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Effect of Some Factors on Fertility and Milk Yield Traits of Simmental Cattle Raised in Teke Region of Türkiye

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ABSTRACT: This study was conducted to determine the effects of some factors on the fertility and milk yield traits of Simmental breed cattle raised with different production scales in Teke Region. The research data includes 635 lactation records of Simmental cows raised in Antalya, Burdur, Denizli, and Isparta provinces between the years of 2011 and 2017. Based on these data, the effects of factors such as enterprise scale, lactation number, season, calving year, and province on fertility and milk yield were analyzed. It was determined that the farm scale, calving year, and calving season significantly affected the fertility traits of calving interval and service period ($P<0.05$). Also, it was detected that lactation number affected the number of inseminations per pregnancy ($P<0.05$). Province significantly affected lactation length, 305-day milk yield, lactation milk yield, and drying period ($P<0.05$). Enterprise scale significantly affected 305-day milk yield and lactation milk yield ($P<0.05$). Calving year affected lactation length, lactation milk yield, and drying time ($P<0.05$) ($P<0.05$). According to findings, there were significant relationships between farm scale, progeny, and milk yield traits in Simmental breed cattle raised in the Teke Region, and as the farm scale increased, calving interval, service period, lactation milk yield, and 305-day milk yield increased. Increasing enterprise scale allowed to increase herd management, care and feeding facilities with providing technological innovations. For this reason, it can be recommended that the developing and implementing comprehensive models on preventing breast, foot, and nutritional diseases and economic efficiency should be applied to increase fertility and milk yield in dairy cattle farms.

Keyword: Simmental; Fertility; Milk yield; Türkiye; Teke Region.

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INTRODUCTION

The Simmental breed takes its name from the Simme River valley in the Berner Oberland of Switzerland. The literal meaning of the breed is "Simme Valley" where the Simme River flows in Central and Western Switzerland (Manzanares-Miranda et al., 2015). The first herd book of the Simmental breed, which is a combined productive breed, was created in 1806, and the first union was formed in Switzerland in 1890 under the name of "Red and White Pied Simmental Cattle Association". The high adaptability of Simmental breed and its good success in crossbreeding with other breeds have caused its usage in large extent in animal farms around the world. It is the second breed in the world, numerically, after the Black-Pet breed (Koç, 2016).

The first cattle import was made in 1925 in Türkiye, and Brown Swiss breed was preferred for a long time. In addition in these years, the Simmental breed was brought to Türkiye with Bonihad cattle imported from Hungary. However, Simmental studies were later abandoned. Holstein, Jersey, Aberdeen-Angus, and Hereford breeds were brought to Türkiye in 1958, and some Simmental breeds were brought to Türkiye from Germany in the 1970s (Akman et al., 1990; Alpan and Aksoy, 2012). Simmental cattle have become the second most reared breed among the cultural breeds in Türkiye, after the Holstein Friesian. The important reasons for the preference of the Simmental breed are (a) the low milk/feed parity and (b) the rapid body gain in fattening due to the increase in meat prices (Koç 2016).

"Teke region" of Türkiye consists of Antalya, Burdur, Denizli, Isparta and Muğla provinces. It took its name from the "Teke Beylik", a Turkmen tribe that settled in this region. The region bears the traits of nomadic people who have had a unique social and cultural identity since the medieval times (Sari 2012, Ananoymus 2018).

The desired characteristics of today's cattle breeds are that their milk yield, fertility, health and growth characteristics are close to the targeted values. Fertility traits can be influenced by some factors such as lactation number, breeding season, number of breedings etc. (Lamming et al., 1998; Andrews, 2003; Noakes et al., 2001). Therefore, this study was conducted to determine the effects of some factors on the fertility and milk yield traits of Simmental cattle raised at different production scales in Teke Region.

MATERIALS AND METHODS

The research material consists of 635 lactation records containing the fertility and milk yield parameters of Simmental breed cows of enterprises located in Antalya, Burdur, Denizli, and Isparta provinces between 2011 and 2017, obtained from the data of the Central Association of Breeding Cattle Breeders of Türkiye.

