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Foreword

With the ongoing drought across much of the maize growing area of Australia, 'Water to Gold' was indeed an appropriate theme of the sixth triennial conference of the Maize Association of Australia in February 2006. Taking advantage of the high water productivity of maize for profitable maize production depends on markets, the ability to produce high yielding quality grain with high resource use efficiency, while maintaining a sustainable production system. A coordinated industry, with effective information and extension systems, is needed to assist growers to achieve these goals. Therefore, the conference was organised around the themes of future visions for the maize industry, improving capacity to supply and production efficiency, and environmental sustainability. Thirty-eight papers were presented clustered around five main topics – water use efficiency, agronomy, diseases, breeding and environmental sustainability. This special issue of the *Australian Journal of Experimental Agriculture* presents 14 selected papers addressing these topics.

In his keynote address 'Managing climate risks in Australia: options for water policy and irrigation management', Khan (2008) emphasised the need for Australian water legislation and policy to incorporate climate change and adaptive management options, taking advantage of state of the art climate forecasting methods.

A highlight of the conference was the analysis of a near Australian record 20.5 t/ha commercial crop grown in northern Victoria in 2004–05 (Birch *et al*. 2008*a*). The analysis showed that yield was near the maximum possible for the weather conditions that season, although it could have been even higher with a higher plant population. This work also provided an example of the application of crop models for both retrospective analysis of crop performance and assessment of long-term variability of crop yield under a range of management options. Three other papers in this issue also presented examples of the use of crop models to evaluate management options for maize in environments ranging from rainfed to fully irrigated (Birch *et al*. 2008*b*; Humphreys *et al*. 2008; Peake *et al*. 2008). Finally, Birch *et al*. (2008*c*) presented progress in the development of an architectural model of maize under development to incorporate the impact of water stress on maize canopy characteristics, with a view to improving the ability to simulate maize crop performance under suboptimal water supply.

The high yielding crop described by Birch *et al*. (2008*a*) was grown on a well-structured, deep clay soil using subsurface drip irrigation. In the same season, on a poorly structured soil in southern NSW, O'Neill *et al*. (2008) showed that subsurface drip-irrigated maize out-yielded sprinkler- and furrow-irrigated maize by 17 and 12%, respectively. Total water productivity with subsurface drip irrigation was 30% higher than with furrow irrigation. In the same season, total water productivity of sprinkler irrigated maize in southern NSW and northern Victoria was 8 and 11% higher than furrow- or border-check-irrigated maize, respectively (Greenwood *et al*. 2008; O'Neill *et al*. 2008).

Mycotoxins are becoming a major issue for the Australian maize industry, exacerbated by increased water deficit stress in recent years. The maize industry has developed supply chain protocols to minimise the risk of exceeding market specifications of aflatoxin levels. The science underpinning these protocols is presented in three papers by Blaney *et al*. (2008), Bricknell *et al*. (2008) and Chauhan *et al*. (2008).

The majority of maize residues are burnt in the intensively irrigated grain production systems of the southern Murray–Darling Basin, with large losses of nutrients, especially nitrogen and organic carbon, in addition to particulate air pollution and release of the potent greenhouse gas, nitrous oxide, to the atmosphere. Concerns about soil health and environmental sustainability have led to considerable interest in methods to retain the large amount of maize crop residues (typically 10–15 t/ha) in the field. The life cycle assessment of maize by Grant and Beer (2008) showed that on-farm activities accounted for 36% of greenhouse emissions in the production cycle from pre-farm to the production of corn chips. Nitrous oxide emissions from nitrogen fertilisers were the single largest source of on-farm emissions. Meyer *et al*. (2006) found that residue incorporation reduced nitrous oxide emission from 2.7 to 1.5% of the applied nitrogen. Therefore, switching from stubble burning to stubble incorporation would achieve a 30% reduction in on-farm emissions (Grant and Beer 2008). Furthermore, significantly more fertiliser nitrogen was recovered in the grain with stubble incorporation than burning, while more fertiliser nitrogen was recovered in the soil with stubble burning (Edis *et al*. 2008). Nitrous oxide emission rate increased throughout the range of fertiliser rates tested (0–300 kg N/ha). No isolates of phytopathogenic *Rhizoctonia* were recovered from soil or maize roots in continuously cropped maize (third crop) with stubble retention; however, there was considerable colonisation of roots by *Pythium* and *Fusarium* species (Harvey *et al*. 2008). Shoot biomass of both maize and wheat increased when grown in sterilised soil compared with the natural field soil. The results suggested the need to develop root disease management strategies for maize based on integrating more effective fungicide applications and strategic crop rotations.

The conference was held at Griffith, NSW, on 21–23 February 2006. The conference organising committee was chaired by Kieren O'Keeffe of NSW Department of Primary Industries and included representatives of Pacific Seeds (Phil Williams), Pioneer Seeds (David Burcham), MIA Rural Services (Rob Gill), Rawlinson and Brown (Mark Zanatta), Elders (Allan Jones), CSIRO (Liz Humphreys) and three farmer representatives (Matt Toscan, Sam Mancini and Greg Young), together with the then President of the MAA (Nick Hutchins) assisted by Tanya Cowell.

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