İstanbul Üniversitesi
Veteriner Fakültesi Dergisi

Journal of the Faculty of
Veterinary Medicine Istanbul University

İstanbul Üniv. Vet. Fak. Derg. / J. Fac. Vet. Med. Istanbul Univ., 43 (2), 132-139, 2017
doi: 10.16988/iuvfd.324052

Araştırma Makalesi ***Research Article***

Determination of Reproduction and Lactation Parameters in the First Production Year of Brown Swiss and Simmental Cows Imported From Austria[#]

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Geliş Tarihi / Received:
01 February 2017

Kabul Tarihi / Accepted:
13 April 2017

Key Words:
Adaptation, Brown Swiss, cattle, lactation, Simmental, reproduction

Abstract

This study was aimed at determining the adaptation levels of pregnant Brown Swiss and Simmental cows, imported from Austria to a dairy cattle enterprise in Manisa, according to their first year performances. Reproduction and milk yield performances of Brown Swiss and Simmental cows was focused in this paper. Insemination, pregnancy and birth parameters for Brown Swiss and Simmental cows were found to be similar. The first insemination interval and gestation length of Simmental cows were shorter than Brown Swiss cows. For Brown Swiss and Simmental cows, real milk yield was 9205.61 L and 8351.05 L; milk yield for 305-days was 8115.71 L and 7693.44 L; the lactation period was 356.0 days and 337.7 days respectively. The differences between breeds according to real and 305-days milk yield were statistically significant. The cows that calved in November and December reached a higher milk yield performance. The effect of calving month on cows' persistence in first lactation was significant, but the effect of breeds was not significant. Considering that the mean milk yields of Brown Swiss and Simmental cows in first lactation were over eight thousand liters, it can be said that the cows imported from Austria genetically have dairy potential and they can show this dairy potential from the first yield-year onwards.

Introduction

In Turkey, the quantitative sufficiency of cattle has become disputable because of the rapidly developing socioeconomic structure, population growth and increasingly industrialized character of the livestock sector since 2000s. It is reported that the milk produced in the country is sufficient for domestic and foreign markets, but insufficiencies occur occasionally in red meat and raw hide supplies to domestic markets, and this causes instability and extreme increases in red meat prices. Breeding and butchery cattle are imported at times to prevent unstable increases in red meat prices, and this situation has positive/negative impacts on national economy and livestock sector in the short, medium and long terms (Aydın et al., 2010).

It is reported that livestock imports can cause currency loss as animals are excluded from production early because of adaptation problems to a new place, and the expected productivity cannot be met. However, they can contribute to an increase in the culture cattle breed in the country and accelerate the genetic progress. In Turkey, the regions that import livestock most are Aegean, Eastern Marmara, Mediterranean and Western Marmara regions, respectively (TURKVET, 2016).

Increasing and sustained productivity in livestock enterprises depends on improving animals' genetic capacity as well as optimizing their environmental conditions and ensuring their quick adaptation to the geographical, climatic and vegetative conjuncture.

The purpose of this study was focused on pregnant Brown Swiss and Simmental cows, imported from Austria to a private dairy cattle enterprise, which has recently started operation in Manisa Province, to compare their reproduction and milk yield performances in their first production year, to identify the impact of

[#]This study was arranged from a part of the first author's PhD thesis. The present study was supported by Research Fund of Istanbul University (Project No: 23141)

breed and calving month on those parameters, and to find the adaptation capabilities of cattle based on performance.

Materials and Methods

The research protocol of the current study was approved by the Ethic Committee of the Istanbul University (Approval number: 2012/31)

Description of the Material

The study was conducted in a private dairy cattle enterprise, which was located in Manisa and which has recently started livestock operations. Manisa is located in Western Anatolia Region between 27 08' and 29 05' eastern longitudes and 38 04' and 39 58' northern latitudes. It has Mediterranean continental climate. Precipitation generally occurs in winter, and summer is dry. The bare and steep side of the Spil Mountain in Manisa faces the city and creates a scorching climate in summer and freezing one in winter. The temperature is below zero for an average of 26 days per year (Municipality of Manisa, 2017).

