Experiential learning as a basis for extension practice with Maltese vegetable growers of western Sydney

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A thesis presented in fulfilment of the requirement for the Degree of Master of Science (Hons) in Systems Agriculture.

School of Agriculture and Rural Development
University of Western Sydney

March 1996
PLEASE NOTE

The greatest amount of care has been taken while scanning this thesis,

and the best possible result has been obtained.
Declaration

I hereby declare that except where the contributions of others are acknowledged, this thesis is the result of my original research and has not been submitted to any other university or institution.

Ashley Arthur Senn
ABSTRACT

This thesis details a journey of discovery for the author and certain Maltese vegetable growers of the Sydney region, in particular nine growers involved in an extension project which promoted reduced cultivation in vegetable production. Significant changes in farm practice occurred. Seven of the nine growers changed their cultivation practices as a result of the author's intervention. Furthermore, there were significant changes with regard to fertilisation and other practices. While the changes in farm practice which occurred were deemed positive, it is nevertheless difficult to judge their broader importance. The author's intervention in the Sydney vegetable industry was prompted by concerns that vegetable farming may, in part, have been contributing to a decline in water quality in the Hawkesbury-Nepean river. Reduced cultivation in vegetable production was seen as a potential, and partial, solution to the observed decline in water quality. Growers did reduce their cultivation, and (in one case) subsequently noticed a lesser degree of soil erosion. However, the off-farm impact of these changes was not assessed.

This thesis is primarily concerned with the characteristics and effectiveness of extension and adult learning within a community of Maltese vegetable growers. Farm practice forms part of the context of this human-based research. Extension was practised according to principles of experiential learning theory, action research, and andragogy (i.e. adult education). This approach, which used newer, "alternative" extension strategies, was undertaken to evaluate the effectiveness of such strategies. This was done because there is contention in the literature regarding the relative merits of "traditional" and "alternative" approaches to extension.

The research and extension emphasis in this study progressively changed from a consideration of technique, to learning styles, to interpersonal relationships and individuals' constructs. It was found, in this circumstance, that relationships between the author and the grower were paramount. They provided a framework of trust and acceptance within which extension techniques could be effective. The term "sphere of activity and interest" is introduced to describe those thoughts and activities which are part of the habitual "self" of individuals. It was discovered that the apparent "spheres of activity and interest" of Maltese vegetable growers are very similar. The author contends that extension agents should concentrate upon those "kinds of experience" which the target category or group finds "meaningful", that is, within their spheres of activity and interest.
The experiential learning theory of Kolb was found to be eminently applicable to extension in this context. The experiential learning cycle provided a suitable framework for the conduct of extension activities, and the learning of the author. The learning of the growers involved remains undescribed. Significant changes occurred, for example all nine collaborators of the reduced cultivation project exhibited an increased curiosity toward "scientific" agriculture. However, it was not possible to describe the internal dynamics of the participants' learning. It is contended that theories of decision-making extant in extension theory describe changes in circumstance rather than cognitive process.

Kolb's experiential learning theory, and principles of action research and adult education which share much in common with experiential learning theory, involve interpretivism, reflection, and peoples' interaction. To varying degrees, all of the main attributes of experiential learning theory were observed, and found to be beneficial, in the extension which forms the basis of this study. It was discovered that it was sufficient for the author to inspire growers with broad concepts, such as the idea that reduced cultivation is practicable. These broad concepts were then applied by growers to their situations by them building upon their existing "local" knowledge. It is suggested that extension agents concern themselves less with attempts to change clients' attitudes, and instead encourage farmers to trial innovations and draw their own conclusions. While this research emphasises the paramount nature of interpersonal relationships in promoting voluntary change, it should be noted that a key aspect of many "alternative" extension strategies, that is, group work, was found to be of very limited usefulness with these Maltese vegetable growers.

It is suggested that future research in extension consider characteristics of the internalisation of knowledge and the role of clients' emotional well-being, with respect to farmers' learning. Guidelines for extension with Maltese vegetable growers of the Sydney region are listed toward the end of this thesis. It is suggested that many of these guidelines are generalisable to other circumstances of extension.
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I thank my supervisory panel for their guidance and constructive criticism. Prof P.S. Cornish (principal supervisor), Dr F.M Kelleher, and Dr R.J. Fisher provided insightful comment which greatly strengthened this research. Prof Cornish was instrumental in providing me with the opportunity to undertake this Masters degree. I acknowledge his consistent support. Later in the research, Dr Fisher joined the supervisory panel and contributed to the development of this thesis. I thank Dr Fisher for his generous assistance, which helped to clarify my thoughts and develop my understanding of the constructivist paradigm of inquiry.

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# TABLE OF CONTENTS

Title Page  
Declaration  
Abstract  
Acknowledgements  
Table of Contents  
List of Figures  
List of Plates  
List of Tables  
Glossary

## 1. INTRODUCTION

1. General Introduction  
   2. The Author  
   3. An Introduction to the Research Context  
      1. An Introduction to the Sydney Vegetable Industry  
      2. Threats Facing the Sydney Vegetable Industry  
      3. Extension Services to the Sydney Vegetable Industry  
      4. "Adoption of Permanent Beds for Vegetable Production"

## 2. THEORETICAL BACKGROUND

1. Literature Review of Agricultural Extension  
2. Literature Review of Action Research  
3. Literature Review of Adult Learning

## 3. METHODOLOGY AND AIMS

1. A Rationale for the Research  
2. Development of the Aims  
3. The Aims of the Research  
4. Methodology  
5. Methods  
   1. Methods mostly for data quality and analysis  
   2. Methods mostly for finding out  
   3. Methods mostly for promoting change

## 4. THE RESEARCH CONTEXT IN DEPTH

1. The Maltese  
2. The Maltese Collaborators of the Permanent Bed Project  
3. Maltese Vegetable Farms - physical factors  
4. Maltese Vegetable Farms - socioeconomic factors  
5. Maltese Vegetable Growers of the Sydney Region

1  
2  
6  
8  
8  
12  
14  
14  
18  
19  
37  
60  
87  
88  
94  
96  
97  
99  
101  
104  
107  
113  
114  
115  
118  
123  
124
<table>
<thead>
<tr>
<th></th>
<th>Figure Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Adopter distribution</td>
<td>22</td>
</tr>
<tr>
<td>2.</td>
<td>Adopter categories</td>
<td>22</td>
</tr>
<tr>
<td>3.</td>
<td>The agricultural information system</td>
<td>26</td>
</tr>
<tr>
<td>4.</td>
<td>Dewey's problem-solving cycle</td>
<td>31</td>
</tr>
<tr>
<td>5.</td>
<td>The four stages of the experiential learning cycle</td>
<td>41</td>
</tr>
<tr>
<td>6.</td>
<td>A double loop model of a learning system</td>
<td>42</td>
</tr>
<tr>
<td>7.</td>
<td>The Johari Window</td>
<td>42</td>
</tr>
<tr>
<td>8.</td>
<td>Action research as a three-dimensional spiral of spirals</td>
<td>46</td>
</tr>
<tr>
<td>9.</td>
<td>How action research converges toward precision</td>
<td>47</td>
</tr>
<tr>
<td>10.</td>
<td>Learners' self-concept</td>
<td>63</td>
</tr>
<tr>
<td>11.</td>
<td>Learners' experience</td>
<td>64</td>
</tr>
<tr>
<td>12.</td>
<td>Learners' readiness to learn</td>
<td>64</td>
</tr>
<tr>
<td>13.</td>
<td>Learners' orientation</td>
<td>65</td>
</tr>
<tr>
<td>14.</td>
<td>Structural dimensions underlying the process of experiential learning and the resulting knowledge forms</td>
<td>67</td>
</tr>
<tr>
<td>15.</td>
<td>The experiential learning theory of growth and development</td>
<td>69</td>
</tr>
<tr>
<td>16.</td>
<td>The reflection process in context</td>
<td>80</td>
</tr>
</tbody>
</table>
# LIST OF PLATES

<table>
<thead>
<tr>
<th></th>
<th>Image Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Erosion of a bare paddock following heavy rain</td>
<td>9</td>
</tr>
<tr>
<td>2.</td>
<td>Vegetable growers are often poorly familiar with the inputs they use</td>
<td>9</td>
</tr>
<tr>
<td>3.</td>
<td>A healthy crop of cabbage</td>
<td>10</td>
</tr>
<tr>
<td>4.</td>
<td>A typical Maltese vegetable farm on undulating country at Luddenham</td>
<td>10</td>
</tr>
<tr>
<td>5.</td>
<td>Collaborator Joe Attard with his &quot;hiller/hoe&quot;</td>
<td>16</td>
</tr>
<tr>
<td>6.</td>
<td>Weighing a crop from the permanent bed trials</td>
<td>16</td>
</tr>
<tr>
<td>7.</td>
<td>Geoff Storey addressing the growers on the Gatton trip (Sept 1995)</td>
<td>110</td>
</tr>
<tr>
<td>8.</td>
<td>In a potato field near Whitton, MIA (Sept 1993 bus trip)</td>
<td>110</td>
</tr>
<tr>
<td>9.</td>
<td>The author at the January 1994 field day</td>
<td>111</td>
</tr>
<tr>
<td>10.</td>
<td>A custom-built minimum tillage implement at the January 1994 field day</td>
<td>111</td>
</tr>
<tr>
<td>11.</td>
<td>Young lettuce seedlings on beds</td>
<td>119</td>
</tr>
<tr>
<td>12.</td>
<td>Young lettuce seedlings on hills</td>
<td>119</td>
</tr>
<tr>
<td>13.</td>
<td>Growers watch Sam Dimech and his bean-knife cultivator at the January 1994 field day</td>
<td>120</td>
</tr>
<tr>
<td>14.</td>
<td>Maltese growers have a strong interest in farm machinery</td>
<td>120</td>
</tr>
<tr>
<td>15.</td>
<td>The group meetings developed positive atmospheres</td>
<td>160</td>
</tr>
<tr>
<td>16.</td>
<td>Growers chatting at the January 1994 field day</td>
<td>160</td>
</tr>
<tr>
<td>17.</td>
<td>A small (100 cm width) Dondi rotary hoe</td>
<td>C</td>
</tr>
<tr>
<td>18.</td>
<td>A large (300 cm width) Howard rotary hoe</td>
<td>C</td>
</tr>
<tr>
<td>19.</td>
<td>Jim Saliba's &quot;bed-lifter&quot;</td>
<td>C</td>
</tr>
<tr>
<td>20.</td>
<td>A &quot;bed-maker&quot; for forming hills</td>
<td>C</td>
</tr>
<tr>
<td>21.</td>
<td>A scarifier built by Vic Saliba</td>
<td>C</td>
</tr>
<tr>
<td>22.</td>
<td>A medium-sized (150 cm width) rotary hoe</td>
<td>C</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Habermas' three &quot;knowledge-constitutive&quot; interests</td>
<td>57</td>
</tr>
</tbody>
</table>
## GLOSSARY

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>boom sprayer</td>
<td>a device for applying pesticide, etc.</td>
</tr>
<tr>
<td>choice</td>
<td>a strong complimentary adjective, for example &quot;a choice crop&quot;</td>
</tr>
<tr>
<td>D shed</td>
<td>the shed at Flemington Market especially for Sydney growers</td>
</tr>
<tr>
<td>floor</td>
<td>ground, for example, &quot;don't put the leaves on the floor, they've got disease&quot;</td>
</tr>
<tr>
<td>grass</td>
<td>all weeds, including broad-leaf ones</td>
</tr>
<tr>
<td>ground</td>
<td>soil</td>
</tr>
<tr>
<td>legs</td>
<td>stems of plants</td>
</tr>
<tr>
<td>manure</td>
<td>in addition to its ordinary meaning, it can refer to all plant nutrients</td>
</tr>
<tr>
<td>the markets</td>
<td>Flemington Market, Sydney</td>
</tr>
<tr>
<td>tillage</td>
<td>cultivation</td>
</tr>
<tr>
<td>working the ground</td>
<td>cultivating</td>
</tr>
</tbody>
</table>
1.1. General introduction

The research was carried out over a three year period (1993-1995) with Maltese vegetable growers of the Western Sydney region, New South Wales (NSW), Australia. The key participants were the author, who concurrently worked for a government department (NSW Agriculture) as an extension officer to the Sydney vegetable industry, and nine Maltese vegetable growers working eight farms. The author's intervention was prompted by concerns that then-current farming practices, including cultivation, may have been contributing to an observed decline in environmental quality in the Hawkesbury-Nepean catchment. The aim of this research, however, was to use and evaluate new alternatives to so-called traditional agricultural extension; and achieve beneficial change. Adult learning among Maltese vegetable growers became a major focus of the research.

There is a sizeable vegetable industry located on the fringes of suburban Sydney. The industry produces approximately $100 million p.a. (farm-gate value) of vegetables from around 1300 farms. Both the Sydney vegetable industry, and the environment within which it operates, are complex and dynamic. There are threats to the industry. Among these is the perception that vegetable farming is partly to blame for a decline in the water quality of the Hawkesbury-Nepean river and its tributaries.

By Australian standards, the Sydney vegetable industry consists of small farms, and many of them. Sydney's vegetable growers tend to be isolated and poorly educated. Overwhelmingly, they are from non-English speaking backgrounds. There is very little industry cohesion among growers. These factors contribute to a situation where agricultural extension is difficult.

In this thesis, extension is defined as "a communication intervention to achieve voluntary change among targeted categories or groups". Agricultural extension has changed in recent decades, especially the past decade. There is decreased emphasis on the "transfer" of technical innovations and increased emphasis on the development of farmers. This is appropriate. After all, the role of extension is to change farmers, not farms. The change in the nature and concerns of agricultural extension parallels related trends within other human-based sciences. An overall trend is a move
away from solely "positivist" research approaches to an embrace of "constructivist" paradigms of inquiry too.

The author's "mechanism of entry to the client system" was an extension project which promoted techniques of reduced cultivation, including permanent beds, to vegetable growers of the Sydney area. Permanent, or semi-permanent, beds are simply raised beds that are kept for several or many crops. Their alternative, which was the industry norm, is to destroy the beds and furrows and aggressively cultivate between each crop.

The "permanent beds" project was conceived by Cornish and Murison of NSW Agriculture. Cornish moved to UWS-Hawkesbury in late 1992 and became the author's principal M.Sc. supervisor. The project was carried out by NSW Agriculture with funding from the Federal government's National Landcare Program (NLP) over the period January 1993 to June 1996. The author was manager of this relatively small project. The objective of the project was "To demonstrate and achieve adoption of semi-permanent beds for vegetable production in the Sydney basin, using a process of farmer participation". The project objective provided a focus for a large part of the author's extension activities. However, this human-based research was not confined to achievement of the objective of the permanent bed project.

The author entered the research context with almost no knowledge of Sydney vegetable growers, relatively little knowledge of the vegetable crops they grow, some experience in extension but no knowledge of extension science, and total ignorance of action research and related paradigms of inquiry. His previous exposure to the Sydney vegetable industry and Maltese growers consisted of one week of participation in a survey of Sydney region vegetable growers. The survey was organised by Murison of NSW Agriculture and held in June 1992. At that time the author interviewed six Maltese vegetable growers.

After several months of familiarisation with the research context and relevant literature, it was decided to concentrate upon Maltese growers as they dominate the Sydney vegetable industry. Furthermore, they are a distinct community. Sydney's Maltese growers, or their parents, mostly
came to Australia in the 1950s to 1970s. All have a farming background. Maltese growers normally use imperial units of measurement and so these are often used in the text (along with their metric equivalents).

The word "collaborator" refers specifically to the growers who were recruited to the permanent bed project mentioned above, and who managed trials of permanent beds on their properties. Most observations and reflections in this research relate to the nine collaborators. However, significant contact was also made with around 50 additional Maltese vegetable growers of the Sydney region.

In this research my underlying objectives were to:

i) understand Maltese vegetable growers of the Sydney region and their industry, and
ii) improve the lives of Maltese vegetable growers, and myself. This second objective was to be achieved by the development of improved learning skills and the use of better farm and extension practices.

These underlying objectives remained throughout the research, although specific aims changed. The two original research aims were to: i) compare reduced cultivation with existing cultivation in vegetable production; and ii) compare the effectiveness and characteristics of "action research" and "transfer of technology" as extension methodologies with vegetable growers of the Sydney region. The first aim remained constant throughout the research, however, the author's technical and environmental emphasis decreased greatly over time. Cultivation forms part of the context of this human-based research.

The second aim was modified substantially. For reasons outlined in the "Development of the Aims", the comparison of extension methodologies was abandoned. The focus of the research became an evaluation of extension conducted in accord with many action research principles; although no claim is made that this was purist action research. Adult learning among Maltese vegetable growers also became a major focus of the research. Aims were further refined as part of the research process, and are explained in sections 3.2 and 3.3.
The methodology of this research was experiential, with a relatively heavy emphasis on qualitative and interpretive techniques. The methodology was guided by the theories of Kolb, Knowles, Lewin, Whyte, Boud, and others. A key aspect of the methodology was use of the experiential/adult learning/action researching cycle, in order to maximise learning and situation improvement.

In brief, extension activities were carried out with a community of vegetable growers in order to investigate extension practice. Such investigation provided insight into differing extension methodologies, for example "participatory action research" and "transfer of technology", as interpreted and applied by the author (in consultation with others). The activities also provided insight into the research context, most specifically, the adult learning of members of a community of Maltese vegetable growers. Tentative conclusions are drawn and guidelines for extension within this community formulated.

Post script This thesis details research which encompasses both positivist and interpretive traditions. Therefore, the choice of style of reporting was not straightforward. Due to the personal nature of this research, and hopefully for interesting reading, most text is in the first person. Also note that the collaborators are refereed to by pseudonyms.
1.2. The author

I urge the reader to consider my background and possible biases when reading this thesis. I introduce myself as an Anglo-Saxon Australian male, 29 years of age. My background is urban. I have a Bachelor of Agricultural Science degree gained at the Waite Institute, University of Adelaide (1985-1988). During the four years of this course I became familiar with biological, chemical, and physical aspects of agriculture. However, human-based aspects were not covered. For example, I did not receive a single lecture on agricultural extension. In May 1990 I became an extension horticulturist for NSW Agriculture. Prior to the start of the permanent bed project and enrolment at UWS-Hawkesbury, I had 2½ years of experience as an extension agent but relatively little experience with vegetable production.

I would like to inform the reader of aspects of my nature likely to have particular relevance to the research. My positive aspects, or strengths, appear to be my eagerness to learn, pragmatism, analytic ability, friendliness, and openness of approach. My negative aspects, or weaknesses, appear to be my initial ignorance, imbalance of activities, reluctance to try, and self-doubt. Another aspect is my change in emphasis as the research progressed.

My interests are broad and, although I love variety, I also like to know many topics well (rather than just have a shallow understanding). I am reasonably pragmatic and likely to choose an option which is feasible. I have a careful, methodical nature and my analytic ability is very strongly developed. I am able to link isolated facts into a coherent story, understand peoples' motivations, and so on. I consider myself a friendly, easy-going sort of person. I feel this aspect has been of help in this people-orientated research. I like to help people (those that are friendly to me) and be honest with them.

Like all people, I have weaknesses. I have noticed in myself a reluctance to try. By this, I mean a reluctance to carry out, for example, a mind-mapping exercise with vegetable growers - in case they find it a "waste of time". I identify an imbalance of activities in the research. For example, I spent more time reading about how to survey compared to actually surveying growers. I can see
periods in the research where I did plenty of reading and reflection but little activity, and other times where I did plenty of activity but reflected little upon it. In hindsight, I consider I should have intertwined my active and reflective phases more.

During the research, I experienced confusion and self-doubt as I was exposed to new, fundamentally different approaches to research and situation improvement. The confusion I experienced was perhaps unavoidable given the difference between my background and the philosophy of the "new paradigm" research approaches which guide this Masters project. The confusion was probably helpful in "freeing up" my existing ideas.

I believe I changed greatly over the three years of the research. There was an incremental change in my approach. My emphases shifted from technical to human aspects, quantitative to qualitative data, and from environmental concerns to a desire to keep the vegetable growers I was working with happy. I became more aware of myself and my assumptions about life. I consider that I am now less naive. For example, I used to think I only had to do one fantastic survey (or some other activity) and all my research questions would be answered. I now have a greater appreciation of how continual interaction (e.g. action and reflection, dialogue between practitioners) creates knowledge which is but temporary in nature. Very importantly, I have come to more greatly value action as a part of learning. The experiential/Adult learning cycle has had a profound influence on the way I view problem-solving and learning.

In conclusion, my time at UWS-Hawkesbury has exposed me to new, radical, and fundamentally different views of, and approaches to, agriculture, science, research, and situation improvement. I value these "alternative" paradigms which emphasise the desirability of conducting agricultural extension and research with due recognition of our humanness. I retain a strongly analytic nature but have undergone significant change over the period of this research. I now have a much greater appreciation of the power of experiential learning. I also have a deeper awareness of the research context and its human aspects, which includes my own self.
1.3 An introduction to the research context

1.3.1. The Sydney Vegetable Industry

There is a sizeable vegetable industry located on the fringes of suburban Sydney. The industry produces approximately $100 million p.a. (farm-gate value) of vegetables from around 1300 farms (Anon. 1995a). The main crops produced are lettuce, miscellaneous Asian vegetables and herbs (bunch lines), greenhouse cucumbers, Brassicas (cabbage, cauliflower, and broccoli), tomatoes and potatoes. A characteristic of the Sydney industry is the production of perishable and high-input crops. Closeness to markets continues to be an important competitive advantage for Sydney growers. The industry supplies most of Sydney's needs for these crops and some produce is exported interstate or overseas. The vast majority of vegetables grown around Sydney are sold at Flemington Market, which is Australia's largest central market - and also one of the largest in the world. At this market most produce is sold by agents; however, there is a large shed especially for Sydney vegetable growers. In "D shed" around 300 growers sell their own produce. Thus, whilst most growers supply their produce to agents for sale, a sizeable minority of Sydney vegetable growers handle the entire production chain (seeding crops to sale to retailers) themselves. There are also direct sales which by-pass the Sydney market, e.g. a larger grower may supply a supermarket chain direct. A small but significant and increasing minority of transactions are of this kind.

By Australian, but not world, standards most Sydney region vegetable farms are small. Sizes range from a couple of "igloos" (semi-cylindrical greenhouses of perhaps 400m² each) or an acre (0.4 ha) of tomatoes over summer to 200 acres (80 hectares) of cultivated paddock. There are many farms of 5 acres (2 ha) in size and many more of 25 acres (10 ha). Nearly all farms are family-run businesses that employ little or no outside labour. There are some small, part-time vegetable growers, but most growers work full-time on their farm. They work very hard. It is normal to work 12 hours a day six days per week. Some growers work 90 hours per week - virtually all their waking hours.

There are far fewer vegetable farms and farmers in the Sydney region now compared to
Plate 1 Erosion of a bare paddock following heavy rain

Plate 2 Vegetable growers are often poorly familiar with the inputs they use
Plate 3 A healthy crop of cabbage

Plate 4 A typical Maltese farm on undulating country at Luddenham
ten, twenty, and more years ago. Several decades ago, most vegetable farms were only a couple of acres (1 ha) in size. Nowadays, twenty or more acres (8 ha) are needed to support a family unless very intensive cropping (e.g. hydroponics, igloos) is practised. As Sydney's urban area has spread, vegetable growers have retreated (Anon. 1995a).

Since most growers work for themselves and by themselves, with only family help, they are rather isolated. The typical farm is relatively small in size and so the ratio of suppliers/consultants to growers is low too. Growers generally have a minimal amount of education, often only to primary school level. Their farm systems are complex and include modern technological inputs, for example pesticides and artificial fertilisers, which they tend to understand only poorly. In the words of a consultant working for the largest supplier of inputs to the industry (Ace Ohlsson Pty Ltd, based at Flemington markets), all these factors add up to a situation where "the growers are starved of information" (D. Lobb, pers. comm. 1993).

A most important aspect of the Sydney vegetable industry is the ethnic background of growers (Anon. 1995a). Ethnic background influences, to a very large degree, what crops a grower produces, how they are grown, whom the grower will have as friends, and even whom he will marry. The majority of growers were born overseas. Those born in Australia nearly always have both parents from the same ethnic group, and later marry into that ethnic group themselves.

The major ethnic groups and their kinds of farm are:

* Maltese: larger farms, e.g. 25 acres (10 ha) growing cabbage, lettuce, potato, silverbeet, and summer crops; some hydroponic systems,

* Italians: similar to Maltese but more older growers on smaller farms and many tomato growers,

* Chinese: Asian vegetables and herbs on 5 acre (2 ha) farms,

* Lebanese: greenhouse cucumbers, many hydroponic systems, some larger farms,

* Yugoslavs: many tomato growers, some greenhouse,

* Vietnamese: Asian vegetables and herbs on 5 acre (2 ha) farms,

* Cambodians: cherry tomatoes and snowpeas on leased land, and
* Anglo-Saxons: larger farms with potatoes, cauliflower, and sweetcorn.

The most significant groups are the Maltese, Chinese and Lebanese. Of these, the Maltese have the greatest number of growers, volume and value of crop grown, and area of land under cultivation. A NSW Agriculture mailing list indicates that just under 50% of vegetable growers in the Sydney region are Maltese. There are approximately 700 Maltese-owned farms. NSW Agriculture data (unpublished) also estimates that approximately 50% of the value of production, and 70% of the volume and area of vegetable production in the Sydney region is in Maltese hands.

1.3.2. Threats Facing the Sydney Vegetable Industry

Sydney's vegetable growers and their industry operate in a complex, dynamic environment which contains threat. There is a need for growers to learn and adapt. In my opinion, the major threats facing the Sydney vegetable industry are market competition, environmental concerns, and increasing regulation (including bureaucratic "red tape").

With regards to market competition, improved transport, new varieties, cool storage, and new production districts are enabling the production of ever more produce over longer and longer seasons. With their expensive land and usually greater pest and disease problems, Sydney growers are often at a disadvantage compared to other production districts. However, as the Australian vegetable industry as a whole becomes more efficient and competitive, so too must its Sydney component.

Environmental concerns regarding vegetable production may be linked to ecological factors, human-based issues, or both. There is concern that modern, input-intensive farming practices are leading to soil degradation and erosion, stream eutrophication and siltation, and ground water pollution (Cullen and O'Loughlin 1982, Tisdall and Huett 1987). However, the extent of these deleterious effects, the degree to which vegetable farming (as opposed to dairying, turf farming, sewage treatment plants, etc.) is causing these, and what can and should be done are all contentious issues (Anon. 1995a).
Also contentious are the largely human-based issues of pesticide drift, visual amenity and noise (Anon. 1995a). There are many rural residents on the fringes of Sydney who believe vegetable growers are rough, ill-educated individuals who should move their unpleasantly odorous (because of chicken manure), noisy, even dangerous (pesticide drift) operations "somewhere else". These rural residents and their urban sympathisers have a lot more political power than do vegetable growers.

What is the balance of the rights of farmers and the rights of nearby residents? According to NSW Agriculture, growers' rights are being degraded and neighbours' complaints upheld (J.Wilson, pers. comm. 1995). The "red-tape" threat is linked to environmental concerns but has characteristics of its own. Government authorities, particularly local government, are increasingly stringent in their requirements of farm businesses (Anon. 1995a). There are onerous demands that buffer strips be maintained, hours of operation be restricted, and so on. To remain competitive, growers need to produce ever greater values of crop as time goes by. This usually means a new, larger farm. However, the costs of new land and the efforts involved in dealing with "red-tape" have, in cases, become prohibitive. There is already a considerable number of growers, perhaps older ones in particular, who have "given up" their farming activities because of increasingly stringent bureaucratic requirements. It should be noted that growers' sometimes exaggerated perceptions of these requirements, their generally poor ability to deal with bureaucracy, and their dislike of governmental "interference", also play a role.

Such is the nature of the major threats facing the Sydney vegetable industry. The threats are manifest in an environment of uncertainty, where no one really knows the market future for a particular commodity, how to deal with environmental issues, or what rules and regulations will be in place in ten years' time. There is conflicting information and differing views. The best outcomes for the Sydney vegetable industry will rely upon dialogue leading to mutual appreciation and agreement; and flexible, active learning by all important "stake holders". Maltese vegetable growers need to continue to learn so that they may achieve their desired future.
1.3.3. Extension Services to the Sydney Vegetable Industry

NSW Agriculture employs full-time District Horticulturists (Vegetables) at Windsor and Gosford. These District Horticulturists service the northern Sydney basin (and since the end of 1994 the whole of the Sydney basin) and the Central Coast of NSW (immediately north of Sydney) respectively. Until the end of 1994 a further District Horticulturist was based at Camden to service vegetable growers of the southern half of the Sydney basin. These NSW Agriculture staff are complemented by a far greater number of company representatives who also provide advice to Sydney vegetable growers. Most notable are representatives of Ace Ohlsson Pty Ltd (resellers of pesticides, fertilisers, seeds, and other inputs), Organic Fertilisers (resellers of chicken manure, fertilisers and pesticides), and half a dozen seed companies. The role of private consultants in providing an extension service to Sydney vegetable growers is negligible.

Informal sources of advice, most obviously the growers themselves, are very important within the Sydney vegetable industry. Depending upon the nature of the problem, it may be said that a grower will turn (in decreasing order of importance) to his own experience, his friends who are growers, his supplier (e.g. pesticide reseller) and, finally, NSW Agriculture for advice (Murison 1995). The majority of Sydney's vegetable growers have never sought advice from NSW Agriculture, or do so only rarely, such as once every few years (Murison 1995). Given that two or three District Horticulturists (Vegetables) service around 5000 growers (if one counts each adult farm worker separately), this situation is not surprising. However, there are other factors involved. These are raised in Chapter 6.

1.3.4. "Adoption of Permanent Beds for Vegetable Production - Sydney Basin"

As mentioned in the "General Introduction", this extension project promoted techniques of reduced cultivation, including permanent beds, to vegetable growers of the Sydney region. Permanent, or semi-permanent, beds are simply raised beds that are kept for several or many crops. The project was carried out by NSW Agriculture from January 1993 to June 1996. The project was a relatively small one, with only two staff substantially involved: an extension horticulturist (the author, 75% of
time) and a field assistant (50% of time). The author was both the manager and principal investigator of the project. As stated in the "General Introduction", the objective of the project was "To demonstrate and achieve adoption of semi-permanent beds for vegetable production in the Sydney basin, using a process of farmer participation".

The project was prompted by two rather different concerns. The first was that of environmental degradation. There was awareness of declining environmental quality in the Hawkesbury-Nepean river and its tributaries (Cullen 1991). This awareness is shared by vegetable growers, who have noticed poorer crop performance after floods (the opposite of previous experience), more rapidly corroding foot valves, and murky, smelly water. There was concern among scientists that vegetable farms within the Hawkesbury-Nepean catchment were, in part, contributing to this decline (Davis et al. 1991; Cornish, Kuczera, and Murison 1992). It was considered that reduced cultivation techniques, and other production techniques, such as fertiliser banding and earthworks, were opportunities to reduce off-farm environmental impacts (e.g. Butler and Cock 1991). For example, reduced cultivation could lead to reduced erosion which, in turn, could lead to less silt and phosphorus (the key factor responsible for blue-green algal blooms) in the Hawkesbury-Nepean river.

The second concern was that of improving the effectiveness of extension. It was noted that traditional extension approaches had had limited success in securing the adoption of reduced cultivation (tillage) practices elsewhere in Australia (Pratley and Cornish 1985, Vanclay 1992). It was considered that newer extension approaches based on farmer participation (e.g. Chamala 1987) may be better means to achieve the adoption of permanent beds in the Sydney area. To this end, a process of farmer participation was used whereby ten farmers (nine Maltese and one Cantonese Chinese) were recruited to have trials of permanent beds on their nine farms. The collaborators looked after the trials themselves and made final decisions on which crops were grown and how. At the time of writing (early 1996) each trial had grown at least five sequential crops.

It should be noted that permanent beds were seen as "proven technology". Following their development at Tatura, Victoria from the late 1970s onward (e.g. Adem and Tisdall
Plate 5 Collaborator Joe Attard with his "hiller/hoe"

Plate 6 Weighing a crop from the permanent bed trials
1984, Tisdall and Adem 1988), permanent beds had been successfully used in the Hay and Murrumbidgee Irrigation Areas of inland NSW (Maynard 1995, Thompson 1995) for the production of a variety of crops, including vegetables. They had also been successfully trialed (1984-1987) on the NSW central coast at Somersby, 90 km north of Sydney (Hocking et al. 1987). The benefits of permanent beds, when compared to normal (more intensive) cultivation, were seen to be the same or slightly better crop yields, improvements in soil structure, much reduced input (cultivation) costs, improved trafficability and the ability to increase cropping frequency (Hutchins 1987). In essence, the technique increases profitability and has a benign or positive effect on the environment. At the same time, it was recognised that the details of permanent beds for particular soil types and vegetable farming systems of the Sydney basin remained to be worked out. It was considered that the adoption of permanent beds would not be a simple one-step matter since changes in cultivation would be linked to changes in other farm practices, for example fertilisation (P. Cornish, pers. comm. 1992). It was recognised that a participative approach would be able to draw upon Sydney growers' experience and innovation in order to formulate practices of reduced cultivation suitable to their situations.
CHAPTER TWO   THEORETICAL BACKGROUND
2.1. Literature review of agricultural extension

Introduction
Formal extension arose late last century (Van den Ban and Hawkins 1988, Arnon 1989). Extension is practised in many fields, for example preventive health and traffic safety, but appears to be most developed within agriculture (Röling 1988:19). Types of extension which may be identified are: information extension, human resource development, emancipatory extension, persuasive extension, and extension as a policy instrument. Present-day extension reflects its historical influences; which may be cultural, institutional, etc. In different countries extension can refer to advisory work, enlightenment, and/or education. Consequently, definitions of extension vary. Röling (1988:39) has identified five common elements of definitions of extension. These are: 1) extension is an intervention, 2) extension uses communication as its instrument of change, 3) extension can only be effective through voluntary change, 4) extension focuses on a number of different target processes and outcomes which distinguish it from other communication interventions, and 5) extension is deployed by an institution. One widely-quoted definition is "extension involves the conscious use of communication of information to help people form sound opinions and make good decisions" (Van den Ban and Hawkins 1988:9).

Extension relies upon communication to induce voluntary change in targeted groups (Röling 1988:43). Hence, client objectives must either be the same as, overlap, be linked to, or be made to fit, the objectives of the extension agency. By far the most common extension organisations are those which want to affect their clients' behaviour in order to achieve an objective of their own (Röling 1988:49). Röling (1988:39) refers to the disparity of client and extension goals as "the contradiction". This contradiction, together with varying interpretations of what extension is, has led to both methodological and intellectual confusion in extension science and practice. However, the underlying logic of agricultural extension is the same as for extension in other fields. Principles of sociology, adult learning, psychology, etc., are used to induce change.

Communication requires shared meaning. Within extension, communication interventions seek to mobilise, transfer information, impart skills and create organisation (Röling 1988:41). It is crucial to
note that extension is effective through changing people (i.e. farmers) - not things (i.e. farms). Of the "4Ps" of the marketing mix (i.e. product, price, promotion, and place), extension is limited to "promotion". On its own, extension is considered a weak instrument of policy. For example, price policy has a much greater effect on behaviour. On the other hand, extension may be the only politically-acceptable means of inducing change deemed desirable. Further, such change in clients' behaviour and attitudes may be more permanent than, for example, a temporary monetary subsidy.

Information is overt whereas knowledge is covert. Röling (1988:47) considers that knowledge is not transferable. Rather, information may be transferred and then transformed (by cognitive processes such as reflection) into knowledge. Other authors make the same distinction using different terms. For example, Checkland (1991) refers to "data" and "information" (the later being data which has been cognitively processed). Yet others distinguish between "knowledge" and "wisdom".

**Extension science**

Extension as a science is derived from sociology (Röling 1988:21). According to Röling (1988:22), the earliest research question in extension science, one which is still being asked, is "How do I get them where I want them?" This question is asked by experts who have knowledge they believe to be important to the target categories or groups. At this stage the emphasis is on improving the instrument of intervention, that is, extension methods. Differences in client and extension goals are ignored. Extension models such as "transfer of technology" (TOT) are congruent with this linear and causal view of extension. Communication in TOT is seen as basically one-way and top-down. In the simplified characterisation of Russell et al. (1989:5), the process is:

research → knowledge → transfer → adoption → diffusion.

Röling (1988:23) identifies the subsequent research question of extension science as being "Why don't they do what I want them to do?" Responses to this question can take the form of either, 1) adapting the target to the message, or 2) adapting the message to the target. The first response, in which the message's good is unquestioned, prevails among experts whereas the second approach is
more likely to be adopted by those whose livelihood depends upon successful extension, for example extension workers paid by farmers.

Communication in extension ought be a two-way process. The linkage model of communication (Havelock et al. 1973:11-19) incorporates bottom-up flows of communication, for example clients to researchers, extension agency personnel and management; as well as top-down flows, for example from research/extension to farmers. Both are needed for effective extension. Top-down flows dominate communication in extension, but less so than several decades ago. Bottom-up flows have increased in the recent past as a result of approaches such as "farmer first", advocated by Chambers et al. (1990). Such flows may be initiated by the extension agency (e.g. needs assessment), the clients (e.g. farmer lobby groups), or market forces (Röling 1988). They increase extension effectiveness by helping agents to appreciate clients' circumstances, objectives, and knowledge - then adapt extension activities accordingly. Bottom-up flows should be increased further. Röling (1988:65) believes that "the fastest gains in extension effectiveness can be made by measures to strengthen the flow of information from and about target clients to the interviewing party".

The diffusion and adoption of innovations
The diffusion and adoption of innovations is the research topic most extensively studied by extension science. There are literally thousands of published reports which have addressed questions such as: what are the characteristics of people who adopt innovations slowly or quickly, what are the reasons for non-adoption, and how do potential adopters communicate among themselves about innovations? Rogers (1962:13) defined an innovation as "an idea (or practice or object) perceived as new by the individual" - it does not have to actually be new. Formerly, the generally accepted model of diffusion was that described by Everett Rogers (1962) in his influential book "The Diffusion of Innovations". At that time Rogers, who has since changed his views (Arnon 1989:746), put forward the concept that innovations were first adopted by a very small group of people, say 2.5% of the farmer population, who are referred to as "innovators". If the innovation proved to be successful then categories of farmers referred to as "early adopters, the early majority, the late majority, and the laggards" successively followed suit and adopted the innovation (Rogers 1962:168-171). Implicit to this view is a normal distribution of "innovativeness".
Innovativeness, also referred to as "progressiveness" or "the willingness to accept risk", was often conceived as a kind of psychological trait. Likewise, failure to innovate was, and is, seen to be due to psychological factors leading to a "resistance to change". Non-adoption was blamed on factors such as conservatism and fatalism. This view, labelled the "individual blame hypothesis" may be contrasted with the "system blame hypothesis" - which emphasises the inability to adopt due to the lack of inputs and land tenure, poverty, etc. Galjart (1971, cited by Röling 1988:46) has stated there are three conditions necessary for change, "one must know how to, one must want to, and one must be able to".

Theories of decision-making have been developed in recognition of the fact that there can be considerable delays between farmers becoming aware of an innovation and their adopting it. One normative-type model recognised the following stages: awareness, interest, evaluation, trial, and adoption (Rogers 1962:119). However, such an idealised explanation of decision-making is no longer accepted as adequate (Van den Ban and Hawkins 1988:102). A model of decision-making developed by Rogers and Shoemaker (1971:103) recognises the following stages: knowledge, persuasion, decision (to accept or reject the innovation), and confirmation. This model is widely-
accepted and has stages similar to other current models of behavioural change (Chamala 1987:402). There is greater recognition today that innovations may be rejected or else adopted then later abandoned.

The factors which influence adoption may be classified as: 1) individual - e.g. the farmer's education and goals; 2) situational - e.g. specific farm characteristics, community norms, land tenancy; and 3) technological - i.e. characteristics of the innovation itself, such as observability and relative advantage over existing practice.

Many studies have been carried out to characterise farmers who are early adopters. According to Van den Ban and Hawkins (1988:107), "remarkably similar results have been found in a diverse range of situations and groups throughout the world". However, there are many published reports which suggest otherwise (Guerin and Guerin 1994). Two disadvantages of studies which estimate farmers' innovativeness are that most correlations are poor, and that such studies, which are usually one-off, tend not to be able to separate cause from effect. Among the individual factors most strongly and consistently associated with "innovativeness" are education, contact with extension agents, higher social status, larger-sized farms and a willingness to use credit. Youthfulness is not strongly associated with innovativeness. Neither are farmers' attitudes. Despite much discussion to the contrary, there are a number of studies drawn from agriculture which show that attitudes are not closely related to behaviour (e.g. Vanclay 1992).

Since the 1970s much emphasis upon the reasons for non-adoption has shifted away from individual, psychological factors toward situational factors. For example, farmers labelled as progressive were formerly seen as being early adopters because of their favourable individual characteristics, such as eagerness to learn and willingness to accept risk. However, there is now greater emphasis placed on the favourable situational circumstances of these farmers. It has also been recognised that progressive farmers may deliberately withhold or distort information on an innovation and that they may be socially isolated (Röling 1988).
Farmers may be labelled as "high-access" or "low-access" according to the resources available to them. High-access farmers are in a better position to adopt and low-access farmers may be unable to adopt. Farmers belong to rural communities and thus are subject to group norms. These norms influence individuals' farming practices and hence adoption. Put simply, "people behave in certain ways because others expect it of them" (Röling 1988:44).

There are inherent characteristics of innovations which have influence upon adoption. Rogers (1962) proposed that the following, which are all positively correlated to adoption, are particularly relevant: relative advantage, compatibility (with existing farm practice, values, norms, etc.), simplicity, trialability and observability. Note that in his original text Rogers refers to the later three characteristics as complexity, divisibility, and communicability respectively. It is crucial to appreciate that it is farmers', not researchers', perceptions of these attributes which influence adoption behaviour.

