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Cocksfoot

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Introduction

Cocksfoot (*Dactylis glomerata*) is a moderately deep-rooted perennial grass, originating in Europe, North Africa and temperate Asia.

The diversity of environments in which cocksfoot developed has given rise to two distinct subspecies. The first is the temperate type (*Dactylis glomerata* ssp. *glomerata*), which originated in cooler northern regions of Europe and Asia. The second is the Mediterranean type (*Dactylis glomerata* ssp. *hispanica*), which originated in the summer-dry areas of southern Europe and North Africa. An additional group, possessing characteristics of both the temperate and Mediterranean types, developed in the central regions of Europe. This third group is referred to as 'intermediate types'. The growth characteristics and areas of adaptation of these subgroups differ significantly, and must be taken into consideration when choosing a variety to sow. This will be discussed more fully in following sections.

Cocksfoot was introduced to Australia (probably accidentally) in the early days of European settlement, and had become naturalised in areas of NSW and Victoria by the 1850s. There is evidence that farmers had recognised the potential of cocksfoot at this early stage, and were harvesting and sowing seed.

There was little breeding and development of cocksfoot in Australia up until the 1940s, as seed could be cheaply imported from New Zealand and Denmark. These imported varieties performed reasonably well in the higher average annual rainfall (AAR >750 mm) areas, but failed to persist in medium and lower rainfall areas. Intensive breeding and development from the late 1940s through to the 1970s resulted in the development of varieties better suited to Australian conditions. However, cocksfoot was still not widely grown outside of high rainfall tablelands environments.

More recent breeding programs, coupled with a re-evaluation of some previously available but under-utilised varieties, have shown that cocksfoot can be successfully grown in medium and medium-low rainfall areas, as well as high rainfall areas. The critical factor is to choose a variety that is best suited to the climatic region.

Description

Cocksfoot is a tufted perennial grass. The growth habit of mature plants can differ significantly, with some forming moderately sized tussocks, while others tend to be more prostrate. Crown height also differs significantly between varieties. Those varieties with an elevated crown require more careful grazing management for persistence.

The leaves of cocksfoot are very distinctive, being folded lengthwise near the base of the plant (as opposed to phalaris, which is rolled). Depending on the variety and grazing management imposed, the leaf may be folded along most of its length, or may open out to be flatter in cross-section. Also depending on variety and grazing management, leaves can measure between 10 and 80 cm in length. Leaves are hairless.

The seed head is dense and spike-like in appearance when it first emerges. With maturity, it

Figure 1. Cocksfoot

becomes open and branched. Seeds are very small, with 95,000 to 1,300,000 seeds/kg.

Adaptation

Cocksfoot can be grown successfully in areas receiving a minimum of 450 mm AAR in southern NSW, or 550 mm in northern NSW. Cocksfoot grows well in a variety of soils with pH ($CaCl_2$) greater than 4.0. It has a high tolerance of aluminium, and will also grow well in shallow soils. It does not perform well in soils that are prone to waterlogging.

Not all varieties are suitable to be grown in all areas. It is very important that a variety from the most appropriate subspecies for a given area is chosen, to ensure maximum persistence and, therefore, agronomic performance.

Hispanica subspecies

These are often referred to as Spanish cocksfoots. They are suited to areas receiving low to moderate rainfall (AAR 450-650 mm), or where frequent, prolonged (5–6 months) moisture stress occurs over the summer–autumn period. Varieties of this subspecies become dormant at the end of spring, when temperatures rise. They will remain dormant over summer, until sufficient rainfall is received in autumn and temperatures decline. This is referred to as 'obligate dormancy'; that is, the plant becomes dormant and remains dormant, regardless of how much rainfall is received in summer.

Varieties of this subspecies are very drought-hardy, and produce the majority of their annual production from autumn through to the end of spring.