In the study, farm sizes were scaled as Group I (1-50 head), Group II (51-100 head), and Group III (101 head and above) enterprises with dairy cows. The calving interval (CI), the service period (SP), Number of insemination per pregnancy (IPP), and first calving age (FCA) traits were used as fertility parameters. The lactation number was between 1–5. The 5th lactation and above were categorized as a single lactation group, with each lactation sequence between lactations being a group. Seasons were classified as winter (December, January, and February), spring (March, April, and May), summer (June, July, and August), and autumn (September, October and November). The calving years were between 2011 and 2017.

Information on animals with a lactation period longer than 550 days and shorter than 220 days, and calving ages younger than 23 months and older than 62 months for the first calving and subsequent lactations was not considered for the consistency of the study. Simultaneously, calving age in subsequent lactations was not taken into account, except for the values obtained by adding 12 months to the lower limit of the previous calving age and 14 months to the upper limit. Information other than the values obtained by adding months was not considered. Additionally, data regarding CI of less than 310 days and more than 650 days were not used. The standard lactation period is considered as 305 days. Lactation milk yields longer than this period were corrected using conversion factors based on 305 days. No changes were made in the standard lactation period is considered as 305 days (Alpan, 1992).

The data were processed using Microsoft Excel 2016 and statistically analyzed by using Minitab 16.0 software packages. The least squares method was used to determine the effects of factors related to province, enterprise scale, lactation number, season, and calving year on fertility and milk yield traits. Tukey multiple comparison test was used to compare the subgroups of the factors found to be important.

The statistical model described below was used to determine the factors affecting fertility and milk yield traits.

$Y_{ijklm} = \mu + A_i + B_j + C_k + D_l + F_m + e_{ijklm}$

μ= mean of total observed values

A_i= Production scale effects of enterprises (i = 1-50, 51-100, ≥ 101 heads)

B_j= Effects of calving year (j= 2011, 2012, 2013, 2014, 2105, 2016, 2017)

C_k= Effects of provinces (k = Antalya, Burdur, Denizli, and Isparta)

D_l= Effects of lactation number (l = 1, 2, 3, 4, 5)

F_m= Seasonal effects (m = spring, summer, autumn, winter)

Y_{ijklm}= Observed fertility traits at the scale of enterprises (i), calving year (j), provinces (k), lactation number (l), and calving season (m)

e_{ijklm}= Random sampling effects

RESULTS

The least-square means of some factors affecting the fertility traits of Simmental cattle are presented in Table 1. It was determined that the effects of the province on CI, SP, and FCA were significant (P<0.05). It was determined that the CI and SP values of Burdur province were shorter than those of Antalya, Denizli, and Isparta provinces. While the FCA was determined as 984.40 days in Isparta, it was similar to those of Antalya, Burdur, and Denizli provinces, determined as 875.30, 867.80, and 857.60 days, respectively. It was found out that the effect of the province on the number of insemination per pregnancy was not statistically significant (P>0.05), calculated as 1.43, 1.51, 1.46, and 1.54 in Antalya, Burdur, Denizli, and Isparta, respectively.

The effects of the farm scale on CI and SP were statistically significant (P<0.05). It was observed that the farm scale did not cause any changes in the parameters of the number of insemination per pregnancy and age at the first calving (P>0.05).

It was determined that the effect of calving year on CI, SP, and insemination number per pregnancy was significant (P<0.05). The lowest CI and SP were determined as 363.00 days and 80.00 days in 2017, respectively, while the maximum was determined as 420.70 days and 137.72 days in 2014. The lowest number of IPPs was 1.35 in 2016, and the highest one was 1.68 in 2015. It was found out that the effect of calving year on FCA was insignificant (P>0.05).

It was determined that the effects of the calving season on CI and SP were statistically significant (P<0.05). The lowest CI and SP were determined in the autumn season as 386.90 days and 103.89 days, respectively. These values were as 418.20 days and 135.17 days, respectively, in the spring season. It was determined that the effects of calving season on the number of IPP and the calving age on the first calving age was insignificant (P>0.05).

It was determined that the effects of lactation number on CI and SP were insignificant (P>0.05), but its effect on the number of IPP was significant (P<0.05). The lowest number of IPP was calculated as 1.11 in the first lactation, and the highest IPP was calculated as 1.68 in the second lactation.

The least-square means of the effects of some factors on milk yield traits are given in Table 2. The effects of the province on lactation length (LL), 305-day milk yield (305-day MY), lactation milk yield (LMY), and length of dry period (LDP) were statistically significant (P<0.05). The highest LL was determined as 365.80 days in Denizli province, and the lowest LL was detected as 325.40 days in Burdur province. 305-day MY and LMY were the highest values in Denizli province, 6579.40 and 7925.10 kg, respectively, and the lowest values in Isparta, 5258.50 and 5847.20 kg, respectively. The highest LDP was calculated as 57.41 days in Burdur province, and the lowest one was calculated as 18.31 days in Isparta province.

