Sire Evaluation for Milking Duration

A Senior Project

presented to

the Faculty of the Dairy Science

California Polytechnic State University, San Luis Obispo

In Partial Fulfillment

of the Requirements for the Degree

Bachelor of Dairy Science

by

James Macedo

March, 2013

ACKNOWLEDGMENTS

This project would not have been possible without the help of several individuals within the dairy industry. My advisor, Dr. Stan Henderson, provided the opportunity to research this project. Dr. Henderson guided me throughout the project and assisted in obtaining these data. Dr. Henderson also assisted in compiling these data and developing the manuscript. Without the help of Dr. Henderson, this project would not have been successful.

Many other people were extremely helpful in undertaking this project. First and foremost, three dairy producers allowed for their herd information to be analyzed. Mr. Steve Shehadey, Mr. B Van Beek, and Mr. Doug Van Beek were extremely helpful and positive about the project. They allowed for me to obtain data from their herds and publish it in my manuscript. In addition, several individuals aided in the collection of data. Ms. Cathy Myers and Mr. Tom Townsend obtained the data from the Bar 20 Dairy. Mr. Bill Verboort traveled to Dairyland Farms and Van Beek Brothers Dairy and obtained the data needed for the project. Last but not least, Mr. Bruce Golden and Mr. Dennis Edlund assisted me in analyzing the data I have obtained. Dr. Bruce Golden guided me through the statistical analysis and data analyzing allowing for a logical paper to be developed. Mr. Edlund provided me with a herd-mate comparison and also provided me with information for my project.

Without the constant aid of these individuals, this project would not have been a success.

ABSTRACT

The objective of this study was to utilize electronically recorded data from on-farm milk recording systems and herd management software to determine if a sire has a genetic influence on his daughter's milking duration. Measurements of milking duration from three dairy facilities were taken between January 27, 2013 and January 31, 2013. These measurements supplied 25,070 observations, corresponding to 9,418 cows and 895 sires. These data were evaluated with a SAS alongside a herd-mate comparison. The statistical analysis demonstrated that a sire does have a genetic influence on the milking duration of his progeny. The Van Beek Brothers and Dairyland Farms data sets reported an estimated covariance of 0.117 and 0.1491 for sire with heritability of 0.18947368 and 0.46706868 respectively. In addition, the herd-mate comparison showed some differences amongst sire ranging from the mean of 12.62 minutes. After comparing sires with over 50 daughters, a total of 35 bulls, the deviations between daughter milking duration were between -2.91 and 2.03 minutes. Based on the results presented in this study, it appears that further research will be required to finalize any significant outcome. With increasing technologies, the recording of milking duration will become more accurate and efficient to acquire. As producers begin to focus more on efficiency and profitability, the need to group the milking duration of their animals will increase. Future research should be conducted on milking duration to determine the factors that influence the time it takes cows to milk out.

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INTRODCTION

For many years, genetic information in the areas of milking speed and milking duration for the daughters of Holstein sires has been readily available. In the past, these statistics were provided by dairy producers' evaluations and verbal communications between AI stud organizations and individual producers. Being reported subjectively, these data was at risk for multiple biases and error. In addition, these data were evaluated differently by each AI organization, making sires amongst different organization incomparable. Several studies have been conducted attempting to accurately measure milking speed and milking duration. Two studies reported a milking speed heritability of .011, after evaluating a single observation per animal. Meyer and Burnside (1987) concluded that single observations are insufficient as they do not account for different factors that may occur across lactations.

With the implementation of milk recording systems and herd management software, these biases and errors are easily removed and true milking durations can be calculated. The use of on-farm computers allows for dairy farmers to closely regulate the efficiency of their herd, especially within the milking parlor. Most producers measure this efficiency with the amount of "turns" they run through the barn per hour. Having direct measure of each individual cow's milking duration; the producer is able to manage his herd in a much more precise way.

One way to further manage his herd would be to group his slower or faster milking animals together. This would allow for more efficiency in the barn and less stress on the cows. According to a study by Zhang et al (1994), having exceptionally high milking speeds can be undesirable as it heightens the chance of developing mastitis. With records of milking duration, producers could cull faster milking animals and potentially reach quality bonuses, providing more profit.