Glomerata subspecies

These are often referred to as temperate cocksfoots. Varieties of this subspecies maintain active growth throughout the year, and will respond to rainfall in all seasons. Because of this, they should only be sown in high rainfall areas (AAR >700 mm southern NSW and >800 mm northern NSW). Varieties of this subspecies tend to have poor drought tolerance, and should not be sown in areas where prolonged summer drought is common.

Intermediate types

Varieties in this group are suited to areas with moderate to high rainfall (AAR >550 mm). They are less summer-dormant than hispanica types, and will respond to summer rainfall events if they occur. Unlike temperate types, however, they will become dormant if soil moisture is limiting. Varieties in this group are often referred to as expressing 'facultative dormancy'; that is, they will continue to grow if there is sufficient moisture, but will become dormant if moisture is limiting.

Scale of dormancy

While the descriptions of dormancy given above apply in general, the scale of dormancy is continuous, similar to the scale of growth activity for lucerne. This means that a variety classed as summer-dormant may be more or less dormant than other varieties from the same subspecies.

Generally, the harsher the environment (lower rainfall, higher summer temperature) into which the plant will be sown, the more strongly dormant the chosen variety should be.

Figure 2. Cocksfoot seed head at anthesis. Photo courtesy Alain Peeters, University of Louvain, Belgium.

Growth habit

In addition to considering the importance of which subspecies to choose a variety from for a given environment, it is also critical that a variety best suited to the type of grazing enterprise is also chosen.

Low crown, prostrate varieties tend to be better suited to enterprises where sheep are the main grazing animal, or where grazing cannot easily be controlled. These varieties have their growing

points located closer to the ground, and are less susceptible to damage by grazing.

Erect-growing varieties with high crowns require closely monitored rotational grazing in order to persist. These are best suited to cattle enterprises, or those in which grazing can be very well controlled.

Current varieties

Hispanica subspecies

Kasbah was developed by the Waite institute in South Australia, and released in 1970. It was developed from germplasm collected in Morocco, where average annual rainfall was 270 mm. Kasbah has a semi-erect to erect growth habit. It is the most summer-dormant cocksfoot variety currently available in Australia, and has very high tolerance of drought. It is suited to low to moderate rainfall areas (AAR 450-650 mm) of NSW, or areas with prolonged summer moisture stress.

SendaceΦ was developed by the Tasmanian Institute of Agricultural Research, using germplasm collected in Spain. Seed will be available from 2008. It is a very compact, densely tillered, fine-leaved variety. Sendace Φ has a very prostrate growth habit, making it very tolerant of persistent close grazing once established. Sendace Φ is resistant to attack by cockchafers.

UplandsΦ was developed by the Tasmanian Institute of Agricultural Research, using germplasm collected in Spain. Seed will be available in 2008. It is a very densely tillered, fine-leaved variety with a semi-erect growth habit. It is slightly less summer-dormant than Sendace Φ, but still has good drought tolerance. Uplands Φ is resistant to attack by cockchafers.

Intermediate types

Currie was developed jointly by the CSIRO and the Western Australian Department of Agriculture, from material collected in Algeria in 1937. It was released in the 1950s. Historically, it has been the most widely used cocksfoot variety in Australia. It has moderate drought tolerance. Currie is well-suited to moderate to high rainfall (AAR >550 mm) areas of NSW.

Glomerata subspecies

Porto was developed by the Tasmanian Department of Agriculture, from material collected in Portugal in 1954. It was released in 1972. It has a semi-erect to erect growth habit, and is later maturing than Currie. Porto is best grown in areas with high rainfall (AAR >700 mm), and where significant quantities of rainfall are received in summer.

Grasslands Wana was developed in New Zealand from material collected in north-western Spain. It was released in 1980. It was selected for low crown, prostrate growth habit and dense tillering.

Grasslands KaraΦ was developed in New Zealand, by crossing the cultivar Grasslands Apanui with two Portuguese experimental lines, and then backcrossing the progeny with Grasslands Apanui. Grasslands Kara Φ was released in Australia in the late 1980s. It has an erect growth habit, and is better suited to grazing by cattle than sheep.

