***icipe* – Working in Africa for Africa…**

The International Centre of Insect Physiology and Ecology (*icipe*) was established in 1970 in direct response to the need for alternative and environmentally friendly pest and vector management strategies. Headquartered in Nairobi, Kenya, *icipe* is mandated to conduct research and develop methods that are effective, selective, non-polluting, non-resistance inducing, and which are affordable to resource-limited rural and urban communities. *icipe*'s mandate further extends to the conservation and utilisation of the rich insect biodiversity found in Africa. *icipe*'s Capacity Building Programme aims to promote the development and utilisation of sustainable arthropod management technologies by enhancing the research and training capabilities of countries in Africa. The Centre's major areas of capacity building activity are: (i) Capacity building and professional development of university lecturers, researchers, and professionals in insect and related sciences; (ii) institutional development by nurturing and strengthening higher education, research and extension institutions; (iii) promoting innovations on insect science, in collaboration with regional and national agricultural research and advisory services, and the private sector. These objectives are realised through postgraduate training at PhD and MSc levels, professional development schemes for scientists, and non-degree training for technicians, scientists, community members and extension workers.

The Climate-Smart Push–Pull Technology is a knowledge-intensive technology for use by the millions of smallholder farmers in Africa who need to manage the four most significant constraints to efficient production of staple cereal crops under hot, dry conditions (insect pests, i.e. stemborers and fall armyworm, the parasitic striga weed, soil degradation, and lack of livestock fodder). The strategy is contributing to increased agricultural productivity and enhanced environmental sustainability and resilience, while lessening the effects of climate change.

DONORS: European Union and Biovision Foundation, Switzerland.

COLLABORATORS: Kenya Agricultural and Livestock Research Organisation (KALRO); Ministry of Agriculture (MOA), Kenya.

Visit: www.push-pull.net

ACKNOWLEDGEMENT: We gratefully acknowledge the financial and technical support of our core donors: Swedish International Development Cooperation Agency (Sida); the Swiss Agency for Development and Cooperation (SDC); the Australian Centre for International Agricultural Research (ACIAR); the Norwegian Agency for Development Cooperation (Norad); the German Federal Ministry for Economic Cooperation and Development (BMZ); and the Government of the Republic of Kenya.

Photos: *icipe*

International Centre of Insect Physiology and Ecology (*icipe*)
PO Box 30772-00100 Nairobi, Kenya
Email: icipe@icipe.org | Website: www.icipe.org
Support *icipe*: www.icipe.org/support-icipe

Stemborer larva

Fall armyworm damage

USE THE CLIMATE-SMART PUSH–PULL TECHNOLOGY

and produce more maize and sorghum by controlling stemborers, fall armyworm and striga weed

Striga weed infestation

Climate smart push pull field

icipe

EUROPEAN UNION

biovision

Have you seen stemborer and fall armyworm damage your cereal crop?

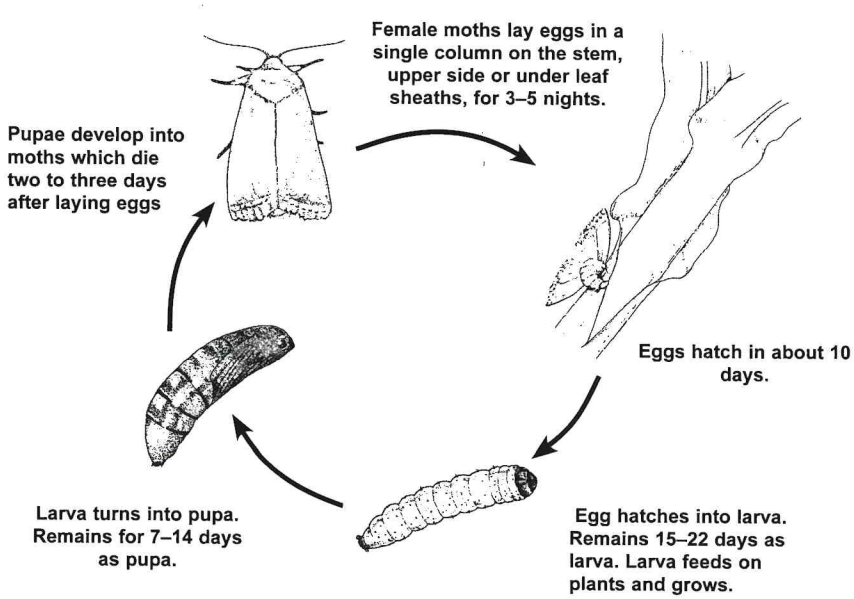
Harvest losses are big. If you were to harvest ten bags of maize or sorghum, you would lose eight sacks due to stemborer and *Striga*. Extreme fall armyworm attack and damage to crops can lead to minimal or no harvests.

