THE USE OF MILK RECORDS OBTAINED BY DIFFERENT RECORDING SCHEMES IN SIRE EVALUATION OF HOLSTEIN CATTLE IN EGYPT

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SUMMARY

A total number of 431 complete lactation records of 169 cows representing the first three parities and sired by 50 sires was collected from a private Holstein commercial farm belonging to the International Company for Animal Wealth over three years. Only sires which had at least two daughters having records of at least 70 days lactation period were included. The study aimed at utilizing monthly, bimonthly and trimonthly milk recording schemes in estimating total milk yield (TMY), heritability (h^2) and sires' transmitting abilities (STA) for TMY. Data were analyzed according to Harvey (1990). The model underlying each record included sire as a random effect, year and season of calving as fixed effects, and age at calving as a quadratic covariate.

The results showed no significant differences among TMY of the first lactation calculated from monthly, bimonthly and trimonthly milk records. In case of all lactations, the differences (from monthly) were significant when trimonthly recording was used in calculating TMY. The correlation coefficients between TMY of the first lactation estimated from the different schemes ranged from 0.982 to 0.993. Corresponding coefficients for all lactations ranged from 0.970 to 0.993.

Estimates of h^2 of TMY of the first lactation obtained from the different milk records ranged between 0.241 and 0.376. Highly significant correlation coefficients were found among STA's calculated from the different milk recording schemes. A highly significant rank correlations (P<0.0001) were observed among the rankings of sires according to their transmitting abilities estimated from monthly, bimonthly and trimonthly milk records.

Keywords: Holstein, sire evaluation, milk recording schemes, Egypt

INTRODUCTION

The monthly test-date procedure for milk recording is widely used in estimating total milk yield. El-Tawil (1959), Yousef et al. (1961) and Sadek et al. (1994), reported that once-a-month milk recording system could be applied for estimating TMY in Egyptian buffaloes and Friesian cows with a high degree of accuracy.

Applying milk recording schemes with limited number of visits throughout the lactation (bimonthly or trimonthly) may be necessary under Egyptian field conditions, in order to reduced cost, time and effort. The main objective of this work was to utilize monthly, bimonthly and trimonthly milk records in estimating :1)TMY of the first and all lactations of Holstein cows, 2) h^2 of TMY for the first lactation and 3) STA's of Holstein sires for TMY of the first lactation.

NATERIALS AND METHODS

The data used in this study were collected from a private Holstein farm located in Giza governorate and belonged to the International Company for Animal Wealth. Data comprised 431 complete lactation records of TMY of 169 Holstein cows sired by 50 sires. Each sire had at least two daugters having records of at least 70 days lactation period. The data covered the first three parities during the period from 1991 to 1993. All cows in this herd are imported from USA since 1991 and were registered in the Holstein Breed Association.

Total milk yield for each cow was calculated by three milk recording schemes:1) Monthly (MON) milk production of each test day was multiplied by 30.5 to calculate the monthly production. Summing up of the monthly production estimates resulted in the TMY, 2) Tests were taken every other month starting either with the first or the second month to produce two sets of records. Milk production of the test day for either bimonthly odd months (BOM) or bimonthly even months (BEM) of the lactation period was multiplied by 61 to calculate the milk production of the two-month intervals between tests. The TMY was then estimated by summing up the production of each two months throughout the lactation period and 3) Tests were taken every three months. Also, two sets of records were produced, trimonthly 1 (TR1), where milk recording started in the first month of lactation and at three-month intervals and trimonthly 2 (TR2), where milk recording started in the second month of lactation and at three-month intervals. Milk production of the test day was multiplied by 91.5 to estimate the production of every three months. The total milk yield was estimated by summing up the production of each three-months throughout the lactation period.

The criteria used for comparing both bimonthly or trimonthly milk records with monthly milk records were: 1) Percentage from monthly = [a/b*100], 2) Bias from monthly = a - b and 3) Percentage bias from monthly = (a-b)/b*100 ,where,a = Bimonthly or trimonthly milk records and b = Monthly milk records.

Data were analyzed according to Harvey (1990). The model underlying each record included sire as a random effect, year and season of calving as fixed effects, and age at calving as a quadratic covariate. Simple correlation coefficients between monthly (as standard method) and both bimonthly and trimonthly milk yield records were calculated using SAS program (SAS Procedure Guide, 1988).

Estimates of heritability for TMY of the first lactation were calculated as: $h^2 = 4\delta^2 s / (\delta^2 s + \delta^2 e)$,where, $\delta^2 s$ = the sire component of variance and $\delta^2 e$ = the error component of variance. Standard errors for the estimates of h^2 were computed according to Swiger *et al.* (1964).

