IMPACT OF MILK YIELD ON ECONOMICS OF HOLSTEIN HERDS UNDER EGYPTIAN CONDITIONS

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SUMMARY

The aim of this study was to compare empirically between the profitability of two Holstein herds in relation to their productive and reproductive performance under intensive production system in Egypt.

Data of productive and reproductive traits of 1867 lactation records obtained from 850 Holstein cows of different parities belonging to the International Company for Animal Wealth, Giza, were analyzed. According to the level of milk yield, two herds were synthesized. The first (H1) was supposed to produce milk equal to the average lactation yield ($\overline{X}$ = 8535 Kg), while the second (H2) was proposed to produce high milk yield equal the average plus (at least) one standard deviation (SD = 2721 Kg). Technical coefficients of post-partum service interval, number of services per conception, days open, daily milk yield, lactation period, total milk yield, dry period and calving interval were estimated from the obtained data and used to run the simulated herds. Cows of the two herds were supposed to be managed as in the original farm (source of data).

To compare between the two simulated herds, a deterministic model was used to calculate the annual gross margins and benefit / cost ratio as economic parameters. Prices of inputs and outputs were based on the current market and farm gate prices.

The interval from parturition to the first insemination, to conception and the calving interval were 101.4, 195.5 and 472.3 days for H1 vs. 126.5, 341.0 and 618 days for H2, respectively. Moreover, H2 needed more number of services to conceive (3.9) than H1 (2.6), indicating poorer reproductive performance of high yielding herd.

From economic point of view, annual variable cost of H1 was LE. 4834 vs. LE. 5252 for H2. However, the annual gross margin of H2 was higher than that of H1 by 19.9% (LE. 3214 vs. LE. 2680) and the benefit /cost ratio of H2 is LE. 1.61 vs. 1.55 for H1.

In conclusion, extension of calving interval for high yielding herds seems more profitable than the herds that have shorter calving interval and lactation period.

Keywards:Holestein, high yielding, productive life, profitability

INTRODUCTION

Milk production in Egypt is less than the threshold of self- sufficiency representing 72%, of the domestic demand (MALR, 2000). Due to the low

potentiality for milk production of local breeds, importing breeds is adopted to increase milk production in commercial herds where intensive systems are followed.

Milk production revenues depend on the reproductive efficiency of the herds (Barkawi *et al.*, 1999 and Ahmed *et al.*, 2000). Regular calving (every 12-13 months) is one of the main targets of dairy farmers. This makes available maximum numbers of lactation per lifetime production of cows and provides the farmer with more offspring for replacement or sale.

Long calving interval might be the main reproductive disorder of high yielding dairy cattle. This is mainly due either to low conception rate (40-50 %) and / or high early embryonic mortality (Butler and Smith, 1989).

The poor reproductive performance of high yielding cows may affect the overall economic performance of the herd especially under high ambient temperature (Jainudeen and Hafez, 1987).

Under such circumstances few studies are available to evaluate the impact of the length of calving interval on the farm profitability.

Raising the profitability of a farm may be judged by the gross margins of the enterprise. A major reason for difference in gross margin is the level of yield obtained and price of the products. High yielding cows may need additional costs will be incurred and the decision should be based on whether the extra returns would be greater than the additional costs involved.

The present study aimed at evaluating the economic performance of two Holstein herds having different levels of milk production and length of calving interval using simulation technique based on technical coefficients estimated from real data.

MATERIAL AND METHODS

Data and management

Data of productive and reproductive traits of 1867 lactation records (from 1991-2000) were obtained from 850 Holstein cows belonging to the International Company for Animal Wealth, located at Giza Governorate. According to the level of milk yield, records were divided into two groups, 1) average milk production group ($\overline{X}$) and 2) high ($\overline{X}$ +1 SD) milk production group.

Deterministic productive and reproductive coefficients of the two groups were used to generate two herds. The first herd (H1) has milk production equal to the average of Holstein cows under the Egyptian conditions (8535 Kg., and the second (H2) contains high yielding cows (11, 256 Kg.).

Management of the two herds was supposed to be similar to the standard of practices used in the original farm. Cows were fed according to their live body weight, milk production level and pregnancy status (NRC, 1998). Cows were artificially inseminated at the first detected estrus after parturition using imported frozen semen from USA. Cows were machine milked 2-4 times daily according to their milk production level.

Costs and revenues were estimated according to the technical coefficients and management practices.

Technical coefficients and assumptions

Records were statistically analyzed to estimate the productive and reproductive technical coeffiecients of the two simulated herds (daily milk yield, lactation period, total milk yield, dry period, post-partum service interval, number of services per conception, days open, and calving interval). The following assumptions were adopted in calculating farm budget.

