Good practices in agricultural adaptation: Findings from research in Maize, Sorghum and Cotton based farming systems in Zambia

Petan Hamazakaza

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Introduction

This paper presents a summary of key findings on the project: “Agricultural adaptation practices to climate change” which was carried out in Chirundu/Siavonga and Chibombo districts of Zambia. The research was undertaken as part of an African-wide project that also looked at Burkina Faso, Cameroon, Ethiopia, South Africa and Togo.

Climate change and agriculture in Zambia

Climate change is now topping the list of agriculture development challenges. It endangers the 80% of Zambia’s population that in rural areas and draws their livelihoods from natural resource-based smallholder production systems (e.g. agriculture, fisheries and forestry). These systems are already under pressure from environmental degradation and inadequate management practices. In the policy context, the Sixth National Development Plan (2010 – 2015)(SNDP) stipulates that the agricultural sector will continue to be a strategic area of focus in promoting economic growth, reducing poverty and creating employment. In view of the significant economic impacts of climate change on agriculture, especially among the smallholder farmers, and in order to meet the aims of the SNDP, the Zambian agricultural sector is now experiencing a silent revolution. Traditional agricultural practices are shifting towards production systems that are aimed at adapting to the dynamic agroclimatic conditions.

Target Study Commodities

This assignment targeted three crops; maize, sorghum and cotton. Maize has been included in this study for two reasons. Firstly it plays an important role in food security and livelihoods, particularly among smallholder farmers. Secondly it has received the largest share of government and donor investment with regard to climate change adaptation practices. Sorghum is the second most important cereal food crop, and most grown cereal crop under drought and high temperature conditions in Agro-Ecological Region I of Zambia. Cotton is the most important cash crop grown in the drought prone areas of Zambia. These crops have shown significant fluctuations in production levels over the years. Causes of these fluctuations are agroclimatic as well as linked to crop management and input access-related issues. A report by Nijhoff (2009) indicates that the maize and sorghum productivity levels in Zambia are far below the global average. Maize average yield for the smallholder farmers in Zambia is about 1.9ton/hectare compared to the 4.47ton/hectare global average. The sorghum average yield is about 0.67ton/hectare compared to the 1.30ton/hectare global average. Such low productivity levels call for an elaborate understanding of the crop production practices under which these crops are grown, and particularly how to maintain and improve production under climate change.

Evidence for changing rainfall patterns in Chibombo and Siavonga districts

Past rainfall from 1999-2013 was investigated using data from the Zambia Meteorological Department. This short period of information cannot be taken in isolation to be evidence for climate change, given the underlying rainfall variability in southern Africa, but it does show a trend for drying in recent years. The average number of rain days for the last 13 years is about 67 in Chibombo as compared to the expected normal of 150 days or five months of rainfall in a normal season (figure 1). The average maturity period for most maize, sorghum and cotton varieties in Zambia ranges from about 115 to 150 days. The change in the rainfall pattern, particularly the ever-shortening rainy season, implies farmers have to adapt agricultural production practices and technologies to match the conditions. This includes taking up very early maturing varieties coupled with adoption of moisture conservation technologies.

