

Push-pull and gender:

improving livelihoods and social equity

The landscape of Sub-Saharan Africa is dominated by smallholder family farms, where women provide the majority of agricultural labour but seldom own the land they farm. Women often lack some or all of the resources needed to grow enough food to ensure household food security – whether seeds, tools, fertilisers, knowledge or the power to make strategic decisions about the farm.

In this region, grain is at the heart of the household economy, grown for both consumption and sale. But cereal production is constrained by invasive insect pests and weeds, degraded soils and increasingly erratic seasonal rainfall. Getting enough to eat is a constant worry for too many households. The need for adaptive agricultural practices that can cope with increasingly variable climatic conditions and still produce adequate food has never been greater; but neither has the need to ensure that these practices work for and are extended to female as well as male farmers.

Push-pull, developed by Professor Zeyaur Khan and his team of scientists at the International Centre of Insect Physiology and Ecology (icipe), in collaboration with Rothamsted Research (UK) and national partners, is a novel conservation agriculture technology. It effectively tackles the four greatest productivity constraints facing the African cereal farmer: stemborers, the recently introduced and extremely voracious fall armyworm, the parasitic weed striga, and diminishing soil fertility.

Targeting women and men equally has always been a basic principle in the dissemination of push-pull, which has particular benefits for women farmers. Adopting the technology usually means producing more grain using less labour, reducing the time women must spend digging and weeding, and freeing them to invest their time in more productive activities. It also often increases women's incomes.



Consolata James adopted push-pull in 2002 and, thanks to the improved yields and diversified income the technology has brought, her family is now food secure. This success helped her stature in the community to grow. She became a farmer-teacher and in 2006 was ordained as a pastor. She is now happy to combine farming, teaching and pastoral duties. "Although I schooled only up to Form One," she says, "many people have learned from me."

**236,000 FARMERS
HAVE ADOPTED
PUSH-PULL SINCE
1998. OF THESE, 52%
ARE WOMEN.**

Push-pull dissemination has been built on respect for farmers' knowledge, their capacity to learn basic agro-ecological science, and their potential as peer educators. As a result, in addition to benefitting food security, education, health and incomes, dissemination of the technology has also built skills, confidence and networks among female farmers.

What is push-pull?

Developed in 1997 by a team of scientists at *icipe* and Rothamsted, push-pull is a novel cropping system designed to integrate pest, weed and soil management in cereal-based farming systems. It involves driving cereal stemborers away from the crop by using a repellent intercrop plant, desmodium (the 'push'), while at the same time attracting stemborers with a border crop of Napier grass or brachiaria grass trap plants (the 'pull'). Chemicals released by the desmodium roots also eliminate the troublesome parasitic weed striga.

When farmers adopt push-pull they not only achieve a dramatic and sustainable increase in cereal yields, they also benefit from enhanced soil fertility and obtain year-round fodder for their animals. The repellent properties of desmodium also appear to be highly effective in guarding against attack by fall armyworm, a potentially devastating insect pest that first appeared in Sub-Saharan Africa in late 2015 and has since spread across the continent.

During the past 25 years, Professor Khan and his team of scientists at *icipe* have consulted farmers at every stage of the development and adaptation of the technology and encouraged adopters to educate other farmers. This approach means that the spread of push-pull is rooted in a set of farmer-centred and inclusive extension practices.

The close relationships built with farmers have helped *icipe* scientists to respond to changing needs and circumstances by adapting the technology. When farmers reported that the original push-pull companion plants could not always

withstand the increasingly frequent high temperatures and long dry spells, the *icipe* team, in collaboration with Rothamsted Research, developed 'climate-smart' push-pull, which includes two drought-tolerant companion plants.

Gender inequalities in smallholder agriculture...

