Technology Transfer to Improve the Implementation of the

FARMS System for Decision Support

in the Field of Risk Management, Irrigation Cost Estimation and Whole Farm Planning

PW Botha, LK Oosthuizen & JA Meiring

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Water Research Commission

TECHNOLOGY TRANSFER TO IMPROVE THE IMPLEMENTATION OF THE FARMS SYSTEM FOR DECISION SUPPORT IN THE FIELD OF RISK MANAGEMENT, IRRIGATION COST ESTIMATION AND WHOLE FARM PLANNING

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Final report to the Water Research Commission

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EXECUTIVE SUMMARY

OBJECTIVES

The aims of this technology transfer project were firstly, to train agribusinesses, bureau services and advisors in the main irrigation areas of South Africa to implement the RiskMan (Risk Management), IrriCost (Irrigation Cost Estimator) and FARMS (Firm Level Agricultural Management Simulator) computer software for decision-taking support in the field of risk management, irrigation cost estimation and whole farm planning respectively; and secondly, to give these organizations and individuals the necessary support in order for them to apply the abovementioned computer software on a continuous basis.

TECHNOLOGY TRANSFER PROCESS

New technology must pass through several stages before it is accepted. The five stages of adoption are awareness, interest, evaluation, trial and adoption. The implementation strategy with this technology transfer project consisted of a combination of methods, messages and approaches followed by the research team. The first step was to identify target groups to whom the three programs of the FARMS system: IrriCost, FARMS and RiskMan were demonstrated. The demonstration days took place at Jacobsdal and Bloemfontein (Free State Province); Douglas and Vaalharts (Northern Cape Province); Groblersdal (Mpumalanga); Elsenburg (Western Cape Province); Pietermaritzburg and Mount Edgecombe (KwaZulu-Natal Province). The demonstrations were attended by the contact person of that area together with potential adopters of the technology. These demonstrations were used to create awareness and interest in the use of the models. The next step was to arrange workshops for interested persons for specific models to make further progress with the technology adoption process. The website was used to provide additional information about forthcoming courses and continuous support on larger scale adoption and application.

The third step was to present the courses on IrriCost, FARMS and RiskMan as one-day workshops. Altogether 23 courses were presented to 311 trainees. The trainer was a project researcher who has been fully involved in the development of all three models since 1998. Eight IrriCost training courses were presented to 109 trainees in six provinces, except Gauteng, Northwest and KwaZulu-Natal. Two courses were presented in the Free State Province – one at Jacobsdal with 5 trainees, and one at Bloemfontein with 11 trainees. Two courses were presented in Mpumalanga Province – one at Groblersdal with 8 trainees, and the other at Nelspruit with 14 trainees. The other four courses were presented in the Eastern

Province at Queenstown with 19 trainees; one course in Limpopo Province at Thohoyandou with 35 trainees; one course in the Northern Cape Province at Kimberley with 7 trainees; and one course in the Western Cape at Paarl with 10 trainees.

Also eight FARMS training courses were presented in seven provinces for 107 trainees, except Gauteng and Northwest Province. Two workshops were presented in the Free State Province – Jacobsdal with 5 trainees, and Bloemfontein with 11 trainees. The representation of the courses in the other six provinces are the same as for the IrriCost training, namely 22 trainees in Mpumalanga Province (Groblersdal and Nelspruit), 19 trainees in the Eastern Province (Queenstown), 35 trainees in Limpopo Province (Thohoyandou), 7 trainees in the Northern Cape Province (Kimberley), and 10 trainees in the Western Cape Province (Paarl).

Lastly, seven RiskMan training courses were presented in six provinces (95 trainees), except Gauteng, KwaZulu-Natal and Northwest Province. One workshop was presented at Bloemfontein for 11 trainees. Two courses were presented in the Eastern Province – 17 trainees (Queenstown) and 4 trainees (Gamtoos Valley, Patensie). Lastly, one course each was presented in the Limpopo Province with 35 trainees (Thohoyandou), the Northern Cape Province with 7 trainees (Kimberley), Mpumalanga Province with 8 trainees (Groblersdal) and the Western Cape Province with 10 trainees (Paarl).

The course evaluation responses of the trainees were in general positive for all three programs. The vast majority of the respondents were of the opinion that the course contents of all three programs are good. In general they feel that:

- the time duration of each of these one-day training workshops was too short;
- they need follow-up training;
- they think they will be able to use these computer programs; and
- they need further support through telephone and electronic assistance and regular workshops.

The capacity which was built into 311 trainees scattered across the provinces was attained through the train-the-trainer model. The potential multiplier effect which could be catalyzed by the 109 trainees on IrriCost is on average 1 450 farmers per trainee of whom at least 70% are from previously disadvantaged communities. The potential multiplier effect which could result from the 107 trainees on FARMS are on average 2 100 farmers per trainee of whom 45% are from previously disadvantaged groups. The potential multiplier effect which could be catalyzed by the 95 trainees on RiskMan are on average 1 100 farmers per trainee, of whom approximately 85% are small-scale farmers in previously disadvantaged communities. Thus one project researcher trained 311 trainees in two years, who in their turn could potentially train approximately on average 4 600 farmers per trainee. The vast majority of these farmers (approximately 75%) are small-scale farmers in previously disadvantaged communities.

ACHIEVEMENT OF OBJECTIVES

In general it can be concluded that the first project objective was achieved through 23 workshops to 311 trainees in at least six provinces for each of the three models. With regard to the second objective it cannot be claimed that all 311 trainees will be able to use these models on a continuous basis. With hindsight better results could have been attained, if the train-the-trainer model was applied from the beginning of the project. Then a smaller group of potential trainers could have received intensive training over a longer period. These trainers could then be supported on a continuous basis as they train their farmers.

RECOMMENDATIONS

- The train-the-trainer model is an efficient approach in a situation where advisors in the provincial departments of agriculture are expected to transfer technology to farmers. The train-the-trainer model is based on the multiplier effect. Selected advisors can be trained to train other advisors or farmers.

- The methods and messages of the implementation strategy with the technology transfer process should be focused on a smaller number of competent potential trainers who could receive in-depth extended training, as well as continuous support. In this way a 24-hour helpdesk could be created for trainers who in their turn could offer a 24-hour helpdesk for their farmers.

- Technology is one of the greatest drivers for progress in agriculture. But new technology is only a tool. Therefore, the most important aspect is how the technology is used. The role of the trainers should be to demonstrate how the use of the new technology could make a difference in the lives of communities.

- Policymakers must formulate policies with incentives to facilitate technology transfer in agriculture. The extension service to small-scale farmers should be revitalized to perform this function. The public sector should play a major role by providing training to implement best management practices by small-scale farmers.

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The project team would like to express their gratitude and appreciation to a number of persons and organizations.

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Dr GR Backeberg	Water Research Commission (Chairman)
Mr AS Coetzee	GWK Limited
Mr JJ Janse van Rensburg	Department of Agriculture, Free State Province
Mr NE Knoetze	Oranje-Riet Water User Association
Mr DF de Wet	Oranje-Riet Water User Association
Mr JJ Momberg	Vaalharts Water User Association
Mr JHL Potgieter	Vaalharts Water User Association
Prof LK Oosthuizen	University of the Free State
Prof GF Ortmann	University of KwaZulu-Natal
Dr DP Troskie	Department of Agriculture, Western Cape Province
Prof JA Meiring	University of the Free State (Project leader)
Mr JF Taljaard	JTPS Close Corporation (Committee secretary)
Mrs G Kruger	Water Research Commission (Coordinator)

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Prof André Meiring
PROJECT LEADER
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CHAPTER 1

INTRODUCTION

The FARMS system is a comprehensive farm management decision-support system consisting of the FARMS (Firm level Agricultural Management Simulator) computer program, RiskMan (Risk Management) and IrriCost (Irrigation Cost) programs. The FARMS program generates short-term whole farm plans and enterprise budgets with fixed quantities and prices. The RiskMan computer program assists decision-makers in characterizing farming risks. The IrriCost program is an aid for estimating costs of irrigation systems. The proper estimation of irrigation costs is critical for irrigators to be able to evaluate efficient water use techniques.

The FARMS system was tested for several farmers in irrigation areas of Riet River, Rama and Loskop (Meiring, Oosthuizen, Botha and Crous, 2002). The next step was to transfer these technologies to the main irrigation areas of South Africa.

The aims of this technology transfer project was firstly, to train agribusinesses, bureau services and advisors in the main irrigation area of South Africa to implement the RiskMan, IrriCost and FARMS computer software for decision-taking support in the field of risk management, irrigation cost estimation and whole farm planning respectively; and secondly, to give these organizations and individuals the necessary support in order for them to apply the above-mentioned computer software on a continuous basis.

In contrast to a scientific report which usually consists of the methodology, results and discussion of results, this technology transfer report gives an account of the interactive approach which was followed to carry out the implementation strategy, and gives feedback on the demonstrations and courses which were presented. Capacity building achieved with this project was highlighted.

CHAPTER 2

AN INTERACTIVE APPROACH

2.1 TECHNOLOGY TRANSFER

Technology transfer is more an art than a science because it focuses on how people adopt new technologies, motivational theories, communication strategies, and how information spreads through rural communities. New technology must pass through several stages before it is accepted. The five stages of adoption are awareness, interest, evaluation/comparison, trial and adoption (Bembridge, 1993). A criticism of the five-stage process is that it implies that a decision to adopt a new technology is always carefully considered. However, a farmer may sometimes act in an impulsive and illogical way. If he/she acts in this way, the technology is likely to be unsuitable for him/her and will probably be discontinued (Bembridge, 1993:183). An alternative model of the adoption process consists instead of four functions: knowledge, persuasion, decision and confirmation (Bembridge, 1993:183).

The rate at which an innovation will be adopted depends on the characteristics of the decision-makers, the social system, the decision-makers' views of the nature of the innovation, exposure to communication channels and the trainee's efforts. Research has shown that acceptance of new technology takes place over time. According to the adoption curve, 2% of the population will be innovators, 13% of the population will be early adopters, 34% will be early majority adopters, 34% late majority adopters, and 16% of the population will be laggards (Bembridge, 1993:184).

An interactive approach was taken to do the technology transfer of this project. This approach was adopted from a previous WRC technology transfer project conducted by Annandale *et al*. (2005). The point of departure for the technology transfer process was to identify contact persons in the different irrigation areas with whose assistance demonstration days could be arranged. Then, through interaction between the contact persons and attendees of the demonstrations, potential trainees for the ultimate training workshops were identified. As a starting point, the individuals and organizations identified by Annandale *et al*. (2005) were contacted and utilized to plan the demonstration days for the three software programs, namely IrriCost, FARMS and RiskMan.

The role of the person who is doing the technology transfer is to use the stages of adoption to plan an implementation strategy. In this project the implementation was done in two stages.

The first stage was the demonstration of the models which served to create awareness and further interest among the targeted individuals. Courses were then presented to assist potential adopters in making comparisons and giving guidance in putting the models into practice. A website was also developed to provide additional information and support on larger scale adoption and application.

2.2 WEBSITE

The address reserved for the FARMS website is "http://www.uovs.ac.za/farms". A map of the website is presented in Table 1. The site was developed to meet five objectives: firstly, to give a brief review of the FARMS system as well of each of the three programs separately; secondly, the making available of a demonstration version of IrriCost, FARMS and RiskMan; thirdly, to also make the user guides of each program available (each chapter of each program is downloaded separately so that users do not get frustrated with long download times or downloading unwanted information); fourthly, to advertise courses, and lastly to supply users with contact details.

TABLE 1: A MAP OF THE FARMS SYSTEM'S WEBSITE

FARM MANAGEMENT AIDS
- IrriCost
- FARMS
- RiskMan

IRRICOST
- Uses
- Features
- Downloads
- IrriCost user's guide: PDF format

FARMS
- Uses
- Features
- Downloads
- FARMS user's guide: PDF format

RISKMAN
- Uses
- Features
- Downloads
- RiskMan user's guide: PDF format

COURSES

CONTACT US

LINKS

WATER RESEARCH COMMISSION
UNIVERSITY OF THE FREE STATE
ESKOM

2.3 MAINTENANCE PROGRAMMING

After the first IrriCost training course certain major and several smaller changes were made to the program. In altering their tariff structures, Eskom caused two of the major changes. Previously the relevant fixed costs comprised a basic charge. Consumers now pay both service and network charges. These could have been added together for the old version, but the program was modified to prevent confusion. Only one energy charge appears for each supply size. Until June 2002 different charges were paid for the first 400 kilowatt hour (kWh) and the quantity of kWh more than 400. Operating costs were calculated correctly with the previous version of IrriCost if the same energy charge was entered for both categories.

Eskom replaced Ruraflex's basic charge with a service, administration and network charge. The latter charge was treated as a variable cost although Eskom regards it to be fixed. A unit of rand per kilovolt ampere (R/kVA) was the first reason why the project team treated this network charge in such a manner. Secondly, both the voltage and transmission surcharge are calculated as a percentage of one or more variable cost components as well as the network costs. These surcharges are part of total variable irrigation cost.

The last major change was made to various water cost calculations of IrriCost. Few conspicuous changes were made to the input fields. However, formulas were adjusted so that additional water purchases can be made without having to complete the field for water quota per scheduled hectares. All water charges can be reported as variable costs in this manner.

Concerning the FARMS and RiskMan programs only minor programming modifications were necessary.

