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UPSCALING THE BENEFITS OF PUSH-PULL TECHNOLOGY FOR SUSTAINABLE
AGRICULTURAL INTENSIFICATION IN EAST AFRICA



This project has received funding from the European Union's Horizon 2020
research and innovation programme under grant agreement No. 861998.

What is Push-Pull?

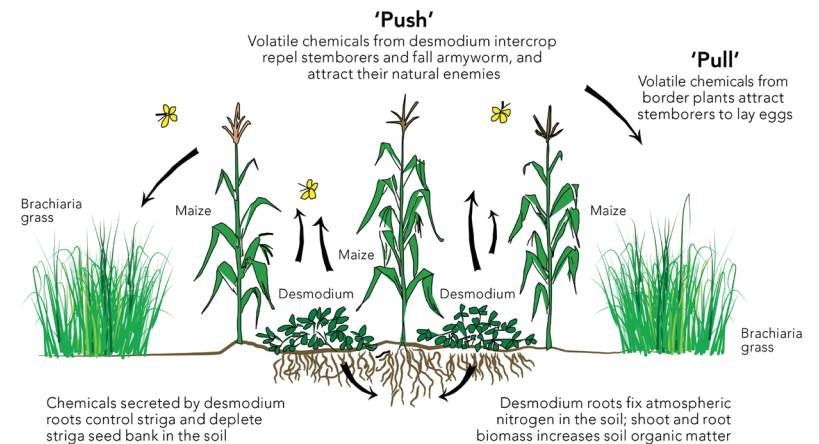
Push-pull is a farming system where a cereal crop is intercropped with the legume desmodium, and the plot is surrounded with Napier or brachiaria grass for control of stemborers, fall armyworm and striga weed. If well established, the plot produces a high yield of healthy cereal crops. The desmodium and Napier or brachiaria grass also provide nutritious and quality feed for livestock.



Using the push-pull system for planting stops the damage caused by stemborers (left), fall armyworm (middle) and striga weed (right)

How does push-pull work?

Push-pull stops stemborers and fall armyworm attacking food crops by using rows of desmodium planted between the rows of cereal plants, and a border of Napier or brachiaria grass planted around the plot. Desmodium is a 'push' plant, which pushes the moth away from the food crop when it is time for it to lay its eggs. Napier and brachiaria are 'pull' plants, which attract the moth so that it lays its eggs away from the crop.



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Push-pull stops striga taking away nutrients from the food crop because natural chemicals in the desmodium stop the roots of the striga from growing and attaching themselves to the roots of the crop plants.

On top of dealing with stemborers, fall armyworm and striga, using push-pull improves food safety by reducing aflatoxin in maize grains that seriously harm human health. It also improves soil health and fertility.

Desmodium fixes nitrogen, improves carbon sequestration and availability of phosphorus in soil, adds organic matter to the soil, conserves soil moisture and enhances soil biodiversity, thereby improving soil health and fertility.

It provides ground cover and, together with the border of Napier or brachiaria, protects the soil against erosion. Perennial plants of desmodium, Napier grass and brachiaria help in intensifying cereal-livestock systems by providing high quality animal fodder throughout the year.

What do the Push-Pull fields look like?



A Conventional Push-Pull field with silverleaf desmodium and Napier grass (upper left), Climate-Smart Push-Pull field with greenleaf desmodium and brachiaria grass (down left).



In drier areas, the best plants for push-pull are greenleaf desmodium between the rows of crop, and brachiaria grass around the border.

Following are success stories of Push-Pull farmers from Eastern Africa.



A dairy goat feeding on fodder from Push-Pull companion plants.

Success Stories of Push-Pull Farmers: 1. Food Security through diversification

Grace Anyange's three-acre farm feeds her and the 14 other members of her family. She heard about push-pull when her husband attended a baraza (farmers' meeting) in Maseno district, Kenya, in 2011.

In 2012, she planted push-pull on a quarter-acre of her farm. Impressed by the increased maize yield and supply of fodder, she has added another quarter-acre every year since then.

Before adopting push-pull, Grace and her family only ate home-grown maize for two months of the year. "Now", she says, "we can feed this huge family!" – normally she does not have to buy in any maize.

Their cows are also healthier, and they no longer lose calves through lack of milk. "If my husband hadn't gone to that group meeting," she says, "we wouldn't be where we are today." Grace says that push-pull has brought other changes: "The training gave us the curiosity to try things out." She keeps crossbreed goats in a dairy unit, and hens in a poultry unit.