In much of Africa, ancestral land has been passed from father to son for generations. On a traditional smallholder family farm, while the entire household works together, it is men who have title to the farmland, decision-making power, and control over the sale of farm produce. The distribution of agricultural labour throughout the seasonal cycle is also gendered: men traditionally clear bushes and work with ox-drawn ploughs, while women and children dig and weed by hand, and harvest and process the crops.

This context limits the rights and potential of many women farmers. Their social and economic position is further constrained by structural imbalances, particularly their access to education. Although there is now gender parity in primary education, less than half of Kenya's girls enrol in secondary school, and even fewer access higher education.

HIV/AIDS has had a profound effect on gender relations. High mortality rates, primarily among men, mean that most households include several orphans, women are taking on even greater responsibilities, and there are many more female-headed households. One outcome



Hand-weeding striga, which attaches itself to the roots of the cereal crop, is a particularly physically demanding task, usually performed by the women. Helen Ndede, pictured in the push-pull plot she planted six years before, says "Before, this field was full of purple flowers. When I tried to pull the striga weed, it was so strong I would fall over."



The St Mary's Women's Group, pictured with Professor Khan, adopted push-pull in 2013. Groups like these are an important source of mutual support for women farmers, and activities often include micro-credit and rotational savings as well as joint learning of agricultural technologies.

How does push-pull work?



A **conventional push-pull** plot planted with a maize crop. Push-pull was introduced to farmers in 1998 using silverleaf desmodium (*Desmodium uncinatum*) as an intercrop and Napier grass (*Pennisetum purpureum*) as a border crop.



Push-pull effects 80–90% control of fall armyworm in Kenya and 65–75% control in Uganda. The control is primarily via the ‘push’ effect of desmodium, but some farmers have reported egg-laying of fall armyworm on Napier grass, an inappropriate host.



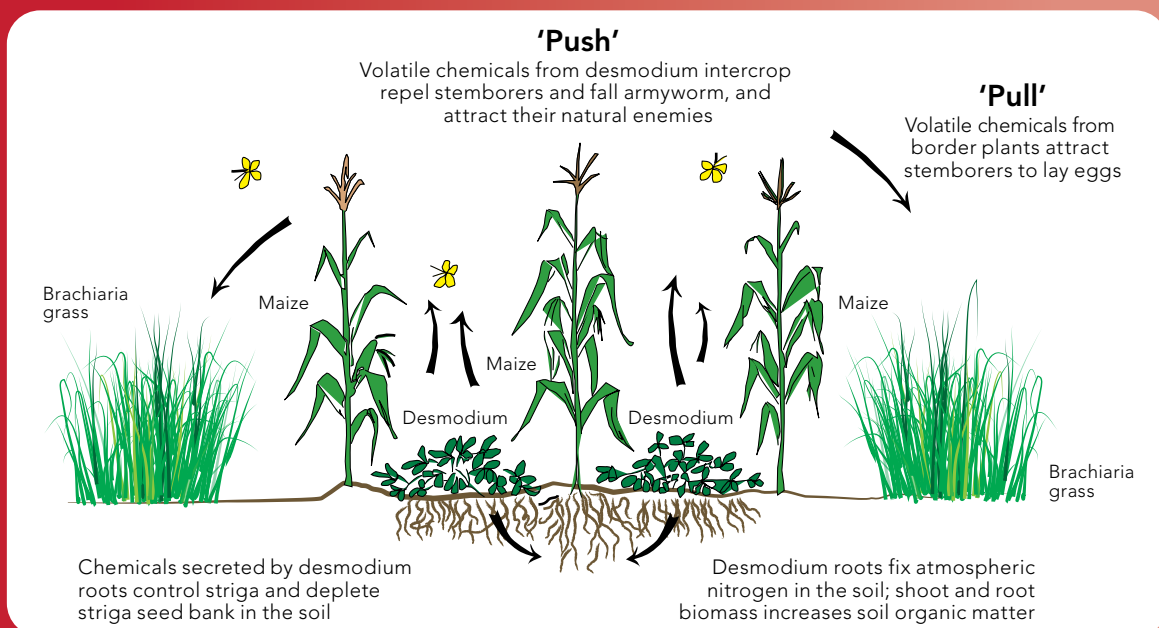
A **climate-smart push-pull** field planted with sorghum. Climate-smart push-pull was developed in 2011 to withstand long droughts and high temperatures. Introduced to farmers in 2012, it uses two drought-tolerant species: greenleaf desmodium (*Desmodium intortum*) as an intercrop and brachiaria grass (*Brachiaria* ‘Mulato II’) as a border crop.