CHAPTER 3

THE FARMS SYSTEM

As was mentioned in the introduction, the FARMS system consists of three computer software programs which can be used individually or as a unit (Meiring, Oosthuizen, Botha and Crous, 2002). The FARMS system can also be used in conjunction with the Soil Water Balance model (SWB) and Water Administration System (WAS). For detail information the reader is referred to the above-mentioned report (Benade et al., 2002).

In this section, the linkage between the FARMS system and SWB as well as WAS is described firstly; and secondly the IrriCost, FARMS and RiskMan programs are highlighted.

3.1 THE LINKAGE BETWEEN THE FARMS SYSTEM AND SWB AS WELL AS WAS

Figure 1 presents a diagram of the electronic linkage between the FARMS system and SWB as well as WAS. The simulation of yields for alternative crop rotation systems, whole farm planning, risk simulation, irrigation scheduling and the water requisition for a system can all be done with these computer programs. This is also the sequence in which the actions take place and will be reviewed accordingly.

SWB is a computer program which is mainly used for real-time irrigation scheduling. However, crop yields for different irrigation levels including deficit irrigation, can also be simulated. The SWB crop growth model can therefore also be used for scenario modeling and as a planning tool. Another application is the simulation of crop rotation systems.

In the planning mode the FARMS system is subsequently used for the economic and risk analyses of these alternatives. All important variables can be analysed at enterprise level. However, the main capacity of the FARMS system is to enable whole farm analyses. Among others, fixed as well as variable irrigation costs and water requirements are estimated and financial statements generated. The risk of variable irrigation quantities, product prices and crop yields/livestock production is simulated accordingly. On the basis of this a choice can be made between alternatives (such as crops or mechanisation) simulated with the aid of SWB.

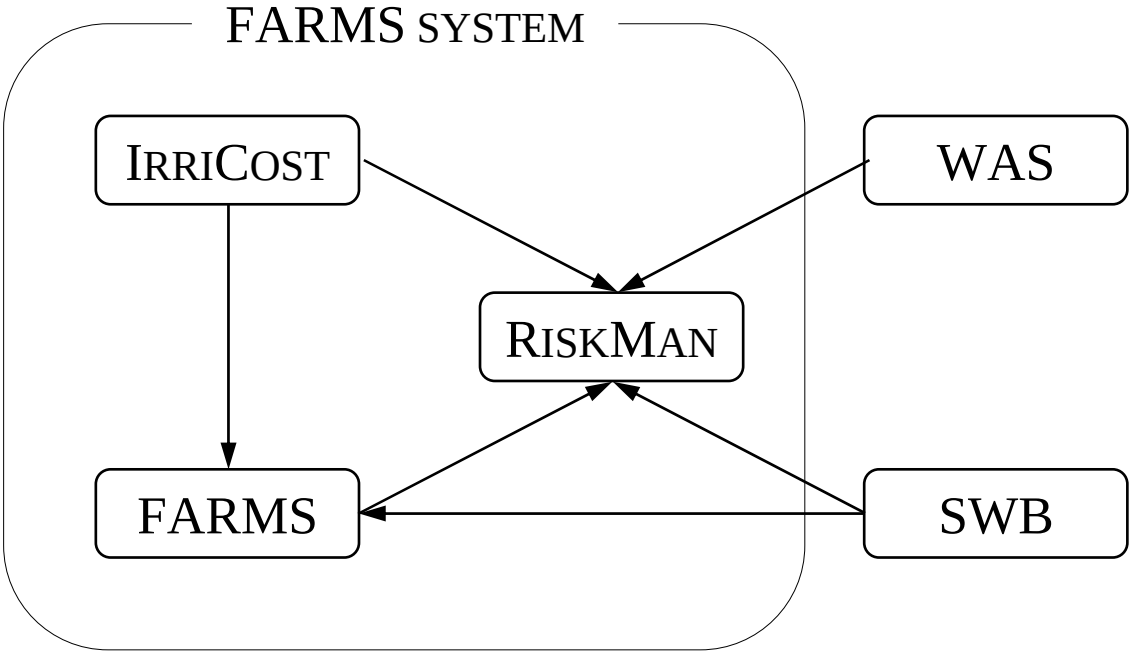

FIGURE 1: THE ELECTRONIC LINKAGE BETWEEN THE FARMS SYSTEM AND SWB AS WELL AS WAS

With implementation of the plan, real-time irrigation scheduling for the best crop rotation system can again be done by means of SWB. Actual soil water measurements are required for accurate irrigation scheduling. However, this is not feasible on a large scale. The second best option is the simulation of crop growth and soil water balance which requires fewer measurements. Simulated values can also be updated in SWB with these measurements. Consequently the irrigation quantity and timing are determined accurately.

The WAS computer program is mainly used for the management of water supply and the administration of water accounts. Among others, WAS also records which crop is grown on a specific field as well as the yield and irrigation quantity. These historical yields and irrigation quantities are imported into the FARMS system to simulate the risk of variable irrigation quantities and crop yields. In this manner risk is taken into account with the evaluation of alternatives.

3.2 THE IRRICOST COMPUTER PROGRAM

IrriCost emanated from SPILKOST 2.0 and is an aid for the management of irrigation costs. Both the capital and operating costs ought to be considered in purchasing a new irrigation system. Similarly operating costs are important during the replacement or upgrading of an existing irrigation system. The largest contribution of IrriCost is in the management of operating costs. IrriCost is a Windows-based program which was developed to estimate the

cost of centre pivot and hand line irrigation systems. The user is able to estimate fixed as well as variable irrigation costs with this program.

Table 2 presents the main menu and input as well as output options of IrriCost. The inputs are managed under two sections in the main menu of the program. General program inputs are managed under the general option, and irrigation system specific inputs under the data option. The results of IrriCost are available in the main menu under output. These three menu options are subsequently discussed.

3.2.1 *GENERAL PROGRAM INPUTS*

Electricity tariffs and charges, water charges, interest and inflation rates, electric motor capacities and friction fall under general program inputs. These inputs only have to be updated periodically, most of them once a year. IrriCost is able to estimate irrigation costs for either a Ruraflex or Land rate electricity tariff. Both tariffs should be adjusted annually by means of Eskom publications or their website. Water charges are divided into those for private irrigation and government schemes. The latter has to be updated annually with schedules from the Department of Water Affairs and Forestry. Interest and inflation rates do not change at fixed times and should be adjusted accordingly. A list of available electric motor capacities is given. It is possible to replace any motor in this list with another one. Lastly pipe friction coefficients can be altered or another kind of pipe added. All the above-mentioned general program inputs eliminate the repeated entering of information.

3.2.2 *IRRIGATION SYSTEM SPECIFIC PROGRAM INPUTS*

System specific program inputs comprise management, system characteristics, capital investment, insurance as well as electricity tariffs and labour costs. Firstly, management factors that affect irrigation costs have to be entered. The main objective of system characteristics is to specify the phases of an irrigation system. A phase is a continuous section in which friction remains unchanged. New phases are for example preceded by a change in the kind of pipe, pipe diameter or the occurrence of a pump. Certain system design values in this section are calculated, but can be overwritten. Subsequently capital investment is required separately for the major components of the irrigation system. Penultimately insurance tariffs should be entered and an electricity tariff selected. The number of peak, standard and off-peak hours irrigated is required if Ruraflex was selected. Lastly, the wage rate for labour has to be entered. A crop rotation system can be compiled when IrriCost is run.

TABLE 2: THE CATEGORIES UNDER CERTAIN MAIN MENU OPTIONS OF THE IRRICOST COMPUTER PROGRAM

FILE

GENERAL
- ELECTRICITY TARIFFS AND CHARGES
- WATER CHARGES
- INTEREST AND INFLATION RATES
- ELECTRIC MOTOR CAPACITIES
- FRICTION

DATA
- MANAGEMENT
- SYSTEM CHARACTERISTICS
- CAPITAL INVESTMENT
- INSURANCE TARIFFS
- ELECTRICITY TARIFFS
- LABOUR COSTS

RUN

OUTPUT
- FIXED IRRIGATION COSTS
- VARIABLE IRRIGATION COSTS
- IRRIGATION COST SUMMARY
- BUDGET
- GRAPHIC COST PREDICTION

HELP

3.2.3 *PROGRAM OUTPUTS*

Fixed as well as variable irrigation costs, an irrigation cost summary, budget and graphic cost prediction make-up the outputs of the program. Interest, depreciation, insurance, labour (R/month), electricity (R/month) and water (R/month) are the fixed costs taken into account. Variable irrigation costs again comprise electricity (c/Kwh), water (c/m^3), labour (R/hour) as well as repairs and maintenance costs. These costs are also expressed per cubic meter of water since they are variable costs. Electricity costs per cubic meter of water is a weighted mean of the first 500 and the number of more than 500 kilowatt-hours consumed per month in the case of Land rate and the number of peak, standard and off-peak hours in the case of Ruraflex. Variable water costs are calculated for each interval if a uniform charge is not paid. The marginal factor cost of water is an additional calculation in the irrigation cost summary. These are the extra costs incurred to apply an additional unit of water. The budget comprises a technical and economic section. Land as area under crops is expressed in terms of double cropping (or season hectares) as well as water utilised and still available are summarised per enterprise in the former section. The economic section allocates fixed and variable costs to the various enterprises. Fixed costs are allocated according to the number of season hectares and variable costs according to the quantity of water. The crop sequence is taken into

account if the water charge is not uniform. Consequently the more expensive water is allocated to the crops irrigated at the end of the water year. The last output of the program is a graphic presentation of fixed and variable irrigation costs per hectare.

3.2.4 *THE LINKAGE BETWEEN IRRICOST AND FARMS AS WELL AS RISKMAN*

The electronic transfer of data between IrriCost and FARMS as well as RiskMan lessens the duplication of program inputs and the manual entering of outputs. Several system characteristics, capital investment and electricity tariff inputs under the data option in the main menu of IrriCost can be exported. Likewise all the necessary fixed and variable irrigation cost outputs can be obtained electronically. The specific program inputs and outputs will be explained more fully under the import options of FARMS and RiskMan.

3.2.5 *APPLICATION POSSIBILITIES*

Advisors at agribusinesses as well as farmers can benefit from the IrriCost program by applying it. Irrigation systems are easily evaluated before the purchase of a new system or replacement or upgrading of an existing one. Different electricity tariffs can also be readily compared. The effect of an electricity tariff and charge or water charge increase can be determined. All fixed and variable costs as well as the marginal factor cost of water are calculated in each of these cases.

3.3 THE FARMS COMPUTER PROGRAM

FARMS is a computer program for short-term whole farm and enterprise analyses with specified fixed quantities and prices for a specific financial year. Credit as well as cash flow, and income statements and balance sheets are generated for different production systems. Machinery, irrigation and labour reports are also compiled.

Table 3 gives an explanation of the file, general, data, reports and graph main menu options in FARMS. The personal information of farmers can be managed with the program. An address and telephone numbers option appears under file in the main menu. However, this information is not linked with the farmers in the database for whom analyses are performed. The general and data options in the main menu structure the program inputs. General program inputs are grouped under the general option and farm specific program inputs under the data option. Results are accessible by means of the reports and graph main menu options. Both the two program input and output menu options of FARMS are subsequently discussed.

3.3.1 *GENERAL PROGRAM INPUTS*

Categories, input as well as product prices and machinery database are the options available under general in the main menu of FARMS. Cost and supplier categories are dealt with. The former determines into which categories costs in the credit and cash flow statements are divided. Input prices for crops and livestock are managed separately. These prices should be updated every season with the help of the respective suppliers. Like input prices, product prices for crops and livestock are managed separately. The cash price of a specific product has to be adjusted regularly if a price for the entire product was not contracted forward. The machinery database concludes the general program inputs. Market values and list prices in this database should be updated annually. List prices can be updated with the Guide to Machinery Costs (2004) and market values for tractors with the AGFACTS Used Tractor Price Guide (AGFACTS, 2004). The input as well as product prices and machinery database options greatly reduce the duplication of program inputs.

TABLE 3: THE CATEGORIES UNDER CERTAIN MAIN MENU OPTIONS OF THE FARMS COMPUTER PROGRAM

FILE
- OPEN DATABASE
- CLOSE DATABASE
- OPTIONS
- ADDRESS AND TELEPHONE NUMBERS
- PRINT SET-UP
- PRINT BLANK FORM
- EXIT

GENERAL
- CATEGORIES
- INPUT PRICES
- PRODUCT PRICES
- MACHINERY DATABASE

DATA
- STARTING DATE SET-UP
- ECONOMIC VARIABLES
  - Interest and inflation rates
  - Fixed obligations
  - Assets
  - Overhead cash flow
- LAND
- IRRIGATION SYSTEMS
- MECHANISATION
  - Parameters
  - System
- OPERATION DATABASE
- LABOUR INFORMATION
- CROP ENTERPRISES
- LIVESTOCK ENTERPRISES

RUN

REPORTS
- ASSET AND RESOURCE MANAGEMENT
  - Machinery
  - Irrigation
  - Labour
- ENTERPRISE EVALUATION
- FINANCIAL REPORTS

GRAPHS
- MACHINERY
- IRRIGATION
- LABOUR

HELP

3.3.2 *FARMS SPECIFIC PROGRAM INPUTS*

The options under data in the main menu of FARMS are starting date set-up, economic variables, land, irrigation systems, mechanisation, operation database, labour information and crop as well as livestock enterprises. A starting date for the 12-month analysis must be selected first. There are a further four options under economic variables, namely interest and inflation rates, fixed obligations, assets and overhead cash expenditures. Balances and limits and intermediate- as well as long-term liabilities are required in the fixed obligation section. Assets imply repairs as well as maintenance and insurance of buildings and equipment and current assets. The latter is needed for the balance sheet. Rent received, other as well as non-farm income, debt consolidation, rent paid, other expenses, cost of living and income tax are taken into account by means of overhead cash flow.

