Photo: Anderson Temu

Digging the pit

Sowing maize in pits: farmer innovation in Tanzania

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Wilbert Mville, a 34 year-old farmer, lives in Itulike Village in Njombe District in the Southern Highlands of Tanzania. This is an area of sloping and undulating land at an altitude of between 990-2200 m. Temperatures range from 13 to 18ºC, and annual rainfall (November-April) varies with altitude from 600 to 1500 mm. The dominant soils are red kaolinitic clays with moderate natural fertility and medium to high water-holding capacity. Under continuous cropping, they degrade quickly through compaction, and plant rooting is shallow.

Research-minded farmers

In these and similar areas of southern Tanzania, the Indigenous Soil and Water Conservation Programme (ISWCP) set out to identify farmer innovators. This was the first step in establishing a process of Participatory Technology Development (PTD). Researchers and extensionists were trained in tools for farmer-led analysis and experimentation, an approach very different from the scientist-led research that dominates the official level in Tanzania.

Two PTD training workshops in March 1998 and April 1999 were crucial to changing the attitude and behaviour of researchers and extensionists from a conventional transfer-of-technology approach to a more participatory one. Workshop participants learned about innovation and informal experimentation by "research-minded" farmers. It was stressed that these should not be confused with "progressive" or "contact farmers" who had the resources to adopt techniques suggested by extension officers. Farmers who are less responsive to such messages often have fewer resources, but may still be very active in trying out new things in their farming system (Veldhuizen et al. 1997).

Locally-developed LEISA

A field trip during the 1998 workshop in Njombe exposed researchers to farmer innovation. Godson Lupenza, a village extension officer (VEO) in Njombe who had seen Mville's maize pits, suggested that a field-work group should visit him. The group members marvelled at Mville's willingness to speak, listen and answer questions, and his amazing knowledge. He had developed several innovations, e.g. different ways of planting maize, a pipe system to distribute water and cattle urine to his fields, a tree nursery and fish ponds. The scientists were keen to analyse these innovations and start joint research with Mville, who had already – on his own initiative – outlined topics for experimentation:

- comparing maize yield from large and small pits;
- trying bigger pits, each seeded with up to 30 plants, without thinning;
- sowing on raised seedbeds in old pits (from the previous season) to observe yield response to residual fertility;
- using compost instead of manure and crop stover as organic fertiliser;
- one top dressing of slurry compared with three top dressings.

Closer look

When two of the researchers (Temu and Malley) visited Mville again in February 1999, he explained that his ideas came from seeing that extension officers recommended sowing 2-3 seeds together in rows if there were enough nutrients (organic or inorganic). He reasoned that it must be possible to sow many more seeds in a pit that was rich in organic matter and still obtain a good yield. Since the soils on his farm are exhausted and because he had enough farmyard manure (FYM), plant materials and animal feed refuse, he set about designing the pit method. A year later, in 1997, he tried it on a small scale and modified it in 1998.

His technique involves digging pits 60-120 cm in diameter, 30-60 cm deep and 75-100 cm apart. Crop residues and manure (one bucket of 20-litre) are put into each pit and mixed with topsoil. 20-25 maize seeds are then sown in each pit and later thinned to 15-18 plants, depending on the size of the pit. He top-dresses the maize with a mixture of manure slurry from the kraal floor and urine collected with his piped system, diluted 1:1 with water. On each of three consecutive days, he applies about 2 litres of this mixture per pit. The following season, he makes new pits on the undisturbed soil between the previous season's pits. In this way, he hopes eventually to saturate the field with organic manure and thus improve the soil. Mville noted that he harvested 20 bags/acre (5 t/ha). When he planted in rows his yield was less than 5 bag/acre (1.25 t/ha).

Mville's wife works with him and has introduced her own experiments. For example, after the maize was harvested, she planted leafy vegetables irrigated by the pipe system to see how residual fertility could be used.

Technical staff

In the 1998/99 season, Mville began a trial to compare the effect of pit size on maize yield, a topic he had mentioned during the first workshop. He and his wife jointly monitored the trials, and she kept the records. A neighbouring farmer, Rose Kitamkanga, saw what Mville was doing and decided to experiment on her own to find out whether pit planting with manure produces more local maize than conventional row planting. The technical staff (researchers and extensionists) joined these experimenting farmers in the middle of the growing season. We had still been trying to work out mechanisms for participatory research, so the farmers started their trials without us! We helped them identify simple assessment criteria so that, at the season's end, they could use them to interpret the results. The farmers were able to record many parameters, the researchers only had to record a few including pit dimension, grain yield and soil analysis. Grain yield was measured at harvest in the presence of the innovators, VEOs and researchers.

