VOLUME 1 OF 2: MAIN REPORT

On-Farm Application of In-Field Rainwater Harvesting Techniques on Small Plots in the Central Region of South Africa

JJ Botha, JJ Anderson,
DC Groenewald, N Mdibe,
MN Baiphethi,
NN Nhlabatsi,
& TB Zere



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Water Research Commission

ON-FARM APPLICATION OF IN-FIELD RAINWATER HARVESTING TECHNIQUES ON SMALL PLOTS IN THE CENTRAL REGION OF SOUTH AFRICA

Volume 1 of 2

MAIN REPORT

JJ Botha[1], JJ Anderson[1], DC Groenewald[2], NN Nhlabatsi[1], TB Zere[1], N Mdibe[1] & MN Baiphethi[1]

[1]ARC - Institute for Soil, Climate and Water, Private Bag X01, Glen 9360
[2] Department of Sociology, University of the Free State, Bloemfontein 9300

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EXECUTIVE SUMMARY

ON-FARM APPLICATION OF IN-FIELD RAINWATER HARVESTING TECHNIQUES ON SMALL PLOTS IN THE CENTRAL REGION OF SOUTH AFRICA

J.J. Botha, J.J. Anderson, D.C. Groenewald, N.N. Nhlabatsi, T.B. Zere, N. Mdibe & M.N. Baiphethi

Water harvesting is the process of concentrating rainfall as runoff from a larger area for its productive use on a smaller area. Rural communities can benefit greatly from the use of the in-field rainwater harvesting (*IRWH*) technique developed by the Agricultural Research Council (ARC) - Institute for Soil, Climate and Water (ISCW) at Glen in the Free State Province through a project that was funded by the Water Research Commission (WRC). This innovative technique has the potential to reduce total runoff to zero and evaporation from the soil surface considerably, resulting in increased yields due to increased plant-available water. Intensive field experiments on clay and duplex soils, conducted over a period of six seasons, indicated that *IRWH* increased maize and sunflower yields by as much as 50%, compared to conventional production techniques (*CON*). Research results over a number of years have indicated that the *IRWH* technique is sustainable in terms of increased agronomic productivity, entrenchment of risk, conservation of the natural resources base, social acceptability and economic feasibility. These projects were funded by the WRC, Department of Agriculture (DoA), Free State Department of Agriculture (FSDA) and the ARC-ISCW. The research circle would have been completed in full when the *IRWH* technique was carried over to the rural communities in the Thaba Nchu area. The time was ripe to implement this technology. Therefore the WRC approved and funded this project that initially was planned to implement the *IRWH* technique in only six rural communities around the towns of Thaba Nchu and Botshabelo over a two-year period. The project had two main objectives: (a) to exchange technology (*IRWH*) as effectively as possible with the owners of small areas of land, those who have access to communal land and to Department of Agriculture officials (especially those of the Extension services); and (b) to assist and support the farmers and extension officers with the application of the *IRWH* technique. These two objectives were achieved concurrently by making use of various innovative communication channels.

The technology exchange process expanded so rapidly when many more households and communities than initially anticipated implemented the *IRWH* technique that the need to implement a proper exit strategy for the new communities and households arose. The project duration was extended and the DoA agreed to fund the extension period with the focus on the implementation of an exit strategy. A third objective was added to the initial two objectives, namely to deliver guidelines for farmers and trainers, respectively, on *IRWH*.

Communication methods used to disseminate *IRWH* technology were a combination of individual, group and mass approaches. Mass approaches used to disseminate *IRWH* information were local radio stations, television stations, video, brochures, pamphlets, leaflets, training manuals, newsletters, scientific publications, songs and posters. Group approaches used consisted of on-station and on-farm demonstration plots, on-farm trials, focus group discussions, seminars and conferences, workshops,

short courses, farmers' and information days, training sessions, computer programs, 3D models, focus group discussions, support by ARC-ISCW technical assistants (TAs) and festivals. The individual method included activities like visits (office or farm), letters, telephone calls and informal contacts. These various communication channels were used at different stages of the technology exchange process. By using various communication channels in most cases at least one of them conveyed the correct messages to an individual or group. It was observed during the project that at certain stages in the technology exchange process certain communication channels played a specific role. During the initiation phase, video, pictures and posters played an important role to introduce the *IRWH* technique for the first time. These visual pictures or evidence made the farmers curious and presented hope to them. Thereafter the 3D model was a very good communication channel to explain and demonstrate the differences between *CON* and *IRWH*. This communication channel explained the principles of the *IRWH* technique. Demonstration plots, when used correctly, presented the opportunity to involve the farmers from the beginning (application and implementation) all the way through to the end of the growing season (harvesting) and the fallow period. At the demonstration plots, activities like the application of the *IRWH* technique, planting of various crops, fertilization, weeding, insect and pest control, harvesting and maintenance were demonstrated. The farmers were encouraged to participate in these actions in order to master the various arts. This presented the opportunity for the farmers to be involved as if they were demonstrating the technique. It helped with ownership of the technique. Focus group discussions and support from the ARC-ISCW TAs played a very important role to mobilize the individual farmers and communities, address problems as they appear, motivate and encourage the farmers. Festivals were the tools that created excitement; they motivated and encouraged the farmers. Festivals contributed towards the explosion of the use of the *IRWH* technique in the target area. This is one of the best communication channels to motivate and encourage people and contributed towards keeping the momentum. It also presented a fantastic platform to communicate with each other and to convey the intended messages. Festivals also presented the perfect opportunity for the farmers to be recognized for their efforts, hard work and dedication.

Quite a number of capacity building actions specifically about the *IRWH* system took place during the duration of the project with extension officers, youth workers and farmers in the form of training courses and workshops. Formal and informal educational sessions were first conducted with the extension officers and thereafter the extension officers and researchers conducted the same training with the farmers. Educational training sessions did not focus solely on *IRWH*. Much broader topics were addressed. Training focused on different soil types, crop nutrition, weed control, insect control, management practices, utilization of natural resources, record keeping and budgeting, markets and marketing, the role and function of committees, conflict resolution, communication skills, etc. Formal and informal educational training courses, pre- and post-harvest focus group discussions, information days, farmer-to-farmer training and water harvesting festivals over periods of four to five days were also used to build the capacities of farmers. During the focus group discussions, certain aspects were discussed and a lot of planning and goal setting took place. Apart from the formal capacity building actions, the farmers received knowledge each day that the TAs and researchers visited them. The emphasis was on regular contact, which was vital during this project.

The farmers were encouraged to work in groups in order to minimize mistakes in construction and planting. In each group there would be those who had proven to be competent as leaders to guide others. The farmers were encouraged to form committees in every community. The committees/groups consisted initially of just a few members, approximately 10 per community in the four communities selected in the beginning phase of the *IRWH* project. These people were tasked with participation on the demonstration plots that were set up in their communities, and organized the villagers for all the activities and meetings that took place. These groups started growing as more farmers and communities took up the technique and led to the establishment of community-based water harvesting interest groups (CB:WHIGs) in each community. The ARC-ISCW (Glen) facilitated the formation of informal CB:WHIGs for small-scale farmers in 42 communities around Thaba Nchu and Botshabelo. As the number of farmers and communities using *IRWH* techniques increased, a decision was taken by representatives from each group and community to form a municipal-based water harvesting interest group (MB:WHIG) and this body was named the Tswelelopele Small Farmers Cooperative (TSFC). The association is a semi-formal umbrella body for the informal CB:WHIGs in the communities. Amongst the institutions that were co-opted into the structure were the municipality, the tribal authority and the local agriculture office. In general, a CB:WHIG operates at the community level in terms of assisting the members with their day to day challenges. These may include the scheduling and arranging of collective labour utilization, the collection of subscription fees, mobilizing farmers to assist each other in preparing the *IRWH* basins, and collectively performing activities like planting, weed and pest control. The MB:WHIG serves as a mouthpiece for the farmers from all the communities and is able to regularly (once a month) call meetings for all the CB:WHIGs to discuss challenges and issues that arise from individual communities and address them as a collective. It aims at ensuring better communication amongst members of the MB:WHIG who were also members of the CB:WHIGs and thus enables them to communicate the decisions of the MB:WHIG timeously to the communities. Another purpose of the structure was to discuss common challenges with the project team or any other stakeholder.

Various motivators and demotivators were identified that influenced the adoption process of the *IRWH* technique. The perceptions of the non-adopters were also documented by spending time with them in the communities to find out their reasons for not implementing the *IRWH* technique. The best way to enter a community was also documented.

Colourful training guidelines for farmers and extension officers were created to complete the third objective. Training manuals were developed during the project and created a very good platform for the training guidelines. The guidelines were tested and evaluated by the researchers, TAs, farmers and extension officers. Suggestions and improvements were included in the final document.

Twenty-eight demonstration plots were set up during the course of the project. Sixty-eight oral presentations and eleven poster presentations were presented at scientific congresses, symposiums or workshops during the project. Twenty-four of these presentations were international. Five pre-harvest and three post-harvest festivals, four formal training sessions and three formal workshops for the farmers, three formal training sessions and four formal workshops for extension officers, three information

or farmers days, three exhibitions and five open days were conducted during the course of the project. Besides the formal training and workshops, informal training and workshops were also conducted at the festivals, and many informal training sessions were conducted in each of the 42 communities. One radio interview; one video/CD production about *IRWH;* two physical interactive three-dimensional models; a simple three-dimensional computer model visualizing the *IRWH* technique with the rainfall-runoff-infiltration processes according to different rainfall events; two TV appearances; one article in a local newspaper (Volksblad); one article in the official newsletter of the Department of Agriculture (AgriNews); one article in the WRC's magazine (Water Wheel); two articles in the Go Farming magazine; and two colourful training guidelines, one for farmers and one for extension officers, were produced during the project.

This project directly resulted in one Masters degree and the results from the project contributed towards one Ph.D. degree. Two other Ph.D. degrees will also benefit from the project.

Results of the expansion of the *IRWH* technique indicated that during the first growing season (2001/02) six households of backyards in four communities applied the technique. By 2002/03 this had increased to 108 households in six communities, and in 2003/04 the number had further increased to 400 households in 37 communities. The number of households in the communities that applied the *IRWH* technique during the 2003/04 season varied between one and 55 families per community. Before planting time for the 2004/05 season the number had further increased to more than 1033 households in 42 communities and one trust farm. The number of households in the communities that applied the *IRWH* technique before the 2004/05 season varied between three and 100 families per community. These results reveal a phenomenal increase, over a relatively short period of time, in the application of *IRWH* in homestead gardens. It seems that this result was due to the combined impact of an efficient extension programme from the ARC-ISCW, effective and innovative communication channels and a successful new crop production technique, which was self-demonstrating.

The overall main conclusion is that the farmers in the Thaba Nchu and Botshabelo areas are capacitated with the know-how to produce their own food with the *IRWH* technique. Their capacities were built by the use of various communication channels at different stages of the technology exchange process. The farmers and extension officers were assisted and supported with the application and utilization of the *IRWH* technique. The farmers have been empowered to be able to communicate in one voice and also have more bargaining power to avoid exploitation.

The components of an exit strategy are to: (a) involve stakeholders; (b) institutionalize structures and groups; (c) plan and conduct demonstrations of the technology; (d) train extension officers and farmers to empower them with knowledge and skills; and (e) exchange the technology and information. Taking the above-mentioned into consideration it can be concluded that a successful exit strategy was implemented by the ARC-ISCW.

The application of the *IRWH* technique has contributed towards:

a) Higher crop yields;
b) Greater crop biodiversity;
c) Household food security;
d) Job opportunities;
e) Higher incomes;
f) Better health;
g) Educated farmers;
h) Reduction in crime in the community; and
i) Better social lives.

RECOMMENDATIONS, INCLUDING ADDITIONAL RESEARCH NEEDS

(a) Farmers and Extension Officers

- Apply the *IRWH* technique to obtain higher yields.
- Make optimum use of backyards and croplands to fight food insecurity and poverty.
- Demonstration plots also play an important role in unlocking the potential of the cropland.
- Extension officers should be demonstrators of new technology and fully participate in similar programmes.
- Agricultural extension should be fully committed and involved in order for development projects to be sustainable.
- Extension officers should use various communication channels during technology exchange processes. By using various channels the possibility of conveying the correct and intended message to an individual and groups is much higher as compared to the use of a single communication channel. Different communication channels assist with conveying different messages to the farmers.
- Various motivators and demotivators were identified that could influence the adoption process of the *IRWH* technique in the target area. Extension officers must take note of these motivators and demotivators, and manage them in an appropriate way.

(b) Administrators and Policy-makers

- A very good foundation has been laid for people in rural communities in the study area to become self-sufficient, produce more, and to earn a good income using the *IRWH* technique. A long-term efficient extension programme should be encouraged and developed to maintain the current status and expectations. It is a long-term process that should be continued in the future and expanded to other areas of South Africa.
- When a new crop production technique is to be introduced into rural communities, one should first start with the homesteads. These provide a simple environment for promoting a new technique through training. The starting point of a new technique should first focus on food security, and later expand to larger scale operations.
- The farmers in positions of responsibility must be capacitated with leadership and management skills. There is also a need to popularize and

motivate for the adoption of the constitution with relevant alterations to meet the local conditions.

- A future focus should be on the development of the croplands of rural communities into sustainable enterprises.
- Before a new project starts in a particular province or area it should be communicated to a government department who should be responsible for coordinating the various projects in that province or area in order for these projects to complement each other.
- The government must assist the farmers by providing them with the necessary tools to apply the *IRWH* technique. Food security departments supply farmers with tools, but some of them are a waste of money. It is recommended that such departments rather supply appropriate tools, like for the application of the *IRWH* technique, to farmers who have already grouped themselves and have proved that they are actively involved in agriculture by making use of sustainable techniques.
- Education and training structures must be in place.
- Support structures in the form of the Department of Agriculture's Extension Service and technical aid from the Agricultural Research Council and universities need to be in place.
- Attention also needs to be given to marketing structures and strategies.
- Institutional arrangements and land tenure aspects also need attention.
- An exit strategy should form part of all development projects and these projects should be conducted over a period of more than three years for them to implement a successful exit strategy in order for the projects to be sustainable.
- The agricultural extension policy and structure in South Africa needs to be streamlined to support and run development projects that address important issues like poverty alleviation and food security.
- It is time that water harvesting should become a programme instead of just a project in South Africa.

(c) Researchers

- To ensure the sustained success of crop production using the *IRWH* technique in the rural communities, especially the expansion from backyards to croplands, certain structures are of fundamental importance. The mechanization of the *IRWH* technique should be researched to ensure that it meets the requirements of the five pillars of sustainability.
- To ensure the sustained success of crop production, institutional arrangements and land tenure aspects should be researched.
- Ways of combining crops and animals in an integrated *IRWH* system need to be investigated.
- Future research is needed with regard to introducing a permanent crop into the *IRWH* system.

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Dr GR Backeberg	Water Research Commission
Mr PS van Heerden	Consultant
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DEDICATION

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LIST OF ABBREVIATIONS

AI	=	aridity index (rainfall/evaporation)
ARC-IAE	=	Agricultural Research Council - Institute for Agricultural Engineering
ARC-ISCW	=	Agricultural Research Council - Institute for Soil, Climate and Water
BBT	=	Botshabelo, Bloemfontein and Thaba Nchu FM
CBPO	=	Community-based producer organization
CB:WHIG	=	Community-based water harvesting interest group
CON	=	conventional tillage
DoA	=	Department of Agriculture
DWAF	=	Department of Water Affairs and Forestry
Es	=	evaporation from the soil surface (mm)
Eva	=	reference crop evaporation (Class A pan - mm)
FNB	=	First National Bank
FSDA	=	Free State Department of Agriculture
FSDE	=	Free State Department of Education
FSDH	=	Free State Department of Health
FSDTEEA	=	Free State Department of Tourism, Environmental and Economic Affairs
FSDWAF	=	Free State Department of Water Affairs and Forestry
FSRE	=	Farming Systems Research and Extension
GIS	=	Geographical Information System
ha	=	hectare
IRWH	=	in-field rainwater harvesting
Max.	=	Maximum
MB:WHIG	=	Municipal-based water harvesting interest group
Min.	=	Minimum
M.Sc.	=	Magister Scientiae
OSWU	=	Optimizing Soil Water Use Consortium
PAR	=	Participatory Action Research
Ph.D.	=	Philosophiae Doctor
PRA	=	Participatory Rural Appraisal
R	=	runoff (mm)
SADC	=	Southern African Development Community
T	=	temperature (^{o}C)
TA	=	Technical Assistant
TSFC	=	Tswelelopele Small Farmers Cooperative
UFS	=	University of the Free State
VISWBP	=	Visual Water Balance Process
WCT	=	Water Conservation Technology
WRC	=	Water Research Commission

1. INTRODUCTION

1.1. MOTIVATION

Water scarcity affects rainfed crop production and directly threatens the livelihood of millions of people, particularly in developing countries, and especially in sub-Saharan Africa. In the semi-arid area of southern Africa water and soil fertility are the main factors limiting food production. Developing communities are the most seriously affected by the resultant unsatisfactory level of food security and sustainability which prevails in these areas. Poverty, food insecurity and unemployment are generic to the rural communities of poor countries in the sub-Saharan African region. South Africa, with its large rural population, is not excluded from this problem. Charlton & Rose (2002), National Treasury (2003) and HSRC (2004) estimated that more than 14 million people, or about 35% of the population in South Africa, are vulnerable to food insecurity and that 43% of households suffer from food poverty. In the Free State Province of South Africa, 54% of the population is food insecure, 56% suffer from poverty and 31% are unemployed (Department of Agriculture - Free State, 2006). In relation to smallholder agricultural needs in the semi-arid regions of the Southern African Development Community (SADC), Kronen (1994) accentuates the need to develop water harvesting and water conservation techniques. She estimates that 10 million people live in these areas. In the Free State there are also a large number of households living on smallholdings under similar conditions (Department of Agriculture - Free State, 1996). They are considered to be "very important" clients of the Department of Agriculture. In central South Africa, small-scale resource-poor farmers occupy a large area east of Bloemfontein. The area has a large population living in 42 communities scattered around the two towns of Thaba Nchu and Botshabelo. These were formerly part of the Bophuthatswana homeland. This semi-arid study area is marginal for crop production because of relatively low and erratic rainfall and predominantly duplex and clay soils. These conditions result in low and often no yield because of high water losses due to runoff (R) and evaporation from the soil surface (Es). There is therefore a great need for research, technology exchange and also training at all levels, to ensure that problems are effectively dealt with.

Water harvesting is a term that describes a number of different practices that have been used for centuries in dry areas to collect and utilize rainfall more efficiently. Plato (400 BC) writes (in Criteas) of land degradation due to the decline in rainwater harvesting as long ago as 400 BC. Water harvesting is based on the principle of depriving (naturally or artificially) part of the land of its share of rain (which is usually not used productively) and adding it to another part where it can be utilized beneficially (Oweis, Hachum & Bruggeman, 2004). Van Rensburg, Botha, Anderson & Joseph (2005) proposed a classification system whereby water harvesting methods are categorized as ex-field (outside the farm boundary), in-field (within the farm) or non-field (e.g. rooftops), according to the location of the catchment area.

The ability to harvest rainwater empowers women and men in many countries of the world to secure the livelihood of their families. It is proving a vital aspect of the fight against poverty and contributes substantially to improved management of water at household, community and city level. Proper husbandry of rainwater is a key aspect

of integrated water resources management as it enhances groundwater recharge, balances water resources demands, and favours ecological sustainability.

Rural communities can benefit greatly from the use of the in-field rainwater harvesting (*IRWH*) technique developed by the Agricultural Research Council (ARC) - Institute for Soil, Climate and Water (ISCW) at Glen, Free State Province (Hensley, Botha, Anderson, Van Staden & Du Toit, 2000; Botha, Van Rensburg, Anderson, Hensley, Macheli, Van Staden, Kundhlande, Groenewald & Baiphethi, 2003). "Matangwana" is the Sotho name for *IRWH* used by farmers in the Thaba Nchu and Botshabelo area. The *IRWH* technique combines the advantages of water harvesting, no-till, basin tillage and mulching on high drought risk clay soils (Figure 1.1). This innovative water conservation technique has the potential to reduce total runoff to zero and Es considerably, resulting in increased yields due to increased plant-available water.

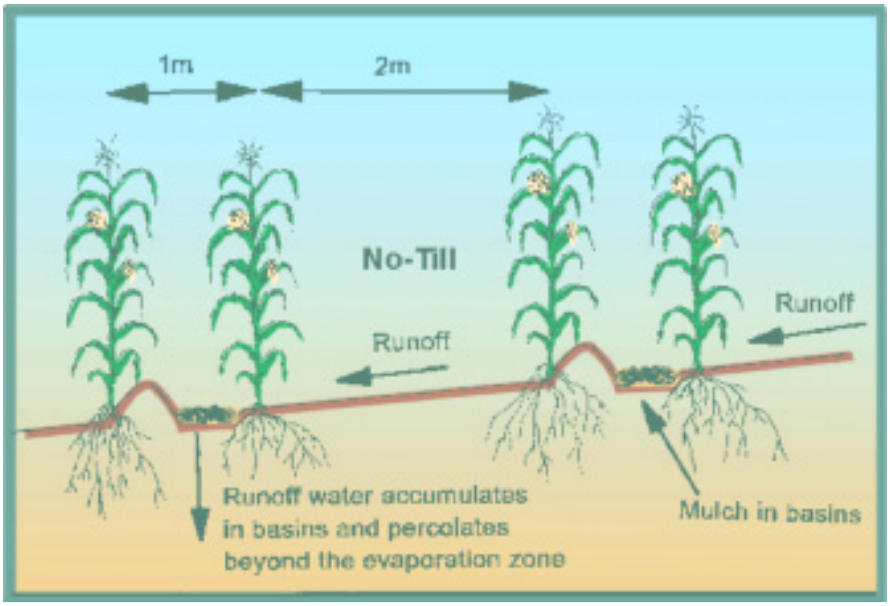


Figure 1.1 A diagrammatic representation of the in-field rainwater harvesting technique.

The *IRWH* technique consists of promoting rainfall runoff on a 2 m wide strip between alternate crop rows, and storing the runoff water in the basins. Water collected this way can infiltrate deep into the soil below the surface layer from which evaporation takes place. Organic material or stones can be applied to the basins and the runoff area in various combinations to facilitate the water conservation process. Mulch in the basins helps to suppress evaporation, while mulch on the 2 m wide runoff strip has a dual purpose, firstly to reduce or suppress soil movement, and therefore promote sustainability of the land resource base, and secondly to suppress evaporation from the soil surface (Botha *et al*., 2003). Fully-grown crops may benefit especially during dry seasons from the water stored in the soil volume underneath the runoff area, which is unavailable early in the growing season. After the basins have been constructed, no-till is applied to the land as a whole. Due to the absence of cultivation a crust soon develops on the runoff strip.

1.2. BACKGROUND AND JUSTIFICATION

Intensive field experiments on clay soils on the Glen/Bonheim ecotope (on-station) and in the Thaba Nchu area (on-farm) demonstrated over a period of six seasons that, compared to conventional (*CON*) production techniques, *IRWH* could increase maize and sunflower yields by as much as 50% (Botha & Van Rensburg, 2004). The term ecotope defines an area of land on which the natural resources that influence yield (climate, topography and soil) are reasonably homogeneous (MacVicar, Scotney, Skinner, Niehaus & Loubser, 1974).

As rainwater harvesting and conservation technologies are agro-ecosystem specific, technologies and innovations need to complement the bio-physical and socio-economic conditions of the target areas. Research work over a period of six years has indicated that the *IRWH* technique is sustainable by investigating the five pillars of sustainability (agronomic productivity, entrenchment of risk, managing of natural resources, social acceptability and economic feasibility) (Botha *et al*., 2003). Part of the problem outlined above was addressed in the Water Research Commission (WRC) project entitled "Optimizing rainfall use efficiency for developing farmers with limited access to irrigation water". In this project the Glen/Bonheim, Glen/Swartland, Vlakspruit/Arcadia and Khumo/Swartland ecotopes were studied. Valuable lessons were learned (Hensley *et al*., 2000) and, where relevant, each of these lessons was incorporated into a new WRC project entitled "Water conservation techniques on small plots in semi-arid areas to enhance rainfall use efficiency, food security and sustainable crop production". The five pillars of sustainability were studied in two WRC-funded projects to ensure food security. Three pillars (agronomic productivity, entrenchment of risk and managing of natural resources) were studied in a three-year project entitled "Water conservation techniques on small plots in semi-arid areas to enhance rainfall use efficiency, food security and sustainable crop production". Two pillars (social acceptability and economic feasibility) were addressed in a three-year project entitled "Socio-economic impact study on water conservation techniques in semi-arid areas". Another internationally funded project was initiated to enhance the scientific knowledge with regard to certain essential physical processes. The title of this project was "Quantifying and modelling the influence of different mulches on evaporation from the soil surface" (Botha, Anderson, Van Staden, Van Rensburg, Beukes & Hensley, 2001; Van Rensburg, Nhlabathi, Anderson, Botha, Van Staden & Kuschke, 2002).

This provided a valuable opportunity to enhance and consolidate the recommendations developed so far regarding water conservation techniques to promote food security and sustainable production. The research circle would be completed in full when this newly developed technology is carried over to the communities. The time was ripe to implement this new technology, but further advanced research should not be neglected and must run parallel with the technology exchange actions.

Technology in agriculture development needs to be seen broadly, covering both the technical and the institutional and organizational dimensions (Van Averbeke, 2004). While the *IRWH* technique has the potential to contribute to food security, poverty alleviation and job creation, the sustainable adoption and management will be conditioned by the matrix of institutions that exist or are lacking in the communities

(e.g. resource tenure and property rights systems). According to Shaffer (1995), formal rule changes, and by extension technology changes, intended to change a particular performance may fail to produce the expected results because of the informal institutions in the relevant matrix. This necessitated the need to analyze the effects of existing and missing institutions in Thaba Nchu on the performance of the *IRWH* technique.

Transferring exogenous technology to poor smallholders is notoriously difficult. The landscape is littered with ruins that witness failed attempts at improving the lives of the rural poor through the transfer of external agricultural technology. They act as reminders to proceed with care, irrespective of the approach that is being used (Van Averbeke, 2004).

The WRC approved and funded this project that was initially planned to be conducted over a period of two years and implement the *IRWH* technique in only six rural communities around the towns of Thaba Nchu and Botshabelo. However, the technology exchange process expanded so rapidly when many more households and communities than initially anticipated implemented the *IRWH* technique that the need to implement a proper exit strategy for the new communities and households arose. The project duration was therefore extended and the Department of Agriculture (DoA) agreed to fund the extension period with the emphasis on the implementation of an exit strategy. The DoA also included a third objective to the two existing objectives, as given in Section 1.3.

1.3. PROJECT OBJECTIVES

a) To exchange technology (in-field rainwater harvesting techniques - *IRWH*) as effectively as possible with the owners of small areas of land, those who have access to communal land and to Department of Agriculture officials (especially those of the Extension services).

b) To assist and support the farmers and extension officers with the application of the *IRWH* technique.

c) Deliver guidelines for farmers and trainers, respectively, on *IRWH*.

1.4. LAYOUT OF REPORT

The report is structured as follows:

- Chapter 2 describes in detail the materials and methods used in this study.
- Chapter 3 documents the procedures that were used to introduce and transfer the *IRWH* technique and evaluates the different communication channels used in this study to establish “best practices” in technology transfer.
- Chapter 4 analyzes the adoption process looking specifically at the motivators and demotivators and describes the best way of entering a community with a new technology.
- Chapter 5 traces in detail the reasons for the development of community-based production organizations in the Thaba Nchu area and explains the creation of

the community and municipal-based water harvesting interest groups in that area.

- Chapter 6 discusses the process of creating training manuals for the farmers and extension workers.
- Chapter 7 provides the conclusions, recommendations and suggestions for further research.
- Chapter 8 describes the various forms of capacities that were built during the course of the project.
- Chapter 9 lists the various research outputs of the project.

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2. MATERIALS AND METHODS

2.1 DESCRIPTION OF THE STUDY AREA

2.1.1 GENERAL

In central South Africa small-scale resource-poor farmers occupy a large area east of Bloemfontein. The area has a large population living in and around the two towns of Thaba Nchu and Botshabelo. These were formerly part of the Bophuthatswana homeland. This semi-arid study area is marginal for crop production because of relatively low and erratic rainfall and predominantly duplex and clay soils. These conditions result in low and often no yield because of high water losses due to runoff and evaporation from the soil surface.

This section presents a brief description of the study area, in terms of the natural agricultural resources. The description of the study area was based on Geographical Information System (GIS) coverages obtained from various sources, and based on findings from previous studies. The study was carried out in the Thaba Nchu area of the Free State Province (Figure 2.1). Thaba Nchu is located about 60 km east of Bloemfontein. The area consists of the town of Thaba Nchu and the 42 communities spread north and south of the town. The total size of the study area is 127 562 ha. The residents of the villages are small-scale, mainly livestock farmers. Land in this area is communally owned. Each community has a certain amount of land that is divided into three parts, namely residential, agricultural and communal grazing land (Table 2.1). Residential and cropping land is allocated to individual households after they obtain permission to settle in the community by the tribal authority, while communal pasture is available for grazing by animals belonging to all members of the community (Kundhlande, Groenewald, Baiphethi, Viljoen, Botha, Van Rensburg & Anderson, 2004).

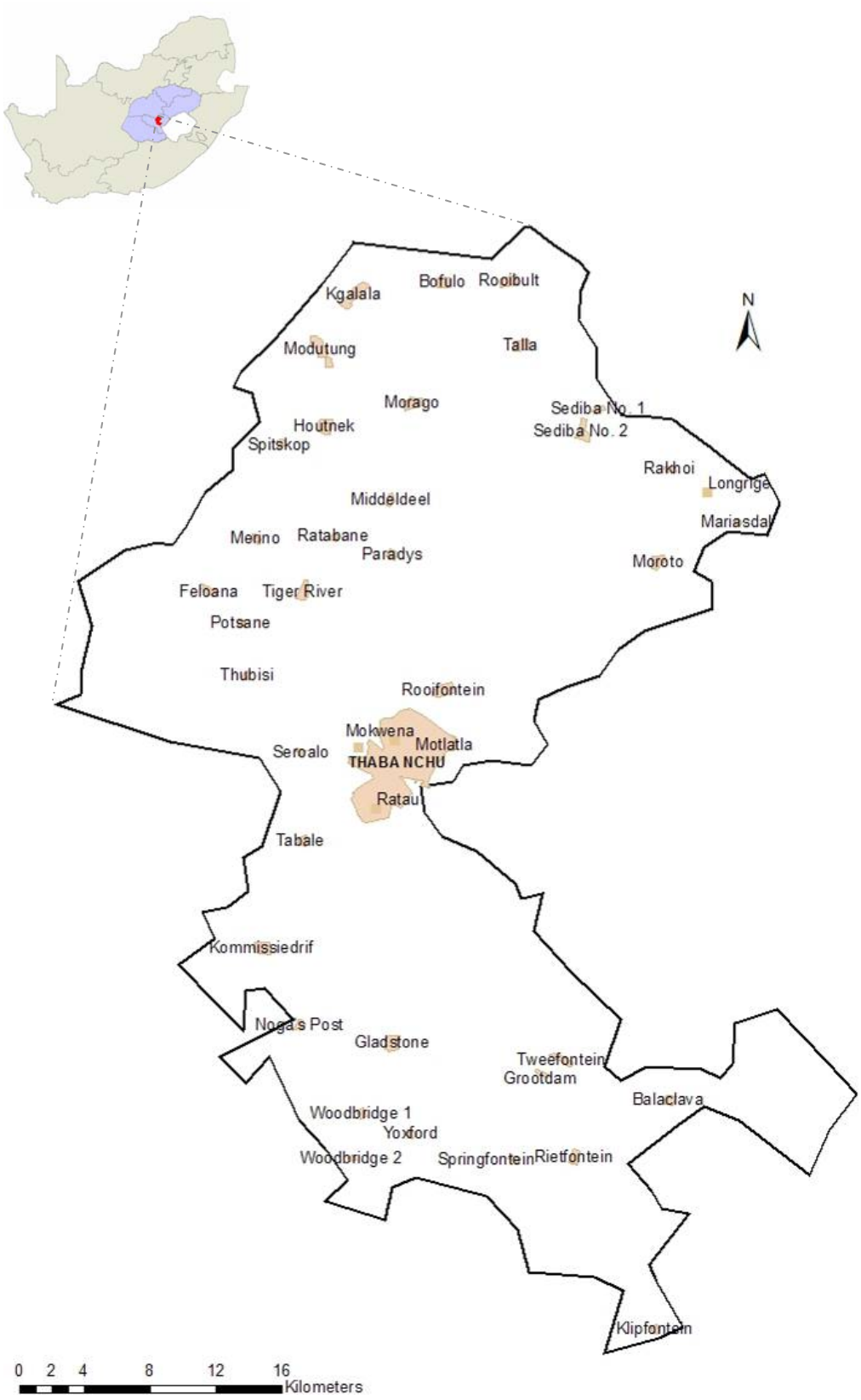


Figure 2.1 Location map of the Thaba Nchu area, indicating its location in South Africa, its boundaries, and the locations of the town of Thaba Nchu and the communities. Note that the scale bar applies only to the area within the boundaries of the Thaba Nchu area.

Table 2.1 Thaba Nchu communities together with the land area (ha) of each community earmarked for one of the three land uses, namely residential, cropping and grazing land (Kundhlande *et al.*, 2004)

COMMUNITY NAME	RESIDENTIAL	ARABLE	GRAZING
Balaclava	20	354	846
Bofulo	34	215	2 017
Kommisiedrift	40	260	1 989
Feloanè	30	80	1 208
Gladstone	60	378	2 972
Grootdam	20	200	840
Houtnek	50	290	1 649
Kgalala 1	70	300	1 974
Kgalala 2	80	300	2 028
Klipfontein	20	320	878
Longridge	10	110	260
Maraisdal	10	160	730
Merino	40	170	1 995
Middeldeel	25	190	1 852
Motlatla	50	148	2 041
Moroto	25	134	1 240
Mothusi	30	327	1 727
Morago	70	300	1 650
Nogaspost	40	137	1 992
Paradys	40	274	1 795
Potsane	30	110	830
Post	10	195	300
Rhakhoi	20	200	1 175
Rooibult	60	216	2 017
Rooifontein	50	260	3 704
Rietfontein	66	231	1 723
Ratau	90	250	1 650
Sediba Trust	50	250	1 049
Sediba Scheme	15	80	225
Seroalo	24	180	1 434
Spitskop	42	190	1 964
Springfontein	18	160	716
Talla	52	514	2 486
Tiger River	40	230	1 790
Thubisi	26	300	1 528
Tweefontein	40	280	1 210
Victoria Nek	15	150	1 104
Woodbridge Scheme	15	110	320
Woodbridge Trust	15	130	870
Yoxford	36	266	2 179
Total	**1 478**	**8 929**	**59 957**

2.1.2 CLIMATE

The long-term climate data recorded at Glen was used to describe the general climatic characteristics of the study area. Rainfall and temperature data for Glen has been recorded since 1922 and class A-pan evaporation data from 1958-2000. Mean monthly values are presented in Table 2.2 for the period 1922-2003. The high evaporative demand and relatively low rainfall make this a semi-arid climate, with worst conditions for crop production generally occurring during December and January. Rainfall during these months is generally very erratic with much of it in the form of high intensity rainfall events. March rainfall is the second highest and also the most reliable, with the additional advantage that this month also has the lowest

evaporative demand of the summer growing season. The long-term average evaporation for March is 177 mm. March also has the highest aridity index – the ratio of rainfall to evaporation – with a value of 0.46. This feature can be used to advantage by planting crops with a short growing season early in January.

Table 2.2 Long-term monthly and annual climate data from the Glen meteorological station (ARC-ISCW data); rain and temperature data: 1922-2003; evaporation: 1958-2000

Vari-able	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Long -term total / mean
Rain (mm)	8	12	19	49	68	67	83	78	81	49	20	9	543
Evap.*[1] (mm)	94	141	198	239	256	292	277	208	177	126	111	82	2198
MaxT*[2]	17.8	20.6	24.4	25.4	28.3	30.2	30.8	29.5	27.4	23.9	20.5	17.9	24.8
Min T	-1.6	0.9	5.2	9.2	12.0	14.0	15.3	14.8	12.6	7.8	2.8	-1.1	7.5
Av. T	8.1	10.7	14.8	17.5	20.1	22.0	23.0	22.1	19.9	15.8	11.6	8.2	16.2
AI*[3]	0.087	0.083	0.098	0.205	0.266	0.228	0.302	0.374	0.456	0.391	0.180	0.110	0.232

*[1] Class A pan
*[2] T = temperature in °C; mean values for the month
*[3] Aridity index = rain/pan evaporation

The average total long-term rainfall may appear to be adequate for the production of cash crops but the intensities and distribution are of such a pattern that the water available during the crop growth cycle is inadequate to support good crop growth and yields. Rainfall events with less than 10 mm occurred 90% of the time, but this represents only 31% of the total amount of rain that falls. Only 4% of the rainfall events occurred in the form of heavy thundershowers of more than 20 mm, representing 40% of the total rainfall. Adequate soil water storage during the summer and autumn fallow period, and the incidence of timely and significant spring rain, are therefore essential for good yields.

Extremely low winter and very high mid-summer temperatures are experienced in this environment, coupled with very little rainfall during the winter and spring growing season. July is the coldest and driest month with a long-term average temperature of -1.6°C and rainfall of 8 mm. Frost occurs every year. On average one can expect a frost-free period of 253 days a year, with the first average frost day on 20 May and the last average frost day on 8 September. In this sort of climate there is generally no shortage of radiation, resulting in the high evaporation from the soil surface.

2.1.3 TOPOGRAPHY

The study area consists mainly of flat topography with frequent hills. A contour map for the area is presented in Figure 2.2.

As shown in Figure 2.2, the elevation of the study area ranges from below 1400 m on the lower lying areas to above 2000 m above sea level at the mountain tops south of

Thaba Nchu. The slope ranges from 0% to more than 75%. Analysis of the proportion of each slope class revealed that 73% of the total Thaba Nchu area has less than 3% slope, 90% has less than 7% slope and 96% has less than 12% slope. This indicates that a nearly 80% of the study area would be potentially suitable for crop production provided the soils were suitable. Some of these areas with suitable soils were utilized for other land uses such as residential, roads, dams, etc.

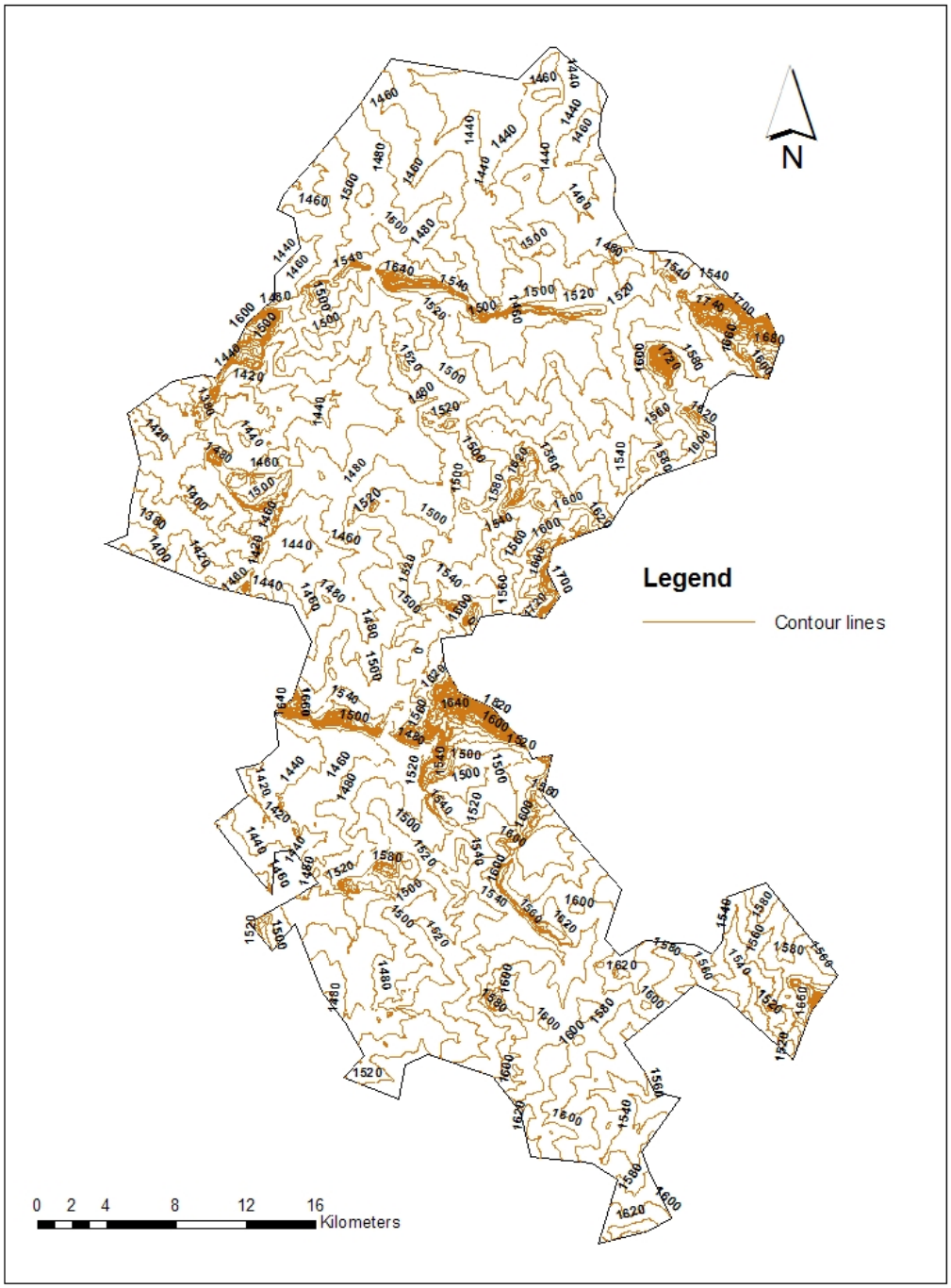


Figure 2.2 A contour map of the study area with 20 m interval contour lines.

2.1.4 SOILS

The soils in the study area are generally characterized by high clay content and shallow soil depth. The land type data (Land Type Survey Staff, 1972-2001) was utilized to provide a preliminary description of the soils in the study area. The study area is covered by three main land types, namely Dc17 (52.8%), Db37 (29.3%), and Ca33 (13.3% of total area). Other land types (Ai7, Ca24, Ca35, Db88, Ib91 and Ib99) occupy only 4.6% of the total area (Figure 2.3).

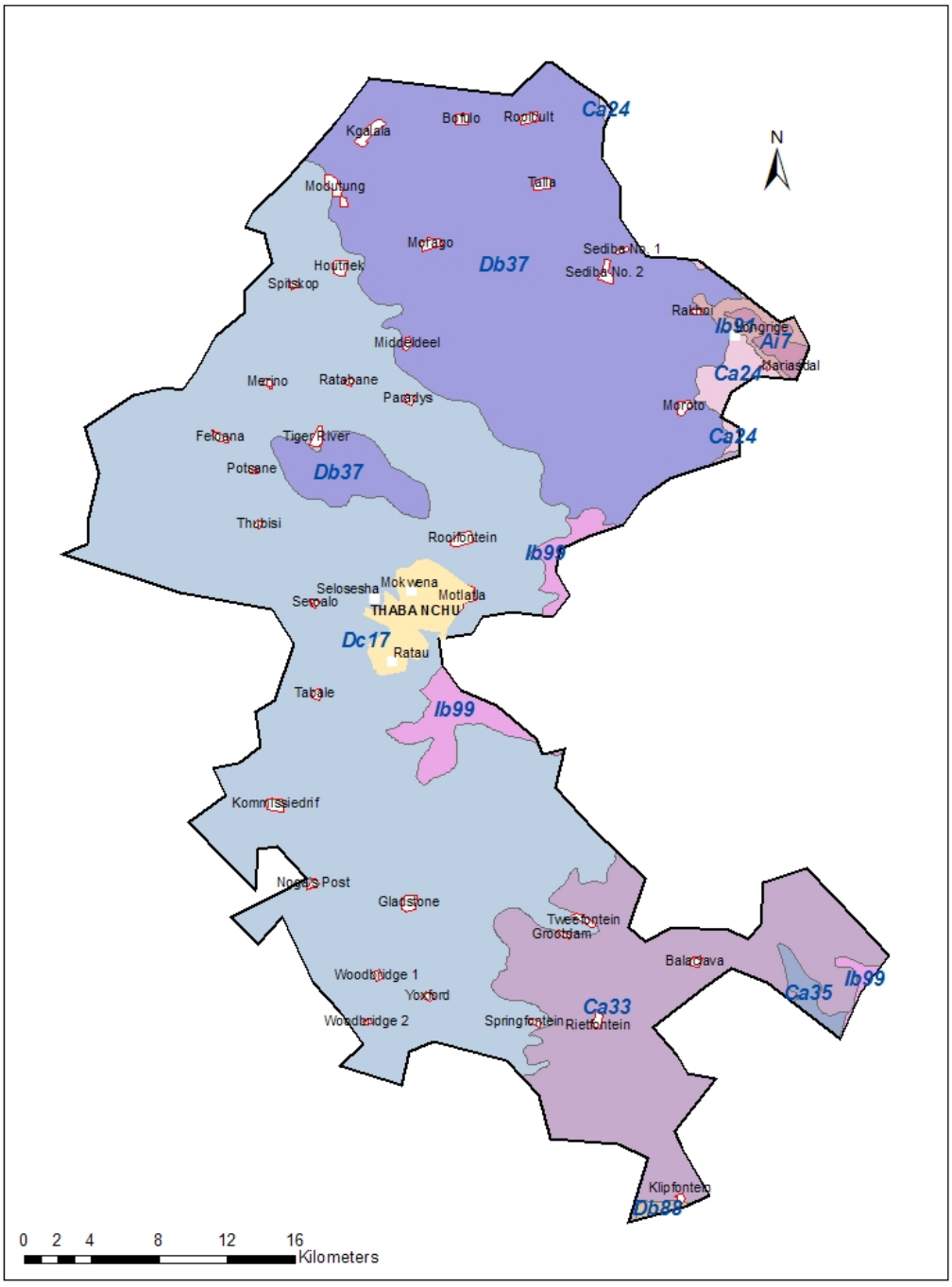


Figure 2.3 Land types of the study area.

As shown in Figure 2.3, land type Dc17 covers more than half of the study area. This land type is characterized by an abundance of dolerite intrusions. Dolerite provides relatively easily weatherable, base-rich parent material for soil formation. This partly explains the fact that this land type is dominated by margalitic soils with vertic and melanic A horizons. If deep enough, these are good soils for *IRWH* because of their high water-holding capacity (Hensley & Le Roux, 2006). These observations were confirmed via field observations at several Thaba Nchu communities within the Dc17 land type. Data from random augering over several sites indicated that most of Dc17 consisted of high clay, shallow (400-700 mm deep) soils. Slight waterlogging was observed during the very wet 2005/06 season (e.g. at some plots in Gladstone).

Land type Db37 contains a smaller amount of dolerite intrusions than Dc17. Compared to those on Dc17 the soils in this land type have lower clay contents. Duplex soils, mainly Valsrivier and Swartland, are dominant. Waterlogging problems were common during the 2005/06 season (e.g. in Rooibult).

Land type Ca33 is another important land type in the study area. This land type consists of relatively deep soils generally with higher water-holding capacities. Waterlogging was, however, very common in many of the communities located in this land type during the rainy season of 2005/06. The soils in this area are poorly drained, with gleying (G) horizons being common. This, together with the generally higher rainfall in this land type, are probably the main causes of the frequent waterlogging problems for various crops including dry beans and maize.