Land is the next option under data in the main menu. The fields of own and leased land have to be entered separately. These lists then remain at hand to merely select a field on which a specific crop is going to be planted. Subsequently the details of each irrigation system are required. Systems with which crops are going to be irrigated can then simply be selected from the list. At least the market values, list prices and fixed as well as variable electricity and water costs in this list should be updated annually. Two more data options are parameters and system under mechanisation. Parameters imply fuel, lubrication and repairs as well as maintenance. The machines of a mechanisation system can be selected from the machinery database. However, insurance and licenses should be added.

Operation database is the next data option. A machine and implements for an operation have to be selected from the mechanisation system. No more than two implements can be simultaneously hitched to a specific machine. Among others the user must indicate whether costs have to be based on working width, hours or kilometres (for example for implements, stationary machines and trucks respectively). The labour information option manages permanent labour salaries, hourly remuneration and available field- as well as man-hours.

Enterprise information, products, irrigation, operations, yield independent as well as variable inputs and additional labour make up the crop enterprises option. A distinction is made between the main and by-products. Fields (in the land option) as well as irrigation systems, product prices, operations (in the operation database) and input prices are program inputs which can be carried over to enterprise information, products, operations and yield independent as well as variable inputs respectively. The last option under data in the main menu is livestock enterprises. Enterprise information, products, crop enterprises utilised, production independent as well as variable inputs, stock flow, insurance and labour all receive attention. As in the case of crop enterprises, a distinction is also made between the main and by-products of livestock enterprises. Product prices, crop enterprises and input prices only need to be selected from lists on the products, crop enterprises utilised and production independent as well as variable input pages respectively. Livestock categories entered on the stock flow page also appear automatically on the insurance page.

General and production system pages for the run option in the main menu facilitate changes to key variables. The user has to indicate on the former page in what way negative credit and cash flow closing balances must be managed. In the same way that a cash flow statement traditionally represents the banking account, a credit flow statement represents the cooperative or production account in FARMS. Field, growing season, area, whether a specific crop is irrigated or not, irrigation system and whether a specific livestock enterprise must be included in the production system or not can be changed on the production system page. Consequently the user need not go back to the different data options.

3.3.3 *PROGRAM REPORTS AND GRAPHS*

Warning messages appear during a run if the overdraft or production loan is exceeded within a specific month. Reports in the main menu of FARMS comprise asset as well as resource management, enterprise evaluation and financial reports. Machinery, irrigation and labour are a further three options under asset and resource management. The former addresses annual fixed as well as variable costs and monthly hours in total as well as for each crop enterprise. All costs and hours are given per machine. Irrigation implies costs for each system and pump hours as well as the quantity of water per month for each crop enterprise. Labour deals with permanent man-hours available as well as utilised and temporary man-hours. Man-hours are reported monthly for each crop enterprise.

Enterprise evaluation is the next reports option. This implies the funds flow and budgets for each crop and livestock enterprise. The crop enterprise budgets give amounts for the entire area as well. Moreover ownership costs are allocated to the various enterprises. Gross margin and margin above specified costs are expressed per millimetre water as well. Financial reports are the last option under reports in the main menu. A credit as well as cash

flow and income statement and a balance sheet form part of this option. Own capital leverage and current total liability, current and return on total as well as own capital ratios are calculated at the bottom of the balance sheet.

Graphs in the main menu comprise of a machinery, irrigation and labour option. Fixed as well as variable machinery cost pie charts, fixed, variable and total machinery cost stacked bar charts and an available as well as utilised machine hour column chart are available under the former option. A distinction is made between machines in all the cases. The irrigation option presents a monthly water requirement line chart. Labour is the last graphs option. An available as well as utilised permanent, temporary and total utilised man-hour column chart falls under this option.

3.3.4 *IMPORT OPTIONS FROM IRRICOST*

Details of irrigation systems are required under the data option in the main menu of FARMS. These details can be entered manually if the user does not have IrriCost at his/her disposal. Otherwise irrigation system details may be imported from this program. An import button appears on the irrigation systems page (under the data main menu option) if ”Use IrriCost” under options in the file menu is ticked. Several technical and economic program inputs required for FARMS have already been entered in IrriCost. Variable electricity and water costs (both expressed in cent per millimetre hectare) again are IrriCost outputs required as inputs for FARMS, and therefore these IrriCost inputs and outputs need not to be transferred manually.

3.3.5 *THE LINKAGE BETWEEN FARMS AND RISKMAN*

Many inputs and outputs of FARMS can be exported to RiskMan. The former implies general as well as farm specific inputs. These include product prices, interest as well as inflation rates, fixed obligations, land, irrigation systems and crop as well as livestock enterprises. The product prices option falls under general and all the other options under data in the main menu of FARMS. Interest as well as inflation rates and fixed obligations are options under economic variables. Outputs from machinery, enterprise evaluation and financial reports can be transferred electronically to RiskMan. Machinery is a subsection of asset and resource management. All three options are found under reports in the main menu of FARMS. The specific interfaces are discussed under the import options of RiskMan.

3.3.6 *IMPORT OPTIONS FROM SWB*

There are two import options from SWB to FARMS. Firstly, fields and crops can be imported if the ”Use SWB” option under file in the main menu of FARMS is ticked. Fields is a variable for

land, and crops a variable for crop enterprises. Both options fall under data in the main menu. Secondly, personal information of farmers can be imported into FARMS. The ”Use SWB addresses” option must be ticked to transfer addresses and telephone numbers electronically. Options and addresses as well as telephone numbers are file menu options. However, all the above-mentioned program inputs can still be entered manually if the user does not have access to SWB.

3.3.7 *APPLICATION POSSIBILITIES*

FARMS is intended for advisors at agribusinesses and farmers. However, reasonably detailed information is required. Various analyses from enterprise to whole farm level are possible. The effect of a different input or product price can be determined at once with the aid of FARMS. A new loan can also be entered quickly. The area of a crop enterprise is easily changed or a livestock enterprise included or excluded for an analysis. Options exist for credit and cash flow closing balances to be kept as such or consolidated with long-term liabilities or for the credit flow closing balance to be paid from the banking account. Thus decisions concerning resources (that is machinery, water and labour), buying land or equipment, introducing new enterprises, using contractors, and so forth can be facilitated.

3.4 THE RISKMAN COMPUTER PROGRAM

The purpose of the RiskMan computer program is to assist decision-makers in characterising risk. This program was developed because there was lack of a tool to readily take risk into account within a dynamic farming environment. The different risks of each enterprise are handled separately although a result is presented by means of one cumulative distribution. Risk related to interest rate, irrigation cost, price and yield variability as well as hail damage can be taken into account separately or jointly with RiskMan.

Table 4 shows the options under those main menu items that manage most of the information of RiskMan. A personal information database can be built up with this program. The former is maintained independently under the address and telephone numbers option in the file menu. Program inputs are managed under the data option and outputs under the output option in the main menu. These two options are subsequently discussed.

3.4.1 *DATA INPUTS*

The inputs of RiskMan are managed under general farm information, fixed obligations, crop as well as livestock enterprises and correlation in the data menu. General farm information implies fixed costs, land and irrigation systems. The fixed obligations option comprises default interest rates (indicator rates) and intermediate- as well as long-term liabilities. Indicator rates are necessary for the quantification of interest rate risk.

TABLE 4: THE CATEGORIES UNDER CERTAIN MAIN MENU OPTIONS OF THE RISKMAN COMPUTER PROGRAM

FILE
- OPEN
- CLOSE
- OPTIONS
- ADDRESS AND TELEPHONE NUMBERS
- PRINT SET-UP
- PRINT BLANK FORM
- EXIT

DATA
- GENERAL FARM INFORMATION
- FIXED OBLIGATIONS
- CROP ENTERPRISES
- LIVESTOCK ENTERPRISES
- CORRELATION

RUN

OUTPUT
- RESULTS
- RECOMMENDATIONS

HELP

The crop enterprises option is next under data in the main menu of RiskMan. Enterprise information, products, irrigation, price, yield and hail damage pages have to be completed for each crop enterprise. Single values or a cumulative, triangular or normal distribution is required on the irrigation, price and yield pages to be able to take the respective risks into account. Livestock enterprises are the next data option. This option comprises an enterprise information, products, price and production section. As in the case of crop irrigation, price and yield risk, livestock price and production risk can be characterised by means of single values or a cumulative, triangular or normal distribution. Correlation is the last option under data in the main menu of RiskMan. Users can enter or calculate yield-production, price as well as irrigation, product price and hail damage coefficients with the program if they want to take correlation into account.

A general, production management strategies and risk distributions section form part of the run main menu option of RiskMan. These three sections make it possible to change key variables without returning to the original input pages. Besides their risk attitude (that is risk preferring, neutral or averse), users have to select in the general section which of irrigation, yield/production, price, hail and interest rate risk must be taken into account for the subsequent run. In the production management strategies section growing season, area and whether the crop is irrigated, and hail damage must be taken into account, and whether a specific livestock enterprise must be included or not can be easily changed. Provision is made to compare three production systems with each other at a time. Distributions are the last

section of the run main menu option. In this section users must select a distribution (that is single values or a cumulative, triangular or normal distribution) from those completed for each crop and livestock enterprise.

3.4.2 *PROGRAM OUTPUTS*

Results and recommendations are the options under output in the main menu of RiskMan. The former implies a cumulative distribution function table as well as graphs and statistics for yields/production and prices. Recommendations comprise among others these same outputs for total margin above specified costs and net cash flow. Strategy evaluation is a further section of this option. The three production systems are ranked by means of stochastic dominance with respect to a function in this section.

3.4.3 *IMPORT OPTIONS FROM IRRICOST AND FARMS*

Almost all the inputs for RiskMan can also be obtained electronically from other computer programs. Basic characteristics and the fixed, as well as variable water and electricity, costs for a specific irrigation system need not to be entered manually. Irrigation systems are imported from IrriCost into the relevant section of general farm information under data by ticking the “Use IrriCost” option under file in the main menu of RiskMan.

In the same way inputs and outputs of FARMS can be imported by ticking the “Use FARMS” option. Fixed costs and land (both general farm information sections), intermediate- as well as long-term obligations and crop as well as livestock enterprise information and products are involved. These are all data menu options in RiskMan. Fixed costs imply insurance and license fees for machinery, insurance, electricity and water for irrigation, insurance and repairs as well as maintenance of buildings and equipment and labour. Yield (production in the case of livestock) independent as well as variable and other costs are some of the enterprise information which can be imported from FARMS.

3.4.4 *IMPORT OPTIONS FROM SWB AND WAS*

“Use SWB” and “Use SWB addresses” options are available under file in the main menu of RiskMan. Fields, crops, irrigation quantities and yields can be imported from SWB if the former option is ticked. A field ID is required on the land page of general farm information and a crop enterprise on the enterprise information page of crop enterprises in RiskMan’s data menu. Irrigation and yield values are also crop enterprise sections. “Use SWB addresses” is the second SWB option in the file menu. The personal information database of SWB is imported electronically if this option is ticked. Consequently this information appears under address and telephone numbers in the file menu. File is a main menu option of RiskMan.

The values imported from SWB are simulated yields and the associated irrigation quantities. Alternative historical application quantities and yields can be imported from WAS. The “Use WAS” option under file in the main menu of RiskMan must be ticked to activate this function. As before, the data is pasted in the single values subsection of irrigation and yield respectively. The latter two are crop enterprise sections under data in the main menu.

3.4.5 *APPLICATION POSSIBILITIES*

Any agribusiness advisor or farmer can use RiskMan. The minimum particulars required from a user are a few overhead amounts and distributions for the risky variable. All other data can be obtained from existing enterprise budgets. The risk of various alternatives can be evaluated. For example variable irrigation quantities result in variable operating costs. This operating cost risk of different irrigation systems can be evaluated by means of RiskMan. Likewise the risk of financing an irrigation system with a loan can be estimated. The yield or production and price risk of different crop systems and enterprises as well as the inclusion or exclusion of livestock enterprises can also be evaluated readily with RiskMan, for instance a harvest time day price as opposed to a contracted price.

CHAPTER 4

THE INITIAL DEMONSTRATIONS

The demonstrations of the FARMS (Firm Level Agricultural Management Simulator), IrriCost (Irrigation Cost) and RiskMan (Risk Management) programs formed an important part of the interactive approach taken to transfer knowledge and skills to use the abovementioned computer software models. In the next sections feedback is given of the eleven demonstrations which were presented in seven provinces.

The departure point of each demonstration was to give perspective on the place of each of the models in farming decision-making, as well as the conjunctive use of the FARMS system with irrigation scheduling techniques such as the Soil Water Balance (SWB) and a Water Administration System (WAS). Reasons were given for using these models, and then the type of answers one can answer would be discussed.

