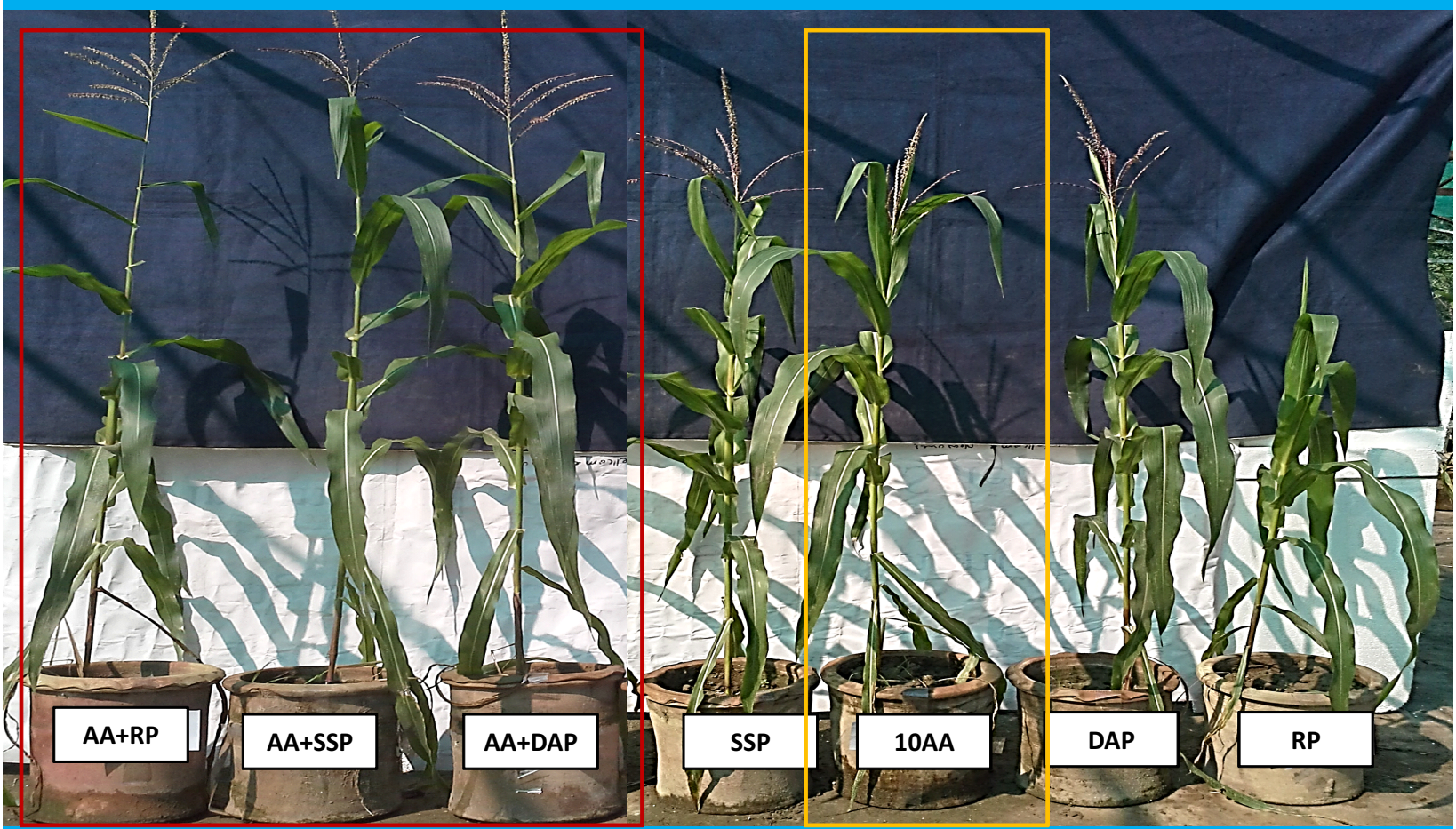
Formulation of Acidified Organic Product for Enhancing Phosphorus Use Efficiency in Maize

