

CropMate™ a web based decision support tool helping farmers make agronomic decisions using historic and forecast weather and climate data.

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Abstract

The NSW Department of Primary Industries (DPI) launched an interactive website called CropMate™ in February 2011 in conjunction with the Grains Research and Development Corporation (GRDC). The website provides grain producers, advisors and agronomists in eastern Australia an online ‘one-stop-shop’ access to soil and crop management decision support tools linked to Bureau of Meteorology (BoM) weather and climate information and 100 years of rainfall data of the Queensland Climate Change Centre of Excellence. It is designed to provide timely and accurate climate and agronomic information to assist users make informed planning and management decisions about grain cropping during the crop management cycle.

This paper provides an overview of CropMate™. The program is divided into 5 sections, which are aligned to different parts of the cropping cycle. The pre-season planning pages analyse historic climate data and seasonal forecasts and provide the latest information on the influences on climate such as ocean temperatures. Decision support tools such as ‘CropChooser’ and ‘VarietyChooser’ are also located in the pre-season planning pages. The sowing pages contain recent rainfall and temperature analyses, synoptic charts as well as a decision tool to help decide which variety of a particular crop to plant. Spraying pages interpret current and historic data into spraying advice. Tracking the season pages uses climate and agronomic data to support nitrogen topdressing decisions and difficult low rainfall questions such as salvaging crops for hay, silage or grain. The harvest page can collate the nutrient use of the crop just harvested.

Key Words

CropMate™, decision support, website, climate, weather, crop chooser, variety chooser

Introduction

A survey conducted by George et al (2007) found that producers, consultants, government extension officers and educators required systems to enable them to manage the next extended wet or dry period, and improve capacity in identifying and capitalise on the latest climate information and seasonal climate outlook. CropMate™ is a central hub containing decision support tools developed by NSW DPI with funding from GRDC to address this issue. At the time of project development (2004–10), Nguyen et al (2006) reported historically slow uptake of decision support tools, contributed by fear of using computers, time constraints, complexity, lack of local relevance, lack of end-user involvement, and mismatching between developers’ and users’ understanding of requirements. CropMate™ has been designed to be an online ‘one-stop-shop’ that addresses many of these issues. It is quick, simple to use, and has local relevance with local climate and/or farm-specific data input by the user. Outputs of CropMate™ include integrated gross margins, calculated seeding rates and calculated fertiliser N rates. These outputs help users make informed planning and management decisions during the cropping cycle. CropMate™ is divided into 5 sections, which are aligned with the cropping calendar: pre-season planning, sowing, spraying, tracking the season and harvest. CropMate™ has been publicised in the media and GRDC cropping updates and its usage has been tracked using Google Analytics®. This paper outlines the source and methodology behind key website pages and presents examples of the outputs. Public usage of the CropMate™ website since its launch is documented.

Methods

How does a user navigate into the CropMate™ website?

To access the CropMate™ website home page, the user can search with the key word CropMate™ using a search engine or use the url, <http://cropmate.agriculture.nsw.gov.au>. Once in the home page (Figure 1a), the user selects a state and a town and presses enter (Figure 1b). The user can then activate the drop-down menus for each of the 5 sections of the cropping calendar (tabs) using the cursor. The drop-down menus are in turn organised into sections (Figure 1c).



Figure 1. Steps to navigation into the CropMate™ website.

How was data in each section sourced and/or compiled?

The data for all the climate and weather components of CropMate™ are sourced from the Bureau of Meteorology (BoM) using url links and 100 years of rainfall data (Queensland Climate Change Centre of Excellence). Trigger points in these pages are set by the user, e.g. heat stress threshold in the ‘Frost and heat risk’ page in the Pre-season planning section.

The decision support tools in each of the 5 sections are underpinned by a substantial amount of published and unpublished research. For example, ‘CropChooser’ can be used to estimate soil nitrate at sowing as well as generate gross margins for a range of winter or summer crops with biological and nitrogen benefits of the crops factored in. The algorithms used in these calculations for stations north of Dubbo draw on 40 years of experimentation in northern NSW and southern Queensland (Herridge 2011). For the stations south of Dubbo, sowing soil nitrate is calculated using algorithms modified from the Lime and Nitrogen Budgeting guidelines published by Helyar et al. (2002).

Gross margins in ‘CropChooser’ are calculated using data sourced from the current ‘Farm Enterprise budgets’ (NSW DPI 2012). ‘SowMan’ uses observational data collected over a number of years by NSW DPI researchers and agronomists (Liu 2010). ‘VarietyChooser’ is an electronic decision tree based on the NSW DPI Winter Crop Variety Sowing Guides (Mathews and McCaffery 2012). These publications use National Variety Trial (NVT) MET (Multi Environment Trial) analysis data. The ‘Sowing rate calculator’ is a basic calculator using seed characteristics and plant population chosen by the user and includes plant population guidelines (Mathews and McCaffery 2012).