2.1.5 SUITABILITY FOR CROP PRODUCTION USING *IRWH*

In the past the study area was generally considered marginally suitable or unsuitable for crop production (Eloff, 1984; Schoeman, Van der Walt, Monnik, Thackrah, Malherbe & Le Roux, 2002). This is due to the semi-arid climate with erratic rainfall together with the high clay soils prevalent in this area. The land in the study area has been used mainly for grazing. With the introduction of *IRWH*, there is a good potential of producing grain and vegetables to support the farmers' families.

Tekle (2004) subdivided land type Dc17 into 66 soilscapes. He defines a soilscape as a mapping unit consisting of a portion of land mappable at a scale of 1:50 000 in such a way that it facilitates the identification of potentially arable land. It consists of a hillslope or combination of hillslopes, with a characteristic pedosequence of which the lower boundary is a drainage line. He quantified the fraction of each soilscape that is suitable for crop production using *IRWH*. He reported that of the total area of land type Dc17, 24% is estimated to be suitable for sunflower and maize production using *IRWH*. Assuming that this ratio applies for the Thaba Nchu area, the area suitable for crop production using *IRWH* would be 0.24 x 127 562 ha or 30 615 ha. Although this is a first approximation, it indicates that there is a high potential of beneficially implementing *IRWH* in the Thaba Nchu area.

Field soil survey and/or appropriate predictive mapping procedures need to be conducted in order to delineate the areas in Thaba Nchu that are suitable for crop production using *IRWH*, and to refine the present estimate of suitable area.

The *IRWH* technique has been specifically designed for ecotopes that have marginal potential for crop production and for small-scale farmers. Suggested suitable lower and upper rainfall limits are 500 and 700 mm, respectively. The range of soil forms considered suitable for water harvesting is very wide and includes soils generally considered to be of marginal potential for crop production in semi-arid areas, e.g. vertic, margalitic and duplex soils (excluding Estcourt form). To ensure minimal losses from deep drainage, soils with a low water-holding capacity in the root zone should be avoided, like sandy soils with a coarse texture. The minimum rooting depth for a soil to be considered depends mainly on two factors: a) capacity of the root zone to store available water for crop production; and b) degree of aridity of the climate. Taking the above-mentioned aspects into consideration, the recommended rooting depth should be in the region of 700 mm. This includes the high clay B-horizons. Field experiments to determine the upper slope limits acceptable for sustainable crop production with *IRWH* on different ecotopes still need to be carried out. A first approximation is that the slope of the soil should not exceed 7% for non-erodible soils (Hensley, pers. comm., 2006, Dept. Soil, Crop and Climate Sciences, University of the Free State, Bloemfontein).

2.2 EXIT STRATEGY AND PARTICIPATORY ACTION RESEARCH

2.2.1 INTRODUCTION

There is general consensus that there has been a paradigm shift in approaches to poverty reduction and the role of agricultural research. The new and holistic approaches to poverty reduction have implications for monitoring and impact assessment activities in agricultural research programmes. Traditionally, impact assessment techniques were mainly based on economic efficiency. While economic efficiency is necessary for assessing the impact of agricultural research on poverty, it is not sufficient. This is so due to the understanding of poverty having broadened to include intersectoral issues, micro-meso-macro links, the effects of institutional failure and the need to negotiate indicators of impact. Consequently, there has been a move towards more holistic approaches to poverty reduction, as are captured within a livelihoods approach. This approach requires changing the way in which agricultural research is implemented and monitored.

The new and holistic approaches to poverty reduction have their limitations since participatory poverty assessment is continuously underscoring the complex and dynamic nature of poverty, the importance of institutions both as rules of the game and organizations, and the impossibility of capturing poverty in a single measurement. There has been cutting-edge research on what constitutes poverty, descriptions of a livelihood, and on where poverty can be addressed through agricultural research projects and programmes. However, less attention is given to how research managers should change the ways in which they plan, implement and monitor the new and holistic approaches to poverty reduction. According to Carney (1999), cited by Shaxson (1999), agricultural research has an important role to play in these new approaches to poverty reduction, but a whole new set of challenges need to be met before researchers and research decision-makers can clearly show the links between nuts and bolts of agricultural research and poverty reduction.

2.2.2 AN EXIT STRATEGY

In the context of the new conceptual framework, the sustainable livelihoods approach, existing impact assessment techniques have been shown to have limitations. This is mainly because they are embedded in the neoclassical paradigm, which generally uses the partial equilibrium analysis to study the impact. While economic efficiency should remain an objective in agricultural research, there are two points to note. Firstly, a holistic approach to poverty alleviation requires an understanding that poverty cannot only be addressed by improving economic efficiency since sustainable agriculture is more than just developing a technological innovation. There is a need to create new organizational alliances and new forms of communication with widely different groups to increase the scale of the impact of the innovation. Therefore, adopting a sustainable livelihoods approach means acknowledging the enormous level of institutional failure that exists and that conditions the impact of agricultural research (Shaxson, 1999). This necessitates that a well-designed and proper exit strategy be put in place in order to improve the continuity of agricultural projects or programmes for poverty alleviation.

The adoption of a sustainable livelihoods approach means that agricultural researchers must change their behaviour, both as individuals and as organizations. It is important that emphasis be given to the changes that need to be made within the implementing institutions and their collaborators (stakeholders). This was usually thought of only in the planning stages of projects. However, it is important as the management processes will affect the decisions taken about where to invest the scarce agricultural research resources. It becomes important, therefore, to negotiate at the outset (with all stakeholders) an exit strategy for the end of the project.

Exit strategies generally involve two parallel strategies; phasing out of technical support and phasing out technical assistance. In particular, an exit strategy requires the following:

- Involvement of local stakeholders starting from the planning stage of programme or project activities.
- Flexible and decentralized programming and realistic objectives.
- Activities to promote, train and consolidate national service providers.
- Capacity building. This is a central aspect of an exit strategy. It helps to raise local ownership and will facilitate the raising and efficient management of project funds at a local level. In addition it helps the local role-players to take up the responsibilities that were initially performed by the external cooperating agencies.

In the context of the transfer of the *IRWH* technique to farmers in the Free State, all the components of an exit strategy were dealt with. In the introduction of the technique, the project team tried to involve most of the local stakeholders. These included among the most critical, the Free State Department of Agriculture (FSDA) and the farmers. The FSDA's extension personnel most targeted were those in the project area, Thaba Nchu. In the initial phases of the project extension was very much part of the implementation phase, but due to some administrative and capacity constraints that participation slowly dwindled and currently there are concerted efforts to resuscitate that as part of an exit strategy. These efforts seem to be bearing fruit even though there are still a lot of challenges that need to be addressed. Top of that

list is the full participation from the extension staff in order for them to give the farmers support that mostly came from the project team.

While collaboration with the FSDA was challenging, a lot of inroads were made in terms of building capacity within and among the communities that participated in the project and ultimately took up the technique. Even though the project team gave all the technical and material support, extension and farmers were correctly made aware that the project will come to an end, by which time extension and the farmers should be in a position to continue on their own. In order for this happen, extension and farmers were given technical training which they also had to share with new entrants. Many capacity building activities took place. The idea was to first conduct training for the extension officers, where after extension was supposed to conduct the same training for the farmers with the project team as backup. Initially the ARC-ISCW technicians were responsible for demonstrating the technique but as more and more farmers took up the technique the ARC-ISCW relied on the support from leader farmers to also guide, help and assist with the new entrants. The technicians focused on the construction of the technique, planting of various crops and maintenance. Added to that, farmers were encouraged to work in groups in order to minimize mistakes in construction and planting. In each group, there would be those who had proven to be competent as leaders to guide others. These groups started growing as more farmers and communities took up the technique and led to the establishment of community-based water harvesting interest groups (CB:WHIGs) in each community. As more communities took up the technique and established their own CB:WHIGs, it was necessary to start another structure that represented all the communities in the project area, namely a municipal-based water harvesting interest group (MB:WHIG). This was formed from representatives from each participating community and the structure serves as a mouthpiece for all the farmers. Another purpose of the structure was to discuss the common challenges with the project team or any other stakeholder. Amongst the institutions that were co-opted into the structure were the municipality, the tribal authority and the local agriculture office. Later on, efforts were made to consult other food security/livelihoods improvement projects within the area as well as other stakeholders in order to improve their effectiveness. This was done in order to show that the projects complement each other more than compete with each and hence farmers need not abandon those in which they were already involved.

2.3 PARTICIPATORY ACTION RESEARCH

Babbie (2001) defines participatory action research (PAR) as a research paradigm where the researcher's function is to serve as a resource to those being studied. This is usually done with disadvantaged groups to empower them to act effectively in their own interest. The community defines their problems and remedies and takes the lead in research that will help them to achieve their aims. PAR gives the community access to information with power. This power has in the past been kept in the hands of the dominant class, gender or group. Once the members of the community see themselves as researchers, they regain power over knowledge (Babbie, 2001). Holman (1987) and Pottier (1993) consider PAR to be research from the underside, i.e. a participative bottom-up approach in which the investigated becomes the investigators. The PAR model has specific terms which are important, namely community, mobilization,

capacity building, empowerment, human well-being, self-reliance and community participation. Each of these is briefly described below.

2.3.1 COMMUNITY

In this context the community is seen as a local community, a rather small area, a neighbourhood and a community of interests, a group or a composition of people who share physical and social space. The awareness and interaction of individual, family and community strengths and mutual needs are recognized in this community. PAR helps the community to create informal and social support networks in cooperation with professional helpers, to prevent or cure a problem on primary, secondary and tertiary level (De Vos, Strydom, Fouchè & Delport, 2002). Social support networks (CB:WHIGs and MB:WHIG) were established in the communities.

2.3.2 MOBILIZATION

The PAR model focuses on the engagement and mobilization of participants as active agents in the process of creating knowledge, reaching a collective objective and solving problems (Rahman, 1993). As the farmers have created the structures they now have the ability to monitor their progress more effectively. They have even drawn up ways of exchanging this technology with those who have not heard of it or are even struggling with it.

2.3.3 CAPACITY BUILDING

Capacity building refers to the potential and capacity of the people in the particular community and to the process of assisting them in developing skills at various levels in order to become the masters of their own development and thus acquire the capability to manage their own future (De Vos *et al.,* 2002). Farmers and extension officers who were interested in learning more about the *IRWH* technique and in applying it in their backyards were visited by the researchers at regular intervals. They were taught to master all the technical aspects of *IRWH* such as land preparation, maintenance, planting, marketing and much more. Many workshops and formal and informal training sessions took place which taught the extension officers and the farmers about different soil types, crop nutrition, weed and insect control, management practices, leadership, conflict resolution, communication skills, teamwork, group dynamics, record keeping and budgeting, markets and marketing and the role and function of committees, etc.

2.3.4 EMPOWERMENT

PAR endeavours to empower deprived and disenfranchised people with research capabilities so that they can identify and transform their situation for themselves, and it takes place in an ongoing learning process for everyone involved (De Vos *et al.,* 2002). Other forms of empowerment through PAR are conscientisation, emancipation and learning (Babbie & Mouton, 2001). The farmers were empowered in various ways. They were relieved from hunger so that they could teach others to do the same. In many instances they said that they felt they were educated people because they could use a measuring tape, use different types of fertilizers and seeds. They could now hold meetings and write down action plans without the guidance of the ARC-

ISCW team. At present they are learning how to organize and run their own *IRWH* festival.

2.3.5 HUMAN WELL-BEING

De Vos *et al*. (2002) regard welfare or human well-being as "the efforts of a community to help its people achieve a condition of overall health, emotional comfort and economic security". Human well-being should be the focal point and aim of the total research endeavour and development process and includes well-being on all levels, including the social, economic, technological, political, cultural and spiritual potential of people in their communities (De Vos *et al*., 2002).

2.3.6 SELF-RELIANCE

De Vos *et al.* (2002) define self-reliance as a driving force for creative activity that requires an awareness of one's creative assets, confidence in one's ability to solve life's problems, the courage to take on challenging tasks, and the stamina to make sustained efforts.

2.3.7 COMMUNITY PARTICIPATION

Community participation can be seen as the creation of a democratic system and procedure to enable community members to become actively involved in the institutions and systems that govern their lives and to assume responsibility for their own human development. Community participation provides a sense of belonging, a commitment to common goals, a willingness to assume responsibility for oneself and others, and a readiness to share and interact (De Vos *et al.,* 2002). The *IRWH* technique brought people together that no one thought would ever work together. In all the communities there are different clans and tribes, and it was also difficult working with a Xhosa if you were a Sotho. In a community known as Woodbridge 2 there was such a problem but because these farmers wanted to belong to something and had the same goals, and the willingness to take responsibility to better their lives, they put all the dynamics aside and were committed.

2.4 COMMUNICATION CHANNELS

Various communication channels or methods are available to diffuse information and can be broadly divided into three groups, *viz.* mass media, group approach and individual approach.

2.4.1 MASS MEDIA

Mass media comprises the methods and organizations used by specialist social groups to convey messages to a large socially mixed and widely dispersed audience. Those most commonly used by extension staff are newsletters, posters and radio. These methods create awareness about the existence of new technologies, or to enforce other, face-to-face extension activities (Nyakuni, Shone & Erickson, 2001).

The Agrometeorology Unit at the University of the Free State, Faculty of Natural and Agricultural Sciences, did a radio talk show on climate forecast on Botshabelo, Bloemfontein and Thaba Nchu (BBT) fm. On the talk show farmers were advised on what they should plant, when to irrigate and when to harvest (Netshiukhwi, pers. comm., 2006, ARC-ISCW, Glen).

Communication methods used to disseminate *IRWH* information during the project were local radio stations, television stations, video, brochures, pamphlets, leaflets, training manuals, newsletters, scientific publications, songs and posters. The following are examples of the various mass media methods used during the study:

- Various pamphlets, leaflets and brochures were created during the project, especially at the beginning. These materials were also translated into Sotho and distributed to the farmers during information days and other technology exchange activities. A very good example is the ten steps to convert land into an effective *IRWH* system (Appendix 2.1).
- Many posters (scientific and popular/awareness raising) were created during the project. These posters were presented and displayed at scientific congresses, agricultural shows, exhibitions and other technology exchange actions like farmers' days, festivals, training events and workshops, etc. The posters are listed in Chapter 9.
- An *IRWH* song and dance was created which the farmers are well equipped with.
- Volksblad, 9 April 2003. *Stelsel besorg kleinboere landerye om van te droom* [Afr.] (Article on application of in-field rainwater harvesting in the Thaba Nchu area).
- An article entitled "Rainwater harvesting boosts crops in Free State" was printed in the official newsletter of the Department of Agriculture (AgriNews), April 2003.
- A radio interview with Radio Oranje about the implementation of water harvesting in the Thaba Nchu area was broadcast on 23 May 2003.
- An article entitled "Water harvesting: A key to food security for Africa?" was published in the WRC magazine "Water Wheel", May-June 2003, Volume 2 No. 3.
- A video/CD production of the *IRWH* technique was produced. This video/CD was played at all the 42 communities (more than once) and at various technology exchange actions. It was also distributed to interested people and organizations. The video/CD is entitled "*IRWH* to promote sustainable livelihoods" (June 2003) and featured *IRWH* in some of the communities where this new crop production technique has been used. The video/CD clearly showed the difference between crops produced with *CON* and *IRWH*. The yields also demonstrated that the *IRWH* technique is superior to the *CON*.
- Three newsletters were created and distributed amongst the *IRWH* farmers from the 42 communities. The newsletter consists of events that were conducted during the previous three months, *IRWH* activities that need to take place during the following three months, tips about planting, maintenance, marketing, challenges experienced by the farmers, *IRWH* success stories, etc.
- A documentary on *IRWH* was broadcast on the programme Ulimo on SABC 2 on 2 April 2006.

- An article in the Go Farming magazine entitled "In-field Rainwater Harvesting". GO FARMING (2006) – For the Farmers of Tomorrow, Volume 1 No. 1 pp. 24-26.
- An article in the Go Farming magazine about a farmers' day at Glen, where the focus was water harvesting, entitled, "Go Farming presents its first Farmers' Day". GO FARMING (2007) – For the Farmers of Tomorrow, Volume 1 No. 6 pp. 42-45.

2.4.2 GROUP APPROACH

The group approach is the most common way to deliver extension messages to the community. It is used where the goals can be determined beforehand. Group methods include meetings, discussions and workshops. The group approach provides good feedback, helps to reduce misunderstandings, and promotes interaction among participants that later will result in sharing experiences and obtaining new ideas (Nyakuni *et al*., 2001).

The *IRWH* technique has been adopted by many farmers and therefore requires a lot of coming together and talking about various issues that concern them. The technical team held group meetings at all the communities every month, and after that they concentrated on the communities that had problems or those that had any inputs. These meetings were not only held by the technicians but by researchers as well, post- and pre-harvest festivals and field days were also conducted where farmers exchanged ideas and learned a lot. Below are examples of the group approaches used during the course of this study.

2.4.2.1 Information, farmers' and open days, exhibitions and demonstrations

2.4.2.1.1 Information and farmers' days

The ARC-ISCW team stayed in constant contact with the farmers in the Thaba Nchu and Botshabelo area who had implemented *IRWH*. Numerous farmers' days and information days were held at the beginning of the technology exchange phase, to provide the farmers with information and advice. Farmers were given the opportunity to share their experiences and problems with *IRWH*. During some of these days farmers visited the experimental site at Glen, the demonstration plots at Khumo and Vlakspruit, and homestead gardens and croplands in the communities where *IRWH* had been implemented. During each of these gatherings the principles of *IRWH* were once again explained and demonstrated. The whole process of storing water for crop production with *IRWH* was explained as visually as possible by means of pictures, photos, posters and a 3D scale model to make understanding the technique as easy as possible. After the farmers had seen the practical demonstration of the *IRWH* technique, most of them indicated that they fully understood the technique and were convinced that it could be used to improve crop yields dramatically.

2.4.2.1.2 Open days

Whenever open days were conducted at the Glen Agricultural College, the ARC-ISCW was invited to participate and present and exhibit their work. Various communication channels were used to showcase and promote *IRWH* like showing a video about the technique, displaying a scale model of the *IRWH* technique compared

to *CON*, posters, pamphlets etc. Students, farmers from the Free State Province, officials from the FSDA and various other stakeholders, attended these open days.

2.4.2.1.3 Exhibitions

Whenever and wherever opportunities to exhibit occurred, like at National Agricultural Week, Water Week, SET Week and the World Summit for Sustainable Development, the research team made use of the opportunity to exhibit, explain and promote the *IRWH* technique. The technique was introduced and exhibited at various events beyond the boundaries of the target area. By giving *IRWH* more exposure the team cherished the hope that the technique might eventually spread to other areas with suitable soils. However, the target audience was not always only rural small-scale farmers with limited access to natural resources. School children, researchers, farmers and others attended many of these events. The role that *IRWH* can play in the alleviation of poverty and malnutrition was also communicated to Department of Agriculture officials, extension officers and farmers on various other occasions, including Integrated Food Security workshops.

2.4.2.1.4 Demonstrations

The *IRWH* technique was introduced and demonstrated to the educators and learners from various schools by using a 3D visual model that shows simply how the technique works in the field. The purpose of this was to showcase *IRWH* to learners and educators. The idea was to create a passion for agriculture, hence not taught in most schools in the country; and in turn promote awareness of healthy eating (balanced diet) by linking up with the Department of Health (DoH) and Department of Education (DoE). Therefore, school children were encouraged to learn how to grow their own crops for consumption by using the *IRWH* technique so as to curb the habits of bad eating. All those present, educators, learners and other participants, showed a great eagerness to learn more about the technique so that they could apply it at their various schools.

2.4.2.2 Pre- and post-harvest focus group discussions

At the beginning of the technology exchange phase pre- and post-harvest focus group discussions were conducted, but as more people got involved these were replaced by pre- and post-harvest festivals.

2.4.2.2.1 Pre-harvest focus group discussions

Pre-harvest focus group discussions were held in the beginning of the project with the extension officers and farmers from both Botshabelo and Thaba Nchu as the two main focus groups. The main purpose of these days was to explain the benefits of *IRWH* as compared to *CON*. The new technology was introduced and explained in both English and Sesotho. The financial incentives of the *IRWH* technique were emphasized. The farmers were taken on excursions to either on-station demonstration plots at Glen, on-farm demonstration plots at the farms Khumo and Vlakspruit, or demonstration plots in the communities. Pre-harvest focus group discussions were conducted during March, which coincided with the flowering period of the crops demonstrated. This is the best time to demonstrate visible differences between techniques.

2.4.2.2.2 Post-harvest focus group discussions

In the beginning of the project post-harvest focus group discussions were conducted. After the crops had been harvested and the results were known, they were presented at gatherings organized at Thaba Nchu and Botshabelo either by officers of the FSDA or the ARC-ISCW project team. Close cooperation was maintained throughout with the Farming Systems Research and Extension (FSRE) section at Glen and the relevant branch of the FSDA Extension Service in connection with these technology exchange actions. The aims of the post-harvest focus group discussions were to introduce and promote the *IRWH* technique, show the benefits of the technique compared to *CON*, discuss the climate and yields of the previous season and motivate the farmers to implement the *IRWH* technique. The technique was explained by means of slides, posters, pictures and an interactive physical 3D scale model. Yields of the previous growing season obtained at the on-station experimental site at Glen and the on-farm demonstration plots at Khumo, Vlakspruit and in the communities were also communicated to the farmers. For most of the farmers who attended these gatherings it was the first time that they were formally introduced to the *IRWH* technique. Most of them seemed to be very enthusiastic about the new technique and indicated that they intended to start constructing basins at their homesteads immediately.

2.4.2.3 Festivals

As more people got involved in this project the pre- and post-harvest focus group discussions were replaced by pre- and post-harvest festivals. The major purpose of these festivals was to share knowledge and experiences with the farmers who have already adopted the technique, and they were therefore dubbed a "fest-of-knowledge". Secondly the festivals aimed to create awareness amongst communities and other development stakeholders with particular reference to those in agriculture.

2.4.2.3.1 Pre-harvest festivals

Pre-harvest festivals were conducted during March to coincide with the flowering stage of the crops, which is the best time to observe visible differences between the different techniques. Many actions that were supposed to take place between flowering and the next growing season were also addressed during the pre-harvest festivals. The objectives of the pre-harvest festivals were to: 1) bring all the farmers together from different communities with different knowledge, understanding and ideas and exchange experiences and information with regard to *IRWH*; 2) bring farmers, extension, researchers, politicians and the municipal body together in exchanging knowledge on the *IRWH* techniques; 3) expose and promote *IRWH*; 4) empower farmers to fight poverty and food insecurity; 5) get feedback on all the activities that have been taking place in the various areas; and 6) encourage farmers to adopt and expand the *IRWH* technique.

The first festival was scheduled for four days during March (17-20) 2003. Members of the communities in which the *IRWH* technique had already been implemented as well as neighbouring communities that had not yet heard of or seen *IRWH* were invited to this festival. All the people who participated in implementing the technique were invited, together with five representatives from each new community. In accordance with expectations, approximately 400 farmers attended each day of the first festival.

Arrangements for the second water harvesting festival started early in February 2004. It was planned and arranged by members of the ARC-ISCW research team at Glen and the technical assistants. When the first water harvesting festival was held during March 2003 the *IRWH* technique had been implemented in only six communities. By the time the second festival was held the technique had already been introduced in 37 communities in the Thaba Nchu and Botshabelo area. Because of the large number of communities that attended, they were demarcated into four groups. During the festival, scheduled from 15-19 March 2004, each group attended only one day whilst the last day of the festival was attended by the executive committee of all the communities. A pre-harvest information day was also held at Sediba Scheme on 7 April 2004 in order to promote the *IRWH* technique in this particular area where some of the communities did not participate fully. The objective was to showcase the *IRWH* technique to small-scale farmers in the 14 communities. Each community was mandated to send at least 10 farmers. The representation was done such that there was an equal number of experienced users of the *IRWH* technique and newcomers.

As the number of farmers and communities using *IRWH* technique in the Thaba Nchu area has increased tremendously (from 400 farmers in 37 communities during the 2003/04 season to 1033 farmers in all 42 communities during the 2004/05 season), the area was divided into five zones with each zone comprising about eight communities and on average about 200 farmers. The 2005 festival was spread over six days in accordance with the zonal divisions of the farmers. The first 5 days were zonal festival days and the sixth day brought together all the farmers from the different zones to one place.

Preparations for the festival were done in collaboration with the farmers, ARC-ISCW and the FSDA. Previously the festival was only the responsibility of ARC-ISCW and in recognition of involving the other relevant stakeholders, a steering committee comprising farmers (zonal representatives), the FSDA and ARC-ISCW (Glen) was constituted. The main objective of the organizing committee was to be responsible for preparing the festival. This was seen as a vehicle for opening up future collaborations with other stakeholders, especially the farmers and Provincial Department of Agriculture as they are the ones who will ultimately have to see to the continuance of the *IRWH* technique in the area. In the same light, the Thaba Nchu Extension office and the Food Security Unit represented the FSDA on the steering committee. Each member of the steering committee was allocated a specific role and all performed their duties satisfactorily as shown by the success of the festival.

The same procedure was followed during 2006. The area was divided into five zones, each consisting of about 8 communities and an average of 200 farmers. The festival was spread over 6 days in accordance with zonal division of the farmers, the first five days were zonal festival days: zone 1 visited zone 4; zone 2 visited zone 5; zone 3 visited zone 1; zone 4 visited zone 2 and zone 5 visited zone 3. The final day brought together all the farmers from the different zones.

Buses were hired to transport the farmers from their communities to the various venues and excursions and back again. During the first four days the farmers had the opportunity to visit various backyards of leading farmers in various rural communities to share and exchange ideas and information. Farmer-to-farmer training sessions and

discussions also took place as well as field visits where the participants were shown around chosen communities.

The highlight of these occasions was the visits to the backyard gardens and trial plots where farmers themselves explained their experiences with the *IRWH* technique and how it has improved the soil structure, increased crop production and enhanced their livelihoods. The farmers went on excursions to experimental plots or demonstration plots either at Glen or at croplands or backyards at the homesteads in the Thaba Nchu and Botshabelo areas to experience the difference between the *CON* and *IRWH* techniques. In the beginning of the project the focus was on the differences between *CON* and *IRWH*. Later on as more farmers implemented the *IRWH* technique and got acquainted with it the focus was not solely on *CON* versus *IRWH* but also on important management practices like fertilization, weed control and insect control. *IRWH* demonstration plots with the following treatments were visited: weed control vs. no weed control, insect control vs. no insect control, and fertilizer application vs. no fertilizer application vs. kraal manure.

The farmers also visited a number of different homesteads of leading farmers in various communities in the Thaba Nchu and Botshabelo area. This was a highlight of the festival. It was an honour and a privilege for farmers to be chosen to share their results and experiences with other farmers, and was recognition for their efforts and results. The leading farmers shared all their experiences, challenges and successes with the other farmers. The farmers also visited other leading farmers or groups of farmers that were setting a good example, for instance the benefit of working groups. During these visits the farmers learned a lot and witnessed the various crops planted within the *IRWH* system. The other farmers also had the opportunity to ask questions or make remarks. It was a fantastic platform to exchange information. In the beginning of the project the technical assistants of the ARC-ISCW presented much of the work, but as the farmers got more involved they presented most of the work themselves with the TAs only in the background for support (Figures 2.4-2.7).



Figure 2.4 A farmer whose backyard was visited addressing a group of farmers.



Figure 2.5 Backyard owners from Kommisdrift with some of the crops they planted.



Figure 2.6 One of the backyard owners from Gladstone with her mature maize crop.



Figure 2.7 A backyard garden at Potsane showing the use of stone and straw mulch.

After a visit to a demonstration plot and various homesteads the farmers gathered for lunch at a hosting community. A leading community was identified to host a particular day. Once again it was an honour for a community to be chosen to host a day as it was part of recognition to that community for good performance. The hosting community prepared the food and all the group discussions took place at that community. Sometimes farmers from the hosting community arranged displays of their produce of vegetables to show off to the other farmers. Sometimes they also cooked a variety of traditional dishes using their own produce. After lunch it was time for group discussions (Figure 2.8). The farmers were split into smaller groups and they discussed what they had learned and what impressed them during the day. The main points of the discussion were the evaluation of *CON* versus *IRWH*, advantages and disadvantages, challenges and successes; whether they saw the effect of weeds and fertilizer on crop growth; how to budget to buy their own inputs; functioning of the *IRWH* committees; markets; how to keep good relations between the various role-players; how to encourage other people to join the *IRWH* technique; what to do to be independent; what they needed to improve; and planning and goal setting for the future. Sometimes training was conducted on identified critical or neglected issues like leadership qualities, role and function of leaders and committees, support to a leader, markets etc. Experts in certain fields and subjects were also made part of the festivals to present on certain issues like marketing strategies and record keeping.

The last day of the festivals that was conducted in the form of a workshop was held at suitable venues in Thaba Nchu. During the last day of the first festival in 2003 all the people who participated in implementing the technique were invited, together with five representatives from each new community. Three committee members from each of the 37 communities attended the last day of the pre-harvest festival during 2004. For this day the farmers had to travel to the venue on their own cost. The start of the workshop was delayed because some of the farmers' transport arrived late in town. The programme finally commenced at about 09h00. The effort that the farmers made to attend showed how highly they appreciate the *IRWH* technique. One member from each active *IRWH* household from 42 communities attended the last day of the pre-harvest festival during 2005. The last day of the pre-harvest festival during 2006 was attended by some 250 enthusiastic community members from the Thaba Nchu and Botshabelo area, who represented more than a 1000 households in the specific area (five representatives per community and MB:WHIG members). The aim of the last day was to get feedback, discuss results of the group discussion and the way forward.

Many dignitaries from the provincial and national Departments of Agriculture, ARC-Central Office and ARC-ISCW, the tribal leadership (Chief Moroka of the Barolong tribe), Free State Rural Development, Mangaung Local Municipality, Department of Water Affairs and Forestry, University of the Free State, etc. attended the last day of the festivals. These stakeholders also participated in the programme of the day.



Figure 2.8 Farmers busy with group discussions at Rooibult.

The farmers brought some of their produce for display and interestingly some used this opportunity to sell their produce. People were singing *IRWH* songs they composed themselves. Following the addresses by the various dignitaries, the beneficiaries of the project also had to present the challenges and opportunities. On behalf of the farmers were the five zonal representatives. Some farmers were invited to share their success stories. Farmers and extension officers from the Eastern Cape also attended the festival during 2005 and shared their experiences with the farmers of the Free State Province.

Exhibitions on display included an oil press, a maize grinder, and a solar plate. The uses of these were explained and demonstrated to the farmers by the various stakeholders, who also shared their vision and offered their support to the farmers as well as words of encouragement.

During this day the farmers, extension officers, FSRE officials and stakeholders were asked to discuss various topics. Representatives of each group were then asked to present their findings. Issues discussed included the following:

- Goals of the farmers.
- Exchange of *IRWH* experiences with others.
- Highlights of the festival.
- What can be done to improve collaboration?
- Needs.

The responses of the farmers from the various zonal days to the questions asked during the group discussions were reported back. The questions were as follows: number of people in the group; average period of use of *IRWH*; performance of CB: WHIG; reasons for leaving; issues which need to be addressed in order to improve

returns; percentage of farmers that will continue with *IRWH* in the absence of ARC-ISCW support; signs of waterlogging in backyards; soil erosion reduction; increase in biodiversity and government extension support.

Sometimes farmers from various communities performed dramas, poems and songs about the *IRWH* technique. The performance was very entertaining and enjoyable. The actors had even produced a water harvesting song that was sung by all the farmers in the hall. The poem was filled with motivation and was very interesting and enjoyable. The extension officers and researchers judged the various performances and crowned the winners.

The winning community of the growing season was announced and presented with a prize. The people from the winning community were very happy about the prize and promised to expand to the cropland. As part of the celebration local traditional dancers were invited to entertain the farmers in between the speeches (Figure 2.9).



Figure 2.9 Traditional dancers from Motlatla entertaining the audience on the final day of the *IRWH* festival.

A highlight of the last day of the 2006 festival was the attendance of the then Minister of Water Affairs and Forestry, Hon. B. Sonjica. On 29 March 2006 Mr. J.J. Botha and Dr. D.J. Beukes were asked to brief the Minister about all the water harvesting endeavours of ARC-ISCW, especially about the progress in the Free State Province. They also indicated issues on the way forward like scaling out the technique to other districts and the poverty nodes, combining *IRWH* with supplemental irrigation, rangeland improvement, recharge of aquifers and roof water harvesting. After the briefing the Minister visited home gardens in one of the rural communities, Gladstone, in the Thaba Nchu area to gain first-hand knowledge of the very successful implementation of the *IRWH* technique that has been promoted by the ARC-ISCW Glen research team. At Gladstone Mrs. Olivier and Mrs. Motlokgelwa explained to the Minister how the technique works and how their vegetable and maize yields have increased with consequent increases in home income (Figure 2.10).



Figure 2.10 Mr. Botha discussing *IRWH* issues in home gardens of Gladstone community with the Minister of Water Affairs and Forestry and provincial officials.

The Minister's visit coincided with DWAF's National Water Week celebrations in the Free State Province and she addressed the Rainwater Harvesting Workshop. She thanked the farmers for their warm welcome and said that the first time she heard about *IRWH* was when Mr. Botha presented a paper in the Netherlands. She also said that she was very proud of the people from the Free State Province producing their own food despite the normally dry conditions. The Minister said that she would like to see *IRWH* implemented in other provinces and that she would make sure the *IRWH* project gets full support from the government. She was pleasantly surprised, not only by the success stories, but also by the enthusiasm and singing of the delegates. The Minister promised that her department would contribute to roof water harvesting by making funds available for storage tanks and asked for an action plan from her own personnel, as well as a project plan from ARC-ISCW. She promised to give the *IRWH* farmers water tanks for supplementary irrigation.

A soul touching moment came when the ARC-ISCW Glen team and the farmers lit candles, demonstrating the beginning and the expansion of the *IRWH* technique (Figure 2.11): *"In the beginning there was darkness and this signified a lack of hope and faith. Suddenly, there was light and it started with one individual, then a community and later many communities*".



Figure 2.11 Farmers lighting candles to demonstrate the expansion of the *IRWH* technique.

2.4.2.3.2 Post-harvest festivals

Post-harvest festivals were conducted between September and December at the Botshabelo indoor soccer stadium. The objectives of the post-harvest festivals were to: 1) expose and promote the *IRWH* technique; 2) recap on the results of the previous season (climate and yields); 3) recap on all the activities that took place during the previous season; 4) discuss challenges and successes of the previous season; 5) plan for the new season; and 6) motivate farmers to adopt and expand the *IRWH* technique.

The post-harvest festivals were attended by farmers (one member per *IRWH* household), researchers, provincial and national Department of Agriculture officials, and other stakeholders like the ARC-Central Office and ARC-ISCW, WRC officials, the tribal leadership (Chief Moroka of the Barolong tribe), Mangaung Local Municipality, Free State Department of Tourism, Environmental and Economic Affairs (FSDTEEA), University of the Free State, etc. These stakeholders also participated on the programme of the day either by sharing their vision, indicating their help and support to the farmers or by encouraging the farmers to continue with their good work. The farmers who mostly started their journey to the venue as early as 04h30 that morning arrived on hired buses from Big Sky Public transport service. Traditional dancers provided entertainment in between items on the agenda.

These days were opened with a prayer. Thereafter the purpose of the day was explained. The history and importance of the *IRWH* technique was detailed. Various stakeholders presented their views. This was followed by a slide show that recapped the past season in terms of climatic conditions; yields of different farmers in the Thaba Nchu area; *IRWH* activities; expansion of the *IRWH* technique to more backyards and croplands; demonstrations and experiments; incomes of successful farmers; challenges like communication; committees; marketing and markets. Planning for the new season was also addressed in terms of what, where and how to plant, and how to access markets. The importance of a realistic action plan for the next growing season was also highlighted.

Leading farmers from each zone were given a chance to express their feelings about *IRWH* and to share some of their success stories and tips to be successful. Zonal representatives were also given a chance to talk about achievements and failures during the past season in their respective zones. They also shared what they think should change in their zones in order to be more successful. The chairperson of the MB:WHIG introduced the executive committee and explained their role and functions. He also expressed his view about *IRWH*, successes and challenges and encouraged the farmers to work hard together to fight poverty and food insecurity.

The winning communities were announced, using the following criteria: knowledge of technique, participation, expansion rate, management of *IRWH* technique, crop diversity, yields, record keeping, functioning of the committee, committee independence and empowerment of women and youth. The prizes included rakes, spades, watering cans and knapsack sprayers. The recipients of these prizes were very excited and some were seen wiping away tears of joy. The prizes were organized as presented in Table 2.3.

Table 2.3 Prizes that the winning communities received during the 2004/5 season

1ST PRIZE	2ND PRIZE	3RD PRIZE
15 rakes 15 spades 15 hoes 3 ropes 2 measuring tapes 5 watering cans 2 knapsack sprayers stationery	10 rakes 10 spades 10 hoes 2 ropes 2 measuring tapes 2 watering cans 1 knapsack sprayer stationery	5 rakes 5 spades 5 hoes 1 rope 1 measuring tape 2 watering cans stationery

It was explained how easy it is to win the prize for being the most active community if you keep to your action plan. Most of the communities indicated that they would like to win the competition the following season (Figure 2.12).



Figure 2.12 Community members attending the post-harvest festival during November 2006.

Thereafter certificates were handed to the farmers and extension officers who had successfully implemented and used the *IRWH* technique for one or more growing seasons.

Journalists from the Daily Sun, Free State news and Mosupatsela fm also attended the post-harvest festivals.

2.4.2.4 Training and workshops

Training can take the form of workshops or one-day courses. The objective is to provide practical, technical or managerial skills, to stimulate the participant's interest in opportunities and to allow participants to exchange ideas.

Extension training – April 2002:
On 16 April 2002 training was conducted for extension officers and youth workers responsible for the communities in and around Thaba Nchu and Botshabelo. The main aim was to improve their knowledge and understanding of the basic concepts of the *IRWH* technique, and to establish their role in this particular project. Optimum participation from all individuals was ensured by grouping in such a way that in each group there was a representative from ARC-ISCW, an extension officer and a few youth workers. Topics discussed included: aims of extension officers, youth workers

and researchers regarding the *IRWH* technique; benefits and problems of *IRWH*; and the role of extension officers, youth leaders and researchers in the implementation of the *IRWH* technique. A whole range of views were expressed in this regard and in the final analysis it can be said that there was general enthusiasm amongst the youth workers who were mostly unfamiliar with the *IRWH* technique. They expressed their interest in introducing the technique in their respective schools but stressed that it was not going to be easy, given their transport limitations. Extension officers, on the other hand, were quite familiar with the technique and said that it was beneficial. They further mentioned that they had absolutely no objections to being a part of the *IRWH* team as long as it did not take up too much of their time relative to the Department of Agriculture's priority programmes.

Workshop – July 2002:
From 16-18 July 2002 a three-day workshop was held at Glen for the extension officers and the leader farmers of the respective communities where *IRWH* was practised. The aim of this workshop was to train the participants on the basic concepts of climate, pedology, teamwork, leadership and the *IRWH* technique, using field excursions as an integral part of the exercise.

Workshop – August 2002:
From 6-8 August 2002 a workshop on *IRWH* was held at Glen. Three representatives from each community where the *IRWH* technique was already implemented, and two representatives from communities where it would be implemented during the 2002/03 season, attended the workshop. Four extension officers also attended and a total of twenty farmers were present. They were given training on the basic principles of *IRWH* and each of the participants received material on "How to convert your land into an effective *IRWH* system".

Workshop – February 2004:
A workshop that focused on the empowerment of extension officers to become demonstrators of the *IRWH* system was held from 9-11 February 2004 at Glen. Five extension officers and three SASO workers (Specialized Auxiliary Service Officers) attended the course, all of whom were actively working in the Thaba Nchu, Botshabelo, Dewetsdorp and Excelsior region. The seven technical assistants, who are in the service of the ARC-ISCW based at Glen, also attended the workshop. These TAs were working in the communities in and around the towns of Thaba Nchu and Botshabelo where they demonstrate and help with the implementation of the *IRWH* system to produce various cash and vegetable crops. Experts who specialize in the fields of water harvesting, economics and group motivation presented the workshop.

In order to make the workshop as efficient as possible, each day focused on a main theme. On the first day of the workshop participants were made aware of the natural resources in their area. They were introduced to the basic principles of Soil Science (land type, ecotope, map scale and terrain morphological unit), Crop Production (seedbed preparation, planting depth, plant density, row spacing, inter-row spacing, fertilizer sources, fertilizer placement and control of weeds, insects and diseases), Agrometeorology (influence of climate on crop production) and Economics (finances, record keeping and budgeting). On the second day the principles of *IRWH* were discussed and a video about *IRWH* was shown. This was followed by practical hands-on training in the construction of basins and planting of different crops with the *IRWH*

system. The extension officers and SASO workers learned fast and they quickly mastered the art of construction. They then planted maize, watermelon, pumpkin, dry beans, beetroot, spinach and carrots (Figure 2.13). The third day focused on motivation, role and function of the extension officers and the way forward. Participants were given the opportunity to share their experiences, concerns and problems that they encountered with the *IRWH* system. Together the participants had set goals and drawn up an action plant to successfully implement the *IRWH* technique. The goals of most of the groups were to double the number of existing backyards where *IRWH* is used and to motivate the communities to actively participate in the project. Extension officers committed themselves to be demonstrators of the technique and every extension officer promised to set up at least one demonstration plot. A talk on effective technology transfer and motivation was presented.



Figure 2.13 Extension officers and SASO workers receive hands-on training in the construction of basins and the planting of various crops within the *IRWH* system.

Before the formal presentations the participants were given a test to write. The test questions focused on the very basics of crop production and the *IRWH* technique. Test results were extremely poor and gave a clear indication that the participants' knowledge on these subjects was not at all up to standard. The outcome of the test results was a further motivation as to why there is a great need to hold the introductory and more advanced training courses.

At the end of the workshop the participants wrote exactly the same test as they wrote at the beginning. The aim of this exercise was to determine whether the workshop had achieved its aim of improving the knowledge of the extension officers in the field of *IRWH*. Although the test results were significantly better than their first attempt they were still not good enough.

Workshop – November 2004:
ARC-ISCW (Glen) in conjunction with the WRC held a two-day workshop with the theme "Up-scaling in-field rainwater harvesting: Application, Status, Constraints and Challenges". The workshop was held at the Bloem Spa Lodge, Bloemfontein from 1-2 November 2004. The main aim was to explore possibilities and constraints for the expansion of the *IRWH* technique from homesteads to the croplands, and identify the challenges and how best can they be addressed in order to facilitate the commensurate expansion. The first day of the workshop comprised mainly of the researchers and other stakeholders and day two was a demonstration and field day for the participants

and the farmers in the study area. In addition to the day one participants, two farmers from each community were invited and joined on the second day for a demonstration of equipment by the participating stakeholders (ARC-Institute for Agricultural Engineering; ARC-ISCW; Golder Associates) at Merino near Thaba Nchu.

After the demonstration, the participants were divided into groups to discuss the machinery and implements that were demonstrated. Each group comprised both scientists and farmers. The main responsibility for the scientists was mostly to guide the discussion. Some of the issues raised included reasons for wanting to expand, the constraints and the possible strategies to aid expansion. From the discussions with the farmers it was quite clear that they want to expand their production by using the crop fields. This, however, comes with a lot of challenges that cut across political, social, economic and cultural spheres.

In the final analysis, there was general agreement that there is a need to explore the expansion of the *IRWH* technique if poverty and food insecurity are to be addressed. This can best be done if *IRWH* could be increased in scale and that requires some investment in machinery. The machinery should first be accessible to the farmers at affordable prices. Some of the reasons that were found to be hampering expansion included: lack of inputs; no fencing in the crop fields; lack of manpower; lack of machinery; theft of crops; weeds and land tenure conflict.

Workshop – August 2005:
A one-day review and planning workshop for the different stakeholders was held at Glen on 23 August 2005. The purpose of the workshop was as follows:

- To get the relevant stakeholders from different levels together to introduce the project.
- To reflect on activities, achievements and challenges of the past years.
- To obtain an endorsement of stakeholders in the selected study areas to conduct the project.
- To draw up a memorandum of understanding with the stakeholders.
- To discuss and structure a work programme for the current year.
- To assign responsibilities to role-players on the tasks to be performed.

Researchers, extension officers, project team members and FSDA officials attended the review and planning workshop.

Extension training – November 2005:
On 15 November 2005 a group of extension officers from the Motheo District received training at Glen during a training workshop for extension officers on the overall management of the *IRWH* technique. It involved ARC-ISCW researchers and technicians as educators, and ten extension officers from the Free State Department of Agriculture as learners. The purpose of the workshop was to prepare the extension officers to train farmers in the *IRWH* technique which was scheduled for 17 November 2005, as agreed at a meeting on 23 August 2005.

The various topics on which the officers were enlightened were prepared in such a way that handouts were issued and then followed by a lecture or demonstration in the field. The various topics that were covered were as follows:
(Topic 1) Utilization of natural resources, role and function of *IRWH* technique.
(Topic 2) Planting of different crops using *IRWH* technique.

(Topic 3) Application and maintenance of *IRWH* technique.
(Topic 4) Pest and weed control.
(Topic 5) Communication skills and conflict resolution; Role and function of committees.
(Topic 6) Markets and Marketing
(Topic 7) Value adding.
(Topic 8) Record keeping

Prof. D.C. Groenewald from the Department of Sociology at the University of the Free State was the facilitator of the workshop. He lectured the extension officers on the importance of their work. All the extension officers mentioned that it was not possible for them to be available to teach the farmers what they had learned owing to the fact that they had other issues to attend to on 17 November 2005.

Farmer training – November 2005:
A one-day farmer training workshop was held at the Thaba Nchu Civic Centre on 17 November 2005. Five farmers from each community out of the 42 communities involved in the *IRWH* technique were selected. The workshop was conducted by the ARC-ISCW instead of the extension officers who unfortunately could not all make it that day. The various topics on which the farmers were trained were prepared in the form of handouts which were distributed to the farmers prior to each presentation or demonstration in the field. The topics were the same as those mentioned under extension training above.

Workshop – September 2006:
On 13 September 2006 a strategic one-day workshop was held at Glen between the farmers and the various stakeholders involved to discuss the way forward (Figure 2.14). One of the objectives of the day's deliberations was to explore possibilities and constraints for the expansion of the *IRWH* technique from homesteads to croplands, and identify the challenges and how best can they be addressed in order to facilitate the commensurate expansion. There was general agreement that there is a need to explore the expansion of the *IRWH* technique if poverty and food insecurity are to be addressed. This could best be done if the *IRWH* technique could be implemented on a larger scale, which would require investment in implements, which should be accessible to the farmers at affordable prices. However, other issues that needed to be addressed were whether farmers actually want to expand to the croplands, why they would want to expand and why they cannot expand at the moment.



Figure 2.14 Farmers attending a one-day up-scaling workshop at Glen.

Some of the reasons that were found to be hampering expansion were: lack of inputs; no fencing in the crop fields; lack of manpower; lack of implements; theft of crops; weeds and land tenure.

Short course – November 2006:
A short course on the basic principles of *IRWH* was held at Glen during November 2006. Four extension officers and 53 members of communities in the Thaba Nchu area attended the course. The basic aspects of the soil-plant-atmosphere system were discussed and the following topics were addressed:
Soil: Participants were introduced to some pedological and physical aspects of soils.
Crop: Important management aspects were covered such as weed and pest control, fertilization, cultivars, planting density etc.
Climate: The basic aspects of climate were covered, as well as explaining why it is important in crop production to be aware of all the different parameters.
Economy: Research results from *IRWH* were shared with the participants.
Social: The basic characteristics of effective teams were introduced to the participants to help them form a sound basis for effective teamwork within their community.

Informal training:
Community members received informal training on a regular basis during the duration of the project. Technicians visited the communities at least three times a week to give guidance and provide help and support. Technical assistants from the ARC-ISCW, stationed at Glen, have consistently visited farmers in the communities involved in the project. The visits have been in the form of meetings, scheduled interviews and field inspections. The meetings were plenary sessions whereby the farmers, including community and zonal representatives, would discuss the work programmes for the month and the way forward. During field inspections the technicians monitored and gave advice on technical issues pertaining to the *IRWH* technique like weeding, chemical control of insects and weeds, and maintenance of the *IRWH* structures (Figure 2.15).