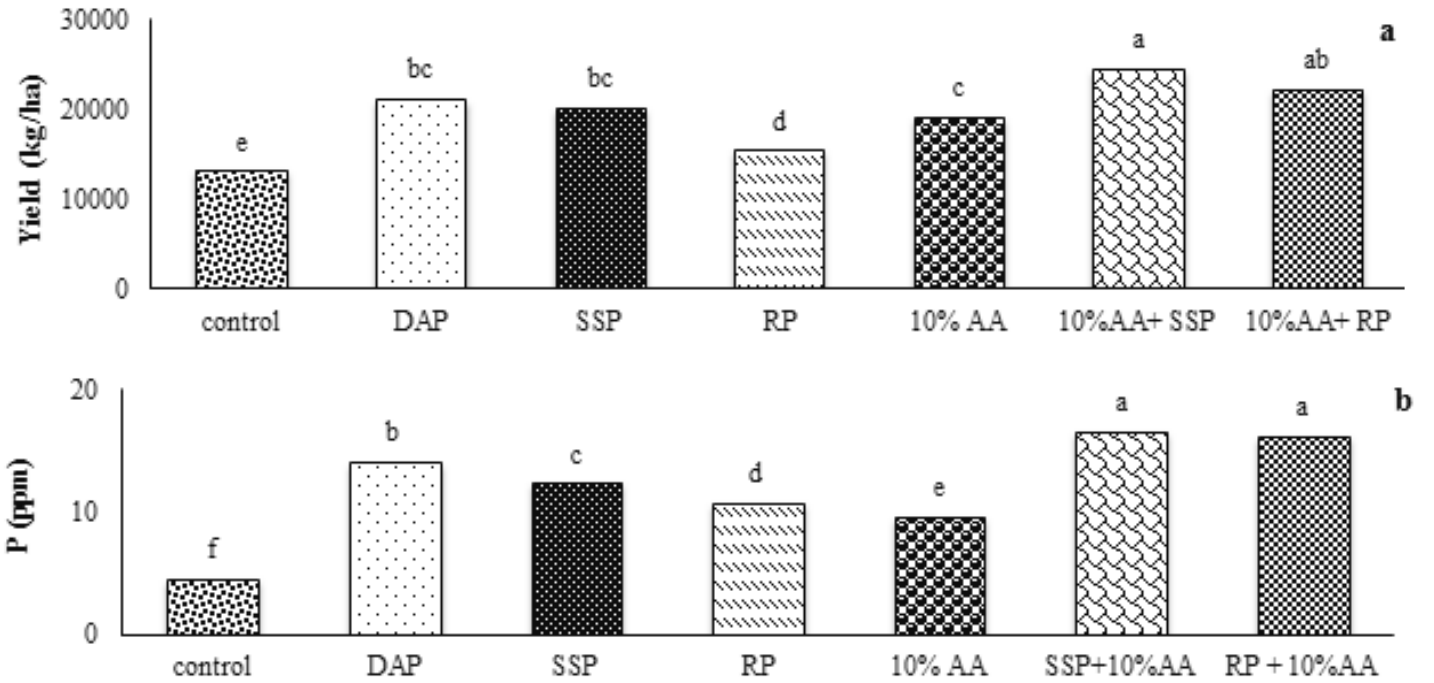
Muhammad Naveed, Shamaila Noureen, Annum Sattar, Muhammad Khalid and Hafiz Naeem Asghar

Soil Microbiology and Biochemistry,
Institute of Soil and Environmental Sciences,
University of Agriculture, Faisalabad

Population explosion, globally, is demanding amplified agricultural production that is directly associated with soil phosphorus (P) availability, which is receiving more and more attention with time. As a 2nd essential macronutrient, it is considered indispensable for plant growth and long term productivity. Further, its deficiency is the prime cause of 30-40% reduction in crop yield. The bioavailability of P is strongly tied to soil pH that is >7.5 in Pakistani soils thus, simple addition of P fertilizer at normal rates can not result in optimal yield and crop quality. To resolve this obstacle, in addition to fertilizers, acid producing materials like S° simultaneously used with Sulfer Oxidizing Bacteria (SOB) and organic matter was found effective and economical to enhance P solubility. Elemental S° oxidation could be accelerated when linked with the use of organic matter, reason being, an increase in heterotrophic SOB and may be due to production of acids from decomposition of OM, which stimulates the activity of heterotrophic bacteria. But, here the issue is massive use of OM and S°, making it uneconomical for small scale farmers. So, there is a dire need to devise a better alternative that is economical and farmer friendly as well. So, to keep in view the entire scenario, an acidified amendment has been prepared through bio-augmentation of a mixture of S° and cow dung with SOB which can enhance the availability of locked soil P.

Sulfer Oxcidizing Bacteria were isolated and screened on the basis of pH reduction in media, sulfate ion production and P solubilization for acquiring the most efficient SOB strains. Then, acidified amendment was prepared through bio-augmentation of mixture of S^o and cow dung with SOB. Commercial acids were used as reference control. Most suitable level of amendment (S^o) was selected on the basis of pH reduction of product. The product was tested as solid and liquid with chemical P fertilizer (SSP, DAP and RP). Field and pot trials on maize were conducted in ISES-UAF to observe the effect of acidified amendment on growth, yield and P uptake. Along with the recommended dose of chemical P fertilizer and significant increases growth, yield and P uptake were recorded. The product is now ready for extensive evaluation on farmer's fields before commercialization.





Significance in field

There is no doubt that soil P management through this innovative strategy will be helpful to enhance crop growth and yield. It is predictable that use of this approach will enhance maize yield upto 5-16% compared to the traditional fertilizer use. Additionally, use of this low pH product will not only reduce the use of synthetic fertilizers and enhance the bioavailability of indigenous P sources, but, it could be a profitable way to manage on farm agricultural waste, ensuring environmental sustainability norms to fulfill the ultimate goal of achieving sustainable food production in the country and worldwide.