Results

The results of these two trials, plus more from other farmer innovators, were pre-

sented in two farmer experimentation workshops held in November 1999 in Iringa and Mbeya Districts. Assisted by researchers and VEOs, the farmers used flipcharts to present their data to the other innovators. Results were discussed in a plenary session.

Farmers' comments

Mville and his wife noted that the larger pits produced better results than the smaller ones (8.8 compared to 3.6 t/ha). Rose noted that the maize yield from pits was 50% higher than from rows. The other farmers made the following comments on the trials and the results:

- the plot size for large pits was smaller than for small pits;
- the exact amount of FYM in Mville's trial was not known;
- the fertilisation schedule differed in the comparison of row and pit planting;
- the amount of urea applied was not specified.

Table 1: Results from Mville's experiment, using introduced maize variety

	Size of pit	
Parameter	**Large**	**Small**
Area of maize plot (m²)	28	100
Number of pits	8	56
Number of plants	192	448
Depth of pits (cm)	60	30
Spacing between pits (cm)	105	85
Diameter of pits (cm)	123	58
FYM applied at sowing	not known	not known
Top-dressing (manure slurry)	15	3
Maize cob weight at harverst (kg)	19.8	14.9
Grain yield (bags/acre)	35	14.4
Grain yield (t/ha)	8.8	3.6

Table 2: Results from Rose's experiment, using local maize variety

	Sowing method	
Parameter	**Pits**	**Row**
Area of maize plot (m²)	100	100
Number of pits	40	13
Number of plants	480	303
Depth of pits (cm)	60	-
Spacing between pits (cm)	60	90
Diameter of pits (cm)	59	-
FYM applied at sowing (l)	10	-
Top-dressing (manure slurry)	-	Urea
Maize cob weight at harverst (kg)	16.1	16.4
Grain yield (bags/acre)	24.0	16.0
Grain yield (t/ha)	6.0	4.0

Observations

It was interesting to note that farmers saw the need to standardise non-experimental factors so that fair comparisons could be made between treatments. During the workshops, researchers guided farmers to brainstorm about other rules that could improve experiments in the next season.

The importance of design, replication, randomisation, controls and plot area for trials, for example, were discussed. We all agreed that these principles would be put into practice when joint experiments were conducted in the 1999/2000 season.

Innovation spreads

The pit-planting technique spread quickly and was made known through:

- visits by individual farmers (mainly neighbours) to Mville's farm;
- farmer-exchange visits facilitated by the ISWCP;
- farmer-innovator and farmer-experimentation workshops;
- publication in the Swahili newsletter *Pambazuko* produced by a national farmer network (MVIWATA);
- presentation by Mville at the NANE Annual Agricultural Show in Arusha in August 1999;
- publicity through church congregations.

A quick survey made in Itulike and Wikichi Villages in Njombe District in June 1999 found that 71 farmers had already adopted or were adapting the innovation. Three farmers in Iringa District, who had seen it during exchange visits were trying out pit planting for themselves. However, while farmers are keen on the technique, it was agreed during the farmer-experimentation workshops that the innovation will be studied again in the 1999/2000 season and that the rules of experimentation decided upon in the workshop should be applied. Initially, only two treatments were selected: row vs. pit planting. We agreed on factors to be kept constant and data to be monitor. There are 11 farmers (replicates) doing the trial in Njombe and 3 in Iringa District. The trials are being closely monitored by farmers, extensionists and researchers.

Advantages to explore

Mville's data suggest that his technique may be a promising alternative to conventional row planting. However, labour input comparisons are needed. Pit planting cannot be easily mechanised; it may therefore be more suitable for farmers who cannot afford mechanisation. From our point of view, the advantages of this innovation appears to be:

- improved soil productivity over time;
- simpler weeding, as weeds only need be hand-pulled from the pits;
- reduction in labour for field preparation, because tillage is minimal: only in the pits;
- less erosion, as less soil is detached from non-pitted area;
- the pits collect runoff, allowing it to infiltrate and be conserved in the spongy organic fraction of the soil in the pits;
- concentration of nutrients in the pits and looseness of the soil favour maize root growth and nutrient absorption.

After analysing the results of the initial PTD trials, we will start working with the farmers on further studies to explore the potentials of this local innovation. ■

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The result, healthy growth of maize

Photo: Anderson Temu