

Study of 305- Day Milk Yield, for First Three Lactations, of Jersey Cows Under Conditions of Small Scale Family Farms

I. Effects of Calving Age and Season on Total Variance of Milk Yield.

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Data of 935 first lactations, 607 second lactations and 432 third lactations obtained by 1476 Jersey cows that are managed in small scale family farms, under conditions of low input production system were analyzed in order to study effects of factors: age and month of calving on variance of 305-day milk yield. Analyze of variance carried out according to a GML with fixed factors showed statistical effects of these factors – age on calving (CA): first lactation ($P<0.05$), second lactation ($P<0.05$), month of calving (CS): first lactation ($P<0.001$), second lactation ($P<0.01$), third lactation ($P<0.05$) and herd (H): first, second and third lactations ($P<0.001$).

Average growth of 305-day milk yield, in second lactation was 198 kg more than first lactation, and 271 kg more in third lactation compared to second lactation. To make possible the comparison of milk yield obtained by cows in different physiological conditions, it is necessary that 305-day milk yield be adjusted in order to reduce effects of calving age and month.

Keywords: Milk production, Jersey cattle, small scale farms, age and month of calving

Küçük Ölçekli İşletme Koşulları Altındaki Jersey İneklerinde İlk Üç Laktasyonda Üçyüzbeş Günlük Süt Verimi Üzerine Araştırmalar

Düşük gelirli üretim sistemi koşulları altındaki küçük ölçekli aile işletmelerinde yetiştirilen 1476 Jersey ineğinden elde edilen 935 birinci 607 ikinci 432 üçüncü laktasyon kaydı yaş, buzağılama ayı faktörlerinin 305 günlük laktasyon verimi değişkenliğindeki etkilerini incelemek üzere analiz edilmiştir. Sabit faktörlü GML modeli ile yürütülen varyans analizi sonucunda bu faktörlerden buzağılama yaşının (CA), ilk ($P<0.05$), ikinci laktasyon üzerine ($P<0.05$); buzağılama ayının ilk laktasyon ($P<0.001$), ikinci laktasyon ($P<0.01$), üçüncü laktasyon ($P<0.05$) üzerine ve Sürü faktörünün (H): ilk ikinci üçüncü laktasyon üzerine etkili olduğu ($P<0.001$) anlaşılmıştır. Üçyüzbeş günlük süt verim miktarındaki ortalama büyüme ikinci laktasyonda birinci laktasyondan 198 kg daha fazla üçüncü laktasyonda ise ikinci laktasyona göre 271 kg daha fazladır. Farklı fizyolojik koşullardaki ineklerden elde edilen süt verim miktarlarını karşılaştırmayı mümkün kılmak bakımından 305 günlük süt verimlerinin buzağılama yaş ve ayının etkilerini azaltmak için düzeltilmesi gerekir.

Key words: süt üretimi, Jersey sığırları, küçük ölçekli işletme, buzağılama, yaş ve ayı

Introduction

Under conditions of small scale farms, selection of cows may be carried out according to different scenarios. Farmer is interested to obtain so many calves from a cow in order to produce meat and too much milk to meet family needs for dairy products. Meantime, as cow is one of the most important investments in small scale family farms, it is advisable that decision for productive longevity is taken in according to its productive

capacity. For that, it is necessary that farmer to write down notes for milk and reproduction performance and supported on these data to take appropriate decision.

Under conditions of small scale family farms, where the possibilities for setting up and functioning Milk Recording System is very limited, it is advisable that milk recording be organized and accomplished as a responsibility of

farmer, by himself. Experience obtained in the framework of project "Support for Breeding Program Development of Jersey cattle that are managed in family farms in Shkodra and Malsia E Madhe Region, fulfilled in collaboration with Turkish Agency for Support and Development (TIKA) showed that a such solution is adequate and also provides good results, under conditions of small scale family farms in Albania. A Data Base was established as a output of this Milk Recording System for Jersey cattle, where the data for first three lactations of cows managed in 783 family farms were included in. By this database is possible to set up scenarios for cow selection, which could also give good results, where additive genetic variances are difficult to be estimated. On the other hand, by statistical processing of these data is possible to judge and give recommendations for improvements that have to be made for cow management from farmer.