The visitor records for the CropMate™ website were sourced from Google Analytics®. All outputs of CropMate™ are graphically and numerically displayed in a HTML format on the website.

Results

Pre-season planning analyses average temperature, rainfall and evaporation and provides seasonal forecasts and information on the influences of climate, such as the impact of Southern Oscillation Index (SOI) on rainfall. The decision tools provide estimates of soil water and nitrogen, frost and heat risk as well as gross margin analyses of the various cropping options. For example, a consultant at Loxton, SA, has been thinking through the impact of high levels of fallow rainfall and how these compare to high rainfall events in the past. He selects Loxton and opens the seasonal rainfall boxplots to see the ranges of rainfall that occur locally (Figure 2a). He then selects comparison of monthly rainfall and puts in 3 previously high rainfall years in the last 40 years – 1971, 1997 and 2010.

A farmer at Moree, NSW, looks up the impact of the SOI on rainfall to compare La Nina, Neutral and El Nino years. He then uses simple paddock data from the client to estimate soil water and nitrogen for the coming season. Finally, with inputs of commodity prices and growing costs (NSW DPI 2012) and the latest seasonal forecasts (Figure 3a), he compares gross margins for wheat, durum, barley, canola, chickpea and faba beans (Figure 3b).

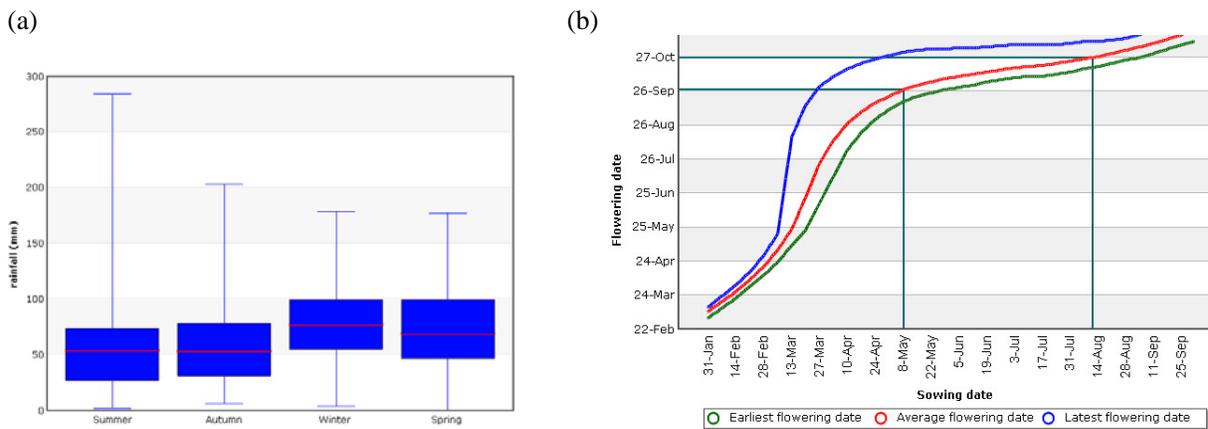


Figure 2. (a) Loxton season boxplots of rainfall (mm) sourced from the CropMate™ website on 23 July 2012; (b) Wagga Wagga sowing windows sourced from the CropMate™ website on 17 April 2012.

