

Effects of frequent irrigation and previous gypsum application on light interception and growth of lucerne

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Gypsum alone, or in conjunction with ripping, has improved yields of lucerne by 35% in a large-scale experiment on Lemnos Loam at Tatura (A.J. Taylor and K.A. Olsson, these proceedings). This additional experiment compares growth on gypsum-treated and non-treated soil under the standard fortnightly irrigation schedule and under a weekly schedule.

Methods

Existing gypsum-treated (G, 12 t/ha) and control (C) bays were split and irrigated at weekly (W) or fortnightly (F) intervals during rapid growth. The experiment lasted 45 days, encompassing an extended cutting cycle. Three quadrats of 0.25 m² were taken at least weekly to measure leaf area index (LAI) and leaf and stem dry weight. Tube solarimeters measured daily intercepted photosynthetically-active radiation (PAR).

Results and Discussion

Yields on day 29 from initial watering, when the stands were beginning to flower, are shown in Table 1.

Table 1. Effect of irrigation frequency and gypsum treatment on growth characteristics and yield of lucerne.

Treatment	\underline{C}_F	\underline{G}_F	\underline{C}_W	\underline{G}_W
dry matter yield (day 29, t/ha)	3.26	3.48	4.70	5.20
max production \underline{PAR} intercepted	0.87	0.85	0.95	0.97
\underline{E} (g/MJ \underline{PAR})	1.36	1.30	1.60	1.86
\underline{f}_L	0.42	0.33	0.31	0.30
\underline{E}_L (m ² /g)	.023	.030	.032	.033

Light interception reached a maximum by day 25. There were no differences between treatments when interception was related to LAI, suggesting no basic difference in the light intercepting properties of the stands. Higher yields were associated with greater light interception. Growth was analysed by integrating differential equations which described top growth in terms of the efficiency of utilisation of intercepted \underline{PAR} (\underline{E} , g/MJ) the fraction of current photosynthate allocated to leaves (\underline{f}_L), and the ability of leaves to generate leaf area from assimilated dry matter (\underline{E}_L , m²/g). Low values of \underline{E}_L reflect stress effects on leaf expansion. The lower yields of treatments \underline{C}_F and \underline{G}_F were associated with lower \underline{E} , and treatment \underline{C}_F also showed a high and a low \underline{E}_L . Dry matter production in treatments \underline{C}_F and \underline{G}_F was therefore inhibited, and leaf expansion and stem production of treatment was also affected. Thus more frequent watering, combined with a small positive effect of gypsum, improved rates of canopy photosynthesis in relation to light intercepted, increased leaf area development and consequent light interception, and enhanced dry matter production, particularly in the stem.