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

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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
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
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)


- 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

Note:
- Numbers game
- Allow time
- Encourage involvement
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

- 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

- 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 grasslands
Thrust 3: Water Utilisation for Poverty Reduction and Wealth Creation

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

• 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

• 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

RESEARCH FLOW

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Thrust 4: Water Resource Protection and Reclamation

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

- 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

- 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 warning 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

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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