Sowing dates in perennial and perennial type hybrid ryegrass seed crops

Key Points

- Earlier sowing produces greater forage and, therefore, added economic value.
- When three years data were combined, there was a significant downward trend in seed yield, at 0.17%/day, or 3.4kg/ha/day for a 2000kg/ha crop (Figure 2).
- Spring emerged tillers are an important component of yield when sowing after 1 May; they contributed greater than 50% of seed yield from the later sowing dates. These results contradict popular belief that spring tillers don’t contribute to seed yield.
- Economic analysis suggests that for each day of delay in sowing, combined losses from forage and seed yield equates to approximately $11.60/ha/day. Seed losses from delayed sowing for growers not grazing are less severe, at approximately $5.00/ha/day, although greater losses could be encountered through too much forage production if sown early.
- Italian ryegrass seed crops are currently under investigation.

Background

Three years of sowing date trials have been completed on Perennial and Hybrid ryegrass cultivars. Investigations have focused on forage production, tiller production and tiller contribution to final seed yield.

These trials have all been completed at Lincoln. Hence, growers from cooler regions should consider adjusting data for their respective areas where information is referred to as a calendar date e.g. if winter in Methven is two weeks earlier, adjust sowing date results by approximately two weeks. Where information is referred to in thermal time, it is not site or season specific and can be transferred across all regions.

Vegetative growth and tillering

Tillering is a continuous process and therefore a grass plant comprises of a collection of tillers of different ages. Before reproductive initiation has taken place perennial grasses remain vegetative. Each tiller continues to produce new leaves (foliage) at a rate dependent primarily on temperature (thermal time or degree days). As new leaves are formed an axillary bud is present in the leaf axil. Under periods of vigorous plant growth the axillary bud will transform into a tiller. Since tillers are associated with leaf production their formation is also driven primarily by temperature. Therefore, earlier sowing dates have the potential to produce more tillers/m² from the same sowing rate. Year one data (Arable Update, Herbage No. 43) has shown more tillers at closing from early sowings (vegetative tillers), but with little difference at harvest (number of reproductive tillers) from five sowing dates, spreading 100 days from 22 February. Ryegrass, unlike cereals, can produce “late season” tillers at the base of reproductive tillers during spring, these are likely to remain vegetative or form late seed heads.

Reproductive initiation

Photoperiod and vernalisation are the two environmental triggers required for the floral induction of perennial ryegrass (and to a certain degree, hybrid ryegrass, depending on cultivar). The change from vegetative to reproductive growth occurs after exposure to a period of cool temperatures (vernalisation - likely to be between about 0 and 10 ºC) followed by an increase in day length. The critical requirements for vernalisation and day length are likely to vary between cultivars and lead to differences in ear emergence and harvest date.

Results

Dry Matter Production

Sowing date, in effect alters exposure to accumulated temperature and solar radiation, which in turn affects biomass production (leaf and tiller production) and grazing options. Sowing date and grazing are therefore tools for canopy management and will alter biomass present at closing. Three years of data has shown large reductions in forage production and forage based income where sowing date was delayed (Table 1 and Figure 1). Differences in dry matter accumulation between years (as shown in Figure 1) showed a similar rate of decline. Between year differences are likely to be due to differences in fertility, management etc. Production between perennial and hybrid ryegrasses followed the same trends.
Table 1: Utilised dry matter production (cultivar Samson) and associated thermal time (°C days) from different sowing dates until final grazing for two seasons

<table>
<thead>
<tr>
<th>Sowing date</th>
<th>Accumulated thermal time</th>
<th>Utilised DM (ha)</th>
<th>Forage based income ($/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Feb 2005</td>
<td>2274</td>
<td>5659</td>
<td>679</td>
</tr>
<tr>
<td>03 Mar 2005</td>
<td>1938</td>
<td>6717</td>
<td>806</td>
</tr>
<tr>
<td>31 Mar 2005</td>
<td>1513</td>
<td>3726</td>
<td>447</td>
</tr>
<tr>
<td>20 Apr 2005</td>
<td>1274</td>
<td>2689</td>
<td>323</td>
</tr>
<tr>
<td>30 May 2005</td>
<td>1091</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26 May 2005</td>
<td>920</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>22 Feb 2003</td>
<td>2054</td>
<td>4810</td>
<td>577</td>
</tr>
<tr>
<td>13 Mar 2003</td>
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<td>310</td>
</tr>
<tr>
<td>14 Apr 2003</td>
<td>1339</td>
<td>1920</td>
<td>230</td>
</tr>
<tr>
<td>02 May 2003</td>
<td>1153</td>
<td>643</td>
<td>77</td>
</tr>
<tr>
<td>30 May 2003</td>
<td>884</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Forage based income calculated on 12c/kg utilised DM.

Figure 1: Utilised dry matter production from two seasons as sowing was delayed after 1 February (cultivar Samson)

Yield components

Early sowing produced greater numbers of tillers/m² at closing (4500 vs. 1922 for late February and early May respectively). However, two years of trials have shown little difference in the number of reproductive tillers present in mid December, when the sowing date is before 1 June. Sowing after 1 June reduced tiller numbers. Spring formed tillers (after mid September) made up 50% of reproductive tillers when sowing date has been delayed after early/mid May. This suggests:

- Under earlier sowing conditions, the number of tillers that remain vegetative or die is high compared to later sowing dates.
- Under later sown conditions, tillers which emerge in the spring tend to become reproductive as opposed to vegetative.

Sowing date had little effect on other yield components, with a trend for late sown ryegrass to have fewer spikelets/ear but floret number was inconsistent between cultivars and sowing date.

Seed yield

In cereals, earlier sowing often leads to higher grain yield through an increase in dry matter production as associated with greater exposure to solar radiation and temperature. In grasses however, earlier sowing leads to greater than optimum forage production which can interfere with seed production. Under these circumstances grazing must occur or seed yield will be limited due to excess lodging and its associated losses. Three years of data from Lincoln (cultivar Samson) has shown a significant trend for later sowing dates to reduce seed yield (Figure 2). No dramatic drop off in seed yield has been experienced. This trend equates to 0.17% per day or 3.4kg/ha/day for a 2000kg/ha crop (or approx. $5/ha/day, excluding forage).

No differences have been seen between perennial or hybrid ryegrasses or between cultivars and the trend has been similar.

Economics

Dry matter production was reduced on average by approx. 55 kg/ha/day from delayed sowing (Figure 1). At 12c/kg DM this equates to $6.60/ha/day. For certain cultivars this loss may be higher if their ability to produce DM is greater than the cultivars used in these studies i.e. Hybrid or Italian cultivars. Rate of seed yield decline was about 0.17% or 3.4kg/ha/day for a 2000kg/ha crop (three year average). Therefore at $1.50 this equates to approx. $5.00 per day, overall, each day sowing is delayed a potential loss of $11.60 accumulates (assuming grazing has occurred). If sowing early and no removal of forage is planned, a decrease in seed yield could be expected from most forage grasses through excess lodging (not necessarily the case with turf types).

These results contradict earlier sowing date information available where seed yield has declined markedly with delayed sowing date. It has been considered that autumn formed tillers have provided a greater contribution to seed yield. Possible explanations include, new cultivars, soil nitrogen levels, soil fertility levels etc. Further work would be required to confirm these.

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