Now Grace raises rabbits, too – and says there is a ready market. The family also eats meat much more often. Grace became a farmer-teacher in 2013, and has trained more than 20 groups in push-pull.

She says that helping others towards food security is a job she loves. "They pray for me every day," she says, "because I have made a difference in their lives."



Photography: icipe

Photography: icipe

2. Paying school fees with push-pull maize

Before she adopted push-pull in 2013, Eunice Baraza says that there was more striga than maize on her four-acre farm in Tororo district, Uganda. “It was like I was growing the flower as a crop!” she says.

When she attended a group meeting in her village, Eunice was inspired by a set of visiting push-pull farmers from Kenya. She received further training and established her first plot, adding a climate-smart push-pull plot the following year.

Eunice is full of praise for the field staff who helped her learn how to use the technology. “I have never seen an organization with such committed staff as *icipi*. They give you constant encouragement, even when you are down.

There was a time when we were really struggling with our push-pull and they pitched in to help on the farm.” Eunice now produces enough maize to feed her family, and has some surplus to sell. She also produces surplus fodder. She sells some for cash, and exchanges some for milk to feed her family.

Eunice left school in Primary 7, and she wants all her daughters to stay at school longer than she did. Her oldest daughter had to leave school in Senior 1 because of lack of money for school fees, but Eunice hopes that the extra cash from push-pull gives her the chance to go back.



Photography: icipe

3. Learning new skills through push-pull

When Dorcas Josephat’s husband was disabled by an accident in 2011, she and her five children shouldered the burden of farm work.

That year, she attended a training on push-pull and women’s role in agriculture, delivered through a local extension centre funded by the Diocese of Tarime, Tanzania.

The training triggered the formation of a women farmers’ group. Dorcas and some other members got permission from their husbands to plant push-pull. The first half-acre Dorcas planted with push-pull was far from her house, but close to a river and a road.

Many people saw the fine crop of maize and fodder and asked her about it. Dorcas remembers that she “began to become popular.”

She also began to develop her skills in reaching out to other farmers and showing them how to use push-pull. Dorcas was eventually elected as a farmer-facilitator and planted a plot nearer the house.

She says that the “most positive things about push-pull are that my eyes are opened as a woman, and that I have extra income.” She makes money from selling her maize, surplus fodder, and the milk her cows produce on their better diet. Daily milk production has risen from below 10 litres a day to between 15 and 18.



Photography: icipe

4. Saving money from a small plot

Like most farmers in Kenya's Vihiga district, Rumona Mayoka only has a very small plot of land to help her make ends meet for her family. She has always grown maize on her quarter-acre, but striga had taken hold, and the shamba was purple. She was forced to rely on her income as a tailor, and contributions from her husband who works away, to feed and pay school fees for her five children.

In 2012, she heard about push-pull at a workshop for women with disabilities. She liked the technology because it controls striga, but also because it gave smallholders a chance to cultivate with little labour. She arranged for an *icipe* field officer to visit her own group, and they established a group plot on rented land.

Rumona then persuaded her husband to let her start cultivating push-pull on their land. She no longer buys maize all year round. Instead, she buys when the price is low, and stores her harvest for home consumption, selling the surplus when prices in the market rise. She sells her brachiaria grass and desmodium to neighbours with dairy cows, and puts the income into a merry-go-round savings scheme.

Rumona says that push-pull has improved her income and her confidence. It has helped her to see that she is equal to able-bodied people, and that she has the power to do what other people do.



Photography: *icipe*

5. Working together to succeed with push-pull

Margaret Ombul is a member of the Pioneer Self-help Group. Since forming in 2011, the group has gone from strength to strength, and push-pull has been key to that success. All 21 members have adopted it. They have a demonstration plot on Margaret's farm and are using cuttings from it to expand the plots on their own farms.

They also have a 'bank' of disease-resistant Napier grass which they are using to replace unhealthy plants and provide clean planting materials to other community members. When they first took on push-pull, few of the group members had any livestock, so they sold their push-pull fodder to neighbours.

Eventually, thanks to the quantity of fodder they were producing, the Pioneer group also received dairy cows from an NGO. The heifer that Margaret received from the NGO has just calved, and she will pass the calf on to another member.