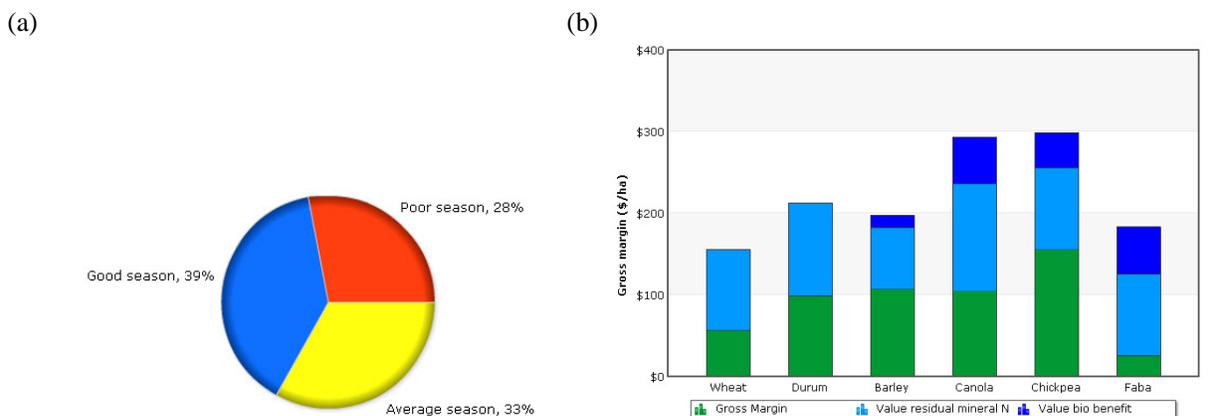


Figure 3. (a) Moree National Seasonal Rainfall Outlook probabilities for August to October 2012, issued 18 July 2012 and sourced from the CropMate™ website on 23 July 2012; (b) Moree probability weighted average gross margins which include the valuation of residual nitrogen and biological benefits, sourced from the CropMate™ website on 23 July 2012.

Sowing pages contain recent rainfall and temperature analyses, climate forecasts and synoptic charts as well as a decision tool, ‘VarietyChooser’, to help decide which variety to plant. For example, an agronomist at Wagga Wagga uses the CropMate™ website to access the monthly daily weather observations. The accumulated rainfall page allows him to compare this year with the average. Wagga Wagga received 761 mm for the year to 17 April 2012 compared to an average yearly rainfall of 513 mm. He then went to the ‘SowMan’ decision tool and selected the sowing window option for Ventura wheat. The sowing window for this variety is calculated to be 5 June–31 July, after accounting for frost risk and potential heat stress (Figure 2b).

Spraying pages provide current rainfall, wind, temperature and Delta-T conditions. There are also forecasts and synoptic charts and a decision tool to predict when rust will occur. For example, a farmer in Cowra was considering spraying on 21 January 2011 at 1.30 pm. The following information for 1 pm was supplied by BOM – temperature 30.9°C, Delta-T 10.1°C, relative humidity 37%, wind speed 11 km/hr N, current spray status poor, limited by temperature and Delta T.

Tracking the season pages presents observations for the month, comparisons of accumulated rainfall, a decision tool for nitrogen topdressing, and a calculator to compare the outcome when salvaging crops for hay, silage or grazing.

Harvest pages have up-to-date observations for the month, information on recent rainfall, forecasts and synoptic charts. The decision tools include harvest wrap that incorporates an estimate of crop water-use efficiency (WUE).

Since the launch of the website in late February 2011 to June 2012 there has been an average of 553 hits per month from 360 visitors to the site (Figure 4). The peak use in the first year occurred from May to August and again in November. On average 47% of visits were return visits.

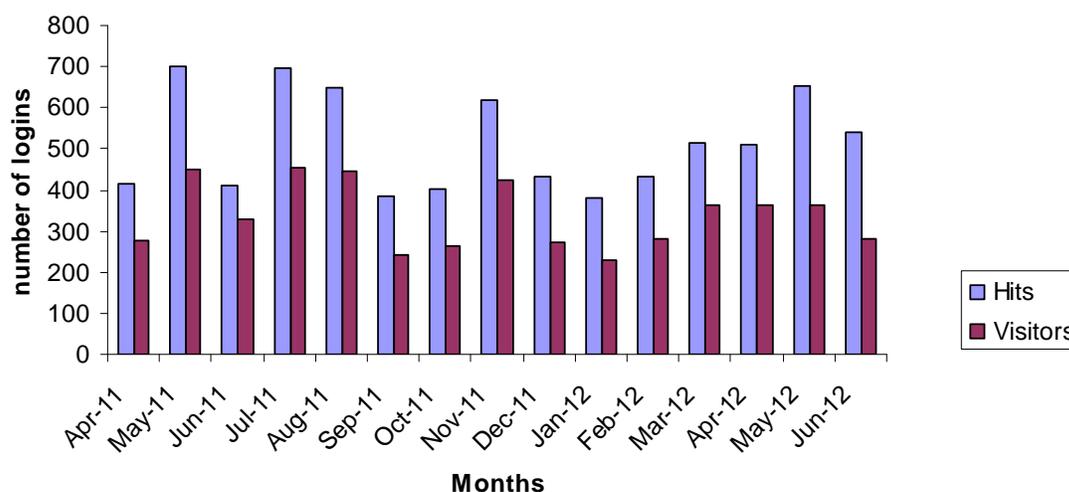


Figure 4. Google Analytics® showing number of hits and the number of visitors to the CropMate™ website during April 2011 to June 2012.

Conclusion

CropMate™ is an example of how innovative research can be used to support grain grower decision making by incorporating research data (particularly around fertiliser use, variety performance, water use efficiency and sowing time, agronomic knowledge and climate information) into the decision support systems. With the current uncertainty about future climate, decision support tools that assist the grower in making decisions that include climate and agronomy in the same process will improve their approaches to risk management.

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