Agriculture Notes

Forage Cereals - Establishment

Viv Burnett, Rutherglen

Updated: January 2008
AG1269
ISSN 1329-8062

This Agnote provides information on the establishment of forage cereals in dryland dairying areas in Victoria.

Introduction

Forage cereals, within the cereal species of oats, wheat, barley or triticale, have the potential to be an integral part of providing year round feed in a dryland dairy system. They can provide feed to overcome autumn and winter forage shortages, allow the making of whole crop cereal silage, and provide the dual options of grazing and grain production. Cereals are highly suited to dryland farming and can tolerate a wide spectrum of soil conditions. In the vegetative phase they are similar in palatability and nutritive value to ryegrass for livestock.

Climate and soils

Forage cereals can be grown in most areas of Victoria where annual rainfall ranges from 300 to over 1,000 mm. The majority of cereal crops are grown in areas where annual rainfall is winter dominant, occurring from April through to November, north and west of the Great Dividing Range. Extended growing seasons in southern Victoria can provide options to grow late-maturing forage cereals, some of which can be sown in late February – early march.

Forage cereals are generally tolerant of a wide range of soil types and conditions except for prolonged water-logging. Short periods of flooding are tolerable provided the water drains off the crop within 3-4 days. They can be grown on sandy, clay loam and heavy clay soils, providing drainage is adequate, and are tolerant of a wide pH range ($CaCl_2$) 4.5 – 7.5, although strongly acidic soils (pH $CaCl_2$ < 4.5) must be avoided, or treated several months ahead with lime. This pH requirement must extend down the soil profile to at least 30 cm as cereal roots will easily reach these depths in suitable soils.

Paddock selection

Selecting a paddock for forage cereal production will depend on how the forage cereal will be used on the dairy farm. If the forage cereal is to provide additional grazing, then a well drained paddock that can resist pugging damage from dairy cows should be chosen. A paddock that has higher fertility and is well drained should be chosen to provide maximum dry matter production.

It is best to select a paddock that has a low level of pasture grasses to avoid the risk of cereal disease transmission. Annual pasture grasses can be hosts for such diseases as Take-all, Rhizoctonia, Fusarium and Pythium. In traditional cereal growing areas, pasture grasses can be removed from the paddock in the year prior to cereal establishment by using herbicides to 'winter clean' the pasture or by green manuring to prepare the seed-bed. However, in dryland dairying areas, a summer forage crop (*Brassica*, maize, sorghum, millet) or spring sown 'hunter and herb' mix will help to reduce grasses.

Tough grasses such as bent grass, couches and kikuyu must be satisfactorily controlled before autumn sowing of cereals. These grasses will compete with the cereal for nutrients and moisture, both in autumn at establishment and in the following spring.

Soil fertility requirements

Forage cereals will grow in most soils, but respond to good soil fertility levels, especially available phosphorus (P) and nitrogen (N). A soil test should be conducted prior to cereal establishment to determine the pH status, and the P and N availability of the soil. It is important to remember that nutrient is removed from soils when cereals are grazed and/or harvested for grain or silage so this must be replaced on a regular basis (Tables 1 and 2).

Table 1. Nutrients removed (kg) per tonne of grain production.

Crop type	Nitrogen	Phosphorus	Potassium	Sulphur
Wheat	21	3.0	5	1.5
Triticale	21	3.0	5	1.5
Barley	20	2.7	5	1.5
Oats	17	2.5	4	1.5

Table 2. Nutrient removal from whole crop cereal silage based on 15 t DM/ha.

Nutrient	Nutrient removed (kg/ha)
Nitrogen	160-325
Phosphorus	28-37
Potassium	290-470
Sulphur	22-32
Calcium	30-40
Magnesium	18-22

Although there are generally large reserves of P in many soils as a result of long periods of superphosphate application, the majority of this P is in an insoluble form and is unavailable for plant growth. So forage cereals should be sown with P applied with the seed in the drill row. Normally, a combination fertiliser such as diammonium phosphate (DAP) that supplies both P and N is used at the rate of 100-150 kg/ha. This will supply sufficient P and N for germination and vegetative growth. Higher applications of P may result in better production but this will be dependent on seasonal conditions, crop choice and soil fertility.

