Using a participatory action research, development and extension (PARD&E) process to adapt grain production systems to a changing climate

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Abstract

Since 1996, cropping farmers across north-western Victoria have faced the lowest rainfall period on record, raising concern about future seasons with the threat of climate change. This has resulted in a need to build adaptive capacity within the industry to deal with a changing climate. To investigate changes that may be required, a project has commenced using a Participatory Action Research Development and Extension (PARD&E) methodology involving two farmer groups in the Wimmera region. PARD&E engages farmers and researchers in open discussions aiming to identify priority areas for local research. The major aim of this project was to improve crop water use efficiency (WUE), as this was seen as the best strategy to increase resilience to variations in climate including those likely under climate change. This approach empowers farmers to influence the research being carried out in their area leading to accelerated practice change while offering scope to investigate complex, system level changes that may be necessary for adaptation. Initial survey work (Nuttall et al. 2010) highlights that farmers have already undertaken considerable practice changes in adapting to drier seasonal conditions.

In 2009, four priority areas were identified for investigation: stubble management, optimal rotations, controlled traffic farming and alternative nutrition. Each of these priorities were identified as strategies with the potential to increase WUE and improve resilience to climate variability. While trial results so far are preliminary, substantial learning has already occurred; farmers have been exposed to the intricacies of scientific process due to high transparency, researchers have gained a greater understanding of the practicalities of the farming systems they are investigating and extension staff have refined their knowledge of planning and implementing scientifically valid field trials. Although the PARD&E approach is very labour intensive, it has produced trials and results that are meaningful to researchers and sufficiently relevant to guide practice change on farm into the future.

Key words

Farmer groups, water use efficiency

Introduction

Over the last 14 years north-western Victoria has faced the driest period on record. Horsham, situated in the central Wimmera region has experienced a 17% decrease in annual rainfall and a 21% decrease in growing season rainfall (April to October) relative to long term averages of 313 mm and 445 mm respectively (Bureau of Meteorology 2009). This has resulted in poor crop yields and restricted profitability forcing farmers to consider new ways of managing the considerable climatic risks inherent in this region. Many farmers in this area have already made large changes to their production systems in response to recent conditions. Examples include increasing stubble retention and adopting new technologies such as GPS guidance leading to increased efficiency and sustainability (Nuttall et al. 2010).

In order to quantify the benefits of some of these practices, two farmer groups from the Wimmera (Horsham East and Sheep Hills) were involved in a PARD&E process. Participative action research (PAR) based methodologies have been employed across many countries and spanning many areas of research from community health (Rains and Ray 2007) to environmental conservation (Hannah et al. 1998). They have also been used in northern Australian agriculture in instances such as the FARMSCAPE project (Carberry et al. 2002). The PAR process differs from more conventional research models in that it encourages greater participation from the clients (in this case farmers) in setting research

goals and in the research process offering a sense of ownership and improved transparency (Carberry 2001). We hypothesised that this process will enable targeted, relevant research to be conducted leading to accelerated adoption of practices that can reliably improve crop WUE, increasing the resilience of the grains industry in an uncertain climatic future. The aim of this paper is to provide an overview of the lessons learnt from the first year of using a PARD&E approach to meet these goals.

Methodology

The first component of the PARD&E process was to identify what individual farmers in each group thought were important adaptive strategies that may assist them to increase WUE and manage climate variability. Initial meetings involved a facilitated discussion between research and extension staff with approximately 15 members of each group and a small number of local agribusiness advisors. A broad set of objectives were identified and then refined by vote. After identifying the four most popular topics for each group, smaller 'focus' groups of 5 farmers were elected to undertake further meetings with research and extension staff. These groups were tasked with planning rigorous field trials to investigate the topics identified.