In addition to management practices, milking duration could also be linked to the genetics of a sire. If heritable, the milking duration could be collected for A.I. bulls and used in bull proofs. This would allow for dairy producers to control the milking duration of their herd using sire genetics. Similar to selection for production, type, or calving ease, producers could also assess bulls for their milking duration or milking speed. Breeding with bulls that have similar milking durations could allow for producers to group the times it takes their cows to milk out. This could potentially increase efficiency and profitability. In addition, companies such as Alta Genetics, ABS Global, Select Sires, and Accelerated Genetics could use milking duration as a selling point amongst producers, similar to the genetic effect of calving ease.

With the volatility of the dairy industry, the importance of efficiency and management is increasing rapidly. Producers utilize every tool available to increase profit. Currently, there is not statistics recording milking duration or the sire effect of milking duration. Observations should be collected and the genetic evaluation of sires should be used to manage milking duration of producing cows.

LITERATURE REVIEW

Milking Speed.

Most of the research conducted on the dairy industry lies in the area of milk production. Milk production is an important aspect; however it is only one of the contributing factors to overall efficiency and profitability. In a study of national selection indexes in several countries, conducted by Miglior et al. (2005), it was found that the importance of several other traits has increased in the past decade. Even as the scope of traits has widened, milking speed has been given little attention. Milking speed is a crucial trait, in that a cow that milks slowly may decrease the efficiency of the milking parlor, whereas faster milking animals will require less labor and potentially leads to a higher profit (Sewalem et al. 2010 and Wiggans et al. 2006). Consequently, increased milking speed may influence decreased teat sphincter tension, lowering the cow's resistance to infection of her udder from pathogens (Boettcher et al. 1997). Alongside an increase in the incidences of mastitis, a faster milking speed will lower labor costs and decrease electrical power usage (Karacaören et al. 2005).

In other countries such as Canada, milking speed has been recorded for several years and accounts for up to 2% of culling of animals. (Burnside et al. 1971; Westell et al. 1982; PATQL, 1999; CDN, 2009). These Canadian studies have assessed the heritability of the milking speed trait vary from study to study. Heritability refers to the portion of an animal's phenotypic variation controlled by their genes. Essentially, heritability is the part of the total variation that can be transmitted to the next generation by gametes. (Bourdon. 2000) Wiggans et al. (2006) estimated that the heritability of milking speed to be 0.22. Milking speed heritability was estimated to be 0.11 by Zwald et al. (2005) and 0.10 by Rensing et al (2005). These variations are caused by the subjective collection of data. The data collected for these studies were provided by farmers classifying their animals into 5 categories: very slow, slow, average, fast, and very fast (Meyer and Burnside. 1986).

In addition to estimates of the heritability of milking speed, several correlations were developed in several studies (Wiggans et al 2006; Sewalem et al 2010). Table 1 displays the correlation between an estimated breeding value for milking speed and conformation, reproduction, and auxiliary traits in Canadian Holsteins.

Table 1. Redrawn from Sewalem et al (2010). Correlations between estimated breeding value for milking speed and conformation, reproduction, and auxiliary traits in Canadian Holsteins

Trait	Value
Conformation Traits	
Udder depth	0.239
Udder texture	0.229
Mammary system	0.224
Teat length	-0.205
Height at front end	0.194
Overall conformation	0.172
Median suspensory	0.128
Bone quality	0.122
Rear udder attachment height	0.144
Angularity	0.103
Rear leg side view	0.082
Pin width	0.073
Front teat placement	0.068
Rear teat placement	0.068
Feet and legs	0.061
Dairy Strength	0.059
Reproductive traits	
Calf size, cow	-0.074
First service to conception, cow	-0.068
Days open	-0.065
Number of services, cow	-0.062
Calf survival, heifer	0.055
Non return rate	-0.055
Calf size, heifer	-0.051
Direct calf size, heifer	-0.044
Calving ease, cow	-0.041
Number of services, heifer	-0.040
First service to conception, heifer	-0.039
Calf survival, cow	0.035
Age at first service, heifer	0.032
Non return rate, heifer	-0.030
Gestation length, heifer	-0.030
Calving to first service, cow	-0.028
Auxiliary Traits	
Somatic cell score	0.246
Herd life	0.094
Milking temperament	.150

In addition to these conformation, reproductive, and auxiliary traits, there is also a correlation between milking speed and dry matter intake. The correlation between dry matter intake and milking speed ranges between 0.17 to 0.26 (Karacaören et al. 2005). Due to the heritability of milking speed being over 0.20, the genetic evaluation of sires could provide the means to predict if his daughters will be slow or fast milkers.

