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Minimising Pesticide Impacts – A Best Practice Management Model for the Cotton Industry

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1.0 EXECUTIVE SUMMARY

This report arises from a scoping brief presented to the author on 19th May 1995. The brief required an overview of the R&D Program currently being conducted under the management of Dr Nick Schofield of the Land & Water Resources R&D Corporation and jointly established by that body, the Cotton R&D Corporation and the Murray-Darling Basin Commission. The R&D program is entitled "Minimising the Impact of Pesticides on the Riverine Environment Using the Cotton Industry as a Model."

The main requirement of the brief was to advise how outcomes of the R&D program could be transferred to adopted best on-farm practice. In pursuing this it would be necessary to gain overview knowledge of the program, investigate the applicability of a best practice technique to the industry and identify barriers to successful adoption. A framework by which to proceed was required and project phasing to be considered.

The project was carried out by widespread interview of people in and around the industry, including all identified participants in the R&D Program. Visits were made to major growing centres in New South Wales and Queensland. Also a scanning review of a large amount of available literature was undertaken. The information gathered was checked against standard management models, on the move, so as to allow completion in the short time available.

The study concluded that the Cotton Industry is a dynamic and motivated sector of agricultural industry. It is highly aware of the problems it faces with respect to pesticide contamination of rivers and is ready for change. Problems were seen in that the industry was part of a large network of interested organisations with inputs, programs and outputs on the pesticide issue, thereby blurring responsibility and diffusing action.

Furthermore there exist no clear paths and structures to turn research output into practice. Ownership of projects is not sharply defined nor is there a basis of good management practice models to build a framework for action. Lack of widespread common understanding of management techniques and terminology exacerbates the situation.

Adopting an approach of Best Management Practice seemed a clear choice for implementation. A framework is described by which this could be implemented, with the emphasis on getting the best solution available.

Barriers to successful adoption of Best Practice by growers are identified and key elements in overcoming these are explained. Throughout, the emphasis is on participation by growers in the action plans designed to ensure their future.

The recommendations of the report are:-

1. The Cotton Industry should consider bringing forward a program to deal with pesticide contamination of rivers. The current R&D Program will produce valuable results. but will not keep pesticides out of the rivers. It is not likely to result in regulatory levels for the critical pesticide Endosulfan being reliably achieved. Therefore the Industry should aim to attain the best possible result with current technology, enhancing that as new technology becomes available.

2. The tools of the pesticide minimisation program should be broadened beyond the outputs of the R&D Program. All available inputs should be used to ensure the best possible solution is obtained.

3. A Best Management Practice approach should be used, as this is well understood and can have high utility for users if properly designed.

4. The project should strive for a high adoption rate by growers to ensure the objective of pesticide minimisation is attained and to maintain the industry's position with regulators. This success should be insured by:-

    4a. The quality of the Best Practice Manual which should be simple, relevant and up-to-date.

    4b. The involvement of growers, through their key reference bodies, in the formulation and review of the Best Practice code.

    4c. A high quality communication and education package.

    4d. The consideration of an Accreditation mechanism involving third party audit.

5. The project should be progressed using Action Oriented Management techniques to engender a Thrust for Achievement. This will ensure focus on the critical objective and establish a success pathway through the network of involved interests.

6. Consideration of the use of TQM should be postponed until such time as the industry has developed a firm base of good management practice with regard to pesticide usage.

2.0 INTRODUCTION AND OVERVIEW

This report deals with a scoping brief given on 19th May 1995 by the Land and Water Resources R&D Corporation. A copy of the brief is found in Appendix I.

The overriding aspect of completing this project was the time pressure involved. Only 15 business days were available from the start of the project until the delivery of the draft report. The Cotton Industry and its associated organisations represent a diverse and geographically dispersed area of operation. This increases the difficulty of completing a study in such limited time.

To deal with this, a strategy was adopted that involved taking a standard set of management models to set up a feasible outline for the task requirements. An intensive data collecting procedure was set in motion at once. This consisted of contacting a large number of people within the industry and its associated groups and seeking their knowledge, data and opinions upon the problem of cotton pesticides in river systems. In addition a considerable body of literature was acquired and perused.

Throughout this procedure the outlined model was constantly checked for applicability against the incoming data. Thus the fit of the model could be adjusted on the move. Since the models used have wide acceptability in the management of a variety of business settings, this approach could yield a quicker result than a more formal one.

To further ensure that the proposed model was valid, it was checked out constantly with appropriate people during information gathering interviews. Their comments and criticisms again allowed refinement to be an ongoing, parallel process.

Such data collection poses the danger of subjectivity, but by looking for recurring information and themes and by checking against published literature, a reliable scenario can usually be developed. The following points became clear during the process:-

- Everybody was aware of the problems faced by the industry with respect to pesticide contamination of rivers.
- There was a considerable level of concern about possible outcomes. This was most evident with growers, who felt they needed help urgently.
- Whilst everybody would like to see a "magic bullet" solution appear, there was an acceptance that improvement would take time and hard work.
- A strong theme of despair existed in some people, in that a large gap appears to lie between the allowable level of the most notorious pesticide (Endosulfan) and the levels achievable with existing technology. The fear was that the use of Endosulfan would be banned (at huge cost to the industry) and that growers were relatively powerless to do anything to avoid it.
- At the other end of the spectrum there was optimism about positive outcomes from research efforts. Whilst, understandably much of this came from researchers, the Transgenic Cotton development was widely viewed with great hope.
- An important observation was the large number of organisations involved in and peripheral to the Cotton Industry. These are of many different types: industry bodies, government and semi-government entities, land and water care groups, consultants, service providers (and their associations), commissions, research organisations and so on. Each of these has a concern and some input to the pesticide problem and their interests are, for the most part, highly legitimate.

- It was also very evident that almost all the afore mentioned organisations produced written output in some form. Thus there were clear signs of duplication, varying emphasis and information overload for the ultimate user.

- Many of the people interviewed and some of the literature reviewed used management terms such as "Benchmarking", "Best Practice" and "Total Quality Management (TQM)". These terms were used with different meanings by different sources. Questioning usually revealed that no clear understanding of these management techniques pertained. In particular the term "Benchmarking" was poorly understood.

