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Fertility of Soils

A Future for Farming
in the West African Savannah

With 87 Figures

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*Food and Agriculture Organization
of the United Nations*

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Preface

Between the gates of the Sahara and the leafy canopy of the forest of the wet tropics there stretches the vast Sudano-Sahelian area of Africa in which for the past 50 years France has maintained a continuous program of agricultural development. France has forged close links for scientific and technical cooperation with the national organizations for research and development which, since gaining independence, the countries of this part of the world have progressively established.

The application of research results has been rewarded by success in some development projects but there have also been some unfortunate setbacks through a tendency to introduce, without change, intensive methods which had proved successful in Europe.

Much has been achieved by these research and development organizations. Their experimental results, observations, and experience are recorded in many written accounts. Some records of the work done are difficult to obtain and they are of variable quality. They have not been widely distributed. Some information is to be found only in the collective memory of a small group of pioneers in francophone tropical agriculture; there is a risk that some of this accumulated capital of knowledge may be lost. The new generation of tropical agriculturalists, and even some with experience, tends to ignore the work of their predecessors and seems to be convinced that agricultural science in the tropics can only be put on a sound basis by starting again from scratch.

The African countries and the international, regional, or bilateral organizations for cooperation and finance need the answers to many questions and it is essential that the results obtained over the so-called development years by the agricultural research and development organizations in the sub-Saharan savannah should be collected, examined, and assessed.

Doubts have been expressed, following the recent years of drought, as to the actual capacity of the soils to sustain an intensified, productive agriculture. Some think that intensification carries a risk of irreversible damage to the ecosystem. There are signs of declining fertility and erosion. Is this the inevitable result of the introduction of inappropriate and costly technology by the extension organizations? Is it perhaps possible that the desire for short-term profit in some de-

velopment projects has caused the importance of maintaining soil fertility to be overlooked?

The French Ministry of Cooperation and Development has therefore asked CIRAD¹ to survey the experience gained by the agricultural research and development organizations working in the Sudano-Sahelian area; to investigate the condition of the soils and whether it may be improved; to see if it is possible to arrive at soundly based recommendations upon which sustainable farming systems can be based.

First, the geographical area covered is described. Then the objectives of the study are set out and the methods used outlined. Before proceeding any further, the familiar but somewhat imprecise term "fertility" must itself be defined. The term is only meaningful in the context of the possibility of evolving a sustainable agricultural system which will meet the needs of the peasant farmers. Any techniques suggested must be within their means; any system proposed must meet their needs; if not, the proposed solutions cannot be viable.

We have tried here to cover the question of "fertility" in the widest possible sense. This is a difficult task and the chapters which follow may perhaps be compared with the furrows which a man has dared to plough in spite of the perils of the ground and the inadequacy of his tools, in his attempt to transform a seemingly inhospitable field into a more rewarding soil. Like our ploughman, we try to open regular furrows always in the same direction so that one supporting another, they cover the whole of our subject. Doubtless the reader may find the efforts of the laborer a little tedious. Much of the work constitutes a review and may therefore seem a little dull to the reader. It is inevitable that there will be some repetition, but each chapter attempts to add complementary information, confirm a hypothesis, or introduce a new concept.

It is hoped that this procedure, despite its imperfections, will help all those who, directly or indirectly, are concerned with agricultural development in Africa to discern the goal and to realize the promise offered by proper management of soil fertility in the sub-Saharan savannah. The ploughman alone does not ensure the harvest; he makes a contribution, others must sow the seed.

The inspiration for this book came from the French Ministry of Cooperation and Development where many, in particular Michel Casse, Louis Caudron and Therese Pujolle, were convinced that the problem of achieving sustainable farming systems in this part of Africa was of paramount importance. It is the result of the work of

¹ CIRAD: Centre de cooperation internationale en recherche agronomique pour le developpement, Paris. This is the "umbrella" under which are grouped the specialized French research institutes active in tropical agriculture: IRAT, IRHO, IRCT, CTFT, CEEMAT, IEMVT, DSA, IRCA, IRCC, IRFA, GERDAT.

many people rather than of one man and it is impossible to thank them all by name.

I have been fortunate to have the cooperation of so many colleagues in IRAT, IRCT and ORSTOM who have been generous with their advice and encouragement. We have had many illuminating and sometimes passionate discussions which have served to clarify my aims and to assemble the whole in a form which is hopefully clear and readable.

I would like to thank many young colleagues, including Bernard Triomphe, who were responsible for assembling, sifting, and interpreting the mass of data and, especially, Cecile Rabot, who was responsible for the assessment of the results of long-term experiments, expressing them finally in a digestible yet precise form. I feel that some apology is due to Chantal Canales who, for hours a day and for months, typed the several versions of the draft.

Also to be thanked are Jacques Bodichon, scientific editor, Marie-Therese Allafort, who managed the data bank and checked the references, Christian Gounel for the text figures and all those who saw the publication through to the final product.

I have been fortunate in my translator, Philip Gething, an agronomist with some experience in West Africa. Our discussions served to clarify my thoughts; translation is not just a matter of words but of ideas and ways of thinking. The translation was funded by the Ministry of Cooperation and Development, FAO, and CIRAD and thanks are due to them.

CHRISTIAN J. M. G. PIERI

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List of Acronyms of Research and Development Organizations

AGRHYMET	Centre Régional de Formation et d'application en AgroMétéorologie et Hydrologie Opérationnelle
BDPA	Bureau de Développement de la Production Agricole
CCCE	Caisse Centrale de Coopération Economique
CFDT	Compagnie Française de Développement des Textiles
CIDT	Compagnie Ivoirienne pour le Développement des Textiles
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CTFT	Centre Technique Forestier Tropical (CIRAD)
DRA	Direction de la Recherche Agronomique Togo, Tchad
DSA	Département des Systèmes Agraires (CIRAD)
FAC	Fonds d'Aide et de Coopération (Ministère de la Coopération France)
FAO	Food and Agriculture Organization of the United Nations
GERDAT	Departement de gestion, recherche, documentation et appui technique (CIRAD)
ICRISAT	International Crops Research Institute for the Semi- Arid Tropics
IDESSA	Institut de Développement des Savanes (Côte d'Ivoire)
IEMVT	Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux (CIRAD)
IER-DRA	Institut d'Economie Rurale – Direction de la Recherche Agronomique (Mali)
IFDC	International Fertilizer Development Center
IITA	International Institute of Tropical Agriculture (Ibadan, Nigeria)
IFDC	International Fertilizer Development Center
IMPHOS	Institut mondial du Phosphate
INERA	Institut National d'Études et de Recherches Agricoles
INRA	Institut National de Recherche Agronomique

XVIII List of Acronyms of Research and Development Organizations

INRAN	Institut National de la Recherche Agronomique du Niger
IRA	Institut National de la Recherche Agronomique (Cameroun)
IRAT	Institut de Recherches Agronomiques Tropicales et des Cultures Vivrières (CIRAD)
IRCT	Institut de Recherches du Coton et des Textiles Exotiques (CIRAD)
IRHO	Institut de Recherches pour les Huiles et Oléagineux (CIRAD)
ISRA	Institut Sénégalais de la Recherche Agricole
ORSTOM	Institut Français de Recherche Scientifique pour le Développement en Coopération
SATEC	Société d'Aide Technique et de Coopération
SCET	Société Centrale pour l'Équipement du Territoire
SEDES	Société d'Études pour le Développement Economique et Social