

Fertilizer micro-dosing for improved smallholder crop production in Tanzania

Policy Brief

November 2018

Mutabazi, K.D., Urassa, J.K., Saidia, P., Chilagane, E., Mwinuka, L., Sieber, S., Graef, F.



Plate 1: Unfertilized plot



Plate 2: Fertilized plot

Courtesy: Tran-SEC

Executive Summary

Fertilizer use in Sub-Saharan Africa Tanzania is very low compared to other countries.

As a consequence crop yields are poor due to the continued decline of soil fertility and continued cultivation without or with limited fertilizer use to replenish soil nutrients. Consequently, this threatens the livelihoods of the millions of Tanzanians dependent on agriculture. The poor use of chemical fertilizers is caused among other things by ignorance, high fertilizers prices, and the packaging practice of fertilizers in quantities of 50 kg. This policy brief recommends that developing countries such as Tanzania need to create a conducive environment to increase the uptake of chemical fertilizers through educational campaigns, the use of farmer field schools, and packaging of fertilizers in such a way that all farmer categories can buy in accordance to their immediate needs. Doing the above in line with other recommended crop husbandry practices

will raise smallholder farmers' crop yields, their income levels, and ultimately their general well-being. Therefore, increasing uptake of chemical fertilizers has to be a top agenda if reduction of poverty, food and nutritional security are to be achieved in a sustainable manner. This will also minimize further agricultural extensification while at the same time conserving the environment.

Introduction

Africa and Sub-Saharan Africa (SSA) in particular, has the least average chemical fertilizer consumption estimated at 8.3 kg/ha (Morris et al., 2007; Chianu et al., 2012) which is among the major factors undermining crop yields. Despite the benefits from mineral fertilizer and the efforts by the Tanzanian government to raise the availability of subsidized fertilizer to farmers, increasing crop production is still a challenge due to the low

amounts of fertilizer used (Mourice et al., 2014). Efficient use of mineral and organic fertilizer, combined with good crop practices, such as crop rotation and intercropping, helps to halt soil degradation, restore fertility and increase agricultural production.

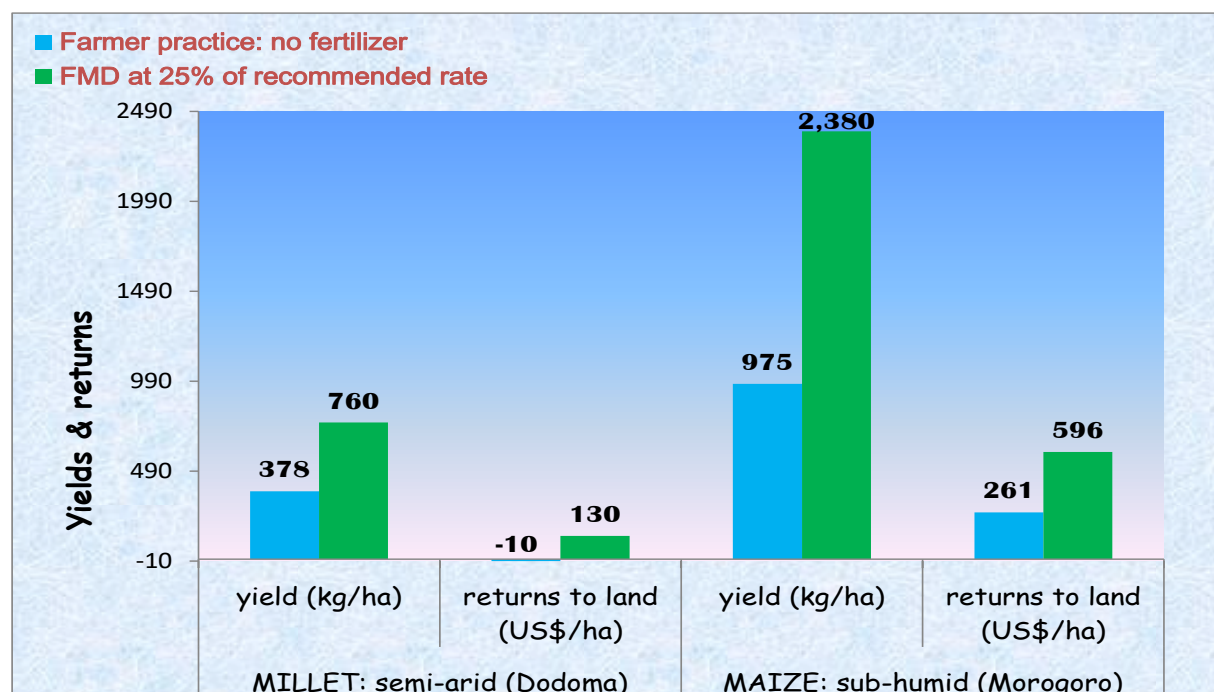
Fertilizer micro-dosing (FMD) and rainwater harvesting through tied ridges (RWH) have been cited as appropriate technologies for replenishing soil nutrients and improving soil moisture to raise crop production (Page et al., 2010; Mahoo et al., 2012). However, fertilizer use by most smallholder farmers in developing countries, Tanzania included is limited due to a multitude of factors: these include ignorance, high fertilizer prices and the packaging practice of fertilizer (FAO 2012, Saidia et al. 2018). Packaging of fertilizer usually in 50 kg sacks according to FAO (2012) is not suited to the low demand levels of the poorest farmers who generally only need a few kilos at a time.