The first animal material of the enterprise comprised of 352 cattle imported as pregnant cows from the Innsbruck region of Austria. Among those imported cattle, 70 were Brown Swiss and 282 were Simmental (Spotted/Simmental/Fleckvieh) breeds. Brown Swiss and Simmental cows, which were imported as pregnant cows, completed their first calving approximately between the 954.47 and 922.79 days (first calving age), and then the enterprise began insemination and milking. The pregnant cows that were imported to the enterprise calved between June and December. Insemination was planned for 65 Brown Swiss and 272 Simmental cows, while 15 cows were referred to sorting or compulsory butchery due to various reasons. The completed lactation records of 50 Brown Swiss and 237 Simmental cows were evaluated to determine their milk yield performance.

Animal Management

The stables of the enterprise were constructed in a free interval and semi-open system. When the cows were brought to the enterprise, they were first taken into quarantine, and then were placed in equal numbers in 4 different paddocks in the stables. After the transport, the cows were vaccinated with IBR, BVD, Clostridium, Pastorella vaccines. After the first vaccines were completed, the cows were subjected to special feeding with coarse fodder (30% hay, 25% clover, 30% corn silage, 10% vetch, 5% pregnant cow factory feed mix).

The cows that calved had 3 different rations in the lactation period, namely post-calving, lactation and dry-period rations. After calving, they were subjected to post-calving feeding for a week, and then lactation feeding. First period ration consisted of: 14% clover, 48% corn silage, 3% vetch, 11% periodical pulp, 24% factory lactation feed mix. In the lactation period, the energy amount was increased and 11% clover, 50% corn silage, 4% vetch, 12% periodical pulp, 23% factory lactation feed mix was given. Lactation feed was prepared according to the cows with high and low milk yields in the progressing milking periods. The dry-period feed consisted of: 19% clover, 38% corn silage, 30% vetch, 4% periodical pulp, 9% dry-period factory feed mix.

Milking was made automatically in the milking parlor with 24 Rotary System on the basis of two-milking a-day, and milk amounts were recorded simultaneously in the herd management computer program. Insemination and milking data, which was recorded in the “DairyPlan” Herd Management Program, was used for calculating the reproduction and milk yield parameters addressed by the study.

Statistical Analysis

The parameters calculated for determining cows’ reproduction performance were: parameters expressed in rate as well as first insemination interval, insemination number, service period, calving interval, and gestation length. The parameters calculated for determining cows’ lactation performance were: lactation period, real milk yield, 305-days milk yield, and persistence. Performance parameters were grouped according to breed and calving month, and “GLM (General Linear Models)” procedure was applied. “Duncan Multiple İnterval Test” was used for significance controls between groups, and “chi square test” was used for significance controls between breeds in the reproduction parameters expressed in percentage. Milk yield in lactation periods was calculated by using the individual daily milk amounts found in 15-day episodes, and t-test was used for comparing the periodical daily milk yield of both breeds. In persistence estimations, the amounts of milk produced by each cow in the lactation period were identified for 100-day segments (P1: first 100 days; P2: second 100 days; P3: third 100 days) and the proportioning between periods was made according to those amounts. SPSS (Statistical Package for the Social Sciences) program package was used for all statistical analysis (SPSS, 1999).

Results

Reproduction Parameters

Table 1 and Table 2 indicate the reproduction parameters and significance controls between groups for Brown Swiss and Simmental breeds.

Table 1. Some Reproduction parameters and significance controls between Simmental and Brown Swiss cows in the first production year (%).

Properties	Brown Swiss		Simmental		General		Significance
	n	%	n	%	n	%	
Cows to be inseminated	65		272		337		
Pregnant cows	50	76.92	233	85.66	283	83.98	N.S.
Non pregnant cows	15	23.08	39	14.34	54	16.02	N.S.
Cows that pregnant in the 1st insemination	20	40.00	96	41.21	116	40.99	N.S.
Cows that pregnant in the 2nd insemination	9	18.00	48	20.61	57	20.14	N.S.
Cows that pregnant in the 3rd insemination	8	16.00	42	18.02	50	17.67	N.S.
Cows that pregnant in the 4th+ insemination	13	26.00	47	20.16	60	21.20	N.S.
Cows with live birth	45	90.00	218	93.56	263	92.93	N.S.
Cows with stillbirth	1	2.00	4	1.72	5	1.77	N.S.
Cows with preterm	1	2.00	0	0.00	1	0.35	N.S.
Cows with aborts	3	6.00	11	4.72	14	4.95	N.S.
Cows with spontaneous birth	17	37.78	95	43.58	112	42.59	N.S.
Cows with assisted birth	21	46.67	103	47.25	124	47.15	N.S.
Cows with difficult labor	7	15.56	20	9.17	27	10.27	N.S.
Cows with single birth	44	97.78	200	91.74	244	92.78	N.S.
Cows with twin birth	1	2.22	18	8.26	19	7.22	N.S.
Calves born alive	46		236		282		
Male calves	25	54.35	119	50.42	144	51.06	N.S.
Female calves	21	45.65	117	49.58	138	48.94	N.S.
Calves born spontaneously	16	34.78	95	40.25	111	39.36	N.S.
Calves born with assistance	21	45.65	116	49.15	137	48.58	N.S.
Calves born with difficulty	9	19.57	25	10.59	34	12.06	N.S.