Figure 2.15 An ARC-ISCW technical assistant conducting a meeting with community members.

2.4.2.5 Demonstrations

Demonstrations are a practical way of teaching new skills and stimulating farmers to apply them. Demonstrations are an effective extension tool if they are followed by complementary activities. Two types of demonstrations are commonly used in extension, namely: a) method demonstration, and b) result demonstration. Method demonstration is to show people how things are done and why they are done in that manner. Result demonstration is to show the advantages of a recommended practice under local conditions. Both methods were used during this study.

2.4.2.5.1 On-station demonstrations

Statistical and semi-statistical field experiments were conducted at the Glen Agricultural College to compare the *CON* technique with the *IRWH* technique and were funded by two previous WRC projects (Hensley *et al.,* 2000; Botha *et al.,* 2003). These on-station experiments were also used as demonstration plots during information days and festivals. The farmers visited on-station demonstration plots at the Glen/Swartland and Glen/Bonheim ecotopes under controlled conditions where *IRWH* was compared with *CON* (Hensley *et al.,* 2000). Later on the *IRWH* technique was compared with various mulches such as organic and stones on the runoff area and the basin area (Botha *et al.,* 2003).

2.4.2.5.2 On-farm demonstrations

On farm demonstration plots were first applied on two farms in the Thaba Nchu area, Khumo and Vlakspruit, to compare *CON* and *IRWH* practices, sponsored by the WRC (Hensley *et al.,* 2000; Botha *et al.,* 2003). It was noticed that the people from the rural communities were very eager to apply the *IRWH* technique and therefore for this project the focus has shifted towards the households in rural communities. In order to support these households it was decided to implement demonstration plots in the communities instead of on the farms.

The objective was to set up demonstration plots on which the effect of applying *IRWH* can be compared with the *CON* practice, on the croplands as well as in the backyards of homesteads. The *IRWH* plot was divided into two plots, one managed by the farmers themselves with guidance from the research team, with the researchers and farmers managing the other plot (training/demonstration plot). Early in the project life the researchers realized that the demonstration plots at the croplands were not successful especially to get the households to participate. It was therefore decided to focus on backyards.

At the start of the project demonstration plots were set up in either the backyards of homesteads or at schools or clinics of four communities. The aims of these on-site demonstration plots were to: a) demonstrate the advantages of *IRWH* over *CON*; b) demonstrate and train farmers in the application and maintenance of the *IRWH* system; and c) demonstrate and train farmers in the planting of various crops within the *IRWH* system. The aim was also to involve the farmers in all the actions taking place on the demonstration/training plot. As more farmers started to adopt the *IRWH* system in various communities it was decided that the communities had become too many to apply demonstration plots all over. Therefore another approach was followed. It was decided that demonstration plots would be replaced by on-site training in all the new communities. The farmers were trained on a small area at a

homestead chosen by the community on how to construct the *IRWH* system and how to plant various crops. The idea was that interested farmers could duplicate what they had learned in their own homesteads. All the activities taking place during the growing and fallow seasons were demonstrated at *IRWH* plots at homesteads. As more farmers started to adopt the *IRWH* technique, demonstration plots were set up in at least one community per zone, in total at least five demonstration plots. The focus of the demonstration plots shifted from comparing *IRWH* with *CON* towards demonstrating the effect of various management practices within the *IRWH* system in order to improve crop yields even more. Farmers do not always understand the importance of weeding, fertilization or insect control if a researcher or an extension officer preaches it. It is therefore better for the farmers to see for themselves the effects of these management practices on crop growth and yields in order to understand their importance. The different treatments were: kraal manure vs. fertilizer vs. no fertilizer; weed control vs. no weed control; and insect control vs. no insect control. Apart from seeing the effect of different management practices, the demonstration with kraal manure, fertilizer and no fertilizer also give the farmers options. The demonstration indicated that if it is not possible to buy expensive fertilizer then it is better to apply kraal manure compared to no fertilizer application. These demonstration trials were used during festivals, information days or for visitors.

Another *IRWH* project sponsored by the DoA has two on-farm statistical experiments at Bofulo and Sediba. The aim of these trials was firstly to show the farmers the importance of investing in fertilizers (the treatments were 0, 30, 60 and 90 kg N on the *IRWH* technique), and secondly to compare the *IRWH* technique with *CON* tillage (treatments were 0 and 60 kg N). These on-farm experiments were visited during the festivals.

2.4.2.6 Focus group discussions

Focus group discussions involve collective activity. The method was used with the group of *IRWH* farmers in every community in order to draw them together to apply their knowledge, their experience and expertise to a specific phenomenon such as *IRWH*. During the group discussions success stories were shared, challenges were discussed, the communities and individual households were taught to set goals and work out an action plan in order to achieve their goals, and planning was conducted. After the technique had been introduced it was regarded as of great importance to conduct regular group discussions. The technical assistants drew up a schedule in which they planned their group discussions with the various communities. The discussions were conducted on a monthly basis. The TAs also conducted training on various aspects during the group discussions. In the beginning the TAs drew up an agenda, conducted the meetings and kept the minutes. Later on these responsibilities were given to the farmers in order to build their capacities. This has progressed in such a way that the TAs only attend these meetings and contribute wherever they can.

Group discussions have also progressed in such a way that the MB:WHIG executive board and the general assembly conduct meetings every month. These are also in the form of a group discussion.

2.4.2.7 Computer program

The potential to rebuild the farmers' capacity is huge and the ARC-ISCW team is constantly working on simple methods to disseminate the technical information. An interactive computer animation program (Visual Water Balance Processes for In-Field RainWater Harvesting – VISWBP-*IRWH*) that visually displays the infiltration process in the runoff and basin area during rain events was created. With this program it is possible to select the surface treatment (stones, organic mulch or bare) and the rainfall amount. The runoff and infiltration processes are visually displayed and the amount of water that infiltrates on the runoff and basin area is then calculated. This animation program was used as an aid to explain complicated processes to farmers and train extension officers.

2.4.2.8 Three-dimensional models

According to Van Rensburg, Groenewald, Botha, Anderson, Van Staden & Kundhlande (2003), processes such as runoff, infiltration, drainage, evaporation and transpiration are by nature very complex to analyze and understand. These processes play an essential role in any crop production system. Farmers who are able to conceptualize the practical impact of each of these processes on crop yield, tend to adopt new sustainable technologies more readily than those who do not understand it. Consequently, the packaging and communication of information to communal farmers in rural areas holds the key to enhance the socio acceptance of a particular technique. Two of the major factors that influence the packaging and dissemination of information are the low level of literacy of rural farmers and their geographical location. These factors should be carefully accounted for when planning technology exchange interventions (Van Rensburg *et al.,* 2003).

Therefore a physical three-dimensional model that interactively illustrates the importance of water balance processes related to crop production, comparing *CON* to *IRWH* crop production techniques, was developed. The model consists of two components, namely, a water supply part and a crop-soil part. Rainfall is simulated through the water supply system using micro-sprinklers installed at each corner on the topside of a frame (1.2 x 1.2 x 1.2 m) (Figure 2.16). Square tubing (25 mm) was used to construct the foldable frame. The bottom part of the frame, which supports the crop-soil component, can be adjusted vertically to create different soil slopes. The crop-soil component consists of a 1.16 x 1.16 x 0.16 m sponge. Topsoil is evenly spread over the surface of the sponge representing *CON* tillage. Runoff and soil erosion were demonstrated when the sprayers were activated. A second sponge was prepared to represent the *IRWH* technique, which consists of a 2 m wide runoff strip followed by a 1 m wide basin strip (Figure 2.17). During the simulation of rainfall, processes such as runoff and run-on into the basins were illustrated. The importance of storing rainwater in the soil and the restriction of evaporation was also targeted during discussions that followed the demonstrations.

The physical water-crop production scale model was demonstrated at every possible opportunity during farmers' days, information days, expos, workshops, discussion groups etc. within the Thaba Nchu and Botshabelo districts.

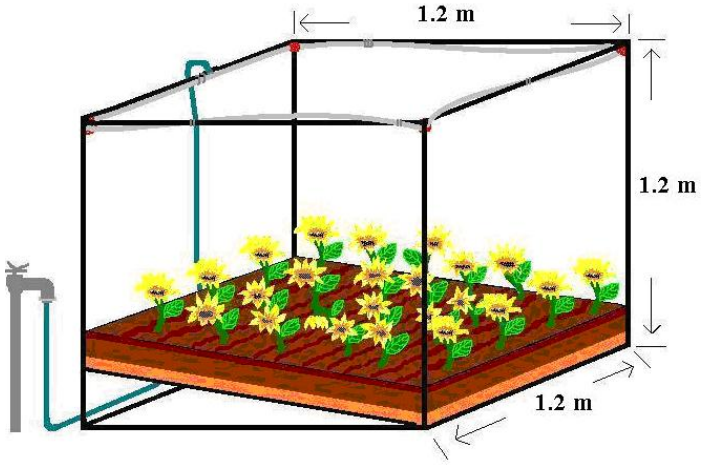


Figure 2.16 A diagrammatic representation of the 3D scale model to simulate rain on the *CON* treatment (Van Rensburg *et al.,* 2003).

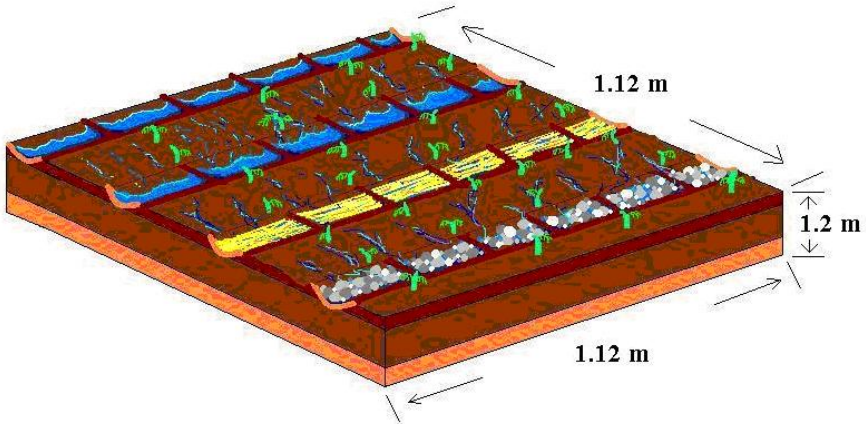


Figure 2.17 A diagrammatic representation of the ***IRWH*** system (Van Rensburg *et al.,* 2003).

2.4.2.9 Training of technical assistants

All the technical assistants received informal training throughout the project. The capacity building of the TAs is discussed in Chapter 8. They received training on all the *IRWH* activities and management practices. They were people from the area and during the project they worked in the communities. They trained and supported the extension officers with the application and maintenance of the *IRWH* system.

2.4.3 INDIVIDUAL APPROACH

The individual approach is the most common method of technology dissemination and includes activities like visits (office or farm), letters, telephone calls and informal contacts (Matata, Anandajayasekeram, Kiriro, Wandera & Dixon, 2001). The approach is used for interaction with farmers on a one-on-one basis. Farmers in this instance ask the extension officers questions and the latter offer advice and

motivation. According to the new financial services charter, banks have until 2010 to increase access to their products and services by 50% to people who were previously denied this access by law or who were ignorant of them because of a lack of education or business exposure. Recognizing both this obligation and the possibility of forming a new customer base, First National Bank (FNB) extended one of its commercial farmer products to developing farmers in QwaQwa. When farmers take out a FNB production loan, the bank fixes a minimum floor price for the crop through its grain-trading subsidiary, Rand Merchant Bank. Farmers must then, during the production season, fix a price higher than the floor price for their crop on the South Africa Forex Exchange. This guarantees a price from which the farmers can repay their loan. To reduce the production risk, FNB sent out an Agricultural Economist Extension officer to give the farmers extension services. He supervises the production on the farms, visiting each farmer up to twice daily during the planting season. This narrows the likelihood of a crop failure due to farmer error (Farmer's Weekly, 2004).

The 42 communities were divided amongst the technical team. Each TA was responsible for about six communities and had a programme that guided them on which community they had to visit. During these visitations there was one-on-one interaction between a specific farmer and a technician. Various issues were discussed; the technician checked if the basins were constructed correctly, whether the farmer has planted correctly, if their yards were clean and also offered advice on other issues. The technical assistants and researchers phoned some of the farmers on a regular basis. Some of the farmers even called the researchers and technical assistants on their own to ask advice, invited them to visit them or just to talk to each other. In the case of the individual approach the emphasis was on regular contact. This is the only way to win the confidence of the people and to build relationships.

Informal contact like farmer-to-farmer involves innovative farmers developing and promoting improved land management practices. These farmers take the role of extension agents by carrying out extension activities such as training, exchange of visits and demonstrations to transfer skills and experiences to other farmers (Nyakuni *et al.,* 2001).

A farmer from the Potsane community used stone mulch in the basins to minimize evaporation. Other farmers saw this and were interested as they had the same problem. At the moment more farmers are using this method. Another farmer from the Merino community had a problem with the steams of the pumpkin covering other vegetables and therefore depriving them of sunlight. The farmer then devised a plan in which he inserted poles at the beginning and end of the basins. He then tied the steam of the pumpkin with a strong rope to the poles therefore giving the steams the right direction in which to grow. Farmers who had the same problem saw this and are now practising it. Another farmer had a huge backyard and worked on his own, but this created problems as the bending when planting gave him backache. The farmer who is good in welding then decided to build a tool for himself to help him plant faster and more comfortably.

2.5 DATA COLLECTION METHODS

2.5.1 FOCUS GROUP DISCUSSION

Structured participation in the process was of major importance. More than one group discussion has been used to enhance the quality of the result (De Vos *et al*., 2002). A period of time was spent with the communities to gain first-hand experience of the lives of people, their daily routines (what they do in the morning, afternoon and evening), the meanings they attach to things such as the arrival of the *IRWH* technique within their communities and how they deal with the changes the technique brings.

Comprehensive field notes were documented throughout the period and questions asked about (1) the farmers' life history, (2) the present, the here and now or immediate, (3) and the perceived future, life expectations, hopes and dreams of the participants involved in the study. This was important because it gave the researcher a deeper understanding of what kind of lives the farmers lived and if the *IRWH* technique was good for them. The medium of language used was Sesotho and sometimes Xhosa as some of the participants were Xhosa speaking.

2.5.2 IN-DEPTH INTERVIEWS

In-depth interviews are the most frequently used method of data gathering in qualitative research. The individual interviews allow the participants to speak for themselves rather than subject them to a battery of the researcher's own predetermined, hypothesis-based questions (Babbie & Mouton, 2001). In-depth interviews were conducted with participants on an individual level. A total of ten farmers from each community participated. These were the same farmers who participated in the focus group sessions. The questions were very informal and allowed the participants to speak freely. The interviews took place at the participants' residences for 4-5 hours daily and 6 days in total. Each interview lasted about 30 minutes and was conducted, recorded and transcribed by the researcher. In the process almost 30 hours of recorded data was collected. The questions included:

- How did you find out about the *IRWH* technique, was it from your neighbour, a technician etc?
- How do you feel about the *IRWH* technique, is it a good or bad technique, and has it made any difference in your life or that of your family?
- Have you experienced any problems with the *IRWH* technique, whether in constructing the basins, controlling weeds or knowing how to plant?
- Have you experienced any good things concerning the *IRWH* technique, such as good yields, an extra income, and social improvements?

However, like all methods of data collection, problems were encountered. For example, sometimes appointments were made which did not suit the participants, and at the interview they were tired or stressed. The interviewer would then try to distract them from what they were feeling by sharing a joke. There was less anonymity (in other words the interviewer met them face to face), but this was an advantage in this study because the participants knew the interviewer and were prepared to discuss the issue openly. All of the problems can be avoided if the participant feels at ease with the interviewer. This was the case because, prior to the interviews, much time was spent with the participants which assured them of confidentiality.

2.5.3 PERSONAL INTERVIEWS

Personal interviews using structured questionnaires are an exceptionally sensitive and well suited means of developing an intimate understanding of experiences best communicated through rich narratives and detailed examples. Consequently, the knowledge constructed in the interview cannot be accepted as an independent given, let alone as a direct representation of an underlying reality. Rather this knowledge is a socially co-constructed creation.

Personal interviews were conducted with 20% of the farmers from each community with a total of 240 participants. The respondents were the same in some cases and in others not. The interview schedule comprised Sections A and B. For Section A interviews were conducted with the head of the household or a representative. This section dealt with information regarding the household. For Section B, interviews were conducted with one member of each household actively involved in the *IRWH* project. This was not necessarily the same person.

The personal interview was strongly interactive in nature. The researchers were not concerned simply with passively collecting the participant's statements like gathering pebbles on a beach. Rather, they were much more directly involved as they actively steered and co-ordinated the course and nature of the interview.

The researchers set up a personal interview schedule, which took about 2 weeks as there were many sections to be covered. These sections focused on (1) household demographic features such as age, gender, job of respondent; and (2) the adoption of the *IRWH* technique such as what size of your plot do you use for crop production using *IRWH* and are you going to expand the portion of plot used in the future? A number of flipcharts were designed for use in the study. These were shown to the participants to explain certain questions and to assist them in supplying the requested information (see Appendix 2.2).

When the organizing of the interview schedule was completed, training was given to an agricultural technical team to assist with the interviews. The team consisted of six candidates who were working within the communities before the study. They knew the languages spoken and the lifestyles of the farmers. Each interview lasted for about two hours depending on the level of literacy and concentration. These interviews as a whole lasted for a month. They took place from Monday to Friday.

2.5.4 PERSONAL OBSERVATION

This phenomenological approach was important to the researchers as they endeavoured to gain an in-depth insight into the manifestations of reality. The focus was on the everyday and natural experiences of the *IRWH* farmers. The researcher's main concern was to gain feeling, impressions, and experience the circumstances of the real world of the *IRWH* farmers by living alongside them, and by interpreting and sharing their activities. The researchers were aware that the only way to view the world as a participant in the setting was by getting close to the farmers and becoming an insider. They studied the customs, lifestyles and cultural context of the participants in a culturally sensitive manner.

2.6 INDICATORS

2.6.1 TECHNOLOGY EXCHANGE INDICATORS

The indicators used to quantify the success of the technology exchange process and the various communication channels were mainly the perceptions of an adult in a household who is actively involved in *IRWH*. In-depth interviews from a structured questionnaire were conducted with 240 households to investigate the specific impact and effectiveness of the various technology exchange tools used during this study. Verifiable indicators of the show of interest and effectiveness of the different communication channels included the number of people attending training courses, people's opinions of the communication channels, the number of people adopting the *IRWH* technique, etc. The indicators can be both quantitative and qualitative.

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3. IMPACT OF DIFFERENT COMMUNICATION CHANNELS

3.1. INTRODUCTION

Technology transfer is the process applied by researchers, developers and extensionists through which new knowledge, ideas, skills, information, methods, procedures, techniques, tools or technology are introduced to potential users (Matata *et al.*, 2001). In this case the ARC-ISCW research team at Glen are the developers of the new technology (*IRWH* technique) and the small-scale farmers in the communities in and around the two towns of Thaba Nchu and Botshabelo the potential users. Transfer of technology is interpreted as a process of extending technology to potential users (farmers) and as an interactive methodology that involves farmers, researchers and extensionists or change agents. Under different approaches, other authors (e.g. Chambers, 1983) have defined transfer of technology as a one-way process where the researcher produces innovations that are passed on to extension workers who in turn pass them on to farmers. For Participatory Action Research (PAR) the diffusion of new knowledge is a technique which is integral to the research process. The diffusion of results within PAR primarily refers to the systematic return of knowledge generated by PAR to the participants. This is considered a central obligation of any change agent; as the knowledge generated is ultimately intended for the participants themselves it is they who should be its owners (Babbie & Mouton, 2001). Proper technology transfer has occurred when the recipients understand how the technology works and adapt it to their own situation and needs. For technological change to benefit most, education is essential for transfer to occur. For technology transfer to occur successfully, which is the case when the new technology is incorporated in people's technological repertoire, ownership of the technology also needs to be transferred (Van Averbeke, 2004).

Informal ways of technology development and transfer occur among farmers on a continuous basis. In both the developed and developing worlds, farmer experimentation and innovation are important sources of new technology, and farmer-to-farmer extension is an important way in which new technology is disseminated (Roling & Brouwers, 1999). Santikarn (1981) outlines various mechanisms for transferring technology. He describes features of direct foreign investment (packaged transfer) as well as unpackaged channels – dissemination through books, journals, exhibitions, purchases of hardware, technology contracts, licensing agreements etc. Podder (1988) considers technology transfer to less developed economies to be a part of the global diffusion process of knowledge. Simon (1991) looks at the international technology market and intra-firm transfer.

According to Rogers (1995) the four major factors that influence the diffusion process are: (1) the innovation itself; (2) how information about the innovation is communicated; (3) time; and (4) the nature of the social system into which the innovation is being introduced. An innovation is an idea, a practice or object that is perceived as new by an individual or other unit of adoption**.** In this case it is the *IRWH* technique. Communication channels are the processes by which participants create and share information with one another in order to reach a mutual understanding. Diffusion is a particular type of communication in which the message content that is exchanged is concerned with a new idea. The essence of the diffusion process is the

information exchanged through which one individual communicates a new idea to another or several others. At its most elementary form the process involves: (1) an innovation; (2) an individual or other unit of adoption that has knowledge of the innovation or experience with the innovation; (3) another individual or other unit that does not yet have experience with the innovation; and (4) a communication channel connecting the two units. A communication channel is the means by which messages get from one individual to another (Rogers & Scott, 1997). Jeremy (1991), in his introduction to the study of some of the major transfers between Britain, USA and Japan in the last and present centuries, outlines five important questions which must be addressed in order to understand the spread of technology and its significance for any country: a) What slowed down or accelerated transfer?; b) How did the movement of technology occur?; c) How was the imported technology adopted in the receptor country?; d) Was this technology modified or further developed?; and e) Were there any reverse flows to the country of origin? According to Rogers (1995), the nature of communication channels used to diffuse the innovation at various functions in the innovation-decision process or how the movement of technology occurred is one of the most important variables that influence the rate of adoption.

Technology can be transferred or disseminated in a variety of ways. The different methods can be broadly categorized into three groups, namely individual, group and mass (Adams, 1982). The individual methods of dissemination or face-to-face methods are the most common method of technology dissemination. Although the farmer benefits from the individual attention of the exchange agent, especially where there is a low level of literacy, this method is expensive because all the farmers cannot be reached by this method and travel and time is costly. Individual contact with farmers can take various forms like farms visits, office visits, letters, telephone calls and informal contacts (Matata *et al*., 2001). Group methods of dissemination are more frequently used to disseminate technologies and practices than the individual farmer methods. In this case the exchange agent acts as a facilitator. More farmers and other relevant stakeholders could be reached by utilizing the group methods compared to the individual farmer methods. Group methods are particularly effective in persuading farmers to try a new technology or practice. Group methods involve the physical demonstration of technologies or practices, or the exhibition of results of good farming practices, and include method and result demonstrations, field days, training, workshops, meetings and focus group discussions (Matata *et al*., 2001). Group methods can be costly in terms of time (preparation and planning) while there is the possibility that the messages only reach the selected target groups (Matata *et al*., 2001; Nyakuni *et al*., 2001). Mass media for technology dissemination is a channel of communication which exposes large numbers of farmers to information at the same time. This includes media which can convey information in the following ways: sound (radio and audio cassettes); moving pictures (television, cinema and video, especially for methods and group dynamics); widespread popularisation like print (posters, newspapers and leaflets); electronic (e-mail, fax and Internet); agricultural shows; campaigns (awareness) and traditional media (songs and dances) (Haralambos & Holborn, 2000; Matata *et al*., 2001; Nyakuni *et al*., 2001). The advantage of mass media is that a message can be sent at a high speed to the receiver and will cost very little once the necessary infrastructure is in place (Matata *et al*., 2001). Mass media are facing several difficulties including funding, poor linkages, poor rural infrastructure and low education of the target group (Matata *et al*., 2001; Nyakuni *et al*., 2001).

Many dissemination or diffusion methods are available, with their various advantages and disadvantages. According to Matata *et al*. (2001), a new idea or technology can be most effectively disseminated to a farmer if the correct medium is used. Therefore, the question that needs to be answered is: what are the best dissemination or communication channels (methods) to exchange information and knowledge about *IRWH* to small-scale farmers in the Thaba Nchu and Botshabelo areas?

The aims of this chapter are to (1) document the procedures that were used to introduce and transfer the *IRWH* technique, and (2) evaluate the different communication channels used in this study to establish "best practices" in technology transfer.

3.2. MATERIALS AND METHODS

3.2.1. COMMUNICATION CHANNELS

Various communication methods used to transfer the *IRWH* technology as effectively as possible are listed below and are discussed in detail in Chapter 2.

Individual:

- Personal visits by research team
- Support by ARC-ISCW technicians

Group:

- Demonstration plots
- On-farm trials
- Seminars
- Conferences
- Workshops at locations convenient to the farmers
- Short courses
- Field days
- Training sessions
- Computer program
- Training of technical assistants that can be employed by the Department of Agriculture
- 3D model
- Focus group discussions
- Support by ARC-ISCW technicians
- Festivals

Mass:

- Brochures
- Pamphlets
- Training manuals
- Newsletters
- Scientific publications in peer-reviewed journals
- Technical reports and journal publications
- Articles in management-oriented publications
- Drama
- Video

- Posters
- Song and dance
- Festivals.

3.2.2. INDICATORS TO VERIFY EFFECTIVENESS OF DIFFERENT COMMUNICATION CHANNELS

Verifiable indicators of the show of interest and effectiveness of the different communication channels included: the number of people attending training courses; people's opinions of the communication channels; and the number of people adopting the *IRWH* technique. The indicators were both quantitative and qualitative.

Specific indicators of the success of the technology exchange process used in this study were:

- Number of people attending technology exchange action (indication of interests).
- People's opinions of the different technology exchange actions or tools.
- Number of households that implemented the *IRWH* technique (Chapter 4).
- Number of communities in which the *IRWH* technique has been implemented (Chapter 4).

3.2.3. DATA COLLECTION

In-depth interviews from a structured questionnaire were conducted with 240 households to investigate the specific impact and effectiveness of the various technology exchange tools used during this study. Ms. Mdibe and six technical assistants from the ARC-ISCW (Glen) were trained beforehand by Prof. Groenewald to conduct in-depth interviews in the participant's choice of language. Most interviews were conducted in Sesotho in the participant's home. They were conducted with an adult in the household who is actively involved in *IRWH*. A number of flipcharts (Appendix 2.2) were designed and shown to the participants to explain certain questions and to assist them in supplying the requested information. The different communication channels evaluated were:

- Demonstration plots (group)
- Drama (mass)
- Video (group and mass)
- 3D model (group)
- Posters (mass)
- Focus group discussions (group)
- Support by ARC-ISCW technicians (individual and group)
- Festivals (group and mass).

3.3. RESULTS AND DISCUSSION

Results of the number of participants reached with a particular communication channel and the effectiveness of the respective tool are presented in Table 3.1. Support by ARC-ISCW technicians includes both individual and group approaches. Posters are part of mass media while festivals include group approaches, individual

approaches, farmer-to-farmer training, demonstration plots and others. Results indicate that the greater numbers of participants were exposed through support by the ARC-ISCW TAs, followed by festivals, focus group discussions, demonstrations, playing the video, posters, drama and the 3D model. Ninety-six percent of the participants were exposed to regular contact or support from technicians from the ARC-ISCW. Support by ARC-ISCW technicians (96%), festivals (94%), focus group discussions (90%) and demonstrations (89%) managed to reach more than 85% of the participants with some form of technology exchange action.

Table 3.1 Results of attendance (%) and effectiveness (%) of different communication channels

COMMUNICATION CHANNEL	ATTENDANCE	EFFECTIVENESS
Demonstration plots	89	84
Drama	36	53
Video	68	71
3D Model	31	44
Posters	38	37
Focus Group Discussions	90	63
Support by ARC-ISCW technicians to farmers	96	70
Festivals	94	78

The impact or effectiveness of a communication channel was measured in terms of the number of specified characteristics (seven in all) it addressed. Participants had to list the number of specified characteristics from the questionnaire that related to a particular communication channel, which they recognized from pictures of the different communication channels on a flipchart. Results indicate that the demonstrations was the most effective communication channel followed by festivals, playing the water harvesting video, support from ARC-ISCW technicians, dramas, 3D model and posters. The results show that 84% of the participants related between five and seven (high) of the specified characteristics with demonstration plots, 78% with festivals, 71% with watching the water harvesting video and 70% with support from ARC-ISCW technicians. These were the only communication channels with an effectiveness of 70% and more.

Results from the perceptions of the 240 adult persons indicated that with regard to the number of people being exposed and the effectiveness of a particular communication channel to address *IRWH* aspects, the most successful tool was festivals, followed by demonstration plots and support from ARC-ISCW technicians tied in second place, with focus group discussions and watching the *IRWH* video jointly in the third place. However, 68% of the participants indicated that festivals managed to address seven out of seven of the specified characteristics, and 67% indicated that demonstration plots also address all seven characteristics. Watching the *IRWH* video was indicated by 43% of the participants to address all seven characteristics compared to 38% for the focus group discussions.

Most of the participants (63%) indicated that when they first applied the *IRWH* technique they made mistakes. Eighty percent of the participants indicated that these mistakes were pointed out to them during the festivals. The majority of the

participants (62%) realized during the festivals that they made other mistakes with the implementation of the technique. Almost all of the participants who realized that they have made mistakes (99%) indicated that they will correct their mistakes. In terms of the knowledge that the participants gained at the festivals, 99% indicated that it will help them to become self-sufficient/food secure while 98% indicated that it will help them to improve the economic situation of their households. All the participants who attended the festivals indicated that the event encouraged and inspired them to continue and that they will definitely attend another festival.

Apart from evaluating the various individual communication channels used in terms of exposure and effectiveness, the very successful technology exchange phase was the result of the use of various communication channels at different times and stages of the process. People are different and not everybody reacts, feels and thinks the same way. Therefore by using various communication channels in most cases at least one of them will convey the correct messages to an individual or group. Another important fact is that technology exchange is a process. Therefore it is important to constantly and continuously reiterate and convey the same messages. Technology exchange needs effort, passion, planning and excitement even if the best communication channels are available.

It was observed during the course of the project that at different stages in the technology exchange process certain communication channels played a specific role. During the initiation phase, video, pictures and posters played an important role to introduce the *IRWH* technique for the first time. These visual pictures or evidence made the farmers curious and presented hope to them. Thereafter the 3D model was a very good communication channel to explain and demonstrate the differences between *CON* and *IRWH*. It explained the principles of the *IRWH* technique, the role and function of the basin and runoff areas respectively, complicated processes like R (loss of valuable rainwater), erosion (loss of valuable topsoil), Es, infiltration and deep drainage.

Demonstration plots were a communication channel that when used correctly presented the opportunity to involve the farmers from the beginning (application and implementation) all the way through the growing season to the end (harvesting) and the fallow period. At the demonstration plots the application of the *IRWH* technique was demonstrated but the farmers were encouraged to participate in this action in order to master the art of application. The same procedure applied for planting of the various crops, weeding, insect control and maintenance. It also presented an opportunity for the farmers to be involved as if they were demonstrating the technique. It helped with ownership of the technique and created anticipation or expectations for the farmers. During flowering of the crops the real value of the demonstration plots came to the fore. This was when the farmers saw the difference in terms of plant height and growth between *IRWH* and *CON*. It was the cherry on the cake that helped to totally convince the farmers to buy into the new technology and contributed towards a total change in attitude and mind shift. Demonstration plots also presented an opportunity to make use of the farmers who participated with all the activities during the growing season to convey the message to the other farmers. The farmers tend to believe their fellow farmers more than outsiders or strangers. The last aspect of the demonstration plot was harvesting. This was where the farmers saw the difference in yield between *CON* and *IRWH*, the real and final test.

Focus group discussions and support from the ARC-ISCW TAs played a very important role to mobilize the individual farmers and communities, address problems as they appeared, motivate and encourage the farmers. These actions began after the farmers started to show interest in the *IRWH* technique and continued over the years. Many social problems appeared, but the focus group discussions and regular support from the ARC-ISCW TAs presented the farmers with a perfect platform to address these problems. The regular support also indicated to the farmers the commitment of the ARC-ISCW that they could trust them, and very soon strong relationships were formed between the two. This also supplied the platform to keep the farmers involved, set goals, plan for the next season etc.

Festivals was the tool that linked all the above-mentioned together, and therefore the use of different communication channels during festivals. Festivals created excitement; they motivated and encouraged the farmers. Festivals exposed the *IRWH* technique and the farmers. This was where the individual farmer could say to themselves, if they can do it then so can I. Festivals contributed towards the explosion in the use of the *IRWH* technique in the target area. This is one of the best communication channels to motivate and encourage people and contributed towards keeping the momentum. It presented a fantastic platform to communicate with each other and to convey the intended messages. Festivals also presented the perfect opportunity for the farmers to be recognized for their efforts, hard work and dedication. Only the best farmers presented their work at the festivals. Festivals created excitement towards the technique and presented people with 'what if' scenarios: what if I do this? Once people had bought into the technique and started to implement it, festivals were initiated and have never stopped. To date five very successful pre-harvest and three post-harvest festivals were conducted during the course of this project.

3.4. SUMMARY

A new idea or technology can be most effectively disseminated to a farmer if the correct medium is used. Various communication channels are available, each with its own advantages and disadvantages. The question that needed to be answered was: what are the best dissemination or diffusion methods (tools) to exchange information and knowledge about *IRWH* to small-scale farmers in the Thaba Nchu area?

In-depth interviews from a structured questionnaire were conducted with 240 households in the participant's choice of language with an adult who is actively involved in *IRWH* to investigate the specific impact and effectiveness of the various technology exchange tools used during this study. The different communication channels evaluated were: demonstration plots (group); drama (mass); video (group and mass); 3D model (group); posters (mass); focus group discussions (group); support by ARC-ISCW technicians (individual and group); and festivals (group and mass). Specific indicators of success of the technology exchange process used were: a) number of people attending technology exchange action; and b) people's opinions of the different technology exchange actions or tools (effectiveness).

It was concluded that festivals was the most successful communication channel in terms of number of people being exposed and the effectiveness of the particular

communication channel, followed by demonstration plots, support from ARC-ISCW technicians, showing the *IRWH* video and focus group discussions. These were the top five communication channels used in this particular study. The reason why festivals did so well can be attributed to the fact that they consist of a number of different communication channels, like farmer-to-farmer training, demonstration plots, focus group discussions, a workshop and training.

The very successful technology exchange phase was the result of different communication channels used during various stages of the technology exchange process. It is therefore recommended to use various communication channels during technology exchange processes since the possibility of conveying the correct and intended message to an individual and group is much higher as compared to the use of a single communication channel. Different communication channels assist in conveying different messages to the farmers. However, it must also be cautioned that even by using the best communication channels, success cannot be guaranteed without effort (hard work), passion, excitement and a good action plan.

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4. EXPANSION OF *IRWH* IN THE TARGET AREA

4.1. INTRODUCTION

According to Botha (2006), a number of water conservation technologies that have shown great potential for decreasing poverty and food insecurity have been developed through research over the years. Unfortunately, low adoption of these techniques occurred in rural communities (Botha, 2006). Twomlow & O'Neill (2003) claim that a household's ability to adopt different crop management options depends on a range of socio-economic and biophysical factors. They further anticipate that if research and development do not take these factors into consideration, households will not adopt innovative techniques. Botha (2006) suggested the other angle could be that low adoption rates are a direct result of not investigating the five pillars of sustainability. Sustainability involves the appropriate use of crop systems, and agricultural inputs supporting those activities, that maintain economic and social viability while preserving the productivity of land. The requirements for sustainable crop production according to Smyth & Dumanski (1993) are improvement in agronomic productivity, reduction in production risk, conservation of the natural resource base, economic viability and social acceptability. Botha (2006) recommended that any new technology should not be out-scaled before preliminary results have indicated that it is sustainable.

4.1.1. DIFFUSION

According to Rogers (1995), time is one of the four major factors that influence the diffusion process. A time dimension is involved in: (a) the innovation decision process by which an individual passes from first knowledge of an innovation to its adoption or rejection; (b) innovativeness of an individual or other unit of adoption, i.e. the relative earliness/lateness with which an innovation is adopted, compared with other members of a system; and (c) the innovation rate adoption in a system which is usually measured as the number of members of the system that adopt the innovation in a given time period. Each potential adopter's willingness and ability to adopt an innovation depends on: (i) knowledge change which occurs when an individual or other decision-making unit learns of the existence of an innovation and gains some understanding of how it functions; (ii) persuasion that occurs when an individual forms a favourable/unfavourable attitude towards the innovation; and (iii) decision-making that occurs when an individual engages in activities that lead to an adoption or rejection of an innovation. Implementation occurs when an individual applies an innovation while confirmation occurs when an individual seeks reinforcement of their decision to apply/reject an innovation. An individual may reverse this previous decision if exposed to conflicting messages about the innovation. According to Rogers & Scott (1997), there are five adopter categories or classifications of members of a social system on the basis of their innovativeness, namely: innovators, early adopters, early majority, late majority and the laggards (Figure 4.1).

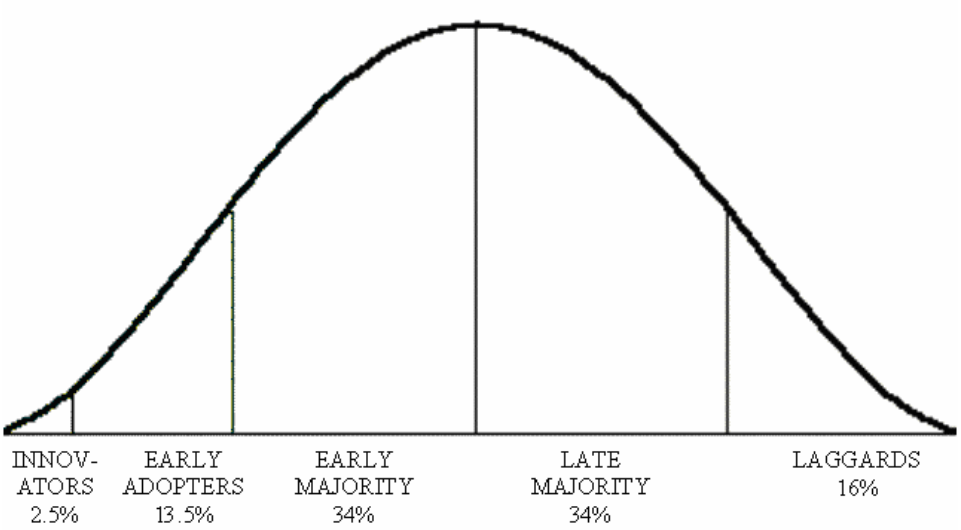


Figure 4.1 The five adopter categories in the diffusion of innovations (Rogers & Scott, 1997).

- Innovators are the first 2.5% of the individuals in a system to adopt an innovation. Venturesomeness is almost an obsession with innovators. Their interest in new ideas leads them out of a local circle of peer networks and into more cosmopolite social relationships. Communication patterns and friendships among a clique of innovators are common, even though the geographical distance between the innovators may be considerable. Being an innovator has several prerequisites. Control of substantial financial resources is helpful to absorb the possible loss from an unprofitable innovation. The ability to understand and apply complex technical knowledge is also needed. The innovator must be able to cope with a high degree of uncertainty about an innovation at the time of adoption. While an innovator may not be respected by the other members of a social system, the innovator plays an important role in the diffusion process, mainly that of launching the new idea in the system by importing the innovation from outside. Thus, the innovator plays a gate-keeping role in the flow of new ideas into a social system (Rogers & Scott, 1997).

- Early adopters are the next 13.5% of the individuals in a system to adopt an innovation. Early adopters are a more integrated part of the local system than innovators. Whereas innovators are cosmopolites, early adopters tend to be localites. This adopter category, more than any other, has the greatest degree of opinion leadership in most systems. Potential adopters look to early adopters for advice and information about the innovation. This adopter category is generally sought by change agents as a local missionary for speeding the diffusion process. Because early adopters are not too far ahead of the average individual in innovativeness, they serve as a role model for many other members of a social system. The early adopter is respected by their peers, and is the embodiment of successful, discrete use of new ideas. The early adopter knows that to continue to earn the esteem of colleagues and to maintain a central position in the communication networks of the system; they must make judicious innovation decisions. The early adopter decreases uncertainty about a new idea by adopting it, and then conveying a subjective evaluation of the innovation to their peers through interpersonal networks (Rogers & Scott, 1997).

- Early majority is the next 34% of the individuals in a system to adopt an innovation. The early majority adopt new ideas just before the average member of a system. The early majority interact frequently with their peers, but seldom hold positions of opinion leadership in a system. The early majority's unique position between the very early and the relatively late to adopt makes them an important link in the diffusion process. They provide interconnectedness in the system's interpersonal networks. The early majority are one of the two most numerous adopter categories, making up one-third of the members of a system. The early majority may deliberate for some time before completely adopting a new idea. "Be not the first by which the new is tried, nor the last to lay the old aside," fits the thinking of the early majority. They follow with deliberate willingness in adopting innovations, but seldom lead (Rogers & Scott, 1997).

- Late majority is the next 34% of the individuals in a system to adopt an innovation. The late majority adopt new ideas just after the average member of a system. Like the early majority, the late majority make up one-third of the members of a system. Adoption may be the result of increasing network pressures from peers. Innovations are approached with a sceptical and cautious air, and the late majority do not adopt until most others in their system have done so. The weight of system norms must definitely favour an innovation before the late majority are convinced. The pressure of peers is necessary to motivate adoption. Their relatively scarce resources mean that most of the uncertainty about a new idea must be removed before the late majority feel that it is safe to adopt (Rogers & Scott, 1997).

- Laggards are the last 16% of the individuals in a system to adopt an innovation. They possess almost no opinion leadership. Laggards are the most localite in their outlook of all adopter categories; many are near isolates in the social networks of their system. The point of reference for the laggard is the past. Decisions are often made in terms of what has been done previously. Laggards tend to be suspicious of innovations and change agents. Resistance to adoption of innovations on the part of laggards may be entirely rational from the laggard's viewpoint, as their resources are limited and they must be certain that a new idea will not fail before they can adopt (Rogers & Scott, 1997).

The other element in the diffusion of new ideas is the social system. A social system is a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. The members may be individuals, informed groups, organizations and subsystems. The social system constitutes a boundary within which an innovation diffuses. How the system's social structure affects diffusion has been studied. A second area of research involved how norms affect diffusion. Norms are the established behaviour patterns for the members of a social system. A third area of research has to do with opinion leadership, the degree to which an individual is able to influence informally other individuals' attitudes or overt behaviour in a desired way with relative frequency. A change agent is an individual who attempts to influence clients' innovation decisions in a direction that is deemed desirable (Rogers & Scott, 1997).

People are born into a complex culture, which includes knowledge, beliefs, customs, norms, and values shared by members of a society. Culture has been defined as the

way of life of members of a society (Giddens, 1993). People's culture becomes so familiar to us that it is taken for granted, and we do not question what we do or even why we do it. Everyday life is reality that rarely requires explanation. Social life would be chaotic, if not impossible, if it were not so. Extraordinary numbers of cultural expectations are learned from birth. These expectations or norms constitute the fundamental social rules in accordance with which persons normally act. Norms are defined as expectations of how one should act, behave and even feel in certain situations. Norms are situation bound, and vary according to the position and role that is relevant. Cultural expectations underline almost every facet of daily interaction with others, and give structure to our daily lives.

Social inequality is realities of all societies where people with differing ascribed and achieved statuses have varying degrees of access to opportunities, decision-making processes and other scarce resources in a society. These differences are reflected in the prevailing systems of stratification. Although people are free to make choices and decisions in their everyday lives, the range of alternatives from which they choose are limited by social structure into which they are born (Karp &Yoels, 1993).

When the *IRWH* technique was introduced to the Thaba Nchu communities, it was noticed that some communities were very fast in adopting and accepting the technique, while other communities were very slow on the uptake. This was also the case within a community as there would be those who adopted with no problem and those who struggled. The aims of this chapter are to analyze the adoption process, looking specifically at: a) the motivators (how to encourage the adoption of a technique) and demotivators (possible factors that discourage the adoption of the technique; b) the perspective of non-adopters; and c) the best way of entering a community with a new technology.

4.2. MATERIALS AND METHODS

The expansion of the *IRWH* technique in 42 communities was studied. Information about the numbers of the household that implemented the *IRWH* technique was recorded by the ARC-ISCW technicians during the focus group discussions, meetings and regular contact sessions. The expansion graphs of the 42 communities were drawn. The farmers who had not adopted the technique were visited for a period of time to find out the reasons. Qualitative methods were used such as focus group discussions, and personal observation to find the best way of entering a community. In-depth detail about the materials and methods is discussed in Chapter 2.

4.3. RESULTS

4.3.1. EXPANSION OF *IRWH* IN THE TARGET AREA

Results of the expansion of the *IRWH* technique are presented in Figure 4.2. According to Botha (2006), six households of backyards in four communities applied the *IRWH* technique during the first growing season (2001/02). By 2002/03 this had increased to 108 households and six communities, and in 2003/04 the number had further increased to 400 households in 37 communities. The number of households in

the communities that applied the *IRWH* technique during the 2003/04 season varied between one and 55 families per community. Before planting time for the 2004/05 season the number had further increased to more than 1033 households in 42 communities and one trust farm (Botha, 2006). The number of households in the communities that applied the *IRWH* technique before the 2004/05 season varied between three and 100 families per community. These results reveal a phenomenal increase, over a relatively short period of time, in the application of *IRWH* in backyard gardens. It seems that this result was due to the combined impact of effective communication channels and an efficient extension programme by the ARC-ISCW, as well as a successful new crop production technique, which was self-demonstrating (Botha, 2006). The expansion graphs of the 42 communities are presented in Appendix 4.1.

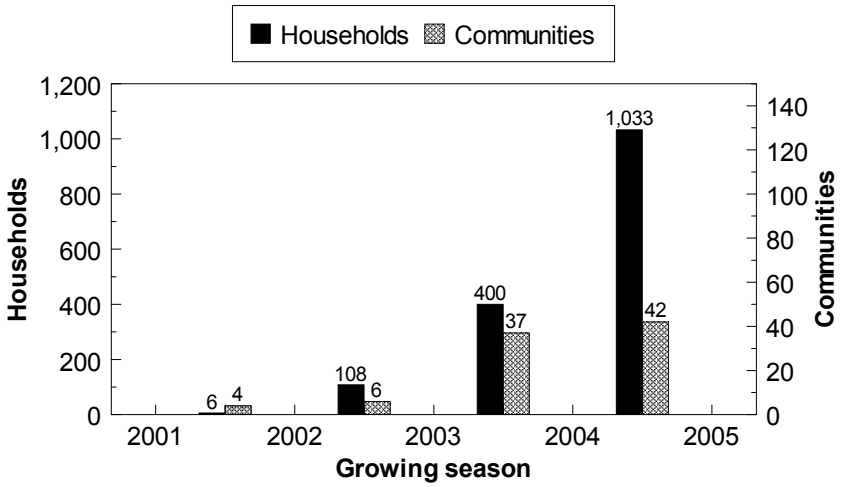


Figure 4.2 A graphical representation of the expansion of *IRWH* in different rural communities and households during the 2001/02 to 2004/05 growing seasons (Botha, 2006).

4.3.2. EXPANSION PROCESS OF COMMUNITIES

This project was originally supposed to start in April 2002, but unfortunately only started officially in October 2002. Two previous WRC-funded projects ended in 2003, which means that overlapping took place between the three projects. Therefore, this project will report on the entire technology exchange process that has taken place since the *IRWH* technique was taken to the rural communities. During the two previous WRC projects between the ARC-ISCW and the UFS, the *IRWH* technique was introduced in four rural communities (Paradys, Talla, Yoxford and Feloanè) during the 2001/02 growing season. To get a complete perspective it is suggested that the reports of Botha *et al.* (2003) and Kundhlande *et al.* (2004) should also be read.

