DEPARTMENT OF AGRICULTURE AND FISHERIES, SOUTH AUSTRALIA

Agronomy Branch Report

RYEGRASSES

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RYEGRASSES

COMMON NAMES: Annual ryegrass, Wimmera ryegrass, rigid ryegrass. The term "drake" or "darnel" refer to one particular species. Wimmera ryegrass is named after the district of that name in Victoria where the plants were first observed to be useful fodder.

BOTANICAL NOMENCLATURE: The botanical name of drake is *Lolium temulentum* L. Of the other annual ryegrasses, the following species are recorded for South Australia: *L. rigidum* Gaud. and *L. loliaceum* (Bory and Chaub.) Hand.-Mazz. There are two biennials or perennials. *L. perenne* L. (perennial ryegrass) probably and *L. multiflorum* Lam. (Italian ryegrass) definitely, has annual forms. There is apparently much hybridization between these species which accounts for almost continuous variation between the features of each species. In earlier South Australian literature, *L. loliaceum*, *L. remotum* and *L. subulatum* have been used incorrectly, for the annual species *en masse*.

There are three other annual species which are recognised, although they have not yet been recorded for South Australia. These are *Lolium canariense* Steud., *Lolium remotum* Schrank, which has been recorded in flax crops grown in Victoria, and *L. persicum* Boiss. & Hohen. ex Boiss.

L. loliaceum is sometimes regarded as a variety of *L. rigidum*. In that case its name would be *L.rigidum* var. *rottbolloides* Heldr. ex Boiss.

IDENTIFICATION: The ryegrasses may be readily identified in the vegetative state by their flat, shiny dark-green leaves which are completely hairless. The bases of the stems are usually purplish-red especially when young. The young emerging leaf blades of *L. perenne* are folded whereas those of the other species are rolled. It is difficult to separate the other species in the vegetative stage.

At flowering, the plant may reach almost 1m in height. The inflorescence is a spike, bearing few to many, solitary, sessile, 2- to 22-flowered spikelets in two ranks alternating on opposite sides of the rhachis. Each spikelet has one outer glume (except the terminal spikelet which has two). The lemmas are mor or less ovate or oblong: they may have more or less straight awns up to 2,5cm long. The paleas are similar to the lemmas in size and shape. There are 3 stamens and 2 styles. The grains are usually closely and rather tightly held by the lemma and palea. They are oblong to narrow-elliptic, rounded to subacute at base, rounded and with a whitish apical area at the distal end.

The following key may be followed to separate the species and varieties recorded for South Australia.

Key to the *Lolium* spp. of South Australia

Plants annual (but may be biennial or perennial, especially in *L. perenne*), spikelets longer than the outer glume which is usually less than 15mm long.

Usually perennial, lemmas awnless, spikelets 2-10 flowered leaf shoot folded in bud ..... *L. perenne*

Lemmas with prominent awns, spikelets 10 flowered leaf shoot rolled in bud ..... *L. multiflorum*

Plants always annual, spikelets generally shorter than the outer glume which is usually longer than 15 mm.

Mature grains plump and thick, only 2-3 times longer than wide ..... *L. temulentum*

Mature grains more than 3 times longer than wide.

Florets large, 6.0-12.0mm long, 1.0-2.5mm wide; spikelets only 2- to 4- flowered, with long (2.0-6.5mm)rhachilla segments; glumes usually acute or acuminate, 14-25mm long ..... *L. subulatum*

Florets smaller, 3.0-8.5 (rarely to 10)mm long, 0.9-2.0mm wide; spikelets 2- to 11- flowered with short (1.0-3.5mm) rhachilla segments; glumes obtuse to acute 4-20mm long.

Rhachis somewhat cylindrical or angular in cross section slender to somewhat indurated, (0.5-) 1.0-1.5 (-2.0)mm in diameter at lowest nodes of rhachis; lemmas or florets usually 4.5-8.5mm long: spikes 9-30cm long ..... *L. rigidum*

Rhachis cylindrical, indurated, 1.5-3.5mm in diameter at lowest nodes or rhachis; lemmas or florets usually 3.0-7.0mm long; spikes 3-11 (-20)cm long; culms usually less than 30cm long ..... *L. loliaceum*

LIFE CYCLE:

Successive germinations of annual ryegrass occur after the opening rains. Early growth is slow but steady during winter. In late winter and early spring, there is a rapid production of herbage followed by stem elongation and head emergence. Flowering may commence as early as late July in drier localities and continues until late November in wetter areas.

BIOLOGY:

After the seed has formed there is some summer dormancy which disappears during autumn, although from 10-20% of the total seed reserves are induced into dormancy by darkness i.e. by being buried. Some germination will occur during summer, but the main germination occurs at the usual time of the opening rains. Compared to some other weedy grasses, annual ryegrass still has a substantial germination into early winter, by which time cereal crops have been planted.