4.1 JACOBSDAL: FREE STATE PROVINCE

Mr Nico Knoetze was approached for help with identifying key role players in the area. He invited board members of the Orange-Riet Water User Association, GWK Limited staff and lead farmers to a demonstration of the FARMS system. This demonstration took place at Jacobsdal on 16 April 2003. IrriCost, FARMS and RiskMan inputs were only listed as a result of the extent of some of these programs. However, in this manner people got an idea of each program's data requirements. Outputs of IrriCost and FARMS were discussed in detail. RiskMan was demonstrated. Emphasis was put on the application possibilities of all three programs. The electronic transfer of inputs and outputs between IrriCost, FARMS as well as RiskMan and other data sources including SWB as well as WAS were dealt with in conclusion. The whole demonstration was finished in approximately three hours.

4.2 VAALHARTS: NORTHERN CAPE PROVINCE

Mr Japie Momberg was the contact in Jan Kempdorp. He invited board members of the Vaalharts Water User Association, staff of agribusinesses and lead farmers to a demonstration. The latter took place on 27 May 2003. Changes were made to the presentation following on feedback during the demonstration in Jacobsdal. The largest of these was to use a better method for pointing out differences between the FARMS system

and financial record keeping programs. Telephonic enquiries in reaction to the demonstration have already been received.

4.3 DOUGLAS: NORTHERN CAPE PROVINCE

Initially Mr André Coetzee who is the product research manager at GWK Limited was contacted. He recommended that dates should be fixed during a quieter season. Meanwhile Mr Johann Bornmann who is information technology general manager at GWK Limited and Mr Dup Haarhoff who is product services manager visited the University of the Free State. It was decided that Mr Haarhoff would attend the demonstration in Jacobsdal. Subsequently he informed Mr Coetzee regarding the FARMS system. The latter person realised that Mr Abraham Bekker, who is the farm information manager, is actually the appropriate contact. Mr Bekker was contacted and he visited the University. He invited the manager of the Water User Association and lead farmers to a demonstration. This demonstration took place at Douglas on 10 June 2003. Everybody felt that information of a few farmers should be entered with the help of the project team and Mr Bekker. In this manner the application possibilities of the programs were demonstrated and Mr Bekker was trained simultaneously.

4.4 LOSKOP: MPUMALANGA PROVINCE

The Loskop Irrigation Board's manager was contacted regarding a demonstration. Mr Johan van Stryp referred the team to one of his colleagues. From then on Mr Dirk Ferreira helped with arrangements. The demonstration was given on 18 May 2004 at the Irrigation Board's offices. Nine people attended. They included representatives from OTK Limited, the farmers' association, Loskop Irrigation Board and a trainee as well as lead farmers. It was decided that Messrs Ferreira and Collett (Larry) would identify course-goers. The latter person is the farmer's association chairman. Mr PJP Mynhardt (Piet) from Loskop Grondvogmetings will also give support to users once courses are finished.

4.5 ELSENBURG: WESTERN CAPE PROVINCE

Initially a contact in Worcester of NB systems' Dr Benadé (Nico) was phoned. Mr EW Weideman (Erwin) from the Department of Water Affairs and Forestry referred the project team to somebody from the Department of Agriculture. Subsequently they rather contacted Dr DP Troskie (Dirk) of the same Department, who is a steering committee member. Mrs Malan (Wilna) from Elsenburg made all the arrangements for a demonstration. Staff from the Department of Agriculture (Elsenburg as well as Vredendal) and irrigation boards and a trainee made up the 10 attendants. Next the FARMS system was sent to Mr Roux (André) at Elsenburg. Potential course-goers were identified with the help of Mr Roux and a few other attendants after they had looked at the programs.

4.6 GAMTOOS: EASTERN CAPE PROVINCE

The farmers' association chairman was initially approached on advice of Mr P (Pierre) Joubert who is the Gamtoos Irrigation board manager. Subsequently Mr Joubert suggested that the project team contact Mr AAB (Ben) Costerus of Gamtoos Vallei Agri Limited because no feedback was received from this chairman. A demonstration was organised for 10 August 2004 with the help of Mr Costerus. Individuals from the irrigation board, cooperative and members from the farmers' association attended. Afterwards more information was sent to Mr Costerus for potential course-goers. The project team awaits feedback from Mr Costerus.

4.7 ELSENBURG: WESTERN CAPE PROVINCE

A steering committee member, Mr JJ (Hans) Janse van Rensburg was able to secure an hour for the project team at an Agricultural Economics Working Group (later changed to Agricultural Economics Standing Committee) meeting. This meeting took place on 20 September 2004 near Elsenburg in the Western Cape Province. Twenty-one individuals were present. There were representatives from all provinces except the Northern Cape. Representatives from the National Department of Agriculture and Land Bank also attended the meeting. Feedback from the staff of the KwaZulu-Natal Province resulted in a demonstration and course being scheduled for February 2005.

4.8 PIETERMARITZBURG: KWAZULU-NATAL PROVINCE

Mr Neil Whitehead was the contact person for the demonstrations in Pietermaritzburg on 9 February 2005. Of the 9 attendants, three were engineers and the others agricultural economists of the KwaZulu-Natal Department of Agriculture.

4.9 MOUNT EDGECOMBE: KWAZULU-NATAL PROVINCE

For the demonstrations of the FARMS system at Mount Edgecombe on 11 February 2005, Dr Neil Lecler was the contact person. Eight of the participants were from the SA Sugar Research Institute and one from Illovo.

4.10 BLOEMFONTEIN: FREE STATE PROVINCE

Demonstrations of the FARMS system were presented at the University of the Free State for two staff members of the Department of Agricultural Economics and nine graduate students on 4 March 2005.

4.11 KLERKSDORP: NORTHWEST PROVINCE

The demonstrations of the FARMS system in Klerksdorp on 18 March 2005 were attended by 5 persons of whom two were from Senwes and three were farmers. Mr Theuns Dreyer of Senwes was the contact person.

CHAPTER 5

THE COURSES AND EVALUATION OF THE TRAINING

In this section the training and handling of course material are described, a summary of evaluations of the three courses by the participants is given, and the capacity building process is discussed.

5.1 COURSE MATERIAL AND TRAINING

In general, for all three programs, the participants received a published WRC report with the user's guides as well as a compact disc (Meiring, Oosthuizen, Botha and Crous, 2002). In addition the following materials were made available: Tariffs and charges booklet of Eskom (Eskom, 2004); water charges from a schedule of the Department of Water Affairs and Forestry (Department of Water Affairs and Forestry, 2004) (AGFACTS for list prices of machinery (AGFACTS, 2004); machinery cost guides (*Guide to machinery costs, 2004*)); interest rates from a bank website; inflation rates from the Quarterly Bulletin of the South African Reserve Bank as well as their website; and the Irrigation Design Manual (1999) of the Institute of Agricultural Engineering at Silverton.

With each training session the relevant theory was briefly explained, as well as how the three programs of the FARMS system can be used together, and in conjunction with the SWB and WAS models. More time was usually spent with RiskMan explaining the concept of a cumulative distribution function and its interpretation. Each course-goer received hands-on training with the relevant computer program. The training took them systematically through the user's guide. With the data which were fed in, the reports were then interpreted. Depending on the specific group, the trainer then prompted them to generate more data from their region which were used, in case of the FARMS program, to analyse the effects on a whole farm basis.

At a more general level, participants were also trained to make back-ups and transfer data between users. At the beginning of the training an attendance list was completed, and at the end of the session the course was evaluated by the course goers. Depending on the group, the training on IrriCost and RiskMan could be completed easily in one day. However, for FARMS one day training was not enough for all the groups.

Altogether 23 courses were presented, eight courses on IrriCost, eight courses on FARMS and seven courses on RiskMan. Attendance lists for all the courses are available. A list of names of the attendants at one of the training workshops, and their organizations at different locations are given in Table 5. Photos of all attendees are given in Appendix H.

TABLE 5: A COMPILATION OF ATTENDANTS AND THEIR ORGANIZATIONS FOR THE DIFFERENT COURSES AT DIFFERENT PLACES, 2004-2005.

LOCATION	COURSE	NAMES	ORGANIZATION
Patensie Eastern Cape Province	RiskMan	AAB Costerus S Groenewald JP le Roux D Rautenbach PW Vermaak	Gamtoosvallei Agri Beperk Gonnakop Boerdery Boplaas Boerdery Ripple Hill Boerdery Retouw Landbou
Queenstown Eastern Cape Province	IrriCost	G Bicknell M Fono SS Fono AL Gqulu MS Gusha SC Jakavula LL Jongisa V Madini NP Mayekiso NA Mseleni N Ndlondlo Y Ngcaba GG Nofemele V Ntushelo Y Nqingwana NJ van Pletzen R Polo TC Raath D Wagenaar	Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture
Bloemfontein Free State Province	IrriCost	AS Fourie TC Fourie NP Hadebe JJ Janse van Rensburg RM Mamphiswana NZ Mdlulwa MO Motankisi RJ Myburgh BT Nkhobiso TW Shasha N Smit	Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture Department of Agriculture
Jacobsdal Free State Province	IrriCost	DF de Wet SJ de Wet JH Posthumus FP Verster FD Wessels	Oranje-Riet Water User Association Ninham Shand Oranje-Riet Water User Association Joubert & Verster Wilreza

Jacobsdal Free State Province	RiskMan	I du Plooy M du Plooy MA du Preez M Jacobs Y Mocké L Scheepers L Steenkamp N van der Walt E van Heerden	Inkoos Boerdery CC - Du Preez Konsultante Bossiesbult Boerdery Jarusha Boerdery CD Wilke Boerdery Kynoch N van der Walt Trust -
Pietermaritzburg KwaZulu-Natal Province	FARMS	G. Archer R. Mckay	DAE – ADSS DAE – ADSS
Thohoyandou Limpopo Province	IrriCost	NJ Balosi JK Baloyi MC Bopape HS Chavalala KS Dikgale FD Legodi MQ Letsoalo MI Mabilo SR Makwarea JH Maletuna MA Mangena ZS Mantsha Manuatte M Mapatha MJ Maphori LA Masekoameng ME Mashiane Mathabula TH Matombe NM Mehale HN Mmotla EP Mnisi JT Moagi TJP Mogano KG Monare MM Mohololа RH Mootane JI Morgi MP Mosima MF Mphahlele NP Mudimeli TP Mukhomu M Musetha NP Muvhali MR Ndlovu NG Netshimbuffeng MC Ngoasheng SM Nkuna LE Ramohlale DL Rangata PL Rangoge ML Rikhotso SR Sasa NP Tema TA Tshithivhe MM Mohololа	Dept. of Agriculture Dept. Agriculture DOA Dept. of Agriculture LPDA Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture DOA Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Tompi-Seleka Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Extension Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Madzivhandila Dept. of Agriculture Dept. of Agriculture Dept. of Agriculture Extension Dept. of Agriculture

Nelspruit Mpumalanga Province	IrriCost	F Buys NC Chiliza JGB Davel PP Kgole NT Komade BA Marshau RM Masiongo MB Maueansu SPM Ndola RR Nemakonde P Nkamule MG Sambo B Shongwe M Struthers	DALA Extension Lowveld Agricultural College DALA Extension DALA Extension Agriculture & Land Administration DALA Extension DALA Extension DALA Extension DALA Extension DALA Extension Agriculture & Land Administration DALA Extension DALA Extension DALA Extension
Groblersdal Mpumalanga Province	IrriCost	H Botha DT Brönn L Donovan LS Du Plessis D Ferreira P Mynhardt SJ Nel PJS Nel JJ Prinsloo G Risseeuw L Snyders W Van Wyk	Botha Boerdery DT Brown Boerdery Boerdery Boerdery Loskop Besproeiingsraad Loskop Grondvogmetings De Wagendrift Boerdery De Wagendrift Boerdery CIS Beleggings Risseuw Boerdery Rooiblom Boerdery Boerdery
Kimberley Northern Cape Province	IrriCost	Z Dlamini Z Mbokane N Mceta K Mokgothu TN Nkoane D Oganne EM Ramafoko	Dept Agriculture Dept Agriculture Dept Agriculture Dept Agriculture Dept Agriculture Dept Agriculture Dept Agriculture
Paarl Western Cape Province	IrriCost	E Becker D Curry N De Kock C Du Toit Calla Du Toit G Du Toit L Ferreira F Hugo D Meyer DL Meyn E Molteno D Ontong R Pistorius R Smit E Stofberg A Thops C Van Rooyen J Zulch	Katspruit Boerdery Curry Farms Elsenburg De Keur Ouplaas JD Kirsten (Edms) Bpk Dept. of Agriculture De Keur The Bee Brand Trust Zonquas Boerdery Wakkerstroom Môrester Landgoed Dwarsbergplaas Dwarsbergplaas PDA Wakkerstroom

5.2 EVALUATION OF COURSES

The evaluation form (Appendix A: course evaluation questionnaire) which was used to get feedback from the trainees was a Likert-type questionnaire (5-point scale: Very good [5], good [4], reasonable [3], poor [2] and very poor [1]), consisting of 8 structured questions and open-ended questions for comments. The evaluation form was adjusted to suit each of the three programs on course contents respectively. In the next sections the evaluation results for each of the programs are given. As an example the Bloemfontein participants are pictured in the photo below (Figure 2).

