PARTICIPATORY DESIGN OF AN ON-FARM AGRONOMIC RESEARCH PROGRAM IN CENTRAL QUEENSLAND

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Summary. In 1992, ten farmers were interviewed in Central Queensland (six in Capella, in the Central Highlands; and four in Banana, near Moura, in the Dawson-Callide). This was part of a pilot study to establish a programme of on-farm research. The outcome was a research program based on the farmers' own experiments (either in hand, or planned) and their statement of their own research requirements. This applied both to content and experimental design. The participatory design process is helping to re-define the appropriate roles of farmers and professional researchers in the conduct of on-farm experimentation, the way in which the research is done, and the requirements for valid causal inference.

INTRODUCTION

In recent years, there has been increasing interest amongst agricultural researchers in systems methodologies that look at the problems of agricultural production in a more holistic way (10,15). These ideas have come from several sources: from Farming Systems Research (FSR), as applied to problems of agricultural development in less-developed countries (4,14); from the crop and soil modellers who have used a more reductionist approach to understanding the behaviour of the biophysical components of agricultural systems (11); and from softer systems methodologies developed in an industrial context (13). These approaches differ in many ways: the extent to which people are included within the system boundaries; the formalism of the system representation; and the nature of the trade-off between understanding (by whom?) and usefulness (for whom?). We feel that it is both feasible and desirable to bring these different approaches together, within a systems framework, and to get some balance between them.

Several groups in Australia have now done Rapid Rural Appraisals (RRAs) as a way of defining research agenda (6,9). The RRA is seen as the critical first step in FSR (2). RRA is a methodology that can be applied in different ways. Researchers here have tended to adopt Hildebrand's *sondeo* method (8). This involves a lot of outside people, perhaps a dozen, with different professional perspectives, not necessarily related to the issues of agricultural production. It is felt by the proponents of this process that this gives a much richer picture of the farming system than one that is more clearly focussed on the use of particular technological components. In this it differs from an alternative method used by Collinson in the early days of FSR (3). The Collinsonion approach attempts to capture two different perspectives embodied in two (at most three) professional researchers: typically, an agronomist and an economist. Often, these researchers will be working with farmers on the amelioration of problem situations over an extended period. We believe that these relationships are important for a successful outcome, more important than marginal differences in perspective that might come through use of a *sondeo*. It was with these considerations in mind that we used an informal survey to help define the agenda for a pilot study of collaborative on-farm research on broadacre dryland cropping in Central Queensland (CQ). The overall procedure is equivalent to a "participatory RRA" (12).

METHODS

Two groups of farmers were selected. The location of the two groups was based on agro-ecological grounds: one in Capella in the Central Highlands; one in Banana, near Moura, in the Dawson-Callide. There are differences in history of cultivation, in soils, and in rainfall. The two areas represent the two major cropping areas in CQ. The farmers were selected through a third party who knew the area well: in Capella, through a private agricultural consultant; in Banana, through a local extension officer with the Queensland State Government. All the farmers were recognised locally as active experimentalists who thought a lot about what they did.

In a preliminary visit, in August 1992, we discussed with each of the groups our ideas about doing on-farm research on problems that growers themselves saw as important; on which they were already experimenting; and on a scale, and in such a way, that this caused minimal disruption to their normal production practices. The groups endorsed our proposal that this was an appropriate way to go about agronomic research.

The first round of interviews took place over one week in October 1992. The interview was informal, but covered property details (size, history of cropping), the way in which crops were managed (planting dates, crop choice, surface management, weed management, nutrition), and the farmers' requirements for research (what problems they thought important, how they were researching the problem themselves). A second round of interviews took place about six weeks later. This checked the results of the first round and began a process of negotiation about the details of proposed experiments.

RESULTS

A coherent pattern emerged from these interviews. This differed in the two areas selected for study. In the Capella area, farmers were unanimously concerned with declining soil fertility and the development of an appropriate response. They recognised that fertility had been declining steadily since this area had been opened up after the Second World War. In some cases, this realisation had come suddenly e.g. after a new piece of ground had been cropped. Previous research by QDPI had highlighted the problem of declining grain protein levels in sorghum (7), a sign that nitrogen fertility had declined. Several of the farmers had been experimenting for several years with phosphorus (MAP) and nitrogenous (urea, anhydrous ammonia) fertilisers. Those farmers who were using fertiliser were satisfied that there is a response to N and P, although the response had not brought the yield and protein levels up to those previously obtained in the area when it was first cropped. All the farmers had had soil tests done at various times. The soils were often low in sulphur and, to a lesser extent, zinc. One farmer had experimented with fertiliser containing sulphur and is sufficiently convinced of its efficacy that he now uses it routinely.

