Developing low-risk production strategies for maize in dryland farming

Summary

The project aims were

1. Development and testing of strategies to minimise production risk for maize through use of appropriate hybrid maturity, skip rows and plant population density, together with starting soil water, seasonal climate outlook and hence, yield expectation.

2. Participatory on-farm research with maize growers exploring options for use of maize in the northern region.

3. Assess opportunities for dryland maize in different regions through simulations and risk analyses.

Report Disclaimer

This document has been prepared in good faith on the basis of information available at the date of publication without any independent verification. Grains Research & Development Corporation (GRDC) does not guarantee or warrant the accuracy, reliability, completeness or currency of the information in this publication nor its usefulness in achieving any purpose. Readers are responsible for assessing the relevance and accuracy of the content of this publication. GRDC will not be liable for any loss, damage, cost or expense incurred or arising by reason of any person using or relying on information in this publication. Products may be identified by proprietary or trade names to help readers identify particular types of products.
but this is not, and is not intended to be, an endorsement or recommendation of any product or manufacturer referred to. Other products may perform as well or better than those specifically referred to. Check www.apvma.gov.au and select product registrations listed in PUBCRIS for current information relating to product registration.

Copyright
Grains Research and Development Corporation. This publication is copyright. Apart from any use as permitted under the Copyright Act 1968, no part may be reproduced in any form without written permission from the GRDC.

Old or Archival Reports (Projects that concluded in 2007 or earlier)
The information contained in these older reports is now several years old, and may have been wholly or partially superseded or built upon in subsequent work funded by GRDC or others. Readers should be aware that more recent research may be more useful for their needs. Findings related to agricultural chemical use are also potentially out of date and are not to be taken as a recommendation for their use.

Conclusions
This project has achieved its aims of improving recommendations for dryland and supplementary irrigated maize production. In doing so, it has raised the profile of maize as a viable alternative to grain sorghum and cotton in certain situations when combined with good agronomy. A key to the success of the project has been the close relationship with influential agribusiness partners which has aided in spreading the message, carrying out of on-farm research and links with the grower community.

Recommendations
Through the efforts of this project, the profile and role for maize in the dryland systems of the northern region have been lifted. On-going research, development and extension (RDE) are needed to support grower decision-making, hybrid evaluation, and overall system performance involving maize.

Outcomes
The outcomes expected from the project were (1) improved grower confidence in the use of maize in their farming systems as evidenced by an increased area of maize grown, (2) the grains industry having a clearer picture of the potential expansion of maize production into new niches and districts.

Economic outcomes:
Increased area of maize grown as well as higher yields will improve the economic performance of dryland farming systems in south east Queensland (QLD) and northern New South Wales (NSW).

Environmental outcomes:
While improved environmental performance was not a primary aim of this project, the work on supplementary irrigated maize production systems will indirectly result in more efficient use of water and hence, less losses to the environment. By better matching of water to yield potential, more water will be used as evapo-transpiration, and less as run-off and deep drainage.

Social outcomes:
A major social impact of dryland farming in marginal areas is the riskiness of farm incomes associated with climate variability. The incorporation of dryland maize as a spring plant option, before that of grain sorghum, has the potential to spread the risks of dryland farming and enable income to be distributed more evenly throughout the season.
Highly variable rainfall in the maize growing areas of southern and central Queensland has resulted in a shift away from maize production towards crops such as sorghum and cotton. Grower confidence has also suffered due to fluctuating market prices. There is increasing demand for maize as a feed grain and for silage from the expansion of the feedlot beef industry and intensification of dairy production, particularly on the Darling Downs. In addition, there is a demand from grain growers to evaluate a wider array of summer crop options following the recent downturn in sorghum, sunflower and cotton prices, and problems with fusarium in irrigated cotton lands. Experience with groups of new maize growers prior to this project indicated that maize is a highly acceptable alternative to other summer crop options. One group’s experience of the potential role maize can play in a cropping system was extended to a wider audience in the northern region through participatory on-farm research. At an eco-regional level, the need to identify new niches (e.g. Central QLD) which the industry can exploit for improved profitability and decreased risk of the cropping enterprise was addressed through scenario analysis. This project has had a significant impact on the irrigated and dryland maize growing industries of southern QLD and northern New South Wales. This has been carried out through successful application of on-farm research in partnership with agribusiness and simulation analyses to devise new and improved industry recommendations for growers and also identify new niches for the crop in the farming system.

