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Media Release

Small fertilizer doses yield big impact in sub-Saharan Africa

Less can have more impact if appropriate fertilizer is applied to the crops at the right time, in the right quantity, at the right spot. In sub-Saharan African countries, the fertilizer microdosing technique developed by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and partners is helping farmers to increase agricultural productivity.

Microdosing has reintroduced fertilizer use in Zimbabwe, Mozambique and South Africa in the southern part of African continent; and Niger, Mali and Burkina Faso in western Africa. And through this intervention, ICRISAT and partners have surmounted the barrier to productivity increase which even crop improvement could not overcome.

In 2006, which has been declared as the International Year of Deserts and Desertification by the United Nations, ICRISAT's microdosing initiative is improving the livelihood of the poor and marginal farmers of sub-Saharan Africa (SSA) through enhanced agricultural productivity in the drylands.

According to Dr William Dar, Director General of ICRISAT, the strength of the microdosing initiative has been the strong partnerships with donors, international and national agricultural research and extension systems, NGOs and farmer communities. "Microdosing permits small farmers to get good impact by adding affordable quantities of fertilizer to the fields. And through the *warrantage* credit scheme in western Africa, the farmers are effectively linked with the markets," Dar added.

Farmers in the project countries have developed innovative techniques to apply microdoses of the appropriate fertilizer. While the farmers in southern Africa use fertilizer measured out in an empty soft drink or beer bottle cap, in western Africa the farmers measure fertilizer with a three-finger pinch and apply it in the same hole in which the seed is sown.

Linking microdosing to relief in southern Africa

ICRISAT's programs in southern Africa initially emphasized the development of more drought tolerant varieties of sorghum and pearl millet. A combination of international and national crop breeders selected earlier maturing varieties with good food and feed qualities. These offered large yield gains in drought years when the rainy season ended early. But yield gains during normal or longer rainy seasons were smaller.

Dr Steve J Twomlow, ICRISAT's Global Theme Leader on Agro-Ecosystems and the leader of the microdosing project in southern Africa, explains "though there was good adoption by farmers of improved varieties, we realized that we did not get the expected yield increase. There had to be some other limiting factor." The idea of microdosing derived from the recognition that nitrogen was often in shorter supply than water.



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The problem was that few small-scale farmers in these drought-prone regions used any fertilizer. For instance, surveys in southern Zimbabwe showed that less than 5% of the farmers used chemical fertilizers. And even more unexpectedly 60% of the households owning livestock did not even use available cattle manure as soil amendment. Farmers argued that these inputs were too risky. Despite years of extension advice, they did not understand the value of fertilizer.

“We began from the realization that poorer farmers in drought-prone areas will not invest in fertilizer – or at most, only in very small quantities,” says Twomlow. “The question was not what quantity of fertilizer will maximize yields, but rather how to maximize returns from a small investment in fertilizer.”

ICRISAT challenged an international workshop of scientists to assess how best to allocate two 50 kg bags of fertilizer on a small-scale farm through a crop systems simulation exercise. Again, the key question was not how to maximize yields, but how to maximize the returns to a severely resource-constrained investment. The simulation allowed options of concentrating the fertilizer on one plot or spreading this. Labor resource constraints highlighted the farmer’s problems of weed control. To the surprise of many, the largest gains were achieved by spreading the fertilizer broadly.

ICRISAT worked with the Zimbabwean Department for Agricultural Research and Extension (AREX) and several non-government organizations to implement on-farm participatory trials where a limited number of farmers experimented with the application of small quantities of ammonium nitrate through a method later called microdosing. These results confirmed the simulation results.

ICRISAT then challenged the larger donor and NGO community to promote application of these findings in their post-drought recovery programs. In 2003/04 cropping year, 170,000 farmers were provided 25 kg bags of ammonium nitrate with advice on how to apply this on an acre of grain crop. Virtually every farmer achieved a significant yield gain – with most obtaining a 30-50 percent improvement in harvest. More than 40,000 tons of additional grain was produced and ultimately consumed by many of the poorest farmers in the country. This additional production reduced the costs of Zimbabwe’s food aid imports by more than US\$ 8 million.

