21_4441_Brade.pdf
Session 21; Wilfried.brade@lwk-niedersachsen.de

Milk performance of Jersey-F1-Cows (North American Jerseys x Holsteins) in comparison with pure-bred Holsteins in different production levels

Wilfried Brade[1)], Jutta Jaitner[2)] und Friedrich Reinhardt

1 Introduction

The Holstein cattle are clearly superior to all other milk cattle breeds as regards the quantity of milk protein per cow and lactation produced. Further advantages of Holstein cattle are their excellent milkability, udder suspension or teat size and teat placement. Admittedly, some traits in Holstein-cattle are in need of improvement: the calving traits (= proportion still-/difficult births) or fertility; traits with generally low heredity.

Practical breeders from Saxony and Lower Saxony (at the turn of the millennium) also encouraged North American Jersey bulls - known for having a higher predisposition to milk quantity with a significantly lower milk fat content in comparison to the Danish Jerseys to be tested as a possible crossbreeding partner for German Holstein cows.

The results presented in the meantime should be subsequently analysed with particular consideration of realised milk performance within various production levels.

2 Material and Methods

The current attempt at crossbreeding is based on Jersey embryonic imports from North America which were transferred to prepared recipient animals in Germany. A few of the sires were also bought as yearling bulls in North America and raised there. They were put to use by the importing of their deep-freeze sperm.

After judging the animals or rather licensing the bulls at the age of about 1 year all of the Jersey bulls were put through the same testing procedure with random mating as Holstein bulls (= test bulls) of the same age. Meanwhile offspring groups from the testing procedure are available.

The performances of the F1-offspring (from the mating of the North American Jersey bulls, NJ) were compared with those of their purebred Holstein fellow animals (GH).

The purebred Holsteins were – in the interest of a correct logging of the genetic level of the respective fathers – additionally split up into two groups (offspring of GH-test bulls, offspring of previously selected, offspring tested GH-bulls; BV-bulls). Table 1 contains an overview of the data.

[1)] Tierärztliche Hochschule Hannover (TiHo) und Landwirtschaftskammer (LWK) Niedersachsen, FB Versuchswesen, Johannssenstraße 10, 30159 Hannover (Germany)
(email: wilfried.brade@lwk-niedersachsen.de)
[2)] Vereinigte Informationssysteme Tierhaltung w.V. (VIT), Heideweg 1, 27283 Verden (Germany)
(email: jutta.jaitner@vit.de bzw. friedrich.reinhardt@vit.de)

