# Kenya overcomes pests and weeds with ecological solutions



In East Africa, maize farmers are overcoming some of their most damaging plant and insect pests in an ecologically sustainable manner. A proven approach called the'push-pull system' utilises ecology to improve yields by stopping plant and insect pests. A multi-year study in six districts of Kenya showed consistent maize yield gains for the push-pull system over monoculture, sometimes as high as 350% (Khan 2008). The integrated approach relies on ecological knowledge and diverse farming methods rather than chemicals or GE (genetic engineering).

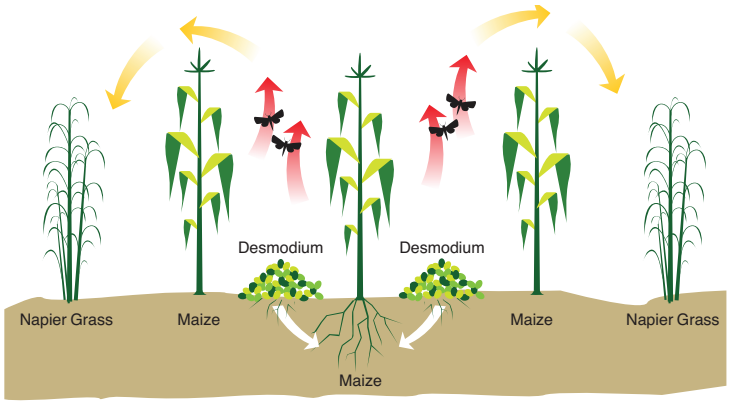
## Pest and weed problems in East Africa

Maize is Africa's largest cereal crop, with cultivation particularly important in East and Southern Africa. But many maize fields are plagued by witchweed, also called striga (*Striga* spp.). Witchweed is a parasitic plant that attaches itself to maize roots, depriving its host plant of nutrients. It is a problem that infests 40% of the arable land in Africa's savannas and is estimated to cost farmers US$7-13 billion per year (Khan 2007).

Stem-boring caterpillars are also a serious problem in African maize. Particularly harmful are *Chilo partellus* and, at higher altitudes, *Busseola fusca*, both of whose larvae chew holes in maize stalks and consume the plants from within. Stem borers destroy 20-40% of Africa's maize harvest on average, and as much as 80% in heavy infestations (Gatsby 2005).

Working with Kenyan farmers, scientists from the International Centre of Insect Physiology and Ecology (ICIPE) in Nairobi have developed an integrated ecological approach that controls both witchweed and stem borers in maize without chemicals and other expensive inputs, making it especially appropriate for Africa's many resource-poor farmers.

## The push-pull system




**Red arrow:** 'Push': Compounds released into the air by intercropped plants repel moths away from the maize.

**Orange arrow:** Compounds released into the air by border 'trap plants' attract moths to lay eggs, away from the maize.

**White arrow:** In addition, compounds secreted by desmodium roots inhibit the attachment of witchweed to maize roots and causes suicidal germination of witchweed seed in soil (see overleaf).

The scientific name of the system is stimulo-deterrent diversion. It is popularly known as 'push-pull', a name that describes how the system works to divert pests from maize. Push-pull farmers plant two species in addition to maize - one that repels pests from the maize plants (the 'push'), and another that attracts the pests away from the maize (the 'pull'), called a 'trap crop'.

The push is provided by an African native legume called silverleaf desmodium (*Desmodium uncinatum*). Desmodium is planted in rows beside maize. It naturally produces compounds that have a repellent effect on stem borers. Desmodium causes stem borers to perceive the area to be infested with fellow caterpillars, and thus already heavily exploited. Consequently, stem borer moths avoid the desmodium (and the maize beside it), and look elsewhere to lay their eggs (Khan 2007).

The pull in the system is provided by Napier grass (*Pennisetum purpureum*), which is planted on the perimeter of maize fields. Stem borers are attracted to Napier grass and prefer to lay eggs on its leaves over maize. In addition to luring stem borers away, the Napier grass is often a reproductive dead-end for the caterpillars, because it has a particularly effective response to stem borer infestation. When the eggs hatch and attempt to bore into the plant, it releases a sticky substance that immobilises the larvae, reducing damage and increasing the chances that the larvae will be eaten by a predator, such as a bird.

## Witchweed control and other benefits of ecological farming

Beyond controlling stem borers, both plants serve other important functions.

Desmodium controls witchweed. It does this by acting as a 'false host' of the parasite. Witchweed seeds are stimulated to germinate when in proximity to the desmodium. They seek to attach to the desmodium; but the legume does not support their continued growth, and the witchweed dies.

While other legumes are also false hosts of witchweed, for reasons that are not fully understood, silverleaf desmodium is particularly effective at reducing and even eliminating witchweed in maize fields. ICIPE scientists are studying the plant to learn why.

Both desmodium and Napier grass are also useful as animal feed, and can be harvested by push-pull farmers for sale or to feed to their own cattle. Once established, both plants grow back to protect the next crop of maize. Finally, desmodium is a nitrogen-fixing legume that improves soil fertility, boosting maize yields.

Push-pull has potential to expand to other crops, notably sorghum and millet, both important African food sources. Research is underway to adapt the system to these and other crops.

Push-pull is enabling African farmers to overcome some of their most damaging plant and insect pests in an ecologically sustainable manner. The system depends on diversity, rather than pesticides and herbicides, reducing use of chemical inputs and meaning that established push-pull fields have significantly lower costs to farmers than conventional maize farming.

**Sources**

Gatsby Charitable Foundation (2005). The Quiet Revolution: Push-Pull Technology and the African Farmer. Gatsby Occasional Paper, April 2005.

Midega CAO, Khan ZR, Van den Berg J, Ogol CKPO, Bruce TJ and Pickett JA (2009). Non-target effects of the 'push-pull' habitat management strategy: parasitoid activity and soil fauna abundance. Crop Protection, doi:10.1016/j.cropro.2009.08.005.

Khan ZR, Midega CAO, Njuguna EM, Amudavi DM, Wanyama JM and Pickett JA (2008). Economic performance of the 'push-pull' technology for stem borer and Striga control in smallholder farming systems in western Kenya. Crop Protection 27: 1084-1097.

Khan ZR, Pickett JA, Hassanali A, Hooper A and Midega CAO (2008). Desmodium for controlling African witchweed: present and future prospects. Weed Research 48: 302-306.

Khan ZR, Muyekho FN, Njuguna E, Pickett JA, Wadhams LJ, Pittchar J, Ndiege A, Genga G, Nyagol D and Luswet C (2007). A Primer on Planting and Managing 'Push-Pull' Fields for Stem borer and Striga Weed Control in Maize (2nd Ed.). ICIPE, Nairobi.



Published in 2010. Written by Edward Hammond