- Finally, it was abundantly clear that the Cotton Industry was progressive, proactive and highly committed to the need for change. Their support for their various organisations and their funding of research efforts are positive indicators of the likely success of any improvement program.

The overview revealed the problems inherent in pursuing a plan to turn research output into practice on the farm, using good management techniques. These are seen to be:

- The **large number of interested entities**. This tends to diffuse responsibility and blur information flow. This is despite the legitimacy and commitment of those involved.

- The **lack of a common language of management terms**. Whilst it is fruitless to be over-concerned with definition, a clear understanding of key concepts helps markedly with improvement programs.

- The **lack of a clear pathway to ultimate success** (such as meeting regulatory requirements for pesticide levels).

- The **lack of existing structures** to complete the transformation from knowledge to practice.

These factors must be allowed for in the strategy.

3.0 THE RESEARCH PROGRAM

All identified participants in the R&D Program were interviewed. Firstly they were asked to describe their project in some detail. Secondly they were asked to report progress. The next question invited them to speculate upon the likely practical application of their work in cotton field practice. Finally, for those working in the field, an opinion was sought as to the attitude of growers towards the research and their readiness for change. Important points gathered from this survey are as follows:-

- The program is well designed and wide ranging, addressing the key points in the problem of pesticides in rivers.
- The program will eventually delineate a fairly complete history of what happens to pesticide after it leaves the spray nozzle. Understanding these pathways will undoubtedly help in closing or at least constricting some of them.
- There is, however no evidence to suggest that all pathways can be closed, so that pesticide will continue to enter the river systems. The discovery of the large scale evaporation of Endosulfan and its transfer to waterways via surface exchange is a good example of this intractability.
- Whilst extension to this part of the research may eventually result in more controllable pesticide movement (eg. new formulations, adjuvants) it is not possible to account for these at this time.
- The research is confirming and quantifying better known and more obvious modes of contamination, such as runoff. Some of the practices resulting from this work (eg stubble mulching, alternate spray technology) will probably have more immediate application. They will not stop pesticide reaching the river though.
- Research into degradation modes of pesticide and its enhancement by various means may lead to breakthroughs, but these are probably far off. In any case their on-farm application is likely to be difficult or impossible in many growing localities.
- Work on monitoring the effects of pesticides by microfauna studies and the like is essential, but is after the event and therefore removed from the objective of stopping the contamination.
- Overall there is no certainty about how much pesticide would get into rivers even if everything that could be done was done. There remains a feeling that Endosulfan levels might exceed the (very low) regulation level even under the best of currently understood practices.
- Field researchers reported that growers they encountered were cooperative, involved and keen for change.

The R&D program is not likely to overcome the pesticide problem in the near future. Some outcomes will generate or confirm Best Practice procedures. The involvement and approval of growers is a highly positive aspect.

4.0 MANAGEMENT TECHNIQUES

In this section are some brief notes about three management techniques in common usage today. Of course these are already used to varying extents in agribusiness. Here the aim is to define and describe the techniques to ensure commonality of understanding.

4.1 BENCHMARKING

Benchmarking has been described in many ways, the following definition seeks to capture the essential elements of the technique:-

> **Benchmarking is a technique by which we compare our own performance against the best. This allows the setting of goals which are known to be attainable. It also helps to devise an improvement strategy which has legitimacy. The process seeks to provide a basis for aiming at, reaching and surpassing the best performer in the chosen field.**

The essential elements here are the identification of the best performer and the comparison of one's own performance to that level. This is an inescapable aspect of benchmarking. In the present study the term was widely misunderstood.

Some people thought that a benchmark meant "what we are doing now". Others saw it correctly as a target, but missed the aspect of its derivation from the best performer. Commonly, the terms "benchmark" and "best practice" were used interchangeably, as though they meant the same thing.

The diagram on the next page clearly summarises the position of the benchmark in improvement processes. It shows the relationship between various reference marks in common management parlance. This diagram is self explanatory and will be allowed to stand without detailed explanation.

The scope of this brief does not allow a full explanation of the benchmarking process, but here are some key features:-

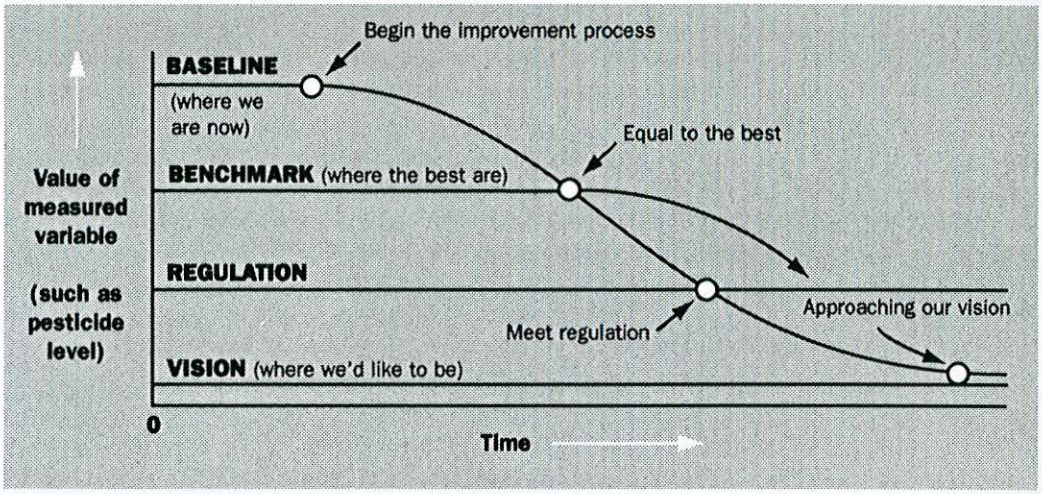
- It is first necessary to define what measures will be benchmarked. These can be either outcomes (eg. pesticide level in a river), processes, products or services.
- Then benchmarking "partners" must be selected, ie. those who will be surveyed to discover the benchmarks. Partners can come from a variety of sources, important ones being:-

  Internally – who is best within our organisation (eg. the Australian Cotton Industry)?