If establishing forage cereals into a previous or existing legume pasture, there should be sufficient N available to the germinating cereals. Forage cereal research carried out at Demodairy near Terang South in Victoria in 2005 and 2006, showed negligible response to N when applied at several stages of growth.

Use of DAP at sowing will supply N but rates in excess of 150 kg/ha DAP should be avoided as N that comes into direct contact with cereal seed can burn the germinating seedling. Additional N, such as urea, can be supplied to the crop immediately after the first grazing to stimulate vegetative growth. A further N application can be applied just as stem elongation is about to begin. This is when the first 1-2 nodes become noticeable at the base of the main stem, and usually occurs in late July-early August.

N can also be applied when the flag leaf has started to emerge but crop height and wheel damage to the stems will be of serious concern unless 'tramlines', permanent wheel lines, have been set up at sowing. This application will often improve crude protein content but will have minimal effect on yield.

Weed management

Ideally, the management of weeds for forage cereal production should commence in the preceding year with the aim of reducing the annual grass weed burden. Annual grass weeds need to be managed as they compete directly with forage cereals for nutrient, moisture and light. They cannot be controlled by herbicides once the cereal crop is established.

Control can occur by strategic grazing management or by 'winter cleaning' an existing pasture using herbicide to prevent seed set. The advantage of 'winter cleaning' is that annual grass weeds are prevented from seeding, however, this method may result in reduced dry matter availability in the late winter/early spring period. More appropriately for dairying and high rainfall areas, the selected paddock can be cultivated and summer cropped to prepare the soil and establish grass weed control for the autumn sowing of the forage cereal. Any summer weeds which established in the summer crop will need to be controlled before sowing the cereal.

Whichever cereal establishment method is used, some pre establishment weed management of grasses and broad leaved weeds is required. This can then be re-enforced with a knockdown herbicide prior to sowing to ensure that the forage cereal germinates in a weed free seed-bed. Withholding periods for herbicides need to be checked carefully in the planning of a weed control program. Timing of individual sprayings, 'plant back' timelines and growth stages of the emerging cereal and the targeted weed are some of the issues which must be addressed in effective weed management.

If dual purpose forage cereals are chosen and grain production becomes an objective, then closer attention to maintaining a relatively weed-free crop becomes more important. Consultation with professional agronomists or the local chemical re-seller can provide information on herbicide selection.

Figure 1. Strategic grazing can reduce annual grass weeds prior to cereal establishment.

Sowing methods

1. Conventional cultivated seed-bed

Forage cereals can be sown into cultivated seed-beds. The advantage of a cultivated seed-bed is that it provides a weed free environment for cereal seeds to germinate and establish. It will also ensure that any compacted layers or hard pans are broken down so that roots can penetrate down through the soil profile. The disadvantages of a cultivated seed-bed are that break rains could prevent cereal sowing due to trafficability and soil structure may be damaged by cultivation. Organic matter levels will be reduced and cultivation is a higher cost than minimal or no-till options. However, cultivation is usually the most reliable for cereal establishment.

2. Direct drill

Forage cereals can be direct drilled just before or after break rains in autumn. The advantages of direct drilling are that there is no cultivation so soil structure is preserved, trafficability isn't generally a problem and cereals can be sown at the optimal time without delays for soil preparation.

The disadvantages are that weed management using herbicides needs to be effective if the cereals are to have the early competitive advantage. The seed establishment

environment using direct drilling is not as good as that of a cultivated seed bed. Direct drilling also requires the correct choice and management of machinery in relation to the soil type and time of sowing, to be comparable to success from a cultivated seed bed.

Figure 2. Direct drilling of wheat into pasture.

3. Dry sowing

Sowing cereals using direct drilling into a dry seed-bed so that they are ready to germinate when the break rains arrive is often practiced by grain producers. The advantages of this method are that sowing can be done early in the season when time permits. The disadvantage of dry sowing is that patchy or unreliable rainfall early in the season may result in partial germination and subsequent drying out of seed reducing establishment density. In comparison to other seeds, cereals are generally tolerant of patchy break rainfall and if sown at the appropriate depth (3-4 cm), will germinate only when sufficient moisture is available.

Sowing depth

Sowing depth will depend on seasonal conditions and the species and cultivar that is being sown but as a general rule, forage cereals are sown at an average depth of 3-4 cm. Sowing too deep can affect emergence and shallow sowing can risk desiccation or damage from herbicide uptake.