In addition to largely interpretive studies of why individuals do or do not adopt, diffusion research has concerned itself with the spread of innovations within interacting social systems (Rogers and Shoemaker 1971). A tremendously influential outcome of diffusion research has been the conception that innovations spread from a small category of "innovators" to the rest of the farming community. Two types of farmers are often discussed in relation to this small category of innovators, namely "progressive farmers" and "opinion leaders". Actually, opinion leaders are not necessarily very innovative but they may, because of their influence within a community, be targeted by extension agents and thus become early adopters of an innovation by default. Opinion leaders tend to be socially active and willing to help their fellow farmers (Van den Ban and Hawkins 1988:116). Each group will have its own opinion leaders. These individuals may be identified through "sociometric analysis", participant observation, or interviews.

The "diffusion of innovations" paradigm has been criticised for legitimising the circularity of "a form of extension which follows the path of least resistance: benefiting those who know best how to look after themselves and neglecting those who need assistance but are hard to reach" (Röling 1988:27). The paradigm was also criticised for largely ignoring how knowledge is generated and
utilised, neglecting the heterogeneity of social systems, having a pro-innovation bias, and excessively concentrating on socio-psychological factors as reasons for non-adoption. Diffusion research has been criticised for its lack of power to predict circumstances in which diffusion will occur (Röling 1988). However, it is important to note that the phenomenon of diffusion does occur - whether we understand it or not.

**Recent changes in emphasis**

The theory and practice of agricultural extension has changed, and is continuing to change, in response to advances in related fields (e.g. psychology), the observed outcomes of previous extension, and changes in the environment in which extension operates. Current agriculture is subject to rapidly increasing complexity (Russell et al. 1989:2). There is increased emphasis on marketing and sustainability. According to Bawden (1991), the "production" phase of Australian agriculture has been superseded by phases of "productivity" and "persistence". The growth and evolution of agricultural extension in Australia has corresponded to these stages (Woog 1987).

In many cases, the adopter categories of the diffusion research tradition have been replaced by target categories in the marketing research tradition (Röling 1988:29). The industry led technology development (ILTD) approach, with can be considered as a modification of "transfer of technology", has arisen in industrialised countries as private sector agribusiness has strengthened and industry-funded R & D corporations have been established (Acker and Lev 1993). The ILTD approach has accommodated demands that public sector expenditure on agricultural research and extension be reduced, and that research and extension objectives be more in accordance with industry wants (Acker and Lev 1993).

Perhaps the major advance of extension science and practice in recent years has been the widespread application of systemic approaches (e.g. Underwood 1985a, Chamala 1991, Campbell and Junor 1992) in order to cope with the increased complexity of agriculture. Extension is referred to as a subsystem within agricultural information systems and agricultural knowledge systems.
Russell et al. (1989:5) recognise two main traditions in extension; technical innovation and human resource development. These authors refer to human resource development as an entirely different and much newer tradition. Russell et al. (1989) contend that all of the significant reviewers of agricultural extension see transfer of technology on its own as an inadequate model for extension. These authors (1989:6) go on to say "the more complex nature of agricultural systems today requires that the two traditions be braided together in a much more sophisticated way than has ever been the case to date".

Increasingly, extension theorists and practitioners are advocating the need to see farmers as adult learners (Davey 1987, Russell et al. 1989). For example, since the mid-1980s academics at the University of Western Sydney-Hawkesbury have been working towards "the analysis and development of extension services which encompass farmers, researchers and extension personnel as co-learners focussing on common understanding and improvement of complex farming systems" (Kelleher et al. 1991). Woog (1987) states that the focus of attention has shifted towards the farmer, with questions being asked such as: how do farmers cope, how do they learn, and why do they do things the way they do?

The "participatory action research" (PAR) approach to agricultural extension, as espoused by Whyte and others, has potential to accommodate many, if not all, of the changes mentioned above. PAR, and related approaches such as the "farmer-back-to-farmer" model of Rhoades and his colleagues (1984), have been tried with success in a variety of settings, particularly in lesser
developed countries (e.g. Rhoades et al. 1987, Maclure and Bassey 1991). However, it is the opinion of at least some reviewers of extension, for example Guerin and Guerin (1994), that the efficacy of PAR has not yet been widely "proven". PAR has definite advantages as an extension approach in the tradition of human resource development, but it should not be seen as a complete replacement for "transfer of technology" approaches to extension; nor as a panacea for the past, present, and future problems of agriculture and agricultural extension.

Trends within agricultural extension favouring systemic approaches, holism, the utilisation of farmers' local knowledge, client empowerment, situation-specificity (e.g. targeted programs), flexibility and responsiveness are apparent and are likely to strengthen. However, despite these trends, there is still a long way to go. The progressive farmer approach and the "transfer of technology" model have been extensively criticised over the past two decades, yet they still dominate extension activity today - both in Australia (Guerin and Guerin 1994) and throughout the world (Arnon 1989:750-751).

The role of extension

Arnon (1989:694) has stated that the objective of extension is "to bring about an improvement in farming through the application of science and technology but also to promote the social, cultural, recreational, intellectual and spiritual life of the rural people". These developmental and societal objectives usually cannot be achieved by extension on its own. To be effective, extension must be combined with research, the provision of inputs and credit, markets, and so forth.

Particularly in lesser developed countries, government extension agents may have roles associated with the provision of inputs and credit, regulation, etc. These roles may decrease the trust that farmers have in extension agents. Credibility has been identified as "the single most important influence on the success of advisory services and individual extension personnel". Practicality is one key factor which establishes credibility. Also crucial to the success of extension agents is their technical competence.
Extension's main role is generally considered to be the provision of information so that agriculture may be modernised and updated. Extension can act as a link between agricultural practice and research, by reporting on field conditions to researchers and by selecting and disseminating information from agricultural research. This link is by no means perfect.

It is important to note that "information extension" is used by most governments as a means to develop national economies through agricultural industries, provide cheap food for (politically-active) city dwellers, and so on - its primary role is not to help individual farmers. Another major role of all extension, including agricultural extension, carried out by government agencies is that of policy implementation. "Educate rather than regulate" is a common catch-cry. Since the 1980s the role of governmental agencies in agricultural extension has been the subject of much debate. There have been moves to reduce government funding of extension, encourage commercially-funded extension and consultation, foster greater collaboration between government and industry, etc. Rivera and Gustafson (1991:266) see an important future role for public section extension as being to coordinate activities and ensure accountability of the "agricultural extension complex" as a whole. Rivera (1991:189) also puts forward the view that "sustainability is potentially a unifying concept for agriculture and a central strategy for extension worldwide".

Two further roles of extension are "emancipation" and "human resource development". In the former case, extension is seen as an instrument for achieving societal objectives such as equality and self-fulfilment. The role of human resource development is congruent with the self-help ideal of many, but not all, extension approaches. At least some extension specialists, including Van den Ban and Hawkins (1988:22), consider it more effective and beneficial for extension to educate farmers in processes of problem solving, rather than advising farmers how to solve specific problems. Human resource development can be considered on a collective as well as individual level, for example extension can be used to assist farmer organisations.

**Strategies for extension**

Extension is frequently carried out in combination with other methods, such as the supply of inputs. However, by commonly-accepted definition, extension only operates in the realm of
communication. Therefore, the methods available to extension are simply the provision of advice and the influencing, whether overtly or covertly, of clients' knowledge and attitudes.

There are three strategies that extension can employ to induce change. These strategies, which are not mutually exclusive, are:

1) the "development and influence strategy" (*do to*) - working to get the farmer in a situation considered desirable by the extension agent or organisation.
   Asks "*How do I get them where I want them?*"

2) The "social marketing" strategy (*do for*) - working for the clients' interests.
   Asks "*How do I develop an offering which my target clients want?*"

3) The "problem-solving" strategy (*do with*) - working jointly with clients to solve their problems.
   Asks "*How do I help people achieve what they themselves want to achieve?*"

The "development and influence" strategy is typified by extension agents trying to persuade farmers to act in a better manner - without invitation from the farmers. This strategy is conceptually based on linear models such as "transfer of technology" and "sock-it-to-them" (Röling 1988). In the "social development" strategy the finer detail of extension activity is determined by clients' wants, but the overall objectives of the extension program are determined by the intervening party. There is a strong tendency for followers of this strategy to focus on problems they are able to solve. The "problem-solving" strategy is used to address both complex and simple issues raised by the farmers themselves. Its goals tend to be highly abstract, for example client emancipation and self-realisation. However, few governments are willing to devote tax monies toward the achievement of such vague goals. Followers of the "problem-solving" approach cannot be jacks-of-all-trades. Therefore, interventions of the *do with* strategy tend to rely heavily upon the client-initiated use of services of organisations and programs using *do to* and *do for* strategies (Röling 1988:57).

The best strategy, or mix of strategies, will depend on the circumstances involved, for example is the problem of a technical nature or does it depend greatly on the farmer's values? Van den Ban and Hawkins (1988:25) express the opinion that where there are clear, widely-applicable solutions
backed up by research, where farmers cannot be relied upon to look after their long term interests, and where the extension organisation's role is to meet the presumed needs of society rather than those of individual farmers - then the "development and influence" strategy is appropriate. In situations opposite to the above the "problem-solving" strategy is best. Finally, the "social marketing" strategy is likely to be suitable for situations between these above two extremes.

Planning for extension

When planning for extension, we require insight into the role of voluntary behaviour in generating, remedying or preventing the problem (Röling 1988:58). Effective extension requires that extension agentsanalyse a farmer's situation before deciding what is to be done. Common between models for the planning of extension mentioned in recent literature is their emphasis on dialectics, holism, and the ultimate goals of extension. Röling (1988:61) places emphasis on consideration of factual and normative conceptualizations of situations, that is, on "what is" and "what should be". He advocates a single loop of Dewey's problem-solving cycle as a means of generating a hierarchy of extension objectives, with societal objectives being paramount. Van den Ban and Hawkins (1988:219) state that decisions about goals, target group, messages, methods and organisation influence each other. They propose that planning proceed using a spiral process, in which these five considerations are progressively refined with each cycle of the spiral. Van den Ban and Hawkins (1988:92) also advocate use of the Bos (1974) decision-making model when planning. Bos' model is essentially a dialectic between choice (goals, means) and knowledge (facts, interpretation of facts) which is carried out until "our uncertainty becomes less important for us than the efforts we have made to reduce this uncertainty" (Van den Ban and Hawkins 1988:92).
Figure 4 Dewey's problem solving cycle (source: Röling 1988:58)

For a number of reasons, the participation of farmers in planning, as well as other stages of extension, is desirable. Two kinds of participation may be recognised: i) mobilising farmers to participate in an extension program and do what experts believe is good for them; and ii) empowering farmers to influence decisions taken about the extension program. Farmers' participation is not the panacea for extension's lack of perfection. For example, farmers may request more service without really changing what they do, an extension agent's attention may become fragmented, and negative reactions may occur in communities because of the choice of participants. Nevertheless, participation can yield important advantages which may not be obtainable otherwise. No matter what the degree of farmer participation is, it is highly desirable that all parties discuss explicitly, then agree upon, the respective roles they will play in a given extension program. To finalise planning, a quotation of Van den Ban and Hawkins 1988:222) is appropriate: "A better program can be planned by integrating farmers' knowledge and values with extension agents' knowledge and methodologies".

Methods of extension
It is not intended to discuss extension methods in detail, however, they will be briefly mentioned. The communication methods which may be used in extension practice are:

i) mass media - print, radio and television
ii) group methods - speeches, demonstrations, excursions, discussions

iii) individual methods - face-to-face, dialogue over the phone, etc.

The mixture of methods chosen depends upon the circumstances in which the extension agent is working and his or her goals. Each kind of extension method has its own advantages and disadvantages. For example, print and electronic media can be used to reach large audiences quickly and cheaply, however, there is little scope for interaction between members of the audience nor feedback to the extension agent. Individual methods can be very powerful and provide detailed feedback. On the other hand, they are expensive and time-consuming. Group methods, depending on their degree of formality, are intermediate between the above two types in terms of the size of the audience and opportunities for interaction and feedback (Van den Ban and Hawkins 1988:128).

It is generally considered that mass media are important in creating awareness and arousing interest, but they appear to have little direct influence on decision-making. Rather, when making decisions, individuals tend to value the judgement of others whom they know and trust. Both "the sender and the receiver tend to employ selective processes when using mass media, which often results in the receiver distorting the sender's messages" (Van den Ban and Hawkins 1988:129). On the part of the sender, there is selective publication. On the part of the receiver there is selective attention, perception, remembering, acceptance and subsequent discussion. These selective processes are employed in such a manner as to reinforce one's existing knowledge and opinions, and avoid contradiction to the same.

While the choice of medium is important, the manner of its use is of greater importance. Easy comprehension is a vital attribute of extension messages appearing in print. German research reviewed by Langer, Schulz von Thun and Tausch (1981, cited Van den Ban and Hawkins 1988:136) suggests there are four independent factors involved and that for easy comprehension written articles should: 1) use simple language; 2) be well-structured; 3) make the main points briefly; and 4) make writing stimulating to read. Messages, including pictures, should be targeted and pre-tested. It is worth noting that a dramatic but not particularly factual message may do more to achieve situational improvement than a more informative message - which is also less interesting.
The spoken word is relatively easily forgotten. Unless the speaker is particularly dynamic or the topic interesting, audience attention tends to wane after just fifteen minutes or so (Van den Ban and Hawkins 1988:145). However, speeches can be useful in raising awareness. They are easily modified to suit the audience, and they can be followed (or preceded) by discussion to build upon the awareness raised.

Demonstrations can be of "results", for example crop performance under different management practices, or "method", for example how to prune a fruit tree. Demonstrations are useful for convincing people who tend not to think abstractly (Van den Ban and Hawkins 1988:149). Methods demonstrations are necessarily done in small groups so that all may see what is going on. Practice of the method by audience members is highly desirable. Results demonstrations may be on farms or on research stations. It is common for farmers to consider that a demonstration is not applicable to their farm because of situational differences. For this reason, it is important to state the conditions under which the result was obtained, and choose sites carefully. In general, sites should be in locations of average rather than above average favourability. Excursions are similar to results demonstrations. Excursions are best if a few farms (or other sites) are visited in-depth and if farmers rather than "experts" do most of the talking.

Discussion groups are best small, with say five to eight members. Shepherd (1969) refers to five features of successful small groups. These are: objectives, role differentiation, values and norms, membership and communication. Objectives should be clear and the group members have goals which are the same or else compatible. There should be explicit role differentiation with official and unofficial leaders known. Values should be similar among group members. Norms must be clear and agreed upon, with the group taking action through consensus. Very little difference in norms (rules) can be tolerated. Membership should be clear-cut and heterogeneous so that there is a diverse range of skills, experience, etc. However, heterogeneity should not be excessive to the extent that it is difficult for members to find shared values and accept group norms. Communication should be open and full. There should be no withholding of relevant information and the group's leadership should facilitate communication by all group members. The views of Shepherd are
similar to those of other experts on small groups, for example Knowles and Knowles (1972) and Zander (1982). Clarity (of goals, action) and consensus are essential so that groups may be cohesive and productive.

**Evaluation of extension**

Evaluation is a systematic process of observation and reflection which can determine whether extension goals have been reached and whether the correct steps were taken to reach those goals. It is a subjective process since the criteria for evaluation depend upon value judgements. Mortiss (1988:117) provides the following pragmatic definition: "evaluation is the process of determining how well you are doing and what you are trying to do". Monitoring is a management technique with many similarities to evaluation, however, it merely involves observation and not a review against established criteria as does evaluation.

It can be useful to distinguish between *formative* evaluation - which gathers information prior to the development of the main body of an extension program, and *summative* evaluation - which tries to measure the end results of an extension program. Formative evaluation is particularly concerned with inputs and implementation whereas with summative evaluation the emphasis is on outcomes. The distinction between these two types of evaluations is somewhat arbitrary - being dependent on what one defines as a discrete extension program.

Some theorists, for example Guba and Lincoln (1989), have a broad and encompassing conception of formative evaluation. These theorists see evaluation as a continuous cyclic process which, in many ways, is equivalent to the action research of Lewin and experiential learning as expounded by Kolb (1984). Thus, the processes of evaluation, situation improvement, and adult learning can very much overlap.

Who should evaluate? Evaluation may be carried out by the extension agent, by an evaluation specialist within the extension organisation, or by an independent research worker. The independent research worker will be best placed to conduct an "objective" evaluation using a "fresh" approach,
however, the extension agent will be most familiar with the situation and best placed to act upon
the results of the evaluation.

Just as there are hierarchies of extension goals, so too may there be considered a hierarchy of
levels, each with its own criteria, at which extension may be evaluated. Bennett (1976, cited Van
den Ban and Hawkins 1988:235) recognises eight levels ranging from consequences for society to
the programming of extension activities. It is considered, at least in part, that changes at higher
levels are due to changes at lower levels. However, at the important higher levels extension
evaluation faces the everpresent problem that change may have been a consequence of unstudied
influences rather than the extension program.

Formal evaluation typically proceeds by proposing the null hypothesis that the extension program
has had no effect, then trying to reject that hypothesis (Van den Ban and Hawkins 1988:233).
When carrying out summative evaluation, the evaluator is often faced with the choice of: i) a
carefully controlled experiment in which the effects of extraneous factors are excluded; and ii) an
experiment in a natural setting in which extension is given in the normal way. In practice, at best
naturalistic "quasi-experiments" are achieved due to the practical difficulties associated with fully
random allocation of items, for example people and areas, to treatments. Designs other than
experiments should also be considered. For example, one may gather information several times in a
"times series". Pre- and post-extension surveys are of this kind. Discussion groups are useful in
gathering in-depth information. Surveys are the most popular technique for formal evaluation.

Mortiss (1988:117) cautions that evaluation is expensive and that "preoccupation with measurable
results could lead to distortion of extension activities and direct them into those areas which are
easily measured". Mortiss recommends that the extension agent always be self-critical and seek
feedback, and that most evaluation be informal.

**Summary**
In this thesis, extension is defined as "a communication intervention which seeks to induce
voluntary change in targeted categories or groups". Extension is usually deployed by an institution,
which seeks to achieve its own objectives. However, these objectives are often different to clients' objectives. Röling (1988:39) refers to this disparity of objectives as "the contradiction". Because extension relies upon voluntary change, client objectives must either be the same as, overlap, be linked to, or be made to fit, the objectives of the extension institution. Extension can be considered a science in its own right, or as a branch of rural sociology. Extension practice, whether in agriculture or in other fields, has the same underlying logic. Principles of sociology, adult learning, psychology, etc., are used to induce voluntary change in clients.

Extension theory and practice reflect their historical influences. In the past, agricultural extension has been pre-occupied with the diffusion and adoption of technical innovations. The term "transfer of technology" was used to describe the overall approach of extension at that time. "Failure" to adopt innovations in farm practice was, and still is, blamed on individuals' unfavourable psychological characteristics. However, there came greater recognition of the fact that many farmers did not have the capacity to adopt, that not all technical innovations were improvements over existing farm practice, and that marketing and the context of agriculture within broader systems should be taken into account.

In recent years, the focus of attention has shifted from the farm to the farmer him or herself. The technical innovation and industry development role of extension is still dominant throughout the world. However, the human resource development role has become stronger. Farmers are recognised as adult learners. Nowadays, many see extension's role as being to help farmers help themselves. The extension approaches to achieve such a goal are evolving. There is controversy over which "new" approaches to extension may best achieve objectives in the human resource tradition. One approach frequently promoted is action research. Action research forms the topic of the following literature review.
2.2. Literature review of action research

Action research is a research paradigm explicitly concerned with improvement in social situations through the taking of informed action and the development of relevant theory which is used to guide further action. Practice and theory are intimately intertwined as action research proceeds via a spiral process of taking action, reflecting, taking more action, etc. This approach had its origins in social and educational research earlier in this century. In particular, Kurt Lewin, a social psychologist who coined the term "action research" in the 1940s, is considered the originator of this research paradigm. In the past fifty years action research has progressed and diversified as it has been applied, with mixed results, in fields such as sociology, education and agriculture.

Descriptions and Definitions of Action Research

Action research was first explicitly described by Lewin in his 1946 paper "Action Research and Minority Problems". In this paper, Lewin describes action research as "research which will help the practitioner". In a social management setting, Lewin (1946) described action research as "a comparative research on the conditions and effects of various forms of social action, and research leading to social action". Lewin's revolutionary contribution was his conception that action research "proceeds in a spiral of steps each of which is composed of a circle of planning, action, and fact-finding about the result of the action" (Lewin 1946). This process formalises the link between theory and practice. It also makes clear the notion that action research is a continuous process of improvement whereby practice and theory inform each other's development. It is worth noting that Lewin's conception of action research was that of improved practice and understanding leading to achievement of a pre-conceived goal. This broad goal was to be revised with each cycle of action and evaluation.

There is concern among many practitioners of action research that "too purist a definition (of action research) is disenfranchising" (Altrichter et al. 1991). This concern has to be balanced with the need for rigour and shared meaning. It is notable that few definitions explicitly mention the distinctive process of inquiry used in action research. Most so-called definitions of action research provided in the literature may more appropriately be labelled as descriptions. However, it should be
acknowledged that action research needs only be defined at what Limerick (1991) calls the "meta-pattern level". Limerick points out that, at the level of technique, "action research cannot by definition stabilise: it must be a constant process of debate and discovery".

Dick (1993) provides a broad description of action research as: action - to bring about change in some community or organisation or program; and research - to increase understanding on the part of the researcher or the client, or both. Dick mentions there are action research methods whose main emphasis is upon action, and there are others whose main emphasis is upon research.

Whyte et al. (1991:20) mention that "in participatory action research (PAR), some of the people in the organisation or community under study participate actively with the professional researcher throughout the research process from the initial design to the final presentation of results and discussion of their action implications". It appears that Whyte is widely respected within sociology and the action research community, however, this description would dismay some other action researchers. Firstly, it is not evident from this description whether any action occurs besides data gathering and analysis. Secondly, the spiral process has been reduced to a single cycle. Thirdly, despite mention of collaboration at all stages, one has the decided impression that the professional researcher is very much in control of the research process.

A widely accepted definition of action research, which very closely mirrors its meaning as intended by Lewin, is that of Rapoport (1970). Rapoport has stated:

Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework.

Another widely accepted definition of action research is that of Carr and Kemmis (1986:162), who state:

Action research is simply a form of self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own social or educational practices, their understanding of these practices, and the situations in which these practices are carried out.
Stephen Kemmis is one of the most vocal proponents of action research within education. He is also one of the key figures in the development of the rationale and theory of action research. Together with colleague Wilf Carr, Kemmis has identified three minimal requirements for action research (Carr and Kemmis 1986:165). These three requirements, which are individually necessary and jointly sufficient for action research to occur, are:

(a) the project takes as its subject matter a social practice, regarding it as a strategic action susceptible to improvement.
(b) the project proceeds through a spiral of cycles of planning, acting, observing and reflecting, with each of these activities being systematically and self-critically implemented and interrelated; and
(c) the project involves those responsible for the practice in each of the moments of the activity, widening participation in the project gradually to include others affected by the practice and maintaining collaborative control of the process.

Considerable time was spent debating the nature of action research at the "International Symposium on Action Research in Higher Education, Government and Industry", held in Brisbane in 1989. At the symposium, Kemmis argued that "not every useful and valuable change process needs to be redescribed in terms of action research (Altrichter et al. 1991). The symposium's participants came up with a "working definition" of action research composed of two distinctive parts: (1) an "axiomatic part" - a definition indicating what is meant by action research; and (2) an "empirical part" - an inventory of "rules of thumb" collecting reflected research experiences of action research. The definition (see Altrichter et al. 1991) is as follows:

**If yours is a situation in which**

* People reflect and improve (or develop) their own work and their own situations.
* by tightly interlinking their reflection and action.
* and also making their experience public not only to other participants but also to other persons interested in and concerned about the work and the situation, i.e. their (public) theories and practices of the work and the situation.

**and if yours is a situation in which there is increasingly**

* Data gathering by participants themselves (or with the help of others) in relation to their own questions.
* Participation (in problem-posing and in answering questions) in decision-making.
* Power-sharing and the relative suspension of hierarchical ways of working towards industrial democracy.
* Collaboration among members of the group as a 'critical community'.
* Self-reflection, self-evaluation and self-management by autonomous and responsible persons and groups.
* Learning progressively (and publicly) by doing and by making mistakes in a 'self-reflective spiral' of planning, acting, observing, reflecting, replanning, etc.
* Reflection which supports the idea of the '(self-)reflective practitioner'.

then Yours is a situation in which ACTION RESEARCH is occurring.

Concepts Related to Action Research

A key distinguishing feature, and strength, of action research is its spiral nature. Lewin (1946) introduced the concept in the following manner:

A pre-conceived objective exists, but its exact nature and the means to achieve it are not clear. Examination of the objective and fact-finding about the present situation can lead to: i) an overall plan of how to reach the objective, and ii) a decision in regard to the first step of action. The first step of action is taken. This is followed by observation. The observation is used to evaluate the action and generate new insight. It also serves to plan the second step of action and to modify the overall plan. A second cycle of planning, executing, and reconnaissance follows the first cycle, and is in turn followed by further cycles.

Lewin's cycle has since been developed further, most notably by Kolb (1984). The cycle is now often referred to as the "adult learning cycle" or the "experiential learning cycle". Kolb refers to the four phases of the cycle as being: active experimentation (AE), concrete experience (CE), reflective observation (RO), and abstract conceptualisation (AC). However, most often the phases are simply referred to as: plan, act, observe, and reflect. The Kolbian/Lewinian learning cycle is depicted on the following page.
Figure 5 The four stages of the experiential learning cycle

(source: Bawden 1991:15)

With regards to this learning cycle, the basic assumption is that people can learn and create knowledge (1) on the basis of their concrete experience, (2) through observing and reflecting on that experience, (3) by forming abstract concepts and generalisations, and (4) by testing the implications of these concepts in new situations, which will lead to new concrete experience and hence, the beginning of a new cycle (Zuber-Skerritt 1991:xiv).

Chris Argyris and Donald Schön have taken this concept further and proposed that there is "single-loop" learning, corresponding to the learning cycle depicted above, and "double-loop learning", which follows the same process but at a higher level of conception - a "meta-level". For example, concepts such as action learning refer to single-loop learning, while others such as critical thinking (i.e. thinking about thinking) belong to the meta-level of double-loop learning. Bawden (1991) captures the essence of these two learning processes, and their difference, when he states: "There is the 'first order' issue relating to the situation we are exploring, and there is the 'second order' issue relating to the way we are inquiring into the 'first order issue'".
Argyris and Schön also refer to people's "espoused theories" and their "theories-in-use". Espoused theory refers to "the world view and values a person believes she follows in her behaviour", while theory-in-use refers to "the world view and values implied by her actual behaviour" (Dick and Dalmau 1991:6). The two are usually rather different (e.g. Argyris 1982). The theories of Argyris and Schön are not easy to understand, however, the previous diagrams may help.

There are a number of other attributes of action research, plus related concepts, which are best mentioned at this stage. Learning is defined as the acquisition of knowledge and skills (Anon. 1981). Research is defined as systematic investigation in a field of knowledge to discover or establish facts or principles (Anon. 1981). In the opinion of Bawden (1991), researching is learning with the special intention of adding to public knowledge. Russell (1987) states that the focus of action research will always be a "system". He quotes Bateson (1971:243) who has defined a system as "any unit containing feedback structure and competent to process information".

Bawden (1991) describes the action researcher as a "participant-observer researcher". He states that this kind of researcher studies "soft" systems, which are so labelled because the system's characteristics are not clearly defined. Neither are the goals of the research. The participant-observer researcher becomes an integral part of the action researching system. There is a dynamic
and collaborative relationship between the researcher and those researched, a relationship in which both learn together. Goals of the research emerge as the inquiry proceeds.

There are many terms in the literature which are likely to be unfamiliar to the lay person. According to Guba and Lincoln (1989:83), ontology is that branch of philosophy dealing with existence or being. It asks "What is there to be known?" Epistemology is that branch of philosophy which deals with the origin, nature, and limits of human knowledge. It asks "What is the relationship of the knower to the known (or knowable)?", i.e. "How can we be sure that we know what we know?" Methodology is that branch of philosophy which deals with methods, systems, and the rules for the conduct of inquiry. It asks "What are the ways of finding out knowledge?" Therefore, ontological refers to matters of existence and epistemological to considerations of truth. Methodology can refer to the study of method (as in double-loop learning) or simply to collections of related methods. Pedagogy and andragogy are "the art and science of teaching". Andragogy is for adults and pedagogy for children, or as a generic term.

It is necessary to discuss one more concept at this stage; that of the nature of "reality". Action research strongly emphasises the subjective nature of human reality. It considers that each of us conceives the outside world differently according to our "Weltanschauung" (e.g. Wilson and Morren 1990:41-44). Apparently, the German word "Weltanschauung" has no close English equivalent, but two similar terms are "worldview" and "window of the world". "Weltanschauung" refers to the whole of our idiosyncratic and cultural beliefs, understandings, etc., which influence our perceptions of what we see and hear. Many action researchers either ignore or refute the idea of a "true" external reality which is independent of its observers. Instead, great emphasis is placed upon the generation of shared meaning among the participants of action research. In the words of Bawden (1991), "the universe ... is observer-dependent!"

**How To Do Action Research**

There is no single "correct" way to carry out action research. Rather, action research is a paradigm encompassing a number of methodologies and a multiplicity of methods and techniques. Action research methodologies have been developed by Lewin; Corey; Stenhouse; Elliot and Ebbutt;
Kemmis, McTaggart and Grundy (the Deakin School); Whyte; etc. Other methodologies which may either be considered to be kinds of action research, or closely related but different, include: Action Science (Argyris and Schön), Critical Social Science (the Frankfurt School, notably Habermas), Fourth Generation Evaluation (Guba and Lincoln), and Soft Systems Methodology (e.g. Checkland, Wilson).

There are strong similarities between the above methodologies. The key attributes of action research are:

1. use of a series of self-informing cycles of action and reflection
2. multiple information sources and dialectics
3. based on a social practice which is amenable to improvement
4. collaborative and participative - collaboration between members of the action research group in an equitable manner and meaningful participation by practitioners in as many stages of the research process as possible.
5. use of the language and views of the practitioners, i.e. interpretive in nature
6. a critical community of researchers - i.e. an expanding community in which members subject their own practices and understandings, and the practices and understandings of others, to critique.

One may note the similarity between the attributes of action research and the methods by which quality in action research may be attained. This is no coincidence. Action research is a rigorous and useful paradigm.

Most accounts of action research tend to say why to use action research, or why not to use so-called "traditional" scientific approaches, but they rarely detail how to do action research. McNiff (1988) is an exception. With regards to the practicalities of action research, McNiff (1988:67-71) recommends that we: start small, plan carefully, set a realistic time-scale, involve others, keep others informed, arrange for feedback, and organise a writing schedule. Writing is not only to produce a document for the funding body of the research. For many action researchers, the act of writing helps to clarify ideas (McNiff 1988:70).
Below are some techniques to choose from at each of the four possible steps of a single cycle of action research. Most of this material comes from the learning workshop of a residential for students of the Master of Applied Science (Systems Agriculture) course of the School of Agriculture and Rural Development, UWS-Hawkesbury, Richmond, NSW, held in February 1993.

I. DIVERTING - What is there?

**Characteristics:** emotional, sensory, creative, imaginative, open-minded.

**Goals:** generation of alternatives, problem/opportunity sensing, imagining the implications of ambiguous situations, awareness of and sensitivity to others' feelings and beliefs.

**Techniques:** mind mapping, brainstorming, creative problem solving, browsing literature, visiting, active listening, role-playing, surveying, interviewing, Delphi.

II. ASSIMILATION - What does it mean?

**Characteristics:** perceptive, intuitive, analytical, logical

**Goals:** planning, formulating theory, establishing criteria, defining problems, organising information, building conceptual models, analysing qualitative and quantitative data, testing theories and ideas.

**Techniques:** thinking, manipulating data, game theory, computer simulation and modelling, experimental design, selecting root definitions, CATWOE, force-field analysis, hypothesis theory, mind-mapping, SWOT, conceptual modelling, statistical analysis.

III. CONVERGING - What will we do?

**Characteristics:** discriminating, interpretive, decision-making, evaluating

**Goals:** creating new ways of thinking and doing, narrowing down alternatives, capturing the essence of situations, interpreting data, designing experiments, choosing the best solution, setting goals, making decisions.

**Techniques:** experimenting, calculations, lateral thinking, decision trees, linear programming, crystal ball imagery, validating conceptual models.

IV. ACCOMMODATION - How will we do it?

**Characteristics:** action, intention, practical, experiential

**Goals:** execution of plans, implementation of decisions, committing resources, committing oneself to objectives, seeking or exploiting opportunities, influencing and leading others, dealing with people, being personally involved.

**Techniques:** implementing change, critical-path scheduling, consensus seeking, training.
The spiral cycle:
It is not necessary to slavishly follow the steps above in their presented order - and to do so for cycle after cycle (Checkland 1989, Bawden 1991). Indeed, it has been observed by practitioners of action research (e.g. Brown et al. 1988:346) that "starting by focussing on the action research process itself is unlikely to succeed". In practice, one may skip steps, go backwards, get stuck at a particular step, etc. One may also consider a particular problem satisfactorily resolved after one or two cycles, whereas other problems may require many cycles of action and reflection. Furthermore, once one "problematic situation" is tackled, invariably others arise as one's inquiry proceeds. McNiff (1988:44) has made the useful suggestion that a three dimensional spiral of spirals be considered. In this case, in addition to the spiral dealing with the initial or main "problem", there are "spin off" spirals dealing with side issues as they arise.

![Figure 8](source: McNiff 1988:45)

The important thing, when considering the spiral process of action research, is "At each step, use the information so far available to determine the next step" (Dick 1993:12). Dick (1993:11) explains the overall procedure of action research in the following manner:
"One is faced with a problematic situation; a situation to be improved through action research. However the exact nature of the problem is uncertain. So too is the methodology to be used. By initially addressing a 'fuzzy question' with 'fuzzy methods', the best one can hope for is a 'fuzzy answer'. However, this fuzzy answer does go some way towards defining both the problem and the methods for its solution. In the next cycle 'less fuzzy' methods are used to yield 'less fuzzy answers', which in turn lead to a 'less fuzzy' definition of the problem. The continued refining at each stage of inquiry allows us to converge toward precision".
Multiple information sources and dialectics:
The second key methodological guideline of action research is to work with multiple information sources (Dick 1993:12). These sources will preferably be independent or partly independent. Such a procedure is often referred to as "triangulation". Triangulation does not imply the use three sources of information, rather it is a term borrowed from trigonometry. It refers to use of known reference points (or known information) to determine the position (or nature) of an unknown point (or unknown information). Dick (1993:12) provides the following examples of multiple information sources:
* different informants
* different research settings
* the same informant responding to different questions which address the same topic
* information collected at different times
* different researchers
* different methods.
A different, but related, process is that of dialectic. Dialectic is a technique of logical argument first used by philosophers of ancient Greece. Its steps are: thesis, antithesis, and synthesis. Dialectic dialogue consists of sequential question-answer pairs. It may be compared to negotiation, where interplay between two differing positions leads to shared understanding and an agreement upon a single, mutually-acceptable position. A dialectic focuses on differences rather than similarities. The aim of the dialectic process is to create a synthesis of two differing positions - it is not for one point of view to oust or supplant the other (McNiff 1988:41).

With experiential learning in mind, Bawden (1991:17) identifies three dimensions: concrete and abstract, action and reflection, and integration and separation. Each of these dimensions can be used to create a dialectic. So too can multiple sources of information which offer differing views.

**Interpretive emphasis:**

Action research is based in the human realm, therefore considerable effort needs to be devoted to developing shared understanding between participants - so that communication is as meaningful as possible. Familiarity with the language of practitioners is probably best gained through participant observation, unstructured interviewing, and active listening. "Immersion" in a natural setting is the best way for an outside facilitator to expose him or herself to the everyday language of the practitioners. It is this language which has most meaning in their lives. A sympathetic and interested listener is most likely to hear such language. On the other hand, a more "detached" outside facilitator is more likely to be spoken to in terms the speaker anticipates the facilitator is already familiar with. Tape recording conversation is a good way for the outside researcher to become familiar with the jargon of a particular group. This jargon is likely to include different-to-usual meanings of words of a shared language as well as words and phrases peculiar to that group.

At the same time, an outside facilitator will have jargon which he or she wishes to introduce to the group. Attempts to introduce this unfamiliar language to members of the action researching group should not be overdone. It is better that the outside facilitator communicate his or her "outside knowledge" and "outside language" to the group of practitioners "at their level". It is most common
for technical specialists and tertiary qualified professionals to over-estimate their client's familiarity with their specialist language and jargon.

Facilitation and collaboration:
Some practitioners of action research, for example Kemmis and McTaggart, consider action research to be primarily carried out by practitioners, such as a group of mothers or farmers, rather than outside professionals. However, such authors do acknowledge that "In practice, the prospects for successful action research seem greatly enhanced when it is undertaken with a facilitator from outside the immediate situation being studied" (Brown et al. 1988:341). On the other hand, most authors of literature on action research (e.g. Whyte et al. 1991) appear to consider that there is one action researcher or a small group of researchers, who work in close collaboration with a group of practitioners, e.g. maize farmers, or representatives of those practitioners. Regardless of emphasis on who is doing the research, all authors agree that the role of outside "experts" (who may be experts in group processes rather than technical specialists) should be facilitative rather than prescriptive.

There are many roles that an outside facilitator of action research may undertake. Hopefully, at least some of these roles will be temporary, that is, as the action research group develops the practitioners will rely less and less upon the outside facilitator. The roles of a facilitator include the following: providing an outsider's perspective, being the focus of the group, a teacher of action research method, critic, group recorder, group representative, source of personal support, source of practical assistance, and resource person (Brown et al. 1988:341).

Facilitation may be seen at two levels - at the group level (when all members of the action researching team are together) and at the individual level, that is, when the outside facilitator interacts with individuals outside the group setting. Negotiation is crucial. It should be collaborative and on-going. Negotiation should take place in a well-informed environment. Issues to be negotiated include: the basis for the facilitator's involvement, the types of intervention anticipated, the limits of the inquiry, the extent of the commitment to the project and the collaborative group,
the nature and destination of any published accounts, and the conditions for the facilitator's withdrawal (Brown et al. 1988:344).

Good facilitation requires keen judgement. For example, the facilitator will have to judge which mix of approaches is best so that a balance is struck between allowing the practitioners to generate personal knowledge and the need to make practical gains (Brown et al 1988:345). Rapoport (1970) states "the art of action research resides to a large extent in choosing the correct context (for feedback), timing confrontations and "interventions". It may be desirable for a facilitator to destabilise a situation so that beneficial change may occur. Lewin (1952) mentioned such destabilisation as the first of three steps for permanent change, such as an increase in the productivity of factory workers. In the view of Lewin (1952) a successful change involves:
unfreezing (if necessary) the present level (of performance), moving to a new and higher level, and freezing group life at the new level. Candy, Harri-Augstein and Thomas (1985:103) state that it is a widely-reported phenomenon that "improved performance has a tendency to drop off, or return to old levels, unless new skills become internalised, and the learner becomes comfortable at new, higher levels of operation". These authors promote the support of learners between adoption and the internalisation of a new skill.

Lewin subscribed to the force-field account of group dynamics and social phenomena (e.g. Lewin 1952). As such, he considered a situation of non-change as one of "quasi-stationary equilibrium", in which opposing forces were equal. According to Lewin it is necessary to recognise that a social standard to be changed has the nature of a 'process' - it is not a 'thing'. Lewin (1952) contended that change may be achieved in two ways: (i) by increasing forces in the desired direction of change, or (ii) by diminishing opposing forces. Lewin considered that the first method achieves desired results at the cost of increased tension, therefore the method of minimising opposing forces is preferred. To put it another way, it is best to achieve change by removing barriers rather than crashing through them.

In his paper "Three dilemmas in action research", Rapoport (1970) addresses the issues of (i) ethics, (ii) goals, and (iii) initiatives. According to Rapoport, good action research has an ethical
basis and a balance of scientist's (i.e. 'outside' researcher and facilitator) and clients' (i.e. practitioners and co-researchers) interests. With regards to ethics, Rapoport considered it necessary to work with reputable firms or groups (of clients), identify and keep in mind the overlap of interests of the two parties, maintain confidentiality and anonymity (so that informants may avoid reprisal), encourage autonomy (on the part of the client), and (for the facilitator) avoid manipulation and partisan involvement in disputes within the client organisation or group.

Rapoport (1970) has stated that the goals of scientists and practitioners tend to be rather different, although their interests are ultimately allied. It is desirable that a contract, which makes the overlapping goals of the outside facilitator and the client group explicit, be agreed upon. With regards to the dilemma of initiatives, Rapoport (1970) points out that clients do not necessarily know what is best for themselves. He states "the presenting problem might not be the most important one" and "If the researchers allowed the definition of the problem and associated initiatives to rest too exclusively with the client, he might be slighting both the practical and scientific goals of the exercise". Further, clients may reject suggestions for desirable change because of defensive reactions. Skilful facilitation will reduce the occurrence of "the rejection phenomenon". Once again, a balanced approach is required. Just as the client is not always right, neither is the outside facilitator always right.