  Functionally – who is best within our business area (eg. the World Cotton Industry)?

  Generically – organisations who use similar processes (eg. Crop Growing)
- Data is collected by appropriate means – often a survey.
- The benchmark performance is discovered and the gap in one's own performance revealed.
- Targets and action plans can be devised to close the gap.
- Implementation follows with movement toward the benchmark.
- Results are reviewed and targets are reset as needed. Note that the chosen benchmark is probably not fixed over time, as its owners will probably also be working for improvement.

Benchmarking as an improvement tool



The strength in benchmarking is that targets are of demonstrated achievability (somebody has done it). The drive is to be "best in class".

There are concomitant gains in the benchmarking exercise. A most important one is that, when collecting data, information is discovered which can lead to the identification of Best Practice procedures. It is this fact that likely leads to confusion between the terms – they are closely linked , but are different aspects of the search for improvement.

While it is a powerful tool, the application of benchmarking in the Cotton Industry might be constrained due to lack of benchmarking partners.

4.2 BEST PRACTICE

The term "Best Practice" is common throughout business and the concept is easily understood. In this study it was found in several "handbook" type publications and raised by many of those interviewed.

For the purpose of completeness a definition is attempted here:-

Best Practice is a method of management whereby we identify, record and recommend the best way to carry out a particular process. It involves diligent analysis of known practice and rigorous screening to ensure that practice recommended is viable.

Perhaps the biggest problem in Best Practice approaches is the quality and legitimacy of the practice recommended. There is an understandable tendency to 'overkill' in best practice exercises and recommended practice may reflect the needs of the compiler more than those of the user.

Furthermore, unless Best Practice recommendations or codes are rigorously developed, they may lack legitimacy with end users and thus suffer poor adoption.

Inputs to a best practice exercise can come from a range of sources:-

- 'Know-how' is often a good source, since actual practice tests processes over time and in varying environments. The difficulties are that it is usually not recorded or codified, nor is it rigorously proven. Know-how is commonly collected by survey of users. This has the important benefit of allowing participation and encouraging acceptance and adoption of the outcome.

- Technology is a more reliable source of input. Here the information is established and proven practice which is documented and codified. It is often the adopted outcome of previous R&D efforts. Technology can be collected from the extant literature. Its legitimacy and acceptance by users requires careful attention.

- Research and Development can be a source of Best Practice and is a key consideration in this brief. The advantages are clear, the scientific method produces results of known reliability. Disadvantages also exist and the path from R&D output to established technology may be difficult.

- Benchmarking is another source of Best Practice information (the connection between the two now established). It has the great advantage that, as it has identified the best performer, there is a clear connection to Best Practice.

Best Practice Management is a clear choice for the current project as it fits the need to turn R&D output into on-farm practice. It is a widely understood concept which is already used within agribusiness.

4.3 TOTAL QUALITY MANAGEMENT

Total Quality Management (TQM) is a modern concept, though its roots in Quality Control date back to the post-war period. The term was used by a number of people interviewed, but was not found to any extent in the literature surveyed. This suggests that it is a new concept to the industry and that is understandable since TQM is an end point of good management practice rather than a beginning.

Total Quality Management is a business philosophy intended to ensure the achievement of customer satisfaction. It involves careful design of a product or service and the institution and maintenance of systems to ensure that the design is always realised.

The two key aspects of TQM then are the design of the required output and the system which guarantees the quality of the output. The output is defined in broad terms, some of the important elements are as follows:-

Management Responsibility – descriptions of policy, structure, procedures, monitoring, recording and review.

Quality System – full description of the quality control procedures including documentation, responsibilities, updating methods and consistency with customers' specifications.

Document Control – the system for compiling, approving and distributing documentation, dealing with outdated documents and the codification of documents.

Purchasing – Procedures to ensure all supplies conform to specification, identification and control of supplies, dealing with non-conforming supplies.

Traceability – The capability to identify all outputs and the processes involved.

Process Control – Work instructions, training of operators, records.

Control of Test Equipment – Suitability of equipment, registration, calibration to primary standards, records.

Corrective Action – Procedures, recording, prevention of recurrence.

Quality Records – Procedures, documentation, indexing and archiving, storage facilities.

Quality Auditing – Planning regular audits, conduct by qualified people, recording, corrective action.

Training – Procedures, documentation, responsibility.

This list of some of the requirements of a TQM system shows what a formidable task it is to implement. The difficulty is exacerbated in a diverse and dispersed business sector like the Cotton Industry. Most importantly, a successful TQM system can only be built upon an existing and workable management system with process control, standards and measurement in place.

It is suggested that the Cotton Industry, with particular regard to control of pesticide contamination of rivers, is not at that stage and that TQM is something for the future.

Having said that, it is believed that some of the concepts of TQM can be adopted into a Best Practice model.

5.0 TASK ORIENTATION

The clear and pressing need for the Cotton Industry is to get something done about the pesticide problem. Pressure from regulators, the environmental movement and from the values of the industry participants is severe. Whilst there is great hope in various research programs there is also a feeling at the grower level that big problems lie just ahead.

The pressure for results is frustrated by a number of things, for example:-

- Uncertainty about the value or timing of the research output.
- Lack of clear responsibility for doing something.
- The seeming huge gap between where we are and where we must be (ie. the regulations).
- The hope that emergent and novel alternative technology (such as transgenic cotton) will solve the problems.

Following are some concepts which can clarify the path through this minefield.

5.1 TOOLS VERSUS TASK

A logical trap which it is easy to fall into is to confuse the tools with the task. In business it is advisable to decide first what has to be done, then decide how it is to be done (including what tools are needed).

In the present study the task is to fix the problem of pesticide in the rivers. The tools available for this are many and varied, but they are all means and not ends!

So the research program is a tool which will produce technology and best practice, but it is one tool amongst many which can be used to get the job done. Focussing on the R&D effort instead of on the task can add to the piecemeal approach to problem solving which seems to be common in the industry.

