

TRUE REPRODUCTIVE AND RELATED DISORDERS IN DAIRY FARMS OF DIFFERENT BIOSECURITY LEVEL

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Abstract

Incidence of the most significant true reproductive and related disorders in six dairy farms with total of 766 cows (farm 1 – 107; farm 2 – 175; farm 3 – 49; farm 4 – 400; farm 5 – 20 and farm 6 – 11 milking cows) with different system of rearing and different biosecurity level were analysed in this paper. Reproductive efficiency in dairy cows is a key factor for milk producers, and numerous studies have identified impaired reproductive performance as a major cause of reduced production efficiency in the dairy industry.

Biosecurity level and information regarding reproductive disorders were collected by questionnaire (Hristov and Stanković, 2009), and analysed and compared by method of multidimensional criteria of total discriminating effect.

Two of farms (farms 1 and 2) were assessed as very good with marks 4.00 and 4.10, two of them (farms 3 and 4) as good with marks 3.19 and 3.48, and another two (farms 5 and 6) as insufficient with marks 1.91 and 1.97, respectively. According total discriminating effect in respect to the biosecurity level lowest ranked farm (farm 6), farms 1, 2, 3, 4, 5 and 6 were ranked as 2nd, 1st, 3rd, 4th, 5th and 6th, respectively, but in respect to reproductive disorders occurrence rate lowest ranked farm (farm 4), farms 1, 2, 3, 4, 5 and 6 were ranked as 1st, 4th, 2nd, 6th, 5th and 3rd, respectively.

Partial discrepancy between estimated biosecurity level and reproductive parameters of the farms derives from the fact that reproduction data were collected for entire year, while achieved biosecurity level, although resulting from the prior efforts and work done, describes obtained level of biosecurity in on particular moment of time and do not cover all potential causes of reproductive disorders. Assessed biosecurity level provides important information about herd health, and therefore potential reproduction problems.

Keywords: *biosecurity, dairy, disorder, farm, reproduction*

Introduction

Reproductive efficiency in dairy cows is a key factor for milk producers, and numerous studies have identified impaired reproductive performance as a major cause of reduced production efficiency in the dairy industry.

Proper animal health care considers not only the veterinary and zootechnical, but also the microbiological and epidemiological aspects, managerial and economic relevance, and furthermore product and production process quality assurance related features. As an ultimate outcome of such approach, veterinary herd health and production management programmes may be designed, as well as biosecurity plans, and/or quality risk control programmes (Lievaart *et al.*, 2005; Noordhuizen and Jorritsma, 2005).

Pre-harvest food safety is the complex of measures that needs to be taken at farm level (farm supply and on-farm procedures) that aim at preventing and/or minimizing the amount of food-borne health risks to humans carried into the food chain via animals and animal products (Blaha, 2005).

According to Anon. (2009), reproductive disorders reflect prolonged or short-term poor welfare, such as lack of oestrus, embryonic loss or early abortion due to stress experienced for longer or shorter time periods around parturition and in early lactation, or related to the poor welfare directly, particularly dystocia and genital infections associated with pain or inflammatory reactions. Good hygiene is essential at calving to reduce risk of genital infections.

The fertility of dairy cows is multi-factorial, and many factors influence the reproductive performance. Such factors include management regime (Bielfeldt *et al.*, 2006), environment (Windig *et al.*, 2005), genetics (Roxstrom, 2001), nutrition (Butler, 2000), and biological and health status (Fourichon *et al.*, 2000). The heat detection rate or heat detection efficiency (HDE) is crucial when wanting to impregnate cows. If few cows in heat are detected, few cows will subsequently be inseminated and few cows will become pregnant. Herds with good HDE can achieve better results according to many reproductive performance indicators (Mayne *et al.*, 2002).

Similar to the situation with mastitis, reports of the relationships between health status, expressed through condition scoring (CS) and calving-related problems are equivocal. Markusfeld *et al.* (1997) reported that poor body condition is associated with a risk of retained placenta and uterine infection after calving while Berry *et al.* (2007) could find no relationship between body condition and dystocia or still births. Cows in low body condition have poorer reproductive performance even when data was adjusted to account for differences in yield (Pryce *et al.*, 2001). Failure to get in calf, especially where the farming system has a high level of reliance on seasonal pasture growth, is a major cause of culling in New Zealand dairy systems (Xu and Burton, 2000) hence survival characteristics and longevity are negative correlated to CS. However, the full extent to which this attribute of longevity is a valid indicator of welfare, particularly where shortened life is based upon a management decision to cull, is subject for debate. Moderate body condition at calving for mature cows and some over it for first and second calvers is advised because cows calving at less than moderate will produce less milk and are more likely to have reproductive problems (Macdonald and Roche, 2004).