After a number of contact sessions held with the farmers to introduce the new farming technology, through pre- and post-harvest focus group discussions as well as a number of other technology exchange sessions on previous projects, it was decided that it was time to take the *IRWH* technique to the people. Preliminary planning and liaison with the extension officers in land type Dc17 (Thaba Nchu area) took place, where the goals and the objectives of the project were stated. Out of the discussions it was revealed that the Thaba Nchu agricultural ward is divided into three zones, the northern, central and southern zones, for purposes of assigning agricultural extension

officers. Four communities were selected in collaboration with the extension officer for the 2001/02 season: Yoxford in the southern region, Talla in the northern region and Paradys from the central region, while Feloanè was inevitably selected as the fourth community and as a second in the central region because the residents had already indicated tremendous keenness to implement the *IRWH* technique.

Preliminary planning and liaison with the selected communities took place where the objectives and project activities were explained. Following these meetings, another round of meetings were held with farmers in the communities to determine the level of interest amongst them to participate in field trials of the *IRWH* technique during the 2001/02 cropping season.

The objective was to set up demonstration plots in each community on which the effect of the *IRWH* technique is compared with *CON*, if there was sufficient interest amongst farmers to participate in the exercise. The *IRWH* plot was divided into two subplots, one managed by the farmers themselves with guidance from the research team, with the researchers and farmers managing the other (training/demonstration plot). All the action that took place on the training/demonstration plots was done in collaboration with the farmers. It was clearly stated that the process would be carried out over a period of three years as restricted by the requirements of the project (financial limitations and predetermined project duration). During the first year/growing season (2001/02) of the project, only demonstration plots (cropland or homesteads) and training were conducted. In the following years, interested people expanded the technique and the ARC-ISCW team assisted with knowledge. Demonstration and farmer-managed trials were planned and laid out in collaboration with the involved farmers.

The aims of the meetings were for researchers and the farmers to plan for the carrying out of the training/demonstration trials, to select plots where the trials would be located, to select a team of farmers to act as a project committee for the purposes of the trial, the choice of crop for each community for the first season of the trials and the supply of inputs. In each community ten members volunteered for the management committee, and they selected a chairperson and a deputy. During the meeting, the role and function of the committee was discussed, namely to act as a link between the farmers and the researchers, to make decisions regarding the timing for carrying out production practices (such as weeding, application of pesticides, etc.) on the trial plots, and to mobilize all interested farmers to came and work on the training plots. In all communities farmers expressed interest in applying the *IRWH* technique in their homesteads.

Following the meetings, arrangements were made for conducting soil surveys to determine soil depth and other soil properties at the sites selected for the trials to make sure that the soils were suitable for *IRWH*. The communities chose to apply the technique either on their croplands or in their homesteads or both. Most households in all the communities have suitable soils in the homesteads. The farmers from Talla chose a homestead, those in Yoxford chose two homesteads and their cropland, those in Paradys chose their cropland and those in Feloanè chose two homesteads and their cropland. The farmers in Yoxford chose maize because of the need to produce food for household consumption. The farmers in Paradys chose sunflower because of its potential to generate cash income. The farmers from Talla chose dry beans, and those

in Feloanè chose sunflower, maize and dry beans. Members of the committees and some community members were involved in the demarcation and construction of these plots. During the 2001/02 growing season people from the communities of Talla, Paradys, Yoxford and Feloanè were involved in the planting process and were trained to plant maize, sunflower and dry beans, depending on which crop(s) the specific community had chosen.

During the 2002/03 season the project was extended to four new communities: Balaclava, Tweefontein, Woodbridge 1 and Grootdam. People from Woodbridge 1, not far from Yoxford, also expressed their interest after attending a technology exchange action at Yoxford where they saw the *IRWH* plots compared to *CON*. They invited the ARC-ISCW team via extension personnel to enlighten them about the technique. Demonstration trials on the farm Willow Park belonging to the Lekhule trust funded by the Free State Department of Agriculture were conducted during 2000 to 2003. Some of the people belonging to the Lekhule trust lived in the community Tweefontein. The people from Tweefontein showed interest in the *IRWH* technique and the team went on to hold a public gathering at Tweefontein during May 2002. Since the owner of the tractor that has been used to prepare soil in Tweefontein was from Balaclava and after some members of Balaclava attended an information day at Tweefontein, interest amongst the Balaclava people mounted and the ARC-ISCW team visited their community. The people of Balaclava were introduced to the concepts of the *IRWH* on 26 September 2002. A farmer from Grootdam attended a technology exchange session at Tweefontein and decided that he was going to apply the technique at his homestead. He contacted the team and showed them his *IRWH* plots. The same process as already explained under the 2001/02 season was followed. The project and the *IRWH* technique were introduced to these communities. Preliminary planning and liaison with the communities took place where the objectives and project activities were explained. It was clearly stated that the process would be carried out over a period of two years as restricted by the requirements of the project (financial limitations and predetermined project duration). During the first season in a particular community, demonstration plots (cropland or homesteads) were laid out and training of community members took place. From the second year, interested people expanded the *IRWH* technique to their homesteads and the ARC-ISCW team supported and assisted with knowledge. The same procedure was followed during the 2002/03 season. The farmers from Woodbridge 1 chose an area at the school, those in Tweefontein chose the clinic and their cropland, and those in Balaclava chose a homestead, whilst in Grootdam where it was only one household it was done on their homestead. A visual manual on "10 steps to convert your land into an effective *IRWH* system" was drawn up and provided to all the participants to help them to understand the application of the *IRWH* technique better, and a video on *IRWH* was produced and shown to the people with the same aim. Demonstration and farmer-managed trials were planned and laid out in collaboration with the involved farmers. The farmers from Woodbridge 1 chose maize and dry beans, those in Balaclava chose to start with maize and dry beans but also certain vegetables (carrots, spinach, beetroot, pumpkin, tomatoes and watermelon), those in Tweefontein chose maize and dry beans and the farmer in Grootdam chose maize, dry beans and vegetables (pumpkin, spinach, beetroot, and tomatoes).

At the beginning of the 2002/03 season the Yoxford community implemented the *IRWH* technique at 46 out of 86 homesteads. Planting started on 30 October 2002.

The community started with maize and beans with the assistance of technicians from ARC-ISCW. The community members formed an association called "Mahata-Mmoho" (meaning people working together) since the beginning of the 2001/02 growing season, as a strategy to encourage team spirit amongst the people who have adopted this technique. Out of the 46 plots, 45 were planted. The one that was not planted belonged to one of the three members who resigned from the association. The members grouped themselves according to the blocks that they resided at. They believed that this kind of grouping would install a sense of ownership and cooperation amongst them. The individual interests of respective blocks determined selection of crops per block, and it was decided that after harvest, all members would get a share of the harvest. In this manner, they ensured that they would encourage each other to work hard in looking after the plots and looking forward to a shared harvest. Maize, however, was agreed upon as their staple food and was planted in every garden in addition to other selected crops. Whatever was decided upon per block was considered compulsory for that block.

The number of homesteads in the Feloanè community increased to 11. The people from Feloanè planted maize, dry beans and potatoes. During the 2002/03 season the communities of Yoxford, Feloanè, Woodbridge 1, Balaclava, Grootdam and Tweefontein were involved in the planting process and were trained how to plant different crops (maize, dry beans, carrots, pumpkin, watermelon, beetroot, spinach, tomatoes, potatoes and watermelons). The people from the different communities planted their own crops.

After a water harvesting festival that took place during March 2003, a natural expansion process started. The extension officers and people from different communities contacted the ARC-ISCW (Glen) to inform them of their interest in the *IRWH* technique. The interested communities were visited to meet the people and the headman. The headman was informed of the *IRWH* technique and as soon as he promised his cooperation and blessing, the *IRWH* technique was introduced to the communities by means of an *IRWH* video, pictures and posters, and thereafter the same procedure as already discussed took place. During the 2003/04 season the *IRWH* technique naturally expanded to 30 new communities. During that season another approach was followed because the communities became too many to apply demonstration plots all over. It was decided that there wouldn't be any demonstration plots in the new communities. On-site training took place in all the new communities. The farmers were trained at a small area at a homestead on how to construct basins and from there the interested farmers had to duplicate it in their own homesteads. Another approach was also followed whereby the *IRWH* technique was first introduced to the homesteads since experience over the three years has shown that homesteads provide a simple environment for promoting the *IRWH* technique through training. During the 2003/04 season the people from the 30 new communities were trained, before planting started, to plant different crops. To make the whole planting process easier a simple stepwise planting manual, with visual descriptions on how to plant maize, dry beans, spinach, green beans, pumpkin, watermelon, squashes, cabbage, carrots, and beetroot within the *IRWH* system, was compiled in English and Sotho and distributed to every committee in the rural communities that applied the *IRWH* technique. Also included in the manual is a list of all the equipment and material needed to plant, and why it is needed, e.g. measuring stick or rope to measure

out the distances for every crop. The people from the different communities planted their own crops with the assistance and guidance of the TAs and researchers.

As more and more farmers and communities took up the *IRWH* technique it led to the establishment of community-based water harvesting interest groups (CB:WHIGs) in each community. As more communities took up the technique and established their own CB:WHIGs, it was necessary to start another structure which represented all the communities in the project area, namely a municipal-based water harvesting interest group (MB:WHIG). This was formed from representatives from each participating community and the structure serves as a mouthpiece for all the farmers. Another purpose of the MB:WHIG was to discuss the common challenges with the project team or any other stakeholder.

There are 42 communities in the whole of Thaba Nchu. This area was divided into a northern and southern area by the project team. Three TAs were allocated to each area. The TAs comprised two permanent employees and four contract staff (who were later employed by the ARC-ISCW as a result of this project). Each TA was responsible for a number of rural communities, in other words they acted as exchange agents and mentors. The TAs kept records of everything that happened, all the meetings, training conducted, planting, problems, how the crops looked, yields etc.

After the pre-harvest festival during March 2004 the IRWH technique was implemented in all 42 communities by more than 1000 households. The same approach as mentioned during the 2003/04 season was followed.

4.3.3. MOTIVATORS AND DEMOTIVATORS

Various motivators and demotivators were identified that influenced the adoption process of the *IRWH* technique and are presented in Table 4.1.

Table 4.1 Motivators and demotivators that influenced the adoption of *IRWH*

MOTIVATOR	DEMOTIVATORS
Create excitement	Project overload
Leadership-pro	Cultural issues
Establish structure	Village politics
Collective action/Communal approach	Lack of respect for each other
Positive sanctions	RDP houses – small homesteads
Good communication/co-ordination	Drought
Good yield	Job opportunities
Regular meetings	Leadership-anti
Festivals	Confusion
Video	Cliques
Action plan	Subscription fee
Maintenance	Dysfunctional committees
Income from *IRWH*	Unfulfilled promises
Communication channels	Dependency syndrome
Simplicity of technique	Lack of tools

4.3.3.1. Motivators

4.3.3.1.1. Create excitement

When change agents introduce a technology, excitement should be created as far as possible since excitement is contagious. The reason for this is that many change agents go into communities trying to promote whatever they have created; therefore there is a lot of competitiveness. Farmers tend to become bored with something that has been done before. When *IRWH* was introduced in the respective communities a lot of excitement was created and the word people love using most is that there was "hype". People wanted to know what this technique was that everyone seemed to be talking about. The ARC-ISCW team also put in a lot of effort to maintain the excitement. Every time an event was taking place, effort was put in to improve it and make it different from the previous time in order to keep and build on the excitement. The ARC-ISCW team used video, demonstrations, pamphlets, 3D models and so forth to encourage the adoption of the *IRWH* technique. More details about the communication channels used are presented in Chapters 2 and 3.

4.3.3.1.2. Leadership-pro

It is of great importance that the change agents involve any form of leadership within a community. If the leaders support the technology that is being implemented then the chances of many people in that specific community adopting the technique are very high. What must be kept in mind is that all power rests on these people; the headman himself has given them authority. There is also some form of chain that the leaders form and if change agents can convince two or three leaders then the rest will follow. The building of a new leadership should be encouraged as far as possible, in order to keep new leaders growing up to replace the older leaders or if some of the existing leaders move away. An example is the community of Yoxford which was very sceptical about the *IRWH* technique until an influential and opinionated leader who was part of the early adopters got involved and implemented it (Figure 4.3). Soon after that (September 2002) all the other farmers followed. The number of households increased until February 2005 when he left the community for a better job. This community wrote their own constitution and held their own meetings.

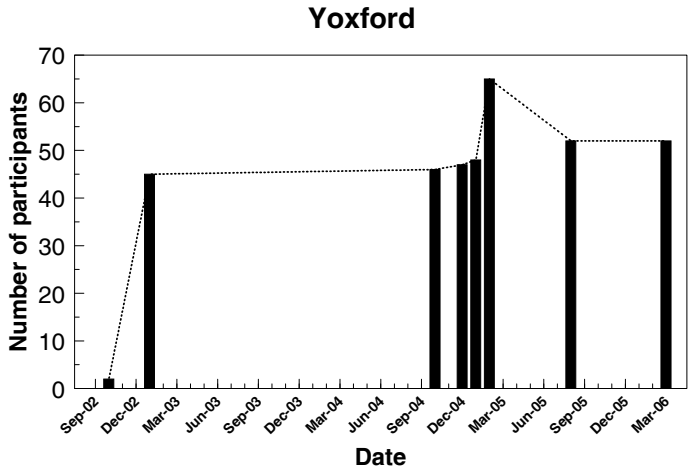


Figure 4.3 A graphical representation of the expansion of *IRWH* in households in the Yoxford community.

4.3.3.1.3. Establish structure

It is well-known that in all the communities there must be some form of structure, whether it is the headman's committee or any similar structure. It was observed that people adhered to some form of structure. Structure to them means order, progress and confidence. Everybody can sing together but definitely not talk together. These were the aspects the farmers knew and felt very strongly about. It was observed that in the villages where a strong active committee like the CB:WHIG was present, the people were successful with the application of the *IRWH* technique and a lot of progress was evident. Therefore it is very important to use the existing structures or set up structures as soon as possible.

4.3.3.1.4. Collective action/Communal approach

The saying "a lot of hands make the work lighter" is well known and should be used to encourage the members of a community to work hand in hand. More problems were experienced when people worked alone. Yoxford is a very good example of collective action (Figure 4.3). This community grouped themselves and made the work lighter. They were called "Mahata-Mmoho" which means walking together. The members grouped themselves according to the blocks that they resided in. They believed that this kind of grouping would instil a sense of ownership and cooperation amongst the members. The individual interests of respective blocks determined selection of crops per block, and it was decided that after harvest, all members would get a share of the harvest. In this manner, they ensured that they would encourage each other to work hard in looking after the plots and looking forward to a shared harvest. Maize, however, was agreed upon as their staple food and was planted in every garden in addition to other selected crops. Whatever was decided upon per block was considered compulsory for that block. This also helped the older generation to keep up with what was going on; these older farmers felt that if they worked alone then they made a lot of mistakes.

Another example is a few farmers from Woodbridge 2 who worked in the cropland and had a register to check who were present. This was done to avoid conflict when harvest time came.

4.3.3.1.5. Positive sanctions (encouragement from ARC-ISCW)

It is always good to give people compliments on a job well done. What is meant by positive sanction is, for example, the informal pat on the back, "you can do it", etc. The ARC-ISCW team realised what it meant to the farmers if the technicians visited them. They would work very hard in cleaning their backyards and coming up with new things and, therefore, would love to be appreciated. Therefore the regular contact sessions and visits were very important because they laid a foundation to encourage the farmers. The farmers were always recognized for a job well done and encouraged to keep up the good work and even try to do better.

4.3.3.1.6. Good communication/co-ordination

Good communication and co-ordination are very important to avoid any conflict. If a message is sent to the leadership it will move smoothly to others on the lower levels. A lot of problems were experienced when there was no order. People had no form of guidance and did things on their own and this later created confusion. The farmers indicated that during this project, good communication acted as a motivator to them.

Good communication meant well-informed farmers who knew exactly what was going on and that minimized the risk of confusion.

4.3.3.1.7. Good yield benefits during the first year

It is important to implement a technology that works. The *IRWH* technique is easy to use and produces good yields. When people went into the communities and asked what the technique had done for them the first thing they said was "Chayi ingata" which means good yields. They reported that in the past their produce was bad because of drought and bad production practices. So it is clear that people just want something that is practical and that works. The *IRWH* technique had another benefit and that was the ability to indicate during the first season that higher crop yields were attained. People saw from the beginning the benefits of using the *IRWH* technique. They did not have to wait for a number of years to see the benefit. This encouraged people to implement the *IRWH* technique because they saw already during the first season that it was working.

4.3.3.1.8. Regular meetings

Meetings are an important source of information and they clarify where people are, where they are going and where they come from. In all 42 communities meetings are held on a weekly and monthly basis. In these meetings farmers discuss their concerns, suggestions and their plans for the future. The farmers indicated that regular meetings were definitely a motivation that encouraged them to implement and continue with the *IRWH* technique.

4.3.3.1.9. Festivals

The ARC-ISCW has a tradition of having *IRWH* festivals twice a year. There are the pre-harvest and post-harvest festivals that are discussed in detail in Chapter 2. The pre-harvest festival is usually held during March and the post-harvest festival during September. These are the occasions put aside specifically for the farmers, to show off their abilities. These festivals were first run and organized by the ARC-ISCW, who then considered it important to teach the farmers how to do it on their own so that they can empower themselves. Looking at many of the adoption graphs (Appendix 4.1) sharp increases in the number of farmers after March and September are visible and can be attributed to the success of these innovative festivals.

4.3.3.1.10. Video

The video was one of the many communication channels used for technology exchange in this project. When the video was shown to the farmers explaining in detail what this technology entailed, the farmers were excited as they had been involved in many unreliable projects. What was also motivating was that they saw some of the farmers they knew in the video. This was good because they felt that if that farmer could understand and use this technique then so can they. They were so motivated they asked that if another video was going to be made then they wanted to be in it. Some even said that they wanted to be movie stars by being featured in *IRWH* technology videos!

4.3.3.1.11. Good goals and an action plan

The farmers were taught how to set goals for themselves and their respective communities and then to break down the goals into smaller goals with an action plan to achieve them. To some of the farmers this was very strange. In the past they only

held meetings with no action plan to follow. When the technicians introduced the goal setting and the action plan to them, they were excited, saying that they were now professionals. The technicians started slowly but surely, explaining how it was done and just how important it was to be committed to it. For the first time some of the farmers knew what they wanted and how they were going to achieve it.

4.3.3.1.12. Maintenance

Weed control has been a very sour topic for the farmers as they had absolutely no idea of controlling weeds in the past. When the technique was introduced to them they were told how important it was to maintain their backyards. The ARC-ISCW team provided them with mechanisms to deal with weeds and insects. They became so motivated that they are now also telling others how beautiful their backyards would be if they just controlled their weeds!

4.3.3.1.13. Income from IRWH

Income is one of the intended outcomes of the *IRWH* technique. After the farmers had harvested, they received such good yields that they sold some of it. The money received was used to buy meat, pay school fees and even buy furniture. This motivated them to continue with *IRWH* and motivate other farmers to do the same.

4.3.3.1.14. Communication channels

The farmers in general saw the communication channels as motivators and their use should be encouraged. They said that some of the older farmers who have a low level of, or no education felt that the communication channels such as the 3D model, demonstration plots and the constant visits by the TAs made it easier for them to understand what the technique entailed.

4.3.3.1.15. Simplicity of technique

The *IRWH* technique is a simple uncomplicated technique. This definitely encouraged adoption. People realized that they don't need a degree to be able to use it. They also realized that they don't need a tractor or fancy equipment to implement the technique. Anybody and everybody can implement it, therefore it is duplicatable.

4.3.3.2. Demotivators

4.3.3.2.1. Development project overload without any coordination

Many development projects are being implemented in the study area and they all have good intentions. But the problem arises when too many people work in one community and there is no coordination amongst them. Then it is as if the different projects compete against each other rather than complement each other. Farmers are human beings and naturally want everything, and this could cause conflict and confusion. An example is the communities of Gladstone (Figure 4.4) and Potsane, which were overwhelmed with too many projects and were unable to cope with the workload. Other projects/departments came with agricultural tools and said that the tools were only for those who were not part of the *IRWH* project (Figure 4.4 – October 2004). Naturally some of the members left the *IRWH* project for the tools and chickens. The project team approached the specific department and sorted out the problems. Once this was done some progress took place (Figure 4.4 – after July 2005). Things like this could damage very good work that has been done over many years. Sometimes development projects do not respect other projects. An example is

hydroponics that emerged in the Thaba Nchu area. The implementation agency misused the water harvesting structures (CB:WHIGs and MB:WHIG) that were formed by the farmers and the ARC-ISCW. They told the farmers that they were working with the ARC-ISCW, even mentioning the names of the TAs. When the farmers confronted them and asked where the TAs were they replied that they quickly went to other communities. They then used the CB:WHIG and MB:WHIG meetings to promote their hydroponics, which were not even investigated or well researched for a drought-prone area like Thaba Nchu where water is the biggest limitation. Hydroponics were handed out for free and the farmers were encouraged to leave water harvesting and rather practise hydroponics. When the implementing agency was confronted they denied everything. Luckily the project team successfully dealt with this problem that had created confusion amongst the farmers. Projects in particular areas, districts and provinces should be well coordinated. Most of these projects could complement each other if the correct approach is used. Therefore it is recommended that before a new project starts in a particular province or area it should be communicated to a government department who should be responsible for coordinating the various projects in that province or area.

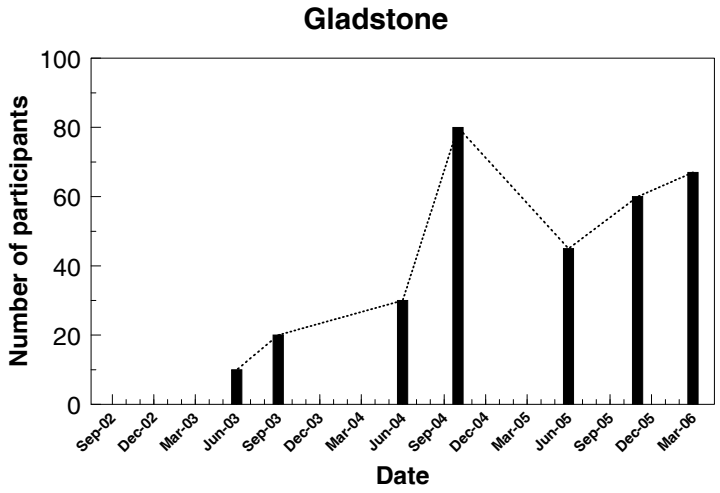


Figure 4.4 A graphical representation of the expansion of *IRWH* in households in the Gladstone community.

4.3.3.2.2. Cultural issues

People were brought up under various situations and under specific belief systems. There is a saying "when in Rome, do as the Romans do". This means that if a change agent goes into someone's property they should do as the owner does. People are different and what one person values someone else might totally disregard. It is a pity when cultural aspects block the path of progress. A community known as Houtnek (Figure 4.5), in particular, regards people with papers, pens, and wearing fancy clothes as outsiders and you can forget about convincing them about anything. Talla for instance, before major changes occurred, had a serious problem with women wearing pants, no hat, and talking directly to the headman. This was regarded as extremely rude. Therefore cultural issues should be kept in mind and handled with sensitivity and people should respect them.

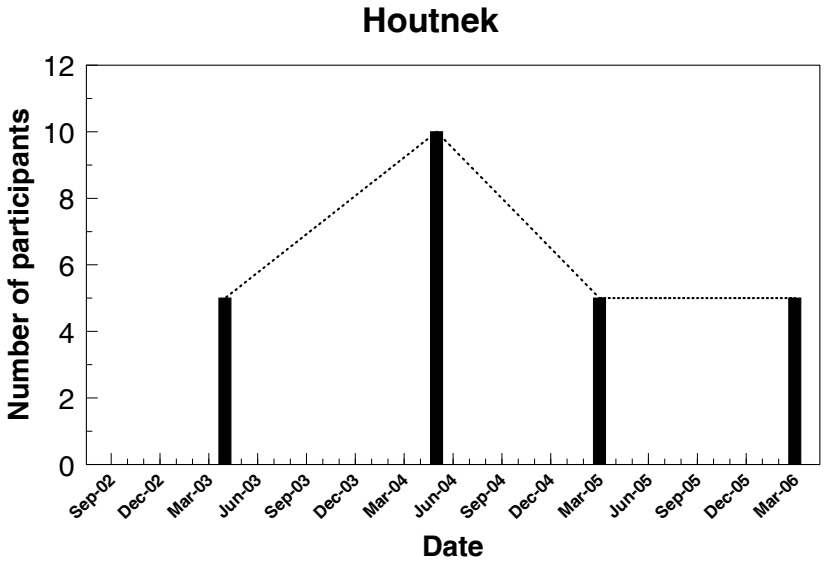


Figure 4.5 A graphical representation of the expansion of *IRWH* in households in the Houtnek community.

4.3.3.2.3. Village politics

Village politics are present in all places at all times. People will always have something to talk about. When change agents introduce a technology, they should make a point of letting the people know that they (the agents) are there to work and to bring about progress in the people's lives. Village politics should be left outside the work environment. The ARC-ISCW experienced a lot of problems in this area as some people totally refused to work together as they merely did not like each other. Many clashes took place between the youth and the elderly.

4.3.3.2.4. Lack of respect for each other

Respect is what everyone wants but unfortunately in the era that we are living in there is not much respect for one another. There are communities such as Ratabane and Middledeel where the older generation feel that the younger generation does not respect them. When they held meetings most of the things they talked about were not for the older people. An example would be talking fast, using difficult words and expecting that the older people should understand. The reverse also occurs when the older generation is leading but is not interesting enough. The younger ones feel going to meetings is a waste of time as nothing new happens. Unfortunately this is the reality so it is important to be able to find a balance between these two age groupings.

4.3.3.2.5. RDP houses – small homesteads

RDP houses were very interesting demotivators. All of the *IRWH* farmers use their backyards to plant. The sizes of the backyards vary, some are big and others medium to small. In recent years the government has taken upon itself to build houses for the people living in the communities, including those who were implementing the *IRWH* technique. In the small homesteads where the government had to build they destroyed the *IRWH* basins. Many of the basins are now covered by houses, as the farmers also wanted a better house to live in.

4.3.3.2.6. Drought

Over the years while working in Thaba Nchu the technicians have seen how the lack of water demotivates people. The little water they have they use to bath, drink and to do their laundry. The *IRWH* technique is specifically designed for these conditions as it uses only rainwater. Despite this they still felt the need to water their crops from time to time. This, however, has the same effect on all the other agricultural practices like *CON* and is not unique to this project or technique. Drought is a bigger problem for the farmers that use *CON* practices.

4.3.3.2.7. Leadership-anti

If the leader of a community such the headman or any influential person does not want to adopt a technology, the chances that the community will adopt are very small to zero. If some of the farmers want to adopt that specific technique after seeing that it works, they will be isolated in a community until they stop using it. A very good example of this happened in Houtnek where the headman was not interested in the technique. He influenced everyone to such an extent that those who had adopted the technique abandoned it. They did not call meetings as they were too few and they feared being ostracised.

4.3.3.2.8. Confusion

Many times confusion was created by either poor communication or other projects as already described in Section 4.3.3.2.1. The subscription fee paid to the respective CB:WHIGs also created confusion as many of the farmers did not know what was going to happen with the money paid. Subscription fees are discussed in Section 4.3.3.2.11. Another example was implementing agents from a hydroponics project that misused the CB:WHIG and MB:WHIG structures and created confusion amongst the farmers.

4.3.3.2.9. Cliques

In some of communities there is what is called cliques. These have leaders and if the leader does not want to be part of the *IRWH* project they would influence the clique to follow. A typical example was in the community of Balaclava where a farmer implemented the *IRWH* technique and everyone in this particular community was doing the same, until one day she became angry and withdrew, with all the others following her example. In this instance it is important to have workshops, daily visits to encourage farmers to make their own decisions and not to just follow. This is said because most of the women who withdrew really needed the *IRWH* technique while the leader of the group was actually well off and did not need the benefits of *IRWH*.

4.3.3.2.10. Job opportunities and death/loss of leadership

This aspect affected those who are fairly young and are looking for jobs. This can be a major downfall of a technology as it is always those who are in leadership positions who leave for a better life. Examples of this are in Yoxford where the leader got a better job (Appendix 4.1 – April-May 2005) and Klipfontein where a very strong leader passed away. Other examples were some of the farmers who left everything and worked on temporary employment opportunities like the building of toilets to get money in their pockets. Afterwards when the contract work was completed they picked up their agricultural activities. Therefore it is recommended that a lot of attention should be focused on building strong succession leadership. In case something happens to the strong leader, new leaders can continue.

4.3.3.2.11. The subscription fee

This is the money the farmers have to pay to their respective CB:WHIGs and MB:WHIG. The MB:WHIG's constitution only expected them to give 20% of their monthly donations from CB:WHIGs to the MB:WHIG. The amount varied from community to community, and from R1 up to R10 per person per month. This monthly donation caused a lot of problems as some farmers felt that they could not effort it. This was a good effort by the board, as they wanted to open a bank account for the farmers and save some money for them. It was also going to help transport the members to and from meetings, to buy seed and other inputs as well as getting sponsorship, because as it is known that sponsors want to see if the farmers have made any effort to improve their situation. It is recommended that the change agents ensure that people are prepared for such an intervention as it might cause a major problem otherwise.

4.3.3.2.12. Dysfunctional committees

All the communities have their respective CB:WHIGs who guide them in making decisions. These committees attend various meetings and report back to the farmers. It is very important that the members want to be part of the committee to really make a difference and not only because it is a status symbol. If they have been forced then their commitment will be very weak. They have to be able to tolerate each other and work together to make life better for the farmers. The TAs found that in some of the communities, committees that could not work together were causing confusion, and farmers later left because no meetings were scheduled, or reports being given.

4.3.3.2.13. Unfulfilled promises

When the team started to work in the communities one of the first things the farmers mentioned was that this would be the same as all the other projects. Many people and projects had entered the communities in the past with empty promises. None of those people or projects are still there. When the *IRWH* technique was introduced the ARC-ISCW promised the farmers seed, and this was indeed delivered. The food security section of the FSDA supplied the farmers with seed but unfortunately it arrived very late and all sorts of excuses were given. Some of the farmers became discouraged and stopped using the technique, saying that the FSDA was unreliable. Another example is related to the Department of Water Affairs and Forestry who promised to give the farmers tanks in early 2006. They are still waiting for them which has caused a lot of uneasiness among the farmers as they feel that change agents do not stick to their end of the bargain.

4.3.3.2.14. Dependency syndrome

This aspect is more related to the farmers. There are some farmers who are just too dependent on the government for help. They feel that they have the right to the support, and if they are not given this support they simply would not adopt a technology. These are farmers who in most cases love living on handouts and have been doing so for as long as they could remember.

4.3.3.2.15. Lack of tools

Less than 23% of the 240 farmers interviewed indicated that they have their own garden tools. For the 77% that do not it is a demotivator and one of the main constraints that influenced the adoption of the *IRWH* technique. When it rains the circumstances are conducive to the preparation of the *IRWH* plots. Then everybody is

using their own tools and they won't lend them to others until they are finished. When the latter finally receive the tools the soil is already too dry. Woyessa, Pretorius, Van Heerden, Hensley & Van Rensburg (2006) found similar results in their study conducted in the same area. It is recommended that the government assist the farmers by providing them with the necessities to apply the *IRWH* technique.

4.3.4. THE PERSPECTIVES OF NON-ADOPTERS

The ARC-ISCW team did not only want to focus on the perspectives of the adopters. They also wanted to get the view of the non-adopters. The question to be asked was why do other farmers within a community totally refuse to adopt any technology? A period of time was spent in these communities with those who were non-adopters to find out why they were not adopting the technique. Their responses are summarized as follows:

4.3.4.1. Lip service/broken promises

The farmers felt that too many projects were coming into their communities and making all sorts of promises, but when it came to delivering what they had promised then suddenly they had a lot of excuses or they were nowhere to be found.

4.3.4.2. Cultural/belief aspects

Many farmers have very strong cultural beliefs. They have lived their lives following them; their children have been raised around this belief system, which makes it very difficult to change. In some communities there were people who were totally against change, especially if it comes from someone who they saw as an outsider.

4.3.4.3. Gender

It was very surprising to realise that in some households what the man says goes. The structure of the home is made up of father, mother, children and even grandparents in that order. If the father feels that he does not want to adopt a specific technique it means that the mother cannot. If she does, she would have spoken against the wishes of her husband and in that way would be seen as disrespectful. Respect is the most treasured element by a man, and if that is tampered with the wife might find herself without a husband.

4.3.4.4. Other important prerequisites

Firstly, the change agents must create a demand for the intervention; dissemination must convince potential adopters that they will really benefit from the intervention. Secondly, the change agents must encourage appropriate adaptation, sometimes known as reinvention of an innovation. This occurs when adopters modify the intervention to fit local conditions after its original development by others. Elements of intervention such as the content and format of an educational programme may be modified or deleted and new elements may be added and this may cause tension. Encouraging adaptation may accelerate the rate of adoption, but some changes may result in a loss of effectiveness, dependability or other valued attributes of the innovation. Thirdly, technical support must be provided for the adopters. Intervention

researchers and the implementers are the primary knowledge experts of the intervention. The adopters may require support personnel from the research team to assist with adapting the intervention to meet their specific needs. Fourthly, mass media techniques such as newspapers, radio and television programmes should be used. These techniques allow a selected number of society's members to have great influence over the attitudes and opinions of others. Mass media often shapes mass opinion, thereby affecting social change.

The implementing organizations need to look out for several things when dealing with farmers. Firstly they have to realise the need for behavioural change; before people will modify their behaviour they have to recognize the need to change their behaviour. In the *IRWH* project context this involved the farmers realizing that they need to change the way of working their land to produce more food (higher yields) and in some cases make extra money. Secondly they need to know exactly what behaviour should be changed. Simply talking about the *IRWH* technique in general will rarely have any effect on the behaviour because it refers to a whole category of behaviours instead of the specific behaviour (Ajzen, 1988). Intention to change behaviour refers to all the motivational factors that influence behaviour. This is connected to how hard people are prepared to try and how much effort and planning they are prepared to put into changing their behaviour. In this instance it is important to motivate the farmers to adopt a technique that will change their lives for the better. This can be done by using the various communication channels discussed in Chapter 3. In addition to this, it is necessary to reinforce the intention that directly corresponds to the specific behaviour. So although general motives are important, specific behavioural patterns must not be forgotten, such as the advantages of cleaning your backyard daily or even weekly to avoid problems with weeds.

Also of importance are attitudes towards the behaviour and the influence of subjective norms; the attitude of the individual towards the behaviour (way of working the land) must be positive to increase the likelihood that the behaviour will be carried out. Often the attitude towards certain behaviour is influenced by a group of norms and expectations. Thus converting land will be negatively viewed if it is perceived as the knowledge from “outsiders”. In this regard the importance of focus groups or farmer-to-farmer and the desire to fulfil expectations is relevant, because it is focus groups that hold certain norms that in turn influence the behaviour of individuals. Pressure to please spouses also leads individuals not to adopt or practise any interventions. The desire to fit in or please others is part of social life.

Self-efficacy, that is having the intention to change behaviour is, however, not enough. People should also believe that they have the ability to perform the desired behaviour. Efficacy refers to a person’s belief in his/her ability to control behaviour (Ajzen, 1988). If the farmer does not believe that they can produce better yields using the *IRWH* technique then they are unlikely to change their behaviour simply because they do not think they have the ability to do so.

4.3.5. THE BEST WAY OF GAINING ENTRANCE

An appointment with the headman is the most important departure point as it opens up the door to everything. The headman must be involved and given an explanation exactly what it is all about; otherwise he can refuse to co-operate. After his

involvement and openness the same meeting must be called with the community, where the same purpose is explained. During this meeting pictures and posters of the *IRWH* technique could be shown, compared to *CON*. The video of the *IRWH* technique is also very important as well as the 3D model. If the farmers show interest then the team should arrange for another meeting to demonstrate the application or the implementation of the *IRWH* technique. For this purpose, an independent plot chosen by the farmers must be used as a demonstration/training plot. This may be at a school, church, etc. All the future activities will take place on this plot. This is where the farmers will be taught how to do certain things. Firstly the TAs will explain the ten steps and demonstrate how the basins are constructed and thereafter give the farmers a chance to try themselves. The farmers must be given a period of time to get used to the idea of constructing basins before the TAs can continue. Other appointments will be set up where the TAs will teach the farmers about planting, weed and insect control, etc. All this training will take place on the chosen plot at certain time intervals during the growing and fallow period. The TAs will start by teaching them how to plant the crop that they have selected. At this point it is important to make sure that the farmers are not bombarded with too much information. They will also be given detailed training on weed/insect control and maintenance. At this point the farmers must be encouraged to elect a committee and hold regular meetings. A date must then be set to elect a committee. On this day the TAs will explain the importance of a committee, how to elect it, its functions, and its roles. As soon as the committee is elected the TAs will work hand in hand with them to find out about the progress in the communities. This, however, does not mean that the TAs will no longer work with farmers individually or as a group. They will still have one-on-one discussions with the farmers and attend some meetings which they have planned. Thereafter the TAs will encourage the farmers to write down their goals and draw up an action plan. The TAs will make a copy of this and make sure that the farmers keep to their action plan. After all of this is done the TAs will keep on visiting the farmers, motivating and supporting them, by using one of the many motivators of the *IRWH* technique such as the festivals held each year. At these festivals the farmers meet with others to exchange ideas and to see what other farmers are doing.

4.4. SUMMARY

This project was originally planned to implement the *IRWH* technique in six rural communities around Thaba Nchu and Botshabelo. The application of the *IRWH* technique in homesteads revealed a phenomenal increase over a relatively short period of time. A thousand households in 42 rural communities around Thaba Nchu and Botshabelo successfully implemented the technique. This was the result of a combined impact of the use of effective and creative communication channels, an efficient extension programme by the ARC-ISCW and an impressive successful new crop production technique, which was self-demonstrating.

During the technology exchange process various motivators and demotivators were identified that influenced the adoption process of the *IRWH* technique. The identified motivators were: create excitement; leadership-pro; establish structure; collective action; positive sanctions; good communication/co-ordination; good yield; regular meetings; festivals; video; action plan and goals; maintenance (capacitated farmers); communication channels; income from *IRWH*; being able to see the benefits from the

first year; and a simplistic technique. The demotivators were: project overload; cultural issues; community politics; lack of respect for each other; RDP houses (other projects); drought; job opportunities; leadership-anti; confusion; cliques; subscription fee; dysfunctional committees; unfulfilled promises; dependency syndrome; and a lack of tools.

The perceptions of the non-adopters were also documented by spending time with them in the communities to find out their reasons for not implementing the *IRWH* technique. Some of the reasons were: lip service/empty promises by individuals and organizations; cultural beliefs; gender issues and others. The best way to enter a community was also documented.

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5. EXIT STRATEGY THROUGH THE EMPOWERMENT OF RURAL COMMUNITY-BASED PRODUCER ORGANIZATIONS

5.1. INTRODUCTION

There is an increasing emphasis on the importance of the role of community-based producer organizations (CBPOs) in efforts towards poverty alleviation and development. This can be done on the basis of linking with the existing organizations that have links with the many farmers in those organizations. Therefore, there is a need to create and/or strengthen such organizations if projects are to have a bigger impact on the farmers and the areas in which they are implemented.

5.1.1. DEFINITION AND IMPORTANCE OF COMMUNITY-BASED PRODUCER ORGANIZATIONS

According to Rondot & Collion (2001), it is difficult to sort through the many and diverse types of rural organizations. These organizations exist for different purposes and at different levels: local, regional and national. Despite difficulties in identifying or defining the diverse rural organizations, generally a distinction is made between traditional and formal organizations.

5.1.1.1. Traditional (informal) producer organizations

In most rural communities there is evidence of some of the organizations that aim at facilitating the smooth operation of subsistence/family-based agriculture. The main purpose of such organizations is to reduce the uncertainties of an agricultural activity, stabilize production conditions, and cope with peak labour demands (Rondot & Collion, 2001). These organizations are used as instruments by which societies have developed to regulate the relations between members concerning access to means of production (land and water), technical practices, agricultural calendar, and other issues of concern. Such organizations are mostly internal in nature and are thus able to foresee and resolve conflicts between members of the local community. An important characteristic of traditional organizations is that they are dependent on other forms of social development and thus their functioning is marked by the relationships that exist within a society.

5.1.1.2. Formal (new) producer organizations

Formal producer organizations are radically different from the traditional ones (Haubert & Bey, 1995; Rondot & Collion, 2001). While traditional producer organizations mostly regulate internal relationships of members, formal organizations mainly aim to organize the relations of the group with the external world. These organizations act as an interface structure (Rondot & Collion, 2001) that could be a means to: (a) facilitate/accelerate the integration of rural people into the market and global society; and (b) improve the relations of rural societies with their environment (market and global society). While producer organizations differ in their structure (traditional or formal), they are all developed to mediate between rural producers and others who act in their economic, institutional and political environment. According

to Rondot & Collion (2001), this results in producer organizations being hybrid structures in which two different logics and two 'meaning systems' are involved.

Generally, producer organizations are membership organizations created by farmers (or other groups) to provide services to them, and their objectives include: (a) better management of their resources and assets (e.g. water user associations, herder associations, etc.); (b) expansion of their access to natural resources, their basic means of production (land, forest, pastures, and water resources); (c) improved access to services, credit and market outlets by leveraging them as a result of their representative and advocacy activities; and (d) making their voices heard in decision-making processes as well as policies that affect the context in which they produce, market, transform and export their products. Collectively, farmers gain more bargaining power and can thus have an effective input in decision-making.

5.1.2. ROLES AND FUNCTIONS OF DIFFERENT TYPES OF PRODUCER ORGANIZATIONS

Producer organizations usually assume several functions and these are used to differentiate between the diverse types and number of producer organizations. Generally, rural organizations assume three broad functions: policy formation and advocacy, economic (production and marketing), as well as local development (Collion & Rondot, 1998).

5.1.2.1. Advocacy or policy formation producer organizations

These types of organizations perform a representative role and lobby on behalf of members. They represent members' interests in negotiations with government, donors or the private sector. Examples of advocacy organizations include associations, syndicates and unions.

5.1.2.2. Economic and technical producer organizations

Economic and technical producer organizations provide services to their members such as production information, facilitating access to inputs and market, credit, support for storage, processing and marketing services. These may take several forms including unions, producer associations, cooperatives and economic groups.

5.1.2.3. Local development

Producer organizations are usually requested to support local development processes and improve the quality of community life. These organizations often substitute local government in countries where decentralization has not yet taken place. Typically producer organizations are local entities (existing at community and inter-community levels). They can be represented at regional and national levels where policy decisions are made. Common among producer organizations is that the function and levels of organization are related. Therefore, local problems that require a local collective are better solved by one or more local grassroots producer organizations. Economic organizations, on the other hand, are usually stronger at the local and regional levels, for example in access to services, rural credit and primary markets, natural resource management, or resolving natural resource access issues.

5.1.3. RATIONALE FOR IMPORTANCE OF CBPOs IN AN EFFECTIVE EXIT STRATEGY

It is generally accepted that local participation in development and poverty alleviation is important. This allows the poor to also inform and participate in initiatives that aim to assist them and thus improve their livelihoods. The involvement of local communities in development and poverty alleviation activities is also an important avenue for researchers and donors to better understand. As already indicated, community-based organizations are created for various reasons and they have different roles to play.

There are several observations to be made and emphasized about producer organizations. They are an important mode of economic and social regulation, and their development is actually economic as well as a social investment. Secondly, the rural poor also want to participate in the initiatives that are aimed at developing them and their involvement can best be achieved through the use of producer organizations. In other words, producer organizations need to be involved in rural development policy. The organizations can be called upon to compensate for public or private institutional failure. This thus requires that they be capacitated sufficiently to dispense their mandate. Finally, support to producer organizations is an investment in social capital that will help to fight rural poverty and improve return on other types of investments.

The ARC-ISCW (Glen) research team opted to form and work in partnership with community-based producer organizations. Some of the communities in the study area had informal farmers' groups and others at different stages of being formalized. At the time the *IRWH* technique was introduced there were mostly youth groups, which were involved in activities such as community home gardens in Yoxford and Paradys. These formations were initially used as a means through which the *IRWH* technique was to be introduced to the community. But since these groups already had their own membership and roles and objectives, there was a need to develop those which were specifically aimed at implementing the *IRWH* technique. This medium was important as it allowed interested farmers to learn together the new *IRWH* technique. The section that follows traces in detail the reasons for the development of CBPOs in the Thaba Nchu area.

5.1.4. ISSUES TO BE CONSIDERED IN DEVELOPING CBPOs

Community-based producer organizations do not usually have the resources to achieve their objectives fully. As a consequence, the organizations often need establishment or reestablishment support. This means that they need to be reviewed periodically to ensure that they remain focused to help them adapt and change. In many cases, these organizations are expected to take up responsibilities that were formally performed by development agencies or donors, even government departments. Normally, due to limited access to resources, such organizations may not match the expectations of the development agencies and donors. Furthermore, these organizations do not always get the support they are entitled from the donors and development agencies (Collion & Rondot, 1998; Rondot & Collion, 2001).

A major challenge for the majority of producer organizations is to build balanced technical, economic and political partnerships. The processes entail 'learning by doing' which cannot be easily reduced to the establishment of simple procedures and this will modify the power relations between the different stakeholders. Producer organizations with their limited resources are unable to mitigate the technical, economic, social and political challenges faced by rural communities. They thus require alliances and partnerships to offer support and assistance. However, the demands/expectations of the producer organizations are not always on a par with the requirements of those who want to support them. This is exacerbated by the fact that there are always inequalities in accessing information, levels of expertise, and control of financial resources, therefore putting the producer organizations in a disadvantaged position in the partnerships and alliances they create. In many cases, governments or donor agencies can easily impose their views and aims, which may result in some tremendous misunderstandings and frustrations for all the stakeholders. As a result, this may lead producer organizations to be transformed into instruments of donors or government.

5.1.4.1. Capacities which require strengthening

There are two major principles that characterize producer organizations and help identify the capacities that need strengthening. These are the principles of utility and identity. In utility, the producer organizations need to be useful for their members, and members need to be actively committed. This helps them to achieve the objectives they have set for themselves. Producer organizations need to be identified in terms of a history and a geographic space shared by their members. Secondly, they need to have operating rules that regulate the relations between members as well as between members and the outside world. The third aspect of identity relates to a vision of their future and what they aim to achieve. In the absence of an identity, a producer organization will be a formless group that is used by others to accomplish their objectives (Rondot & Collion, 2001). However, the two principles (utility and identity) are not cast in stone as they need to be adjusted depending on the activity and environment of a given producer organization. Producer organizations need to have their own identity and agenda, as well as know how to interact with their political and economic environment. They need to understand their agenda, constraints, capacity, and limitations of other groups, and be able to mobilize enough resources (internal and external) to implement their activities.

Based on the above, producer organizations need to be strengthened such that they are able to analyze their own needs, formulate their requests in realistic and operational terms, and negotiate with others involved in their sphere of activity. According to Rondot & Collion (2001), once this is achieved the producer organizations will be able to manage the process of adapting to whatever challenge that may arise. In order to assist producer organizations, support is needed to strengthen their strategic, technical and financial capacity. Some of the strategic capabilities include an effective communication programme to access external information and disseminate that information to members. Secondly, leaders of producer organizations need to improve their management skills to better understand such issues as market intelligence, donor operating mechanisms and strategies, and policy analysis. Producer organization senior officials need to be effective. Finally, producer organizations need to be

empowered to generate and manage their own funds and be accountable to their members and other stakeholders.

