The Research and Development Strategy on Water Utilisation in Agriculture in a Changing Environment

Gerhard Backeberg and Andrew Sanewe
Water Research Commission, Pretoria

Mandate of WRC :

- Ensure that research is undertaken in collaboration with universities, science councils, government departments or other organisations
- Disseminate knowledge regarding results of research and promote development work for the purpose of application

Functions of WRC :

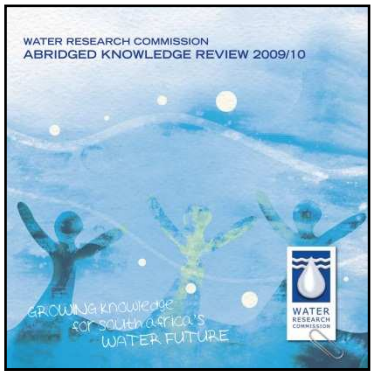
- Establishing water research needs and priorities
- Funding water research on a priority basis
- Enabling effective transfer of information
- Promoting co-ordination, communication and co-operation
- Supporting capacity development

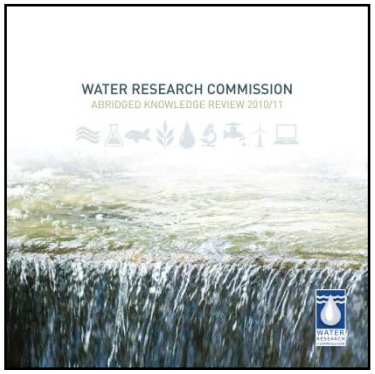
SANCID 2012 Symposium
Alpine Heath Resort, Drakensberg
20 – 23 November 2012

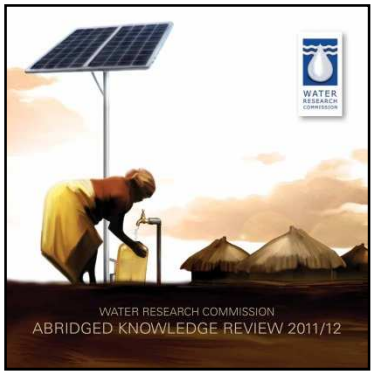
Key strategic area: Water Utilisation in Agriculture Strategy and business plan

- Core strategy
- Strategic context (needs analysis, technical trends, stakeholders, research providers)
- Scope (people in farming, sub-sectors, problems, scientific disciplines)
- Links to WRC vision & mission
- Contributions to cornerstones of WRC strategy

- Implementation plan
- Thrusts & programmes, current & new projects
- Research portfolio (objectives, course of research, allocation of financial resources)
- Contribution to impact areas (society, economy, environment)
- Budgets (current & new projects, total income and expenditure)







Research and development strategy

- Strategies that work (Ferreira, 2005)
- Setting objectives/goals
- Determining a course of action
- Allocating resources
- Core content of good strategy (Rumelt, 2012)
- Diagnosis of the challenges, obstacles, opportunities
- Guiding framework for dealing with challenges
- Set of coherent actions and resource commitments
- Leadership with developing and re-establishing strategy (Porter, 2008)
- Specifying and explaining the direction (goals, actions, etc.)
- Adhere to strategy as basis for trade-offs
- Conviction and courage not to deviate from strategy

"Good strategy requires leaders who are willing and able to say no to a wide variety of actions and interests"

(Richard Rumelt, 2012)

Diagnosis of challenges and priorities

- **2000 Presidential imperative programme on integrated sustainable rural development**
- Alleviate poverty through enhanced production and employment
- More equitable distribution of resources
- Improve quality of life of marginalised groups
- Sustainable use and management of natural resources





Diagnosis of challenges and priorities (continued)

- **2010 Programme of Action of Presidency**
- Outcome 7: Vibrant, equitable and sustainable rural communities and food security for all:
- Output 1: Sustainable agrarian reform
- Output 2: Improved access to affordable and diverse food
- Output 4: Improved employment opportunities and promotion of economic livelihoods
- Outcome 10: Environmental assets and natural resources that are well protected and continually enhanced:
- Output 1: Enhanced quality and quantity of water resources
- Output 2: Reduced greenhouse gas emissions and climate change impacts





