Growth responses of subterranean clover to temperature

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The effects of temperature on the growth of subterranean clover depend on the plant density, the amount of dry matter present, mineral nutrition, the solar radiation and the genotype. Since it is difficult to measure growth responses to temperature in the field due to associated variation in light flux density or growth stage, controlled environment chambers are often used for this purpose.

'Woogenellup' at a density of about 2,000 plants m^{-2} responded positively to temperature increase (15 to 30?C) early in ontogeny but negatively at later stages of growth (1). Little quantitative information is available on the way different genotypes respond to temperature and the experiment described below was conducted to measure the growth rates of four cultivars of clover at two contrasting temperatures when grown with or without nitrate.

Methods

Small swards were established in pots at approx. 12,000 plants m^{-2}, seedlings inoculated with *Rhizobium trifolii* and irrigated daily either with a complete nutrient solution containing 7.5 mM NO3- (+N) or with an equivalent solution free of mineral N (ON). Harvests were made every 7 days and growth curves constructed by linear regression. Four cultivars were compared for response to NO3- in a growth room at 10?C in one experiment and later in the same cabinet at 20?C. The light flux density was 400p.mol quanta $m^{-2}s^{-1}$. Daylength was 12h. The regression analysis involving intercept and slope accounted for 98% of the total variation generated by time, genotype, NO3- and temperature.

Results and Discussion

The crop growth rates (g.pot^{-1} day^{-1}) for each cultivar under each condition are given in the table.

Cultivar		Crop Growth Rate 10°C	20°C
Daliak	+N	0.148	0.136
	0N	0.127	0.121
Clare	+N	0.173	0.165
	0N	0.146	0.138
Woogenellup	+N	0.174	0.136
	0N	0.162	0.125
Mt. Barker	+N	0.134	0.138
	0N	0.117	0.119

Main Effects and Interactions	
Temperature	: 10°C>20°C
NO3-	: 7.5>0
Genotype	: Clare>Woogenellup >Mt. Barker>Daliak
Temp x NO_3	: n.s.
Genotype x NO_3	: significiant
Genotype x Temp	: significant

The fact that the crop growth rate was greater at 10?C than at 20?C confi[r]ms our earlier finding (1) for the cultivar Woogenellup established at a lower denisty (2,000 plants m^{-2}). Thus very young swards of sub-clover appear to be depressed in growth rate by even the moderate temperature of 20?C (no interaction was apparent) and plants may benefit from available mineral nitrogen during establishment. The vigour of Clare was clearly evident whilst Woogenellup, which has a reputation for winter production, was better than Mt. Barker. Woogenellup also responded better than other cultivars to 10?C cf 200C.

These results show that early growth of subterranean clover swards is generally favoured by low temperature and by the addition of nitrate and that there is some variation between cultivars in response to both temperature and nitrate.

4. Fukai, S. and Silsbury, J.H. 1976. Aust. J. Plant Physiol 3: 327-43.