

# Demand for products of irrigated agriculture in sub-Saharan Africa

by

**P.J. Riddell and M. Westlake**  
FAO Consultants

and

**J. Burke**  
FAO Land and Water Development Division

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

ISBN 92-5-105581-5

All rights reserved. Reproduction and dissemination of material in this information product for educational or other non-commercial purposes are authorized without any prior written permission from the copyright holders provided the source is fully acknowledged. Reproduction of material in this information product for resale or other commercial purposes is prohibited without written permission of the copyright holders. Applications for such permission should be addressed to:

Chief

Electronic Publishing Policy and Support Branch  
Information Division

FAO

Viale delle Terme di Caracalla, 00153 Rome, Italy

or by e-mail to:

[copyright@fao.org](mailto:copyright@fao.org)

© FAO 2006

# Contents

<b>Acknowledgements</b>	<b>viii</b>
<b>Preface</b>	<b>ix</b>
<b>List of acronyms</b>	<b>x</b>
<b>1. Introduction</b>	<b>1</b>
Background	1
Structure of report	2
<b>2. Irrigation in the context of sub-Saharan Africa</b>	<b>3</b>
Definitions of irrigation	3
The regional context	3
The structure of markets and price formation	6
Processing and marketing systems in sub-Saharan Africa	10
Self-sufficiency as an objective and a tool in demand analysis	11
Increased irrigation in sub-Saharan Africa and its impact on commodity prices	12
How irrigation responds to demand – the process	13
Physical interventions	15
Non-physical interventions	15
Financing modalities	16
Summary	18
<b>3. Data sources and methodology</b>	<b>19</b>
Analysis of supply and demand	19
Crop sectors	19
Sub-Saharan Africa component regions	20
Natural resources	20
Agriculture	23
Cropping patterns / farming systems	23
Areas under agricultural water management	25
Irrigated yields	25
<b>4. Baseline</b>	<b>27</b>
Analysis of projected production and consumption of agricultural commodities in sub-Saharan Africa	27
Population growth	27
Production	27
Projected self-sufficiency ratios and trade	31
Calories	35
The contribution of irrigated agriculture	37
Land and water resource utilization in irrigation	41
Typical irrigated yields	43
Summary	47

<b>5. The impacts of irrigated agriculture</b>	<b>49</b>
Value chains and the influence of irrigation on marketing and processing	49
Spatial and temporal impacts	49
Spatial impacts	49
Temporal impacts	51
Impacts on quality	52
Impacts on the stability and predictability of production	53
Other social impacts	54
Environmental impact	55
<b>6. Getting to 2030: the yield question and natural resources constraints</b>	<b>57</b>
Introduction	57
A regional view of yield growth forecasts	57
Natural resources constraints	62
<b>7. Trends and opportunities</b>	<b>67</b>
The international trading environment	67
The Generalized System of Preferences	67
The Uruguay Round Agreement on Agriculture	67
The Agreement on the Application of Sanitary and Phytosanitary Standards	68
Trade agreements and preferences	69
Market prospects for the main crop groups	71
General considerations	71
Cereals	71
Non-cereal staple food crops	75
Other food crops	76
Livestock and dairy	78
Beverage and industrial crops	78
Summary	79
Regional demand and the potential for intraregional trade in maize, wheat and rice	80
An appropriate irrigation sector response	80
The prospects for financing irrigation	81
<b>8. Conclusions and recommendations</b>	<b>85</b>
<b>References</b>	<b>87</b>
<b>Annexes</b>	<b>89</b>
1. The FAO typology for areas under agricultural water management	89
2. Composition of sub-Saharan Africa regions	93
3. The SUA commodity groups	95
4. AQUASTAT data for the sub-Saharan Africa regions	103
5. Regional SUAs	107
6. Trade data for sub-Saharan Africa – wheat; rice; coarse grains; oils and fats; sugar	115

7. Analysis of annual regional calorie surpluses and shortfalls by staple crop group, 1997/99	121
8. Analysis of regional calorie surpluses and shortfalls by staple crop group, 2030	125