N.S.: Not significant (P>0.05)

The pregnancy and inseminations performed in the enterprise indicated that the pregnancy rate was 76.92% for Brown Swiss and 85.66% for Simmental cows. Respectively, 40.00% and 41.21% of pregnant cows conceived in the first insemination. For Brown Swiss, 90.00% were live birth, 4% were stillbirth and 6.00% were abort; for Simmental, 93.56% were live birth, 1.72% were stillbirth and 4,72% were abort. For Brown Swiss, 97.78% of births were single and 2.22% were twin; for Simmental, 91.74% of births were single and 8,26% were twin. Spontaneous/unassisted, assisted and difficult labor rates were 37.78%, 46.67% and 15.56% for Brown Swiss respectively and 43.58%, 47.25% and 9.17% for Simmental respectively.

The first insemination interval were 75.59 and 67.61 days for Brown Swiss and Simmental cows respectively. The cows that had their first calving in July completed their involution period earlier than the cows that calved in August, September, October and November. For the whole herd, the mean insemination number for conception was 2.23; the service period was 119.96 days; and mean calving interval was 406.8 days. The gestation lengths of Brown Swiss and the cows that calved in November and December were longer. The differences between breed and calving months were statistically insignificant except for first insemination interval and gestation length.

Milk Yield Parameters

Table 3 indicates the mean values and significance controls between subgroups for Simmental and Brown Swiss cows, which calved between June and December, in terms of real milk yield, 305-day milk yield, lactation period and persistence values.

The table shows that Brown Swiss cows had higher performance than Simmental cows in terms of real and 305-day milk yield. The differences between two breeds

Table 2. Mean values and significance controls for Simmental and Brown Swiss cows in the first production year in terms of reproduction parameters.

FACTORS		First Insemination Interval			Insemination Number			Service Period			Calving Interval			Gestation length		
		n	x	s_x	n	x	s_x	n	x	s_x	n	x	s_x	n	x	s_x
BREED	Brown Swiss	50	75.59^{a}	3.44	50	2.29	0.19	50	123.60	9.37	47	411.01	9.80	64	284.92^{a}	1.02
	Simmental	233	67.61^{b}	1.83	233	2.17	0.10	233	116.31	4.99	222	402.59	5.13	261	282.04^{b}	0.57
CALVING MONTH	June	12	71.32^{ab}	6.50	12	2.05	0.35	12	109.20	17.68	12	393.09	17.99	10	263.65^{e}	2.31
	July	30	57.79^{b}	4.17	30	2.37	0.23	30	119.83	11.35	28	410.26	12.00	31	280.01^{d}	1.34
	August	46	78.60^{a}	3.38	46	2.32	0.18	46	135.75	9.20	43	419.63	9.69	49	283.24^{d}	1.07
	September	62	76.99^{a}	2.96	62	2.02	0.16	62	114.91	8.07	58	401.54	8.48	74	286.51^{c}	0.87
	October	81	74.77^{a}	2.60	81	2.27	0.14	81	128.23	7.09	78	415.59	7.33	97	288.05^{bc}	0.77
	November	44	74.08^{a}	3.70	44	2.31	0.20	44	121.91	10.07	42	408.82	10.49	52	289.47^{ab}	1.10
	December	8	67.62^{ab}	7.86	8	2.29	0.43	8	109.86	21.40	8	398.66	21.77	12	293.45^{a}	2.12
OVERALL		283	71.60	2.14	283	2.23	0.12	283	119.96	5.82	269	406.80	6.03	325	283.48	0.64
SIGNIFICANCE	Breed		*			N.S.			N.S.			N.S.			**	
	Calving Month		**			N.S.			N.S.			N.S.			***	
	Breed X Cal. Month		N.S.			N.S.			N.S.			N.S.			N.S.	

N.S.: Not significant; * P<0.05; ** P<0.01; ***P<0.001

a,b,c,d,e : The differences between the means marked with different letter in the same column are significant (P<0.05).