Diagnosis of challenges and priorities (continued)

- **2001 Strategic plan for South African agriculture**
- Strategic goals
- Basic premises
- Expected outcomes
  - Increased creation of wealth in agriculture and rural areas
  - Increased investment in agriculture
  - Increased employment
  - Increased income
  - Reduced poverty and inequalities
  - Improved farming efficiency
  - Improved national and household food security

Diagnosis of challenges and priorities (continued)

- **2010 Integrated growth and development planning**
- Economic growth and development
- Job creation
- Rural development
- Sustainable use of natural resources
- Maintenance of biodiversity and ecosystems
- Sustainable livelihoods
- Food security





Diagnosis of challenges and priorities (continued)

- **2009 Green Paper: "Anticipating and addressing strategic issues and trends"**
- Long-term availability of water
- Energy consumption and production
- Conservation, bio-diversity, climate change mitigation and adaptation
- Food security and sustainable rural development
- Innovation, technology and equitable economic growth
- Poverty, inequality and the challenge of social cohesion
- National health profile and health care strategies





Diagnosis of challenges and priorities (continued)

- **2011 National Development Plan: "Trade-offs and risks for agricultural expansion"**
- Investing in water resource and irrigation infrastructure
- Providing innovative market linkages for small scale farmers
- Creating tenure security for communal farmers
- Supporting innovative public-private partnerships
- Improving skills development and training
- Increasing investment in research and development for agriculture





Diagnosis of challenges and priorities (continued)

- **2008 DWA Water for growth and development**
- Efficiency and water saving in agriculture
- **2008 DOA National Agricultural Research and Development Strategy**
- Natural resource base characterisation and monitoring
- **2007 IFPRI Overview of world food situation**
- Agriculture, nutrition and health
- **2005 DBSA Development report**
- Strategy that strengthens farm/non-farm linkages for employment and income generation
- **2003 CAADP of New Partnership of Africa's Development**
- Water management to increase productivity of agriculture





Guiding framework:
Strategic focus and key drivers for research

- Improving knowledge of water use in the processes of production of food, forage, fibre and fuel crops
- Improving knowledge of management processes by people who are using water in the food value chain
- Improving knowledge of natural processes and people-induced impacts of water resource use





Guiding framework: (continued)
Objectives for Research Programmes

Create knowledge, utilise opportunities and solve practical problems with objectives to:

- Increase biological, technical and economic efficiency of water use
- Reduce poverty through water-based agricultural activities
- Increase profitability of water-based farming systems
- Ensure sustainable water resource use through protection, restoration and reclamation practices

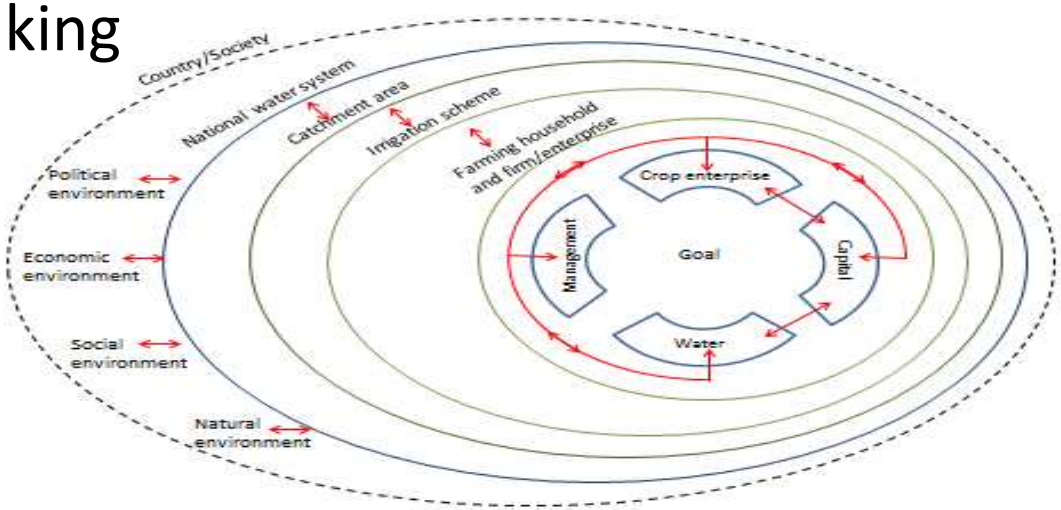
Improve food security and livelihoods of people dependent on agriculture