Push-pull prevents stemborers and fall armyworm attacking cereals by intercropping with a ‘push’ plant, desmodium, and planting around this intercrop a border of a stemborer-attractive, ‘pull’ plant, Napier grass or brachiaria grass.

In addition to repelling or pushing the stemborers and fall armyworm away from the crop, desmodium also suppresses the parasitic weed, striga. It stimulates germination of the striga seeds, then inhibits growth of their roots, thereby preventing attachment to host plants.

On top of dealing with stemborer, fall armyworm and striga, the leguminous desmodium fixes atmospheric nitrogen, 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 surrounding grass trap crop, protects the soil against erosion.

See www.push-pull.net for more information.



of these changes is that the role of women as primary breadwinners has become more socially acceptable.

The need to care for those bereaved by AIDS or living with HIV has also caused shifts in the household and kinship networks that provide a basic social safety net for rural Africans. On the eastern shores of Lake Victoria, cooperative groups – particularly women’s groups – have always formed an important part of social and economic life. But in recent decades they have also gradually become the principal social mechanism for the delivery of services and programmes, ranging from healthcare to agricultural extension and small enterprise development – a process which has accelerated since the pandemic.

...and aiming for gender equity in the spread of push-pull

Jimmy Pittchar, *icipe* social scientist, explains that “*icipe*’s development philosophy is guided by the premise that ownership of a productivity-enhancing agricultural technology by its beneficiaries is the key to sustainable uptake.” Because of this, he continues, “we pursued a deliberate policy of working equally with male and female farmers, because women provide most of the labour on farms, and through them the greatest impact of the push-pull innovation on farm households could be realised.” But in order to reach women with the vital information they need to improve food production, it is necessary to work

directly with them where possible, but also to work with men, and to encourage men and women to work together.

To achieve the objective of gender parity in extension, *icipe* has relied on three interlinked and overlapping pathways: (a) working with those women farmers, many of them widows, who have access to land and the necessary power within their households to adopt new farming practices; (b) working with male farmers with the primary objective of improving household food security, but also ensuring that information about push-pull reaches the women in their households; and (c) working through groups, often in partnership with other implementing organisations and donor agencies, many of which specifically target support to women.

The third pathway has proved particularly fruitful in reaching vulnerable women who lack access to agricultural resources, but who are already working together to improve their food security or increase their incomes, and are often able to add push-pull to their portfolio of collective activities. It has also been a useful way to reach and encourage men and women who are working in partnership. Through following these pathways, push-pull extension has not only delivered knowledge and benefits directly to women, but also created a positive enabling environment affording them greater power in making decisions that affect their lives and over control of household resources.



The Yenga Push-Pull Farmers Group in Kisumu County was started in 2008 and now has 135 members, including 75 women. “It has united us at the village level,” says chairman Boniface Ongondo Ahono. “It is most important that we include young widows and other women.” Here, group members display the One World Award which their treasurer Rachel Agola (fifth from left) accepted in 2010.

Women and positive outcomes of push-pull



Before she adopted push-pull on her own farm, Juliet Mwendha says that striga was a very bad problem and soil fertility was poor. Afterwards, the plots were cleared of striga. With less labour needed to produce food for her own family, Juliet was free to dedicate more time to the church group garden.

