

Abstract

Soil fertility is the most limiting factor for crop production in the Sahelian zone of West Africa. Over 95% of soils in this region are sandy and pose a great challenge to sustainable management. The poor structure and coarse texture of sandy soils results in low water holding capacity. Nutrient contents and nutrient retention are low, thus causing a low inherent fertility status for agricultural production.

In the recent past, scientists have evaluated the potential of different technologies in addressing the soil fertility problems in the sandy Sahelian soils with the aim of increasing food production. Research results have shown that yields can be increased three to five times with the improvement of soil fertility using organic and inorganic fertilizers. Combinations of these materials also improve an array of other soil properties such as organic carbon content, cation exchange capacity (CEC) and pH. The main constraint to combining inorganic-organic materials is the high costs of inorganic fertilizers and the low availability of organic fertilizers at the farm level. Crop rotation and intercropping systems have also shown potential in increasing food production and improving soil fertility. Rotation systems increase biological nitrogen fixation and improve fertilizer use efficiency. The use of locally available phosphate rock, which could be an alternative to the use of high cost imported P fertilizers, has also shown potential for alleviating soil P limitations in these sandy soils, improving yields and the efficiency of N and water use. Hill placement of inorganic fertilizers and manure is superior to broadcasting. Fertilizer applied to crops in “micro-doses” and hill placed, combined with the use of crop residues and/or manure offers profitable natural resource management technologies to farmers. Successful experience from Niger has shown that adoption of microdose technology can increase production by more than 100% and farm incomes by 50% but requires supportive and complementary institutional innovation and market linkage. Combined water harvesting techniques and integrated nutrient management (INM) in the drier areas of the West African region clearly shows that higher yields can be achieved. In the Central Plateau of Burkina Faso, stone bunds alone doubled sorghum yield compared to the control and could reduce risks of crop failure in erratic rainfall years.

A bottleneck to the use of these profitable soil fertility-enhancing technologies is the low capacity of farmers to invest in these technologies. In order to have these technologies to reach millions of farmers, a new integrated soil fertility management (ISFM) paradigm has been adopted which integrates biological, physical, chemical, social, economic and political factors. Future research challenges include strategies to increase the legume component for a better integration of crop-livestock production systems, exploiting genetic variation for nutrient use efficiency and integration of socio-economic and policy research with the technical solutions. Another very important issue for research is how to increase crop biomass availability at farm level to alleviate the constraint of non-availability of organic amendments. Use of decision support systems, modeling, and GIS are important in order to extrapolate research findings to other areas in which successful technologies can be expanded/scaled out to reach more farmers.