It should also be noted that there is no universal approach to supporting producer organizations. This support needs to be tailor-made and participatory ('learning by doing' process) which will vary among different localities. In many cases, the support is often an integral part of rural development activities. However, ways of strengthening producer organizations depend to a large extent on the type of institutional mechanisms and methods used. Strengthening the strategic capabilities of producer organizations is closely linked with development of human and financial resources of producer organizations.

In developing producer organizations, attention should be given to developing communication programmes, as this will assist them to access strategic information. The gathering and processing of information requires skilled personnel, so producer organizations should be supported to develop their own communication programme. It is also crucial that the development of producer organizations needs government involvement, since the willingness of government to empower producer organizations is crucial. The long-term sustainability of producer organizations requires that government be willing to shed some of its responsibilities in the design and implementation of rural development policy.

Empowering community-based producer organizations is crucial, yet it is not an easy exercise. Consideration should be given to guaranteeing access to support as long as they meet the criteria. It is crucial to understand the strengths and limitations of producer organizations as well as understanding their diversity. This will allow them to determine for which capacities they need support. This can be achieved effectively through demand-driven procedures. Producer organizations should be assisted to determine their needs. However, the development of producer organizations has inherent risks and problems, chief amongst them are the legitimacy of the leadership. In some cases the leaders may be out of touch with the realities of their members, and thus lack accountability to their members. This poses a risk of giving more power to the local aristocrats to the detriment of the members of the producer organizations. A well-designed communication programme that ensures openness for all groups can better mitigate the risk. The 'learning by doing' process, which is commonly used in empowering producer groups, may lead to the misuse of funds. Another risk may be the shift of existing power relations, hence creating counter forces in a community. However, more effective and stronger producer organizations always lead to the redistribution of power. Capacity building of producer organizations is usually a slow and uneven process. It is regulated by social behaviour and cultural norms, in addition to economic principles. Therefore, donors may get impatient and force the process artificially, resulting in the producer organizations being unsustainable.

5.1.4.2. Partnerships with agricultural service providers

The existence of producer organizations and their effective functioning requires that there should be a change in the way research and extension are performed. The pressure increases with the presence of well-organized producer organizations. The changes that are required are those that will increase the participation of producers in the functioning of their institutions. For research organizations the questions arise as

to whether the focus should be on research and development or on production systems research. There is also an increased demand for the introduction of participatory diagnostic methods in identifying the real needs of producers. Research and extension institutions also need to transform from being centralized to decentralize in order to enable the producers to play an effective role. Finally, the changes to be encouraged must include the establishment of a consultative network between research, extension and producer organizations. However, there should be incentives that will encourage the researchers to listen more carefully to producers and their organizations and thus be able respond accordingly and promptly to their needs.

5.1.5. RESEARCH, DONORS AND CBPOs

While the importance of producer organizations cannot be over-emphasized, there were difficult hurdles that had to be crossed and they provide a lesson for all those wishing to establish or strengthen the organizations. Producer organizations are even more important where research and extension institutions can no longer meet the needs of the producers. In instances where small-scale farmers do not get the attention they require from the research and extension establishments, some groups of small-scale farmers have shown that they are able to do research and come up with results that are directly applicable in their own situations.

5.1.5.1. Lessons learnt across the world

Important lessons relating to the establishment and strengthening of producer organizations have been learnt over the world. It is generally agreed that there should be a favourable policy environment. This is a primary requisite, as it requires institutional re-organization. There should be a willingness on the part of donors and technology generators to withdraw from some of the activities that they were doing and allow the producer organizations to perform. Secondly, it has been learnt that there should be institutional commitments to decentralization. Research and extension should be fully committed to shedding some of their responsibilities and create close links with the producer organizations.

Farmers in various parts of the world do not have the same concerns and thus the development of producer organizations needs to take into consideration the local context. In many cases, the development of such organizations was normally based on three themes, namely agriculture, rural development and farmer identity. These themes require different approaches from direct support to grassroots farmer organizations, supporting farmers to attain a foothold on the economic and political system as well as support for cooperation amongst farmers.

The challenges to be met in developing and strengthening producer organizations firstly require that there be an improvement in the flow of information. With more information, producer organizations are able to make more informed decisions and are better able to participate in decision-making processes, both their own and with the outside world. Producer organizations require more than just support projects; they need to be supplied with the tools and the opportunities to be used. There should be a place for the producer organizations in the day to day running of things; they need to be given certain tasks and a fund that can respond quickly to farmers' proposals. As much as possible there must be a conscious effort to avoid applying western models to

farmers' associations, the reason being that the historic and economic contexts are radically different. Producer organizations should thus be assisted to find their own institutional solutions. This will strengthen their interactions with the various social groups in a community or society.

5.1.6. EVOLUTION OF CBPOs: A CENTRAL ISSUE FOR AN EXIT STRATEGY

The majority of rural Africans remain poor and food-insecure despite widespread macro-economic, political and sectoral reforms that have mostly failed to stimulate significant agricultural productivity improvements. As a result, there is an increasing population that produces on marginal lands so as to satisfy the increase in food demand and the land available for production is rapidly being exhausted across the African continent. Therefore, there is intense pressure to intensify agriculture so as to improve productivity without the expansion of the cultivated area (FARA, 2004). This requires prudent long-term management of the natural resource base that is the foundation of agriculture. Contrary to the widely held negative view on the relationships between population growth, poverty and natural resource management, studies have found that small-scale and poor farming households can accomplish substantial investments in both sustainable resources and in diversifying their livelihoods (Tiffen, Mortimore & Gichuki, 1994; Mortimore & Tiffen, 2004). These studies concluded that a growing rural population and well managed natural resource base are not incompatible, and improved farm productivity and income are appropriate targets for public policy together with alternative income opportunities. This implies that there is a need for appropriate policy changes to the complex problems of rural poverty and food insecurity.

While generally there have been great strides made in terms of the development of agricultural productivity increasing innovations, the adoption thereof has been less than expected hence not achieving the expected results. There are numerous reasons that have been put forward to explain the low adoption and utilization of productivity-enhancing innovations amongst small-scale resource-poor farming households. Some of the reasons include an emphasis on the technical aspects of the techniques without looking at their socio-economic aspects relative to the targeted beneficiaries. In recognition of the above, more innovative methods for increasing adoption rates and the sustainable use of the techniques were developed which recognize the important role of the farmers in technology development and exchange. Among these are approaches such as participatory rural appraisal (PRA) and PAR. These approaches do not only recognize farmers simply as being beneficiaries but that they should be partners in research aimed at improving and diversifying their livelihoods. The participation of farmers may take a variety of forms, from individuals to households and whole communities.

Many water harvesting and supplemental irrigation systems have failed, despite good techniques and design, since the social, economic and management factors were inadequately integrated into their development (Bazza & Tayaa 1994; Oweis, Hacum & Kijne, 1999). In some cases the sustainability and impacts on the environment have been overlooked, therefore Botha (2006) claimed that for technologies to be accepted and implemented, the five pillars of sustainability (increase in production; conservation of the natural resources; decrease in production risk; economic viability; and social acceptability) should be investigated. One of the important conditions for

the success of water harvesting techniques is the acceptance by the resource users, both male and female. The risk levels and the profit potential for investment of labour and other inputs must also be acceptable. However, there are few studies that have assessed the economics of water harvesting and supplemental irrigation (Oweis *et al*., 1999). Water harvesting techniques more often require commitment and cooperation of a group of farmers in the construction, operation and maintenance of facilities, to coordinate and control the use of the catchments, cropping areas, and the boundary structures. The transaction costs for these activities may be very high. However, an important and obvious condition for the success of water harvesting is the economic feasibility in both the initial construction and the maintenance costs. The acceptance by the local community and the economic viability of water harvesting are improved when the water harvesting system is not looked at as a free-standing technique but as part of a community or regional land use management plan (Oweis *et al*., 1999). It follows that for improved and sustainable adoption and application of water harvesting techniques, the farmers need to be effectively and efficiently involved in the development and/or the adoption of the techniques. Studies have shown that this can be better achieved by the development of community-based farmer organizations/groups. These groups are important in the communities as they have specific roles and have been used traditionally to pull together resources in the development of the communities. They help in the mobilization of communities and organizing community activities. The development of community interest groups, therefore, helps to push the new techniques into the community development agenda.

5.2. MATERIALS AND METHODS

5.2.1. INCEPTION PHASE OF THE *IRWH* TECHNIQUE IN THABA NCHU

Taking cognizance of the important role of the participation of farmers in technology development and transfer phases of the *IRWH* technique, the principles of PAR and PRA were followed to introduce and further research the feasibility of the *IRWH* technique in the area. This took the form of community meetings, focus group discussions and individual interviews as described in detail in Chapter 2. This chapter focuses on the activities that led to the creation of the CB:WHIGs in the different communities in the Thaba Nchu area, and also outlines the basic principles behind the creation of the groups and some of the challenges that the initial groups faced.

Based on agreements made in the community meetings in the selected communities, the need to demonstrate the *IRWH* technique was well accepted. The selected communities for the inception trials in 2001 were Feloanè, Paradys, Yoxford, and Talla. In each community, a site was identified where the villagers and the research team set up a demonstration plot for the *IRWH* technique. The research team and the villagers managed these demonstration plots. As a result, a group of ten representatives from each community was elected by the communities. The group was to be the 'official' link between the villagers and the research team. The team was responsible for running the day to day activities in the demonstration plots.

The management of the demonstration plots rested on the research team with the participation of the community representatives. Community representatives organized the villagers for all activities and meetings that took place. These included planting,

fertilizer application, hand and chemical weeding and pest control. The demonstration plots were a learning exercise for the communities involved as they learnt together and appreciated the amount of labour that was needed in the setting up of the system. However, from the onset the research team made it clear to the selected communities that the technique involved a large outlay of manual labour during the construction phase. Therefore, the farmers were encouraged to work in groups in order to offset the amount of labour needed. This marked the beginning of the resuscitation of collective action among villagers. This concept was welcomed as it was embedded within the communities when it comes to large initiatives. The community members were familiar with working together in other spheres of their lives.

5.2.2. THE BEGINNINGS OF CBPOs IN THABA NCHU: THE PROCESSES

After the success of the demonstration plots, the community committees were expanded into community groups as more people showed interest in taking up the *IRWH* technique. These groups assisted each member in the establishment of the system in their backyards. It should be noted that while demonstration plots were set up in the backyard gardens and the croplands, most farmers opted for starting in their backyards mainly due to lack of fences in croplands. While this was not an option of choice, it served to help the farmers observe the technique more closely in their own backyards (small plots) and thus master the technique before they could employ it in the croplands. However, within these community groups some farmers formed smaller groups, and expanded the technique to croplands with varied success.

As more farmers joined, the community committees were transformed into CB:WHIGs. The main function of these groups was to pull together labour for the various cultural practices inherent in the system. These were mostly the same as under the community committee set-up. At this point, the communities went a step further by 'formalizing' the groups into fully-fledged community groups with the intention to help in the exchange of the technology among the rest of the community. Together with the research team technical assistants' support, the model proved to be quite successful. The model was that the communities which were interested in taking up the *IRWH* technique were firstly advised to group together, then the technique would be introduced and demonstrated to the farmers in the group who will then take up the technique and thus be responsible for nurturing those who would enter along the way, with the assistance and support from the research team, especially the TAs.

Most of these groups were partially formalized and some of them were given names in the vernacular, which mostly depicted the spirit and purpose for which the technique was taken up. An example of such a name is Mahata-Mmoho in Yoxford, which literally means "stepping together". This epitomised the fact that the farmers in this community were stepping together into improved agricultural production and improved livelihoods. Table 5.1 indicates some of the names of the community *IRWH* interest groups. As seen from the deduced meanings of the vernacular names of the various groups, the central theme was a realisation of the potential for farmers to start using their available resources. The *IRWH* technique had rekindled a spirit of optimism to once again start producing crops as it promised better returns. The farmers responded positively to it, as well as the call to work collectively. This,

however, was not a new way of working as there were traditional systems that contained collective action like *letsema*[1].

Table 5.1 Examples of the vernacular names of community water harvesting groups and their meaning/purpose

VILLAGE	VERNACULAR NAME	LITERAL MEANING	DEDUCED PURPOSE
Yoxford	Mahata-Mmoho	*Stepping together*	Working together
Mokwena	Re ka kgona	*We can*	Together it is possible
Gladstone	Le tjabile	*It has dawned*	It is time for a fresh start
Woodbridge 2	Tsoga o itirele	*Its time to do it yourself*	A call for members to realise their potential to do something themselves (independently from government assistance)
Tabale	Vukuzenzele	*Wake up and do it yourself*	Help yourself, no else will if you don't
Ratau	Phaphamang	*Wake up/rise*	Start working for yourselves

The groups were then dubbed CB:WHIGs. Of the initial groups, the Yoxford group proved to be the most successful as it managed to increase its membership quite dramatically during the year of inception in 2001. The group was also quite vibrant and creative as they even set up a quasi constitution which governed the running of the group. The leadership was motivated as it included one of the youthful community leaders. As a result the group was even officially registered as an agricultural producer group. To a large extent, the Yoxford example proved to be a driver for the movement towards community-based *IRWH* groups. However, like any community driven initiative, the expansion of the membership brought with it its own challenges and opportunities. One of the major challenges for the expanded groups was the "free rider" problem. This manifested itself mostly by way of some farmers not attending all the activities of the groups but still benefiting from other members. The typical problem was whereby a member would be helped by the whole group to perform certain activities in his/her backyard but then would not partake in the same for other members of the group. This demotivated some members, as they felt cheated and betrayed. In an effort to curb this problem, the groups started having penalties for absenteeism and other general wayward behaviour among members.

Despite the noble initiatives by the communities, some problems persisted or new ones developed. One of the greatest challenges for the community-based groups was the expansion of the technique to the croplands. Most of these fields had a perimeter fence, which was either collapsing or had collapsed completely. Since the members

[1] *Letsema* was usually called at the beginning of the rainy season to encourage farmers to start preparing their fields. This will in most cases be accompanied by people preparing some food or beverages and only those who assisted the host family will be served; however, this was coordinated by the traditional leadership to ensure that everyone who needed help and can afford to host be given a chance to do so.

did not have private ownership of these fields, coupled with a lack of resources, they could not fence their specific sites without the permission of the community leadership in the form of the tribal authority. In some instances, some of the community groups were fortunate to have some perimeter fencing on their croplands, but they faced more challenges as the use of the croplands was governed by community consensus. Traditionally the croplands were used as grazing for domestic animals in winter, but this became a problem for the *IRWH* farmers since the *IRWH* structures are supposed to be permanent. So this meant that in winter, the animals would destroy the constructed basins. It created a conflict in the community which put the interest of the *IRWH* farmers against the whole community, a battle that they lost before it started. Aggravating the problem was the fact that most of the *IRWH* farmers fell in the lower echelons of the power (institutional) structures within the communities, so they found themselves pitted against the stronger members in the community in terms of power. Another issue was that the introduction of *IRWH* improved the economic status of the poorer in society, and thus was faced with friction from the economically powerful (mostly livestock owning) members.

However, with the support from the ARC-ISCW Glen team, a number of meetings were held with the community as well as the leadership to find an amicable solution to some of these problems. To this day, some of the cases remain unresolved, but this has not stopped the CB:WHIGs from continuing with their drive to increase the number of people who are using the *IRWH* technique in the communities. The groups continued to grow, as more and more people took up the technique in their respective communities. While this presented an opportunity it also brought with it some major challenges. For most communities, interest alone in using *IRWH* was not enough as the new entrants and the older members had to contribute towards the running of the groups. This came mostly in the form of stricter operational regulations and the payment of subscription fees. Some people had a problem paying their subscription fees, which ranged from as little as R1 per month to about R10 per month. However, the community committees were relentless in their effort to encourage people to pay their dues towards the upkeep of the groups. In some instances, some members left the groups and started working independently.

From the ARC-ISCW's point of view, it was the informed view that the groups are the ones to come up with solutions to these impediments and the team provided only the necessary support. In an effort to understand the status of CB:WHIGs in the study area, a series of meetings were held with several communities that had CB:WHIGs in place and had implemented the *IRWH* technique. This was done during the week of 16-20 August 2004. The main aim of the meetings was to hold discussions pertaining to the functioning of the CB:WHIGs. Secondly, during the tour a questionnaire was administered to some farmers in the identified communities.

In the meetings with the CB:WHIGs and/or their committees, a set of questions were discussed that aimed at directing the meetings. The interviewers ensured that the farmers kept within the issues to be discussed. The questions for the meetings were as follows, in the order that they were discussed:

- When was the community WHIG established?
- Reason for establishment of the WHIG.
- Identify current or potential challenges of the WHIG.
- How do the participants envisage solving the problems?

- Determine the membership of the WHIG (% proportion of total households).
- Does the community have written rules and regulations for the WHIG?

5.2.3. EVALUATION OF STAKEHOLDERS

To quantitatively and qualitatively evaluate the stakeholders, formative and summative evaluation methods were used. Formative evaluation is a type of research that is conducted while an activity, process or system is ongoing, in order to improve its effectiveness. Summative evaluation, on the other hand, is conducted to reach a decision about the effectiveness of an activity, process or system after it has run its course (Rogers, 1995).

In some instances purposive sampling was used, as specific information was needed that only the farmers could provide. Qualitative methods of data collection were used, such as participatory observation (where the researcher spent a lot of time in this specific project to gain in-depth understanding of the various stakeholders) and in-depth scheduled interviews were conducted with the farmers.

5.3. RESULTS AND DISCUSSION

5.3.1. PROCESSES IN DIFFERENT VILLAGES

The communities selected from the 42 communities for the scheduled visits consisted of the initial two communities (Yoxford and Feloanè) that were included in the inception of the trials, and six other communities (Rooibult, Modutung, Woodbridge 2, Potsane, Klipfontein, Balaclava) that had recently started using the *IRWH* technique.

5.3.1.1. Yoxford village

The group was formed in 2001 and named Mahata-Mmoho. The name implies that the purpose of the group is to work collectively in order to produce crops using the *IRWH* technique. The reasons for the establishment of the group were informed by the incidence of poverty, lack of employment, and the *IRWH* technique availing an alternative to these challenges. However, it should be noted that Yoxford was one of the communities which had the initial *IRWH* demonstration plots.

The farmers also reported that it was easier to use the *IRWH* technique as a group since they could assist each other in the construction, as the initial construction requires an outlay of labour. The group aimed at pulling together their limited resources, especially labour to prepare their plots in time for the next crop. In general the group was quite positive about the *IRWH* technique and appreciated the importance of working together. The group developed ways of helping each other on the technical aspects of *IRWH* technique. The farmers were able to pool together their knowledge and hence were able to identify shortfalls in each other's knowledge of the *IRWH* technique.

While the group in Yoxford was progressive, they still faced some challenges and had identified potential challenges. Some of the challenges included lack of funds to

purchase variable inputs (seeds, fertilizers, pesticides and herbicides), as well as unstable membership (some members were lost due to various reasons, especially movement out of the community to seek employment elsewhere). The farmers stated that the *IRWH* technique was a productive technique, but it had not yet adequately provided enough income for the participants due mainly to poor markets and inability to access proper markets.

An important challenge that the farmers identified was the lack of fences around their croplands. This was important for the expansion of the *IRWH* technique to the croplands from the backyard gardens. In an effort to acquire funding for fencing the fields, they applied to the Free State Department of Agriculture but their applications were unsuccessful. Land tenure was also identified as a major challenge. This is in light of the fact that all land is communally owned and there is no private ownership of land. The result is that all land use systems have to be accepted by the community, and this may prove difficult to solve once the community decides a particular use of a piece of land. At the time of the meetings, there was an ensuing dispute between the WHIGs and the rest of the community. The WHIGs had constructed basins in the croplands, but in winter animals were grazed in the croplands and the animals destroyed the *IRWH* basins. However, the issue was dealt with through the tribal authority and an agreement was reached that the farmers practising the *IRWH* technique were to be allocated a portion of the croplands and then had it fenced-off to prevent the animals from entering their fields.

The farmers were then asked to state how they propose to deal with the challenges. One of the suggestions was that the research team helps the groups to develop a constitution, draw up business plans and provide general information on applying for funding from government departments. On the issue of membership, it was disclosed that membership is per household as opposed to individual membership. Approximately 63% of the households in the community have adopted the *IRWH* technique. A CB:WHIG congress was held on 26 August 2004 at the Civic Centre in Thaba Nchu, where an Executive Board was elected for all the 42 CB:WHIGs practising the *IRWH* technique. This body was named the MB:WHIG. Presently the farmers have their own CB:WHIG that has been transformed into a cooperative (primary cooperative), which reports to a zonal cooperative (secondary cooperative). The zonal cooperative reports to the MB:WHIG, which forms a tertiary cooperative.

5.3.1.2. Woodbridge 2 village

The community is about 10 km from Yoxford and they started their water harvesting group between July and October 2003. Woodbridge 2 is one of the communities that got interested in water harvesting after they witnessed its success in Yoxford and after attending a pre-harvest festival. The group started with a group of five farmers who were working together to construct basins in the croplands. Working in a group was seen as a vehicle to pull together the knowledge about the *IRWH* technique and also to aid support from ARC-ISCW as more farmers could be assisted at a time. The group also helped to remind each other about the proper practices and activities to be carried out (an internal correction mechanism). More importantly the villagers pointed out that they formed their group after seeing the benefits of group effort in Yoxford. The latter's success motivated the farmers in Woodbridge 2 to form a CB:WHIG. Group

efforts were seen as reducing internal squabbles, or politics, as they were able to spread the technique among other farmers in a shorter period of time.

The major challenge that the group had, or foresaw, was the acquisition of inputs and market access for the surplus production resulting from increased production. However, the group felt it had a responsibility to identify a market for its members, for example marketing the produce as a group as opposed to individual marketing. Another challenge was that the group was concerned about what was going to happen to them when the ARC-ISCW, which supported and assisted them, withdraws when the project comes to an end. Presently the farmers have their own CB:WHIG that has been transformed into a community cooperative.

5.3.1.3. Feloanè village

The *IRWH* technique in Feloanè was introduced in 2001. A community committee was formed during 2001 but the leadership was weak and there was constant conflict between the youth and the elderly. A strong CB:WHIG group was established during July 2004. During the introduction phase the only people who had knowledge of the *IRWH* technique were those participating in the demonstration trials. The group was established because more people became interested after being exposed to the demonstration trials and farmers' festivals. These helped farmers realise the importance of the *IRWH* technique, hence an alternative production practice to the *CON* practices. The farmers realised the importance of pulling together resources (mainly labour) as an important reason for the establishment of a stronger group. It was pointed out that it was easier and faster to work as a group to construct and maintain the *IRWH* technique.

While the group had seen the advantages of working together, they expressed the fear of crop theft from the croplands, which were on the outskirts of the community. Secondly, the villagers had low confidence in the agricultural (government) extension services. The main challenge faced by the group was low participation of members in the group activities. This was because some farmers would only participate as far as their own backyards; thereafter their participation in assisting other farmers left a lot to be desired. A second major challenge was the poor attendance of group meetings arranged by the CB:WHIG leadership. This further stifled the progress of the group since the meetings were unable to collectively reach a consensus. On the production side, the farmers lamented the difficulty in acquiring inputs (seeds, fertilizers and chemicals). Tied to that was the shortage/unavailability of hand implements/ machinery to work the cropland. Land tenure regime was also found to be a limiting factor since most of the land was held communally. This meant that the farmers did not have full control of how they used their land as would be the case under private ownership. While this was not really a major problem currently since most farmers are using homestead gardens, it will become more important when they want to expand their operations to the croplands and/or beyond the available land for a household. Even though not all farmers in the community who have access to arable land are using it, those who want to use more than the allocated land cannot simply use land that is not currently in use. Permission has to come from the tribal authority, as well as the rightful 'owners'. Already this issue has been addressed and the farmers now just need fencing material for the croplands.

In spite of the above difficulties, the group leadership is working hard on fully establishing a group and mapping the way forward for the *IRWH* farmers in the Feloanè community. The group holds monthly meetings and has been transformed into a community cooperative. Once a month they send their representative to attend a general assembly meeting where all the CB:WHIGs are represented to discuss issues that affect them and also plan the way forward.

5.3.1.4. Potsane village

Potsane has got some of the more successful farmers in the *IRWH* technique. The group was established in December 2003. The reason for establishment was due to encouragement from the ARC-ISCW (Glen), as well a realisation of the need to pool together labour resources. The research team encouraged and promoted working together and the formation of groups as far as possible. As already stated, the villagers realised that it would be easier to establish the system by helping each other in terms of expending labour and learning together. The group was established to be a reservoir for local technical assistance among the farmers. This allowed the farmers to learn together and thus be able to assist each other during the collective establishment of the system in any member's backyard.

Like the *IRWH* groups in other communities and any new group, Potsane was grappling with the drafting of a constitution for the group. This was found to be important, as it would state the operations of the group. The group currently operates on generally accepted rules and regulations that have been formalized. Another major challenge cited was the unequal size of backyard gardens; this creates problems when farmers have to help each other. They complained that they spent much more labour on the bigger plots as compared to smaller ones. However, the group was trying to find amicable ways of dealing with this discrepancy. Since they could not expand their backyards, the resolution was to partition the area that they would work together on. This was in the form of just helping people with larger plots based only on an average size of the backyards, while for the rest the owners must find other ways to finish off their backyard. In other words the area larger than an average size of backyards stayed the responsibility of the owner. One possibility that was put forward was that the owners of the bigger plots be charged an agreed fee if the group helps in the whole backyard beyond the agreed size. In addition to these operational challenges, the group also cited a poor understanding of the *IRWH* system as a challenge. They needed to be trained more on the operation of the system as most members had just recently started using the technique. This was done by providing scheduled visits by the ARC-ISCW technical assistants and training guidelines were prepared and demonstrated to the farmers during workshops to ensure an understanding of the technique.

Based on the positive impact of the *IRWH* technique, the farmers expanded their operations to the croplands but there were no fences. The farmers, at first, were not certain if they were allowed to only fence their specific fields (about 1.87 ha), but now this has been agreed upon by the tribal authority through the community headman. Currently the croplands for all households have a single perimeter fence, which has collapsed in many parts thus posing the threat of damage to crops by animals.

5.3.1.5. Klipfontein village

The WHIG for Klipfontein was established in October 2003 due to the encouragement of the project team. The reason for establishment was primarily to avail a platform for farmers to learn from and with each other. This would also provide the farmers with a better medium to teach new entrants. The members realised the importance and ease of learning in groups, as they are then able to remind each other. As the system requires an outlay of labour during the construction phase, grouping together was found to be important in establishing the system in farmers' backyard gardens over a short space of time. Working in a group was also important in popularising the system in the community as the members generally appreciate the importance of the *IRWH* technique in crop production for their area.

Despite the ambitious and noble grounds on which the group was founded, it had some challenges, which they deem important for the sustainability of the group and *IRWH* in their community. One such challenge was the lack of implements to assist in the construction of the system at a larger scale. At first some of the farmers had to rely on borrowing from fellow villagers. Problems started when their founding member died in 2004. The community group was infested with problems in that there was another grazing pasture project that had been implemented by the FSDA without prior agreement and involvement of the entire community, but with certain individuals who did not have the blessing of the community. There was an obvious division between the youth of the community and the elderly. It become difficult even to protect the demonstration plot that was within the school compound, in that every year some of the villagers would cut the fence and let the sheep and goats feed on the crops. This created very deep division in the community until a series of meetings involving the MB:WHIG and ARC-ISCW technicians were held to solve the problems. The farmers even used some of the tools meant for the other project to work on their backyards. Peculiar to Klipfontein, the membership was quite low even though the community was one of those where *IRWH* demonstrations were established. After the death of the leader farmer the group lost a lot of members. Thereafter the membership stood at nine households for a long time, which was a worrying issue. This low membership was attributed mainly to community politics that had also spilled over into the group. The group was nonetheless determined to solve some of the challenges and forge ahead. The group was also mostly informal, as it did not have a constitution that governed it. As a result, the group asked for assistance in drafting a constitution, which was offered through the MB:WHIG by the ARC-ISCW.

5.3.1.6. Balaclava village

Balaclava established its CB:WHIG group in October 2002. This implies that the group was one of the few pioneering CB:WHIGs, mainly to pull together the labour resources as well as to obtain information on *IRWH* principles and practices in order to improve their livelihood and thus alleviate poverty. Food insecurity was and still is a common problem in most of the communities.

Poor communication amongst members was cited as an impediment, but over the years this has been addressed. The insufficient number of tools featured prominently among the challenges, especially with regard to expansion to the croplands from the homestead gardens. The farmers were happy with the support that they received from

the ARC-ISCW and encouraged the latter to continue with information dissemination to strengthen the knowledge base of the farmers. They realised the importance that working more effectively as a group was a better medium to recruit more people. The group also suggested that the community groups needed training in leadership and in drafting constitutions for their respective groups. Related to this would be to at least provide guidelines on how to develop a constitution. The ARC-ISCW developed a template constitution that was circulated in all the communities. It was supposed to be used as an example to draft a constitution that suited their own conditions.

5.3.1.7. Rooibult village

The CB:WHIG in Rooibult was established during September 2003. At that time the group only had 18 member households. This group was mainly established through encouragement by the ARC-ISCW. However, the members also realised the potential of the *IRWH* technique to reduce poverty, unemployment, food insecurity and crime. The farmers realised that they get much higher yields with the *IRWH* technique than from the *CON* practice, so the number of farmers involved increased dramatically since its establishment. In addition, the group aimed to reduce total dependence on government support as they would be able to help themselves with the resources at their disposal, this being mainly labour and land, and only ask for assistance to supplement what they cannot produce themselves as farmers, but which was essential for their survival.

The main challenge identified by the farmers was the poor market access for their produce after a good harvest. This was compounded by the fact that the community market was too small to absorb all the surplus produce from *IRWH* farmers, a problem that became more evident as more and more farmers took up the technique. Movement of members out of the community due to various reasons (e.g. employment in the nearby urban areas) was another challenge faced by this group. Natural causes like late rains, pests and weeds (mostly lawn grass) were identified as important challenges. The problems were worsened by the fact that they had no structures to deal with their problems collectively as a group. This challenged the ARC-ISCW to intervene, particularly in giving attention to some of the issues to better equip the farmers to be able to deal with them. As in the other communities, the expansion of *IRWH* to croplands is curtailed by the absence of fences in the crop fields. In addition, it may not be easy to expand to the croplands, as that would require some mechanization. Another challenge which was seen to reverse/impede the gains of the group, was the "free rider" problem whereby people who were assisted in their own backyards would not do the same for others. Also the farmers had unequal plot sizes, which tended to disgruntle the membership and thus reduce collective action in the backyards. The farmers proposed that government fence their fields and also look at the potential of assisting with tractors to help plough the fields to reduce labour in the construction of the basins.

The group started with only 18 members and has since increased to about 80 households. However, despite the tremendous growth in membership the group is still to come up with the rules and regulations with a view to drafting a constitution. At the moment they are operating mostly on commonly agreed group principles even though they have not yet been formalized. The group would also like to formalize itself so that they can be able to access government assistance and improve their operation.

5.3.1.8. Modutung village

In Modutung the CB:WHIG was established in September 2003. The reasons for establishment were mostly similar to those in the other communities. These included encouragement from the ARC-ISCW, the quest to reduce poverty, unemployment and food insecurity. The challenges faced by the group included the encouragement of farmers to work more closely together, absenteeism from group-organized activities and the "free rider" problem. Market access and the lack of fences in the croplands were seen as important challenges to the expansion of the group and the adoption of *IRWH* in the community. However, the group was working hard on ensuring that it consolidates itself. This was to be achieved by more persuasion of the farmers to realise the importance of working together.

5.3.2. MEETINGS WITH SELECTED CB:WHIGs

From humble beginnings the CB:WHIGs have now grown into fully-fledged cooperatives. Currently all 42 CB:WHIGs are being registered as cooperatives at community level. These organizations are the powerhouses for the proper functioning of *IRWH* in the various communities. The groups consisted initially of just a few members, approximately 10 per community in the four communities selected in the beginning phase of the *IRWH* project. These people were tasked with looking after the demonstration plots that were set up in their communities, and organizing the villagers for all the activities and meetings that took place. This arrangement had a profound effect on the adoption of the *IRWH* technique, as well as on the efforts of the ARC-ISCW technicians who visited these communities on a weekly basis to address issues pertaining to the technique. The TAs put a lot of effort into capacitating, supporting and assisting the members, who were trained in the construction and application of the *IRWH* technique and were then able to impart their knowledge to the rest of the community members who were interested in taking up the technique. Credit needs to be given to Yoxford, which used the group approach effectively and achieved a lot from it. Most communities then followed this approach, which was effective in that the ARC-ISCW dealt with farmers in groups instead of as individuals in each community. The success in Yoxford community, however, could be attributed to the fact that they already had a spirit of collective action and a strong presence of youth leadership. These groups were seen as the 'eyes and ears' for the elderly members of the community, and as a result managed to build trust between the villagers and the ARC-ISCW. Moreover, the ARC-ISCW showed commitment to its work, as shown by their emphasis on the establishment of demonstration plots before the farmers could take up the technique. These demonstration plots also helped the villagers to realise the importance of working together.

Although there was tremendous success in encouraging the farmers to work collectively in the adoption of the *IRWH* technique, there were a lot of challenges that cropped up which in most cases were community oriented, in that some of the farmers were not committed in their efforts. For example, when collectively doing backyard-to-backyard preparation, some of the farmers will only participate in their own backyards but not help with those of others. The "free rider" problem was generally seen in most communal settings. For a long-term solution, the different communities decided to form CB:WHIGs in order to have a set of rules and regulations with clearly stated mechanisms for dealing with those who break the rules.

5.3.3. COMMUNITY EMPOWERMENT THROUGH THE CB:WHIGs AND THE MB:WHIG

5.3.3.1. Status of the CBPOs in Thaba Nchu

During the time of writing this report, the CBPOs, or CB:WHIGs, were being registered as cooperatives. Previously in 2005, the farmers had registered as an association but later on realised that their interest or objectives would be better served when registered as cooperatives. Therefore, the ARC-ISCW, together with the MB:WHIG member farmers, FSDTEEA and Thaba Nchu Tribal Authority, undertook an initiative to help in the registration of the various CB:WHIGs into cooperatives. The MB:WHIG, for example, was able to mobilize other farmers to participate in the organizing of a farmers' festival together with the ARC-ISCW on 28 November 2006. An important observation from the meetings with the different community organizations is that farmers do not realise the power they have as collective entities of communities compared to individual communities. This is demonstrated by the fact that the groups almost all listed the same challenges, which they can effectively and efficiently address as a group of communities rather than as individual communities. Market access, for instance, was a real problem but not peculiar to the farmers around the Thaba Nchu area. Due to the small quantities of surplus produce from individual farmers or communities, they are unable to attract or respond to a large enough market, but if they pool all their produce together they could enter into a bigger market and maybe even end up processing their produce to get better prices at a later stage. The farmers have now been taught about markets, marketing and value adding. Since they all shared the same problems in 2004, with the help of the ARC-ISCW the farmers at a congress of CB:WHIGs gave birth to an interim umbrella body called the MB:WHIG. The MB:WHIG was an interim committee established to develop an operational structure of the organization and a constitution, which would be binding upon all member groups practising the *IRWH* technique.

5.3.3.2. Roles and functions of the CB:WHIGs and MB:WHIG

The ARC-ISCW (Glen) facilitated the formation of informal CB:WHIGs for small-scale farmers in 42 communities around Thaba Nchu and Botshabelo that use *IRWH* to produce crops in homestead gardens and small croplands. As the number of farmers and communities using *IRWH* techniques increased, a decision was taken by representatives from each group and community to form a MB:WHIG and this body was named the Tswelelopele Small Farmers Cooperative (TSFC). The association is a semi-formal umbrella body for the informal CB:WHIGs in the communities. The main aims of the two tiers of organizations are to:

- promote the long-term sustainable and viable use of *IRWH* techniques amongst the members and communities (the latter will be achieved in consultation with other stakeholders);
- collectively produce and market crops and thus contribute to reducing household food insecurity, alleviating poverty, and reducing unemployment and crime in the community;
- have a strong body of profitable small-scale farmers that would facilitate movement towards commercial farming.

The above aims were mostly those which informed and consolidated the need to establish and strengthen the already existing like-minded CB:WHIGs to ultimately form the TSFC. The CB:WHIGs were structured such that they are grassroots-based groupings. This meant that while the CB:WHIGs are autonomous in terms of the day to day running of their affairs, they feed into the collective objective of the overall cooperative, the MB:WHIG. The CB:WHIGs are thus entitled to retain their identity and determine how best to operate. They can draw up their own rules and regulations as long as they are not in conflict with those of the umbrella body MB:WHIG.

In general, a CB:WHIG operates at the community level in terms of assisting the members with their day-to-day challenges. These may include the scheduling and arranging of collective labour utilization, the collection of subscription fees, mobilizing farmers to assist each other in preparing the *IRWH* basins, and collectively performing activities like planting, weed and pest control.

5.3.3.3. Operational structure and aspirations of the TSFC

The community groups were initially a forum for farmers to learn together and assist each other in the implementation of the *IRWH* technique. This helped to offset the labour requirements for both the farmers and the ARC-ISCW as it created a forum for the dissemination of information from the research team, as well as providing a channel for feedback from the communities concerned. However, as more farmers showed a willingness to adopt the technology, it proved a useful forum to address them and teach them about the technique. These structures were initially quite informal and had been given names. For example, Yoxford had written their own constitution with the view to being registered formally with the relevant authorities.

The MB:WHIG serves as an umbrella body for all the communities, the purpose being to be able to regularly (once a month) call meetings for all the CB:WHIGs to discuss challenges and issues that arise from individual communities and address them as a collective. The MB:WHIG comprises an Executive Board and General Assembly. The General Assembly is the final decision-making body of the association, whereas the Executive Board is an implementation tool for all the decisions taken by the General Assembly. This was to help ensure that all the decisions were made by the CB:WHIGs, as opposed to the Executive Board making the decisions for the member groups without consultation. It also aimed at ensuring better communication amongst members of the Board who were also members of the community executive committees and thus would be able to rapidly communicate the decisions of the MB:WHIG to the communities. While the members of the General Assembly were elected at community level, the community representatives elected the Board from the General Assembly. However, being elected on the Board requires that a member relinquishes whatever position they held on the community committee.

5.3.3.3.1. Structure of the Executive Board

The Executive Board is the administrative wing of the MB:WHIG, consisting of 11 elected members and three ex-officio members. The ex-officio members act in an advisory position to the Board and include the ARC-ISCW and other stakeholders which are accepted by the General Assembly and thought to be necessary for them to carry out their objectives. These institutions ensure that at least appointed members

abide by the constitution and are available for a maximum term of two full cropping seasons or one year.

The elected members of the board are:

- Chairperson
- Vice Chairperson
- Secretary General
- Administrative (minute) Secretary
- Treasurer
- Publicity Secretary (Public Relations Officer)
- Zonal representatives, each representing one of the five zones.

The roles and functions of the different portfolios are explained in the constitution of the association (Appendix 5.1). The constitution was developed from a consultative process, which was spearheaded by the Board. The consultation took the form of workshops and meetings. The community representatives provided the rules and regulations for each community and these were used to determine the issues that were common among the different communities. These served as cornerstones upon which the constitution was drawn up.

5.3.3.3.2. Aspirations of the TSFC

Since its inception the TSFC's aim was to be a mouthpiece for the farmers from the different communities. The establishment of the association was from a realisation that the farmers had similar problems and aspirations, which needed to be collectively addressed such that the communities could learn from each other and with each other. While an issue may be a serious challenge for one community, another community which had the same problem could perhaps shed light on how they handled it. The association then provided a platform for farmers and researchers to learn from each other and chart a way forward. The purpose of the association and its aspiration is entoned in the slogan/motto of the TSFC which is *Tsoga o itirele*, meaning "Wake up and work for yourself". The association was expected to help the farmers to:

- engage in mutual assistance (constructing the *IRWH* system, planting, harvesting, processing of produce);
- assist in arranging farmer-to-farmer training and other technology exchange activities;
- increase collective self-help capacities of the members;
- increase group members' collective negotiating and marketing power; and
- improve the overall farming conditions of small-scale farmers in the Thaba Nchu area using the *IRWH* technique.

5.3.4. STAKEHOLDER INVOLVEMENT

5.3.4.1. Identification of stakeholders present from the start of the project

The ARC-ISCW was the implementing agency of the project. The farmers and Thaba Nchu Tribal Authority were the clients and major role-players in the project. The success of carrying out the project objectives primarily depended on them. The WRC funded the project, whilst the FSDA on behalf of government and farmers provided

agricultural support through the extension services department. The University of the Free State was represented by the Department of Sociology.

There were a number of people involved in the new agricultural crop production system, and for the project to succeed those involved had to understand and then synthesize their requirements into a cohesive vision with the farmers. However, it is important to note that different stakeholders might have had the same objectives or vision, but different ways on how to attain these objectives. Consultative workshops and meetings were held during the course of the project to make sure that as it progressed there were consultations between the different stakeholders involved. There were also pre-harvest and post-harvest festivals held annually to showcase the ability of the *IRWH* technique to produce good crops under semi-arid conditions. Frequently communicating with stakeholders ensured that they fully understood what the project team was doing and were aware of the progress of the project at all times. All the stakeholders (existing and potential) were invited to participate in all the activities like festivals, information days and workshops and to make suggestions.

5.3.4.2. Roles and functions of the different stakeholders

The roles and functions of the various stakeholders are basically determined by the project's objectives or tasks that have to be carried out by all those involved in the project. Some of the roles are to: (1) fully participate in farmer activities such as festivals and farmers' days, and attend meetings for farmers and stakeholders; (2) support the farmers in which ever way to accomplish their part in the overall project, for example by means of village meetings or visits, or financial assistance where possible on issues related to the project; (3) offer training to farmers especially village committees, CB:WHIGs and MB:WHIG; and (4) assist and be part of the exit strategy. Some of the stakeholders and their roles in the project are discussed below.

5.3.4.2.1. Water Research Commission

The WRC funded the project, and were also responsible for ensuring overall project execution. The WRC funded the first water harvesting project in the 1990s and continued to fund follow-up *IRWH* initiatives. The WRC funded a 3-year water harvesting project entitled "Optimizing rainfall use efficiency for developing farmers with limited access to irrigation water" (Hensley *et al.*, 2000). In this project *IRWH* was compared to the normal conventional tillage technique (*CON*). The WRC then funded a second 3-year project entitled "Water conservation techniques on small plots in semi-arid areas to enhance rainfall use efficiency, food security and sustainable crop production" (Botha *et al.*, 2003). The WRC also sponsored a third water harvesting project in the Free State Province entitled "Socio-economic impact study on water conservation techniques in semi-arid areas" (Kundhlande *et al.*, 2004). With the last two projects it was possible to study the five pillars of sustainability (agronomic productivity, entrenchment of risk, managing of natural resources, social acceptability and economic feasibility) to ensure food security. The short-term data revealed that the *IRWH* technique is sustainable and also contributes to food security. It was argued that the research circle would be completed in full when this newly developed technology (*IRWH*) would be adopted by the rural communities. Given the state of research on the *IRWH* technique the time was ripe to implement the new technology. To achieve this goal the WRC was prepared to fund the current project. With the vision of the WRC as sponsors it was possible to start with detailed research

work on the *IRWH* technique and take it through to the application of the technique in rural villages by means of various projects funded by them.

As a stakeholder the WRC fulfilled more than their role, and even participated in most of the festivals and workshops. They initiated the process to get the Department of Agriculture involved in this project and extend its duration.

5.3.4.2.2. Department of Agriculture

The DoA funded an additional year of the project in order to strengthen the exit strategy. The DoA was also responsible for ensuring project execution. The DoA funded various other *IRWH* projects. They guided the researchers by indicating that they would like to see training guidelines as one of the outputs. The DoA also participated in activities like festivals and workshops.

5.3.4.2.3. ARC-Institute for Soil, Climate and Water

The ARC-ISCW was the institution tasked with the implementation of the *IRWH* technique in rural villages in and around the Thaba Nchu and Botshabelo area. The ARC-ISCW conducted various demonstration trials. They supported the farmers by demonstrating and training them in: how to construct and maintain the *IRWH* system; plant different crops; control pests and diseases; fertilization practices; various management practices; utilization of natural resources; record keeping and budgeting; markets and marketing; the role and function of committees; conflict resolution; communication skills, etc. Regular visits by ARC-ISCW technicians dealt with issues not only pertaining to the technical aspects of the *IRWH* technique, but also on how best to keep the technique sustainable when support from the ARC-ISCW is no longer available. The MB:WHIG and CB:WHIGs (institutionalization) were also formed as a strategy to ensure sustainability, as well as to form part of an exit strategy. The main focus for the formation of CBPOs was to enable the farmers to be able to have bargaining power on the sale of their produce, teach them about value adding, markets and marketing strategies. Some of the assistance from the ARC-ISCW included the provision to farmers of agricultural inputs such as seeds, fertilizers etc. Training workshops and meetings were held periodically to enhance a better understanding of the technique. The ARC-ISCW also linked the farmers with various stakeholders.

5.3.4.2.4. Free State Department of Agriculture: Agricultural Extension Services

The ARC-ISCW wanted this institution to be part of the project from the beginning so as to have a smooth exit strategy. A problem encountered, however, was that there was not enough commitment and willingness from the extension officers to rally behind the farmers in terms of technical support. On 28 October 2002, at the first WRC Reference Group meeting, one member was concerned about the manpower available to support the targeted communities. Mr. Ramanamane from the FSDA Extension and Development Directorate pointed out that there were ten extension officers in his Department who could help with the project. Four of these extension officers would work full time in the Thaba Nchu and Botshabelo area. Unfortunately constant restructuring of the extension personnel occurred. The district manager of extension, Mr. Tshediso Ramanamane, was appointed at the end of 2002, while the head of extension, Mr. Dan Makena, was appointed at the end of 2003. All these changes, and the fact that the extension personnel changed constantly, made it very difficult to build their capacity within the *IRWH* technique and to hand over ownership and responsibility for the successful implementation of an exit strategy to

them. Unfortunately for the project, Mr. Ramanamane, who was doing a very good job at that time, got promoted. A workshop that focused on the empowerment of extension officers to become demonstrators of the *IRWH* system was held on 9 February 2004 at Glen. Eight extension officers from the Thaba Nchu, Botshabelo, Dewetsdorp and Excelsior region attended the workshop. On this occasion it was promised that extension officers would be delegated to assist the farmers who were implementing the *IRWH* technique. However, this promise was not fulfilled. During the pre-harvest festival of March 2004 some of the extension officers were only present just before and during lunch and then disappeared. When they were asked why they did not attend the entire festival they mentioned that they received other work to be completed. On the last day of the pre-harvest festival conducted during March 2004, the farmers confronted Mr. Makena and informed him that they did not see or know the extension officers in their area. They mentioned that the last extension officer they knew was Mr. Madiba who was transferred a long time ago. Mr. Makena promised that the problem would be addressed. During the pre-harvest festival conducted during March 2005, extension officers and farmers from the Eastern Cape attended. They asked where the extension officers from the Free State Province were because they did not see them. During August 2005, a workshop was held in Glen with the ARC-ISCW, extension, farmers and the UFS (Department of Sociology). During this workshop the main aspect was to sort out the work programme. The farmers complained that they never see the extension officers in their villages. The extension officers said that their programme did not allow them enough flexibility to do other things. They had a lot of work to do and they were not the final decision-makers. The ARC-ISCW then asked all three stakeholders to look at the draft programme and see where they could fit in. This was also a problem for the extension officers as they were not sure of their programme. On 3 November 2005 training for fifteen extension officers was supposed to take place, an event that was agreed with them well in advance. Unfortunately only three extension officers arrived almost two hours late. This event was eventually conducted on 15 November 2005. It was agreed that training would be given to extension officers and then they would give the same training to the farmers with the researcher in the background for support. The training workshop was attended by ten extension officers. Various topics on which the extension officers were to be enlightened were prepared in such a way that handouts were issued, followed by a lecture or demonstration in the field. The following topics were covered during the workshop: (1) utilization of natural resources, role and function of *IRWH* technique; (2) planting of different crops using the *IRWH* technique; (3) application and maintenance of the *IRWH* technique; (4) pests and weed control; (5) communication skills and conflict resolution; (6) role and function of committees; (7) markets and marketing; (8) value adding; and (9) record keeping. The extension team were taught on all the aspects mentioned above and were very confident, but this was all in vain as they could not train the farmers because of other obligations. On 17 November 2005 community members received formal training at the Civic Centre at Thaba Nchu from the ARC-ISCW team and not the extension officers as promised, on all aspects of producing your own food using the *IRWH* crop production system. The extension team did not attend this event. They mentioned that it was difficult for them to commit to anything since they would plan for certain events but their management would then tell them to leave everything and do other things.