FIGURE 2: BLOEMFONTEIN PARTICIPANTS

5.2.1 COURSES ON IRRICOST

Eight IrriCost training courses were presented in six provinces. The provinces not covered were Gauteng, Northwest and KwaZulu-Natal. The evaluation results for the two courses in the Free State Province at the beginning of the project (Jacobsdal and Bloemfontein) are lacking. Altogether 109 course-goers were trained to use IrriCost. Two courses were presented in Mpumalanga Province – one at Groblersdal with 8 trainees, and the other at Nelspruit with 14 trainees. Two courses were also presented in the Free State Province – one at Jacobsdal with 11 trainees and the other at Bloemfontein with 5 trainees. The other four courses were presented in the Eastern Province at Queenstown with 19 trainees; one course in Limpopo Province at Thohoyandou with 35 trainees; one course in the Northern Cape

Province at Kimberley with 7 trainees; and one course in the Western Cape at Paarl with 10 trainees. The sample size is therefore 93, although 109 participants were trained.

The trainees were asked to evaluate the following aspects of the course contents:

a) Electricity tariffs
b) Water charges
c) Economic variables
d) System properties
e) Fixed irrigation cost reports
f) Variable irrigation costs

TABLE 6: RESULTS ON COURSE CONTENTS OF THE IRRICOST MENUS, 2004-2005 (N = 93)

Item		Groblersdal $n_1 = 8$	Kimberley $n_2 = 7$	Nelspruit $n_3 = 14$	Paarl $n_4 = 10$	Queenstown $n_5 = 19$	Thohoyandou $n_6 = 35$
Electricity tariffs	**Minimum**	4	4	3	4	3	1
	Mean	4.5	4.7	4	4.4	4.3	3.5
	Maximum	5	5	5	5	5	5
Water charges	**Minimum**	4	3	3	2	3	2
	Mean	4.5	4.6	3.9	4.1	3.9	3.4
	Maximum	5	5	5	5	5	5
Economic variables	**Minimum**	4	4	2	3	2	1
	Mean	4.5	4.6	3.6	3.9	3.9	3.3
	Maximum	5	5	4	5	5	5
System properties	**Minimum**	4	3	3	3	3	1
	Mean	4.5	4.4	3.7	3.8	4	3.3
	Maximum	5	5	4	5	5	5
Fixed irrigation cost reports	**Minimum**	4	4	3	3	3	1
	Mean	4.5	4.4	3.7	4.2	4	3.5
	Maximum	5	5	5	5	5	5
Variable irrigation costs	**Minimum**	4	4	3	4	2	2
	Mean	4.5	4.4	3.7	4.3	3.9	3.6
	Maximum	5	5	5	5	5	5

For more details about an explanation of these aspects, the reader is referred to Chapter 3 (paragraph 3.2). Table 6 summarizes the feedback results from trainees on IrriCost course contents. The average scores for the above-mentioned six questions are approximately 4 on

the scale (meaning they feel it is good), except for the large group of 35 trainees in Limpopo Province who felt the contents were reasonable to good (3, 4 on the scale).

Participants were asked: **Does IrriCost have application possibilities to use in your line of work?** The vast majority of trainees felt positive about this question, ranging from 85% to 100% of the respondents in the different provinces. The following useful comments were made by the trainees in Limpopo Province. One respondent said that he/she thinks it still needs further explanation for attendants in order to apply it. Another felt that he/she needs basic computer skills. One said it will be useful for commercial farmers and those in export businesses. And another one said that IrriCost will have relevant application possibilities to use on the irrigation projects.

Useful comments were given by trainees on what they think could help to improve the course. The unedited responses are given in Appendix B. The common denominator was the time factor – that one day for the course was not enough. Other comments related to the time factor are: follow-up courses should be given; more time should be given to do exercises; more practical examples; and not a once-off training.

Another comment dealt with the applicability of the IrriCost program to emerging farmers. One respondent from the Limpopo province suggested that the program should be modified to meet “rural small-scale farmers” at their level based on their available resources. Suggestions were made to provide training to all technical people in the government sector.

Some comments deal with data specifications. Costs for diesel engines should be an alternative to electricity costs. A suggestion was made that records should be kept at scheme level and the data should be collected at scheme level. Working hand in hand with engineers would help to provide additional information with regard to inputs, was also a suggestion.

The next question was: **Will you now be able to use IrriCost?** More than 80% of the respondents felt they would be able. Some motivated their answers with the following comments:

- Yes, but I am not confident
- Yes, but some help at the beginning
- Yes, theoretically but not practically per se
- Yes, partly
- Yes, but regular practices have to be carried out
- No, because of little computer skills.

The follow-up question was: **Would you require further support from the research team?** Almost 90% of the respondents needed further support. The kind of support they need is displayed in Appendix C. The major comments were:

- Give more training
- Give telephonic and e-mail support
- Training on how to apply the course on real farm situation, especially for small-scale farmers
- Regular workshops
- Handling data input in the program
- Train “low level extension officers on the ground”

The questionnaire ended with an opportunity to give other comments. About 35 respondents responded. Most of the respondents felt that the trainer did a good job and that the course was well presented. Some reinforced their feeling that more time should be allocated to presenting the course. This part of the questionnaire relates to the following questions on the questionnaire:

- Competence of the facilitator
- Has the course met your expectations
- New or worthwhile information gained
- Course organization
- Venue
- Food
- Professional contacts made

The majority of the respondents were of the opinion that the trainer was good to very good (4,5 / 4 / 3,9 / 4,9 / 4,6 / 4,3 respectively at Queenstown, Nelspruit, Thohoyandou, Kimberley, Groblersdal, and Paarl). In general the trainees felt that the course met their expectations reasonably well with the participants in Thohoyandou at the lower end of the scale. New or worthwhile information gained got more or less the same score. The course organization was good, with the exception of the greater number of participants Thohoyandou who thought it could be better. The scores for the venue and food varied from reasonable to good. Most of the participants felt they made good professional contacts.

5.2.2 COURSES ON FARMS

Eight FARMS training courses were presented in seven provinces for 107 trainees. The provinces not covered were Gauteng and Northwest. Again the evaluation results for the two courses in the Free State province (Jacobsdal, 5 trainees and Bloemfontein, 11 trainees) are lacking. The representation of the courses in the other six provinces are the same as for the IrriCost training, namely 22 trainees in Mpumalanga Province (Groblersdal and Nelspruit), 19 trainees in the Eastern Province (Queenstown), 35 trainees in Limpopo Province

(Thohoyandou), 7 trainees in the Northern Cape Province (Kimberley), and 10 trainees in the Western Cape Province (Paarl). The sample size is therefore 94, although 107 participants were trained.

The questionnaire was the same as the one for IrriCost, except for the contents part of the course. The trainees were requested to evaluate the following aspects of the course contents.

a) Input and product prices
b) Mechanization
c) Economical variables
d) Irrigation systems
e) Enterprise budgets
f) Asset and resource management
g) Enterprise evaluation
h) Financial statements

The reader is referred to Chapter 3 (paragraph 3.3) for more background information. Table 7 contains the feedback results on FARMS course contents. Again the average scores for the above-mentioned questions were approximately 4 on the scale, suggesting that in general all the groups in the six provinces think the contents are good except for the large group of 35 trainees in Limpopo Province who felt the contents were reasonable to good (3,5 on the scale).

The next questions were open-ended where respondents gave their comments. On the question of **whether FARMS have relevant application possibilities in your line of work**, more than 80% felt they have. Some motivated their responses with the following comments:

- Yes, but it should cater for previously disadvantaged farmers
- Yes, only for large-scale farms
- Yes, especially on the part of financial and enterprise budgets
- Yes, if there is relevant information
- Yes, it provides whole farm planning information and is relevant to financial and overall performance analysis of projects.

TABLE 7: RESULTS ON COURSE CONTENTS OF THE FARMS MENUS, 2004-2005 (N = 94).

Item		Groblersdal $n_1 = 8$	Jacobsdal $n_2 = 9$	Kimberley $n_3 = 7$	Paarl $n_4 = 13$	Queenstown $n_5 = 19$	Thohoyandou $n_6 = 38$
Input and product prices	**Minimum**	4	4	3	3	3	3
	Mean	4.5	4.6	4.4	3.9	4.1	3.6
	Maximum	5	5	5	5	5	5
Mechanisation	**Minimum**	3	3	3	3	3	2
	Mean	4.3	4.4	4.3	4	4.2	3.5
	Maximum	5	5	5	5	5	5
Economic variables	**Minimum**	4	4	3	3	3	1
	Mean	4.3	4.6	4.7	4	4.1	3.4
	Maximum	5	5	5	5	5	5
Irrigation systems	**Minimum**	4	2	3	3	3	2
	Mean	4.4	4.3	4.4	3.9	4	3.6
	Maximum	5	5	5	5	5	5
Enterprise budgets	**Minimum**	4	3	3	3	3	2
	Mean	4.4	4.4	4.6	4.1	4.1	3.4
	Maximum	5	5	5	5	5	5
Asset and resource management	**Minimum**	4	4	3	3	3	1
	Mean	4.4	4.6	4.3	4	4.1	3.3
	Maximum	5	5	5	5	5	5
Enterprise evaluation	**Minimum**	4	4	4	3	3	2
	Mean	4.4	4.6	4.4	4.2	4.2	3.4
	Maximum	5	5	5	5	5	5
Financial statements	**Minimum**	4	3	4	3	3	3
	Mean	4.4	4.4	4.4	4.2	4.3	3.7
	Maximum	5	5	5	5	5	5

Again useful information came from the trainees on the question **what they think could help to improve the course**. The unedited responses are reproduced in Appendix D. There were trainees in all the groups who felt that the training should be longer than one day, with follow-up courses and more practical examples and exercises to do. There were two comments about the livestock enterprise budgets which could be improved. Some trainees in Limpopo Province said they need computers to do their work, and they need on-farm training.

The next question was: **Will you now be able to use FARMS?** Almost 80% of the respondents said they would be able to use FARMS. Some motivated their answers with the following remarks:

- Yes, with help
- Yes, but end-user assistance is essential
- Yes, with practice
- Yes, but not 100%, maybe 60%
- Yes, with thorough reading of the manual
- Yes, but no computer in local offices
- No, there was power failure and I did not practise it, so not quite sure whether I will be able to use it

The follow-up question was: **Would you require further support from the research team?** Almost 80% of the respondents needed further support. The kind of support they need is reproduced in Appendix E. The major comments were:

- Telephonic assistance
- Electronic assistance
- More courses
- New updates
- On inserting data on the program
- Supervision with first scheme
- Technical and professional support
- Training and computer literacy
- Analysis and interpretation of results
- Help with implementation of the program

More than 20 respondents used the opportunity to give other comments at the end of the questionnaire. Most of the comments were related to the seven questions dealing with:

- Competence of the facilitator
- Has the course met your expectation?
- New or worthwhile information gained?
- Course organization
- Venue
- Food
- Professional contacts made

The majority of the respondents judged the trainer was good to very good. In general, the trainees felt that the course met their expectations reasonably well, again with the participants in Thohoyandou at the lower end of the scale (3,4). The course organization was good as well as their opinions about worthwhile information gained. The scores for the venue were good except for the one in Thohoyandou where participants regarded it to be poor. The majority of the respondents felt the food was good as well as the professional contact that they made.

5.2.3 COURSES ON RISKMAN

Seven RiskMan training courses were presented in six provinces for 95 trainees. The provinces left out were Gauteng, KwaZulu-Natal and Northwest. The evaluation results for the Free State Province are not included (11 trainees). Two courses were presented in the Eastern Province – 17 trainees (Queenstown) and 4 trainees (Gamtoos Valley, Patensie). Lastly, one course each was presented in Limpopo Province with 35 trainees (Thohoyandou), the Northern Cape Province with 7 trainees (Kimberley), Mpumalanga Province with 8 trainees (Groblersdal) and the Western Cape Province with 10 trainees (Paarl). The sample size is therefore 84, although 95 were trained.

The questionnaire was the same as those for IrriCost and FARMS, except for the contents part of the course. The trainees were asked to evaluate the following aspects of the RiskMan course contents:

a) Cumulative distribution function theory
b) Enterprise budgets
c) Input distributions
d) Cumulative distribution function results

The reader is referred to Chapter 3 (paragraph 3.4) for more background information about RiskMan.

Table 8 summarizes the feedback results on the RiskMan course contents. Again the average scores for the above-mentioned questions were approximately 4 on the scale, implicating that in general all the groups in the five provinces were of the opinion that the contents are good, except for the large group of 35 trainees in Limpopo Province who felt the contents were reasonable to good (3,7 on the scale).

TABLE 8: RESULTS ON COURSE CONTENTS OF THE RISKMAN MENUS, 2004-2005 (N = 84).

Item		Groblersdal $n_1 = 8$	Kimberley $n_2 = 7$	Paarl $n_3 = 13$	Patensie $n_4 = 4$	Queenstown $n_5 = 17$	Thohoyandou $n_6 = 35$
Cumulative distribution function theory	**Minimum**	4	3	3	3	3	3
	Mean	4.6	4.3	4.2	3.8	4.1	3.9
	Maximum	5	5	5	4	5	5
Enterprise budgets	**Minimum**	4	3	2	4	3	3
	Mean	4.5	4.3	4.1	4	4.2	3.7
	Maximum	5	5	5	4	5	5
Input distributions	**Minimum**	4	3	3	3	3	2
	Mean	4.6	4.4	4.2	3.8	4.1	3.6
	Maximum	5	5	5	4	5	5
Cumulative distribution function results	**Minimum**	4	3	3	4	3	3
	Mean	4.6	4.1	4.2	4	4	3.7
	Maximum	5	5	5	4	5	5

The next part of the questionnaire included open-ended questions. On the question of **whether RiskMan has relevant application possibilities in your line of work**, approximately 90% of the respondents felt they have. Some motivated their responses with the following comments:

- Yes, I am working with business plans and drought program
- Yes, because of simplicity
- Yes, in all agribusiness enterprises

Again useful comments were given by trainees on **what they think could help to improve the course**. The unedited responses are given in Appendix F. The overall feeling was that not much could be done to improve the course, but they need more time to internalize the material, they need more practice, and follow-up training. One suggested that it would be great if the program could compile enterprise budgets.

