

The Effect of Drying Length on Cow Production and Lactation Persistence

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Abstract: Effects of drying length on production level and lactation persistence were sought on the Simmental cows in Jagodina. During studies, all the cows were at the stage of second lactation and raised in equal conditions of diet and keeping. The cows were split up into two groups, according to drying length. The groups had 30 cows each. The first group included cows with normal drying length of 61.93 days, and the second those with a short one of 19.5 days.

The cows of the first group produced 5641 kg milk and 217.5 kg milk fat for 305 days of lactation, whereas those of the second group produced 4446 kg milk and 192.25 kg milk fat for the same period of drying. The differences were tested by t-test, showing the differences of 1194.5 kg in milk production and 41.4 kg in lactic acid per lactation thus being highly statistically significant ($P < 0.001$).

The data helped graphic outline of lactation curvatures in both cow groups studied, with the first having normal lactation persistence, and the second indicating unsatisfactory course of lactation.

Key words: drying length, persistence, lactation, cow

Introduction

Normal milk production in lactations is often disturbed not achieving the expected production level as presumed by genetic potential of production head.

In fact, a range of factors are thought to affect production process: diet, care, keeping, health, inheritance and entire technological process applied. Various factors cause variations in production and lactation persistence.

One of the most significant segments of the technological process in cow's milk production is considered an optimal care taken during drying off

period. This period is particularly important since, just at that time, the most intensive intrauterine calf growth takes place when the optimal keeping condition should be provided for. Many authors think that in the last two months of gravidity fetus develops most intensively so that at the end of gravidity, in Simmental cows, it may weigh 40kg, which is 70% of entire body weight.

Drying off of the cows normally lasts 60 days. This period of time must be upheld so as to enable mothers to prepare well for normal giving birth to calves as well as to provide all the preconditions necessary for milk production in the next lactation.

Modern technology of cattle raising and utilising is increasingly based upon scientific knowledge in zootechnique, selection and rational technological-technical solutions in terms of keeping, housing, diet and care. Thus, conditions for positive interaction of production potentials of the highly production head and production factors may be provided for together with those created by man. Not only does high milk production but also cow's health, fertility, housing, diet and care matter in achieving highly economical cattle production. In this sense, one of the most important segments is considered to be cow's drying off period to which due attention was paid in this study. Technological process is to start since that period within which cow's organism passes through the most complex physiological processes, hence, cows should be treated with carefully chosen diet and with utmost care.

In addition to effects of the environmental factors on the level of milk production and milk fat, drying off (Gutic, 1978) period also directly affects lactation length, particularly the occurrence of short lactations and premature drying off due to improperly prepared cows and a shortened drying off period.

Materials and Method

Studies were conducted on the ITG farm, Jagodina, on which highly productive Simmental cows originating from Germany are raised. All the cows were in II lactation. The cows with normal length of drying and those with a short one were picked out and divided into two groups with 30 cows each.

All the cows were raised under equal conditions of housing and diet according to technology commonly applying to the farm. I group with 30 cows were subjected to testing of drying length, lactation length and milk and milk fat production. Data on milk and milk fat production were calculated for 305 days of lactation.

The same data were sought in II group of cows, with a short drying off period. All the data for both groups of cows were statistically processed, mutually tested by t-test for significance of differences in production traits. In addition, lactation frequencies (absolute, cumulative, relative and relative-cumulative) were processed with graphically outlined lactation homogeneity for both groups.

Lactation curvature was given for both cow groups, for the whole lactation period of 305 days, for the first, second and third 100 days on the basis of which lactation persistence indices were computed.

Results and Discussion

All the cows were raised under equal conditions of housing, diet and care in order to eliminate effects of the environmental factors. Special care was paid to the cows at the time of preparation for calving, during calving and immediately after calving when the cows were still in the stable.

Diet was organised in such a way that in the first month of lactation all the cows had desired meal, on the basis of daily production, as if they had produced 30 l milk. The meal contained good quality roughages and was well balanced both with respect to nutritional matter and minerals to improve even by two nutritional classes in the next two months, whereupon it was given controlling milk and milk fat production, but was also improved by one nutritional class (by nutritional class is meant two litres of milk per daily meal).

During drying, diet was designed at the level of 12 l of daily milk production, including some roughages and rigorous control of udder state. Mechanical milking, three times in the first months of lactation, and twice in the later period, was arranged.

Milk production and milk fat were controlled once a month, and the analyses were made in the existing laboratory.

