In Zimbabwe, a bottle cap’s worth of fertilizer applied in the right place at the right time—leading to dramatic improvements in yields and incomes of smallholder farmers.

Inclusiveness is about bringing life-changing innovations to millions of smallholder farming families who have the biggest needs—techniques that are adapted to smallholder, resource-poor farmers.

The President of the International Fund for Agricultural Development (IFAD) Dr Kanayo Nwanze, speaking at the 6th Africa Agriculture Science Week opening ceremony in Accra, Ghana, said “We have seen good results from a fertilizer microdosing technique developed by ICRISAT and its partners, using a bottle cap system so farmers can measure out small, affordable amounts of fertilizer.” Dr Nwanze believes that there is huge potential to increase yields using low-cost and existing technologies.

Escaping subsistence farming

Crop yields in the semi-arid areas of Zimbabwe have been declining steadily over the years, mainly due to a decline in soil fertility and droughts. Research results show that between 75 and 90% of cropped land in Zimbabwe is unfertilized each season, and average application rates for nitrogen fertilizer by smallholder farmers is only 3 kg per hectare.

But how can resource-poor farmers get the highest returns from the fertilizer quantities they are able to afford? Resource poor farmers are likely to adopt lower rates as these are what they can afford. With
By 2012, close to 300,000 farmers were practising the technology and have achieved productivity gains of up to 100%. This intervention has improved household food security, and saved US$ 7 million in food imports annually.

Positive results, they will be encouraged to invest more in fertilizer, which will trigger a process of movement from impoverished subsistence farming to prosperous market-oriented farming.

Since 2003, ICRISAT has been promoting microdosing—targeted application of small, affordable quantities of fertilizer directly where the plant needs it—at the roots. Farmers apply 6 g doses of fertilizer, about a full bottle cap of ammonium nitrate (AN) fertilizer per two to four plants, in the hole where the seed is placed at the time of planting. Microdosing is equal to about 8-10 kg of nitrogen per hectare, approximately a fifth of the recommended application rate.

Partners and nongovernment organizations (NGOs) began establishing on-farm trials across Zimbabwe in 2004 to demonstrate the microdosing approach. In each trial, the farmer selected a cereal crop, and compared results with and without fertilizer.

Despite poorer than average rains during the 2005-2006 season, grain yield increases of 30-50% were recorded in areas with widespread adoption of microdosing, and almost every farmer achieved a significant yield gain. During this same season, over 170,000 households increased cereal production levels by an estimated 40,000 tonnes, significantly improving household food security.

**Documenting impacts**

In 2013, an extensive impact assessment study titled “Impact of Fertilizer Microdosing Research and Development in semi-arid Zimbabwe” was conducted to assess and document the impacts of microdosing research and technology transfer undertaken by ICRISAT and partners in eight districts of the country.

The picture painted by the results—a sustainable and inclusive growth within the participating districts, proving that innovations designed for the poor farmers help them move from subsistence to progressive farming.

Promotion of microdosing has raised the adoption of the technique by about 30%. In Zimbabwe’s Natural Region IV, microdosing increased maize yields by 80% under conditions experienced in 2012 in low rainfall regions of the country.

By 2013, adoption of microdosing technology by smallholder farmers in the semi-arid regions of Zimbabwe had generated a net present value (NPV) of US$ 26 million with an internal rate of return (IRR) of 36%. At the household level, survey results show that microdosing has contributed to intensification by facilitating use of fertilizer, while enhancing food sufficiency by generating higher yields in maize and small grains.

Microdosing adoption has been enhanced by fertilizer subsidies, but promotion has had a large impact distinct from the effect of fertilizer subsidies. By increasing household cereal yield and contributing to food security, microdosing has supported women’s empowerment within male or joint-headed households. Households in wards that received microdosing training report higher levels of food security, consistent with higher food yields.

**An inclusive and participatory approach**

Since 2003, microdosing implementation in Zimbabwe has involved training, extension and promotion facilitated under a consortium of donors, working with nine international NGOs and a number of local NGOs.

During 2003-2006, more than 160,000 resource poor households received at least 25 kg of nitrogen fertilizer and a simple flyer in the vernacular explaining how to apply the fertilizer to a cereal crop. This was followed by ICRISAT linking with the Zimbabwe Fertiliser Company (ZFC), from which 12 trade stores received small fertilizer packs to sell to farmers.
Until 2013, ICRISAT continued to conduct microdosing training to different stakeholders, now outside the consortium. More than 650 lead farmers, 241 government extension officers and 119 extension officers from 16 local and international NGOs have been trained.

The way forward

“Our impact assessment study shows that smallholder farmers’ investment in microdosing has really unlocked the power of chemical fertilizers in some of the low-rainfall areas of Zimbabwe,” said Dr Alex Winter-Nelson, Agricultural Economist, University of Illinois at Urbana Champaign and lead investigator of the impact assessment study.

“Sustaining and expanding the benefits of microdosing technology will require efforts to ensure that private agro-dealers are able to stock the small fertilizer packs in a timely manner and to package it in a manner that smallholder farmers find useful,” he said. “This is complicated by the financial capacities of agro-dealers and by difficulty in projecting fertilizer demand, which varies with rainfall.

“We also need to work on extending training to underserved areas and to train extension personnel in low-rainfall areas. Female-headed households were significantly less likely to adopt microdosing than others, possibly reflecting labor shortages or difficulties accessing fertilizer. Understanding the particular constraints that female farmers face and adapting the methods or the training to their circumstances could also help extend adoption of the technique.”