J. Agric. Sci. Mansoura Univ., 32 (10): 8181 - 8190, 2007

EFFECT OF CALVING SEASON, PARITY AND AGE AT FIRST CALVING ON PERFORMANCE TRAITS AND PHENOTYPIC CORRELATIONS BETWEEN THESE TRAITS IN HOLSTEIN FRIESIAN COWS

Abbas, S.F.

Animal Production Dept., Faculty of Agriculture, Assiut University, Assiut 71526, Egypt, address E-mail: abbas@aun.edu.eg

ABSTRACT

The effects of calving season , parity and age at first calving on performance traits and phenotypic correlations between these traits were studied in. 587 Holstein Friesian cows Mean 305- day milk yields and calving Interval were significantly affected by calving season while this effect was non-significant on daily milk yield, lactation length and dry period. Milk traits, calving interval and dry period were significantly different. The calving interval was highest in third parity (452 days) and lowest in the first parity (404 days). The dry period was highest during 3rd lactation (161 days) and lowest in the 1st lactation (81 days). The decreasing, in milk yield with increasing parity suggesting that factors other than parity cows was contributing to the observed results. Age at first calving indicated that daily milk yield and mean 305 day milk yield were highest (P <0.01) for calving at 28 to 30 months compared with cows calving at 24 to 27 months. Whereas calving interval was highest for calving at 24 to 27 months compared with 28 to 30 month of age at first calving. Highly significant. positive phenotypic correlations of lactation length with milk yields, calving interval, 305- day yields and daily milk yield were 0.73, 0.60 0.87 and 0.23, respectively. The phenotypic correlations were found to be negative between dry period and milk yield (-0.30) daily yield (-0.36) and 305- day yields (-0.18). Results may imply that Holstein-Friesian cows in sub tropic are not producing up to their potential probably because of shortcomings in management and relatively harsh climatic conditions.

Keywords: Holstein Friesian, phenotypic correlations, Productive and reproductive performance

INTRODUCTION

Holstein Friesian is one of the best dairy cattle breed raised in the tropical and sub-tropical regions. Milk yield is the major trait of economic importance in dairy breeds. The yields of farm animals are the result of the combined effects of genotype and environmental conditions. In order to increase the yield level, it is necessary to optimize the environmental conditions and to improve the genetic structure of the animals. Environmental factors can be classified as factors with measurable effects (age, season, age at first calving, calving interval, milking frequency, etc.) and factors with unmeasurable effects (infectious diseases, parasitic infestations, etc.). A number of factors have been reported to affect milk production in the tropics. These include genetic, climatic, disease, feeding, year of calving and managerial factors (Payne and Wilson 1999; Msanga *et al* 2000 Epaphras *et al*., 2004). Animal factors such as breed, age, stage of lactation, parity and even milking frequency, have also been reported in other studies to affect

milk production (Tekerli *et al* 2000; Johnson *et al* 2002). This study was conducted to investigate the environmental factors affecting productive and reproductive traits for Holstein Friesian cows and the phenotypic correlation between these traits.

MATERIALS AND METHODS

Data: The data were collected from records of 309 Holstein Friesian cows from Ghot- Al-Sultan farm 180 kilometer Southwest El-Beda, Libya. latitude 31°32' N, and longitude 20°21' E..

Table (1): Minimum and maximum seasonal temperature (°C) and relative humidity (%).

Season	Temperature (°C)		Relative Humidity (%)	
	Max	Min	Max	Min
Winter	17.03	8.08	81.97	52.17
Summer	33.03	19.72	75.29	29.17

Feeding and managing cows: The production system in the farm was semi-open system. Cows were milked two times / day and fed concentrate according to their milk production. Hay, ray grass and barley were fed as maintenance rations. The hay was fed four time / day (2 kg / cow). Green pastures were only available during winter season. Mineral salt blocks and water were freely available for all times.