During investigations, the cows of both groups were subjected to continual expert and veterinary control with utmost care taken. All the cows from the first group had normal calvings, without any adverse effects on the production itself, whereas three cows from the second group had placenta retainment, and two milder form of paresis post partum.

Tab.1. Variability and Drying off Duration (days)

Group	n	$\bar{x} \pm S \bar{x}$	SD	CV(%)	Variations	
					min	max
I	30	61.93 $\pm$ 0.366	2.01	3.24	57	67
II	30	19.50 $\pm$ 0.530	2.90	4.715	16	26

From tab.1., one can see that the average drying length in the first cow group amounted to $\bar{x}$ = 61.93 days, which is, taken physiologically and productionally normal. Many authors think that such duration is enough to properly prepare cows for normal calving and for the next lactation, too.

In the second group of the cows, the average length of drying was $\bar{x}$ = 19.50 days, with variability of 4.71% and variation interval of 16-26 days. Drying period was extremely short with all production results, stemming from individual abilities of cows to resist negative effects of various factors, being the consequence of a short drying period and by no means of the cow's genetic potential.

The mean lactation length of I group amounted to $\bar{x}$ = 316 days, standard error of arithmetic median $S \bar{x}$ = 1.69, standard deviation 9.31, variation coefficient 2.94% and variation 280-330 days. Lactation length was satisfactory in this group allowing for the highly productive cows, with an average milk production of 23 l recorded in the first month.

Tab.2. Variability and Whole Lactations Duration (days)

Group	n	$\bar{x} \pm S \bar{x}$	SD	CV(%)	Variations	
					min	max
I	30	316 ± 1.69	9.311	2.94	280	330
II	30	352 ± 2.56	14.06	3.99	331	385

In the second group of cows, lactation length averaged $\bar{x}=352$ days, ranging from 330-385 days, which is too long to suit production with no satisfactory yearly fertility possible.

In their studies, *Arapovic et. al.*, (1976) recorded significant differences between lactation length and drying period, being at the level of 5% ($P<0.05$).

Production of milk and milk fat in both cow groups is presented in tab.3 and 4.

Tab.3. Variability and Milk Production in Standard Lactations (kg)

Group	n	$\bar{x} \pm S \bar{x}$	SD	CV(%)	Variations	
					min	max
I	30	5641 ± 100.9	552.8	9.80	5033	7096
II	30	4446 ± 56.28	308.4	6.88	3908	4996

In the first group of cows, the average milk production of 305 days was found to amount to $\bar{x}=5641$ kg milk, with low variability of 9.8% and variations ranging from 5033 to 7096 kg.

In the second group of cows, with short periods of drying, milk production was considerably lower, amounting to $\bar{x}=4446$ kg, with standard deviation of median $S \bar{x}=56.28$, standard deviation 308.4 kg, variation coefficient 6.88% and variations from 3908 to 4996 kg.

For comparison, milk production in I cow group was higher by 1195 kg than that achieved in II group. Based upon t-test, this difference is considered to be highly significant ($P<0.001$).

In addition to milk production, milk fat production for 305 days of lactation was also statistically processed in both groups of cows.

Tab.4. Variability and Lactic Acid Production in Standard Lactations (kg)

Group	n	$\bar{x} \pm S \bar{x}$	SD	CV(%)	Variations	
					min	max
I	30	217.5 ± 5.21	28.57	13.13	176.1	274.5
II	30	176.1 ± 2.78	15.25	8.66	152.4	204.8

In I cow group, milk fat production averaged $\bar{x}=217.5$ kg with variations coefficient $CV(\%)=13.13\%$ and variations from 176.1 to 274.5kg.

In II group, milk fat production in standard lactation of 305 days averaged $\bar{x}=176.14$ kg, with much lower variability of 8.66% and variation from 152.4 to 204.8 kg milk fat.

The difference in lactic acid production between I and II cow group amounted to 4.4 kg in favour of I group, being highly high significant ($P < 0.001$).