Material and method

Incidence of the most significant reproductive disorders in six dairy farms with total of 766 cows (farm 1 – 107; farm 2 – 175; farm 3 – 49; farm 4 – 400; farm 5 – 20 and farm 6 – 11 milking cows) with different system of rearing and different biosecurity level were analysed.

Biosecurity level and information regarding reproductive disorders were collected by questionnaire (Hristov and Stanković, 2009). Biosecurity indicators related to isolation of the farm (position and isolation level, introduction of newly acquired animals into the herd, traffic control, attitude towards visitors, feeding and watering control, manure management, attitude towards other animals, rodents and birds' control, sanitation) were considered and evaluated. In order to evaluate relevant biosecurity indicators, grades were defined: 5 - excellent, 4 - very good, 3 - good, 2 - sufficient, 1 - insufficient, there are resources for improvement 0 - insufficient, with no resources for improvement, and rating scale: 0-1,99 as insufficient, 2,00-2,49 sufficient, 2,5-3,49 good, 3,5 – 4,49 very good and 4,5 – 5,00 excellent, were defined. SWOT analysis (Strength, Weakness, Opportunity and Treat) was performed afterwards, completing data of possibilities of dairy farms isolation as biosecurity aspect of production.

The obtained data were analysed and compared by method of multidimensional criteria of total discriminating effect.

Results and discussion

In table 1 is presented biosecurity level assessment of six dairy farms. Two of farms (farms 1 and 2) were assessed as very good with marks 4.00 and 4.10, two of them (farms 3 and 4) as good with marks 3.19 and 3.48, and another two (farms 5 and 6) were assessed as insufficient with marks 1.91 and 1.97, respectively.

Although heard health status was the best assessed indicator of biosecurity level of the farms, from good (farm 6 – 3.40) to excellent (farm 1), many other indicators revealed weaknesses threatening reproduction success on these farms, such as biosecurity organisation on the farm (1.30 and 1.33 respectively both farms 5 and 6), attitude towards equipment (1.33 for both farms 5 and 6), traffic control (1.10 and 1.33 for the same farms) and visitors policy (1.44, 1.83 and 1.42 respectively for farms 4, 5 and 6).

Table 1. Dairy farms biosecurity level assessment

	farm 1	farm 2	farm 3	farm 4	farm 5	farm 6
System of rearing	<i>loose</i>	<i>loose</i>	<i>loose</i>	<i>loose</i>	<i>loose</i>	<i>tied</i>
1. Biosecurity organisation on the farm	4.67	4.33	4.00	3.22	1.30	1.33
2. Isolation	5.00	4.40	3.25	3.60	1.83	2.20
3. Quarantine	5.00	5.00	5.00	4.71	2.14	1.33
4. Herd health status	4.80	4.70	4.20	3.60	3.90	3.40
5. Attitude towards equipment	5.00	3.67	3.33	5.00	1.33	1.33
6. Traffic control	4.10	3.40	2.40	2.1	1.10	1.33
7. Visitors policy	2.29	2.71	2.43	1.44	1.83	1.42
8. Feeding and watering	4.71	5.00	3.33	4.14	3.57	2.43
9. Manure management	5.00	5.00	3.50	5.00	3.33	3.33
10. Dead animals disposal	5.00	2.67	2.00	2.50	2.33	2.00
11. Attitude to other animals on the farm	3.67	3.00	2.33	3.33	1.67	1.33
12. Pest control	3.17	5.00	3.25	3.33	2.33	2.67
13. Sanitation	4.53	4.38	2.40	3.28	1.77	1.53
<i>Average grade*</i>	4.00	4.10	3.19	3.48	1.91	1.97
<i>total discriminating effect</i>	22.421	22.451	17.338	16.583	16.164	5.680
<i>rank</i>	II	I	III	IV	V	VI

* $F=29.909^{**}$, $S_d=0.3522$

The farms were ranked by method of multidimensional criteria of total discriminating effect as sum of the discriminating effects in respect to the biosecurity level lowest ranked farm (farm 6), farms 1, 2, 3, 4, 5 and 6 were ranked as 2nd, 1st, 3rd, 4th, 5th and 6th, respectively. The first ranked (farm 1 and 2) are those with highest value of total discriminating effect (22.451 and 22.421, respectively), and the last was farm 5 with total discriminating effect of 5.680, revealing extreme heterogeneity of obtained results.