Statistical Analysis: Age at first calving was divided into three classes, being the first class was 24 to 27, second 28 to 30 and the third from 31 to 36 month. Three parities of dam were defined ; 1, 2 and 3. The calving lactation, two seasons were defined ; Winter season from October to March and Summer season from April to September.

Data were statistically analyzed using the general linear model according to SAS (1996) for the effect of age at first calving, calving season, and parity of dam as main factors.

Fixed effect model:-

$$Y = \mu + G_i + S_j + P_k + SIRE_m + E_{ijklm}$$

μ = Overall means

G_i = Effect of the i^{th} age at first calving.

S_j = Effect of the j^{th} calving season.

P_k = Effect of the l^{th} parity of dam

E_{ijk} = Experimental error.

Correlation coefficients between milk yield traits were calculated .

RESULTS AND DISCUSSION

Season of calving: Season effects on economically important traits are of interest because of their association, especially in the tropics, to direct effects of forage availability and quality, temperature and humidity on the animals. The analysis of variance (Table 2) showed that mean 305- day yields and calving Interval were significantly affected by calving season while this effect was non-significant on milk yield, daily yield, lactation length and dry period. Cows calving in the summer season (dry season) produced more 305- day yields, however, cows calving in this period had longest calving interval (Table 2). Feed supplementation may help to solve this problem. The benefits of a better feeding and management on production and reproduction of cattle have been documented (Román-Ponce, 1992; Vaccaro *et al*., 1997; Combellas, 1998, Parra-Bracamonte *et al*. 2005. This agree with and Parra-Bracamonte *et al*. (2005) in Mexico and Vaccaro (1992) who found more milk per cow in Venezuela when calving occurred in the dry season compared to the other seasons. However, Hernández-Reyes et al. (2000) and Román *et al*. (1978) did not find significant differences between seasons in Yucatan and Veracruz, Mexico, respectively. Villegas and Román (1986) observed that cows calving in the rainy season in Veracruz had the best milk performance. Seasonal differences in milk traits are expected to be influenced by feeding management practices in the regions or herds, as well by the type of tropical climate (sub humid or humid). Under Tunisian conditions. Nagarcenkar and Rao (1982); Rao *et al.* (1984) and Gandhi and Gurnani (1987) also observed non-significant effect of season of calving on milk yield. Ajili *et al.* (2007) found that Mean milk production in the summer season was low (5807 kg). Poor management may hamper the restitution of cows body reserves and consequently affect cow performances in subsequent lactations. That is, the length of the cow's productive life is reduced.

Table 2: Least- Square means and standard errors lactation milk yield , daily milk yield, lactation length, 305- day yields, calving interval and dry period as influenced by calving season.

Traits	N	Summer	Winter
Milk yield (kg)	306	5068.08 ± 106.24	4921.51 ± 100.97
Daily lactation (kg)	302	16.30 ± 0.26	15.85 ± 0.25
Lactation length	309	309.04 ± 4.33	302.70 ± 4.02
305- day yields (kg)	309	4970.13± 78.39 a	4724.92 ± 84.13 b
Calving Interval (days)	218	403.63 ± 4.97 a	418.33 ± 4.74 b
Dry period (days)	218	91.43 ± 3.58	98.93 ± 3.35

a, b Values with different superscript in the same row within item are differ significantly (P<0.01).