The success of this initiative has encouraged growing interest in neighboring countries. Microdosing is now being tested in Mozambique and South Africa. In addition, fertilizer companies are starting to take note. Companies in Zimbabwe and South Africa have agreed to support the distribution of smaller fertilizer packs with the advance on how best to apply them.

A pinch of fertilizer supported with “*warrantage*” in western Africa

ICRISAT scientists working in the Sahelian region adjacent to the Sahara Desert realized that to improve productivity of pearl millet and sorghum at least 100 kg of Compound Nitrogen-Phosphorus-Potassium (NPK) fertilizer is required per hectare. It was so since the region had received minimal or almost no fertilizer application over decades.

According to Dr Ramadjita Tabo, ICRISAT’s Deputy Director for West and Central Africa and Regional Coordinator, Desert Margins Program (DMP), the poor farmers in Niger, Mali and Burkina Faso would have needed to spend around US\$40 per hectare to follow the recommendation on NPK use. “We could not recommend something that we were sure the farmers would not be able to afford. So we had to find a way to reach the right component to the right spot at the right time,” adds Tabo.

Since much of the soil in the Sahelian region is sandy it was realized the most limiting factor was phosphorus. “Initially we used 6 gms of NPK (15:15:15) per hill for a total of 60 kg NPK per hectare. We then searched for a fertilizer with a higher concentration of phosphorus and decided to use Di-Ammonium Phosphate (DAP), which means that only 2 grams of fertilizer is required per plant, reducing the total fertilizer use to 20 kg per hectare,” says Tabo.

DAP or NPK is placed along with the seed and covered with soil. The West African farmers found a labor-saving method for microdosing. While one farmer goes about making holes the second follows him or her with two vessels: one with the seed and the other with DAP or NPK. He plants the seed and puts a three-finger pinch (sufficient for 2 gm) of fertilizer and pushes the soil over the hole with his feet. This microdosing is supplemented with 1 gm of urea per plant three weeks after sowing.

On an average, microdosing has resulted in yield increases between 44 and 120% for pearl millet and sorghum. However, even with increased production, the market dynamics is such that the farmers do not get the right price for the produce since they do not have the ability to store grain, which they sell to middle men at low prices during harvest. The project, through the *warrantage* or inventory credit system system overcame this problem.

The first step was the creation and strengthening of farmers’ associations in the project villages. These associations built warehouses for grain storage. The farmers keep their grain for safekeeping in the warehouses immediately after the harvest, when the grain price in the market is the lowest due to high supply. The associations give a credit of 80% of the grain price to the farmers, which the farmers use for dry-season activities such as raising Africa Market Garden (AMG) with fruit and vegetable trees rearing and fattening sheep or extracting groundnut oil. When the price for sorghum and millet improves, the farmers return the credit taken from the association, retrieve their grain and sell it in the market.

The associations also use their economies of scale to purchase fertilizers and other inputs in bulk and store them in input shops in the villages. This is broken down into smaller packets and sold to farmers. Microdosing when combined with *warrantage* has resulted in 52 to 134% improvement in income for 12,650 farm households in the three countries.

The project is supported by the United States Agency for International Development and implemented by ICRISAT and a broad consortium of partners. They include the Institut de l’Environnement et de Recherches Agricoles du Burkina Faso, the Hunger Project, the Institut d’Economie Rurale du Mali, Sasakawa Global 2000, Winrock International, the Institut National de Recherche Agronomique du Niger, Project Intrans FAO, the International Fertilizer Development Center, the Tropical Soils Biology and Fertility Institute of the International Center for Tropical Agriculture, NGOs, and farmers’ organizations.

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