Table 3. Mean values and significance controls for Simmental and Brown Swiss cows in the first production year in terms of lactation parameters.

FACTORS		Lactation period (day)			Real milk yield (L)			305-days milk yield (L)			Persistence (%)					
											$P_{2:1}$		$P_{3:1}$		$P_{3:2}$	
		n	x	s_x	n	x	s_x	n	x	s_x	n	x	s_x	x	s_x	x	s_x
BREED	Brown Swiss	50	356.00	9.83	50	9205.61^{a}	314.15	42	8115.71^{a}	195.26	42	108.0	2.4	99.0	3.6	91.3	2.2
	Simmental	237	337.70	5.18	237	8351.05^{b}	165.54	166	7693.44^{b}	111.23	166	108.8	0.9	98.0	1.3	89.6	0.8
CALVING MONTH	June	13	337.44	17.86	13	7881.31	570.72	9	7234.77^{cd}	380.72	9	127.3^{a}	4.7	124.3^{a}	6.9	97.4^{ab}	4.2
	July	28	350.72	12.35	28	8435.63	394.60	15	7323.37^{d}	297.80	15	111.9^{b}	3.3	104.2^{b}	4.9	92.8^{ab}	3.0
	August	48	359.24	9.49	48	8811.89	303.16	39	7770.92^{bcd}	186.88	39	104.5^{c}	1.7	97.7^{b}	2.5	93.5^{a}	1.5
	September	65	339.61	8.26	65	8770.82	264.00	42	7990.97^{bc}	178.92	42	104.8^{bc}	1.5	98.5^{b}	2.3	93.8^{a}	1.4
	October	82	349.23	7.41	82	8838.17	236.71	63	8013.75^{bc}	148.11	63	101.6^{c}	1.3	90.4^{c}	1.8	89.0^{b}	1.1
	November	43	346.47	10.66	43	9219.29	340.47	34	8530.30^{a}	213.28	34	108.1^{bc}	4.5	93.8^{bc}	6.6	86.8^{abc}	4.1
	December	8	345.24	22.44	8	9491.21	717.05	6	8467.92^{ab}	461.39	6	100.6^{bc}	4.8	80.6^{c}	7.7	79.9^{c}	4.4
OVERALL		287	346.85	6.09	287	8778.33	194.58	208	7904.57	124.25	208	108.4	1.3	98.5	1.9	90.5	1.2
SIGNIFICANCE	Breed		N.S.			**			*					N.S.			
	Calving month		N.S.			N.S.			**					**			
	Breed X Cal. Month		N.S.			N.S.			N.S.					N.S.			

N.S. Not significant; * P<0.05; ** P<0.01

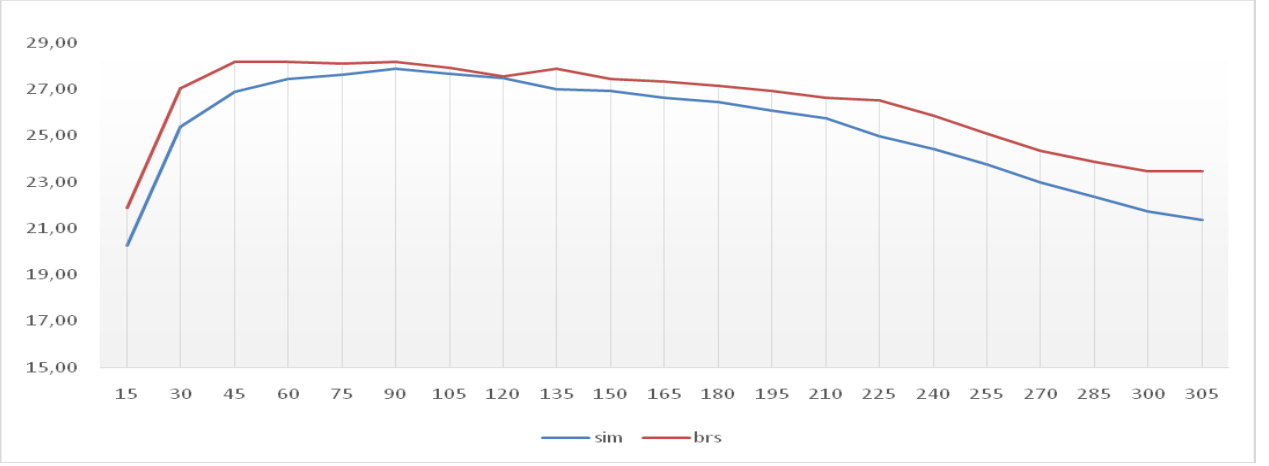
a,b,c,d : The differences between the means marked with different letter in the same column are significant (P<0.05).

were statistically significant. For Brown Swiss cows, real milk yield was 9205.61 L and 305-day milk yield was 8115.71 L. For Simmental cows, those values were 8351.05 L and 7693.44 L respectively.