Grasslands Tekapo was developed in New Zealand, using material provided by Portuguese sources. The actual origin of this material is unknown. It was released in 1995. It is a prostrate, densely tillered, fine-leaved variety.

Grasslands VisionΦ was developed in New Zealand, by crossing Grasslands Kara Φ with Grasslands Wana. It was released in 1996. It has a semi-erect growth habit, and is more densely tillered and persistent than Grasslands Kara Φ.

Howlong was developed in France from selections made from the cultivar Porto. It was selected for increased growth, low re-heading and disease tolerance. It has been available in Australia since 2002.

Yarck was developed in Australia from selections made from the cultivar Porto. Compared with Porto, it is slightly earlier maturing. It was released in 2006.

MegatasΦ was developed by the Tasmanian Institute of Agricultural Research, from material collected in Spain in 1989. It was selected for increased seedling vigour, leafiness, and a low crown, which improves grazing tolerance. Seed will be available in 2008. It is slightly later maturing (3 days) than Porto.

Oxen was selected from the cultivar Porto. It has an erect growth habit.

Superseded or difficult to obtain varieties

Hispanica subspecies

Berber was developed at the Waite Institute in South Australia, from material collected in Morocco. It was released in 1967. It has characteristics similar to Kasbah. Seed is difficult to obtain.

Intermediate types

Brignoles was developed by the CSIR (now CSIRO), from seed collected in southern France in 1931. It was released in Australia in the mid 1960s. Brignoles is slightly later maturing than the cultivar Currie, and is more susceptible to leaf rust and

frost damage. Also, seed retention is poor. Seed is no longer commercially available.

Neptune was developed by the CSIRO and the Western Australian Department of Agriculture, from germplasm collected in Portugal. It was developed in conjunction with Currie. Seed is no longer commercially available.

Glomerata subspecies

Akaroa is a New Zealand variety, widely used in Australia prior to the commencement of domestic breeding programs. It is no longer available in Australia.

New Zealand Cocksfoot was developed in New Zealand as an alternative to Akaroa. It was released in 1938, and was used widely in Australia prior to the commencement of domestic breeding programs.

Grasslands Apanui was developed in New Zealand from populations of New Zealand Cocksfoot. It was selected for greater uniformity, and was released in 1953. Commercial seed crops were first grown in Australia in the mid 1960s. Grasslands Apanui displayed better growth and seedling vigour than earlier varieties. Seed is no longer available.

Aberystwyth S.26 was developed in Wales from material collected in Devon. This cultivar forms large tussocks. Winter and spring production and seedling vigour were generally poorer than Australian and New Zealand varieties available at the time, although it exhibited superior summer and autumn productivity. It was sown extensively, particularly in high rainfall areas of Victoria. Seed is no longer available.

Aberystwyth S.143 was developed in Wales prior to the 1940s, with some modifications in breeding being made after its initial development. Certified seed crops were first grown in Australia in 1952. It is a prostrate variety. Under Australian conditions, it showed poorer seedling vigour and herbage production than other varieties; but, due to its prostrate habit, it had good grazing tolerance. Seed is no longer available.

Cressy was developed by the Tasmanian Department of Agriculture in the 1930s; however, due to World War II, final development of this cultivar was not completed until the 1950s. It was released in 1962. Cressy is a densely tillered, semi-prostrate variety. Seedling vigour and productivity was superior to both S.26 and S.143. Seed is difficult to obtain.

Establishment and management

Sowing

Paddocks in which cocksfoot will be sown should be managed in preceding years to minimise weed and insect burdens. This strategy is not specific to cocksfoot, and should be used when considering sowing any pasture species.

Insufficient weed control prior to sowing is the greatest cause of establishment failure in perennial grass-based pastures. Like phalaris (*Phalaris aquatica*), cocksfoot seedlings are very susceptible to competition from more vigorous annual grasses, such as annual ryegrass (*Lolium rigidum*), barley grass (*Hordeum vulgare*) and vulpia (*Vulpia* spp.). It is essential that these weeds be controlled prior to sowing. Spray-topping paddocks in the years preceding sowing can greatly assist in controlling these problem grasses. Additionally, delaying sowing for several weeks after the autumn break will encourage weeds to germinate, thus allowing another opportunity to control them prior to sowing.

