot dryland pastures.

MANAGING SUBTERRANEAN CLOVER

The Beef + Lamb New Zealand-funded Max Clover project is carried out by Lincoln University. The aim is to develop grazing management guidelines for sub clover so it can provide high quality feed from August to October in summer dry areas. Recommendations developed in the project are included below.

AUTUMN

Before sub clover germination in autumn, aim to keep grass in pastures short with a mass of 700-1000kg of dry matter per hectare (1-2 cm). After a good strike, spell the pasture until sub has at least four trifoliate leaves. Sub thrives when it is given a good chance to establish before its first grazing.

The longer the sub clover has to establish and put roots down in autumn, the greater the dividends come spring. Pasture growth rate in a moist March is likely to be twice the April rate. In May, growth is usually half that of April.

Don't be tempted to feed the green 'pick' in autumn if pasture mass is under 1000kg of dry matter per hectare (2cm).

WINTER

During early winter, pasture should be grazed hard (ie. 700-800kg dry matter per hectare) to remove dead grass material. This means clover is less likely to be shaded by grass in spring.

SPRING

Reap the rewards. The spelled sub clover-dominant pastures will provide maximum ewe lactation during lambing.

Light grazing (to 1500-2000kg dry matter per hectare) encourages seed production. It is recommended for every paddock once every five years or when sub clover populations are low (ie. less than 200 plants per square metre – or two seedlings under your fist).



SPRING STOCKING RATE TRIALS

Grazing intensity Max Clover studies on the stony soils at Ashley Dene are investigating how to avoid overgrazing sub clover during seed set yet control grasses such as cocksfoot or tall fescue.

Trials at Ashley Dene showed that high stocking rates with 20 ewes per hectare and their twin lambs gave satisfactory lamb liveweight gains of 310g per head per day and 12kg per hectare per day. However, the sub clover seed set was severely reduced and seedling population the following autumn was down to only 220 seedlings per square metre.

A lower stocking rate of 10 ewes per hectare with twin lambs gave 370g per head per day but only 7.5kg per hectare per day, although a better opportunity for seed production.

CULTIVARS

Sub clover evolved in the Mediterranean area with winter rain and dry summers. New Zealand's oceanic climate with some summer rain and cooler temperatures can adversely affect the normal sub clover life cycle. However, up to a third of our total pastoral area has a summer moisture deficit where annual clovers can make a significant contribution.

Cultivars of sub clover have been selected in Australia for flowering date, persistence, productivity and hardseededness.

EARLY CULTIVARS BEST FOR LOW RAINFALL AREAS

The earliest flowering cultivars are suited to areas with low rainfall (less than 500mm) while the later flowering cultivars are adapted to higher rainfall (more than 700mm). Moisture is required for 10 weeks from the start of flowering for good seed yields.

For example, Woogenellup starts flowering in early to mid September so it is better suited to dry areas than the later flowering Leura which starts flowering in early October. Dry areas include steep/sunny faces or soils with low water holding capacity (eg. very stony river terraces).

In an average year in the droughty-soil site, Woogenellup is more likely to set seed than the later-flowering Leura.

Late cultivars like Leura are suited to soils that are moist throughout November.



SOW EARLY AND LATE CULTIVARS TOGETHER

Where rainfall is variable from late October to December, it is a useful strategy to sow an earlier cultivar such as Woogelleup with a later one, like Leura. The pasture should then be better able to exploit both dry and wetter seasons.

SOW SUB WITH PERENNIAL CLOVER IN MORE SUMMER MOIST SITES

In more favourable summer dry sites (shady hill faces, deep soils) the early spring production of annual clovers such as sub, followed by their strong flush in October/ November, complements the late spring start of rapid growth by perennial clovers. A mix of annual and perennials gives greater legume production over a range of seasons.

LEAF SIZE AND FORM

Small leafed, prostrate sub types have been a feature of the more recently released cultivars (Goulburn, Demark, Leura). These were sourced from Sardinia. Larger leafed types such as Woogenellup are considered to be more vulnerable to intensive set stocking.

RIVERINA GOOD FOR WET WINTERS

Cultivars such as Riverina belong to *T. subterraneum* sub- species *yanninicum* and may have a place in areas that are very wet in winter.

AVAILABILITY OF SEED

All seed is currently imported from Australia and is available through most seed agents. However, sometimes seed supplies and cultivar choices are limited by drought in Australia and New Zealand biosecurity requirements. The possibility of growing sub clover seed in New Zealand is being investigated.

