RECOGNISING THE UNRECOGNISED: FARMER INNOVATION IN NORTHERN MALAWI

A report by Find Your Feet

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FIND YOUR FEET

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ACRONYMS

ADC	Area Development Committee
AEDC	Agricultural Extension Development Coordinator
AEDO	Agricultural Extension Development Officer
ASWAp	Agriculture Sector Wide Approach
AVO	Assistant Veterinary Officer
EPA	Extension Planning Area
EU	European Union
FYF	Find Your Feet
NASFAM	National Smallholder Farmers' Association of Malawi
NGO	Non-governmental Organisation
RUFA	Rural Foundation for Afforestation
VDC	Village Development Committee

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Front cover photo: Lead Farmer Costas Mfune from Rumphi district, Malawi.

Established in 1960, Find Your Feet is a UK-based international development charity (No. 250456) which supports rural communities in South Asia and Southern Africa to build a future free from poverty. Over the past 52 years, FYF has supported hundreds of thousands of people to increase their food production, conserve biodiversity, set up small businesses, access clean water, healthcare and education, and have a voice in their community.

BACKGROUND TO THE STUDY

This report provides an overview of the findings from a Farmer Innovation Study conducted by Find Your Feet in 2011. The study was conducted in the district of Rumphi, in northern Malawi.

FARMER INNOVATION

There are currently almost one billion people in the world living in chronic hunger[i]. Persistent hunger and poverty in most low-income countries, increasing food price volatility, and the 2008 food crisis all demonstrate the failure of the current global food system to meet the needs of the rural poor. In 2009, the International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) reaffirmed this point in its report 'Agriculture at a Crossroads', which argued that 'business as usual' approaches to agriculture will not enable poor countries to address development and sustainability goals[ii].

Moreover, the global food system faces a number of emerging challenges, including increasing demand, constrained natural resources, and the increasingly evident impacts of climate change and HIV and AIDS[iii]. In this context, the need to develop innovative approaches to meet the needs of the rural poor is all too evident.

Informal experimentation and innovation in agriculture have always taken place, driven by creativity, necessity, and opportunity. Farmers are a rich source of indigenous knowledge and practice. However, the knowledge and expertise of farmers has historically been undervalued, and there has been little convergence between informal innovation and formal research and development systems[iv].

The dominant model of farmer support has been a top-down, 'transfer of technology' approach, whereby scientists determine research priorities, generate technology and pass it on via subject matter specialists to extension workers to transfer to farmers. This approach excludes farmers from the development and dissemination of new technologies. It has led to low adoption of these technologies, which are often considered irrelevant by farmers and fail to take into account their social, economic and environmental circumstances.

Over the past thirty years, there has been increasing recognition that farmers have valuable knowledge and experience to bring to the process of agricultural research and development, and that as the end users of technology, they should be actively involved in all stages of this process[v]. This recognition has led to a gradual shift away from the linear transfer of technology model, towards 'innovation systems' approaches, which view innovation as an interactive process involving a range of actors with different knowledge and skills. At the same time, the understanding of innovation has broadened from a sole focus on technologies, to include socio-economic, cultural and institutional changes - with the understanding that the technical aspects of innovation are also social[vi].

There is a growing movement of individuals, organisations and networks working on the development of participatory innovation approaches, ranging from farmer-led approaches, in which farmers define the research agenda, to approaches that build the capacity of farmers to participate in formal research[vii].

However, there is an inherent challenge in implementing such approaches, which demand new sets of knowledge, attitudes and skills, when farmers in many countries are still viewed as passive end-users, with little or no involvement in developing techniques, technologies and systems designed to meet their needs.

THE MALAWIAN CONTEXT

In Malawi, agriculture is the backbone of the economy, employing about 80 per cent of the total workforce and contributing over 80 per cent to foreign exchange earnings. The majority of farmers are resource-poor subsistence farmers, and smallholder production contributes almost 70 per cent of the national agricultural output[viii].

Historically, agricultural policies in Malawi - government intervention in the post-independence period, market-led private sector development under the Structural Adjustment Programmes of the 1980s and 1990s, and the poorly targeted agricultural subsidy programmes implemented from 1998 to 2003 - have excluded smallholder farmers from decisions taken and failed to take into account their diverse and complex needs.

Agriculture in Malawi has been characterised by low productivity, as a result of, *inter alia*, increased population density leading to land shortages and increased exploitation of natural resources, decreased soil fertility, lack of access to irrigation and purchased inputs, poor links to markets coupled with low consumer purchasing power, and weak, unrepresentative farmer organisations. The country is also highly vulnerable to droughts, floods and external economic shocks.

In recent years, Malawi has experienced increased productivity and positive agricultural growth, largely as a result of a costly Farm Input Subsidy Programme introduced in 2006, combined with favourable weather patterns over the past few years. However, the levels of rural poverty, food insecurity and undernutrition remain high, and many resource-poor farmers still lack access to information, inputs, services and markets that would enable them to increase their food production, improve their nutritional status, and enhance their financial security. There is a clear need for innovative approaches to agriculture that will enable smallholder farmers to increase their production, while safeguarding the natural resources on which they depend.

In the Malawi Growth and Development Strategy for 2006-2011 the government recognised the importance of research, science and technology to national socio-economic development[ix]. The government has also explicitly acknowledged the importance of pluralistic agricultural innovation systems in the national agricultural development and food security strategy - the Agriculture Sector Wide Approach (ASWAp) - which aims to 'facilitate the development of an innovation chain to which all partners contribute[x].'

In line with this commitment, the Ministry of Agriculture has begun to complement traditional technology transfer approaches to research and extension with more demand-driven, participatory approaches, such as Farmer Field Schools and the Lead Farmer approach described below (BOX 1). These approaches have helped to redefine the relationship between farmers and extension workers, and promote a more multi-directional flow of information.

However, the translation of policy level commitments into practice remains a challenge, and has so far been impeded by low public expenditure on agricultural research and extension, limited and inappropriately trained human resources in the agricultural sector (partly as a result of HIV and AIDS), and weak linkages between the different actors involved in innovation.

As a result, agricultural development seeks to emulate the high input approaches of the developed world and little cognisance is taken of the skills, innovations and farming systems developed by farmers themselves.

BOX 1. THE LEAD FARMER PROGRAMME: FARMER-TO-FARMER EXTENSION CREATING SPACE FOR INNOVATION

The Lead Farmer programme was piloted in 2004 by the Mzuzu Agricultural Development Division, in association with the NGOs Find Your Feet and Harvest Help, with the financial support of the Norwegian Development Fund. The Lead Farmer approach recognises the skills of farmers at the local level and uses these skills to promote effective 'horizontal' learning. It is inherently community-led and provides an alternative to top-down donor-dependent models which leave farmers reliant on a decreasing number of agricultural extension officers, and short-term consultants or technical experts, for advice or guidance.

The approach entails working with communities and farmer groups to identify innovative and successful farmers with the skills, aptitude and commitment to work with their communities towards the ultimate goal of sustainably increasing productivity. The selected farmers participate in a comprehensive training programme to equip them with the technical, communication and leadership skills to become 'Lead Farmers'.

Each Lead Farmer has Follower Farmers, who observe and learn from them, and are seen as 'trainees', with the potential to become Lead Farmers themselves in future. A Lead Farmer is expected to perform three functions: impart knowledge of local conditions, constraints and solutions to Follower Farmers; teach Follower Farmers a simple set of technologies that will conserve the natural resource base; and provide a community-based forum for sharing knowledge and information.

Since 2004, almost 300 Lead Farmers have been trained in three districts in the north of Malawi, each of whom has up to 100 Follower Farmers. To date, over 20,000 farmers, a number which is steadily growing, have been trained in sustainable agricultural technologies, which are providing them with viable and more sustainable alternatives to costly high input practices. The success of the Lead Farmer approach has had a ripple effect. Initially, it was adopted by other NGOs in the Northern Region, and then by the Ministry of Agriculture through its divisions elsewhere in Malawi. It has now been adopted throughout Malawi.

It has been well documented that farmers learn best from their peers, and they are often more willing to accept innovations observed in the fields of other farmers than messages disseminated by extension workers[1]. By facilitating the sharing of knowledge, information and technologies between farmers, the Lead Farmer programme has helped to enhance both the creation and dissemination of local innovations.

[1] This has indeed been our own experience.

AIM OF THE STUDY

In this context, the aim of the Farmer Innovation Study was to acknowledge the creativity and ingenuity of smallholder farmers in Malawi and to reaffirm the valuable role that they can and, indeed, do play in the development and dissemination of new technologies, approaches and systems.

The specific objectives of the Study were to:

- Identify and document farmer innovations with relevance to Find Your Feet's work;
- Recommend innovations with potential for replication for further research and validation; and
- Disseminate effective innovations to stakeholders including farmers, government extension workers, scientists and formal researchers.

STUDY METHODOLOGY

For the purposes of the study, the following definition of innovation was adopted: 'the process by which people develop new and better ways of doing things - using their own resources and on their own initiative'[xi]. This includes the appropriation and reformulation of an existing idea or practice which may result in simultaneous uptake in different places. An innovation is thus embodied in a technique, technology or practice that is an outcome of this process.

The study did attempt to draw a distinction between scientific and local or indigenous knowledge, but recognised that local people's science[xii] may be both 'scientific' and instrumental in achieving desirable agricultural outcomes. Similarly, while the potential dichotomy between traditional agricultural practices as opposed to more recent or modern introductions serves no practical purposes, it does, in the context of this study, do so for heuristic purposes. What is more critical here is the inclusion of local farmers in a participatory dialogue about their farming futures[xiii].

The study was conducted using the following methods:

Focus group discussions. In order to identify relevant innovations, focus group discussions were held with farmers in four of the Extension Planning Areas (EPAs) of Rumphi district – Bolero, Chiweta, Katowo and Mhuju. The meetings were attended by 114 farmers in total (mainly Lead Farmers and Follower Farmers), as well as representatives from the local Area and Village Development Committees (A/VDCs), government agricultural extension workers, and representatives of local NGOs, such as the National Smallholder Farmers' Association of Malawi (NASFAM).

Individual interviews. A total of 14 individual farmers and one group were selected to participate in more in-depth interviews. The interviews were conducted at the farmers' homesteads to allow demonstrations of innovations where applicable. A questionnaire to guide the interviews had been designed in advance, but interviews were fluid and open-ended and the questions were to some extent determined by the nature of the innovation being discussed.

Visits to renowned innovative farmers. In addition to the 14 farmers identified through the focus group discussions, two other Lead Farmers were visited as part of the study: Frederick Msiska and Eston Mazolo. Frederick and Eston are regarded as exemplary farmers, both of whom have been recognised by the government for their respective innovations. It was felt that visits to their farms would complement the findings of the study.

FINDINGS OF THE STUDY

Over the course of the study, the participating farmers described a number of innovations, which could be grouped into the following categories:

- **Livestock care and treatment.** Many of the innovations related to the care and treatment of livestock. Innovations in this category ranged from the use of indigenous plants to treat parasites and diseases to the production of homemade chicken feed.
- **Pesticide production and application.** Several of the innovations related to pesticide production and application, particularly the use of locally found plants as low-cost alternatives to inorganic pesticides. One farmer had developed a simple pesticide sprayer made from locally available materials, and was selling the sprayer in local markets.
- **Fertiliser production and application.** Innovations in this category included the use of animal manure, leguminous plants and crop residues, either individually or in combination, in the form of a solid (basal) or liquid (top dressing) application, as low-cost alternatives to inorganic fertilisers, as well as variations on the recommended application of inorganic fertiliser.
- **Water conservation and use.** Innovations in this category ranged from basic drip irrigation systems to the diversion of an underutilised stream for irrigation and fish farming.
- **Other innovations.** Some of the innovations were harder to categorise and fell simply into a 'miscellaneous' category. They ranged from the generation of household 'electricity' from goat manure to the production of equipment, such as a homemade wooden wheelbarrow.

The case studies that follow outline a selection of the innovations highlighted through the study.

CASE STUDY 1: REDUCING LIVESTOCK TREATMENT COSTS THROUGH THE USE OF PLANT REMEDIES

The first case study (BOX 2) relates to the use of the Tephrosia and Neem plants as acaricides. This practice is not currently widespread in northern Malawi, although the plants are used in many countries and their effectiveness has been demonstrated by a number of studies worldwide[xiv].

An important distinction is normally made between an innovation and an invention. While an invention is a technique or technology that is new in absolute terms, having never been developed anywhere else, innovations may be techniques or technologies that are widely practised elsewhere, but are new to a particular locality[xv]. The appropriation of a technique or technology, its modification and subsequent inclusion into a farmer's repertoire is justifiably termed local or indigenous knowledge[xvi].

In this case, the farmer introduced the use of these plants in a new locality, which is why this example is an innovation. He did this on his own initiative, building on his knowledge of the plants' properties, and transposing their application from other contexts (i.e. the use of Tephrosia in fish farming and Neem for medicinal purposes) to his own context (their use in livestock treatment).

BOX 2. TOMBOZGHANI MHANGO

Tombozghani Mhango is a Lead Farmer from Zyatepta village in Mhuju. He keeps livestock, including chickens.

In 2008, Tombozghani agreed to look after a friend's chickens. He soon discovered that they had ticks, which had spread to his chickens. He visited the local vet, who said that he had no drugs on hand to treat the ticks.

Tombozghani knew that the Tephrosia plant *(Tephrosia vogelli)* was traditionally used in fish farming to kill fish, so he decided to try using the plant to treat the ticks. He was also aware of the Neem tree *(Azadirachta indica)*, which he had heard could cure numerous diseases, so he decided to combine the two plants, in the hope that their collective strength would kill the ticks. Not having access to Tephrosia or Neem, Tombozghani took leaves from the plants of a neighbour.

He pounded the leaves of the two plants together, mixed the leaves with water in a bucket, and left the mixture to infuse for 12 hours. He then dipped each of the infected chickens into the solution. He found that the solution killed the ticks within a few hours.

Tombozghani has since started growing his own Tephrosia and has been using this method on his chickens since 2008. Since that time, he has not needed to purchase commercial acaricides. Inspired by his success, several other farmers have now adopted the practice, including the owner of the Neem tree.

This innovation offers a low-cost alternative to costly chemical acaricides for the treatment of ectoparasites in livestock, and as such, it has the potential to be replicated by other farmers. However, further research is required to determine the most effective dosage and application (including whether the combination of the two plants is more effective than using them separately), as well as the long-term effects of their use on livestock.

CASE STUDY 2: DEVELOPING LOW-COST PESTICIDES USING PLANT COMBINATIONS

Experimentation is a crucial part of the innovation process. In the next case study (BOX 3), the farmer experimented with a range of combinations of plants as pesticides, before finding the mixture that he considered to be most effective. He did this on his own initiative, based on his own knowledge of plant properties and discussions with the local extension worker. Although the process involved informal experimentation or "people's science" as mentioned above, rather than formal scientific research, the farmer applied basic scientific principles, such as the use of a 'control' plant for comparative purposes, and the testing of different plants both individually and as combinations in order to determine the most effective remedy.

BOX 3. EDWARD MGHOGHO

Edward Mghogho is a Lead Farmer from Khutamaji village in Katowo. His farm is a model farm and provides him with food and income, as well as being a site for training Follower Farmers. He is involved in manure making, conservation farming, traditional crops, farmer experimentation, agroforestry, pit planting, natural pesticides (from local trees) and drip irrigation for his fruit trees.

Edward grows a range of fruit trees, including mangoes. After planting his mango trees, Edward noticed that lack of moisture was impeding their growth. He developed a basic drip irrigation system using plastic bottles tied to the trees which slowly released water to the roots of the plant and noticed a marked improvement in the quality of the trees. However, he then found that the trees were being damaged by pests, including flies and grasshoppers.

Not having the money to buy chemical pesticides, Edward discussed the problem with the local agricultural extension worker, and the idea of using indigenous plants as pesticides arose. Edward began experimenting with a range of local plants, trying them individually and blended together to determine the most effective plants to use as pesticides. He selected plants that he knew to have a bitter taste and a pungent aroma. He found that some plants on their own were not effective, but when combined with different plants, their collective strength proved effective. Edward also used one tree as a 'control', to which he did not apply any of the plant pesticides.

"Having been brought up in the village, I know the plants that are bitter, and those that are sweet. I use this to make the pesticides. I mix plants and get the combinations right as a part of my experimentation. I use traditional plants and newly introduced, such as Tephrosia, to make the right mixtures."

Edward has developed his own typology for the pesticides he uses:

- Pest killers (that function in a similar way to conventional pesticides);
- Pest repellents (that repel the pest once it eats the crop); and
- Pest repellents (that repel the pest before it attempts to eat the crop).

The most effective mixture was a combination of the bulbs, leaves and roots from eight indigenous plants. These plants are pounded together in equal measure, left to soak in water, and then the mixture is sieved. The resulting solution is poured into a bottle and tied to the tree, together with another bottle containing pure water for irrigation. The bottles are refilled every morning, and drip from 6am to 6pm. A fresh batch of the solution is made every few days, and the mixture is used on the trees throughout the year.

Edward also sprays this solution onto the leaves of the trees and onto his other crops, including maize and vegetables. He has been using this method for the past few years and has found that his mango trees have been consistently pest-free. On his advice, three people have copied this method and Edward plans to teach it to other farmers in future.

In addition to the plant combination used on the mango trees, Edward is continually experimenting with plant combinations and has identified a number of different combinations which he finds more effective on different plants.

Indigenous plants can provide a low-cost, sustainable alternative to the use of inorganic pesticides, and so this innovation also has the potential for replication by other farmers. However, as with the previous case study, there is a need for further research, in order to determine the plants' effectiveness as pesticides, both individually and collectively, the appropriate dosage and application, and the time that needs to elapse before the fruits can be safely eaten.

CASE STUDY 3: MAKING LOW-COST, ORGANIC FERTILISER FROM ANTHILL SOIL

While invention often concerns a single technique or technology, innovation frequently involves the combination of existing techniques or technologies in new ways in order to enhance their impact.

The next case study (BOX 4) relates to the production of organic fertiliser from anthill soil. The concept of using soil from anthills as a source of plant nutrients is not a new one - anthill soil has been tested and used for years, and its nutrient-rich properties are well documented. This case study is given as an example of innovation because it involves the combination of existing technologies.

BOX 4. NELLIE GONDWE

Nellie Gondwe is a Lead Farmer from Jodi village in Bolero. Nellie grows maize using the pit-planting technique but cannot afford inorganic fertiliser.

Nellie has many anthills on her land. In the past, she avoided growing crops on the anthills like other farmers, because the soil was too compact and suffered from moisture deficiency. In 2010, however, her son heard at school that anthill soil can be very fertile, and has a better structure than normal soil and more nutrients, which are brought up from deeper soil by the ants. Nellie decided to try using the soil from the anthill, mixed together with goat manure, on her maize.

She mixed one wheelbarrow of anthill soil with one of goat manure and applied this mixture to her maize pits. She also planted vegetables around the edges of the anthill, where the soil was less compact.

The combination of anthill soil and goat manure was very effective, and Nellie noticed a significant improvement in the quality of her maize, particularly in the pits. The vegetables planted around the edge of the anthill also grew well and she did not need to use manure on them at all. Nellie has been using this method for the past year and plans to continue using it in future.

In this case study, rather than planting crops directly onto the anthills as other farmers in her area were doing, the farmer decided to take the soil from the anthill and mix it with goat manure before applying it, thereby enhancing the plant nutrient content and properties of the anthill soil and also reducing the amount of manure required. This innovation has good potential for replication by resource-poor farmers, offering a low-cost alternative to inorganic fertilisers.

CASE STUDY 4: INCREASING MAIZE YIELDS THROUGH IMPROVED PLANT SPACING

Government extension services often adopt a blanket, 'one-size fits all' approach, using standard messages for all areas. This approach fails to acknowledge that what works in one context may not be effective in another. For this reason, innovation frequently entails the adaptation of recommended practices to suit a particular context. In the next case study (BOX 5), a farmer using the same basic principles underpinning the extension message on maize planting, changed the plant population density (number of plants per given unit area) to meet his own circumstances.

BOX 5. JUSTICE MAHOWE

Justice Mahowe is a Lead Farmer in Mahowe village in Bolero. Justice has always been a farmer but from 1994 to 1995 he worked as a General Clerk with the Ministry of Agriculture, during which time he had the opportunity to work closely with a local research station.

At the end of each year, Justice reviews his farming practices, in order to determine which methods are working best and which are not. He then develops innovative ways to increase production.

When growing maize, Justice found that the planting method recommended by government - 25cm between plants, with 1 plant per station - was not as effective in larger areas of land as in smaller plots. In larger areas, the 25cm spacing worked well in the first few rows of his field but in the middle, where light was scarce, the maize was thinner and of poorer quality.

Justice recalled that when he had worked with the agricultural research station, they were planting 2 plants per station at 60cm apart. He divided this figure by two, and decided to try planting his maize at 30cm apart with 1 plant per station, instead of the recommended 25cm.

Using this method, Justice found that there was more space and light for the maize plants, and his maize was healthier and more productive. With 25cm spacing, the plants produced 1-2 cobs per stalk (although the second cob would be very small and often poorly developed), but with 30cm spacing, he gets 2-3 good quality cobs per stalk. Justice has been using this method since 2007 and says that the increases in yield achieved through the increased spacing outweigh the reduced plant population.

In this case, the farmer found that the recommended maize plant spacing was not appropriate for his farming system - an increased plant population density led to greater plant competition and a noticeable decrease in light penetration - and adapted the method. He did this on his own initiative, based on close monitoring of plant growth throughout the season, but building on the knowledge and experience gained during his time working with a research station.

This case study demonstrates the need for further research into optimum plant spacing under different plant nutrient regimes and the need for modified recommendations for farmers' different circumstances. The usual practice of making general recommendations, based on predetermined plant spacing for predicted yields, which are in turn dependent on assumed fertiliser applications, is unhelpful in the reality of low input agriculture. In other words, information about a technology needs to form part of a dialogue on technological choices, rather than the adoption of a singular approach that diverges from farmers' needs or preferences.

CASE STUDY 5: INCREASING PEST-RESISTANCE IN TOMATOES THROUGH GRAFTING

The grafting of plants on to better suited rootstocks is a practice that started thousands of years ago. Grafting in this case study (BOX 6) is an example of applying accepted agricultural practices to new possibilities.

BOX 6. JOHN GONDWE

John Gondwe is a Lead Farmer from Chahanga village in Chiweta. He has been experimenting with grafting fruit trees for several years.

John grows tomatoes on his land, which require a lot of fertiliser and attract lots of pests. In 2009, he decided to try grafting tomatoes with the Nthula (bitter/thorn apple) plant *(Solanum panduriforme, also known as Solanum incanum),* which grows well naturally and has fewer pests than the tomato plant.

John used the Nthula as the mother plant (rootstock) and the tomato as the secondary plant (scion). He found that the Nthula plant took on the desirable qualities of the tomato plant and grew large fruits, which required significantly less fertiliser and attracted fewer pests.

John and his family have been eating these tomatoes for the past two years. He is keen to work with a research station to test the safety of the fruits, so that he can start selling them in his shop.

That tomatoes and Nthula belong to the same ‘family’ (genus) of plants was probably unknown to the farmer, yet his powers of observation and innovation led him to this combination of plants. There is little reason to presume that the tomatoes are dangerous - although the bitter/thorn apple does not produce an edible fruit - and there are many examples elsewhere of similar grafting practices. Nonetheless, further research is necessary to determine the full potential of this innovation and to address any health and safety issues that may arise.

CASE STUDY 6: REVIVING THE PRACTICE OF TRADITIONAL SEED CONSERVATION

By definition, traditional practices, rooted in the past, cannot be regarded as innovations. However, the revival of traditional practices - reinvented for the present - can be considered an innovation if it takes place in a context where such practices are undermined by the prevailing extension orthodoxy. In Malawi, the Ministry of Agriculture, Irrigation and Water Development, through its promotion of maize, including successive agricultural input subsidy programmes, has promoted the use of modern varieties, usually hybrid seeds, over traditional varieties which are often lower yielding but better adapted. The next case study (BOX 7) illustrates the revival of traditional seed conservation as an innovation in this context.

BOX 7. EDWARD MGHOGHO

Edward Mghogho, as above, conserves traditional seeds, which he defines as those that were grown by the ancestors either for food or for their medicinal values.

He has separate plots for the traditional varieties, which include finger millet, pearl millet, sorghum, sweet sorghum, cowpea, green gram, sesame, Bambara groundnut, traditional maize (Kafula - a small early maturing variety and a late maturing variety) and okra.

He sources his seed from a variety of people and places. For example, he accessed his finger millet seed from the local extension officer, whereas his pearl millet seed came from farmers residing in neighbouring Zambia.

For Edward, these seeds are both a source of pride and a necessity, given the unpredictability of the weather. He says that they must be conserved to ensure cultural continuity - otherwise they will be forgotten.

Thus for Edward it is not a case of either/or but rather a strategy to adopt what best suits his farming needs in the present with an eye on the future. Acutely aware of the drought resistant properties of the more traditional crops such as sorghum and millet and the particular characteristics of the local maize varieties he cultivates, he plants a diversified mix of crops to mitigate risk and to provide him with nutritious food. But this does not preclude him from planting modern varieties of seed. As he says: *"a farmer must be active, constantly seeking ways to improve his practices, because it is only in this way that he can have a better life."*

CASE STUDY 7: ENHANCING THE NATURAL RESOURCE BASE

This utilisation of locally available resources is exemplified in the following case study (BOX 8), which describes a collective community response to a livelihood opportunity. Building on advice from a fisheries expert and local knowledge about water diversion practices, the Chowe Fish Pond Group has enhanced the natural resource base by capturing and conserving water for fish production and irrigation.

BOX 8. THE CHOWE FISH POND GROUP

The Chowe Fish Pond, in Bankharo Village, Mhuju, is the collective initiative of a group of farmers from the local community to make better use of their available water resources and to develop an income generation opportunity simultaneously. Noting that a local farmer had established a small fish pond by diverting a stream, the group decided to follow his example and to establish a much larger fish pond that would enhance food security and provide income for its members.

Based on his initiative and prior experience, the local farmer, Wiseman Kayuni, was elected to become the Chair of what was to become the Chowe Fish Pond Group, with 20 members (9 women, 11 men). The fish pond was manually dug by the members. Excavated soil was dumped along the perimeter of the pond, which was compacted to form a raised and largely impermeable wall. The bottom of the pond was also compacted to make it impermeable. Inlet and outlet pipes were placed to allow water to flow through the system. Once all this had been accomplished, a small canal was dug - diverting the stream to the inlet pipe - and the pond was filled with water.

A pigeon house on stilts was established in the pond, so as to enrich the water and to provide fish food. At the same time, bananas and sugarcane were planted around the edge of the pond, making use of the lateral water seepage that occurred.

Making full use of what would become an enriched water source, the group decided to grow vegetables as an income generator for the group and a source of funding for the fish enterprise. The fish pond was stocked with a suitable species (*Tilapia spp.)*, while the group, waiting for the fish to mature, continued farming. Now that the pond is in full production, the group continues its farming activities, growing vegetables as well as some maize and soya beans to feed the fish. The fish are caught in a net (by driving them from one side of the pond to the other) and collected for sale.

Thus, an underutilised stream provides farmers with a conserved resource that is robust, resilient and utilisable in multiple ways: with irrigation water for their vegetables, wet soils for moisture-loving perennials such as banana and sugarcane, and a rich protein source in the fish they farm, and hence a diversified livelihood opportunity.

CASE STUDY 8: ADDRESSING THE CHALLENGE OF SOIL INFERTILITY

The next case study (BOX 9) highlights one farmer's attempts to address one of the main constraints to successful agricultural outcomes in Malawi – soil infertility.

BOX 9. ESTON MAZOLO

Eston Mazolo comes from Chimbangara village in Bwengu, Mzimba district, where he is the Chief of the village. Eston owns 80 hectares of land, on which he grows mainly maize, as well as tobacco, beans, and groundnuts. He grows both local and hybrid maize, keeping the local maize for family consumption and using the hybrid maize for sale. He has access to gravity irrigation and owns chickens, ducks, cows, pigs and goats.

Eston became a Lead Farmer in 2003 and has 64 Follower Farmers. In 2008, he attracted nationwide fame for inventing a new type of manure pellets to be used as top dressing. The pellets are made from goat or chicken droppings, ash and the leaves of an agroforestry tree[2]. The tree does not grow naturally, so Eston planted some on his land.

The pellets are highly effective as an organic fertiliser and easier to store and transport to the field. As a result of the invention of these pellets, and various other innovations, Eston was voted second runner up in the 2008 Malawi's Nation's Achiever Awards.

Other farmers, having heard Eston speak about the pellets on the radio, have now adopted this practice.

Eston is continually experimenting with new techniques on his land. He has recently started making vermi-compost (compost made using special worms) and plans to experiment with the use of termites in compost-making. He is also currently conducting trials with a new type of compost, which is made from pulverised limestone, ash and chicken droppings.

[2] Agroforestry is the growing of both trees and agricultural/horticultural crops on the same piece of land. They are designed to provide tree and other crop products and at the same time protect, conserve, diversify and sustain vital economic, environmental, human and natural resources (AgroForestry Research Trust).

CASE STUDY 9: AN EXEMPLARY INNOVATIVE FARMER

In the final case study (BOX 10), both the abilities of an individual farmer and the institutional constraints faced by resource-poor farmers in general are recognised.

BOX 10. FREDERICK MSISKA

Frederick (Fred) Msiska is a farmer from the village of Maloto in Ntchenachena. Fred owns three acres of land, on which he grows a wide range of crops, including cassava, maize, beans, soya, various fruits and vegetables and macadamia nuts. He practises conservation agriculture[3], and has adopted simple water harvesting technologies for his domestic water, and soil moisture conservation techniques for his crops.

Fred became a Lead Farmer in 2005 and now has over 170 Follower Farmers. Over the years he has established a farmer field school at his homestead, where farmers come to learn, and share information and techniques. Fred has been recognised in various ways for his exemplary work as a Lead Farmer. The Ministry of Agriculture, Irrigation and Water Development has designated him a 'Master Lead Farmer', and the Paramount Chief of Rumphi District has recommended him as a 'Trainer of Trainers'.

He says, *"The Banda government used to target only those with a tertiary education, and felt that it was not worth investing in others. The Muluzi government was highly business-oriented, and ignored us. More recently, resource-poor farmers have been elevated up to a point. They have more recognition ... but more needs to be done if agricultural development is to become a reality ... There is a real need to recognise the knowledge that local farmers have and the contribution they can make to challenging poverty."*

Fred is continually experimenting and innovating. His many innovations include: a lamp for his office; a tool to measure and demarcate planting stations for maize and legumes; and the generation of 'electricity' from maize bran. He has an excellent knowledge of indigenous plants and uses a combination of plants to protect his macadamia nuts from insect attack. He pounds together leaves from three local plants, mixes them with water, and injects the resulting solution directly into the trunk of the tree where the pests reside using a syringe. Fred says that this solution has kept his trees free from pests.

Fred's homestead is a model of efficiency and nothing is wasted. He has designed a latrine system with two holes, which are used alternately. After use, sieved ash and soil are poured into the hole. When one hole is full, it is left to produce manure, and the other hole is used. The manure is then used on the crops. Fred has constructed a tap outside the latrine for hand washing, and he plants seeds under the tap, so that the runoff water is not wasted.

"In the Lead Farmer training, we were taught three things: (1) practise sustainable agriculture; (2) look to farming for an economic return; and (3) be innovative. I have focused on the first of those three points, in order to ensure the fertility of my soil. I am now satisfied that I will leave my children healthy and productive soil, and I can start to think about the business side. Unfortunately, people often have a short-term perspective. Many of my fellow farmers started by focusing on the business side of farming, and as a result, their soils lost fertility."

[3] Conservation agriculture, broadly speaking, is a farming systems approach that aims to conserve and enhance the natural resource base by maximising plant or plant residue cover through no or minimum tillage. It involves planting directly into existing crop stubble (with or without prior herbicide use) and may involve the use of additional mulches. It aims to maintain soil moisture, reduce soil tillage, minimise soil erosion, improve organic matter content and suppress weed growth as an alternative to conventional systems which involve total or partial soil inversion in preparation for planting.

Fred Msiska is clearly a very innovative man, constantly on the lookout for new opportunities. However, there is a clear difference between recognising the man and recognising the innovations. While Msiska is recognised as a person who innovates there has, thus far, been very little effort or impetus to build upon his innovations. Msiska therefore suffers from a number of constraints: as an individual largely dependent on his own resources; as a Lead Farmer, who despite many Follower Farmers cannot valorise his knowledge beyond his own immediate neighbourhood; and as a leader of a potential collective, who lacks the institutional mechanisms through which appropriate linkages can be sought.

CONCLUSION

Smallholder agriculture is both complex and dynamic, and farmers are constantly required to respond to new challenges in the form of social, political, economic and environmental change. The study findings demonstrate that farmers in Rumphi district are continually experimenting, adapting and innovating, in order to find new and better means of production and organisation to address these challenges.

Their innovations are driven by a range of interlinked factors: economic factors - such as the inability to afford external inputs or grow enough food to be food secure; environmental factors - such as the need to adapt to climate fluctuations or restore infertile soils which cannot be rested due to small landholdings; social factors - such as migration, HIV and AIDS, and less labour availability; cultural factors - such as the need to use certain plants for ritual and other purposes; and political factors - such as the availability of subsidised fertilisers and seeds as a form of political patronage by a neopatrimonial state. The determinants of farmer innovation are hard to isolate. While some farmers innovated out of necessity, adversity or opportunity, others took a more systematic approach to innovation, such as the farmer who, on an annual basis, reviews past outcomes as a means to improving his farming practices.

The farmers drew upon many sources of inspiration for their innovations. Some had revived and adapted 'traditional' knowledge and practice; some had adapted recommended techniques; and others had adapted techniques learnt from other farmers or research stations.

Several of the innovations highlighted through the study have the potential to be replicated by other farmers. However, farmers' knowledge often goes unrecognised and under-utilised. There are also considerable gaps in the knowledge of farmers that need to be recognised, relating, for example, to the identification of pests and diseases that impact on their agriculture. Farmers often relate the incidence of a disease to a context rather than tracing the causal mechanism - for example, late blight occurring in overcast conditions rather than the onset of a fungal infection.

This serves to highlight the importance of establishing innovation systems that bring together, in different ways, the many actors involved, including farmers, scientists, extension workers and private sector organisations. This arguably remains the greatest challenge.

By identifying innovative ways to increase production, improve organisation, or reduce dependence on external inputs, farmer innovations have significant potential to improve the quality of life for farming families in Malawi and reduce their impact on the environment. As climate change adaptation and mitigation become increasingly important, there is clearly the need for a shift from the conventional approach to agriculture - top down imperatives based on general recommendations on purchased inputs - to a nuanced, iterative process of farmer interaction, participation and empowerment, with new and robust stakeholder interlinkages. Science may have a lot to offer resource-poor farmers, but the potential of local knowledge and farmer innovation will constitute its building blocks as a technical intervention which is underpinned by new institutional forms and relationships that challenge 'business as usual'.

RECOMMENDATIONS

These recommendations are a direct outcome of the study, but are complemented by FYF's work elsewhere in Malawi.

- **Recognise the knowledge and practice of farmers.** It is clear from the study that farmers possess considerable knowledge about the environment in which they farm, the crops they cultivate and the animals they keep. While it should not be assumed that indigenous knowledge alone will provide a solution to the many challenges faced by smallholder farmers, farmers should be acknowledged as the custodians of valuable farming knowledge that needs to be recognised, validated and used more generally.

- **Disseminate successful farmer innovations.** Although not all innovations require further research, existing successful farmer innovation is worthy of wider dissemination. Researchers and farmers should collaborate in participatory research to find answers to specific problems, build on existing knowledge and verify farmers' innovations for effectiveness and safety.

- **Facilitate increased dialogue between all actors involved in agricultural extension.** Current models of farmer support are unidirectional and tend to be based on the Training and Visit System, where the agricultural extension officers communicate a message to farmers. There is a need for dialogue in which farmers, extension workers and other stakeholders are involved in finding mechanisms that build on farmers' knowledge and practice and address their needs more directly.

We are in fact calling for a reorientation of agricultural research and development towards:

- Adopting a multifunctional view of agriculture;
- Re-emphasising mixed farming models;
- Promoting agricultural and biological diversity; and
- Ensuring that agrarian and land reform increase security of tenure (which is not synonymous with a process of land privatisation).

This in short requires a democratisation of agricultural development, enabling the voices of resource-poor farmers to be heard and their knowledge to be recognised.

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x Republic of Malawi, 2010, op. cit., page 61.

xi This is the definition developed by Prolinnova, as outlined in its publication, Notes on Local Innovation and Participatory Innovation Development (op cit., page 1). Prolinnova is an NGO-initiated programme to build a global learning network to promote local innovation in ecologically-oriented agriculture and natural resource management.

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