Milking Duration

Milking duration, also known as total milking time, is defined as the amount of time a cow takes to completely milk out, beginning at the seating of the cups to the complete removal of the machine (Moore et al. 1983). In the past milking durations have been recorded, however, the data was collected from unreliable sources, such as surveys or direct conversations with producers. The data was reported subjectively; therefore they were exposed to errors and biases. With the incorporation of new technologies such as electronically recording milking systems and herd management software, milking duration can be collected without biases and on a much larger scale (Zwald et al. 2004).

Being directly related to milking speed, milking duration, also known as milk flow time and total milking time, also has an optimal amount of total milking time. A cow that has a short milking duration, may milk out to fast, causing teat end damage or increased risk to mastitis. On the contrary, a super slow milking cow may hinder the parlor flow and lower overall efficiency. Also, many producers strive to uniform their herds (Zwald et al. 2004). In the study by Zwald et al. (2004), 73,547 observations of milking duration were observed on 10,152 Holstein cows from 1551 sires. Table 2 displays the summary of the milking duration data (Zwald et al. 2004).

Table 2. Redrawn from (Zwald et al. 2004). Summary of milking duration data.

Variable	Number
Total observations	73,547
Total lactations	14,844
Total cows	10,152
Total herds	29
Total sires	1551
Mean observations/lactations	5.0
Mean lactations/cow	1.5
Mean cows/herd	350
Mean daughter/sire	6.5

After reviewing the data, Zwald et al. (2004) found that the average time for milking duration was between 4 and 5 minutes. As a reference, Figure 2 displays the distribution of the average of phenotypic observations for each individual cow in the study. Cows ranged from 1 to 13 minutes with the majority milking within 3 to 6 minutes. The data is slightly skewed to the left and Zwald et al (2004) suggests that future studies attempt to normalize the graph.

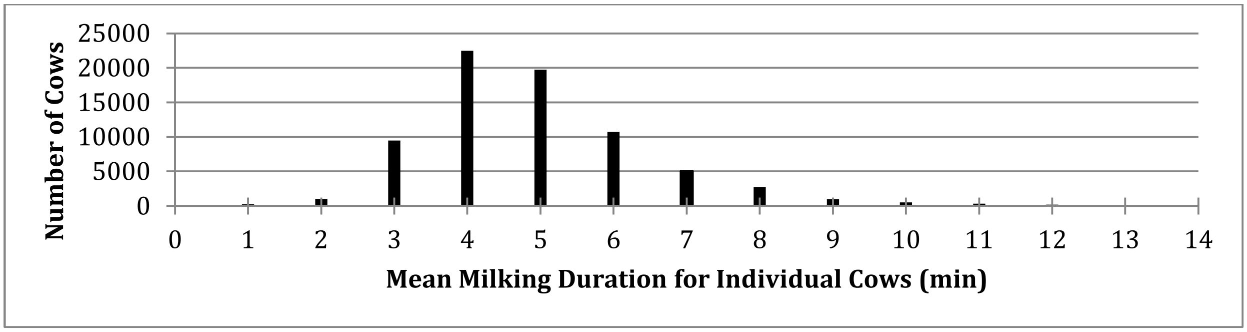

Figure 1. Estimated from (Zwald et al. 2004). Distribution of the mean of single, weekly measurements of milking duration for individual cows in the present study.

Also from Zwald et al (2004), Figure 2 displays the average milking duration for each herd. The results lie between 3.5 and 7 minutes. There are nearly equal amounts of observations on either side of 5 minutes. This suggests that herd management can greatly affect the milking duration of a cow. Parlor design, employee handling, and milk let down time are some of those factors.