Effect of parity: According to parity effect milk traits, calving interval and dry period were significantly different (P > 0.01) (Table 3). In the present investigation the lactation length was longer in first parity as compared to the second and third parity. The differences in milk-yield traits in our study were partly due to a shorter lactation length for the third parity cows. The overall lactation length in the first, second and third parity is in agreement with reported those by Yadav *et al.* (1994) and Sreemannarayana and Rao (1995). Dhara *et al*. (2006) reported that in fact, the highest productions under sub tropic conditions were obtained early in the cow's career, during the first lactation(5922 kg) and total milk yield, daily milk yield and 305- day yield were declined rapidly in second and third lactation. In the present study differences between the highest and lowest in first and third parity for daily milk yield and 305- day yield were 8.45 kg and 2575.44 kg, respectively (Table 3). Such a performance is still lower than recorded in more favourable conditions for all lactations (World Holstein- Friesian Federation, 2006). Holsteins produce the maximum of milk in the fourth and fifth lactations in their countries of origin (World Holstein-Friesian Federation, 2006). Harsh conditions and food shortages in some cases may compromise performances of cows with high potentials for milk production. These decreasing, suggesting that factors other than parity cows was contributing to the observed results. However, the longest calving interval obtained for the first parity cows is similar to those found in previous studies in the tropics (Villegas and Román, 1986; Vaccaro, 1992); Parra-Bracamonte *et al.* (2005). The longer calving interval could be due to a delay in the re-start of postpartum estrus in lactating young cows and to the greater effect of the stress of lactation in younger than in older cows (Galina and Arthur (1989). Also, due to longest dry period. The longest calving interval had the lowest milk yield or milk yield per day (Table 3). Vaccaro *et al*.. 1997 suggested correction for this case when evaluating cows for selection. Dry period was significantly longer in first party (161 days) compared with second (119 days) and first parity (81 days). Part of parity effect on dry period was related to body condition of the cow at calving. Cows in good body condition at calving produce higher milk yield during the following lactation than in cows in thin body condition at calving.

Effect of age at first calving: Table (4) summarize Least- Square means and standard errors of total milk yield , daily milk yield, lactation length, 305-day yield, calving interval and dry period as influenced by age at first calving. Total milk yield, lactation length, and dry period were not affected by age at first calving. Similar observations were found by Venkayya and Anantkrishnan (1957) and Agarwal (1962) and Rakshe (2003) who reported no effect of age at first calving either on milk days or dry days in buffalo.

Age at first calving is an important economic criterion. It does allow not only for time winning and then an increased production but also affects the lifespan of cow in the herd. In the present study the estimates for age at first calving indicated that cows calving at 28 to 30 months produced more (P <0.01) milk for daily milk yield and mean 305 day lactation than cows calving calving at 24 to 27 months.

3-4

Whereas calving interval was highest for calving at 24 to 27 months (Table 4). The influence of age at first calving on total milk yield was consistent with published results (Boujenane *et al*. (2000); Boujenane (2002). These results suggested that optimal age at first calving is 28 to 30 months. 28 and 30 months of age at first calving, Heifers that calve early spend more of their life producing milk than heifers that calve later.

Advanced age at first calving dramatically increases herd costs. An extra day to first calving is estimated to cost 13 times as much as an extra open day (Cady and Smith 1996). In other hand, may be animals Calving before 24 months may be had a risky option due to problems associated with rapid growth. Since calving weight, not calving age, is the major factor affecting lactation milk yield. Perez *et al*. (1999) estimated mean of age at first calving 28.6 months in Spain. The primary advantages of reducing age at first calving include reducing rearing costs as well as reducing the amount of time in which the heifer is only a capital drain on farm resources. The primary disadvantage of reducing age at first calving is that it is frequently associated with a reduction in first lactation milk yield (Meyer *et al*. 2005).

Phenotypic correlations: Phenotypic correlations among different productive and reproductive traits are presented in Table (5). Highly significant. positive phenotypic correlations of lactation length with milk yield, 305 day lactation and daily yield were obtained (0.73, 0.60 0.87 and 0.23 respectively. Similarly phenotypic correlations of total milk yield with calving interval, 305 day lactation and daily yield were 0.22, 0.94 and 0.81, respectively, the latter were high and positive. These correlations are comparable to most of those reported in the literature (Ben Gara, (1998) and Ajili *et al*., (2007).The phenotypic correlations were found to be negative between dry period and total milk yield (-0.30) daily yield (-0.35) and 305-day yield (-0.18). Similarly negative phenotypic correlations were observed for calving interval and daily lactation (-0.27). A negative effect of early calving on milk yield was obtained in our study and may be due to insufficiently developed heifers. Nilforooshan and Edriss (2004) considered the effect of age at first calving had negative correlation between milk yield and age at first calving. Positive correlations show that yield is the most important trait for culling and cows with satisfactory yields tend to stay longer in the herd (Ben Gara, (1998); Tsuruta *et al*. (2004) Ajili *et al*. (2007).