The Pioneer members agree that they used to work much harder, on much larger plots, to produce less maize and sorghum. Cultivating push-pull means that they can save time for other things. They also say that selling desmodium and reducing soil erosion are other benefits of push-pull. Why has the group been so successful? "Our objectives are clear," says Margaret. "We are committed, and we have full participation. And we share the work, so that none feels overburdened."



Photography: *icipe*

6. Sustained high yield means surplus grain

For twenty-seven years, Mary Otuma has farmed alone on her one acre of land in Bondo, Kenya, that she inherited when her husband died. She supports her daughter-in-law and three granddaughters.

In 2006, Mary planted a 21 x 25m plot of push-pull with maize. Yield rose from 10 to 70kg in the first season, and to 120kg in the second season. Since then, she says, yield only falls if there is a dry spell.

But after a very long dry period, Mary's silverleaf desmodium began to dry out. When she heard about climate-smart push-pull,

she planted a 15 x 15m plot of sorghum with greenleaf and brachiaria, and saw yield rise from 6 to 48kg.

After adding this second plot, Mary bought a sheep, which is tethered and fed on desmodium.

A third plot of maize with climate-smart push-pull, was added the next season, and a fourth in 2013, using vines and splits from other plots. Mary's harvest from all four plots meant that she produced a maize surplus for the first time in her life, selling two 80kg sacks of grain.

When Mary has planted the fifth plot she is planning, her whole farm will be under push-pull.



Photography: icipe

7. Push-pull is sustainable organic agriculture

Paskalia Shikuku is a farmer-teacher who works through Mungao Sustainable Agriculture, an umbrella community-based organisation, which began in 2008 with 20 farmers who worked together to learn about sustainable organic agriculture.

In 2011, Paskalia met *icip*e field worker Isaac Onyango, who taught her how to cultivate push-pull. She planted push-pull on her own farm and in the first season worked with seven other farmers. The next season, she worked with twenty more. When Isaac introduced greenleaf desmodium and mulato, things really took off. Paskalia has now spread push-pull to 130 farmers, including 100 women. She says that adopters “like the money and the fodder

that comes from push-pull, but mostly it is about the striga weed.”

Paskalia's own farm is organic: she uses no chemical fertilizers, pesticides or herbicides. Her top-dressing is liquid manure, plant tea and bio-slurry. She intercroops with desmodium to prevent soil erosion. Her two push-pull plots and three local cows are the centrepiece of this agroecological farm which produces groundnuts, soya, maize, beans, sorghum, cassava and vegetables.

Paskalia's four daughters were seven, five, four and three years old when their father died. They all went to high school, but the third did O-levels, and the fourth is now in college. The extra income from push-pull, says Paskalia “is why the last two ladies have gone to school better than the first two.”



Photography: icipe

8. Even a small field can help you diversify

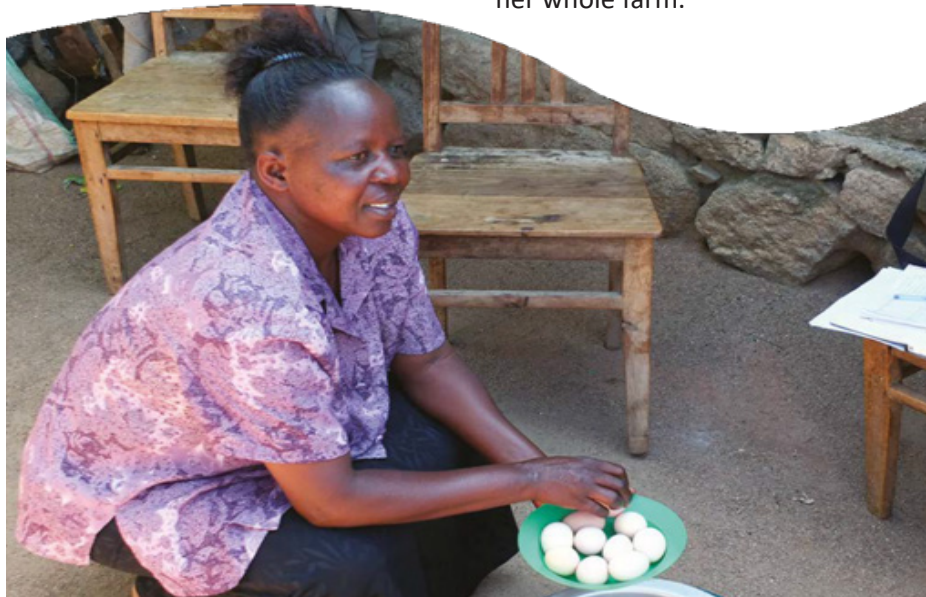
Most of the land on Tausi Sono's six-acre farm is under drought crops like cassava. But she has always grown a little maize.

