The Challenges of Rainfed Agricultural Practices in Mali-Redefining Research Agenda- A Short Communication

Abstract

Mali is one of the least developed countries with an economy that relies heavily on rainfed cereal production. Rural communities are faced with extreme poverty as a result of unpredictable rainfall pattern and lack of appropriate agricultural intervention practices. Most agronomic practices in support of development in the past had emphasized farm-level productivity issues with limited scope for managing interactions among components and actors beyond the level of the farm. Several studies showed different techniques practiced at farm level to improve the agricultural productivity. However rural communities at large are unable to cope with the impacts of climate change and other shocks related to agricultural input supplies and market access. In this short communication paper recent findings related to the challenges of rainfed agricultural practices were discussed to inform policy makers, researchers and development practitioners to re-define approaches towards sustainable agricultural development. In addition new research agenda was discussed that aim to integrate interactions among components and actors beyond the level of the farm to improve rural resilience.

Keywords: Agricultural productivity; Climate change; Farming practices; Rainfed agriculture; Rainfall variability; Semi-arid region; West Africa; Watershed development; Mali

Short communication

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Birhanu Zemadim*

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Africa

***Corresponding author:** Birhanu Zemadim, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), West and Central Africa (WCA) Regional Hub, BP 320, Bamako, Mali Tel: (O)+232-070-920-0; Email: z.birhanu@cgiar.org

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Abbreviations: CMDT: Compagnie Malienne pour le Developpement des Textiles (Mali); DNM: Direction Nationale de la Meteorologie (Mali); IER: Institute Economy Rurale

Introduction

Located in West Africa and land locked, Mali is one of the least developed countries with an economy that relies heavily on rainfed cereal production [1]. Smallholder agricultural production is dominated by rainfed production of millet, sorghum and maize for meeting food demands and on cotton for the market. Agricultural production is inadequate to feed Mali's population, which is growing at a rate of nearly 3% per year and at present over a quarter of Mali's population is undernourished [2]. Mali has multiple vulnerabilities to climate variability and change. A major constraint for crop production is the amount of rainfall and its intra and inter-annual variability [3,4]. The rainy season is short and varies in length, with the number of rainy days varying from year to year [5]. High evaporation losses (in excess of 50% of annual rainfall) and a dominance of sandy soils with low water holding capacity, result in soil water shortage during the growing season, when rains are erratic [6]. Thus farmers have little control over the environment, with little access to irrigation, limited financial means with which to invest in water harvesting structures or inputs [3]. To cope with the challenge of uncertain planting rains recent findings [4,7] recommended a crop management practice based on adjusting the planting date and choice of variety at a farm level. However, due to the erratic rainfall patterns, the first rain suitable for planting is often followed by several dry and hotter days that may cause the planting to fail and oblige the farmer to re-plant. Delayed planting can avoid this problem, but late planting results in a substantial shortening of the growing season and, consequently, in lower yields [4].

According to Mali's Direction Nationale de la Meteorologie (DNM), Mali has become hotter and drier over the last several decades [1]. Analyses of recent temperature records showed an increase in temperature over the latter part of the 20th century. As a result the region is likely to get hotter as a result of global warming [8]. High temperature occurring in combination with drought [8] will lead to increased crop water stress and therefore cause scalding in cereals, disturb flowering and strongly reduce crop yields. The precipitation trend in the southern part of Mali for example, Sikasso region, for 1960-2005 indicate that overall annual precipitation decreased slightly, with a significant reduction in the wettest months (July and August), while precipitation at the beginning of the rainy season (May) increased [9]. Other constraints to the agricultural productivity in the region are related to availability of labor, poor adoption rates of agricultural inputs, for example fertilizer rates and poor fertility of the soil. At the beginning of the rainy season lack of or insufficient labour can hinder the capacity of the farmer to prepare the soil, thereby causing a delay in the planting date [4]. Mineral fertilizer is often not available or too expensive, or its application is risky. So yields per hectare are dropping [3]. The soils are very sandy soils (Arenosols) predominate. They are of low fertility, organic matter levels are inherently low and soil structure is near absent. Environmental conditions are such that the build up of organic matter levels through management is not an easy task. Measures that could improve moisture availability are dearly needed in this case. The question therefore is how to decrease overland flow, improve water infiltration and reduce evaporation from the soil surface and topsoil, given the prevailing soil conditions [10]. Existing practices revealed that most agricultural practices are concentrated on individual farm fields and the few increase in production of cereal staples (millet and sorghum) in Mali was

mainly due to land expansion rather than to an increase in yields per ha [4] and without integrated natural resources management and community participation [11].

To overcome these challenges this paper is proposing a watershed management approach that integrates activities beyond the level of the farm. Programs on watershed development and management are considered as a potential engine for agricultural growth and development in fragile and marginal rainfed areas [12,13]. Natural resource management at a watershed scale, including ground water recharge for example, produces multiple benefits in terms of increasing food production, improving livelihoods, protecting the environment, addressing gender and equity issues along with biodiversity concerns [14-16]. In arid and semi-arid tropics one key element of watershed development interventions is the concept of livelihood security and environmental sustainability. In these regions the watershed strategy is significant in conserving and managing scarce resources such as land and water to meet the growing demands for food [16].

Presently there are no documented evidences in the area of watershed management by the government of Mali though there is a big interest from the national agricultural research institution (IER) and CMDT. The important role of IER in applied and adaptive research and the connection of CMDT via the extension service, to local communities and farmers make IER and CMDT potentially very important actors in the watershed development program in Mali. There are also lessons to learn from watershed programs in India and other parts of East Africa. It should be noted that careful documentation and comparative analysis of the effectiveness, efficiency and sustainability of appropriate technologies is necessary in order to establish sustainable watershed program. There is a strong need for people to sense implemented activities and the activities need to be replicated by the inhabitants of the watershed. Lessons learnt through the work at the pilot learning site need to be extrapolated to other areas having similar concerns as well.

Conclusion

The current short briefing outlined the major constraints to agricultural productivity in Mali. The findings serve as a base to re-define the approach towards sustainable agricultural practices. One option that could be considered here is watershed management practices that were proved successful in India and parts of East Africa. Watershed management practices address component interactions between farms and between farms and other landscape units (forests, springs, ground water sources, rivers etc.), a missing component from most agricultural practices in the past. Obtaining maximum benefits out of these component interactions however requires the people of the watershed to collaborate with each other and often with outside parties providing services as well.

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