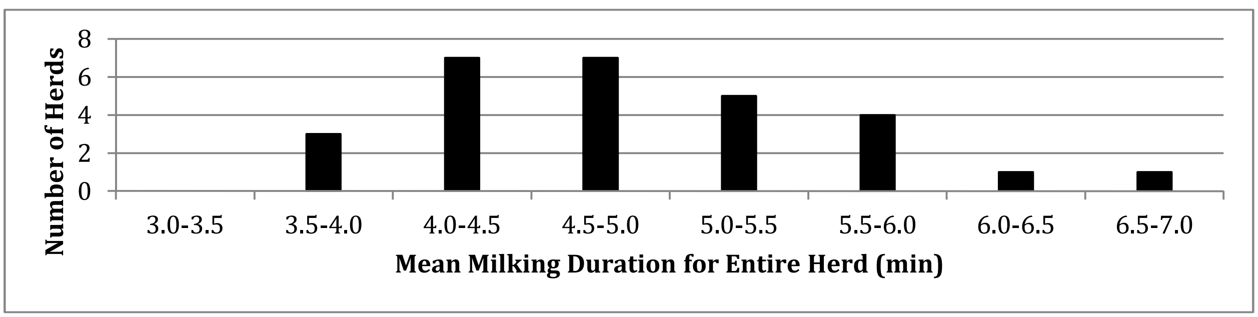

Figure 2. Redrawn from (Zwald et al. 2004). Distribution of the mean of single, weekly measurements of milking duration for entire herd in the present study.

In the study by Zwald et al. (2004), the estimated heritability of milk duration was .017, similar to other estimated reported by Meyer and Burnside (1987) and Boettcher et al. (1998). The study reported the regression of milking duration on milk yield was positive, demonstrating that higher milk yield is connected to an increased milking duration. In addition, the milking duration yield proved to be shorter of first lactation animals in comparison to higher lactation animals. Also, cows that were milked 3x daily had shorter milking durations than those who were milked only 2x (Zwald et al. 2004).

Alongside those comparisons, milking duration is also related to several different characteristics. The predicted transmitting abilities (PTA) of the sires ranged between -.48 for the faster milking progeny and .59, with the slower. Additional correlations were made between the PTA milking duration and the PTA for teat placement and teat length, equaling -.14 and .20, respectively. Those correlations indicate that sires who father cows with wide teat placement and those who have longer teats, milk out slower. Furthermore, the correlation between PTA milk duration and PTA for somatic cell score was -.15, displaying that cows that milk out the fastest; also tend to have higher somatic cell scores. Table 3 is displaying the correlations between PTA for milking duration and other traits that are routinely evaluated in Unites States Holstein sires (Zwald et al. 2004).

Table 3. Redrawn from (Zwald et al. 2004) Correlations between PTA for milking duration and other traits routinely evaluated in United States Holstein sires.

Trait	Correlation with PTA-MD
Milk yield	-0.05
Fat percentage	0.00
Protein percentage	0.03
Somatic cell score	-0.15
Productive life	-0.10
Daughter pregnancy rate	-0.09
Clinical mastitis	-0.09
Fore udder attachment	-0.07
Rear udder height	0.03
Rear udder width	-0.02
Udder cleft	-0.07
Udder depth	-0.08
Front teat placement	-0.14
Teat length	0.20

In addition to correlations, the distribution of the mean was skewed to the right. The shape also resembled a lactation curve of a cow. It takes the shape of a lactation curve because a cow's milking speed stays relatively constant for her lactation curve, therefore, milk duration changed as the amount of milk increases or decreases (Zwald et al. 2004).

Sire Evaluation

Improvements in dairy genetics have been a main focus of the dairy industry for several years. Development of sire evaluations began in the 1930's with the yields of a bull's daughters being compared to their dams. This process discovered the merit of the dam; however it failed to consider any variation within the environment. In 1961, the daughter-dam comparisons were replaced by the herd mate comparison. The herd mate comparison accounted for environmental factors but did not entirely analyze the genetic differences or for the merit of mates of bulls. In 1974, the national genetic evaluation system was revised again. The system would begin to consider merit of the sire of herd mates, accounting for any genetic trends. A fixed genetic base was implemented to simplify comparisons across several generations. Today, the fixed genetic base changes every five years. The new program became the Modified Contemporary Comparison. The Modified Contemporary Comparison was effective, however it failed to account for merit of the mates of the bulls and it ignored information from the progeny of offspring from the bulls. Finally in 1989, an animal model was implemented that permitted simultaneous evaluation of both bulls and cows, considering all relationships (Wiggans. 1991). Today, the industry has developed a new model, entitled, Total Performance Index, also known as TPI. The equation for TPI is in Figure 1. The abbreviations of TPI are described in Table 4 and the categories of TPI are exhibited in Table 5.