Sowing rate

Sowing rates will vary according to species (seed size and weight) and time of sowing. Generally, as sowing date is delayed from the ideal time, sowing rate should increase. For example, Crackerjack triticale sown in mid April at 80-100 kg/ha may need to be sown at 100-120 kg/ha in late May.

Sowing date

The sowing date can range from late summer to early winter for varieties suited to autumn sowing. 'Spring-sown' varieties can be sown late winter to early spring.

Early sowing will depend on species and varieties within that species, whether it will 'run to head' if sown early and reliability of rainfall. Generally forage oats and winter wheat can be sown as early as mid February through to early April. Triticale tends to be sown in late April through to June and barley from late May to early July.

If sowing after autumn break rains have commenced, it is important to ensure that forage cereals are sown as early as possible to capitalize on their initial fast growth in warm weather and soils.

Cultivars

Listed below are many of the varieties currently available for use as forage cereals. Current breeding programs within each species are producing more suitable cultivars (higher yield and nutritive value, wider sowing windows and harvest times) for the high rainfall areas of south eastern Australia.

For the latest cultivar information please consult the Victorian Winter Crop Summary found at www.dpi.vic.gov.au/agriculture&food/crops, pastures&weeds/grain crops/Victorian Winter Crop Summary – 2006. Local agronomists and local seed companies specializing in forage cereals are also sources of cultivar and sowing information.

1. Oats

Oats can provide both quantity and quality forage for dryland dairy systems in the vegetative growth stages. Their nutritive value declines as the grain begins to form in the head due to the amount of seed husk compared to other cereal species.

Oats are a highly resilient and competitive cereal in different environments. In comparison to other cereals, there are fewer options for weed control in oats and the grain harvesting window is narrow due to shedding so choosing to grow oats needs to be carefully considered if grain production is required. Cultivars suitable for dryland dairying purposes are presented in Table 3.

Table 3. Forage cereal species and cultivars suitable for grazing, silage or hay production in dryland dairy farming.

Species	Purpose	Cultivars
Oats	Grazing, silage or hay	Enterprise, Graza 50, Graza 68, Gwydir, Heritage Lordship, Targa, Taipan, Drover, Quoll, Wandering, Kangaroo, Brusher, Marloo, Wallaroo, Wintaroo, Volta, Nugene, Warrego, Eurabbie, Yiddah, Glider, Esk, Quoll, Wandering, Kangaroo
Wheat	Grazing, silage or hay	Brennan, Marombi, Mackellar, Rudd, Tennant, Teesdale, Kellalac, Frelon, Amarok, EGA Wedgetail
Barley	Grazing, silage or hay	Dictator, Gairdner, GairdnerPlus
Triticale	Grazing, silage or hay	Breakwell, Hillary, Jackie, Maiden, Crackerjack, Pacific Falcon, Monstress, Abacus

2. Wheat

Wheat suitable for forage must be sown early in order to achieve maximum dry matter (DM) production for grazing, followed by a silage harvest, or potentially for grain production, if required. Typically forage wheat is of the 'winter wheat' type which has a wide sowing window, requires a cold period during its growth and has a range of maturities. If sown early (eg. March) in favourable moisture and temperature conditions, growth rates of up to100 kg/ha/DM/day can be achieved. During the grazing period average growth rates should be about 30-60 kg/ha/DM/day. Available cultivars are shown in Table 3.

3. Barley

Several barley cultivars are available as feed (grain for animal feeding) and as forage varieties, and can be sown later than oats, wheat and triticale. Forage barley can be sown as late as early July if seasonal and soil conditions allow. Barley is generally less tolerant of acidic soils compared with wheat. Current forage barley cultivars are presented in Table 3.

4. Triticale

Triticale is a cereal developed by breeders from a cross between wheat and ryecorn. Triticale is a hardy cereal, being adapted to a wide range of soil and seasonal conditions. Triticale can tolerate more water-logging than the other cereals but not as well as ryegrass pastures. Triticale can be more susceptible to frost damage than other cereals due to its longer flowering time. Current forage triticale cultivars are presented in Table 3.

Further reading

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Acknowledgments

We acknowledge the contribution to this Agnote by Project 3030, which is jointly funded by Dairy Australia, the Victorian Department of Primary Industries and the University of Melbourne.

The previous version of this Information Note was published in April 2007.