5.3.4.2.5. FSDA: Research and Management

The FSDA through their LandCare unit funded a 3-year water harvesting project where demonstration trials were conducted on the farms of two trusts, namely Itemeleng and Lekhula. The FSDA also made land available to the ARC-ISCW for field experiments and demonstrations. The FSDA initiated a research forum for the Free State between them and the ARC-ISCW, where possible fields of research were to be identified and discussed. Mr. Siegfried van der Merwe, who heads the Research Section, has been in regular contact with the ARC-ISCW research team. Mr. Van der Merwe also fully participates in activities like festivals.

As a token, in 2005 the FSDA gave the farmers wheel barrows, rakes and seed for their backyard gardens, which was highly commendable on their part to help the farmers. After the WRC Reference Group meeting on 12 April 2006, regular contact between Dr. Masiteng (FSDA, Director of Food Security) and the researchers has taken place. Currently from 6 January 2007, three extension officers volunteered to coordinate the cooperative registration process and offer transport to the farmers.

5.3.4.2.6. Tswelelopele Small Farmers Cooperative

Since the farmers were the recipients of the innovation, the acceptance or rejection of the *IRWH* technique lies squarely on their shoulders. The *IRWH* technique was accepted with open arms by the farmers which was encouraging. The farmers' main responsibility was to learn as much as possible about the technique, which they did. They have successfully implemented the *IRWH* technique at their homesteads with very good results. They took ownership of the technique and know that the responsibility lies with them. A total of 42 villages have implemented the technique and are busy spreading it to other neighbouring villages.

5.3.4.2.7. University of the Free State (Department of Sociology)

The UFS Department of Sociology, led by the late Prof. D.C. Groenewald, contributed immensely in the preparation of questionnaires that were used to get information from farmers and extension officers. Prof. Groenewald also guided the sociological aspects of the study. He produced training material and supported the farmers by training, visits, as well as participating fully in activities relevant to his responsibilities.

5.3.4.2.8. Other stakeholders

Other stakeholders involved in the project were: Thaba Nchu Tribal Authority (TTA), Mangaung Local Municipality (MLM), Free State Department of Health (FSDH), Free State Department of Education (FSDE), Free State Department of Tourism, Environmental and Economic Affairs (FSDTEEA) and Free State Department of Water Affairs and Forestry (FSDWAF).

The TTA allowed the project to be carried out in their villages through the headmen who reported to Kgosi Moroka. Kgosi Moroka also attended the festivals and even participated by doing the welcoming and other sessions at the festivals. Currently the TTA has granted permission to the farmers involved in this project the right to use part of the croplands in their respective villages. The MB:WHIG and the General Assembly meetings are being held at the Barolong Boardroom free of charge.

The FSDTEEA has trained the farmers on what cooperatives are and how they operate. They also trained the farmers, extension officers and other interested members in a one-day workshop organized by the ARC-ISCW on 5 January 2007 on processes involved in registering a cooperative. At the time of compiling this report the following villages were already registered as primary cooperatives: Rietfontein, Springfontein, Balaclava, Tweefontein and Grootdam.

During March 2003, Mangaung Local Municipality sponsored T-shirts that were designed for the farmers in the various villages. Other institutions in these villages and schools work directly with the farmers and their families, for example HIV/Aids and obesity related projects by the Department of Health and Education. These projects directly work in tandem with *IRWH* in that the farmers are encouraged to grow vegetables or crops that will contribute positively to their health in order to avoid a nation of obese individuals. There are other projects, especially at school level, where children were encouraged to get involved in agricultural activities, and where the importance of a balanced diet is encouraged. The Department of Labour, for example, had funded a project through a private company to teach farmers the importance of applying fertilizers and marketing their products. The company targeted farmers who were practising the *IRWH* technique as it was easy to organize them for demonstrations. All these organizations had one aim in mind: to grow crops for the betterment of life, alleviation of poverty and ensuring food security for those concerned. The ARC-ISCW contributed by introducing a technique that allowed them to grow crops to sustain their livelihoods. The ARC-ISCW was also asked to introduce and demonstrate the *IRWH* technique in other districts in the Free State Province. The FSDWAF (Mr. Paul Ntili) were involved in the project, especially in the form of attending festivals and motivating the farmers. They also gave an award to the female farmers involved in *IRWH* in the Free State Province and even took one of the female farmers, Mrs. Mokgothu, to a sitting of Parliament in Cape Town. The FSDWAF involved the ARC-ISCW in their Water Summit during July 2005 and the National Water Summit in March 2006, where presentations were made and posters about *IRWH* were exhibited, respectively; and they even made sure that the then Minister of Water Affairs and Forestry, Hon. B. Sonjica, attended the last day of the pre-harvest festival during March 2006.

5.3.4.3. Stakeholder workshops

Identified and potential stakeholders were invited to all the pre- and post-harvest festivals during the project, which included a workshop as part of the programme, in order to keep them involved and updated about the project. In September 2005 the stakeholders gathered at a Stakeholder Workshop at Glen. The master of ceremonies was Mr. Izak Ntobolong Moloi (Extension Officer, Thaba Nchu). The MEC for Agriculture in the Free State Province, Mr. Casca Mokitlane, delivered a well-prepared welcome address for the various stakeholders. The purpose of the workshop was as follows:

1. To get the relevant stakeholders from different levels together to introduce the project.
2. To reflect on activities, achievements and challenges of the past years.
3. To obtain an endorsement of stakeholders in the selected study areas to conduct the project.
4. To draw up a memorandum of understanding with the stakeholders.

5. To discuss and structure a work programme for the current year.
6. To assign responsibilities to role-players on the tasks to be performed.

The following views were expressed by different stakeholders at the workshop:

Dr. Malcolm Hensley, representing the UFS Department of Soil, Crop and Climate Sciences, mentioned that if the *IRWH* technique could be practised on the entire 800 000 ha of land available east of Bloemfontein, the country, especially the Free State Province, would not talk about poverty anymore but where to sell their produce. He emphasized the need for the stakeholders to be involved in the *IRWH* technique as it is a crucial way of alleviating poverty in the province.

Dr. Sizwe Mkhize of DoA said that the *IRWH* research team looked at the science behind the technique, the appropriateness of the technique or the benefit that people are likely to derive from the technique. He also mentioned that the project needs to be upgraded to a programme rather than a project since it has spread thus far. Finally he challenged the province to take the project further because the FSDA is the leader in terms of *IRWH* research and activity on the ground.

Dr. Andrew Sanewe of the WRC said that the WRC has been involved with the present project since 2002 and it is one of the successful projects funded by his organization. He also said that they are encouraged by the rapid growth of the project in the province. The project has attracted international attention with papers presented in Russia, the Netherlands and Australia. It has also attracted the attention of national government where talks between DWAF and DoA are in the pipeline.

Mr. Dan Makena (District Manager, Thaba Nchu) and Mr. Sieg van der Merwe (Deputy Director: Research, Glen), representing the FSDA, said that the department would continue to offer support to the *IRWH* farmers. Mr. Van der Merwe said that the FSDA intends to take the technique to all districts in the province. The LandCare unit also expressed their interest in the project.

Mr. Molatodi, chairperson of the MB-WHIG which is named TSFC, said that the farmers are grateful for the technique that has helped them to increase their yields, but now that more people are producing food for themselves, they are experiencing problems with the surplus produce. He urged the government to help them in setting up a cooperative where they can sell their produce collectively.

Mr. B. Molawa, Rural Agricultural Manager of Mangaung Local Municipality, expressed his gratitude at being part of the workshop since many studies are conducted in the area and the municipality is not aware of all of them. He pledged that MLM will support the project by selling the *IRWH* concept to all areas in the municipality and he also urged the project team to look at ways to enhance the project so that it changes people's lives.

Dr. Koos Eloff of the ARC-ISCW encouraged the various stakeholders to be actively part of the project and support it.

Prof. Dirk Groenewald of the UFS Department of Sociology said they are working closely with the ARC-ISCW research team in the villages around Thaba Nchu.

A memorandum of understanding was drawn up between the stakeholders that indicated they would like to actively participate and contribute towards the success of the project.

5.3.4.4. Evaluation of the role-players on the exit strategy

The farmers were asked five questions and their responses are presented in the following tables:

Question 1: Do you recognize the organizations presented in Table 5.2?
The results indicated that all the farmers present knew the ARC-ISCW (11) and FSDA extension (11) but only two of the 11 farmers knew any other stakeholders and they only knew the UFS Department of Sociology (Table 5.2).

Table 5.2 Recognized stakeholders

Do you recognize these stakeholders?	ARC-ISCW	FSDA (extension)	Others
Yes	11	11	2
No	0	0	9
Total	11	11	11

Question 2: From which organization do you receive support concerning the IRWH technique?
Table 5.3 indicates that the only stakeholder providing support to the farmers is the ARC-ISCW. Only one farmer stated that he had received support from the agricultural extension services.

Table 5.3 The stakeholders which provide farmers with support

Which of the stakeholders provide support?	ARC-ISCW	FSDA (extension)	Others
Yes	11	1	0
No	0	10	11
Total	11	11	11

Question 3: How do you rate the level of support from these organizations?
The results in Table 5.4 reveal that the farmers rated the ARC-ISCW as having supported them the most. One farmer did receive support from the extension officers but rated it as poor.

Table 5.4 Level of support

Rate, based on level of support	ARC-ISCW	FSDA (extension)	Other
1=good	11	0	0
2=average	0	0	0
3=poor	0	1	0
Total	11	1	0

Question 4: How regularly do they visit?
The results in Table 5.5 indicate that most of the farmers were visited weekly by the ARC-ISCW. Two of the 11 farmers indicated that they get visitations from the ARC-ISCW once a month. The rest of the stakeholders do not visit them at all. While talking to them the technical assistants realized that the extension team either does not visit them or only helps them with other matters outside the *IRWH* technique, for example, giving technical support on how to best sell their animals.

Table 5.5 Time intervals of visits

Visitation	ARC-ISCW	FSDA (extension)	Other
Daily	0	0	0
Weekly	9	0	0
Monthly	2	0	0
Not at all	0	0	0
Other	0	0	0
Total	11	0	0

Question 5: Did the stakeholders provide you with needed information?
The farmers indicated that the ARC-ISCW is providing them with the necessary information to improve on their crop production enterprises (Table 5.6). However, it is worth mentioning that in 2004 the FSDA Food Security Division provided agricultural inputs and tools to some of the villages.

Table 5.6 Provision of required information

Provision of information	ARC-ISCW	FSDA (extension)	Other
Yes	11	0	0
No	0	0	0
Total	11	0	0

5.3.5. CHALLENGES AND LESSONS LEARNT

The establishment of CBPOs in the Thaba Nchu area still faces some challenges that may have reference in other areas where a similar project is undertaken. The most common among the challenges was the "free rider" problem, which seemed to be prevalent in most of the communities, as well as the lack of support from the extension officers in the area. Another major challenge was to define exactly who is a member of the association and who is not. This was mostly aggravated by the fact that some farmers had been working alone but still getting the necessary support, but this problem was attended to and solved.

The CBPOs in the Thaba Nchu area were established in the backdrop of enormous support from the ARC-ISCW through several externally funded projects. This created an environment where the communities expected support indefinitely mostly through agricultural inputs and technical assistance. However, due to the fact that this project was funded for a specified period, the beneficiaries needed as time progressed to take some of the responsibilities as their own. The major challenge currently faced by the community groups (grassroots) is unwillingness by the members to contribute financially to the day to day running of their CB:WHIGs due to the dependency syndrome of most of the communities, who are expecting the ARC-ISCW or the

FSDA to continue providing fertilizers and seed, so they can provide for themselves and make the whole project sustainable.

The subscription fees enable the community leaders to attend meetings. At first there was misunderstanding or mistrust amongst members, which might have led some of the farmers to feel uncomfortable giving their subscription to the community representatives. It is worth noting that some unscrupulous individuals and institutions that employ unprofessional ethics in pushing through their agendas were now using these structures to exploit the farmers. For example, an organization implemented a poorly planned project on hydroponics and claimed to be working together with the ARC-ISCW, but in the end they were exposed by the CB:WHIGs. The latter told this organization to follow the right channels of participatory planning to allow the CB:WHIGs to ask questions rather than have a technology forced upon them.

Like other small-scale farmer producer organizations, there are still important institutional challenges. The association at the General Assembly and Executive Board level is currently fully functional and everyone seems to understand their roles. However, at community level the groups have not yet been fully developed as they fail to identify and understand their linkages with the main body, and most importantly, to collect monthly subscriptions. There is still a need for the farmers to be trained in areas of management, marketing and value adding. Although a number of workshops and meetings were held to address these, more needs to be done. Since producer organizations need to gradually increase their absorptive capacity to fulfil their roles, any strategy aimed at strengthening them should take advantage of their organizational potential and develop it. This should take the form of serious leadership training, where leadership should be able to disburse information to rally the members and inspire them. The leadership also needs to be able to promote cohesion among the membership, which will manifest itself in the form of a community of interest and a capacity to mobilize their interests. These features seem to be lacking in the current CBPOs where most members have not yet taken ownership of their initiatives.

There is a need for training in transparent and efficient systems of accounting, through documented records of the proceedings of all the constituent bodies of the association. Currently, there are still shortcomings in terms of the accurate recording and subsequent distribution of such records to the full membership. While the General Assembly is kept abreast of all the activities and records, there are still some representatives who do not communicate these messages to their communities on time. For the organization to be more viable there is a general need for training on the issues of financial management, administration, operation of the organizations, as well as responsible behaviour by some of the Executive Board members.

Stakeholders need to be involved and should be encouraged to actively participate. Agricultural extension officers, one of the most important stakeholders, should be committed towards development projects and therefore be fully involved and actively participate at all times.

5.4. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The farmers involved in the *IRWH* technique formed producer organizations with a structure that is illustrated in Figure 5.1. In terms of company registration, CB:WHIGs were registered as *primary cooperatives* and the MB:WHIG as a *secondary cooperative* according to the Cooperatives Act No. 14 of South Africa of 2005. The TSFC, with the help of the ARC-ISCW, has a fully functional constitution that governs them on how the primary and secondary cooperatives should operate and how each member of the organization is expected to carry forward the mandate of the TSFC. The TSFC's main aim is to reduce food insecurity, alleviate poverty, improve their living standards, contribute to the creation of employment opportunities and empower themselves through the application of the *IRWH* technique.

As illustrated in Figure 5.1, the TSFC operates at three different but complementary levels (MB:WHIG, zonal and community levels). There is the Executive Board, the General Assembly, both with a sub-sector of zonal representatives, and then the CB:WHIGs. The Executive Board and MB:WHIG operate at municipal level including all the CB:WHIGs, while the zonal representatives are only responsible for a block of communities that are geographically closely located in the same zone. It was decided that the TSFC should affiliate to any relevant body or authority that advances the same objectives as that of the TSFC, as long as it is not exploitive, is legal, is not unscrupulous and is within the bounds of their constitution.

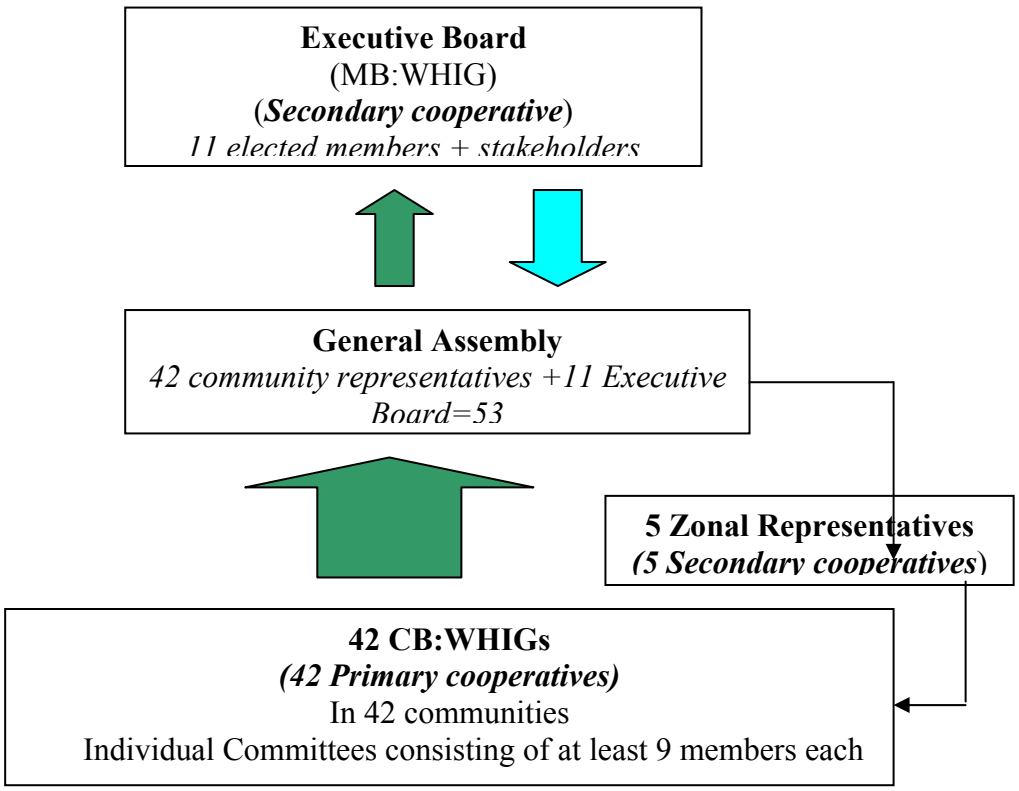


Figure 5.1 Diagram illustrating the various organs that constitute the TSFC.

The ARC-ISCW (Glen) team has trained the extension officers, farmers and especially all the leaders of the TSFC on: conflict resolution, communication skills, role and functions of committees, markets and marketing, value adding and the importance of keeping records. Training was also done on all technical aspects that are important for the *IRWH* technique, for example: utilization of natural resources; role and function of *IRWH* technique; construction of basins; planting of a variety of crops; weeding, pest and disease control; importance of applying fertilizers; maintenance; and keeping rainfall data. The ARC-ISCW (Glen) team has also conducted a number of demonstration trials in the target area.

Before these structures were created, the ARC-ISCW (Glen) team would attend to farmers individually but this created problems. For example, logistics and providing coordinated technical support by the ARC-ISCW TAs were problematic. The TAs at times would find themselves spending more time attending to problems associated with the *IRWH* technique for a particular zone and yet neglecting other zones. But after the CB:WHIGs were formed it became easier for the TAs to plan to meet the farmers in groups, communicate non-contradictory messages more distinctly and do a lot more than they could have achieved if the community committees were not formed. Even after the formation of these committees, some of the farmers took time to really understand the functions of the responsibilities of the community representatives.

The TSFC made it possible for the *IRWH* farmers to meet at least once a month to share their successes and failures, pave the way forward for the future, and meet the various stakeholders to share information. It also gave the farmers more bargaining power. It protected them from unscrupulous people who came with projects under the pretence that they are working together with the ARC-ISCW. Some of these unscrupulous alleged stakeholders were taken to task by the farmers, especially when they realised that an innovation was not going to benefit them at all. The farmers wanted to be involved in the planning and execution of some of the tasks at management level to enable them to develop and be capacitated.

There were other benefits that came with the formation of these structures in that there was recognition by various stakeholders, for example government, municipality, tribal authority and many more. The farmers are now able to agree on the selling price for a certain product, for example the price of 25 litres of shelled maize if bought from any of the communities. They will also be kept up to date on how much money they had deposited into the bank in terms of their subscriptions and contributions towards the organization. Like all other small-scale farmer producer organizations, there are still important institutional challenges. The association at the General Assembly and Executive Board level is currently fully functional and everyone seems to understand their roles. However, at community level the groups have not yet been developed fully as they fail to identify and understand their linkages with the main body. But in general, there is clear appreciation that efforts should be made at grassroots level to train the leadership, and training has been provided in terms of workshops for the farmers who are in positions of leadership.

To crown it all, the farmers organized through the MB:WHIG a ‘post-harvest farmers festival’ on 28 November 2006 which was a huge success. This is an indication that this is just the beginning and bigger things are still to come. As a way forward, the

farmers together with the ARC-ISCW have realised that there is an urgent need to create marketing structures that would ensure that both their produce and organization is sold to the outside world.

In terms of stakeholder involvement, from the beginning there were only a few stakeholders involved in the *IRWH* project, but as time progressed a number of others came on board. The FSDTEEA became involved to encourage the farmers to register their co-operatives. MLM and TTA also bought into the project owing to the fact that it is their farmers who are benefiting from this technique. Most of the stakeholders involved played a role in one way or another, but some were not fully committed to the project. An example is the extension officers who only started showing commitment to the project in mid-2006 through pressure from the ARC-ISCW, MB:WHIG and Dr. Masiteng. The farmers are presently at a critical stage in the exit strategy of trying to do things on their own rather than being helped by the ARC-ISCW. The objective was to give ownership of the project to the farmers thus ensuring its sustainability.

It is concluded that the ARC-ISCW has: 1) exposed and involved various stakeholders to the project; 2) empowered the farmers through demonstrations, training and capacity building actions; and 3) facilitated the formation of institutions, in order to pave the way for a successful exit strategy. Furthermore the formation of the CB:WHIGs and MB:WHIG was a worthwhile exercise in that it enabled the ARC-ISCW and other organizations to work and communicate with the farmers in a more coordinated fashion. Most importantly the farmers have been empowered to be able to communicate in one voice and also have more bargaining power to avoid exploitation. However, agricultural extension in the Free State Province has not shown the necessary commitment and participation. A number of reasons were put forward by individual extension officers for their failure to participate fully.

It is recommended that an exit strategy should form part of all development projects and that these projects should be conducted over a period of more than three years in order to implement a successful exit strategy and thus be sustainable. The farmers should continue with registration as cooperatives in order to have more bargaining power. The farmers in positions of responsibility are capacitated with leadership and management skills in order to be able to lead the TSFC farmers to greater heights. Agricultural extension should be fully committed and involved in order for development projects to be sustainable. It is also recommended that agricultural extension policy and structure in South Africa need to be streamlined to support and run development projects that address important issues like poverty alleviation and food security.

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6. TRAINING GUIDELINES FOR TRAINERS AND FARMERS

6.1. INTRODUCTION

Once the *IRWH* technique was adopted it expanded faster than planned. The technique was supposed to be implemented in only four communities, but when other neighbouring communities heard about it they wanted to implement it too, which is why the *IRWH* technique it is now being applied in 42 communities. Therefore, training the extension officers and the farmers on the *IRWH* technique was an important part of the diffusion process. As the number increased, it became impossible to satisfy individual farmer's training needs in the required time and so the development of training guidelines was initiated. But during the process it was realised that colourful and easy to understand information would be more appropriate.

The Department of Agriculture, who funded the final phase of the project, suggested that training guidelines must be developed. The question of what needed to be included in the training manuals was investigated. To get the full benefits of *IRWH* the farmers should grasp the technique properly. Inclusion of the procedure for planting various crops (e.g. planting depth, intra-row and inter-row spacing and fertilizer application rate) is also important, as well as issues to do with the general maintenance of the *IRWH* structures, marketing of produce, value adding, and record keeping.

After the formation of the CB:WHIGs and MB:WHIG, discussed in Chapter 5, it became easier to arrange meetings, farmer training workshops, and an extension officer training workshop.

6.2. MATERIALS AND METHODS

6.2.1. TRAINING MANUALS FOR FARMERS AND EXTENSION OFFICERS

A multi-disciplinary team of the ARC-ISCW, including the UFS Department of Sociology, prepared informal training manuals for the farmers and extension officers. Figure 6.1 portrays part of a farmer group that was involved in a training session.

The topics covered were: utilization of natural resources, general background of soils in the Motheo district in the Free State Province, role and function of the *IRWH* technique, planting of 13 different crops, application and maintenance of the *IRWH* technique, pest and weeds control, communication skills, conflict resolution, role and function of committees, markets and marketing, as well as value adding. Training workshops were organized to train first the extension officers and then the farmers.



Figure 6.1 CB:WHIG members attending a training meeting on 24 July 2006.

6.2.2. TRAINING GUIDELINES FOR FARMERS AND EXTENSION OFFICERS

After the development of the training manuals, which were being improved every year, the foundation for the creation of training material for the *IRWH* technique was laid. A multi-disciplinary team from the ARC-ISCW comprising an agronomist, agrometeorologist, soil scientists, sociologist, agricultural economists and a graphic designer developed the training guidelines. As part of the development process, the farmers and extension officers were to evaluate the ease with which both the farmers and extension officers were able to understand the material contained in the guidelines. For the farmers, the ARC-ISCW TAs would give the training guidelines to a farmer of their choice to check whether its content is easily understood. This was done with a reasonable number of randomly selected farmers. There were also formal sessions in the form of meetings and workshops with the 42 CB:WHIG chairpersons where presentations were made to further check if the material was relevant. Where farmers or extension officers felt that the guidelines were was either too simple, complicated or not understandable in dealing with the various technical and social aspects of the *IRWH* technique, adjustments were made. Most of the representatives would come to the meetings equipped with concerns from other community farmers who would either raise their concerns on certain issues with the guidelines or contribute to how they could be improved for ease of understanding (Figure 6.2).

Dealing with extension officers proved to be problematic, since even trying to convene a meeting with them, let alone getting feedback, in most cases proved futile. But those who looked through the extension officers training manual did their best to offer suggestions on the content. Seven ARC-ISCW TAs also worked through the guidelines and came up with suggestions or improvements.



Figure 6.2 MB:WHIG Executive Board training meeting on 18 October 2006 where the training guidelines were tested.

6.3. RESULTS

Colourful training guidelines for farmers and extension officers were developed, which are available from the Water Research Commission (Extension Manual; Volume 2 of this report). These guidelines were introduced to the farmers and stakeholders on 28 November 2006 at a post-harvest festival (Figure 6.3).



Figure 6.3 Introduction of training guidelines to approximately 1500 farmers on 28 November 2006.

6.4. SUMMARY

Colourful training guidelines for farmers and extension officers were created as one of the outputs of this project. Training manuals developed during the project created a very good platform for the training guidelines. The guidelines were tested and evaluated by the researchers, TAs, farmers and extension officers, whose suggestions and improvements were included in the final document.

7. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1. GENERAL DISCUSSION

Food insecurity, poverty and unemployment are serious problems associated with resource-poor rural households, especially in areas where water is the scarcest natural resource. The situation is aggravated where rainfall is highly variable over time and space, in addition to clayey soils that are difficult to manage. In semi-arid and sub-humid areas, water is the main factor limiting crop productivity. It is therefore the main factor determining the "people carrying capacity" of agricultural land. In large areas of the Free State Province, rainfall is marginal for crop production without irrigation. In these areas most of the rainfall occurs in the form of heavy thundershowers that result in considerable amounts of runoff. Soil water losses due to evaporation are also very high. This results in low yields or most of the time no yield at all. To combat this problem, water harvesting can be used to maximize crop-available water for increased yields.

Water harvesting is the process of concentrating rainfall as runoff from a larger area for use on a smaller area. Rural communities can benefit greatly from the use of the in-field rainwater harvesting technique developed by the ARC-Institute for Soil, Climate and Water at Glen in the Free State Province, through a project funded by the Water Research Commission. This innovative water conservation technique has the potential to reduce total runoff to zero and evaporation from the soil surface considerably, resulting in increased yields due to increased plant-available water. Intensive field experiments on clay and duplex soils, conducted over a period of six seasons, indicated that *IRWH* increased maize and sunflower yields by as much as 50%, compared to conventional production techniques. Research results over a number of years have indicated that the *IRWH* technique is sustainable in terms of increased agronomic productivity, entrenchment of risk, conservation of the natural resources base, social acceptability and economic feasibility. These projects were funded by the WRC, Department of Agriculture, Free State Department of Agriculture and ARC-ISCW. The research circle would have been completed in full when the *IRWH* technique was carried over to the rural communities in the Thaba Nchu area. The time was ripe to implement this technology. Therefore the WRC approved and funded the present project that was initially planned to be conducted over a period of two years and implement the *IRWH* technique in only six rural communities around the towns of Thaba Nchu and Botshabelo. The project had two main objectives: (a) to exchange technology (*IRWH*) as effectively as possible with the owners of small areas of land, those who have access to communal land and to FSDA officials (especially those of the Extension services); and (b) to assist and support the farmers and extension officers with the application of the *IRWH* technique.

The technology exchange process expanded so rapidly when many more households and communities than initially anticipated implemented the *IRWH* technique that the need to implement a proper exit strategy for the new communities and households arose. The project duration was extended and the DoA agreed to fund the extension period with the focus on the implementation of an exit strategy. An additional objective was added to the initial two objectives.

This project had three objectives. The extent to which each of these has been achieved will form the basis of the discussion in this chapter.

(A) To exchange technology (*IRWH*) as effectively as possible to the owners of small areas of land, those who have access to communal land and to Department of Agriculture officials (especially those of the Extension section).

Communication methods used to disseminate *IRWH* technology as effectively as possible to the owners of small areas of land, those who have access to communal land and to Department of Agriculture officials were a combination of individual, group and mass approaches. Mass approaches used were local radio stations, television stations, video, brochures, pamphlets, leaflets, training manuals, newsletters, scientific publications, songs and posters. Group approaches used were on-station and on-farm demonstration plots, on-farm trials, focus group discussions, seminars and conferences, workshops, short courses, training sessions, a computer program, 3D models, support by ARC-ISCW technicians, farmers' and information days, and festivals. The individual method included activities like visits (office or farm), letters, telephone calls and informal contacts.

Twenty-eight demonstration plots were set up during the course of the project. Sixty-eight oral and eleven poster papers were presented at scientific congresses, symposiums or workshops during the project. Twenty-four of these presentations were international. Five pre-harvest and three post-harvest festivals, four formal training sessions and three formal workshops for the farmers, three formal training sessions and four formal workshops for extension officers, three information or farmers days, three exhibitions and five open days were conducted during the project. Besides the formal training and workshops, informal training and workshops were also conducted at the festivals, together with many informal training sessions in each of the 42 communities. One radio interview, one video/CD production about *IRWH*, two physical interactive 3D models, a simple computer model visualizing the *IRWH* technique with the rainfall-runoff-infiltration processes according to different rainfall events, two TV appearances, one article in a local newspaper (Volksblad), one article in the official newsletter of the Department of Agriculture (AgriNews), one article in the WRC magazine (Water Wheel), and two articles in the Go Farming magazine were produced during the course of the project.

In-depth interviews from a structured questionnaire were conducted with 240 households to evaluate the different communication channels used in this study to establish 'best practices' in technology transfer. The different communication channels evaluated were demonstration plots (group), drama (mass), video (group and mass), 3D model (group), posters (mass), focus group discussions (group), support by ARC-ISCW technicians (individual and group), and festivals (group and mass). Specific indicators for success of the technology exchange process used in this study were: a) number of people attending technology exchange action; and b) people's opinions of the different technology exchange actions or tools (effectiveness). Results indicated that festivals was the most successful communication channel, followed by demonstration plots, support from ARC-ISCW technicians, showing the *IRWH* video and focus group discussions. These were identified as the top five communication channels. The reason why festivals did so well can be attributed to the fact that they

included a number of different communication channels, like farmer to farmer training, demonstration plots, focus group discussions, workshops and training.

As well as evaluating the various individual communication channels, different channels were used at different stages of the technology exchange process since in most cases at least one of them will convey the correct messages to an individual or group. It was observed during the course of the project that at different stages in the technology exchange process certain communication channels played a specific role. During the initiation phase, video, pictures and posters played an important role to introduce the *IRWH* technique for the first time. Thereafter the 3D model was a very good communication channel to explain and demonstrate the differences between *CON* and *IRWH* since it explained the principles of the *IRWH* technique. Demonstration plots, when used correctly, presented the opportunity to involve the farmers from the beginning (application and implementation) all the way through to the end of the growing season (harvesting) and the fallow period. At the demonstration plots activities like application of the *IRWH* technique, planting of various crops, fertilization, weeding, insect and pest control, harvesting and maintenance were demonstrated. The farmers were encouraged to participate in these actions in order to master them. This presented the opportunity for the farmers to be involved as if they were demonstrating the technique themselves. It also helped with ownership of the technique. Focus group discussions and support from the ARC-ISCW technical assistants played a very important role to mobilize the individual farmers and communities, address problems as they appear, and motivate and encourage the farmers. Festivals was the tool that linked all the above mentioned together, through the use of different communication channels. They created excitement, motivated and encouraged the farmers. Festivals contributed towards the explosion of the use of the *IRWH* technique in the target area. This is one of the best communication channels to motivate and encourage people and contributed towards maintaining the momentum. It also presented a fantastic platform to communicate with each other and to convey the intended messages. Festivals also presented the perfect opportunity for the farmers to be recognized for their efforts, hard work and dedication.

The very successful technology exchange phase was the result of different communication channels used during various stages of the process, commitment, passion, good planning and a lot of hard work from the project team.

(B) To assist and support the farmers and extension officers with the application of the *IRWH* technique.

While collaboration with the Free State Department of Agriculture was challenging, a lot of inroads were made in terms of building capacity within and among the communities that participated in the project and ultimately implemented the *IRWH* technique. Even though the project team gave all the technical and material support, extension officers and farmers were correctly made aware that the project will come to an end, by which time they should be in a position to continue on their own. In order for this to happen, extension officers and farmers were given technical training which they also had to share with new entrants. Many capacity building activities took place. The idea was to first train the extension officers, where after they were supposed to conduct the same training for the farmers, with the project team as

backup. Initially the ARC-ISCW TAs were responsible for demonstrating the *IRWH* technique but as more and more farmers took up the technique the ARC-ISCW relied on the support from leader farmers to guide, help and assist with the new entrants. The TAs focused on the construction of the basins, planting of various crops and maintenance. Added to that, farmers were encouraged to work in groups in order to minimize mistakes in construction and planting. In each group there would be those who had proven to be competent as leaders to guide others. These groups started growing as more farmers and communities took up the technique and led to the establishment of community-based water harvesting interest groups in each community. The ARC-ISCW (Glen) facilitated the formation of informal CB:WHIGs for small-scale farmers in 42 communities around Thaba Nchu and Botshabelo that use *IRWH* to produce crops in homestead gardens and small croplands. As the number of farmers and communities using the *IRWH* technique increased, a decision was taken by representatives from each group and community to form a municipal-based water harvesting interest group named the Tswelelopele Small Farmers Cooperative. This association is a semi-formal umbrella body for the informal CB:WHIGs in the communities and serves as a mouthpiece for all the farmers as well as a forum to discuss common challenges with the project team or any other stakeholder. Amongst the institutions that were co-opted into the MB:WHIG were the municipality, tribal authority and local agriculture office.

In general, a CB:WHIG operates at the community level in terms of assisting the members with their day to day challenges. These may include the scheduling and arranging of collective labour utilization, the collection of subscription fees, mobilizing farmers to assist each other in preparing the *IRWH* basins, and collectively performing activities like planting, weed and pest control. The MB:WHIG serves as an umbrella body for all the communities, the purpose being to be able to regularly (once a month) call meetings for all the CB:WHIGs to discuss challenges and issues that arise from individual communities and address them as a collective. The MB:WHIG comprises an Executive Board and General Assembly. The General Assembly is the final decision-making body of the association, whereas the Executive Board is an implementation tool for all the decisions taken by the General Assembly. This is to ensure that all the decisions are made by the CB:WHIGs as opposed to the Executive Board making decisions for the member groups without consultation. It also aimed at ensuring better communication amongst members of the Board who were also members of the community executive committees and thus would be able to rapidly communicate the decisions of the MB:WHIG to the communities. While the members of the General Assembly were elected at community level, the community representatives elected the Board from within the General Assembly. However, being elected to the Board requires that a member relinquishes whatever position they held on the community committee.

The ARC-ISCW (Glen) team has trained all the leaders of the TSFC in conflict resolution, communication skills, role and functions of committees, markets and marketing, value adding and the importance of keeping records. Training was also given on all the technical aspects that are important for the *IRWH* technique, e.g. construction of basins, planting of a variety of crops, weeding, pest and disease control, applying fertilizers, maintenance and keeping rainfall data.

Before CB:WHIGs and MB:WHIG structures were created, the ARC-ISCW (Glen) team would attend to farmers individually, but this created problems. For example, logistics and providing coordinated technical support by the ARC-ISCW TAs were problematic. The TAs at times would find themselves spending more time attending to problems associated with the *IRWH* technique for a particular zone but neglecting other zones. After the CB:WHIGs were formed it became easier for the TAs to plan that they could meet the farmers in groups, communicate non-contradictory messages more distinctly and do a lot more than they could have achieved if the community committees had not been formed. From humble beginnings the CB:WHIGs have now grown into fully fledged cooperatives. These organizations are the powerhouses for the proper functioning of *IRWH* in the various communities. The groups consisted initially of just a few members, approximately ten per community in the four communities selected in the beginning phase of the *IRWH* project. These people were tasked with participation on the demonstration plots that were set up in their communities, and organizing the villagers for all the activities and meetings that took place. This arrangement had a profound effect on the adoption of the *IRWH* technique, as well as on the efforts by the ARC-ISCW technicians who visited these communities on a weekly basis to address issues pertaining to the technique. The TAs put a lot of effort into capacitating the members, supporting and assisting them. The members were trained in the construction and application of the *IRWH* technique and were then able to impart knowledge to the rest of the community members who were interested in taking up the technique. The ARC-ISCW dealt with farmers in groups instead of as individuals in each community. The ARC-ISCW showed commitment to its work as shown by their emphasis on the establishment of demonstration plots before the farmers could take up the technique. These demonstration plots also helped villagers to realise the importance of working together.

During group discussions and meetings, farmers shared their success stories and challenges, and the communities and individual households were taught to set goals and work out an action plan in order to achieve those goals. The TAs drew up a schedule in which they planned their group discussions with the various communities, which were conducted on a monthly basis. They also conducted training on various aspects during the group discussions. In the beginning the TAs drew up an agenda, conducted the meetings and kept minutes. Later on some of these responsibilities were given to the farmers in order to build their capacity. This has progressed in such a way that the TAs now only attend the meetings and contribute wherever they can. Group discussions have also progressed in such a way that the MB:WHIG Executive Board and the General Assembly conduct meetings every month. These are also in the form of a group discussion.

A number of capacity building actions specifically about the *IRWH* system took place during the duration of the project with extension officers, youth workers and farmers in the form of training courses and workshops. Formal and informal educational sessions were first conducted with extension officers, and thereafter the extension officers and researchers conducted the same training for the farmers. Educational training sessions did not focus solely on *IRWH* but addressed much broader topics. Training focused on different soil types, crop nutrition, weed control, insect control, management practices, utilization of natural resources, record keeping and budgeting, markets and marketing, the role and function of committees, conflict resolution, communication skills, etc. Formal and informal educational training courses, pre- and

post-harvest focus group discussions, information days, farmer-to-farmer training and water harvesting festivals over periods of four to five days were also used to build the capacity of farmers. During the focus group discussion, certain aspects were discussed and a lot of planning and goal setting took place. Apart from the formal capacity building actions the farmers received knowledge each day the technicians and the researchers visited them. The farmers are now able to apply the *IRWH* technique, plant different crops and maintain the system. They have also developed in such a way that they are using the *IRWH* technique very successfully to produce food and are able to conduct farmer-to-farmer training.

Results of the expansion of the *IRWH* technique indicated that during the first growing season (2001/02) six households of backyards in four communities applied the *IRWH* technique. By 2002/03 this had increased to 108 households in six communities, and in 2003/04 the number had further increased to 400 households in 37 communities. The number of households in the communities that applied the *IRWH* technique during the 2003/04 season varied between one and 55 families per community. Before planting time for the 2004/05 season the number had further increased to more than 1033 households in 42 communities and one trust farm. The number of households in the communities that applied the *IRWH* technique before the 2004/05 season varied between three and 100 families per community. These results reveal a phenomenal increase, over a relatively short period of time, in the application of *IRWH* in homestead gardens. It seems that this result was due to the combined impact of an efficient extension programme from the ARC-ISCW, effective communication channels and a successful new crop production technique, which was self-demonstrating.

Various motivators and demotivators were identified that influenced the adoption process of the *IRWH* technique. The identified motivators were: create excitement, leadership-pro, establish structure, collective action, positive sanctions, good communication/co-ordination, good yield, regular meetings, festivals, video, action plan and goals, maintenance (capacitated farmers), communication channels, income from *IRWH,* a simplistic technique and being able to see the benefits from the first year. The demotivators were: project overload, cultural issues, community politics, lack of respect for each other, RDP houses, drought, job opportunities, leadership-anti, confusion, cliques, subscription fee, dysfunctional committees, unfulfilled promises, lack of tools and dependency syndrome.

The correct way to enter a community is to make an appointment with the headman. The headman must be involved and explained to exactly what it is all about. After his permission to continue, the same meeting is called with the community. During this meeting pictures could be shown of the *IRWH* technique, the video and the 3D model. After the farmers show their interest, arrangements can be made for another meeting to demonstrate the application or the implementation of the *IRWH* technique. For this purpose, an independent plot chosen by the farmers must be used as a demonstration/ training plot. This may be in a school, church etc. All future activities will take place on this plot. This is where the farmers are taught how to construct the basins, plant a variety of crops, weed and insect control, fertilization, harvesting and maintenance. The TAs first demonstrate the activity where the farmers would do it themselves. The farmers are then encouraged to elect a committee and hold regular meetings. The TAs explain the importance of a committee, how to elect one, its functions and role. As

soon as the committee is elected the TAs work hand in hand with the committee on the progress of the community. This does not mean, however, that they will no longer work with farmers individually or as groups. They can still have one-on-one discussions with farmers and attend the planned meetings. The TAs encourage the farmers to write down their goals and draw up an action plan, of which they make a copy and constantly refer to. The TAs keep on visiting the farmers, motivating and supporting them by using one of the many communication channels.

When some of the farmers were asked to comment on the project at a stakeholder workshop, they replied as follows:

Mrs. Martha Shuping from the community Springfontein said "I don't know how I could ever have survived without the *IRWH* technique. When people are fast asleep I work because I know what I am going to get out of it. My backyard is full of basins at the moment. I work from 5 am till late at night. I am very excited because it's the very first time that I am taught something and can do it with no problem."

Mrs. Selina Mokgothu from Potsane said "I am very thankful to this new technique and the information given to us by the ARC-ISCW people. This technique has helped a lot, as I am able to plant twice and eat much more than most people would. I am a very active woman and have a God-given talent to lead people. In our village we have a committee which works and all our money matters are handled correctly."

Mr. Daniel Thagane from Sediba commented "The *IRWH* is a good technique and a farmer can actually make a lot of money from it. The people from the ARC-ISCW have taught us how the basins are made, how to clean them and how to plant. They constantly visit to encourage and motivate us. What is left is for us to take the technique further and prove to them that what they did was not a waste of time."

Mrs. Olivier from the village Gladstone said "Since *matangwana* (*IRWH* in Sotho) was introduced to me, I eat and sell my produce. I always have money as I spend less on groceries. I am a woman and must provide for my family. God has given me the people from the ARC-ISCW to assist me, and I am not going to waste this opportunity. In the past, farmers worked very hard and received next to nothing, but now the farmers using this new technique, work hard and get a lot of food to feed their families."

(C) Produce guidelines for farmers and trainers in *IRWH*.

Colourful training guidelines were created for farmers and extension officers. Training manuals developed during the project created a very good platform for the training guidelines. The guidelines were tested and evaluated by the researchers, TAs, farmers and extension officers. Suggestions and improvements were included to produce the final document.

7.2. CONCLUSIONS

The overall main conclusion is that the farmers in the Thaba Nchu and Botshabelo area are capacitated with the know-how to produce their own food using the *IRWH*

technique. Their capacities were built by the use of various communication channels at different stages of the technology exchange process. The farmers and extension officers were assisted and supported with the application and utilization of the *IRWH* technique. The more than 1000 households that adopted the *IRWH* technique successfully in a short time span is an indication that the technology exchange process was a success. The successful application and expansion of the *IRWH* technique was the result of a combined impact of the use of effective and creative communication channels, an efficient extension programme by the ARC-ISCW and a successful and impressive new crop production technique, which was self-demonstrating. But even the best communication channels cannot guarantee success without effort (hard work), passion, excitement and a good action plan. The formation of the CB:WHIGs and the MB:WHIG was a worthwhile exercise in that it enabled the ARC-ISCW and other organizations to be able to work and communicate with the farmers in a more coordinated fashion. Most importantly the farmers have been empowered to be able to communicate in one voice and also have more bargaining power to avoid exploitation.

The components of an exit strategy are to (a) involve stakeholders, (b) institutionalize structures and groups, (c) plan and conduct demonstrations of the technology, (d) train extension officers and farmers to empower them with knowledge and skills, and (e) exchange the technology and information. Taking the above mentioned into consideration it can be concluded that a successful exit strategy was implemented by the ARC-ISCW.

The application of the *IRWH* technique has contributed towards:

a) Higher crop yields,
b) Greater crop biodiversity,
c) Household food security,
d) Job opportunities,
e) Higher incomes,
f) Better health,
g) Educated farmers,
h) Reduction in crime in the community, and
i) Better social lives.

7.3. RECOMMENDATIONS AND ADDITIONAL RESEARCH NEEDS

(a) Farmers and extension officers

- Apply the *IRWH* technique to obtain higher yields.
- Make optimum use of backyards and croplands to fight food insecurity and poverty.
- Demonstration plots play an important role in unlocking the potential of the cropland.
- Extension officers should be demonstrators of new technology and fully participate in similar programmes.
- Agricultural extension should be fully committed and involved in order for development projects to be sustainable.
- Extension officers should use various communication channels during technology exchange processes. By doing so the possibility of conveying

the correct and intended message to an individual or group is much higher as compared to the use of a single communication channel. Different communication channels assist to convey different aspects of the message to the farmers.

- Various motivators and demotivators were identified that could influence the adoption process of the *IRWH* technique in the target area. Extension officers must take note of these and manage them in an appropriate way.

(b) Administrators and policy-makers

- A very good foundation has been laid for people in rural communities in the study area to become self-sufficient, produce more, and earn a good income using the *IRWH* technique. A long-term efficient extension programme should be encouraged and developed to maintain the current status and expectations. It is a long-term process that should be continued in the future and expanded to other areas of South Africa.
- When a new crop production technique is to be introduced into rural communities, one should first start with the homesteads. These provide a simple environment for promoting a new technique through training. The starting point should focus on food security and later expand to larger-scale operations.
- The farmers in positions of responsibility must be capacitated with leadership and management skills. There is also a need to popularize and motivate for the adoption of a constitution with relevant alterations to meet the local conditions.
- A future focus should be on the development of the croplands of rural communities into sustainable enterprises.
- Before a new project starts in a particular area or province it should be communicated to a government department who should be responsible for coordinating the various projects so that they complement each other.
- The government must assist the farmers by providing them with the necessary tools to apply the *IRWH* technique. Food security departments supply farmers with tools, but some are a waste of money. It is recommended that they rather supply appropriate tools, like for the application of the *IRWH* technique, to farmers who have already grouped themselves and have proved that they are actively involved in agriculture by making use of sustainable techniques.
- Education and training structures must be in place.
- Support structures in the form of the Department of Agriculture's Extension Service, and technical aid from the ARC and universities need to be in place.
- Attention needs to be given to marketing structures and strategies.
- Institutional arrangements and land tenure aspects need attention.
- An exit strategy should form part of all development projects, which should be conducted over a period of more than three years in order to implement a successful exit strategy and be sustainable.
- The agricultural extension policy and structure in South Africa needs to be streamlined to support and run development projects that address important issues like poverty alleviation and food security.

