THE PRODUCTION PERFORMANCE OF HOLSTEIN-FRIESIAN DAIRY CATTLE IN WEST JAVA

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ABSTRAK

MAHYUDDIN, P; S.B. SIREGAR, N. HIDAYATI, dan T. SUGIARTI. 1997. Kinerja produksi sapi perah Friesian Holstein di Jawa Barat. *Jurnal Ilmu Ternak dan Veteriner* 2 (3): 145-151.

Untuk mengetahui gambaran produktivitas sapi perah Friesian Holstein di Indonesia, dilakukan studi lapangan di Kecamatan Cisarua (Bogor) dan Tanjungsari (Sumedang). Di Cisarua, studi dilakukan pada 175 ekor sapi yang sedang laktasi (bervariasi antara 2 - 11 bulan). Pengukuran yang dilakukan adalah pemberian rumput dan konsentrat, produksi susu dan lingkar dada. Pengukuran ini dilakukan selama 24 jam untuk setiap ternak. Data tanggal beranak, tanggal inseminasi dan bulan kebuntingan diambil secara wawancara dengan peternak. Di Tanjungsari, studi dilakukan pada 102 ekor sapi yang lepas melahirkan. Pengukuran produksi susu dan lingkar dada dilakukan pada permulaan studi dan kemudian sekali setiap bulan selama 3 bulan berturut-turut. Produksi susu mencapai 3.700 l dan 3.400 l per laktasi dengan percepatan penurunan produksi rata-rata 0,03 l/h dan 0,05 l/h masing-masing untuk Cisarua dan Tanjungsari. Rasio konsumsi konsentrat : hijauan adalah 1 dan 1,4 masing-masing untuk Cisarua dan Tanjungsari, dan rasio tersebut menurun dengan menurunnya produksi susu. Efisiensi energi metabolis pakan di kedua lokasi tersebut kira-kira sama (0,12 l/MJ). Persentase induk yang kehilangan bobot badan di Cisarua selama tiga bulan pertama lebih rendah (46 %) dibandingkan dengan yang dipelihara di Tanjungsari (77 %). Kira-kira 68 % dari populasi mempunyai laju konsepsi (LK) > 50 %, sisanya seharusnya dikeluarkan, yaitu 24 % mempunyai LK yang rendah dan 8 % mempunyai *days open* > 150 hari. Dari 61 induk yang diamati, masing-masing 71 % dan 21 % mempunyai proyeksi jarak beranak 12 bulan dan 13 - 14 bulan. Dapat disimpulkan, baik produksi susu maupun efisiensi reproduksi dari sapi perah yang dipelihara di Jawa Barat masih rendah.

Kata kunci: Sapi Friesian Holstein, efisiensi reproduksi, produksi susu

ABSTRACT

MAHYUDDIN, P; S.B. SIREGAR, N. HIDAYATI, and T. SUGIARTI. 1997. The production performance of Holstein Friesian dairy cattle in West Java. *Jurnal Ilmu Ternak dan Veteriner* 2 (3): 145-151.

The production performance of Holstein-Friesian cows in West Java was evaluated in two areas, Cisarua district (Bogor) and Tanjungsari district (Sumedang). In Cisarua the evaluation was made on 175 cows with different stage of lactation (2 - 11 months). Feed offered, both forage and concentrate, milk production and chess girth were measured from each animal for 24 h only. Date of calving, date of service and stage of pregnancy were recorded by interviewing the farmers. In Tanjungsari the study was conducted on 102 postpartum cows. Milk production and chess girth were measured at the beginning of the study and then once a month (morning and afternoon milking) for 3 months. Milk production was 3,700 l and 3,400 l per lactation with declining rate of 0.03 and 0.05 l/d for Cisarua and Tanjungsari area respectively. The ratio of concentrate : forage consumption was 1 and 1.4 in Cisarua and in Tanjungsari respectively, and the ratio was reduced as milk production declined. The efficiency of conversion of feed ME to milk yield was approximately the same (0.12 l/MJ) in both location. The proportion of cows lost weight in Cisarua during the first three months was lower (46 %) as compared to that in Sumedang (77 %). Approximately 68 % of the population have conception rate (CR) > 50 % , the remaining should be culled, 24 % have low CR and 8 % have days open > 150 days. From 61 cows observed, 71 % and 21% have a projected calving interval of 12 months and 13 - 14 months respectively. It can be concluded that milk production and reproduction efficiency of Holstein cows in West Java are considered low.

