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Enhancing Crop-Livestock Systems in Conservation Agriculture for Sustainable Production Intensification

*A Farmer Discovery Process
Going to Scale in Burkina Faso*



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A Farmer Discovery Process Going to Scale in Burkina Faso

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FOREWORD

This is a story about how, through its PRODS/PAIA initiative (see Box 1), FAO assisted groups of farmers in five farming communities in the moist savanna zone of Burkina Faso to enhance their crop-livestock systems through Conservation Agriculture (CA) practices, including crop diversification, using an innovative farmer discovery process, to bring about agricultural intensification and improvement in livelihoods. FAO's assistance was delivered largely by working with national institutions, adding value to ongoing stakeholder resources and activities. Hence, this is a story about how FAO worked with a range of stakeholders including the farmers and their communities, and the research and extension stakeholders, to create convergence and enable a farmer-based discovery process to experiment with a set of fundamentally new principles and elements in their farming practices for integrated crop-livestock production intensification.

CA with its three essential components – no-till and minimum soil disturbance, crop diversification with legumes in crop rotations and mixtures, and building up of a mulch on the soil surface with plant residues of previous crops including cover crops -- constituted the new principles for simultaneously enhancing soil health, productivity and income, and ecosystem services. It is a story of positive intensification outcomes brought about by adapting 'proven principles and practices' of CA and crop diversification into existing crop-livestock systems through a farmer-based discovery process linked to coordinated technical support through FAO from a range of research and development stakeholders.

The positive outcomes offer a real promise and an opportunity for bringing about a large scale impact on agricultural productivity and livelihoods in the moist savanna zone of West Africa, often referred to as the potential 'bread basket' because of the zone's high productivity potential for integrated crop-livestock production. The conceptual elements draw substantially from new innovations in sustainable intensification in similar agro-ecologies in the savannas of Brazil. This publication describes the multi-stakeholder process which led the successful outcomes, and the opportunity for a greater change that now exists and should be harnessed for sustainable agricultural development, nationally and regionally.

Shivaji Pandey

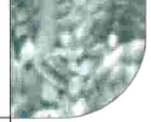
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BOX 1 PRODS/PAIA

PRODS/PAIA initiative of FAO refers to the concept of integrated agricultural production systems (PRODS) as a priority area for interdisciplinary actions (PAIA) approach. The PRODS/PAIA approach was developed to foster strong collaboration and partnership with national and regional agencies, institutions and non-governmental organizations (NGOs), civil society and the private sector. The principal objective of the PRODS/PAIA effort is to promote a holistic system approaches and to better address the socio-economic dimensions of the introduction, adaptation, use and dissemination of appropriately validated integrated production systems technologies for intensification, including the social process of learning itself, e.g., farmer discovery process linked to Farmer Field Schools. Integration highlights the complex linkages that should be developed as farmers and rural communities shift from traditional production system to market-oriented intensified production systems and practices. Horizontal integration seeks to improve the nature of the system itself, e.g., from tillage-based to no-till with crop diversification and rotation, and soil cover with plant residues and mulches, and the management across the various components of the system, namely crops, animals, trees and fish. Vertical integration seeks to improve management of commodities through production, processing, marketing and distribution, which will result in added value for the produce to increase farm revenue.



OVERSIGHT AND ACKNOWLEDGEMENTS

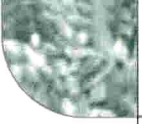
A very large number of colleagues have assisted in the work reported in this publication. It is not possible to name every one of them individually. However, it must be acknowledged that without their dedication, and often voluntary service, it would not have been possible to carry out the pilot phase of the project, or the conceptualisation of the follow-up scaling process, reported in this publication. This publication is dedicated to them all.

The pilot project activities and the scaling-up process were overseen by Eric Kueneman from the Plant Production and Protection Division (AGP) of FAO in Rome with assistance from Brahim Kebe at the FAO Regional Office in Accra, and advice from staff of AGP, particularly Theodor Friedrich, William Settle, Caterina Batello and Amir Kassam, and the staff of the FAO Office in Burkina Faso.