Improving household and community food security

One of the most attractive outcomes of adopting push-pull for women farmers is that they can produce a reliable crop that is free from pests and weeds with relatively little labour. Improved household food security is one of many benefits associated with this outcome, but many women also drive local initiatives aiming to improve the food security of the poorest in their communities.

In Uganda's Bugiri District, Juliet Mwendha adopted push-pull on her family farm in 2008. She and her husband are active members of the Mutere Catholic Church Group, which has taken on the responsibility of feeding and paying school fees for 100 orphans. Group members work together in their shared garden, five acres of land borrowed from Juliet and her family.

The group grows a range of crops, with three push-pull plots at the centre overseen by Juliet. The maize harvested from these plots goes to feed the orphans, is taken to the schools where some of them board, or sold to pay their school fees in cash. The fodder goes to a flock of ten local goats, which Juliet keeps for the group as a form of savings.

Enabling the education of girls and young women

Whether in Kenya, Tanzania or Uganda, when push-pull farmers are asked what they did with any extra income gained from adopting the technology, they almost invariably reply "we paid school fees." Meeting the costs of education – which increase steeply from the books and uniforms required by most primary schools to fees for secondary and college education – is a preoccupation for many, especially when families are large and often include one or more orphans.

When faced with financial constraints, most families still tend to give priority to educating boys. In the majority of cases, adopting push-pull increases household income through improved production of grain, milk or both. In many push-pull families, this means that girls are less likely to be excluded from education through lack of resources.

Many schools in the region accept payment in kind, with milk and maize being the most common form of currency. For Maureen Ambubi, a widow in Kenya's Vihiga County, sending her youngest girl to school with two litres of milk was the start of a journey that ended with both her daughters and a son attending university, all funded from the proceeds of her push-pull plots.



In Busia District, Uganda, proceeds from the push-pull plot where Annette Taaka is pictured have funded the secondary education of six girls, including four orphans.



Margaret Anyango is happy that her communication talents, fostered by the Participatory Video Initiative, are helping other farmers learn about sustainable production. Since 2012, she has been involved in video training for more than 250 farmers, sharing information on push-pull planting and management. She has also developed her own farm enterprise, with push-pull fodder supporting her two cows and calves, one goat and four sheep. She has recently become aware of the threat of fall armyworm, and has seen for herself how maize planted with an intercrop of desmodium can escape damage from the caterpillars, while the surrounding fields are badly affected.

Building women's knowledge and skills

Education is about more than ensuring that children attend school; it is also about life-long learning. Push-pull extension, with its strong emphasis on teaching farmers about how the technology works and fostering peer education, has contributed to building the knowledge, skills and self-belief of many women farmers. For some, it has also earned them greater respect from their husbands, allowing them more decision-making power within the household.

Push-pull has created a network of farmer-teachers across the region, who support *icipe* technicians in training other farmers in the technology, travelling from farm to farm to support implementation. For many women

farmer-teachers, the experience is transformational, building their social confidence and networks. One such is Rispa Ouso: after adopting the technology in 1998, she went on to plant a total of four plots on her family farm, and built up strong friendships with other adopting farmers and *icipe* field staff. A natural mobiliser, Rispa was elected as a farmer-teacher by her fellow farmers in 2005, going on to participate in numerous training activities and field days. The self-confidence she gained helped her decide to become a community health worker.

Since 2012, *icipe* has been pilot-testing participatory video as a learning tool for non-literate farmers. Margaret Anyango, who has been a member of the Yenga Push-Pull Farmers Group since 2009, has learned how to use a video camera and computer to record farmers' own narratives and use these to encourage uptake and good agronomic practices.

Exposure and respect

Many of the female push-pull farmers whose skills and talents have been nurtured by the programme's activities have become leaders in their communities and role models for other women. A key part of their growth and development is exposure to new experiences and ideas. For some, this has meant participation in farmers' forums and media appearances, while for others – like Yenga Push-Pull Farmers Group treasurer Rachel Agola, who travelled to Germany to receive her One World Award – it has resulted in the chance to travel within their own countries and even overseas.



