2 The need for ISFM
2.1 Introduction

In this section we first provide the context and relevance of this handbook, and explain why we need to move from ‘silver bullet’ to ‘best-fit’ solutions built on the principles of integrated soil fertility management (ISFM) for farming systems development in sub-Saharan Africa (SSA).

2.2 The context

Over the next 40 years the population of SSA is set to increase by 700 million inhabitants. This translates into a massive increase in the need for food, feed, fibre and fuel, in a region where many countries already import significant amounts of food. But how can food, feed, fibre and fuel production be increased? While it is likely that there will continue to be some further expansion in the area cultivated, there are many competing claims on land for urban development and for wilderness. Given current crop yields there is great potential to increase agricultural production through intensification of production on land already under cultivation.

Yield intensification is usually concerned with increasing the yield of crops but may also involve increasing the number of crops grown in each field each year. In addition to the sparing of land for other uses, yield intensification has benefits of increasing returns to labour (i.e. reducing the drudgery of intensive labour investment for little return), and increasing farmers’ food self-sufficiency and incomes. The bulk of SSA’s food requirements will continue to be produced by small-scale farmers who represent about 70% of the population in SSA.

The term ‘smallholder farmer’ is an umbrella term that encompasses a huge diversity of types of farms within a myriad of farming systems. We can make a distinction between two types of small-scale farmers:

- farmers engaged in the production of crop products and livestock for sale in local markets; and
- farmers engaged in agriculture either to achieve food security or as a sideline activity to supplement livelihoods based on employment or small-scale business activity.

In both farm types, improvements in soil fertility can contribute to increased yields but the appropriate approach to soil fertility improvement may be very different. For example, farmers linked into the market are usually in a stronger position to borrow money from the bank and invest in inputs (improved seed, fertilizers, agrochemicals) by comparison with farmers producing for local consumption who may not be able to borrow money to purchase inputs and are often averse to the risk of investing in agricultural inputs. For this reason, ISFM places great emphasis on adapting proven principles of soil fertility management to the farmer’s situation and goals (i.e. production for the market or for local consumption).

Improvement in agricultural productivity by small-scale farmers – the so-called ‘Green Revolution’ – has underpinned the economic developments that have taken place over the past 50 years in Asia. Industrial development has taken place but food security has been maintained at regional and often national levels, and small-scale farmers now benefit from expanded markets for their products in rapidly growing cities. The Green Revolution focused attention on improving productivity in lowland, and usually irrigated, rice-based systems where variability between farms is much less than the variability between farms and landscapes found in SSA. The emphasis was placed on wide-scale implementation of ‘best-bet’ technologies that could be implemented effectively across large areas.

As we shall see, farming system development in SSA requires very different technologies and approaches to productivity improvement to those used successfully in the predominantly irrigated farming systems in Asia. Nevertheless, some features are common to both regions, particularly with regard to the role of the state as:

- a primary driver of agricultural productivity improvement in small-scale farms;
- a source of finance for infrastructure and institutions required to better integrate farmers into markets for inputs (i.e. fertilizers, seeds, agrochemicals and credit) and outputs; and
- a source of research and extension leading to the dissemination of information on appropriate technologies for soil fertility management to a diverse range of farmers.
ISFM has the greatest potential for impact in SSA in areas where:

• there is a need for crop intensification due to high and increasing population; and
• farmers have access to markets for their products.

2.3 Farming systems development in sub-Saharan Africa (SSA)

Kofi Annan, the former Secretary General of the United Nations, called for ‘a uniquely African Green Revolution in the 21st century’, that should recognize the rich diversity of Africa’s people, soils and farming practices as well as the urgent need to increase agricultural productivity. But how do we develop and target ISFM technologies to improve productivity given the huge diversity and heterogeneity of African farming systems?

African agriculture is highly diverse, with major farming systems matched to each of the main agroecologies. Zooming in within each of these broad classes of farming systems we find another level of substantial variability at more local levels. Within any given country or region there are also more localized gradients of rainfall, and large differences between regions in terms of socio-economics and access to markets. Even down to the village level, there is a wide diversity of farming livelihoods differing in production objectives, wealth and resource endowment.

Much of the heterogeneity within the farming systems is caused by spatial variability in soil fertility, which arises due to two main factors:

• First, inherent differences that arise due to the parent material from which the soil has evolved and the position in the landscape that influences how soil develops. Together these are often referred to as the ‘soilscape’. A large proportion of soils in Africa are derived from some of the oldest land surfaces in the world with few nutrients left. Where younger, volcanic soils occur these are inherently richer in nutrients, but may have other soil fertility problems such as fixation of phosphorus into forms that cannot be easily accessed by crops.

• Second, past management by farmers has a major influence on soil fertility. In a shifting cultivation, or bush fallow system, soil fertility of a field will be influenced by how long it has been cultivated since the last fallow period and the length of the fallow period. On small, intensively managed farms the quantities and quality of organic manures and fertilizers that have been added to the soils in the past will determine the current soil fertility status. If manure is only applied to fields close to the homestead, strong soil fertility gradients can be seen and soil fertility usually declines as you walk further from the house.