The next question was: **Will you now be able to use RiskMan?** Approximately 85% of the respondents said they will be able to use the program. Some motivated their responses with the following comments:

- Yes, but need some practice
- Yes, with the help of experts

- Not sure
- Little, because I am not computer skilled

The follow-up question was: **Would you require further support form the research team?** Approximately 85% of the respondents indicated that they would need further assistance. The kind of support they need is displayed in Appendix G. The major comments were:

- Telephonic assistance
- Electronic support
- Assistance with interpretation of graphs (cumulative distribution functions)
- Technical support
- Further training
- Implementing the program in rural areas
- Supervision of first projects/schemes

More than 30 respondents used the opportunity to give other comments at the end of the questionnaire. Most of the remarks were about appreciation for the course as well as the trainer. Related to these issues, are the seven other questions on the questionnaire:

- Competence of the facilitator
- Has the course met your expectations
- New or worthwhile information gained
- Course organization
- Venue
- Food
- Professional contacts made

The vast majority of the respondents felt the trainer did a very good job; they were also of the opinion that their expectations were met and satisfied with the new information gained and professional contacts made. Their opinions about the venue and food varied from reasonable to very good.

At the completion of the courses, a course attendance certificate was sent to each trainee. An example of a course attendance certificate is attached in Appendix P.

5.2.4 CAPACITY BUILDING

The train-the-trainer model which is based on the multiplier effect was used to build capacity with the project. From the start it was clear that few small-scale commercial farmers would

have access to a computer. Thus the focus would be to train the advisors who provide these farmers with advice.

The evaluation sheet which was used to evaluate the courses had the following questions:
If you are a trainee or any other service provider, how many clients do you have?
Number of large-scale farmers: _____
Number of small-scale farmers: _____
Total number of farmers if you cannot divide them into abovementioned categories: _____

These questions were posed to the trainees in all three programs of the FARMS system. Unfortunately some training at the beginning was given without getting feedback. However, in total, feedback from 271 trainees was received. The results are given in Tables 9, 10 and 11. Unfortunately the number of large-scale farmers plus the number of small-scale farmers do not add to the total number of farmers in all cases if the respondent could not divide them into the abovementioned categories. It was not clear to all participants that the third part of the question should only be answered if the allocation between the two farmer groups could not be made.

5.2.4.1 MULTIPLIER EFFECT WITH TRAINING IN IRRICOST

Feedback results were received from 93 trainees on the IrriCost program. These responses came from participants in five provinces: the Eastern Cape, Northern Cape, Western Cape, Limpopo and Mpumalanga. Table 9 contains the data. In the Eastern Cape Province the 19 respondents serve on average 139 farmers, ranging from zero to 1 000. On average 115 small-scale farmers are advised plus 8 large-scale farmers. In Mpumalanga Province the scenario is more or less the same – on average about 100 small-scale farmers plus 11 large-scale farmers are advised per respondent. The situations in the Northern Cape and Limpopo are almost unmanageable in the case of certain trainees. On average in Limpopo Province 74 small-scale farmers are advised per trainee plus 21 large-scale farmers. And in Northern Cape on average almost 6 000 small-scale farmers are served per trainee plus another 2 500 large-scale farmers.

TABLE 9: NUMBER OF FARMERS SERVED PER TRAINEE AT THE IRRICOST TRAINING WORKSHOPS, 2004-2005.

Item		Groblersdal $n_1 = 8$	Kimberley $n_2 = 7$	Nelspruit $n_3 = 14$	Paarl $n_4 = 10$	Queenstown $n_5 = 19$	Thohoyandou $n_6 = 35$
Number of large-scale commercial farmers	Minimum	0	0	0	0	0	0
	Mean	38	2 414	11	0	8	21
	Maximum	300	5 973	55	0	80	400
Number of small-scale commercial farmers	Minimum	0	1 500	0	0	0	0
	Mean	0	5 958	100	0	115	74
	Maximum	0	9 027	1 000	0	1 000	833
Total number of farmers	Minimum	0	1 500	0	0	0	0
	Mean	38	8 150	176	0	139	198
	Maximum	300	15 000	1 000	0	1 000	2 000

Thus, according to the multiplier model: one trainer trained 109 trainees who in turn will on average train 140 farmers in the Eastern Cape Province, 200 farmers in Mpumalanga, 200 farmers in Limpopo Province, and 8 000 farmers in the Northern Cape Province. Altogether the 109 trainees will train on average 1 450 farmers of whom approximately 70% are from previously disadvantaged communities.

5.2.4.2 MULTIPLIER EFFECT WITH TRAINING IN FARMS

Table 10 summarizes the training feedback results on FARMS from 95 trainees. These responses were from trainees in six provinces: the Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga, North West and Western Cape. In the Eastern Cape Province the 19 respondents serve on average 119 small-scale farmers plus 8 large-scale farmers. In Limpopo the total number of farmers does not correlate with the separate categories of small-scale and large-scale farmers. On average 300 farmers are advised per trainee. For the Northern Cape it is on average 2 400 large-scale farmers plus 6 000 small-scale farmers per trainee.

TABLE 10: NUMBER OF FARMERS SERVED PER TRAINEE AT THE FARMS TRAINING WORKSHOPS, 2004-2005.

Item		Groblersdal $n_1 = 8$	Jacobsdal $n_2 = 9$	Kimberley $n_3 = 7$	Paarl $n_4 = 13$	Queenstown $n_5 = 19$	Thohoyandou $n_6 = 38$
Number of large-scale commercial farmers	**Minimum**	0	-	0	0	0	0
	Mean	41	-	2 414	5	8	25
	Maximum	300	-	5 973	60	80	400
Number of small-scale commercial farmers	**Minimum**	0	-	1 500	0	0	0
	Mean	1	-	5 958	4	119	58
	Maximum	6	-	9 027	50	1 000	833
Total number of farmers	**Minimum**	0	-	2 053	0	0	0
	Mean	42	-	10 079	18	139	302
	Maximum	300	-	15 000	120	1 000	5 000

Thus, according to the multiplier model for the FARMS training: one trainer trained 95 trainees who in turn will train on average 140 farmers in the Eastern Cape, 300 farmers in Limpopo, 10 000 farmers in the Northern Cape, 40 farmers in Mpumalanga (Loskop Dam), and 18 farmers in the Western Cape. Altogether the 95 trainees will train on average 2 100 farmers of whom approximately 75% are from previously disadvantaged groups.

5.2.4.3 MULTIPLIER EFFECT WITH TRAINING IN RISKMAN

Training feedback results on RiskMan in five provinces from 84 trainees are given in Table 11. These responses are from respondents in the Eastern Cape (21 trainees), Limpopo (35 trainees), Northern Cape (7 trainees), Mpumalanga (8 trainees), and Western Cape (13 trainees). In the Eastern Cape Province the 21 trainees serve on average 122 farmers. In Limpopo about 200 farmers are served on average per trainee. Again there is irregularity with the total number of farmers versus the separate number of small-scale and large-scale farmers. In the Northern Cape about 6 000 farmers are served per trainee of whom about 3 400 are small-scale farmers. In the Loskop Dam area of Mpumalanga 42 farmers are served per trainee of whom only one is a small-scale farmer. In the Western Cape 9 farmers are served per respondent. Altogether the 84 trainees will train on average 1 100 farmers of whom approximately 85% are small-scale farmers in previously disadvantaged communities.

TABLE 11: NUMBER OF FARMERS SERVED PER TRAINEE AT THE RISKMAN TRAINING WORKSHOPS, 2004-2005

Item		Groblersdal $n_1 = 8$	Kimberley $n_2 = 7$	Paarl $n_3 = 13$	Patensie $n_4 = 4$	Queenstown $n_5 = 17$	Thohoyandou $n_6 = 35$
Number of large-scale commercial farmers	Minimum	0	0	0	0	0	0
	Mean	41	708	0	0	25	55
	Maximum	300	3 000	0	0	300	1 000
Number of small-scale commercial farmers	Minimum	0	0	0	0	0	0
	Mean	1	3 365	0	0	53	51
	Maximum	6	9 027	0	0	380	833
Total number of farmers	Minimum	0	1 500	0	0	0	0
	Mean	42	6 208	9	25	97	192
	Maximum	300	15 000	120	100	460	1 170

CHAPTER 6

SUMMARY AND RECOMMENDATIONS

The aims of this project were firstly, to train agribusinesses, bureau services and advisors in the main irrigation areas of South Africa to implement the RiskMan (Risk Management), IrriCost (Irrigation Cost Estimator) and FARMS (Firm Level Agricultural Management Simulator) computer software for decision-taking support in the field of risk management, irrigation cost estimation and whole farm planning respectively; and secondly, to give these organizations and individuals the necessary support in order for them to apply the above-mentioned computer software on a continuous basis.

6.1 TECHNOLOGY TRANSFER

The communication and implementation strategy with this technology transfer project consisted of a combination of methods, messages and approaches followed by the research team. The first step was to identify target groups, which was done through contact persons, which was followed by demonstrations of the three programs of the FARMS system, namely FARMS (the whole farm planning model), IrriCost (the irrigation cost estimating model), and RiskMan (the farming risk management model).

The basic messages of these three programs were different, but together they formed a unit. With IrriCost the basic message was that irrigation costs are high and these costs must be managed and for that the farmer/advisor needs to estimate all the costs of any irrigation system. The basic message for the FARMS training was that the farmer/advisor needs to plan the farming activities by deciding what to produce, which production methods to use and how much to produce. The farmer/advisor needs to draw up enterprise budgets and projected financial statements, which can be done by FARMS. For estimating the water quantities and crop yields, models such as SWB and WAS could be used in conjunction with FARMS. The basic message for the RiskMan training was that all farming outcomes are uncertain and therefore the farmer/advisor cannot depend on average numbers but needs to manage the cumulative distribution of outcomes which can be done by RiskMan.

The methods which were used to carry out the implementation strategy were a mix of telephone discussions, demonstrations of each of the three programs, training courses and the use of a website. These methods are based on the five stages of adopting new technology: awareness, interest, evaluation, trial and adoption (Bembridge, 1993:183). Eleven

demonstrations of all three programs were presented in seven provinces, except for Gauteng and Limpopo. Two demonstrations each were presented in the Free State Province (Jacobsdal and Bloemfontein), the Northern Cape Province (Jan Kempdorp and Douglas), and Western Cape Province (both at Elsenburg College). In the other provinces one demonstration in each province was carried out. The demonstrations were attended by the contact person of that area together with potential adopters of the technology. These demonstrations were used to create awareness and interest in the use of the models. The next step was to arrange workshops for interested persons for specific models to make further progress with the technology adoption process. The website was developed to provide additional information about forthcoming courses and continuous support on larger scale adoption and application.

Very good training guides were provided to trainees by the WRC which consisted of a published report and compact discs. The trainer was a project researcher who was fully involved in the development of all three models. Modifications to the models were done by the researcher in collaboration with a computer programmer who also participated in the development of the models but is now a private trainee.

Altogether 23 courses on the three computer programs were presented for 311 trainees. Eight IrriCost training workshops were presented for 109 trainees in six provinces, except for Gauteng, Northwest and KwaZulu-Natal. Two courses were presented in the Free State Province – one at Jacobsdal with 5 trainees, and one at Bloemfontein with 11 trainees. Two courses were presented in Mpumalanga Province – one at Groblersdal with 8 trainees, and the other at Nelspruit with 14 trainees. The other four courses were presented in the Eastern Province at Queenstown with 19 trainees; one course in Limpopo Province at Thohoyandou with 35 trainees; one course in the Northern Cape Province at Kimberley with 7 trainees; and one course in the Western Cape at Paarl with 10 trainees.

Also eight FARMS training courses were presented in seven provinces for 107 trainees, except for Gauteng and Northwest. Two workshops were presented in the Free State Province – Jacobsdal with 5 trainees, and Bloemfontein with 11 trainees. The representation of the courses in the other six provinces are the same as for the IrriCost training, namely 22 trainees in Mpumalanga Province (Groblersdal and Nelspruit), 19 trainees in the Eastern Province (Queenstown), 35 trainees in Limpopo Province (Thohoyandou), 7 trainees in the Northern Cape Province (Kimberley), and 10 trainees in the Western Cape Province (Paarl).

Lastly, seven RiskMan training in six provinces for 95 trainees, except for Gauteng, KwaZulu-Natal and the Northwest Province. One workshop was presented at Bloemfontein for 11 trainees. Two courses were presented in the Eastern Province – 17 trainees (Queenstown) and 4 trainees (Gamtoos Valley, Patensie). Lastly, one course each was presented in the

Limpopo Province with 35 trainees (Thohoyandou), the Northern Cape Province with 7 trainees (Kimberley), Mpumalanga Province with 8 trainees (Groblersdal) and the Western Cape Province with 10 trainees (Paarl).

