

Out-scaling 4R Nutrient Stewardship Knowledge to Support Crop Production Intensification in Ethiopia (ETH-1)

Summary

The International Plant Nutrition Institute (IPNI) SSA program in collaboration with local partners has successfully initiated a project to disseminate 4R Nutrient Stewardship knowledge to support crop production intensification in Western Kenya. The pilot project focused on developing effective models for validation and dissemination of 4R practices suitable for smallholder farming systems, using on-farm demonstrations to validate the impact of various 4R techniques, including site- and crop-specific fertilizer recommendations, on crop productivity and profits. The project has also developed various 4R knowledge products for farmers, extension agents and fertilizer dealers, while using various media platforms to communicate 4R information to farmers. Opportunities exist to scale out the project output to Ethiopia to support government-led initiatives to increase fertilizer use and develop site-specific fertilizer blends. The availability of a detailed soil map for Ethiopia, developed as part of the AfSIS project will provide soil information that will be used as a basis for adapting the 4R nutrient stewardship to local climatic and soil conditions.

As Ethiopia takes steps to support agricultural growth, approaches and tools to develop and effectively transfer 4R Nutrient Stewardship knowledge to extension systems and smallholder are essential to ensure sustainable crop production intensification. This project will be implemented in collaboration with the Ethiopian Institute of Agricultural Research (EIAR), Agricultural Transformation Agency (ATA), the Ministry of Agriculture, CIMMYT and IFDC to demonstrate the impact of various 4R techniques on crop productivity and profits. Linkages will also be created with Digital Green to enhance dissemination of information using video technology. The project will adapt various 4R knowledge products developed in Kenya for use by extension systems, farmer groups, and fertilizer dealers in Ethiopia. The main outputs of the project will include:

- New agronomic and economic knowledge generated on the impact of 4R components on crop production intensification in high potential maize production zones.
- Extension agents and lead farmers in pilot sites trained on implementation of 4R practices.
- 4R extension pamphlets for smallholder farming systems in SSA developed in English and local language.
- 4R knowledge and project outputs from the pilot sites disseminated through television, radio and print media.
- Videos of main project activities and impact of the project in the pilot site.
- 4R Content developed in form of short messages ‘tips’ and disseminated to farmers.

Introduction

The effort to initiate the Green Revolution in Sub-Saharan Africa (SSA) was launched by former UN Secretary General Kofi Annan in 2004, and is taking off to varying degrees within the region.

To achieve sustainable increases in crop productivity in SSA, there is need to increase fertilizer use, and support farmers to manage the fertilizers properly to ensure that crops are provided with the correct and adequate nutrients under variable soil fertility conditions. In Ethiopia, inherently infertile soils are widespread, and characterized by problems of soil acidity and multiple deficiencies of nutrients. Despite the recognition of multiple nutrient deficiencies as a major constraint to crop productivity in the country, fertilizer recommendations for maize production in many countries only cover N and P, resulting in very poor crop yield responses and low nutrient use efficiencies.

IPNI is implementing research and development activities in collaboration with various institutions to apply science to produce outputs (scientific and extension publications and decision support tools) that contribute to improved understanding of the role of best fertilizer management practices in crop production intensification in SSA. The main focus is to provide direction in plant nutrient management guided by the principles of 4R Nutrient Stewardship. 4R Nutrient Stewardship is defined as applying the right fertilizers, from the right source, at the correct rate, on time and in the right place.

A project to support maize production intensification based on the 4R Nutrient Stewardship concept was initiated in Western Kenya in 2013 and implemented in collaboration with international research organizations, Kenya Agricultural Research Institute, fertilizer distributors, extension agents and farmers. The project has demonstrated that farmers can economically increase maize productivity from the current average of 1.5 t/ha to 6 t/ha by selecting the right source and rate of fertilizer and applying the fertilizer at the right time and place in addition to other good agronomic practices, including the use of improved maize varieties, timely planting and weeding. The project has generated strong evidence for the potential to intensify maize productivity demonstrated in Western Kenya based on balanced fertilizer use, particularly with the addition of K to standard NP fertilizer recommendations. Field-based learning centers have also been facilitated through demonstrations showing the importance of various nutrients (macro and micronutrients) in the production of major crops. Various knowledge products have been developed to improve both the access to information and application of 4R knowledge to increase crop productivity. The proposed project will build on the successful pilot project in Western Kenya to scale out effective approaches for disseminating nutrient management knowledge in farming systems in SSA. The project will be implemented in the high potential maize and production zones in Ethiopia.