The transmitting abilities of sires was calculated by the Best Linear Unbiased Predictor (BLUP) method (Harvey, 1990).The product-moment correlation was

calculated using SAS program (SAS, 1988) to measure the correlation among estimates of STA. Spearman's rank correlation was calculated to establish the relationships among the ranking (SAS, 1988) obtained by estimated STA.

RESULTS AND DISCUSSION

A. Estimation of total milk yield using monthly, bimonthly and trimonthly milk records

The results obtained by El-Tawil (1959), Youssef *et al.* (1961) and Sadek *et al.* (1994), recommended that once-a-month milk recording could be applied for estimating total milk yield of Egyptian buffaloes and Friesian with a high degree of accuracy. In the present study total milk yield estimated from monthly recording was considered as the standard method for estimating TMY. All estimates of TMY obtained using different recording schemes will be compared with corresponding monthly estimates.

Table 1 presents the least-squares means (LSM) and standard errors of TMY of the first lactation calculated from monthly, bimonthly and trimonthly milk records of Holstein cows. The results showed that BOM, BEM, TR1 and TR2 milk records (8010, 8063, 8078 and 8184 Kg, respectively) overestimated as compared with 7850 Kg calculated from MON records. All differences, however, were not significant. These findings are supported by the results shown in table (2) which presents the criteria used for comparing bimonthly and trimonthly milk records with monthly records. The different recording schemes could be ranked, according to percent bias from monthly, as BOM, BEM, TR1 and TR2, respectively. This means that as the interval between successive recordings increases the % bias also increases. The correlation coefficients (Table 3) between TMY calculated from monthly records and that estimated from bimonthly and trimonthly milk records were hilghly significant (P<0.01). The values ranged from 0.982 between TR2 with MON to 0.993 for either BOM or BEM with MON.

Table 1. Least-Squares means (LSM) and standard errors (SE) of total milk yield of the first lactation calculated from monthly, bimonthly and trimonthly milk records (N= 211)

	LSM	SE
Monthly records	7850	362.1
Bimonthly records		
Bimonthly odd months	8010	360.5
Bimonthly even months	8063	382.6
Trimonthly records		
Trimonthly-1	8078	370.9
Trimonthly-2	8184	382.2

In the case of all lactations (Table 4), the differences between estimates of TMY calculated from bimonthly (odd or even months) and that of MON records were not significant. While, the differences were highly significant (P<0.0120 and P<0.0002) when TR1 and TR2 records were used for estimateing TMY. Table 5 presents that

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the highest bias (564 Kg) was obtained when using TR2 records for estimating TMY, while the lowest was observed in case of . The correlation coefficients (Table 6) between TMY of all lactations calculated from monthly records and that estimated from bimonthly and trimonthly records were highly significant (P<0.01). The values ranged from 0.970 between TR1 with MON to 0.991 for BEM and MON.

Table 2. A comparison of bimonthly and trimonthly milk records with monthly milk records for estimating total milk yield of the first lactation (N=211)

	% of monthly	bias (Kg)	Percent bias
Bimonthly records			
Bimonthly odd months	102±0.26	200±21.4	2.4±0.26
Bimonthly even months	103±0.28	205±21.7	2.5±0.28
Trimonthly records			
Trimonthly-1	104±0.40	336±34.1	4.0±0.40
Trimonthly-2	104±0.46	360±34.5	4.4±0.46

The comparisons between the four recording schemes examined (BOM, BEM, TR1 and TR2) indicated that bias and percent bias increase as the interval of recording increases. These results are in accordance with those obtained by El-Tawil (1959), Youssef et al. (1961) on Egyptian buffaloes and Friesian cattle and Bayley et al. (1952) on Holstein cows. Bimonthly scheme appeared to be satisfactory and economically feasible for practical application, since the correlation coefficients between TMY estimated by bimonthly and monthly milk records are very high. Using bimonthly scheme as an accurate procedure for estimating total milk yield was supported by Van Vleck and Henderson (1961); Keown and Van Vleck (1971); Pardhan (1988) and Hamed (1995).

Table 3. The correlation coefficients between total milk yield of the first lactation calculated from monthly, bimonthly and trimonthly milk records

	BOM	BEM	TR1	TR2
MON	0.993**	0.993**	0.983**	0.982**

** = P<0.01

Table 4. Least-Squares means (LSM) and standard errors (SE) of total milk yieldc of all lactations calculated from monthly, bimonthly and trimonthly milk records (N= 431)

	LSM	SE
Monthly records	7855	318.2
Bimonthly records		
Bimonthly odd months	8130	315.4
Bimonthly even months	8107	332.9
Trimonthly records		
Trimonthly-1	8258	320.9
Trimonthly-2	8324	343.8

Table 5. A comparison of bimonthly and trimonthly milk records with monthly milk records for estimating total milk yield of all lactations (N=431).