- Fixed herd size and structure of 100 lactating cows per each simulated herd.
- Mature body weight = 600 kg
- Conception rate per herd = 80 %
- Age at first calving = 24 month (731 day)
- Calf sale price was estimated at calving = LE. 800
- Annual veterinary care cost=LE. 50 per head for (H1) and LE. 65 per head for (H2).
- Rectal palpation / time = LE. 10
- Semen dose = LE. 50
- Annual manure production per head = 15 m^3 / year for (H1) and 17.5 m^3/year for (H2)
- Price of m^3 manure LE. 20.
- Number of parities of H1 assumed to be 4 according to (Abdel-Salam, 2000) as a control.
- Culling age= [Age at first calving + (4 parities * the calving interval of H1)]
  (24 month * 30.5 day) + (4 * 472.3)= 2631 day (7.2 years).
- Price of inputs is based on the current market price.
- Price of outputs is based on the current farm gate price.

Criteria of Economic Assessment

Gross margin is one of the more realistic measures to evaluate farm profitability (Barnard and Mix, 1993). To compare between H1 and H2, annual gross margins as well as, discounted measure, benefit / cost ratio (present worth of benefits divided by present worth of costs) were used as economic tools for comparing between the two simulated herds.

Statistical Analysis

The data were analyzed by least squares ANOVA using the general linear model of SAS (1998). The fixed effects linear model was used to analyze the productive and reproductive traits and to develop technical coefficients of the two simulated herds.

RESULTS AND DISCUSSION

Lactation period and total milk yield of H2 increased by 1.4 and 1.5 times more than H1, respectively, however, the dry period was almost similar in the two studied herds. The present results showed that H2 has poorer reproductive performance than H1. High milk producer cows have longer ($P<0.01$) intervals from parturition to the

herds. The present results showed that H2 has poorer reproductive performance than H1. High milk producer cows have longer (P<0.01) intervals from parturition to the first insemination and to conception. This consequently prolonged the calving interval, due to the increase in the number of services per conception, by about 30% relative to H1 (Table 1).

This may be attributed mainly to the negative energy balance of the high yielding cows particularly during the peak of lactation (Butler and Smith, 1989). High milk production particularly at high ambient temperature may cause physiological stress that might lead to a depression of the interior pituitary secretion. Such depression causes delay in resumption of ovarian activity post-partum which elucidate the increase of post-partum service interval. Moreover, it may lead to early embryonic mortality (Diskin and Sreenan, 1980) leading to increase number of services per conception and prolongation of calving interval.

The present results agree with the reports of Butler and Smith, (1989) and Muller *et al.* (2000), reporting low reproductive efficiency for high milk production cows.

Table 1. Estimate of technical coefficients ($\overline{X}$) and standard error (SE) for the two simulated herds

Trait	H1	H2
Reproductive traits		
Post-partum service interval (day)	101.4 ± 1.4^{b}	126.5 ± 3.03^{a}
No. of services per conception	2.6 ± 0.04^{b}	3.9 ± 0.09^{a}
Days open (day)	195.5 ± 3.1^{b}	341.0 ± 6.6^{a}
Calving interval (day)	472.3 ± 3.1^{b}	618.0 ± 6.6^{a}
No. of parities	4.0	3.1
Productive traits		
Daily milk yield (kg)	23.3 ± 0.11^{b}	25.8 ± 0.25^{a}
Lactation Period (day)	375.2 ± 2.2^{b}	518.0 ± 4.8^{a}
Total milk yield (kg)	8535.0 ± 37.8^{b}	12942.9 ± 81.8^{a}
Dry off period (day)	97.7 ± 1.76^{b}	100.3 ± 3.9^{a}

[a,b] Means with different superscripts are significantly different at P<0.01.

Economic assessment

Gross output of H2 is more than that of H1 by about 12.7%. This may be attributed to the higher milk revenues. Milk yield is considered the major source of farm revenues. It represents 87.8 % and 90.3 % of the total gross output for H1 and H2, respectively (Table 2).

Annual variable cost per cow of H2 is higher (P< 0.01) than that of H1 by about 8.6 %. This difference between the two herds attributed mainly to the extra feeds to cover the extra produced milk and to semen cost, since cows in H2 need more semen doses to get pregnant. Feeding represents the major element of the variable cost. It contributing 87 % and 90 % out of the total variable costs for H1 and H2, respectively (Table 2).