Key words: Holstein-Friesian cow, reproduction efficiency, milk production

INTRODUCTION

Dairy cattle in Indonesia are mostly imported from Australia and New Zealand and are originally U.S. Holstein breed. These animals entered this country in 1979 when Indonesia government started its dairy cattle development program. Breeding is performed mostly through artificial insemination (AI) using semen from imported progeny-tested bull produced by the AI center in Lembang and Singosari. Thus dairy cattle in Indonesia have a high genetic potential for milk production.

The ability of these animals to grow, reproduce and lactate to maximal genetic potential is determined by the climatic and biological environmental and their interaction during growth and developmental stages and at lactation. Dairy cattle raised in the tropics is known to have low productivity. Some of the basic underlying environmental problems are high temperature and humidity conditions, low quality of forages, diseases and parasites.

Nutrient deficiencies in tropical forages cause inefficient utilisation of feed results in a high metabolic heat. This metabolic heat together with high temperature and humidity at times causes heat stress with a direct effect on feed intake (LENG, 1992). Thermal stress in heifers delays puberty, lengthen estrous cycle, shorten the estrous and more difficult to detect (DALE *et al.*, 1959). In adult cows, it causes long estrous cycle (STOTT and WILLIAMS, 1962) and higher frequency of anestrous (GANGWAR *et al.*, 1965). Cows with high body temperature have been observed to have low conception rate (ULBERG and BURFENING, 1967). ROMAN-PONCE (1987) however, pointed out that the most consistent observation during thermal stress exposure is a reduction in length of estrous from 18 h considered normal to 10 h or less.

The effect of nutrition on reproduction has been reviewed recently by ROBINSON (1996) and FERGUSON (1996). Deficiency of nutrients in diet or reduced dry matter intake may result in a deficiency of energy-yielding nutrients and results in more negative energy balance (occur after calving) for a longer period of time. The degree and duration of negative balance period may influence the magnitude of effect on reproductive performance (FERGUSON *et al.*, 1989). Although dairy cows normally loss about - 0.5 body condition score unit post calving, several studies show that cows losing more than that value had significantly lower conception rate (FERGUSON, 1996). The interaction between body condition at calving and subsequent feeding level to their influence on the interval to first post-partum estrous has been demonstrated by the work of WRIGHT *et al.* (1992). They found that thin cows (condition score 2.2) on a low compared with a high intake of metabolisable energy (ME) had a longer interval whereas in fat cows (2.9) the difference between the low and the high feeding levels in the duration of post-partum anestrous was small and not significant. Lost of body protein delays estrous cyclicity but if the correction is made by feeding high rumen undegradable protein which stimulate body fat mobilisation and milk production, the interval to first estrous will increased (SINCLAIR *et al.*, 1994). Restriction of energy intake may impede follicular development (LUCY *et al.*, 1991), decrease luteal function (VILLA-GODOY *et al.*, 1988) and delay first ovulation (BUTTLER and SMITH, 1989 and LUCY *et al.*, 1991).

Management of dairy cattle in West Java however, may reduce heat stress of the animals since they are raised in upland area and kept in open shed. Furthermore, since feeding concentrate has been practised by the farmers it may increase the efficiency of basal feed and this would reduce the metabolic heat stress.

Since tropical climates have a significant influence on the expression of an animal's genetic potential for production, adaptation to the environment will be a reflection of the adjustments of the various physiological systems.

This paper presents some data from the field study to evaluate the productivity of dairy Holstein in Indonesia particularly those raised in West Java.

MATERIALS AND METHODS

The study was conducted in Cisarua district (Bogor) and Tanjungsari district (Sumedang). Cisarua is located 650 - 1,100 m above sea level, with temperature of 17.8 ^{0}C - 23.9 ^{0}C and rain fall of 1,120 - 1,610 mm /year and humidity of 92%. Tanjungsari is located between 250 - 855 m above sea level and temperature 23 - 28 ^{0}C and humidity of around 80%. In Cisarua forty (40) farmers with 175 cows with different stage of lactation (2 - 11 months) were involved. Forage and concentrate offered, milk production (morning and afternoon) and chess girth were measured from each animal for 24 h. Date of calving, date of insemination and stage of pregnancy were recorded by interviewing the farmers. In Tanjungsari, the measurement was made on 102 postpartum cows at the beginning of the study, then at 30 days interval for 3 months.