It is likely that Best Practice drawn only from the R&D project will be insufficient to deal with the problem of pesticides in rivers and a more widespread approach seems advisable.

5.2 NETWORKS

One of the difficulties identified in the overview was the large number of bodies involved in the Cotton Industry. As pointed out this tends to affect the assignment of responsibility – there is always somebody else who is dealing with some aspect of the problem. The current research program is a positive move in that it captures a number of issues under one management. The aim now must be to extend that focus into implementation.

An aid to this is to view the various organisations as a Network of Resources. Thus they have information to give and opinions to pass on, but they do not run the project. While their needs are listened to they are peripheral to getting the task done.

This raises the concept of Flank Issues. This term refers to issues which, while important, are not in the pathway between Task Definition and Task Achievement. An example of this would be the regulated level of pesticide in a waterway. Important as this is, it does not bear upon the task of translating research findings into practice on the farm. Rather it is an external issue and needs to be dealt with by appropriate entities and structures. The research project specifically refers to minimising the impact of pesticides, not meeting the regulation.

The foregoing concepts can be incorporated into the action oriented management style **Thrust for Achievement**. Here the emphasis is on getting the job done. The key elements of the thrust are:-

Defining the Task – by deciding what the task is, who owns it (ie. who is responsible to see it gets done) and who will do it.

Setting Up the Implementation Entity – creating a position or a group which will do the job. Giving this entity the authority, resources and support needed. Ensuring dedicated time availability.

Specifying Standards of Performance – as to what must be done and when it must be completed.

Monitoring Progress – ensuring that the job is being done. Deflecting flank issues. Keeping the project focused.

Since what has been set in train is highly focussed and channeled it is reasonable to expect that an achievement pathway has been established.

Another very important aspect of the Thrust for Achievement concept is that of the right time to move. In complex situations there is never a 'right' time to start, there are always barriers in the way or developments around the corner. Unfortunately procrastination is the enemy of good business management, if we wait till all is right, then nothing gets done. For example in the present project, it is tempting to wait for research findings or for the promised results of transgenic cotton developments (the 'magic bullets'). These outcomes are unknown at this time, in some cases we may wait in vain. Meanwhile pesticide is in the rivers and continues to go in!

It is often wise to get on and do the best we can with what we've got.

Late breaking developments can usually be incorporated, what is needed is *action.*

6.0 A MODEL FOR BEST PRACTICE MANAGEMENT

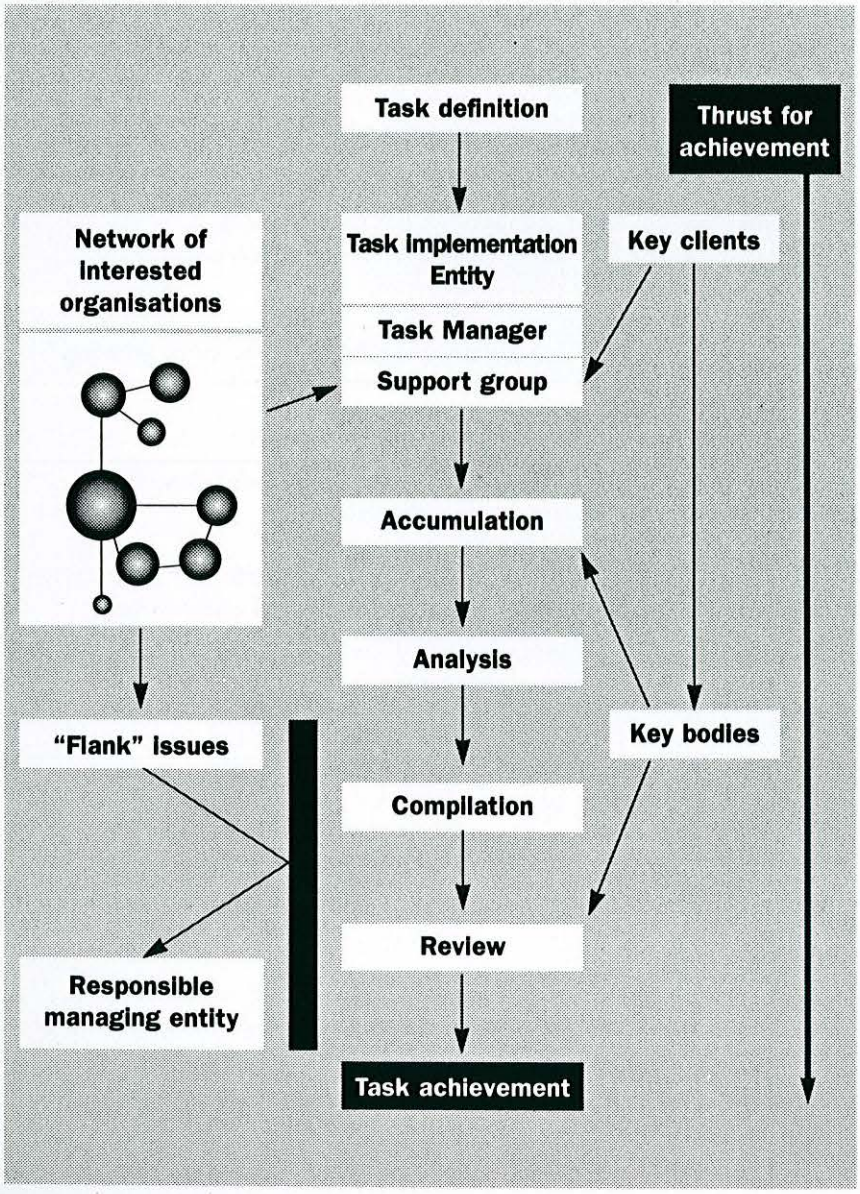
It seems clear that what is required is a set of Best Practice guidelines for the cotton grower which will serve as a reference point and rule book. Growers interviewed made it clear that they were seeking help in this regard. Logically these guidelines would be set out in a Best Practice Manual. The characteristics of this manual should be:-

- It should contain Best Practice information which is *legitimate.* The information, whatever its source must be carefully screened to ensure it reflects known and proven facts. A 'grab bag' approach where everything that anybody thinks might help is put in, 'just in case', would reduce the value and acceptance of the document.