As light inhibits germination, annual ryegrass prefers a shallow covering of 2-3cm for maximum emergence, but it is still able to germinate fairly freely from as deep as 10cm, as the following figures show:

Depth of Planting (cm)	% Emergence of Ryegrass
0	64.4
1.5	79.0
2.5	78.8
7.5	34.2

(After Smith, 1968)

Early ryegrass growth is not as vigorous as that of barley grass. It

is for this reason that the latter grass is highly valued as an early winter feed in annual pastures.

Ryegrass is very palatable. In contrast to many other grasses even the heads are readily eaten by stock. Grazing management has a marked effect on the seed production and hence persistence of ryegrass.

Effect of different grazing management on the proportion of annual ryegrass in a mixed sward

Percentage Composition Autumn 1964	Previous Management: Two Years Moderate Grazing 1962-63	Previous Management: Two Years Heavy Grazing 1962-63
Annual ryegrass	32.3	1.6
Barley grass	61.3	86.6
Clover	2.9	2.9
Other species	4.4	9.8

(After Smith, 1968)

Furthermore, seed harvesting ants preferentially gather ryegrass seeds as they are awnless and relatively light. These two factors will reduce the amount of seed available. In an uncultivated pasture paddock, the seed that does remain is not buried which, as shown above is not the condition for maximum germination. In mismanaged annual pastures, annual reyegrass tends to disappear to be replaced by weedier grasses.

In crops, ant nests are destroyed by cultivation, stock are excluded, and the turning of the soil buries the seed. As these factors, which in pastures operate against ryegrass persistence, are removed, and as this plant has a greater proportion of seed left to germinate late in the season when the crop has been planted, ryegrass becomes the dominant grassy weed of cereal crops throughout much of southern Australia. Field populations of 20 000 ryegrass seeds per square metre have been recorded from Western Australia.

ORIGIN AND CURRENT WORLD DISTRIBUTION:

Originally from Europe and the North Atlantic Islands the Mediterranean basin and the Middle East, these plants have followed European settlement around the globe. The annual species in particular, flourish in those regions having a Mediterranean climate.

HISTORY IN AUSTRALIA:

Ryegrasses were introduced into Australia very early after settlement. The perennial forms were imported and were planted as forage plants in the western districts of Victoria as early as 1853. The annuals were introduced, even earlier. Specimens collected around Adelaide by von Mueller and others from 1847 onwards are in the National Herbarium, Melbourne. Drake was

recorded as infesting the Australian wheat crop in 1795. As contaminants of cereal seed they spread throughout Australia with the expansion of grain production, as old botanical records clearly show.

Drake was a great problem in cereals until the late 1940's but has since diminished, until now, it is very rare. The disappearance of this weed problem is linked with the introduction of harvesting by direct heading. Previously the stripper in general use harvested the cereal heads and weeds, and the grain was subsequently winnowed which removed chaff but not foreign matter. The header threshes the heads and by passing the thrashed material over a screen, drake seed is cleaned out during heading about the same time more effective stationary cleaning machinery was introduced. The overall effect was that drake was cleaned out of wheat intended for seed in subsequent season. This plant is considered to be an obligate weed i.e. it can only exist as a weed, in this case, of cereals. If it is not planted it cannot persist and quickly dies out.

The other annual ryegrasses are generally prized as fodder grass. The "Wimmera" strain was noticed in the Victorian area of that name in 1917 and has become a recommended component of annual pastures. As they freely seed they have become very common throughout temperate Australia in cropping land.

LEGAL STATUS:

No species of ryegrass has ever been proclaimed as a noxious weed anywhere in Australia. Cultivars of perennial ryegrass are included in seed certification schemes of various States.

CURRENT DISTRIBUTION IN AUSTRALIA:

Within South Australia the annual ryegrasses have spread widely and they now occur throughout the cropping areas. There are no known preferences for a particular soil type, and climatic limitations e.g. rainfall and frost, are those that limit cereals anyway. Annual ryegrasses are also found in perennial pasture country, although it is possible that such plants are annual forms of perennial ryegrass. And the distribution throughout temperate Australia is very similar.

WEEDY PROPERTIES:

The annual ryegrasses are the cause of a significant human health problem in South Australia. About 15% of the adult population of this State suffers from seasonal hay fever. Of this group between 70 and 80% are estimated to be affected by ryegrass. Pollen is found in particularly high concentrations in the Adelaide area as north-east and north-west winds which are prevalent in spring blow the pollen to the metropolitan area. The Adelaide Hills causes a "bowl effect" in which the pollen settles in the lee of the range. Many thousands of people suffer mild to very severe discomfort as a result of their allergy to ryegrass pollen. Medical treatment will alleviate much of the problem and this appears to be the only practical course of action, as the huge ryegrass population is beyond any economical method of control. It is noted in passing that wild oats (*Avena fatua*) Yorkshire fog grass (*Holcus lanatus*) and phalaris (*Phalaris* spp.) also cause hay fever but to a minor extent compared to ryegrass.

Since antiquity, drake has been known to have poisonous properties, and flour made from contaminated wheat has in turn been poisonous. The toxic principle has generally been ascribed to a fungus which may infest the grain, producing an alkaloid, temulin. No well-documented case of this poisoning has ever been recorded in Australia.