Trials were conducted on local farms during 2009 with plots sown and treatments applied using farmer equipment wherever possible. Key plant and soil measurements including soil water and nitrogen, plant emergence, biomass and yield were taken at key times throughout the season in order to measure crop water use under the various treatments. Capacitance probes were installed in certain trials to track and communicate soil water dynamics throughout the season. As part of the PARD&E process, meetings were held during the season to update the farmer groups on trial progress. Final results were presented to the groups early in 2010 at pre-season meetings. These meetings included evaluation and facilitated discussion to assess whether the trials had met the expectations of the group and whether the participants wished to make changes to any of the trials or the strategies under investigation.

Results and Discussion

The PARD&E methodology for setting the initial research priorities was extremely successful. In total approximately 30 landholders took part in this process across the two groups with a broad range of ideas suggested for further investigation from emerging technologies such as variable rate fertiliser application and controlled traffic farming (CTF) to questions on crop rotation and the role of livestock in local farming systems. In total there were far more ideas raised than could be covered by the resources available. Refinement of the ideas identified four main priorities including options for managing stubble, alternative fertiliser products, the benefits of CTF and improving rotations. It is anticipated that these four priority areas all have the potential to improve either soil water harvesting and storage and/or optimise crop health, both of which improve crop WUE thereby increasing resilience to variations in climate. With research priorities set the learning process began for all parties involved.

Initially, the design of field trials to address these priorities was complex. Conventional trials offer the researcher greater flexibility in their design as they simply involve setting aside an area of the paddock and applying the treatment structure. However, as part of the PARD&E process, these trials aimed to fit into the farmer's production system, thereby encouraging farmer participation and increasing confidence in the 'real world' application of the strategies tested. After consideration, it was decided that where possible, trials would be implemented using the farmer's equipment while certain treatments and measurements would be applied/taken using research scale equipment. This approach highlighted to the participants the complexity of designing statistically robust field trials capable of objectively addressing the issues raised. In particular, participants recognised the importance of replication. Evaluation at the completion of the 2009 season showed that 80% of participants felt that designing and implementing field trials was a complicated process. Research and extension staff also learnt a number of lessons by participating in the PARD&E process. By designing trials that were able to fit into existing farming systems, research staff gained a greater understanding of the practicalities of the farming systems under investigation. Extension staff improved their understanding of the intricacies of trial design and they also received a lesson in creative communication with one of the research staff utilising a chocolate cake cut

in half to represent a soil profile helping to explain to growers a cross paddock transect survey designed to measure the benefits of CTF.

The main trials undertaken during 2009 included a stubble management trial at Sheep Hills and an alternative fertiliser trial at Horsham East. Implementation of the trials proceeded as planned during autumn and meetings were held throughout the growing season to discuss the progress of the trials. These meetings were well attended by growers attracting groups of 10-15. Despite the lack of results at this early stage, those involved were still interested to see whether there were visual differences as a result of various treatments and appreciated the lag phase between running trials and presenting results. Outputs from the capacitance probes were also presented at each meeting and were of great interest to participants. The ability to track soil moisture through the soil profile and observe trends over time was a very successful extension tool, initiating conversation and generating interest in a relatively new technology to dry land farming. Following on from the success of these probes during 2009, they have been re-installed in 2010 and will be formally calibrated to give growers greater confidence in the outputs and also broaden their understanding of soil water dynamics.

Good scientific practice requires a wide range of soil and plant measurements to be taken throughout any trial. However it was found that the most important measurements from the farmer's perspective were taken at harvest when yields, biomass and soil moisture were measured. The trial that generated the most interest in 2009 was the alternative fertiliser challenge where a total of 6 treatments tested the 'best bet' recommendations of four fertiliser companies against 'zero fertiliser' and 'farmer rate' controls. This trial resulted in statistically significant differences between certain treatments (Fig 1) and while this does not offer a conclusive finding that any of these options are superior, it does show that with appropriate design, rigorous measurements and planning that it is possible to design field trials that can fit into an existing farming system, while delivering meaningful results to both farmers and researchers alike.