For this purpose, all data of milk records for first three lactations were firstly adjusted to 305-day lactation and afterwards, these data were analyzed according to GML in order to estimate effects of calving age and month on total variance of milk production. This analysis was carried out for data of first three lactations. Results of this statistical analysis will serve as basis for the study of adjustment method of milk production in order to reduce effects of these factors on total variance of milk yield for first three lactations

Material and Method

Date for 305- day milk yield of 935 first lactations, 607 second lactations and 432 third lactations obtained by 1476 cows that have been managed in 783 family farms were analyzed according to fixed linear regression model (GML) as follows :

$$Y_{ijkl} = \mu + a_i + b_j + h_k + e_{ijkl} \quad (1)$$

where :

Y_{ijkl} – milk production of cow "I" grouped at the level " k" of factor "herd", that has calved in month "j" and age of calving "i"
 μ - mean of population

a_i – effect of calving age

First lactation: 6 classes, 21-26 months

Second lactation: 11 classes, 31-41 months

Third lactation: 16 classes, 44-59 months

b_j – effect of calving month

h_k – effect of herd

e_{ijkl} – residuals $N(0, \sigma_e^2)$

Factor "herd" means the whole actions and interactions of factors related to production system, which is applied in farm, such as: housing, level of knowledge and techniques of animal management, which are applied by farmers, etc.

All of small scale farms were grouped in four groups. For this purpose, level of milk yield adjusted to 305-day lactation obtained by first lactation cows was used as criterion

Results and discussion

The structure of data for each lactation according to factors "calving age and month" are given in Table 1 and Table 2.

As seen, age of cows at first calving has small variation. About 80 % of cows have calved at the age of 22-25 months. The lowest age of calving is 21 months, whereas the highest one is 26 months. This is a situation that highly changes from those referred by foreign and domestic authors. For our opinion, this situation is related to the fact that cow population analyzed are composed of cows managed under conditions of small scale family farms, where action of farmer for entering in riproduction of heifer is of great effect. This action is notably shown in the variations of ages of first and second calving. So, as shown in Table.1, second calving are more frequent at the interval of ages 33-36 months (about 50 % of calving) and third calving are more frequent at the interval of 46-50 months (about 58 %). Meantime, as shown, there are no cases that cows at the same age of calving have different number of calving. *Leroy, P et al 1978, 1979, 1980; Miller, P.D. 1970; Kume, K etc 1988, 1989, 1991, Dervishi, V. 1991* paid special attention study of overlapping number of calving and age on calving

Table.1 The structure of data according to different levels of factor “ calving age”

First Lactation		Second Lactation		Third lactation	
age	heads	age	heads	age	heads
21	67	31	27	44	21
22	104	32	29	45	30
23	179	33	81	46	33
24	245	34	105	47	74
25	229	35	115	48	62
26	111	36	92	49	45
		37	36	50	38
		38	45	51	22
		39	33	52	18
		40	26	53	16
		41	18	54	12
				55	10
				56	11
				57	16
				58	15
				59	9

Table. 2 The structure of data according to different levels of factor “month of calving”

Months	First Lactation		Laktacioni II-te		Laktacioni III-te	
	heads	%	heads	%	heads	%
January	95	10,1	35	5,7	31	7,2
February	102	10,9	89	14,6	58	13,4
March	127	13,6	123	20,2	71	16,4
April	132	14,1	102	16,8	65	15,0
May	105	11,2	78	12,8	40	9,2
June	48	5,1	52	8,5	25	5,8
July	22	2,3	31	5,1	31	7,2
August	27	2,9	20	3,3	22	5,1
September	43	4,6	22	3,6	18	4,1
October	58	6,2	16	2,6	27	6,2
November	94	10,0	23	3,8	15	3,5
December	82	8,8	16	2,6	29	6,7

As explained in literature, this situation is as a consequence of fact that calving intervals are very long, beyond limits of obtaining a calving in year. Meantime, as it is a consequence of influence of non genetic factors, which are mainly related to cow management, different authors recommend that this overlapping be treated as part of studying the effect of non genetic factors in the total variance of milk production. Study of this situation and explanation of its dynamics at a certain population is considered as one of main methodological requests that have to be respected

for taking decision in relation to the way of adjusting milk production in order to reduce the effect of calving age.

Interest of farmer, who manages 1-2 cows at his farm, is to obtain a calf for every year. It is one of his main economic objectives to which, the farmer pays special attention. We think, that is main reason that ages of calving are closely related to number of calving in Jersey cow population analyzed. Intervals of these ages are distinguishable to each calving, creating at the same time discontinuation from one calving to the

other. So, first calvings are performed until at the age of 26 months, second calvings begin at the age of 31 months; meanwhile, maximum age of second calvings is 41 months; and third calvings begin at the age of 44 months. It must be stressed that there were data for cows that had calved for the first time at the age of less than 21 months and higher than 26 months. In addition, there were cows that the second calving were performed at the age less than 31 months or over 41 months, but their number was negligible (only 20 heads), which could not be considered as representative cases to be taken into account in order to be studied.