- It is time that water harvesting becomes a programme instead of just a project in South Africa.

(c) Researchers

- To ensure the sustained success of crop production using the *IRWH* technique in the rural communities, especially the expansion from backyards to croplands, certain structures are of fundamental importance. The mechanization of the *IRWH* technique should be researched to ensure that it meets the requirements of the five pillars of sustainability.
- To ensure the sustained success of crop production, institutional arrangements and land tenure aspects should be researched.
- Ways of combining crops and animals in an integrated *IRWH* system need to be investigated.
- Research is needed with regard to introducing a permanent crop into the *IRWH* system.

8. CAPACITY BUILDING

Much of the attention in the current study was on how to ensure the involvement and participation of all the role-players (members of particular communities, extension officers and researchers) in the research project, and also on ensuring that the knowledge and skills of all concerned are increased. Participatory research approaches have the advantage of developing the capabilities of the participants. De Vos, Strydom, Fouchè & Delport (2002) describe capacity building as the process of assisting people with the potential and capacity to develop skills at various levels to manage their own future. Various capacity building actions took place during the project, as detailed in Chapter 9. In this chapter, capacity building of the farmers, extension, researchers and technicians will be discussed.

8.1. FARMERS

The farmers involved with Matangwana received knowledge each and every day when they were visited by the technicians and the researchers. Two farmers, Mr. Esau Motlalile from the community Yoxford and Mr. Makgetha Setlaba from the community Woodbridge 1, attended an International Water Conservation Symposium during April 2003. A report from Mr. Motlalile about his views of the symposium is presented in Appendix 8.1. Some of the farmers received jobs; three farmers had an opportunity to appear on television and another farmer from Yoxford (Mr. Motlalile) had an opportunity to go to Brazil to attend a no-till excursion during February 2004. This farmer is now so equipped that he received tenders and has employed other farmers. Formal and informal educational training courses, pre- and post-harvest focus group discussions, information days, farmer-to-farmer training and water harvesting festivals over periods of 4-5 days were also used to build the capacities of farmers. During the focus group discussions, certain aspects were discussed and a lot of planning and goal setting took place. Formal and informal educational sessions were first conducted with extension officers and, thereafter, extension personnel and the researchers conducted the same training with the farmers. Educational training sessions did not focus solely on *IRWH*, but also addressed much broader topics. Training focused on different soil types, crop nutrition, weed control, insect control, management practices, utilization of natural resources, record keeping and budgeting, markets and marketing, the role and function of committees, conflict resolution, communication skills, etc. Some farmers were also given an opportunity to be part of workshops with the stakeholders and this had a great influence, as they felt important and empowered. The farmers were also given an opportunity to visit the Eastern Cape to learn about the same technique under different conditions. This built their confidence as they encouraged the other farmers to hold on to what they were given. Mrs. Selina Mokgothu from Potsane had the opportunity to fly to Cape Town for a sitting of parliament. She mentioned that it was an incredible experience to fly. Two farmers, Mr. Motlalile and Mrs. Makama, had the opportunity to attend and participate in two exhibitions held by the WRC as part of a marketing day at their offices in Pretoria. Many leading farmers presented their work to other farmers and stakeholders during farmers' days, festivals and workshops. The farmers were also included in the planning and arrangements of the festivals. They have developed in such a way that they planned and arranged large parts of the post-harvest festival

conducted during November 2006. The farmers are able to apply the *IRWH* technique, plant different crops and maintain the system, and are also able to conduct farmer-to-farmer training.

8.2. EXTENSION

A number of capacity building actions, specifically about the *IRWH* system, took place during the project with extension officers and youth workers in the form of training courses and workshops (Chapter 9). One of the extension officers, Mr. Theboho Mothwa, attended a no-till excursion in Brazil together with one of the leading *IRWH* farmers during February 2004. The extension officers from Thaba Nchu and from other places like Wepener, QwaQwa and Tweespruit were encouraged to work hand in hand with the ARC-ISCW to extend the *IRWH* technique and to take charge of the *IRWH* project with the aim of sustainability. These extension officers were also part of a review and planning workshop as well as a stakeholder workshop; they were invited to all the *IRWH* festivals and were trained on various issues related to farming in the Thaba Nchu area. Formal and informal educational sessions were first conducted with the extension officers and thereafter the researchers and extension officers conducted the same training for the farmers.

8.3. RESEARCHERS

Ms. Nonceba Mdibe was given an opportunity to complete her M.Sc. and to work for the ARC-ISCW to gain experience. The topic of her dissertation is: "The outcome evaluation of the in-field rainwater harvesting technique in the Thaba Nchu and Botshabelo regions", which was submitted to the University of the Free State Department of Sociology and was accepted. She has finished her data collection, and analysis stages, and is busy with the writing-up of her research findings. Prof. Pelser and Mr. Botha are her mentors. Ms. Mdibe presented an oral paper at the International Sociological Association World Congress of Sociology in Durban in July 2005, with the title: "Factors affecting adoption rate of the in-field rainwater harvesting technique in the Thaba Nchu and Botshabelo regions". Her paper was very well received. She also presented an oral paper at the SANCID Symposium held at Aventura Swadini in Mpumalanga from 15-17 November 2006. Her paper was entitled: "Social impact of the in-field rainwater harvesting technique in the Thaba Nchu area". Ms. Mdibe has been involved in many of the *IRWH* activities, namely the arrangements of the festivals, daily activities of the festivals, and the attendance of very important farmer meetings, such as those with the headmen, other role-players such as the Free State Department of Agriculture (food security), the council, and an organization which specializes in indigenous food. From her arrival in 2004 she was involved with helping out those communities that were very slow in adopting the *IRWH* technique and those that experienced problems in general such as the communities of Nogas Post and Talla. During 2005 she was involved in monthly attendance of the MB-WHIG meetings and was part of a workshop held for the farmers in Thaba Nchu. Later that year she was part of the training given to the farmers and the extension officers. Her role was to give training in communication, its effect and role in their lives as farmers and extension officers. Ms. Mdibe is working on a new WRC-funded project under the leadership of the UFS from February 2007.

Mr. Mompathi Baiphethi is registered for his Ph.D. at the UFS Department of Agricultural Economics. He will use some of the data from this project for his studies. Prof. G. Viljoen, Prof. G. Kundhlande and Mr. J.J. Botha are his mentors. Mr. Baiphethi has contributed to a number of conference papers and has also presented several papers. He is involved in many of the *IRWH* activities such as participating in the establishment of 42 CB:WHIGs and the MB:WHIG; regular meetings with the groups that needed assistance in improving the management of the affairs of the community groups; participating in the facilitation of the drafting, writing and subsequent final constitution of MB:WHIG; assisting with the translation of the constitution into Sotho and distribution to all the communities; as well as being involved in a leadership workshop for the leaders of the CB:WHIGs and MB:WHIG. He is also involved in monthly meetings with the Executive Board and General Assembly of the WHIGs since August 2005. Mr. Baiphethi is working on a new WRC-funded project under the leadership of the UFS from April 2006.

Mr. Cobus Botha used some of the data generated from this project as well as data from other WRC projects for his Ph.D. thesis entitled: "Evaluation of maize and sunflower production in a semi-arid area using in-field rainwater harvesting", which was submitted in November 2006.

Mr. Kobus Anderson might also use some of the data generated by the project for his Ph.D. thesis.

The researchers (Messrs Botha, Anderson, Nhlabatsi and Baiphethi, Ms. Mdibe, Dr. Zere and Prof. Groenewald) attended and conducted various capacity building actions, and gave many national and international presentations, as detailed in Chapter 9.

8.4. TECHNICIANS

The in-service training process of the TAs has proceeded over a number of years. The TAs are now able to carry out many tasks like implementation of *IRWH* structures, as well as planting and maintaining different crops. They also play a very important role regarding technology exchange actions. They assisted and conducted a number of technology exchange actions in the form of farmers' days, information days with extension officers, farmers' and information days with colleges, water harvesting festivals, and led focus group discussions. They are responsible for the success of the *IRWH* technique in the rural communities. They have also acquired the skills to work with people (improved communication skills), and conduct and lead meetings with committee members and people in the communities. Their leadership qualities have come to the fore and improved tremendously. They are also able to go to the library to gather information about specific topics and summarize the information. They already gathered information about leadership, motivation, role and function of a committee, teamwork etc. and held group discussions with the communities about the specific topics. They also assisted in the compilation of a simple stepwise planting manual with visual descriptions on how to plant different crops within the *IRWH* system, and translated it into Sotho. Each TA is responsible for a number of rural communities where they act as exchange agents and mentors. The TAs keep records of everything that is happening, such as all the meetings and training that takes place, planting, problems, how the crops look and their yields etc.

The technicians have gained a lot of experience during this project, not only agriculturally but also economically and sociologically. In terms of sociology, they were trained on how to conduct questionnaires and be part of interviews. This project also provided finance for the technicians to get their drivers licences. Four TAs are currently employed by the ARC-ISCW, in other words this project contributed towards job creation for four of the technicians.

Mr. Daniel Thuthani attended a study tour to Zambia on conservation agriculture from 24 February to 6 March 2006. This study tour was a valuable learning process and experience for Mr. Thuthani.

8.5. SUMMARY

This project contributed towards one Ph.D. (Faculty of Natural and Agricultural Sciences, Department of Soil, Crop and Climate Sciences at the University of the Free State); one Ph.D. (Faculty of Agricultural Economics at the University of the Free State); one M.Sc. (Department of Sociology at the University of the Free State) and might also contribute towards another Ph.D. (Faculty of Natural and Agricultural Sciences, Department of Soil, Crop and Climate Sciences at the University of the Free State). The project contributed towards the employment of four TAs at the ARC-ISCW (Glen) and enabled them to get their drivers licences. Many farmers and extension officers were capacitated as a result of the project, which assisted farmers, extension officers, researchers and TAs with the potential and capacity to develop skills at various levels to manage their own future.

8.6. REFERENCES

DE VOS, A.S., STRYDOM, H., FOUCHE, H. & DELPORT, C.S.L., 2002. Research at grass roots for the social science and human service professions. 2nd ed. Van Schaik Publishers, Pretoria, South Africa.

9. LIST OF RESEARCH OUTPUTS

9.1. PRESENTATIONS

- Seven papers were delivered at the Combined Congress of the Soil Science Society of South Africa (SSSSA), South African Society of Crop Production (SASCP) and Southern African Society for Horticultural Sciences (SASHS) held in Stellenbosch in January 2003. Mr. J.J. Botha received a medal from the SSSSA for the best poster presentation. The titles of the presentations were:
    - Diurnal fluctuation of temperature, humidity and water content as affected by mulching – L.D. van Rensburg, N.N. Nhlabatsi, J.J. Botha, J.J. Anderson, P.P. van Staden & M.S. Macheli (oral presentation). (Indirect result of project.)
    - Water conservation techniques on small plots in semi-arid areas to increase crop yields – J.J. Botha, J.J. Anderson, L.D. van Rensburg, M.S. Macheli & P.P. van Staden (oral presentation). (Direct result of project.)
    - Evaluation of evaporation subroutines of various models as affected by mulching – N.N. Nhlabatsi, L.D. van Rensburg, J.J. Botha, J.J. Anderson, P.P. van Staden & M.S. Macheli (oral presentation). (Indirect result of project.)
    - The application of crop modelling technology to quantify risk for marginal crop production areas – J.J. Anderson, J.J. Botha, L.D. van Rensburg, M. Hensley & P.P. van Staden (poster). (Indirect result of project.)
    - Quantifying evaporation under various mulching strategies – J.J. Botha, J.J. Anderson, L.D. van Rensburg, D.J. Beukes, P.P. van Staden & M. Hensley (poster). (Indirect result of project.)
    - Small-scale farmers response to in-field water harvesting technology using visual models – L.D. van Rensburg, J.J. Botha, J.J. Botha, D.C. Groenewald, M.S. Macheli & P.P. van Staden (poster). (Direct result of project.)
    - Characterization of the Glen/Bonheim-Onrus ecotope – P.P. van Staden, L.D. van Rensburg, M. Hensley, J.J. Botha & J.J. Anderson (poster). (Indirect result of project.)

- On 17 March 2003 three presentations were delivered at the Water Harvesting Festival held at Glen. The titles of the presentations were:
    - The long walk to improve crop production at grass root level – L.D. van Rensburg, J.J. Botha, J.J. Anderson, M.S. Macheli & P.P. van Staden. (Direct result of project.)
    - In-field rainwater harvesting: Principles & Crops – M.S. Macheli, L.D. van Rensburg, J.J. Botha, J.J. Anderson & P.P. van Staden. (Direct result of project.)
    - Application of in-field rainwater harvesting in rural communities in semi-arid areas of South Africa – J.J. Botha, L.D. van Rensburg, J.J. Anderson, G. Kundhlande & M.S. Macheli. (Direct result of project.)

- Five oral papers and one poster were presented at the Water Conservation Technologies (WCT) Symposium held at Bloem Spa Lodge in Bloemfontein from 8-11 April 2003. The titles of the presentations were:
    - Application of in-field rainwater harvesting to stabilize crop yields in rural communities in semi-arid areas of South Africa – J.J. Botha, L.D. van Rensburg, J.J. Anderson, G. Kundhlande, M. Hensley & M.S. Macheli. (Direct result of project.)
    - Water conservation techniques on small plot plots in semi-arid areas to increase crop yield – J.J. Botha, J.J. Anderson, L.D. van Rensburg, M.S. Macheli & P.P. van Staden. (Direct result of project.)
    - Development and evaluation of a physical model to exchange technology on crop production techniques – L.D. van Rensburg, D.C. Groenewald, J.J. Botha, J.J. Anderson & P.P. van Staden. (Direct result of project.)
    - Socio-economic considerations for successful water harvesting for improved agricultural production in semi-arid areas – G. Kundhlande, J.J. Botha & L.D. van Rensburg. (Indirect result of project.)
    - A preliminary analysis of the economic viability of a water conservation technique in semi-arid areas in South Africa: A case study from Thaba Nchu in the Free State Province – M.N. Baiphethi, G. Kundhlande, M.F. Viljoen, J.J. Botha & L.D. van Rensburg. (Indirect result of project.)
    - The use of crop modelling to compare different tillage techniques – J.J. Anderson, J.J. Botha & L.D. van Rensburg (poster). (Indirect result of project.)

- On 25 April 2003 a presentation on: "The role of the Water Harvesting Group in the war against malnutrition and poverty through agriculture" by L.D. van Rensburg, J.J. Botha, J.J. Anderson, P.P. van Staden, M.S. Macheli & N.N. Nhlabatsi was made at an Imbiso of the Free State Department of Agriculture in Verkeerdevlei. (Direct result of project.)

- Mr. J.J. Botha and Dr. L.D. van Rensburg attended the 11th International Conference on Rainwater Catchment Systems in Mexico City, Mexico, from 25-29 August 2003 and presented four oral papers. More than 600 people attended the congress. The titles of the presentations were:
    - Empowerment of rural communal farmers in South Africa through the application of in-field water harvesting – J.J. Botha, L.D. van Rensburg, J.J. Anderson, G. Kundhlande & M.S. Macheli. (Direct result of project.)
    - Evaluating the agronomic sustainability of mulching of the in-field water harvesting crop production system – J.J. Botha, J.J. Anderson, L.D. van Rensburg, M. Hensley & M.S. Macheli. (Indirect result of project.)
    - Impact of visual models on farmers perceptions with regard to the understanding of the in-field water harvesting technique – L.D. van Rensburg, J.J. Botha & J.J. Anderson. (Direct result of project.)

- On-station and on-farm in-field water harvesting research in Southern Africa using sunflower as a reference crop – L.D. van Rensburg, J.J. Botha, J.J. Anderson, M. Hensley & P.P. van Staden. (Indirect result of project.)

- Five oral papers and one poster were presented at the South African Society for Atmospheric Sciences (SASAS) Congress held in Pretoria from 14-15 October 2003:
  - The use of crop modelling technology to compare different tillage techniques – J.J. Anderson, J.J. Botha & L.D. van Rensburg (poster). (Indirect result of project.)
  - Prediction of topsoil temperatures under various mulching conditions for the Glen/Bonheim-Onrus ecotope – N.N. Nhlabatsi, L.D. van Rensburg, J.J. Anderson & J.J. Botha. (Indirect result of project.)
  - Problem solving research in rural communities in the Free State province through the application of in-field rainwater harvesting – J.J. Botha, L.D. van Rensburg, J.J. Anderson, M. Hensley, D.C. Groenewald, G. Kundhlande & M.S. Macheli. (Direct result of project.)
  - The impact of mulching on evaporation, runoff, sediment transportation and maize yield within an in-field rainwater harvesting system – J.J. Botha, L.D. van Rensburg & J.J. Anderson. (Indirect result of project.)
  - Balancing on-farm and on-station in-field rainwater harvesting research on sunflower in the Free State – L.D. van Rensburg, J.J. Botha & J.J. Anderson. (Direct result of project.)
  - Assessing the application of scale models to facilitate communal farmers understanding of the in-field rainwater harvesting system – L.D. van Rensburg, J.J. Botha, J.J. Anderson & D.C. Groenewald. (Direct result of project.)

- On 18 November 2003 a talk on: "Introducing best practices to the farmers of Sterkspruit (Bensonville) to secure agricultural sustainability" by J.J. Botha, L.D. van Rensburg & J.J. Anderson was presented at a farmers' day at Sterkspruit. (Direct result of project.)

- On 27 February 2004 a talk on: "Water harvesting in South Africa" by L.D. van Rensburg, J.J. Botha, J.J. Anderson, M. Hensley & M. de Lange was presented at the Water Research Commission in Pretoria. (Direct result of project.)

- On 12 March 2004 a talk on: "Water harvesting in South Africa" by L.D. van Rensburg, J.J. Botha, J.J. Anderson, M. Hensley & M. de Lange was presented to a Senegalese delegation at the Department of Agriculture in Bloemfontein. (Direct result of project.)

- On 24 March 2004 a talk on: "Water harvesting in South Africa" by L.D. van Rensburg, J.J. Botha & J.J. Anderson was presented at Roodevallei Country Lodge, Pretoria. (Direct result of project.)

- Dr. L.D. van Rensburg, Mr. J.J. Anderson, Mr. J.J. Botha and Mr. N.N. Nhlabatsi attended an OSWU (Optimizing Soil Water Use) Workshop held at the ARC-ISCW in Pretoria from 26-27 July 2004 and gave three presentations:
    - The use of systems models in small scale farming in semi-arid areas of South Africa – J.J. Anderson, J.J. Botha & L.D. van Rensburg. (Indirect result of project.)
    - Assessment and modelling of water harvesting techniques to optimize water use in a semi-arid crop production area in South Africa – J.J. Botha, J.J. Anderson, L.D. van Rensburg & D.J. Beukes. (Indirect result of project.)
    - Modeling evaporation from the soil surface as affected by mulching and soil factors – L.D. van Rensburg, N.N. Nhlabatsi, J.J. Anderson, J.J. Botha, & R. Kuschke. (Indirect result of project.)

- Mr. J.J. Botha and Dr. L.D. van Rensburg attended the 55th International Executive Council and International Conference on "Food Production and Water: Social and Economic Issues of Irrigation and Drainage" in Moscow, Russia, from 5-11 September 2004 and presented four papers:
    - Evaluating the sustainability of the in-field rainwater harvesting crop production system – J.J. Botha, L.D. van Rensburg, J.J. Anderson, D.C. Groenewald, M. Hensley, G. Kundhlande, M.N. Baiphethi & M.F. Viljoen. (Direct result of project.)
    - Water harvesting through in-field runoff – J.J. Botha, L.D. van Rensburg, J.J. Anderson & M. Hensley. (Indirect result of project.)
    - The design and function of the in-field rainwater harvesting system to improve agronomic sustainability – L.D. van Rensburg, J.J. Botha & J.J. Anderson. (Indirect result of project.)
    - The economic feasibility of in-field rainwater harvesting techniques in semi-arid areas of South Africa: A case study of Thaba Nchu, Free State Province – M.N. Baiphethi, M.F. Viljoen & G. Kundhlande. (Indirect result of project.)

- Mr. J.J. Botha and Dr. L.D. van Rensburg presented two papers at the Fertilizer Congress held in Pretoria from 27-28 September 2004:
    - Water and nitrogen use efficiencies of various soil water conservation techniques on a clay soil – J.J. Botha, L.D. van Rensburg, J.J. Anderson & M. Hensley. (Indirect result of project.)
    - Estimating nitrogen budget for maize-sunflower-maize rotational system under in-field rainwater harvesting practices – L.D. van Rensburg, J.J. Botha & J.J. Anderson. (Indirect result of project.)

- Mr. M.N. Baiphethi presented a paper at the Agricultural Economics Association of South Africa (AEASA) 42nd Congress held on 21-23 September 2004 in Somerset West:
    - Quantifying the effect of in-field rainwater harvesting (*IRWH*) production techniques on household food security for communal farmers in Thaba Nchu, Free State Province. The co-authors of the

paper were M.F. Viljoen, G. Kundhlande, J.J. Botha and L.D. van Rensburg. (Direct result of project.)

- Mr. J.J. Botha and Mr. M.N. Baiphethi attended a WRC marketing day at their offices in Pretoria where the following quasi-scientific poster was presented on 13 October 2004:
  - Enhancing the long-term sustainability of in-field rainwater harvesting techniques through the use of formal and informal rural structures – M.N. Baiphethi, J.J. Botha, L.D. van Rensburg & J.J. Anderson. (Direct result of project.)

- Two presentations were made at a workshop with the theme: "Up-scaling in-field rainwater harvesting: Application, Status, Constraints and Challenges", held at the Bloem Spa Lodge, Bloemfontein, from 1-2 November 2004:
  - Towards a turn-around strategy for alleviating poverty at household level through up-scaling of water harvesting – M.F. Viljoen & L.D. van Rensburg. (Direct result of project.)
  - Up-scaling water harvesting from backyards to croplands in the Free State Province: successes, constraints and challenges – J.J. Botha & L.D. van Rensburg. (Direct result of project.)

- A paper was presented at the International Workshop on Water Resource Management for Local Development held at Loskop Dam from 8-11 November 2004:
  - Application of the in-field rainwater harvesting technique in rural communities in South Africa to fight poverty and food insecurity – J.J. Botha, M.N. Baiphethi, L.D. van Rensburg & J.J. Anderson. (Direct result of project.)

- Mr. J.J. Botha presented a paper and Mr. M.N. Baiphethi a poster at the SANCID Symposium held at the Fish River Sun, Eastern Cape, from 17-18 November 2004:
  - Up-scaling water harvesting from backyards to croplands in the Free State Province: successes, constraints and challenges – J.J. Botha, M.N. Baiphethi, L.D. van Rensburg & J.J. Anderson. (Direct result of project.)
  - A model to quantify the impact of *IRWH* techniques on household food security – M.N. Baiphethi, M.F. Viljoen, G. Kundhlande, J.J. Botha, L.D. van Rensburg & J.J. Anderson. (Direct result of project.)

- Two oral papers and one poster were presented at the SSSSA Congress held in Potchefstroom from 11-13 January 2005:
  - Evaluating the long-term risk assessment of the in-field rainwater harvesting technique – J.J. Botha, L.D. van Rensburg & J.J. Anderson. (Indirect result of project.)
  - Evaluating the agronomic sustainability of the in-field rainwater harvesting technique – J.J. Botha, L.D. van Rensburg & J.J. Anderson. (Indirect result of project.)

- Short-term carbon changes in the topsoil under conventional and in-field rainwater harvesting techniques – J.J. Botha, L.D. van Rensburg & J.J. Anderson (poster). (Indirect result of project.)

- Mr. J.J. Botha was invited to present a paper at the FAO/Netherlands Conference Water for Food and Ecosystems held at The Hague, The Netherlands, from 31 January - 5 February 2005.
  - Bio-physical requirements and socio-economic acceptance of infield rainwater harvesting and conservation in the semi-arid central region of South Africa: A case study of in-field rainwater harvesting in South Africa – J.J. Botha, G. Kundhlande & A. Sanewe. (Direct result of project.)

- Mr. J.J. Botha presented two papers at the South African Extension Officers Congress held in Bloemfontein on 11 May 2005:
  - In-field rainwater harvesting in the Thaba Nchu area: Theoretical background and research results – J.J. Botha, J.J. Anderson, M. Hensley & L.D. van Rensburg. (Direct result of project.)
  - In-field rainwater harvesting in the Thaba Nchu area: Technology transfer – J.J. Botha, J.J. Anderson, L.D. van Rensburg & M.N. Baiphethi. (Direct result of project.)

- Mr. J.J. Botha attended the Free State Water Summit held in Bloemfontein from 20-21 June 2005 where he delivered a presentation on in-field rainwater harvesting in the Thaba Nchu area. (Direct result of project.)

- Mr. J.J. Botha presented a paper entitled: "A case study of in-field rainwater harvesting in the Free State Province" at the inception workshop of WRC project no. K5/1563: "Water resources management in rainwater harvesting: an integrated systems approach" held at the St. Georges Hotel, Johannesburg, on 30 August 2005. (Direct result of project.)

- On 3 October 2005 Mr. J.J. Botha and Mr. M.N. Baiphethi gave two presentations at the WRC:
  - In-field rainwater harvesting: biophysical factors. (Direct result of project.)
  - In-field rainwater harvesting: economic analyses. (Direct result of project.)

- Mr. J.J. Botha attended the Organisation for Economic Co-operation and Development (OECD) Workshop on "Agriculture and Water: Sustainability, Markets and Policies" held at Adelaide Convention Centre, Adelaide, South Australia, from 14-18 November 2005, and presented a paper entitled: "Evaluating the agronomic sustainability of the in-field rainwater harvesting technique" – J.J. Botha, J.J. Anderson, L.D. van Rensburg & M. Hensley. (Direct result of project.)

- Six papers were delivered at the Combined Congress of the SSSSA and SASCP held in Durban from 23-26 January 2006. The titles of the presentations were:

- Optimizing nitrogen application within the in-field rainwater harvesting system on the Glen/Swartland ecotope – J.J. Anderson, J.J. Botha & P.P. van Staden (poster). (Indirect result of project.)
- Evaluating the sustainability of the in-field rainwater harvesting crop production system – J.J. Botha, L.D. van Rensburg, J.J. Anderson, D.C. Groenewald, M. Hensley, G. Kundhlande, M.N. Baiphethi & M.F. Viljoen. (Direct result of project.)
- To plant or not to plant? Impact of pre-plant soil water content – J.J. Botha, J.J. Anderson, L.D. van Rensburg & M. Hensley (poster). (Indirect result of project.)
- Introduction of a legume in a crop rotation system – J.J. Botha, L.D. van Rensburg & J.J. Anderson. (Indirect result of project.)
- Evaluating maize yield under conventional and in-field rainwater harvesting techniques with different nitrogen applications – K.N. Mokgohloa, J.J. Botha & J.J. Anderson. (Indirect result of project.)
- The effect of various mulching strategies on temperature regimes in a clay soil under semi-arid conditions – N.N. Nhlabatsi, L.D. van Rensburg, S. Walker & J.J. Botha. (Indirect result of project.)

- Mr. J.J. Botha, Mr. J.J. Anderson, Dr. D.J. Beukes and Mr. N.N. Nhlabatsi attended the SADC Land and Water Management Programme Scientific Symposium in Lilongwe, Malawi, from 14-16 February 2006, and delivered four papers:
  - Quantifying evaporation under various mulching strategies on two ecotopes – J.J. Botha, J.J. Anderson, L.D. van Rensburg, M. Hensley & D.J. Beukes. (Indirect result of project.)
  - Optimizing nitrogen application within the in-field rainwater harvesting system on the Sediba/Sterkspruit ecotope – J.J. Anderson, J.J. Botha & N.N. Nhlabatsi. (Indirect result of project.)
  - Application of an evaporation model to aid in crop productivity for small-scale farmers in semi-arid areas – N.N. Nhlabatsi, L.D. van Rensburg & S. Walker. (Indirect result of project.)
  - Application of the in-field rainwater harvesting technique in rural communities in South Africa to fight poverty and food insecurity – J.J. Botha, J.J. Anderson, L.D. van Rensburg, M. Hensley, D.C. Groenewald & M.N. Baiphethi. (Direct result of project.)
- Mr. J.J. Botha and Dr. D.J. Beukes attended the Water Summit held in Pretoria from 4-5 May 2006 where Mr. Botha presented a poster entitled "Alleviating poverty through water harvesting". (Direct result of project.)

- At the Sustainable Rural Livelihoods (SRL) Conference held at ARC-Central Office in Pretoria from 4-6 July 2006, Mr. J.J. Botha presented a paper entitled: "Application of the in-field rainwater harvesting technique in rural communities in South Africa to fight poverty and food insecurity" – J.J. Botha, J.J. Anderson, L.D. van Rensburg, M. Hensley, D.C. Groenewald & M.N. Baiphethi. (Direct result of project.)

- Ms. N. Mdibe presented a paper on "Factors affecting the adoption rate of the in-field rainwater harvesting technique (*IRWH*) in the Thaba Nchu

area" at the International Congress of Sociology held in Durban during July 2006. (Direct result of project.)

- Mr. J.J. Botha attended the 2nd Regional Workshop on Agricultural Water Management in Eastern and Southern Africa, held in Maputo, Mozambique, from 18-22 September 2006, and presented a paper entitled: "Application of the in-field rainwater harvesting technique in rural communities in South Africa to fight poverty and food insecurity" – J.J. Botha, J.J. Anderson, L.D. van Rensburg & M. Hensley. (Direct result of project.)

- A paper entitled: "Towards household food security using rainwater harvesting and conservation practices: A case study of *IRWH* in Thaba Nchu, Free State" was presented at the 44th Annual Conference of the AEASA held in Grahamstown, Eastern Cape, from 20-22 September 2006. (Direct result of project.)

- Two presentations were made at the SANCID Symposium held at Aventura Swadini, Mpumalanga, from 15-17 November 2006:
  - Water harvesting through in-field runoff – J.J. Botha, L.D. van Rensburg, M. Hensley & J.J. Anderson. (Indirect result of project.)
  - Social impact of the in-field rainwater harvesting technique in the Thaba Nchu area – N. Mdibe, D.C. Groenewald, J.J. Botha & J.J. Anderson. (Direct result of project.)

- Four papers were delivered at the Combined Congress of the SSSSA, SASCP and SASHS held at Aventura Badplaas in January 2007:
  - Assessment of the environmental impact of the in-field rainwater harvesting technique – J.J. Anderson & J.J. Botha. (Direct result of project.)
  - Application of the in-field rainwater harvesting technique in rural communities in South Africa to fight poverty and food insecurity – J.J. Botha, J.J. Anderson, D.C. Groenewald, L.F. Joseph, N.N. Nhlabatsi & L.D. van Rensburg. (Direct result of project.)
  - Improving maize yields on a semi-arid ecotope in South Africa using in-field rainwater harvesting – J.J. Botha, J.J. Anderson, L.D. van Rensburg & M. Hensley. (Direct result of project.)
  - In-field rainwater harvesting in the Thaba Nchu area: Assessment of land suitability and the agronomic impact – T.B. Zere, J.J. Botha, J.J. Anderson & N.N. Nhlabatsi. (Direct result of project.)

- At the SADC 2nd Scientific Symposium of the Land and Water Management Applied Research and Training Programme held in Gaborone, Botswana, from 20-22 February 2007, Mr. M.N. Baiphethi presented a paper entitled "Towards achieving household food security using rainwater harvesting and conservation practices within the SADC region: A case study from South Africa" – M.N. Baiphethi, M.F. Viljoen, G. Kundhlande, J.J. Botha. & J.J. Anderson. (Direct result of project.)

9.2. REPORTS AND PUBLICATIONS

- Anderson, J.J., Botha, J.J. & van Rensburg, L.D., 2003. The use of crop modelling to compare different tillage techniques. In: D. Beukes, M. de Villiers, S. Mkhize, H. Sally & L. van Rensburg (eds). Proceedings of the Symposium and Workshop on Water Conservation Technologies for Sustainable Dryland Agriculture in Sub-Saharan Africa (WCT), Bloemfontein, South Africa, 8-11 April 2003. (Indirect result of project.)

- Baiphethi, M.N., Kundhlande, G., Viljoen, M.F., Botha J.J. & van Rensburg, L.D., 2003. A preliminary analysis of the economic viability of a water conservation technique in semi-arid areas in South Africa: A case study from Thaba Nchu in the Free State Province. In: D. Beukes, M. de Villiers, S. Mkhize, H. Sally & L. van Rensburg (eds.). Proceedings of the Symposium and Workshop on Water Conservation Technologies for Sustainable Dryland Agriculture in Sub-Saharan Africa (WCT), Bloemfontein, South Africa, 8-11 April 2003. (Indirect result of project.)

- Botha, J.J., Anderson, J.J., van Rensburg, L.D., Macheli, M.S. & van Staden, P.P., 2003. Water conservation techniques on small plot plots in semi-arid areas to increase crop yields. In: D. Beukes, M. de Villiers, S. Mkhize, H. Sally & L. van Rensburg (eds.). Proceedings of the Symposium and Workshop on Water Conservation Technologies for Sustainable Dryland Agriculture in Sub-Saharan Africa (WCT), Bloemfontein, South Africa, 8-11 April 2003. (Indirect result of project.)

- Botha, J.J., van Rensburg, L.D., Anderson, J.J., Groenewald, D.C., Kundhlande, G., Hensley, M. & Macheli, M.S., 2003. Application of in-field rainwater harvesting to stabilize crop yields in rural communities in semi-arid areas of South Africa. In: D. Beukes, M. de Villiers, S. Mkhize, H. Sally & L. van Rensburg (eds.). Proceedings of the Symposium and Workshop on Water Conservation Technologies for Sustainable Dryland Agriculture in Sub-Saharan Africa (WCT), Bloemfontein, South Africa, 8-11 April 2003. (Direct result of project.)
- Kundhlande, G., Botha, J.J. & van Rensburg, L.D., 2003. Socio-economic considerations for successful water harvesting for improve agricultural production in semi-arid areas. In: D. Beukes, M. de Villiers, S. Mkhize, H. Sally & L. van Rensburg (eds.). Proceedings of the Symposium and Workshop on Water Conservation Technologies for Sustainable Dryland Agriculture in Sub-Saharan Africa (WCT), Bloemfontein, South Africa, 8-11 April 2003. (Indirect result of project.)

- Van Rensburg, L.D., Groenewald, D.C., Botha, J.J., Anderson J.J. & van Staden, P.P., 2003. Development and evaluation of a physical model to exchange technology on crop production techniques. In: D. Beukes, M. de Villiers, S. Mkhize, H. Sally & L. van Rensburg (eds.). Proceedings of the Symposium and Workshop on Water Conservation Technologies for Sustainable Dryland Agriculture in Sub-Saharan Africa (WCT), Bloemfontein, South Africa, 8-11 April 2003. (Direct result of project.)

- Botha, J.J., Anderson, J.J., van Rensburg, L.D., Hensley, M. & Macheli, M.S., 2003. Evaluating the agronomic sustainability of mulching of the in-field water harvesting crop production system. Proceedings of 11th International Conference on Rainwater Catchment Systems, Mexico City, Mexico, 25-29 August 2003. (Indirect result of project.)

- Botha, J.J., van Rensburg, L.D., Anderson, J.J., Groenewald, D.C., Kundhlande, G. & Macheli, M.S., 2003. Empowerment of rural communal farmers in South Africa through the application of in-field water harvesting. Proceedings of 11th International Conference on Rainwater Catchment Systems, Mexico City, Mexico, 25-29 August 2003. (Direct result of project.)

- Botha, J.J., van Rensburg, L.D., Anderson, J.J., Hensley, M., Macheli, M.S., van Staden, P.P., Kundhlande, G., Groenewald, D.C. & Baiphethi, M.N., 2003. Water conservation techniques on small plots in semi-arid areas to enhance rainfall use efficiency, food security, and sustainable crop production. Water Research Commission of South Africa, Pretoria. (Indirect result of project.)

- Van Rensburg, L.D., Botha, J.J. & Anderson, J.J., 2003. Impact of visual models on farmers perceptions with regard to the understanding of the in-field water harvesting technique. Proceedings of 11th International Conference on Rainwater Catchment Systems, Mexico City, Mexico, 25-29 August 2003. (Direct result of project.)

- Van Rensburg, L.D., Botha, J.J., Anderson, J.J., Hensley, M. & van Staden, P.P., 2003. On-station and on-farm in-field water harvesting research in Southern Africa using sunflower as a reference crop. Proceedings of 11th International Conference on Rainwater Catchment Systems, Mexico City, Mexico, 25-29 August 2003. (Indirect result of project.)

- Baiphethi, M.N., Viljoen, M.F., Kundhlande, G., Botha, J.J. and van Rensburg, L.D., 2004 Quantifying the effect of in-field rainwater harvesting (*IRWH*) production techniques on household food security for communal farmers in Thaba Nchu, Free State Province. Proceedings of AEASA 42nd conference, Somerset West, Cape Town, 21-23 September 2004. (Direct result of project.)

- Botha, J.J., Baiphethi, M.N., van Rensburg, L.D. & Anderson, J.J., 2004. Application of the in-field rainwater harvesting technique in rural communities in South Africa to fight poverty and food insecurity. International Workshop Proceedings of the Water Resource Management for Local Development: Government, Institutions and Policies, Loskop Dam, 8-11 November 2004. (Direct result of project.)

- Botha, J.J., Kundhlande, G. & Sanewe, A., 2005. Biophysical requirements and socio-economic acceptance of infield rainwater harvesting and conservation in the semi-arid central region of South

Africa. Proceedings of FAO/Netherlands Conference: Water for Food and Ecosystems, The Hague, Netherlands, 31 January - 5 February 2005. (Direct result of project.)

- Botha, J.J., van Rensburg, L.D., Anderson, J.J., Groenewald, D.C., Kundhlande, G. & Macheli, M.S., 2005. In: R. Auerbach (ed.). Rainwater harvesting, organic farming and landcare: A vision for uprooting rural poverty in South Africa. Rainman Landcare Foundation. (Direct result of project.)

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- Nhlabatsi, N.N., van Rensburg, L.D. & Walker, S., 2006. Application of an evaporation model to aid in crop productivity for small-scale farmers in semi-arid areas. Proceedings of the SADC Land and Water Management Programme Scientific Symposium, Lilongwe, Malawi, 14-16 February 2006. (Indirect result of project.)

- Botha, J.J., 2007. Evaluation of maize and sunflower production in a semi-arid area using in-field rainwater harvesting. Ph.D. thesis, University of the Free State. (Direct result of project.)

9.3. MEDIA

- On 23 May 2003, Dr. L.D. van Rensburg gave a radio interview with Radio Oranje. The talk was about the implementation of water harvesting in Thaba Nchu. (Direct result of project.)

- A manual with 10 steps on how to implement the *IRWH* technique was published and is handed out at information and farmers' days to people who show interest in the technique. (Direct result of project.)

- A video/CD production of *IRWH* was produced with the title: "In-field rainwater harvesting to promote sustainable rural livelihoods (June 2003)". (Direct result of project.)

- Two physical interactive three-dimensional models that represent a CON and *IRWH* treatment were created to visually demonstrate the advantages of the *IRWH* technique at information and farmers' days. The models are also used to explain complicated processes such as runoff, infiltration drainage and evaporation. (Direct result of project.)

- A simple three-dimensional computer model was produced which visualizes the *IRWH* technique with the rainfall-runoff-infiltration processes according to different rainfall events. This model can also visualize the effect of different mulches on the runoff area and in the basin area. The model is used to explain complicated processes such as runoff, infiltration and drainage. It is a very useful training tool to explain to extension officers and farmers what is happening during a rainfall event. (Direct result of project.)

- On 7 December 2005, Mr. J.J. Botha, Mr. S.D. Thuthani and Mrs. S. Mokgothu (a farmer from the community Potsoane) appeared on the 20:00 News on SABC 2 and 3 concerning *IRWH* in the Free State. (Direct result of project.)
- On 14 March 2006, Mr. J.J. Botha accompanied a camera team from AgriTV to some of the backyard gardens in Thaba Nchu where the *IRWH* technique was successfully implemented. The documentary on in-field rainwater harvesting was broadcast on Morning Live on SABC 2 on 2 April 2006. (Direct result of project.)

9.4. PRESS RELEASES

- Volksblad, 9 April 2003. *Stelsel besorg kleinboere landerye om van te droom* [Afr.] (Article on application of in-field rainwater harvesting in the Thaba Nchu area). (Direct result of project.)

- AgriNews (Official newsletter of the Department of Agriculture), April 2003. Rainwater harvesting boosts crops in Free State. (Direct result of project.)

- The Water Wheel, May - June 2003, Volume 2 No. 3. Water harvesting: A key to food security for Africa? (Direct result of project.)

- GO FARMING – For the Farmers of Tomorrow. Volume 1 No. 1 p 24-26. In-field Rainwater Harvesting. (Direct result of project.)

- GO FARMING - For the Farmers of Tomorrow. Volume 1 No. 6 p 42-45. Go Farming presents its first Farmer's Day. (Direct result of project.)

9.5. VISITORS

- On 18 February 2003, Mr. J. Dimes, a crop modelling expert from ICRISAT, based in Bulawayo, Zimbabwe, visited the ARC-ISCW water harvesting group at Glen to predict yields for maize production under *IRWH* using the APSIM model.

- A delegation from the Angolan Department of Agriculture, accompanied by the MEC of Agriculture in the Free State Province, visited the Glen experimental site during April 2003. Mr. J.J. Botha accompanied them.

- Approximately 60 delegates from the Water Conservation Technology Symposium visited the Glen experimental site where the *IRWH* technique is investigated, as well as some demonstration trials and farmers' plots located in the Thaba Nchu area, on 10 April 2003.

- On 13 May 2003, six farmers and two agricultural technicians from the Rustenburg area visited Glen. Three researchers from ARC-ISCW (Pretoria) and the Programme Manager, Dr. D.J. Beukes, accompanied them. The farmers who attended were mainly commercial farmers, farming with sunflower and cotton. During the last growing season the *IRWH* technique was demonstrated in one of the visiting farmer's fields. However, the demonstration trial was not very successful due to late land preparation, late planting and unfavourable climatic conditions. Therefore it was decided to bring the people to Glen where this technique has been successfully employed for the past 6 years.

- On 2 June 2003 the Soil Classification Working Group classified the soil profile pits at Glen where the *IRWH* technique was implemented. Dr. L.D. van Rensburg accompanied them.

- On 3 June 2003 a student from Germany, Sibylle Hassler, visited the *IRWH* trials at Glen.

- On 5 August 2003 about 100 delegates who attended the LandCare congress in Bloemfontein visited backyards in Yoxford, one of the communities in the Thaba Nchu area where the *IRWH* technique was introduced, to familiarize them with the technique.

- Mr. Lesley Hay from Randwater in Johannesburg visited some *IRWH* demonstration plots on 20 August 2003. The purpose of the visit was to investigate the possibility to use the *IRWH* technique to grow shrubs and trees on steep slopes next to the roads in the greater Gauteng area.

- On 19 September 2003, Mr. Whitbread from the crop modelling group in Towoomba, Australia, visited Glen to test and calibrate the APSIM model with a South African dataset. Experimental data of maize and sunflower produced with the *IRWH* technique was used for the calibration.

- Mr. Jean Boroto and Jean Mark visited some of the communities in Thaba Nchu where the *IRWH* technique is used on 28 June 2005. The aim of the visit was to gather more information about the technique.

- A group of 14 rural small-scale farmers from Limpopo Province visited backyard gardens in Thaba Nchu on 7-8 September 2005 to familiarize themselves with the *IRWH* technique. They were very impressed with what they saw and indicated that they would also introduce this method of planting in their respective communities.

- Fifteen farmers and extension personnel from the Royal Bafokeng region attended a farmers' day on 23 March 2006 in Thaba Nchu.

9.6. CAPACITY BUILDING

- On 16 April 2002, training of the extension officers and youth workers took place at Glen. Twenty-five people attended the training, the aim of which was to improve their knowledge and understanding of the basic concepts of the *IRWH* technique and to establish their role in the project.

- During 16-18 July 2002, leading farmers from the participating villages and extension officers were trained at Glen. Training on the basic concepts of climate, pedology, teamwork, leadership and the *IRWH* technique itself was given, and a field excursion formed an integral part of the workshop.
- At an *IRWH* workshop held from 6-8 August 2002, the yields of the 2001/02 season were presented to the people of Yoxford, Talla, Paradys and Feloanè, and the extension officers. The season was discussed as well as the differences between the normal *CON* tillage and the *IRWH* technique. The principles of the *IRWH* technique were discussed, a video on *IRWH* was shown, and a visual manual on "10 steps to convert your land into an effective *IRWH* system" was provided to help the people to understand the application of the *IRWH* technique better.

- From 24-28 February 2003, farmers from the Thaba Nchu area were taught at an information day the basic principles of the *IRWH* technique. Visual aids were used.

- Two farmers, Mr. Esau Motlalile from the community Yoxford and Mr. Makgetha Setlaba from the community Woodbridge 1, attended an International Water Conservation Symposium during April 2003.

- A workshop that focused on the empowerment of extension officers to become demonstrators of the *IRWH* system was held from 9-11 February 2004 at Glen. Five extension officers and three SASO workers attended the course. The seven TAs who are in the service of the ARC-ISCW based at Glen, also attended the workshop. Experts who specialize in the fields of water harvesting, economics and group motivation presented the workshop.

- One of the extension officers, Mr. Theboho Mothwa, and a farmer, Mr. Esau Motlalile from the community Yoxford, attended a no-till excursion in Brazil together with one of the leading *IRWH* farmers during February 2004.

- A one-day review and planning workshop for the farmers, extension officers and the research team was held at Glen on 23 August 2005 to plan for the future and to draw up coordinated work programmes.

- On 22 September 2005, various stakeholders gathered at a Stakeholder Workshop at Glen. The purpose of the workshop was as follows:
  a. To get the relevant stakeholders from different levels together to introduce the project.
  b. To reflect on activities, achievements and challenges of the past years.
  c. To obtain an endorsement of stakeholders in the selected study areas to conduct the project.
  d. To draw up a memorandum of understanding with the stakeholders.
  e. To discuss and structure a work programme for the current year.
  f. To assign responsibilities to role-players on the tasks to be performed.

- On 15 November 2005 a group of extension officers from the Motheo District received training on the basic principles of rainwater harvesting. Other aspect that also received attention included planting of various crops, maintenance, weed and insect control, harvesting, value adding, marketing and communication.
- On 17 November 2005 community members received formal training at the Thaba Nchu Civic Centre on all aspects of producing your own food using the *IRWH* crop production system. Inputs from farmers were deliberated upon and the way forward was put into place with respect to *IRWH* in their respective communities.

- Mr. S.D. Thuthani attended a study tour to Zambia on conservation agriculture from 24 February - 6 March 2006.

- CB:WHIG members attended a training meeting on 24 July 2006.

- On 13 September 2006 a strategic one-day workshop was held at Glen between the farmers and the various stakeholders involved to discuss the

way forward, especially on issues of marketing their produce and moving into croplands.

- At the MB:WHIG Executive Board meeting on 18 October 2006 the training guidelines were tested.

- A short course on the basic principles of *IRWH* was held at Glen during November 2006. Four extension officers and 53 community members of communities in Thaba Nchu attended the course.

- Community members received informal training on a regular basis during the duration of the project. Technicians visited the communities at least three times a week to give guidance and provide help and support.

9.7. TECHNOLOGY EXCHANGE

- On 13 March 2002, pre-harvest focus group discussions were held at Yoxford. Community members from Feloanè, Yoxford, Paradys and Talla participated.

- On 14 March 2002 a pre-harvest focus group discussion was held at Paradys, Talla and Feloanè. Community members from Feloanè, Yoxford, Paradys and Talla participated.

