Thermal time requirements for leaf appearance of ‘Frontier’ balansa clover

Balansa clover (Trifolium michelianum) produces mainstem leaves at a faster rate than white clover (T. repens) and Perennial ryegrass (Lolium perenne) but axillary leaf initiation occurs at a similar time.

Background
Balansa clover is an annual Mediterranean species that complements the ubiquitous white and subterranean clovers (T. subterraneum) in pasture mixtures of dry coastal regions of New Zealand. Successful autumn re-establishment of annual clovers in a perennial pasture requires rapid leaf appearance and canopy expansion into open spaces to minimise competition for light.

Results
The number of leaves on the mainstem increased linearly with thermal time above a base temperature of 4.4 °C (R²=0.96).

Unifoliate (spade) leaf appearance was estimated at 171 °Cd, phyllochron at 60 °Cd and axillary shoot development at 463 °Cd using a T_b of 0 °C.

Materials and Methods
‘Frontier’ balansa (TSW = 0.9 g) was sown in controlled environment cabinets (Conviron PGV36) with the photoperiod set to 8 h light, 8 h dark with 4 h transitions. Five temperatures were used and recorded at the soil surface. A linear model of cumulative primary stem leaf appearance rate vs. thermal time (Tt) was used to define base temperature (T_b) and phyllochron. Axillary shoot development was analysed by exponential curve fitting.

Discussion
Thermal time requirements for leaf initiation, phyllochron and onset of axillary shoot development were comparable to subterranean clover.

The phyllochron of white clover and ryegrass are 94 and 101 °Cd (T_b=0 °C), respectively (Black et al., 2002), and would therefore give autumn germinating balansa clover a ~ 3:2 leaf appearance advantage in a pasture.

Mainstem and total leaves of ‘Frontier’ balansa clover against accumulated thermal time (T_b=0 °C)

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Meat & Wool, New Zealand (www.meatnz.co.nz)
Lincoln University Agriculture and Life Science Division.
D. P. Monks
D.J. Moot
Agriculture and Life Sciences Division,
PO Box 84
Lincoln University
Canterbury, New Zealand.
email: monksd2@lincoln.ac.nz