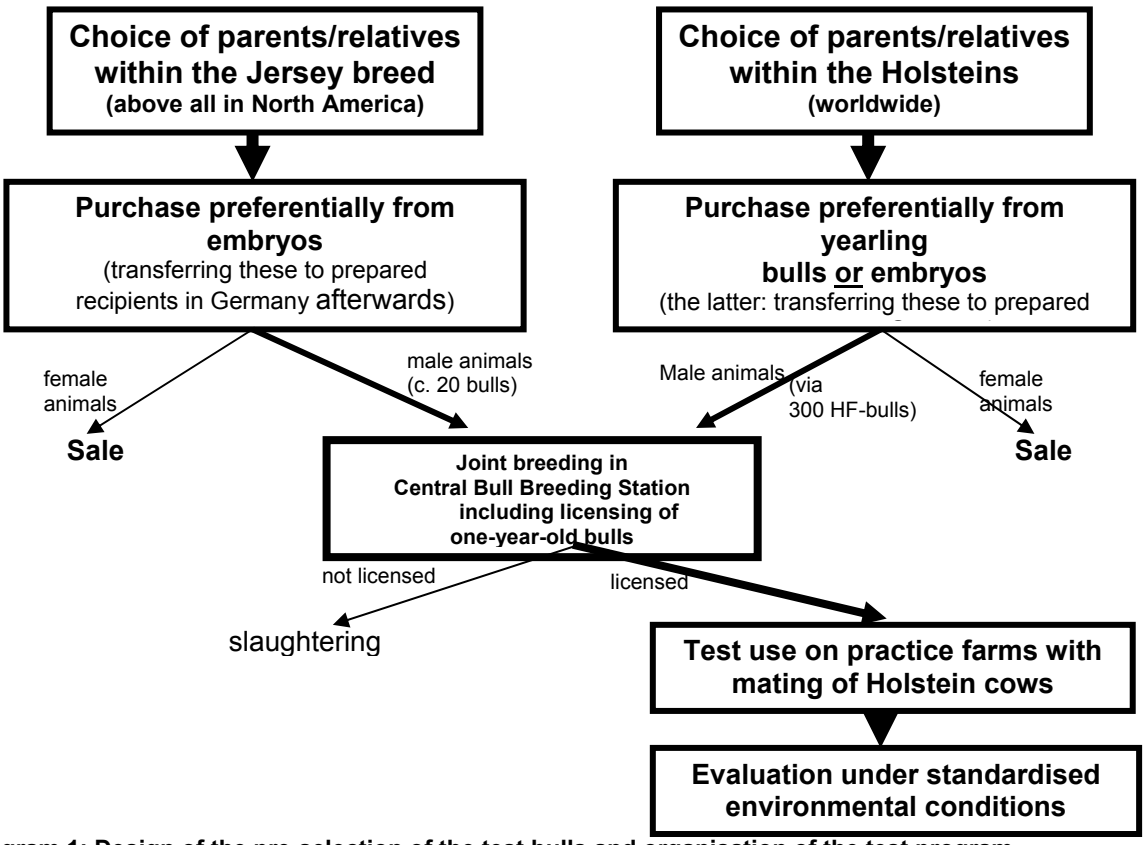

Diagram 1: Design of the pre-selection of the test bulls and organisation of the test program

Table 1: Phenotypic means of first-calf cows - milk performance traits (1st lactation)

Breed/ Origin of cows	Animal no. (N)	Milk yield (kg)		Fat-%		Protein-%	
		$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
• F1 (NJ x GH)	1000	6040.3	1828.0	4.56	0.5	3.58	0.3
• GH (Father: test bulls)	10236	7619.9	2227.4	3.98	0.5	3.36	0.2
• GH (Father: proven bulls)	18201	7721.9	2078.4	3.99	0.5	3.38	0.2

Since in the offical German breeding valuation no cross-breeding animals are taken into consideration, only the determined breeding values for the GH fathers can be shown.

To compile the particularly interesting influence of the production level on the performance dissimilarity of the F1 animals compared to the GH the available data depending on the mean performances of GH fellow animals in the herd (= respective total from milk fat and milk protein quantity) were divided up into three levels (cp. table 2).

Table 2: Number of first-calf cows depending on production level and descent

Production level (Fat kg + protein-kg)	Origin/Breed of young cows			Total
	F1 (NJ x GH)	GH (Father: test bulls)	GH (Father: proven bulls)	
> 570 kg	274	4106	6994	11374
510 kg – 570 kg	443	4661	8620	13724
< 510 kg	283	1469	2587	4339
Total	1000	10236	18201	29437

This "splitting up into three" of the respective production level formed the basis for the further analysis of the performances of various origins.

The evaluation of the available data took place in VIT Verden using the SAS software program package.

3. Results

3.1. Influence of production level with regard to observed trait differences in the milk performance

In table 3 the calculated mean milk performances of various origins (LSQ mean) – are compiled – after excluding environmental influences.