	%of monthly	bias (Kg)	Percent bias
Bimonthly records			
Bimonthly odd months	103±0.28	237±17.7	3.4±0.28
Bimonthly even months	104±0.22	282±15.6	3.7±0.22
Trimonthly records			
Trimonthly-1	105±0.46	372±28.7	5.4±0.41
Trimonthly-2	107±0.39	564±28.2	7.4±0.39

B. Estimation of heritability of total milk yield of the first lactation.

Estimates of sire and error components of variance and heritability and their standard errors for TMY of the first lactation calculated from monthly, bimonthly and trimonthly milk records are presented in table 7. Compared to monthly milk records, the percentages of variance attributed to sire in each of BEM and TR2 were higher (9.4 and 8.4, respectively) than that of MON (7.9). The estimates of h^2 of TMY of the first lactation calculated from BEM and TR2 were also higher (0.376 and 0.336, respectively) than the corresponing estimate of h^2 obtained from MON (0.314). The values of percentage of sire variance in case of BOM and TR1 were almost similar (6.0 and 6.1, respectively) and less than that of monthly records. the estimates of h^2 for BOM and TR1 were almost equal (0.241 and 0.243, respectively) and less than the estimate of h^2 of TMY calculated from MON (0.314).

Table 6. The correlation coefficients between total milk yield of all lactations calculated from monthly, bimonthly and trimonthly milk records

	BOM	BEM	TR1	TR2
MON	0.988**	0.991**	0.970**	0.975**

** = P<0.01

Table 7. Estimates of sire (δ^2_s), and error (δ^2_e) component, of variance and heritability (h^2) and their standard errors (SE) for total milk yield of the first lactation

	δ^2_s	V%*	δ^2_e	h^2	SE
Monthly records	463817	7.9	5438643	0.314	0.257
Bimonthly records					
Bimonthly odd months	376884	6.0	5891446	0.241	0.250
Bimonthly even months	586423	9.4	5657078	0.376	0.263
Trimonthly records					
Trimonthly-1	402209	6.1	6214795	0.243	0.251
Trimonthly-2	541803	8.4	5909768	0.336	0.259

* The sire variance component as percentage of the total variance.

C. Estimation of sires' transmitting abilities

The minimum and maximum values of sires' transmitting abilities for 50 Holstein bulls are presented in Table (8). The distribution of sires' transmitting abilities (Table 9) showed that about 48% of the bulls have negative transmitting abilities in case of MON and BEM records. In the meantime, the percentage reached 52, 46 and 50% in case of BOM, TR1 and TR2, respectively. Compared with monthly milk records, the percentages of bulls having the same rank are 28, 44, 28 and 26%, for BOM, BEM, TR1 and TR2, respectively. When the top five sires (the top 10%) were identified according to their transmitting abilities obtained from monthly, bimonthly and trimonthly milk records, the same 4, 4, 4 and 5 sires were chosen for BOM , BEM, TR1 and TR2, respectively Table (10).

Table 8. Minimum and maximum values of sires' transmitting abilities for total milk yield of the first lactation

	Minimum	Maximum
Monthly records	-712	769
Bimonthly records		
Bimonthly odd months	-629	650
Bimonthly even months	-835	937
Trimonthly records		
Trimonthly-1	-725	717
Trimonthly-2	-798	820

No. of sires = 50

Table 9. Distribution of sires' transmitting abilities (STA) for total milk yield of the first lactation

	STA estimates			
	Positive		Negative	
	No. of sires	%	No. of sires	%
Monthly records	26	52	24	48
Bimonthly records				
Bimonthly odd months	24	48	26	52
Bimonthly even months	26	52	24	48
Trimonthly records				
Trimonthly-1	27	54	23	46
Trimonthly-2	25	50	25	50

Table 10. Ranking of the top five bulls (the top 10%) according to their transmitting abilities for total milk yield of the first lactation

MON	BOM	BEM	TR1	TR2
1	1	1	1	1
2	2	2	2	2
3	3	3	3	3
4	4	6	5	5
5	6	5	13	4

The product-moment correlation coefficients (Table 11) between estimates of sires' transmitting abilities obtained from monthly, bimonthly and trimonthly milk records were larger in all cases than 0.97. These figuers demonstrated how close were the estimates of sires' transmitting abilities calculated from different recording schemes. In the meantime,the rank correlation coefficients among the rankings of sires according to their transmitting abilities were highly significant (p<0.0001). The values of Spearman rank correlations ranged from 0.982 (between TR1 and MON) to 0.993 (between BEM and MON).

