Farmers' perceptions of climate change: a case study from the Portuguese Centro Region

J. L. Rocha[1], I. Dinis[1], C. Dias-Ferreira [1,2]

[1] Polytechnic Institute of Coimbra & CERNAS, College of Agriculture, Coimbra, 3045, Portugal
[2] Universidade Aberta, Lisboa, Portugal
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Presenting author email: joanarocha@esac.pt

Abstract

This work aims at better understanding how farmers in the Centro Region of Portugal perceive climate change and to assess their will to adopt adaptation practices. The target region lays in the transition between Mediterranean and Atlantic climate and is thus particularly vulnerable to climate change, so adoption of adaption strategies at farm level is crucial. Farmer's knowledge, perception and experience play an important role in the adaption process. In order to better understand the drivers and obstacles that might arise towards climate change adaption actions a field survey was carried out using a sample of farmers from this region. The four most relevant farming types in the region were included in the study, namely maize, rice, vegetable and livestock. Preliminary results show that the farmers are well aware of climate change and several best management practices, such as low till, use of improved seeds, use of drip irrigation systems have already been adopt to some extent. These results can help to define local best management practices for the farming and livestock sectors that will be more efficiently accepted and adopted by farmers.

Introduction

United Nations states that climate change is the defining issue of our time and now is the defining moment to act upon it (UN, 2019). The predicted impacts of climate change in Portugal are consistent with a pattern of global warming. That is, a tendency to decrease annual precipitation and longer periods without rain. Consequently, droughts are expected to be more severe and desertification is a reality that calls for action. Furthermore, extreme events, such as floods and hurricanes are expected to be more frequent (Santos, Forbes, & Moita, 2001).

Agriculture and livestock husbandry are activities that strongly depend on the climate conditions. Additionally, the climate projections for the Mediterranean region foresee devastating impacts on the development of crops and livestock. The Portuguese Centro Region, in respect to landscape and climate, is very diverse. It is comprised of sea level and mountainous areas (up to 1990 m). The climate is a transition between Mediterranean and Atlantic climate with an average rainfall of 800 to 1000 mm (Ferreira et al., 2017). Agriculture and livestock are important economic activities in this region; agricultural units with livestock production cover 31% of the land area (879,7 ha) and farm units are characterized as being mainly small and medium sized units, but with a significant number of livestock (Almeida, 2011).

Due to the particular vulnerability of Portuguese agricultural systems to climate variability, the government published the national strategy for adaptation to climate change (ENAAC, 2013), which presents the upcoming impacts of climate change and best management practices to adopt in order to minimize such impacts. However, to successfully transfer these national plans to a regional level requires a sound knowledge about the farming practices in the specific area and the complex socio-environmental systems regulated by biophysical constraints. Environmental awareness, such as the adoption of best management practices, is frequently induced by individual, societal, historical and cultural circumstances (Nguyen, Seddaiu, & Roggero, 2019). Knowledge, perception and experience play an important role in determining whether and in what manner adaptation actions will take place. Understanding the obstacles that might arise towards climate change adaption actions, is thus essential for their successful implementation at regional level. Farmers' knowledge is mostly built from experiences, interactions with other farmers and the environments they live in. Knowledge usually shapes behavior, which is communicated through attitudes.

This work aims at better understanding how farmers in the Centro Region of Portugal perceive climate change and to assess their will to adopt adaptation practices.

Methods

A face-to-face field survey was conducted to 20 farmers in the Centro Region of Portugal. The survey was designed containing closed and open questions. The closed questions aim to gather data about *business as usual* farming practices in the study area covering topics such as soil, water, livestock, and residues management. In addition, open questions were also asked concerning the farmers' perception of soil quality, water availability

and livestock management changes during the last decades. Finally, to assess knowledge and believes concerning climate change at local scale questions were asked questions about its causes and consequences. Farmers were selected according to a snow ball procedure, in which an initial small set of known farmers were interviewed and asked to indicate other farmers to be interviewed next. A limit was set to the number of interviews for each farming type, so that the percentage in the sample closely followed the distribution in the region. Each field interview took approximately 20-25 minutes to complete. The answers were hand-written in the field, transferred to an excel spreadsheet and then further analyzed using R (mean, standard deviation and box plots).

Results and Discussion

The food crops produced in this region with higher market value are maize and rice. Temperatures above 30°C damage cell division and amyloplast replication in maize kernels resulting in reduced grain size, in other words lower production. Rice shows a similar reaction, its pollen viability and production decays as temperature reaches 33°C and ceases when temperature is above 40°C (Bhattacharya, 2019). Therefore, the production of a whole region can be at stake if agricultural practices are not changed. Rice production and climate change are like an intrinsically connected loop. Rice production is responsible for large emissions of methane ($CH4$), which is a greenhouse gas with a warming potential 28 times higher than carbon dioxide (CO_2) (IPCC, 2014). Furthermore, pollination of rice flowers is extremely sensitive to higher temperatures. The same can be said for vegetables production, higher temperature can negatively impact the yield and quality of the production, increase plagues and plant diseases, as well as it can interfere with the effectiveness of plant protection products. The projections of climate change impacts concerning livestock production can be very negative, animal welfare can be severely affected. Cattle farming is responsible for the highest share of greenhouse gases from agriculture, but on the other hand, the production of milk is significantly lowered when temperature is above 26°C.

Therefore, changes in farming practices are fundamental to lower agricultural and livestock activities emissions and to adapt to climate change.

The farms were grouped according the predominant farming types in the region: rice, maize, livestock and vegetable production. Preliminary results show that the farmers are aware of the climate change and show that several BMPs, such as low till, use of improved seeds, use of drip irrigation systems have already been adopt to some extent. The surveys are on going, and more results will be presented at the conference. These results can help to define local best management practices for the farming and livestock sectors that will be more efficiently accepted and adopted by farmers.

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