Table 3: *LSQ-means ($\bar{x}_{LSQ}$) and standard errors (s_{LSQ}) for milk performance traits depending on the production level*

Production level (Fat-kg + Protein-kg)	Traits (1st Lactation)	Origin/breed of first-calving cows					
		F1 (NJ x GH)		GH (sire: test bulls)		GH (sire: proven bulls)	
		$\bar{x}_{LSQ}$	s_{LSQ}	$\bar{x}_{LSQ}$	s_{LSQ}	$\bar{x}_{LSQ}$	s_{LSQ}
> 570 kg	Milk yield	6278.7	104.6	7967.2	29.7	7846.5	23.8
	Fat-kg	288.7	3.9	310.2	1.1	308.6	0.9
	Protein-kg	227.3	3.3	266.3	0.9	264,5	0.8
	Fat-%	4.58	0.03	3.94	0.01	3.98	0.01
	Protein-%	3.59	0.01	3.34	0.01	3.37	0.01
510 – 570 kg	Milk yield	5594.4	82.3	7012.5	27.5	7147.8	21.4
	Fat-kg	256.4	3.1	277.3	1.0	281.0	0.8
	Protein-kg	201.9	2.6	235.1	0.9	241.0	0.7
	Fat-%	4.59	0.02	4.00	0.01	3.98	0.01
	Protein-%	3.60	0.01	3.35	0.01	3.37	0.01
< 510 kg	Milk yield	5263.9	102.9	6535.8	46.9	6546.7	36.0
	Fat-kg	236.6	3.8	261.1	1.7	260.6	1.3
	Protein-kg	186.4	3.3	221.6	1.5	220.9	1.1
	Fat-%	4.51	0.03	4.03	0.01	4.03	0.01
	Protein-%	3.53	0.01	3.38	0.01	3.37	0.01

The F1-cows are inferior to the purebred GH cows in the milk yield (kg). This inferiority is also the case for the milk fat and milk protein quantities. Both GH groups differ only slightly from each other.
The increasing inferiority of the F1 animals compared to the GH cows can be statistically validated as well at least for the milk quantity performance. In other words: the performance comparison of F1 cows with German Holstein cows (GH) accounts for the existence of a genotype-environment-interaction.
With increasing production level the relative excellence of purebred Holsteins grows compared to their contemporaneous F1 animal peers regarding milk performance.

3.2 Calving and fertility traits

A superiority of Jerseys compared to Holsteins regarding calving and fertility traits is repeatedly shown (e.g. WHITE, 2000; MONTGOMERIE, 2002; MALTECCO et al., 2006; BRADE et al., 2006).
In addition to the evaluated milk performance traits the maternal calving and fertility traits of the F1 animals were also compared to the respective performances of their contemporaneous fellow peers in the GH herd (tables 4 and 5). It remains to be mentioned that all GH animals were combined in one group due to the unavailability of dissimilarity of both paternal groups (test bullls; BV bulls).

Table 4: LSQ-means for maternal calving traits [1)]

Normal size/Traits	**Mean values[2)] ($\bar{x}_{LSQ}$)** **F1-animals (NJ x GH)**	**pure-breds (GH)**	**Significance**
Calving process (0/1) (0 = easy/normal, 1 = difficult)	**0.5 %**	**3.4 %**	**
Stillbirth rate (0/1) (0 = alive, 1 = dead)	**6,9 %**	**10,5%**	**

[1)]only mating with Holstein bulls taken into consideration
[2)] took influencing variables in model into account: herds, calving year x calving month, breed, rest

The superiority of the F1 animals regarding calving traits is statistically validated (table 4). The F1 animals indicate – after the first calving – shorter rest or rather empty periods between calvings. Since the gestation period does not differ the calving intervals for the F1 animals are likewise significantly shorter.

Table 7: LSQ-means for maternal fertility

Normal size/Traits	**Mean values[1)] ($\bar{x}_{LSQ}$)** **F1-Animals (NJ x GH)**	**pure-breds (GH)**	**Significance**
Calving insemination interval (days)	76.3	84.5	***
Delay time (days)	29.9	36.7	**
Empty period (between calvings) (days)	105.1	120.3	***

1) took influencing variables in model into account: herds, calving year x calving month, breed, rest

A better non-return-rate of the F1 animals compared to the GH cows is, however, not accounted for in the presented material.