The chess girth data is converted to live weight (LW) and the LW then is used to calculate feed consumption when milk production (Y) is known.

Dry matter intake = 0.025 LW + 0.1 Y.(MAFF, 1975).

Calculation of milk production/300 days lactation

Cisarua

Milk yield is normally increase to a peak from 1 to 3 months of lactation then it declines steadily afterwards. The estimation of milk production per year (300 days lactation) from 24 h data collected from individual animal with different stage of lactation may be valid if it is assumed that all factors affecting milk production in this area were the same.

Data of milk yield per animal/day were grouped according to the stage of lactation, in this case from 1-3 months, 4 - 6 months, 6 - 9 months and 10 - 11 months.

If the average milk yield per lactation group is Y_{1-90} , Y_{90-180} , $Y_{180-270}$ and $Y_{270-300}$, the estimated milk production per lactation is (M_Y)= (90 x Y_{1-90}) + (90 x Y_{90-180}) + (90 x $Y_{270-300}$) +(30 x $Y_{270-300}$)

Tanjungsari

Two groups of animals were identified. There were 22 animals (group I) which in the lactation stage of increasing milk yield to a peak level and 80 animals (group II) which were in the stage of declining milk yield. We assumed that group I is those in the first 3 months of lactation and group II is those in the second stage of lactation. Take the average milk yield of group I ($Y_{1\text{-}90}$) to calculate 90 days milk yield. Take the average top point of the two groups as the peak point of lactation and get the declining rate of milk yield of group II to calculate the remaining milk yield (270 days). In this case, the peak lactation was 16.2 l/d and the declining rate was 0.05 l/d.

The estimated milk production per lactation is the sum of 90 x ($Y_{1\text{-}90}$) + the 270 days milk yield.

Table 1. The chemical composition of concentrate made by cooperative in Cisarua and Tanjungsari

Nutrient	Concentrate	
	Cisarua	Tanjungsari
Crude protein	16.40	16.80
NDF	42.10	41.60
Fat	6.10	5.90
Ca	1.09	1.61
Na	0.66	0.57
P	0.89	0.62
Mg	0.45	0.44
ME (MJ/kg)	10.4	9.00

RESULTS AND DISCUSSION

Milk production

Table 2 and 3 show that the estimated milk production of Holstein-Friesian cows raised in Cisarua and Tanjungsari is 3,700 l and 3,400 l respectively. This estimation although was crude, it may be close to the true value, since factors affecting milk production (such as genetic of the animals, feed and feeding and reproduction management) were the same for each animal in such a small location. The estimated milk production in these areas approximately similar to that in New Zealand (3,000 - 4,000 l) but lower than that in Europe (4,000 - 5,500 l) or America (> 6,000 l)(LENG, 1992). In New Zealand cows are grazed on high quality temparate pasture (20 - 30% crude protein, 75 - 80% digestibility) with little or no additional inputs. In Europe they are fed a high quality forage and grain based concentrate (16 - 20% crude protein and 75 - 85% digestibility), whereas in USA feeding is based on grain with added protein meals and minimal forage. As shown in Table 2, farmers in West Java tend to feed the cows a diet with 50% to 60% concentrate all year round; thus the production efficiency of dairy cattle in Indonesia is still lower than that in the developed countries. This is also true for other developing countries in the tropics. It is postulated that the low productivity of animals in the tropics stems from an inefficient utilisation of the feed because of deficiencies in the basal diet (LENG, 1990).