It was clear that: farmers in the group had recognised a problem with the performance of their production system; they had been experimenting (to varying degrees) with possible solutions, largely based around the use of inorganic fertiliser; there was concern that the response to fertiliser was not as great as it should be, that there was something else wrong; and there was anecdotal evidence that supported the hypothesis of a sulphur deficiency, in addition to recognised deficiencies in nitrogen and phosphorus, although little agronomic research had been done on this.

There was concern in Banana too about soil fertility levels, but inorganic fertiliser was not used nearly so extensively as by the Capella group. These farmers were also active experimenters. All farmers in the group were considering how to incorporate nitrogen-fixing crops into their rotations. One farmer was using mung beans; another lucerne; another snail medic; the fourth was considering the use of lablab or cowpea. As in the case of concern about sulphur deficiency in Capella, the farmers in Banana knew little about the behaviour of these species in CQ.

Some secondary issues also emerged: the use of an organic formulation of powdered rock as a fertiliser; measurement of liveweight gains in cattle grazing lucerne so that a rational decision about its value as a ley pasture could be made; concern about the excessive persistence of the herbicide atrazine; the use of a weed-activated sprayer; and marketing strategies.

Farmers were consistently anxious that research should interfere as little as possible with their normal operations. Planting and harvesting are critical times. Plot sizes of 5-50 acres were suggested as appropriate so that, if the experiment worked, there would be some immediate benefit. Small plot experiments were definitely not appreciated. Often, the site and layout of an experiment had already been decided by the farmer. The fact that an experiment was on someone else's property was not an issue, since everyone could learn by looking over the fence.

Thus, distinct research agenda appeared for the two groups: in Capella, a program looking at the management of nitrogen, phosphorus and sulphur nutrition using inorganic fertiliser; in Banana, a program aimed at maintaining nitrogen at present high levels using leguminous crops, with a small project to look at the persistence of atrazine. The problem of measuring cattle liveweight gain was referred to QDPI animal husbandry staff. The research programme had been very largely defined by the farmers themselves. It has subsequently been established on this basis.

The farmers also defined the constraints under which a program of on-farm research should operate. These had been anticipated by the researchers, but the informal survey helped to reinforce the reality of these constraints. Farmers are willing to share the experience of their own experiments. These are usually on a large scale with few treatments or replications. The role of the professional researcher in helping to monitor the performance of these treatments, and to help explain the basis for treatment effects, was recognised by farmers as a useful activity, something that they could not, or would not, do adequately themselves.

DISCUSSION

We are deliberately adopting an approach to on-farm agronomic research that differs in many ways from traditional practice: the research agenda are largely set by the growers we have approached; the experimental designs are very simple, with minimal replication and randomisation; the trials are on a production scale and subject to the constraints associated with normal commercial practice; and we shall be relying on continuous detailed monitoring in order to make valid causal inferences about treatment effects. Our approach emphasises the importance of locking into experimental programs already being carried out by farmers, networks of farmers and professional researchers for monitoring and evaluation, and the use of crop and soil process models to generalise between farms and through time.

We feel that we have good reasons to depart from the requirements of classical experimentation in order to gain the benefits of participation (focus, scale, ownership), and a better understanding of the constraints and opportunities that farmers face in normal commercial practice. Participation in the design and implementation of on-farm trials is well-documented in developing countries (1). We are trying to link farmers' informal research and knowledge of their local farming system with more formal on-farm testing procedures. The approach differs from that of Ison and Ampt (9) in that we are deliberately seeking problem situations where we feel that there is an opportunity for the kind of professional input we can provide. Let farmers do the things that they can do well; professional researchers have a distinctive and genuinely creative role of a different kind.

Acceptance of these constraints on the way on-farm research is carried out does have a cost: we shall have to re-examine the requirements for valid causal inference if the result of our research is to be more than just anecdotal. We are seeking to address this through the use of cropping system models to take account explicitly of (at least some) possible threats to valid causal inference. Our research is quasi-experimental (5). Even though on-farm research using traditional experimental designs is technically possible, we shall need to borrow increasingly from the social sciences to do it effectively.

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