QUALITY, QUALITY ASSURANCE AND QUALITY IMPROVEMENT IN AGRONOMIC RESEARCH

K.A. Parton

Department of Health Services Management and Public Health,
University of New England, Armidale, NSW 2351

Summary. Quality assurance (QA), once restricted to manufacturing industry, is now invading many activities distant from this origin. Concerns have been voiced about QA in relation to research in agronomy. After defining QA, its evolution in the business world is examined to provide guidance about its expected impact in agronomy. As long as it is introduced within the research process in a continuous-improvement-in-quality framework, it should be welcomed by researchers. However, given recent experience in Australian universities, it is unlikely that this ideal will be achieved.

INTRODUCTION

The terms *quality*, *quality assurance* and *quality improvement* are usually greeted with hostility by scientists. Partly, this reaction seems to be based on the suspicion that additional external constraints are about to be placed on research activity as the quest for accountability is pursued by others. Partly it stems from ignorance about the terms. The current paper has the dual aims of clarifying those aspects of the quality movement that agronomic researchers should be concerned about and those that they should welcome.

In the next section, definitions of quality and (QA) are provided. This is followed by a discussion about the evolution of quality management in business and its parallels with agronomic research. This leads on to the idea that QA, as it has commonly been applied, is opposed to continuous improvements in quality. The application of QA in universities is reviewed as an example of this problem. In the concluding section, advice is given for researchers on capturing useful components of quality in their work.

QUALITY AND QUALITY ASSURANCE

In a tertiary education context (2), QA has been defined as *All those planned and systematic actions necessary to provide adequate confidence that an education service will satisfy given requirements of quality*. This defines QA as a system of procedures (hurdles to be leaped) designed to ensure that quality is produced.

This raises questions of what we mean by quality and who is setting the QA hurdles. Quality is a slippery concept. According to Pirsig (8), *you know what it is, yet you don't know what it is... some things are better than others...But when you try to say what quality is, apart from the things that have it, it all goes poof!* One way out of this conundrum is to argue that quality is subjective; it is in the eye of the beholder. Different beholders will desire different aspects of quality and logically will wish to establish different QA procedures.

Garvin's (5) approach to the examination of product quality is more helpful. He argues that there are eight dimensions of the quality of a product: performance, reliability, durability, serviceability, features, conformance, aesthetics and perceived quality. While there may be some disagreement about the dimensions of quality, especially as one transfers the concept to agronomy, there seems merit in attempting to specify quality in terms of its components. The different stakeholders in agronomic research would place different weights on the various dimensions.

With respect to the second question, concerning who is setting the QA standard, the beholder of agronomic research was once primarily the scientific community. The legacy of this period is that there are in place a well-tried set of procedures that assure quality for this audience, e.g. peer review of articles before publication. Now the audience for agronomic research outputs is wider and includes funding bodies, farmers, local and regional planners, politicians and the general community. Each of these has

different requirements for quality. Each would favour particular QA measuring instruments, emphasising particular dimensions of quality.

For example, a quality aspect that seems to be becoming more desired by funding bodies is that research projects should produce results of immediate relevance. So do farmers who are becoming much more aware of the potential impact of the outputs of scientific research.

The general community wants even more. Its QA tests would include the contribution of the project to sustainability. While sustainability is a complex issue, some things can be said about it. An holistic approach is required to address it. Typically, a number of communities are party to sustainability issues. The QA demands on projects that address such issues will differ according to community.

A significant issue is that the old peer review method was QA from within the research process, while the newer, more broadly-based, QA is from outside.

CONTINUOUS IMPROVEMENT IN QUALITY

It is worth examining the evolution of quality management in business because it is a leading indicator of likely events in agronomic research, and it highlights likely problems of externally-imposed QA procedures. The most important feature of this review is that the best way to assure quality is not through inspection, but through empowerment of individual researchers. Garvin (6) provides a readable description of the evolution of strategic quality management in business. The commentary in this section uses it as a starting point.

In the era before mass production, highly-skilled artisans crafted individual products. Quality was taken for granted. Mass production introduced the need for interchangeable parts and this required the precise measurement of tolerances through formal inspection. While modern quality management does not rely on inspection (with the negative connotations that surround it) as its primary approach, many still think that it does. This is partly why QA is so disliked.

The next stage in the development of quality management was the introduction of sampling of finished products and the use of statistical quality control. As early as 1931 (9), it was recognised that variation in quality of what were meant to be identical products was a characteristic of all production processes. The management task became one of defining what was acceptable variation. Shewhart (9) developed simple statistical methods (the forerunner of process control charts) for defining the limits. During World War II, sampling of batches of mass-produced products replaced 100% inspection, as statisticians realised that an average defect rate for a process of say less than 1.5% could be detected with a sample size of 50 from a batch of 10,000. The emphasis was still on inspection of final product.

