Challenges of On-Farm Research – Insights from the Central Queensland Farming Systems Experience

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ABSTRACT

The "Sustainable Farming Systems for Central Queensland" project aims to develop profitable and sustainable farming systems in central Queensland and to have these systems widely adopted. Farmer-based groups are involved in on-farm research into system components at ten locations in central Queensland, with project staff facilitating and guiding this research and system development.

At the project's inception, on-farm research was seen as a means of integrating Research, Development and Extension (R,D&E), resulting in research outcomes relevant to producers therefore improving the rate of adoption. Although the use of on-farm research has produced locally relevant system components that are being adopted, using this methodology has not been without its challenges. This paper describes the experiences of the authors in implementing on-farm research, detailing the challenges faced and methods used to deal with them.

KEY WORDS

On-farm research, farming systems, sustainability.

INTRODUCTION

Large scale agriculture began in Central Queensland (CQ) in the late 1940s, with the Brigalow Scheme leading to the development of large areas of brigalow soils for cropping from 1962 (3). Since then, there has been a marked decline in the nitrogen fertility of cropping soils in CQ (1). In their review of CQ farming systems, Spackman and Garside (3) noted that soil fertility decline along with the availability and efficient use of soil water were major factors affecting farming systems in the region. These issues became the impetus for the initiation of integrated R,D&E aimed at developing more sustainable farming systems in CQ.

The project "Sustainable Farming Systems for Central Queensland" began in 1997 to address these issues, with the aim of developing profitable and sustainable farming systems and having them adopted throughout the region. A participatory action learning approach has been taken, with ten farmer groups throughout CQ investigating components of profitable and sustainable farming systems on 22 development sites. These development sites are paddock scale investigations into issues identified by the group and are managed using the cooperator's machinery. Each group consists of eight to ten producers, a primary and a secondary facilitator, a technical liaison officer and an agricultural consultant. Such an approach, integrating research, development and extension to develop farming systems on-farm has not been used in the region before. This paper describes the experiences of the authors in implementing on-farm research, detailing the challenges faced and methods used to deal with them. A number of important considerations for projects intending to use on-farm research as a R,D & E tool are also discussed.

MATERIALS AND METHODS

At the start of the project, groups were formed around existing social networks in various districts throughout CQ. An issue identification exercise was held with each group to decide on the research questions that would be investigated. This was followed by discussions to determine the locations of

development sites for each group. Project staff then met with the cooperator to determine the layout of the site and how treatments would be laid out. The first treatments were implemented following pre-plant soil sampling for nitrate and water. Some months after this, a full soil survey was carried out on each site to characterise the physical and chemical properties of the soil, map soil variation and assess suitability for use as a development site. A peer review of all sites was held late in 1998, to examine whether or not each site was able to meet the requirements of the group and produce accurate data. A team consisting of the group facilitator and technical officer, the project biometrician, a project member not associated with the group and the site cooperator were involved in each case. Some changes to site layouts have occurred as a result of this review.

There are a number of common variables measured on all sites, although the full range of measurements taken varies from group to group and site to site. Soil nitrate and plant available water are measured at increments throughout the soil profile prior to planting and following harvest to determine crop nitrate and water use. Plant populations are counted following emergence, with grain yield and protein or oil content are recorded at harvest. Daily weather data including rainfall amount and intensity, temperature, humidity and radiation are recorded at a number of weather stations situated on or near the development sites. Crops are planted, managed and harvested using the cooperator's machinery or contractor, with soil measurements and plant population counts carried out by project technical staff. Data collected from each season is collated and summarised by project staff before being presented to the group for their interpretation and discussion.

RESULTS AND DISCUSSION

Learning outcomes

There have been a number of learnings gained from our experiences in the project, particularly in terms of site design and layout. In the initial stages of the project, enthusiasm amongst the groups was high and the project team was keen to capitalise on this to keep the groups progressing. As a result, many of the designs and locations of the development sites were poorly planned. In most cases, replication and randomisation of treatments did not occur, which later caused confounding of the results at a number of sites. Treatment effects were also masked by factors such as slope and variability in soil type.

This caused problems for both the project team and the groups in interpreting the results, however it has made both parties more aware of the need for good trial designs and layout. In particular, group members now see the need for replication in on-farm trials after the problems encountered in interpreting data from non replicated sites. This is an interesting learning for project staff, as it was initially believed that cooperators would not be interested in replicating treatments as it would be difficult to achieve and be another imposition on their time. Biometricians were not involved in the early stages of site selection and layout, but are now seen to be essential if useful data is to be produced. Fortunately, the peer review involved both biometricians as well as project staff not familiar with each site. This allowed problems with site designs to be rectified, with an external point of view able to identify opportunities that those closely involved with the group and its development sites may not have identified.

In the haste to maintain enthusiasm, the development sites were established before the results of the soil surveys were completed. This in itself has caused problems, as project staff have since realised that many sites are not representative of other paddocks in the area. A number of cooperators have now indicated that poor performing paddocks were offered as these provided the greatest potential for improvement and a challenge to see if they could be made to perform better. Unrepresentative sites have resulted in responses that are not representative of other paddocks within the district. In turn, this has caused some groups to become disillusioned with the site as it is incapable of answering their questions, resulting in a loss of ownership in activities associated with the site. At the time that sites were selected, many of the project staff involved were unaware of such problems with the paddocks.

