Appendix 2: Effect of deficit rainfall and rooting depth of perennial ryegrass on pasture production in South East Australia.

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Abstract

The biophysical model DairyMod (Johnson *et al*. 2008) was used to simulate the annual and seasonal production of perennial ryegrass (*Lolium perenne* L.) pastures for the three dairying regions of Elliott (North West Tasmania), Ellinbank (South East Victoria) and Terang (South West Victoria). Five rooting depth treatments were assessed; a baseline rooting depth of 30 cm, and then increments of 10 cm to a maximum of 70 cm. Six differing rainfall scenarios were implemented; a baseline rainfall scenario (current rainfall pattern for the period 1971 to 2008) and five deficit increments between 0.5 and 0.9 of the baseline rainfall. Mean annual and seasonal pasture production (kg DM/ha) figures for each rooting depth/rainfall treatment was calculated for the period 1971 to 2008.

There was a positive linear relationship between rooting depth (cm) and annual pasture production (kg DM/ha.year) for each rainfall scenario. The greatest benefit of increasing rooting depth was observed over the spring period, and to a lesser extent summer, in all regions. There was very little benefit of increased rooting depth in autumn and winter when the winter-dominant rainfall patterns of these regions was sufficient for maintaining growth, especially if rainfall deficits were minimal. Increasing the rooting depth from 30cm to 50cm was able to alleviate the impact of a 20% decline in rainfall on mean annual pasture production at Ellinbank. However, this increase in rooting depth was not able to overcome a 20% rainfall deficit at the other two regions, with an 8.8 and 0.9% decline in mean annual pasture production for Terang and Elliott, respectively. At all three regions, when the rainfall deficit exceeded 20%, a doubling of the rooting depth to 60cm was not able to alleviate the effects on mean annual pasture production. This indicates that although the adaptation of increasing rooting depth may be considered a very favourable adaptation strategy for adapting to a drier future climate, the ability to alleviate the impacts under significant rainfall decline is limited. Shallow rooted perennial temperate pastures, such as perennial ryegrass, are currently considered the main forage source for dairy cattle in temperate regions of SE Australia. However, a changing and variable climate may lead to alterations to the current the forage base. Further work is required to analyse the adoption of these forage combinations at whole of farm system level and under agreed climate projection scenarios for the differing regions.

References

Johnson IR, Chapman DF, Snow VO, Eckard RJ, Parsons AJ, Lambert MG, Cullen BR (2008) DairyMod and EcoMod: Biophysical pastoral simulation models for Australia and New Zealand. Australian Journal of Experimental Agriculture 48, 621–631.