The final aspect of collaboration and participation in action research to be mentioned concerns the efficiency, in terms of time and outcome, of group work and work with individuals. Many proponents of action research state, without reference to supportive studies, that group work is very time consuming (e.g. Brown et al. 1988:342). However, Lewin (1952) has reported studies where the opposite was true. In one study, carried out by Klisurich in an Iowa hospital, mothers were given recommendations on the feeding of cod liver oil and orange juice to their newly born babies. The mothers were counselled individually or in groups of six, by the same person (Klisurich), using the same information, and for the same length of time (25 minutes). The groups of six had not existed previously and most group members did not have contact with the other members of their group either before or after the counselling. Klisurich found, two and four weeks later, that the percentage of mothers following the advice received during counselling was twice as
great when the group method was used. In other words, for the same 25 minute investment of the facilitators' time, efficiency was twelve times as great when using group methods!

Lewin (1952) reports similar findings on the effectiveness of group versus individual processes for inducing behavioural change in the same paper. He provides interesting discussion on why the findings should be so. Lewin contended that "both the mass approach (e.g. a lecture) and the individual approach place the individual in a quasi-private, psychologically isolated situation". For issues where social standards are involved, and those issues are very widespread, it is well recognised that individuals tend to be unwilling to depart far from group standards. However group standards are not static, for example "If a change of sentiment of the group becomes apparent during the discussion, the individual will be more ready to come along" (Lewin 1952). Thus, Lewin concluded "it is easier to change the ideology and social practice of a small group handled together than of single individuals". The findings reported by Lewin have profound consequences upon how to conduct action research.

**Critique:**

Self-critique by individuals and collective critique within the group carrying out the action research (since it is normally a group activity) will ensure that understandings have been tested, and as many as possible restrictions to, and opportunities for, development have been identified. Too often improvements in social situations are hindered because of unthinking adherence to habits and traditions which may be unjust, irrational, or simply inefficient.

Critique explores these habits and traditions. It does so by being aware and informed, hence honest flows of information and meaningful reflection are vital. Habermas (cited by Kemmis and McTaggart 1988:13-14) refers to "ideal speech situations" - "where considerations of power, prestige and status of participants are put aside so that discussion of alternatives can take place on an equitable and rational basis". Certainly these situations are, on the whole, desirable. However, in practice, critique is still effective in less-than-ideal conditions of communication. The outside facilitator of action research should not naively assume that practitioners will always act in the best interests of the group. Rapoport (1970) addresses this issue when he states it is important for the
outside facilitator "to assess the personal and political motives for (clients) reacting to information in certain ways".

It is desirable that an ever-widening circle of informants be used to provide critique as the action research progresses. This helps ensure that the understandings of the action researching group are confirmed (or else disputed then modified). It also helps an outside facilitator of action research ensure that the group of practitioners he or she is working with are representative of their category or wider group.

With regards to outside facilitators, a small multidisciplinary group of four to seven is ideal to help ensure effective critique of the facilitation. When the outside facilitator is working alone with the action researching group, then it is highly desirable that he or she consult with colleagues from time to time. For example, these colleagues could be on a steering committee of the action research project. The role of the researcher who is leading an action research group is an active one. Rapoport (1970) states "Self-control and insight are essential to this new kind of advocacy role, and may be assisted by the participation of colleagues in new kinds of teamwork arrangements". Russell (1987) introduces the interesting concept of "homeostasis" in the following manner; "There is a real risk ... that the (action researching) system will adjust over time to the input of the researcher so that a state of homeostasis will prevail and change will no longer be possible". The involvement of knowledgeable but relatively detached outsiders, both researchers and practitioners, can help avoid homeostasis as well as ensure effective critique.

Finally, the public presentation of an action research project can make known beneficial discoveries and outcomes of the project. This can be both an exercise in public relations and a method of extension to induce desirable change in the wider community.

**Topics for action research:**

Action research is appropriately applied to questions relating to the value of practice (McNiff 1988:75). In general, action research is prompted by feelings of dissatisfaction with present practice and the situation in which it occurs. However, there need not be a problem - merely a desire for
improvement. In the typical case where a practitioner is the principal action researcher, for example a teacher, it is recommended (e.g. Brown et al. 1988, McNiff 1988) that the process be initially focussed upon specific problems or questions which are immediately relevant to the practitioners, of interest to them, and amenable to improvement through change. Action research tends not to be useful for "macro" issues and issues where practice has little effect on a situation or where the practitioners have little or no power (Kemmis 1982, cited by McNiff 1988:74).

Brown et al. (1988:345) consider that "neither is action research suited to the mere identification of factors in good practice". Action research requires action and finding out of the effects of that action - unobtrusive fact-finding within the present situation is insufficient. Brown et al. (1988:346) also state that "starting by focussing on the action research process itself is unlikely to succeed. Successful action research is most likely when it is applied to relevant and manageable issues. McNiff (1988:76) advises "Settle on an idea YOU can do something about".

**Three Kinds of Rigorous Inquiry**

Three paradigms of inquiry tend to be identified in the action research literature:

1) **positivist**, empirical-analytic, rationalist, reductionist science;
2) **interpretive**, hermeneutic science; and
3) **constructivist**, naturalistic, action researching, critical social science.

Each of these paradigms has its own ontology, epistemology and methodologies. The outcomes of these paradigms in terms of research emphasis, researcher behaviour, etc., may also be distinguished.

The positivist paradigm encompasses what is variously called conventional, reductionist, rationalist, or empirical-analytic science. Positivism has a realist ontology. It asserts that there is a single reality which is independent of its observers. This reality operates according to the "orderliness principle" which states that the universe acts in an orderly and predictable manner subject to laws of nature. The positivist answers the question "Does a falling tree make a sound when there is no one to hear it?" with "Of course!"
The realist ontology referred to by some as naive realism holds that reality exists and that disciplined inquiry can converge *exactly* upon it. In other words, natural laws can be discovered which exactly describe reality "as it truly is". According to Guba and Lincoln (1989:85), the idea that science will converge upon reality has been mostly rejected in favour of critical realism/critical multiplism. This ontology holds that it is impossible to discover reality except from within a particular, usually disciplinary, perspective. However, it is still believed that there is a reality. Perhaps the reader is familiar with the story about some blind men describing an elephant differently according to the part of the animal they are touching. Well, in the belief of the critical realist, there really is an elephant (Guba and Lincoln 1989:85).

The epistemology of positivism is dualist and objectivist (Guba and Lincoln 1989:84). This epistemology asserts that it is possible, indeed mandatory, for an observer to exteriorise a phenomenon being studied. This detached and distant stance creates what is referred to as the "subject-object dualism".

In complete contrast, the constructivist paradigm has a relativist ontology. This ontology asserts that there exist multiple, socially-constructed realities. In the opinion of some constructivists, for example Guba and Lincoln (1989:86), these constructs are *ungoverned by natural laws*. However, it seems most constructivists ignore issues of existence for the reason that they are unimportant to living. Constructivist "truth" is defined as the best informed (amount and quality of information) and most sophisticated (power with which the information is understood and used) construction on which there is consensus (Guba and Lincoln 1989:84). There may be several constructions extant that simultaneously meet the criteria of best informed and most sophisticated. A corollary of this ontology is that others' views may be considered to be relatively uninformed or unsophisticated, but it makes no sense to label them as "wrong".

The epistemology of constructivism is monistic and subjectivist. It asserts that the inquirer and the inquired-into are interlocked in such a way that the findings of an investigation are the literal
creation of the inquiry process (Guba and Lincoln 1989:84). Hence, the classical ontology-epistemology distinction is meaningless in the constructivist paradigm.

For some practitioners, interpretivism has a realist ontology and is a kind of positivism. For others, it is the methodology of constructivism. While many recognise interpretivism as a distinct paradigm of its own, the author prefers to see it as a methodology which, according to one's ontological beliefs, is encompassed within either positivism or constructivism.

"Post-positivist paradigms" can refer to approaches considered to chronologically follow positivism, i.e. constructivism and interpretivism. Alternatively, it can refer to the positivist paradigm - but with a "modern" emphasis towards relevance, richness, subjectivity, applicability, etc. Post-positivism according to the later interpretation would emphasise qualitative approaches to data gathering and so on. However, its ontology is still realist.

The methodology of positivism is described as interventionist. According to Guba and Lincoln (1989:84), an interventionist methodology strips context of its contaminating (confounding) influences (variables) so that the inquiry can converge on truth and explain nature as it truly is and really works. On the other hand, constructivism uses a hermeneutic (also called interpretive) methodology. This methodology involves a continuing dialectic of iteration, analysis, critique, reiteration, reanalysis, and so on, leading to the emergence of a joint (among all the inquirers and informants, i.e. among ethic and emic views) construction of a case (Guba and Lincoln 1989:84).

Helmstadter (1970, cited by Graziano and Raulin 1989:6-9) has labelled the common methods of acquiring knowledge as tenacity (the acceptance of an idea because others have believed it for a long period of time), intuition (this supposedly operates without intellectual effort, and, in the opinion of some, without involvement of the senses), authority (the acceptance of information as valid because a respected source claims it to be so), rationalism (in which knowledge is developed through processes of reasoning, i.e. logic), empiricism (the gaining of knowledge by experiencing through our senses), and science (which involves a systematic interplay between rationalism and empiricism).

56
Carr and Kemmis (1986) provide stimulating discussion on the nature of human inquiry in their book "Becoming Critical: Education, Knowledge and Action Research". These authors are particularly influenced by Jürgen Habermas of the Frankfurt School of critical theorists. Habermas (cited by Carr and Kemmis 1986:134) has attacked "scientism" - that is, "science's belief in itself". He argues that scientism, by evaluating all knowledge in terms of natural scientific knowledge, makes it virtually impossible to comprehend traditional science as just one form of knowledge among others. For Habermas, knowledge is not produced by "pure" intellectual activity, rather it is the outcome of human activity motivated by natural needs and interests. These needs and interests are referred to as "knowledge-constitutive interests" because they guide the way in which knowledge is constituted in different human activities.

Table 1 Habermas' three "knowledge-constitutive" interests.
(source: Carr and Kemmis 1986:136)

<table>
<thead>
<tr>
<th>Interest</th>
<th>Knowledge</th>
<th>Medium</th>
<th>Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical</td>
<td>Instrumental (causal explanation)</td>
<td>Work</td>
<td>Empirical-analytic or natural sciences</td>
</tr>
<tr>
<td>Practical</td>
<td>Practical (understanding)</td>
<td>Language</td>
<td>Hermeneutic or &quot;interpretive&quot; sciences</td>
</tr>
<tr>
<td>Emancipatory</td>
<td>Emancipatory (reflection)</td>
<td>Power</td>
<td>Critical sciences</td>
</tr>
</tbody>
</table>

Carr and Kemmis (1986:135) refer to technical knowledge as being concerned with control of the natural world. They state (1986:135) that Habermas considers the symbolically structured domain of "communicative action" not to be reducible to positivist scientific knowledge. However, Habermas also considers interpretive science to be lacking since the subjective meanings understood are themselves in turn influenced by conditions (ideological, cultural, political, historical, etc.) which limit "both the scope of individuals' intentions and the possibility of their realisation" (Carr and Kemmis 1986:135). According to Habermas, an emancipatory interest goes
beyond narrow concerns with subjective meanings in order to acquire "knowledge of the objective framework in which communication and social action occur" (Carr and Kemmis 1986:136).

It has been mentioned that differing paradigms lead to different researcher behaviour. Bawden (1991) distinguishes four kinds of researcher - three of which are "detached" researchers and one of which is a "participant-observer researcher". The three kinds of detached researcher will be mentioned first. The "expert researcher", for example the physicist or biologist, studies the natural world. He or she is well-qualified in his or her discipline but generally has little interest in the remainder of the world, including those parts of the world which interact with his or her speciality. Bawden considers the social scientist to be similar in nature. That is, focussed upon a small area of speciality, which is invariably influenced to a large degree by factors which are not investigated. On the other hand, the third kind of detached researcher, the "hard systems researcher", studies whole systems. There is keen interest in the interaction of components and the manipulation of the system to achieve externally-imposed goals. Such systems are labelled "hard" because their characteristics such as boundaries, inputs, outputs and major functions, are clearly defined (Checkland 1989, Bawden 1991). The fourth kind of researcher identified by Bawden, the "participant-observer researcher", also studies systems - but of a different kind. "Soft" systems are labelled as such because system characteristics are not clearly defined. Neither are the goals of the research. Bawden states that the participant-observer researcher becomes an integral part of the action researching system. There is a dynamic and collaborative relationship between the researcher and those researched, a relationship in which both learn together. Goals of the research emerge as the inquiry proceeds. It can be seen that Bawden's fourth kind of researcher acts according to constructivist methodology.

There are fierce debates within the action research literature on the relative merits of different kinds of inquiry. Much is written. In the end, I consider that debates regarding paradigms of inquiry come down to matters of balance within particular contexts. And exactly where the best balance lies is a matter of judgement depending on human values. These debates can be as debilitating as they are enlightening. The important thing is that we all address our assumptions so that we may engage our world in better ways and thereby improve our lives.
Summary

At the conclusion of the literature review of agricultural extension it was mentioned that action research has been promoted as an alternative approach to extension. Action research has been used with success in agricultural settings since the 1960s and 1970s - although not extensively. Action research focuses upon practitioners improving their own lives through the twinned development of understanding (theory) and practice (action). Action research is eminently applicable to agricultural extension in the human resource tradition for a number of reasons. Among these are the following: the role of extension is to change farmers rather than farms, farmers have much valuable knowledge which is applicable to the problematic situation (hence a collaborative and interpretive approach is best), farmers are more likely to change if they are personally involved in a project (hence a participative approach is best), extension depends upon communication (hence an interpretive approach is best), and improvements in agricultural practice and understanding depend upon action, and observation and reflection upon action (hence self-informing cycles of action and reflection are best).

Action research is a practical, human-based methodology which focuses upon situation improvement through voluntary change. Therefore principles of action research are very much applicable to agricultural extension. However, action research is not a major stream of research in its own right. If wishing to become familiar with the theoretical fundamentals of farmers' learning and behavioural change, it is necessary to explore literature on adult learning. Adult learning forms the topic of the following review.
2.3. Literature review of adult learning

Introduction
Learning has been defined as "the process whereby knowledge is created through the transformation of experience" (Kolb 1984:38). Each word of this excellent definition is pregnant with meaning and implications. I do not consider that one can distinguish between experiential learning and other forms of learning. All learning is experiential. Maturana and Varela (1988) have written a profoundly illuminating, although difficult to read, book on the biological roots of human understanding. In "The Tree of Knowledge" (1988:27), these authors state "Everything said is said by someone" and "All doing is knowing and all knowing is doing". It is mentioned (1988:26) that "every act of knowing brings forth a world". Maturana and Varela (1988:29) go on to define knowing as "effective action, that is, operating effectively in the domain of existence of living beings". It may be necessary for the reader to consult "The Tree of Knowledge" to adequately appreciate these sayings, however, the fact remains that our learning is inescapably a function of our human form. At a fundamental level, there is only experiential learning. Hereafter, except when discussing the work of David Kolb, I will drop the modifier "experiential" and simply refer to "learning".

The great educator John Dewey recognised two experiential processes which lead to learning. The first of these, "trial and error", is limited by the specificity of the problem solved and the scope of practicable exploration. The second process Dewey identified was "reflective activity", which involves the perception of relationships and connections between the parts of an experience. Dewey explained reflection upon experience as a learning loop, continually feeding back and forth between the experience and the relationships being inferred (Boud et al. 1985:11-12).

Boud, Keogh, and Walker (1985:18) consider that "experience consists of the total response of a person to a situation or event" and that "reflection is a form of response of the learner to experience". These authors define reflection in the following manner: "reflection in the context of learning is a generic term for those intellectual and affective activities in which individuals engage to
explore their experiences in order to lead to new understandings and appreciations. It may take place in isolation or in association with others" (Boud et al. 1985:19).

If one consults a typical dictionary one is unlikely to find the word "andragogy". However, the word "pedagogy" will be there, and defined as "the art or science of teaching" (e.g. Anon. 1981). Pedagogy is derived from the classical Greek words "paid" (child) and "agogos" (leading). Therefore, pedagogy is more specifically the art and science of teaching children. However, sometime in the past, this term came to refer to the teaching of all people. In the words of the leading adult educator Malcolm Knowles (1970, cited by Ingalls 1973:5), "most teachers of adults have only known how to teach adults as if they were children". In the same passage, Knowles also states, "Most of what is known about learning has been derived from studies of learning in children and animals". Although progress has been made since 1970, these comments of Knowles are still relevant today. So what is "andragogy"? Andragogy is "the art and science of leading adult learning", i.e. helping adults to learn (Ingalls 1973:10). The word is derived from the classical Greek "andr" (adult) and "agogos" (leading). According to Ingalls (1973:10), andragogy was first coined by the German grammar school teacher, Alexander Kapp, in 1833. However, the word has only become common, particularly in Europe, in the past few decades. Related to andragogy are the terms "self-directed learning" and "autonomous learning". In this review, I refer to the later terms simply as "adult learning".

**A change in emphasis**

John Ingalls (1973:1) refers to our living in an age of rapid and accelerating change; an age where we are often faced with an over-abundance of information and choice. He continues by voicing concerns over the viability of the "transmittal" theory of education. Ingalls (1973:2) suggests that perhaps the purpose of educators should be "to stimulate in the learner a desire to engage in a lifelong process of discovering what he needs to know". The parallels between this change in emphasis in adult education, and the changes being encouraged within extension, are obvious. The "transmittal" approach to education, where a commodity called "knowledge" is transmitted to the learner, has the same methodological base as the "transfer of technology" approach to extension. On the other hand, many influential researchers of adult education (e.g. Knowles, Boud, Habermas)
and extension (e.g. Röling) reject these approaches as fundamentally unsound for a number of reasons. A key reason is that knowledge is not transferred, it is emergent. In the words of Kolb (1984:38), "knowledge is a transformation process, being continuously created and recreated, not an independent entity to be acquired or transmitted".

The "new paradigm" approaches to extension, which include action research, are in accordance with the view that the role of the extension agent (or facilitator of adult learning) is to stimulate processes of continuing discovery and growth, of which learning and situational improvement on- and off-farm will be the outcomes. The extension authorities Van den Ban and Hawkins (1988:22) have stated "Farmers may be educated in two different ways. They may be taught how to solve specific problems or they can be taught the process of problem-solving" (italics inserted). These authors then suggest (1988:23) "an important task for extension agents (is) to support and facilitate ... self-directed learning". Such statements are one example of the similarity between modern views of adult learning and agricultural extension.

**Pedagogy and andragogy**

The basic format of the pedagogical model is a *content plan*, while the basic format of the andragogical model is a *process design* (Knowles 1984:13-14). In his characterisation of each approach, Knowles (1984:8-9) states that some basic assumptions and characteristics of the pedagogical model are: the only role for the learner is to submissively carry out the teacher's instructions, the learner has little experience and techniques of transmission are paramount, readiness to learn is largely a function of age, learning is to have a subject-centred orientation, and learners are motivated by external pressures. In contrast, the assumptions and characteristics of the andragogical model are: the learner is self-directing and will not learn as well if feeling unduly imposed upon by the facilitator, the learner enters the educational activity with substantial experience which is a valuable resource for themselves and other learners, adults become ready to learn when they experience a desire to know or do something in order to perform more effectively in some aspect of their lives, adults enter an educational activity with a problem-centred orientation to learning, and the more potent motivators for learning are internal for example self-esteem (Knowles 1984:9-12).
Ingalls (1973:9), with acknowledgement to Knowles (1970), chooses to highlight the differences between andragogy and pedagogy with reference to four basic concepts. These are:

i) **Self-concept**

Children are dependent people while adults, by very definition, have a self-concept of autonomy. Even though many adults enter educational settings expecting to be treated like children, once in a submissive position they will tend to feel resentful. This negative feeling will interfere with their learning. The implication is that the relationship between the teacher and the student is reciprocal in the case of andragogy and one-way in the case of pedagogy.

![Diagram of Pedagogy and Andragogy](image)

**Figure 10** Learners' self-concept (source: Ingalls 1973:6)

ii) **Experience**

Adults, in the course of their living, have accumulated vast amounts of experience. They tend to say "I am my experience". On the other hand, children have not, in general, had the opportunity to accumulate much experience. They tend to think "experience is what happens to me". Thus, within pedagogy, the experience of students is seen as having little worth. There is an emphasis on one-way communication techniques. Within andragogy, on the other hand, two-way communication is the norm. Indeed, students can be teachers and learners at the same time. The experience of students is seen as valuable resource which is used to facilitate the learning process.
iii) Readiness to learn

Educational development occurs best through a sequencing of learning activities, for example arithmetic needs to be taught before trigonometry. However, adults tend to have already developed basic competencies. In pedagogy, the teacher decides both the content of the learning, and how and when it will take place. On the other hand, in andragogy the learners decide what they want to learn based on their perceptions of the demands of their life situations. The facilitator of andragogical learning acts as a resource person to help the learners form interest groups and diagnose their own learning wants.

Figure 12 Learners' readiness to learn (source: Ingalls 1973:8)
iv) Time perspective and orientation to learning

Pedagogy is in terms of "preparing for the future" while andragogy is for "doing in the present". Andragogy is a process for problem finding and problem solving in the present. This problem-centred approach is in contrast to the subject-centred orientation of pedagogy.

![Diagram showing differences between Pedagogy and Andragogy](source)

Figure 13 Learners' orientation (source: Ingalls 1973:9)

Before moving on, it is appropriate to mention two additional points. Firstly, there is no fundamental difference in the way children (not including infants) and adults learn (Knowles 1970, cited by Ingalls 1973:4). Rather, it is the situations surrounding learning that differ greatly between children and adults. Secondly, in some circumstances, andragogical methods are entirely appropriate for children, and pedagogical methods appropriate for adults, for example in basic skills training (Knowles 1984:6). To a strictly limited extent, the two approaches to education can be complementary.

Experiential learning

A key exponent of experiential learning is David Kolb, who has devoted a most informative book to the subject. The discussion in this sub-section is derived from the work of Kolb, who in turn acknowledges the earlier work of many others, including Kurt Lewin, John Dewey, and Jean Piaget.

Kolb (1984:25-38) characterises learning with the following statements:

* learning is best conceived as a process, not in terms of outcomes
* learning is a continuous process grounded in experience
* the process of learning requires a resolution of conflicts between dialectically opposed modes of adaptation to the world
* learning is an holistic process of adaptation to the world
* learning involves transactions between the person and the environment
* learning is the process of creating knowledge

It was stated in the introduction to this literature review that learning is inescapably a function of our human form. Our brain has left and right hemispheres. These hemispheres are related, but perform different functions. Kolb (1984:58) considers there to be a convergence of evidence from the fields of philosophy, psychology, and physiology describing two basic structural dimensions of the learning process. The first is a prehension dimension that includes two dialectically opposed modes of grasping experience, one via direct apprehension of immediate concrete experience, the other through indirect comprehension of symbolic representations of experience. The second is a transformation dimension, which includes two dialectically opposed modes of transforming experience, one via intentional reflection, the other via extensional action. These structural dimensions, and Kolb's rendition of the adult learning cycle are depicted on the following page.
Kolb has introduced the concept of learning styles. He states (1984:95,97) "Learning styles are conceived not as fixed personality traits but ... as adoptive states or orientations that achieve stability through consistent patterns of transaction with the world. For example, I may encounter success as I deal with a problematic situation using an analytical (assimilatory) orientation. This success may then reinforce my assimilatory tendencies further. On the other hand, such tendencies do not mean that I will approach every situation, every time, with that orientation. All of us use all of the four orientations to learning, but to varying degrees. Kolb labels the four learning styles as accommodation (doing), divergence (exploring), assimilation (analysing), and convergence
(deciding). He states that these styles are influenced by our past experience and present environment, eg. the demands of our current job. No one learning style is superior to the others, neither is it best to achieve a "balanced as possible" score when having one's learning style assessed. It is true, however, that the learning styles will differ in their applicability according to the nature of the problematic situation faced.

In addition to the two dimensions of prehension and transformation, Kolb proposes a third dimension to learning - that of development (see Figure 15 below). According to Kolb, the four functions of the learning process (i.e. accommodation, divergence, assimilation, and convergence) become increasingly integrated at higher stages of development. Kolb (1984:140) refers to learning development in the following manner: "This process is marked by increasing complexity and relativism in dealing with the world and one's experience and by higher-level integrations of the dialectic conflicts among the four primary learning modes" (italics inserted). He further states (1984:141) that the process of human development through learning can be divided into three broad stages of maturation: acquisition, specialization, and integration. These three stages of maturity are related to chronological age, however, an individual's development will also depend on their environment and idiosyncratic nature. Furthermore, development is not simply a matter of progressing from one discrete stage to another - the aspects of development are as varied and complex as our own nature.
Figure 15 The experiential learning theory of growth and development
(source: Kolb 1984:141)

Further models and theories of adult learning

The "personal construct theory" of George Kelly (1955, cited by Boud et al. 1985:23) is often referred to in discussion on learning. This theory refers to the unique and differing perceptions of individuals. It states that objects, events or ideas are only meaningful when seen from the perspective of the person construing their meaning. One may think that conceptions may differ
among individuals, but that perceptions do not. For example, discounting differences in eyesight, one may consider that when different people look at the same object they will see the same image because their instrument for seeing, i.e. the human eye, is identical. However, this is not the case. For each retinal neuron of the optic nerve, there are hundreds of other neurons which also project onto the optic nerve (Matura and Varela 1988:162). Kelly's personal construct theory has significant implications for adult learning.

Symbolic interactionist theory, first expounded by Herbert Blumer of the Chicago School, also emphasises the differing perceptions of individuals. The theory states "that people react to circumstances as they see them, that different people see circumstances differently" (Worsley et al. 1977:548-549). Symbolic interactionism holds that individuals, as well as being socialised, are also self-determining and capable of spontaneity and improvisation (Worsley et al. 1977). According to Worsley et al. (1977:552) "the symbolic interactionist perspective sees social order as emerging from the ongoing process of interaction between the members of a society as they define and react to situations". One may replace "social order" with "knowledge" in the previous sentence, as the later is also an emergent product of peoples' interaction. According to Foddy (1993:20), "in brief, symbolic interactionists claim that social actors in any social situation are constantly negotiating a shared definition of the situation ... and interpreting one another's behaviour as they imaginatively construct possible lines of interaction before selecting lines of action for implementation".

Symbolic interactionism sees human communication as reflexive in character (Foddy 1993). To provide an example of this reflexive character, when a survey respondent encodes his answer to a question he will take into account his own purposes and presumptions/knowledge about the interviewer, as well as his perceptions of the interviewer's presumptions/knowledge about himself (i.e. the respondent). There are parallels with the Action Science of Argyris and Schön, which also emphasises taking account of other's presumptions. There are also highly significant parallels between symbolic interactionist theory and experiential learning theory, the constructivist research paradigm, and action research. For example, each emphasises the emergence of shared understanding, of constructs, as individuals interact. Worsley et al. (1977:547) capture one
similarity neatly when they state "(symbolic interactionist theory sees that) participants in an organisation are 'working it out' even as they carry it on".

Knowles, as stated earlier, sees the basic format of andragogy as process design. His conception of this process design (Knowles 1984:14-18) consists of seven elements:

i) **Climate setting**
Knowles contends that a climate which is conducive to learning is a prerequisite to effective learning. The physical aspects of such a climate would be a comfortable room temperature, regular meals and breaks, chairs arranged in circles, etc. However, Knowles considers the psychological climate to be of greater importance. Aspects of a psychological climate conducive to learning include mutual respect, collaborativeness, mutual trust, supportiveness, openness and authenticity, pleasure, and humanness. Knowles encourages his students to support each other, and defines his role as that of helper. He provides support by "accepting learners with an unqualified positive regard". He considers that learning should be fun, and says "The more people feel they are being treated as human beings, the more that they are likely to learn".

ii) **Involving learners in mutual planning**
Knowles contends that people feel committed to a decision in proportion to the extent to which they have participated in it. Likewise, people tend to feel uncommitted to a decision to the extent that they feel others are making it for them and imposing it on them.

iii) **Involving participants in diagnosing their own needs for learning**
Knowles considers that a balance has to be struck between the felt wants of learners and the ascribed wants that their organisations or society has for them. He recommends the use of competency models, from which learners can identify gaps between where they are now and where they would like to be.

iv) **Involving learners in formulating their learning objectives**
Knowles recommends the use of "learning contracts" at this stage. The procedure Knowles uses to help students design and execute learning contracts is as follows: 1) each learner transcribes a diagnosed learning want into a behaviour to be achieved (for simple learning) or a direction of improvement in ability (for more complex learning), 2) necessary resources and strategies to achieve the learning objective are jointly identified, 3) the learner specifies what evidence will be
collected for indicating the extent to which each objective was accomplished, and 4) the learner specifies how this evidence will be judged or validated. After the learners complete their first drafts of the contracts they review them with small groups of their peers, then with Knowles himself. Thereafter, the contracts are executed while Knowles acts as a consultant and resource to the student.

v) **Involving learners in designing learning plans**

See the discussion on "learning contracts" in section iv) above.

vi) **Helping learners carry out their learning plan**

See the discussion on "learning contracts" in section iv) above.

vii) **Involving learners in evaluating their learning**

See the discussion on "learning contracts" in section iv) above.

Knowles makes the further point that, in accordance with trends apparent within the field of evaluation, much of this evaluation will be qualitative, rather than quantitative, in nature.

A revealing study of development in adult learners was conducted by Perry and his colleagues (1970, cited by Boud 1981:30) among Harvard undergraduate students. The intellectual and ethical development of students was characterised with reference to a sequence of positions which describe the students' general approach to learning and the world. It is interesting to note the parallels between the increasing sophistication identified by Perry, and other researchers' renditions of human development (e.g. that of Kolb 1984). The nine positions identified were:

**Position 1**: The student sees the world in polar terms. Right answers for everything exist.

**Position 2**: The student perceives diversity of opinion and uncertainty, and accounts for them as unwarranted confusion.

**Position 3**: The student accepts diversity and uncertainty as legitimate, but still temporary in areas where authority "hasn't found the answer yet".

**Position 4**: (a) The student perceives legitimate uncertainty, and diversity of opinion, to be extensive and raises it to the status of an unstructured epistemological realm of its own in which "anyone has a right to his own opinion". This realm he sets against authority's realm
where right-wrong still prevails; or (b) the student discovers qualitative contextual relativistic reasoning as a special case still within authority's realm.

**Position 5:** The student perceives all knowledge and values, including authority's, as contextual and relativistic.

**Position 6:** The student apprehends the necessity of orienting himself in a relativistic world through some form of personal commitment (as distinct from unquestioned or unconsidered commitment to simple belief).

**Position 7:** The student makes an initial commitment in some area.

**Position 8:** The student experiences the implications of commitment, and explores the issues of responsibility.

**Position 9:** The student experiences the affirmation of identity among multiple responsibilities and realises commitment as a *constant, unfolding activity* through which he expresses his lifestyle" (Perry 1970, cited by Boud 1981:30-31; N.B. summarised by the author, italics inserted).

Entwistle and Ramsden (1983, cited by Boud *et al.* 1985:24), and others, have identified two approaches to learning which they classify as "deep" and "surface" approaches. In the "surface" approach there is the "treatment of tasks as unrelated, an emphasis on memorisation and an attitude of unreflectiveness". On the other hand, the "deep" approach is characterised by an "integration of formal learning with personal experience, the formation of relationships between parts of knowledge, and a search for meaning". Entwistle and Ramsden point out that students can, and do, choose to adopt either of the two extremes of approach, or something in between, depending on their circumstances and their intentions at the time.

A leading theorist and exponent of the "new" approaches to adult learning is Jack Mezirow. Mezirow has been influenced by the Frankfurt School, which includes Jürgen Habermas. Like the Frankfurt theorists, Mezirow presents many of his concepts in trinities, in the tradition of Hegel. Mezirow (1985:17) distinguishes three interrelated but distinct functions of adult learning: instrumental (technical) learning, dialogic (interpretive) learning, and self-reflective (emancipatory) learning. Each of the three functions "has its own distinctive learning purpose, content, methods,
and *its own criteria* for assessing the validity of an idea" (Habermas 1971, cited by Mezirow 1985:18; italics inserted).

Mezirow (1985:18-19) considers instrumental learning to be task-orientated problem solving that is relevant for controlling the environment or other people. Somewhat unfairly and mistakenly, in my opinion, Mezirow (1985:26) considers the learning espoused by Knowles to be primarily instrumental. Mezirow states that, in instrumental learning, meaning is inferred deductively. The learning always involves a prediction (e.g. a hypothesis) about observable things or events that can be proved correct or incorrect. It is directed towards the determination of cause-effect relationships. Instrumental learning is learning "how to" - it does not deal with "why". In Mezirow's opinion (1985:18), there is a widespread assumption that all adult learning proceeds as does instrumental learning. He says this has been a most pervasive distortion, and hindrance, to research on adult learning and the application of andragogy.

In dialogic learning, "we learn what is valid in the assertions of others, and we gain credence for the validity of our own ideas by relying on as broad a consensus as possible of those whom we accept as informed, objective, and rational. Because new information and new criteria of rationality can always emerge, the validity of consensual judgements arrived at through dialogue is always provisional" (Mezirow 1985:19). According to Mezirow (1985:20), "The purpose of dialogic learning is not to establish cause-effect relationships but to increase insight and understanding through symbolic interaction". In such learning, we attempt to understand what others *mean* when communicating with us.

Self-reflective learning is learning by which we come to better understand ourselves. It is particularly concerned with revealing assumptions which hinder our growth. For example, we all have unexamined assumptions, such as "never confront others" and "never do less than or better than others", which have stayed with us from earlier times - particularly the dependent and uncritical (i.e. before we learnt to discriminate) period of childhood. Many of the assumptions will no longer be relevant and have become "dysfunctional", while others were always erroneous and unhelpful, for example "never cooperative with the police, not one of them can be trusted". Such
dysfunctional assumptions hinder our attempts to live a more rational, just, and fulfilling life. It is only by revealing our assumptions, through individual and collective reflection, and examining them that we can choose to retain or discard them. We cannot understand and overcome what we are unaware of. Mezirow (1985:21) talks of self-reflective learning in the following manner, "The learner is presented with an alternative way of interpreting feelings and patterns of action; the old meaning scheme or perspective is reorganised to incorporate new insights; we come to see our reality more inclusively, to understand it more clearly, and to integrate our experience better".

Mezirow has developed a critical theory of self-directed learning. I consider this theory to provide useful insights into adult learning. Mezirow regards adult learning with reference to meaning schemes and perspectives. According to Mezirow (1985:21-22), meaning schemes are sets of related expectations which guide the way in which we experience, feel, understand, judge, and act upon our situation. A meaning perspective is a personal paradigm involving cognitive, conative, and effective dimensions. It is a frame of reference made up from a system of meaning schemes, which assimilates and transforms new experience, and positions us for action. By defining our expectations, a meaning perspective selectively orders what we learn and the way we learn it.

Mezirow discriminates between meaning perspectives on the basis of authenticity. He states (1985:22) "one meaning perspective is more authentic than another meaning perspective when it is more informed by complete and accurate information; more inclusive, discriminating, and integrative of experience; more free from the influence of internal or external constraint or coercion: more critically reflective - informed by a clear understanding of the historical, cultural, and biographical reasons for its having been acquired in the first place and of the functions that it fulfils; and more permeable - open to discourse with alternative perspectives on disputed validity claims". Mezirow further states (1985:22) "The fully functioning, self-directed adult learner moves consistently toward a more authentic meaning perspective".

Mezirow (1985:22-23) contends that three learning processes are operative in each of the domains involving instrumental, dialogic, and self-reflective learning functions. The first process is learning within meaning schemes, i.e. learning to further differentiate and elaborate within the meaning
schemes we take for granted. The second process is learning new meaning schemes. It involves incorporating new meaning schemes, which are sufficiently consistent and compatible with existing meaning schemes, within a prevailing meaning perspective. In this case, "the prevailing perspective is strengthened, because the understanding that it makes possible extends to new areas of experience" (Mezirow 1985:23). Mezirow states that identification plays a large role in this second kind of learning.

The third process is learning through meaning transformation, that is, becoming aware of specific assumptions ... on which a distorted or incomplete meaning scheme is based and, through a reorganisation of meaning, transforming it" (Mezirow 1985:23). Mezirow (1985:24) states that there are two ways in which transformation works: "Old meaning schemes or perspectives are brought into consciousness and negated, or they are modified and synthesized with a more insightful new viewpoint".

Learning through meaning transformation can be a dramatic and painful process. Mezirow (1985:24) contends "Perspective transformation occurs in two dimensions, either through an accretion of transformations in specific meaning schemes or as an epochal transformation of a system of meaning schemes. The former is more common, the latter more dramatic". Epochal transformations involving an ideology are akin to religious conversion. Because epochal transformation often involves a comprehensive reassessment of our deep-seated values, it is a painful process in which the affective dimension of learning plays a crucial role.

Mezirow is particularly interested in discourse (as defined by Habermas) leading to dialogic and self-reflective learning via meaning transformation; with the outcome of full enfranchisement of the learners. Mezirow is greatly concerned that people become aware of and then work to overcome the assumptions which inhibit their growth and ability to live the kind of life they wish for. Hence, Mezirow places great importance upon self-reflective learning. He considers that the literature on adult learning theory neglects critical reflectivity, "which is what makes meaning transformations possible" (Mezirow 1985:25).
Mezirow has definite ideas about the kinds of goals of adult learning which are worthy, and the role that the facilitator of adult learning should play. Some may see his thoughts as utopian and potentially prescriptive. Mezirow states (1985:27) "it seems gratuitous to fix learning objectives at the outset as criteria against which learning gains are to be assessed" and "The oppressed tend to internalize the values of their oppressors". He goes on to say (1985:28) "Real interests (learning goals) are the interests we would form if we had more perfect knowledge and freedom". Mezirow provides the example of "a woman who has always accepted the traditional stereotypic woman's role" and says "She would know what she wanted if she could know what she could want" (Mezirow 1985:28). Mezirow contends (1985:28) that it is the role of the adult educator to attend to the learning needs or interests "that help learners to move in the direction of more authentic meaning perspectives". This is to be done by enabling the learners to "participate fully and freely in dialogue so that they come to understand their experience better while preserving the rights of others to do the same" (Mezirow 1985:28).

Stephen Brookfield shares similar sentiments to Mezirow. He states (1985:10) "We operate within self-imposed limits ... we are trapped in our own history". Hence the need for critical reflection and perspective transformation. Brookfield goes on to say (1985:10) "it is hard to imagine an adult deciding to shift paradigms, transform perspectives, or replace one meaning system with another purely as a result of his or her own free will". Brookfield (1985:10) recommends that the adult teacher "encourage adult students to view knowledge and truth as contextual, to see value frameworks as cultural constructs." He also states that self-directed learners do not learn in isolation. Rather, the more successful of such learners rely heavily upon informal networks, peer comparison, etc. Brookfield refers to what Mezirow calls "meaning perspectives" as the learners' "mediatory mechanism". According to Brookfield (1985:9), each learner has a unique mediatory mechanism which classifies all new stimuli. The mechanism is a product of the learner's experiential learning to date. Like Mezirow, Brookfield strongly encourages critical reflection in adult learners. Also like Mezirow, he defends the right of adult educators to put forward other meaning perspectives (other ideologies) to learners which may be useful in revealing the learners' "true" interests.
Brookfield is critical of the "theoretical edifice" of adult learning, as develop by Malcolm Knowles and Allen Tough (among others). He states andragogical theory has a number of doubtful propositions and a dangerously narrow sampling frame (i.e. middle-class whites of North America). Brookfield (1985:6) is critical of those who think along the lines "Self-directed learners are ... so in control of their learning that those who teach adults are merely resource persons whose role is to facilitate this learning". He continues by stating "if followed to its logical conclusion, this positions condemns adults to conduct self-directed learning projects within their own, often narrowly defined, frameworks of thought and action".

Reflection

Reflection is at the heart of adult learning. It is the cognitive process whereby experience is explored, transformed, and made meaningful. The outcomes of reflection can include new perspectives on experience, changes in behaviour, readiness for the application of new knowledge, and commitment to action. The transformations of meaning perspective and the self-reflective learning mentioned above are outcomes of reflection. In adult learning sessions it is often assumed that reflection is occurring, and effectively so for each learner. However, Duley (1981:611, cited by Boud et al. 1985:8) has pointed out that "The skill of experiential learning in which people tend to be the most deficient is reflection". Furthermore, unconscious reflection is considered, at least by Boud et al. (1985:19), to be insufficient for effective learning.

If wishing to learn about reflection, a perusal of Boud, Keogh and Walker's (1985) excellent book "Reflection: turning experience into learning", particularly the Introduction and Chapter One, is highly recommended. Except where otherwise indicated, the following discussion derives from the writings of these three authors in the abovementioned book.

Habermas (1974, cited by Boud et al. 1985:25) has defined a purposeful reflective process which he calls "critical intent". This is seen as "the disposition to investigate and reconstruct an aspect of the social and moral environment to achieve enlightenment and ultimately emancipation". Habermas' "critical intent" is closely related to Mezirow's "perspective transformation" and Freire's "conscientization". All three processes involve learners becoming critically aware of how their
assumptions about the world, their habitual ways of thinking and acting, constrain them. Such enlightening processes are typically carried out in group settings.

Mezirow (1981, cited by Boud et al. 1985:25) has developed upon the theoretical framework of Habermas to identify and define some of the major dimensions, or types, of reflection. Mezirow defines some of these concepts as follows: reflectivity is the act of becoming aware of a specific perception, meaning or behaviour of our own; affective reflectivity is becoming aware of how we feel; discriminant reflectivity assesses effectiveness, judgemental reflectivity is making and becoming aware of our value judgements; and conceptual reflectivity is becoming conscious of our awareness and critiquing it.