- On 17 January 2003, Dr. L.D. van Rensburg and Mr. J.J. Botha visited some "saaidam" farmers in Calvinia. The *IRWH* technique was introduced to the farmers as an alternative for crop production under very dry conditions.

- On 25 and 28 February 2003 information days took place at Glen where the on-station trials were located. The participants were transported from Thaba Nchu to Glen for the event. The information day began with a quick overview on the scientific aspects of crop production in semi-arid areas.

- A rainwater harvesting festival was held in Thaba Nchu from 17-20 March 2003. The event started at Glen, from where it moved to the Thaba Nchu area. Members of the communities attend the festival, the purpose of which was to:
  i) Empower people to fight poverty and food insecurity;
  ii) Expose and promote *IRWH;*
  iii) Exchange knowledge; and
  iv) Bring farmers, extension officers, researchers, politicians and municipal services closer together.

- On 4 December 2003, Mr. J.J. Botha and a leader farmer, Mr. Motlalile, participated in an exhibition held by the WRC in Pretoria as part of their marketing day.
- The second rainwater harvesting festival that was attended by members from 37 communities took place from 15-19 March 2004. The purpose of

the festival was to bring all the farmers together and exchange experiences with regard to *IRWH*, as well to encourage them to adopt and expand the *IRWH* technique by visiting some of the communities to see what they have been done with the knowledge they have gained about *IRWH* and what has been achieved.

- On 7 September 2004 the Glen Agricultural College held an open day. A video about the *IRWH* technique was shown to the people who attended.

- A post-harvest festival, attended by about 1000 people, was held on 22 September 2004 at the Botshabelo stadium.

- On 13 October 2004, Mr. J.J. Anderson, Mr. M.N. Baiphethi and Mrs. Makama, one of the community members, attended a function at the WRC in Pretoria where they had put up a display about *IRWH*.

- The ARC-ISCW (Glen) in conjunction with the WRC held a two-day workshop with the theme: "Up-scaling in-field rainwater harvesting: Application, Status, Constraints and Challenges" at the Bloem Spa Lodge, Bloemfontein, from 1-2 November 2004. The first day of the workshop comprised mainly of the researchers and other stakeholders and day two was a demonstration and field day for the participants and the farmers in the study area.

- A post-harvest festival was held at the Botshabelo stadium on 24 September 2004. More than 1000 community members attended the event.

- On 1 December 2004 Mr. J.J. Botha and Mr. M.N. Baiphethi attended a WRC function at Blyde River where they had the opportunity to introduce the *IRWH* technique to potential stakeholders.

- The third farmers' festival for the *IRWH* farmers in Thaba Nchu took place from 22-24 March and 29-31 March 2005. The main purpose of the festival was for farmers to share information and experiences with *IRWH* and also get feedback on all the activities that have been taking place in their areas. In addition, farmers from five communities in the Eastern Cape were invited to the festival so that they could also share their experiences as new entrants as well see how *IRWH* has contributed to the well-being of the farmers in Thaba Nchu. The total attendance of the zonal days and the final day was about 1350 participants.

- The Free State Department of Education invited the ARC-ISCW to demonstrate the *IRWH* technique to educators and learners of the Leroux Public School in Ladybrand and Selosesha Public School in Thaba Nchu on 23 and 24 November 2005, respectively. A 3D model was used that shows simply how the *IRWH* technique works in the field. Mr. N.N. Nhlabatsi and Mr. K.N. Mokgohloa gave the presentations. All those present showed great eagerness to learn more about the technique so that they could apply it at their various schools.

- A farmers' festival was held at the Botshabelo stadium on 6 December 2005 where about 1000 farmers converged to seek the way forward. Certificates of acknowledgement from the ARC-ISCW were presented by Dr. Andrew Sanewe of the WRC. There were also prizes for the leading farmers and communities.

- Mr. J.J. Botha and Mr. M.N. Baiphethi attended a SARIA workshop from 30-31 January 2006 in Pretoria.

- An *IRWH* farmers' festival took place in Thaba Nchu from 22-24 and 27-29 March 2006. The main aim of the festival was for the farmers to share information and experiences with *IRWH* and also to get feedback on activities that have been taking place in their communities.

- On 7 and 19 October 2005 the Free State Department of Health invited the ARC-ISCW to demonstrate the *IRWH* technique that has been used and researched in the province for about nine years.

- A farmers' day, including various theoretical and practical demonstrations, was held on 29 September 2006 at Glen.

- A post-harvest festival was held at the Botshabelo stadium on 28 November 2006. A total of about 1200 farmers attended the event where they put together strategies on how to solicit funds to enable them to be self-reliant and sustain the *IRWH* technique in future. Kgosi Moroka and various dignitaries from the FSDA, Mangaung Local Municipality and the FSDTEEA also attended the festival.

9.8. TRAINING MANUALS

- Two colourful training guidelines were produced, one for farmers and the other for trainers in *IRWH*.

9.9. AWARDS

- The Department of Water Affairs presented the ladies in Thaba Nchu who are using *IRWH* with a special recognition award for the efforts they are making to conserve water for household food production.

- Mr. J.J. Botha received a medal from the SSSSA for the best poster presentation delivered at the Combined Congress in January 2003 in Stellenbosch.

- Mr. J.J. Botha received a medal from the SSSSA for the best oral presentation delivered at the Combined Congress in January 2006 in Durban.

- Mr. J.J. Anderson received a medal from the SSSSA for the best contribution to research development in soil science at the Combined Congress in January 2007 at Aventura Badplaas.

APPENDICES

Appendix 2.1 Ten steps to convert land into an effective *IRWH* system



Appendix 2.2 Flipcharts used during personal interviews

POSTERS

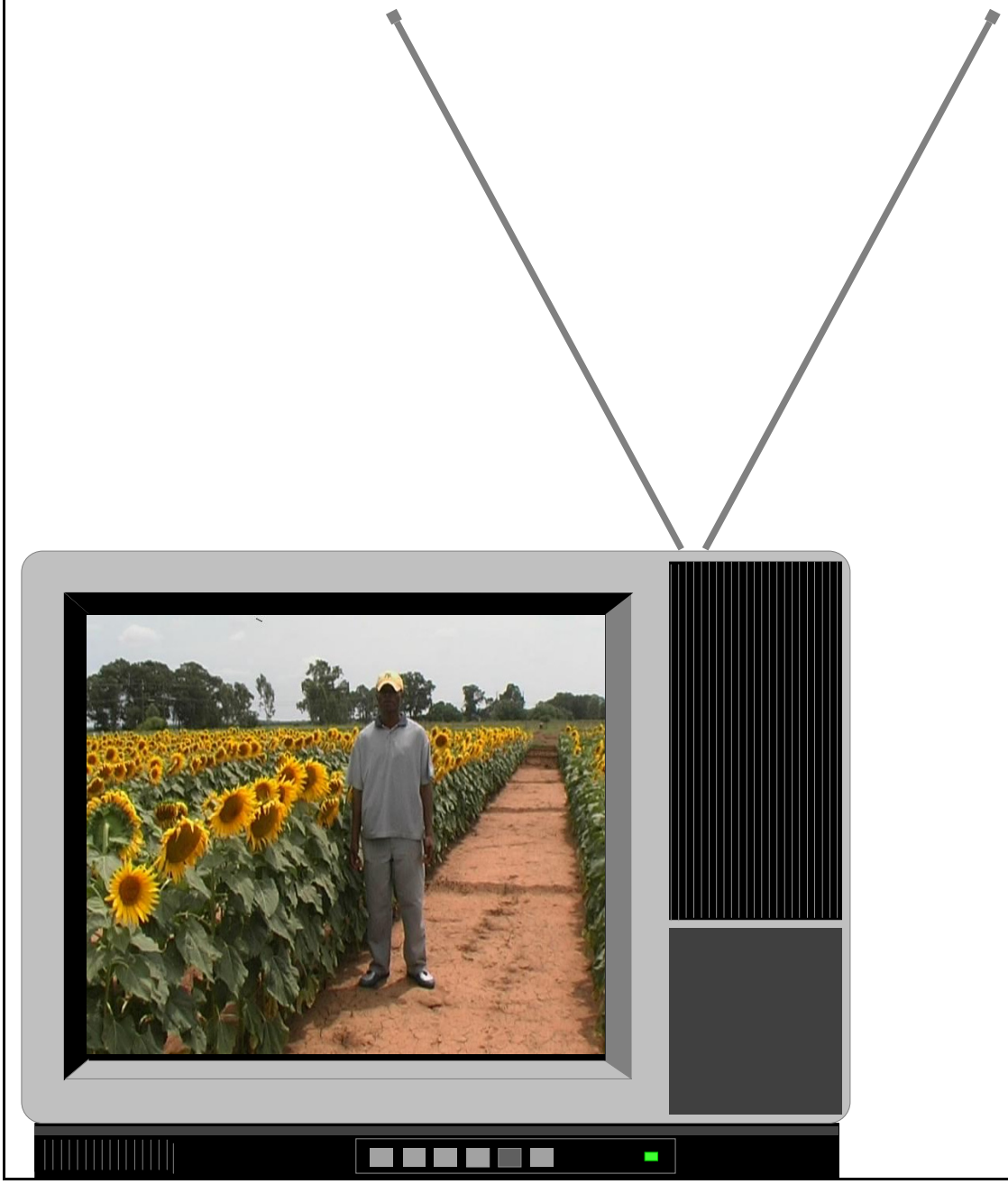




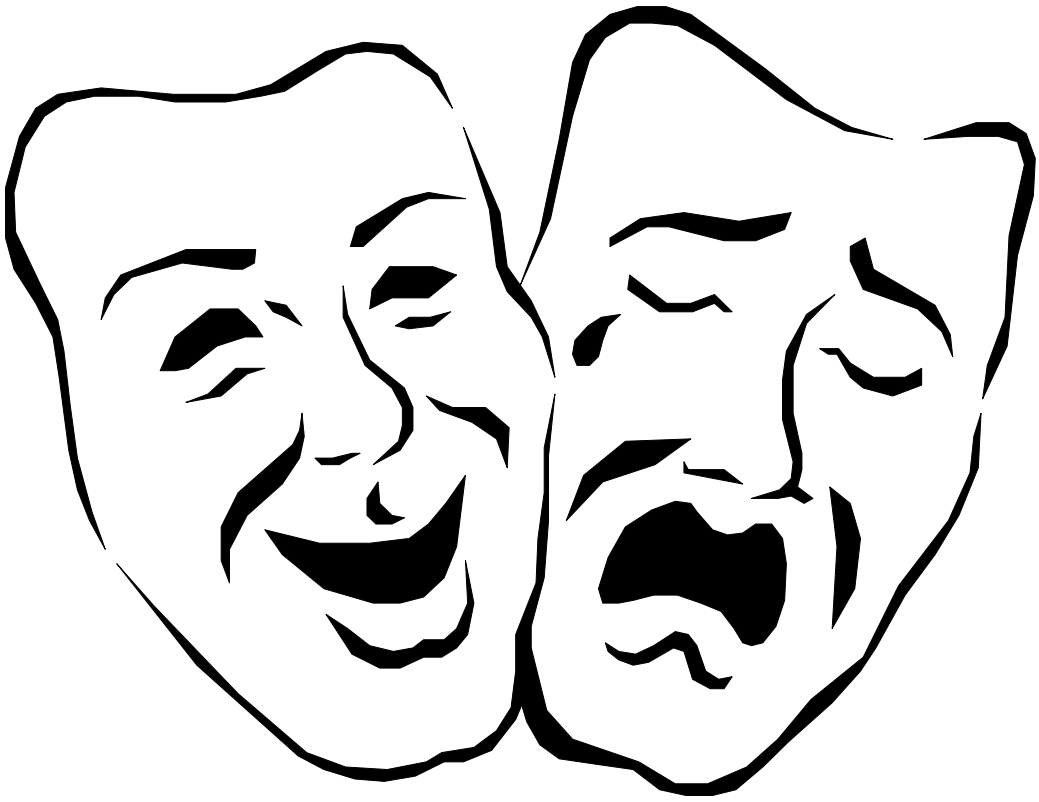




Video



Drama



Focus group discussions



Demonstration plot



Demonstration plot



Support given to farmers



(Extension)

Support given to farmers (ARC-ISCW)



Support given to farmers (ARC-ISCW)



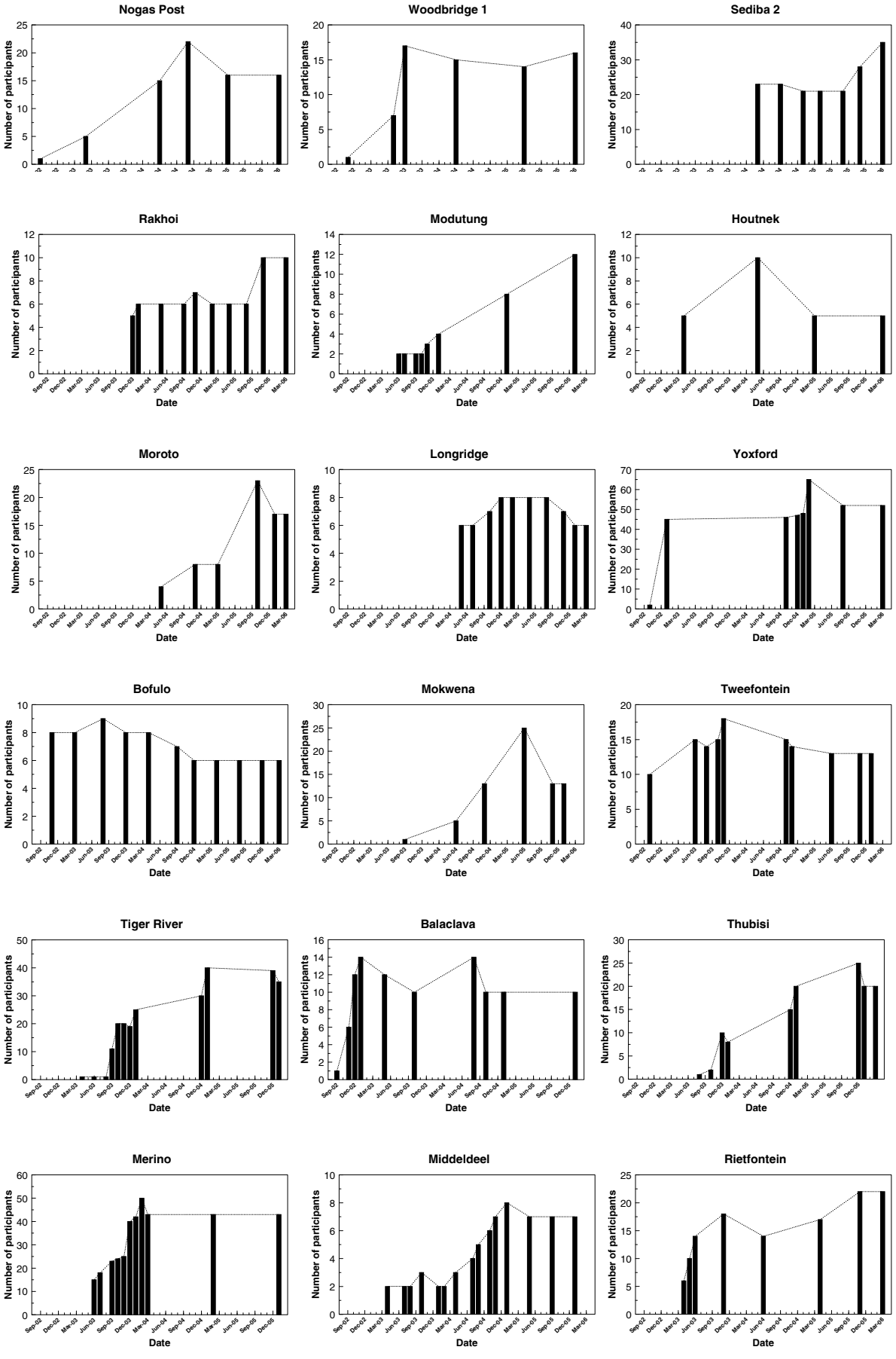


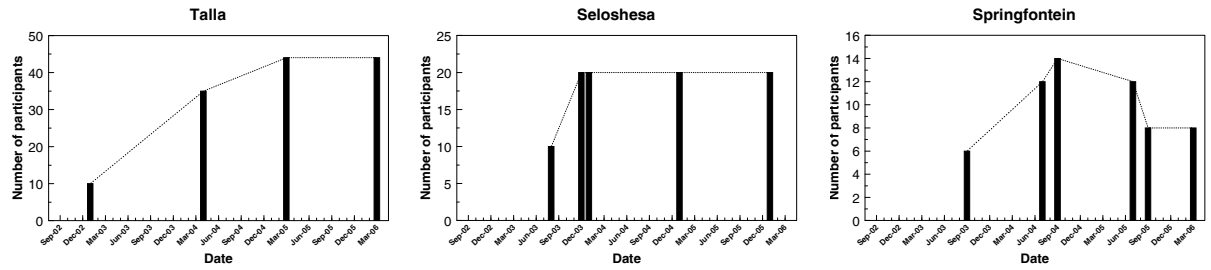


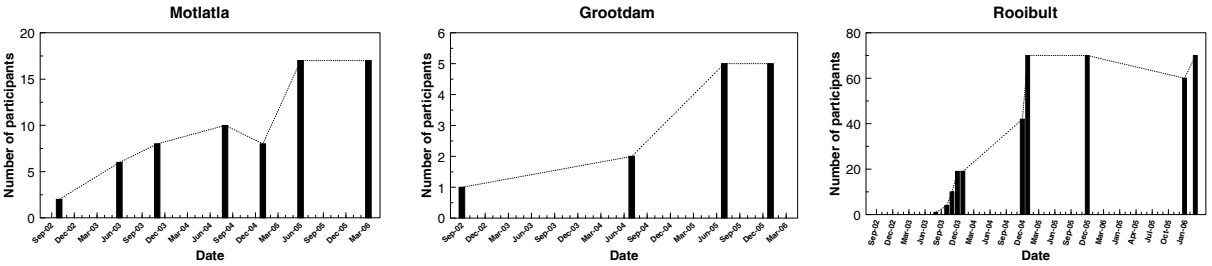


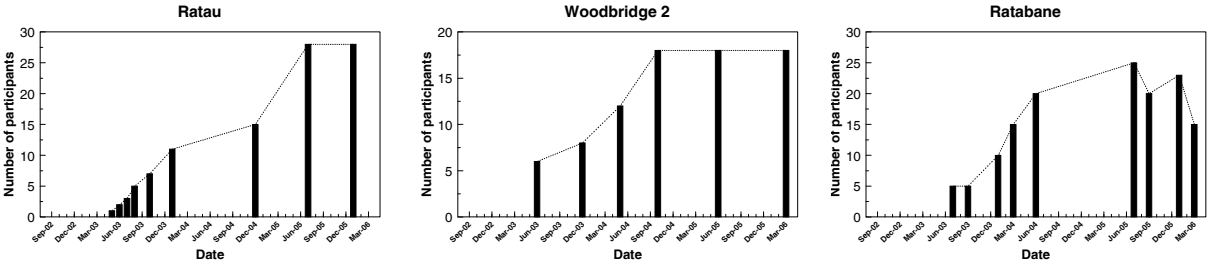


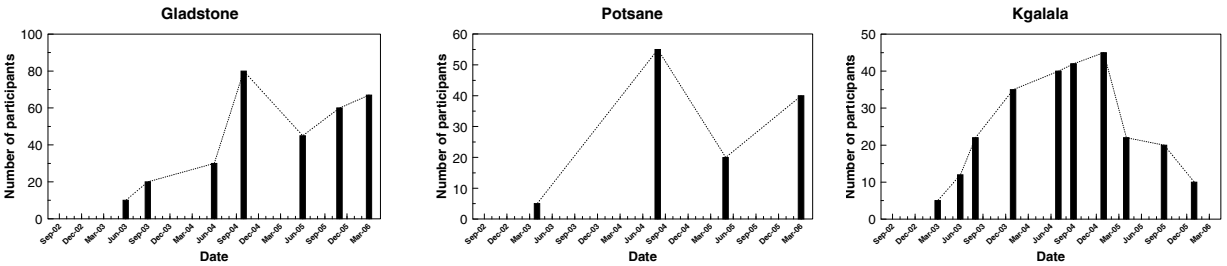

Appendix 4.1 Expansion graphs of the 42 communities

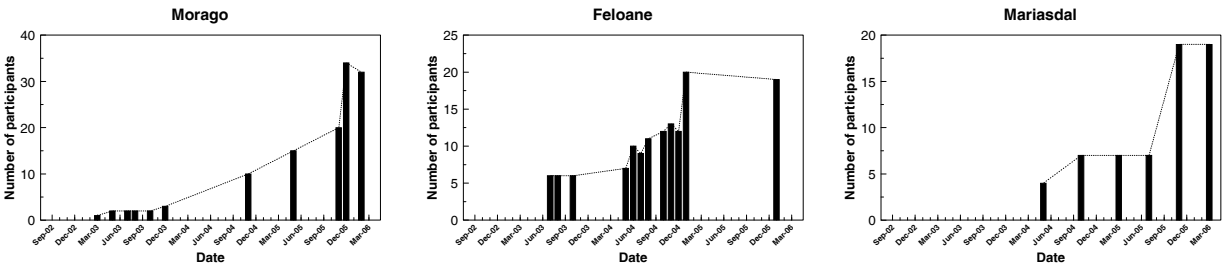


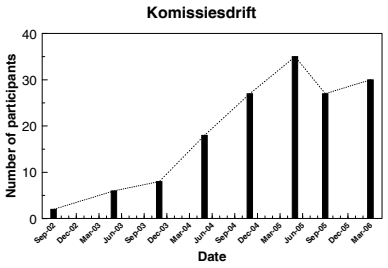

Talla
Seloshesa
Springfontein
Number of participants
Date

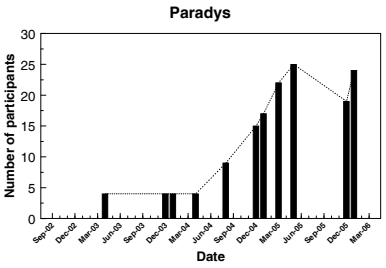

Motlatla
Grootdam
Rooibult
Number of participants
Date

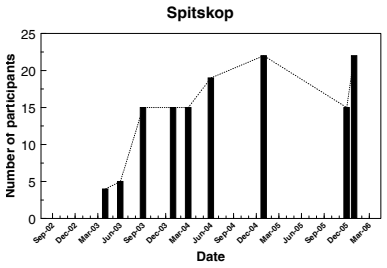

Ratau
Woodbridge 2
Ratabane
Number of participants
Date

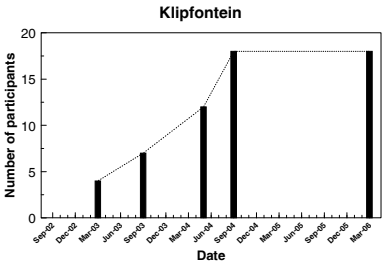

Gladstone
Potsane
Kgalala
Number of participants
Date

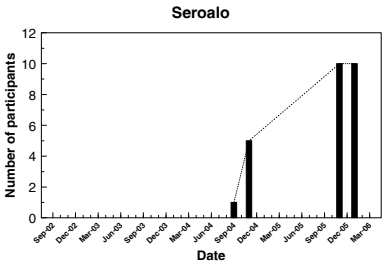

Morago
Feloane
Mariasdal
Number of participants
Date

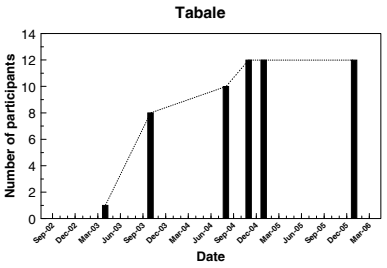

Komissiesdrift
Number of participants
Date

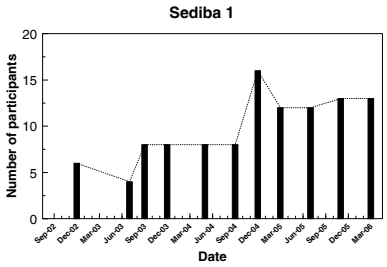

Paradys
Number of participants
Date

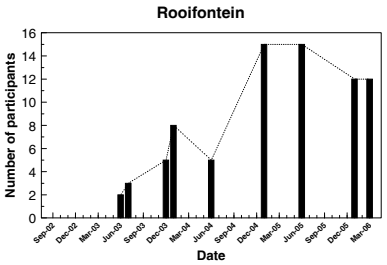

Spitskop
Number of participants
Date


Klipfontein
Number of participants
Date


Seroalo
Number of participants
Date


Tabale
Number of participants
Date


Sediba 1
Number of participants
Date


Rooifontein
Number of participants
Date

Appendix 5.1 Constitution of the Tswelelopele Small Farmers Cooperative

CONSTITUTION OF TSWELELOPELE SMALL-SCALE FARMERS COOPERATIVE (THABA NCHU)

SECTION ONE: PREAMBLE

We, the Tswelelopele Small Farmers Cooperative, realize the need to reduce food insecurity, alleviate poverty, create employment and reduce crime in our rural communities by increasing small-scale agricultural production through the application, promotion and use of IRWH technique. We are small-scale farmers who are committed to increasing agricultural production through the adoption and adaptation of new or improved indigenous production techniques, as well as being active role players in the generation of new technologies aimed at improving the farming conditions of small-scale farmers in Thaba Nchu and Botshabelo areas respectively. We commit ourselves to enriching and empowering small-scale farmers towards the development of a profitable and commercial agricultural sector in the rural Thaba Nchu area. Driven by the success of In-field Rainwater Harvesting (IRWH) techniques, we resolve to form an association that will be responsible for aiding the development and success of small-scale arable farmers to be a vibrant, viable and sustainable agricultural sector in the Central Free State Province. We further resolve, through the association, to be an important role player in the South African agricultural sub sector by enabling small-scale farmers to fully and significantly participate in regional economic development, and subsequently the national economy in the long run.

MOTTO:TSOGA O ITIRELE (Wake up and work for yourself)

SECTION TWO: NAME

2.1 The name of the association shall be Tswelelopele Small Farmers Cooperative, *herein after referred* to as TSFC

SECTION THREE: GENERAL OBJECTIVE

3.1 To use, propagate, capacitate and encourage the use of the In-field Rain Water Harvesting (IRWH) technique in order to reduce food insecurity, alleviate poverty, create employment and reduce crime.

SECTION FOUR: OBJECTIVES

4.1 To facilitate the agricultural skills development of members to run viable and sustainable agricultural projects.
4.2 To use the IRWH technique in the production of crops.
4.3 To participate in profitable and successful business ventures that will benefit the cooperative and its members.
4.4 To contribute towards creating jobs, alleviating poverty and reduce crime by encouraging own agricultural production amongst members and the community.
4.5 To conduct community awareness and environmental care.
4.6 To collectively aid the production of enough crop yield surplus and market it for the members.
4.7 To encourage the members, especially women and youth, to embark on environmentally friendly agricultural production activities.
4.8 To ensure economically vibrant, food secure, healthy and safe rural communities.
4.9 To ensure that all members involved serve the interest of the TSFC and protect its interest at all times.

SECTION FIVE: MEMBERSHIP

.
5.1 TSFC shall be open to all members of affiliated water harvesting interest groups
5.2 Village members shall be affiliated to the TSFC through their Community Based Water Harvesting Interest Cooperative CB:WHIC
5.3 An individual CB:WHICH group shall be allowed to join TSFC provided it has more than 10 households in a village and is recognized as such by the community it represents.
5.4 A village water harvesting group will be affiliated to TSFA by paying a monthly subscription to the Executive Board Treasurer an amount equivalent to 20% of the total subscription of the CB:WHICH group **[A minimum of R5 per month per member payable to the CB:WHICH**].
5.5 The CB:WHICH group(s) after consultation with the MB:WHIC shall determine their subscription rates.

5.6 RIGHTS OF MEMBERS

5.6.1 All members of affiliated CB:WHIC's are eligible to stand for elections to the executive board ***provided*** they are the legitimate nominated delegates by their CB:WHICs to attend the ***ELECTION CONGRESS or GENERAL ASSEMBLY*** a MUST have meeting to be held every last week of January of every after 2 years.

5.6.2 All members shall have a right to policy formation and decision making through the respective CB: WHICs and Zonal Cooperatives (ZC).

5.6.3 All members shall have the right to access of resources and information.

5.6.4 Every member (individual and/or group) has the right to be protected from any kind of unfair treatment and/or harassment by his/her CB: WHIC, ZC and MB: WHIC.

5.7 TERMINATION OF MEMBERSHIP

5.7.1 A cooperative(s) and/or individual(s) shall cease to be a member of TSFC upon resignation or sacking or the dissolution of that particular group(s) and/or the individual(s) ceases to be a member of a recognized water harvesting interest group.

5.7.2 A cooperative(s) and/or individual(s) shall cease to be a member of TSFC is no longer serving the interest of the TSFC or not involved in IRWH crop production technique.

SECTION SIX: STRUCTURE

6.1 TSFC shall operate at three different but complementary levels (municipal, zonal and village/community level).

6.2 There shall be the Executive Board (Tertiary Cooperative), the General Assembly with a sub-sector of Zonal Cooperative Representative(s) (ZCR) (Secondary Cooperatives), and CB: WHICs (Primary Cooperatives).

6.3 The Executive Board together with the General Assembly are the highest decision making body for all levels of the cooperatives.

6.4 Zonal Cooperatives shall have elected members from the Zonal CB: WHICs village members, does not necessarily be an elected CB: WHICH member. These ZCR members will be elected in a ***Zonal cooperative congress to be held once in 2 years and must be endorsed by the GENERAL ASSEMBLY prior to taking office***.

6.5 TSFA shall affiliate to any relevant body deemed appropriate by the General Assembly and serving the same interest as the TSFC.

6.6 GENERAL ASSEMBLY

6.6.1 At the municipal level the cooperative shall consist of the ***General Assembly*** and the ***Executive Board.***

6.6.2 The General Assembly shall consist of 42 village chairpersons or nominated representative to attend the general assembly from the 42 CB: WHICs, plus the 5 ZCR members and 6 other Executive Board members. [Total of 53 members].

6.6.3 The General Assembly is the highest decision and policy making body and elects members for the Executive Board and endorses members of ZCR.

6.6.4 The term of office of the General Assembly is 2 years and can only serve for a maximum of 2 terms or 4 years, after which must not stand for elections for at least another 2 years.

6.7 COMPOSITION OF EXECUTIVE BOARD

6.7.1 The Executive Board shall consist of:

6.7.1.1 The Chairperson
6.7.1.2 The Secretary General
6.7.1.3 The minute secretary
6.7.1.4 The Treasurer
6.7.1.5 The Publicity Secretary
6.7.1.6 5 ZCR members
6.7.1.7 Electoral Officer
6.7.1.8 ARC-ISCW (Glen) (ex officio)
6.7.1.9 FSDA (ex officio)
6.7.1.10 TTA (ex officio)
6.7.1.11 MLM (ex officio)
6.7.1.12 FSDTEEA (ex officio)
6.7.1.13 FSDE (ex officio)
6.7.1.14 FSDH (ex officio)

6.8 DUTIES OF THE EXECUTIVE BOARD

6.8.1 Be responsible for the daily administration of TSFC.

6.8.2 Be responsible for the implementation of programs of TSFA.

6.8.3 Report regularly to the General Assembly at all sittings thereof.

6.8.4 Evaluate the progress of TSFC.

6.8.5 Hold office for a period of not more than 2 years.

6.8.6 Not hold any office in the CB: WHICs.

6.8.7 Shall have authority to dismiss any member of the Executive Board who flouts protocol and absconds from his or her duties as set out in the code of conduct.

6.8.8 Shall have the authority to co-opt someone to replace the dismissed member subject to the **endorsement** of such a member by the General Assembly.

6.8.9 Shall call all General Assembly sittings once every month and as when there is justification or need arises to call a General Assembly sitting(s).

6.8.10 Shall have the authority to enter into contract with any institution, individual or parties for the sole purpose of advancing the aims of TSFC.

6.8.11 Shall be the sole guardian and administrator of all the possessions of TSFC and its affiliate member groups.

6.8.12 In consultation with other stakeholders, shall organize water harvesting festivals, information days and congresses at least once each growing season.

6.8.13 The Executive Board shall serve as the Secretariat at the General Assembly meetings.

6.9 The Chairperson shall:

6.9.1 Be a resident and active member of an affiliated CB:WHIC

6.9.2 Be the Chief Executive Officer of TSFC.

6.9.3 Be responsible for the application and implementation of the principles, policies and programmes of TSFC.

6.9.4 Represent TSFC in all external affairs, where this is not possible appoint, the Executive Board shall decide who will represent TSFC.

6.9.5 In consultation with the General Secretary have powers to take emergency decisions which are in the interest of TSFC and have to be ratified by the Executive Board and where possible the General Assembly.

6.9.6 Maintain regular contact with other Executive Board members in order to ensure that they perform their assigned duties.

6.9.7 Preside over all meetings of the Executive Board and chair water harvesting congresses, festivals and information days.

6.9.8 Together with the General Secretary draw up, and in consultation with other Executive Board members, the agenda for Executive Board and General Assembly meetings.

6.9.9 Deliver a speech at all General Assembly meetings, festivals, congresses and information days as a way of opening the gatherings and/or meetings.

6.9.10 Be the face of TSFC.

6.9.11 Be applying the IRWH technique at his/ her backyard or cropland(s).

6.10 The General Secretary shall:

6.10.1 Be a resident and active member of an affiliated CB:WHiC.

6.10.2 Be the Chief Administrative Officer of TSFC.

6.10.3 Keep all records of TSFC.

6.10.4 With the Chairperson be the custodians of all the assets of TSFC

6.10.5 With the Chairperson convene Executive Board and General Assembly, festivals, information days, congresses and set the agenda thereof.

6.10.6 Coordinate all the activities of TSFC and the Executive Board members.

6.10.7 Head the policy formulation of ACTS and be the Speaker of all General Assembly meetings.

6.10.8 Present a secretariat report on the activities of TSFC at all Executive Board and General Assembly meetings, and whenever required to do as at a properly constituted and called gathering

6.10.9 Be the Acting Chairperson in the absence of the Chairperson.

6.10.10 Ensure that all Executive Board members are informed of all the Board meetings.

6.10.11 Ensure a smooth transfer of all the records and assets of TSFCA to the next Executive Board.

6.11 The Electoral Officer (Non-Member preferable an ex-officio):

6.11.1 Be the chairman of all meetings of the TSFC were elections are being conducted at all the structural levels of the TSFC.

6.11.2 Conduct elections and make sure that all election regulations are followed without favor and are fair to all as per the constitution.

6.11.3 Make sure that all election procedures are not flouted all members at all times. Failure to do so will mean that disciplinary measures to be effected by the General Assembly.
6.11.4 Advice the General Assembly, Executive Board and CB: WHICs on elections procedures.
6.11.5 Be present and chairing all election meetings.
6.12 The Treasurer shall:
6.12.1 Be a resident and active member of an affiliated CB:WHIC
6.12.2 Be responsible for the initiation and coordination of fund raising activities of TSFA with the Publicity Secretary and the General Secretary.
6.12.3 Ensure a smooth transfer of all financial records to the next Executive Board treasurer after an independent audited financial statement.
6.12.4 Present a budget annually, in consultation with the Executive Board but has to be endorsed by the General Assembly.
6.12.5 Present an *audited* financial statement of TSFA annually at the last General Assembly meeting of the year in December.
6.13 The Publicity Secretary shall:
6.13.1 Be a resident and active member of an affiliated CB:WHIC.
6.13.2 Be the Chief Information Officer and be responsible for promoting TSFC in media related activities.
6.13.3 Be responsible, together with ZCR for publicizing all the activities and meetings of TSFC at Board and General Assembly levels.
6.13.4 Ensure that the positions, policies and principles of TSFA are well reflected in the public.
6.13.5 In consultation with the Chairperson, issue press releases for TSFC.
6.13.6 Be responsible, together with ZCR, for publicizing **once** in 6 months a well written newsletter for TSFC.
6.14 Zonal Level
6.14.1 All affiliate CB:WHIC's in a zone shall form a Zonal Cooperatives committee.
6.14.2 The Zonal Cooperative committee shall elect a ZCR member (coordinator)
6.14.3 The Zonal Coordinator representatives his/her zone in the Executive Board
6.14.4 The zonal committee shall coordinate all the activities of affiliated CB:WHICs in a particular zone.
6.15 The Zonal Representative shall:
6.15.1 Be a resident and active member of an affiliated CB:WHiC.
6.15.2 Regularly convene zonal meetings once a month, preferably before and after the General Assembly meetings
6.15.3 Ensure that the zone is adequately represented at the General Assembly meetings and Executive Board.
6.15.4 Ensure that the policies and programmes of TSFC are implemented at zonal level.
6.15.5 Submit reports of the activities of the zone to the Secretary General at the Executive Board meeting.
6.15.6 Be endorsed by the Executive Board and/or General Assembly
6.15.7 Share in the collective responsibility of the Executive Board.
6.15.8 Shall present written reports on activities or progress in their zones.
6.15.9 Shall announce dates of village meetings at the general assembly
6.15.10 Shall present a program of their tasks for the month and also report on the progress of the previous month.
6.16 Village level (Primary Cooperative) (CB:WHIC) shall:
6.16.1 Be the primary organ of TSFC
6.16.2 Elect one member to be part of the zonal committee and General Assembly.
6.16.3 Be constituted of 5 or more members.
6.16.4 Elect their own executive committees.
6.16.5 Pay an annual prescribed subscription fee to TSFC (Executive Board) not less than R60-00 per year in order to remain affiliated.
6.16.6 Have its own constitution which is in line with the municipal (TSFC) constitution.
6.16.7 All CB:WHICs must send constitutions to the Executive Board to be approved by the General Assembly.
6.17 Duties of the CB:WHIG Executive Committee
6.17.1 Shall be responsible for the implementation of the policies and programmes of TSFC.
6.17.2 Shall be responsible for organizing and expanding TSFC at village level.
6.17.3 Shall represent all village members in the village.

6.17.4 Shall maintain regular contact with the Zonal Committee, Executive Board and the General Assembly through the respective representative(s).
6.17.5 Shall send a report to the ZCR representative on the activities of the village CB:WHIC
6.17.6 Shall protect the interests of its members at village within the principles, policies and programmes of TSFC.
6.17.7 Shall contribute to the policy formulation of TSFC.
6.18 Vacation of seats
6.18.1 A member of any committee of TSFC; *Executive Board, General Assembly, Zonal Committee, Village Executive Committee, any structure or committee thereof*, shall vacate his/her seat if he or she
6.18.1.1 Ceases to be a resident and active member of an affiliated CB:WHIC
6.18.1.2 Resigns from his or her seat in writing to the Chairperson, *of the relevant structure of TSFC*, one month before such a resignation is due.
6.18.1.3 Absents himself/herself voluntarily from three (3) consecutive meetings of the relevant structure of TSFC without obtaining leave to so or without enough reason to do so.

SECTION SEVEN: MEETINGS

7.1 EXECUTIVE BOARD MEETINGS
7.1.1 The Chairperson shall convene a meeting of the Executive Board within 72 Hours after the Election of the new Board.
7.1.2 There shall be nine (9) Executive Board members in a term of office *unless business dictates otherwise. Such additional members are subject to approval by the general assembly.*
7.1.3 Sittings shall preferably be ***and not confined*** to workdays.
7.1.4 There should be punctual attendance at meetings which should be made known to concerned members in good time.
7.1.5 Clear decisions with no equivocation must be taken and be practicable within the scope of TSFC structures.
7.1.6 All the above are applicable in all structures of TSFC.
7.1.7 The Executive Board shall have at least one a*nd not necessarily* two meetings in a month.

SECTION EIGHT:

8.1 GENERAL ASSEMBLY MEETINGS
8.1.1 Shall elect the Executive Committee at its first meeting of the term of office.
8.1.2 Shall meet *but not necessarily* once in a month.
8.1.3 The Secretary General shall be the Speaker or Chairperson of all General Assembly meetings.
8.1.4 Shall evaluate the functioning of the Executive Board.
8.1.5 Shall have the authority to dissolve and appoint the Executive Board with a two thirds majority either though voting or a signed petition of all members present.
8.1.6 Shall be constituted by all village representatives, zonal representatives and the Executive Board.
8.1.7 Shall be the highest decision making body of TSFC.
8.1.8 All decision taken by the General Assembly will binding on all structures of TSFC.
8.1.9 In case of standoff regarding an item of discussion, the final decision shall be decided by a simple majority with the endorsement of the Electoral officer.
8.1.9.1 Decisions so taken are final and only subject to review with a two thirds majority of the General Assembly.
8.1.9.2 A petition signed by a two thirds majority can force the board to call an urgent general meeting.

8.2 ZONAL MEETINGS
8.2.1 Shall constitute of all the village representatives and members in a zone.
8.2.2 Shall be convened as often as is required but at least once a month prior to the first General Assembly.
8.2.3 Meetings shall be chaired by the Zonal Representative (Coordinator).
8.2.4 Decisions taken at zonal meetings will and can only be applicable to the villages (CB:WHICs) in the zone *unless ratified by the General Assembly as applicable to all affiliate member groups.*

8.3 VILLAGE (CB:WHIG'S) EXECUTIVE COMMITTEE MEETINGS
8.3.1 Shall be held as often as possible but at least once in a fortnight
8.3.2 Shall be constituted of all executive committee members.
8.3.3 Decisions taken by the executive committee shall be binding on all the concerned members.
8.3.4 Decisions taken should be in line with the aims and objectives of TSFC and practicable within the scope of the concerned CB:WHIC.

SECTION NINE: QUORUM

9.1 Fifty percent plus one (50% + 1) of the concerned membership will constitute a quorum of any meeting of the structures of TSFC.
9.2 Failing which a meeting will be adjourned for 48 hrs and be reconstituted. Otherwise a special meeting will have to be called.
9.2.1 A special meeting shall be called with a 75% majority of the present members calling for such through a vote or a pertion.
9.3 Required votes at a properly constituted meeting shall be two thirds majority and all questions and decisions shall be decided by a simple majority

SECTION TEN: DURATION AND DISSOLUTION

10.1 Terms of office
10.1.1 The General Assembly shall:
10.1.1.1 Shall be constituted by all the CB:WHICs representatives.
10.1.1.2 CB:WHICs representatives chairperson shall sit in the General Assembly for at least one full growing season.
10.1.2 The Executive Board shall:
10.1.2.1 Be elected once every two years by the sitting General Assembly at the opening of its term in January of that year.
10.1.2.1 Election of the Executive Board shall be secret ballot through an independent Electoral Officer (non member and/or ex officio members).
10.1.2.2 Shall be dissolved by a motion of the General Assembly at the end of its two year term.
10.1.2.3 A motion for the dissolution of the Executive Board shall be followed by a motion to elect a new Executive Board at the same General Assembly sitting that dissolves the Executive Board.
10.1.3 The Zonal Committee shall:
10.1.3.1 Be constituted by all village representatives of the villages in the zone.
10.1.3.2 Shall be reconstituted as often as new committees are elected in the concerned villages except the ZCR Representative.
10.1.3.3 Elect the ZCR representative every two years in line with the term of office of the Executive Board.
10.1.4 The Village Executive Committee shall:
10.1.4.1 Shall be elected as often as practically possible but at least should span one full growing season.

SECTION ELEVEN: AMENDMENTS

11.1 The constitution may only be amended subject to a motion to the effect.
11.2 The motion to amend the constitution should be accompanied by the 80% signatories of affiliated member groups.
11.3 No amendment may be made which would have the effect of making the cooperative cease to exist.

SECTION TWELVE: CODE OF CONDUCT

12.1 Violation of the Code of Conduct
12.1.1 Misconduct or any behaviour that is judged to be disrepute to TSFC.
12.1.2 Any person guilty of misconduct shall be judged to have committed a violation of the code of conduct.
12.1.3 Violation of the code of conduct shall include:

12.1.3.1 Behaviour that is judged to be a violation of non-sexism and democracy.
12.1.3.2 Negligent handling of official documents.
12.1.3.3 Any unauthorized use of TSFC property, funds and equipment for personal advantage.
12.1.3.4 Malicious disruption of meetings that undermines the integrity of an individual member or of TSFC as a whole.
12.1.3.5 Blatant and disruptive contravention of the decision(s) collectively made by the executive committee, executive board or general assembly and/or its sub committees.
12.1.3.6 Deliberate misrepresentation of any structure (s) of TSFC decision or position
12.1.3.7 Negligence of official responsibility, which *includes and not confined to*:
12.1.3.7.1 Non-attendance of two or more TSFC structure (s) meetings without due apology.
12.1.3.7.2 Failure to perform delegated tasks on time without good reasons.
12.1.3.7.3 Arriving late for a meeting without an apology.

12.2 Disciplinary Procedures

12.2.1 Any structure of TSFC, through the relevant executive body, can motivate for the actuation of a disciplinary committee if it is felt there is a violation of the code of conduct

12.2.2 The disciplinary Committee shall consist of three nominated members of the relevant executive body members, and judgments are to be ratified by the Executive Board.

12.2.3 The accused member(s) can seek recourse from the General Assembly in event that they are not satisfied with the outcomes of the Disciplinary committee conclusions and judgments.

12.2.4 The General Assembly shall appoint a five member Appeals Committee in the event of such being needed.

12.2.5 In the nomination of the Disciplinary committee and Appeals committee, the appointing executive body should be sensitive to gender and locality and endeavour to incorporate the diversity of views prevalent on the issue.

12.3 Procedure for the Disciplinary Committee

12.3.1 Clarity should be reached as to the aspect of conduct that the accused is perceived to have violated.

12.3.2 The accused should be allowed to offer defense.

12.3.3 The decision should be reached on the degree of violation and an appropriate sentence should be recommended.

12.3.4 The disciplinary committee should motivate for its decisions and make recommendations for the appropriate sentence.

Appendix 8.1 Report from Farmer on WCT Symposium held at the Bloem Spa Lodge in Bloemfontein from 8-11 April 2003

By Makoekoe Esau Motlalile

OBJECTIVE
The main objective of this report is to give a farmer's perspectives, experiences and lessons learned from the symposium.

Firstly, it was an honour for us the rural small-scale farmers to be chosen from such a large pool of farmers in South Africa to be ambassadors at the Symposium. We would like to thank the Symposium Organizing Committee more especially the ARC-ISCW crew based at Glen for their invitation.

LOGISTICS
As far as logistics were concerned, every thing was highly satisfactory.

TECHNOLOGIES
We were exposed to a wide range of techniques. Some of these we knew and was practiced by most farmers in the past e.g. ripping and ridging. What amazed us was the fact that most countries were still using cattle as traction power, while this was considered to be an outdated practice in our area. Some were new to us, for example potholing and Mocuna short fallow. Most of these technologies if not all were not demanding in terms of implementation. Irrespective of some similarities in these technologies, it was evident that no single technique could work in all areas, due to differences in rain patterns, soil types and other factors.

LESSONS LEARNED
Even though we knew the importance of weeding, we did not realize how vital it is towards increasing production yields. We also learned that mulching proofed to have a huge contribution towards yield increase. Soil nutrients and drainage capacity were also very crucial factors, which contributes to yield increases. Most technologies addressed issues of food security, job creation, income generation, land and environmental care.

FIELD EXCURSIONS AT YOXFORD AND BALACLAVA
Farmers were motivated a lot by the visit of representatives from around the Globe. Farmers are beginning to realize the importance of hard work and dedication and visits like this encourages them even more. Ever since they were involved in the implementation of the *IRWH* technique, they have hosted a number of International guests and they view the technology as having a high tourism potential.

RECOMMENDATIONS
It is recommended that in future more farmers be invited to the Symposiums of this nature. All presenters send their documents in time prior the symposium to be typed and ready when it starts.

In spite of the fact that one had to struggle with the ascent of some presenters and shortage of their presentation documents the Symposium was a success and farmers enjoyed every moment of it.