The field work in Burkina Faso was coordinated by the staff from the Institut National pour de l'Environnement et de Recherche Agricoles (INERA) at Farako-ba, led by Souleymane Ouedraogo, with assistance from Estanislasse Sankara and Karim Traoré of INERA and from the staff of the Direction de la Vulgarisation et de la Recherche-Développement (DVRD) including Clement Combassere and Salou Traoré, and from the Direction Régionale de l'Agriculture de l'Hydraulique et des Ressources Halieutiques des Hauts-Bassins (DRAHRH/HB), the National de Semences Forestieres (CNSF), and the Women's Association.

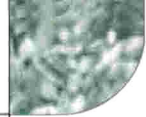
The project benefited from collaboration with other FAO initiatives in Burkina Faso, particularly the Integrated Pest Management-Farmer Field School project (IPM-FFS), the Special Programme of Food Security (SPFS), and several international organizations such as CIRAD, IITA, ICRAF, ILRI, ICRISAT and FARA provided technical guidance and plant genetic resources to the project.

The conceptualization of the follow-up activities was coordinated by Eric Kueneman with input from a number of colleagues including: Soulayman Nacro, Coordinator, FAO project on Integrated Pest and Production Management (IPPM) and William Settle; Souleymane Ouedraogo and Estanislasse Sankara from INERA; Ye Dofihoyan, Clement Combassere and Salou, Traoré from DRAHRH/HB ; Boipelo Freude and Jean Claude Legoupil from FARA in Accra, and Paulo Roberto Galerani, EMBRAPA-



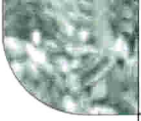
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Amir Kassam coordinated the preparation of this publication in collaboration with Eric Kueneman, Brahim Kebe, Anthony Youdeowei and Souleymane Ouedraogo. Magda Morales provided valuable assistance with the graphic design and formatting.

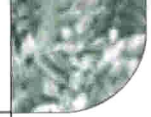


ACRONYMS AND ABBREVIATIONS

AGRA	Alliance for Green Revolution in Africa
BNF	Biological Nitrogen Fixation
CA	Conservation Agriculture
CAADP	Comprehensive African Agricultural Development Programme
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CIRDES	Centre International de Recherche pour le Développement de l'Élevage en Zone Soudanienne
CNSF	Centre National de Semences Forestières
CoP	Community of Practice
DRAHRH/HB	Direction Régionale de l'Agriculture de l'Hydraulique et des Ressources Halieutiques des Hauts Bassins(DRAHRH/HB).
DVRD	Direction de la Vulgarisation et de la Recherche-Développement
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária
FAAP	Framework for African Agricultural Productivity
FAO	Food and Agriculture Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
FFS	Farmer Field Schools
FORC	Forestry Conservation, Research and Education Service of FAO
GAP	Good Agricultural Practices
ICRAF	International Centre for Agroforestry Research
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFAD	International Fund for Agricultural Development
IFDC	International Fertilizer Development Centre
IITA	International Institute of Tropical Agriculture
INERA	Institut National de l'Environnement et des Recherches Agricoles



ILRI	International Livestock Research Institute
IPM	Integrated Pest Management
IPPM	Integrated Production and Pest Management
MoA	Ministry of Agriculture
MoAR	Ministry of Animal Resources
NGO	Non-Governmental Organization
NRM	Natural Resource Management
PAIA	Priority Areas for Interdisciplinary Action
PRODS/PAIA	Integrated Production Systems/Priority Areas for Interdisciplinary Action
R&D	Research & Development
SARD	Sustainable Agriculture and Rural Development
SOM	Soil organic matter
SPFS	Special Program for Food Security
UN	United Nations
UNPC-B	Union Nationale des Producteurs de Coton du Burkina (National Cotton Growers' Union of Burkina)