To raise fertilizer use in Tanzania and other developing countries there is need for more awareness creation through fertilizer micro-

dosing demonstrations or other innovative and validated techniques (FAO, 2012). However, for better success of uptake of FMD there is need of linking agro-input shops to Farmer Field School (FFS). Generally, FFS help rural communities to gain a clear understanding of the role that an input such as FMD plays in crop production.

Farm-level assessment of FMD

- The importance of fertilizer use in raising crop productivity at both recommended and even relatively smaller doses is well reported in literature (Hayashi et al., 2008; Camara et al., 2013; Mwinuka et al., 2016; Okelebama et al., 2017).
- FMD studies conducted by Saidia et al. (2018) and Chilagane et al. (2018) in collaboration with farmers in semi-arid and sub-humid regions of Tanzania for two seasons in 2015 and 2016 show higher yields and returns to land when FMD was applied compared to when it was not (see Figure below).



Farm-level effects of FMD on grain yields and returns to land

- In the semi-arid Chamwino district, Dodoma, FMD at 25% recommended rates equivalent to 15 kg/ha N and 10 kg/ha P fertilizers of respective recommended doses of about 60 kg and 40 kg/ha can increase pearl millet yield and returns by 101% and 1400% over the farmer's practice of not using chemical fertilizer respectively.
- In the sub-humid Kilosa district, Morogoro, FMD at 25% recommended rates equivalent to 20 kg/ha N and 10 kg/ha P fertilizers of respective recommended doses of about 80 kg/ha and 40 kg/ha can increase maize yield and returns to land by 144% and 128% over the farmer's practice of not using chemical fertilizer respectively.
- Notably, FMD is not a replacement of recommended fertilizer application rates but rather a transitional pathway needed to influence smallholder farmers to use fertilizer after seeing yield improvements associated with FMD at modest investment in fertilizer. The National Panel Surveys (NPS) indicate that between 2008 and 2015 it is only around 12-17% of farming households that used inorganic fertilizer (NBS, 2017).
- Lack of knowledge on amount of chemical fertilizers to be applied. Access to FMD information and/or demonstrations.
- Lack of small fertilizer packages for farmers who need fertilizers in small weighted lots such as 5 and 10 kg packs.
- Poor handling fertilizer by agro-dealers i.e. agro-dealers repackaging fertilizers locally to meet demands of those farmers who cannot buy 50kg. Such malpractice affects the quality of the fertilizer in the opened lot.

Conclusion

FMD is a promising innovation to promote wider and increased use of chemical fertilizer as to upgrade food grain yields and associated financial returns to land under rain-fed farming systems in semi-arid and sub-humid areas.

