



Food and Agriculture Organization
of the United Nations

Cropping systems diversification to enhance productivity and adaptation to climate change in Malawi

BRINGING TOGETHER EVIDENCE AND POLICY INSIGHTS

KEY MESSAGES

- ▶ **Widespread maize monocropping in Malawi exposes farmers to significant livelihood risk in the context of increasing climate variability.** 36 percent of rural households grow maize in monocrop. These farmers are often poor and land constrained, and experience low levels of productivity and high production volatility.
- ▶ **The effects of crop diversification on farm productivity and income volatility in Malawi varies across cropping systems.** Maize in combination with legumes is the only cropping system in Malawi that is significantly associated with an increase in productivity and a reduction in crop income volatility. Contrary to expectations, cropping systems with 3 or more crops do not significantly reduce crop income volatility relative to maize monocropping.
- ▶ **Market weaknesses for many non-maize crops in Malawi limit the benefits from diversification.** Higher volatility in prices of many non-maize crop is a disincentive to the adoption of diversified systems and pushes farmers toward monocropping.
- ▶ **Household constraints are a key barrier to adopting more diverse cropping systems.** Sufficient household assets, particularly land, enable households to overcome the investment and risk costs associated with crop diversification.
- ▶ **Coordination between private and public investments are required to improve the incentives for diversification in Malawi.** A coordinated effort to strengthening input and output markets for non-maize crops, combined with public support to overcome household-level resource constraints to diversification (including public works programmes, input subsidies, and cash transfers) is necessary to promote widespread crop diversification.

Introduction

The promotion of agricultural diversification is high on the policy agenda of Malawi. Indeed, the effective promotion of crop diversification is required to achieve the three objectives set out in Malawi's newly released National Agriculture Investment Plan (NAIP). First, in order to achieve objective of increasing the share of agricultural GDP from commodities other than tobacco and maize requires that farmers have the resources and market incentives to profitably adopt a range of alternative crops. Second, crop diversification can be an effective climate adaption strategy by helping farmers to spread market and production risks across a large number of crops, thus contributing to the NAIP's second objective of improving the well-being and livelihood of Malawians now and in the future. Finally, crop diversification has the potential increase in dietary diversity and food availability, thus contributing to improved nutrition outcomes.

However, the effectiveness of crop diversification at improving the welfare and well-being of Malawians depends on the combination of crops adopted by farmers and their associated agronomic and market attributes. For example, some crops, such as legumes, can confer agronomic benefits through the fixation of atmospheric nitrogen, while others may be naturally drought resistant, such as cassava. Alternatively, some crops may face considerable market volatility due to international price movements or local weakness in markets. Without proper investments and policies, diversification into these crops can expose households to considerable risk and lead to a potential deterioration in household welfare.

This brief aims to assist policy-makers and cooperating partners in Malawi to identify diversification pathways that can produce measurable benefits in terms of productivity and crop income resilience for small-scale farmers, and to identify investments and policy options to promote the adoption of beneficial crop diversification. In particular, this brief examines a) the household level factors to influence the adoption of different cropping systems; and b) the effect of adopting a particular cropping system on maize productivity and crop income volatility in order to determine which crop diversification strategies improve farmers' livelihood while reducing their exposure to market and climatic risks.

Defining and analysing cropping systems in Malawi

This brief focuses on seven different cropping systems, which are based on combinations of four categories of crops: dominate staple (maize), alternative staple (e.g. cassava, millet, sorghum, rice, sweet potato), legumes (e.g. groundnuts, pigeon pea, soy, beans, cow peas), and cash-crops (e.g. tobacco, cotton). To do this, the analysis uses the national representative Integrated Household Survey, which collects information on individual-, field-, and community-level characteristics for the agricultural seasons 2010/2011 and 2013/2014. Drawing on these data, a multinomial endogenous treatment effect econometric model is used to estimate the effects of each of these seven systems on household maize productivity and crop income volatility (relative to maize monocropping), as well as the key socio-economic, institutional, and biophysical factors that push or pull a farm to adopt a particular cropping system.

