بسم الله الرحمن الرحيم

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EVALUATION OF PRODUCTIVE AND REPRODUCTIVE PERFORMANCE OF HOLSTEIN AND ITS F1 CROSSBRED WITH MONTBELIARDE IN EGYPT

By

MOHAMED MAGDY IBRAHEEM BADR
B.Sc. Agric. Sci. (Animal Production), Fac. Agric., Cairo Univ., 2008

THESIS
Submitted in Partial Fulfilment of the
Requirements for the Degree of

MASTER OF SCIENCE

In

Agricultural Sciences (Animal Production)

Department of Animal Production
Faculty of Agriculture
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APPROVAL SHEET

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Date: 26 / 01 /2022

SUPERVISION SHEET

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Title of Thesis: Evaluation of Productive and Reproductive Performance of Holstein and its F1 crossbred with Montbeliarde in Egypt.
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ABSTRACT

This study was carried out to compare the milk production and reproductive performance of pure Holstein (HO) cows with those of their first generation (F1) crossbreds with Montbeliarde bulls (MO x HO) in four commercial dairy herds under the Egyptian conditions. Data used in this study comprised 2268 records for the first four lactations of 531 HO cows and 536 MO x HO crossbred cows during the period between 2012 and 2020. Data were analyzed using the least squares method by XLSTAT software. Crossbred cows were significantly superior ($P < 0.05$) compared with pure HO cows for 305-day milk yield, scoring 9210±96 kg versus 7987±149 kg. Moreover, crossbred cows had significantly higher daily milk yield (30.0±0.45 kg) than pure HO cows (25.9±0.52 kg). Despite that, Pure HO cows had significantly greater days in milk (399±6 days) than MO x HO crossbred cows (341±5.2 days). With regard to reproductive performance, MO x HO crossbred cows had significantly ($P < 0.05$) less number of services per conception and days open than pure HO cows (2.6 ±0.16 vs. 3.7 ±0.18 services and 132±5.2 vs. 190±6 day, respectively). However, the statistical difference between MO x HO crossbred cows and pure HO cows for age at first calving was not significant (22.9±0.11 vs. 23.1 ±0.15 months). It was concluded that under Egyptian subtropical conditions, the first generation of crossbred cows exhibit better performance compared to pure HO cows in milk production and reproductive traits. These findings could provide an effective strategic option for the genetic improvement of dairy cattle in subtropical regions.
Keywords: Crossbreeding, Holstein, Montbeliarde, milk production, reproduction, Egypt

DEDICATION

This work is dedicated to the soul of the late ***Dr. Ali Attia Nigm****, Professor of Animal Breeding, Faculty of Agriculture, Cairo University and Former Dean of the Faculty for his advice, guidance, and support throughout the supervision of this thesis.*

I dedicate this work to my parents and brothers for all the support they lovely offered during my post-graduate studies.

A special feeling of gratitude to my wife ***(AYA Hagag)*** *for supporting and encouraging me during my work.*

I also dedicate this work to my lovely kid ***(Ahmed)****.*

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LIST OF ABBREVIATIONS

TMY	Total milk yield.
305-dMY	305-day milk
DIM	Days in milk.
DMY	Daily milk yield.
AFC	Age at first calving.
NSPC	Number of services per conception.
DO	Days open.
HO	Pure Holstein breed
MO	Pure Montbeliarde breed
MO × HO	F1 crossbred cows between Montbeliarde breed and Holstein
BCS	Body condition score
A. I.	Artificial insemination

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INTRODUCTION

Over the last decades, the worldwide milk production has been dominated by the Holstein (HO) breed due to the intensive continuous selection for milk production trait (Heins *et al.*, 2012). However, the superiority in milk production had direct negative effects on other functional traits related to survival and reproductive traits as a result of continued increases of inbreeding which leads to higher rates of culling and reduction of profitability (Heins *et al.*, 2012 and Puppel *et al.*, 2018).

To overcome these challenges, dairy cattle holders have tended to use the crossbreeding strategy between pure Holstein and other dairy cattle breeds. Crossbreeding dairy breeds may be a feasible way to achieve significant improvement in milk production, fertility, and health traits more quickly than pure breeds (Dezetter *et al.*, 2017). Crossbreeding seeks to take advantage of positive heterosis effects and complementarity between dairy breeds by introducing the desirable genes and decline the rate of inbreeding (Sørensen *et al.*, 2008 ; Knob *et al.*, 2020 and Clasen *et al.*, 2021).

Several previous studies have been conducted to compare the performance of pure Holstein with their first generation (F1) crosses such as HO × Simmental cows (Knob *et al.*, 2020 and Knob *et al.*, 2021) and HO ×Viking Red cattle (Hazel *et al.*, 2017a) and HO × Nordic Red cattle (Clasen *et al.*, 2018) and HO × Jersey cows (Prendiville *et al.*, 2010) and HO × Brown Swiss (Blöttner *et al.*, 2011 and El-Tarabany *et al.*, 2016).

These studies had shown positive outcomes of crossbred cows compared with pure HO ones especially for fertility, health, and survival traits with the possibility to increase the rate of genetic gain for these economically valuable traits (Shonka-Martin *et al.*, 2019 and Clasen *et al.*, 2021).

Recently, the Montbeliarde (MO) breed has received considerable interest as the best complement with Holstein in crossbreeding programs (Hazel *et al.*, 2017a). Montbeliarde is a French breed that was subjected to heavy selection for fertility, health traits, body condition, and milk quality traits (Heins and Hansen, 2012 and Hazel *et al.*, 2017a).

Numerous comparative studies have been conducted between pure HO and MO x HO crossbreds to assess their productive and reproductive performances. The productive traits in terms of milk, fat, and protein yields were very closed between the two genetic groups (Heins *et al.*, 2006 ; Heins and Hansen, 2012 ; Hazel *et al.*, 2013 ; Buckley *et al.*, 2014 and Hazel *et al.*, 2014).

However, MO x HO crossbred cows revealed superiority compared to pure HO cows for fertility traits in terms of first-service conception rates, days open, days to first breeding, and number of services per conception (Hazel *et al.*, 2014 and Hazel *et al.*, 2017a). Likewise, MO x HO crossbred cows had advantages over pure HO cows for survival traits including survival to subsequent calving and mortality rates (Heins *et al.*, 2012 ; Hazel *et al.*, 2014 and Hazel *et al.*, 2017a). Consequently, MO x HO crossbred cows had greater longevity and lower

total health cost per cow than pure HO cows which means greater profitability for crossbreds (Heins and Hansen, 2012).

Furthermore, the calves resulted from the mating of Montbeliarde sires with Holstein dams were significantly greater in their birth weight than calves from pure HO without any significant increase in calving difficulty and stillbirth rate (Heins *et al.,* 2010). Also, milk from MO x HO crossbred cows exhibits a lower somatic cell score compared with milk from pure HO cows (Heins and Hansen, 2012).

Montbeliarde breed started at Egypt to be used for crossing with HO at the first time in 2009 when some of commercial dairy owners, Dairy Link company & 4GENETICS for dairy solutions company imported frozen semen from France through the biggest association for this breed at France (COOPEX MONTBELIARDE). But no available published studies were found concerning the evaluation of milk yield or reproductive traits of MO x HO crosses in Egypt. Therefore, this work is considered the first study on the Montbeliarde crossbreed cows in Egypt. The objective was to compare the milk yield and reproductive performance of pure Holstein cows with those of first-generation crossbreds of Montbeliarde with Holstein cows in four commercial dairy herds in Egypt.