TPI

$$[\frac{27(PTAP)}{19.4} + \frac{16(PTAF)}{23.0} + \frac{10(PTAT)}{.73} - \frac{1(DF)}{1.0} + \frac{12(UDC)}{.8} + \frac{6(FLC)}{.85} + \frac{9(PL)}{1.26} - \frac{5(SCS)}{.13} + \frac{11(DPR)}{1.0} - \frac{2(DCE)}{1.0} - 1(DSB)/.09]3.8+1832$$

Figure 3. Redrawn from (Holstein Association Website). Total Performance Index equation.

Table 4. Redrawn from (Holstein Association website). Abbreviations of the TPI equation

Traits	Abbreviations
PTA Protein	PTAP
PTA Type	PTAT
Udder Composite	UDC
PTA Productive Life	PL
PTA Daughter Pregnancy Rate	DPR
PTA Daughter Stillbirth	DSB
PTA Fat	PTAF
STA Dairy Form	DF
Feet &Legs Composite	FLC
PTA Somatic Cell Score	SCS
PTA Daughter Calving Ease	DCE

Table 5. Redrawn from (Holstein Association website). Weighting of major categories.

Major Categories	Weight in %
Production	43%
Health & Fertility	29%
Conformation	28%

Milking speed and duration are not taken into account in the current Total Performance Index; however the traits are valuable to the efficiency and financial sucess of current dairy facilities (Boettcher et al. 1997; Wiggans et al. 2006). These traits are important and recently the attention regarding them has increased (Sewalem et al. 2011).

MATERIALS AND METHODS

Data were collected from three commercial dairy herds within California. Bar 20 Dairy (Kerman, CA) provided 2 observations of 6924 cows through 2 milkings. Bar 20 Dairy is equipped with the milk recording system from DeLaval (Kansas City, MO) and utilizes the herd management system, DHI-PLUS (DHI-Provo, Provo, UT). Dairyland Farms (Tipton, Ca) provided 3 observations of 2386 cows throughout 3 milkings. Van Beek Brothers Dairy (Tipton, CA) provided 6 of observations of 2069 of cows throughout 6 milkings. Both Dairyland Farms and Van Beek Brothers Dairy are equipped with the milk recording system AfiMilk (Afikim, Israel) and use the herd management system Dairy Comp 305 (Valley Ag Software, Tulare, CA). Data were collected using a test recording service (Agritek Analytics, Visalia, CA) and through DHI-Provo.

An electronic measurement was taken for milking duration at every milking for several consecutive milkings and saved externally. These data were uploaded in Microsoft Excel and prepped for statistical analysis. Animals that did not have proper identification were removed leaving 14, 356 observations to be reviewed. The sum of data is summarized in Table 6. In addition, the data was sent to the Holstein breed association (Holstein Association USA, Brattleboro, VT) to be analyzed for herd-mate deviations. During this process, the data was averaged for cows with several milkings, leaving only 9418 observations. The sum of this data set is exhibited in Table 7.

Table 6. The summary of milking duration data used by statistical analysis.

Total Observations	14,356
Total Cows	14,356
Total Herds	3
Total Sires	860
Mean Daughters/Sire	16.69

Table 7. The summary of milk duration data for herd mate comparisons, by sire averages.

Total Observations	9418
Total Cows	9418
Total Herds	3
Total Sires	895
Mean Daughters/Sire	10.52

RESULTS AND DISCUSSION

Results of the Statistical Analysis

The statistical analysis of these data was conducted alongside Dr. Golden on March 6, 2013. The results varied on each facility, possibly due to the data being collected separately and having different numbers of observations from each facility. Two of the three data sets converged correctly, however one was unable to converge after a single iteration. Covariance estimated were taken and used to calculate the heritability of a sire's effect on milking duration. Covariance measures of how much two random variables change together. If the greater values of one variable correspond with the greater values of the other variable, the variables tend to show similar behavior, the covariance is positive. On the contrary, if the larger values of one variable correspond to the smaller value of the other variable, the covariance is negative.