Smallholder farms are not always market oriented. While some families ‘make a living’ out of agriculture, others keep the family land for other reasons (e.g. a ‘place to stay’, social insurance) and regard agriculture as a secondary activity. Many rural families in Africa are below the poverty line and cultivate crops on land that is already degraded. It is too simplistic to assume that promoting the use of agricultural inputs through price policies or subsidies will automatically and sustainably boost productivity and improve livelihoods. This is particularly the case when rural families have diverse sources of income and perhaps hope to leave agriculture at some time in the future.

All soil-improving technologies have a cost in terms of labour and land. Further, as both mineral fertilizers and organic matter are scarce nutrient resources, ISFM focuses on how to manage them efficiently. The approach described in this handbook represents a substantial shift in concepts away from the idea of ‘blanket recommendations’ for fertilizers. Instead the focus is on how to target ISFM technologies to different farmers and crops within their farms. We suggest simple ‘rules-of-thumb’ that have been derived from scientific principles and local farmers’ knowledge and tested thoroughly in the field.

2.4 Targeting technologies – from ‘silver bullets’ to ‘best fits’

It is clear that ‘one-size-fits-all’ or ‘silver bullet’ solutions that can be applied across large regions do not exist for SSA. Instead, technologies need to be targeted to farming systems and farms while recognizing their agroecological and socio-economic environments – to different ‘socio-ecological niches’. So instead of talking about baskets of ‘best-bet’ technologies we prefer to refer to locally adapted ISFM technologies as ‘best-fit’ options.
• One-size-fits-all or silver bullet solutions attempt widespread implementation of a particular approach without adaptation to the local situation.

• Best-bet solutions are adapted to some situations.

• Best-fit solutions are specifically adapted to the local situation.

New approaches to the problem of poor soil fertility use the principles of ISFM recognizing that:

• neither practices based solely on mineral fertilizers nor solely on organic matter management are sufficient for sustainable agricultural production;

• well-adapted, disease- and pest-resistant germplasm is necessary to make efficient use of available nutrients; and

• good agronomic practices in terms of planting dates, planting densities and weeding are essential to ensure efficient use of scarce nutrient resources.

In addition to these principles we recognize:

• the need to target nutrient resources within crop rotation cycles, going beyond recommendations for single crops; and

• the importance of integrating livestock within farming systems.

Despite major changes in thinking concerning sustainable development of agriculture in Africa, implementation of new ideas and approaches remains problematic. Information transfer to agricultural development workers (NGOs,
extension workers) is slow and most information available from government offices in SSA countries is decades old. The diversity of local conditions in terms of economic and infrastructure development as well as agroecology suggests the need for best-fit approaches to information delivery services.

In developing guidelines, decision making can be divided into three time horizons:

- **Operational decisions** address the short-term, day-to-day management of the farm in relation to weather, crop development, livestock feeding needs and so on.

- **Tactical decisions** are concerned with the medium term, such as which crops to grow in which field in a given season, and the selection of production methods in line with the farm organization.

- **Strategic decisions** concern the long term, such as farm organization in relation to endowments of land, labour and capital for investment, and in relation to production orientation in terms of choice of crop rotations, and investment in different types of livestock.

### 2.5 Conclusions

In the next section we will explain what ISFM is and how it can be used to increase productivity in farming systems in SSA.

### 2.6 Reading list

This reading list is provided as a lead into recent literature. Each citation is followed by comments and explanation of the citation in *italics*. Where the source is downloadable, a link is provided.


*This report gives an overview of a series of important reports concerning agriculture and the Millenium Development Goal 1 to halve hunger and poverty by 2015. Available online.*


*This article addresses the difference between operational, tactical and strategic decision making at farm level.*


*In this paper you will find an interesting description of the widely different livelihood strategies of smallholder farmers.*


*This article addresses the diversity of smallholder farming systems in Africa and discusses application of farming systems analysis to assist in targeting of ISFM technologies.*


*A book on integrated soil fertility management in Africa.*

This conference paper discusses targeting ISFM technologies to address Kofi Annan’s vision of a Green Revolution that recognizes the diversity of agriculture in Africa.


In this article ISFM is defined and explained in detail.
Photo 2.1  Agricultural landscapes in SSA are very diverse and workers must identify ISFM techniques that fit best with the particular area in which they are working. Farmers cultivate food crops and bananas on sloping land in the eastern part of Democratic Republic of Congo (DRC) where appropriate soil conservation is required (1). Lowland rice provides staple food and may present opportunities for market-oriented crop intensification in western Rwanda (2). A large, flat, drained valley-bottom swamp provides opportunities for subsistence crop production in western Rwanda (3). Very steep land cultivated with subsistence crops in western Rwanda where erosion is depleting the soil resource base and permanent crops might be more sustainable (4).

Photo 2.2  Large areas of degraded land in SSA could be rehabilitated and brought into production. Soil rehabilitation requires large amounts of organic residues as well as mineral fertilizer inputs to restore productivity.

Photo 2.3  Soil fertility varies greatly between fields in this farm. Different soil fertility management strategies will be required in each field and the farmer needs to manage all the fields under an overarching strategy.