It was determined that the effects of enterprise scale on 305-day MY and LMY were significant (P<0.05), while its effects on LL and LDP were insignificant. 305-day MY and LMY were calculated as 6211.90 and 7020.70 kg in the highest enterprise scale farms Group III, respectively, and 5820.80 and 6338.70 kg in the lowest enterprise scale Group I.

It was detected that the effects of calving year on LL, LMY, and LDP were significant (P<0.05), whereas its effect on 305-day MY was insignificant (P>0.05). The maximum LL was determined as 359.70 days in 2011, and the shortest LL was 309.30 days in 2017. The highest LMY was calculated as 7295.00 kg in 2011, and the lowest LMY was 6167.20 kg. The shortest LDP was found as 13.05 days in 2011, and the maximum LDP was 64.94 days in 2016.

Table 1. Least square means of some factors affecting fertility traits

Factors	n	Calving interval, day	Service period, day	Number of insemination per successful pregnancy	n	First calving age, day
Province						
Antalya	83	405.10±8.27a	122.11±8.27a	1.43±0.11	40	875.30±29.04b
Burdur	427	380.40±6.06b	97.41±6.06b	1.51±0.08	233	867.80±16.22b
Denizli	49	414.70±9.78a	131.72±9.78a	1.46±0.13	20	857.60±35.23b
Isparta	76	407.70±8.54a	124.75±8.54a	1.54±0.11	42	984.40±29.30a
P values		0.001	0.001	0.905		0.001
Farm scale (head)						
1-50	117	388.30±7.53b	105.21±7.53b	1.48±0.10	62	890.40±25.16
51-100	167	406.90±6.66ab	123.87±6.66ab	1.46±0.09	75	876.70±22.99
≥101	351	410.90±6.27a	127.91±6.27a	1.51±0.08	198	921.70±20.11
P values		0.039	0.039	0.903		0.227
Calving year						
2011	19	390.60±15.40ab	107.60±15.40ab	1.36±0.21ab	17	871.00±39.54
2012	48	409.00±10.37a	125.97±10.37a	1.43±0.14ab	35	913.80±28.41
2013	75	405.70±8.39a	122.71±8.39a	1.47±0.11ab	39	957.40±27.92
2014	87	420.70±7.57a	137.72±7.57a	1.63±0.10ab	22	877.00±34.80
2015	211	414.90±6.03a	131.88±6.03a	1.68±0.08a	143	879.20±18.44
2016	143	410.10±7.04a	127.11±7.04a	1.35±0.09b	69	859.00±23.50
2017	52	363.00±10.44b	80.00±10.44b	1.46±0.14ab	10	916.30±52.28
P values		0.000	0.000	0.045		0.138
Calving season						
Spring	103	418.20±7.61a	135.17±7.61a	1.49±0.10	53	923.50±25.35
Summer	98	402.70±7.66ab	119.66±7.66ab	1.45±0.10	54	855.80±24.54
Autumn	243	386.90±6.59b	103.89±5.59b	1.49±0.09	137	904.70±23.50
Winter	191	400.30±5.89ab	117.27±5.89ab	1.50±0.08	91	901.10±19.44
P values		0.002	0.002	0.976		0.159
Lactation no						
1	335	406.30±4.87	123.34±4.87	1.11±0.06b		
2	155	410.10±6.16	127.07±6.16	1.68±0.08a		
3	61	396.30±9.02	113.29±9.02	1.67±0.12a		
4	53	389.90±9.55	106.87±9.55	1.64±0.13a		
5	31	407.40±12.06	124.41±12.06	1.32±0.16ab		
P values		0.307	0.307	0.000		
Overall	635	401.99±4.79	118.99±4.79	1.48±0.06	335	896.26±15.11

a, b: Different letters show the statistical differences between means in the same column($P<0.05$)

The effects of calving season on 305-day MY and LMY were significant ($P<0.05$), while the effects on LL and LDP were nonsignificant ($P>0.05$). In winter months, the highest 305-day MY and LMY values were calculated as 6210.70 and 6876.00 kg, respectively. It was determined that the effects of lactation number on LL, 305-day MY, LMY, and LDP were found statistically nonsignificant ($P>0.05$).