According obtained data, biosecurity status of the farm could partly indicate reproductive status of the farm, due to indicators related to cows health and other issues that could be closely related to the reproduction on the farm, such as isolation of the farm in respect of pathogen introduction, quarantine of the newly acquired animals, attitude towards working equipment, traffic control and visitors policy, and of course, efficacy of sanitation protocols on the farm. These indicators revealed obvious vulnerability of reproduction success, threatening dairy production on the farm.

Occurrences of reproductive disorders are presented in table 2. According total discriminating effect in respect to the reproductive disorders occurrence rate lowest ranked farm (farm 4), farms 1, 2, 3, 4, 5 and 6 were ranked as 1st, 4th, 2nd, 6th, 5th and 3rd, respectively.

Rather high rates of certain reproductive disorders were noticed on farm 5, especially placenta retention, metritis and finally mastitis (17.39, 13.70 and 13.04, respectively), which was moderate high on farm 6 (8.33).

Partial discrepancy between estimated biosecurity level and reproductive parameters of the farms derives from the fact that reproduction data were collected for entire year, while reached biosecurity level, although resulting from the previous efforts and work done, describes obtained level of biosecurity in on particular moment of time and do not cover all potential causes of reproductive disorders.

Table 2. Reproductive indicators

Observation (in the last 12 months)	farm 1	farm 2	farm 3	farm 4	farm 5	farm 6
System of rearing	<i>Loose</i>	<i>loose</i>	<i>loose</i>	<i>loose</i>	<i>loose</i>	<i>tied</i>
	<i>n</i>					
1. Total herd size	280	400	102	750	23	12
2. Milking sows	107	175	49	400	20	11
	<i>%</i>					
3. Calves lost	0.5	2	2	5	3	2
4. Cows lost	0	0.25	0.98	2	8.70	0
5. Mastitis	2.89	4.25	1.96	4	13.04	8.33
6. Puerperal paresis	1.76	1.75	0	0	8.70	0
7. Retention of placenta	3.57	4.25	0	2	17.39	0
8. Metritis	0	4.25	0	6.93	13.70	0
9. Heath detection and insemination	100	90	85	95	90	80
10. Conception rate	50	50	70	50	30	30
11. Dystokia	0.71	2.25	0	1.33	0	0
<i>total discriminating effect</i>	<i>22.4513</i>	<i>16.58309</i>	<i>22.42150</i>	<i>16.16071</i>	<i>5.68021</i>	<i>17.38789</i>
<i>rank</i>	<i>I</i>	<i>IV</i>	<i>II</i>	<i>VI</i>	<i>V</i>	<i>III</i>

Disease risk identification and disease risk management as primary preventive issues are pivotal in modern animal health care on both the small and larger dairy farms. Biosecurity and quality risk management can both be integrated into current operational veterinary herd health and production management programs (Noordhuizen and Da Silva, 2009), particularly in monitoring and protocols of reproduction, such as insemination, calving and postpartal regimes on farms.

Proper animal health care takes into consideration not only the veterinary and zootechnical issues, but also the microbiological and epidemiological disease aspects, managerial and economic relevance, and furthermore product and production process quality assurance related features. As an ultimate outcome of such exercises, veterinary herd health and production management programmes may be designed, as well as biosecurity plans, and/or quality risk control programmes (Noordhuizen, 2003; Lievaart *et al.*, 2005).

Herd managing staff that perform inseminations themselves instead of using specialized technicians risk reduced herd reproductive performance. Some researchers (Morton, 2000; O'Farrell and Crilly, 2001; McCoy *et al.*, 2006) have proposed that unqualified inseminators contribute to poorer reproductive performance (Buckley *et al.*, 2003). Poorer performance could be caused by worse insemination technique, possibly due to lack of training.

Free-stall herds have displayed better reproductive efficiency (Valde *et al.*, 1997), and studies have demonstrated that the interval between calving and first ovulation and oestrus is shorter in free-stall than tie-stall herds, enabling earlier insemination in free-stall herds (Petersson *et al.*, 2006). When examining the effects of automatic milking on fertility, Kruij *et al.* (2002) found that automatic milking increases the number of days to first service. Fahey

et al. (2002) reported lower calving rates in larger herds, whereas Simensen *et al.* (2010) found that larger herds had better fertility.