The results of the present study are partially in agreement with the results of Khan (1985) and Nilforooshan and Edriss (2004)

Phenotypic performances of Friesian-Holstein cows for productive and reproductive traits were estimated under sub tropic conditions. Results may imply that Holstein-Friesian cows in sub tropic are not producing up to their potential probably because of shortcomings in management and relatively harsh climatic conditions.

Table 5: Phenotypic correlations among various productive and reproductive traits

Traits	Lactation length	Total milk yield	Age at first calving	Calving interval	Dry period	305- day yield	Daily yeild
Lactation length	1	0.727**	-0.031	0.600**	-0.021	0.867**	0.225**
Total milk yield		1	0.029	0.220**	-0.300**	0.942**	0.812**
Age at first calving			1	- 0.083	0.017	-0.025	0.149**
Calving interval				1	0.597**	0.459**	-0.269**
Dry period					1	-0.180**	-0.355**
305- day yield						1	0.584**

Conclusions

This study has investigated effects of calving season, parity and age at first calving on productive and reproductive traits for Holstein Friesian cows and the phenotypic correlation between these traits. The highest productions under sub tropic conditions were obtained early in the cow's career, during the first lactation and declined rapidly in second and third lactation. Such performance is still lower than recorded in more favourable conditions for all lactations. Harsh conditions and food shortages in some cases may compromise performances of cows with high potentials for milk production. The optimal age at first calving is 28 to 30 months. Phenotypic performances of Friesian-Holstein cows were estimated under sub tropic conditions. Results may imply that Holstein-Friesian cows in sub tropic are not producing up to their potential probably because of shortcomings in management and relatively harsh climatic conditions

REFERENCES

Agarwal, O.P. (1962). Certain factors of reproduction and production in water buffalo herd. Indian J. Dairy Sci. 15 : 45-51

Ajili, N. Rekik, A. Ben Gara, A. and. Bouraoui, R. (2007). Relationships among milk production, reproductive traits, and herd life for Tunisian Holstein-Friesian cows. African Journal of Agricultural Research Vol. 2 (2): 047-051

Ben Gara A (1998). Elaboration d'un index génétique pour la selection conjointe des caractéristiques productives et morphologiques chez le cheptel Frison Espagnol. Thèse de doctorat (traduction). Université de Cordoba, Département de génétique. Ecole Supérieure des Ingénieurs Agronomes et forestiers.Espagne.

Boujenane, I. (2002). Estimates of Genetic and Phenotypic Parameters for Milk Production in Moroccan Holstein-Friesian Cows Revue lev. Méd. vét. Pays trop. 55 (1) : 63-67 I

Boujenane I., Reboudi A., Diamoitou B., (2000). Effets Non Génétiques Sur La Production Laitière Des Vaches De Races Holstein Et Frisonne Au Maroc. Actes Inst. Agron. Vét. (Maroc), 20 : 31-38

Cady, R.A. and. Smith,. T.R (1996). Economics of heifer raising programs. Proc. NRAES Conference on Calves, Heifers, and Dairy Profitability: Facilities, Nutrition, and Health. Harrisburg, PA.