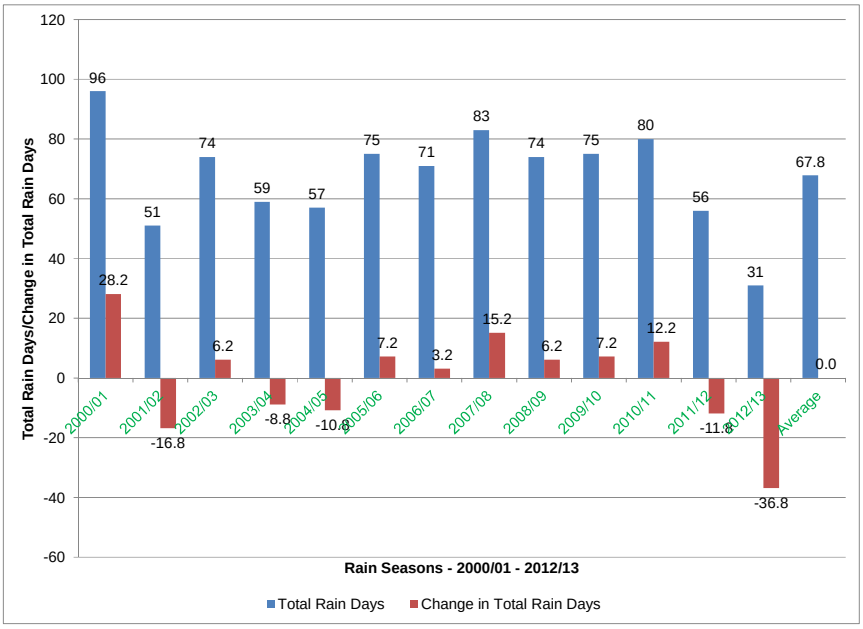

Figure 1. Chibombo district total rain days - 2000/01-2012/13

Siavonga is mainly characterized by sorghum-maize-livestock based farming systems. The district is relatively drier and exhibits significantly shorter rain seasons. A review of rainfall data for the last 13 seasons (1999/2000 to 2011/12) shows a maximum number of rain days of about 51 days (figure 2). This is insufficient for medium and late maturing varieties of maize, sorghum and cotton.

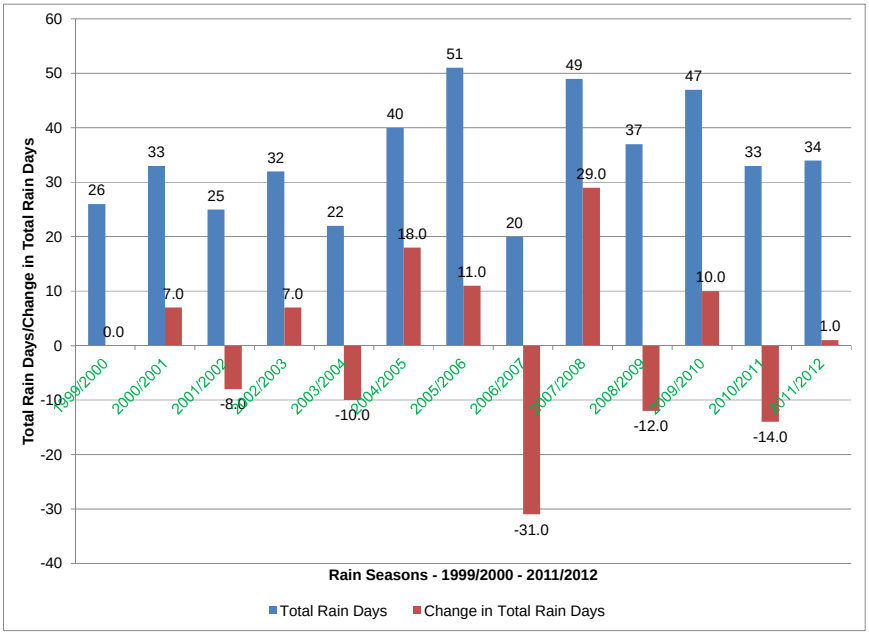

Figure 2. Chirundu/Siavonga district total rain days - 1999/00-2011/12

Agricultural Adaptation Practices observed in Chibombo and Siavonga districts

Early Planting

Early planting is the most widely applied adaptation practice, and provides more flexibility in the case of variable onset of the rainy season. Interviews with farmers in both Chibombo and Chirundu/Siavonga communities found that early planting is practised in two principal forms; dry planting and minimum tillage based on ripping and/or planting basins with first rains. A farmer group under the Conservation Farming Unit (CFU) study team in Mwachisompola Agricultural Camp of Chibombo exlained that they have adopted early planting coupled with the application of ripping or basin land preparation when the soil is still dry before the onset of the rains as well as herbicide application for weed management. Dry planting involves tillage of fields early in the season before the first rains. The major farm implements used for this practice are handhoes, animal drawn rippers or chaka hoe which are being promoted under Conservation Agriculture tillage methods. Dry planting takes place around the months of September – November but is associated with significant risks of seed rotting due to insufficient moisture if early rains are inadequate.

Staggered Planting

Staggered planting is a major response to unpredictable weather conditions (typically coupled with mid-season prolonged). In the Chilindi area of Chirundu district, farmers have adopted the planting of early maturing sorghum early in the season and also late planting of the much more drought tolerant and late maturing varieties. Farmers have innovated the staggered planting method to ensure that at least one of the crops planted within the season escapes unusual weather conditions. Staggering of different crops also take place. Maize and sorghum are staggered with most farmers planting a significant portion of crop under dry planting or with first rains. The remainder of the crop is planted once rains have stabilised, and then the last crop towards end of December/early January of each year in anticipation of a longer rain season. Both early and medium maturing crop varieties are staggered to ensure an early harvest in a good season.

