



THE WORLD FOOD PRIZE



icipe
African Insect Science for Food and Health

Shaping Young Scientists and Shaping Future Science: mentoring World Food Prize interns through push-pull technology

"I left icipe knowing that the work I had done in the push-pull programme had given me a strong foundation for future contributions to food security and agricultural development through science and humanitarianism.

I intend to dedicate my professional life to the cultivation of peace, food security and global development through scientific research."

Anthony J. Wenndt

2011 Borlaug-Ruan Intern and John Chrystal Award winner

Anthony J. Wenndt with his mentor Dr Zeyaur Khan in the push-pull garden at icipe's Thomas Odhiambo Campus at Mbita Point, Kenya.



The International Centre of Insect Physiology and Ecology (*icipe*) in Kenya is an independent international research organisation with a strong African identity. According to its third Director General, Professor Christian Borgemeister, "*icipe* has always had a dual mission of conducting fundamental scientific research while providing practical solutions that make a real change in the lives of people in Africa".

This mission, together with its mandate to develop the scientific knowledge and capacity of young scholars in insect science, has made *icipe* an ideal host institution for the World Food Prize (WFP) Foundation's Borlaug-Ruan International Internship programme. Borlaug-Ruan Internships provide talented American high-school students with a chance to do original research with international scientists in places where poverty and food insecurity are endemic.

The WFP Foundation and *icipe* have had a close relationship since 1995, when *icipe*'s second Director General Dr Hans Herren won the World Food Prize for his pioneering work on biological pest control. Since 1998, *icipe* has hosted fifteen Borlaug-Ruan Interns, five of whom have worked in *icipe*'s push-pull programme under the supervision and mentorship of award-winning entomologist Dr Zeyaur R. Khan. Three of these have gone on to win the prestigious John Chrystal Award, presented each year to the most outstanding Borlaug-Ruan Intern.

Push-pull is a conservation agriculture technology developed by Dr Khan and his colleagues to tackle the two

most important enemies of the African cereal farmer: the stemborer, an insect pest, and striga, a parasitic weed. By planting two types of perennial fodder plants between and around the main cereal crop, push-pull uses the natural chemical relationships between different plants, and between insects and plants, to tackle both constraints. When farmers adopt push-pull, they not only achieve a dramatic and sustainable increase in cereal yields, but they also benefit from enhanced soil fertility and obtain year-round fodder for their livestock.

Push-pull has a range of positive development outcomes. For those who adopt it, the technology improves food security, contributes to better human and animal nutrition and health, and supports learning and education. Since 2011, when *icipe* scientists introduced two drought-resistant intercrop and border crop plants, it has also helped make farming systems more resilient to climate change.

A multi-disciplinary team of scientists and extensionists, led by Dr Khan, have developed push-pull and extended the technology to nearly 70,000 farmers in East Africa. This gives interns in the programme the opportunity for considerable exposure to African farmers and a chance to learn about their livelihoods and the constraints they face. As Jimmy Pittchar, *icipe*'s Social Scientist, points out, "the experience interns gain at *icipe* brings them face to face with reality, and this prepares them to develop skills that transcend any single discipline. It also introduces a human dimension to their education in the bio-sciences, and gives meaning and practical application to the advanced scientific concepts they learn." ◆



Dr Zeyaur Khan has mentored five Borlaug-Ruan Interns since 2000, facilitating their understanding of the complex science behind push-pull technology. Here, he shows 2003 intern and John Chrystal Award winner Megan Srinivas a striga-infested grass plot. "It is," he says, "a gratifying experience to mentor young scholars and give them strong scientific grounding for their nascent careers."

► Broadening horizons and challenging stereotypes

Dr Khan has mentored all of the interns in the push-pull programme from the moment of their arrival at *icipe's* Thomas Odhiambo Campus at Mbita Point, Kenya. Together, mentor and intern decide on the focus and design of an original piece of research, one which builds on the interns' own strengths and interests, asks cutting-edge questions about agriculture and food security, and contributes relevant new knowledge to the ongoing push-pull programme. Selected research themes include the impact of climate change on push-pull farmers, the role of women's groups in the spread of the technology, and the influence of culture, gender and education on food security.