The major shift in quality philosophy, termed *quality improvement* (3) came during the early 1960s. It primarily involved the ideas of total quality control and zero defects. These broadened the responsibility for quality from the quality controllers to everyone in the organisation. The key steps were identification of problems at their source, ensuring that workers were aware of the needs of the consumer of the product and enthusing workers to have the desire to do the job right the first time. A significant component of this approach is the establishment of QA *within* the production process and controlled by those operating the process. When employed in this manner, QA can lead to process improvements that in turn lead to continuous improvements in quality. These improvements occur as the ingenuity of empowered workers is used to ensure that the process is controlled to produce the quality that the consumer desires. The problem is that this new philosophy, which represents a managerial paradigm shift, is not well understood and QA is still usually applied as an external tool of management.

Table 1 provides a comparison between quality improvement and QA as it is usually applied. This type of QA tends to be negative, focusing on who caused the problem. In contrast, quality improvement recognises that most problems (about 85% (4)) are system-based. Thus quality improvement is concerned with improving processes, while QA tends to be directed towards solving problems. By

perpetuating the checking of adherence to a standard, QA is a feedback system that deals with unusual events, is retrospective and tends to leave the process unchanged. In contrast, quality improvement is a feedforward system that attempts to control a process to prevent defects and variations. It has the target of delivering to the customer exactly the quality that the customer expects. Indeed, quality improvement seems to be a natural manifestation of the shift from a producer to a consumer-orientation.

Table 1. Characteristics of quality assurance and quality improvement.

Quality assurance	Quality improvement
Who-focused (negative)	Why-focused (positive)
Retrospective	Prospective
Externally directed	Internally directed
Involves only the few	Involves the many
Reactive	Proactive
Research administrator focused	Researcher focused
Event based	Process based
Inspection approach	Process approach
Quality is separate activity	Quality is integral activity
Focus on solving problems	Focus on improving process

Adapted from (3).

A parallel shift in orientation has been taking place in agronomic research as new stakeholders outside the research process make demands that could influence the form of the research outputs. While it is important to recognise these demands, it seems inappropriate to allow them to set the QA agenda in an externally imposed manner. Quality improvement requires researchers to be allowed imaginatively to set the QA agenda to meet the demands of their more diverse clientele.

Businesses that have used the continuous-improvement-in-quality approach have gained much (7). However, it can take many years for an established organisation to take on this approach (1). While in the UK, the University of Wolverhampton has used this approach for a number of years (2), the university sector in general in the UK and in Australia has largely introduced the old, externally-imposed, QA model. Dissatisfaction with this has been recorded frequently, and this may serve as a warning to its introduction in agronomic research.

DISCUSSION

There is a range of types of agronomic research, from fundamental disciplinary research through to applied, subject-matter research, and from research done by individuals through to that preformed by large research teams. Clearly, the precise manner in which QA would be introduced into each of these will be different because fundamental research is more likely to have a scientific audience, while applied research has a broader community-based audience. Nevertheless, the general lesson learned from the business and university sectors is that the ultimate objective is to attempt to move towards continuous improvement in quality. With this approach, QA should be established from within the research process and not be imposed from outside. This will only work as long as all researchers are aware of the needs of their particular clientele, have the desire to fulfil these needs and are free to manage the research agenda to meet them. The future is one in which there *will* be more accountability. By establishing appropriate QA mechanisms to deliver quality improvement, such accountability will become the ally of sound research.

REFERENCES

1. Crosby, P.B. 1979. Quality is Free: the art of making quality certain. (McGraw Hill: New York).

2. Cryer, P. 1993. Preparing for quality assessment and audit. (Committee of Vice-Chancellors and Principals of the Universities of the United Kingdom: Sheffield).

3. Darr, K. 1991. Quality improvement and quality assurance compared. Hospital Topics, Summer 1991, 4-5.

4. Deming, W.E. 1982. Quality, productivity, and competitive position. (MIT, Center for Advanced Engineering Study: Cambridge, Mass.).

5. Garvin, D.A. 1984. What does 'product quality' really mean? The Sloan Management Review, Fall 1984, 25-43.

6. Garvin, D. A. 1988. Managing Quality. (The Free Press: New York).

7. Omanchonu, V.K. and Ross, J.E. 1994. Principles of Total Quality. (St. Lucie Press: Delray Beach, Florida).

8. Pirsig, R.M. 1974. Zen and the Art of Motorcycle Maintenance. (Morrow: New York).

9. Shewhart, W.A. 1931. Economic Control of Quality of Manufactured Product. (Van Nostrand: New York).