The effect of blue light on leaf growth and plant development in two morphologically contrasted perennial ryegrass genotypes: cellular basis and ecological implications

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Introduction Several major plant responses to competition for light are determined by responses to light signals, in particular to red/far-red ratio (R/FR) and blue light, besides responses mediated through photosynthesis and carbon assimilation (Gautier *et al*., 1999). These responses to light signals allow plants to react to the presence of neighbours and to anticipate the impact of light competition on photosynthesis. The objective of the study was to evaluate the impact of blue light on leaf growth and its cellular basis, on two short and long leaved populations (FC and FL respectively), which were shown to have different competitive ability (Hazard *et al*., 1996).

Material and methods Seeds of FL and FC population were germinated and set into two twin growth cabinets. In one of the cabinets, blue light (400-550 nm) was totally suppressed with plastic filter (Blue$^-$ treatment), and supplemental lamps allowed to get similar PAR (320 µM m^{-2} s^{-1}). Leaf elongation rate (LER), leaf elongation duration (LED) and tiller number were recorded. Epidermal cell elongation rate (CER) and number of elongating cells (NEC) in the leaf growth zone were determined on leaf 6 according to MacAdam *et al.* (1989).

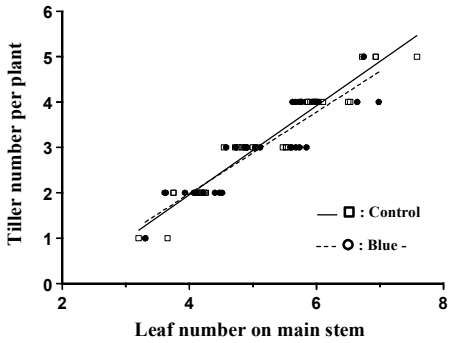

Figure 1 Plant tillers number in relation to leaf number (main stem)

Results Leaf appearance rate was not affected by blue light (not shown). In addition, the relationship between tiller and leaf number on the main stem was similar in control and Blue$^-$ treatment, indicating no significant effect of blue on site usage (Fig. 1). Therefore, blue light did not alter the pattern of plant development (rhythm and co-ordination of organ initiation), in both ryegrass populations. In contrast, blue light suppression significantly altered leaf growth (Table 1). Lamina and sheath length were increased by +32% and + 52% respectively. LER was increased by +38%. The increase in LER was mostly due to increased cell elongation rate (FC) or increased division rate (FL). FL had a greater leaf length response to blue light suppression than FC.

Table 1 Effect of suppressing blue light on leaf growth and cellular dynamics

		Mature leaf 6				Growing leaf 6			
		Lamina length (mm)	Sheath length (mm)	Cell number (cel /file)	Cell length (µm)	LER (mm /d)	LED (d)	CER (µm /cel /h)	NEC (cel /file)
FC	Blue+	175 a	38 a	451 a	475 a	1.2 a	140 a	11.0 a	95 a
	Blue-	219 b	51 b	514 ab	535 ab	1.6 b	136 a	13.0 b	113 ab
FL	Blue+	251 b	46 bc	531 b	548 b	1.5 b	162 b	12.0 ab	115 b
	Blue-	346 c	77 c	625 c	676 c	2.0 c	167 b	12.7 ab	139 c

Conclusion Blue light does not alter the timing and the co-ordination of plant development, in contrast to R/FR (Gautier *et al*., 1999). However, blue light has a major impact on leaf growth and leaf size, due to cell elongation or cell division depending on genotypes. From a grassland ecology point of view, the increase in leaf size under low blue light may i) lead to an increased light capture under situation of competition for light; ii) play a role in the tiller size – tiller density compensations observed according to grazing management.

References

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