Objectives

- To initiate medium-term (four years) field demonstration sites that will form learning centers for 4R knowledge for farmers, extension agents, fertilizer distributors and agricultural development programs.
- Adapt a series of 4R extension products for use in smallholder farming systems in Ethiopia and translate them into local languages to disseminate 4R information to farmers.
- Develop 4R content for use by radio, TV and print media to disseminate 4R information to farming communities in Ethiopia.

The Context for supporting crop production intensification in Ethiopia

Soil Fertility Challenges in Ethiopia

Ethiopian agriculture is dominated by smallholder farmers (< 25 ha) with over 90 percent of cultivated land under food crops (mostly grains). Crop productivity has been low, and cereal yield national average is still less than 2t/ha and pulses are 0.8 t/ha. As available arable land is becoming increasingly scarce, increases in production will be driven largely by intensification of inputs rather than expansion of land area. Poor soil fertility is one of the main factors limiting crop productivity currently with the major problems as follows:

- i. More than 40% of total arable land is affected by soil acidity, of which the distribution is stronger in high potential production areas
- ii. Multiple nutrient deficiencies, including macro and micro-nutrients (N, P, K, S, Zn).
- iii. Severe organic matter depletion, driven by competing uses for crop residues and manure as livestock feed and fuel.
- iv. Severe topsoil erosion of 137 t/ha/year

Some of the major bottlenecks constraining agricultural production in Ethiopia include:

- Lack of up to date information on soil fertility
- No shared soil information database
- Lack of soil test data based fertilizer recommendations
- Weak national research institutions with limited capacity to coordinate research programs and provide directions nutrient management evaluation and dissemination.
- Little emphasis on soil fertility focused extension programs
- Limited research emphasis on plant nutrient management
- Limited coordination between research and extension
- Limited accessibility/affordability to inputs (e.g. fertilizers)
- Inefficiency in distribution and marketing of fertilizers
- Lack of coordination among research institutions
- Limited coordination among soil laboratories

Soil fertility policy and challenges

Within the last one decade the government of Ethiopia (GOE) has developed various policies to curb the challenges facing agriculture and therefore improve average crop yields of major cereals (Teff, maize, wheat) and legumes. These policies are mainly targeting soil fertility improvement, provision of quality seeds, and improvement of extension services, input financing and linking the farmers to output markets.

The country has consistently allocated more than 10 percent of public spending on agriculture in the past 10 years (Fan, Babatunde, and Lambert 2009; World Bank 2010a), has invested heavily in rural infrastructure (Mogues, Ayele, and Paulos 2008), and has made concerted efforts toward agricultural intensification with special attention to the promotion of extension services and fertilizer use (Byerlee et al. 2007). Public investment has expanded access to productive inputs, such as hybrid maize seed and fertilizer. Concerted government spending in extension has also

established over 8,500 Farmer Training Centers (FTCs) and trained 63,000 Development Agents (DAs) from 2002 – 2008. The recent impetus for increasing fertilizer use has been largely driven by the Growth and Transformation Program, which sets annual cereal production targets for each region. Increasing the distribution of fertilizer and improved seed has been the key move for achieving these targets. A clear manifestation of this strategy is the sharp increase in fertilizer imports, which increased from 440,000 tons in 2008 to 890,000 tons in 2012.

The success of these policies is constrained by lack of up-to-date data on site specific soil fertility characteristics and fertilizer recommendations as most of the proposed interventions rely on major national soil surveys dating to the 1980s (FAO) and macronutrient studies from the 1950s–60s. In addition to the lack of actionable, relevant data, the weak linkages between research and extension inhibit the adaption and adoption of these practices by smallholder farmers.