LENG (1990, 1992) suggested that supplements should provide the critical catalytic nutrients that deficient in the diets and balancing availability of nutrient closer to requirements. LENG (1990) reported that supplementing roughage with urea molasse block plus by pass protein (30 % CP) at a rate of 350 g/l milk gave an average milk yield of 5,000 l/305 d or 16.4 l/d. Assuming the average LW of the animals were 400 kg, the dry matter intake (DMI) would be about 11.7 kg. If the metabolisable energy (ME) of the by-pass protein and roughage were within the normal value of approximately 12 - 13 MJ/kg and 7 MJ/kg respectively, the effciency of conversion of feed ME to milk would be 0.4 - 0.42 l/MJ. In comparison with the data from Cisarua and Tanjungsari (see Table 2 and 3), with an average ME intake (MEI) of 105.5 MJ and 99 MJ resulted in milk yield of 12.4 l/d and 11.5 l/d respectively (average yield over 300 days of lactation), the efficiency of conversion of ME feed to milk were the same; 0.12 l/MJ. This lower efficiency may be due to a combination of climatic and metabolic stress caused by inefficient utilisation of basal feed. Although the temperature day and night in both locations is still acceptable for dairy cattle, the humidity is very high. This suggests that cattle raised in the two locations may suffer from climatic stress. Balancing the nutrient closer to requirement suggested by LENG (1990, 1992) may improved milk production by 30 - 40% as seen above. However, it would probably be difficult for the dairy cooperative to assure dairy farmers in West Java to change to the more expensive supplement (Urea molasses block + by pass protein of 30% CP) for higher milk production.

Milk production was higher in Cisarua than that in Tanjungsari (Table 2 and Table 3). This probably due to the ME of Cisarua feed was higher than that of Tanjungsari. In early lactation, dairy cattle are generally in negative energy balance as they are unable to consume enough energy to meet their requirement. Moreover, intake in early lactation is limited by rumen fill when the diet contains 25% to 35% neutral ditergent fibre (NDF) (DADO and ALLEN, 1993). Limitation in energy intake would have been occurred in cows raised in West Java since NDF content in the diet is high approximately 55% (Table5). Approximately 67% and 61% of MEI was used for production (milk + weight gain/loss) in cows raised in Cisarua and Tanjungsari respectively. Since ME used for milk production exceeded the ME available for production, the remaining ME must come from body reserves. In this case, for cows raised in Cisarua and Tanjungsari they require an average of 2 MJ and 15.4 MJ, which would be equivalent to 0.05 kg and 0.38 kg of body fat (assuming the energy value of body fat is 39.7 MJ/kg, ARC, 1980). The proportion of cows in Cisarua that lost their weight during the first three months postpartum was smaller (46%) compared to that in Tanjungsari

Table 2. Milk yield, dry matter intake (DMI), concentrate offered, the ratio of concentrate: forage intake, concentrate: milk ratio, metabolisable energy and its component, the percentage of cows loosing and gain weight in different period of lactation of Holstein cows raised in Cisarua

	Months after calving			
	1 - 3	4 - 6	7 - 9	10 - 11
Milk yield (kg/d)	15.6 ± 4.33	12.8 ± 3.00	10.0 ± 2.21	8.6 ± 2.32
DMI (kg/d)	12.6 ± 1.70	12.4 ± 1.67	11.8 ± 1.84	10.9± 1.63
Forage (kg/d)	5.6 ± 1.1	5.3 ± 0.9	5.1 ± 0.9	4.9 ± 0.6
Concentrate (kg/d)	7.9 ± 1.63	7.9 ± 1.61	7.5 ± 1.78	6.2 ± 1.48
Concentrate: forage	1.0 ± 0.29	1.0 ± 0.29	1.0 ± 0.27	0.9 ± 0.29
Concentrate/ milk	0.5 (0.13)	0.6 ± 0.13	0.8 ± 0.24	0.8 ± 0.27
Metabolisable energy (MJ/d):				
Feed intake	110 ± 22.1	108 ± 15.5	103 ± 17.2	101 ± 17.3
Maintenance	49 ± 5.8	49 ± 5.5	48 ± 6.4	45 ± 5.7
Production	74 ± 11.2	72 ± 11.0	67 ± 12.4	60 ± 10.6
Milk	76 ± 20.9	63 ± 14.7	50 ± 12.4	39 ± 15.7
Live weight change:				
% cows lose weight	46.5	21.6	10.3	-
% cows gain weight	53.5	78.4	89.7	100

Values in bracket are standard deviation. The estimated metabolisable energy (ME) of is 9 MJ/kg with 90 % DM; the estimated forage is 7 MJ/kg with 15 % DM

(77%). It is anticipated that, those that gained weight during the first three months of lactation would have utilised the feed efficiently than those that lost weight (see GARNSWORTHY, 1988). This was true in the present data; the cows in Cisarua required less concentrate per litter of milk produced than those in Tanjungsari. However, as period of lactation extended the feed efficiency was reduced. This is a physiological phenomenon where the partition of nutrient is toward foetus growth not toward milk production.