Early Maturing Varieties

Use of early maturing varieties is another practice used by farmers to make the most of short spells of rain. Sorghum farmers have adopted early maturing varieties, especially Kuyuma, to ensure an early harvest within three to four months after planting. This is compared to the late maturity varieties which are left to grow in the fields even after the season has come to an end around April. Planting of improved early maturing maize varieties has become a common phenomenon among most farmers in the particularly dry area of Chirundu, although it is less popular in Chibombo.

Conservation Agriculture

Consevation Agriculture (CA) is commonly applied among cotton, maize and sorghum farmers. In 1999 the government of Zambia adopted conservation agriculture as a key strategy to help enhance crop productivity and reduce negative impacts of agroclimatic shocks that include climate change, soil degradation and poverty-especially among resource constrained farmers. Key components of CA used by farmers to adapt to climate change include ripping, basin preparation, rotation, and crop residue retention. CA is an effective adaptation practice as a result of donor and government support, active extension officers who are performing ongoing training, and on-farm based crop demonstrations. Factors that can impede the use of CA include limited infrastructure development in rural areas for support services, particularly agro-dealers and low farmer financial capacity. There is also the possibility for conflict with livestock

production. This is because crop residues are used for fodder, but in CA they are also needed to leave in the fields for mulching.

Crop and Livestock Diversification

This practice is implemented by farmers from two perspectives; (1) diversification in terms of varieties within a crop, and (2) diversification across agricultural enterprises. Major crops grown in sorghum-livestock based farming systems include; sorghum, cotton, maize, bulrush millet, cowpea and sesame. In addition to the field crops, off-season crop production for vegetables and green maize is commonly practised. Major crops in maize-based systems include; maize, cotton, soybeans, and groundnuts.

Use of certified improved crop varieties and planting different maturing varieties of the same crop are important. This practice is associated with increased use of drought tolerant and early maturing varieties. Access to improved sorghum varieties remains a challenge compared to maize and cotton. Women and most resource constrained farmers are worst affected as improved varieties are mostly sourced outside the communities.

In terms of diversification across agricultural enterprises, addition of short cycle small livestock (goats, chickens) also takes place. This is critical as a source of quick income to meet household expenditure needs. Furthermore sale of livestock products releases capital to purchase crop inputs, while livestock such as cattle are a source of draught power in the use minimum tillage implements such as rippers and fitarelli planters.

Off-season Crop Production

Off-season crop production for green maize, pumpkins and vegetables is a common practice that supplements field crop production and again ensures that farmers are making use of the temporal variation in resource availability. This practice is an option when there is a local market, including agrodealers who stock required inputs, such as seed, agrochemicals and fertiliser. It also requires appropriate biophysical conditions, including fertile alluvial soils, and suitable weather conditions. Suitable weather conditions include high heat units for fast crop growth in winter (when most smallholder farmers engage in this practice), and availability of perenial water sources for most locations. This practice was largely observed only in locations where extension services have provided training for farmers in off-season crop production.

Gender differences in adaptation good practices

A number of adaptation good practices showed gender differences. Practices that were equally observed among female and male farmers included: early planting, staggered planting, crop-livestock diversification and off-season crop production. These practices require low inputs and are adapted by most resource constrained farmers, including women. Some CA practices showed inequality in terms of access by men and women. This was especially the case for those practices that require additional inputs, for instance the use of draught power such as ripping, fitarelli planters and, to a greater extent, fertilizer use. The cost of improved seeds and crops, for example, is also more likely to be affordable to men than women. Similarly keeping large livestock, such as cattle, is a male gendered responsibility. Practices that require draught power are thus often more difficult for women farmers to access, because they would have to pay for rental in the absence of having access to their own livestock.

Major reasons for differences between men and women are thus related to gender inequality in the context of control over resources (financial and physical). Poverty and social capital assets are also important. Women farmers tend to have weaker linkages to the external institutions that support agricultural production, including development agencies, NGOs and the private sector.

In particular, high poverty levels among female-headed farm households weakens their ability to adapt potential adaptation practices that demand relatively more external inputs (e.g. fertilizers, improved seed, farm implements/mechanization). Women play a bigger role in terms of labor contribution for hand hoe related practices; minimum tillage, planting. This means that, although these practices may enable production in a changing climate, they do so at a time cost to women relative to men. Bearing in mind these gender differences is important to ensure that agricultural adaptations do not inadvertently reinforce existing inequalities between men and women.

For more information, please contact:

Petan Hamazakaza

c/o Kabwe Research Station, P.O. Box 80908, Kabwe, Zambia

Cell: +260 977 440948; Email: hamazakazap@yahoo.com

or visit www.kulima.com/agriculturaladaptation