Fall armyworm damage to cereal crops

How does the striga weed affect your maize or sorghum?

- *Striga* weed puts its roots into the roots of the maize or sorghum plant.
- *Striga* weed thus takes the food the maize or sorghum crop is trying to get from the soil.
- *Striga* seeds can stay dormant in the soil for more than 15 years and germinate when right conditions allow.

Life cycle of stemborers



Stemborer life cycle

How do fall armyworm get into your maize and sorghum crop?

The female fall armyworm moth lays eggs on leaves and stems, and these eggs take 3 to 5 days to hatch to larvae. The larvae then feed voraciously on the maize or sorghum leaves.

Larval feeding results into semi-transparent patches or 'windows' on the damaged leaves, and leave moist sawdust-like frass near the whorl and upper leaves. The destructive larval developmental stage takes 14–22 days.

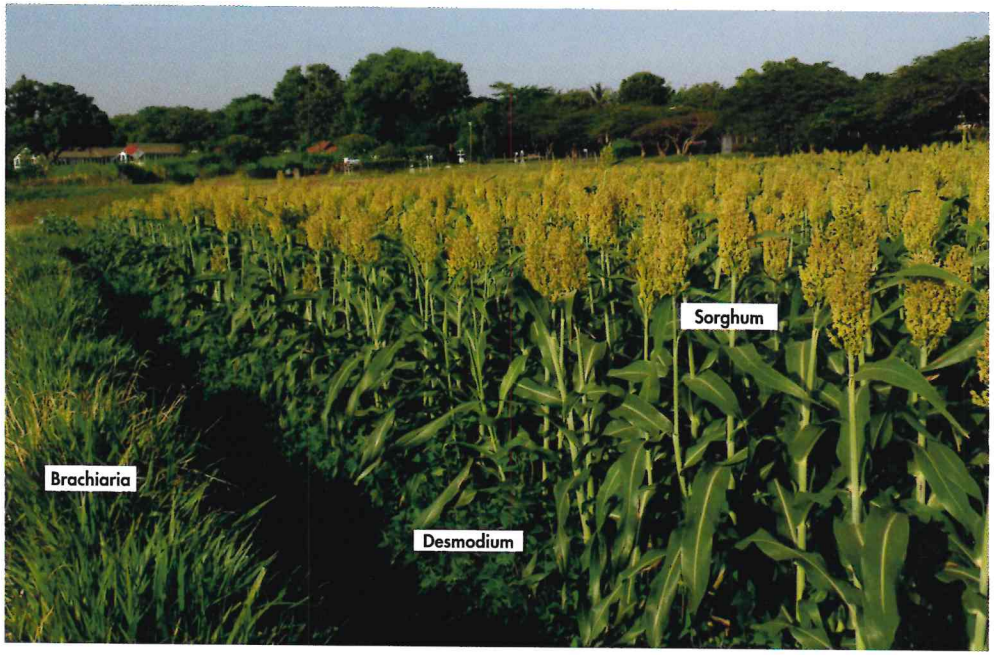
A mature caterpillar has a distinct white line between the eyes that forms an inverted 'Y' pattern on the face. The larva turns into a pupa and in 7–14 days forms into a moth, which emerges after 3 to 4 days and the cycle starts all over again. With the help of the wind, armyworm moths can cover distances of 30 to 100 km per day.