- It must be *relevant* to the individual grower. Manuals which give advice or instruction that the user cannot follow are ineffective. The test for the quality of any instruction manual is whether it gets used.

- It must be *simple.* Whilst the science and technology of pesticide application and control is complex, the resulting rules for farm management are basically simple. The manual should reflect this fact, with the complex explanations and justifications of Best Practice rules confined to appendices. This is a user-friendly approach which helps with acceptance and adoption.

Best Practice Project
MODEL FOR TASK ACHIEVEMENT



- It must be *up-to-date.* If the manual is to be useful it must not become obsolete. This is particularly important in the pesticide application, where the research programs and the emergent technologies may bring quick change to on-farm practices. So the format of the manual should allow quick and easy updates and there needs to be structures and mechanisms to generate and distribute them.

- It should be a *controlled document.* It should not be just handed out loosely, rather issues should be registered and receipted. Updates should be similarly dealt with formally. Here we borrow from principles of TQM.

What is being described here is a working document for the grower rather than a textbook or scientific paper. This concept finds eager acceptance with growers and their supports in the field. The foregoing may appear to be obvious, but examination of available literature on recommended practice for the farmer showed lack of some of these aspects.

The best chance the industry has to turn research findings into adopted Best Practice is to design systems with a focus on the users' needs.

Now let us move to the way this might happen and the problems that will need to be handled. The diagram on the next page seeks to show the essential elements of the process and is the core of this presentation.

The elements of this process are described in the following notes:-
6.1 The Model (Cont.)

Inputs – are shown as derived from a number of sources. These have been described in an earlier section. It is noted again that the current R&D effort is just one of the inputs.

Best Practice Exercise – is conducted by the accumulation of data and its rigorous analysis. The aim is to develop a best practice code that has legitimacy. Here the past and present R&D effort plays an important role as the framers of the document have a knowledgeable and accessible reference source to check out data items.

Some of the data collected will be immediately valid. This will be items which are logically obvious (eg. overspraying) or supported by research (eg. storm run-off). Other data might be invalid due to lack of evidence or past failure in practice (eg. coal filtration beds). In between will be a body of data in doubt. This will require careful examination to determine whether it can generate Best Practice rules. Caution is urged here since validity is key for subsequent adoption. An anecdotal story claims that at one time farmers were advised to plant Willows to help with salinity, only to be told later that they were of no help. This kind of event is best avoided. As stated new developments can be incorporated later.

Best Practice Manual – the output of the exercise, but not the end point of the project. The manual has the characteristics noted above. Of these, the question of relevancy demands further discussion.

The problem is that the cotton industry has different constraints in different growing areas so that one set of Best Practice rules is unlikely to be relevant everywhere. A suggested solution to this is to divide the manual into sections:-

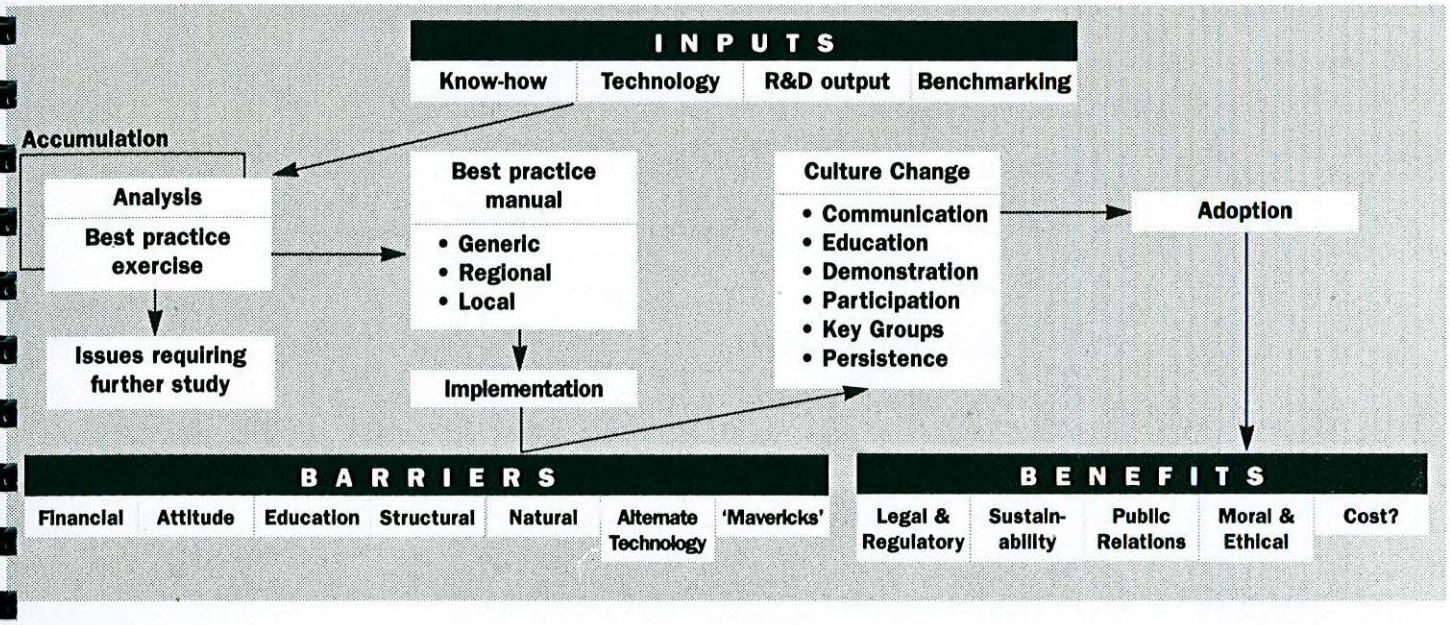
Generic Rules – those which apply everywhere. They would include rules about overspray, container disposal, spraying strategy and the like.