Regarding season (month) on calving, there is clearly a trend for grouping calving during months that favor the highest vegetation of forages in order to utilize the highest physiological potential for milk production of cows. So, 50 % of first calvings, 64.6% of second calvings and 54 % of

third calvings were performed during the period February – May. It should be underline the fact that this situation is not met in literature, in general. In addition, literature deals with questions, which condition and aims to solve problem of more uniform distribution of calvings during the year. According to our judgement, this situation is as a consequence of very limited inputs that are used in small scale family farms. Farmer, in order to reduce negative effects of lack of inputs, has chosen the way of grouping calvings in function of utilizing plentiful forages during the months March-July.

Average 305- day milk yield increased in according to the increase of number of lactation, from first to second lactation by about 198 kg milk and from second to third lactation by about 271 kg milk. Coefficients of variation of milk production for first three lactations are given in Table 3

Table. 3. Average 305 day milk yield

Items	Lactation I	Lactation II	Lactation III
$\bar{x} \pm s$	3017 \pm 751,2	3215 \pm 602,3	3486 \pm 636,3
Cv(%)	24,9	18,7	18,2

In first lactation, coefficient of variation has higher value, meantime its values for second and third lactation are almost equal. This situation is different from that given by Kume, K. 1989 and Leroy, P. 1980. High variation of milk production in first lactation, in this case, can be explained by non uniform response of cows towards conditions of extensive production system, which has brought about the increase of non typical curve percentage in this lactation (Kume,K. Tahiri, F. 2003). Meantime, as animal is grown, possibilities of sustaining these conditions increased. It causes the reduction of variance for cows, which are at the same lactation.

Analyze of variance carried out according to GML (1) for first three lactations is given in Table 4.

As shown, factors analyzed, show statistically significant effects in the variance of 305- day milk yield in first and second lactations, meanwhile that effects of factor “age of calving“ are not

statistically proved for third lactation. A careful judgment of these the proved effects and their comparison to those given in literature (Dervishi, V. 1991, Kume.K. 1989, Leroy, P.1980) show the fact that, under conditions of small private farms, where extensive production system is applied, the dynamics of Jersey cow response towards poor conditions of management is characterized by the same rules. Influence of non genetic factors in the variance of milk production is reduced while animal become adult. In addition, trends of these dynamics are changed in function on production system. Comparing these trends estimated in the herd that is analyzed, to those referred by different authors (Dervishi, V. 1991, Kume.K. 1989, Leroy, P.1980), we remark that in the case of Jersey cows, that are managed in small scale family farms, the trend of reduction of effects of non genetic factors „age on calving“ and „month of calving“ from one lactation (I) to the others (II and III) is lower.

Table 4 Analyze of variance: Model (1)

Source of variance	Lactation I		Lactation II		Lactation III	
	d.f.	F	d.f.	F	d.f.	F
Age of calving	5	2,12*	10	1,98*	15	0,72
Month of calving	11	4,08***	11	3,01**	11	2,21*
Herd	3	5,21***	3	4,11**	3	3,74***
Residuals	917	Variance 21270	584	Variance 23469	404	Variance 21052