## List of figures

1. Population density in Africa, 2002	4
2. Irrigation density in Africa, 2002	5
3. Regional Division of Africa	21
4. Water courses in Africa in relation to national boundaries and internal renewable resources	22
5. Cropping patterns map	23
6. Farming systems map from "Farming Systems and Poverty"	24
7. Trade data profile for sub-Saharan Africa	34
8. Baseline comparison of rainfed production, irrigated production and apparent shortfalls according to 1997/99 calorific equivalents	38
9. Comparison of rainfed production, irrigated production and apparent shortfalls according to calorific equivalents, 2015	39
10. Comparison of rainfed production, irrigated production and apparent shortfalls according to calorific equivalents, 2030	40
11. Irrigated production as a percentage of total production compared with water used for irrigation as a percentage of totally annual renewable water resources	43
12. Central region yield/production comparisons	43
13. Eastern region yield/production comparisons	44
14. Gulf of Guinea region yield/production comparisons	44
15. Indian Ocean Islands region yield/production comparisons	44
16. Republic of South Africa yield/production comparisons	45
17. Southern Region yield/production comparisons	45
18. Sudano-Sahelian region yield/production comparisons	46
19. Yield levels compared with calorific production for sub-Saharan Africa as a whole	46

## List of boxes

1. FAO AQUASTAT update: rate of the annual increase in irrigation areas and areas under water management, 1992–2000 (weighted index)	5
2. The structure of irrigation in Nigeri	13
3. Raising demand for irrigation. Reforms under the Agriculture Sector Development Strategy, United Republic of Tanzania	14
4. The Fresh Produce Exporters Association of Kenya initiative	52
5. The impact of irrigation on poverty: a case-study from the Gambia	55
6. Environmental Solutions from the World Wide Fund for Nature	56
7. Termination of the WTO Multifibre Arrangement	70
8. Rice: market prospects in sub-Saharan Africa	71
9. Sugar: market prospects in sub-Saharan Africa	77
10. Foreword from Zambia's Irrigation Policy and Strategy Document, 2004	83

# List of tables

1. A working template for the FAO area under agricultural water management typology	3
2. Sub-Saharan Africa (incl. South Africa) Rainfed and Irrigation production data	6
3. FAO AQUASTAT update: country irrigation statistics and areas under water management	7
4. AQUASTAT regional distribution of area under water management	8
5. Target yields assumed for the yield gap analysis	25
6. Population and aggregate agricultural output for sub-Saharan Africa, developing countries and the world	27
7. World production of agricultural commodities, 1997/99 baseline	28
8. Production values of commodity groups as a percentage of the value of agricultural production	30
9. Analysis of crop use for feed in Sub-Saharan Africa, developing countries and the world	31
10. Self-sufficiency ratios* analysed by commodity group and region: baseline, 2015, 2030	32
11. Value of net agricultural trade Baseline, 2015 and 2030	33
12. Sub-Saharan Africa calorie shortfalls and the additional production needed to eliminate the apparent shortfall, baseline 2015 and 2030	35
13. Absolute and relative size of projected calorie deficits in Sub-Saharan Africa, by commodity, 2015 and 2030	36
14. Historical growth rates in irrigated areas for all African countries	42
15. Irrigated maize in sub-Saharan Africa for the baseline year	51
16. Environmental risks associated with irrigated agriculture	56
17. Weighted mean yields projected for 2015	58
18. Scenario 1 – no further yield increases between 2015 and 2030	59
19. Scenario 2 – yield gaps between 2015 and targets reduced by 50 percent between 2015 and 2030	60
20. Scenario 3 – target yields achieved throughout by 2030	61
21. Savings in additional irrigated areas afforded by achieving weighted mean yield targets	62
22. Sub-Saharan Africa cereal self-sufficiency under Scenario 1 – no further yield increases between 2015 and 2030	63
23. Sub-Saharan Africa cereal self-sufficiency under Scenario 2 – yield gaps between 2015 and targets reduced by 50 percent between 2015 and 2030	64
24. Sub-Saharan Africa cereal self-sufficiency under Scenario 3 – target yields achieved throughout by 2030	65
25. Comparison of Scenario 2 land and water demands with the available resources for sub-Saharan Africa self-sufficiency	66
26. Projected national, regional and sub-Saharan Africa net trade in 2030	72
27. National, regional and sub-Saharan Africa grain deficits in relation to population and labour, 2030	73