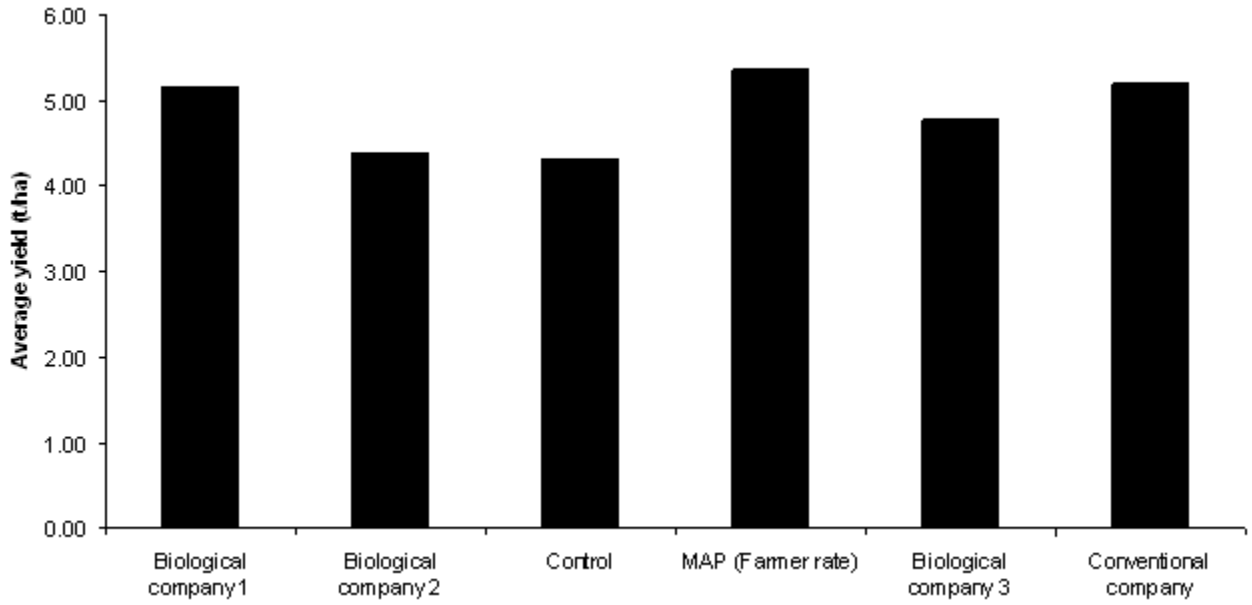

Figure 1. Average barley yield of various fertiliser treatments in 2009 at Horsham East. LSD (P<0.05) 0.61.

Results for 2009 were presented to the farmer groups in March 2010 again, attracting good numbers of 10-15 to each meeting. Participants expressed their enthusiasm for the project, taking a keen interest in the results, asking questions and acknowledging the importance of continuing the trials in subsequent years in order to gain more meaningful results rather than addressing new issues. Evaluation indicated that on average 72% of participants felt that continuing trials into the future was needed in order to

generate results of sufficient merit to aid business decision making. In addition to agronomic measurements, 2009 results were also put into financial context using simple partial budgets which was appreciated by participants because in some cases, treatments resulted in impressive yields; however they incurred significant increases in cost and risk.

This project has added further evidence that research based on a participative action framework can successfully generate both meaningful and rigorous scientific findings while addressing grower needs for targeted, relevant information, which they can trust and take some ownership over in line with the review of Carberry 2001. It is hoped that over the longer term this will result in increased uptake of practices and technologies which can improve WUE and build adaptive capacity at the local and potentially the industry level, assisting farmers with their adaptation to a changing climate.

Conclusion

It is evident that the grains industry of South Eastern Australia will need to evolve in coming years in order to adapt to climatic conditions. This project has shown that PAR based research can be useful in generating interest in and validating agronomic practices that may be able to assist with this adaptation. While trial results to date are preliminary, there have been a number of important lessons learnt from engaging in the PARD&E process and it is envisioned that over the longer term this approach will lead to practice change that is able to sustainably improve the adaptive capacity of the grains industry in the Wimmera region.

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