Climate smart cowpea production and soil-water management in Niger

THE CHALLENGE

Cowpea is a major source of dietary protein for the people of Niger during periods of food insecurity. It can be grown as a forage crop or as a dual-purpose crop that provides high protein grain for human consumption and crop residues of high nutritive value for animals. The cultivation area increased from 1.1 million ha in 1980 to more than 4.7 million ha in 2013. Despite such increases, yields are persistently low averaging around 300 kg/ha compared to the global yield of 1,500 to 3,000 kg/ha. Major constraints for improving yields are low soil fertility and water availability. The crop is relatively sensitive to soil water and nutrient deficits which can reduce yield by 70%. As a legume crop, cowpea can also obtain up to 90 kg nitrogen (N)/ha from the atmosphere through biological nitrogen fixation under adequate soil moisture conditions when using improved cowpea varieties. The challenge for the Government of Niger is to increase cowpea production and farmer income by providing support to farmers with integrated soil-water-crop technologies and practices.

THE PROJECT

Through the IAEA technical cooperation project the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, the Institut National de la Recherche Agronomique du Niger (INRAN) and the Université Abdou Moumouni de Niamey; Institut des Radio-Isotopes (IRI) set out to develop integrated soil-water-crop technologies and practices capable of increasing the yield of cowpea, farmer income and soil fertility. This integrated approach focused on using improved crop varieties of cowpea, appropriate irrigation scheduling and soil fertility management (application of nitrogen and phosphorus fertilizer). The project was carried out in the Sahelian zone of Sadore, one of the major cowpea producing regions in Niger.

Sufficient soil moisture availability through the right irrigation scheduling, the use of improved cowpea varieties and soil fertility management increased cowpea grain yield from approximately 300 to 1,500 kg/ha (an increase of 400%) and very close to global yield levels. In addition the cowpea obtained 70 kg N/ha from the atmosphere of which approximately 65% was translocated to soil and is available for subsequent millet crops. With a minimum wholesale price of USD 0.70/kg the increased yield generated additional farmer income of approximately USD 850/ha. The project was subsequently extended to demonstrate the integrated technologies and practices to more than 500 farmers in the region.

THE TECHNOLOGY

Nitrogen is the most important plant nutrient for plant growth. Adding isotopically labelled (with N-15) fertilizer to soil-plant systems and tracking its movement in the soil and plant helps to quantify the amount of N derived by a legume crop through biological nitrogen fixation. This isotopic technique also helps to quantify how efficiently fertilizer N is used by crops and therefore inform the development of management practices to increase crop N use efficiency.
In Niger, approximately one million small farmers are involved in cowpea cropping in rotation with millet or sorghum with an estimated crop growing area of more than 4.7 million ha. The government, in collaboration with the CGIAR and philanthropic organizations such as McKnight Foundation (USA), is disseminating the technologies and practices developed through this project to other agricultural regions to improve yield. The adoption of the developed technologies and practices will potentially increase annual cowpea production from 1.3 million tonnes to 7.0 million tonnes and national cowpea income from USD 900 to USD 5,000 million\(^5\). In addition, the crop will add approximately 45 kg N/ha making a total contribution of 210,000 tonnes of N during the growing season equivalent to 450,000 tonnes of urea. At an international urea market price of USD 450/tonne\(^6\), an additional saving of USD 200 million can be realised by resource poor farmers, while potentially meeting the N requirements of subsequent rotation crops (millet or sorghum) and helping reduce the overall carbon foot print of cowpea based crop rotation systems.

This integrated soil-water-crop management practice is currently being practiced in Botswana, Burkina Faso, Cote D'Ivoire, Mali and Nigeria for improving productivity and soil fertility of legume based cropping systems. 

For further information, please visit:
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1. FAOSTAT (2013).
4. Based on internal data obtained through Technical Cooperation Project NE55015.
5. Based on internal data on yield increase and area cultivated through Technical Cooperation Project NE55015.
6. Estimates based on internal data.