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Climate variability and change: perceptions, experiences and realities

K.P.C. Rao and A. Oyoo, International Crops Research Institute for the Semi-Arid Tropics; and W.G. Ndegwa, Kenya Meteorological Department

Farming in the semi-arid tropics, where climatic conditions are marginal and highly variable, is a risky enterprise. The main source of this risk is the variability in rainfall that occurs at many different timescales, ranging from seasons to years to decades and beyond. Farmers operating under these conditions make decisions based on their perceptions and experiences gained from several years of keen observation and practice in the field. However, perceptions are influenced by many factors, both real and subjective. For agriculture, factors like farm productivity, crop, market and local preferences, capacity to invest, willingness to take risks and soil quality play an important role. While the role and significance of some of these factors on productivity and profitability can be perceived more easily due to their relative predictability, extreme variability in climate and the random nature of that variability makes it difficult for farmers to accurately perceive trends in climate. In the absence of detailed measurements, perceptions can be biased and unreliable. Climate information can play an important role in helping farmers better understand this variability and its associated risks, and enhancing their decision-making for effective risk management.

Inter- and intra-seasonal variability in rainfall have been the key climatic elements that determine the productive efficiency of rainfed agriculture. While the amount and distribution of rainfall have a direct impact on the productivity of agriculture, its variability contributes to the uncertainty in the expected benefits from investments made, and to the rates of return that farmers receive from these investments. Farmers, operating under these highly variable climatic conditions must have a good understanding of the risks and opportunities such conditions create for them to make best use of available resources. With a good understanding of the historical and current climatic conditions including climate forecasts, it is possible to tailor the management of agricultural systems in a way that capitalizes on opportunities and minimizes risks. While farmers have developed a good understanding about the climate variability at their locations through keen observation, experimentation and practice, there are problems in their perceptions that arise from the complex nature of agriculture and an inherent problem in separating climate impacts from other drivers that also affect agricultural production. Since farmers take decisions based on their perceptions it is extremely important that, while assisting farmers to adapt to climate variability and change, the perceptions, experiences and actuality of changes in climate are placed in the context of the impacts of various drivers on the performance of agriculture. Our work with farmers in Eastern Africa – mainly in Kenya – on managing risks associated with variable climatic conditions, has identified three common perceptions that can be effectively addressed through provision of more accurate climate information to extension officers and farmers. These studies were conducted in the Machakos, Makueni, Kitui, Mwingi and Mutomo districts in semi-arid Eastern Kenya, where the average annual rain fall varies from 500 mm in the lowlands to over 1,050 mm in the hilltops. The annual rainfall is distributed almost equally over two rainy seasons that fall during the periods of March-May (also referred to as 'long rains') and October-December ('short rains'). The studies involved structured surveys, group discussions and interpreting and presenting seasonal climate forecast information in the form of agro-advisories.

Perception 1: the climate has already changed

Farmers across the study locations strongly believe that the climate in their area has changed for the worse. This response is consistent with results reported from surveys conducted elsewhere in Africa. In all these studies, most farmers identified declining rainfall, increased variability in the distribution of rainfall within and across the seasons, and shifts or even disappearance of seasons as the major changes observed. However, the changes that farmers have identified are not obvious from the available rainfall records. Detailed analyses of long-term daily and monthly records from five sites in Kenya where these interviews were conducted indicate no major detectable change in the rainfall during the last four or five decades. For example, at Machakos, Kenya, the longest dry period that the region has ever experienced was between 1966 and 1975, during which the annual and seasonal rainfall was below the long-term average in at least seven out of 10 years. This strong belief among farmers that the climate has changed for the worse despite lack of evidence in the climatic data to support this, is prompted by the declining yields in the area which are more likely due to diminishing soil fertility, low levels of use of inputs, and the expansion of agriculture into marginal lands as the population

Image: ICRISAT

A farmer group in Mwala, Machakos, Kenya doing an exercise aimed at understanding variability in rainfall and evaluating the reliability of seasonal climate forecasts

has grown. The implication of this unsupported perception is that farmers do not pay adequate attention to the actual yield-limiting factors such as soil fertility since they strongly believe that climate change is the main driver for low productivity and that not much can be done to manage it.