Combellas, J. (1998). Nivel de producción de leche y necesidad de concentrados en sistemas sustentados en pastos tropicales. Arch. Latinoam. Prod. Anim. 6 (Suppl.): 45-54

Dhara K. C. , Ray N. and Sinha, R. (2006). Factors affecting production of F_1 crossbred dairy cattle in West Bengal Livestock Research for rural Development. 18 (4).

Epaphras, A., Karimuribo, E.D., Msellem, S. N. (2004). Effect of season and parity on lactation of crossbred Ayrshire cows reared under coastal tropical climate in Tanzania. Livest. Res. Rural. Dev. 6 (16).

Hernández-Reyes, E., Segura-Correa, V.M., Segura-Correa, J.C. and Osorio-Arce, M. M. (2000). Intervalo entre partos, duración de la lactancia y producción de leche en un hato de doble propósito en Yucatán. Agrociencia 34: 699-705.

Gandhi R S and Gurnani, M (1987). Effect of non- genetic factors on first lactation traits of Sahiwal cows. Asian J. Dairy Res. 6: 64-68

Galina, C.S. and Arthur, G.G. (1989). Review of cattle reproduction in the tropics. Part. 2. Parturition and calving intervals. Anim. Breed. Abst. 57: 9-16

Johnson C R, Lalman DL Appeddu-Lisa A Brown-Michael A Wetteman RP Buchanan D. S. (2002). Effect of parity and milk production potential on forage intake of beef cows during late gestation. TEKRAN United States Department of Agriculture, Agricultural Research Service

Khan, U.N. (1985) Ph. D Thesis, University of Georgia, USA..

Meyer, M.J. Everett, R.W, and. VanAmburgh, M.E (2005). Reduced Age at First Calving: Effects on lifetime production, longevity, and profitability. Arizona and new Mexico dairy newsletter cooperative extension the university of Arizona new Mexico state university

Msanga, Y.N., Bryant, M.J., Rutam, I.B., Minja, F.N., Zylstra, L. (2000). Effect of environmental factors and of the proportion of Holstein blood on the milk yield and lactation length of crossbred dairy cattle on smallholder farms in north-east Tanzania. Trop. Anim. Health Prod. 32 (1): 23–31

.Nagarcenkar R and Rao, M K (1982). Performance of Tharparkar exotic crosses for productive and reproductive traits Indian J. Anim. Sci. 52: 129-138116

Nilforooshan M. A. and. Edriss, M. A (2004). Effect of Age at First Calving on Some Productive and Longevity Traits in Iranian Holsteins of the Isfahan Province. J. Dairy Sci. 87:2130–2135

Parra-Bracamonte, G. M. Magaña., J.G.,. Delgado, R.., Osorio-Arce M.M and. Segura-Correa J.C. (2005). Genetic and non-genetic effects on productive and reproductive traits of cows in dual-purpose herds in southeastern Mexico. Genet. Mol. Res. 4 (3): 482-490.

Payne, W J A and Wilson, T R (1999). An introduction to animal husbandry in the tropics. 5th ed. Blackwell Publishing Ltd, Iowa State University Press, U.S. pp 826

Perez, M. A., D. Hernandez, R. Alenda, M. J. Carabano, and. Charfeddine, N (1999). Genetic analysis of true profit for Spanish dairy cattle. Address: www.interbull.slu.se/bulletins/bulletin23/perez.pdf

Rao A V, Rao, G N and Kumar, M. (1984). First lactation performance of Zebu, Zebu x Zebu and Europian x Zebu cows Indian Journal of Animal Science 54: 980-982

Rakshe, P. T. (2003). Effect of age at first calving and subsequent period of breeding on the performance of buffaloes from the college of agriculture pune (ms), India. Buffalo Bulletin vol. 22(1): 7-11

Román, P.H., Cabello, F.E. and Wilcox, C.J. (1978). Producción de leche de vacas Holstein, Suizo Pardo y Jersey en clima tropical. Tec. Pecu. Mex. 34: 21-33.