Cocksfoot can be sown into a conventional seed bed or direct drilled for good establishment. It may also be established by surface broadcasting of seed, but this practice usually results in stands of lower density.

Autumn to early winter is the preferred time for sowing, as this will enable plants to develop a stronger root system prior to the onset of the first summer. Spring sowing may be an option in higher-altitude areas, or areas with more reliable rainfall over late spring and summer.

Cocksfoot should be sown at rates of 1–3 kg/ha, in combination with annual or perennial legumes. Sowing cocksfoot with very competitive grasses, such as perennial ryegrass (*Lolium perenne*), should be considered carefully, as the vigorous nature of ryegrass may adversely affect the establishment of cocksfoot.

As cocksfoot seed is very small, it should be sown no deeper than 10mm.

Fertiliser

For establishment

To optimise establishment, adequate fertiliser should be used when sowing a new pasture. To enhance establishment of cocksfoot-based pastures, the major elements – phosphorus (P), nitrogen (N) and sulphur (S) – are required in most areas. Soil should be sampled and tested prior to sowing, to determine nutrient requirements. Trace elements, such as molybdenum (Mo), may also be required in some areas. Contact your local district agronomist for further assistance.

Maintenance fertiliser requirements

The productivity and persistence of cocksfoot-based pastures will be enhanced by providing adequate nutrition in the form of fertiliser. It is particularly important to ensure that sufficient P and S are provided to maintain the companion legume population, as legumes provide the N required for vigorous growth of non-leguminous pasture species, such as grasses and herbs. Application of trace elements, such as Mo, may also be required (though less frequently than major elements) in some areas. Contact your local district agronomist for further information.

Grazing

Early grazing strategy

Cocksfoot-based pastures should not be grazed intensively during the year of establishment. Grazing should be delayed until plants have formed a strong root system and are well anchored in the soil.

If climatic conditions have allowed sowing in early autumn, and if establishment has been rapid and growth high, a light grazing may be required in early spring, to allow more light to reach companion legumes, and to encourage tillering of young cocksfoot plants.

If sowing has been delayed until late autumn or spring, or the seedling plants are stressed in any way, grazing should be avoided, to allow plants to develop a strong root system prior to the first summer.

Grazing an established pasture

Generally, cocksfoot-based pastures will be more productive and persistent over the long term if they are rotationally grazed. This allows plants to build up root carbohydrate reserves, which are necessary for survival.

To maintain productivity and quality, cocksfoot should not be allowed to become tall and rank between grazings. So that persistence is not compromised, pastures containing cocksfoot should not be grazed below 1200 kg DM/ha.

The period in which the greatest loss of adult plants can occur is over summer. Grazing needs to be closely monitored in this period, to avoid plant losses. This is particularly important in summer-dry areas, such as southern and western NSW. In these areas, out-of-season summer rainfall can stimulate the growth of plants belonging to the temperate and intermediate groups. If several out-of-season rainfall events occur, and the resulting leaf growth is grazed off after each event, the plants' carbohydrate root reserves are rapidly depleted, and the plants may die. In these regions, pastures containing cocksfoot plants of the temperate or intermediate types should not be grazed over summer unless more than 1200 kg DM/ha is present, and animals should be removed once herbage mass falls below this level.

Varieties belonging to the hispanica subspecies are much less likely to respond to summer rainfall events than those belonging to other groups (though the degree of dormancy differs between varieties in this group). While plants are not actively growing over this period, they can still be susceptible to damage by grazing. This is more likely to occur in erect-growing types than prostrate types. Therefore, care should be taken to minimise damage to dormant plants in this period.

In northern NSW, where summer rainfall is more common, pastures containing cocksfoot can continue to be rotationally grazed over summer. Management should aim to remove animals from pasture once herbage mass falls below 1200 kg DM/ha, to avoid unnecessary stress on the plants.