Assisting Dr Khan, a second mentor, Matilda Ouma, accompanied each intern to the field. Her task is to support interns in their interviews with farmers, interpreting responses and facilitating discussions. "Matilda is an incredibly knowledgeable woman," says 2000 intern and John Chrystal Award winner Bian Li, now Director of Planning at the WFP Foundation. "She provided me with so much information and so many insights into how gender relates to food security."

Seeing poverty in rural Africa for the first time was a profound shock for all the interns; as 2010 intern Sydney Schrider says, "it is one thing to read statistics about hunger, and another to witness it first-hand". But through their relationships with their mentors and their conversations with push-pull farmers, this

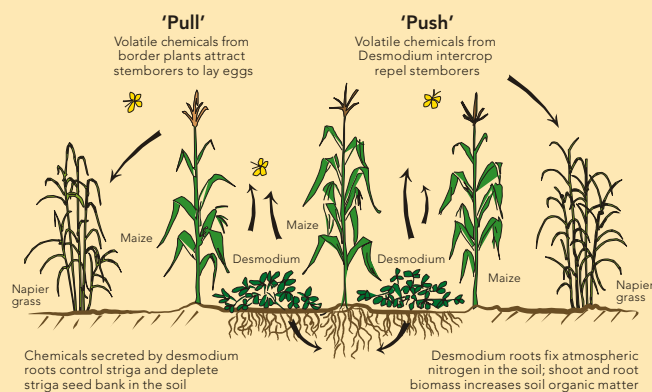


Matilda Ouma's role as mentor is to help interns understand their experiences. "They asked so many questions!" she says. Here, Matilda (right) explains the benefits of push-pull to intern Anne Secor Zwink in 2006.

How does push-pull work?

Push-pull prevents stemborers attacking cereals by intercropping with a 'push' plant, such as desmodium, and planting around this intercrop a border of a stemborer-attractive 'pull' plant, such as Napier grass.

In addition to repelling or pushing the stemborers 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 their attachment to host plants.



A conventional push-pull plot planted with a maize crop. Push-pull was developed in 1997 and introduced to farmers in 1998 and uses silverleaf desmodium (*Desmodium uncinatum*) as an intercrop and Napier grass (*Pennisetum purpureum*) as a border crop.



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 cv mulato II*) as a border crop.

shock was transformed into a respect for the endeavours of rural Africans which challenges many commonly encountered negative stereotypes. "Most of the farmers' stories were inspirational," continues Sydney. "They work tirelessly to provide for their families. I was humbled by their pride and dignity. Even in dire situations, they had hope." ◆

► Fostering interdisciplinary science

The push-pull programme is deeply rooted in interdisciplinarity. The team of natural scientists who discovered the plant-insect relationships at the heart of the technology come from many different disciplines including entomology and organic chemistry. But the programme has always included social scientists, because farming systems cannot be seen as separate from farmers or the social and economic contexts in which they live. Through designing and carrying out their studies, interns in the programme are exposed to the principles and practices of interdisciplinarity alongside their exposure to African farming systems.

Engineering change for women

When Sydney Schrider won her internship, she had a very clear career goal in mind. "I wanted to be a civil engineer," she wrote, "to help provide safe, clean water. I saw my time in Kenya as simply a corollary to my technical studies. I never imagined how relevant it would be." Under Dr Khan's guidance, Sydney was encouraged to study the impacts of push-pull technology, gender and irrigation on food security. She was struck by the social and cultural inequalities which hold back many African women, but she also noticed the importance of female role models and farmer-teachers in empowering women farmers to adopt push-pull.

These lessons have shaped Sydney's career path and priorities. True to her original goal, she is now a civil engineering student at the University of Virginia, USA. When not studying, she is an active member of the Society of Women Engineers. As Elementary and Middle School Outreach Chair, she has become a female role model, developing programmes and activities to encourage young women to enter engineering.