It can be seen from Table 3 that a higher MEI was associated with a higher milk production and less number of animals that lost their weight during peak lactation.

Although protein content of the concentrates were not different between the two areas, the quality of the protein may be different. In Cisarua, the source of concentrate protein were, fish meal, soybean, coconut and kapok seed meal which are highly undegraded (except soybean) in the rumen thus available to the animal. Furthermore, these sources of protein contain higher proportion of lysin and methionine which considered to be limiting amino acids for lactating dairy cows. The availability of these two amino acids was found to variably increase the content and yield of milk protein, milk production and feed intake (SCHWAB, 1996). Whereas the protein source of concentrate made by cooperative in Tanjungsari was mostly rumen degraded protein which derive from wheat pollard.

MAHYUDDIN *et al.* (1994) found that improved both protein content and ME in the diet could reduce the declining rate of milk yield from 0.05 to 0.03 l/d. Our present study showed that improved ME through better quality of feed protein reduced the declining rate to the same extent (Table 3).

Table 3. Milk yield, rate of decline in milk production, dry matter intake (DMI), the ratio of concentrate: forage, the ratio of concentrate : milk, metabolisable energy and its components and percentage of cows which either lose or gain weight during 1 - 3 months of lactation of dairy Holstein raised in Cisarua and Tanjungsari

	Cisarua	Tanjungsari
Milk yield:		
1 - 3 months (l/d)	15.6 ± 4.33	13.3 ± 4.10
per lactation (l)	3,714	3,384
Rate of decline (l/d)	0.03	0.05
DMI (kg/d)	12.6 ± 1.70	12.2 ± 1.90
Forage intake	5.6 ± 1.1	5.1 ± 1.82
Concentrate:forage	1.0 ± 0.29	1.4
Concentrate:milk	0.5 ± 0.13	0.65 ± 0.18
Metabolisable Energy (MJ)/d:		
Intake	110 ± 15.5	99 ± 13.8
Maintenance	49 ± 5.8	47.5 ± 7.60
Production	74 ± 11.2	50.4 ± 8.85
Milk	76 ± 20.9	65.8 ± 19.62
Live Weight Change:		
% Cows which lose weight	46.5	77.4
% Cows which gain weight	53.5	22.5

Feed efficiency expressed as the conversion of concentrate to milk production was better for animal raised in Cisarua (0.5) than those raised in Tanjungsari (0.65). Moreover lower (1 vs 1.4) ratio of concentrate : forage were used in Cisarua as compared to that in Tanjungsari. Both areas, Cisarua and Tanjungsari have a similar type of forage offerred to the animals which consist of crop residues, elephant grass or tree leaves; the proportion of which depends on what is most available at that time. Assuming that the quality of forage from both areas were similar, the different in the feed efficiency would have been due to the difference in the quality of concentrates. However, there was no difference in the efficiency of conversion of feed metabolisable energy to milk yield in both location as calculated above.

Reproduction performance

In this survey, the highest (66%) conception rate observed was at 60 days, the intermediate (51%) was 90 and the lowest (37%) was 120 and 150 days after calving (Table 4). Data of conception rate and S/C for cows concieved > 150 days after calving should be ignored because it only represents 1.7% to 4.3% of the population.

Table 4. The number of inseminated cows with different stage of lactation and its conception rate

Days after calving	No inseminated	Conception rate*	Service/ Conception (%)
60	26	65.4	1.5
90	52	51.9	1.9
120	23	34.8	2.9
150	5	40.0	2.5
180	3	66.7	1.5
210	2	50.0	2.0
240	2	0	0
270	2	0	0

* Conception rate = 100/service per conception

In dairy management, a conception rate higher than 56% or service per conception (S/C) less than 1.8 is considered desirable because it reflects good fertility of cows and the bulls (semen) and good insemination efficiency. Two service per conception or 50% conception rate is usually acceptable and might be realistic in small holders. Herd with S/C greater than 2.5 have severe reproductive problems. Thus according to this survey, 32% of the population should be culled; 24% of them had low conception rate and 8% had days open more than 150 days (see also Table 5). This culling for reproduction failure is considered too high, the ideal value is less than 10 - 15%.