In cases where significant litter has built up over the summer period, pastures should be grazed in late summer and early autumn, to remove the bulk of the litter. This allows adequate light for annual legumes to germinate, and prevents cocksfoot from becoming too dominant in the pasture.

Manipulating plant density

It is wise to allow cocksfoot to set seed occasionally. The frequency with which this is required depends on the density of cocksfoot in the pasture. Where cocksfoot has declined below the desired level, stands can be encouraged to thicken up by reducing grazing pressure over late spring–early summer to allow seed set, grazing at the end of summer to remove litter, and then delaying grazing after the autumn break, to allow new seedlings to establish.

Conversely, if a pasture has become too cocksfoot-dominant, heavy grazing or cutting at the stem elongation phase of growth will prevent seed set. This should be followed by grazing in late summer to remove litter, allowing greater opportunity for other companion species, particularly annual legumes, to germinate and establish. If the legume content in previous years has become too low, additional legume seed may need to be broadcast or direct drilled into the cocksfoot, to re-establish a sufficient legume population.

Pests and diseases

Pests

The most common pests of cocksfoot are pasture grubs. These include the black-headed cockchafer (*Acrossidius* spp.), the red-headed cockchafer (*Adoryphorus couloni*) and the pasture corbie (*Oncopera* spp.).

Cockchafers, at the larva stage, feed on the roots and leaves of pasture plants, and sporadic outbreaks often occur in tablelands areas from autumn through until spring. Cockchafer feeding weakens plants, and plant mortality can occur, particularly if cockchafer attack is followed by periods of moisture stress. Some varieties show good resistance to attack by cockchafers.

Short, open pastures are more attractive to the black-headed cockchafer beetle. Maintaining pasture cover above 600 kg/ha has been found to minimise the beetle's egg-laying activity.

Removing dry pasture residue before autumn will compromise the habitat of the red-headed cockchafer moth, and assist in reducing egg-laying activity.

Pasture corbies are common in Tasmania. In NSW, they are only reported as causing damage to pastures on the Northern Tablelands. The larvae feed on leaf material, and severe outbreaks can result in rapid removal of vegetation. Rank pasture growth is most attractive to the egg-laying moth; therefore, preventing excessive buildup of rank pasture growth will reduce the opportunity for attack.

Newly sown pastures should also be monitored for presence of blue-oat mite and red-legged earth mite. These should be controlled if necessary. Incorporating strategic management practices with regard to control of these pests in the years leading up to sowing can greatly reduce their numbers.

Diseases

Leaf rust can affect some varieties of cocksfoot. It is most commonly seen in wet summers when large amounts of herbage have accumulated. Grazing to reduce herbage bulk will greatly reduce the incidence of this disease.

Herbage production and nutritional quality

Herbage production

Cocksfoot is capable of moderate to high levels of herbage production in well-managed, regularly fertilised pastures. Growth rates of 60–80 kg DM/ha/day are possible in autumn and spring under conditions of good moisture and temperature. In winter, production will commonly range from 5–20 kg DM/ha/day. The actual amount of herbage produced will be influenced by many factors, including elevation, aspect, soil moisture and temperature.

Herbage quality

When compared under the same conditions of fertiliser input, cocksfoot has similar digestibility and crude protein levels to phalaris. Generally, it is of slightly lower quality than ryegrass.

The quality of cocksfoot-based pastures can be maintained by ensuring adequate fertiliser is applied to maintain a good balance of grasses and legumes in the pasture mix, and by grazing appropriately to ensure that cocksfoot does not become rank and unpalatable.

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Warnings

Pasture improvement may be associated with an increase in the incidence of certain livestock health disorders. Livestock and production losses from some disorders are possible. Management may need to be modified to minimise risk. Consult your veterinarian or advisor when planning pasture improvement.

Legislation covering conservation of native vegetation may regulate some pasture improvement practices where existing pasture contains native species. Inquire through your local CMA office or the Department of Natural Resources for further information.

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