The data set for the Van Beek Brothers dairy analyzed 6822 observation from 604 cows and 356 sires. The covariance estimate for sire was 0.1170, while the estimate for the cow within her sire was 1.8037. Lastly, the residual estimates were 0.5511. These results provided a heritability of 0.18947368. The data set from DairyLand Farms produced 3270 results, but only 3253 were used by the SAS program. 1023 different cows were analyzed alongside 139 sires. The covariance estimate for sire was 0.1491, while the estimate for the cow within her sire was .7862. Lastly, the residual estimates were 0.3416. These results provided a heritability of 0.46706868. The results from the statistical analysis are exhibited in Table 8.

Table 8. Summary of Statistical Analysis of Van Beek Brothers and DairyLand Farms

	Van Beek Brothers	DairyLand Farms
Sire	0.117	0.1491
Id(Sire)	1.803	0.7862
Residual	0.55	0.3416
H^2 (Heritability)	0.18947368	0.46706868

The data set from Bar 20 Dairy was unable to be analyzed with SAS. The process failed to converge the data properly. This issue could be related to the quality of the observations or the lack of data.

Results of the Herd Mate Comparison

After conducting a herd-mate comparison on the data, 35 bulls sired 50 daughters or more. 3833 cows contributed to these findings. Similar to the requirements of bull proofs today, these deviations are legitimate for analysis. The average milking duration per milking was 5.55 minutes and the milking duration per day was 12.63 minutes. Negative deviations corresponded to faster milking animals and positive deviations corresponded to slower milking daughters. Of these bulls, the deviations varied from -2.91 to 2.03. In the sample, sire Graybil produced offspring that milked the fastest with a deviation of -2.91 and AltaSleuth's daughters milked out the slowest, with a daughter deviation of 2.03. These data are summarized in Table 9.

Table 9. Results of Analysis for sires with over 50 daughters.

Sire	Daughter Deviation	Count	Sire NAAB	Sire Short Name
50747059	-2.91	55	7H8444	GRAYBIL
129069717	-1.98	53	7H6695	LC
129443405	-1.68	109	11H7319	ALTASUEDE
131688542	-1.44	62	14H4026	AIRRAID
123645630	-1.19	79	7H6349	BEST
131825509	-1.17	113	11H7741	ALTAJURYMAN
128367894	-1.16	71	14H3597	POTTER
129941695	-0.70	57	11H7123	ALTADREW
132395373	-0.61	90	11H7856	ALTASPARTA
61232522	-0.57	129	7H8004	ENVISION
132537018	-0.42	52	7H7560	BLITZ JINTX
295614274	-0.33	237	11H7823	ALTAOLIVER
60718406	-0.26	52	11H8231	ALTAWARRANT
60817488	-0.20	109	7H7763	SANA
130803069	-0.15	187	11H7464	ALTAWILDMAN
132582764	-0.11	96	7H7466	MOSCOW
61704847	-0.07	145	11H8992	ALTAAMERICANA
131857708	-0.03	111	11H7489	ALTAAPOLLO
207831504	0.11	123	11H8477	ALTADORNE
207641240	0.21	62	7H8236	SPARTACUS
133299287	0.25	364	11H8230	ALTAAUGUSTA
132973942	0.25	55	11H8195	ALTABAXTER
135192942	0.35	141	11H8897	ALTACHORAL
9313510	0.39	87	11H7797	ALTAINTRUDER
133528202	0.42	104	11H8340	ALTAFORTIFY
132277989	0.56	94	11H8031	ALTAHATLEY
9255254	0.62	131	11H7791	ALTAROSWELL
129119896	0.63	55	11H6708	ACTIVIST
132135953	0.63	307	11H7871	ALTARUFFIAN
7359017	0.70	150	11H8239	ALTATABOO
132053536	0.77	76	7H7482	BINKY
132557357	1.02	50	7H7838	GLEN
7359166	1.17	73	11H8730	ALTAMYSTIQUE
7359310	2.03	154	11H8851	ALTASLEUTH

In order to evaluate a larger sample, bulls with 10 daughters were included. The sample size grew to include 99 different bulls and 5055 daughters. The daughter deviation varied between -2.91 to 4.25. Again Graybil produced the fastest milking daughters, while Bronco produced the slowest with a duration deviation of 4.25. The data is summarized in Table 10.

