Session 1: Agricultural Production Systems

Improving the efficiency of rock phosphate on high pH soils: Results from participatory research in India

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ABSTRACT

High soil pH levels may limit the availability of phosphorous (P) to crops. In organic farming, the use of synthetic P fertilizers is not allowed. Application of rock phosphate (RP) to crops is one of the alternatives for organic production. However, RP application shows little effect on high pH soils, because the P is not transformed into plant-available forms under alkaline soil conditions. Aiming at the development of locally adapted solutions, we followed a Participatory Technology Development approach, making use of the local knowledge to identify current practices and associated problems by conducting focus group discussions with organic farmers. Farmers stated that they are facing challenges with a P limitation in their cotton-based production systems. In 2011-12, on-station trials with maize, green gram and wheat investigated the potential of several locally available materials to solubilize RP (phosphorus solubilizing bacteria (PSB), tamarind fruits, local vinegar from mahua trees (*Madhuca longifolia*), butter milk (BM), incubating RP into compost). The results of these trials showed that the two most promising options for solubilizing RP were BM and mahua vinegar (MV). Further on-station trials in 2012-13 investigated the effects of BM and MV more closely, focusing on incubation periods and ratios of RP: acidifying liquids. Another study looked at technologies for improved farm yard manure (FYM) management. Results suggested that acidulating RP with BM for a period of one week in a ratio BM:RP = 10:1 leads to a good solubilization of RP. Furthermore, the so-called "shaded shallow-pit system", which was favored by local farmers, best conserved the quality of FYM as a fertilizer. Subsequently, the information of the two studies was combined, and the production of RP-enriched FYM (RP-FYM) by five local lead farmers was initiated in 2012. The RP-FYM produced was distributed to associated farmers (4 per lead farmer) to set up several on-farm trials with cotton and soybean in 2013-14. Results showed an increase of soybean grain and seed cotton yields in the RP-FYM treatment of 40% (1'548 kg ha^{-1} to 2'163 kg ha^{-1}) and 41% (1'170 kg ha^{-1} to 1'646 kg ha^{-1}), respectively, as compared to farmers' practices across a range of farms and soils. To further elaborate on the limiting factors in the production systems, future research will explore the specific effects of P as a part of the RP-FYM fertilizer complex. Potential improvements to the RP-FYM technology such as its combination with wood ash and/or PSB will also be explored. Furthermore, the socioeconomic sustainability of the technology needs to be addressed more thoroughly in order to elucidate potential constraints for adoption.

Keywords: pH levels, phosphorous, soils, India