Table 2. Least square means of some factors affecting milk yield traits

Factors	n	Lactation length, day	305-day milk yield, (kg)	Lactation milk yield, (kg)	n	Length of dry period (day)
Province						
Antalya	83	325.40±8.33b	6036.20±113.36b	6445.50±231.60bc	18	47.89±7.95a
Burdur	427	326.10±6.10b	6335.30±83.03ab	6729.20±169.60b	139	57.41±4.83a
Denizli	49	365.80±9.84a	6579.40±134.01a	7925.10±273.80a	15	56.17±8.05a
Isparta	76	333.50±8.60ab	5258.50±117.08c	5847.20±239.20c	14	18.31±7.83b
P values		0.003	0.000	0.000		0.000
Farm scale (head)						
1-50	117	331.20±7.58	5820.80±103.23b	6338.70±210.90b	30	35.57±5.84
51-100	167	340.80±6.71	6124.40±91.30a	6850.80±186.50ab	32	53.24±5.99
≥101	351	341.10±6.31	6211.90±85.93a	7020.70±175.60a	124	46.02±6.07
P values		0.494	0.007	0.028		0.126
Calving year						
2011	19	359.70±15.51a	6188.90±211.15	7295.00±431.40a	12	13.05±8.34
2012	48	326.60±10.44b	5862.70±142.10	6167.20±290.30c	29	51.69±6.35
2013	75	322.70±8.44b	6226.50±114.96	6679.90±234.90b	45	40.92±5.67
2014	87	345.20±7.63a	5843.50±103.83	6662.80±212.10b	53	45.49±4.64
2015	211	346.70±6.07a	6069.10±82.70	6972.30±169.00a	32	53.58±5.19
2016	143	353.80±7.09a	6144.20±96.54	7187.00±197.20a	15	64.94±8.10
2017	52	309.30±10.51b	6031.50±143.12	6193.10±292.40c		
P values		0.000	0.067	0.004		0.000
Calving season						
Spring	103	337.00±7.66	6119.30±104.27ab	6808.80±213.00a	16	44.20±7.47
Summer	98	345.90±7.71	6042.10±104.95ab	6872.80±214.40a	46	49.67±5.10
Autumn	243	332.30±6.63	5837.30±90.27b	6389.50±184.40b	73	44.61±4.70
Winter	191	335.60±5.93	6210.70±80.72a	6876.00±164.90a	51	41.31±4.68
P values		0.384	0.001	0.037		0.534
Lactation no						
1	335	334.30±4.91	5940.60±66.79	6590.20±136.50	84	44.07±3.77
2	155	344.50±6.21	6004.90±84.50	6788.50±172.60	40	53.95±4.65
3	61	338.50±9.08	5920.50±123.59	6563.10±252.50	36	50.36±5.07
4	53	330.30±9.61	6159.50±130.88	6712.00±267.40	21	46.53±6.35
5	31	341.20±12.15	6236.20±165.35	7029.90±337.80	5	29.82±11.79
P values		0.542	0.234	0.626		0.189
Overall	635	337.71±4.82	6052.35±65.66	6736.70±134.10	186	44.94±3.82

a, b, and c: Different letters shows the statistical differences between means in the same column($P<0.05$)

DISCUSSION

It was reported that in enterprises with good herd management, the best CI value was 365 days, SP was 60-90 days, and IPP was 1.5-2 (Alpan and Aksoy, 2012). It was determined that Burdur Province was the best in terms of CI and SP. The CI, SP, and IPP values detected in this study were better than those reported by Öztürk and Sipahi (2021) in the Holstein in the Teke Region. This shows that Simmental cattle in the Teke Region have better fertility traits than Holstein cattle. In the present study, there was no difference between provinces in terms of IPP values

and that these values were within normal limits. The highest value in terms of FCA is in Isparta province, and the FCA values were similar to the findings by Özkan and Güneş (2011) and higher than the value reported by Öner (2022) at 842.35.