Regional Rules – pertaining to particular regions. An example would be the handling of tailwater, which is quite different for NSW irrigation farmers, off-river dryland farmers and Queensland farmers on State canal systems.

Local Rules – applicable to distinct growing environments, possibly even on an individual property basis where appropriate. These could be considered where local conditions pose particular hazards. For example, establishment of buffer zones or changing some fields to alternate crops could apply here.

This would be the most difficult area to formulate (and to implement), yet with the current gap between achievable and regulated levels of pesticide, it seems inescapable in the long run.

Implementation – is the critical element, without success here, the exercise will be pointless. The industry will risk intervention by government agencies, prescriptive and perhaps draconian measures (such as the banning of Endosulfan). As in most management exercises, implementation is the most difficult step, but it is achievable.



Model for developing best practice

Barriers – are those factors which lessen or prevent the propensity of growers to adopt the Best Practice guidelines. The number of barriers in a complex agribusiness setting is very large and the scope of this brief does not allow a full exploration. An excellent reference in this regard is a report by Dr Bruce Hooper of the Centre for Water Policy Research, University of New England, Armidale entitled "Adoption of Best Management Practices for Dryland Salinity", published in February 1995. This gives a detailed survey of the topic and identifies the range of barriers encountered.

In reduced terms important barriers are seen as follows:-

Financial Considerations – are an ever-present barrier which do not require detailed discussion here. The problem revolves around availability of funds and the perceived benefit to the grower of spending money on Best Practice procedures.

Attitudinal – the individual or group response of growers to change, mediated by custom and practice, history and value sets including attitude to risk.

Education – or the degree of knowledge about the problem and its solutions. This is particularly important for those on the fringes of the industry as some dryland and/or opportunistic farmers are.

Structural – barriers to adoption resulting from inherent infrastructure conditions. The established landform in some growing areas (such as the Queensland State canal system) is an example. Other factors here are financial pressures to maximise land use, the effect of the economy and taxation policies which encourage marginal land use.

Natural – features of the farm environment may offer considerable barriers to individual growers' propensity to adopt. Soil types may inhibit the use of alternate spray technology, slope controls the management of storm runoff and perverse weather conditions can put growers, intent upon the insurance of a spraying, in a dilemma.

Alternate Technology – the promised availability of transgenic cotton with its likely effects on pesticide usage are seen by some to demand caution in expensive practice modifications This is an understandable response.

6.1 The Model (Cont.)

"Mavericks" – to use a word heard frequently during interviews, are always a concern.. There are bound to be some people who will not accept change. They will be a minority and should not hold up the bulk of the industry.

Culture Change – is a the most important part of this model. What is proposed is that widespread adoption of Best Practice among growers requires a change in the value set of the group. Such cultural changes are common in society (eg. attitudes to smoking or drink driving).

The challenge is to have growers adopt best practice because that is what their 'society' does. It is common that people do not adopt change because they cannot see or touch the benefit. Growers see the negative effects of Heliothis on their crops quite easily, they do not usually see the negative environmental effects of pesticide contamination.

Techniques for culture change are well understood. Important ones are:-

Communication

Education

Demonstration – here the R&D program can be of great help. For instance, field demonstrations using the 'rainulator' to show the effect of wheat stubble on sediment runoff have attracted considerable interest and are claimed to be extremely convincing for the technique.

Participation – is a powerful tool in changing attitudes and culture. The more growers are involved in planning and implementing change the more 'ownership' they will take on.

Key Groups – who are respected and trusted by growers have an important role in culture change. A consistent message channeled to farmers through their reference groups will be more likely to be heard and adopted.

Persistence – is always necessary in a major selling exercise such as this is. The determination of the project and task managers is key.

Promoting culture change will overcome many of the barriers to adoption. It can also encourage risk taking to overcome or bypass more entrenched barriers, such as financial conservatism.

Fortunately the Cotton Industry is receptive to change – this is attested to by a wide range of those interviewed. Being relatively young and highly professional it lacks many of the custom and practice restraints of older rural segments.

Adoption – is the final goal, but will it serve the need? The task was to minimise the impact of pesticides on the riverine environment. The methods employed to get to this point have involved using all of the information available, analysed, compiled and transmitted to the growers in the best possible way. Therefore it ought to be the best available solution and present the best outcome.

Pesticide levels in rivers due to cotton growing may not be at regulation levels (some pathways will prove to be intractable), but they should be as low as they can be with existing technology and therefore minimised.

This pragmatic approach of using the best tools to do the best job possible, producing the best possible outcome is recommended.

Benefits – which flow from successful adoption are patently obvious to those in the industry and need not be enumerated here. Cost benefit is, of course, controversial and largely indeterminate at this time.

Perhaps the greatest benefit will be the amelioration of pressure for compliance with regulation. Past experience and discussions with appropriate people during this study, suggest that prescriptive and severe intervention are less likely where an organisation is demonstrating responsibility and self-regulation.

A professional Best Practice approach seems the most effective way to demonstrate the Cotton Industry's commitment to the environment.

6.2 INVOLVING PEOPLE

As has been foreshadowed, a vital part of this process is involving people to the fullest possible extent. This especially refers to growers, the key clients of the Best Practice exercise.

Growers should be consulted during the data accumulation stage of the exercise. They have large stores of know-how to give. Seeking and accepting their input gives the project legitimacy and helps with eventual adoption.

