# Agroecological technology controls pests and weeds with locally available plants

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## Pest management is critical to food production

Farmers' food and livelihoods are threatened by pests and weeds, which damage plants and reduce their productivity. Smallholder farmers in Sub-Saharan Africa have struggled to control the insect pest, stemborer, and the parasitic weed, Striga, by using chemical pesticides. But many cannot afford these expensive inputs.

In Kenya, national and international researchers worked to develop a technology that accommodated the financial constraints of most small farmers. Scientists, together with thousands of Kenyan smallholder farmers, experimented with different approaches to perfect a new technique of agroecological pest management: push-pull.

## Push-pull technology is an affordable, agroecological way to manage pests

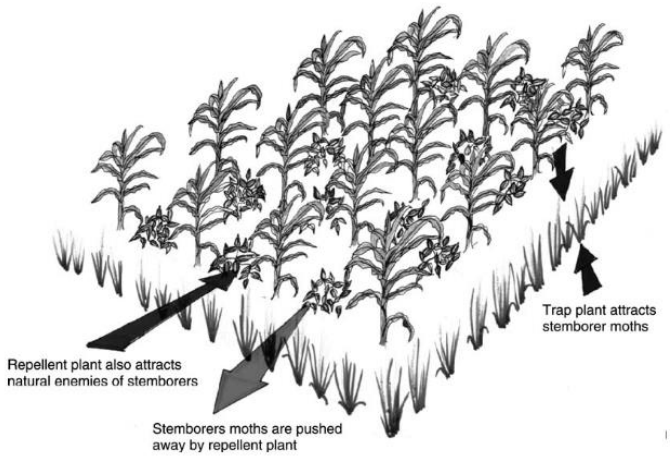


Figure 1. Representation of push-pull farming (Source: Khan et al. 2011).

Push-pull technology draws on a comprehensive understanding of plant and insect interactions. The technology is designed for mixed-cereal cropping systems upon which most smallholders rely for food and income. In the system, the cereal crop is planted alongside Desmodium (Desmodium spp.) (also called companion planting or strip intercropping), a plant which repels (pushes) stemborer moths from itself and the cereal crops near to it, driving them towards Napier grass (Pennisetum purpureum), which is planted on the field's border. Napier grass produces chemicals that attract the stemborer moths, which lay their eggs on these trap plants (pull) rather than on the cereal crops. When the larvae hatch and begin to feed on the Napier grass, its leaves produce a sticky sap that traps the larvae and kills them. At the same time as Desmodium pushes stemborer moths away from itself and nearby field crops, it attracts natural

enemies of the pest, which further control the stemborer population. Desmodium produces chemicals that not only repel the stemborer moth, but reduce the growth of Striga, a parasitic weed that infests cereal cropped fields, causing severe damage with strong yield reduction. The chemicals released by Desmodium's roots induce suicidal germination, greatly depleting the number of Striga seeds, and thus preventing growth of the weed. Both Napier grass and Desmodium are perennial plants, growing throughout the dry season to continue to controlling pests and weeds.

Figure 2. Maize grown with the push-pull technology on the left shows clearly better productivity compared to the right without it. Striga infestation is also seen on the right; © Peter Lüthi/Biovision

## A multifunctional management practice

Push-pull technology was developed to work for farming households who have limited available resources. Besides offering an alternative strategy to expensive pesticides for pest and weed control, push-pull has a number of benefits for farmers and their land.

## ENVIRONMENT

*Soils:* Desmodium is a legume, and thus fixes atmospheric nitrogen that can improve soil fertility after decomposition of organic matter of the plant. Both Desmodium and Napier grass provide mulch that improves soil organic matter and soil moisture.

*Diversity:* The technology promotes agrobiodiversity of both crops and wild species of arthropod insects, which play important roles in agroecosystem food webs.

*Pollution:* Replacing pesticides with plants eliminates the need for pesticides and the chemical residue pollution that accompanies their application.

*Climate change:* Besides improving soil health, increased organic matter also enhances the soil's capacity to sequester atmospheric carbon, contributing to climate change mitigation.

## FOOD & INCOME

The technology's contributions to soil health and pest management have increased the productivity of important food crops.

- 1.75 times increase in maize grain yields, from 2t/ha to 3.5/ha
- 2 times increase in sorghum yields, from 1t/ha to 2t/ha.

Figure 3. Children gather foddergrass for livestock; © Peter Lüthi/Biovision

The intercropped species- Napier and Desmodium- can be harvested as fodder for livestock. Farmers have reported this high-quality feed has improved their livestock's health, resulting in higher meat and milk production.

These improvements lead to better food security, with farmers producing enough to be self-sufficient and sell the surplus to earn greater income.

## Dissemination and impact

Push-pull technology has been described as '*the single most effective and efficient low-cost technology for removing major constraints faced by the majority of small-holders in Eastern Africa resulting in an overall and significant improvement of their food security and livelihoods*' (Fischler, 2010).

Farmer-to-farmer trainings, exchanges and field schools have helped to spread push-pull throughout Kenya, Uganda, Tanzania, and other countries where stemborer and Striga affect maize, sorghum, and millet production. The technology is well-adapted to the temperate and sub-humid climates with rainfed agricultural found across Sub-Saharan Africa and farmers are familiar with its form, as companion planting is a traditional agricultural technique in many places. In 2014, more than 70,000 smallholder farmers were using push-pull in the region, an indication of its accessibility and the ecological and economic advantages it offers.

Figure 4. Push pull field with control field in front; © Stefan Diener/Biovision

## Conclusion

Push-pull is a low-cost agroecological practice that, when implemented, provides multiple benefits to farmers such as increase in food production, enhanced income, improved soil health and pest management as well as providing fodder to livestock. Push-pull's widespread implementation across different African countries is evidence of the functionality and feasibility of this technology for farmers.

## References


Fischler, M. 2010. Impact assessment of push pull technology in eastern Africa. Intercooperation, Switzerland, ICIPE Science Press, Nairobi.

Khan, Z.R., Midega, C.A.O., Amudavi, D.M., Hassanali, A., Pickett, J.A. 2008. On-farm evaluation of the “push-pull” technology for the control of stemborers and striga weed on maize in western Kenya. Field Crops Research 106, 224-233.

Khan, Z., Midega,C., Pittchar J.,Pickett, J., Bruce, T. 2011. Push-pull technology: a conservation agriculture approach for integrated management of insect pests, weeds and soil health in Africa. International Journal of Agricultural Sustainability 9(1), 162-170.

Khan, Z., Midega ,C., Pittchar, J., Murage, A., Birkett, M., Bruce, T., Pickett, J. 2014. Achieving food security for one million sub-Saharan African poor through push-pull innovation by 2020. Phil. Trans. R. Soc. B 369: 20120284. http://dx.doi.org/10.1098/rstb.2012.0284

ICIPE 2015. The ‘push-pull’ farming system: Climate-smart, sustainable agriculture for Africa. The International Centre of Insect Physiology and Ecology. Nairobi.