Table 5. The days open on 61 cows observed in Cisarua

Days open (Day)	Percentage
45	6.7
60	21.3
90	42.6
120	14.7
150	6.5
> 150	8.2

Conception rate which is the number of conception for 100 inseminations (which is the same as pregnancy rate) is influenced by cow fertility, semen fertility, heat detection efficiency and insemination efficiency. It is not the average of each of those factors but the result of their product (multiplication). Thus a problem in one area of reproductive management of a herd may have severe consequences for the pregnancy rate.

Cows fertility may be influenced through direct effects on ovarian function, such as reduced progesteron output by the corpus luteum, or reduced quality of ovum (VILLA- GODOY *et al.*, 1988; LUCY *et al.*, 1991). Metabolic effects of negative energy balance may impose imprinting on developing ovarian follicles (BRITT, 1992), consequently fertility may be reduced for longer period than the negative energy balance. Cows which loose more body condition in early lactation appear to be at risk for delayed ovulation, delayed first insemination and low conception (BUTTLER and SMITH, 1989; FERGUSON *et al.*, 1989; STAPLES *et al.*, 1990). Thus it can be predicted that a higher proportion of cows raised in Sumedang would have a lower conception rate than those raised in Cisarua. This is particularly so if the cows were inseminated at times when ovulatory follicles developed during period of severe negative energy balance.

The high conception rate (66%) in early breedings observed in this study may have been due to ovulating follicles which had developed during a non-streesful dry period; whereas the normal conception rate (50%) may occur with later first service, when developing follicles had developed during positive energy balance (see FERGUSON, 1996). These possibilties however, were not observed in this study.

In West Java, farmers obtain frozen semen from AI center in Lembang, the motile sperm of which is only 40% (P. SITUMORANG, personal comm.). The detection of heat by the farmers is fairly good since each farmer only raise few animals, therefore normally they do not miss the oestrus. However, it is often that the inseminator (cooperative personnel) comes late and miss the heat. This probably the most common constraint in improving reproduction efficiency in Indonesia. This could be solved by synchronising the oestrus of the cows, so that the inseminator may do the job efficiently. Nevertheless, the price of estrous stimulating-hormone is still high and the farmers are reluctant to use it.

Days open which is the period of time elapsing between parturition and subsequent conception is important for estimating breeding values and sires for establishing a breeding policy postpartum. In the present study, approximately 71% and 21% of the cows surveyed (61 cows) had days open of less than 90 days and of 120 - 150 days respectively, thus giving a projected calving interval of 12 months and 13 - 14 months respectively.

There were only 8% of the cows had days open of > 150 days; if these cows had a record of three consecutive and unseccessful service, then they should be culled (see WATTIAUX, 1995). The number of days open depends on factors such as the return of ovarian functions after calving which is influenced by problems at or around calving, the efficiency of estrous detection and the decision of the farmer to maintain a minimum resting period before breeding (WATTIAUX, 1995). Since there were no record on that matters, however it can only be suggested that on average the calving interval of cows raised in Cisarua is low.

The effect of days open on annual milk yield was analysed by BAR-ANAN and SOLLER (1979) who found that the highest annual production for heifers is to have days open 70 - 100 days and that for cows is 30 - 50 days and positively associated with days open in the previous lactation. Furthermore in high yielding herd heifers had the highest productivity when mated earlier than 70 days post partum, while in moderate yielding herd were most productive when mated as early as possible. Therefore, it may be suggested that for cows raised in West Java early mating after postpartum will result in improved milk production.

CONCLUSION AND RECOMMENDATION

Milk production of Holstein-Friesian cows raised in West Java is approximately 3,400 - 3,700 l/ lactation which is lower than the average standard value of Holstein's. The efficiency of conversion of ME to milk was low (0.12 l/MJ), suspected to be due to unbalance nutrient. Cows in this area may suffer from climatic and metabolic stress (caused by deficiency in basal diet). Providing the animal with critical nutrient that deficient in basal diet and balancing the availability of nutrient closer to requirement may improve both milk production and reproduction performance.

Although most cows observed have low (12 - 14 months) projected calving interval, there was a high reproduction failure (32%) caused by low conception rate (< 50%) and long (> 150 day) days open. Factors contributing to the high reproduction failure should be studied with more detail.

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