Guiding framework: (continued)
Thrusts and Programmes: Research Portfolio

- Direction and driving force for research activities
- Comprehensive, inclusive & dynamic
- Annual budget within a 3 year cycle

Research portfolio	2012/13
Current and new projects	R 27.4 million
Total contract budget for 41 projects	R121.8 million

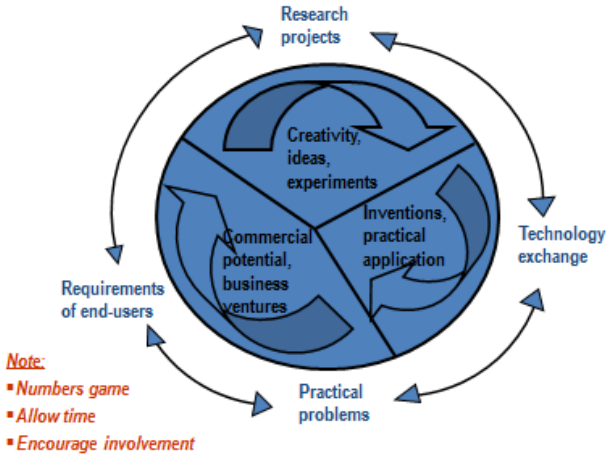
- Systems thinking



Coherent action and resource commitments

- Annual call for research proposals
- Open and directed submissions
- Programmatic and thematic approach
- Specification of available funds
- Direct and manage projects according to innovation process

Taking Research into Practice:
The Innovation Cycle



Thrust 1: Water Utilisation for Food and Fibre Production

Programme 1 : Water-efficient production methods in relation to soils, crops and technology in rain-fed and irrigated agriculture

RESEARCH FLOW

- Generally applicable methods to estimate water use of crops
- Technologies for efficient irrigation scheduling

- Water use of specific crops e.g. indigenous crops, fruit tree crops, wine grapes, crops/trees for bio-fuels, pastures
- Water use and nutritional value of food crops
- Water footprint of food products
- Water use & availability with EO/SI

Programme 2 : Fitness-for-use of water for crop production, livestock watering and aquaculture

RESEARCH FLOW

- Groundwater quality for livestock and human use in rural villages
- Use of greywater for food production in peri-urban areas
- Management of water quality in farm irrigation dams for aquaculture

- Use of irrigation water contaminated with micro-organisms, food safety precautions and water treatment options
- Use of rainwater harvested from rooftops for homestead gardens and domestic use





Thrust 2: Water Utilisation for Fuelwood and Timber Production

Programme 1 : Water-efficient production methods and systems in agro-forestry, woodlands and forestry plantations

RESEARCH FLOW

- Water use of staple food crops and trees in agro-forestry systems
- Water use of indigenous trees

- Water use, biomass production and economic value of indigenous trees in natural and plantation conditions
- Re-establishment of trees and restoring degraded landscapes for employment creation and carbon credits
- Rehabilitation of alien-invaded riparian zones and grass lands





Thrust 3: Water Utilisation for Poverty Reduction and Wealth Creation

WATER RESEARCH COMMISSION

Programme 1 : Sustainable water-based agricultural activities in rural communities

RESEARCH FLOW

- Techniques and practices for RWH & C with homestead food gardens
- Approaches and guidelines for revitalisation of smallholder irrigation
- Checklist for trainers and facilitators