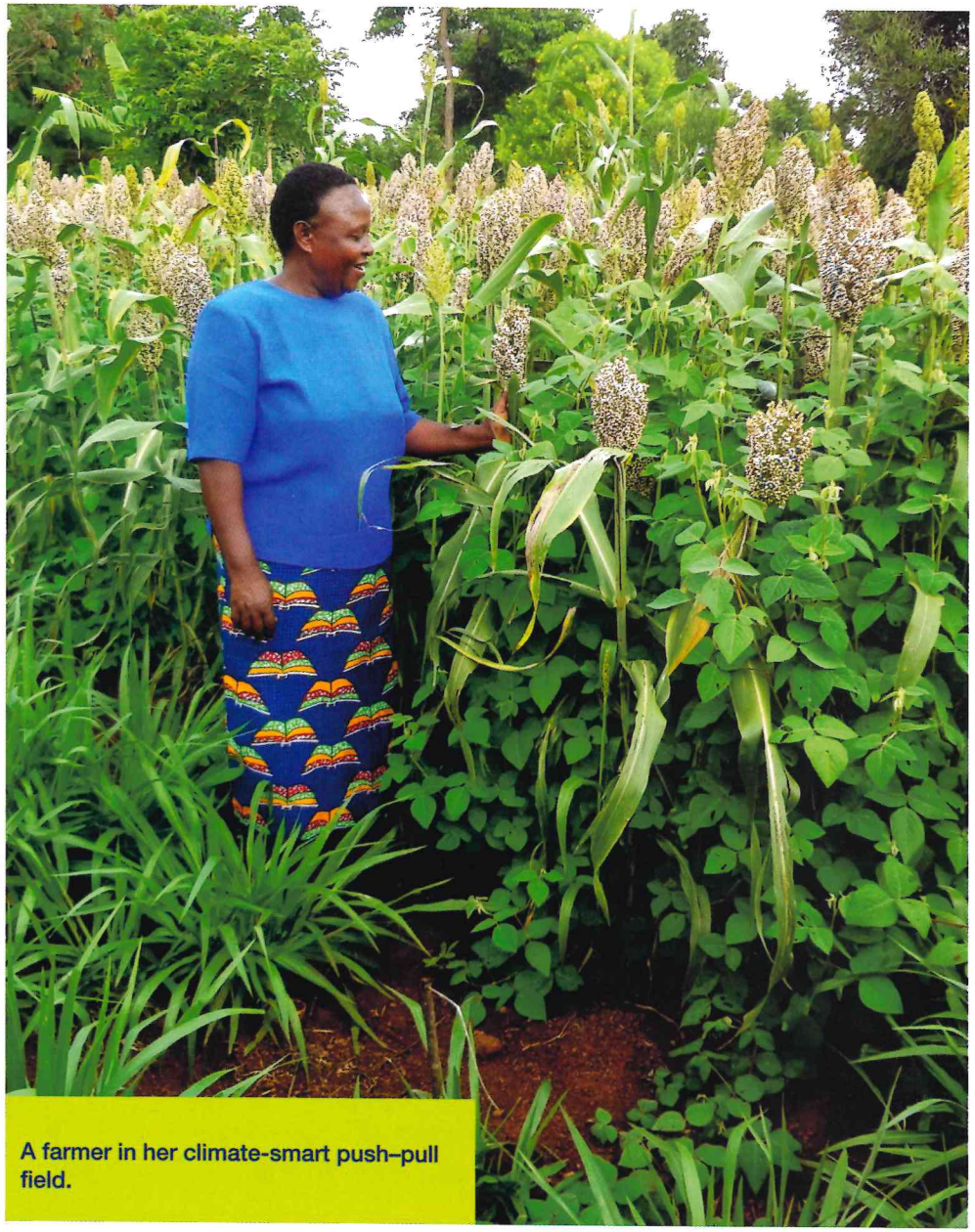
What is the climate-smart push–pull technology?

The Climate-Smart Push–Pull Technology is a cropping strategy to control stemborers, fall armyworm, and *Striga* weed in drier agro-ecologies. The farmers use drought-tolerant *Brachiaria* (cv. Mulato) grass and *Desmodium* legume for management of these pests in their maize or sorghum fields. *Desmodium* is planted in between the rows of maize or sorghum and produces a smell that 'pushes' the moths away from the maize or sorghum crop. *Desmodium* also covers the surface of the ground between the rows of maize or sorghum and chemically stops *Striga* weed from growing on maize and sorghum.

Brachiaria grass is planted around the maize or sorghum crop as a trap plant, and because it is more attractive to stemborer moths, it 'pulls' them to lay their eggs on it. However, *Brachiaria* grass does not allow stemborer larvae to develop on it, due to its poor nutrition for the larvae; thus, few stemborer larvae survive, saving the maize or sorghum crop. The same *Brachiaria* plant defence mechanism applies for the fall armyworm moth, whose larvae do not feed and damage the *Brachiaria* grass that surrounds the food crop; hence, minimal damage occurs in a well-established push–pull field.

A well-planted push–pull field should look like this:





A farmer in her climate-smart push–pull field.