Results showed that the farm scale had significant effects (P<0.05) on CI and SP, which are among the fertility parameters, and as the farm scale increases, these values also increase as the highest values were obtained from Group III. This situation indicates that there were herd management problems related to fertility in Group III (enterprises with more than 101 animals). This may be relate to that the large enterprises preferred young and inexperienced veterinarians to avoid overpaying veterinarians. CI and SP values were lower in Group I and Group II compared to those of Group III. According to these results, it was concluded that raising Simmental up to 100 heads in terms of enterprise-scale in Teke Region would be suitable for CI and SP, which are important fertility parameters. In a study conducted by Özkan and Güneş (2011) on Simmental breed cattle in Kayseri, Türkiye. It was found out that the enterprise scale had no effect on CI and SP. This difference may be due to differences in province, care and feeding management of the animals, or different classifications methods of enterprise scale. In this study, it was determined that the effects of enterprise scale on IPP and FCA were nonsignificant, and a similar situation was reported by Özkan and Güneş (2011).

The effects of calving year on CI, SP, and IPP were statistically significant in this study. Öztürk and Sipahi (2021) found the significant effects of calving year on CI, SP, and IPP in Holstein raised in Teke Region. Gündoğan (2019) found significant effects of calving year on CI, SP, and IPP in Simmental raised in Balıkesir province. Öner (2022) found a significant effect of calving year on CI in Simmental raised in Aydın province. However, Duru and Tuncel (2002) and Özkan and Güneş (2011) reported that the calving year had no significant effects on CI and SP.

In this study, it was found that the effects of the calving season on CI and SP were important. The best values in terms of CI and SP were observed in the autumn season. Demirgüç (2015) found that the effect of the calving season on CI in Simmental grown in Gökhöyük Agricultural Enterprise was important with the best CI value of 342.29 days in winter season. The studies of Öztürk and Sipahi (2021) in Teke Region, Kaya and Bardakçıoğlu (2016) in Holstein raised in Denizli province, Gündoğan (2019) in Simmental raised in Balıkesir province, Çilek and Tekin (2005) in Simmental raised in Kazova agricultural enterprise showed that there was no significant effect of calving season on CI and SP. In this study, it was determined that the calving season did not affect IPP and IBD.

In the present study, it was determined that the lactation had no effect on CI and SP but had an effect on IPP. Demirgüç (2015) found that the effect of lactation number on CI was significant, and its effect on SP was nonsignificant in Simmental grown in Gökhöyük Agricultural Enterprise.

In this study, the CI value was determined as 401.99 days, compared to 379.1 days by Çilek and Tekin (2005) and 379.1 days by Willam et al. (2002), which were 380.5 days, Demirgüç (2015) 367.37 days, Erdem et al. (2015) as 373.2 days, and lower than the values reported by Akbulut (1998) as 408.00 days, Gündoğan (2019) as 411.9 days, and Öner (2022) as 422.98 days.

The SP value (118.99 days) was reported as 93.9 days by Çilek and Tekin (2005) and 93.9 days by Erdem et al. (2015) as 92.8 days, lower than the value reported by Gündoğan (2019) as 139.8 days, close to the value reported by Akbulut (1998) as 116.00 days and Demirgüç (2015) as 116.45 days while the similar value as Akbaş and Türkmut (1990) reported as 118.86 days.

IPP is one of the important fertility traits and was found to be 1.48 in this study. Alpan et al. (1976) found IPP values for Brown, Holstein, and Simmental cattle, respectively, as 2.1, 1.9, and 2.3, while Deliömeroğlu et al. (1996) between 1.6 and 2.0, Çilek and Tekin (2005) detected between 1.76, Erdem et al. (2015) reported 1.96 units and Gündoğan (2019) reported 2.00 units.

In the present study, the FCA determined as 896.26 days was lower than those of Akbulut (1998) 908 days, Demirgüç (2015) 858 days, and higher than those of Gündoğan (2019) 764 days, and Öner (2022) 842.35 days.

The effects of the province on LL, 305-day MY, LMY, and LDP, which are milk yield traits, were statistically significant. The highest LL was determined in Denizli province, and the lowest in Burdur province. In this study, the LL value was defined as 365.80 days in Denizli province, which were similar to the values reported by Sipahi (2022) as 366.50, 366.60, and 363.80 days in Holstein raised in Burdur,

Denizli, and Isparta provinces in the Teke Region, respectively. However, Sipahi (2022) determined the effect of province on LL was insignificant. In this study, the general LL was defined as 337.71 days, which was higher than the values reported by Akbulut (1998) as 291 days, Özkan (2007) as 310.20 days, Petrovic et al. (2009) as 313.88 days, and Gündoğan (2019) as 339.20 days. It was found out that the closer value was reported by Küçük Baykan (2016) as 337.70 days, and higher value was reported by E-Islah (2018) as 359 days for Türkiye.