Lame cows have been reported to have poorer reproductive performance. Sprecher *et al.* (1997) found that cows with high lameness scores had longer intervals from calving to first service and to conception and also required more services per pregnancy. In addition, Hultgren *et al.* (2004) found that the first-service conception risk was lower for cows with sole ulcer. Garbarino *et al.* (2004) found that cows classified as lame had 3.5 times greater odds of delayed cyclicity than did cows classified as non-lame.

Cows with reproductive-related diseases have been associated with impaired reproductive performance (LeBlanc *et al.*, 2002; Dubuc *et al.*, 2011). Oltenacu *et al.* (1990) found that cystic ovarian disease and silent heat syndrome each increased the days open interval by 40 days. They also found that metritis prolonged the interval by 20 days and retained placenta by seven days. Dematawewa and Berger (1997) found that cows with dystocia had more days open and needed more services to become pregnant. Cows calving twins are at greater risk of reproductive disorders, including retained placenta, dystocia, and metritis, which increase average days open and services per conception following the subsequent lactation (Nielen *et al.*, 1989). Peake *et al.* (2011) found prolongation of the interval from calving to onset of the first luteal phase for cows with one or more of three production stressors: lameness, subclinical mastitis, and body condition score loss. However, no significant associations were found between disease events and overall reproductive performance.

According Löff (2012), breed is a factor that should be considered in impaired reproductive performance analyze. Herds of predominantly black and white cows risk poorer reproductive performance and should therefore be closely monitored to obtain higher reproductive performance. Herds with managers who are unqualified inseminators may risk poor reproductive efficiency; consequently, these herds should be closely monitored and herdsmen could be offered refresher courses to eliminate negative factors causing suboptimal conception rates. Heat detection should be addressed by herd advisory services and resources and allocated to herds with low heat detection efficiency. Healthy cows have better reproductive performance, which emphasizes that one should strive to prevent diseases to maintain high reproductive performance. In tie-stall herds should be payed greater attention to the reproductive performance in order to improve the reproductive efficiency. The milk fat/protein ratio could be a good candidate indicator to use in identifying cows at risk of poor fertility, and to determine where preventive measures should be taken.

Risk conditions can be identified through monitoring plans, their impact assessed by adaptive conjoint analysis procedures involving experts (Horst *et al.*, 1996) or quantified by epidemiological studies yielding odds ratios or relative risks (Noordhuizen *et al.*, 2001). Risk conditions can be found at the animal/herd level (e.g. parity; milk yield; breed; lactation stage), the level of cows' environment and management (e.g. barn climate; housing conditions; feed quality), and farm information (milk recording; feedstuff analysis).

Biosecurity plans refer to health management strategies and comprise key components like formal disease risk identification and risk assessment on a particular farm. These plans make proper use of the issues addressed in forenamed paragraphs and convert these into a set of so-called working instructions or protocols (Noordhuizen and da Silva, 2009). For example, a Protocol on General Hygiene procedures, a Protocol on Entrance Procedures for animals, cars, professionals, cattle, a Protocol on Disease diagnostics and Animal treatment, or a Protocol on Good Medicine Application Practice. Therefore, biosecurity builds on further on a general good farming practice attitude.

Conclusions

Taking into account all presented data concerning assessed biosecurity level of six observed dairy farms, it could be concluded:

- according total discriminating effect in respect to the biosecurity level lowest ranked farm (farm 6), farms 1, 2, 3, 4, 5 and 6 were ranked as 2nd, 1st, 3rd, 4th, 5th and 6th, respectively, but in respect to the true reproductive and related disorders occurrence rate lowest ranked farm (farm 4), farms 1, 2, 3, 4, 5 and 6 were ranked as 1st, 4th, 2nd, 6th, 5th and 3rd, respectively;
- partial discrepancy between estimated biosecurity level and reproductive parameters of the farms derives from the fact that reproduction data were collected for entire year, while reached biosecurity level, although consequently from the previous efforts and work done, describes obtained level of biosecurity in on particular moment of time and do not cover all potential causes of reproductive disorders;
- nevertheless, assessed biosecurity level provides important information about herd health, and therefore potential reproduction problems.

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