Policy recommendations

- There is a need for a clear policy and regulations to allow and promote fertilizer re-packaging into small lots of 5 to 10 kg.
- More agro-economical research on FMD innovation is needed in different agro-ecological zones to develop a range of optimal micro-doses in different crop, soil and agricultural water management systems.
- Appropriate use of chemical fertilizers including FMD should be promoted through farmer field schools in different agro-ecological zones to avail knowledge and options for resource-poor farmers to start using chemical fertilizer.

FMD related challenges for wider user among smallholder farmers

- Limited knowledge of farmers regarding the importance of chemical fertilizers sustaining soil fertility and in raising crop yields. The fear of some farmers that chemical fertilizers degrade soils has to be curbed by evidence that appropriate use of such fertilizer improves the soil health.

References

- Camara, B. S., Camara, F., Berthe, A. and Oswald, A. (2013) Micro-dosing of fertilizer- a technology for farmers' needs and resources. *International Journal of Agri Science*. 3 (5):387-399.
- Chianu, J.N., Justina, N.C. & Mairura, F. (2012). Mineral fertilizers in the farming systems of Sub-Saharan Africa. A review. *Agron. Sustain. Dev.*, 32: 545-566.
- FAO (2012). Agricultural input shops. Good practice fact sheet Niger. <http://www.fao.org/3/a-aq214e.pdf> [14/11/2018]
- Hayashi, K., Abdoulaye, T., Gerard, B. & Bationo, A. (2008). Evaluation of application timing in fertilizer micro-dosing technology on millet production in Niger, West Africa. *Nutrient Cycling. Agroecosystems*, 80(3), 257-265.
- Mahoo, H. F., Kahimba, F. C., Mutabazi, K. D., Tumbo, S. D., Rwehumbiza, F. B., Reuben, P., et al. (2012). Adoption and up scaling of water harvesting technologies in Tanzania. Chapter 6. In W. Christley & J. Gowing (Eds.), *Water harvesting technologies in SSA: state of the art*. Routledge: Earthscan.
- Mourice, S. K., Rweyemamu, C. L., Nyambilila, A. A., and Tumbo, S. D. (2014). Narrowing maize yield gaps under rain-fed conditions in Tanzania: effects of small nitrogen dose. *Tanzania Journal of Agricultural Sciences*, 12(2), 55-65.
- Mwinuka, L., Mutabazi, K. D., Graef, F., Sieber, S., Makindara, J., Kimaro, A., & Uckert, G. (2017). Simulated willingness of farmers to adopt fertilizer micro-dosing and rainwater harvesting technologies in semi-arid and sub-humid farming systems in Tanzania. *Food Security*, 9(6), 1237-1253.
- NBS (National Bureau of Statistics) (2017) *National Panel Survey Wave 4, 2014 – 2015*. Dar es Salaam. http://www.nbs.go.tz/nbs/takwimu/nps/NPS_Wave_4_2017.pdf. [22/11/2018]
- Okebalama, C. B., Ali, I., Ebenezer, Y. S., Edward, Y., Robert, C. A., Vincent, L. and Uzoh, I. M. (2017). Fertilizer micro-dosing in West African low-input cereals cropping: Benefits, challenges and improvement strategies. *African Journal of Agricultural Research*, Vol. 12(14), pp. 1169-1176. DOI: 10.5897/AJAR2016.11559
- Page, S.L.J., Karanja, D.K., Mbwaga, A.M., Letayo, E.A.S. and Nsemwa, L.T.H. (2010). The underlying cause of the 2009 sorghum failure in Kongwa district and its implications for Tanzania's vulnerability to climate change. *Food Security* 2(2): 157-167.
- Saidia, P.S., Graef, F., Rweyemamu, C. L., Semoka, J. M. R., Kimaro, A. A., Mwinuka, L., Mutabazi, K. D. and Sieber, S. (2018). Nitrogen and Phosphorus Fertilizer Micro-doses on Maize and Its Effect on Profitability: An Evidence from Sub-humid Farming Systems, Tanzania. *Journal of Economics, Management and Trade*, 21(9): 1-10, 2018.