Potential yield of cocksfoot (*Dactylis glomerata*) monocultures in response to irrigation and nitrogen

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Introduction Cocksfoot is a widely sown grass in temperate pastures. However, while potential yield of cocksfoot can exceed 28 t DM/ha per year, it is often restricted by water, temperature and nitrogen (N). Of these, Peri *et al.* (2002) showed that N was severely limiting in all seasons. The aim of this study was to confirm the potential yield of cocksfoot and quantify the extent of yield reductions due to environmental constraints.

Materials and methods The experiment was a split plot design with three replicates established in October 2003 onto an 8-year old 'Grasslands Wana' cocksfoot monoculture. Irrigation was the mainplot (irrigated (I) or dryland (D)) and N (0 (-N) or 800 kg/ha/y (+N)) the subplot. Irrigation maintained the soil moisture deficit above 50 mm in the top 0.5 m. Nitrogen was applied in eight split applications of 100 kg N/ha at the beginning of ~28-30 d regrowth periods during active growth. Dry matter production was determined from a 0.2 m^2 quadrat cut at the end of each regrowth period. The site was mown to 30 mm and herbage removed from the site.

Results Accumulated DM production was 22.6 t DM/ha per year for I+N (Figure 1a). In comparison, yield was 10.5, 15.1 and 7.5 t DM/ha/y for I+N, D+N and D-N treatments, respectively. The seasonal effect of different temperatures was accounted for by estimating yield against thermal time (Tt) (Figure 1b). Yield increased by 6.5 kg DM/ºCd above a base temperature (T_b) of 2.5ºC under non-limiting N and moisture conditions. In the absence of N, yield consistently increased by 2.9 kg DM/ºCd whereas the D-N treatment produced 2.1 kg DM/ºCd. A broken stick model was used to determine slope for the D+N treatment. The first period was water stressed and D+N pastures grew at a similar rate (1.5 kg DM/ºCd) as the D-N treatments. In the second period water stress had been alleviated by rainfall and D+N treatments produced a similar rate (7.1 kg DM/ºCd) to the I+N treatment**.** The point of inflexion was 2015 Tt units (17/3/04) indicating an eight week lag phase after rainfall began. The broken stick model increased the R^2 from 88.6 to 99.3%. The LSD of the slope was 0.83.

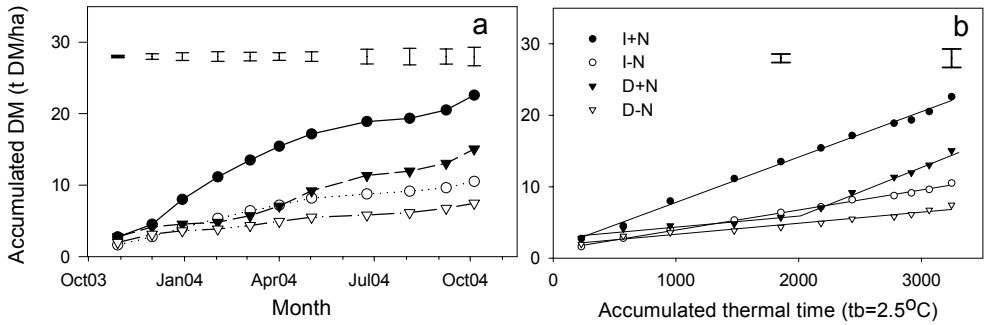

Figure 1 Accumulated DM production of 'Grasslands Wana' cocksfoot, at Lincoln University, Canterbury, New Zealand, against time (a) and thermal time (b) Error bars are LSD ($p \leq 0.05$) for the I*N interactions

Conclusions Cocksfoot pastures grown in Canterbury have the potential to produce 23-28 t DM/ha per year. However, without irrigation or N, yield was 15.1 t DM/ha per year lower. The addition of N through legume fixation or strategic fertiliser use could double the current yield, particularly in periods of feed deficit in the autumn and spring. However, during drought, water stress may limit N uptake and yield will be proportional to total accumulated shoot N. Linear relationships between DM production and Tt provide a repeatable basis for extrapolating results for comparison of cocksfoot monoculture growth in other environments and interpreting seasonal temperature effects.

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References

Peri, P. L., D. J. Moot, & R. J. Lucas (2002). Urine patches indicate yield potential of cocksfoot. *Proceedings of the New Zealand Grassland Association,* 64, 73-80.