The course evaluation responses of the trainees were in general positive for all three programs. The vast majority of the respondents were of the opinion that the course contents of all three programs are good. In general they feel that:

- the time duration of each of these one-day training workshops was too short;
- they need follow-up training;
- they think they will be able to use these computer programs; and
- they need further support through telephone and electronic assistance and regular workshops.

In retrospect it is realised that the group of 35 participants at Thohoyandou was too large. A group of 20 participants should be regarded as the maximum number.

The capacity which was built into 311 trainees scattered across the provinces was attained through the train-the-trainer model. The potential multiplier effect which could be catalyzed by the 109 trainees on IrriCost is on average 1 450 farmers per trainee of whom at least 70% are from previously disadvantaged communities. The potential multiplier effect which could result from the 107 trainees on FARMS are on average 2 100 farmers per trainee of whom 75% are from previously disadvantaged groups. The potential multiplier effect which could be catalyzed by the 95 trainees on RiskMan are on average 1 100 farmers per trainee, of whom approximately 85% are small-scale farmers in previously disadvantaged communities. Thus one project researcher trained 311 trainees in two years, who in their turn could potentially train approximately on average 4 600 farmers per trainee. The vast majority of these farmers (approximately 75%) are small-scale farmers in previously disadvantaged communities.

In general it can be concluded that the project objectives were achieved to a large extent. More specifically, with regard to the first objective, namely to train agribusinesses, bureau services and advisors in the main irrigation areas of South Africa to implement the RiskMan, IrriCost and FARMS computer software for decision-taking support in the filed of risk management, irrigation cost estimation and whole farm planning respectively, the targets were achieved. Altogether 23 training workshops were presented to 311 trainees in at least six provinces for each of the three models. The trainees were mostly from the provincial departments of agriculture, agribusinesses and water user associations.

With regard to the second project objective, namely to give these organizations and individuals the necessary support in order for them to apply the above-mentioned computer software on a continuous basis, it can only be said that 311 trainees were trained but it cannot be claimed that all of them will be able to use these models on a continuous basis. With the

insight which was developed with the concept of the train-the-trainer model, this gap can be filled with in-depth training of a smaller number of selected potential trainers. The adoption of any new technology takes time as the decision-maker goes through the different adoption stages, and therefore sustained support over a longer period should be rendered to the potential trainers.

6.2 RECOMMENDATIONS

- The train-the-trainer model is an efficient approach in a situation where advisors in the provincial departments of agriculture are expected to transfer technology to farmers. The train-the-trainer model is based on the multiplier effect. Advisors can be trained to train farmers. Use can also be made of the concept of the "master farmer-model". The master farmer-model is basically the same as the train-the-trainer model. A master farmer is selected and trained who in his/her turn will train other farmers.

- When applying the train-the-trainer model, the person who is doing the technology transfer should take the adoption phases of new technology into consideration, as well as the time period for adoption. Thus, the methods and messages of the implementation strategy with technology transfer process should be focused on a smaller number of competent potential trainers who could then receive in-depth extended training, as well as continuous support as they carry out the technology transfer process on a continuous basis with their farmers. In this way a 24-hour helpdesk may be created for trainers who in their turn could offer a 24-hour helpdesk for their farmers.

- From the course evaluation feedback from the 311 trainees it was clear that sustained follow-up training is needed. Again the train-the-trainer-model makes it possible to focus on a smaller number of trainers, instead of all 311 trainees. It would be possible to plan a technology transfer project in which potential trainers receive in-depth training at four one-week workshops spread over one year. Not only will it be possible then to teach the fundamental concepts, but also to teach how the models can be used in conjunction with other existing knowledge and how ownership can be taken and better decisions taken.

- One of the greatest drivers for progress in agriculture is technology. But new technology is only a tool. The most important aspect is how the technology is used. The role of the trainers should be to demonstrate how the use of the new technology can make a difference in the lives of communities.

- Policymakers must formulate policies with incentives to facilitate technology transfer in agriculture. The extension service to small-scale farmers should be revitalized to perform this function. The public sector should play a major role by providing training to implement best management practices by small-scale farmers. The national policy for small-scale irrigation should facilitate the critical success factors such as the provision of sufficient infrastructure, training, and finance. Financial incentives should be accessibly put in place to help part-time farmers and new entrants in farming business.

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APPENDIX A

COURSE EVALUATION QUESTIONNAIRE

An example of the course evaluation questionnaire is given. The project data is archived at the Department of Agricultural Economics, University of the Free State.

IRRICOST COURSE: 28 FEBRUARY 2005

EVALUATION FORM

If you are a consultant or any other service provider, how many clients do you have?

Number of large-scale commercial farmers: _____

Number of small-scale commercial farmers: _____

Total number of farmers if you cannot divide them into above-mentioned categories: _____

Please rate the following aspects of this course (this will help to improve future ones). Circle the desired number for each aspect on the given scale.

5	4	3	2	1
Very good	Good	Reasonable	Poor	Very poor

1. Course organization 5 4 3 2 1
2. How would you evaluate the course content of IrriCost menus mentioned below?
   a. Electricity tariffs 5 4 3 2 1
   b. Water charges 5 4 3 2 1
   c. Economic variables 5 4 3 2 1
   d. System properties 5 4 3 2 1
   e. Fixed irrigation cost outputs 5 4 3 2 1
   f. Variable irrigation costs 5 4 3 2 1
3. Competence of the facilitator 5 4 3 2 1
4. Has the course met your expectations? 5 4 3 2 1
5. New or worthwhile information gained 5 4 3 2 1
6. Venue of the course 5 4 3 2 1
7. Food 5 4 3 2 1
8. Professional contacts made 5 4 3 2 1

APPENDIX B

WHAT CHANGES DO YOU THINK COULD HELP IMPROVE THE IRRICOST COURSE?

Should be user-friendly even to emerging farmers.
Give a week or two for the course
N/A
It is evident from the course presentations that there are sifnificant disparities between emerging farmers in the Free State and Eastern Cape. Efforts should be put together to accommodate these disparities
None
The time allocated was too short - I hope if enough reasonable time can be allocated.
Not changes as such but to add some feature like calculating number of seedlings + cultivars.
They should include cost for diesel engine for areas without electricity. Also include water tariffs for each month
Must try to provide to all technical people in the government sector
Improve water tariffs or registration of farmers as water user / licensing because some farmers especially emerging farmers are using water but they are not registered.
We must be given a chance to do an exercise, that'll need extended period for the course.
Have the course every term of the year, not a once off training. Ensure that the information disseminated is properly utilised
Duration of course should be increased
Include costs of pumping with diesel engines.
Supply formulae so as to assist users to double check calculations
More intense in livestock. Practice!
Present examples relevant the size of farmers small-scale and information relevant to commercial farmers
It must be more practical
Given enough time to do thorough presentations. No rush.
More days
More practical examples.
The course must be offered in two days not one day.
Still need to be familiar with the program
If the workshop is over 2 days, so that more practical exercises can be done.
The course is very much good
Computer.
Make the system more clear and advance.
Develop a model to meet "rural small-scale farmers" on water saving, base on their available resource at their level
Keeping records of all information in the scheme. - Data collection for all activities in the scheme. - Improve the production of the farmer on the ground level
If we can be given enough time, say a period of 5 days
None
If the team can have engineers from the dept. who are also involved in the schemes.
Through contact with Escom
So far so good. Once one get used to the program then he can be able to know what changes could be made
Method of irrigation
To have one full week for the course
IrriCost course.
Currently as I don't have enough information I can not recommend anything.
To have good venue and good accommodation

Follow-up course must be organised for the sake of improvements and gain more information.
More time should be spend on practice.
Step by step hand outs
A better venue where there are reliable electricity
Working hand in hand with engineers will help to improve the course because engineers will provide additional information with regard to inputs
1 The availability of the agricultural engineers because as the economists/farmers who don't know anything about the tools.
Venue
Increase the time allocated for the course and have more exercises. The course should be more interactive.
More thorough explanation
Basic computer training
Well organised - organisation.
Regular courses
The course to be attended into two phases - on farm or practicals
More time.
The number of the participants should at least be 10 so that the facilitator can give full attention to everyone.
Good area and enough computer to can all work and know the work
Budget irrigation cost and cost benefit analysis of irrigation schemes
N/A.
None so far.
Much more time will be needed for presentation of the cost.
Make models less complex.
Working on practical situation and data
The model should be made as simple as possible and less information to capture.
Afrikaans programs.
Practical assignment
More applicable to farming lay-out.
Update program
Maybe do more exercises.
None
Save capital + Better future decisions

APPENDIX C

WHAT KIND OF IRRICOST SUPPORT IS NEEDED?

Give us more training.
Able to work with research team so that work experience can be gained.
On certain operations
Telephonically/e-mail - with the new version
An after-care (feedback) has to be done so as to check the success or failure of the conducted course, that is to look the impact it had on the participants.
Support on reading reports and data inputs.
Update on latest versions
Things that I might not be able to do myself but the program can do
Accessing new information from tariffs etc
To ask when I'm stuck with the program.
More of these courses should be given to all officers involved in farming
N/A
How to apply the computer program effectively
Telephonic support.
Notice of upgrades
Telephonically.
Irrigation methods for different agric produce
To illustrate how to use this method or IrriCost practically.
To make the program, understandable at simple hardware
Contact frequently in cost calculation for Combud & labour
On latest information with regard to IrriCost
Further understanding of the some of the costs.
Information
Using the program
Follow-up workshop - Telephonic contact/communication
Technical
Assistance in budget preparation for irrigation
Where I have a problem, I should be able to get assistance.
Improve, more irrigation workshop
Training low level extension officer on the ground. - More extension officer be trained on usage on computer. - This training must be given to district extension workers e.g. extension officers.
Calculating costs
Provide your contact details so that I can talk to you in future. This will help me when I start working on the revitalisation of smallholder irrigation schemes program in the Province (Limpopo)
Someone who will check if the info officials entered in the model was done correctly. Supervisor.
Through workshops and training
More workshop about/concerning economic analysis.
To give workshop to the farmers.
Advice on how some of the calculations are done
Research team.
Give more information about IrriCost.
By means of training and supply with computer
Follow-up course must be arranged
Add a day or two of practically doing the IrriCost course

Training in the operation of Excel program.
Technical
Research team can provide additional information from research conducted.
1 Financial support. 2 Research council.
Variables & information &
After-care on the usage of the model
How to apply this course information on the real farm situation, especially for small-scale farmers project.
To determine the water usage in our district.
I think any kind of support that they can offer.
Regular workshops
On farm research eg practical not theory
Computer skills.
Where I lose understanding I will be pleased if the team can advise me.
To train more on the IrriCost, because I'm not so sure if I can apply this to our real situation for farmers at roots level.
Technical in terms of irrigation specifications
Application of the course
Analysis and installation of the program
Updated information and figures
Further interaction with an instructor
Guidance as to how the system will differ from project to project. If you do not have the whole information needed what other options you have to get the information.
To train more farmers
After-care support, especially on field data collection and analysis
Support
Support
Program detail (functioning)
Continuous.
Updating of programs and retraining
For later data
N/A
Upgrades & detail questions.
Meanings of terms.
Technical
Technical.
Technical.
Correct entering of data
I will call them
Technical. Explaining what info is needed / what exactly is being asked by program

APPENDIX D

WHAT CHANGES DO YOU THINK COULD HELP IMPROVE THE FARMS COURSE?

The course should start by tackling the existing situation in our communities before going commercial.
Give it more time. Take into consideration the fact that some people are slow and besides that it will be good to give it more time for exercises.
N/A
Not really
On livestock enterprise budget - where you are required to work livestock and crops in one enterprise budget
If enough time can be allocated to the course so that it is easy to familiarise with the program
Update us with all the new developments about these programs
Need to improve data from suppliers of equipment for instance price lists of tractor, equipment etc
Getting more training for other officials involved in farming
We must be given a chance to do an exercise so as to ensure that we did understood the course
Duration, it should be increased and participants should be given cases to solve
No changes as yet
Livestock must be improved. More intensive
More intensive livestock.
Correct record keeping - Give direction to the farmers. - Help the farmers to be able to get credit and drawing of business plans.
Enough time
No changes
Changing the venue.
More time in understanding the manual
Proper facilities like computer, practical information from farmers.
1 Venue
A document that clearly defines the course esp. using a PC to search the required info.
Calculation in the use of crop budget, tractor cost and irrigation system.
Farmers will have more information regarding their farming.
Nothing so far
Follow-up course.
Should involve collection of data
Additional computers are still needed in this case.
To improve the course venue must be suitable
The course should be interactive
More practical work should be done with nearby farms.
None at the moment
None
On farm demonstration
The course can be undertaken for full one week
Only the venue must change
Offering practicals and corrections made.
I think they should be more time for learners to do or calculate farms practically using computers.
Once one is used to program then can comment on this
None
We need computers to work

To assist our clients which are farmers in planning of their farming systems.
To much days are needed as we can not accommodate anything in 3 days' time
Understands the clients' standard of course to be offered
Regular workshops
No changes.
Much more time must be allocated for each course; participants must be able to interpret data correctly.
If it can also include other means of irrigation like furrow irrigation
None
Fine-tune the models / try to make them less complex because it takes long before you get results.
To have had a practical situation/data to practise with
No changes, but require a frequent practice
Yes
None
More support.
None
More examples that are relevant to us
Simple scenario example for participants to be able to do in hour and for evaluation directly thereafter
Personal farm visits
None
Linking activities and mechanisation inputs
Adjust so can use in orchard situation where more than one enterprise (variety) in the same block or enterprise.
Make information more relevant to fruit industry
Demo with relevant info?

