Climatic variability and extreme temperature events: impact on ruminant production on pasture

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Introduction

In the pastoral production systems of Uruguay, the animals are permanently exposed to the environment, which affects the physiological and productive responses directly, as well as indirectly through the plane of nutrition.

During the warm months, the combined action of high solar radiation, temperature and humidity of the air, produce a meteorological environment outside the so-called comfort zone of the animal, reducing productivity. This effect is directly verified through the reduction of milk yield and changes in milk composition (Bianca, 1965; Sargent *et al*., 1967).

Grazing sheep undergo exposure to wind, rain and variations in ambient temperature, determining different physiological responses to gain or to lose heat. Extreme cold events (low temperatures, rain and strong winds) affect animal productivity, increasing mortality of newborn lambs. Lamb mortality is an important component of the low weaning rates in Uruguay (reaching 30% on average, Fernández Abella, 1995) and most of the deaths are neonatal, occurring in the first 72 hours of life.

Considering climate as a risk, this project evaluates the impact of extreme temperature events on the productivity of grazing ruminants (cattle and sheep) in Uruguay.

Aims

- To identify the meteorological conditions (extreme event) that cause losses in productivity and characterize the moment of its occurrence, the intensity and the duration of the event.

- To adjust the thresholds of the biometeorological index that best characterizes the effect of these extreme events on animal productivity in Uruguay.

- To determine the magnitude of changes in the characteristics of extreme events at climatic scales.

Expected outcome

The adjustment or development of new biometeorological indexes, validated in grazing systems under widely variable meteorological environments, will allow the public and private sector to issue recommendations on how to adapt to, and how to mitigate the effects of extreme weather events. We expect that the information obtained through this project will be useful for the public sector to implement an early alert system so that the private sector can act to protect cattle and sheep from extreme weather events.

Materials and methods

- The meteorological conditions during production crises, such as lamb mortality and decreased milk yield, as well as the ten days leading up to the event, will be characterized. Lamb mortality will be evaluated in the North-West and Centre of Uruguay. Daily milk yield records from 2009 to 2016 of the Experimental Farm of the Agronomy Faculty at Salto (EEFAS) and of commercial farms will be analyzed for major reductions in yield (over 17% and during at least three consecutive days; Valtorta *et al*., 2002; Saravia, 2009).

- Meteorological data will be collected daily by the Uruguayan Institute of Meteorology (InUMet) and EEFAS, and the following parameters will be recorded: air temperature (maximum and minimum), air humidity (estimation based on the psychrometric pair), mean wind velocity and direction, and rainfall.

- The experimentally identified weather events and those at the commercial farms will be used to adjust or select existing biometeorological indexes, which best describe the conditions under which loss of production occurs.

- The biometeorological indexes to evaluate will be: Temperature and Humidity Index (Thom, 1959), Adjusted Temperature and Humidity Index (Mader *et al*., 2006), Comprehensive Climate Index (Mader *et al*., 2010), Chill Index (Donnelly, 1984).

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