The first period calving took place between June and December in the enterprise. The impact of calving month on real milk yield was not statistically significant (P>0.05), while its impact on the milk yield corrected for 305-day was significant (P<0.01). The milk yields of the cows that calved in November and December were high, while the milk yields of cows that calved in June, July and August were low.

The mean lactation periods of Brown Swiss and Simmental cows were 356.0 and 337.7 days respectively. The impact of breed and calving month on lactation period was not statistically significant (P>0.05).

Graph 1 indicates the first lactation curve values of Brown Swiss and Simmental cows. It shows that Brown Swiss cows had a higher daily milk yield than Simmental cows as of the lactation start. The differences between breeds were statistically significant in the first 15-days and in the last period of lactation between the 225th and 300th days (P<0.05). In the 90th day, the lactation peak value was 28.19 L for Brown Swiss cows, and 27.87 L for Simmental cows. Brown Swiss cows completed the first lactation with 23.45 L while Simmental cows completed it with 21.38 L. While the impact of breed on persistence values was insignificant, the impact of calving month was significant (P<0.01). When lactation periods and mean persistence are assessed together, the second 100-day segment of lactation for Simmental and Brown Swiss cows indicated a higher milk yield compared to the other segments.



	LACTATION DAYS																				
Breeds	**15**	**30**	**45**	**60**	**75**	**90**	**105**	**120**	**135**	**150**	**165**	**180**	**195**	**210**	**225**	**240**	**255**	**270**	**285**	**300**	**305**
Simmental	20.2	25.3	26.9	27.4	27.6	27.8	27.6	27.4	26.9	26.9	26.6	26.4	26.0	25.7	24.9	24.4	23.7	22.9	22.3	21.7	21.3
Brown Swiss	21.8	27.0	28.1	28.1	28.0	28.1	27.9	27.5	27.8	27.4	27.3	27.1	26.9	26.6	26.5	25.8	25.0	24.3	23.8	23.4	23.4
Significant	*	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	*	*	*	*	*	*	**

N.S. Non Significant; * P<0.05; ** P<0.01

Graph 1. Lactation periods and significant controls of Simmental and Brown Swiss cows (L).

Discussion

Reproduction Parameters

Brown Swiss and Simmental cows had a pregnancy rate of 76.92% and 85.66% respectively. Pregnancy rate in first insemination was 40.00% for Brown Swiss and 41.21% for Simmental. These values indicated that Simmental cows reached the target for dairy cattle enterprises, which was 80% and above, but both breeds remained under the target for first insemination pregnancy rate, which was 50% and above (Dinç, 2016). The findings were lower than the results of other studies on Brown Swiss and Simmental cows in general (Balcı, 1996; Deliömeroğlu, 1993; İnal et al., 2003; Koçak et al., 2008; Özkan, 2007). 10% of Brown Swiss cows and 6.44% of Simmental cows lost their calves due to stillbirth and abort. Brown Swiss cows had more cases of difficult labor. Similar studies report that stillbirth and abort rates are around 5-7% (Deliömeroğlu, 1993; İnal et

al., 2003; Koçak et al., 2008). While those results are similar for Simmental, it is understood that Brown Swiss lost more calves during labor. While twin birth rate was 8,26% for Simmental, it was 2,22% for Brown Swiss. The result that Simmental cows were more prone to twin birth is consistent with the reports in literature (Özkan, 2007; Schnitzenlehner et al., 1998). All reproduction parameters expressed in rates indicate that Brown Swiss cows had more negative values compared to Simmental cows, but the differences between breeds were not statistically significant.