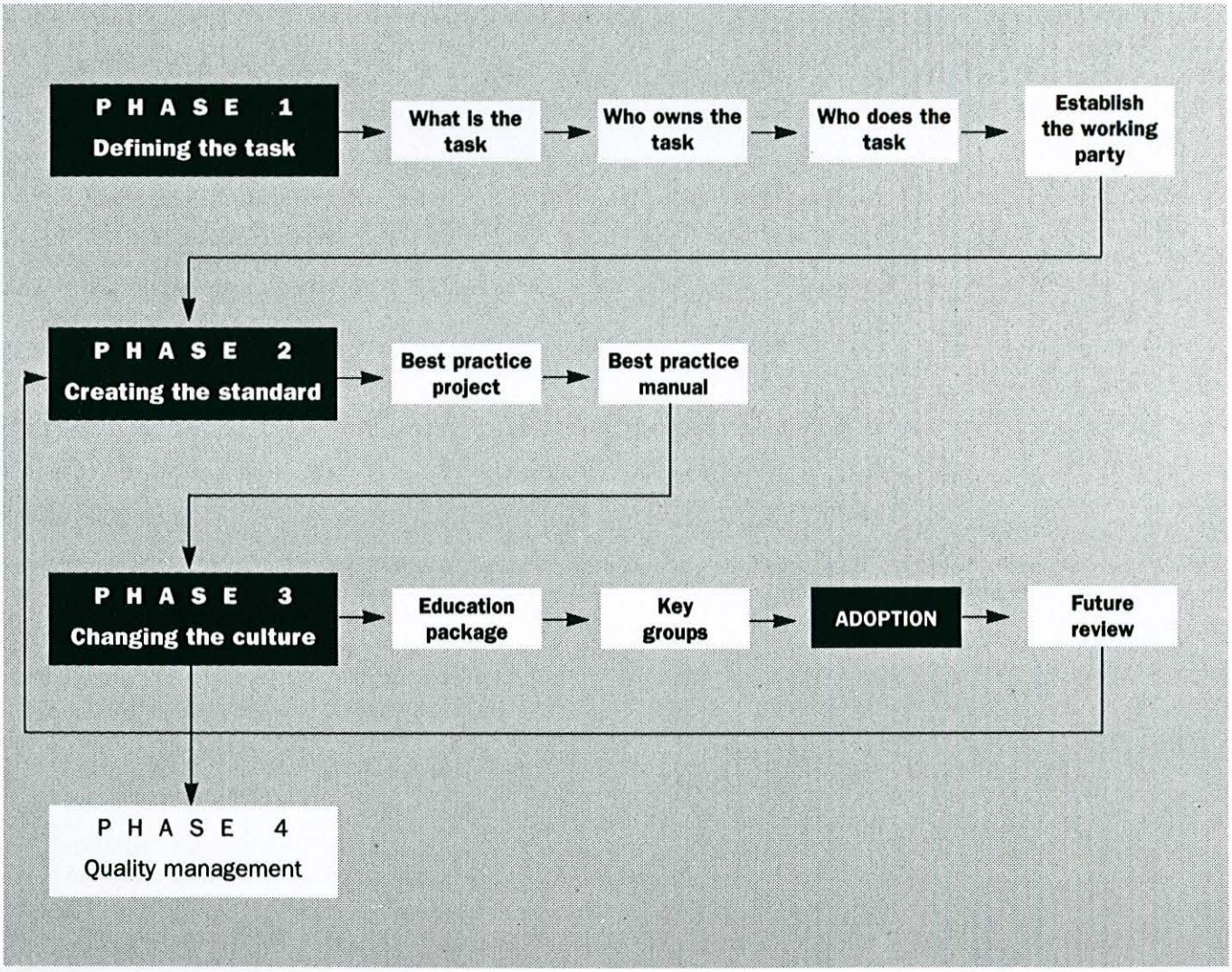
They should also be involved in the review of the draft manual. This ensures that it is not presented to them as a fait accompli over which they have had no control.

Contact with the growers could be on an individual basis or, perhaps more constructively, through growers' groups. The latter tactic provides a mechanism to enhance control by the grower, deal with uncertainty and facilitate follow-up. It may also encourage peer pressure towards participation and cooperation.

Since we are seeking to produce behavior change towards Best Practice this is fundamentally a people exercise and must involve key people to ensure success.
7.0 Phases of the Project

The diagram on the preceding page shows the suggested phases of the project as dealt with in the following notes.

Project Phases



7.0 PHASES OF THE PROJECT

7.1 PHASE I: DEFINING THE TASK

The first phase is the responsibility of the initiating entity, in this case the Program Management Committee of the Joint Research and Development Program. This phase is short and to the point. Its elements are:-

What is the Task? – Defining the task as to title, objectives and time scale is an obvious necessity.

Who Owns the Task? – This requires some introspection and analysis. The joint program is funded by three entities, all with highly legitimate interests in its outcome. The extension of this program into a Best Practice exercise might be similarly organised.

However emphasis is laid on the need for a clear project manager (much as LWRRDC is managing the R&D Program). Further, it is contended that the likelihood of success is enhanced by the nearness of the project managing entity to the Cotton Industry and its growers. An important element of adoption by growers is their feeling of ownership of the solution. Controlling the project through a respected growers' reference group would be an advantage.

Who Does the Task? – Deciding who will do the job is a critical responsibility for the Management Committee. It is suggested that the task size and importance requires a dedicated approach, that is, the nominated task manager needs to be full time on this job. Indeed, the individual should be a "task champion", highly focussed and dedicated to achievement and success.

The mode of procurement of the task manager is for the Management Committee to decide. Whether this is done by secondment, recruitment or consultancy is beyond the scope of this report.

Establish the Working Party – It is further suggested that a working party be established to support the task manager. The members of this party could be drawn from appropriate places in the network of resources, chosen solely for their ability to contribute and not from any ex officio motivation. The chosen people would supply their personal expertise to the task manager and, importantly, act as conduits to the network. By restricting network involvement to established nodes in this way, focus is maintained and dispersion of effort avoided.

Such an arrangement would encourage the THRUST FOR ACHIEVEMENT philosophy recommended for this project.

7.2 PHASE II: CREATING THE STANDARD

The second phase of the project involves creating the Best Practice Manual which will be the standard for future farm practice with regard to environmental responsibility.

This phase has been described in detail in earlier sections. Since it involves accumulation of masses of data and detailed analysis of that data it will necessarily be extensive in time (though it is not possible to suggest the time period needed in this study).

It must be assumed that the task manager will have all the necessary secretarial and administrative support. Working from an established organisation where such support is available is assumed.

The product of this phase is the Best Practice Manual and the system for its control and future updating.

7.3 PHASE III: CHANGING THE CULTURE

This is the most critical phase of the project and the least predictable as to outcome. Here we have a full scale people exercise with its attendant uncertainties. It requires specific skills in education, training and communication.