Powell (1985:43) mentions the method of "currere", which involves: i) recapture of the past with no attempt of interpretation, ii) free association/future integration, iii) description of current feelings, and iv) a synthesis of these three sets of data. Pearson and Smith (1985:72) detail a kind of reflection referred to as "debriefing". They mention that "debriefing is that phase in experience-based learning where purposeful reflection by an individual or a group takes place". The stages of debriefing are described by Pearson and Smith as being: i) what happened? ii) how did the participants feel?, and iii) what does it mean? "Counselling" is a method of facilitating learning, and reflection, favoured by Main (1985). In the words of Main (1985:94) "Counselling involves three phased activities: first listening and exploring, then understanding and relating, and finally focussing and assisting". Main sees counselling as a way to help students be receptive, personalise information and develop trust in reflection.

A model of reflection

Boud et al. (1985:20) state that "the general features of reflection (as espoused by different authors) ... are similar" Boud et al. (1985:36) then proceed to provide an impressive model of the reflective process. This model is relatively complete but the authors do acknowledge that it is not fully supported by research. In their opinion, little research has been conducted on reflection to-date and that which has been undertaken offers few practical guidelines to follow. The model consists of
three stages. These are: returning to the experience, attending to feelings, and re-evaluating the experience.

![Diagram of the reflection process in context](source: Boud, Keogh and Walker 1985:36)

**Figure 16** The reflection process in context

**Returning to experience**

The act of returning to experience, may be prompted by feelings of "inner discomfort" and doubt, or it may be prompted by positive feelings, for example those following the successful completion of a task previously thought impossible. Returning to experience is simply the recollection of events, whether replaying them in the mind as an individual or by recounting them to others in a group setting. It is most important at this stage that there be close attention to detail and that the individual (or group) refrain from making judgements. The learner should stand back from the immediacy of the experience. It can help to review any notes taken and ask oneself "why did I write this?" Returning to experience is not a one-off event, rather it may need to be repeated many times and from many perspectives.

A written record of events (and feelings) can greatly assist the stage of "returning to experience". Walker (1985) promotes the use of a "portfolio" - or work book/dairy. He makes the following recommendations: record personal, spontaneous information in the portfolio as soon as possible, record selectively (i.e. do not write too much), use a 'loose-leaf' style to enable insertion, and
re-read it weekly - perhaps with others. The keeping of a portfolio can be time consuming so it is important to "record less and reflect more" (Walker 1985:66).

Attending to feelings

Boud et al. (1985:29) consider that negative feelings can hinder reflection but not positive ones. They state that if negative feelings form barriers these need to be recognised as such and removed before reflection and learning can proceed. Negative emotional barriers can be overcome, for example, by releasing those emotions, accepting them, "working through" them, or setting them aside temporarily. Caution should be employed with the last tactic, as removing these distorting feelings from our consciousness does not remove the potentially debilitating effects that they have on our mental processes (Boud et al. 1985:30). On the other hand, the authors consider that positive feelings enable us to persist in challenging situations, see events more sharply, and develop emotionally. The possibility that positive feelings can interfere with reflection, for example by contributing to over-optimistic "blindness", is not discussed in the text.

A lone individual can effectively carry out reflection, however, "often the learning process can be considerably accelerated by appropriate support, encouragement and intervention by others" (Boud et al. 1985:36). Boud et al. (1985:38) summarise the role of facilitators of reflection as follows: "to provide a context and a space to learn, give support and encouragement, listen to the learner and provide access to particular devices which may be of use. They may also at times act as a sounding board and help the learner clarify intentions and set goals".

Carl Rogers (1961:357, cited by Knights 1985:88) has argued that "by setting up conditions of psychological safety and freedom, we maximise the likelihood of an emergence of constructive creativity". Knights (1985) promotes facilitative listening as a way to enhance reflection. In her opinion (1985:85) "in the learning situation, reflection is most profound when it is done aloud with the aware attention of another person". Knights recommends that learners be given time to "reflect aloud", without interruption, in an atmosphere of support.
Boud et al. (1985:38) contend that the affective dimension of reflection has not been taken into account in most research on learning. For example, Dewey (1933, cited by Boud et al. 1985:21), and others, have assumed reflection to be a highly rational and controlled process. Some modern theorists primarily interested in politics and power relations within learning, such as Kemmis (1985), also appear to ignore the affective dimension of reflection.

Re-evaluating experience

The first two steps of attending to detail and feelings minimise the risk of "operating on false assumptions or reflecting on information which we have not comprehended sufficiently" (Boud et al. 1985:30). The third step of the reflective process is re-evaluating experience. Boud et al. (1985:30) have distinguished four aspects of re-evaluation. These are: association - relating new knowledge to existing knowledge, integration - seeking relationships among one's knowledge, validation - to determine the authenticity of the ideas and feelings which have arisen, and appropriation - making new knowledge one's own. Depending on the learner's intent, not all of these four aspects will be explored, nor is there necessarily an order to their exploration.

"Association is the connecting of the ideas and feelings which are part of the original experience and those which have occurred during reflection with existing knowledge and attitudes" (Boud et al. 1985:31). The process of association should not be rushed, as associations immediately identified "might only pursue a well-worn path which does not lead to new conceptions" (Boud et al. 1985:37). The psychoanalytic technique of "free association", whereby one suspends judgement and allows the mind to explore freely, is a useful way to become aware of new, potentially fruitful associations. In the words of Boud et al. (1985:32) "The greater the number of associations which can be generated at this stage the greater will be the potential for integration".

"There are two aspects to integration. The first of these is seeking the nature of relationships that have been observed through association. The second is drawing conclusions and arriving at insights into the material which we are processing" (Boud et al. 1985:32). Whereas association brings together ideas in an almost indiscriminate manner, integration begins the process of discrimination in reflection. Visual methods, such as brain-patterns (Buzan 1982), concept maps (Novak 1977)
and Venn diagrams (White 1982) can be useful when dealing with complex cognitive material (all
cited by Boud et al. 1985:32). Where visual methods are inappropriate, the use of analogies,
similes and metaphors can be helpful. Integration is a process of synthesis of one's knowledge.

"In validation ... we are testing for internal consistency between our new appreciations and our
existing knowledge and beliefs, for consistency between these and parallel data from others and
trying out our new perceptions in new situations" (Boud et al. 1985:32). If contradictions arise
from the "reality tests" we impose during validation then it is necessary that we reappraise the
situation and decide on what basis we should proceed. One very common technique which can be
used in validation is rehearsal. Rehearsals, in which our newly-integrated knowledge is conceptually
applied to "real life", can be acted out, for example role-playing; or they can be carried out
cognitively, for example thinking through a potential activity in one's head or as we write it down
on paper.

In many cases it can be sufficient that new knowledge is merely integrated with our "cognitive
map" of the world. However, there is a further step which may occur - the step of "appropriation".
When knowledge is appropriated it becomes part of our value system, part of our ego.
Appropriated knowledge can become a significant force in our lives. Boud et al. (1985:34)
consider that "We usually cannot predict which learning will become such a central part of
ourselves. All that we can hope for is to select those experiences which are significant to us and
ensure that we have processed them in the best way that we can find".

A summary of reflection
Boud et al. (1985) have proposed a model of reflection which includes the stages of "returning to
experience", "attending to feelings" and "re-evaluating experience". This model needs not be
slavishly followed as the different aspects of reflection and experience intermingle. However, the
authors suggest this model may be useful to identify areas where reflection is deficient. Aside from
the most obvious aspect of making time available for reflection, Boud et al. (1985) consider that
the most promising area for the improvement of reflection is in paying sufficient attention to the
learner's affective state and providing support to ensure positive emotions on the part of the learner.
Summary of the literature review and conclusions

The thoughts of some of the leading figures in the field of adult learning, at least within Anglophone literature, have been introduced. Each author has his or her own emphases, but there are important underlying similarities in their conceptualizations of adult learning. There is clear agreement that: learning is a process, there are identifiable elements to this process, knowledge emerges from this process (it is not an independent entity amenable to transmission), learning involves interaction between people and their environment (which includes other people), adult learners bring valuable experience to the learning situation but they also bring self-deceit (which may be uncovered by critical reflection), the role of the teacher of adults is that of facilitator, adults learn best when they are happy and in a supportive environment, and the development of adult learners is characterised by their increased complexity, integration, holism and relativity. Many other aspects of adult learning, upon which there is further agreement in the literature, are mentioned earlier in this review.

There are theories which provide insight into the fundamentals of adult learning. These include Kelly's theory of personal constructs and Blumer's symbolic interactionism. Some of these theories were mentioned earlier but not elaborated upon as they are peripheral to the topic of this review. The theories and models of adult learning which were discussed in detail, for example Kolb's theory of experiential learning and the model of reflection of Boud and colleagues, should not be seen as rigid, final, and prescriptive. Rather, they have the purpose of enhancing our understanding of adult learning through the presentation of coherent stories.

Experiential learning theory, as expounded by Kolb, provides a relatively complete account of adult learning and has profound implications for andragogical practice. One implication is that the process of learning can occur in any situation. In the words of Candy, Harri-Augstein and Thomas (1985:101), "By far the largest proportion of learning occurs in situations, without a teacher, which are neither planned nor mediated as educational". A second implication is that action as well as reflection are necessary aspects of a complete learning experience.
Andragogical theory and practice, as developed by Knowles and his colleagues, is directly applicable to fields such as agricultural extension. Indeed, extension can be considered as applied andragogy. The andragogical process has been described as circular in nature (Ingalls 1973:10). In many other respects too, andragogy can be seen to very much overlap with action research. Knowles (1984:21) has stated "andragogy's greatest impact has been in action".

Many modern theorists of adult learning are particularly concerned with individual and group development and emancipation. These theorists point out our need to become aware of, then overcome, our self-limiting constructs in order to grow. Such development involves transformation of our "world views". Mezirow (1985:23) states "Illumination comes only through a redefinition of the problem". The critical process by which we conduct this kind of learning is called reflection. Boud, Keogh, and Walker (1985) have developed an admirable three-stage model of reflection which emphasises the desirability of our concentrating upon different aspects of reflection at different stages of the process. These authors particularly feel that attention should be paid to the enhancement of positive feelings in learners.

All authors of literature on adult learning emphasise our humanness. We are what we are. Human beings learn best when interacting with others. Therefore, although adults are autonomous in some respects, the most effective learning does not occur when learners are isolated. Boud (1988:29) characterises the stages of development in learning as follows:

Dependence → Counter dependence → Independence → Interdependence

It has been mentioned throughout this review that people learn best when they are internally-motivated, happy and self-confident. The role of the adult educator is that of a supportive facilitator. Carl Rogers is described by Boud (1981:36) as probably the single most important figure in the emergence of self-directed (i.e. adult) learning. Rogers' emphasis on the role of the adult educator is on facilitating group interaction and avoiding directedness. It was Rogers who first used the phrase "unqualified positive regard" to describe his attitude of acceptance and support towards his students. Rogers (quoted in Kirschenbaum 1979, cited by Boud 1981:37) has stated "We moved
from the *method* to the *attitudes* to the *relationship* as the key ingredient in the (educational) process". Boud (1988:39) echoes these thoughts with respect to the fostering of autonomy in the learning of adults. Hence, relationships between the adult educator and his or her co-learners may be considered to be of greater importance than technique; as long as technique is sufficiently in accordance with the basic principles of the adult learning process.

**Some Important Adult Learning Principles** (adapted from Packham 1988, who in turn acknowledges Brundage and MacKeracher 1980).

* adults enter learning with existing knowledge and feelings. These should be respected and valued.
* past experience is both a helpful resource and a potential hindrance to new learning.
* the act of transforming experience requires more time and energy than other types of learning.
* adults learn best in supportive environments.
* adults are highly motivated to learn in areas relevant to their current life functions.
* regular feedback and interaction are necessary for learning development.
* adults learn best when they can set their own pace.
* adult learning ideally focuses on learning for both autonomous mastery of one's own life and for belonging to and participating in groups. Learning programs which omit one or the other will give less satisfaction to the learner.
3.1. **A Rationale for the Research**

Throughout this research my underlying objectives were to:

i) understand Maltese vegetable growers of the Sydney region and their industry, and

ii) improve the lives of Maltese vegetable growers, and myself. This second objective was to be achieved by the development of improved learning skills and the use of better farm and extension practices.

A thesis should contribute to public knowledge. With respect to action research, Dick (1993:38) lists the following categories in which contributions may be made:

* to action research methodologies or methods;
* to the client system, and perhaps (with extreme caution) to other similar systems;
* to possible changes to the client system, and perhaps (with extreme caution) to changes in other settings.

This thesis concentrates on the later two of Dick's categories. Brown *et al.* (1988:349) state that three kinds of data are appropriate for action research, namely, "what the strategic action looked like in practice, the effects the action produced and the circumstances in which the action occurred". In this thesis, much description is provided so that the conclusions drawn may be considered with respect to the circumstances in which they arose. My primary area of research has been concerned with the effectiveness and characteristics of adult learning and extension.

This thesis concentrates upon reporting what happened in the three years of this research in order to provide information on: i) Maltese vegetable growers of the Sydney region, ii) alternative extension approaches as practiced by the author in this context, and iii) the adult learning of Maltese vegetable growers. From the latter two objectives are drawn conclusions which are, to some extent, generalisable. For example, the suggestion of development of a set of guidelines for extension with Sydney vegetable growers was offered at the beginning of the research. This suggestion was acted upon and guidelines are listed at the end of this thesis. The guidelines are the result of three years of collective action and reflection. They serve to integrate the emergent knowledge of the research. The guidelines have been written with the intention of adding to public
information and assisting extension agents in general. However, it must be emphasised that they are not rigid prescriptions. The guidelines may narrow down one's choices of action and thus be helpful, but they also need to be modified, in accord with the reader's judgement, to the particular situation of concern.

The breadth of scope covered by the fields of agricultural extension, adult learning, and action research is so vast that it is perhaps impossible to summarise the knowledge presently contained therein. Many disputes and gaps in knowledge are apparent in these fields. However, resolution of some of these areas of contention is not the primary aim of this thesis. Rather, this thesis aims to contribute to public knowledge by detailing an extension intervention and its outcomes, particularly with respect to adult learning.

I considered it appropriate to become familiar with literature on extension, adult learning, and action research because all of these fields were applicable to the problematic situation I faced at the start of the research; namely, how to achieve beneficial change in farm practice and farmers' learning in an effective manner. These fields are linked by their common elements of learning, situation improvement, voluntary change, and the fact that they operate in the human realm. They were all applicable to the problematic situation because it was farmers who were going to change what they did, I was not going to implement farm practices myself.

As alluded to in each of the three literature reviews, at this point in time there is widespread debate within human-based sciences over the relative merits of what may crudely be labelled as traditional "positivist" science versus newer "constructivist" inquiry (Feyerabend 1975, Reason and Rowan 1981, Oliga 1988, Guba and Lincoln 1989). Differing kinds of rigorous inquiry are introduced and explained in the literature review on action research. Depending on one's choice of paradigm of inquiry, there are trade-offs between rigour and relevance, precision and richness (or accuracy and validity), elegance and applicability, objectivity and subjectivity, and verification and discovery (Guba and Lincoln 1989:112-113).
A sub-debate concerns the effectiveness and value of so-called traditional "transfer of technology" agricultural extension versus "newer" participatory and emancipatory forms. This sub-debate is the subject of many papers at recent Australian extension conferences (e.g. Littmann 1987, Macadam and Wilson 1992, Anon. 1993b), and other publications in the literature (e.g. Anon. 1993a, Anon. 1995b). Russell et al. (1989:5) refer to two main traditions in agricultural extension, namely, technical innovation and human resource development. The former tradition encompasses approaches such as "transfer technology" while the later encompasses approaches such as "participatory action research". These two extension traditions are very different, so too are "positivism" and "constructivism".

The literature contains much evidence of parallel trends within extension, adult education, and action research. The changes which are occurring include:

* decreased emphasis on the *transmission* of knowledge and increased emphasis on *stimulating the emergence* of knowledge,

* greater recognition of people as interrelated but separate biological entities with distinctive learning characteristics,

* decreased emphasis on reductionism and increased emphasis on systemic thought and holism,

* reduced emphasis on *content* and increased emphasis on *process*,

* greater recognition of learners' existing knowledge,

* greater situation-specificity and program flexibility,

* a more ethical approach to the promotion of change, and

* client empowerment.

These trends are in response to the changing environment (includes societal and global "mega-trends") in which the above are carried out, the observed outcomes of previous interventions, and theoretical advances in the above and related fields (e.g. psychology).

With regard to the changing environment, there are factors including the following: increased complexity in agriculture, technological advance, greater demands for life-long education, increased
governmental intervention in community life, decreased governmental intervention in agricultural research and extension (in industrialised countries), greater emphasis on the ethical basis for interventions, increased "modernization" and "Westernization" of humanity, and, perhaps, an infusion of "Eastern" and other philosophies (e.g. systemic thought?) into "Western" thought and practice. Not all of these factors operate in every situation. Also, depending on the time scale one chooses, one could say that a particular factor has become less or more important. For example, public sector intervention in agricultural extension in industrialised countries is much greater than one hundred years ago, but probably less than ten years ago. The recent changes in emphasis mentioned tend to refer to the past ten to thirty years.

With regard to the observed outcomes of previous interventions, Woog (1987) cautions us not to be too judgemental in hindsight. He states it is difficult to adequately recapture a previous environment so that conclusions on the effectiveness of previous interventions may be drawn. Nevertheless, there is broad agreement that "transfer of technology" has been a highly successful strategy for a favourably-placed minority of farmers (Russell et al. 1989). However, there have been negative consequences of the strategy such as the development of unsuitable technology and increased inequality in rural communities (Arnon 1989). For example, the "Green revolution" tremendously increased food production, particularly on a per farm worker basis. Conversely, the revolution increased poverty and hunger among some groups. "Transfer of technology" has been shown to be imperfect, and the agricultural environment is now different. New strategies are needed - not necessarily to completely replace previous strategies, but at least to complement them.

Recent theoretical advances offer opportunities for improved agricultural extension. In particular, I consider experiential learning theory (as developed by Kolb and others) to hold great promise. This theory emphasises "learning by doing" and seems to be eminently applicable to the practice of agriculture. Experiential learning is not confined to simple "trial and error". Reflection is also carried out to transform our experience and our constructs so that we may engage the world in better ways. Experiential learning theory is discussed more fully in the literature review of adult learning.
At a fundamental level, Kelly’s theory of personal constructs, Blumer’s symbolic interactionism, Lewin’s group dynamics and field theoretical approach, Argyris and Schön’s Action Science, and numerous other theories can underpin new approaches to extension. More so at the level of methodology and method, advances in action research (e.g. Rhoades, Whyte), Farming Systems Research (e.g. Hart, Conway), and adult education (e.g. Boud, Brookfield, Knowles, Mezirow) provide guides on how to improve extension practice. Within agricultural extension, the recent thoughtful insights and recommendations of extension experts such as Van den Ban, Chambers, and Röling are worth considering.

There is acute awareness among adult educators and constructivists (e.g. Habermas, Mezirow) that our assumptions, our constructs, influence the way in which we conceive and interact with our world. In summary, our basic philosophy influences our day-to-day action. I see a link between the realist ontology, objectivist epistemology and interventionist methodology of the positivist paradigm and extension strategies of the "do to" kind. In an extreme form, the "do to" strategy treats clients as passive objects who have little to offer the extension program, and who will react predictably according to the method of intervention. Further, I see a link between the relativist ontology, subjectivist epistemology, and interpretive (hermeneutic) methodology of the constructivist paradigm and alternative extension strategies of the "do with" kind. The "do with" strategy places greater emphasis on clients' "local knowledge", collaboration, and human development.

Earlier extension theory, and probably less so extension practice, grossly neglected the humanness of ourselves. Extension theorists such as Lionberger (1960) and Rogers (1962) talked of peoples' "mental flexibility" and "cosmopolite orientation"; but overlooked their emotions, spontaneity, etc. This neglect was ill-founded because learning is inescapably a function of our human form. Maturana and Varela (1988:75) point out that a disturbing agent in our environment, such as an extension intervention, only triggers changes in ourselves, it does not specify or direct these changes. Significantly, experiential learning theory is supported by a wealth of empirical data from fields such as psychology and physiology (Kolb 1984).
The interpretivist and constructivist paradigms and their accordant methodologies have much to offer extension practice and theory. These paradigms are not new, they are merely re-popular (Guba and Lincoln 1989:83). Action research recognises our humanity and shares much in common with experiential learning. Most literature on action research deals with industrial and educational (primary and secondary school) settings. However, there are some examples in the literature of action research being successfully used in agricultural extension (e.g. Maclure and Bassey 1991). Action research has been applied to agriculture, particularly in lesser developed countries, since the 1970s (Whyte 1991). Despite this, there appears to remain a perception that action research is not yet proven as a good methodology for agricultural extension (e.g. Guerin and Guerin 1994).

Naturally, the considerable overlap in the thoughts of different action researchers, adult educators, sociologists, and extension theorists is not complete. There are gaps and disputes in the literature concerning questions such as:

* what is the nature of human communication?
* is client participation in extension programming really that helpful?
* how may self and collective critique be encouraged?
* how generalisable are the results of action research projects?
* is the suspension of collaborators' prestige differentials a necessary part of action research?
* what factors lead to knowledge being appropriated, that is, becoming a valued part of ourselves, as opposed to merely accumulated?, and
* how important for learning is a positive emotional state?

In this research, I have attempted to gain experience and insight which may help to partly answer some of the above questions. I have deliberately focussed upon one community, that is, Maltese vegetable growers of the Sydney region, in the hope that collaborators could more readily interact and perhaps work as a group, and so that opportunities for my deep understanding were enhanced.
3.2. Development of the Aims

The aims were modified as the research progressed. The two original research aims were: i) to compare reduced cultivation with existing cultivation in vegetable production; and ii) to compare the effectiveness and characteristics of "action research" and "transfer of technology" as extension methodologies with vegetable growers of the Sydney region. The first aim has remained the same throughout the research. It is concerned with physical and biological aspects. Therefore, cultivation forms part of the context of this human-based research.

The second aim was modified substantially and became the major theme of this thesis. I began the research in ignorance of newer extension and research methodologies, such as action research. I initially wanted to "prove" to myself that these methodologies can be suitable approaches to extension. Therefore, I chose to directly compare "transfer of technology" and "action research". I intended to achieve this comparison by working with two unlike groups of vegetable growers (four in each group), who were geographically separated. The direct comparison was strongly attacked by some staff members of my Faculty for trying to compare like and unlike, and judging one paradigm, i.e. action research, within the confines of another, i.e. positivism (R. Fisher, pers. comm. 1995). Guba and Lincoln (1989:114) contend that two paradigms cannot be compared in a common study for three reasons: 1) if a problem could be found that could be attacked in one paradigm, it would likely be trivial in the other paradigm, 2) the inquiry products will be very different and therefore non-comparable, and 3) the criteria for judging the "goodness" of the inquiry products would also vary. However, Guerin and Guerin (1994) propose the opposite - although I suspect from a position of ignorance of constructivism. In their "Summary of issues in extension that require further research", Guerin and Guerin (1994) list their first issue as "Effectiveness of participatory approaches relative to that of the classical adoption - diffusion approach to extension". In the minds of many this comparative question of effectiveness remains valid, although difficult to answer.

Because of methodological difficulties, the aim of a direct comparison of "action research" and "transfer of technology", as two distinct and "true to form" extension methodologies, was dropped
near the start of the research (March 1993). Thereafter, a less direct comparison of extension approaches which were "largely action research" and "largely transfer of technology" ensued. However, difficulties remained. For example, I needed to play differing facilitative roles with the two groups. Towards the end of 1993 this lesser comparison was also dropped.

As the research progressed the question emerged "Is action research effective with Maltese vegetable growers of the Sydney region?" More truthfully, the question was "Can I, Ashley Arthur Senn, make action research effective with Maltese vegetable growers of the Sydney region?" This research question did not involve direct comparison of action research with more traditional forms of extension. By that time, I was no longer using "transfer of technology", nor attempting to facilitate two distinct groups of vegetable growers. Specific questions encompassed by the broad research question above included the following:

* is the suspension of status roles desirable for group work in this context?
* can the collaborators or the author conceive idealised systems, e.g. for use in Soft Systems Methodology?, and
* can participative and democratic methods which rely upon clients' initiative, commitment and cooperation be successfully implemented by the author in this context?

To avoid potentially upsetting the sensibilities of some proponents of action research, I do not claim to have carried out purist action research. Rather, I used many principles contained in the action research literature to guide my extension activities and interpretation of the research situation (see "Methods", section 3.5.1). I did so because I believed these principles were appropriate to the problematic issue I faced at the beginning of this research (see "General Introduction"). I would like to emphasise that this extension was not confined to cultivation and pre-determined goals. Furthermore, my desire to research and learn was constantly accompanied by a desire to help those with whom I've worked, in ways that they expressed a wish to be helped.

As my relationships with the permanent bed collaborators and other Maltese vegetable growers developed, and my understanding of the research context and the theory of extension and adult
learning deepened, I became increasingly interested in adult learning. Specific questions related to
the broad issue of adult learning included:
* can extension effectiveness be improved if adapted to individuals' learning strengths, as
determined by Kolb's learning styles questionnaire?
* what are influences upon the appropriation of knowledge, and
* is willingness, rather than ability or know-how, limiting change in this context?

3.3. **The Aims of the Research**

I. Observe, describe, and gain insights into adult learning in the research context. Influences
upon, and aspects of, the learning of both Maltese vegetable growers and myself were
investigated.

II.A Observe, describe, and gain insights into the outcomes of my extension/research activities
with Maltese vegetable growers of the Sydney region.

II.B Determine whether strategies and methods in accord with the action research paradigm
are effective for extension with Maltese vegetable growers of the Sydney region.

II.C Develop guidelines for extension activities with Maltese vegetable growers of the Sydney
region.

III. Investigate the hypothesis that "Reduced cultivation equals ordinary cultivation"; for
vegetable production and with respect to crop quality and yield, and soil attributes. The
aim was to see if Maltese vegetable growers can reduce their present amount of
cultivation and at the same time maintain or improve crop production and profitability.
3.4. Methodology

"Methodology" refers to collections, or systems, of related methods whereas "method" refers to particular techniques. Adult educators, including Carl Rogers and Boud (1981), have emphasised the importance of human relationships over method. Texts on action research and qualitative research warn against slavish adherence to particular techniques and methods (e.g. Checkland 1989, Bawden 1991). Therefore, I let broad principles of experiential learning theory and action research guide my research, but I deliberately chose not to rigidly adhere to a research approach in accord with the recommendations of one or two authors. Indeed, such rigid adherence to method would be indicative of the imposition of "treatments" in the manner of positivism or a "sock-it-to-them" approach to extension (Röling 1988:53).

I would have liked to work with Sydney's Maltese vegetable growers using a problem-solving approach, that is, a "do with" strategy. However, growers chose not to dictate the nature of our joint activities, despite my sincere and repeated offers to do (almost) whatever they wished me to (for a large portion of my time). Therefore, I mostly operated using a social marketing approach, that is, a "do for" strategy (see literature review on extension).

My chosen ontology is critical realism (see literature review on action research). I believe there is a "reality", but it can only be discovered from within the knower's perspective. I consider that this position values both interpretivism and empiricism.

My chosen research methodology may be described as experiential, with a relatively heavy emphasis on qualitative and interpretive techniques. There is great overlap between experiential and adult learning theory, as described by Kolb (1984), Knowles (1984), and others; and action research, as described by Lewin (1946), Whyte (1991), and others. The thoughts of these authors, which are described in the literature reviews, have guided my research methodology.
In particular, I have been guided by the experiential learning theory of Kolb (see the literature review of adult learning for a more complete explanation than the one which follows). Kolb's thoughts are succinctly conveyed by Claxton and Murrell (1987:25-26), who state:

Kolb describes learning as a four-step process. Learners have immediate concrete experience, involving themselves fully in it and the reflecting on the experience from different perspectives. From these reflective observations, they engage in abstract conceptualisation, creating generalizations or principles that integrate their observations into sound theories. Finally, learners use these generalizations or theories as guides to further action, active experimentation, testing what they have learned in new, more complex situations. The result is another concrete experience, but this time at a more complex level.

The key aspect of my methodology is the experiential/adult learning/action researching cycle. Knowledge of the adult learning cycle allowed me to conduct activities in such a way as to heighten the learning of myself and others. For example, group meetings were planned so that divergence, observation, reflection, and convergence (for action) were all addressed. The permanent bed trials were suited to such a process. Each crop can be seen as one turn of the adult learning cycle and the sequence of crops at a particular site as a spiral of improvement - in both cultivation practice and the understanding of cultivation practice and its context.

Personal judgement, achieved in consultation with others, guided which kind of activity and learning was chosen at particular points in time. For example, if upon a farm visit a collaborator seemed in a reflective mood, I could take the opportunity to engage in a conversation in which we reflected upon our past activities and their significance.

In addition to self-informing cycles of action and reflection, the following were also part of my methodology: multiple information sources and dialectics, use of the growers' language and meanings, and self and collective critique. These aspects of the methodology are described in the following section on "Methods". When one considers that this research was based on social practices, i.e. farming and extension practice, and that it involved those responsible for the practice
at each of the moments of activity, i.e. at each of the four stages of the experiential learning cycle; then it can be seen that the research methodology shared much in common with action research.

Data analysis was conducted with reference to the "grounded theory" of Glaser and Strauss. "Grounded theory" involves a triad of data collection (acting), coding (analysing), and memoing (reflecting) (Strauss 1987:11). The theory emphasises a continual going back and forth between these three phases. The aim of coding is to "open up" the inquiry with tentative interpretations. Attempts are made to generate genuine categories from field notes rather than merely precis them (Strauss 1987:29). As time goes by, integration becomes a major focus. Core themes are developed and minor ones discarded. With regards to reporting, grounded theory recommends that the researcher write about concepts rather than events, and only write up one idea at a time (Strauss 1987:127-128). This recommendation was followed when writing the discussion of this thesis.

In summary, the experiential learning theory of Kolb, and similar andragogical theories of others, provided a framework which allowed me to conduct the research with care and rigour. These theories did not prescribe, but rather guided, how each activity was carried out and evaluated.

3.5 Methods

The methods used in this study are summarised below and explained in more detail in the following pages. An arbitrary classification of the methods, the categories of which are by no means mutually exclusive, is also provided:

Methods mostly for data quality and analysis
- keeping a diary - 750+ pages long
- self-informing cycles of action and reflection
- multiple information sources and dialectics
- use of the growers' language and meanings
- self and collective critique - the author with himself, his M.Sc. supervisors, the collaborators and other Maltese vegetable growers, etc.
• coding of diary entries leading to the emergence of themes, to be used to describe the 
research situation or to link to theory on adult learning, extension, and action research.

Methods mostly for finding out
• interviews - unstructured, semi-structured, elite, structured
• participant observation
• farm visits
• literature reviews
• standardised survey
• reduced cultivation trials - crop and soil monitoring

Methods mostly for promoting change
• formation of a small group - with the nine collaborators of the permanent bed project
• problem-solving - problems of vegetable production
• information evenings for growers
• seminars for UWS-Hawkesbury staff and students - to achieve change in myself
• bus trips for growers
• field day for growers
• written material - personal letters, leaflets, magazine articles, posters
• reduced cultivation trials - conduct of same (N.B. managed by the collaborators)

Before describing the methods in detail, it is worthwhile to briefly discuss the overall conduct of the 
research. "Finding out" occurred throughout the research and understandings became deeper as 
time went by. However, it is useful to highlight the period of initial "immersion" in the research 
situation, that is, December 1992 to mid-1993. During this time I familiarised myself by visiting and 
talking to vegetable growers, NSW Agriculture advisory and research staff - especially District 
Horticulturists (Vegetables), suppliers to the Sydney vegetable industry and UWS-Hawkesbury 
academic staff and students. I also reviewed literature on adult learning and cultivation.
As mentioned in the "General Introduction", the permanent bed project was my "mechanism of entry to the client system" and my justification for continuing to work with the growers. The collaborators of the permanent bed project were recruited in March and April 1993 and the trial sites established in the following months. Following recruitment of the permanent bed collaborators, participant observation and problem-solving were used to maintain relationships with these growers, develop a deeper understanding and appreciation of the research situation, and achieve change. Various extension activities were also carried out with the collaborators and other vegetable growers. During 1995, especially towards its end, I decreased the frequency of my farm visits and concentrated more upon completing the literature reviews, analysing data, testing interpretations, and writing up.

3.5.1. Methods mostly for data quality and analysis

Personal diary
I kept diaries since the start of the research. Into these diaries went observations, reflections; and notes from my reading of papers and books. Two diaries are relevant to this research; the first dealing with the permanent bed project and field work and the second dealing with my Masters. A third diary relates to vegetables in general and my work for NSW Agriculture. At the end of 1995 the permanent beds diary was three books in length, that is, ~450 pages, (note that measurements from the permanent bed trials are in other books), the Masters diary two books in length (i.e. ~300 pages), with a further book being exclusively for the literature reviews.

Most of the information in the diaries was entered on the day of observation. However, a substantial amount was entered soon after observation (e.g. a few days later). In the latter case, diary entries were made with reference to rough field notes. Comments of reflection are found throughout the diaries. This reflection was mostly carried out while an event was fresh in my mind, for example I may have visited five farms and then written my observations and reflections upon return to my office in the afternoon of the same day. The notes in my diaries were indispensable as I put together my vast numbers of observations into coherent "stories" and also traced the development of my thoughts, my relationships with the collaborating growers, etc.
Self-informing cycles of action and reflection
These are discussed in "Methodology".

Multiple information sources and dialectics
Examples of multiple information sources included different informants talking of the same situation, and the same informant talking of the same situation at different times. As recommended by Dick (1989, 1993) and Guba and Lincoln (1989), I actively sought out differences in observation and opinion in order to heighten mutual understanding. For example, one collaborator may have expressed his views on the reasons for the performance of a particular crop when asked. Later, I might ask again and obtain a different answer. By me pointing out the differences in answer, the collaborator may then have qualified one or both answers and explained how they were consistent (thus providing me with a deeper understanding of the situation), or he may have been prompted to address the inconsistencies of his thinking. Alternatively, I might ask a family member or another grower their view of something, and compare their answer with that of the grower. The dialectics used in this research were principally conducted between myself and individual collaborators on matters concerning crop production and personal values.

Use of the growers' language and meanings
An interpretive approach was employed in this research. The permanent bed collaborators and other vegetable growers were informants of the research situation and experts in vegetable production. Given our markedly different educational backgrounds, it was necessary for me to learn at least some of the growers' language (jargon) in order for us to communicate effectively. A glossary is contained at the beginning of this thesis. To the best of my ability I tried to understand growers' intended meanings, and use their language when communicating my thoughts to them.

Self and collective critique
Collective critique was carried out through dialogue between the author and his M.Sc. supervisors, the collaborating growers, other vegetable growers, the Field Assistant of the permanent bed project, other postgraduate students at UWS-Hawkesbury, etc. Collective critique was also
attempted at the collaborators' meetings. The author conducted self-critique using quiet and solitude with pen and paper. Reference was made to the diary notes and the model of reflection proposed by Boud et al. (1985) (contained in the literature review of adult learning).

Data analysis

In October and November 1995 the Masters and permanent bed diaries were condensed by the author (acting alone). Abbreviations of diary entries, consisting of observations and some reflections, together with brief current reflections, were made. The abbreviated notes were photocopied twice and the two copies assigned "hypotheses" and "descriptive themes". Next, evidence was sought which appeared to either confirm or deny half a dozen tentative hypotheses which had arisen over the preceding 18 months. Such evidence was labelled with a red pen in the "hypotheses" copy of the diary summary. After reviewing the evidence for and against each tentative hypothesis, first separately and then together, it was decided to combine the hypotheses into the three broad research questions presented in the aims of this thesis. It was also decided that it would be most appropriate to discuss these broad research questions with regard to themes which had emerged from the process of summarising the evidence relating to those questions.

A similar process was used with the "descriptive themes" diary summary, excepting that no attempt was made to pre-guess emergent themes. The red pen markings were made and the occurrence of themes was recorded on separate pieces of paper. Themes were roughly categorised according to the actor or major theme, for example "the collaborators" and "farm socioeconomic". The "occurrence of themes" pages were then reviewed and alike themes amalgamated into a "summary of themes". The author would have preferred to use a number of widely different ways to categorise the themes; but, in the end, it basically came down to assigning themes to structural components of the "research system", for example the collaborators, NSW Agriculture, the author, the Sydney vegetable industry.

The writing up of descriptive themes, insights and results, which followed the initial data analysis, by no means completed the research process. Instead, it triggered a period of intense activity in which the author's ideas were presented to a wide range of people, especially the collaborators, the
author's M.Sc. supervisors, and NSW Agriculture advisory staff, for confirmation and rebuttal. The further information gathered in this process improved the quality of the author's existing material and rectified a few omissions.

3.5.2 Methods mostly for finding out

Interviews
Interviews ranged from being unstructured, to semi-structured, to fully-structured. Most interviews were semi-structured but many were unstructured. Interviews were conducted with reference to the guidelines of numerous authors. Among the key guidelines followed were to consider question-answer behaviour with respect to symbolic interactionist theory (e.g. Cannell 1985, Foddy 1993), use open-ended questions unless fully aware of the question topic (e.g. Moser and Kalton 1971), probe answers non-directly (e.g. Fowler and Mangione 1990), establish the applicability of questions to informants (Foddy 1993), use "floating prompts" to encourage testimony on broad topics (McCracken 1988), be accepting of the informant, and analyse data in several stages (McCracken 1988).

The typical interview was a 20 minute chat in the field between myself and one or two of the project collaborators, with notes being written down in the permanent beds diary once off the farm or later that day. Interviews were not tape-recorded and were conducted by the author alone. An exception to this statement were seven semi-structured interviews on the topics of "cultivation" and "learning", conducted with Maltese growers (non-collaborators) in July 1995. These interviews were carried out and analysed jointly by myself and my Field Assistant, who was also familiar with constructivist theory. Each of these tape-recorded interviews was around 45 minutes in length.

During the first few months of the research I attempted to quickly familiarise myself by visiting growers of different ethnic groups and different areas of Sydney. About 30 growers were visited. I spent time with the two District Horticulturists (Vegetables) employed by NSW Agriculture to service the Sydney industry. Besides interviewing the two horticulturists, many of the farm visits (and all of the early ones) were carried out with them. I also interviewed other NSW Agriculture
staff, such as plant pathologists and soil scientists. Other people interviewed, especially in the first few months of the research, included suppliers to the Sydney vegetable industry (farm equipment, pesticides, etc.), the Presidents of the Freegrowers Horticultural Council and the Australian Chinese Growers Association of NSW, and UWS-Hawkesbury academic staff and students.

**Participant observation**

Following their recruitment, I visited each collaborator of the permanent bed project regularly. Visits were about fortnightly for the first 18 months, then every three to four weeks until the end of the project. On my earlier visits (for the first year) I tried to help the growers with their work for a few hours. For example, I would arrange to help Peter Dimech harvest his cabbage for a couple of hours in the morning, then help Joe Dimech plant lettuce in the afternoon. On my later visits, I did not try to arrange beforehand to help with an activity. If I arrived and the collaborator was busy and I could help, I did so for a short while. Otherwise, I merely talked. This change was due to reasons including a decreased emphasis on discovery and relationship-building (because relationships had formed and my understanding was greater) and back problems. Actually, I only assisted each collaborator for an extended period (more than one hour) on half a dozen to a dozen occasions. However, these few longer periods of work, and the many shorter ones, were extremely valuable in helping me to develop a deep appreciation of the research context and build relationships with the collaborators. In addition to participant observation on the farm, I also visited Flemington Market on about fifteen occasions. On one of these trips I went to the markets with Joe Borg at 12.30 am and returned at 10.30 am, that is, a standard trip for a grower-seller.

**Farm visits**

The vast majority (~80%) of farm visits were to the eight properties of the collaborators of the permanent bed project. The frequency of these visits is discussed above. About 350 to 400 farm visits were made in the first 18 months of the research, and about 250 in the second 18 months of the research (i.e. up to the time of writing). This substantial number of visits allowed my observations and emerging insight to be developed upon regularly. On many occasions my sole reason for visiting was to obtain soil and plant samples or conduct measurements. However, it was rare for me to not stop and talk to the collaborator for a while. I did not talk with the collaborator.
only if he was absent or somehow occupied, for example spraying pesticides. In addition to the collaborators of the permanent bed project, I visited about 80 other Maltese growers. Some of these visits were in response to pest, disease, and/or fertiliser-related enquires directed towards NSW Agriculture. However, most of the visits were associated with the discovery stages of this research and various extension activities of the permanent bed project. The average visit to a collaborator was three-quarters of an hour long and not arranged beforehand. The average visit to a non-collaborator was an hour long and arranged beforehand. I had substantial, repeated contact with about 50 of the 80 growers just mentioned. Thus, this thesis is based on a sub-sample of around 60 Maltese growers.

**Literature reviews**

Literature reviews were intermittently conducted on various topics throughout the research. The topics were: action research, agricultural extension, adult learning, surveying, qualitative research methods, sociology, and cultivation. Some of the reviews were conducted as part of three Masters-by-coursework (M.App.Sc.) electives I completed in 1993. The electives were: "Research Methods" and "Redefining your extension praxis" (both Autumn 1993), and "Structure of Societies" (Spring 1993 - based on working in small groups). To a significant degree, the literature reviews were being refined and expanded even in the final stages of the research - in a search for evidence related to the developing themes.

**Standardized survey**

Two standardized surveys were carried out with the collaborators of the permanent bed project. The first was carried out in May and June 1993 using the questionnaire developed by Murison and colleagues in 1992. Including two Central Coast growers who were later dropped from the project, there were eleven respondents. Each survey form was worked through in detail (N.B. 102 questions) - a process which took two or so hours. At the time, I also asked further questions on social interaction and information exchange. Sam Dimech and Joe Dimech had been surveyed in 1992. In their cases, I wrote down the 1992 responses in red ink, then re-asked most questions again. As mentioned in the "General Introduction", I participated in Murison's 1992 survey and interviewed six Maltese vegetable growers (but not Joe and Sam Dimech). During February and
March I spent considerable time summarizing the data of the 1992 survey (n=45) into an eight-page document - as part of my "discovery" activities.