- Up-scaling of RWH&C to communal croplands and rangelands
- Adaptive research on best management practices and training material for farmers and extension officers
- Water use security and skills development for empowerment of woman for household food security
- Action oriented knowledge transfer for homestead food gardens and cropland RWH

Programme 2 : Integrated water management for profitable farming systems

RESEARCH FLOW

- Soil water management programme for rain-fed farming
- Baseline study and revitalisation of hatcheries for aquaculture
- Development and integrated application of models for water management at field, farm, scheme and catchment scale

- Technology exchange and decision support for efficient irrigation water use from dam wall release to root zone application
- Value chain analysis for optimisation of water use and mainstreaming of emerging farmers
- Water use productivity with entrepreneurial development paths
- Whole-farm modeling, optimisation of water and electricity use

Thrust 4: Water Resource Protection and Reclamation

Programme 1 : Sustainable water resource use on irrigation schemes and within river catchments

RESEARCH FLOW

- Impact of salinity on crop production; and on sustainability at farming and regional economy level

- Guidelines for management of salinity
- Development of GIS to monitor salinity status on irrigation schemes
- Technical standards and financial feasibility of drainage systems at farm and irrigation scheme level

Programme 2 : Impact assessment and environmental management of agricultural production

RESEARCH FLOW

- Knowledge review and modeling of non-point source pollution from field to catchment scale; scoping study on impact of agricultural chemicals on water resources

- Climate change/rainfall/drought/flood forecasting and early warming systems
- Vulnerability assessments with appropriate adaptation strategies for rain-fed and irrigated farming
- Improving grassland carrying capacity, livestock production and RWH&C for biogas generation
- Impact of agricultural chemicals on environmental health

WATER USE FOR IRRIGATED AND RAIN-FED CROP PRODUCTION, AGRO-FORESTRY, AQUACULTURE AND LIVESTOCK WATERING

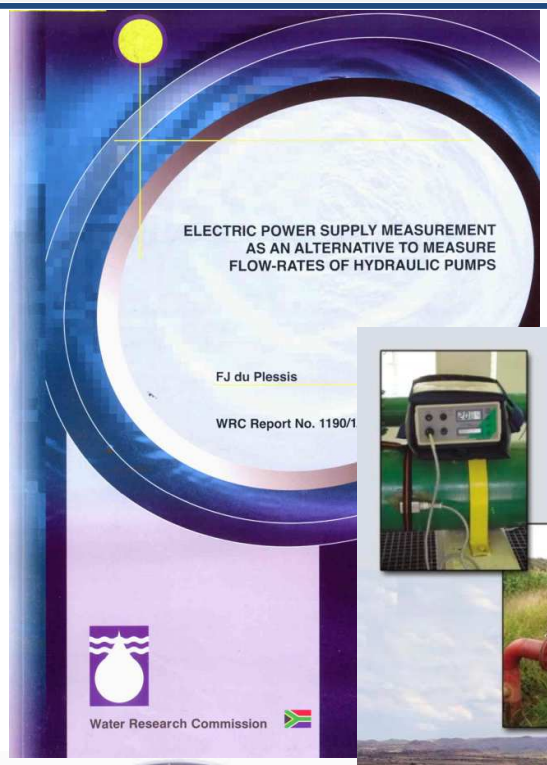
Key Activities According to Research Portfolio

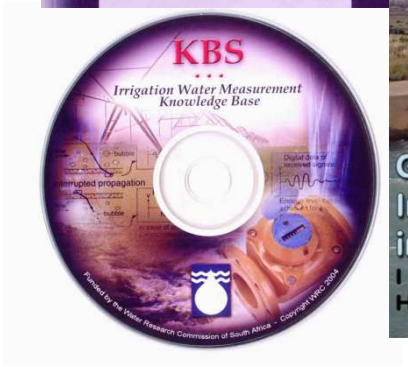
- Increasing the productivity of rainwater and irrigation water use;
- Uplifting rural economies with market directed food production;
- Quantifying the water footprint in food value chains;
- Eradicating hunger and reducing poverty;
- Improving nutrition and health;
- Generating alternative sources of renewable energy;
- Preventing water and soil degradation and pollution;
- Adapting farming systems to climate change.