Around Black Springs and Farrell Flat in the Lower North of South Australia and in the Katanning-Gnowangerup areas of Western Australia, annual ryegrass parasitized by the nematode *Anguina agrostis* and two bacteria, one of which is a *Corynebacterium*, causes inco-ordination, tetanic spasm and death in sheep and cattle. It is not yet clear which organism, or whether it is the combination, that is responsible for the poisonous principle. Originally this toxicity was confined to a small area in each State where it has been observed since about 1960. In the last few years, the problem has become widespread in South Australia. A research investigation is in progress. As no treatment is available at this stage for controlling the nematode and/or the bacterium, the disease must be tackled by reducing the ryegrass population.

The problem of contamination of harvested produce with ryegrasses has a number of aspects. Ryegrasses including drake are no longer a problem in cereal grain with advanced harvesting and cleaning equipment. In Western Australia however, the annual ryegrass, including drake, are serious weeds of linseed crops. Drake in particular is very difficult to clean out of linseed.

Perennial ryegrass seed grown for the sowing of perennial pastures is likely to be contaminated with "off-types" which are usually annual ryegrasses or annual forms of perennial ryegrass. Because of the similarity between the seeds it is impossible to clean the unwanted forms from the perennial ryegrass.

Whilst annual ryegrasses are a valuable fodder plants in the annual pastures of the cereal rotation areas, the same plants are a very serious competitor with annual winter crops, particularly cereals. The vigorous growth of autumn and early winter provides very strong competition which markedly affects crop yields later in the season.

The following table shows the increase in the numbers of subterranean clover plots per quadrat when annual ryegrass is controlled with increasing rates of the herbicide trifluralin :

Rate of chemical l/ha	0	1.4	2.1	2.8	3.5
Plants/quadrat (Average of 8 replicates)	32.8	38.3	46.9	46.6	55.3

(Kloot & Dawes, 1971)

In Western Australia, the competitive effect of annual ryegrass is shown by measurements at Merriden in 1969. This was a dry year in which yield losses by competition were masked by the general water shortage. Yet even under these conditions it was found that 31 ryegrass plants per square metre reduced the wheat yield by 25 per cent.

Further illustrations of yield losses due to annual ryegrass competition are given in the following table in which the yields of wheat in which maximum control of reygrass was obtained are compared with yields from untreated plots. The Victorian data is from 1966 and the South Australian figures from 1969.

	Yield of Wheat Grain (kg/ha)				
	Victoria 1966			S.A. 1969	
	Longeronong	Rutherglen	Dookie	Bute	Maitland
Untreated	1060	1260	2350	1098	2393
Most effective control of annual ryegrass	1480	1960	2950	1391	3165

(Reeves & Tuohey, 1972;
Catt & Baldwin, 1972)

Even as early as prior to the two leaf stage of wheat, the presence of ryegrass adversely affected final yield by reducing tillering due to competition for nitrogen. The results of this early competition was irreversible.

CONTROL:

Generally, control is only required in crops. A minor exception to this would be the need to restore a balance between grasses and legumes in a grass dominated pasture. In the short term, the use of selective grass-killers, such as paraquat or carbetamide would be indicated, whilst over a longer period, the use of phosphatic fertilizers instead of nitrogenous fertilizers would also achieve the same purpose. The following table shows the reduction in numbers of flowering tillers following the application of paraquat at two different times during 1973 to trial plots at Katanning in Western Australia.

The number of flowering tillers of ryegrass on 23/10/73 following various treatments of paraquat

Paraquate treatment	Flowering stalks per 400 sq. cm.
1. 1.4 l/ha 10/7/73	8.4
2. 1.15 l/ha 3/10/73	0.5
3. Nil	19.6

(After Pearce *et al*, 1974)

Ryegrass control may start in the year preceding the crop. Close grazing, mowing or cultivation in spring or burning in the summer, will reduce, often considerably, the amount of seed available to germinate in the crop. The following figures obtained at the Newdegate Research Station, Western Australia, clearly shows the reduction.

The number of plants of annual ryegrass in May, 1971 on plots receiving heavy grazing in 1970 and autumn burning in 1971

Treatment	Plants per 400 sq. cm.
1. Heavy spring grazing 1970	8.2
2. Autumn burnt 1971	22.3
3. Normal grazing 1970	97.1

A combination of treatment 1 and 2 would obviously reduce the seed survival still further.

(Pearce *et al.* 1974)

Similar results have been reported from Victoria. Additionally it was found that mouldboard ploughing gave better ryegrass control and better wheat yields than did disc ploughing.

Prior to crop emergence, triallate, trifluralin and mixtures of both, penoxylan, diallate and alachlor may be used for selective control. Post emergence selective control in cereals has recently been developed with metoxuron and diclofopmethyl. Diuron will also give some control. A larger range of selective post-emergence treatments are available in legume, cruciferous and composite crops.

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