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CHAPTER 1

Introduction

Despite its high productivity potential, the current agricultural land use pattern in the moist savanna zone of Sub-Saharan Africa (Figure 1, zones 7, 8 and 9) and its development prospects for livelihoods and sustainability are beset with serious constraints. These arise mainly from poor soil health and therefore low soil productivity, due to a combination, on the one hand, of soil inversion tillage practices, which degrades soil porosity, organic matter and soil biota, and sub-optimal soil, crop and pest management practices, and on the other of sub-optimal crop diversification and crop residue management, and poor integration of livestock in the production system.

From the economic and livelihood viewpoint, cotton and livestock constitute the bulk of cash income, where as the main food crops are maize, sorghum, cowpea and groundnut. However, the liberalization and globalization of the cotton trade calls for improvements in the competitiveness and productivity of the cotton production system, in terms of reducing the costs of production and raising factor productivities and yields. In the case of livestock production, the main constraint to increasing livestock productivity and output is the lack of adequate supplies of good quality livestock feed in the dry season produced at a competitive cost and without jeopardizing household food security. The need to improve cotton productivity and expand its production, the need to improve livestock feed supplies and expand livestock production of a range of animals as well as strengthen food security implies that: (a) the dominant cotton-cereal-legume production systems in the moist savanna ecologies must be based on efficient management of soil and water and of production inputs such as nutrients, labour and energy and efficient and minimum or no use of pesticides; and (b) the cropping systems must be diversified with high biomass fodder and legume crops, and be managed efficiently to produce increased outputs of fodder and feed, as well as food and fibre, and managed to ensure the gradual improvement and rehabilitation of soil quality over time. Experience

has shown that amongst good farming and crop management practices that can make a significant contribution to meeting these implied needs are practices such as Conservation Agriculture (CA) and integrated pest management (IPM) disseminated through Farmer Field School (FFS) approaches.

Based on multi-stakeholder work facilitated by FAO during the recent years, there are promising prospects for agricultural change in the moist savanna zone in South Western Burkina Faso. And this has enormous implications through scaling-up for harnessing the potential of the moist savanna agro-ecologies that could help provide food, feed and fibre for Africa. New agricultural technologies, particularly the widening of crop choices, and Conservation Agriculture (CA) practices and linking crop production with livestock have been tested and adapted by farmers in the cotton growing areas of the moist savanna and are being disseminated through farmer field schools (FFS). This experience lends support to the notion that a spiral of rehabilitation of land productivity can be established based on integrated production systems in CA. Consequently, new horizons are opening up for agricultural intensification in the moist savanna ecologies of West Africa more generally.

There is now little doubt that the introduction of CA technologies and practices offer enormous potential to simultaneously rebuild and enhance soil fertility, land productivity and agricultural output and farm income. For example, based on similar technologies and practices, over 20 millions hectares of land in the savanna ecology in Brazil have been sustainably intensified and diversified, and similar evaluation is being achieved in other countries in Latin America and in Asia. More recently there is growing evidence of successful soil health and fertility management for agricultural intensification on both large and small-scale farms using CA practices in Africa from countries as diverse as Ghana, Kenya, Madagascar, Malawi, Morocco, Sudan, South Africa, Swaziland, Tanzania, Tunisia, Uganda, Zambia and Zimbabwe, covering a range of agro-ecological and socioeconomic conditions. The fact that CA is now practised on almost 100 million hectares worldwide implies that the principles on which it is based are recognised by farmers as one major potential alternative for enhancing soil fertility and for sustainable agricultural intensification in Africa and internationally.