Perception 2: climate is too risky

Farmers are well aware of the season-to-season variability in their climates. They generally classified the seasons as good, not so good or average, and very dry or poor based on criteria that included factors such as crop yields, early and late onset of the rainy season, and the amount and distribution of rainfall. Most farmers were able to recollect how the season that preceded the survey was, with 49 per cent able to recall the conditions that existed during the previous 10 seasons over five years (there are two seasons per year in Kenya). In general, there is a good consensus between the farmers' rating and the observed conditions for seasons that are either good or poor, except for one or two seasons out of the 10. However, their ability to estimate the frequency distribution of different events and discern long-term trends is more subjective. Farmers tend to attach greater significance to negative events or impacts, which leads to a biased estimation of the frequency of occurrence of negative events. This has important implications in their assessment of risk and in subsequent decision-making. Their perception of higher risk results in a preference for techniques that require low levels of cash and labour investment, and acts as a major deterrent in optimizing input use and taking advantage of improved technologies. We consider this as one of the primary reasons for low levels of adoption of improved technologies in the drier areas.

Perception 3: climate forecasts are unreliable

In general, both farmers and the general public view climate forecasts with a lot of scepticism. Much of this is due to the misunderstanding and misinterpretation of the forecasts that come with different time steps, different levels of prediction skill and different spatial resolutions. Often users cannot generally distinguish between short-range weather forecasts and long-range climate forecasts and their potential applications. Seasonal climate forecasts can form a basis for farmers to plan and manage their farms better, since many management decisions such as crops and the varieties to be planted, proportions of land to be allocated to various crops and the level of investment on inputs need to be taken well before the season starts. Despite their value and usefulness of forecast information, its use by smallholder farmers remains very low because of perceived poor reliability, lack of awareness of the potential applica-

Image: ICRISAT

A woman farmer in Ethiopia explaining rainfall records that she has been recording on her farm

tions and non-availability of timely information in a user-friendly format. Fortunately, Eastern Africa is a region where climate is relatively more predictable due to the strong correlation with El Niño/La Niña episodes. In a study conducted to evaluate the potential benefits of seasonal climate forecasts, we asked farmers to evaluate the skill in forecasts and assess their usefulness in planning and managing their farms. We used hindcasts provided by the International Research Institute for Climate and Society for 43 short rain seasons (October-December) starting from 1961, for Katumani in the Machakos district.

Farmers rated the forecasts, comparing the predicted with the observed seasonal conditions by grouping the seasons into two categories – below normal and above normal for maize growing. According to the farmers' assessment, 35 of the 43 predictions were extremely good and use of these forecasts for farm management could result in substantial productivity gains during wet years and in minimizing losses during dry years. Of the eight misses, farmers considered the four seasons in which below-normal rainfall was predicted but above-normal rainfall was received to be less of a problem, since they represent a lost opportunity but involve no loss on investment. The real problem is with the four seasons that were predicted to be above normal but turned out to be below normal. These are the seasons in which investments guided by forecasts could potentially lead to a loss. However, the observed prediction skills are above the farmer acceptable level of 80 per cent, which is four out of five seasons.

Evidence from our studies clearly establishes that significant benefits can be derived from the use of climate information if it is interpreted and presented in a way that can easily be understood by the end users. Farmers were able to appreciate the value of forecast information when this was interpreted in terms of its agricultural significance and presented in the form of an advisory that summarizes key potentials and risks associated with the type of season predicted. When the usefulness of the advisory service was evaluated after three seasons, most farmers considered the advisories to be extremely useful in planning farm operations, an observation well supported by the willingness of 87 per cent of the farmers interviewed to pay for the service if required.

Given the general complexity and extreme variability associated with climate, it is not only difficult to perceive the trends but also difficult to measure, analyse and explain them accurately. However, the trends derived from longer-term observations and predictions at seasonal scale, which are fairly reliable, have the potential to make significant contributions to addressing the misperceptions and gaps in understanding that have come to light through these studies.