Sydney Schrider and push-pull farmers testing a pedal-operated irrigation pump on Rusinga Island during her internship in 2010. ◆

► Food security, diversification and resilient agro-ecosystems

At a fundamental level, push-pull contributes to food security by tackling striga and stemborers, thereby allowing farmers to harvest more grain. But equally important, it enhances long-term food security by improving soil fertility through using a nitrogen-fixing companion plant. It also supports more productive animals through producing nutritious fodder, thereby encouraging the nutrient cycling and on-farm diversification that are features of stable, resilient agro-ecosystems. Through learning about push-pull, interns absorb lessons about seeing farming as an integral part of the ecosystems that support it.

Supporting sustainable farming from Africa to America

Anne Secor Zwink grew up on a large-scale conventional farm in the American Midwest, where her family "grew corn and soya and raised hogs". Before her internship, she had, in her own words, "a very small and focused view of agriculture".

After her time at *icipe*, she changed the focus of her studies to food science, which she went on to study at postgraduate level. After graduation, she married an engineer and together they decided to return to Anne's family farm. Then, says Anne, "we could start to grow our own food".

Since her return, the farm enterprise has diversified and a vineyard has been planted. Next year, she and her family are planning a large-scale vegetable plot to begin a Community Supported Agriculture enterprise. "This is exciting for me," says Anne, "as the plan has similarities with push-pull. The crops work together and either take up or fix nitrogen, and some plants work as natural insecticides to others." She is also continually on the lookout for small projects to offer her knowledge and past experiences of agricultural development in Africa.



Anne Secor Zwink interviews farmers in 2006 in Kenya's Homa Bay district, discovering how they learned about push-pull. ◆



Bian Li, shown here taking notes at a farmers' group discussion in Homa Bay district during her second visit to *icipe* in 2002, joined the WFP Foundation as its Director of Planning in 2011. She feels that her career "has come full circle" and that this role allows her to "marry together all my various experiences since my internship".

► Inspiring the next generation of scientists and humanitarians

In a time of climate change, we cannot feed the world without scientists from different disciplines who understand agro-ecosystems and are committed to providing farmers with practical solutions to the constraints they face. Inspiring talented young people to enter the agricultural sciences, both natural and social, is crucial to future food security. Equally imperative is ensuring that those working in related disciplines, like health, education and international development, have a strong understanding of the challenges of food production.

The career trajectories of the former Borlaug-Ruan Interns in the push-pull programme illustrate the potential of this internship to educate, motivate and inspire in precisely these ways. For Anthony J. Wenndt, 2011 intern and John Chrystal Award winner, the internship "solidified my passion for agricultural research," and led to him changing his course of study from music to biology. Although still an undergraduate student, he has already carried out research on stem rust disease in wheat in the USA and biological pest control technologies for coffee production in Costa Rica.

A different path lay before Bian Li, 2000 intern and John Chrystal Award winner. She returned to *icipe* in 2002 to do research for her degree dissertation, before working with women's agricultural cooperatives in Ghana. During a subsequent career in finance and the media, Bian remained mindful of the lessons of her internship, particularly concerning the need to motivate both men and women to overcome gender inequalities. She is now an Oxfam Sister on the Planet Ambassador, one of a diverse group of American women leaders who raise awareness of how hunger, poverty and climate change affect women worldwide.

Whether as agricultural scientists, farmers, advocates for the economic and professional advancement of women, public health professionals or civil engineers, the push-pull interns have one thing in common: each has been individually inspired to work towards a better, more food-secure world. In the words of 2003 intern and John Chrystal Prize winner Megan Srinivas, "although some of my friends in Kenya couldn't afford much, they were able to bestow me with the most valuable presents that I have ever received. They gave me their trust, and they provided me with motivation to want to help." ◆

"To talk with farmers has, without a doubt, shaped my priorities in life. It altered what I considered to be important. Food security, human nutrition, and economic development around the world are always on my mind."

Anne Secor Zwink
2006 Borlaug-Ruan Intern

"The dream of World Food Prize founder and Nobel Peace Prize Laureate Dr Norman Borlaug was to inspire young scholars to become the agricultural and humanitarian leaders of the next generation."

*Dr Zeyaur Khan and his colleagues at *icipe* have been key role models, engaging WFP interns in ways that allow them to approach food security with a feeling of personal responsibility, understanding and commitment."*

Lisa Fleming
Director of Global Education Programs,
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