Developing tools for climate risk management in the subtropical dairy region

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Abstract
Seasonal climate forecasts linked to simulation production outputs provide the platform for a tool to support dairy farmers' feedbase management. Probability distribution curves were generated for rainfall and yield for forecasting systems based on the southern oscillation index and sea surface temperature anomaly patterns. The tool provides a comprehensive set of rainfall and forage yield outcomes and is ready to be tested.

Key words
Climate, production, management, variability, indicators, simulation.

Introduction

Correlations between seasonal climate indicators such as the southern oscillation index (SOI) and sea-surface temperature anomaly (SSTA) patterns and rainfall over the subtropical region of eastern Australia provide a basis for seasonal climate forecasts. Linking probability-based climate forecasts to the outputs from production models enables translation of seasonal rainfall forecasts into probability distributions of forage yields. These capabilities provide a platform for a tool to evaluate management options and to support dairy farmers' decision-making.

Methods

Three forecasting systems were used: (a) 3-category average SOI (SOI<-5, SOI -5 to +5, SOI>+5) (Clewett *et al.* 1991), (b) 5-phase SOI [consistently negative (Phase 1), consistently positive (Phase 2), rapidly falling (Phase 3), rapidly rising (Phase 4) and consistently near zero (Phase 5)] (Stone and Auliciems 1992) and, (c) 3-category SSTAs (<-0.8°C, -0.8°C to +0.8°C, >+0.8°C) in the Pacific Nino 3.4 region.

Historical daily rainfall data for a representative location (Kyogle, northern NSW) were used to generate monthly rainfall probability curves for 99 years. The historical monthly rainfalls were then partitioned into one of the categories for each forecasting system and probability curves generated. A significant shift in the probability distribution indicated a difference in rainfall between categories in a system.

Simulation analyses for a rain-grown tropical grass oversown with annual ryegrass were undertaken using DairyMod, with Kyogle daily weather data, to generate monthly forage net growth (kg DM/ha) probability curves for 99 years. The monthly net growth outputs for each category in a forecasting system were analysed in the same way as for rainfall.

Results and Discussion

The following scenarios demonstrate the tool's capability to encourage discussion. For the 5-phase SOI system, the change in the rainfall probability distribution when the July SOI is consistently negative (Phase 1) or consistently positive (Phase 2) compared to all other phases combined is shown in Figures 1(a) and (b), respectively. Again using the 5-phase SOI system, the change in the forage net growth probability distribution when the July SOI is consistently negative (Phase 1) or consistently positive (Phase 2) compared to all other phases combined is shown in Figures 2(a) and (b), respectively.

This tool quantifies climate forecasts into probability-based rainfall and production outputs, allowing farmers to compare likely rainfall and yield outcomes and to assess the risk in making a decision. For example, using the 5-phase SOI system, Figure 1a shows that there is a 50% chance of exceeding 100 mm rainfall when the SOI is negative compared to 70% for all other phases combined. In terms of

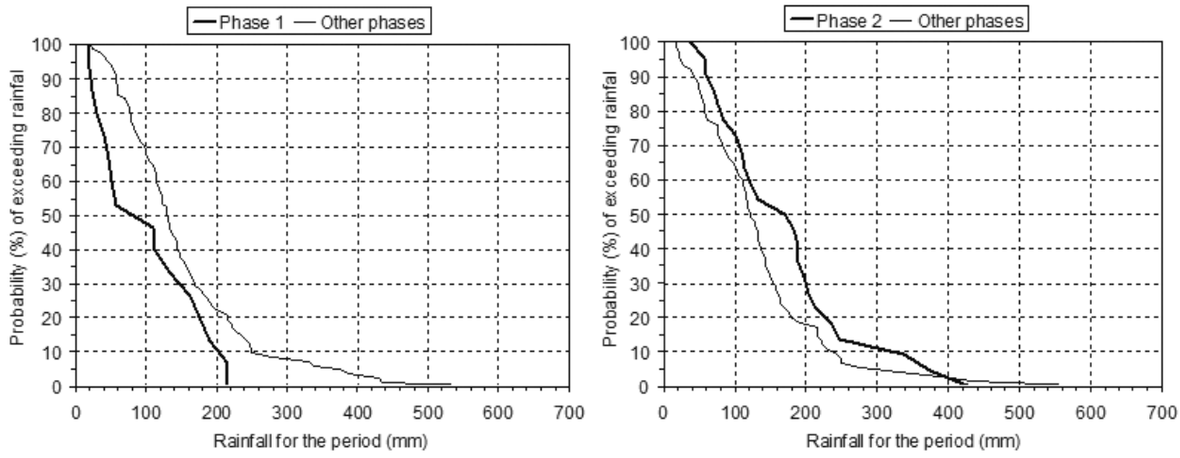

Figure 1. July SOI phase and rainfall probability for July-September (a) Phase1 (left panel) and (b) Phase 2 (right panel).

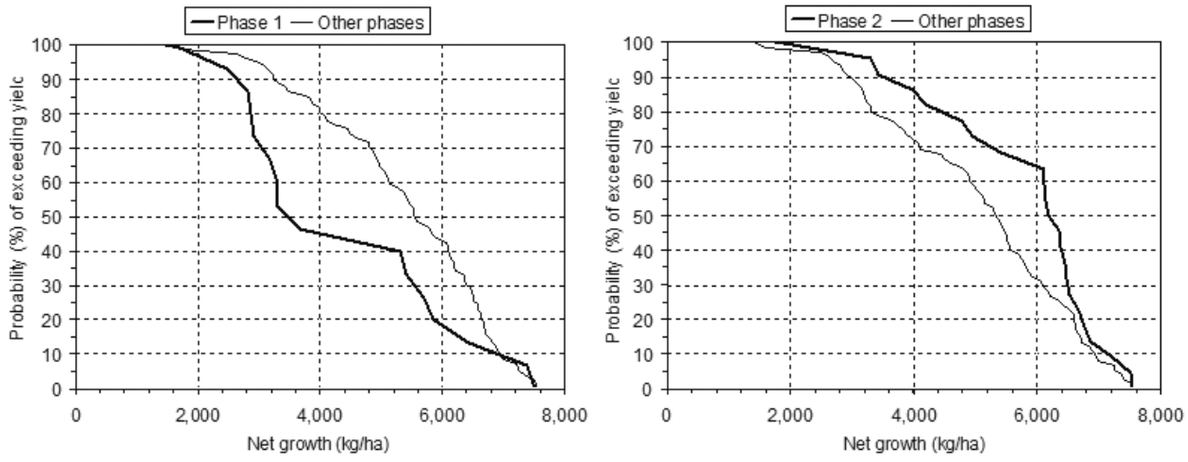

Figure 2. July SOI phase and Kyogle rain-grown ryegrass–tropical grass net growth (DM kg/ha) probability for July-September (a) Phase 1 (left panel) and (b) Phase 2 (right panel).

net growth, Figure 2a shows that when the SOI is negative there is less than 50 % chance of achieving 4,000 kg DM/ha compared to 80% for all other phases combined. Figure 1b and Figure 2b respectively show that when the SOI is positive, the chance of above-average seasonal rainfall and growth is higher than for all other phases combined.

This 'what-if' analysis tool provides a comprehensive set of seasonal rainfall and forage yield outcomes for 3 seasonal forecasting systems and is ready to be tested.

References

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