Table 10. Results of analysis for sires with over 10 daughters.

Sire	Daughter Deviation	Count	Sire NAAB	Sire Short Name
50747059	-2.91	55	7H8444	GRAYBIL
124690866	-2.43	11	11H5929	ALTAALLY
129069717	-1.98	53	7H6695	LC
248743677	-1.84	36	11H7354	ALTALEMMER
129443405	-1.68	109	11H7319	ALTASUEDE
134168494	-1.65	12	7H8228	MR MILK
131688542	-1.44	62	14H4026	AIRRAID
129560263	-1.31	12	11H6716	EDITION
61681262	-1.31	11	11H9688	ALTASOLO
129032447	-1.28	32	11H6440	ALTASYLVESTER
130312341	-1.22	12	29H10641	MANGO
129608932	-1.21	33	11H6414	ALTAALLEGRO
129608932	-1.21	33	11H6414	ALTAALLEGRO
131825509	-1.17	113	11H7741	ALTAJURYMAN
132135971	-1.17	11	14H4148	NIFTY
128367894	-1.16	71	14H3597	POTTER
61643016	-1.05	35	14H4916	JAKE
130161253	-1.03	14	1H6833	TRES
207184639	-1.00	10	7H6758	MR SAM
132045942	-0.83	11	7H7455	GRANGER
60869180	-0.73	10	7H7744	BLADE
129941695	-0.70	57	11H7123	ALTADREW
130895998	-0.64	34	7H7048	COMBAT
60977500	-0.64	24	14H4360	DREVIL
60609783	-0.61	32	7H7428	BOMAZ
132395373	-0.61	90	11H7856	ALTASPARTA
61232522	-0.57	129	7H8004	ENVISION
60259622	-0.57	13	11H7094	ALTAMYRON
130983729	-0.51	22	7H7173	ROLEX
132537018	-0.42	52	7H7560	BLITZ JINTX
126366093	-0.37	43	11H6116	ALTAROLEX
60596968	-0.36	16	7H7841	PRESTON
60083723	-0.34	34	14H3913	HARRY

295614274	-0.33	237	11H7823	ALTAOLIVER
7338826	-0.30	14	11H8035	ALTAGOLDPLATE
60718406	-0.26	52	11H8231	ALTAWARRANT
61166977	-0.21	12	11H8419	ALTAMERCANTILE
60817488	-0.20	109	7H7763	SANA
128385690	-0.17	15	7H6745	ONYX
130803069	-0.15	187	11H7464	ALTAWILDMAN
62743633	-0.13	14	14H5627	CHESTER
132582764	-0.11	96	7H7466	MOSCOW
61429186	-0.09	46	7H8612	BOB
61704847	-0.07	145	11H8992	ALTAAMERICANA
133939626	-0.07	14	7H8012	JABEZ
131857708	-0.03	111	11H7489	ALTAAPOLLO
207655090	-0.03	47	11H8215	ALTATESTIFY
60929138	-0.03	40	7H7870	ROTATER
60919279	0.02	10	7H8233	MORTAIL
135691067	0.03	21	14H4956	DOTSON
17373198	0.04	13	11H5086	ALTABLASTOFF
131644429	0.05	32	7H7396	STRUCTURE
207831504	0.11	123	11H8477	ALTADORNE
138014685	0.13	13	7H9475	JAZZMAN
60540162	0.15	14	7H7285	HHF
61802729	0.16	11	14H4924	KRAMER
207641240	0.21	62	7H8236	SPARTACUS
60745366	0.21	23	7H7785	REAGAN
120547278	0.22	18	7H6155	TRADEMARK
63246000	0.25	10	7H9593	PIRATE
133299287	0.25	364	11H8230	ALTAAUGUSTA
132973942	0.25	55	11H8195	ALTABAXTER
132035749	0.27	30	14H4099	BILLION
131671267	0.35	13	14H4011	DEL
135192942	0.35	141	11H8897	ALTACHORAL
9313510	0.39	87	11H7797	ALTAINTRUDER
133528202	0.42	104	11H8340	ALTAFORTIFY
133126053	0.45	17	7H7712	SOCRATES
133237247	0.45	14	11H8451	ALTAZORO
130153294	0.55	15	14H3831	MARION
130246589	0.55	20	11H7119	ALTAPATTON
132277989	0.56	94	11H8031	ALTAHATLEY
9255254	0.62	131	11H7791	ALTAROSWELL
129119896	0.63	55	11H6708	ACTIVIST
132135953	0.63	307	11H7871	ALTARUFFIAN