Government investment in Fertilizer Import and Blending

Over the last 10 years, Ethiopia total fertilizer imports have increased by more than 50 percent, from less than 370,000 mt in 2002 to almost 890,000 mt in 2012. The main fertilizers imported are DAP and UREA. Ethiopia investment in fertilizer imports has not fully paid off (ATA, 2010); growth in fertilizer use has not resulted in optimal crop yield increases, partly due to imbalanced nutrient use. Recent soil tests show deficiency of 6-7 nutrients while the government has continued to remain focused on importing just DAP and UREA. The government has initiated programs to resolve this problem by building fertilizer blending plants that will produce blends suitable for specific sites in Ethiopia.

As part of this government blending initiative, 18 fertilizer blending plants have been built, one in each of four main agricultural regions. Each of the plants will be operated by a select farmers' cooperative union, including Enderta in Tigray, Merkeb in Amhara, Becho Woliso in Oromia, and Melek Silte in SNNPR. These plants, which will have a production capacity of nearly 250,000 tonnes per year, and are expected to start producing fertilizer in time for the 2014 planting season.

Project Plan

IPNI is proposing a project to take the on-farm based 4R extension program developed in Western Kenya to maize production regions of Ethiopia.

This work would be carried out in cooperation with ATA and the Ministry of Agriculture. The project will also collaborate and leverage resources with on-going ISFM research and development initiative implemented by AGRA, CIMMYT, CIAT and IFDC. The project will also initiate linkage with Digital Green to enhance dissemination of information using farmer-based video technology.

IPNI would initiate the project for a period of 4 years, ensuring the time necessary to build human capacity in the target regions and ensure future sustainability of extension messages.

The project will focus on an integrated framework to effectively address complex soil fertility problems constraining maize productivity in pilot sites, including multiple nutrient deficient, soil acidity and low soil organic matter. Field demonstrations and training activities will be centered adaptation of well-established ISFM and 4R technologies.

The project would be managed by Dr. Shamie Zingore, IPNI director for sub-Saharan Africa based in Nairobi.

Project cost would be \$100,000 USD/year to support the technical staff, on-farm fertilizer trials, field days, training workshops, development and production of extension products and dissemination of 4R technologies through radio programs.

Work plan

Activity 1. Implement long-term field demonstrations to validate site-specific fertilizer recommendations for maize.

Activity	Output	Time
1. 50 Demonstration sites established to validate and disseminate 4R and ISFM information	New agronomic and economic data as well as knowledge generated on the impact of 4R components on maize production intensification. Reports produced.	Data summaries and reports produced every 6 months. ¹
2. Field days conducted	Dissemination of 4R information to various stakeholders including policy makers, local fertilizer companies, researchers etc. Television and print media engaging to publicize project outputs.	Field days conducted every 4 months. At least one news publication/report in mainstream media every 4 months.
3. Field-based training for extension agents and pilot farmers	Knowledge of farmer groups and 50 extension agents on nutrient management based on 4R concept enhanced and reported.	Training workshops conducted every six months. Reports produced.
4. Surveys to assess farmer management practices and yields	Insights into challenges for effective implementation of the 4R practices by farmers gained and documented.	Included in the main report every 6 months.

¹ In addition to the detailed reports produced every six months, short 1-page reports will be produced to highlight project impact.

Activity 2. Develop 4R extension information and material in local language to disseminate 4R information to farmers

Activity	Output	Time
1. Distribute the 4R Extension handbook for use in Ethiopia	200 copies of the 4R Extension Handbook distributed in Ethiopia	First 4 months
2. Development of the 4R extension material by adapting material developed in Kenya	4R extension and training material for smallholder farming systems in Ethiopia developed.	End of year 1 and reviewed annually
3. Development of scripts for 4R radio messages	4R knowledge disseminated on local and agricultural programs on national radio	Messages aired monthly on local radio, and quarterly on national radio.
4. Development of project documentaries	Videos of main project activities and impact for IFA	Every six months ²

² Short videos on project activities and achievements will be captured by project staff on a regular basis and shared with IFA and through various media, including YouTube.