I also surveyed the Maltese collaborators, and their active spouses, using Kolb's (1984) Learning Styles Questionnaire (n=12). The questionnaire and the results appear in "Adult Learning" (section 6.10).

Reduced cultivation demonstrations - crop and soil monitoring
Soil and plant measurements were carried out from the second crops onwards (December 1993 to early 1996) at each permanent bed trial site. Prior to the first crops of the trials the paddock was "fully worked" to loosen existing plough pans. Therefore, there was no difference in cultivation treatment in the first crops of the trials. Excepting to help weigh produce, for example 50 heads of cabbage, or sometimes observe what I was doing, the collaborators did not get involved in making measurements themselves.

3.5.3. Methods mostly for promoting change

Formation of a small group (n=10)
The group's members were the collaborators of the permanent bed project plus myself. Those wives of collaborators active on the farm were also invited to attend, but never did so. The group's sole activity was to have four meetings on Friday nights over a two-year period. Two of the meetings were held at grower's houses, one at my own, and another in a hired room at a sports club. The four meetings were initiated by myself and conducted under my direction.

Problem-solving
As an extension horticulturist working for NSW Agriculture, I was in a position to respond to grower-initiated enquires. Indeed, I often did so. Nearly all enquires concerned crop diseases, pests and nutrition. A few concerned water quality, planning regulations, etc. Most enquires were initiated by the permanent bed collaborators because of my close contact with them. This contact was sustained and so I was often able to see or hear about the results of my recommendations.
Information evenings for growers

Two were held, one in March 1993 and another in April 1994. Both were held in hired halls. The meetings were arranged and presided over by myself. At each meeting there were about half a dozen speakers.

Seminars for UWS-Hawkesbury staff and students

Four seminars of about one hour's length were held. They were presented in March 1993, September 1993, October 1994 and October 1995. In each case I spoke alone, however, the third seminar was immediately preceded by a colleague's seminar on a similar topic. Each seminar included a formal presentation followed by a discussion period of reasonable length.

Bus trips for growers

The trips were held to stimulate growers' learning and interaction, and to see at first-hand other vegetable-growing districts. The first trip was to Griffith (five farms) and Hay (two farms) over 2½ days. We had the pleasure of being conducted by a very experienced extension horticulturist for the Griffith part of the trip. Nineteen growers (17 Maltese, one Yugoslav and one Anglo-Saxon) and two extension horticulturists (myself and the District Horticulturist (Vegetables) at Camden) attended the Griffith and Hay trip. Of the growers, five were collaborators of the permanent bed project. Most of the other growers were friends of the collaborators.

The second trip was held in September 1995 and lasted two days. Fifteen of us (12 Maltese and two Lebanese growers, plus myself) flew to Brisbane then drove two minibuses to the Gatton district. One of the collaborators and four other growers who went on the previous Griffith and Hay trip attended. We listened to two lectures on pesticides at Gatton college, saw reduced cultivation trials at the college, and visited the Queensland Department of Primary Industries Gatton Research Station, a packing shed, and four farms.
Field day for growers

A single field day was held at Sam and Mario Dimech's in January 1994. The day was held in conjunction with the University of Sydney (Cobbitty farm), CSIRO, NSW Agriculture's Plant Diagnostic Service, the District Horticulturist (Vegetables) at Camden, and 16 companies which supply the Sydney vegetable industry (four general, four fertiliser, three seed, three irrigation, and two machinery firms). In addition to the company and NSW Agriculture displays, there was other machinery on display and demonstrations of reduced cultivation (lettuce and silverbeet crops). The field day was extensively promoted.

Written material

The written material produced as part of the permanent bed project included a two-page leaflet inserted in NSW Agriculture's "Vegetable Growers' Newsletter" (distributed free each quarter, a mailing list of 1200), several articles in the Newsletter, leaflets for meetings/field days, and personal letters regarding the results of the permanent bed project to the collaborators and other key growers and interested parties (n=30). The second version of the two-page leaflet appears in Appendix A.
Plate 7  Geoff Story addressing the growers on the Gatton trip (Sept 1995)

Plate 8  In a potato field near Whitton, MIA (Sept 1993 bus trip)
Plate 9  The author at the January 1994 field day

Plate 10  A custom-made minimum tillage implement at the January 1994 field day
Reduced cultivation trials - conduct of same

The conduct of the permanent bed trials was a process of active learning carried out by the collaborators under their management. The trials consisted of two adjacent plots, within the same paddock, which were maintained over a three year period. The lesser cultivated plot was labelled "(-c)" and the plot cultivated to a greater extent "(+c)". Excepting evolving cultivation and fertilisation practices, crops were grown and harvested as they normally would have been (i.e. without my intervention). It can be said that each crop represented one turn of the adult learning cycle and the sequence of crops at each site a spiral of learning.
4.1 The Maltese

The Maltese archipelago is located in the western Mediterranean between Sicily and Libya. It consists of five islands, of which Malta is by far the most populous and the largest (246 km²). People also live on Gozo and Comino. Malta has been inhabited for a very long time. In fact, it is considered that the oldest free-standing structures in the world are megalithic temples on Malta and Gozo which date from c.3250 BC (Anon. 1992). The Maltese are considered to be descended from Phoenicians (Owen 1969). They have been ruled by many peoples over the centuries, notably the Arabs. However, despite foreign rule, the Maltese have managed to maintain a distinct identity and their devout adherence to Roman Catholicism (Owen 1969). In the Napoleonic uncertainly of the early nineteenth century Malta sought to become part of the British empire, and was accepted in 1814. The British gained a deepwater harbour in a strategic part of the Mediterranean and a friendly population which has proved itself helpful in times of war. On the other hand, Malta essentially has no other natural resources. It is interesting to note that, at the turn of the nineteenth century, Malta is considered to have had the highest population density of anywhere in the world (Owen 1969). Consequent to this high density of population and lack of natural resources were two outcomes: highly efficient dryland farmers and human emigration.

Maltese farmers were highly skilled and able to cultivate virtually every square inch of soil on their barren islands with great efficiency (York 1990:3). They were dryland farmers (there being no rivers on Malta) who utilised regular seasonal rain. Many of these farmers were among the Maltese emigrants who chose to settle in other parts of the British empire, most notably Australia. Although skilled farmers, it should be noted that these emigrants were not highly educated. For example, when writing of emigrants from rural Gozo, York (1990:4) states "the Gozitans who made their way to Australia were invariably illiterate or semi-literate, unskilled farm workers or farmers". York (1990:4) goes on to say "On arrival in Australia, Maltese farmers often became labourers, until such time as they saved enough money to establish a farm in their own right".

There are more Maltese in Australia than anywhere else in the world, including Malta. Maltese settlers began to arrive from the 1880s and by the 1920s Australia was the most popular destination
for emigrating Maltese (York 1990). An Assisted Passage Agreement between Australia and Malta was officially implemented in 1949. Most emigration occurred in the decades immediately following World War II. There were several reasons behind Maltese emigration to Australia. First, overpopulation and lack of long-term economic security. Second, a feeling of closer affinity with the English-speaking rather than the Arab-speaking world. Third, a desire to populate "empty" Australia with white people and thus secure part of the British empire. In the words of York (1990:5) "Maltese emigration to Australia was seen, by the imperially-minded - in England, Australia and in Malta - as a process of redistributing an overcrowded tiny corner of empire to a vulnerable grossly underpopulated and vast continent". The Maltese were not universally welcomed in Australia. For example, in the 1920's the Maltese were regularly condemned as "coloured job-jumpers" by elements of the Australian Workers' Union. However, by now the Maltese have firmly established themselves as part of modern Australian society. The Maltese are renowned for their religious faith and hard work. It is largely through their efforts that the people of Sydney have available to them a wide variety of cheap, fresh vegetables.

4.2. **The Maltese collaborators of the permanent bed project**

(Note that these are pseudonyms)

**Joe Borg** - may be considered an opinion leader. He is widely regarded as a good farmer and businessman. Despite his illiteracy, Joe is of high intelligence. Joe is a "good mate" to his many friends but can be wary of strangers. Joe is not an active participant in the scientific agricultural revolution but he does seek to constantly improve his farm practice, especially through better organisation so he can get things done more quickly. Joe is 53 years old. His wife does not help on the farm. Joe sells the farm produce at Flemington Market an average of three mornings a week. He now has a bad back after 28 years of hard physical work. His adult children now do virtually all of the manual work on the farm. The two daughters and Sam's wife work part-time while the two sons (Sam 23, and Peter 21) and the eldest daughter's boyfriend work full-time. The farm has 18 cultivated hectares and is located on undulating country with heavy soil. A wide variety of crops are grown, including lettuce, potatoes, broccoli, cabbage, cauliflower, capsicum, eggplant, zucchini, cucumber, beetroot, rockmelon, and parsley.
**Paul Mifsud** - is a mediocre farmer. Indeed, he has admitted as much to the author. Paul and his wife Mary (they have no children) work eight hectares of land on the Windsor floodplain. They grow potatoes, cabbage, lettuce, capsicum, melons, and a small amount of turf. The produce is sold via agents. Paul and Mary receive many visitors and have a large number of friends. They have a relaxed approach to life. Paul is not particularly interested in improving his farm practice, nor learning in general. His management is rather haphazard and crops suffer as a result. However, Paul takes great pride in his prowess as a shooter. Mary lets Paul make all the decisions on the farm. Paul is likeable and easy to chat with. On the other hand, he tends to be evasive, non-committal and disinterested in "scientific agriculture". He was the most difficult to work with of the permanent bed collaborators.

**Jim Saliba** - is a "top grower". His favourite crop is lettuce and he is said to be one of the best lettuce growers in NSW. Jim works ten hectares of land with his wife Sue and four young children, who contribute in a significant way by helping to plant, etc. The farm is on heavier soil in undulating country. Sue is exceptional in that she does a very wide variety of tasks on the farm and puts in almost as many hours as Jim. Both work very hard and are proud of their farm. Jim sells the farm produce at Flemington Market three days per week. They concentrate on just a few crops - lettuce, cabbage, silverbeet (called spinach) and some capsicum - which they grow well. Jim is the decision-maker and is decidedly a perfectionist. He is highly observant and very keen to learn. Jim tends to be a bit secretive and opinionated. However, he and Sue are pleasant to know and were stimulating to work with in the permanent bed project.

**Peter Dimech** - is a good grower of cabbage and rather conservative. He works 17 hectares of floodplain, but not flood prone, land with his son Mario (22), and wife Sarah plus one full-time worker who is usually some kind of relative. Peter tends to be a bit withdrawn and acquiescent. He is not at all opinionated or openly critical. Thus communication with Peter was not particularly easy for the author. Mario is not a decision-maker and seems to have unrealistic ideas which may be influenced by his part-attendance of a tertiary horticultural course. On the other hand, Mario's greater awareness through higher education may eventually be of benefit. Peter has a steady and
long-term buyer of his cabbage and sells the remainder of his produce via an agent. Peter appears to farm in an intuitive manner and rely upon his existing knowledge. He does not seem eager to learn new ways. Peter is agreeable and mild-mannered but a bit distant.

Joe Dimech - is in his 40s and a brother to Peter. He works a large farm essentially on his own, with only a small (but steady) amount of part-time casual help for jobs such as planting. Joe's wife Jenny looks after their four young daughters and does not help on the farm. Joe grows cabbage and lettuce on 17 cultivated hectares of undulating country with loamy soil. He works hard and is proud to grow a good crop which is delivered to an agent. Like Peter, Joe is conservative and wary of cooperating with other growers. Unlike Peter, Joe is very open with an eagerness to learn, particularly about fertilisers and soil fertility.

Sam Dimech - is in his 30s. He is somewhat unusual in that he makes the decisions on the farm much more so that his father Mario, who is still very active. Theirs is a successful example of generational transfer of control of the family farm. The farm is Sam's life, there is no time for anything else. However, Sam does have an open mind and more interests than many other growers. Sam is keen to learn and a most friendly person. He is also very practical.

Mario Dimech - is brother to Peter and Joe. Mario is less conservative than his brothers. He also seems better educated and is easier to communicate with. Mario is a friendly person and so is his wife Karen, who does not work on the farm. The Dimechs normally have one full-time worker and get the help of Sam's sister and others when particularly busy. The farm is a large one of 45 hectares, of which 25 are cultivated. Their crops are cabbage, lettuce, some silverbeet and some cauliflower. The produce is mostly sold direct to a large supermarket chain. The Dimechs are notable for their large amount of well-maintained farm machinery. They have a good lifestyle and appear to be rather successful in business. Joe Borg once commented to the author that a couple of decades ago the Dimech brothers (Mario, Joe and Peter) were among the best and richest farmers of the Sydney area.
Charlie and Joe Attard - are brothers who work two farms, each of 7.5 cultivated hectares. They work well together. Both are in their early 30s with several young children. Their father is no longer active on the farm. The wives rarely help but a sister, Teresa, often does. Charlie is the more serious of the two. He is interested to learn, as is Joe to a slightly lesser extent. Joe tends to be more relaxed and jovial than Charlie. Both are friendly and easy to talk to. Charlie concentrates on the fertilising, financial records, etc., while Joe concentrates upon the machinery and cultivation. Drought forced them to abandon their Luddenham farm in mid-1994 and at the time of writing the farm was still empty. Consequent too-frequent cropping at their Bents Basin farm caused significant disease problems. The Attards are competent growers but the loss of their second farm and a series of natural disasters (e.g. the Cabbage moth plague of the summer of 1993/94), together with lower profitability because they sell through an agent, encouraged them to temporarily cease farming in January 1996. This was in part to give their Bents Basin farm a rest, but also to try something else in life. Both Charlie and Joe have a degree of pessimism about the hard life of farming, despite their overall liking of vegetable growing.

4.3. Maltese Vegetable Farms - physical factors including cultivation

Growers cultivate to prepare a seedbed, destroy previous crops, and control weeds. Weeds are controlled because they may compete with a crop (for light, water, and nutrients), harbour pests and disease, make harvesting more difficult, and set seed and thereby create greater weed problems in the future. Weeds are also controlled so that the farm looks tidy and "respectable" (Murison 1995).

Most vegetable crops in the Sydney region are grown on raised beds. Such beds are normally around 100 cm wide and have one to three rows of crop. The beds are separated by trafficked laneways, referred to as "gutters" or "furrows", which are from 10 to 30 cm in depth. Some growers produce crops as single rows on small ridges, for example 20 cm high and wide, called "hills". All potatoes are grown in this manner. A large number of growers do not use beds, but instead "grow on the flat". All of these growers are on relatively well draining alluvial soils.
Plate 11  Young lettuce seedlings on beds

Plate 12  Young lettuce seedlings on hills
Plate 13  Growers watch Sam Dimech and his bean knife cultivator at the January 1994 field day

Plate 14  Maltese growers have a strong interest in farm machinery
The main advantage offered by raised beds is improved drainage of the crop's root zone. Until recently, the Sydney industry norm was to destroy beds completely between each crop. Cultivation with ploughs (mouldboard, disc, and chisel), disc cultivators, and large rotary hoes not only destroyed beds but laneways too. If followed by much wet weather, such heavy cultivation could result in a grower on heavier, poorly draining soil losing access (trafficability) to his paddock for periods up to two months! Furthermore, when laneways were re-established for the next crop, they were often in a slightly different position. Thus, the entire paddock could eventually be trafficked and develop a plough pan (a compacted layer which inhibits root growth). Further advantages and disadvantages of permanent beds are listed in Appendix A.

Through farm visits in the first few months of the research I discovered that many growers were cultivating less than they had in the past, for example when compared to five or ten years previously. Usually the change was a recent one, having occurred only a year or two before I "came onto the scene". During my early farm visits growers gave three reasons for their change towards less cultivation. One was that they had tried it and found that it works. A typical statement was "We found we could work the ground less and get away with it" (i.e. still produce a good crop). Another reason was the use of plastic mulch. This represents a considerable investment and growers were encouraged to keep their mulched beds for more than one crop. However, the most important reason was the availability of new machinery, in particular, small (around 100 cm width) rotary hoes.

The small rotary hoes could be used to prepare for planting a paddock too wet for normal cultivating equipment. Thus access was improved and the pattern of cropping more flexible. A Maltese engineer and vegetable grower of Horsley Park (Jimmy Galea) imported 120 custom-made (i.e. suited to hard-setting Australian soils) rotary hoes from Italy in 1988. When I visited Jimmy in mid-1993, 116 had been sold - nearly all to Maltese growers. Together with small rotary hoes made by Howard and other companies, which also came onto the market at about the same time, Jimmy Galea's Dondi rotary hoes appear to be the major factor contributing towards the adoption of semi-permanent beds by Maltese vegetable growers of the Sydney region in the early 1990s.
Farm machinery represents a major investment. As such, it can dictate the way growers do many operations. For example, Sydney's largest vegetable growers, the Grechs at Camden, grow all of their crops as single rows (hills) because their farm is set up to be compatible with their potato machinery. It is important to note that the range of machinery used is large and that there are no standard bed widths. Therefore, the development of some new machinery, for example a customized "single-pass" minimum-tillage implement, is extremely difficult.

Practicality dictates what happens on the farm. An important consideration with regard to practicality is that it is situation-specific. What works for one grower may not for another. For example, growers at Pitt Town do not use beds because "the beds collapse and the water doesn't soak in enough" (Jim and Mario Muscat, 1993) whereas growers on heavier soil at Horsley Park always use beds and, indeed, must do so to avoid waterlogging. Besides soil type, other physical attributes which determine growers' circumstances include access to water, climatic conditions (temperature, rainfall, humidity) and farm size.

On top of differences in growers' machinery and farm physical attributes, there are idiosyncratic differences in their management. Many growers enter a paddock and check their crop every couple of days, while others do so less frequently. Some growers are very fussy while others like to "cut corners". One thing that all growers do, to varying degrees, is experiment. Growers are always conducting small (unreplicated) trials of fertilisers, crop varieties, pesticides, etc. Growers' methods of production are surprisingly dynamic over time.

A final point to make is that disasters occur on the farm. Examples include hail, a pest plague, extremes of weather (a severe late frost, a very hot and windy few days), and drought. To provide an example, in March 1994 Charlie Attard informed me that they were unable to cut a single load from five acres (2 ha) of cabbage at their Bents Basin farm because of infestation by Cabbage moth caterpillars (*Plutella xylostella*). The whole lot had to be ploughed in. Growers often plough in marketable crops when the market price drops below the cost of harvesting, packing, then selling. There can be whole years of low prices in certain commodities. Thus, it is not surprising that growers tend to have great powers of perseverance.
4.4. **Maltese Vegetable Farms - socioeconomic factors**

Agriculture is carried out by people. A vegetable farm is not just a physical entity, it can be labelled as a "human activity system" (Checkland 1989). Growers produce crops in order to satisfy their goals. They have likings for particular crops. For example, Jim Saliba likes lettuce but Joe Borg's son Sam "hates" it. Sam says lettuce involves too much back work (i.e. lots of bending down) and there's also too much packing to do. I think it is important to remember that vegetable growing is a "human activity system" when one considers the promotion of reduced cultivation. Reduced cultivation has advantages, but growers can have values which hinder its adoption. For example, "tractor work" (including cultivation) is relatively easy compared to the manual tasks of chipping (hoeing) and picking old leaves off silverbeet. If a grower, unable to abide leisure and feelings that he hasn't "done enough for the crop", can sit on a tractor and "relax", why wouldn't he? Such unnecessary cultivation, often referred to as "recreational ploughing", is common to other Australian farmers (Vanclay 1992).

Many growers are able to organise their activities and manage their farm businesses well. After three years of observation, I consider that perhaps the two most important factors for the success of growers are to sell their produce themselves (rather than through an agent) and timeliness of operations. Timeliness requires good planning. For example, growers must stagger their crops and not plant so much that they won't be able look after it properly or harvest it all. Growers tend to have a good awareness of what crops will be grown on which pieces of land, and also what crops have been grown. They try to rotate their land and crops as much as possible to reduce disease. Usually, all of this "thinking ahead" and "remembering" is in the mind. Apart from receipts for expenses, very few written records are kept.

Especially if they sell direct to buyers, good growers try hard to keep their customers happy. They do this by continuing to grow and harvest, even if losing money, and by not selling all of their produce to some customers then having none left for other regulars. During the drought (1994)
Sam Dimech bought cabbages for around six months in order to continue long-term contracts with his buyers.

It has been mentioned that growers tend to have great perseverance - which is necessary to face natural disasters and extended periods of market prices below the cost of production. This perseverance is helped by thrift. Growers continually seek to cut the costs of their business expenses, and are modest with regards to their personal expenses too. One can often see a large attractive house on a Maltese-owned farm. However, there will also be a small house on that farm or the farm before. It was in that small house that the grower and his family lived through many years of hard work in order to eventually buy the big house.

For convenience I will refer throughout this thesis to "growers" as adult men. This is partly deceiving. While it is true that virtually all Maltese market gardens are run by men, often exclusively by men, it is also true that a very large number of farms are run with an indispensable input from women. Growers' wives do tasks such as packing, picking, planting, and record-keeping. They do not do tractor work or sell produce. Many wives and daughters work long hours on the farm. There are also some who confine themselves to domestic duties and do not become involved in the farm at all. It should be noted that Maltese families are often large.

Growers (men) talk about their sons taking over the farm, but not their daughters. Only a minority of growers wish for their sons to become farmers (Murison 1995). The majority consider that farming is too much hard work for too little return - and that the "terms of trade" are declining each year. According to Joe Borg, less than 10% of Maltese growers have sons taking over. In my opinion, this figure is perhaps too low, however, certainly the proportion is well under half. There is widespread pessimism about the long-term future of the Sydney basin vegetable industry, especially with regard to the production of low-value crops.

4.5 Maltese Vegetable Growers of the Sydney Region -
with particular reference to the collaborators of the permanent bed project
In this section, the Maltese vegetable growers of the Sydney region are discussed with reference to significant themes. This description is a product of my observations and reflections over the research period, together with the thoughts of others, for example the growers themselves, NSW Agriculture advisory staff, UWS-Hawkesbury students, and suppliers to the Sydney vegetable industry. As such, this description could be viewed as a product of the research. However, it is placed here so that the reader may be informed prior to discussion of the results and outcomes of the research.

i) Practicality

Maltese vegetable growers are very practical people. To successfully run their farm businesses, growers must be able to plan ahead with their cropping schedule, organize their time and prioritize activities, operate and maintain a variety of machines, figure out how to do quickly and cheaply a wide range of physical tasks, and so on. Ideally, they will also keep sufficient financial and other records, be responsive to customer wants, and be good salesmen. Unfortunately, many growers do not have strengths in these latter areas.

Growers' practicality is expressed in one way by their very strong interest in farm machinery. At a field day held in 1994 at Sam and Mario Dimech's, the item of by far the greatest interest was Sam demonstrating the operation of a bean-knife cultivator. As soon as the tractor was started all growers flocked to see the cultivator in action. Machinery was also the item of greatest interest on excursions to Griffith and Hay in 1993 and Gatton in 1995.

The topics of conversation on a 1993 bus trip to Griffith and Hay were revealing. They included the discomfort of the bus, fertilisers, mechanical planters, crop varieties, women, other vegetable growers, market prices, packing, and so on. As one can see from this example, the topics in growers' minds are usually practical ones. Practicality is more than merely talking about how one kind of fertiliser tends to clog the spreader while another runs smoothly. It is also about organisation. On the 1993 bus trip the growers talked a lot about the way the Griffith and Hay growers organized their harvesting and packaging. While the growers could not foresee all the reasons why a certain operation was being done in a certain way, for example, lettuce cartons were
being stacked on a truck tray then being unloaded and stacked on pallets (rather than being directly stacked onto pallets in the paddock); nevertheless, they could quickly picture (whereas I could not) how things were being done and how they might be improved. Growers' interests in improved efficiency focus on cutting costs and saving time. In the words of Joe Borg, "growers are always looking to work faster, quicker, and save money". Growers tend to have good abilities with regard to both quickness and timeliness.

ii) Observational skills

Growers tend to have good observational skills. On the other hand, the complexity of their farming systems tends to undermine their ability to attribute cause to one or a few factors, and therefore know what can be done to favourably change a situation. Throughout the duration of the research I was impressed by the growers' ability to observe. As an example, Jim Saliba plants lettuce on a square spacing in the warmer part of the year and on a rectangular spacing in winter. Jim explained to me how this takes advantage of the sun's relative highness in the sky in summer and the relative obliqueness of its rays in winter. I once commented to Jim about the amount of fireweed (*Senecio madagascariensis*) in his ready-to-pick lettuce. Jim replied by saying he didn't mind the weed since it gave the crop some frost protection and was "far enough behind" not to be unduly competing with the lettuce. On several occasions I've heard growers say how they notice different levels of humidity and pest and disease incidence between theirs and nearby farms, or even between different parts of the same farm. Such observations underlie the importance of situation specificity.

iii) Differing views between growers

Even within areas that do not really touch upon values, growers have differing views. For example, Jim Saliba and Joe Borg believe in preparing their beds and allowing them to settle (e.g. for one month) before planting. On the other hand, Peter Dimech prepares his beds at most a few days before planting - believing preparing them too early will create greater weed problems later. Another example is that of fertiliser banding (a line of buried NPK fertiliser at the time of transplanting) on the Windsor floodplain. The Xibberas brothers used banding successfully for years while other Maltese growers have tried it without significant benefit. This is puzzling, since
the soil type and crops were the same. Many differences in growers' views can be related to
differences in circumstances - but not all.

With regards to cultivation, Joe Borg's son Peter, who has been farming full-time for five years,
once said to me "if the soil type is the same, no matter how you work the ground the crop will be
the same". Other growers, including Mario Dimech, have disagreed with this statement. As well as
differing views between growers, there are differing views between growers and agricultural
scientists. An interesting and less obvious example is that of agricultural scientists believing plough
pans are detrimental to the irrigation of crops because they reduce the depth of rooting - therefore
available soil volume is less and more frequent watering necessary, and growers who believe a
plough pan reduces water movement through the soil profile - therefore the frequency of necessary
irrigations is less.

iv) Persistent views of individual growers
Like all people, Maltese vegetable growers have idiosyncratic views and interests which are
persistent. For example, throughout the three years I have known Joe Dimech he has maintained a
strong interest in fertilisers and soil fertility. On my visits to Joe's farm soil fertility was very often
the main topic of conversation - even the only topic of conversation! At the time of my study,
Cameron of UWS-Hawkesbury conducted research on how people value the quality of water, for
example the water of the Hawkesbury-Nepean river. The research was carried out using groups.
Cameron considered, two years into his research, that the main process apparent was one of
constant rearticulation of previously-held opinions (J. Cameron, pers. comm. 1995). If
generalisable, this observation, and similar observations of my own, have considerable implications
for adult learning and extension.

v) Poor education
There are many Maltese vegetable growers who have only attended primary school in Malta. A
large number of these growers are illiterate, or functionally so (in both Maltese and English). A
typical situation is a farm controlled by Dad in his fifties, who only went to primary school in Malta,
with much or most of the physical work being done by sons who have been educated to secondary
level (Year 10) in Australia. As time goes by and the period of peak Maltese emigration (1950-1970) recedes, a larger number of vegetable farms are being run by Maltese descendants educated wholly within Australia. This category would now be the largest, however, the amount of farms run by growers with only primary education is still significant. A 1992 survey of Sydney vegetable growers of European background (all nationalities proportionately sampled, n=45) found that one-quarter had only been educated to primary school level (Murison 1995).

Among the project collaborators, four have only a primary education (Mario, Joe and Peter Dimech, Joe Borg - i.e. all of the older growers) and five have a secondary education to intermediate level (Years 9 or 10) (Charlie and Joe Attard, Sam Dimech, Jim Saliba, Paul Mifsud - i.e. the younger growers). An Australian education does not necessarily mean growers are adequately literate. There are growers in their 30s who cannot really read and write - although often their wives can for them. For example, Jim Saliba can read and write, but not well. His wife Sue does all their reading and record keeping. Incidentally, Sue has completed a secretarial course at technical college, and so is the only collaborator with a tertiary education. Of the collaborators, Joe Borg is illiterate, Joe Dimech nearly so (and perhaps Peter Dimech), Jim Saliba does not read well, and the remainder seem to have no literacy problems. Poor literacy tends to be hidden by those who suffer it, but I noticed it through often minor details such as Joe Dimech's inability to read out a pump's description over the phone, and growers asking me to fill in details on cheques for them.

vi) Local knowledge and beliefs

The poor formal education of growers is offset by their rich experiences and accumulated knowledge. Indeed, ultimately it is experiential knowledge which enables any practitioner to do their task well, or even at all. Formal education is merely a starting point (however, it is a source of inspiration too). Some of the Maltese growers' "local" knowledge is idiosyncratic, while some is shared between growers to varying degrees. Some of the knowledge would be very useful, while some beliefs may be distinctly unhelpful to growers. Further, some of this knowledge may be easily grasped by non-growers and explained by science, while other knowledge is more obscure.
All knowledge is explained by language. The difference in language between myself and the growers formed a barrier to this research. This barrier was partially, but not fully, overcome. On one occasion a young grower said to me "lettuce likes a (continuously) full stomach - otherwise it won't form a heart" (Paul Grech 1993). He also said "broccoli is good for the soil, it is a good crop to go before lettuce". Clearly, this grower has his own terminology to describe the nutritional requirements of lettuce. Growers can know something but be unable to explain it, either to non-growers or even to each other. Sometimes growers are unfamiliar with words which are taken for granted by agricultural scientists. For example, once Joe Dimech struggled for up to a minute to think of a (English) word for "soil structure". Joe finally chose the word "fibre".

Some of growers' knowledge is easy to grasp, for example lettuce seedlings establish more readily than cauliflower seedlings (Charlie Attard 1993). Other statements are less observable but also easy to accept. For example, Paul Mifsud has told me that "plants love the rain" and that an equivalent amount of water via (overhead) irrigation never gives the same result. Another time Paul said "chicken manure makes the ground dry in summer" - perhaps a reference to water repellence? Some knowledge is intriguing and would be hard to explain. For example, many growers seed according to the phases of the moon. They say (e.g. Joe Vella and John Galea 1993) that plants grow bigger as the moon enlarges, and so too do the beads of broccoli heads.

Of relevance to the permanent bed project is the belief that paddocks "get tired" and need resting (e.g. Joe Dimech 1993). Combined with the common belief that herbicides are "not natural" (held quite strongly by Joe and Peter Dimech), this means mechanical cultivation must be regularly carried out. The equipment for this kind of "clean paddock" cultivation tends to be larger, in order to do a quick job, and is often not on standard wheel spacings. Thus beds get destroyed. Of course, there is always too the belief that "you have to cultivate (aggressively) to get a good crop".

Growers can have a considerable degree of insight. For example, Charlie and Joe Attard had not had soil tests done for several years prior to 1993. They regularly limed their Bents Basin farm but had not limed their Luddenham farm for eight years. I conducted pH tests and found that the pH of the Luddenham farm is high and stable (it seems to overlie calcareous Minchinbury sandstone)
while the pH of the Bents Basin farm falls rapidly with time. Growers also have good memories (not for NSW Agriculture events and the like, but for weather and so on - yes!). Joe Dimech is one grower with a good memory. Joe has told me how he will use twenty years of memory to make sense of a puzzle in the present. While at times a hindrance, the local knowledge and beliefs of Maltese growers are undoubtedly their greatest asset.

vii) The "backwardness" of growers
It may be considered high-handed to criticise a group of hard-working and resourceful people who achieve results, that is, grow high-quality vegetables cheaply. On the other hand, Maltese growers often criticise themselves for "backwardness". I have heard growers say on a number of occasions "you see, lots of growers, especially the older guys, they don't want to learn anything new". Of course, even the most intransigent of growers do change over time. However, their rate of improvement may be insufficient for the competitive environment in which they operate. "Backwardness" is evidenced by growers not having important equipment which they can afford, such as forklifts (N.B. "important" in the opinion of colleagues in similar circumstances, not just in the opinion of a NSW Agriculture horticulturist). It is also evidenced by haphazardness with regards to pesticide use. I've observed one collaborator allow Glyphosate to drip over him as he raised an arm of his boom sprayer - heavens forbid if he did the same with one of his insecticides!

viii) The production priorities of growers
A prominent grower once told me, in all seriousness, that interstate (i.e. outside NSW) vegetable growers "can use good chemicals (have available effective pesticides) which account for 99% of their price advantage over NSW". This statement is one example of the very strong emphasis that growers place upon pesticides. In my opinion, this is their most widespread and frequent area of over-emphasis. Others may beg to differ and suggest that growers' most common area of over-emphasis is production is general - with marketing suffering consequentially. At this point I'm reminded of a comment made by Joe Dimech which would be typical for many growers, especially those that supply agents. Joe once told me "I just grow the crops as well as I can, present them well, then say no more. I don't say to the agent whether they're good or bad. I just let the crop sell itself".
Growers tend to think the more the better. This applies to pesticides, and less so to fertilisers. An example provided by Joe Dimech is typical. I once recommended Joe put gypsum on a sodic paddock at one tonne/acre, and also gave some inoculant and sticker for a vetch cover crop. When I visited soon after, Joe had put on double that rate of gypsum and something like ten times as much sticker as needed. The overdosing of pesticides can be a response to desperation. For example, Sam Dimech once put four insecticides (Thiodan, Ambush, Lannate, and Metasystox) in the same spray mix during the cabbage moth plague of summer 1993/94. The sprays still didn't work (achieve control). When I pointed out that NSW Agriculture does not recommend 4-way mixes of pesticides, Sam admitted he knew better than to mix so many pesticides, but said he was desperate and didn't know what else he could do.

Other aspects to growers' emphasis on pesticides are their frequency of spraying, their aim to be completely pest and disease free, and their search for the "miracle" pesticide that will give complete control and eliminate the need for such things as crop hygiene, pest and disease identification, control of host weeds, care for beneficial insects, and use of resistant crop varieties. It should be pointed out, however, that many growers dislike using pesticides for health reasons, and only do so because the market demands a "perfect" product. In my opinion, the too-high expectations of consumers (and agents/retailers) for a blemish-free product play a large role in the pesticide-intensive nature of the Sydney vegetable industry. So to does the weather, susceptibility of crops, and abundance of pests and disease in the Sydney basin (because of the close proximity of many growers and home gardeners). Many growers say they need to aim for 100% control of pests and disease (via pesticide sprays) in order to achieve the marketable status of "mostly free" of pests and disease. What many would consider as an over-use of pesticides is seen by growers as a worthwhile strategy (the term "insurance policy" has been used) to ensure marketable crops and peace of mind.

Another strong emphasis of growers seems, to me, to be cost-cutting. More precisely, an unwillingness to pay for certain things, such as information. I once showed a draft copy of a NSW Agriculture document on vegetable growing guidelines to Jim Saliba. One would think growers would be interested in the guidelines and find them of some help. However, Jim said "they should
be free, many (growers) won't even pay a dollar for them". On many occasions growers have told me that they, as customers or taxpayers, have a right to free information and will not pay for it. Of Sydney growers, Maltese are among the most reluctant to part with money in exchange for information (J. Capuyan, pers. comm. 1995).

A final point to make is that some emphases are widespread among growers while others are more individual in nature. For example, Joe Dimech has a strong interest in fertilisers and soil fertility. Once we were harvesting the third crop of his permanent bed trials (October 1994). The cabbages in the (-c) and (+c) plots were the same but Joe merely said "that (sameness) doesn't mean much because it was dry. The main differences in crops are due to fertiliser".

ix) Friendliness

On the whole, Maltese are great people to know. I have been pleasantly surprised by their friendliness. There are quite a few occasions where I have visited a grower for the first time unannounced. The grower's typical reaction to a stranger trespassing on their property (i.e. my visit) has been one of friendly acceptance. Even in cases of initial wariness, I found this to soon subside (although others may not). Upon my visits to their properties, the collaborators, unless very busy, were hospitable and made comments such as "nice to see you". The collaborators have done things such as buy me a wedding present (Sam and Mario Dimech) and give me vegetables when I visit (all collaborators). Other Maltese growers I know have telephoned me at my office seeking advice. Their parting comment has often been "Come over when you can (to their farm), you're welcome anytime".

x) Work ethic

Mary Mifsud once said to me "we (Maltese) eat like horses but work hard". Maltese vegetable growers do work hard, and for long hours. Jim Saliba has told me how, for three years with his brother at Schofields, he worked 18 hours per day seven days per week. They used car lights to work until 11 pm then rose at 4 am! Even though Jim is now married with four children, he still works 14 hours per day 7 days per week. Jim sometimes has Friday afternoon off, to go shopping, or Sunday afternoon - when he'll mow the lawn or something similar. Joe Dimech rises to go to the
market at 2.30-3 am three or more days per week (depending on the season) and finishes work at 10 pm, with an hour for lunch but no afternoon nap. On the other days of the week Joe is up at 4.30-5 am. Depending on whether they sell their own produce or not (in which case they leave home at 12.30-1 am and return at 10 am or so for 2 or 3 days of the week usually), growers tend to work 12 hours per day six days per week.

Such busyness means it is difficult for growers to attend courses, spend time talking to university students, etc. I was once discussing with Joe Dimech the best day for me to come and weigh some cabbage from his permanent bed trial site. Not unkindly, Joe said 'It's best if you come on Friday rather than Saturday, I'll have more time to lose then (i.e. he would be less busy)'.

One aspect of the Maltese work ethic is a tendency towards fastidiousness. Most Maltese have neat homes and gardens. Their farm is often very tidy as well. Tidy farms are very much admired by other Maltese. Such tidiness is of benefit with respect to the removal of pest and disease-harbouring weeds and crop residues, etc. On the other hand, some growers are perhaps too fussy. These growers can farm in such a way as to expose themselves, for example, to soil erosion and degradation (through excessive cultivation) and also be less profitable (because of an unnecessarily high level of inputs). Another aspect of the Maltese work ethic is an inclination towards hard physical work - as opposed to "paper shuffling". The collaborators very much approved when I gave them a hand planting or harvesting. Despite the fact that I probably wasn't much help, they were, in the words of Joe Dimech, "glad I got my hands dirty". With this second aspect in mind, the reader is unlikely to be surprised to learn that most vegetable farmers I have talked to who are considering to leave the industry talk of becoming truck drivers.

xi) Work ethic - disadvantages

However, a work ethic can be taken too far. As mentioned above, some growers use too many inputs (cultivation, fertilisers, water, pesticides), with consequent environmental degradation and reduced profitability. Early in my research I met a Maltese agent who until recently was the largest farmer in the Windsor district. He expressed the opinion that growers on the floodplain who don't mouldboard plough every crop are lazy. In the permanent bed trials some collaborators, for
example Peter Dimech (December 1994), tended to say things along the lines of "(the crops in) both patches are same, even though that one (the "-c" plot) wasn't worked properly". Such attitudes, that reduced cultivation is "lazy" or "improper", are common. I think they pose a serious impediment to the adoption of reduced cultivation techniques among Sydney's Maltese vegetable growers.

Perhaps unsurprisingly, because Maltese work hard, they disapprove of those who do not. Once an uncle of Paul Mifsud's made the comment "Australia used to be a beautiful country (several decades ago), but now it's been ruined by the dole bludgers". Such judgements are not made only against the unemployed. For example, in September 1994 I was arranging with Jim Saliba when to weigh some of his lettuce. Possible days were Sunday, Tuesday and Thursday. Jim made the remark, in a sarcastic manner, "Oh, but you guys don't work on Sundays do you?". The most common way I have heard growers criticise or insult another grower is to say "He's lazy and don't work hard enough".

Strong attitudes in favour of hard work can have undesirable effects upon growers and their families. One consequence of relevance to the reduced cultivation project is the tendency of growers not to value their own labour. Thus, if growers can cultivate and still have access to their land, many will (if this statement is unclear, please refer to the cultivation section (4.3) earlier in this Chapter). There are many growers' children who must come to terms with the conflict of their hard work before and after school, and the probably easier lifestyles of their classmates. Growers very rarely go on holidays. It is normal to have less than five days a year away from the farm, and for many growers the figure is no days or just one. There tend to be a lot of weddings, funerals and christenings to attend. Occasionally, there is a fishing or hunting trip. Apart from these, growers tend to just work and work. Myself and others, including Graeme Radcliff, an Anglo-Saxon vegetable grower and member of the Sydney Market Authority, have observed that most Maltese vegetable growers do not know how to relax and enjoy their leisure time.
xii) Cooperation between growers

Sam and Peter Borg have told me "We (Maltese) have our (production) secrets but we also share a fair bit". Maltese growers do cooperate. They do so between friends. For example, a friend of Joe Borg's once told me how Joe had visited his farm and suggested he water less often but longer (the crops improved). They also do so between acquaintances, such as growers with farms close to each other. I once visited some growers at Luddenham and was talking to them about "working the ground" (cultivating) at the right moisture content. The growers mentioned how they, and collaborators Charlie and Joe Attard (who are also nearby), had told a nearby grower not to plough when it is wet. Also worthy of mention are the Theresa Park irrigators. Joe Dimech and four other Maltese growers on the same road operate a pump on the Nepean river. Each grower has allocated certain days to use the pump (to fill his holding dam) and maintenance costs are shared. The scheme had been going for five years in 1994. A revealing example of growers' desire to interact is Jim Saliba's purchase of a rain gauge. Jim told me that the main reason he bought the gauge was so he could have something to talk about with other growers down at the markets.

In May 1993, soon after recruitment, the collaborators were each surveyed using a questionnaire designed by Murison and colleagues in 1992. I attempted to find out how often the collaborators visited other farms or were visited, whether those farms were those of relatives only, the frequency of telephoning another grower for production information, the number of other growers that the collaborators talked to down at the markets, and whether they talked to those growers about detailed production issues. For convenience, I asked the growers just to consider the previous six months.