Deciding on treatments that are representative of group concerns has also been vital to the success of development sites. Site objectives need to be relevant to all group members in order for them to see value in the results produced. In some cases, treatments that were imposed initially are still being

investigated after more than two seasons. This is an indication that the groups initial areas of interest were not clear or focussed enough to provide answers within a reasonable period of time. Those groups that have set clear, achievable objectives still have the greatest interest in what happens on the development sites.

The attitude and commitment of site cooperators has also been vital to the success of on-farm research. Establishing and operating development sites has meant extra work for some cooperators, and can take up some of their time at critical times of the year such as at planting and harvesting. In some cases, the data produced has not been immediately relevant to the cooperator. However, those that can see the benefit to the group and the wider community do not mind doing the extra work. Similarly, cooperators that see value in collecting accurate data from the site and believe in the need to do this over a number of years generally have the most successful sites. A number of problems have been encountered where these factors have not occurred, which has resulted in a loss of data in some cases.

We have found that a partnership between project technical and facilitation staff and the cooperator needs to be developed in order for all parties to recognise each others needs and ensure that meaningful, accurate data is collected. Good communication is an important part of this partnership. Project staff have needed to develop a good understanding of the way in which the cooperator's enterprise operates and who is the main decision-maker. Problems have been encountered when the role of the decision-maker has changed or staff have not dealt with the person making the final decision. This has eroded the partnership between the cooperator and project staff, resulting in a lack of ownership and interest in the development site by the cooperator.

Using cooperators machinery and other equipment on the development sites has also been a learning process. Those sites already using Controlled Traffic Farming have been easier to manage as this system makes it easier to locate replicates in a large paddock and soil samples can be taken from similar areas in the paddock each time. This has added to the accuracy of data collected on these sites. However, there have been difficulties in achieving adequate plant populations on a number of sites, which in turn as confounded results. Similarly, contract harvesters are used on a number of sites and at times have not been fully aware of location of treatments and the need to keep treatments separate. Adequate supervision by either the cooperator or the project staff when the site is harvested has been essential in ensuring that the potential for error is reduced.

These are good examples of how fundamental research requirements can be difficult to achieve in some cases. Even though work carried out on the sites is more developmental (ie. applied research) than pure research, we have learnt that there is still a need to use sound research principles if meaningful results are to be achieved. Carrying out on-farm research does not have to mean that less scientific rigour is used. However, in practical terms it can be difficult to answer some research questions using paddock-scale on-farm research. As such, a balance between practical operation of the site and collection of accurate data has been required on each development site.

Implications of learning outcomes

One of the major implications for other projects considering the use of on-farm research occurs in the initial stages of project activity. It is vital that biometrics staff are intimately involved in the site selection and layout process to ensure that the site developed is able to meet its objectives. Without their involvement, site designs can be ineffective and lead to numerous other problems, including irrelevant data which reduces group satisfaction. Replication and preferably randomisation of treatments needs to be used in order for the site to produce relevant data. Both the cooperator and project staff need to believe in the use of replicating and randomising treatments so that this can occur. A lack of replication and randomisation are common factors in sites that are unable to answer the group's questions.

Carefully considered site selection is also crucial to the development of successful sites. It is important that the site is representative of other farming paddocks in the district and is uniform to avoid confounding of treatment effects. Reid (2) has noted that site history needs to be collected before the trial is established in order to avoid problems from occurring. We agree that soil properties in particular need to

be well understood and that the effect of any limitations present on potential results is recognised before any activities are undertaken. Issues being examined on the development sites need to be relevant to others in the district and be clear and concise in order for the site to be perceived as valuable. This is essential if the group is to have ownership of the site and the issues being investigated on it. Group facilitators need to be aware of this and ensure that clear, achievable objectives are set by the group if interest in the development site is to be maintained. This is also linked to the need for replication of treatments on the site, as a lack of replication will result in irrelevant data and the group becoming disinterested in the site and its objectives.

The attitude and commitment of cooperators is another important factor in the success of on-farm research. Cooperators must see value in collecting accurate data from the site and believe in the need to do this over a number of years. Just as important is the partnership that needs to be developed between project facilitation and technical staff and the cooperator. A balance between the practical operation of the site and accuracy of data collected needs to be found in order for the site to operate smoothly. Without a mutual understanding of each others needs, problems with site management and data collection are likely to occur.

Using cooperators machinery and other equipment to operate the site can cause problems, however a compromise often needs to be reached between the accuracy and extent of data collection. Sound research methods still need to be maintained in order for meaningful data to be collected. This may mean that small scale, pure research trials are still needed to first develop new ideas and carry out detailed, rigorous monitoring. Practical application of these results can then be carried on a larger scale over the remainder of the development site.

CONCLUSION

Projects planning to use on-farm research as a research tool need to be aware of the potential problems that can occur in its implementation. We have identified a number of key factors that are critical to the success of well defined research questions that produces meaningful and accurate data. These include :

1. Use biometricians to ensure that rigorous statistical design is used when establishing sites, including replication and randomisation. The effectiveness to which this is carried out will have a significant effect on the long term success of the trial.

2. Sites selected must be representative of other paddocks in the district, both in terms of soil properties and paddock history. Similarly, the issues investigated on the site must be relevant to the wider district in order for the site to be seen as useful by the group.

3. The attitude and commitment of cooperators has a major impact on the quality of data produced and collected. In particular, cooperators must believe in the need to collect accurate data for the benefit of the group and the wider community.

4. A healthy partnership between the cooperator and project facilitation and technical staff is vital to the success of the site. All parties must understand the balance between practical operation of the site and accurate data collection, and take into account each others requirements in achieving these goals.

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