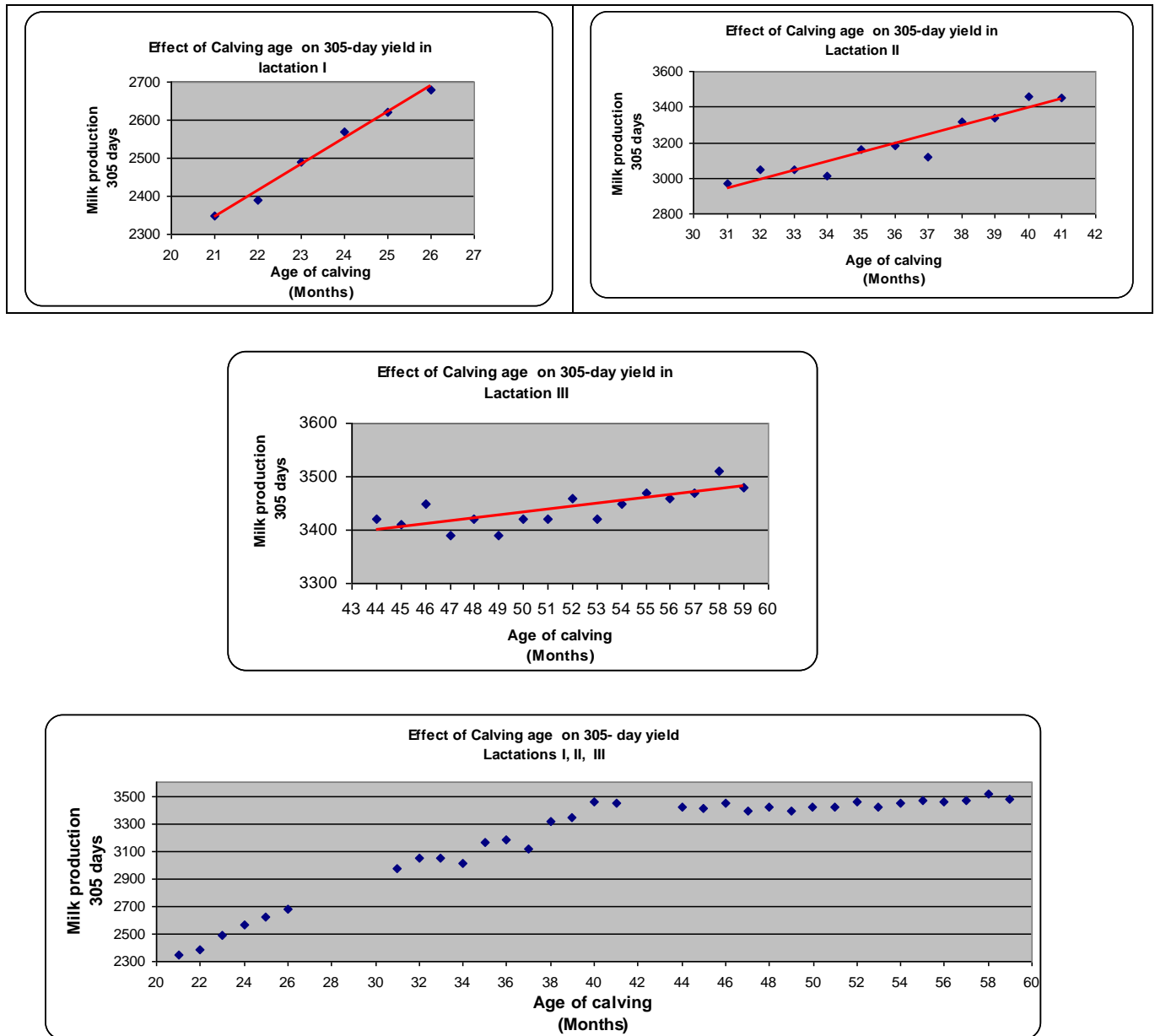


Figure 1. Graphic view of effect “age of calving” on 305-day milk yield

Linear Regression Model used for studying and estimating effects of non genetic factors in total variance of 305-day milk yield for first, second and third lactations, explains 22.7 %, 23.3 % and 20.7 % of this variance respectively.

Using „least squares means“ estimated by GML (1) graphs can be constructed that show the rules according to which effects of calving age and month on 305-day milk yield for first three lactations are carried out.

As seen, the higher age of calving is the higher milk production is for 305-day lactation. In the first lactation, the increase of milk production is, on the average, 69.1 kg milk for every higher month of calving age, in second lactation the increase of milk production is on the average, 42.3 kg milk for every higher month of calving age; the meantime, for third lactation the increase of milk yield is only about 6.2 kg milk per one higher month of calving age.