The average was to have been visited by four to six different growers, half of whom were relatives and half friends. No unfamiliar growers visited, although sometimes an acquaintance neighbour did. In turn, the collaborators visited a similar number of growers. Excepting relatives, one visit per month was typical (e.g. six friends may each visit twice a year). Most of the collaborators rarely (e.g. once every few months) or never telephoned another grower, or were telephoned themselves, regarding production issues. Only Sam Dimech (regularly) and Joe Borg (occasionally) communicated in this way. The main method of communication was face-to-face with other
growers at Flemington markets. The collaborators had circles of friends at the markets ranging from half a dozen to 50. This range reflects the collaborators' interpretation of my survey question and whether the growers sell themselves (and are therefore at the markets for an extended period) or whether they merely deliver to an agent. Some collaborators said if they had a production problem they would talk to anybody at the markets while others said they would only ask friends. Almost invariably, these friends are Maltese. The collaborators mentioned having mostly or entirely Maltese friends, perhaps some Italian friends, sometimes talking to Lebanese, and never talking to Chinese. Note that there is a language as well as a cultural barrier in this latter case.

xiii) Growers' non-cooperation

Cooperation between Maltese growers exists, but it is not widespread. Growers are happy to talk about market prices, the weather, and natural disasters, such as the current plague of looper caterpillar in lettuce. However, the issues of production they are willing to talk about are limited to what crops they have planted or are harvesting, and the performance of particular varieties. More detailed production issues are avoided. A typical attitude is that of Peter Dimech. When I interviewed him in 1993 using Murison's questionnaire, Peter said he hates asking other growers questions, and will only do so if desperate or if they raise the matter first. Responding to the same questionnaire, Joe Dimech said how he was reluctant to visit another grower's farm. Joe said if he entered a good crop which was, for example, later struck by hail he may be blamed for jinxing the other grower's crop. Once Paul Mifsud mentioned that a turf-growing neighbour was envious because Paul had made a bit of money out of a melon crop on land he leased from the neighbour the year before. Paul said the neighbour did not want to lease him the land again. Regardless of how correct Paul's interpretation of his neighbour's feelings were, these examples show that secrecy and envy are part of Maltese farming culture.

Maltese growers concentrate on the same kinds of crops. They supply a mostly-saturated market with the same commodities and so are competitors to each other. Even a fairly cooperative grower like Joe Borg will hope (a bit) that other growers suffer misfortune so that market prices are high. For example, Joe and I visited another grower on the Nepean river in August 1994, when the drought was on. Both Joe and the grower said they hoped (a bit) that it wouldn't rain "so the guys
on dam water can't grow and the market stays good'. Joe has told me the Maltese growers copy to each other, but hide things too. Once the weather was wet and Sydney growers could not harvest their potatoes. Joe decided to put larger-diameter wheels on his potato harvester. By the time the other growers had worked out how Joe was managing to harvest his crop, the market price had dropped and Joe had made $100 000!

Non-cooperation is not limited to between growers. During the course of the research I encountered a fair degree of non-cooperation myself. The first site Paul Mifsud suggested to me for the permanent bed trials did not have easy access to irrigation while Peter Dimech initially offered a site adjacent to trees (which compete with the crop). A soil scientist from NSW Agriculture has told me that farmers often suggest to researchers the poorest site on their farm to do a trial (G. Osborne, pers. comm. 1994). Later, Paul Mifsud harvested the second crop of his permanent bed trial without informing me (it was harvested three weeks earlier than I'd been told it would be ready). Not only did I miss out on the data for that crop, but it was a wet harvest and the beds were destroyed, necessitating the paddock be ploughed again! On another occasion I was trying to find out when Paul would plant a trial crop. One week the seedlings were too small, next they were big and needed planting, and next they were "too small so they'll need a couple more weeks". These comments all referred to the same seedlings.

On another occasion I arranged for Peter Dimech to borrow Jim Saliba's small (100 cm width) rotary hoe for a trial. During a phone conversation the night before Jim was worried that Peter may mistreat the rotary hoe. He managed to say "I don't know the bloke" four times in two minutes. Eventually, everything went smoothly - but I must admit I found the effort involved exhausting! On another occasion I was talking to a grower on the same road as Joe Dimech. The grower mentioned that he and five other local landholders had obtained $36 000 in State government funds (under "Operation Healing") to make contour banks, plant trees, etc. The grower said that Joe didn't want to be involved. Joe's position is typical of Maltese growers. They tend to distrust government (perhaps rightly so) and others who try and interfere with their activities. Their attitude is neatly summed up by Victor Xibberas, secretary of the NSW Freegrowers Horticultural Council (this is the only organisation representing Maltese vegetable growers of the Sydney area). At
various meetings between vegetable growers and government representatives, the author has heard Victor and other growers, say "Why don't you just leave us alone?" and "No, we just want to be left alone".

xiv) Pride
Maltese growers work hard and are proud of what they do. After all, what could be more important than healthy food? Sometimes growers express bewilderment at peoples' values. During a time of bad market prices, Jim Saliba once asked "How can people spend so much money on gambling, but not on food?" It appears most growers are motivated more by the lifestyle that farming gives them (e.g. being their own boss, fresh air and sunshine) and the pleasure of growing crops well, rather than money. Jim Saliba stated this motivation with feeling by saying to me once "Of course it's good to harvest a crop and sell it for a good price, but, for me, the thing that gives me the most pleasure is watching the crops grow. If I cultivate or fertilise and then see the crops respond well, then I know I've done the right thing, and if I can grow the crops well, that's what gives me the most pleasure". Jim says he has been farming for 24 years and "has never looked back".

Growers' pride in what they do was reflected by their desire to show me things whilst visiting their farms. On one occasion I visited Joe Dimech when he was very busy. However, Joe took off five minutes to come down and see how the lettuce crop of the permanent bed trials was going. Joe knew they were good, and I think he just wanted to hear someone else tell him the same. Another time Paul Mifsud was ripping his ground. He grinned and asked me to jump on the tractor to observe how he did it. Such invitations were common on my farm visits.

Growers personalize their farming experience. They have their "favourite" crops. They enjoy being their own boss. This second point was amply demonstrated to me by Joe Borg's son Sam. Until 1994, Sam worked for Joe and simply followed his orders. Then Sam decided to work on his own (with Joe still selling the crop). Once I was talking to Sam as he harvested his first crop. Sam was in an incredibly good mood, both because the yield and price were high, and because the crop was "his very own". Later Sam told me that farming on his own was "the best thing I've ever done". The
extent to which growers personalize farming is perhaps most strongly demonstrated by Joe Borg's statement that "farming is in the blood". Joe believes that an ability to farm is not merely learnt, it is inherited, for example from a grandparent we have never met. Such is the belief of growers in the specialness of farming.
5.1. **Observations of the methods used**

The text below conveys very briefly my observations of the methods used in the research. The methods are categorised and listed in the order they were introduced earlier (see "Methods" section). Not all results are presented here. Many are introduced in the "Discussion" section of this thesis. This style of reporting has been used so that the reader may be presented with complete and coherent stories of significance to this research. The comments on the methods used are followed by more detailed observations of the outcomes of the research and extension.

5.1.1. **Methods mostly for "finding out"**

For me, semi-structured interviews offered "the best of both worlds". Conversations directed solely by growers could flounder or dwell upon topics that weren't always useful talking about, such as the dumping of interstate produce at Flemington Market. On the other hand, too-structured conversations tended to miss some very important points - which were only picked up in later discussions. Depending on the topic, the grower's busyness, and their mood at the time, about twenty to thirty minutes was a good length of interview. On the whole, tape-recording was accepted by growers. However, it was rarely used because of its intrusiveness, the greater amounts of time needed for data analysis, and my satisfaction with the detail of observations recorded in my diaries.

I found participant observation to be a necessary complement to interviews, which, even when on-farm and semi-structured, still had a degree of "artificiality" about them. Participant observation provided me with a great depth of awareness and understanding of the collaborators and their situations. For example, it is one thing to listen to a grower talk about hard-setting soil; it is another thing entirely to plant one thousand lettuce seedlings into such a soil. As time went by, it seemed my participant observation yielded less and less new information as I became increasingly familiar with the collaborators and their farms. The work I did on the farms, even my simple presence, helped tremendously to build relationships with the collaborators.
Farm visits had benefits similar to participant observation, with respect to direct observation of growers' circumstances and face-to-face contact. The timing of visits was important. When growers were busy, for example, picking and packing lettuce before "the sun gets to it" (i.e. before it wilted) they were only willing to stop and talk for a minute or two - literally. At other times, they were willing to talk for an hour. Growers tend to visit Flemington markets on regular days of the week and do certain activities at certain times of the day, for example most harvesting is done in the cool of morning. Through knowing growers' regular activities, I was able to coincide most of my visits with their less busy periods. In general, half an hour was a good length for a "chatting" visit and half to one hour for a "problem-solving" visit. The vast majority of Maltese vegetable growers appreciate the service of a NSW Agriculture extension horticulturist visiting their farm. Once I got to know the collaborators and other Maltese growers, I found it was not necessary to arrange visits beforehand.

The collaborators did not enjoy being surveyed for a couple of hours. They became increasingly "fidgety" towards the end of the questionnaire, and at least one (Paul Mifsud) complained that "all that thinking and words has given me a headache". I went through the Murison's 1992 questionnaire in detail. This was exhausting for both interviewee and interviewer. On the other hand, I obtained a wealth of information which significantly improved my understanding of the collaborators and their situations. I found the survey questionnaire to be a useful instrument for initiating conversation with the collaborators.

At the start of the research, I had access to the 45 completed questionnaires of Murison's 1992 survey. However, interviewers' unfamiliarity with the topics covered, incomplete recording of answers, and illegible handwriting meant that there were "gaping holes" in the data collected. Another deficiency was an over-reliance upon closed questions in the survey form, leading to respondents giving "artificial" answers to questions. I obtained some benefit from reading and analysing the completed questionnaires (those that I had not filled in myself) of Murison's survey - but not a lot. Although fewer in numbers of respondents, my own interviews using the questionnaire were far more rewarding.
The monitoring of the permanent bed trials was useful in helping me to familiarise myself with the crops and soils of the collaborators' farms. For example, by taking bulk density cores I observed at first-hand a soil's structure. The schedule of measurement helped me to make observations I might have otherwise neglected. The crop and soil monitoring consumed a large amount of time, but it did provide data for an extension campaign. It will be argued later (see section 6.2) that it was sufficient to present this data as broad concepts, such as "reduced cultivation 'works' with lettuce on heavy soils of western Sydney", rather than as comprehensive tables including precise data from a large number of crops and demonstration sites. The collaborators were somewhat interested in the results obtained, especially the fresh weights of their harvested crops. However, on the whole, the crop and soil data was of little interest to them. The collaborators were already familiar with their own properties and had seen the crops and soil throughout the growing season. Furthermore, they appeared only slightly concerned with results obtained on others' farms.

5.1.2. Methods mostly for promoting change
The small group made up of the project collaborators and myself was a flop. The few meetings held were well attended and we all enjoyed ourselves. On the other hand, the meetings were merely "social events". The collaborators did not suggest future activities to carry out on a common basis, nor engage in collective critique. My observations and reflections relating to the collaborator group are elaborated upon in the "Groups" section of the "Discussion".

I found problem-solving to be a good way to familiarise myself with aspects of the vegetable farms not directly concerned with cultivation. It was an active, immediate sort of process and I learnt a great deal. Very importantly, problem-solving was a means for me to "give something" to growers and hence build relationships and strengthen my credibility. I noticed in myself a tendency to concentrate on problems and solutions I was familiar with, for example soil fertility and simple recommendations of pesticides for pest and disease control.

Two information evenings were held for vegetable growers; the first in March 1993 and the second in April 1994. The first was advertised by means of leaflets posted to 330 growers in the Windsor district, ten leaflets handed personally to growers, notices in rural supplies stores and D shed at
Flemington Market, and a brief newspaper article in the "Hawkesbury Gazette". This level of promotion attracted 25 growers. About eleven members of NSW Agriculture and UWS-Hawkesbury also attended. Of the 25 growers, there were two women, a few sons, and a disproportionately large (compared to their numbers in the Sydney vegetable industry) number of "Aussies" (Anglo-Saxons). The meeting went well, especially the 20-minute session where groups of six, each lead by a coordinator from NSW Agriculture, discussed cultivation and environmental issues. Discussion was very lively at this time, but it became subdued again when the whole meeting re-assembled.

I held the March 1993 meeting in order to seek four nominations for collaborators for the permanent bed project. With this in mind, an experienced extension horticulturist gave a brief talk, which was generally well-received, on the favourable results of permanent bed experiments conducted by NSW Agriculture at Somersby in 1984-87. Despite this talk, a careful explanation of the project, and my repeated pleas; not one grower expressed an interest in becoming involved in the project. Nor were there any nominations of growers to become involved. On the other hand, after the meeting one grower (Joe Borg) approached me and said I could come to his farm to explain things further to him, and another grower, not present at the meeting, was nominated as a potential collaborator (Paul Mifsud). Both these growers did eventually become collaborators.

The second information evening was a disaster, and a blow to my ego. Only six growers attended (two of them permanent bed collaborators). These growers were outnumbered by four company representatives and four NSW Agriculture staff. The program for the night was very good - a comment made in hindsight by several growers including Sam Dimech and the Grechs at Camden. My mistake was not to promote enough, and to rely upon others to promote the meeting. I had hoped a Vegetable Growers' Newsletter would be posted out (to 1200 Sydney region growers) in time for the meeting, and that the speakers involved would advertise the event, but these things did not happen. For my part, a single visit to D shed, discussion with the collaborators, and leaflets posted to a dozen other growers wasn't enough. In all of my activities, I found that growers needed to be reminded of events a few days before they occur. In the case of the second information evening I didn't do this, and the visit to D shed was too early (2½ weeks before the event). The
poor attendance at the second information evening strongly contributed to my reluctance to hold similar events thereafter.

The growers (and myself) very much enjoyed the bus trips. In attending, they got to see other farms, socialise with each other, and "get away from the farm" for a while. On both trips machinery was the main item of interest. It appeared that the growers had strong empathy with the visited farmers, and vice versa. Often they expressed surprise that other districts were not as advanced as they had expected, for example with regards to harvesting aids and new cool rooms. There was mixing, but generally growers stuck to their existing friends. Growers made the most of their time away on the trips. They did not want to relax, they wanted to see things. The trips stimulated many growers to a significant degree, for example to investigate the feasibility of using anhydrous ammonia or to make a new piece of equipment.

The promotion for the January 1994 field day at Sam and Mario Dimech's was extensive. It included the handing out of 500 leaflets (350 personally in D shed one week before (a Friday) and one day before (a Thursday) the event), a notice in the Vegetable Growers' Newsletter (1200 copies mailed to Sydney growers soon before the event), and notices in "The Land" and "Hawkesbury Gazette" newspapers. Notice leaflets were also placed prominently in supply stores and D shed. This very substantial effort resulted in the attendance of around 60 growers and 20 "others", for example NSW Agriculture and UWS-Hawkesbury staff. In the words of an experienced extension horticulturist for vegetables based at Gosford, this attendance was quite respectable. It is interesting to note, however, that this level of promotion resulted in only three telephone enquires for further information.

I made up some attractive, relatively large text posters for the field day. These were mounted on screens placed next to my site at the boundary of the reduced cultivation and ordinary cultivation plots of Sam and Mario's permanent bed trial. I stood next to a soil pit, two soil profiles, and the posters - and waited for growers to come over. About 15 did so. More precisely, this was the approximate number of growers with whom I spoke at depth on the day. Quite a few more growers approached to a "safe distance", looked at the crops, then wandered over to the
machinery. I was quite surprised how few people read the posters or asked me what was going on. Many did not realise that the performance of lettuce and silverbeet under different cultivation regimes was on display. Even a visiting university lecturer was amongst the many ignorant attendants.

Despite one broken pop-up sprinkler (run over by a vehicle), Sam and Mario thought the day was worthwhile. However, Sam did ask "Why weren't there any speeches?" In hindsight, I think a short speech delivered to the assembled growers would have been worthwhile. I elaborate upon the reasons why a speech was not presented in the "Facilitation" section of the "Discussion".

The written material of produced during the research appeared to have little, perhaps no, effect upon the growers. A two-page leaflet, which I thought was rather good, was inserted in the Autumn 1994 issue of the Vegetable Growers' Newsletter. The leaflet outlined the permanent bed project and the results to date. Despite a mailing list of 1200, only one grower rang me for further information. Upon later farm visits, some growers said they remembered seeing the leaflet, even reading it, but also said they could not remember what it contained. No responses were ever received regarding my several Newsletter articles or personal letters to growers (note that I included my name and phone number for further information on all documents).

Of all the methods for promoting change, the conduct of the permanent bed trials was the most powerful. The outcomes of this process, in terms of changes in experience, knowledge, and practice were highly significant to most, perhaps all, collaborators. These outcomes, in terms of farm practice, are outlined in the following section while themes relating to the conduct of the trials are developed in Chapter Six.

5.1.3. Methods mostly for data quality and analysis

Comments on these methods appear throughout Chapter Six.
5.2. **Outcomes of the research and extension**

5.2.1. **Changes in farm practice**

i) **Changes in cultivation practice**

In the first year following establishment of the permanent bed trials, the permanent bed technique was adopted by six of the nine collaborators on four of the eight farms concerned. Joe Borg, Jim Saliba, Sam and Mario Dimech, and Charlie and Joe Attard (Luddenham farm only) adopted permanent beds as a result of the extension project. At the time of writing, these growers continue to use permanent beds. Conversely, at the time of writing, permanent beds had not been adopted by three growers on their farms, and by two growers on their second farm (i.e. four farms in total). The decisions to adopt were combinations of the availability of suitable machinery, the performance of the permanent bed demonstrations, and the persuasion of the author.

*I stress to the reader that in all circumstances where I refer to my persuasion leading to change, other factors were involved. There were no simple causal relationships between my intervention and changes in farm practice. I also wish to point out that all observations have been confirmed (usually several times) with the relevant collaborators.*

Joe Borg had bought a small (100 cm width) rotary hoe, suitable for the permanent bed technique, a few months before he became a collaborator in the extension project. He had also been persuaded by a friend (John Galea at Horsley Park) to sometimes keep his beds for two crops, and had started to do so in the year prior to becoming a collaborator. On the other hand, Joe had never considered keeping his beds for more than two crops.

As a result of my influence, Joe decided in early 1994 to get three, four, or even more, crops out of each bed before destroying it. He reported, in June 1994, that his crops were the same or often better since the beds were being kept; and that he was keeping his beds on the whole farm except following potatoes (incompatible machinery), silverbeet (*"there's too much grass (weed) by the end*
of the season") and broccoli (too much plant material to be broken down by a light cultivation). At the end of 1995, Joe was keeping his beds following silverbeet and broccoli too.

In Joe's case, the change to permanent beds involved a decreased use of his large tractor (200 cm wheel spacing), large rotary hoe (300 cm width) and disc cultivator; and an increased reliance upon his smaller rotary hoes (150 and 100 cm widths). The frequency of rotary hoeing did not increase, rather, the frequency of other cultivation operations decreased. Following my suggestions, Joe began to rotary hoe more shallowly (e.g. 10-15 cm compared to 20-25 cm) and slightly less often than he had previously. At the end of 1995, Joe mentioned to me that he had only started his large tractor once in the whole year.

A point to make regarding Joe's change in cultivation practice is what seems to be a partial reversion to more intensive cultivation. During many farm visits over the life of the extension project, Joe and I discussed the issue of how many crops can be obtained from beds before needing to fully rework the paddock. In the first year of the project Joe seemed more enthusiastic and mentioned obtaining half a dozen or more crops. Later, he often referred to a maximum of three to four crops for his particular soil type, which is hard-setting. Joe also moved away from one or two rotary hoeings before a crop to two or three. On the other hand, Joe has abandoned practices which destroy his gutters and the entire bed, and so he is keeping his beds for many crops - although cultivating within the bed a bit more aggressively than was the case in early 1994. It can be said that Joe continues to rely heavily upon rotary hoeing for soil preparation. However, he has adopted a form of controlled traffic tillage which can be labelled as a semi-permanent bed technique.

The consequences of this change in cultivation have been a reduced usage of chicken manure (down one third), improved paddock access, and better crop performance. In February 1996, Joe told me "The crops (are) 100% better, not 50% better (now that he keeps his beds)". Joe attributed this improved crop performance to "not bringing up the salty ground" (i.e. not cultivating too deeply) and a greater concentration of nutrients in the crop's root zone. Joe also said that his cultivation time was about the same. Although he was carrying out fewer operations, the smaller tractors were much slower than the large one, which works a greater width with each pass and
travels at a similar speed. On the other hand, Joe reported that his cultivation costs were less because the smaller tractors use much less fuel per hour, and are cheaper to maintain, than the large tractor.

Jim Saliba, in a manner consistent with his inclination towards perfectionism, used to cultivate very intensively prior to his involvement in the permanent bed project. Between crops, Jim used to use a large (200 cm) rotary hoe to around 25 cm two or three times, hill, spread chicken manure, then lightly rotary hoe to incorporate the chicken manure (one pass of a 150 cm rotary hoe to 5 cm only). Since the beds and gutters were destroyed in the initial rotary hoeings, hilling to make new, level beds involved several passes and some three hours per paddock. In fact, Jim took seven hours to cultivate a typical paddock of 2/3 acre (0.26 ha). This figure is much greater than the industry norm of perhaps four to six hours per acre (10-15 hours/ha).

Now Jim takes 1 ½ to 2 hours to prepare a paddock. The savings in time and money have been substantial. The monetary savings have been calculated to be $5000 p.a. This figure comprises $3600 in saved cultivation costs (5 hours saved per paddock of 0.26 ha x $9.50/hr to operate a 60hp tractor x 10 cultivated hectares x 2 crops per year) and $1400 in fertiliser costs (5 t/ha of chicken manure saved x 10 hectares x $14/m³ x ~2m³/tonne). Because crop yields and quality are the same, this money is all profit. The saving in time for Jim and Sue is 375 hours p.a. - which represents over one month of working days!

A small (100 cm width) rotary hoe was purchased soon after Jim became a collaborator of the permanent bed project. Following acquisition of this piece of machinery, Jim decided to keep his beds on the whole farm. More accurately, Jim decided to turn his gutters into permanent laneways. This is mentioned because the first thing Jim did was put a sandbag on the new small rotary hoe so it could cultivate more deeply - to 30cm. I pointed out the potential advantages of shallower cultivation and in the following six months Jim progressively converted his farm over to permanent beds worked to 15 cm in depth, that is, just above the gutters. As an unprompted trial near the start of this process of conversion, Jim compared deep (30 cm) and shallow (15 cm) cultivation in a spring-harvested patch of lettuce. Crop performance was exactly the same.
Following attendance of the bus trip to Griffith and Hay in September 1993, during which he saw a Howard "paraplough", Jim arranged for a "bed-lifter" to be built for use on his farm. The tractor-drawn implement (on a three point linkage) consisted of a frame bearing hillers, rippers and toothed blades designed to do one bed at a time. The implement appears in Plate 19, Appendix C. Unfortunately, the toothed blades were prone to twisting by tree stumps and so were removed. Jim's typical cultivation between crops became one shallow pass (5-10 cm) of the small (100 cm) rotary hoe to break down the previous crop or merely a herbicide spray without any soil disturbance, one pass of the bedlifter (now just a ripper/hiller) to 5-10 cm below the level of the gutters, and another single shallow pass of the small (100 cm) rotary hoe. As mentioned earlier, this took two hours per 2/3 acre (0.26 ha), which was less than half of the time of Jim's previous cultivation practice.

At the time of writing, Jim was keeping his beds for three or four crops then cultivating with the large (200 cm) rotary hoe, while still keeping to the same gutters. Thus, like Joe, there has been a substantial and so far permanent change towards a lesser degree of cultivation, but also a partial reversion to cultivation more intense than that espoused during the first year of the permanent bed project. Jim has not noticed differences in crop performance as a result of his change in cultivation practice. He has, however, noticed that "less soil washes down the gutters (i.e. erosion is less)."

Towards the end of 1993, and six months after recruitment to the permanent bed project, Sam and Mario Dimech started to adopt permanent beds (in their case permanent "hills") on the whole of their farm - excepting the (+c) plot of their permanent bed trial site. In June 1994 Sam reported that some paddocks had produced two crops, others three, and that "lettuce and cauliflower seem to be doing a bit better now the hills are being kept". The Dimech's previous cultivation between crops was one pass of a large (200 cm) rotary hoe to 20 cm to help break down the previous crop, one or more disc cultivations to 15 cm or so to control weeds, spread chicken manure, rip once to 30 cm, another pass of the large (300 cm) rotary hoe to 20 cm, and, finally, hilling. This changed to a greater reliance on herbicides following a harvested crop, slashing or mulching the previous crop without soil disturbance, spreading manure, one pass of a bean knife cultivator to a few inches depth and, finally, one pass of a special "scarifier" to around 10 cm in depth.
One pre-conceived objective of the permanent bed project was to reduce growers' reliance upon rotary hoes for soil preparation. Sam and Mario were the only collaborators who, on occasion, decided not to use rotary hoes at all between crops. When not using a rotary hoe, Sam and Mario relied upon the bean knife cultivator and special scarifier mentioned above. The bean knife cultivator was able to disturb the Dimech's soft soil to a surprising degree. At other times, Sam and Mario minimally used their existing rotary hoe, and later a new "interrow" rotary hoe, to the depth of a few inches once only before planting.

Sam and Mario's adoption of permanent beds approximately halved their cultivation time. They are now keen enthusiasts of reduced cultivation techniques. On the other hand, at least in the case of Mario, there is a limit to their enthusiasm. On one occasion I observed the softness of the Dimech's soil and mused that plants could be (mechanically) transplanted into it without any soil disturbance beforehand. Mario replied "But you have to cultivate". On the other hand, a small patch of lettuce (200 plants) transplanted by hand into soil undisturbed for one month was able to perform perfectly well in the paddock concerned at that time.

Charlie and Joe Attard also adopted permanent beds as a result of their involvement in the permanent bed project. Starting one to two years before their recruitment to the project, Charlie and Joe were sometimes keeping their beds for two crops on their Luddenham farm. Six months into the project (late 1993), Charlie reported that they were changing over to permanent beds on their Luddenham farm. He mentioned they would keep the beds "nearly all the time".

A little over one year after recruitment (July 1994) Charlie and Joe reported that they were saving three hours/acre (7½ hours/ha) at Luddenham. Their previous cultivation had been to rip shallowly (20 cm) with an Agroplow, use a medium-sized rotary hoe (175 cm width) twice, then hill. This took half a day (four hours) per acre (10 hours/ha). They changed to just one pass of their hiller/hoe, which took one hour per acre (2½ hours/ha). Over a year, the savings would have been $1000 in cultivation costs and 1½ weeks of labour (110 hours).

Unfortunately, drought led to the abandonment of the Luddenham farm in mid-1994. At the time of writing it was still empty. At the time of abandonment, Joe reported "our ground is twice as good
now" (following use of the hiller/hoe at Luddenham). Joe explained that "the ground comes up a lot finer", that is, there were less large clods. However, this improvement would more likely be due to differences in the blades of the hiller/hoe compared to the larger rotary hoe, rather than a difference in soil structure.

Also in July 1994, Charlie and Joe stated that they had never kept their beds on the Bents Basin farm, which has a light soil (sandy loam texture). However, they said they would now sometimes keep their beds if the soil was wet. Thereafter, Charlie and Joe cultivated in a similar manner at Bents Basin, but did often keep their beds. At the end of 1995, Joe reported that crop performance was the same, and that cultivation was "a bit quicker".

Peter Dimech, Joe Dimech and Paul Mifsud did not adopt permanent beds during the life of the project. Peter did change his cultivation practice as a result of the project though. Once I showed Peter, using a steel rod soil probe, that an entire paddock of his was underlain by a strong plough pan between 20 and 35 cm in depth. The demonstration was referred to by Peter several times thereafter and about one year later he bought a large ripper. Peter also decreased his frequency of disc ploughing due to the author's influence. Joe Dimech and Paul Mifsud did not appear to change their cultivation practices at all in response to my influence. Both had replaced ploughing with ripping (which is non-inverting) in the years immediately prior to their involvement in the permanent bed project. On several occasions, when I questioned Joe and Paul regarding their cultivation practice, they expressed the opinion that they had already changed and did not need to change further. In February 1996, Joe did say that his permanent bed trial had given him ideas. However, he could not think of any specific examples. Joe went on to say that too many factors were involved to attribute change to one particular influence.

Particularly as a result of the equipment purchase/modification money available from the permanent bed project (approximately $1000 per collaborator or collaborating pair), and the 1993 bus trip to Griffith and Hay, the collaborators bought and/or made new cultivating equipment. As mentioned earlier in this section, Jim Saliba had made a customized "bed lifter". The bed-lifter and the small (100 cm) rotary hoe part-purchased with project funds are now Jim's main implements of
cultivation. Joe Borg himself made a novel ripper/hiller, a blade and roller for gathering plastic mulch and harvesting leeks (both of these implements prompted by the Griffith and Hay trip), modified the wheel spacing on his manure spreader (to avoid compaction to the beds), and adjusted the linkage alignment of his medium-sized (150 cm width) rotary hoe (to better suit his new permanent bed tillage regime). Joe Dimech built an improved version of a prototype hiller/hoe he claimed to have invented ten years previously. Sam and Mario Dimech had built an impressive hydraulically-operated bean knife implement and went on to buy a mulcher and a specialized "minimal-disturbance" rotary hoe. Charlie and Joe Attard had built a hiller/hoe (see Plate 5), which Joe claimed in September 1994 to be "the best thing we've ever bought".

Other growers who were not formal collaborators of the permanent bed project also adopted permanent beds and reduced tillage practices on their properties. For example, a grower who went on the 1993 Griffith and Hay bus trip modified his ripper to disturb only his beds and changed over to a controlled traffic tillage regime. I would have liked to evaluate, in a significant way, the extent of this adoption among Maltese vegetable growers. However, at the time of writing, this had not been done. Despite this, I am aware that diffusion has taken place. The collaborators have influenced the cultivation practice of their associates without my direct intervention. For example, in August 1994 Joe Borg informed me that two nearby growers had started keeping their beds since the beginning of the permanent beds project. At that time, I had not told the two growers of our work, rather, Joe had informed them.

ii) Changes in other farm practices

Naturally, during over two years of close association with the collaborators of the permanent bed project, there were many circumstances where I was in a position to respond to grower-initiated enquires and thus influence farm practice. Indeed, this often happened. I was also able to suggest farm practices to the collaborators. For example, Jim Saliba and Charlie and Joe Attard began to use cover crops (millet, oats), and Joe and Peter Dimech increased their usage of cover crops, following my suggestions. It is not helpful to the aims of this thesis to detail every change which occurred. Instead, some of the changes will be mentioned as evidence in support of the assertion that my extension activities influenced (but did not determine) growers' farm practices.
Following deregistration of the herbicide Lasso (Alachlor), Sam and Mario Dimech had a severe infestation of Stinging nettle (*Urtica urens*). The author followed up their enquiry on control of Stinging nettle and recommended the herbicide Goal (Oxyfluorfen) at the low rate of 50 ml/ha. This was used with great success. Mario later mentioned that, without the Goal, they would have probably lost many acres of cabbages. A more striking example of change was Peter Dimech's switch from flat fan to hollow cone nozzles on his boom sprayer. I suggested Peter replace his sprayer's nozzles during the time of a severe infestation of cabbage moth (*Plutella xylostella*) in summer 1993/94. At the time, I did not realize that Peter had, for over twenty years of farming, been using herbicide-type nozzles for all his spraying operations. Peter reported much better spray coverage and caterpillar control with the new nozzles, which cost only $57.

A complete soil nutrient test was carried out before most crops in the permanent bed trial sites. Some collaborators also had soil tests done, which they paid for, on other parts of their farms. The results of these tests provided much opportunity for the collaborators to improve their fertiliser practice. We discovered that Joe Dimech had higher than necessary levels of phosphorus in his soil (e.g. 170 mg/kg, Colwell extraction). This prompted Joe to have formulated a fertiliser mix containing only nitrogen and potassium. Another example of a collaborator using a new product was Charlie and Joe Attard's use of potassium chloride (muriate of potash) on their Bents Basin farm, which is low in potassium and does not have an excess of chloride. We also found that Peter Dimech had higher than necessary pH levels and so were able to reduce his liming costs.

The collaborators all use chicken manure. Rates of application vary from around 10 to 40 m³/ha/year, with an average of approximately 30 m³/ha/year (15 t/ha/year). The heavier rates tend to be used on lighter soils. A combination of awareness of high soil fertility and shallower cultivation resulted in savings in the amount of chicken manure used; with crops of the same or better quality being obtained. Those collaborators who adopted permanent beds made, on average, a one-third reduction in their usage of chicken manure.
5.2.2 Changes in the collaborating vegetable growers

It would be nice to think I was able to influence the collaborators in ways that will have long term significance to their lives, rather than simply save them a few dollars or solve a pest problem in one crop. I believe that this kind of influence did occur with at least a few of the collaborators. I will provide only two examples here, more instances of change in the collaborators are detailed in Chapter Six.

One may distinguish between changes which build upon an existing condition, and those which appear entirely new. In the case of Joe Borg, in June 1994 Joe informed me that he'd been thinking about how to work quicker (more efficiently) for the past ten of his 27 years of farming. Joe said my emphasis on reducing cultivation had heightened his awareness of time-saving. He then went on to say that he was coming up with ideas on how to improve efficiency more frequently since meeting me. In the case of Sam Dimech, a fellow NSW Agriculture horticulturist who surveyed Sam in June 1992 commented on the survey form that Sam and Mario relied totally upon pesticide resellers for pest and disease identification and control. My experience leads me to believe that this statement would have been true. However, a dramatic increase in Sam's curiosity occurred as a result of our interactions. In March 1994 I visited Sam and was bombarded with questions on insect identification, the effect of water pH on spray efficacy, etc. On that day Sam showed me information he'd obtained on Cabbage moth (P. xylostella) from a seed company representative. He also told me how he'd showed the information to his uncle Joe Dimech and a grower friend. The contrast between that state of affairs and 21 months previously was dramatic. In fact, I noticed an increase in curiosity towards "scientific agriculture" in all project collaborators, especially Sam Dimech, Jim Saliba and Joe Dimech.
CHAPTER SIX
DEVELOPMENT OF THEMES -
FURTHER RESULTS AND DISCUSSION
6.1. **Relationships**

I have come to believe that interpersonal relationships provide a framework, within which techniques of extension may be effective. In my opinion, it is difficult to over-emphasise the importance of "sufficient" interpersonal relationships. For example, I am aware of one Sydney grower who started using semi-permanent beds in 1968. However, because of his secrecy and antagonistic relationships with other growers, at least two (and probably all) of his neighbours, growing the same crops on the same soil, were not using semi-permanent beds when I visited them in 1993 - 25 years later! This highlights a deficiency of the classical "transfer-of-technology" model of diffusion, a deficiency which tends to be ignored, or at least downplayed, by its proponents (e.g. Lionberger 1960, Rogers 1962:193). That is, progressive farmers are often socially-isolated and may not pass on innovations to the remainder of their community (e.g. Anderson 1982, Arnon 1989).

At the start of the permanent bed project the collaborators and myself were strangers. Two and a half years later, I had good relationships with each collaborator and friendships with several. On the whole, it took about six months (10 to 15 visits) to build these relationships to very satisfactory levels. A good example of the development of a relationship is with Joe Borg. On my second visit to his farm (April 1993), Joe said "You don't need to see (to report to) me, just go over (to the proposed permanent bed trial site) and do what you want to do". A few weeks later I rang Joe and mentioned I was going on a trip to the Griffith and Hay vegetable districts. I asked if he had any questions I could chase up for him. Joe replied "no" and said he'd been to Werribee (a vegetable-growing district near Melbourne) recently and didn't need to find out anything more. However, four months later (in September 1993), Joe came on the 2½ day bus trip to Griffith and Hay and enjoyed it. This is significant because not only did Joe change his mind and choose to participate in a learning activity with me, but also 2½ days is a very lengthy commitment for a vegetable grower. Usually, it is difficult to get growers away from their farm for half a day. By the time of the Griffith and Hay bus trip, Joe was regularly inviting me in for coffee or lunch when I visited him. About one year after I first met Joe he was, without my prompting, discussing intimate matters such as personal relationships and his financial returns from farming.
The collaborators' typical reactions to me at the time of their recruitment to the permanent bed project (March and April 1993) were a mixture of wariness and, in some cases, sympathy. Joe had attended the grower's meeting I organised at Windsor RSL in March 1993. Later, at an interview in June 1993 and also a meeting held in September 1993, Joe said he had invited me to his farm, to discuss the possibility of him becoming involved in the permanent bed project, because he "felt sorry for me". As mentioned earlier (see "Results", section 5.1.), at the March meeting I had asked, even pleaded, for volunteers or nominations for growers to become involved in the permanent bed project - without success. At the September meeting, Joe went on to say how Paul Mifsud had told him "Ashley's too nice to say no to". Paul, also present at the meeting, smiled and agreed he had said that. At their time of recruitment Charlie and Joe Attard expressed an attitude which I have found to be typical of Maltese growers. The attitude may be expressed by growers saying, as the Attards did, something along the lines of "Yeah, we'll help you out (by providing a trial site)". Maltese growers often seem to think they have nothing to gain from becoming involved in an experiment or trial, and therefore consider that they are doing the prospective scientist/student a favour by providing them with a research subject.

Prior to their involvement in the permanent bed project, most of the collaborators knew most of the others - whether closely or merely by reputation. However, the activities of the project provided a means for the growers to know each other better, hence their relationships were, in cases, enhanced. For example, Joe Borg and Jim Saliba have stands close to each other in D shed at Flemington Market and, prior to their involvement in the project, used to merely greet each other with a polite "hello". However, as time went by, Joe and Jim began to talk more and share some of their production "secrets".

The 1993 Griffith and Hay bus trip was attended by 19 growers (17 of them Maltese). Unfortunately, the bus was very small and uncomfortable. On the other hand, the squashed-together growers were forced to talk to each other rather than sit separately and stare out the window. Luckily for me, the growers responded to their uncomfortable plight by making the most of it and joking. In the following months I was told by at least two of the growers who attended that the trip became a topic of conversation at Flemington markets and a focal point for those who
attended. Prior to the trip, many of the attending growers knew each other only by sight. However, after the trip, they had a common experience. Thereafter, many of these previously unfamiliar growers began to talk to each other.

The point is often made in the extension literature (e.g. Lionberger 1960, Van den Ban and Hawkins 1988:103) that farmers, in both industrialised and developing countries, tend to make decisions on whether to trial an innovation or not based on conversations with people whom they know and trust. I consider that an avenue of substantial opportunity with respect to the facilitation of extension (or adult learning) is the building of trust and credibility through good interpersonal relationships. In this research I noticed an apparently greater willingness for some collaborators to accept and act upon my advice as time went by. This was most apparent with my recommendations for fertilising (based on soil test results). I attribute this difference to my growing expertise and self-confidence in that area, favourable past results, and - importantly - better personal relationships with the collaborators concerned.

I consider that two factors helped in the development of our relationships. First, I chose friendly, sociable (or reasonably so) collaborators who were largely compatible with my own friendly and easy-going nature. At a more basic level, market gardening is labour-intensive and growers can be isolated. My visits often provided the collaborators, and other growers, with welcome conversation and company. Second, there were financial rewards for the collaborators following their involvement in the permanent bed project, that is, the $1000 for equipment modification/purchase, free soil nutrient tests, and other minor amounts of money. These incentives were complemented by my access to information with potential to improve their farm businesses.

Occasional positive results, such as correction of a nutrient deficiency or disease control following a fungicide recommendation, gave me credibility in the collaborators' eyes - and provided satisfaction to me for having proved useful. Such results do not have to be frequent. For example, one grower went on the 1993 Griffith and Hay bus trip and found it to be rewarding. Thereafter, I did not meet him until a visit to his farm almost two years later. The grower instantly greeted me in a friendly
Plate 15  The group meetings developed positive atmospheres

Plate 16  Growers chatting at the January 1994 field day
manner and agreed, although busy, to an hour-long interview - in return for the favour I had given him two years previously.

Within Australia, and elsewhere, there are trends for extension agents to reduce their direct contact with farmers (e.g. Rivera and Gustafson 1991, Campbell and Junor 1992). This trend, often forced upon the governmental extension services of industrialised countries by bureaucratic elements (e.g. Treasury Departments), can be accommodated to a significant degree by focusing more upon group work and larger farmers. However, whatever methods of extension are finally chosen, and whatever target categories selected, personal relationships will still be a key factor in the effectiveness of the extension.

6.2. Processes and action

Within some circles, for example Horticulturists of NSW Agriculture, Maltese vegetable growers are somewhat notorious for their secrecy regarding methods of production (L. James, J. Capuyan, J. Murison, pers. comm. 1992-1995). Nevertheless, the diffusion of innovations in production does occur among them. Some examples follow.

An example of unintentional diffusion (on my part) is that of the spread of soil fumigation following the January 1994 field day at Sam and Mario Dimech's. Sam and Mario have been "gassing the ground" (fumigating) with Sodium Metham since 1991. Prior to the field day, Sam was unaware of any other vegetable growers in the Sydney area who also did so. I have become aware of only one grower who was using Metham at the time of the field day - that grower started using it in 1992. Sam and Mario displayed their large Metham applicator on the field day, which was attended by 60 vegetable growers (nearly all of whom were Maltese). In the next few weeks, three growers who attended the day ordered Metham applicators from a local engineer who specialises in agricultural machinery - and is from a Maltese vegetable growing family. Since these three growers received their applicators and started fumigating with Metham in mid-1994, many of their neighbours and associates have also started to do the same. At the time of writing, two years after the field day, a sizeable proportion of Sydney's Maltese vegetable growers fumigate with Metham and interest is
high. Metham was frequently mentioned when I was making farm visits to growers at the time of writing.

