

**The investigation of flowering time of late/rare flowering *Lolium perenne*.**

S. Byrne<sup>1</sup>, I. Donnison<sup>2</sup>, L. Mur<sup>3</sup>, E. Guiney<sup>1</sup>

<sup>1</sup>*Teagasc Crops Research Centre, Oak Park, Carlow.*

<sup>2</sup>*Institute of Grassland and Environmental Research, Aberystwyth, Wales.* <sup>3</sup>*University of Wales, Aberystwyth.*

**Introduction**

Flowering in *Lolium* results in reduced nutrient content and reduced digestibility and its inhibition would enhance forage quality. Flowering regulation has been well studied in *Arabidopsis thaliana* (Simpson and Dean, 2002) and orthologs of *Arabidopsis* flowering genes underlying heading date Quantitative Trait Loci (QTL) have been identified in rice (Yano et al, 2000). However it is not clear yet how universally applicable such studies are to *Lolium*. The project goals are to characterise the gene expression profiles of late/rare flowering *Lolium* plants to determine factors affecting flowering and to map the genes involved in the flowering process. Initial studies, reported here, have focussed on the ability of selected plant lines from the Oak Park breeding programme to flower in controlled environments.

**Materials and methods**

The six plant lines have been observed not to flower within the normal time frame (85 days post secondary induction) by the Oak Park breeding group under field conditions in the period 2001-2002 and under pot conditions in 2003. The six lines, representing 3 families, together with a control from each family (a plant in which flowering has been observed) and an early flowering variety (Moy) were vernalised. Five plants from each line were then transferred to growth chambers at 18°C with continuous light for 21 days secondary induction (SI), after which they were monitored under greenhouse conditions for days to heading, day 0 taken as the start of SI (Table 1). Plants from each line were also observed under natural day length conditions in 2004 for days to heading, in this case April 1<sup>st</sup> was taken as day 0 (Table 2). Once heading had occurred selected plant lines were placed together inside pollination bags to be cross pollinated to investigate seed setting ability and to confirm that lines were incapable of self pollination. Pollen viability was determined using 1% acetocarmine stain and viewing under a microscope. Seeds were harvested from all crosses three months post pollination.

**Results**

**Table 1:** Mean days to heading of plant lines given 24hrs light at 18°C for 21 days. (c)=controls

<i>Lolium perenne</i> Lines	Days to Heading (Day 0 = Start of SI)
X 15	Did not head
X 19 (c)	21
J 74	28.6
J 51	29.2
J 54	26
J 47	26.4
J 43 (c)	21.2
V 16	22.6
V 13 (c)	21
Moy	21

**Table 2:** Days to heading (≥ 3 heads emerged for 50% population) of plants under natural day length conditions (2004). (c) = Controls.

<i>L. perenne</i> Lines	Days to Heading (Day 0=April 1 <sup>st</sup> )
X 15	Did not head
X 19 (c)	56
J 74	87
J 51	91
J 54	87
J 47	76
J 43 (c)	66
V 16	90
V 13 (c)	40
Moy	38

All plant lines headed in outdoor pots in 2004, with the exception of X15 (Table 2), a trend not seen in previous years. However, flowering did occur outside the normal heading date range of 35-85 days from April 1<sup>st</sup>. The severely stunted X15 line did produce immature inflorescence in 2004 but they did not fully emerge from the stalk. Heading was also observed under controlled environmental conditions (Table 1). The 3 controls and Moy headed at the same time under continuous photoperiod, in contrast to the time of heading under natural day length conditions. This indicates saturation of the long day requirement. The late/rare flowering lines from the J family, which flowered as many as 8 days later than the other families, appear to have a greater long day requirement. All pollen from heading plants appeared normal when viewed under the microscope. All crosses within J family members yielded greater than 100 seeds. Two crosses carried out within V family yielded only 3 and 5 seeds. No seed was obtained from self pollinated plants confirming self incompatibility, which is characteristic of *Lolium perenne*.

**Conclusion**

All plant lines with the exception of X15 are capable of flowering and setting seed. Based on these results J51 along with X15 appear the most interesting lines for future work.

**References**

- Simpson, G.G. and Dean, C., (2002) *Science*, 296, 285-289.
- Yano, M., Katayose, Y., Ashikari, M., Yamamouchi, U., Monna, L., Fuse, T., Baba, T., Yamamoto, K., Umehara, Y., Nagamura, Y. and Sasaki, T. (2000). *The Plant Cell*, 12, 2473-2483.