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Managing the agricultural calendar as coping mechanism to climate variability: A case study of maize farming in northern Benin, West Africa

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ABSTRACT

Nowadays climate variability and change are amongst the most important threats to sustainable development, with potentially severe consequences on agriculture in developing countries. Among many available coping mechanisms, farmers adjust some of their farming practices. This article aims at exploring observed changes in the agricultural calendar as a response to climate variability in northern Benin. Interviews with local experts (agricultural extension officers and local leaders such as heads of farmer and village organisations) and group discussions with farmers were organised. A household survey was also conducted on 336 maize producers to highlight the factors affecting decisions to adjust the agricultural calendar as a coping mechanism against climate variability. As a general trend, the duration of the cropping season in northern Benin is getting longer with slight differences among and within agro-ecological zones, implying a higher risk of operating under time-inefficient conditions. Farmers receive very limited support from agricultural extension services and therefore design their agricultural calendar on the basis of personal experience. Socio-economic characteristics, maize farming characteristics as well as farm location determine the decision to adjust the agricultural calendar. Consequently, providing farmers with climate related information could ensure a rational and time-efficient management of the agricultural calendar. Moreover, research and extension institutions should help in establishing and popularising clear agricultural calendars while taking into account the driving forces of behaviours towards the adjustment of farming practices as a climate variability response.

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Introduction

There is increasing evidence that both climate variability and climate change will strongly affect the African continent and will be among the most challenging issues for future development, particularly in the drier regions (Adger et al., 2007). Several studies have concluded that agriculture in Africa will be negatively affected by climate change (Pearce et al., 1995; McCarthy et al., 2001; Christensen et al., 2007; Müller et al., 2011). In Benin, agriculture depends heavily on rainfall and whether in the short or long term, climate variability is acting negatively on yields and production (Aho et al., 2006). Exploring the relationships between climate and agricultural production in Benin using predictions from high-resolution regional climate model, Paeth et al. (2008) projected a decrease in agricultural production – with respect to most crops – of 5–20%. Adger et al. (2003) and Kurukulasuriya and Mendelsohn (2006) state that adaptation is one of the policy options for reducing the negative impact of climate change, while Mendelsohn et al. (1994) note that farmers will be especially hard hit if they do not adjust at all to new climates.

Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli (IPCC, 2001). It helps farmers to achieve their food, income and livelihood security objectives in a context of changing climatic and socioeconomic conditions (Kandlinkar and Risbey, 2000). Common adaptation methods in agriculture include the use of new crop varieties and livestock species that are better suited to drier conditions, irrigation, crop diversification, adoption of mixed crop and livestock farming systems, and changes in agricultural activity dates (Bradshaw et al., 2004; Nhemachena and Hassan, 2007; Gnanglè et al., 2012; Yegbemey et al., 2013). Some of these methods (e.g. changes in agricultural activity dates) undertaken in response to short-term climate variability are classified as coping responses.

Considering the strategies developed by farmers for coping with climate variability, a large number of studies (Nhemachena and Hassan, 2007; Gnanglè et al., 2012; Yegbemey et al., 2013) have reported changes in sowing dates. Nevertheless, there is no literature on how exactly the agricultural calendar is currently moving. Whereas it is acknowledged that seasons and even agro-ecological zones are shifting due to climate change, there is still no investigation with the focus on how farmers adjust their whole agricultural calendar in face of climate variability. Thus, this paper aims at exploring observed changes in the agricultural calendar as a response to climate variability in northern Benin. It also attempts to highlight the factors affecting the farmers' decision to adjust their agricultural calendar as coping mechanism against climate variability.

Materials and methods

Study zone, sampling and data

The study took place in northern Benin, located between 8.30° and 12.20° North, and 1.00° and 3.90° East. This region is expected to be more affected by projected climate change than the southern part of the country (MEHU, 2001). There are four distinct agro-ecological zones in northern Benin. The sampling took into account one municipality per agro-ecological zone (Fig. 1) and two villages per municipality. The choice of municipalities and the villages was made with the support of agricultural extension officers, based on the importance of the agricultural production.

The study was conducted through interviews with local experts (agricultural extension officers and local leaders such as the heads of farmers and village organisations), group interviews with farmers, and a household survey. Interviews with local experts were aimed at discussing the suitability of the agricultural calendar adjustment as a climate variability coping mechanism and identifying a list of its major socio-economic drivers. Group interviews with farmers from the selected villages were aimed at cross-checking the information obtained from the local experts and the household interviews, and understanding changes in the agricultural calendar and their drivers.

The household survey, which was conducted with a questionnaire, was aimed at collecting primary data for assessing the factors which influence decisions to adjust the agricultural calendar as coping mechanisms against climate variability. The scope of the questionnaire covered information related to the farmers perceptions of and mechanisms for coping with climate variability, and the decision to adjust the agricultural calendar as a climate variability response. As well, the socio-economic characteristics (i.e. age, educational level, experience in agriculture, contact with extension service, organisation membership, access to credit, and land ownership) and some farming system characteristics, including the farm location were also considered. Since maize is expected to be more affected by climate change (MEHU, 2001), the study respondents were maize producers. A total of 336 maize producers were randomly selected for individual interviews. The collected data were analyzed with the statistical softwares SPSS 19 and STATA 11.

Empirical modelling of farmers' decision to adjust the agricultural calendar

Choices or behaviours towards the decision to adopt agricultural technologies, innovations or new practices are explored by using the Multinomial Logit (MNL) or the Multinomial Probit (MNP) models (Nhemachena and Hassan, 2007; Yegbemey et al., 2013; Hausman and Wise, 1978; Wu and Babcock, 1998). Both models are appropriate for evaluating alternative combinations of choices, including single choices (Nhemachena and Hassan, 2007; Hausman and Wise, 1978; Wu and Babcock, 1998). In these models, the dependent variable is the set of choices (strategies or options) defined as one variable