Important elements are:-

Education Package – This needs to be drawn up by those with the requisite skills. The question will arise as to whether the task manager and working party from Phase II have those skills. While the former may well continue in the role of task champion, it is suggested that the working party would change radically due to the special needs of this phase of the task.

Key Groups – Once again the role of key groups in the education and culture change exercise is emphasised.

Adoption – An important consideration will be how adoption is measured. Possibilities include response to survey, inspection, information through growers' groups or reports from support, service and regulatory bodies.

Of course the acid test is the results flowing from river monitoring (though these can be obscured in some cases by non-cotton pollution).

Consideration should be given to setting up a system of **accreditation**, a concept adopted from TQM. In this, an external auditor carries out a survey of a grower's practices against the standard of the Best Practice Manual. In the right cultural atmosphere this can be a valuable encouragement to growers and a striking demonstration of the industry's responsible attitude. This essence of this measure is the third party audit, an approach which increases the legitimacy of the accreditation over conventional compliance approaches.

Future Review – To retain currency and thus legitimacy, the whole package must be reviewed regularly. This ensures that 'on the ground' learning about the Best Practice rules and also the outcomes of research are fed into the manual in a formal way.

A review mechanism should be set up, probably within an existing body. The same rigour needs to be applied to reviews as pertained in the original exercise.

This phase of the project will need to be ongoing as there will continue to be new developments and new growers will enter the industry. Controlling it through a permanent industry organisation will ensure continuity.

7.4 PHASE IV: QUALITY MANAGEMENT

As has been stated earlier, Quality Control systems and their derivative TQM systems should be built upon a sound base of good management practice and control.

Since the Cotton Industry is at an earlier stage of development, no ethical recommendation could be made now to venture into Total Quality Management.

Some of the tools of TQM, such as Document Control and Accreditation to a Standard have been built into the model.

As the Research Program develops, performance standards will arise, particularly in the area of on-farm monitoring. These will provide the first steps into future quality management.

8.0 RECOMMENDATIONS

1. The Cotton Industry should consider bringing forward a program to deal with pesticide contamination of rivers. The current R&D Program will produce valuable results. but will not keep pesticides out of the rivers. It is not likely to result in regulatory levels for the critical pesticide Endosulfan being reliably achieved. Therefore the Industry should aim to attain the best possible result with current technology, enhancing that as new technology becomes available.

2. The tools of the pesticide minimisation program should be broadened beyond the outputs of the R&D Program. All available inputs should be used to ensure the best possible solution is obtained.

3. A Best Management Practice approach should be used, as this is well understood and can have high utility for users if properly designed.

4. The project should strive for a high adoption rate by growers to ensure the objective of pesticide minimisation is attained and to maintain the industry's position with regulators. This success should be insured by:-

   4a. The quality of the Best Practice Manual which should be simple, relevant and up-to-date.

   4b. The involvement of growers, through their key reference bodies in the formulation and review of the Best Practice code.

   4c. A high quality communication and education package.

   4d. The consideration of an Accreditation mechanism involving third party audit.

5. The project should be progressed using Action Oriented Management techniques to engender a Thrust for Achievement. This will ensure focus on the critical objective and establish a success pathway through the network of involved interests.

6. Consideration of the use of TQM should be postponed until such time as the industry has developed a firm base of good management practice with regard to pesticide usage.

9.0 CONCLUSION

This report has summarised results of work on a scoping brief presented to the author on 19th May 1995. In the time available, an attempt has been made to address all the requirements of the brief to the best possible extent. Some remarks on the attainment of this aim follow:-

1. A good overall view of the R&D Program was achieved and an opinion arrived at as to where it fitted into the picture of the pesticide problem. With regard to current moves towards best practice, it was felt that they were conducted in a piecemeal fashion, that they confused things by using terminology loosely and that they often lacked the simplicity of approach necessary for user friendliness.

2. The requirement to identify and review relevant approaches by comparable industries was less successful due to time constraints. However it is felt that there was adequate evidence within the industry and its associated disciplines of the problems inherent in Best Practice approaches. These were consistent with past experience and current management knowledge. Some good input was obtained from Best Practice studies for dryland salinity and for urban waterways.

3. Barriers to implementation were identified.

4. A framework for technology transfer and adoption was outlined incorporating both the outcomes of the current R&D Program and other emergent technologies.

5. A plan for project phasing was presented.

APPENDIX I: THE BRIEF (EXTRACT)

SCOPING REVIEW - PROJECT BRIEF

Background

In 1993 the Land and Water Resources R&D Corporation (LWRRDC) established a program jointly with the Cotton R&D Corporation (CRDC) and the Murray-Darling Basin Commission (MDBC) entitled "Minimising the Impact of Pesticides on the Riverine Environment Using the Cotton Industry as a Model". The aim of the program is to obtain a quantitative understanding of the mechanisms of pesticide transport, degradation and ecosystem impact, to develop management solutions and implement the solutions through the development of best management practice - supplemented as required by sensible and not overly prescriptive regulations.

Approach

It is proposed to run the exercise in two phases, the first scoping the problem and the second implementing a course of action. This brief describes only the scoping phase. The objectives are:

1. To familiarise oneself with the R&D program and its intended outcomes, and the current approach to implementing best management practice in the cotton industry.

2. To identify and briefly review relevant approaches adopted by comparable rural industries (eg wool).

3. To identify as well as possible in the time frame the principal barriers to the implementation of best management practice or other relevant strategies in the cotton industry.

4. To recommend to the Management Committee, based on this limited review, the best framework for technology transfer and adoption in the cotton industry particularly as it relates to;

   i) the implementation of the outcomes of this R&D program.

   ii) other management practices which will be changing in the industry due to such issues as integrated pest management and genetically engineered new cotton strains.

5. To outline a strategy for the second phase of the assignment which will be directed to implementing the recommended process as well as addressing any particular issues that have arisen in the scoping review and have not been resolved.

Direct Reports

The consultant will be responsible directly to the Program Manager (Dr N Schofield) and indirectly to the Program Management Committee.

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