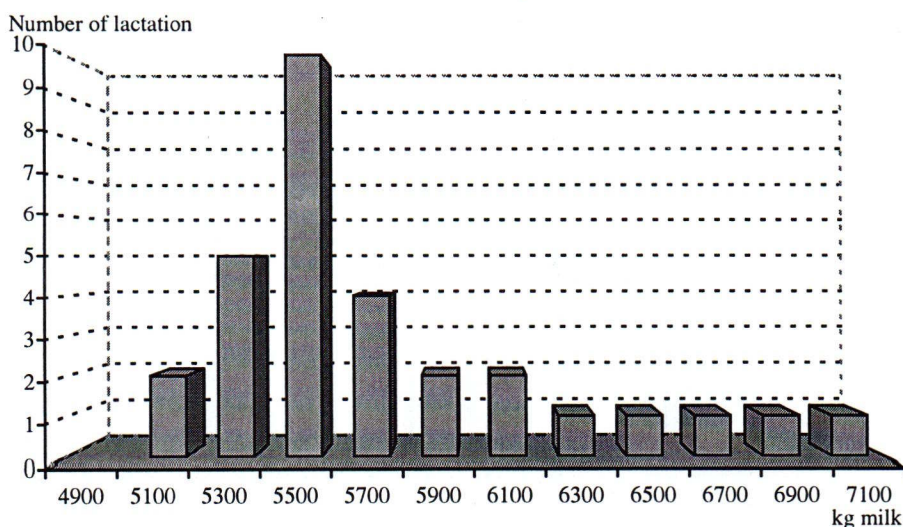
Gutic (1996) pointed out that Simmental cows, imported from Germany to ITG Jagodina farm, had under suitable ambient conditions and with good diet, achieved average milk production of 5140 kg milk (I 5040kg and II 5243 kg), 200.72 kg milk fat (I 199 kg and II 214kg) with milk fat content of 3.90% (I 3.96% and II 4.08%). Studies embraced 155 cows.

Milk production frequency per single standard lactations in I cow group, is given in Tab.5 and Fig.1.

Tab.5. Milk Production Frequency per Single Standard Lactations in I cow group

Limiting class	Mean value	F r e q u e n c y			
		absolute	cumulative	relative %	relative-cumulat.
4800-5000	4900	-	-	-	-
5001-5200	5100	2	2	6.666	6.666
5201-5400	5300	5	7	16.667	23.333
4401-5600	5500	10	17	33.333	56.666
5601-5800	5700	4	21	13.333	70.000
5801-6000	5900	2	13	6.667	76.667
6001-6200	6100	2	2.5	6.667	83.334
6201-6400	6300	1	2.6	3.333	86.667
6401-6600	6500	1	27	3.333	90.000
6601-6800	6700	1	28	3.333	93.333
6801-7000	6900	1	29	3.333	96.666
7001-7200	7100	1	30	3.333	100.00
	$\bar{x} = 5641$	$n = 30$		100.00	

Fig.1. Graphic Outline of Absolute Frequency of Standard Lactations in I Cow Group



From tab.5., one can see the absolute, cumulative, relative and relative-cumulative frequency of the mean values of lactations for 305 days of the first cow group. The highest number of lactations, 10 or 33.3% is within limiting class from 4401 to 6000 kg milk, which is slightly higher than the mean value of all the lactations of this group of cows. The majority of lactations is concentrated around the mean value (19 or 52%) and are distributed in three limiting classes from both, left and right hand side of the mean value.

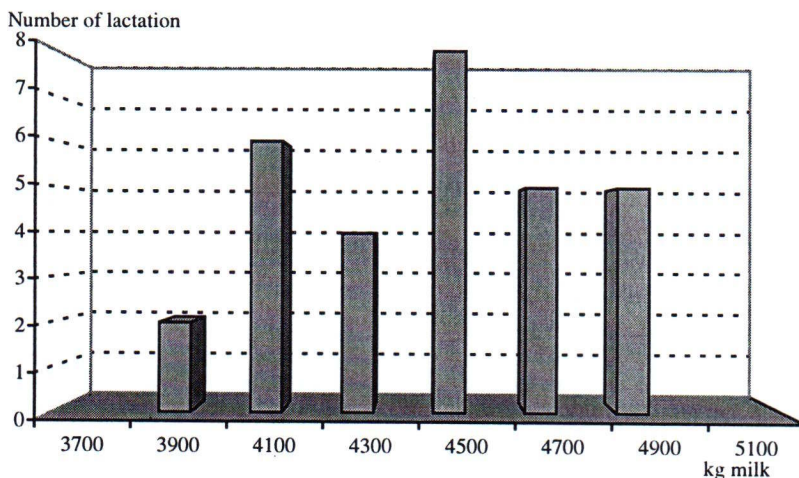
Such an arrangement of the lactations is graphically outlined (graph.1) where the line designating the distribution of lactations levels is narrow and high, nearly symmetric, thereby indicating that so distributed lactations are the result of a well-balanced production group.

Frequency of milk production per single standard lactations in II cow group, is given in Tab.6 and Fig. 2.