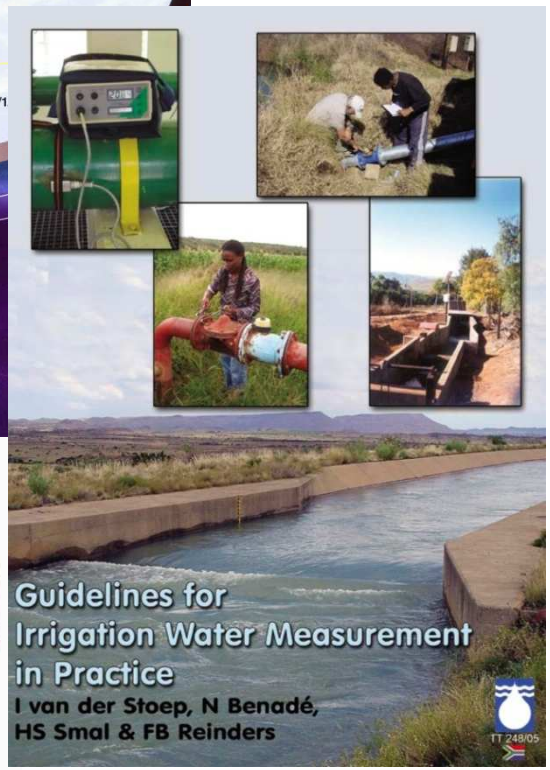




Selected examples of innovation process: Water Measurement



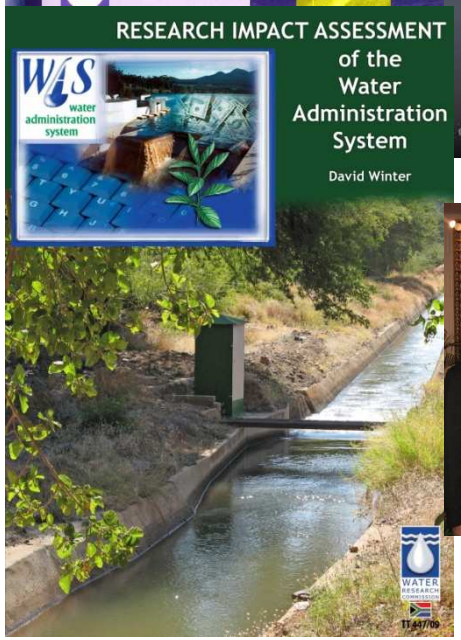


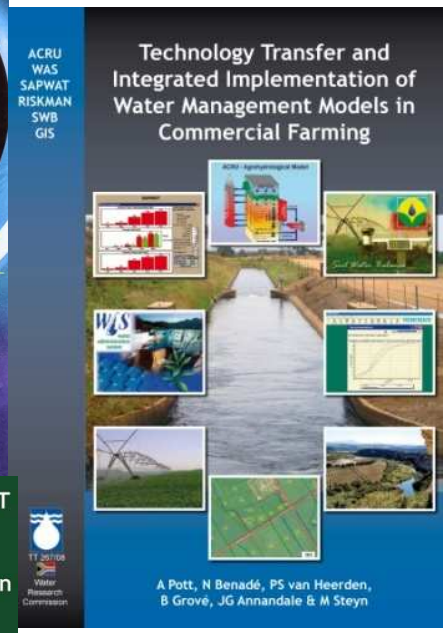


Management

- Indirect measurement of flow-rates through electric power supply
- Direct measurement in canals and pipelines
- Irrigation water measurement knowledge base
  - Two separate research projects 2000 – 2005
  - Technology exchange and guidelines 2006 – 2012
- Training, incentives and regulation for implementation