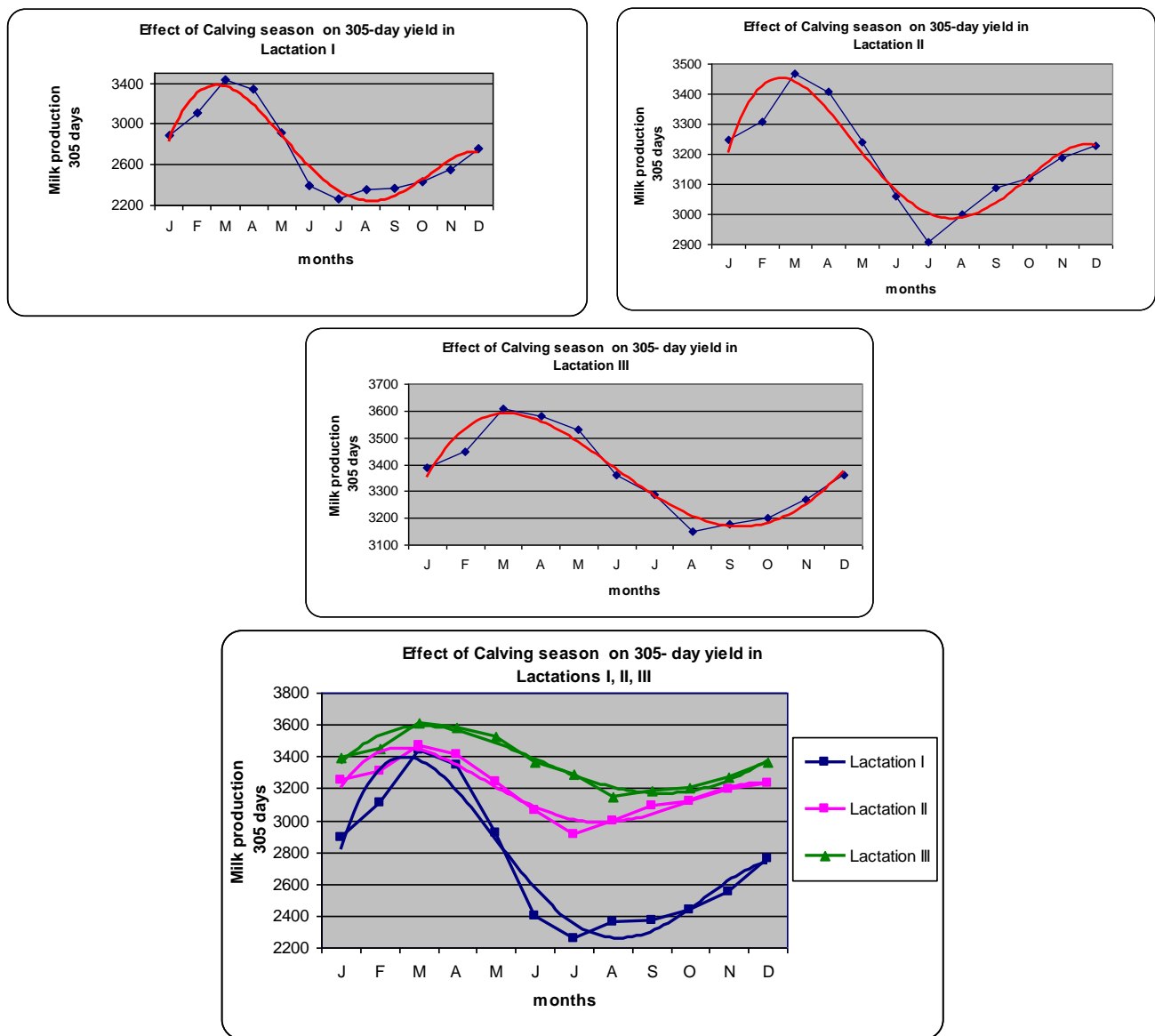


Figure 2. Graphic view of effect ‘month of calving’ on 305-day milk yield

This situation is different from those referred by other authors. So, Kume K. 1989 for Black and White cattle managed in State Farms in Albania, showed an increase out of about 13.8 to 14.2 kg milk for every higher month of cows' ages at first and second calving, while for the third lactation the results are almost the same. As expected, effect 'herd' is statistically significant shown ($P < 0.001$). Meanwhile, as factor 'herd' was constructed as a result of a priori grouping of small scale family

Conclusion

Age and month of calving are two non genetic factors that affect the total variance of 305-day milk yield for first three lactations. Effect of month of calving is higher. Under conditions of extensive production system, characteristic for small scale family farms, this effect, in some cases, may also cause abnormality of consecutiveness of

farms supported on the hypothesis that average level of milk production in first lactation could also serve as the reflection of input level used by farm, - in general meaning- this is a virtual factor, its effect should be only recognized and considered as source and possibility for the most accurate explanation of rules according to which, factors 'age of calving and 'month of calving' have shown their effects in total variance of milk production

physiological processes related with the milk production.

To make possible the most accurate comparison of cows in relation to their genetic capacities, it is necessary to adjust 305-day milk yield in order to reduce constant effects of these factors.

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