# Acknowledgements

The authors of the report would like to thank Jelle Bruinsma and Gerold Bödeker from the Global Perspectives Unit in FAO for their support, encouragement and detailed review of the drafts and for providing the essential AT 2015/2030 data. Thanks are also due to Karen Frenken, Jippe Hoogeveen, Jan Poullisse and Jean-Marc Faurès of the Land and Water Development Division for their continuous advice and comments. Outside FAO, Ijsbrand de Jong and Salah Dargouth, at the World Bank and Tony Peacock and Edward Heinemann at the International Fund for Agricultural Development (IFAD) provided valuable reviews and comments that were much appreciated.

This report forms part of a series of reports produced for a Collaborative Programme on Investment in Agricultural Water Management for Poverty Reduction and Economic Growth in Sub-Saharan Africa carried out jointly by the World Bank, African Development Bank, the (IFAD) and the International Water Management Institute (IWMI).

Finally, the authors would like to thank Lynette Chalk for her untiring efforts and commitment in designing the report and insistence of keeping to deadlines. Her contribution has been greatly appreciated.

Phillip Riddell is a water management consultant specializing in irrigation policy and strategy formulation with long experience in Sub-Saharan Africa.

Michael Westlake is an agricultural economist specializing in agricultural commodities also with a long experience in Sub-Saharan Africa.



---

# Preface

This publication arose from FAO's contribution to a collaborative programme by international organizations (AfDB, FAO, IFAD, IWMI and the World Bank). The programme is entitled "Investment in agricultural water management in Sub-Saharan Africa: Diagnosis of Trends and Opportunities"

The programme comprises a set of component studies that form the basis of a Synthetic report (Volume I) to be compiled by a designated working group representing the five organisations. The component studies are:

- Volume II      Regional demand for products of irrigation agriculture.
- Volume III     Irrigation development and planning and implementation.
- Volume IV     Analysis of irrigation investment performance and costs.
- Volume V      Private sector participation.
- Volume VI     Environmental and health impacts.
- Volume VII    Assessment of food supply and demand using a 'Watersim' model.
- Volume VIII   Poverty reduction.
- Volume IX     Water-livestock-crop production.

FAO's contribution to the collaborative programme is Volume II which is now presented here as an FAO Water Report.

The publication is primarily targeted at agriculture policy makers and managers, prompting them to review the economic basis for new investment in agricultural water management.

Much has been written about the performance of irrigated agriculture in sub-Saharan Africa, but usually from the standpoint of supply of hydraulic infrastructure and institutions. Very little attention has been paid to an examination of the 'pull factors'. This report attempts to redress the balance.

## List of acronyms

ACP	African, Caribbean and Pacific
AGOA	African Growth and Opportunity Act
AoA	Agreement on Agriculture
CP	Collaborative Programme
EBA	Everything but arms
EC	European Community
GATT	General Agreement on Tariffs and Trade
GDP	Gross domestic product
GIS	Geographical information system
GSP	Generalized System of Tariff Preferences
IFAD	International Fund for Agricultural Development
IFI	International financial institution
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
IWMI	International Water Management Institute
IWR	Irrigation water requirement
LDC	Least developed country
MFA	Multifibre Arrangement
MFN	Most favoured nation
NGO	Non-governmental organization
O&M	Operation and maintenance
SACU	Southern African Customs Union
SSA	Sub-Saharan Africa
SSR	Self-sufficiency ratio
SUA	Supply and utilization account
WTO	World Trade Organization