Tab.6. Frequency of Milk Production per Single Lactations in II Cow Group

Limiting class	Mean value	F r e q u e n c y			
		absolute	cumulative	relative %	relative-cumulat.
3601-3800	3700	-	-	-	-
3801-4000	3900	2	2	6.666	6.666
4001-4200	4100	6	8	20.000	26.666
4201-4400	4300	4	12	13.333	39.999
4401-4600	4500	8	20	26.666	66.665
4601-4800	4700	5	25	16.666	83.334
4801-5000	4900	5	30	16.666	100.00
5001-5200	5100	-	-	-	-
$\bar{x}=4446.5$		n = 30		100.00	

Fig.2. An Outline of Absolute Milk Production of Standard Lactations in II cow group



Lactations in this group are distributed in six limiting classes in the ranges of 200 kg milk. The arrangement of lactations in this group is asymmetric so that it is obvious that this group of cows has not achieved a complete production.

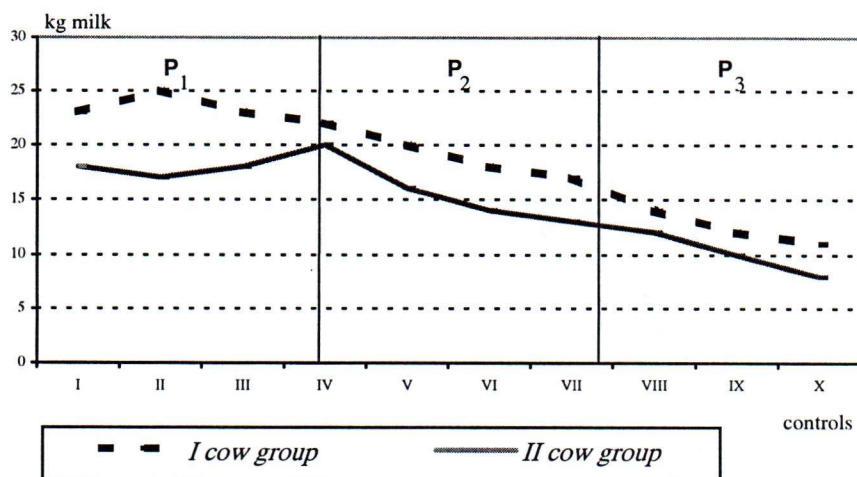
Most of the lactations, i.e. 8 or 26.66% belongs to the limiting class ranging from 4401 to 4600 kg milk.

From Fig.2., one can see the absolute frequency of the mean lactation values for 305 days pertaining to II cow group.

From Fig.2., one can see that production level is stretched and relatively low and asymmetric.

In addition, lactation curvature and its persistence have also been processed the results of which are graphically outlined in Fig.3.

Fig.3. The Course and Persistence of the Lactation Curvature in I and II cow group



The course and persistence of lactation curvature in I cow group are normal. The average initial milk production amounted to 23kg, with a maximum of 25kg milk attained in the second month of lactation whereupon it mildly declined to complete at the level of 11 l milk in the following ten months. Lactation had normal parameters in its persistence. Thus, the first, second and third 100 days accounted for 2350, 1970 and 1400 l milk, respectively. Persistence indices amounted to $P_{1:2} = 83.8\%$, $P_{2:3} = 71.06\%$ and $P_{1:3} = 59.5\%$.

Second group of the cows initially (during the first month of lactation) produced 18 kg milk, to have reached maximum of 20 kg milk not until the fourth month of lactation which completed at the level of 8 kg milk per day.

Persistence of lactation in this group of cows had a quite different character. Thus, the milk produced by these cows in the first, second and third 100 days accounted for 1790, 1630 and 1130 kg, respectively. Persistence index is $P_1=2:1=91.06\%$, $P_2=3:2=69.5\%$ and $P_3=3:1=63.1\%$.

The difference in milk produced in I and II cow group amounted to 1194.5kg milk and 41.5kg milk fat over the lactation of 305 days.

Lactation course in Simmental cows was presented by Cur et.al., (1970). They examined 60 cows which, by calving each month, helped avoid seasonal effects on the course of lactation. The total milk production over ten-month lactation was found to be 4703kg, of which that achieved over the first six months accounted for 67.5%.

When studying the effect of the environmental factors on the milk production, Fercej (1971) processed lactations in 166 first-calving brown cows. Their milk production was controlled in the first, second and third 100 days, and environmental factors effect on the milkiness during lactation, presented. The author considered lactation persistence to be efficient if indices amounted to $P_{2:1}=80\%$ and $P_{3:1}=60\%$, meaning that milk production during the second and third lactation shared 80% and 60%, respectively, compared to that recorded in the first 100 days of lactation.