Table 11. Product-moment and Spearman rank correlations between values of sires' transmitting abilities for total milk yield of the first lactation

	Monthly	Bimonthly		Trimonthly	
		BOM	BEM	TR1	TR2
Monthly records		0.994	0.995	0.988	0.990
Bimonthly records					
Bimonthly odd months	0.992		0.982	0.985	0.983
Bimonthly even months	0.993	0.980		0.988	0.990
Trimonthly records					
Trimonthly-1	0.982	0.979	0.983		0.977
Trimonthly-2	0.988	0.984	0.991	0.978	

Product-moment correlation coefficients are above the diagonal and the Spearman rank correlations are bellow the digaonal.
All estimates are highly significant (P≤ 0.0001)

The above mentioned results indicate that bimonthly and trimonthly milk recording schemes, as compared with monthly test-data records, could be utilized in estimating total milk yield, heritability and sires' transmitting abilities for Holstein cattle with reasonable accuracy.

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إستخدام سجلات اللبن المحسوبة بنظم تسجيل مختلفة فى تقييم طلائق الهولستين فى مصر

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أجريت هذه الدراسة فى مزرعة أبقار الهولستين فريزيان التابعة للشركة العالمية للثروة الحيوانية. شملت الدراسة ٤٣١ سجلا لإنتاج اللبن تمثل أول ثلاثة مواسم لعدد ١٦٩ بقرة ناتجة من ٥٠ طلوقة خلال الفترة من ١٩٩١ الى ١٩٩٣. إستخدمت الطلائق التى لها على الأقل بنتين مع استبعاد السجلات التى يقل فيها طول موسم الحلب عن ٧٠ يوم .تهدف الدراسة الى مقارنة إستخدام نظم تسجيل لإنتاج اللبن مرة كل شهرين ومرة كل ثلاثة شهور مع نظام التسجيل الشهرى لإنتاج اللبن فى تقدير: ١) إنتاج اللبن الكلى فى الموسم الأول و كل المواسم و ٢) العمق الوراثى لصفة إنتاج اللبن الكلى و ٣) القيمه التمريرية للطلائق. أستخدمت بيانات الموسم الأول فقط فى تقييم الطلائق باستخدام طريقة أحسن التقديرات الخطية غير المتحيزة.

و تتلخص أهم النتائج فى الآتى :-

١- كان متوسط إنتاج اللبن الكلى للموسم الأول المقدر من نظم التسجيل المختلفة (الشهرى، كل شهرين بدءاً من الشهر الأول، كل شهرين بدءاً من الشهر الثانى، كل ثلاثة شهور بدءاً من الشهر الأول، كل ثلاثة شهور بدءاً من الشهر الثانى) هو ٧٨٥٠ و٨٠١٠و٨٠٦٣ و٨٠٧٨ و ٨١٨٤ كجم على الترتيب. و كانت كل الفروق غير معنوية. بينما كان متوسط إنتاج اللبن لكل المواسم المتاحة المقدر من نفس نظم التسجيل سابقة الذكر هو٧٨٥٥ و ٨١٣٠ و ٨١٠٧و ٨٢٥٨ و ٨٣٢٤ كجم على الترتيب. وكانت الفروق معنوية فقط بين إنتاج اللبن المقدر من التسجيل مرة فى الشهر ومرة كل ثلاثة شهور.

٢- كانت معاملات الإرتباط بين إنتاج اللبن الكلى المقدرمن نظام التسجيل كل شهرين أو كل ثلاثة شهور مقارنا بالتسجيل مرة كل شهر معنوية جدا سواء فى الموسم الأول أو كل المواسم.

٣-كانت قيم العمق الوراثى لإنتاج اللبن الكلى فى الموسم الاول باستخدام نظام التسجيل مرة كل شهر ومرة كل شهرين (الشهور الفردية و الشهور الزوجية) ومرة كل ثلاثة شهور (بداية من الشهر الأول أو الثانى من موسم الحلب) هى ٠,٣١٤ و ٠,٢٤١ و ٠,٣٧٦ و ٠,٢٤٣ و ٠,٣٣٦ على التوالى.

٤- لوحظ عند ترتيب الطلائق تبعا لقيمها التمريرية المحسوبة من استخدام انتاج اللبن للموسم الأول و المقدر من نظم التسجيل المختلفة أن النسبة المئوية للطلائق التى لها نفس الترتيب كانت ٢٨ و ٤٤ و ٢٨ و ٢٦ على التوالى مقارنة بالتسجيل مرة فى الشهر.

٥- كانت قيم معامل الأرتباط بين تقديرات القيم التمريرية للطلائق المحسوبة باستخدام نظم التسجيل المختلفة عالية جدا . أيضا لوحظ ان هناك تلازم معنوى قوى لترتيب الطلائق باستخدام نظم التسجيل المختلفة مقارنة بالتسجيل مرة فى الشهر.