Water Administration System





WAS

- Research to develop a computerised system for operation of irrigation canals

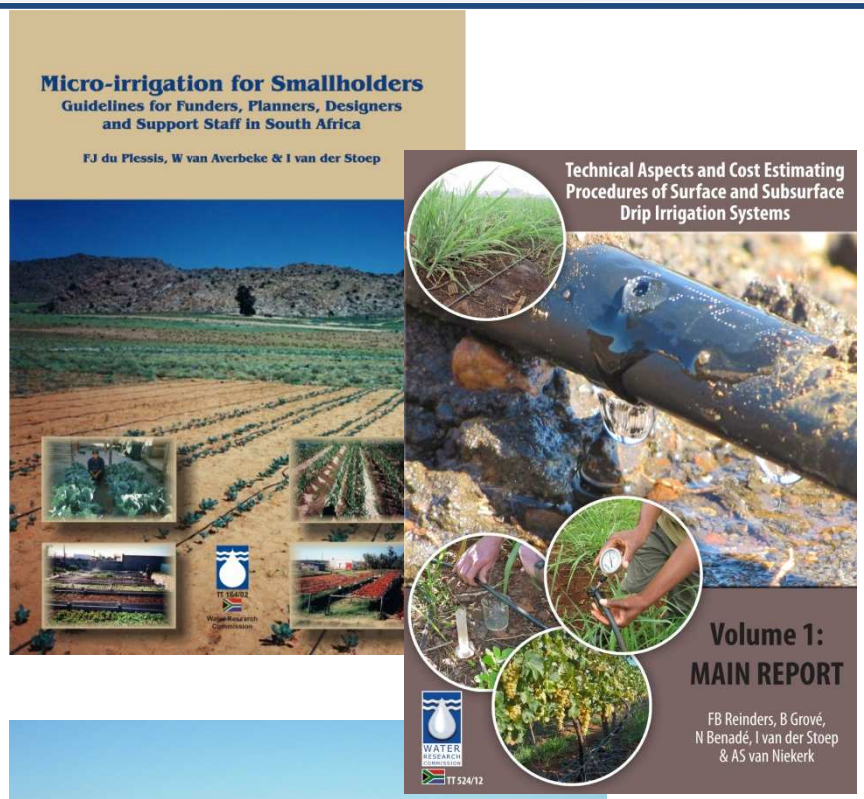
1987 – 1997

- Development and application of
- Water request module
- Water release module
- Water report module
- Water accounts module

1997 to present

- WAS implemented on major irrigation schemes in South Africa
- Establish business venture to install and maintain WAS
- Impact assessment and training for implementation of WAS

Micro and Drip Irrigation



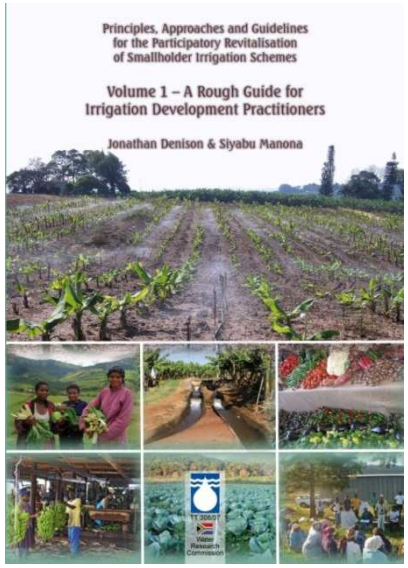
Technology

- Evaluating the appropriateness of micro-irrigation for small-scale irrigation (2001)
- Guidelines for funders, planners, designers and support staff (2001)
- Performance of surface and sub-surface drip irrigation and filtration under field conditions (2002 and 2006)
- Technology exchange for training, costing and maintenance of drip irrigation