Conclusion

In the presented study the results of a comprehensive attempt at crossbreeding North American Jersey bulls with German Holstein cows is introduced.

The results are based on the comparison of offspring of Jersey bulls (F1-animals) with their purebred Holstein stall companions (GH).

With increasing production level the inferiority of F1-animals compared with GH is on the increase. The results back up the existence of a genotype-environment-interaction for milk quantity performance. The superiority of F1-animals in maternal calving traits is statistically safeguarded.

References:

AHLBORN-BREIER, G.; W. D. HOHENBOKEN (1991): Additive and nonadditive genetic effects influencing milk production in dairy cattle: evidence for major individual heterosis. J. Dairy Sci. **74**, S. 592-602

BRADE, E., W. BRADE; M. KLUNKER (2006): Holstein x Jersey – erste Ergebnisse eines Kreuzungsversuches in Sachsen. SRV-Journal, Nr. 3/2006, S. 33-35

BRADE, W. (1992): Crossbreeding effects in the development of the synthetic Black and White (SMR) dairy cattle in East Germany. Livestock Production Science, **32**, 203-218

BRADE, W. (1995): Genetische Grundlagen der Rinderzüchtung. Broschüre, LWK Hannover, 106 Seiten

Bryant, J.R. N. Lopez-Villalobos, J. E. Pryce, C. Holmes, D. L. Johnson and D. J. Garrick (2007): Effect of Environment on the Expression of Breed and Heterosis Effects for Production Traits. J. Dairy Sci. 90:1548–1553

HANSEN, L.; B. HEINS UND T. SEYKORA (2004): Crossbreeding - An Alternative in Dairy Cattle Breeding. Vortrag, DGfZ-Tagung „Herausforderungen für die Gestaltung der Rinderzucht von Morgen“, Leipzig, 4. März 2004

KNOWLTON, K. F. (2000): Are Jerseys part of the answer? The Jersey Journal, **47**, 81-84

LENSCHOW, J.; K. TILSCH (1963): Ergebnisse der Kreuzung von Deutschen Schwarzbunten Rindern mit Jerseyrindern (2. Mitt.). Archiv Tierzucht **6**, 1963, 359-372

MALTECCO, C.; H. KHETIB, V. R. SCHUTZKUS; P. C. HOFFMAN; K. A. WEIGEL, 2006: Changes in conception rate, calving performance and calf health and survival from the use of crossbred Jersey x Holstein as mates for Holstein dams. J. Dairy Sci. **89**, 2006, 2747-2754

METZGER J.S.; L. B. HANSEN; H. D. NORMAN; C. W. WOLFE; J. Pedersen (1994): Comparison of United States and Danish strains of Jerseys for yield traits: Journal Dairy Sci., **77**(5), 1457-1465

MONTGOMERIE, W. A., 2002: Experiences with dairy cattle cross breeding in New Zealand. 53rd EAAP-Meeting, Kairo, 01.-04.09.2002

SCHMIDT, J. (1948/49): Schwarzbunte Niederungskühe und Jersey Bullen. Kreuzungsversuche und ihre Bewertung. Züchtungskunde, Bd. **20**, 1948/49, 29-39

SCHÖNMUTH, G. (1963): Zur Züchtung eines milchreichen Zweinutzungsrindes mit hohem Milchfettgehalt und bestem Euter. Archiv Tierzucht, Bd. **6**, 79 - 92

WHITE, S. (2000): Investigation of Pasture and Confinement Dairy Feeding Systems Using Jersey and Holstein Cattle. MS-Thesis, North Carolina State University, Raleigh (USA), 147 Seiten

WITT, M.; E. WERHAHN; U. E. PFLEIDERER (1973): Ergebnisse eines langjährigen Kreuzungsversuches mit dem Schwarzbunt- und dem Jersey-Rind (II. Mitteilung) Zeitschr. Tierzücht. und Züchtungsbiol. **90**, 16-24

Keywords: Milk cattle, crossbreeding cows, milk, production level, genotype-environment-interaction