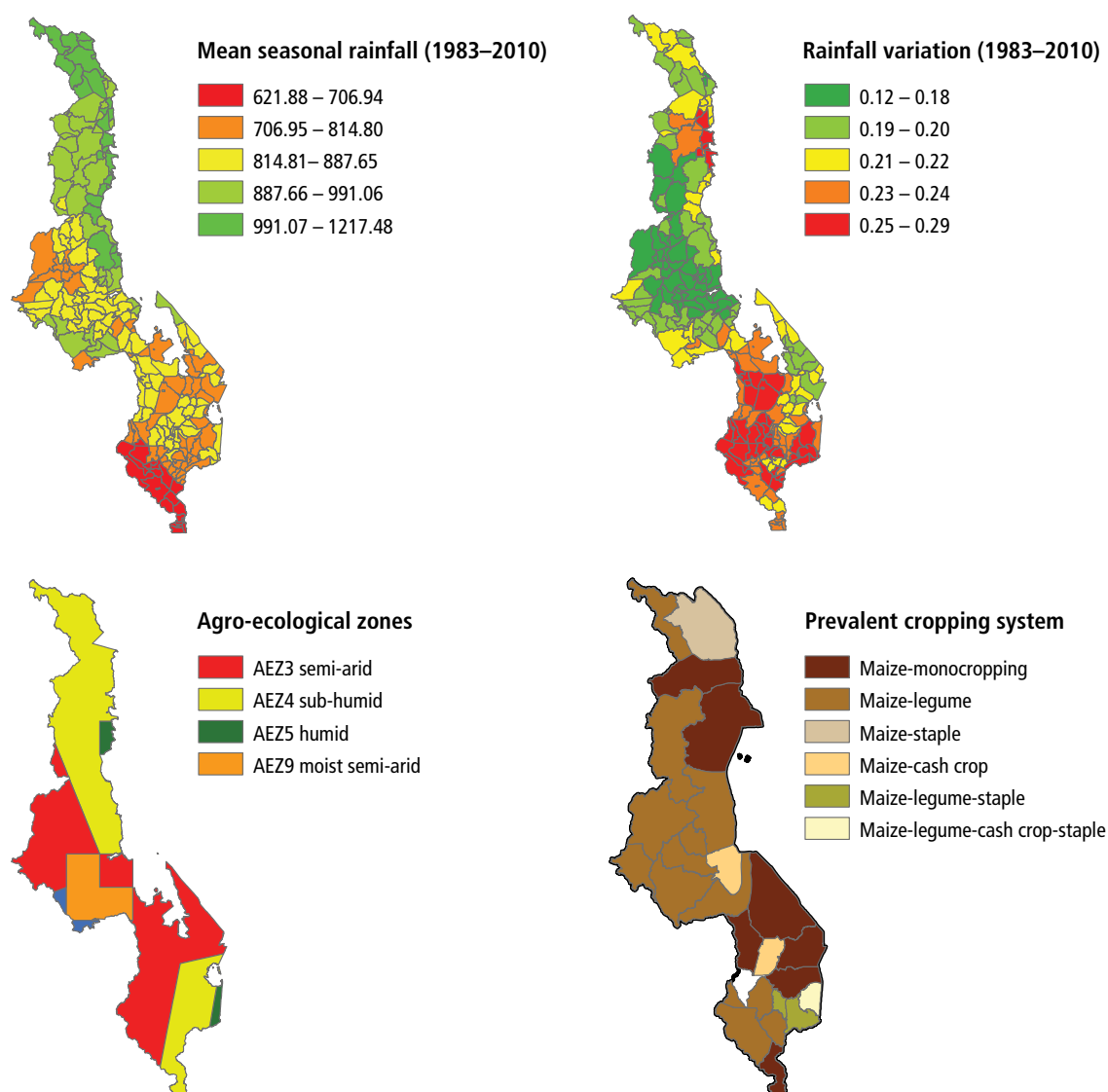
Key findings

Despite a high level of spatial variability in population densities and agro-ecological conditions in Malawi, the vast majority of farmers grow either maize in monocrop or maize with a legume, primary groundnuts and to a lesser extent pigeon pea and soy (Figure 1). Only 28 percent of farmers adopt cropping systems comprised of three or more categories of crops.

Analysis shows that the lack of diversification is related mainly to a combination of household-level socio-economic constraints and institutional factors related to markets for non-maize crops. At household level, the findings suggest that diversification is strongly associated with larger land holdings, higher household wealth status, and better market access condition. These attributes help to lower the risk to a household of diversifying away from primary staple crops and provide households with the resources to do so. However, given that about 80 percent of households in Malawi owns less than 1 hectare of land, and that the majority of the rural population have very low levels of asset and livestock ownership, the majority of households face significant socio-economic barriers to crop diversification.

