# Chapter 5 Adaptive Management Practices for Robust and Profitable Dairy Operations in the Tropics Upon the Uncertainty of Climate Change

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### EXECUTIVE SUMMARY

One of the greatest challenges of dairying in tropical regions of the world is heat stress. Upon the uncertain effects of climate change might have in dairy cattle productivity in the tropics, intrinsic advantages exhibited by heat tolerant breeds, in combination with adaptive nutritional management for heat stress, and modifications to the tropical environment, could be valuable in the quest to assure a robust and profitable dairy operation in our region. In the American continent, farmers have selected bovines better adapted to the region, like the hot and humid environment of Puerto Rico, where we can find "purebred" Holstein cattle that phenotypically have a very short and slick hair. This chapter intends to present the main managements practices carried out in dairy herds in the tropics upon the climate changes.

DOI: 10.4018/978-1-6684-5472-5.ch005

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### INTRODUCTION

One of the greatest challenges of dairying in tropical regions of the world is heat stress (HS). Currently, but worsening in the future, climate changes may also expose the temperate regions of the world to hotter and longer hot seasons, perhaps with higher relative humidity (West, 2003; Berry et al., 2016; Assenget al., 2021). Because the principal dairy breeds have been mostly selected from temperate regions, climate change might increasingly expose dairy cows in all parts of the world to chronic and acute HS, negatively affecting dairy profitability. To minimize the effects of HS, three main management approaches have been identified: 1) selection for heat-tolerance; 2) dietary approaches specifically developed for the heat stressed cow, 3) alterations of the dairy cow's environment (Beede and Collier, 1986; Asseng et al., 2021). Upon the uncertain effects of climate change might have in dairy cattle productivity in the tropics, intrinsic advantages exhibited by heat tolerant breeds, in combination with adaptive nutritional management for HS, and modifications to the tropical environment, could be invaluable in the quest to ensure robust and profitable dairy operations in our region.

## GENETIC DEVELOPMENT AND USE OF HEAT-TOLERANT BREEDS

A valuable strategy to decrease the severity of heat stress (HS) on dairy cattle is the selection of animals with improved tolerance to tropical conditions. For European cattle breeds localized in the tropics, HS is chronic and usually there is only small heat relief at night, if any (Berman, 2011). In addition, year-round intense radiant energy significantly adds to the heat load to these animals. The tropics are particularly harsh to European lactating dairy cows that generate a large amount of metabolic heat (Wheelock et al. 2010). In tropical conditions, the high environmental temperature, combined with augmented humidity, added to the metabolic heat associated to lactogenesis and galactopoiesis, results in greater rectal temperatures in cattle susceptible to HS (West, 2003; Berry et al., 2016). Indeed, once the bovine corporal heat exceeds 25°C, the capacity of dairy cattle to dissipate heat diminishes significantly (Kadzere et al., 2002; Bernabucci et al., 2010; Belhadj et al., 2016), which further diminishes dry matter intake (DMI) and negatively affect galactopoiesis (West, 2003; Berry et al., 2016). As the prospect of global warming threatens extended periods of aggravated HS across the world, severe negative effects on the productivity, reproduction, and welfare of dairy cattle would be a dire consequence of climate change worldwide (Berman, 2011; Mylostyvyi and Sejian, 2019).

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