When she first saw a push-pull plot in 2013, she was not sure about the technology. But she tried it out on a small portion of her maize plot, and the two bags she harvested were enough to convince her that push-pull tackles striga and gives a good yield.

Instead of expanding production, Tausi decided to concentrate all her efforts to grow maize on that small plot, and made a plan to invest the profits in diversifying her farm.

In poor health, she knew she did not want to keep a dairy cow to eat her push-pull fodder. But she wanted to do a project to get income, in the same way that her neighbours were selling milk. So Tausi used the money she earned from selling 12 bags of push-pull fodder to buy chickens and build a poultry unit.

She has nine laying hens, and she gets money every day from selling eggs. Tausi saves in all three savings schemes run by her farmer groups: a merry-go-round fund, an emergency fund, and an education fund for school fees. Together, from a small plot of land, push-pull, poultry and savings have given a new stability to her whole farm.



Photography: icipe

9. Push-pull fodder – less work, more money

Rebecca Thomas's husband is member of a farmer group in Tanzania, and the family have benefitted from a dairy cow. Rebecca decided to adopt push-pull in 2013 to produce fodder.

There is no striga on her farm, and she is not much troubled by stemborer. But desmodium and brachiaria offered her a way out of the relentless work of finding enough food for the cow.

"The animal was a lot of work at first," says Rebecca, and she almost lost hope. "No woman wants to go out to look for grass on top of household chores," she says.

This changed when the animal calved, and began to produce 8 litres of milk a day. Some of the income from milk is for school fees and household items, but Rebecca says that the biggest benefit is that she can access credit, and save money.

"When I have feed to cut and carry," she says, "dairy is the best project. I know I always have money." When Rebecca and her husband lost their house following a business dispute, the milk cow was used as security for the loan they needed to build another.

Rebecca decides how their milk money is to be spent, and every week, alongside all her other expenses, she puts an agreed amount into the moneybox to pay off the loan.



Photography: icipe

10. Spreading the word about push-pull

Millicent Achieng has been a peer farmer for nearly two years. She has a demonstration plot of climate-smart push-pull on her farm in Homa Bay district, Kenya, where she trains groups about push-pull and its benefits. For example, she recently introduced push-pull to a group of 25 women in Kawaware.

Once their training was completed, they received seeds from *icipe*, and Millicent supported them to put what they had learned into practice. "I like being a peer farmer," she says.

"I like giving information to those that don't know." Millicent was trained as a peer farmer by farmers' groups that

are *icipe's* partners in spreading push-pull. Trainees are taught and mentored in groups, returning to discuss with their peers and mentors the challenges they encounter in the field.

Millicent is also an active member of her church, and she combines her work as a peer farmer with her preaching. "Wherever I go," she says, "I talk to people. I tell them that our health is maintained well with organic farming." Her services as a facilitator are increasingly in demand.

Her delivery of talks on healthy living, nutrition and sustainable agriculture at a church camp involving 26 local congregations led to many enquiries, and to her linking six different groups with *icipe* to receive training in push-pull.



Photography: *icipe*

How do I start using push-pull?

1. Clear your land during the dry season and prepare the soil to make it very fine. Demarcate the push-pull plot to plant three rows of Napier or brachiaria grass around the border of the plot, as shown in this drawing.



Drawings: Green Ink

2. Plant alternate rows of desmodium and food crop. The rows of the food crop should be 75cm apart. Make sure that you start and finish with a row of desmodium. You will need 1kg of desmodium seed for 1 acre of land. Plant desmodium with the rains for maximum germination.

3. Early weeding is very important for establishing a push-pull plot. Weed once when the crop is three weeks old and once when the crop is five weeks old.

4. Trim desmodium after three and six weeks so that it does not overgrow in between the maize plants.

5. Push-pull system has now been successfully integrated with high value vegetables, resulting in reduced pest damage, enhanced technology adoption and improved household nutrition, incomes, and livelihoods (please see photo on right).



A Push-pull field integrated with vegetable crop (Kale)

Photography: *icipe*

To learn more about how to get started with push-pull please contact:

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 861998.