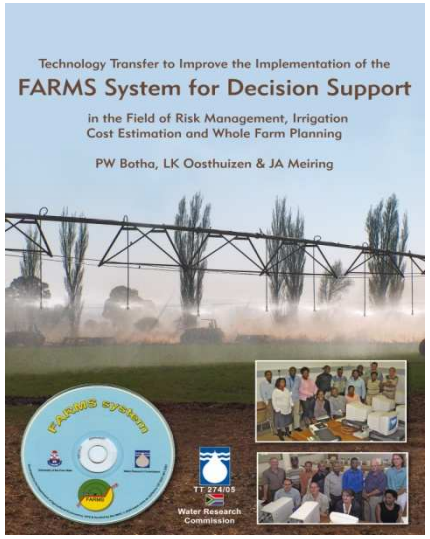
Year	Area	Method of irrigation		
		Flood	Sprinkler	Micro/drip
	ha	%	%	%
1990	1 290 132	32,8	54,4	11,8
2007	1 675 882	14,4 (23,3)	54,9	21,8

Selected examples of thematic and programmatic approach: Irrigation water use

- Entrepreneurial development paths for smallholder irrigation
- Guide for development practitioners on revitalisation of irrigation;
- Low % income from farming for rural livelihoods;
- Establishment of small farming business to increase income and employment.

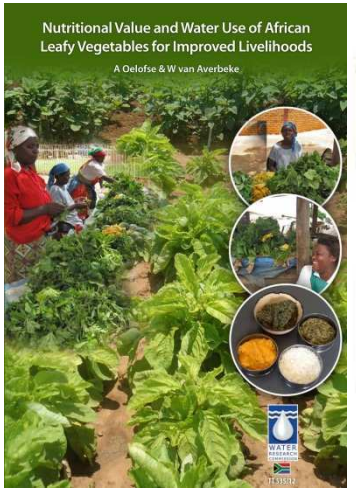


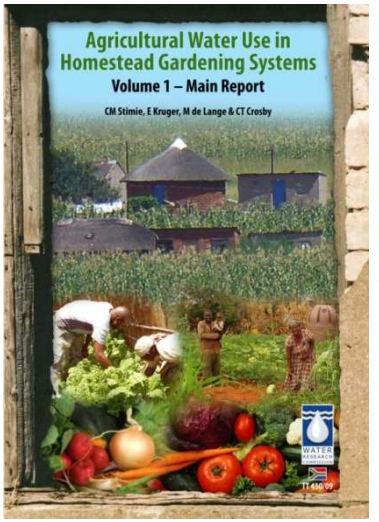
- Optimisation of electricity cost for sustainable irrigation water use
- Substantial increase in electricity rates;
- Research reports on this subject last published in 2002;
- Revision of design standards and feasibility analysis.



Selected examples of thematic and programmatic approach: Rainwater harvesting

- Water use of indigenous legume and grain crops
- Gaps in knowledge of underutilised, indigenous food crops;
- Current and completed research focusses on vegetables;
- Legume & grain crops benefits human nutrition and soil fertility.
- Strategy for action oriented knowledge transfer for training of water use in homestead food gardens and cropland rainwater harvesting
- Sequence of research projects on resource material since 2000;
- Material available for backyard gardens and communal croplands;
- Support of Colleges and AgriSETA trainers to apply knowledge.





Future research focus: Priorities for 2013/14

- Water footprint of selected vegetable & fruit crops
- Measurement and modelling of citrus tree water use
- Water use of indigenous legume and grain crops
- Knowledge and technology transfer for water quality management and aquaculture in farm irrigation dams
- Strategy for action oriented knowledge transfer for training of water use in homestead food gardens and croplands
- Entrepreneurial development paths for smallholder irrigation
- Optimisation of electricity cost for sustainable irrigation water use
- Vulnerability analysis of drought as extreme event in climate change

Future research focus: Priorities for 2014/15

- Water footprint of field and forage food products
- Measurement and modeling of deciduous tree water use
- Rehabilitation of grasslands after eradication of invasive trees
- Contribution of inland freshwater fisheries to rural livelihoods
- Application of EO/SI to determine water availability in commercial agriculture
- Impact assessment of sediment flow in cultivated areas
- Recommendations for further research: ???

- Water use in food value chains
- Modeling of farming with water use curtailment
- Salinity management of irrigated land
- NPS pollution management in agriculture





WATER, FOOD, PEOPLE AND DEVELOPMENT

Notes

Notes