The annual gross margin of H2 increased by 18.5 %. Benefit/cost ratio also increased by 3.9 % as compared to H1. Economicaly, these results revealed that, in spite of (H2) herd required extra variable costs (8.4% more than H1) due to high milk

production needs, it can counter balance its loss in reproductive efficency, eventhough the revenues come from calving is less than that of (H1) by 30%

Table 2. Breakdown of the annual gross output and variable costs per cow of the two simulated herds

Item	H1	H2
Gross output		
Milk	6596	7644
Calves	618	472
Manure	300	350
Total gross output	**7514**	**8466**
Variable Cost		
Feeding	4354	4732
Labor	317	317
Insemination	100	115
Palpation	13	23
Veterinary care	50	65
Total variable cost	**4834**	**5252**
Gross margin	**2680**	**3214**
Benefit / Cost ratio	**1.55**	**1.61**

Due to longer calving interval of (H2), each cow would give 1.9 parity less than that of H1 (Table 1). Results of the financial analysis per cow during its lifetime production is presented in Table 3. From the economic point of view, the overall variable cost for the whole lifetime production of H2 exceeded that of H1 by 10.2%. On the contrary, the total gross output of H2, exceeded those of H1 by 14.3%. Moreover, the profit per cow during the lifetime of H2 was 21.6% more than of H1.

Table 3. Financial analysis (LE.) for the lifetime production per cow of the two simulated herds and the percentage of difference in H2 relative to H1.

Item	H1	H2	%
Gross output	38840	44375	+14.3
Variable cost	24988	27529	+10.2
Gross margin	13852	16846	+21.6

In conclusion, high milk producer cows with longer calving interval are more profitable than those have regular calving every 12-13 months regardless, the value of genetic losses in form of heifers for replacement and/or bulls for insemination. This needs more investigations to quantify the value of such losses and its impact on herd dynamic.

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تأثير ناتج اللبن على اقتصاديات قطعان الهولستين تحت الظروف المصرية

على مصطفى أحمد[1] ، آمال كمال العشيرى[2] ، محمد عبد العزيز ابراهيم[2] ، أشرف هشام برقاوى[2]

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أجريت هذه الدراسة بهدف تقدير أربحية أبقار الهولستين الحلوب المرباة تحت نظام الإنتاج المكثف فى مصر. تم تحليل الصفات الإنتاجية والتناسلية لبيانات ١٨٦٧ سجلاً لإنتاج اللبن لعدد ٨٥٠ بقرة هولستين فى مواسم حليب مختلفة مرباه بالشركة العالمية للثروة الحيوانية بالجيزة. تم تقسيم الحيوانات طبقاً لمستوى إنتاج اللبن الكلي إلى قطيعين: القطيع الأول (ق١) ذو إنتاج لبن كلي يساوى المتوسط العام لإنتاج اللبن في المزرعة (٨٥٣٥ كجم)، والقطيع الثانى (ق٢) إنتاجه من اللبن يزيد عن المتوسط العام بمقدار قيمة الإنحراف المعيارى (٢٧٢١ كجم). استخدم أسلوب المحاكاة لتقدير المعدلات الفنية للقطيعين وهى: الفترة من الولادة حتى أول تلقيحة، عدد التلقيحات اللازمة للحمل، الأيام المفتوحة، إنتاج اللبن اليومي، طول موسم الحليب، إنتاج اللبن الكلي، فترة الجفاف والفترة بين ولادتين.

- تم تقدير هامش الربح ونسبة المنافع/التكاليف كمعايير إقتصادية للقطيعين موضع الدراسة. استخدمت أسعار المدخلات والمخرجات طبقاً للسعر الحالي للسوق وتسليم باب المزرعة.
- كانت الفترة من الولادة لأول تلقيحة، للتلقيحة المخصبة والفترة بين ولادتين ١٠١,٤، ١٩٥,٥ و٤٧٢,٣ يوماً لقطيع ق١ مقابل ١٢٦,٥، ٣٤١,٠ و٦١٨ يوماً لقطيع ق٢، على التوالي. بلغ عدد التلقيحات اللازمة للحمل لقطيع ق٢ (٣,٩) مقابل (٢,٦) في قطيع ق١، مما يشير إلى ضعف الأداء التناسلي للقطيع عالي الإنتاج.
- من الناحية الإقتصادية: قدرت التكاليف المتغيرة السنوية للرأس فى قطيع ق١ بـ ٤٨٣٤ جنيهاً مصرياً مقابل ٥٢٥٢ جنيهاً مصرياً لقطيع ق٢. إلا أن هامش الربح لقطيع ق٢ كان أعلى من قطيع ق١ بنسبة ١٩,٩% (٣٢١٢ جنية مقابل ٢٦٨٠ جنية) وكانت نسبة المنافع/التكاليف لقطيع ق٢ ١,٦١ جنية مقابل ١,٥٥ لقطيع ق١.
- ويدل ذلك على أن أربحية القطعان عالية الإنتاج والتى لها فترة أطول بين الولادتين أكثر من الأبقار قصيرة الفترة بين ولادتين مُنتظمة الولادة.