I gave Joe Dimech an Inoculo soil pH test kit in December 1993 and, as mentioned earlier in "Results" (section 5.2.1.), we had been doing complete soil nutrient tests on his property. In October 1994 Joe informed me that he had been using the kit to test the pH of a nearby grower's soil, and that he had persuaded the grower to get his first ever complete soil test done. It appears that agents of extension may be able to capitalise on the idiosyncratic interests of farmers to promote diffusion, even if those farmers (like Joe) are not, in general, great sharers of information.

A friend of Joe Borg's (Sam, whom I already knew) contacted me in September 1994 to have a full soil test done on his new farm. One week later a friend of Sam's contacted me and asked that I arrange a full soil test for him too. I had known this second grower for a year but that was the first time Mario had contacted me. This example demonstrates the importance of existing personal contacts to diffusion. It also illustrates how ideas are communicated from one person to another; in this case, from myself to Joe to Sam to Mario.

As was mentioned in section 3.1, Maturana and Varela (1988:75) state that a disturbing agent (e.g. an extension agent) in the environment of an organism (e.g. a farmer) only triggers change - it does not specify or direct the change. Many newer approaches to agricultural extension and adult learning emphasise that learning be stimulated rather than information be transmitted (e.g. Ingalls 1973, Russell and Ison 1991). I consider this research to be a good example of how an ignorant outsider (i.e. myself) can, through an emphasis on encouraging local and experiential knowledge to be applied to a problematic situation (e.g. cultivation practice), achieve change. Beneficial change was achieved without my being an expert on cultivation. This is a dramatically different situation to "transfer of technology", where the emphasis is on expertise and fully developing technology, without reference to farmers' local knowledge. This initial development of technology may consume many resources. An approach to extension in the interpretive tradition also differs from most Farming Systems Research; where local knowledge is taken into account, but not explored deeply to fully understand informants' personal constructs.
The details of the information obtained from the permanent bed trials were, I believe, of little to no interest to other Maltese vegetable growers. It appears most growers are content to hear a broad statement along the lines of "We tried reduced cultivation techniques with cabbages and lettuce and found that we could still get good yields". Knowing that the results were obtained in their local area by similar growers, it seems other growers are then inspired to test the broad new concept (i.e. reduced cultivation "works") on their own farm using their own modifications of the concept. Examples in other contexts of successful change following farmers' inspiration with a broad concept include potato storage in Peru (Rhoades 1984) and maize storage in Togo (Maclure and Bassey 1991).

There is a tendency for many agricultural researchers and extensionists to develop and promote information "packages". Certainly more complete sets of information, when compared to isolated recommendations, have their advantages. However, learning is a process of transformation. It is not mere accumulation. Argyris (1982:xv) states "viewing basic research as cumulative and some day leading to a comprehensive guide for action is erroneous". Revans (1984:16, cited by Zuber-Skerritt 1991:xiii) has proposed an equation for learning of the form L: P+Q, that is, learning equals programmed knowledge (i.e. "knowledge in books") plus questioning insight. Revans goes on to say that "the evidence is that a surfeit of P inhibits Q". Maturana and Varela (1988:250) similarly contend that we must abandon the overbearing weight of our certainty so that we may learn and grow. Thus, it can be seen that an extension approach which aims to inspire farmers to modify broad concepts has a strong theoretical backing.

It has been mentioned that, of all the methods for promoting change, the conduct of the reduced cultivation trials was the most powerful. The collaborators who adopted permanent beds did not wait to see the long-term trends in their trials. Instead, they made a decision to use permanent beds on their whole farm after seeing the technique work once (i.e. the second crop of the trials). Actually, decisions were made even earlier than this - at least in the case of Jim Saliba (see "Results", section 5.2.1.). I believe that, with all of the thinking involved in implementing their decisions to establish and maintain trials of permanent beds, at least some of the collaborators
assumed that the permanent bed technique would work for them, and that they may as well adopt it at the time (perhaps also thinking, "Well, if it doesn't work I'll just change back later"). I suspect that the conduct of the permanent bed trials was an example where changes in behaviour led to changes in attitude. This represents a reversal of the usual emphasis of extension, i.e. change peoples' attitudes so they will then change their behaviour.

It is well recognised in psychology that attitudes are generally not predictive of behaviour (Vanclay 1992:99). Rogers and Shoemaker (1971:111-112) mention a tendency for attitudes and adoption to be consistent, but state "we know of many cases in which attitudes and behaviour are quite disparate". Foddy (1993:5) has stated "The evidence for a link between attitudes and behaviour has always been weak". Vanclay (1992) found such disparity among farmers of the Darling Downs in Queensland with respect to their attitudes towards, and adoption of, conservation farming. Vanclay explained that a number of influences were responsible for weakening the potential link between farmers' attitudes and their behaviour. These include farmers' group norms, perception, and circumstance (e.g. financial and knowledge resources). Argyris and Schön (e.g. Argyris 1982) have also reported disparity between what people say they believe in (their "espoused theory") and what they actually do (their "theory-in-use"). Part of the explanation for this disparity resides in the fact that we are not fully aware of all our assumptions, our patterns of thought, which mediate our responses to stimuli. In my opinion, a further plausible explanation may be that we cannot possibly maintain consistency and be aware of all of our consciously-held attitudes at every point in time.

Given the wealth of disconfirming evidence from a wide range of fields, it is time that agricultural extension agents discarded the "attitudes → behaviour" assumption; or at least treated it with extreme caution. In my opinion, the strategy of influencing behaviour via attitudes subscribes to the idea that abstract thinking is the supreme form of learning, and that "learning by doing" is somehow less authentic. As the successful results of the conduct of the permanent bed trials show (see "Results", section 5.2.1.), it may be more rewarding to first concentrate upon changing the behaviour of target clients. Attitudes can then change on the basis of the results of the clients' experience.
6.3. **Communication and understanding**

In this research, at least one of the collaborators was reluctant to point out poorer crop performance in the (-c) plot of his permanent bed trial. A specific incident was Mario Dimech not telling me the third crop of his permanent bed demonstrations was slower to establish in the (-c) plot. After Sam told me of his father's reluctance to mention this fact to me, I asked Mario "Why not tell me?" Mario replied along the lines of "Well, I expected the (-c) crop to catch up (it did) and I thought you wanted to prove that we can cultivate less". Mario's presumption that I was more interested in promoting reduced cultivation than in hearing the actual results of reduced cultivation in his circumstance, was just one of many examples where the collaborators, myself, or all of us, had false presumptions about each other.

Communication and understanding in this research were, I believe, facilitated by good interpersonal relationships, and awareness of each others' circumstances and nature. Kelly's theory of "personal constructs" suggests that the differences between individuals are profound. Yet, shared meaning flourishes among humanity. I have come to believe that the key to mutual understanding is a constant interplay of ideas, a continual interpretation and re-interpretation of constructs. I consider the interpretive nature of action research and other new paradigm methods of inquiry a boon for extension. Not only may meaningful communication be enhanced, but valuable local knowledge can be employed in the extension campaign (e.g. Chambers *et al.* 1990, Fisher 1995). A caution which needs to be heeded when using an interpretive methodology is not to get "bogged down" with detail. A good balance of "local" knowledge and "outside" knowledge is not easy to find (e.g. Arnon 1989:347).

As mentioned in the literature review on adult learning, symbolic interactionist theory states that people have presumptions of others' motives and meanings which they take into consideration when interpreting another's utterance, and when formulating their own speech. This assertion may appear self-evident. However, it is surprising how often people take their own presumptions for granted, and give no thought to checking others' possible presumptions. Argyris and Schön (e.g. Argyris 1982) have shown that peoples' presumptions are very often incorrect. In promoting
voluntary change, such as in agricultural extension, I believe it is desirable that people to make their motivations and presumptions transparent to each other so that trust may develop and effective communication occur. In fact, the exposure of presumptions and motivations is an important part of action research. On the other hand, it is not addressed at all in "transfer of technology" style extension.

I consider symbolic interactionist theory to be useful in helping extension agents better understand their clients' situations. I found that a skeptical, probing approach helped me to understand this complex research situation better. When listening to growers' comments, I often thought to myself "Why is he saying/telling me this?" An example of such an approach, also with reference to the theories of Argyris and Schön, is Underwood (1985b). An awareness of the theory may also be helpful when presenting oneself to others. In this research, I was careful to explain my motivations to the collaborators. On several occasions, the collaborators stated that they appreciated my honesty and frankness. In my opinion, it seems likely that if an extension agent can anticipate possible negative presumptions that clients may have about him or herself, then act to address those presumptions, the engendering of trust and credibility with clients should be easier.

In addition to awareness of my own and others' presumptions, I found it necessary to develop a "deep" understanding of growers' circumstances to adequately know "what was going on" in the research context. For example, I interviewed an innovative user of semi-permanent beds (John Galea at Horsley Park) during Murison's 1992 survey but thought, at the time, that he was an aggressive cultivator. Only after my association with Joe Borg, who is a friend of John, and the 1993 Griffith and Hay trip, which we all attended, did I come to realise that John is a user of semi-permanent beds. Hence the need for interviewers (or extension agents) to be adequately familiar with the survey topic (or problematic situation). It was interesting to note that the two collaborators surveyed twice (in 1992 and by myself in 1993) changed some of their answers. For example, Joe Dimech told me he sprays to be "completely free" of pest and disease whereas the earlier interviewer recorded that Joe sprays to be "mostly free" of pests and disease. This would be an interviewer effect, probably directive probing. These additional examples further underline the applicability of symbolic interactionist theory to human communication and understanding.
6.4. Psychological barriers to learning

When I asked the collaborators whether they had any comments regarding the second letter of results of the permanent bed project (posted to them in July 1994), no feedback was offered. The following comments, made two weeks after the letter was sent, describe whether particular collaborators read the letter or not: Joe Borg had not read it (he is illiterate) but said he might get his daughter to read it to him later, he asked what was contained in the letter; Paul Mifsud thought he had read the letter - but couldn't remember what it contained; Sue Saliba had read the letter completely and discussed it with Jim; Joe Dimech had skimmed through the letter and said "I might read it properly later, but, you know, I'm very busy"; Sam Dimech had read "a bit" of the letter; Charlie Attard had read all of the letter because, he said, "if I don't read it the first time then I'll never read it"; finally, Joe Attard had read half the letter. Possible reasons for these observations, and their implications, are among the topics developed in this section.

There are psychological barriers to learning in any situation. For example, clients may have incorrect, negative presumptions of the educator's motives for wanting to encourage change (of course, their correct suspicions can be barriers too). It would likely be misguided, simplistic, and unhelpful for an extension agent to "blame" a lack of change largely upon negative psychological characteristics of his or her clients. It would also be misguided to metaphorically view certain client attitudes and beliefs as "physical barriers" that need to be "broken down" for change to occur. Nevertheless, clients' attitudes and beliefs do play a role in determining the outputs and outcomes of an "agricultural information system". I consider it legitimate for an extension agent to label some of these client attitudes and beliefs as "negative". In the following text the word "hindrances" is often used as a substitute for barriers.

With regard to Maltese vegetable growers of the Sydney region, I consider the following to be psychologically-based hindrances to learning: growers' poor literacy, low levels of formal education, relative disinterest in the kinds of learning experiences currently available, and limited self-esteem. These hindrances are related. Not all are peculiar to Maltese vegetable growers. For example, if one's criteria were sufficiently lofty, almost any group could be labelled as lacking in
formal education. Nevertheless, hindrances to learning common to many groups should not be ignored by the extension agent simply because they are widespread. After all, something may be able to be done to overcome them.

It has been mentioned (see "Context", section 4.5) that a significant proportion of Maltese vegetable growers are illiterate (in both English and Maltese), and that many more read only poorly. Those growers who are illiterate, or only semi-literate, are probably uncomfortable or ashamed of the fact. At least, Joe Borg is so. I believe growers like Joe avoid situations which expose them to reading, such as the listing of attributes of an ideal farm on a whiteboard. Furthermore, regardless of one's literacy, one does not feel like reading very much at the end of a 14-hour day of hard work.

While all young Maltese growers are competent in spoken English, some older growers have troubles because of their differing language background. This constitutes a barrier to learning in didactic contexts, for example an educational lecture, where the medium of instruction is English. Regardless of their fluency in everyday English, Maltese growers tend to be very much ignorant of the technical terms of agricultural science. For example, many growers collectively refer to all plant nutrients as "manure". Such a classification does not lend itself to an explanation of the differential leaching of nitrogen and phosphorus. However, what do growers have on offer from NSW Agriculture, and others, to help them learn more about the farm inputs they use? Highly-technical bulletins and speeches! Quite simply, growers do not understand much of the terminology used. Combined with a reluctance to ask for things to be clarified, a reluctance I have observed often, much information presented to growers "goes over their heads".

Maltese growers seem to place a lower priority on learning than, for example, working hard. Many growers, particularly older growers (>50 years of age), do not appear to want to learn more. Some sons have told me as much and their fathers, also present, have agreed. One may pose the question, "Is this apparent disinterest in learning adaptive (e.g. due to poor literacy) or is it caused by a fundamental characteristic of the target audience (e.g. a relative lack of emphasis on learning in Maltese culture and greater emphasis on hard work and piety)?" After three years of exposure to
the Maltese community, I still cannot answer this question. However, I consider that the disinterest is in part adaptive. Most growers say they do want to learn, but in ways they prefer. They express indifference to the technical publications they are offered by company representatives and NSW Agriculture horticulturists. The kinds of learning experiences Maltese growers prefer are mentioned later in section 6.6 ("Kinds of Experience") of this discussion.

Nevertheless, it is rather predictable that a grower asked "Do you think it is important to continually learn?" will reply "Yes". I have a strong impression that Maltese believe in "working harder, not smarter". Others who deal with Maltese, and Maltese themselves, have agreed with this impression. I have been unable to find literature which supports, or refutes, this assertion, except a reference in Owen (1969). I consider it revealing that nineteenth century British in Malta reported a peasant-like population who were poorly-educated and without scholarly ambition (Owen 1969). It is possible that traditional Maltese culture has a relative lack of emphasis on learning. Furthermore, this possible "deficiency" may be associated with Sydney growers' disinterest in extension offerings.

Each Maltese vegetable grower is in unique circumstances. However, there is much overlap in circumstances too. I noticed that Maltese vegetable growers seem to have an "obsession" with their own farm and circumstances which hinders interactive processes, such as the flow of information or collective reflection. This obsession was noticeable especially at each of the collaborators' meetings. At the meetings the collaborators went to (what I considered to be) excessive lengths to point out that what works for them may not work for other growers, and vice versa. Although the meetings' discussions were lively and interactive, it was noticeable that the collaborators talked more than listened. There was a tendency for them to relate their own experiences, but ask few questions and points of clarification of the other collaborators. I will argue later (see "Adult learning", section 6.10) that Maltese vegetable growers, like most people perhaps, tend not to have good skills in reflection.

People need emotional support and feelings of well-being in order to learn best. This fact is reported in the literature by many, if not all, leading adult educators. For example, Knowles (1984:16) says "People learn better when they feel supported ... I convey my desire to be
supportive by accepting learners with an unqualified positive regard". In a similar manner, Boud et al. (1985:29) consider that negative feelings can hinder reflection but not positive ones. They state that negative feelings form barriers which need to be recognised as such and removed before reflection and learning can proceed.

I consider that lack of emotional security was a factor which significantly hindered learning and change in this research. Galjart (1971, cited by Röling 1988:46) has stated that three conditions are necessary for voluntary behavioural change, namely, One must know how to, want to, and be able to. Many extension exponents (e.g. Arnon 1989) consider that, of these three conditions, ability tends to be limiting. While acknowledging this is very often the case in the developing world, I cannot agree that ability is the major limiting factor in Australian agriculture, including this context. Instead, I feel willingness was limiting here. I feel so because the reduced cultivation technology I was promoting is cheap (often involving no additional expenditure) and easy to understand and implement (e.g. rotary hoe just once instead of four times).

Furthermore, despite the small sample of just nine collaborators, I consider it revealing that the collaborator who changed the least and who was the hardest to work with (i.e. Paul Mifsud), was also the one whom I would guess has the lowest self-esteem. I can think of many situations where, of Galjart's three conditions, willingness was the one that prevented me from changing. In my opinion, nearly all people one meets in life lack self-confidence - if not in an obvious manner, then certainly deeper down in their selves. Harris (1967) states that adoption of a "You're OK, I'm not OK" stance is an inevitable consequence of human socialisation. This stance is learnt in the dependency of infancy. Harris further suggests that the vast majority of people never, in a fundamental way, progress beyond this stance of limited self-esteem. I contend that Maltese vegetable growers are just like other people, and need support in order to learn effectively.

6.5 The self-interest of learners

Ingalls (1973:34) expresses a view common among researchers of adult learning when he states "Learning is not likely to occur unless a person is internally motivated to learn". Self-motivation is
supported by learners' beliefs, or hopes, that the learning will assist in life-tasks important to him or her. I consider it revealing that the collaborators used me as a resource person for production matters such as pest and disease control, cultivation, and fertilisation. However, they did not take up my repeated offers to assist them in other areas, for example the organisation of a group to lobby NSW Agriculture or seek government funding in order to carry out applied research. It appeared that Maltese vegetable growers are not concerned with learning about, and achieving change in, areas outside of the realm of production, such as marketing and relationships with local and State government. However, a confounding factor may have been the seemingly common assumption of Maltese growers that there is little they can do to influence these areas.

The collaborators expressed their motivation to learn in areas of self-interest by occasionally asking about the crop and soil data obtained from their permanent bed trial sites, and the trial sites of the other collaborators. The most obvious example of self-motivation was in response to the offer of $1000 each towards the purchase or modification of cultivation equipment. This money, provided by the National Landcare Program, was part of the operating funds of the project. As mentioned in the "Context" (section 4.5), Maltese vegetable growers have a great interest in machinery. The offer prompted most, but not all, collaborators to enthusiastically visit equipment suppliers, draw up plans, and so on. The collaborators attitude towards me became very favourable and they expressed a much greater willingness to experiment in the permanent bed trials, despite the potential threat of yield loss. In the end, about $8000 in NLP project funds prompted the purchase of $34000 worth of equipment. Obviously, such a high level of investment by a facilitator of adult learning can only be a rarity. On the other hand, it is perhaps surprising that government and industry-funded research and development (R&D) projects can involve tens of thousands of dollars in operating funds each year; yet not allocate even 1% of this money as "gifts", in forms that the project clients want (e.g. free soil tests), in return for their sometimes costly or inconvenient involvement in the project. Adult learners often expect quick rewards to come from their learning (Knowles 1984). I contend that farmers participating in collaborative extension campaigns are no different.
6.6. **Kinds of experience**

In November 1992, prior to the start of this research, I visited vegetable farms in the Murrumbidgee Irrigation Area (MIA) of NSW. The intention of this visit was to familiarise myself with reduced cultivation techniques, especially permanent beds, which had been recently adopted by some MIA vegetable growers. I was told by one notable innovator that he decided to adopt permanent beds after visiting farms of the Ord River Scheme, Western Australia, where the technique was being used (S. Mancini, pers. comm. 1992). I also learnt that other early adopters of permanent beds decided to adopt after visiting farms using permanent beds in the nearby Hay Irrigation Area. It was apparent that *direct* experience, such as a personal visit, can a powerful influence upon behaviour. Indeed, my trip to the MIA was an example of such direct experience.

The consensus of opinion among researchers of adult learning is that learning is a process of transformation of experience (e.g. Boud 1981, Knowles 1984, Kolb 1984, Mezirow 1985). Experiential learning theory suggests the richer experience, the potentially richer the learning (Claxton and Murrell 1987). In this research, I found direct methods of discovery to be more rewarding than indirect methods. For example, I consider I would have learnt more about Maltese vegetable growers and their farms by simply visiting farms and observing things directly; compared to spending an equivalent amount of time poring over the 45 completed survey forms (39 of which I did not fill in myself) of Murison's 1992 survey, then summarising them into a document - as I did in February and March 1993. Direct methods of observation are often time-consuming (and therefore expensive) and usually lack the breadth of scope that can be provided through secondary information sources. However, in my case, I found that the depth of understanding, and awareness of current issues, that resulted from my own farm visits and interviews with growers more than compensated for these other factors. Such visits also started me upon the road of building relationships with the growers concerned.

In a similar manner, extension methods involving much direct experience were more successful in promoting change among the Maltese vegetable growers than relatively indirect methods. For example, the conduct of the permanent bed trials greatly influenced the collaborators' thoughts and
farm practices, whereas it seems the written materials that growers received through the post had no influence at all. I do not mean to say that reading is not an experience. Nor do I wish to imply that reading on its own, for example a perusal of the Bible or the Koran, cannot have a profound influence upon an individual. Nevertheless, the kind of experience individuals, or alike groups of individuals, are exposed to is of significance.

I consider that the non-reading of Maltese growers is not merely adaptive, that is, not merely due to busyness or a lack of school education. I believe there is more to it than this. For example, I never tinker with my car on the weekends. Never in my life have I pulled apart a motor then re-assembled it "for fun". Quite simply, my "sphere of activity and interest" does not include mechanics. In a similar manner, I believe the "sphere of activity and interest" of the vast majority of Maltese vegetable growers does not include reading, nor abstract "mind games". Such activity is foreign to them.

The term "sphere of activity and interest" can be related to Kelly's "constructs" and Mezirow's "meaning perspectives", but with a greater emphasis on familiar kinds of sensory experience rather than familiar patterns of cognition. Woog (1978) and Roberts (1992) point out that individuals cannot learn new things which are outside the limits of comprehension of their present constructs. Therefore, in a similar manner, and also because extension agents must deal with many clients with the help of relatively few resources; I conclude that extension agents should concentrate upon activities which comprise the "kinds of experience" that the target category or group finds "meaningful", that is, within their "spheres of activity and interest".

Written material may be cheap to produce and distribute, but if the target audience does not want it, as is the case here, then clearly it is the extension agent who must adapt - not the audience. I hasten to point out that other groups of farmers use written material to a significant degree. For example, a recent survey of South Australian farmers found, on average, that farmers spent seven hours per week reading, and that half of that reading was related to farm issues (Kerby 1994).
After three years of observation and reflection, I am of the opinion that Maltese vegetable growers value doing things themselves, seeing things themselves, and talking about things they have an interest in, such as issues of production, with people whom they find credible. I also consider that Maltese growers place very little value upon words on paper (no matter how nicely presented), the contents of speeches, and conversations with people whom they do not yet know and have faith in.

With regards to agricultural practice, the differences between merely hearing or reading about something, and doing or seeing it oneself, are vast. For example, a growers' cultivation of his own paddock and transplanting of a crop into the prepared soil involves his "sphere of activity and interest" and his senses to a much greater degree than his reading of an article on soil structure. A further example mentioned earlier (see "Results", section 5.2.1) was that of me demonstrating to Peter Dimech, with a soil probe, the existence of a plough pan beneath his paddock. This demonstration had a significant effect on Peter, whereas my mentioning of plough pans in earlier discussions did not. The thoughts of the Chinese philosopher Confucius are appropriate to introduce at this point. Confucius said "I hear and I forget, I see and I remember, I do and I understand". In extension literature this adage is often presented as "Tell me and I'll forget, Show me and I may remember, Involve me and I'll understand" (Campbell 1994:98). In many cases, direct personal involvement through action is required for the most effective and meaningful learning to occur.

6.7. Groups

As mentioned in the "Context", there is a reluctance among Maltese growers to discuss details of their production methods. At the first meeting of the collaborators (Windsor district growers only - Joe Borg, Jim Saliba, Paul Mifsud and myself present; Peter Dimech absent) there was tension in the air for the first half hour. Then someone (I think Paul asked Jim) asked another a detailed production question and suddenly the ice was broken. Thereafter, the atmosphere of the meeting was freer and many detailed questions were asked of each other. In the following week I visited Paul Mifsud and was told several times how much he'd enjoyed the meeting and learnt a lot. Each of the collaborators' meetings developed a positive atmosphere. Despite this, and my facilitative
efforts, the collaborators did not form into a cohesive, self-sustaining, and active group. A story of what happened follows.

At the start of the research (i.e. the start of the permanent beds project too) I asked some experienced local extension horticulturists what they thought of the permanent bed project's intended use of discussion groups to achieve adoption. The District Horticulturists (Vegetables) at Camden and Gosford were both against the idea, saying discussion groups with Maltese (and other) vegetable growers of the Sydney region were "hopeless" and "a waste of time". I kept these comments in mind, but decided to still try and use group methods. My decision was influenced by the opinions of university staff and students who reported success using group methods.

The first group meeting was held in September 1993 at Joe Borg's house. Only the four Windsor collaborators were invited. Three turned up (Joe Borg, Jim Saliba, and Paul Mifsud). As just mentioned, the meeting went well. After an awkward first half-hour, the three growers all began to enthusiastically participate by asking each other detailed production questions and relating their own experiences. Near the end of the meeting, I asked the collaborators "What shall we do in the future?" The growers mentioned a few things, such as soil tests and details of how the permanent bed trials could be conducted on their farm. I continued by stating I was willing to devote one day per week, and some financial resources, to whatever they as a group wanted. However, the collaborators did not take up my offer - despite it being repeated several times. Instead, they suggested I do whatever I want, and continue to work with them as individuals. The rejection of this quite generous offer, from someone with whom they were familiar, is one example of the very limited degree to which Maltese vegetable growers desire to work together.

Much the same thing happened at the second meeting, which was held at Peter Dimech's in December 1993. This time, all collaborators were invited. Six turned up - Joe Borg, Peter Dimech, Joe Dimech, Sam Dimech, and Charlie and Joe Attard. Jim Saliba and Paul Mifsud were unable to come, while Mario Dimech, according to Sam, did not want to come. There was no initial period of awkwardness, perhaps because the Attards and Dimechs all knew each other. Like before, the meeting went well and discussion was lively. Also like before, my requests for the collaborators to
suggest future activities for the group were put aside. The collaborators said they had enjoyed talking together but wanted me to be the one to organise any future events. They said they didn't have the time to organise things, and weren't good at it either (I suspect, however, that they could organise a christening party or a shooting competition). The discussion concerned with trying to get specific details on future things we could do together, for example organise a boom sprayer calibration at Charlie and Joe Attard's on a Friday afternoon in three weeks' time, dragged on for twenty minutes without getting anywhere. The meeting was an enjoyable social activity, and Peter and his family had gone to a lot of trouble to prepare things for it, but a stepping stone on the way to forming an active and self-sustaining small group it was not.

My next thought was to expand the membership of the group in the hope that some energetic, self-motivated growers would join. To this end, the third meeting was held in a hired hall and invitation was open to all vegetable growers (note that I knew that all or nearly all who came would be Maltese). As mentioned earlier (see "Results", section 5.1), the attendance was very poor. No lively atmosphere of discussion developed. Given the unsuccessful nature of this meeting, the total lack of feedback after the second meeting, and the lack of ideas on future directions from all three meetings, I decided to concentrate on other activities for a while.

The fourth meeting was not held until July 1995, this time in my home. The attendance was very good. Of the nine collaborators, only Paul Mifsud (who was at the markets) did not come. I think the collaborators felt less at ease at this meeting compared to the first two, perhaps because of the topics I introduced (e.g. a session asking them to help me design a survey questionnaire) and the unfamiliar surroundings. However, there was good discussion at times. Like the meetings before, my pleas for suggestions went unanswered. No plan of future activities was drawn up.

My conclusion, which is in accord with the opinions of the extension horticulturists referred to at the beginning of this section, is that discussion groups are largely a waste of time in this context. I do feel that the collaborator meetings were of some benefit. However, in my opinion, to rely upon discussion groups as a major extension strategy with Sydney's Maltese vegetable growers would be a mistake.
A recent report of agricultural extension in Australia states "Many claims are made about the effectiveness of groups, however, the links are often tenuous and the basis for conclusions not clear" (Anon. 1993a:67). Lewin (1952) reported studies which showed the effectiveness of group methods in extension where the behavioural change desired was related to people's values and group norms (see section 2.2). On the other hand, in circumstances where the behavioural changes desired tend not to involve group norms, and where individual's situations are importantly different, group methods may not be particularly effective. Sydney's Maltese vegetable growers believe their individual circumstances to be unique, and many of their farm practices are not subject to rigid and narrow group norms. These circumstances may, in part, explain why the evening meetings of this research did not lead to significant changes in behaviour.

With regard to the issue of goodwill and enthusiasm toward collective activity, to assume that group methods are appropriate to extension in every community, is, in my opinion, misguided. I think the above example shows that, even when groups have characteristics indicative of success (e.g. are small, have clear goals closely aligned to the members' personal goals, have decisions made in a collaborative manner); group activities may not be applicable. Furthermore, even if a group activity does generate goodwill, there is no guarantee that clients will desire to participate in groups in the future. As a further example, the 1993 Griffith and Hay bus trip, which was instigated by myself, was a successful group event. On the other hand, its success did not lead the growers toward organising future group activities (either with or without me being involved). Heisswolf (1995:5) reported a similar circumstance with Queensland vegetable growers who, following a successful field day, "politely declined to participate in a further short meeting". In my opinion, if a particular category of people are not interested in working in groups - then so be it. I consider it rather high-handed and dismissive of reality to think along the lines of "these people would be eager to work together in groups if only they realised how effective and empowering the method is".

6.8.  Facilitation

It was mentioned previously (see "Results", section 5.1) that, after the January 1994 field day, Sam Dimech asked me "Why weren't there any speeches?" Sam said this after several growers asked the
same question to him, and also commented that they "didn't know what was going on" (note that the event was fully explained in the leaflet each grower was given upon arrival). In fact, I had chosen not to have any speeches on the advice of the District Horticulturist (Vegetables) at Camden. This extension agent was a student of UWS-Hawkesbury at the time and was studying action research as part of his M.App.Sc. course. He felt that a formal speech at the field day would be too intrusive and "prescriptive". Upon reflection, I think a brief (e.g. ten minute) speech by myself would have been a good idea. It would not have been a burden for the growers, who were there for a couple of hours or more. I consider this to be an example of how some adult educators can be too timid in their facilitative role, and allow events to suffer as a result.

Röling (1988:43) has made the observation that students of extension often have an overly strong concern that they may "manipulate" clients - not yet realising that extension is a relatively weak instrument for inducing change, and that, within the limits of the circumstances they find themselves in, people are perfectly capable of looking after their own interests. Perhaps the same criticism can be made of some practitioners of action research. At least some educational theorists, for example Mezirow (1985) and Brookfield (1986), feel strongly that facilitators of adult education should not confine themselves to a passive role. Brookfield (1986:124) states "It is misconceived to talk of self-directedness of learners who are unaware of alternative ways of thinking, perceiving, or behaving". For a facilitator of adult learning to shirk from a leadership role, in the desire not to be "too prescriptive", is not always a good thing.

Experience in this research context leads me to conclude that outside facilitation is needed at virtually all times for group activities with Sydney's Maltese vegetable growers. I hasten to add that Maltese growers can organise their own events. For example, on one occasion Joe Borg took a car load of local growers (seven) down to Crookwell for the day to look at seed potato production. On the other hand, if an outsider (such as myself) comes in and starts suggesting group activities, he or she will have to do most or all of the organising him or herself. Later, after events have been successfully held, this will still be the case. To provide an example from a similar situation, another UWS-Hawkesbury student used regular (i.e. monthly) meetings with cut flower growers of the Sydney area as a means to develop "environmentally-friendly" production guidelines. After 18
months, the growers went from a situation of hostile disunity and dismissal of the value of production guidelines, to one of cooperation and eagerness to develop "their" guidelines. However, despite this progress, as the student attempted to retreat from her facilitative role and place this responsibility more so in the hands of the cutflower growers, the group began to lose interest and cohesiveness (G. Steain, pers. comm. 1994). In this circumstance, and my own, self-sustaining groups did not arise and the facilitator's role needed to be maintained. In action research literature (e.g. Brown et al. 1988) there is frequent reference to instances of practitioners "seizing the initiative" and outside facilitators withdrawing from a leadership role in the action researching group. In my opinion, these instances are less common than implied.

At least some proponents of action research, for example Rapoport (1970), argue that clients of action research projects do not necessarily know what is best for themselves, or act in their own best interests. It goes without saying that ignorant (I do not use the word in a derogatory manner) clients may see no advantage at all in becoming involved in an extension project, which just happens to be using an action research methodology. Many of the growers I approached to become involved in the permanent bed project, and even some of the eventual collaborators, would have been of this opinion. My point is not that the permanent bed project was of benefit to the collaborators, but that such client attitudes of non-appreciation and disbelief can result in people being nominated for a particular project as a joke. I think this was the case with Paul Mifsud. I've come to believe that the two growers who recommended him as a potential collaborator at the Windsor RSL meeting (March 1993) did so as a joke on Paul, and perhaps me. Certainly, they thought Paul would not get seriously angry with them if he found out they were the ones who sent "that annoying university bloke" to his farm. Perhaps too they also thought I would have trouble working with Paul. As it was, Paul was pleasant to know and his intransigence was of benefit to my learning and understanding of the research context. I am reminded of a story about some anthropologists who interviewed South American Indians in order to learn about the Indians' kinship systems. Once the anthropologists learnt the Indians' language better, they discovered that the names they'd so dutifully recorded were along the lines of "big penis" and "fat vulva". The Indians concerned weren't above playing a practical joke on the anthropologists! The intention of this paragraph has been to warn users of collaborative research and extension methods that those
people nominated by the client group to become involved in a project are not necessarily the best nominees.

It has been mentioned (see "Context", section 4.5) that Maltese vegetable growers are very practical people and that their levels of formal education are low. I believe these are two of the main reasons why I found extension activities involving abstract thinking to be unrewarding in this context. Activities such as brain-storming, mind-mapping, and conceptual modelling were poorly received by the collaborators. For example, at the fourth collaborators' meeting (July 1995) I attempted to get the collaborators to describe the characteristics of an ideal farm and ideal farm business. This technique, that is, conceptualizing an ideal situation, is often recommended as part of an extension strategy, for example the Nyngan Technique (Davey 1989). At the time, I made the comment in my diary that "Obtaining suggestions was like pulling teeth out". The room was filled with blank looks, downcast eyes, and bored expressions. Needless to say, we did not come up with a good description of such a farm, and the collaborators' enthusiasm was dampened. I conclude that "waffly" diverging activities, and activities involving complex abstract thinking, are best minimised when working with Sydney's Maltese vegetable growers.

Identification with farmers is widely-documented among extension agents (Rogers 1962, Van den Ban and Hawkins 1988). Such identification, and the building of friendly relationships, is both important for extension effectiveness and a part of human nature. There is, however, a danger of what Russell (1987) refers to as "homeostasis". This is where a facilitator of change becomes so ingrained within his or her system (in my case, Sydney's Maltese vegetable-growing community), like a pearl within an oyster, that an equilibrium is reached and no further change occurs. A way to avoid "homeostasis" is to use a steering committee of non-involved colleagues, and others, to help guide the extension campaign and ensure that the extension agent's goals do not come to unnecessarily converge upon those of his or her clients.

A corollary of the idea that extension's role is more to stimulate learning rather than transmit existing information, is that relationships (between the teacher/facilitator and the learner) are of paramount importance and methods of lesser importance. In the words of Kolb (1984:202), the
teacher (or extension agent) is a "coach or manager of the learning process". I consider that the adult educator, or extension agent, should let the broad principles of experiential learning guide him or herself. The important thing is to always move forward, in a morally-guided manner, building relationships, reflecting further, taking new action, and building evermore sophisticated and widely-accepted constructs with the target category in order to achieve situational improvement.

6.9. **Action research**

This section addresses the third aim of the research, namely, whether methods of extension in accord with action research principles are effective with Maltese vegetable growers of the Sydney region. To re-state the main principles of action research, especially as practiced in Australia within education, I refer the reader to Zuber-Skerritt (1991:xiv), who describes action research as: practical, participative and collaborative, emancipatory, interpretive, and critical. Further, the ultimate goal of action research is to improve peoples' lives through the linked development of practice (action) and theory (understanding).

Earlier in this discussion, I have criticised the taking of action research principles to extremes. However, action research is a methodology which emphasises improvement in human situations, actors' understandings of their world, and the building of relationships based on mutual respect. As such, I consider it appropriate to any extension campaign. I will develop themes around the strengths of action research in the following text and conclude this section in support of action research. Firstly, however, I wish to demolish a "straw man"; in the form of a rather strong and somewhat unfair characterisation of the "transfer of technology" model, applied in this extension context.

What is an alternative to an extension approach based on principles of adult learning and action research? One is the "transfer of technology" model. In such an approach, we would first need to fully develop the technology we wished to extend. Indeed, such suggestions were made at the beginning of my research by soil scientists of NSW Agriculture. One scientist was concerned that I
was intending to promote permanent beds when research hadn't been done, on each of Sydney's main vegetable-growing soil types, to review the effects of permanent beds over an extended period - of at least several years (G. Osborne, pers. comm. 1993). Another soil scientist was similarly concerned, he also suggested that I may wish to base my Masters on developing "ideal" bed dimensions for each soil type (e.g. ideal with respect to water infiltration and drainage).

The above suggestions very much missed the point of the permanent bed project, and other extension projects, for reasons including the following. Firstly, permanent beds had already been tried with success - with vegetables grown on various soil types, under farm and research conditions, for some ten to fifteen years (Hutchins 1987). The technology was already proven, there was no need to prove it again. However, the technology was not yet modified for the specific circumstances to be found in the Sydney vegetable industry.

Secondly, who best to do the modifying of the technology, and how? Prof Cornish and myself considered that the vegetable growers themselves were best placed to develop the technology further. After all, they were the experts in vegetable production, with the land, labour, and equipment to carry out the research. Cultivation is just one factor affecting plant production. If the permanent bed research had been done on a NSW Agriculture research station, at least some other factors (e.g. pesticide application and irrigation) would likely have been very different to normal farm practice. Hence, the research results would have been confounded.

Thirdly, there are no ideal bed dimensions. Farming practices are dynamic and multi-faceted. As aspects of farm practice change, for example as plastic mulch is adopted or as one changes from overhead to drip irrigation, so too the "ideal" for each component may change. I believe it would have been short-sighted to devote many resources to temporarily optimise just one component, i.e. bed dimensions, of a complex and dynamic system. An emphasis on ideal bed dimensions would have been misguided for practical reasons too. As mentioned in the "Context" (see section 4.3), there is a multitude of differently-sized equipment in the Sydney vegetable industry, and there are no standard bed widths. The tremendous investment that existing equipment represents cannot simply be ignored.
Fourthly, vegetable growers, and perhaps others who have developed their skills over a long period of time, are unlikely to be inclined to change what they do on the basis of a "tenuous contact", for example one magazine article written by someone whom they have never met. The extension methods of transfer of technology include written articles, speeches, and researcher-managed experiments. As elaborated upon in "Kinds of Experience" (section 6.6), these methods would have probably had very limited impact among Sydney's Maltese vegetable growers. Clearly, an extension approach other than "transfer of technology" was needed in this circumstance.

The reader familiar with action research and recent extension literature will notice that the deficiencies highlighted in a "transfer of technology" approach for this extension may be overcome by adhering to principles of action research and adult learning. Among other things, action research emphasises situation-improvement (in the view of the practitioners) while adult learning emphasises that adults are autonomous beings wanting to further their self-interest. The participative and collaborative aspects of action research can enable clients to contribute to a project, be intimately aware of it, feel ownership of the emergent outcomes, and develop relationships with each other and the project facilitator. It is desirable that an extension agent conduct his or her activities in a highly interactive manner. Change is best achieved when people are involved. Humans make decisions, such as the decision to adopt agricultural technology, for human-based reasons (which often are not "logical"). Thus, it is crucial that agricultural technology is developed in such a manner that potential recipients feel that the emergent technology is part of their "sphere of activity and interest", and recommended to them by someone whom they know and trust.

The point is often made that the "sphere of influence" of successful action research projects enlarges as time goes by (e.g. Altrichter et al. 1991). Thus, it can be seen that classical diffusion, as described by Rogers (1962), is a part of action research. Furthermore, this diffusion is active, not passive. It is based on developing relationships between people.

The interpretive emphasis of action research helps the outsider, for example a university facilitator of action research, to focus on clients' understandings of their world. Thus, as mentioned earlier, valuable local knowledge can be drawn upon in the research project. There should be less chance of
important differences in emphasis and understanding between the parties involved being undetected and not addressed when using an interpretive approach. Hence, effective communication is more likely. The outcomes of improved communication may include greater mutual respect, appreciation, and understanding between the action researchers.

Another emphasis of action research is "emancipation". Emancipation can refer, for example, to an oppressed and socially-isolated minority group getting its "fair share of the cake", that is, government monies commensurate with its percentage of a country's total population. It could also refer to such a group being allowed to practice its customs without harassment from another, more-powerful, group. In these cases, action research would be the means for the less-powerful group to achieve beneficial change. I do not think the Maltese vegetable growers of the Sydney area see themselves as being oppressed and in need of emancipation. As such, the emancipatory aspect common to many action research projects was not pursued in this extension. Maltese vegetable growers do want a "fair deal" from the Sydney Market Authority, produce agents, and local government. However, the present nature of the growers' relationships with these parties cannot be easily changed in the growers' favour. No attempt was made to do so. This decision is in accord with action research principles. Although action research projects frequently challenge the existing social order, it is nevertheless considered that issues one cannot do anything about are poor choices of topic for action research (e.g. Kemmis 1982, cited McNiff 1988:74).