After calving, second insemination period was performed on Brown Swiss and Simmental cows. Their first insemination time after labor and the mean number of inseminations indicated that the targets expected from dairy cattle enterprises, namely the 60-70 days interval and less than two inseminations, were not met (Dinç, 2016). The insufficiencies in insemination also extended the cows' service period and mean calving interval. Simmental cows completed the involution process earlier, they were taken to insemination earlier, and completed their pregnancies 2.88 days earlier than Swiss Brown cows. The studies made in Turkey on Simmental and Brown Swiss cows found that the first insemination interval was 45.8-72.5 days; insemination number was 1,2-2,3; service period was 99.5-129 days; and calving interval was 374,9-416,6 days (Balcı, 1996; Deliömeroğlu, 1993; İnal et al., 2003; İnci et al., 2007; Koçak et al., 2008; Kopuzlu et al., 2008; Özkan, 2007; Özkök and Uğur, 2007). It can be said that the reproduction parameters of Simmental cows were similar to literature while the reproduction performance of Brown Swiss cows had differences.

Stress caused by transport, having the first calving and first insemination in warm months, and the insufficiencies in rutting follow-up and insemination due to heat stress led to negative results in reproduction performance, and the said factors affected Brown Swiss cows more.

It was found that the calving month had a statistically significant impact on the first insemination time after labor and gestation lengths. The cows that calved in July completed the involution period earlier than the cows that calved in August, September, October and November. This situation can be explained by the fact that rutting detection and inseminations took place in the relatively cooler months of autumn under Manisa conditions. Gestation lengths indicated that the cows were affected by heat stress; the gestation lengths of cows that calved in cool autumn months were close to the ones accepted as normal for the breed, and pregnancies ended earlier in warm months.

Milk Yield Parameters

Brown Swiss cows, which were kept and fed under the same environmental conditions with Simmental cows, reached higher milk yield performance, which was statistically significant. This situation indicated that Brown Swiss cows had more-developed dairy potentials compared to Simmental cows.

According to the results of studies focusing on the milk yield parameters of Brown Swiss and Simmental cows, the mean real milk yields of Brown Swiss cows in their first lactation periods were between 3325 kg and 6219 kg, and their mean 305-day milk yield was between 3063 kg and 6219 kg (Aktaş and Bakır, 2011; Balcı, 1996; Çakıllı and Güneş, 2007; Çilek and Bakır, 2010; Dağ et al., 2003; İnci et al., 2007; Koçak et al., 2008). The 305-day milk yield values of Simmental cows varied between 2779 kg and 3292 kg (Deliömeroğlu, 1993; Koçak et al., 2008; Özkan, 2007; Petrovic et al., 2009). In this study, both the mean real milk yield and the mean 305-day milk yield of both breeds were higher than the ones reported in literature. This may derive from the fact that the cows were supplied from the herds with Austrian origins, which had high milk yield capacity, the rational feeding model implemented during lactation, and herd management program. In addition, while different formulations were used in literature for calculating real and 305-days milk yields, the data set of this study was based on real and up-to-date records received directly from the computerized herd management program rather than formulation calculations, and this might be another reason of difference.

The calving months had an impact on the real and 305-day milk yield. The cows that calved and reached lactation peak yield in warm months (June, July, August) had lower milk yield while the cows that calved in relatively cooler months (November, December) had higher milk yield performances. These findings were consistent with the findings reported by Atashi et al. (2012), Balcı (1996), Özkan (2007), Çilek and Bakır, (2010), Özcan and Altınel (1995), and Şeker et al. (2009). Although heat stress had a negative impact on milk yield, there was no sharp fluctuation in daily milk yield during lactation period. This might be an indication of the endurance of Brown Swiss and Simmental breeds to heat stress. The lactation periods calculated for Brown Swiss and Simmental cows were longer than the ones reported in literature (Aktaş and Bakır, 2011; Balcı, 1996; Çakıllı and Güneş, 2007; Çilek and Bakır, 2010; Dağ et al., 2003; Deliömeroğlu, 1993; İnci et al., 2007) and this derives from the delays in the pregnancy periods of cows.

Lactation curves had a regular course for both breeds, while Brown Swiss cows started and completed

lactation with a higher level of daily milk yield. Considering particularly the period from the 225th day to the lactation end, a statistically significant difference emerges between breeds. Daily milk amounts of Brown Swiss and Simmental cows at the lactation start, peak period (90th day) and lactation end were higher than the amounts reported for Brown Swiss breed by Arslan et al. (2002), Çakıllı and Güneş (2007) and Dağ et al. (2003).

Considering that the mean milk yields of Brown Swiss and Simmental cows in first lactation were over eight thousand liters, it can be said that the cows imported from Austria genetically have dairy potential, that they can show this potential from the first yield-year onwards, provided that attentive and rational caring and nutrition programs are implemented for the herd, and that it is necessary to carry out more attentive insemination and pregnancy follow-ups in order to increase reproduction performance.

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