Román-Ponce, H. (1992). Reproducción y manejo reproductivo de los bovinos productores de leche y carne en el trópico. In: Avances en la Producción de Leche y Carne en el Trópico Americano (Fernández-Baca, S., ed.). Santiago, Chile, pp. 131-168.

SAS, (1996). User's guide: Statistics. Version 6:12 Edition. SAS Inst. Inc. Cary, NC

Sreemannarayana O and Rao A V N (1995) Economic characteristic of Ongole and Jersey x Ongole cows in Andhra Pradesh. Indian Veterinary Journal 72: 107-110

Tekerli M, Akinci Z, Dogan I and Akcan, A. (2000). Factors affecting the shape of lactation curves of Holstein cows from the Balikesir Province of Turkey. J. Dairy Sci. 83: 1381-1386.

Tsuruta S, Misztal, I. Lawlo,r T. J. (2004). Genetic correlations among production, body size, udder, And Productive Life Traits Over Time In Holsteins. J. Dairy Sci. 87: 1457-1468.

Vaccaro, L. (1992). Evaluación y selección de bovinos de doble propósito. In: Avances en la Producción de Leche y Carne en el Trópico Americano (Fernández-Baca, S., ed.). Santiago, Chile, pp. 169-208.

Vaccaro, L., Pérez, A., Mejías, H., Khalil, R. and Vaccaro, R. (1997). Cuantificación de la interacción genotipo: ambiente en sistemas de producción con bovinos de doble propósito. In: Conceptos y Metodologías de Investigación en Fincas con Sistemas de Producción Animal de Doble Propósito (Lascano, C.E. and Holmann, F., eds.). CIAT, Colombia, pp. 67-79.

Vaccaro, L. (1998). El potencial de distintos genotipos para uso de diferentes niveles de manejo. Arch. Latinoam. Prod. Anim. 6 (Suppl.): 83-90

Venkayya, D and C.P. Anantkrishnan. (1957). Influence of age at first calving on milk yield, lactation length and calving interval, of Cows. Indian J. Dairy Sci. 9 (4) : 164-72.

Villegas, C.M. del C. and Román, P.H. (1986). Producción de leche durante el proceso de formación de un rancho de doble propósito en el trópico. Tec. Pecu. Mex. 51: 51-61.

World Holstein-Friesian Federation (2006). Online. http://www.whff.info/

Yadav A S, Rathi, S S. Arora, D. N. and Sing, B. (1994). Genetic studies on some economic traits in Tharparkar cattle. International Journal of Animal Science 9: 123-126.

تأثير موسم الولادة و ترتيب موسم الحليب والعمر عند أول ولادة على خصائص الأداء و الارتباط المظهري بين هذه الصفات في أبقار هولشتين الفرزيان .

سيف اليزل فتحى عباس
قسم الإنتاج الحيواني- كلية الزراعة-جامعة أسيوط

تأثير موسم الولادة و ترتيب مواسم الحليب والعمر عند أول ولادة على خصائص الأداء والارتباط المظهري بين هذة الصفات درست فى ٥٨٧ لأبقار الفريزيان الهولشتين. وجد إن إنتاج اللبن في (٣٠٥ يوم) والفترة بين ولادتين تأثرت معنويا بموسم الولادة بينما هذا التأثير غير معنوي على إنتاج اللبن الكلى واليومي وطول موسم الحليب و فترة الجفاف . هناك اختلافات معنوية ظهرت بين ترتيب مواسم الحليب فى كل من صفات اللبن والفترة بين ولادتين وفترة الجفاف حيث وجد أن الفترة بين ولادتين كانت أطول في الموسم الثالث (٤٥٢ يوم) وأقصر في الموسم الأول (٤٠٤ يوم) بينما فترة الجفاف كانت أطول في الموسم الثالث (١٦١ يوم) وأقصر في الموسم الأول (٨١ يوم)٠ يدل النقص فى إنتاج اللبن مع الزيادة في مواسم الحليب على إن هناك بعض العوامل الأخرى غير مواسم الحليب تساهم في إحداث هذا النقص٠ معدل الإدرار اليومي وإنتاج اللبن في (٣٠٥ يوم) كان مرتفعا في الأبقار التي تلد لأول مرة عند عمر ٢٨ ـ ٣٠ شهرا مقارنة بالأبقار التي تلد لأول مرة مبكرة عند عمر ٢٤ ـ٢٧ شهرا٠ وتدل النتائج على أن العمر الأمثل للولادة لأول مرة هو ٢٨ إلى ٣٠ شهر وكذلك كانت الفترة ما بين ولادتين أقل عند هذا العمر (٢٥-٣٠ شهر) ٠