How to plant a climate-smart push–pull field

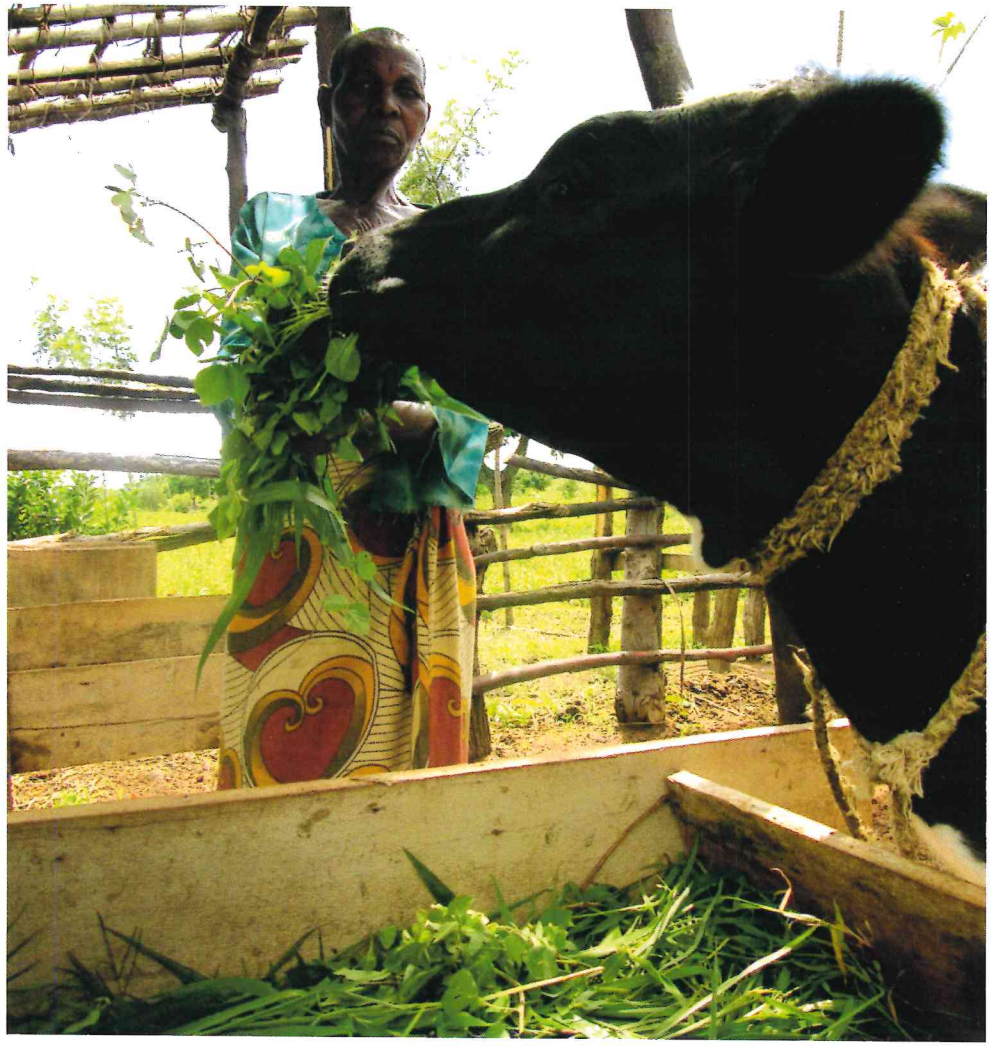
1. Plant drought-tolerant *Brachiaria* grass (cv. Mulato) in a border around the maize or sorghum (cereal) plot.
2. Plant at least three rows of *Brachiaria* all around the cereal field.
3. In the first year, one can plant *Brachiaria* before the rains so that it has a start on the maize or sorghum. The *Brachiaria* will attract the stemborer moths.
4. Get drought-tolerant greenleaf *Desmodium* seeds. You will need 1 kg of *Desmodium* seeds per 1 acre of land.
5. Prepare the soil carefully so that it is as fine as possible, for initial establishment.
6. Using a sturdy pointed stick, make a furrow in the middle of the rows where you will plant the maize or sorghum.
7. Mix the *Desmodium* seeds with superphosphate fertiliser (about one handful of seed and two handfuls of fertiliser)
8. If you cannot afford fertiliser, then mix the seed with fine dry soil. Sow it into the furrows you made and cover with light soil.
9. Plant *Desmodium* seeds with the rains for maximum germination.
10. Plant your cereal seed in rows between the *Desmodium* lines in your field surrounded by *Brachiaria*.
11. Weed the field at 3 and 6 weeks after planting. (In subsequent seasons, the *Desmodium* should not be allowed to overgrow in between the maize or sorghum crops.)
12. Keep the field weed free.

Advantages of adopting the climate-smart push–pull technology

- Increased maize and sorghum yields.
- A continuous supply of cattle green feed from the *Brachiaria* and *Desmodium*.
- Earn an income from sales of green fodder and *Desmodium* / *Brachiaria* hay.
- Nitrogen fixed in your farm by the *Desmodium*, hence saving on fertiliser costs.
- Soil protected from erosion as *Desmodium* acts as mulch.
- Soil retaining water as *Desmodium* acts as a mulch.
- Increase in profits from the sale of *Desmodium* seeds at high prices.
- Increase in cash from selling more milk from your cattle and goats.
- Saving on farm labour, as you do not have to pull out *Striga* weed.
- Cereal crop is protected from fall armyworm by this technology.

Where do I get Desmodium and Brachiaria seeds?

- Greenleaf desmodium seeds: agrovets and other farmers.
- *Brachiaria* (cv. Mulato) seeds: *icipe* and other farmers.
- Maize and sorghum: Seed companies, other farmers and selected stockists.



Livestock feeding on fodder yielded from push–pull plots.