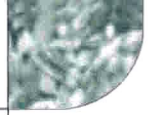
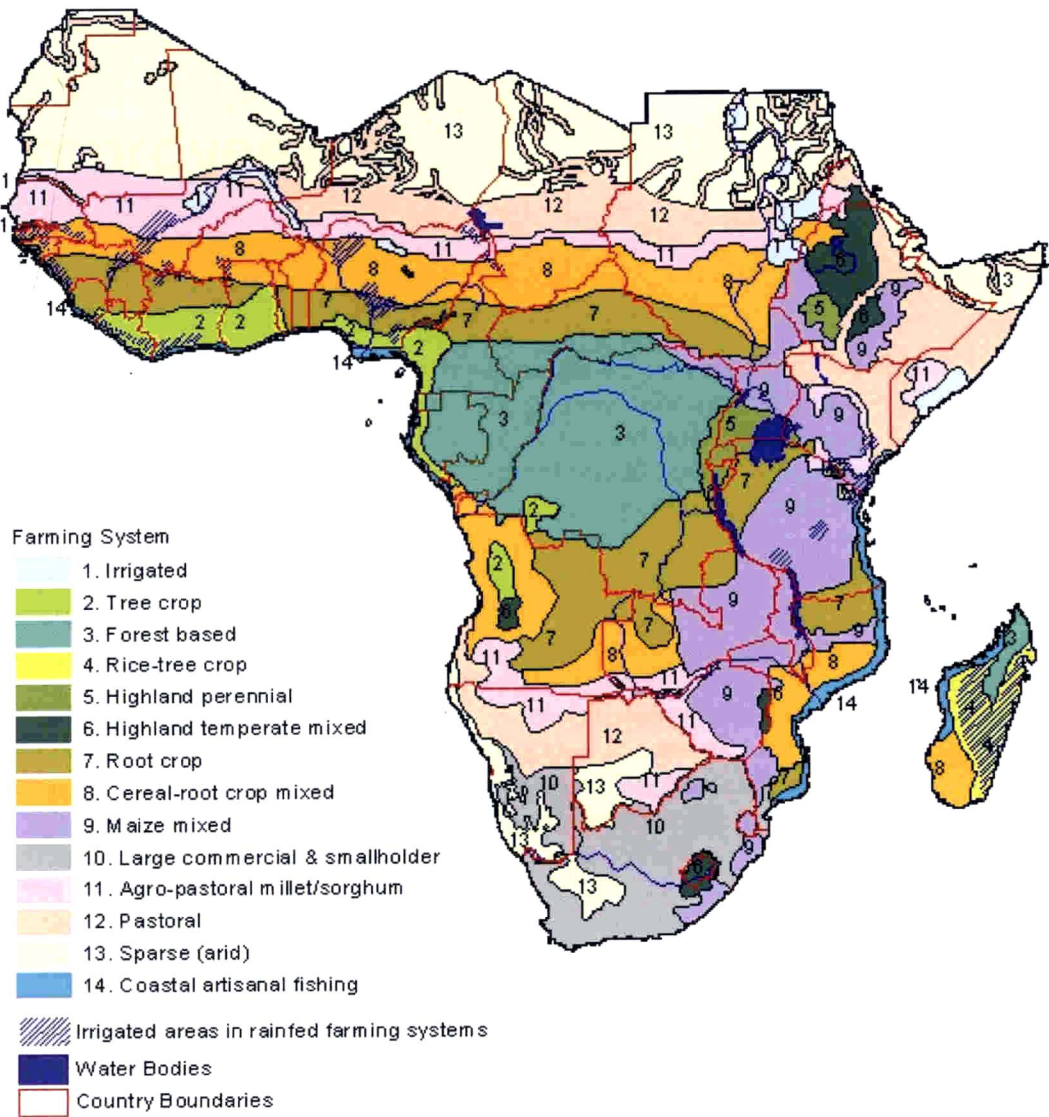


FIGURE 1
Farming systems in Sub-Saharan Africa. Zones 7, 8 and 9 include the moist savanna ecologies.



Source: Dixon, J. and Gulliver, A. (2001). *Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World*. FAO and World Bank, Rome and Washington D.C.