Supporting women like Rita Ochwo, a farmer-teacher from Uganda's Tororo District, is essential to ensuring that the continued spread of push-pull contributes to more equitable gender relations. Rita says that her experience with the technology has brought her respect in the community, lifted her children out of poverty and malnutrition, and given her the assets and self-confidence she needed to start a small poultry business.

Mary Rabilo and her husband feed 13 people from the 3.5 acres of land that they farm in Homa Bay County, Kenya. She adopted push-pull in 2000. Although Mary herself only attended school to Class 7, the profits from her push-pull plots have helped five of her daughters into college and university. These young women are all now working and giving financial support to their parents.



When Mary received a dairy cow from the government's Livestock Development Programme, she was advised to use commercial dairy meal to feed the animal, which incurred high costs. So she developed her own alternative dairy meal from maize, desmodium leaves and ground fish, a cheap and locally available ingredient. When she became a farmer-teacher, she taught this innovation to other farmers alongside their training in push-pull.

Push-pull has supported women scientists through hosting doctoral researchers registered at a number of universities across eastern and southern Africa. Microbiologist Nancy Njeru is one of nine women who have completed PhD studies with the push-pull programme in *icipe*. In addition to discovering why push-pull can protect maize against ear rot fungus, she was able to identify the source of associated toxins, showing that push-pull maize had less fungal infection and less toxin than monocropped maize. This could have major implications for food and feed safety.

A powerful force for change

Transforming gender relations to allow the women who labour on African small-scale farms to access the resources they need to increase productivity and improve food security can only happen gradually. But incremental steps, taken by farmers themselves and the scientists and extensionists who support them, can steadily build into a powerful force for change.

It is crucial to ensure that as many women farmers as possible can access new agricultural technologies. It is also important to support women – not only in farming, but also within the agricultural sciences and extension – as role models and leaders. While the push-pull team have achieved their goal of gender parity in extension, barriers

to African women entering careers in agricultural science remain high, and the majority of scientists are men.

One of several exceptions is Matilda Ouma, a home economist who worked with push-pull farmers for nine years before embarking on a career in the Ministry of Agriculture and academia. Not only has she extended the technology to many thousands of women, she has also acted as mentor to 12 World Food Prize interns, several of whom have gone on to be advocates for gender empowerment in international arenas.

One former intern, Bian Li, went on to become director of planning at the World Food Prize Foundation. She is an



"I like working with communities," says Matilda Ouma (centre). "Being a woman and empowering fellow women is very important to me."

Oxfam Sisters on the Planet Ambassador, and is now co-founder and chief executive of The Hungry Lab. Her internship research with push-pull farmers, undertaken in 2000 when she was just 18 years old, examined the influence of gender on food security. She concluded that "cultural barriers must be broken in order to allow women more freedom to produce," and that this could only happen when men and women work together.

Lessons from the past 20 years of push-pull dissemination can be summarised as an agenda for interlinked changes in agricultural practices and gender relations.

- Continue to ensure that women have the necessary inputs to take up push-pull – including land, tools, knowledge, seeds and decision-making power – and are supported as peer educators, advocates and role models, enabling more women to adopt the technology and strengthening their positions in society and within their households.
- Improve access for women who lack one or more of the necessary inputs to take up push-pull, through working in partnership with other structures and interventions that exist to support them, particularly through work on communal group plots.
- Continue with ongoing efforts to encourage more women into scientific and agricultural careers, in Africa and overseas.

“THE GENDER AND EMPOWERMENT CONVERSATION IS NOT JUST ABOUT WOMEN. IT NEEDS TO INCLUDE MEN.”

BIAN LI

FORMER DIRECTOR OF PLANNING, WORLD FOOD PRIZE FOUNDATION AND BORLAUG–RUAN INTERN AT THE PUSH-PULL PROGRAMME IN 2000

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