Fertilizer microdosing increases agriculture productivity

Smallholder farmers in Niger, Mali and Burkina Faso, who implemented microdosing on their farms saw their yields double or even triple at the end of project period.

Variation in yields between provinces is generally due to the difference in soil fertility and rainfall and linked to the specific characteristics of each agroecological zone.

Microdosing adoption rate
A 2012 study shows:

45,000 farmers adopted microdosing
39% area treated
Of the total cropping area, the treated area was nearly 39%

Challenge in the semi-arid regions of West Africa

- **Agricultural productivity is low and stagnating** due to:
  - Prolonged and continuous decline in soil fertility
  - Low and erratic rainfall
  - Limited use of inputs such as fertilizer and improved seeds because of their high costs and unavailability
  - Recent high population growth has put pressure on arable land and caused land degradation.

- Yields of staple food crops like sorghum, millet and maize are often below 500 kg per hectare (about one-fifth of those in developed countries).

- Production often falls below household food requirements. Farmers are unable to commercialize their harvest to meet other household needs. The poverty cycle worsens as family dependents increase and soil fertility decreases each year.

- Agrodealer networks are poorly developed, farmers have access difficulties because fertilizer markets are often concentrated in urban areas.

- Soils in this zone are sandy and of very low fertility, particularly in phosphorus (P) and nitrogen (N), with P being more limiting to crop growth and yield than N. Crop response to nitrogen is minimal when phosphorous requirements are not met.

- With very little use of fertilizers without any recycling of crop residues, there is a loss of about 22 kg N, 6 kg phosphorus pentoxide and 18 kg potassium oxide per hectare.

- Most smallholder farmers do not replenish their land not because they do not know what to do but because they do not have the resources (including access to credit).

- Sometimes poor farmers organize bulk purchases and share fertilizer purchases at a high US$2 per kg of nutrients (more than five times the world price).

Introducing microdosing

Around 25,000 smallholder farmers in Mali, Burkina Faso and Niger were introduced to the microdosing technique which helped them gain increases in sorghum and millet yields of 44 to 120%, along with a 30% increase in their family incomes.

The regional AGRA project targeted 360,000 households with microdosing technology between 2009 and 2012.

**What is microdosing?** It is strategic application of small quantities of fertilizers (three-finger pinch or full bottle cap) in the planting hole or to the base of the plants shortly after planting (10 to 14 days).

Precision placement helps efficient use of fertilizer, the roots grow out more quickly, and this quick grow-out of roots helps the plants capture more native (non-added) nutrients before the rains leach them down below the root zone.
Advantages of microdosing

Affordable
Reduced investment cost makes it accessible to the poor.

Benefit/cost ratio
It is about 7, 4 and 6 for sorghum, millet and cowpea, respectively.

Improves grain and biomass yields at both reasonable cost and levels of risk on fields that might otherwise be abandoned.

A quick start to the plant seedling:
The facilitation of fast root growth helps in avoiding early season drought and an earlier maturity, thus avoiding end-of-season drought while increasing crop yields.

Outcomes

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1. Manual microdosing is time-consuming and labor intensive
2. Affordability of the fertilizers
3. Sustainability of the practice
4. Impact on biomass and longer-term soil health needs

Improvement in household nutritional need from 61% to 116%
In one study in Burkina Faso poor households in five provinces had sufficient rainfall for crops to meet their water requirements but some were able to meet only 61% of their nutritional needs, however, with the introduction of microdosing it rose to 116%.

Problems of microdosing

1. Manual microdosing is time-consuming and labor intensive
2. Affordability of the fertilizers
3. Sustainability of the practice
4. Impact on biomass and longer-term soil health needs

The solutions
Efforts are now required to mechanize the technology to reduce the labor demand, and to obtain financial support to farmers for the purchase of fertilizers.

The project together with Institut d’études et de recherches agricoles and the private sector in Burkina Faso is in the process of manufacturing and testing of a prototype mechanized tool using animal traction. The prototype is about nine times faster than manual application.

Further research is proposed to investigate the sustainability of microdosing in relation to soil degradation.

The issue of fertilizer packaging is being tackled by convincing agro-dealers that they can sell more fertilizer to small farmers in 1 kg or 10 kg bags rather than the standard 50 kg bags which demand major financial outlay.

The return of nutrient to the soil through crop residues needs to be investigated, along with water regimes and crop rotations including cowpea for nutrient return.

Capacity building

- 133 showcase fields established in Burkina Faso; Mali and Niger
- 393 farmer’s field days were held during the three years of the project, 57,338 participants registered. Participants included farmers, political leaders, local authorities and extension technicians whose presence gave credibility to the project activities, thereby contributing to out-scaling of the technology. The original estimate was for 15,000 participants
- 87% of farmers took part in the farmer field schools. About 440 farmers’ field schools were held, training 20,500 people. Most participants were farmers, along with endogenous animators, agricultural ministry technicians and other officials.

Outcomes

Fertilizer use

The project’s impact survey shows that fertilizer use rates increased from 7.41 kg/ha in the baseline study to 11.45 kg/ha.
- The proportion of farmers using mineral fertilizer increased from 21% at the beginning of the project to 68% in 2012. This is due to the easy access of inputs due to the proximity of input shops as well as availability of inputs in small bags.
- Average distance to an input shop was reduced from 13 km to 6 km.
- Percentage of farmers who used at least one type of mineral fertilizer is 77% compared to a control village where it is 48%.

Food security

- The percentage of households in the project sites with sufficient cereal stocks to cover 12 months is 45% compared to 37% in the diffusion villages.
- Households have gone from being food sufficient for six months at the start of the project to 10.5 months in 2012.
- This improvement in food security also impacted on the health of rural households.

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