Solutions for food security in Africa through sustainable soil fertility management of ecosystems under climate change

Proceedings of the 17th African Association for Biological Nitrogen Fixation Conference held in Gaborone Botswana 17–21 October 2016

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The 17th AABNF meeting took place in Gaborone, Botswana on 17th – 21st October 2016 with the theme “Solutions for food security in Africa through sustainable soil fertility management of ecosystems under climate change”. Speakers at the conference gave presentations under the following eight sub-themes: plant microbe interactions for plant growth promotion, soil fertility management, biotechnological advances, legume pest interactions and food security issues, climatic constraints, forest and range ecology, policy and capacity building, and new and orphan crops. However, the majority of papers presented at the conference were almost equally distributed between the two subthemes of “plant-microbe interactions for plant growth promotion” and “soil fertility management. This probably reflects the fact that soil fertility is still a challenge for most smallholder farmers in Africa. While fertilisers are out of reach for most of them, the use of micro-organisms for promoting plant growth shows promise, especially as a mitigation for climate change. A lot of research is still required to understand plant – microbe interactions.

In most parts of Africa, crop growth on farmers’ fields is still suboptimal. The problems contributing to suboptimal crop production include abiotic factors ranging from low fertility of soil, specifically insufficient N and P, to soil moisture problems. In addition, there are biotic factors such as pests and diseases as well as low yielding genotypes. Compounding these problems, is the issue of climate change and the need for systems to be sustainable in order to reduce the carbon footprints needed to produce crops. For example, a good balance

is needed between the use of inorganic fertilisers and that of microbial organisms that promote plant growth.

The diversity of papers in this special issue was skewed as three papers focused on soybean and its microsymbiont partners. These deal with several aspects of the symbiosis. In addition, two papers discussed the growth of uninoculated soybean on African soils in Ethiopia and Mozambique. Although soybean is not native to the African continent, it has shown a lot of potential as a food crop. To that end, the International Institute of Tropical Agriculture (IITA) has developed soybean genotypes that exhibit promiscuous nodulation with indigenous rhizobia that are expected to perform well in Africa.

One paper discusses nitrate inhibition of nitrogen fixation and its effect on micronutrient accumulation in the shoots of soybean, Bambara groundnut and Kersting’s groundnut. Groundnut is also not an indigenous African legume, but it is widely grown by smallholder as well as commercial growers. Therefore, given its importance, it is surprising that only one paper in this special issue discussed the selection of elite groundnut genotypes using traits such as water use efficiency, N₂ fixing symbiosis and yield. The common bean is another commonly grown crop in Ethiopia and seems to perform well there. That paper examined the effect of rhizobial inoculation and phosphorus application. Cowpea is the most commonly grown grain legume in Africa, so it is interesting that only one and half papers address issues related to this crop. The first discusses the influence of native rhizobia, lime and phosphorus application on its performance in Nigeria. A second paper provides data on the symbiotic performance of cowpea under farm conditions in Botswana. This paper also assesses the symbiotic performance of groundnut and Bambara groundnut. In addition, it also discusses the symbiotic performance of herbaceous legumes growing in the different agro zones. There is just one paper that considers the

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use of Actinomycetes as biofertilisers for improving the growth and yield of maize in Mali.

In conclusion, soil fertility problems in Africa are real. Traditionally, when resources have been optimal, these problems could be corrected by using inorganic fertilisers. However, chemical fertilisers, especially if not used judiciously, are associated with many problems. In today's world, where resources are limited and climate change is a reality, using microorganisms to promote plant growth seems the most plausible solution. Apart from their value

for biological nitrogen fixation, the use of microbes for enhancing other aspects of plant nutrition is an important area for further research but studies are also needed to ascertain their safety. This conference addressed a wide variety of sub-themes and although only a small number of papers were presented in some areas, it is hoped that the publication of this special issue will stimulate further research. This, in turn, will help find solutions to suboptimal crop production in the face of limited resources, an increasing human population, and climate change.