DEPARTMENT OF AGRICULTURE AND FISHERIES, SOUTH AUSTRALIA

Agronomy Branch Report

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EYGRASSES

COMMON NAMES: Annual ryegrass, Wimmers ryegrass, rigid ryegrass. The term "Grass" or "Cereal" refer to one particular species. Wimmers 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 stave is Lolium temulentum L. Of the other annual ryegrasses, the following species are recorded for South Australia: L. rigidum Gaud., and L. multiflorum (Sory 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. Loliumum, L. remontum and L. subtilis have been used incorrectly, for the annual species en mass.

There are three other annual species which are recognized, although they have not yet been recorded for South Australia. These are Lolium cerasiforme Steed., Lolium ramosum Schrantz, which has been recorded in field crops grown in Victoria, and L. perennis Bois., & Hohen. ex Boiss.

L. Loliumum is sometimes regarded as a variety of L. rigidum. In that case its name would be L. rigidum var. rorbdiloides Hedr. ex Boiss.

IDENTIFICATION: The rye grasses may be readily identified in the vegetative stage 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 state.

At flowering, the plant may reach almost 1m in height. The inflorescence is a spike, bearing few to many, solitary, sessile, 5- to 22-flowered spikelets in two ranks alternating on opposite sides of the rachis. Each spikelet has one outer glume (except the terminal spikelet which has two). The lemmas are not or less one-tined or oblong; they may have more or less straight arms up to 15mm 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 must folded in bud .......................... L. perenne

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

The following key may be followed to separate the species and varieties recorded for South Australia.
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, 6.0-12.0 mm long, 1.0-2.5 mm wide; spikelets only 2- to 4- flowered, with long (2.0-6.5 mm) rachilla segments; glumes usually acute or acuminate, 14-25 mm long .................. L. subulatum

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

Rachis somewhat cylindrical or angular in cross section slender to somewhat indurated, (0.3-) 1.0-1.5 (-2.0) mm in diameter at lowest nodes of rachis; lemmas or florets usually 4.5-8.3 mm long; spike 9-30 cm long .................. L. rigidum

Rachis cylindrical, indurated, 1.5-3.5 mm in diameter at lowest nodes or rachis; lemmas or florets usually 3.0-7.0 mm long; spike 3-11 (-20) cm long; culms usually less than 30 cm long .................. L. lollium

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 2-3 cm for maximum emergence, but it is still able to germinate fairly freely from as deep as 10 cm, as the following figures show:

<table>
<thead>
<tr>
<th>Depth of Planting (cm)</th>
<th>% Emergence of Ryegrass</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>64.4</td>
</tr>
<tr>
<td>1.5</td>
<td>79.0</td>
</tr>
<tr>
<td>2.5</td>
<td>78.8</td>
</tr>
<tr>
<td>7.5</td>
<td>34.2</td>
</tr>
</tbody>
</table>

(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
seed 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 stand

<table>
<thead>
<tr>
<th>Percentage Composition</th>
<th>Two Years Moderate</th>
<th>Two Years Heavy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grazing 1962-63</td>
<td>Grazing 1962-63</td>
</tr>
<tr>
<td>Annual ryegrass</td>
<td>32.3</td>
<td>1.6</td>
</tr>
<tr>
<td>Barley grass</td>
<td>61.2</td>
<td>86.6</td>
</tr>
<tr>
<td>Clover</td>
<td>2.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Other species</td>
<td>4.4</td>
<td>9.8</td>
</tr>
</tbody>
</table>

(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 ryegrass tends
to disappear to be replaced by weeder 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 infecting 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 was 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 threshed material over a screem, drake seed is cleaned out during heading about the same time as 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 rye grasses are generally prized as fodder grass. The "Viennese" 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 rye grass has ever been proclaimed as a noxious weed anywhere in Australia. Cultivars of perennial rye grass are included in seed certification schemes of various States.

CURRENT DISTRIBUTION IN AUSTRALIA:

Within South Australia the annual rye grasses 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 rye grasses are also found in perennial pasture country, although it is possible that such plants are annual forms of perennial rye grass. And the distribution throughout temperate Australia is very similar.

WEEDY PROPERTIES:

The annual rye grasses 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 rye grass. Pollen is found in particularly high concentrations in the Aelaide Hills area on north-east and north-west winds which are prevalent in spring blow the pollen to the metropolitan area. The Aelaide Hills causes a "bad 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 rye grass pollen. Medical treatment will alleviate much of the problem and this appears to be the only practical course of action, as the huge rye grass 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 rye grass.
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 Parrell 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-type" 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 number of subterranean clover plots per quadrat when annual ryegrass is controlled with increasing rates of the herbicide trifluralin:

<table>
<thead>
<tr>
<th>Rate of chemical 1/ha</th>
<th>0</th>
<th>1.4</th>
<th>2.1</th>
<th>2.8</th>
<th>3.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plants/quadrat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Average of 8 replicates)</td>
<td>32.8</td>
<td>38.3</td>
<td>46.9</td>
<td>46.6</td>
<td>55.3</td>
</tr>
</tbody>
</table>

(Kloot & McLean, 1971)

In Western Australia, the competitive effect of annual ryegrass is shown by measurements at Merredin 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 ryegrass was obtained are compared with yields from untreated plots. The Victorian data is from 1966 and the South Australian figures from 1969.

<table>
<thead>
<tr>
<th></th>
<th>Victoria 1966</th>
<th>S.A. 1969</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Longeronong</td>
<td>Kambalda</td>
</tr>
<tr>
<td>Untreated</td>
<td>1060</td>
<td>2260</td>
</tr>
<tr>
<td>Most effective control of annual ryegrass</td>
<td>1480</td>
<td>1960</td>
</tr>
</tbody>
</table>

(Reeves & Tusen, 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-killer*, such as parquat 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 parquat at two different times during 1973 to trial plots at Karramoo in Western Australia.

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

<table>
<thead>
<tr>
<th>Parquat treatment</th>
<th>Flowering stalks per 400 sq. cm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 1.4 l/ha 10/7/73</td>
<td>5.4</td>
</tr>
<tr>
<td>2. 1.15 l/ha 3/10/73</td>
<td>0.5</td>
</tr>
<tr>
<td>3. Nil</td>
<td>19.6</td>
</tr>
</tbody>
</table>

(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 Bawadgata 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

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plants per 400 sq. cm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Heavy spring grazing 1970</td>
<td>8.2</td>
</tr>
<tr>
<td>2. Autumn burnt 1971</td>
<td>21.3</td>
</tr>
<tr>
<td>3. Normal grazing 1970</td>
<td>97.1</td>
</tr>
</tbody>
</table>

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 disc disc ploughing.

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

FURTHER READING:


