Food and Agriculture Organization of the United Nations

SAVE AND GROW FARMING SYSTEMS
FACT SHEET 1

MAIZE/LIVESTOCK

Agro-ecological zone
Tropical rainfed
Main cereal Maize
Other crops/products
Meat, milk, fodder, legumes, vegetables

'Push-pull' fights pests, boosts milk production

Stem borers and the parasitic weed *Striga* are the bane of maize fields in Africa. The larvae of an indigenous moth, stem borers eat into the stalks of maize and devour them from within, causing crop losses of from 20 to 80 percent. Ministries of agriculture often recommend the use of synthetic pesticide to control stem borers, but most smallholder farmers cannot afford it.

Striga, a parasitic plant that attaches itself to the roots of cereal crops and siphons off water and nutrients, grows on some 40 percent of sub-Saharan Africa's arable land. In western Kenya, it infests as much as 76 percent of land planted to maize and sorghum, causing annual losses valued at more than Us$40 million. Sometimes, *Striga* infestations can lead to complete crop failure. Control of *Striga* is extremely difficult, as each plant produces thousands of tiny seeds that can remain viable in the soil for many years. As farmers abandon heavily infested areas to cultivate new land, *Striga* follows them.

In 1993, the International Centre of Insect Physiology and Ecology (ICIPE), in Nairobi, began working with the Kenya Agricultural Research Institute, Rothamsted Research (United Kingdom) and other partners to find affordable, environmentally friendly ways of controlling stem borers. What emerged from their work is now known as the 'push-pull' system of integrated pest management, which controls the borers by harnessing complex chemical interactions among plants and insects.

In push-pull, maize is intercropped with the leguminous plant *Desmodium*, while a popular fodder crop, Napier grass, is planted as a border around the field. *Desmodium* produces volatile chemicals that attract predators of maize pests. More importantly, by giving a false distress signal to the moths that the area is already infested, these chemicals 'push' the egg-laying moths to seek out habitats where their larvae will face less competition for food.

Napier grass also produces volatile chemicals that 'pull' the moths towards them, and then exudes a sticky substance that traps the stem borer larvae as they feed. Few larvae survive. Napier grass also attracts stem borer predators. In trials, the number of stem borer eggs, and plant damage caused by stem borer feeding, have been found to be significantly higher in monocropped maize plots than in push-pull fields.

KEY POINTS

'Push-pull' is the basis of an **integrated crop/livestock production system** which does not require high levels of external inputs.

It harnesses **complex chemical interactions** that destroy stem borer larvae and inhibit the growth of *Striga* weed.

The system provides **year-round soil cover**, helps conserve soil moisture and soil structure, and prevents erosion.

Farmers have adapted 'push-pull' to allow intercropping with beans and report that their **maize yields have increased** three to four times.

High quality fodder produced by the system helped 700 to farmers increase milk production by 1 million litres a year.

During the course of their work, ICIPE researchers made a startling discovery: *Desmodium* also acts as a 'false host' to *Striga*, first exuding chemicals that induce germination of its seeds, then releasing other chemicals that inhibit the weed's root growth. Trials of the push-pull system showed that maize plots not only suffered little stem borer damage, but were almost *Striga*-free after two seasons.

The push-pull system of pest control delivers other benefits. Both *Desmodium* and Napier grass are perennial crops that provide year-round soil cover, which helps retain soil moisture, improves soil structure, prevents erosion, and makes the agro-ecosystem more resilient to drought. Since it is a leguminous plant, *Desmodium* also fixes nitrogen in the soil and makes it available to the maize crop.

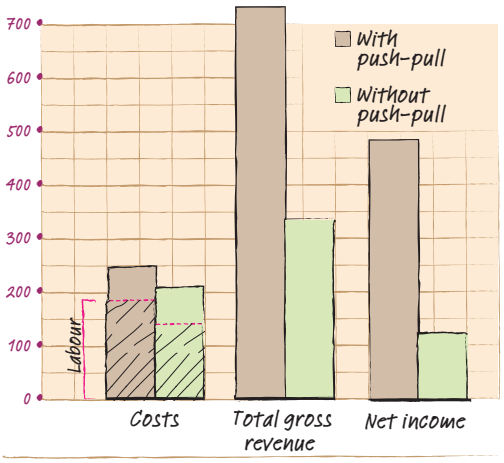
Beginning in 1997, ICIPE and its partners introduced the push-pull system in Kenya and eastern Uganda, using 'farmer teachers' to help them spread the word. By 2010, more than 25 000 farmers around Lake Victoria had adopted it. An impact assessment conducted in 24 villages found that 19 percent of farmers had adopted push-pull primarily to control pests, especially *Striga*, and to increase crop productivity. Seventy-five percent of those farmers said their yields were three to four times higher than before. Some were harvesting 5 tonnes of maize per ha from fields that had previously produced less than 1 tonne. In Kisii district, the income of push-pull maize farmers, per hectare, was three times that of their neighbours. Many farmers had adapted the system to allow for the intercropping of maize with beans and other grain legumes, such as groundnuts, soybeans and cowpeas, and vegetables such as kale.

The Napier grass used in the system has boosted the supply of feed for livestock. In fact, the ICIPE assessment found that fodder production was an important factor motivating farmers to adopt push-pull. For example, farmers in one district on Lake Victoria could satisfy only half of local milk demand owing to the lack of good quality feed. After 700 farmers adopted the system, milk production increased from 7 million to 8 million litres a year.

More livestock fodder means more manure is available for farmers to apply to their fields, which reduces the need for mineral fertilizer. Push-pull farmers have been able to diversify their production by selling organic produce and raising poultry. They use the extra income for a variety of purposes, including paying their children's school fees and improving their housing.

However, the assessment found, some farmers had not adopted push-pull because they did not have enough information about it. Although push-pull saves on labour by reducing the need for weeding, some farmers did not have enough household labour to establish the system in their fields. In addition, farmers with one-year land leases were reluctant to invest in a technology that did not produce rapid benefits.

Economics of maize production, Kisii district, Kenya (US$/ha)



By 2014, as many as 70 000 smallholder farmers in Ethiopia, Kenya, the United Republic of Tanzania and Uganda – of whom more than half are women – were controlling *Striga* with *Desmodium* intercropping.

Push-pull is now seen as the basis of an integrated crop-livestock production system that does not require high levels of external inputs and could significantly improve food security in East Africa. A recent survey of 900 farmers in Ethiopia, Kenya and the United Republic of Tanzania found a high potential for adoption of the system, especially among women and those who were aware of the damage caused by *Striga* and had good access to inputs.

Establishing push-pull as a permanent part of agriculture in the region will require continued support from extension services and the use of community-based extension strategies. It will also require an assured supply of *Desmodium* and *Brachiaria* seed, along with the seed of improved maize varieties and hybrids.

Adapted from:
Save and Grow in practice: maize, rice, wheat. A guide to sustainable cereal production (FAO, 2016).
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http://www.fao.org/3/a-i4009e.pdf
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