Two key recommendations for successful maize production were developed in partnership with industry and communicated to advisers and consultants at field days, seminars, GRDC Updates and through media stories.

The first of these recommendations was to not grow dryland maize in marginal environments in wide or skip row configurations. In contrast to grain sorghum practice, it was found that the maize root system has a poor ability to exploit soil water reserves in skip rows. This went against conventional wisdom and our agribusiness partners (Michael Castor and Associates (MCA), Pioneer HiBred and Pacific Seeds) have now modified their advice to growers. Wide skip rows are now advised against, however, it was also found that a useful strategy to stabilise the risks of growing maize in marginal western environments was to sow early (August to early September), sow at least two hybrids on the farm varying in phenology to spread risks of high temperatures around anthesis, and to only sow when there is at least 120mm of stored soil water in the profile. Simulation studies and on-farm trials conducted in the second and third years of the project showed that this strategy was useful. MCA now actively promotes this management package and views maize as an ‘early sorghum’ in its farming system. MCA has considerable reach and influence with the coarse grain producers in southern Queensland and northern NSW.

The second major recommendation concerns the efficient use of irrigation water in supplementary systems on the eastern Darling Downs. In these farming systems, other crops (such as cotton) compete with irrigated maize for water. Water is often in short supply and there is uncertainty in how to apply what water is available through the season. Seed costs are a major variable cost of production and there is uncertainty about what density to use for different levels of water availability and different soil types. Three seasons of on-farm experiments at Dalby have identified the economically optimum population for different levels of irrigation on black cracking clay soils, also accounting for the cost of water and price for maize. Before this GRDC project, density recommendations were not well defined. This work has shown that considerable yield gains can be made by tailoring density to water inputs. Simulation of various irrigation strategies has also identified a number of optimum strategies in terms of the timing and amount of water for a fixed allocation throughout the season. The results of this work were communicated to a major industry seminar, held in conjunction with Pioneer HiBred in Dalby in July 2004, at attended by approximately 80 advisers and consultants.

Industry-wide analysis has identified several new niches for dryland maize production. Simulation results supported the view of industry participants that maize production is more risky than grain sorghum production in these environments. Median yields and gross margins were produced where a full soil moisture profile was present at sowing, however this suggests that the long-term profitability of maize production may be comparable to that of grain sorghum, particularly in slightly cooler and wetter environments. These results, combined with other advantages of maize production as perceived by industry participants, indicate that a great deal of potential exists to increase maize production in these environments.

Results did not support the suggestion that maize may result in a greater chance of sowing a following winter crop or increased yield reliability in that crop. The longer growing season (compared with grain sorghum) of current maize varieties means that even where maize is planted early to exploit the late August sowing window, soil moisture conditions at crop maturity will be similar to those after a grain sorghum crop planted a month later. Consequently, little advantage could be
expected by the start of the following winter crop sowing window. The widely held industry view that maize confers benefits to the following crop over grain sorghum may be due to other factors, such as the requirement to kill grain sorghum to prevent post-maturity transpiration, or the widely reported but unquantified beneficial effect of maize on soil structure.

This result illustrates the value of simulation modelling technology in providing insights into industry perceptions that are difficult to prove (or otherwise) using traditional field research techniques.

While the production and financial risks of maize production are higher than those of grain sorghum, a number of agronomic and management practices are available that may minimise the level of risk. Good fallow management practices will maximise plant available water (PAW) at sowing and thus maximise yields and reduce risk. Judicious use of seasonal climate forecasts can aid decisions relating to crop selection and appropriate levels of plant population and other agronomic inputs. For example, where seasonal forecasts indicate a high probability of above median rainfall, a decision to sow maize rather than grain sorghum may be justified.

In summary, it appears that significant potential exists to extend dryland maize production into areas previously considered too risky, thereby improving the supply of this sought after feed grain and providing an additional option for producers to use in developing sustainable production systems.

Other research
Future research opportunities for dryland and supplementary irrigated maize were identified:

- Matching of crop nutrition inputs to yield expectations to minimise costs and maximise yields.
- Studies of water use efficiency of whole-crop sequences that involve maize.

Intellectual property summary
All knowledge generated in this project has been released into the public domain for the use of growers and advisers.

Additional information
Papers published