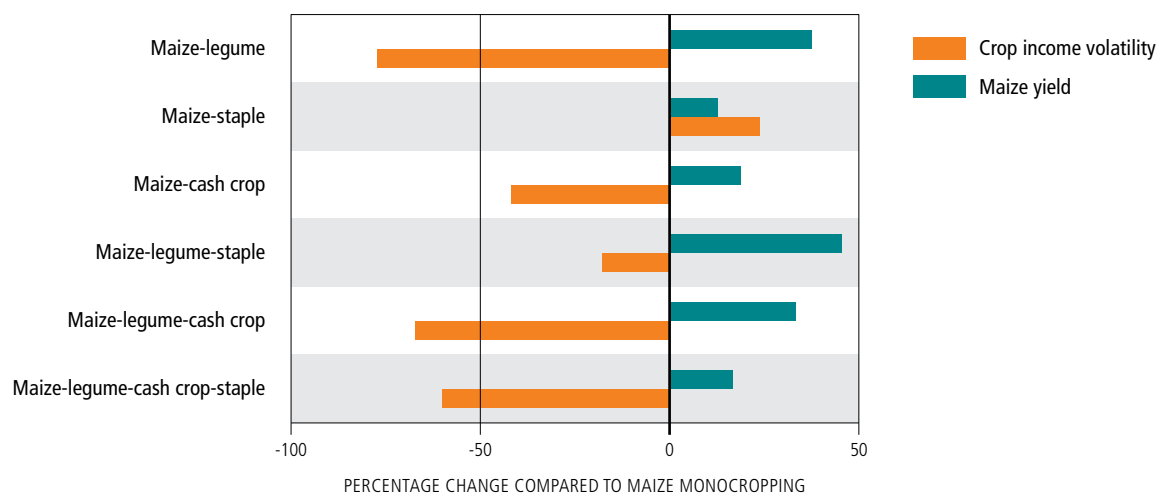
At an institutional level, more functional and competitive private input and output markets are found to pull farmers into the adoption of more diverse systems. However, weaknesses in non-maize markets in Malawi are found to limit the effectiveness of diversification as a resiliency enhancing strategy. As shown in Figure 2, while most cropping systems generate positive effects on maize productivity, diversification in most cases does not help reduce crop income volatility. Indeed, only the maize legume system in Malawi, which in most cases is grown in an intercropped system, significantly reduces crop income volatility.

FIGURE 1 PREVALENT CROPPING SYSTEMS VARY WITH CLIMATIC AND AGRO-ECOLOGICAL DIMENSIONS



Source: FAO, Economic and Policy Analysis of Climate Change (EPIC) team.

FIGURE 2 ASSESSING THE IMPACT OF CROPPING SYSTEMS ON MAIZE PRODUCTIVITY AND CROP INCOME VOLATILITY



Notes: The figure reports the result from the empirical analysis, and * denotes significant statistical impact.

Source: FAO, Economic and Policy Analysis of Climate Change (EPIC) team.

The lack of resilience benefits from most diversification strategies is an important disincentive to diversification, which is likely tied to poor market development and high levels of volatility for crops other than maize and widely grown legumes, such as groundnuts. As shown in Table 1, alternative staples such as cassava and sorghum, and cash crops, such as cotton, have significantly higher levels of price volatility than groundnuts, while cotton has also experienced declining prices over time. Indeed, between 2010–2014 cassava, cotton and sorghum producers have received prices that are 14, 15 and 74 percent more volatile than groundnut prices.

TABLE 1 GROUNDNUTS PRICES ARE LESS VOLATILE THAN ALTERNATIVE STAPLES AND CASH CROPS

Crop	Price growth rate (2010–2014)	Price volatility	Price volatility relative to groundnuts
Cassava	0.29	0.16	14%
Cotton	-0.18	0.16	15%
Groundnuts	0.27	0.14	–
Sorghum	0.22	0.24	74%

Taken together, the analysis suggests that in order to achieve the sustainable diversification required to achieve the development objectives articulated in the NAIP will require policies and investments that can simultaneously support households to overcome the resource constraints to diversification while simultaneously improving the functioning of markets for alternative crops in ways that makes them more attractive to farmers.

Policy options for consideration

The study identifies four broad areas of public and private intervention to address household and market level constraints to crop diversification:

- ▶ Support private investments in markets and rethinking public intervention in output markets.
- ▶ Continue with the reform agenda for the Farm Input Subsidy Programme in the light of the diversification objective.
- ▶ Invest to support compliance with international food safety standards to increase exports.
- ▶ Support the competition in the seed sector.

Support private investment and rethinking public intervention in output markets

Availability of competitive private output markets is one of the prominent determinants for crop diversification in Malawi. Farmers linked to larger and well-functioning markets have greater information about the range of crops for which markets exist and often receive better prices for their outputs. As a result, these farmers have more incentives and capability to diversify their cropping systems than farmers with few output market option.

Conversely, public marketing institutions are found to hinder diversification. Econometric results show that farmers that are farther from Agricultural Development and Marketing Corporation (ADMARC) depots have higher probability of adopting more diverse cropping system. Government intervention into output market are often necessary to guarantee food security of the population, but these interventions should be limited to periods of emergency and carried out in a predictable manner. Actions that create uncertainty, such as ad hoc trade restrictions or price bands, can distort competition and hinder farmers' profits and their ability to invest into diversified cropping systems. Developing policies that enable the Government of Malawi to ensure that food prices remain within acceptable bounds, while at the same time ensuring the government actions in markets are predictable can substantially improve private investment conditions in smallholder output markets. This may include the use of agreed price triggers for increasing the predictability of its actions establishing rules for interventions, price setting and quantities purchased and distributed.

Reform the Farm Input Subsidy Programme in the light of the diversification objective

On-going reforms to the Farm Input Subsidy Programme (FISP) should be continued, keeping the crop diversification agenda in mind. The results show that by moderating maize seed price, FISP allows farmers to move from maize monocropping to systems composed of three or four crops. During the 2016/2017 season, FISP underwent major reforms, including measures aimed at containing the level of national expenditures while increasing participation of private retailers and targeting the more productive farmers. However, continued amendments may be necessary both for the types of input provided and for the varieties of seeds delivered. FISP can support diversification and climate resilience by supporting predictable market demand for certified seed, thus enabling investment in seed multiplication, particularly for crop seeds for which demand is difficult to forecast, such as legumes and alternative staples. To accomplish this objective, FISP's future reforms may consider expanding the varieties of seeds included and differentiating the type of crop promoted depending on the agro-ecological zones of farmers' operation.

Private sector participation in the FISP programme can also be enhanced through: increasing the number of firms that can participate in the tendering process; increasing the involvement of agro-dealers in the supply and distribution of inputs; and, fixing the subsidies to create certainty in expectations of investors.

Investment to support compliance with international food safety standards to increase exports

Public investment to support compliance and monitoring of food safety standards may generate beneficial private investments to support smallholder crop diversification. Improved capacity to comply with international sanitary and phytosanitary standards creates opportunities for exports, higher profits and more incentives for cropping diversification. Moreover, diversification can be promoted through concessional loans to support investment in agro-processing and value addition for non-maize products.

Support the competition in the seed sector

Seed prices emerge as prominent determinants of crop diversification in Malawi. Through a reduction in seed prices, asset poor households are able to overcome key barriers to diversification. It is therefore recommended to consider interventions that support competition in the seed sector and support seed producers, including farm organizations and large companies, to produce sufficient quantities of seeds that are appropriate for different agro-ecological conditions. This may include supporting the production of improved local or landrace varieties. Policy options to consider include:

- ▶ identification and coordination of priority value chains to foster public/private partnerships (PPPs) with respect to the offer of foundation seeds;
- ▶ engagement of more actors to the Seed and Trade Association of Malawi (STAM);
- ▶ connecting the foundation seeds producers to an insurance market.

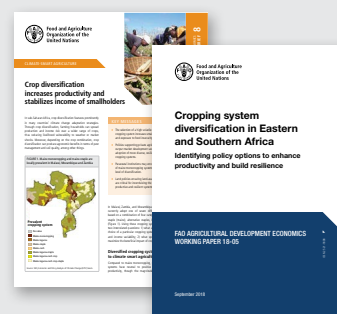
The creation and coordination of PPPs to improve private investments in foundation seed production for a range of crops has the potential to be transformative. As NAIP suggests, the selection of priority value chains for PPPs promotion need to consider the different priorities among participating actors and the changing market conditions. Currently, there is limited participation by private companies in foundation seed development, due to the low price of foundation seeds set up by the public institutions. Through a public/private partnership the price of foundation seeds may be set at a level considered both beneficial for the public welfare and convenient for the private breeding companies.

Expanding active STAM membership is important to improve coordination within seed value chains. STAM can serve as a platform of communication between foundation seeds producers and buyers, and could help facilitate more dialogue to match better demand and supply, reducing the prices of the foundation seeds and increasing the competition between producers. This may involve setting up an online platform for reporting prices and availability of seeds by retailers, so that the potential buyers may be able to compare prices of the closest retailers.

Finally, linking the foundation seeds producers to a (private or public) insurance market or other risk mitigation mechanism may help to facilitate investment in the multiplication of a wider range of certified seeds needed to facilitate diversification. Foundation seed companies tend to produce lower than their potential output because they face a range of risks and uncertainties in their business related to demand forecasts and prices. An insurance mechanism addressing these sources of risk may help the companies to establish a loss ceiling on their investments and thus lower the overall risk of investment.



This brief is prepared by Nicholas Sitko (Programme Coordinator of the Economic and Policy Analysis of Climate Change (EPIC) team, FAO) and Giuseppe Maggio (EPIC Consultant, FAO). It builds on the FAO Agricultural Development Economics Working Paper 18-05 *Cropping system diversification in Eastern and Southern Africa: Identifying policy options to enhance productivity and build resilience* (available at www.fao.org/3/ca1562en/CA1562EN.pdf) and the related FAO Agricultural Development Economics Policy Brief 8 *Crop diversification increases productivity and stabilizes income of smallholders* (available at www.fao.org/3/i9458en/I9458EN.pdf).



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