CHAPTER 2

An analysis of farming systems constraints and opportunities for improvement

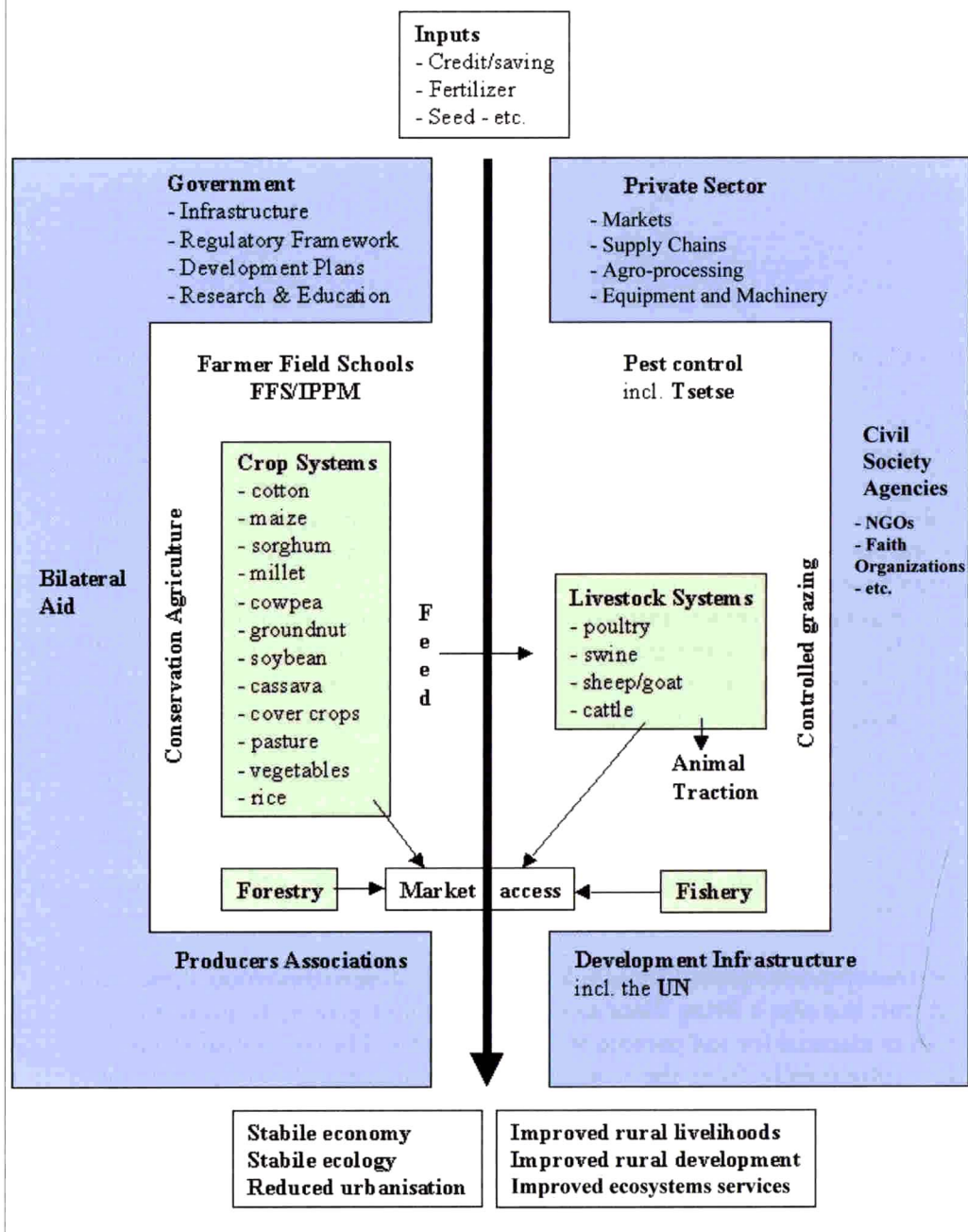
In 2001, an analysis of farming systems in south western Burkina Faso and their constraints was conducted based on participatory rural appraisals to develop a vision of what could be achieved by farmers with right knowledge and multi-stakeholder support in the potential 'bread basket' moist savanna ecology of West Africa for integrated crop-livestock production systems. This established a strategy of an experimental participatory approach to testing the introduction of new concepts and elements into the existing cereals- and cotton-based smallholder farming systems to:

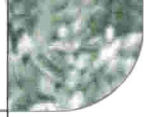
- (a) expand crop choices that would increase the production of livestock feed (dry season needs and grain concentrates for the peri-urban poultry sector) while ensuring adequate biomass supply for soil quality recovery;
- (b) integrate Conservation Agriculture practices as a means to improve and optimize soil-crop-water-nutrient management for sustainable production intensification, given the poor current state of soil nutrient fertility, variable rainfall climate, and inadequate biomass availability; and
- (c) diversify and expand the range of food, feed and tree crops and their integration with livestock into the existing cotton- and maize-based systems.

The tree component provides multiple benefits including erosion control, biofuel and fruit but also a living fence to enable control of grazing to protect crop residues essential for soil protection in CA systems. The conceptual elements draw substantially from the new innovations in sustainable intensification in similar agro-ecologies in the savannas of Brazil (see also Landers, 2007¹).

¹ Landers, J.N. (2007) Tropical crop-livestock systems in conservation agriculture: The Brazilian experience. Integrated Crop Management, Vol.5. FAO, Rome.

FIGURE 2
Overall concept of partnerships and interactions for enhancing crop-livestock interactions for sustainable development production intensification





As the PRODS/PAIA strategy formulation evolved, it became clear that the vision of what could be aimed at and achieved could be best described as the integration of crop-tree-livestock systems in Conservation Agriculture with controlled grazing and pest control as illustrated in Figure 2.

The integration between crops and livestock would be enhanced mainly through the feed (fodder and grain) supply from the diversified crop systems. The integrated production and pest management Farmer Field Schools (FFS-IPPM) would not only ensure good practices in pest control but also serve as the learning sites for new knowledge and technology, and the testing, adaptation and integration of new principles and practices such as new crops or rotations, new soil management practice, new crop husbandry practices, which would be managed through on-farm farmer-discovery benchmark sites.

Feed was considered a serious limiting component to pull producers out of poverty. Thus, new selected crops coupled to practices that address soil degradation (i.e., the need for soil health recovery) are included in the model. CA is a promising approach to rehabilitate degraded lands but living fences are required to protect crop residues from livestock, and FFS are needed to enable farmers to understand and learn the new choices and their implications. The range of benefits in productivity and crop-livestock integrations that could be offered by expanding crop choice through the introduction of new crops are illustrated in Figure 3.

Over the period 2002-2007, FAO supported a 5-year production system intensification and diversification project with the Institut National pour de l'Environnement et de Recherches Agricoles (INERA) at Farako-ba and the Direction de la Vulgarisation et de la Recherche-Developpment (DVRD) in five villages near Bobo Dioulasso in south western Burkina Faso to test and select technologies capable of overcoming the limitations associated with low productivity of the cotton-based crop-livestock production systems. This pilot project introduced and tested improved technologies for soil management, crops and livestock aimed at raising productivity through a benchmark "farmer-participatory discovery" process that not only validated their relevance but also established a body of evidence and a "community of practices" (CoP) ready to support a larger scale dissemination of the promising technologies and practices.

This publication describes the experience and 'work in progress' on a farmer discovery process of capacity building that was delivered through the FAO's PRODS/PAIA initiative to farmers in five farming communities around Bobo Dioulasso in the moist savanna zone of south western Burkina Faso to bring about sustainable production intensification and improvement in livelihoods, food security and ecosystem services (see Figure 4 for a farming systems map of West Africa).