ESTABLISHING SUB CLOVER

SOW MORE SUB CLOVER IF CAN'T 'STEP ON IT' IN SPRING

The need to sow sub can be determined by the lack of it. If you can walk across the paddock in September without standing on sub at each step you have not got enough. You either have a poorly adapted cultivar and/or what you have has been mismanaged. Low populations can be increased by:

- reducing grazing intensity during spring flowering and seed set and/or
- drilling or broadcasting more sub seed in autumn.

DRILLING

If possible, sub seed should be drilled rather than broadcast. This is because the seed is adapted to germinate from seed burrs buried in the top 10mm of soil. Bare (unpelleted) seed should be sown in autumn at a minimum of 6kg per hectare – 10kg per hectare is the ideal. Sub clover should not be sown in spring.

Direct drilling into a run-out cocksfoot-dominant pasture at Lincoln University's light land farm gave excellent results. Graze hard (ie. 600kg dry matter per hectare) until the first good rain in March and then drill sub at 10kg per hectare. Graze to reduce grass competition once seedlings have four trifoliate leaves.

BROADCASTING

Broadcasting success is more dependant on the weather. Hill slopes should be prepared by hard grazing. Stock may be used to tramp seed into the ground immediately after broadcasting. Best results are seen when seed is spread just before a prolonged wet spell in March/April. Predicting the wet spell is the problem!

Loss of soil moisture through evaporation and transpiration is greater in March. A week of moist, dull weather will give a good result but a wet day followed by dry northwesterly weather will result in a false strike. Early April seeding is more likely to achieve a good strike but seedlings will be smaller in winter and more vulnerable to frost.

RATES AND MIXES

Cultivars differ in seed size but in general there are only 15 seeds per square metre for each kilo sown so 10kg per hectare will give about 100 established plants per square metre. The best way to rapidly build a large sub clover seed bank is to sow it alone or at least reduce grass seed rates down to less than half what you normally sow (eg. from 20kg down to 8-10kg perennial ryegrass per hectare).

Another option is to sow sub in autumn with rape (rape at one kg per hectare or less if soil is fertile). The rape is a good nurse crop for the clover and will provide a couple of winter grazings. After the sub clover has given a large spring seed set, grass can be over-drilled the following autumn.

WHEN TO INOCULATE

In areas where annual clovers are scarce or absent, sub clover seed should be inoculated with the correct strain of Rhizobium bacteria in peat inoculant, immediately before sowing. If resident sub and other annual clovers look healthy and pink nodules are present on the roots, inoculation for nitrogen fixation should not be necessary. Sub clover needs a different Rhizobium bacteria inoculant to white clover.

GRAZE LIGHTLY IN FIRST SEASON

Grazing management during the first spring flowering should be lax (ie. over 2000kg of dry matter per hectare). This ensures the cost of establishment is not squandered. Seedling populations re-establishing in that first autumn a year after sowing will be much greater than the 50 to 100 seedlings per square metre achieved after drilling the seed. Minimum satisfactory populations are 500 seedlings per square metre in

grass/clover pastures and 1000 seedlings per square metre in pure stands. If you have five seedlings under the area of your fist (1/100th of a square metre) then that is equivalent to 500 seedlings per square metre.

ACKNOWLEDGMENTS & MORE INFORMATION

The information in this R&D brief comes from the Beef + Lamb New Zealand Max Clover project, FITT studies and Lincoln University trusts and postgraduate studies.

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Related Beef + Lamb New Zealand resources:

R&D Brief 98: Improved forage systems – getting the messages to farmers

R&D Brief 125: Annual legumes enhance animal production from summer dry pastures

R&D Brief 126: Clover and nitrogen to improve cocksfoot dryland pastures

R&D Brief 133: Caucasian clover

FITT project 04FT154: Supreme sub clover

For a copy of these publications, please see the website or contact Beef + Lamb New Zealand: email enquiries@beeflambnz.com or call 0800 BEEFLAMB (0800 233 352)

Relevant papers from the New Zealand Grassland Association:

Effect of ewe stocking rate in spring on sub clover persistence and lamb liveweight gain

Sub clover, cocksfoot and lucerne combine to improve dryland stock production

Clover species cover on summer dry hill country in Central Otago

Suitability of new sub clovers in the Canterbury region

Tom and Anne Costello described how they managed sub clover on their North Canterbury farm for high production at the Legumes for Dryland Pastures Symposium, 2003 (see New Zealand Grassland Association Symposium Proceedings, November 2003, pgs 189 to 192).

Reference book that holds flowering dates: Stewart, A and Charlton, D 2006. Pasture and forage plants for New Zealand. Grasslands Research and Practice Series No 8, Third edition. 128pp.

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