7359017	0.70	150	11H8239	ALTATABOO
132053536	0.77	76	7H7482	BINKY
61332736	0.88	19	7H8170	PAT
131241167	0.89	20	7H7193	DESIGN
131881507	0.92	12	11H7979	ALTAASPIRATION
62253394	0.93	15	11H9624	ALTAESQUIRE
134610106	0.93	27	7H8245	BUSHMAN
132557357	1.02	50	7H7838	GLEN
64401227	1.15	10	11H10338	ALTAQUASAR
7359166	1.17	73	11H8730	ALTAMYSTIQUE
132607164	1.28	10	11H7946	ALTAARMSTRONG
129196732	1.33	18	7H7264	MAN
60540246	1.39	13	7H7566	DEX
132337980	1.42	12	11H7978	ALTACALYPSO
61556923	1.49	11	14H4953	ROD
7359310	2.03	154	11H8851	ALTASLEUTH
131044292	2.03	16	11H7681	ALTADENBY
207189296	2.19	11	7H6919	CREST
131886632	2.64	11	203H1105	CODY
132967761	2.74	32	7H7762	FLINT
8879516	2.95	14	250H833	CHAMPION II
60745352	3.21	45	7H7650	JACKSON
135774702	4.25	28	7H8747	BRONCO

Discussion

The presence of on-farm computers and milk recording systems has allowed for dairy producers to further manage their herds. Pursuing a uniform milking string, could create higher efficiency within the parlor and overall profitability. A previous study evaluated the milking duration of cows in an attempt to determine if the is a genetic influence from sires. Zwald et al (2004) determined an average milking duration of 4.5 minutes. In the current study, the average milking duration was 5.55 minutes. This variation could be attributed to the differences in production yield. Dairyland Farms and Bar 20 Dairy had milking duration averages of 5.4 minutes and 4.95

minutes respectively. Van Beek Brothers Dairy had an average milking duration of 6.3 minutes. This duration was higher due to milking 3x versus milking 2x.

The previous study, conducted by Zwald et al. (2004), found that the estimated heritability of milking duration was .017 and predicted transmitting abilities of individual sires ranged from -0.48 minutes to 0.59 minutes (Zwald et al. 2004). The results of the current study recorded estimated heritability at 0.19 and 0.47. In addition the daughter deviations for bulls with over 50 daughters ranged from -2.91 to 2.03.

The error of the current study lies within the observations. Three separate facilities were observed individually and the results differed at each location. One herd supplied 6 observations, while another only provided 2. The quality of the data could have been improved to obtain more definite outcomes. Zwald et al. (2004), collected a weekly measurement from 29 herds between June 1, 2003 April 1, 2004. The data was uniform and compiled together. These qualities helped provide a more accurate heritability.

CONCLUSION

This study proves that milking durations can be collected and analyzed using electronically recording milking systems. These systems are more accurate than older subjective tests, therefore reducing the chance of error or biases. The study proved that sire has a genetic effect on milking duration of his offspring, however definite heritability could not be reached. Further investigation should be conducted to solidify the finding of this current study.

In addition to clarifying sire effect on milking duration, the study also exhibits several opportunities for advancement in the dairy industry. For example, milk recording systems and herd-management programs do not work collaborate. Dairy Comp 305 software does not continuously store observations of milking duration or peak flow rate (Moore et al. 1983). Also, the method in which milking duration is recorded also differs amongst different recording systems and herd-management software, making evaluations across dairies impossible. These are areas in which the dairy industry could evolve and become more efficient in management.

Even as these problems may exist, the opportunity to utilize milk-recording systems to asses milking duration by sire is possible. As the dairy industry grows and adapts, the use of technology follows. The majority of facilities have on-farm computers and there has been a recent push for management programs that utilize these technologies. The potential for growth exists and through determination, the dairy industry can use these new findings to develop a stronger future.

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