A further emphasis of action research is "critique", that is, critical reflection among the action-researching group. The group does not confine itself to shallow reflection upon the existing situation, but critically examines deeper socio-political assumptions and constraints to improvement (Kemmis and McTaggart 1988). The extent of critique, in both breadth (i.e. the extent of its collective nature) and depth (i.e. the extent to which deep-seated assumptions are examined), will depend upon the particular situation and action research project in question. I do not believe there is a minimum level of collective critique, below which a project is not "true" action research. Such prescriptions are not helpful. Instead, aware judgement should guide what happens in a particular project. However, reflection is an indispensable aspect of adult learning. It has been mentioned (see "Psychological Barriers to Learning", section 6.4) that Maltese vegetable growers do not appear to
be rigorous reflectors when in groups. Thus, a weakness which hindered learning in this research was a relatively low level of collective critique.

A number of aspects of action research (and adult learning) have been mentioned with respect to their applicability to this research. I wish to conclude this section by re-emphasising two further aspects of adult learning and action research. Firstly, both action research and extension are ultimately concerned with improving human welfare, while adult learning takes place with awareness that those involved are autonomous beings wanting to achieve their goals, which will include their own welfare and that of others they care about. It is worth pointing out that extension, action research, and adult learning all emphasise, and rely upon, voluntary client involvement. This commonality is important. Secondly, action research and adult learning proceed via a spiral process of taking action, reflecting, taking more action, reflecting further, and so on (Lewin 1946). In situations which are complex, "messy" and dynamic, as all situations involving human values are, such a flexible and responsive style of learning and improving (i.e. the spiral process) is ideal. All extension occurs in "messy" human-centred situations. Therefore, adult learning and action research are suitable choices of methodology for extension projects.

6.10. Adult learning

Apart from the integration of reflection and action and an emphasis on rich and powerful experience, how may experiential learning theory be used to guide extension? Kolb (1984:196) suggests that differences in peoples' learning styles be taken into account, and instruction be individualised, when facilitating adult learning. Briefly, learning styles are adoptive states or orientations which individuals develop as they interact with their world (Kolb 1984:97). For a further explanation of learning styles, please see the literature review of adult learning.

Kolb suggests (1984:98) that our circumstances, such as our current job, exert a strong influence over our learning style. For example, a university researcher is more likely to be an assimilator (thinker), and a medical doctor a converger (decider). One would expect farmers, practical people that they are, to most likely be accommodators (doers). When I surveyed the collaborators with
Kolb's learning styles questionnaire in 1995, Jim Saliba was rated as an extreme accommodator. On the other hand, the remainder of the collaborators were scattered in the accommodator, converger, and assimilator categories (please see the graphed results in this section). I was an extreme assimilator.

I have reflected upon these results, but cannot see patterns relating the reactions of individual collaborators to the extension activities and their learning styles - despite the fact that I know the collaborators very well. I believe that the concept of learning styles is a useful one, especially if applied to oneself. This conclusion is supported by Smith (1995), who states "extension officers should discover their preferred learning styles ... to appreciate their own strengths and weaknesses". However, in the complex and resource-poor world of extension, I do not consider the determination of the learning styles of clients to be of benefit.

Smith (1995) suggests that the determination of clients' learning styles is of benefit. However, he is unable to establish a link between farmers' learning styles, the nature of particular extension activities (which may be deemed suitable to particular styles of learning), and farmers' adoption of conservation farming. Smith states "lack of adoption of conservation farming is not due to the mismatch of (extension) activities to farmers' preferred learning styles. Rather, adoption is hindered by ... technical issues ... beliefs/values of farmers ... (etc.)". In my opinion, it would be misguided and simplistic to plan extension activities solely on the basis of individuals' learning styles; and the suitability of certain activities to certain styles of learning. There would simply be too many confounding factors to this dichotomy. In a similar manner, Heisswolf (1995:8) rejects Grow's (1991) theory of mismatch between learners' style and teachers' style as a cause for poor learning, and instead emphasises the nature of the learner/teacher relationship with respect to political, philosophical, and psychological dimensions.

The learning styles of the permanent bed collaborators

At the start of my research I thought, as did others at UWS-Hawkesbury, that the identification of learning styles may help make the extension easier. Now, like so many other earlier naive thoughts
The Four Learning-Style Types

CONVERGER
Combines learning steps of ABSTRACT CONCEPTUALIZATION and ACTIVE EXPERIMENTATION

People with this learning style are best at finding practical uses for ideas and theories. If this is your preferred learning style, you have the ability to solve problems and make decisions based on finding solutions to questions or problems. You would rather deal with technical tasks and problems than with social and interpersonal issues. These learning skills are important to be effective in specialist and technology careers.

DIVERGER
Combines learning steps of CONCRETE EXPERIENCE and REFLECTIVE OBSERVATION

People with this learning style are best at viewing concrete situations from many different points of view. Their approach to situations is to observe rather than take action. If this is your style, you may enjoy situations that call for generating a wide range of ideas, as in a brainstorming session. You probably have broad cultural interests and like to gather information. This imaginative ability and sensitivity to feelings is needed for effectiveness in the arts, entertainment, and service careers.

ASSIMILATOR
Combines learning steps of ABSTRACT CONCEPTUALIZATION and REFLECTIVE OBSERVATION

People with this learning style are best at understanding a wide range of information and putting it into concise, logical form. If this is your learning style, you probably are less focused on people and more interested in abstract ideas and concepts. Generally, people with this learning style find it more important that a theory have logical soundness than practical value. This learning style is important for effectiveness in information and science careers.

ACCOMMODATOR
Combines learning steps of CONCRETE EXPERIENCE and ACTIVE EXPERIMENTATION

People with this learning style have the ability to learn primarily from "hands-on" experience. If this is your style, you probably enjoy carrying out plans and involving yourself in new and challenging experiences. Your tendency may be to act on "gut" feelings rather than on logical analysis. In solving problems, you may rely more heavily on people for information than on your own technical analysis. This learning style is important for effectiveness in action-oriented careers such as marketing or sales.
Learning Style Inventory

The learning-style inventory describes the way you learn and how you deal with ideas and day-to-day situations in your life. Below are 12 sentences with a choice of four endings. Rank the endings for each sentence according to how well you think each one fits with how you would go about learning something. Try to recall some recent situation where you had to learn something new, perhaps in your job. Then, using the spaces provided, rank a “4” for the sentence ending that describes how you learn best, down to a “1” for the sentence ending that seems least like the way you would learn.

You may find it hard to choose the sentences that best characterise your learning style. Nevertheless, keep in mind that there are no right or wrong answers—all the choices are equally acceptable. The aim of the inventory is to describe how you learn, not to evaluate your learning ability. Be sure to rank all the endings for each sentence unit. Please do not make ties.

<table>
<thead>
<tr>
<th>Example of completed sentence set</th>
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<tbody>
<tr>
<td>When I learn:</td>
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<tr>
<td></td>
</tr>
<tr>
<td>I am happy</td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td>1. When I learn</td>
</tr>
<tr>
<td>2. I learn best when</td>
</tr>
<tr>
<td>3. When I am learning</td>
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<tr>
<td>4. I learn by</td>
</tr>
<tr>
<td>5. When I learn</td>
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<tr>
<td>6. When I am learning</td>
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<tr>
<td>7. I learn best from</td>
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<tr>
<td>8. When I learn</td>
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<tr>
<td>9. I learn best when</td>
</tr>
<tr>
<td>10. When I am learning</td>
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<tr>
<td>11. When I learn</td>
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<tr>
<td>12. I learn best when</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
The learning styles of the permanent bed collaborators

Figure 2-2 Learning Style Type Grid (Copyright 1976 by David A. Kolb)
of mine, that idea has been abandoned. I suggest that it may be more profitable for an extension agent to concentrate upon the target category's characteristics as a whole (e.g. a disinclination to read, a fascination with machinery) rather than administer a learning styles questionnaire, classify individuals accordingly, then tailor individual extension strategies to suite. Not only would such a process be very time-consuming, but, if the results of this research are anything to go by, it is most unlikely that the members of one's target category would neatly fit into one or two categories of learning style.

In the consideration of Claxton and Murrell (1987:31-33), research experience suggests that the determination of individuals' learning styles (styles defined by Kolb) is extremely useful for purposes of discussion, but not for diagnosis. These authors cite studies where Kolb's model helped students enhance their learning experiences by providing a framework to discuss their learning process (Mark and Menson 1982); and increased retention from 20%, when only abstract conceptualisation was used, to 90%, when all four modes were used (Stice 1987:293). However, Claxton and Murrell (1987:33) also cite studies which report that achievement did not vary as a function of learning style (Ballard 1980); and that there was no association between learning styles and reactions to instructional methods (Fox 1984). These later findings are similar to those of this research, that is, the determination of individuals' learning styles appears to be unhelpful to extension. Unfortunately, because of the collaborators' total unfamiliarity with the concepts of Kolb, and their disinclination towards abstract thinking, my several attempts to describe the experiential learning cycle were unrewarding. Therefore, a potential benefit of the concept of learning styles, that is, as a tool to describe (and therefore enhance) learning, was not achieved in this circumstance.

The Kolb learning styles questionnaire presented big problems for two of the nine collaborators, namely, Peter and Joe Dimich. When I read through the questionnaire with Joe and Peter they behaved exactly the same. Both were clearly uncomfortable and wanted to "escape their interrogation". Instead of trying to prioritize the four possible responses to questions they picked examples of their past experience and related those examples to me. It took fully 15 to 20 minutes to struggle through four questions before we finally decided "enough was enough".

190
Soon after the fourth collaborators' meeting (July 1995), during which adult learning and the results of the Kolb questionnaires were discussed, I visited Peter to talk about the process of learning. Unfortunately, we could not have a meaningful conversation, at least not on that day (nor did I have luck on other occasions). Peter said something along the lines of "I'm doing OK, so there's no need to change". He also seemed to indicate that his idea of learning was merely to try new things. Thus, it appears that Peter learns by "trial and error" and does not recognise "reflectivity". On the same day, Joe Dimech said "I've been too busy to think about the learning". He explained that he remembers well and will use twenty years of memories to make sense of a puzzle in the present. The responses of Joe and Peter seem to indicate that their learning lacks critical reflection, and that their openness to new constructs is largely limited to what they can do themselves.

Many theories of decision-making have been developed in agricultural extension (e.g. Rogers and Shoemaker 1971) and adult learning (e.g. Bos 1974, cited Van den Ban and Hawkins 1988:92). Extension theorists usually approach the issue of delay between awareness of an innovation and final decisions to adopt or not adopt the innovation with reference to stages. For example, "Telephone Contact, Small Talk, The Problem Encountered, The "Working Together" Stage, Rapport, and the Cooling Off Period" (Anderson 1982:25-30). However, the evidence for identified stages is often weak (Van den Ban and Hawkins 1988:102). Furthermore, not all stages may be addressed. These theories actually describe developments in circumstance rather than peoples' cognitive processes. Knowles (1984:5) refers to a similar situation within educational theory when he states he realised, in the 1950s, that "educational psychologists had not been studying (the internal dynamics of) learning at all, but reactions to teaching".

I admit I cannot really explain how I decide. I also have a suspicion that the way in which I decide varies greatly according to circumstance; for example urgency, the importance of the decision, its likely consequences (will it affect others or only myself, likelihood of great harm or benefit), relevant information available, and so on. My attempts to find out how the collaborators and other Maltese vegetable growers decide failed. Our thoughts were confused on the issue. As such, my
hope (and that of my M.Sc. supervisors) that I could justify this research on the basis of documented changes in the decision-making of the collaborators was not fulfilled.

Of the nine collaborators, Sam Dimech seemed the most likely to be able to explain his decision-making and provide insight into his learning. Upon my visit to Sam's farm soon after the fourth collaborators' meeting, Sam did not elaborate upon what he saw as his method of decision-making. Instead, he said that the kind of learning required depends on the situation, for example learning how to grow caulies or attending a lecture on environmental pollution. He further said that responses to the Kolb questionnaire are arbitrary. The responses to the questions were ranked from 4=most appropriate to 1=least appropriate. In Sam's words, "(if asked at another time) the 4's would stay the same and maybe the 3's, but the 2's and 1's would change".

To put it bluntly, three years of close association with the collaborators, lesser association with around 60 other Maltese growers, and much personal reflection for the same period of time, did not yield any precise descriptions of the process of adult learning in this context. However, there was ample corroborative evidence that the broad principles of experiential learning are suitable guides to extension among Sydney's Maltese vegetable growers. The broad principles which appear to be supported by this research are that: learning involves action - not just abstract thought, learning occurs through interaction with one's environment and other people, adults bring valuable experience to a learning situation, people have constructs which mediate their learning interests and their responses to their environment, and self-esteem plays an important role in learning.
7.1 Summary and Conclusions

On the whole, I found Maltese vegetable growers to be practical, observant, friendly, hard-working (often too much so), poorly-educated, proud, submissive, and cooperative to a limited extent. Needless to say, growers are individuals with differences as well as similarities.

Beneficial change was achieved as a result of the extension activities. Changes in farm practice, and farmers themselves, occurred. Among these changes were growers' increased curiosity in "scientific agriculture" and improved farm profitability (due to reduced cultivation and fertiliser inputs).

The outcomes of the permanent bed trials, which were examples of farmer-managed on-farm research, provide corroborative evidence that an extension approach which aims to stimulate farmers to consider change, and focuses on behaviour rather than farmers' attitudes, can be successful. It was found that the introduction of broad concepts, such as "reduced cultivation works", was sufficient to promote change. Growers used their existing knowledge to modify broad concepts so that they could be applied to their particular circumstances. It is not necessary to first change farmers' attitudes in the belief that they will change their behaviour. In this case, growers probably agreed to initially change their behaviour (i.e. implement the permanent bed trials) as a "favour" to myself. Most probably, it helped that the growers were provided with rewards for their involvement in the permanent bed project. Furthermore, Maltese tend to be very agreeable. In circumstances where the change to be implemented is uncomplicated and very unlikely to have negative consequences, it seems reasonable that the extension agent request farmers to trial the innovation as a "favour". Note that this approach is likely to work in a fairly limited range of situations, for example where the rapport between the farmer and extension agent is good, and the change advocated is sufficiently compatible with the farmer's wants.

The term "sphere of activity and interest" is introduced in this thesis to describe those thoughts and activities which are part of the habitual "self" of individuals. Observations of more than 60 Maltese vegetable growers revealed them to have spheres of activity and interest very much in common. On the basis of the reactions of Maltese growers to differing "kinds of experience", I strongly suggest
that extension activities undertaken be within the realm of those kinds of thoughts and activities which the target category or group finds "meaningful". Extension agents generally do not have the resources to change their clients' meaning perspectives and therefore should not attempt to do so.

The ideal extension activity for Maltese vegetable growers would be held on the farm of a respected local grower, be in late afternoon (after the day's work has been done), preferably on Friday, involve moving machinery and topics such as pest and disease control using pesticides, consist of demonstrations and informal discussion, and provide food (pastizzis, chips, sandwiches) and drink (soft drink, beer) and opportunity for social interaction.

In this research, I was unable to explicitly describe learning in terms of decision-making or other cognitive processes; neither with respect to the learning of the growers, nor even myself. However, it was observed that learning involves interaction, symbolism and personal involvement. The results of differing extension activities provide evidence that the richer the experience, the more that is learnt.

I found many principles of action research and the human resource development tradition of extension to be appropriate with Maltese vegetable growers. Among these principles were an interpretive approach to understanding clients' circumstances and collaboration with clients at each stage of an extension campaign. However, other principles were found to be less applicable. Discussion groups were found to be of very limited use for extension with Maltese vegetable growers. So too was the "do with" strategy of extension, which places the initiative for collaborative activity in the hands of the client. I found that active facilitation was required in this situation. When working with Maltese growers, the extension agent should be prepared to organise everything him or herself.

Relationships between myself and the growers were paramount in this research. They provided a framework within which extension activities could be successful. If there is no rapport between the extension agent and farmers, then many extension activities are unlikely to be considered earnestly by the farmer. For example, a demonstration, which involves first-hand observation, may be
considered in earnest but not a one-to-one conversion, which involves things heard second-hand. Trust which has been built up over time carries much weight in attempts to influence others.

Knowledge of the experiential learning cycle helped me greatly in this research; and in the planning, conduct, and evaluation of particular activities. However, to replace isolated "sock-it-to-them" interventions with a series of interventions, for example in the form of a three-step process, is still, in my opinion, over-emphasising technique and under emphasising approach. It should be remembered that extension operates in the messy, dynamic, uncertain, emotive, and subjective human realm - a realm that does not lend itself to the imposition of "treatments".

After three years of research in extension, I believe that all that one can do is approach the problematic situation in an empathetic, involving, active and reflective, etc., manner and then do, in collaboration with others, the best that one can. To presume that the problematic situations which face extension can be understood and acted upon according to narrowly defined techniques, including "fail-safe" processes, is misguided and self-deceiving.
7.2 Guidelines for extension with Maltese vegetable growers

On the basis of the three years of research, I conclude that the most important roles of the extension agent are to: foster relationships with a sufficiently broad range of target clients (not just "progressive farmers"); employ multi-way communication to develop mutual understanding, trust, and capitalise on clients' existing knowledge and biases; develop extension offerings that clients want; intertwine action with reflection - at least on a personal level; and follow the broad principles of adult learning yet be pragmatic, flexible, and situation-specific.

Guidelines for extension with Sydney's Maltese vegetable growers follow. These guidelines are the distilled essence of the three years of research. They are not "fixed in stone", nevertheless, it is hoped that they have applicability to many other contexts. "General guidelines" refer to guidelines applicable to many situations of extension. The "Specific guidelines" are especially for Maltese vegetable growers of the Sydney region. However, many of the specific guidelines will also have applicability to other categories and groups.

Guidelines for Extension with Maltese Vegetable growers
of the Sydney Region

General guidelines

- Recognise the humanness of the growers and yourself.
- Conduct your activities with a moral disposition. Allow your wise judgement to be influenced by the views of many others, and regular self-review.
- Conduct most, but not all, of your extension activities with reference to flexible but planned programs.
- Have a small number of key programs, e.g. three or four. Avoid putting all your eggs in one basket, or spreading yourself too thin.
- Allow the planning and updating of programs, in fact all activities, to be guided by the broad principles of adult learning and extension science.
* Among these principles will be the building of personal relationships, the intertwining of action and reflection, collaboration, holism, and the use of interpretive techniques and multiple information sources.

* Any extension program should include elements of the four key areas of the adult learning cycle. The four areas are:
  i) divergence (asks "what is there?") - what is the problematic situation, can it be redefined, are there factors involved not yet accounted for?
  ii) assimilation (asks "what does it mean?") - what influences what, and why?
  iii) convergence (asks "what shall we do?") - what are our priorities, and our first steps?
  iv) accommodation (asks "how will we do it?") - how do I ensure that the first, and subsequent, steps of the campaign occur?

* Keep in mind your overall goals. Devise a hierarchy of extension goals (e.g. in the manner of Bennet 1976 or Röling 1988).

* Prioritize your activities. Regularly review these priorities.

* Set boundaries to your extension programs. Stay within those boundaries unless you have good reason not to.

* Have a wide circle of informants and collaborators to ensure that:
  i) your activities and goals take into account the "broader picture", and
  ii) your goals do not unnecessarily converge with those of your farmer clients.

* Seek to develop a deep understanding of your clients' situations. While obtaining information from clients, search for underlying reasons. Do not take everything at face value. Regularly question your own assumptions too.

* Concentrate more upon good personal relationships rather than extension technique.

* Do not rely upon the "progressive farmer strategy", that is, do not focus only upon industry leaders. Instead, rely mostly upon identified opinion leaders.

* Include among your clients farmers from each category. Do not focus only upon farmers who are receptive and easy to work with. However, spend only a minority of time with these "recalcitrant" farmers.

* There will be some farmers who will be particularly antagonistic and troublesome. Be polite and then ignore them. You cannot please everybody.
* Always aim for balance, for example between the wants of your clients and your employer, the potential demand for your service and what you can actually deliver, situation maintenance and situation improvement, focussed programs and non-focussed extension, the development of relationships and the avoidance of "cronyism".

* Plan and execute extension programs in regular consultation with others.

**Specific guidelines**

* While maintaining a collaborative approach, be prepared to organise everything yourself.

* Actively seek feedback, including negative feedback - it is unlikely to be volunteered.

* Use the growers' language (their jargon) when communicating with them. You may safely assume they are unfamiliar with many terms you take for granted, e.g. pH, IPM, leaching, erosion.

* Be practical. Offer advice on techniques which are cost-effective, easy to manage, compatible with your client's farming system, and (preferably) observable.

* Focus upon issues of crop production such as pest and disease control and fertilisation. Growers are less likely to be receptive to advice on irrigation or non-production issues such as marketing and stress management.

* Collaborate with other industry suppliers. Take advantage of them too, e.g. refer growers' varietal enquires to seed company representatives and seedling suppliers.

* Maintain a friendly, empathetic, and confidential approach. Show an interest in the growers and their crops. It may help to be a bit "macho", if that is your natural style. Otherwise, try not to be too "soft". Above all, be honest in your dealings and the way you present yourself.

* Good topics of conversation are growers' crops, market prices, the weather, other growers and industry news.

* Poor topics of conversation are highly abstract issues unrelated to the farm, things you and the grower can do nothing about (talking about "the economy" is a waste of time), and growers' incomes.

* Try to accommodate the fact that growers much prefer your visit to their farm rather than be contacted via the telephone or letter. Very few growers will resent your unannounced visit.

* Try to visit growers at their convenience. Growers tend to have regular periods of busyness and "quietness". Those growers who sell their own produce often have two hours of sleep after lunch.
on market days. It is best to visit from late morning onwards, especially on Friday. Monday is also a good day for visiting. Ignore these considerations if the enquiry is urgent.

* Value growers' time, and your own. On farm visits, be two to ten minutes if the grower is busy (e.g. harvesting) and ten to 45 minutes if they are not.

* Telephone growers at lunchtime (12-1.30 pm) and evening (6-8 pm). Messages can be left with family members. Unless you have checked with the grower beforehand, do not ring after 8 pm - he may be going to the market at 1 am the next day.

* Answer pest and disease and other urgent enquires as soon as possible. An early incomplete answer is better than a too late complete answer.

* Always get back to a grower who had an enquiry, even if only to say "sorry, no answer" (this response will likely be accepted).

* Concentrate upon one-on-one contact (e.g. farm visits), small field days, grower-managed trials (in some circumstances) and excursions (e.g. a bus trip). Show photos.

* Rely less so on short and simple written articles, large field days, occasional information evenings, and irregular meetings of small groups.

* Avoid complex written articles, regular discussion groups, and activities which involve abstract thinking (e.g. "brain-storming") - especially in large group settings.

* Good topics for extension activities include machinery, new varieties, new pesticides, pest and disease control, and ways to save on inputs.

* Advertise events widely. Post leaflets to growers and/or distribute them in D shed. Notices may be inserted in "The Land" and "Good Fruit & Vegetables". Involve industry suppliers in events and seek their help in promotion. The most important supplier of inputs to Maltese growers is Ace Ohlsson Pty Ltd in Warehouse J, Flemington Market.

* Telephone or otherwise contact growers one to three days before an event to remind them of it.
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APPENDIX A

Extension Leaflet
Semi-permanent beds for vegetable production
- a good way to farm

Dear grower, this leaflet is to let you know what has been happening in the project "Adoption of Permanent Beds for Vegetable Production - Sydney Basin". This project is promoting reduced cultivation, including the technique of permanent beds, to vegetable growers of the Sydney area. It is being conducted by NSW Agriculture with part-funding from the Federal government’s National Landcare Program. A great strength of the project is that all the work is being carried out on growers’ properties under their management.

A sequence of crops are being grown on the farms of eight Maltese vegetable growers of Western Sydney. The soils on these properties range from sandy loams to medium clays. One paddock was selected on each grower’s farm in autumn 1993 and divided into two sections. In the first section reduced cultivation is carried out and the beds or hills are kept; in the second section the grower cultivates as he normally would have. The twin crops are being compared and suitable techniques of reduced cultivation developed.

What are semi-permanent beds?
The effort and expense involved in forming beds is considerable, yet many vegetable growers completely knock down their beds and start over again for each new crop. There must be another way which saves time and money, but still gets a good crop. There is - it’s a production technique called permanent beds, which was developed at Tatura and Hay about 15 years ago. Depending on the situation, the beds are kept for up to 10 years. Some ripping is carried out, but ploughing is avoided altogether during the life of the bed. Nowadays there are over 35 000 hectares (85 000 acres) of permanent beds in inland NSW being used to grow cereals, cotton, and vegetables. This area is increasing each year. Griffith and Hay vegetable growers have found that permanent beds get the same crop, or sometimes a slightly better crop; with a lot less input - therefore profitability is greater.

Why permanent beds are a good production technique:
* By concentrating on shallow cultivation and avoiding ploughing, costs are greatly reduced. Cultivation time, and therefore machinery maintenance and fuel costs as well, are typically reduced by one-half to two-thirds - but the crop is the same or better.
* Paddocks which are bedded-up drain better and, since the firm gutters are kept, access during wet conditions is improved. There is less waterlogging too.
* Soil compaction due to traffic is confined to a smaller area of the paddock.
* The best soil is kept at the surface where most of the roots are. Manure and fertiliser are not lost by being buried too deep.
* Organic matter levels are higher and therefore soil structure is better. Organic matter is oxidised and destroyed when it is exposed to the air by cultivation.
* Because of improved soil structure there is less surface crusting and increased infiltration (soaking in) of water. More rapid and even wetting of the soil is a major reason for the widespread adoption of permanent beds inland.

Some Problems:
* Existing plough pans (layers of compacted soil) will need to be loosened before setting up the semi-permanent beds. Soils may be hard-setting.
* Shallow cultivation, especially rotary hoes in soil that is too wet or too dry, can also damage soil structure. Beds can slump and lose their shape too.
* If organic matter levels are high (this is unlikely) soil-borne diseases such as Rhizoctonia may become more common.
* Coping with large amounts of trash, for example, after broccoli.
* Incompatible with potatoes and carrots. Different widths of machinery.
The results so far (autumn 1996):
Since we started in autumn 1993 each grower has grown at least five crops on their trial (experimental) paddocks. The crops include cabbage, cauliflower, broccoli, lettuce, silverbeet (spinach), pumpkin and sweetcorn. We have been doing plant and soil measurements to see the effects of reducing cultivation. Overall, we have found no significant differences between the "reduced cultivation" and "ordinary cultivation" sites. In other words, crop yields and quality have been the same despite some growers greatly reducing their amount of cultivation.

At this stage, five of the project’s eight growers have decided to keep their beds or hills on their whole farm. These growers are all on heavier soils but, as was indicated earlier, we have found that permanent beds work on lighter soils too. Only time will tell how long we can keep the beds. One grower at Horsley Park gets up to 15 crops out of his beds! One of the project’s growers has beds which have yielded 7 good crops. For all of these growers the crops are doing the same or better now that the beds/hills are being kept. One reason for the crops doing better may be the benefits of improved soil structure, such as improved penetration of water. Another is probably the concentration of manure and fertilisers in the crop’s root zone. These growers have cut back their use of chicken manure by around one-third now that they keep their beds and don’t work the ground as deep.

For some of the growers the reduction in cultivation by keeping their beds has been large. There have been big savings. All five growers who are now using semi-permanent beds on their farm are saving half or more of the time they used to spend on cultivating their paddocks. One grower is making a modest saving of 3 hours per acre (0.4 hectares). If we use NSW Agriculture figures of $9.50/hour to run and maintain a 60 HP tractor, and two crops per year grown on 20 acres (8 hectares), the savings are $1140 per year. Because the crop return is the same, this money is all profit. Another of the project’s growers now takes 1½ to 2 hours to prepare a paddock (¾ acre) compared to 7 hours the way he used to farm. The savings for this grower are $3500 PER YEAR! Consider the savings in time too. According to our calculations, this grower now has an extra 375 hours, or OVER ONE MONTH OF WORKING DAYS, per year. That’s a lot of extra time to get things done!

In conclusion, just like at Griffith and Hay, Sydney vegetable growers have found that they can greatly cut back on cultivation inputs but get the same crop. With new equipment and new ideas, growers can work out for themselves the best and most profitable ways to work their soils. Those of you on heavier soils in particular may like to try keeping your beds if you don’t do so already. Following a lettuce crop would be a good start. We invite you to consider how you might reduce your cultivation and increase your profitability. We also invite you to experiment with equipment other than rotary hoes in your quest to grow good crops, make a living, and look after your soil.

For more information please contact: Ashley Senn
Horticulturist (Vegetables)
NSW Agriculture, Windsor
ph: (045) 770 600

NSW Agriculture

REMEMBER: LESS INPUTS (cultivation) + SAME CROP = MORE MONEY
APPENDIX B

The Permanent Bed Trial Results
# Crop and soil data from the permanent bed trials (1993-1995)

| Grower and crop number | Crop type and variety | Growing period | Cultivation treatment | Crop fresh wt at harvest (kg) | Crop dry wt at harvest (g) | Soil bulk density at harvest (t/m³) | Comments
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>J. Borg Crop Two</td>
<td>Lettuce cv. Rodeo</td>
<td>Dec 93 - Jan 94</td>
<td>(-c) (+c)</td>
<td>0.81 ± 0.06</td>
<td>33 ± 4</td>
<td>1.30 ± 0.04</td>
<td>puffy and/or small due to heat, 50% cut (+c) slightly better</td>
</tr>
<tr>
<td>J. Borg Crop Three</td>
<td>Lettuce cv. Magnum</td>
<td>Mar 94 - Apr 94</td>
<td>(-c) (+c)</td>
<td>0.91 ± 0.05</td>
<td>36 ± 8</td>
<td>1.47 ± 0.06</td>
<td>poor, less than half cut both plots same</td>
</tr>
<tr>
<td>J. Borg Crop Four</td>
<td>Broccoli cv. Marathon</td>
<td>Jun 94 - Sep 94</td>
<td>(-c) (+c)</td>
<td>0.24 ± 0.03</td>
<td>26 ± 3</td>
<td>1.39 ± 0.09</td>
<td>mediocre quality but nearly all cut both plots same</td>
</tr>
<tr>
<td>J. Borg Crop Five</td>
<td>Silverbeet cv. Fordhook Master</td>
<td>Nov 94 - Mar 95</td>
<td>(-c) (+c)</td>
<td>N.A. *</td>
<td>24 ± 3</td>
<td>1.39 ± 0.09</td>
<td>good quality both plots same</td>
</tr>
<tr>
<td>J. Borg Crop Six</td>
<td>Silverbeet cv. Fordhook Master</td>
<td>Apr 95 - Aug 95</td>
<td>(-c) (+c)</td>
<td>N.A. *</td>
<td>1.46 ± 0.07</td>
<td>mediocre quality, not sidedressed both plots same</td>
<td></td>
</tr>
<tr>
<td>P. Mifsud Crop Two</td>
<td>Sweetcorn cv. Snowsweet</td>
<td>Dec 93 - Jan 94</td>
<td>(-c) (+c)</td>
<td>not done</td>
<td>not done</td>
<td>not done</td>
<td>mediocre quality both plots same</td>
</tr>
<tr>
<td>P. Mifsud Crop Three</td>
<td>Lettuce cv. Greenway</td>
<td>Jun 94 - Sep 94</td>
<td>(-c) (+c)</td>
<td>1.14 ± 0.21</td>
<td>46 ± 8</td>
<td>1.22 ± 0.05</td>
<td>good quality, 90% cut both plots same</td>
</tr>
<tr>
<td>P. Mifsud Crop Four</td>
<td>Lettuce cv. Diamond</td>
<td>Feb 95 - Apr 95</td>
<td>(-c) (+c)</td>
<td>1.19 ± 0.18</td>
<td>44 ± 6</td>
<td>1.18 ± 0.04</td>
<td>good, 90% cut both plots same</td>
</tr>
<tr>
<td>P. Mifsud Crop Five</td>
<td>Cabbage cv. Ruby Ball</td>
<td>Jun 95 - Nov 95</td>
<td>(-c) (+c)</td>
<td>1.94 ± 0.44</td>
<td>142 ± 23</td>
<td>1.22 ± 0.10</td>
<td>mediocre and very variable both plots same</td>
</tr>
<tr>
<td>J. Saliba Crop Two</td>
<td>Cabbage cv. Savcy King</td>
<td>Dec 93 - Mar 94</td>
<td>(-c) (+c)</td>
<td>3.85 ± 0.32</td>
<td>281 ± 27</td>
<td>1.34 ± 0.06</td>
<td>good, 95% cut both plots same</td>
</tr>
<tr>
<td>J. Saliba Crop Three</td>
<td>Lettuce cv. Greenway</td>
<td>Jun 94 - Sep 94</td>
<td>(-c) (+c)</td>
<td>0.94 ± 0.22</td>
<td>39 ± 8</td>
<td>1.26 ± 0.08</td>
<td>small but good, &gt;95% cut both plots same</td>
</tr>
<tr>
<td>J. Saliba Crop Four</td>
<td>Lettuce cv. Impact</td>
<td>Feb 95 - Mar 95</td>
<td>(-c) (+c)</td>
<td>1.04 ± 0.13</td>
<td>38 ± 6</td>
<td>1.25 ± 0.05</td>
<td>good quality, &gt;95% cut both plots similar, more disease in (-c)</td>
</tr>
<tr>
<td>J. Saliba Crop Five</td>
<td>Cabbage cv. Savoy Prince</td>
<td>Apr 95 - Aug 95</td>
<td>(-c) (+c)</td>
<td>3.08 ± 0.25</td>
<td>not done</td>
<td>1.22 ± 0.08</td>
<td>small but reasonable quality both plots same</td>
</tr>
<tr>
<td>J. Saliba Crop Three</td>
<td>Lettuce cv. Green Coronet</td>
<td>Apr 94 - Aug 94</td>
<td>(-c) (+c)</td>
<td>3.40 ± 0.48</td>
<td>297 ± 36</td>
<td>1.20 ± 0.05</td>
<td>very poor emergence in (-c) only (-c) 2/3 the bulk of (+c) at incorporation</td>
</tr>
<tr>
<td>J. Saliba Crop Five</td>
<td>Japanese millet cv. Shinohe</td>
<td>Jan 93 - Mar 94</td>
<td>(-c) (+c)</td>
<td>N.A.</td>
<td>4.7 ± 0.6 t/ha</td>
<td>1.22 ± 0.03</td>
<td>good quality, some disease, 80% cut both plots similar, (-c) &quot;a bit behind&quot;</td>
</tr>
<tr>
<td>J. Saliba Crop Three</td>
<td>Japanese millet cv. Shinohe</td>
<td>Jan 93 - Mar 94</td>
<td>(-c) (+c)</td>
<td>N.A.</td>
<td>6.1 ± 2.2 t/ha</td>
<td>1.22 ± 0.07</td>
<td>good quality, some disease, 80% cut both plots similar, (-c) &quot;a bit behind&quot;</td>
</tr>
<tr>
<td>J. Saliba Crop Five</td>
<td>Japanese millet cv. Shinohe</td>
<td>Jan 93 - Mar 94</td>
<td>(-c) (+c)</td>
<td>N.A.</td>
<td>6.1 ± 2.2 t/ha</td>
<td>1.22 ± 0.07</td>
<td>good quality, some disease, 80% cut both plots similar, (-c) &quot;a bit behind&quot;</td>
</tr>
<tr>
<td>P. Dimech Crop Four</td>
<td>Pumpkin cv. Jarrahdale</td>
<td>Sep 94 - Jan 95</td>
<td>(-c) 7.85 ± 1.80 * 6.99 ± 1.43</td>
<td>not done</td>
<td>1.28 ± 0.10 1.32 ± 0.07</td>
<td>good, ~90% cut both plots same</td>
<td></td>
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</tr>
<tr>
<td>P. Dimech Crop Five</td>
<td>Lettuce cv. Greenway</td>
<td>Jun 95 - Aug 95</td>
<td>(-c) 1.22 ± 0.16 1.34 ± 0.22</td>
<td>44 ± 6 46 ± 6</td>
<td>1.20 ± 0.04 1.19 ± 0.03</td>
<td>fair quality (+c) heavier but (-c) better quality</td>
<td></td>
</tr>
<tr>
<td>J. Dimech Crop Two</td>
<td>Cabbage cv. Green Coronet</td>
<td>Dec 93 - Feb 94</td>
<td>(-c) 3.81 ± 0.52 4.12 ± 0.75</td>
<td>248 ± 34 254 ± 39</td>
<td>1.11 ± 0.12 1.03 ± 0.07</td>
<td>good quality, ~95% cut both plots same</td>
<td></td>
</tr>
<tr>
<td>J. Dimech Crop Three</td>
<td>Cabbage cv. Green Coronet</td>
<td>Jun 94 - Oct 94</td>
<td>(-c) 4.34 ± 0.43 4.33 ± 0.37</td>
<td>282 ± 27 278 ± 25</td>
<td>1.13 ± 0.04 1.22 ± 0.07</td>
<td>good quality, 90-95% cut both plots same</td>
<td></td>
</tr>
<tr>
<td>J. Dimech Crop Four</td>
<td>Lettuce cv. Patriot</td>
<td>Feb 95 - Mar 95</td>
<td>(-c) not done</td>
<td>41 ± 10 49 ± 14</td>
<td>1.09 ± 0.06 1.14 ± 0.09</td>
<td>poor due to caterpillar damage, harvested early. Both plots similar.</td>
<td></td>
</tr>
<tr>
<td>J. Dimech Crop Five</td>
<td>Lettuce cv. Greenway</td>
<td>Aug 95 - Oct 95</td>
<td>(-c) 1.19 ± 0.21 1.21 ± 0.21</td>
<td>48 ± 7 43 ± 7</td>
<td>1.19 ± 0.05 1.17 ± 0.08</td>
<td>good size and hearts, 90% cut (+c) slightly better</td>
<td></td>
</tr>
<tr>
<td>S. Dimech Crop Two</td>
<td>Silverbeet cv. Compacta Slobolt</td>
<td>Dec 93 - Feb 94</td>
<td>(-c) 2.55 ± 0.60 2.25 ± 0.57</td>
<td>127 ± 25 133 ± 27</td>
<td>1.01 ± 0.04 1.03 ± 0.07</td>
<td>poor quality - wind, heat, and hail, &lt;50% cut, both plots similar</td>
<td></td>
</tr>
<tr>
<td>S. Dimech Crop Three</td>
<td>Lettuce cv. Greenway</td>
<td>Jul 94 - Oct 94</td>
<td>(-c) 0.85 ± 0.07 0.80 ± 0.10</td>
<td>47 ± 6 48 ± 7</td>
<td>0.96 ± 0.03 1.00 ± 0.05</td>
<td>fair quality, ~60-70% cut (-c) heavier and less disease (big vein)</td>
<td></td>
</tr>
<tr>
<td>S. Dimech Crop Four</td>
<td>Cauliflower cv. All Rounder</td>
<td>Mar 95 - Jul 95</td>
<td>(-c) 1.97 ± 0.29 1.91 ± 0.32</td>
<td>89 ± 13 86 ± 17</td>
<td>1.03 ± 0.08 0.99 ± 0.05</td>
<td>good quality, even, &gt;95% cut (-c) a bit larger?</td>
<td></td>
</tr>
<tr>
<td>Attard Crop Two</td>
<td>Cucumber cv. Dasher II</td>
<td>Jan 95 - Mar 95</td>
<td>(-c) 0.38 ± 0.07 0.39 ± 0.06 *</td>
<td>8 ± 2 9 ± 1 *</td>
<td>1.37 ± 0.04 1.31 ± 0.07</td>
<td>quality good, yield low (+c) more even but lower yield</td>
<td></td>
</tr>
<tr>
<td>Attard Crop Three</td>
<td>Lettuce cv. Greenway</td>
<td>Apr 95 - May 95</td>
<td>(-c) 0.80 ± 0.11 0.75 ± 0.11</td>
<td>35 ± 4 27 ± 3</td>
<td>1.35 ± 0.07 1.41 ± 0.04</td>
<td>good quality, ~95% cut, (-c) slightly heavier but slightly more disease too</td>
<td></td>
</tr>
<tr>
<td>Attard Crop Four</td>
<td>Lettuce cv. Broncho</td>
<td>Jun 95 - Sep 95</td>
<td>(-c) not done</td>
<td>not done not done</td>
<td>1.38 ± 0.04 1.42 ± 0.03</td>
<td>fair quality both plots same</td>
<td></td>
</tr>
<tr>
<td>Attard Crop Five</td>
<td>Lettuce cv. Patriot</td>
<td>Oct 95 - Nov 95</td>
<td>(-c) 1.01 ± 0.17 1.07 ± 0.19</td>
<td>31 ± 4 33 ± 5</td>
<td>1.51 ± 0.10 1.40 ± 0.11</td>
<td>quality mediocre, hail and thrips both plots similar</td>
<td></td>
</tr>
</tbody>
</table>

**Explanations**

A. Each collaborator cultivated in a different manner. The degree of difference between the cultivation treatments varied (see "Results", section 5.2.1).
B. Mean of 50 individual plants per plot. Only plants harvested by the collaborator were sampled.
C. Mean of 10 individual plants per plot. Only plants harvested by the collaborator were sampled.
D. Six cores of 209.27 cm³ per plot, at 5-10 cm, within the plant row.
E. Comments of the collaborators and the author. Harvest percentages based on counts of 200 plant positions per plot.

* Individual plant weight not indicative of yield on an area basis, e.g. Cucurb or multiple-pick silverbeet.
Plate 17  A small (100 cm width) Dondi rotary hoe

Plate 18  A large (300 cm width) Howard rotary hoe
Plate 19  Jim Saliba's "bed-lifter"

Plate 20  A "bed-maker" for forming hills
Plate 21  A scarifier built by Vic Saliba

Plate 22  A medium-sized (150 cm width) rotary hoe