Lactation in cows and its persistence were also processed by Milošić Miroslava and Gajić, I., 1974, with average daily milk production studied from I to VII lactation, coupled with coefficients of lactation repetitiveness in spotted cows. Thus, the daily milk production was reported to be the lowest in I lactation ($7.78 \pm 0.24\text{kg}$) and the highest in VII (11.17 ± 0.24). The differences in the milk production between lactations were significant to the nearer successive lactations, but insignificant to the further ones.

The effect of course and shape of lactation on the Croatian Simmental cow's fertility was examined by Baloković and Šić (1986), who cited that drying off lasted a bit longer in the cows with normally-shaped lactation curvature (78.10 days) than that in those with abnormally-shaped one (74.62 days).

When studying the effect of lactation persistence on the milk production, Gutić et al., (1997), emphasized that the average milk production studied in 36 Simmental cows in the first, second and third 100 days of lactation, amounted to 2243kg, 1470kg and 1110kg milk, respectively. Persistence indices were found to be $P_{1:2}=65.5\%$, $P_{2:3}=75.5\%$ and $P_{1:3}=49.5\%$, respectively. The differences in milk production per three-month periods were found to be highly significant ($P<0.01$).

Conclusion

Based upon the descriptive statistical analysis of production parameters in the two groups of Simmental cows, formed according to differing drying off length, raised on the ITG farm in Jagodina, the following may be concluded:

- The length of drying amounted to 61.93 days in I cow group, with variations from 57 to 67 days, and 19.50 days in II cow group, with variations from 16 to 26 days;

- The duration of full lactations was reported to be 316 days, with the low variation of only 2.94% in I cow group, and 352 days in II cow group, with variation interval from 331 to 385 days;

- Milk production in standard lactations in both cow groups amounted to 5641kg, with variability of 9.80%, and to 4446kg with variations from 3908 to 4996 kg found in II cow group. The difference in milk production in both cow groups was found to be statistically highly significant ($P<0.001$);

- milk fat produced in standard lactations amounted to 217.5kg in both cow groups, with variation from 176.1 to 274.5kg and 176.1kg and that of 15.25% recorded in the second group. The difference in milk fat production achieved the two groups was found to be statistically high significant ($P<0.001$);

- Based upon milk production level frequency, I cow group was found to be concentrated around the mean value with narrow and symmetric distribution of the frequencies, whereas in II cow group, milk lactation production distribution scatter was much higher, and

- First cow group had normal lactation curvature with persistence indices $P1:2=83.8\%$, $P2:3=71.06\%$ and $P1:3=59.5\%$, respectively. Persistence indices in II cow group were $P1:2=91.06\%$, $P2:3=69.5\%$ and $P1:3=63.1\%$, respectively.

All the results obtained suggest that with respect of all production parameters, II cow group had the lower production level and unsuitable lactation persistence. Drying off period is therefore considered one of the most important segments of the highly production cow growth technological process and drying of 60 days should be thus rigorously abided with utmost care taken.

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UTICAJ DUŽINE PERIODA ZASUŠENJA NA NIVO PROIZVODNJE I PERZISTENCIJU LAKTACIJE KRAVA

-originalni naučni rad-

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Rezime

Istraživanja uticaja perioda zasušenja na nivo proizvodnje i perzistenciju laktacije krava obavljena su na populaciji simentalских krava u Jagodini. U vreme istraživanja sve krave bile su u drugoj laktaciji i uzgajane su u istim uslovima ishrane i nege. Krave su podeljene u dve grupe, prema dužini perioda zasušenja. Svaka od grupa imala je po trideset krava. U prvoj grupi svrstane su krave sa normalnom dužinom perioda zasušenja od 61.93 dana, a u drugoj krave sa kratkim periodom zasušenosti od 19.5 dana.

Krave prve grupe ostvarile su proizvodnju mleka u laktaciji od 305 dana 5641 kg i 217,5 kg mlečne masti, dok su krave u drugoj grupi za istu laktaciju ostvarile 4446 kg mleka i 192,25 kg mlečne masti. Ove razlike su testirane t-testom i pokazalo se da je razlika u mlečnosti od 1194,5 kg i 41,4 kg mlečne masti po laktaciji statistički vrlo visoko značajna ($P < 0,001$).

Na osnovu dobijenih podataka izrađen je grafički prikaz laktacionih krivulja u obe ispitivane grupe i utvrđeno je da su krave u prvoj grupi imale normalnu perzistenciju laktacije dok su krave u drugoj grupi nezadovoljavajući tok laktacije.