APPENDIX E

WHAT KIND OF FARMS SUPPORT IS NEEDED?

Telephonically / Believe that questions will arise as soon as I have to enter my own data.
Phoning in and updates.
Electronically
Determination of values that changes annually.
Telephonic assistance.
Telephonic is OK.
Succession course
Same as above.
Give it another time. Maybe a week.
The research team will definitely be of importance in terms of practical experience.
On certain operations
Yes, an after-care is needed so as to measure the success / failure of the course.
Feeding some data especially in calculated %
Having more courses of this nature as frequently as possible eg once every term to improve our confidence in our field of specialisation
Yes, when I'm stuck with the program
End user support
Update on latest version and new developments
Reading reports
Telephonic
New upgrades and practice.
Telephonically.
Communicate with other regions for further doing other workshops
Training in this course with more time
A support where I don't understand some of the principles
On inserting data on the program.
Supervision for first project/schemes to be done.
The course to the farmers.
Mentoring and future communication thus follow-up course.
Teaching more about farm aspect.
Professional support.
Training.
To come & make presentation or workshop to few of our economists.
Follow-up course.
Collection of data
Additional information from researchers is required.
Through additional material
After-care
More computers
Where I have problems
None
Methodology used to acquire relevant information
More advice and information
Advice, when failing to use the FARMS
Technical support
Training on computer literacy
To help in practicing FARMS (using computers)
To help with parts I don't understand
Technical - in case one get stuck
Team work Financial support.

Monitoring
Computer skills
Regular workshops
Share more information and practise the farms together.
Analysis and interpretation of results. Installation of the program and continuous updating.
Updated information and figures
The implementation of the FARMS system for management decision-making in livestock farming and other enterprises.
Continual interaction with an instructor.
Constant communications to provide more information to help to implement the system.
To further train the farmers to use the model.
After-care support for trouble-shooting areas
Data
Follow-up
Continuous
Info updates.
Inquiry via email and certain model scenarios, for capturing to have answer of eg cash flow closing balance to ensure you have captured correctly.
Farm visit
Application of my data to the system to make sure my groupings and applications do not limit the program
Upgrades! Links.
Telephonically E-mail
Modifications as above.
With entering and collecting data
Advice on set up

APPENDIX F

WHAT CHANGES DO YOU THINK COULD HELP IMPROVE THE RISKMAN COURSE?

No changes
If this program can compile enterprise budgets, it will be great
I have not thought about it yet, but I will inform you when I start using the program in my line of work.
Duration of the course should be increased and tasks should be given to participants to ensure competency
If enough time can be allocated, so that one can familiarise with some terms of program.
None
Different save directory for every project/client.
To do it in practice
Making a follow-up course
The program uses a lot of probabilities and guessing and makes it difficult if you don't have someone to help you with like market manager
Running a practical example right through to final evaluations.
Good, as is.
No recommendations on possible improvements. Probably at a later stage.
More practice will help us.
None
Not much.
None
To set enough time of being ? of their course
More time on manual or if they can be distributed before the course starts
On-farm practicals
Let's start on the basics before we progress on with our lecture
Improve the awareness among farmers in my district
Yes
More exercises and practical work can improve the course
Punch original data
So far so good
Planning for the farmers on their budget
Planning for my duties - Record keeping by farmers
Practicals taking data with nearby commercial farmers
None at present
Practical applications
To know when and how to help my farmers.
Computer course must organised.
Increase the level of lecturing speed.
Facilitator should try to talk faster than he is talking now. He should try to make the lesson interesting.
More time must given for the course
Course venue
No change
Regular workshop
More practice will help to improve the course from us learners
To incorporate more emerging farmers
More training required
None
Using the real data

Nothing so far.
None so far
Time and more information and explanation needed
None
Exchange rate, Long-term crops.
Give one practical example with memorandum to let every person do his/her own capturing and evaluate against a memorandum.
Run some information continuous over period of years.
None
Analysis of long period crops
More detail in the manual of how to run the programs. Manual in Afrikaans.
Demo model - fruit.

APPENDIX G

WHAT KIND OF RISKMAN SUPPORT IS NEEDED?

In implementing RiskMan in rural areas such as places in Eastern Cape
To be helped when I'm stuck in this program.
New ideas and programs Telephonically support when using RiskMan
More on data capturing & assessment.
To help me with other aspects of RiskMan which could arise when I am playing around the program.
If a back-up course (Feedback) can be arranged so as to see the results of the course.
Whatever is needed.
Need more training.
System operation
Telephonic.
Updates
Getting more work that will need me to use the program
With filling of data that is needed.
Data input.
Be knowledgeable about further changes in their work.
Support on inputs and decision making.
Moral support
Using other variables such as diseases, policies, pests, etc in the analysis.
Mentorship and practicals (field).
Technical support
More advice and information
Estimations of risks
To gain more depth knowledge of RiskMan
Computer skills, data analysis, mentorship on the ground
Irrigation cost, yields
Supervision for 1st projects/schemes to be done
Yes
Technical support Financial support.
If encountered problems using it in the computer
Frequent visits
Anything that can enable me to better understand the model and use it.
Where I'm getting lost especially when implementing it to small-scale farmers
Cumulative distribution.
To be ? ? updated when there are new programs & developments.
To have another workshop of the RiskMan
Training must be done for furthering our knowledge.
Special visit at intervals for follow-ups
Application of the system
Computer training course
RiskMan.
Computer course must be organised
To share information with others.
To share the information with the team. Get more valuable information about RiskMan.
Training
Technical
I'll know that when I get used to the program.
Regular workshops

Research suppose
Back-up support
More training
Further interaction
To train our farmers.
Continuous communication line so that I have problem implementing the system that I have someone to consult for help.
To install the program and interpretation.
Info.
Clear up obscurities
Continuous
Later support
Costs/income for multiyear crops.
Updates and links to Excel
To find out something via e-mail if one get stuck.
Email + Telephonic + A presentation to farmers yearly in June as part of course in financial management.
Farm visit
Help with interpretation of graphs.
Explanatory
Advice
To enter the correct information at the correct places
To make sure the correct information is entered at the correct place

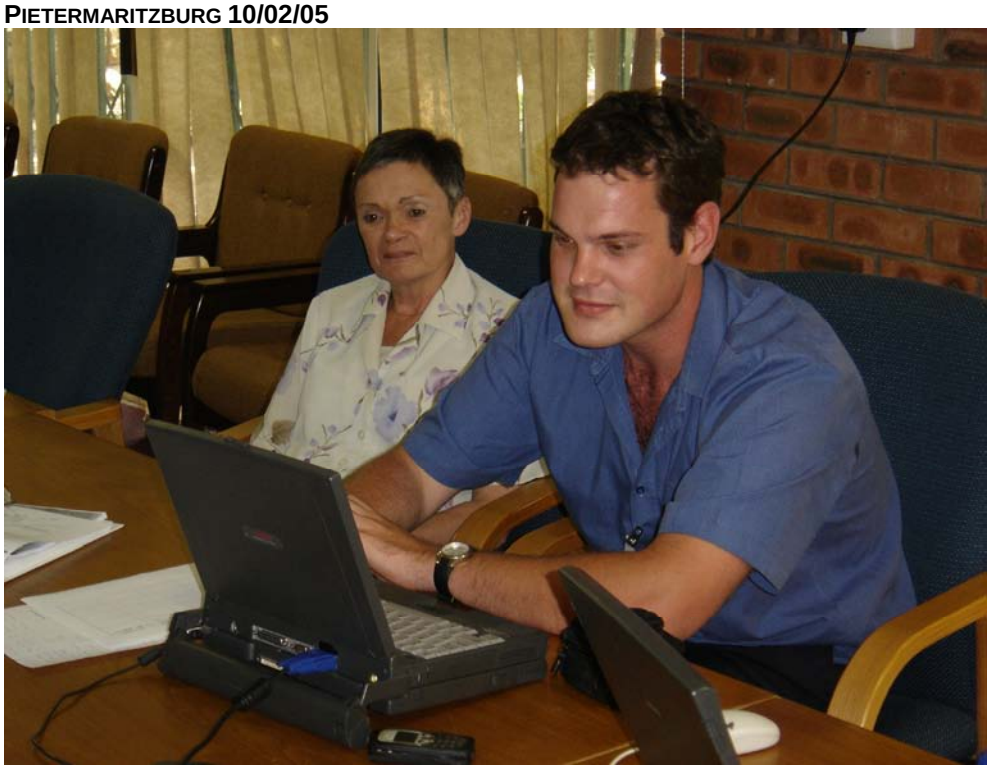
APPENDIX H

GROUP PHOTOS – PATENSIE (09/03/05), JACOBSDAL (28/01/05), PIETERMARITZBURG (10/02/05), THOHOYANDOU (4-16/03/05), NELSPRUIT (11/03/05), GROBLERSDAL (11-13/04/05), KIMBERLEY (04-06/04/05) AND PAARL (16-18/05/05)

PATENSIE 09/03/2005

JACOBSDAL 28/01/05

PIETERMARITZBURG 10/02/05

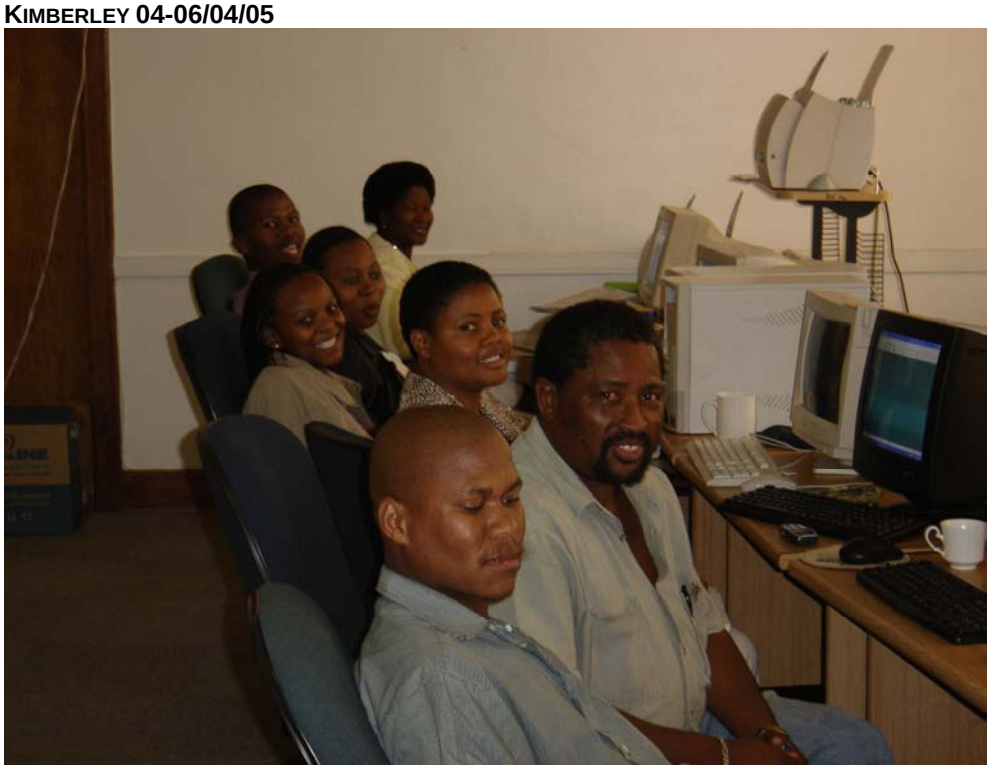


THOYANDOU 4-16/03/05

NELSPRUIT 11/03/05

GROBLERSDAL 11-13/04/05

KIMBERLEY 04-06/04/05



PAARL 16-18/05/05

APPENDIX I

AN IRRICOST ATTENDANCE CERTIFICATE

DIE UNIVERSITEIT VAN DIE VRYSTAAT | **THE UNIVERSITY OF THE FREE STATE**

in samewerking met | in association with

DIE WATERNAVORSINGSKOMMISSIE | **THE WATER RESEARCH COMMISSION**

verklaar hiermee dat | hereby declare that

voorletters en van / initials and surname

die bywoningsgebaseerde kortkursus in | has satisfactorily attended the

IRRICOST VIR BESPROEIINGSKOSTEBERAMINGS | **IRRICOST FOR IRRIGATION COST ESTIMATION**

bevredigend bygewoon het op | attendance based short course on

28-02-2005

Leeruitkomstes: *Die vermoë om IrriCost sagteware te kan gebruik om die kostes vir spilpunte en handlyne te bereken*

Study outcomes: *The ability to employ IrriCost software for centre pivot and dragline cost calculations*

Kursusinhoud:
Landelike elektrisiteitstariewe & -pryse
Watertariewe
Makro-ekonomiese veranderlikes
Tegniese besproeiingsaspekte
Versekering
Arbeid
Vaste besproeiingskoste
Rente
Depresiasie
Veranderlike besproeiingskoste
Herstel- & onderhoudskoste
Marginale faktorkoste

Course content:
Rural electricity tariffs & charges
Water charges
Macro-economic variables
Technical irrigation aspects
Insurance
Labour
Fixed irrigation costs
Interest
Depreciation
Variable irrigation costs
Repair & maintenance costs
Marginal factor cost

Voorsitter: Departement Landbou-ekonomie
Chairman: Department of Agricultural Economics

PW Botha
Kursusfasiliteerder / Course facilitator