In this study, 305-day MY and LMY were detected higher in Denizli province and lower in Isparta province compared to the other provinces. In this study, the average 305-d MY and LMY values were lower than those reported by Küçük Baykan (2016) as 7693.44 and 8351.05 kg in Simmental in Manisa province, by Gündoğan (2019) as 7602.60 and 7888.40 kg in Simmental in Balıkesir province, while our values higher than those of Demirgüç (2015) as4181.47 and 4363.01 kg in Amasya Gökhüyük Agricultural Enterprise, and by Erdem et al. (2015) as 5700.00 and 5764.50 kg. Our current values were close to the values reported by Bolacalı and Öztürk (2018) as 6060.30 and 6413.04 kg in Simmental grown in Çorum province. In this study, the general average of LDP was determined as 44.94 days, with the highest value in Burdur province (57.41 days) and the lowest value in Isparta province (18.31 days). Additionally, the general average LDP 44.94 days were lower than the findings 73.6 days in Simmental in Gündoğan (2019), 64.89 days in Simmental in Manisa province by Küçük Baykan (2016), and 64.89 days in Simmental in Manisa province by Erdem et al. (2015) in Amasya province as 66.6 days, and as 57.67 days reported by Bolacalı and Öztürk (2018) in Simmental grown in Çorum province.

This study resulted that the effects of enterprise scale on 305-day MY and LMY were significant. 305-day MY and LMY were determined as the highest in Group III and the lowest in Group I. These findings determined that as the enterprise scale increases, the amount of milk obtained and the enterprise are more likely to benefit from the advantages of economies of scale. These findings are compatible with the results of some studies showing the relationship between farm scale and milk yield (Zepeda 1995, Zimmermann and Heckelei 2012, Sipahi 2022). It was also reported in the studies that there was a positive relationship between enterprise scale and farm size and that enterprise scale had a positive effect on farm profitability (Bravo-Ureta and Rieger 1990, Gloy et al. 2002). According to findings, as the enterprise scale grows, the success of management, organization, care, feeding management, and breeding in dairy farms and their awareness and knowledge on these issues increase (Sipahi 2022). In this study, it was determined that the effects of enterprise scale on LL and LDP were nonsignificant. However, Sipahi (2022) reported that the effect of enterprise scale on LL was significant.

This study determined that the effects of calving year on LL, LMY, and LDP were statistically significant ($P<0.05$), but it was nonsignificant ($P>0.05$). on 305-day MY. In various studies, it was reported that the effects of calving year on LL, 305-day MY, LMY, and LDP were significant (Demirgüç 2015, Bolacalı and Öztürk 2018, Gündoğan 2019, Ağrap 2022).

It was determined that the effects of the calving season on 305-day MY and LMY were statistically significant ($P<0.05$), but its effects on LL and LDP were nonsignificant ($P>0.05$). 305-day MY and LMY were the highest in winter season. Özkan and Güneş (2007) and Sipahi (2022) reported that the effects of the calving season on 305-day MY and LMY were significant ($P<0.05$) and the highest values were obtained in autumn and winter.

It was determined that the effects of lactation number on LL, 305-day MY, LMY, and LDP were nonsignificant ($P>0.05$). 305-day MY and LMY were detected the highest values in the fifth lactation.

CONCLUSION

With this study, it was concluded that the values of CI, SP, and insemination number per pregnancy in Simmental cattle raised in the Teke Region were generally better than those reported in Türkiye. According to present study, the effects of the production scale on CI and SP were statistically significant. The biggest factor in prolonging the lactation period may be due to the longer SP, which is the time from birth to pregnancy, and the period between the two calving periods.

This study revealed the significant relationship between farm scale and fertility and milk yield traits in Simmental breed cattle raised in the Teke Region, and that CI, SP, LMY, and 305-day MY increase as the farm size increases. Increasing enterprise scale, herd management, care and feeding management, etc. Increases the opportunity to provide technological innovations in subjects. For this reason, it can be recommended that dairy cattle breeders develop

and implement a comprehensive model that focuses on preventing breast, foot, and nutritional diseases and economic efficiency through studies aimed at increasing both fertility and milk yield.

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