هناك فروق عالية معنوية ايجابية في الصفات المظهرية لصفة طول موسم الحليب مع أنتاج اللبن الكلى و الفترة بين الولادتين وإنتاج اللبن في (٣٠٥ يوم) وإنتاج اللبن اليومي (٠,٧٣ ، ـ ٠,٦٠ ، ـ ـ ٠,٢٣ ٠,٨٧ على التوالي ٠ كما وجد ارتباط مظهري سالب لفترة الجفاف مع إنتاج اللبن الكلى (ـ٠,٣٠) ومع إنتاج اللبن اليومي (ـ٠,٣٦) وإنتاج اللبن في (٣٠٥يوم) (ـ٠,١٨). من نتائج هذه الدراسة يتضح أن تربية أبقار الفريزيان تحت الظروف المصرية من رعاية ومناخ يؤثر سلباً علي إنتاجية هذه الأبقار من الحليب وكذلك علي بعض الصفات التناسلية محل هذه الدراسة.٠

Table 3: Least- Square means and standard errors of total milk yield , daily milk yield, lactation length, 305-day yield, calving interval and dry period as influenced by parity of dam.

Traits	N	Parity 1	Parity 2	Parity 3
Total milk yield (kg)	292	5921.52 ± 81.05a	4273.48 ± 84.77b	2151.56 ± 113.43c
Daily yeild (kg)	292	18.19 ± 0.19 a	14.26 ± 0.24 b	9.74 ± 0.30 c
Length of lactation	296	323.47 ± 4.02a	296.75 ± 3.74b	220.69 ± 10.03c
305- day yield (kg)	296	5474.39 ± 68.30a	4327.27 ± 5.15b	2898.95 c ± 113.25
calving Interval (days)	258	403.78 ± 4.32b	421.91 ± 6.05ab	452.00 ± 7.44b
Dry period (day)	254	80.96 ± 2.47 c	119.02 ± 4.22b	160.77 ± 22.21a

a, b, c Values with different superscript in the same row within item are differ significantly (P<0.01).

Table 4: Least- Square means and standard errors of total milk yield , daily milk yield, lactation length, 305-day yields, calving interval and dry period as influenced by age at first calving

Traits	N	Age at first calving from 24 to 27 month	Age at first calving from 28 to 30 month	Age at first calving from 31 to 36 month
Total milk yield (kg)	256	4888.66 ± 161.48	4990.70 ± 103.11	5120.50 ± 140.20
Daily yield (kg)	254	15.39 ± 0.34 b	16.21 ± 0.26 a	16.49 ± 0.35 a
305- day yield (kg)	257	4547.03 ± 124.75 b	4886.34 ± 85.86 a	5028.40 ± 105.33 a
Lactation length (day)	257	306.91 ± 7.50	303.78 ± 3.81	307.72 ± 5.52
Calving interval (day)	196	430.18 ± 7.53 a	405.64 ± 4.89 b	408.13 ± 6.40 b
Dry period (day)	191	99.03 ± 5.29	91.65 ± 3.51	97.21 ± 4.35

a, b, Values with different superscript in the same row within item are differ significantly (P<0.01).