

Original paper

REPRODUCTIVE AND RELATED DISORDERS ON DAIRY FARMS WITH DIFFERENT LEVELS OF WELFARE QUALITY*Stanković B.*¹, Zlatanović Z.², Hristov S.¹, Maksimović N.³, Božić A.⁴*¹University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080, Belgrade – Zemun, Serbia²High Agriculture and Food College, Ćirila i Metodija 1, Prokuplje, 18400, Serbia³Institute for Animal Husbandry, Autoput 16, 11080, Belgrade – Zemun, Serbia⁴University of Novi Sad - Faculty of Agriculture, trg D. Obradovića, 11080, Novi Sad, Serbia*Corresponding author: baxton@agrif.bg.ac.rs**Abstract**

In this paper reproductive results of six dairy cows farms with total of 766 (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 welfare level were analyzed. A dairy cow reproductive efficiency is a key factor for milk production - impaired reproductive performance is a major cause of reduced production in dairy industry.

Welfare and reproductive disorders data were collected by questionnaire regarding criteria of Animal Need Index (ANI – Bartussek et al., 2000) and compared by multidimensional criteria of total discriminating effect. Possibility of movement, lighting and air quality in the accommodation facility, type and quality of floor, possibility of social contacts with other cows and interaction of stockman with cattle were compared and analysed in respect of farm welfare. In respect to the welfare level of lowest ranked farm (farm 6), farms 1, 2, 3, 4, 5 and 6 were ranked as 4th, 2nd, 1st, 5th, 3rd, and 6th, respectively, but in respect to the 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. Discrepancy derives from the fact that reproduction data were collected for a year, while welfare assessment describes reached level in on particular moment of time, not covering all potential causes of reproductive disorders.

Reduced reproductive success would seem promising as information about poor farm welfare, although good results often are not related to good welfare. Nevertheless, assessed welfare protection level provides important information about herd health and potential reproduction problems, pointing out that there are many opportunities for improving the quality of the welfare of dairy cows, mostly through improving the housing conditions of dairy cows.

Key words: *dairy cow, farm, reproductive disorder, welfare*

Introduction

There are three types of concern about animal welfare that prevalence: those involving the biological functioning of the animal, those involving the animals “feeling”, and those that

involve the ability of the animal to live a “natural” life (Fraser, 2003). People concerned with the biological functioning of the animal (most often veterinarians and farmers) generally focus on disease, injury, poor growth rates, and reproductive problems. There is little disagreement about whether such problems are of welfare concern, and much research in animal welfare has focused on these issues (Rushen et al., 2008).

Reproductive efficiency in dairy cows is essential in dairy milk production, and many studies have identified impaired reproductive performance as a major cause of diminished production efficiency in the dairy industry. Reduced reproductive success would seem promising in providing information about poor welfare. There is much evidence that animals in poor condition (e.g. those that are ill or suffering from chronic stress) are less likely to reproduce successfully. Critics of animal agriculture often argue that the low reproductive rate of dairy cattle is an indicator of poor welfare. However, as we argue later, while poor welfare may indeed lead to lower reproductive success, it does not follow that high reproductive success indicates a lack of welfare problems (Rushen et al., 2008).

According to EFSA (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. The aim of this paper was to establish the relationship between the most significant reproductive disorders and welfare level on the farm.

Materials and methods

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 dairy cows) with different system of rearing and different welfare level were analyzed.

Welfare quality level and information regarding reproductive disorders in the last 12 months were collected regarding criteria of Animal Need Index (ANI – Bartussek et al., 2000). The ANI method includes the most important five animal welfare categories: 1. possibility of movement, 2. lighting and air quality in the accommodation facility, 3. type and quality of floor, 4. possibility of social contacts with other cows and 5. interaction of stockman with cattle.

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

Results and discussion

As it could be seen in Table 1, in respect of possibility of movement, the best marked was farm 3 (9 points), then farms 1 and 2 (5 points), farms 4 and 5 (4.5 points), and finally, farm 6 (2.5 points). In respect of type and quality of floor, the best assessed farms were farm 3 (6 points), and farms 1, 2 and 4 (4.5 points). Farm 5 gained 3 and farm 6 2.5 points. Considering lighting and air quality in the accommodation facility, the best marked farm was farm 1 again (7 points), then farm 2 (5.5 points), farms 4 and 5 followed with 5 points, farm 1 had 4.5 points and farm 6 had 2.5 points. Chances for possibility of social contacts with other cows

were the best on farm 3 (5 points), than on farm 5 (3.5 points), 3 points on farm 2, 2.5 points on farm 1, and finally, 1.5 points on farm 6. Interaction of stockman with cattle was the best on farm 5 (8 points), then farms 2 and 6 (7.5 points), and on farms 3, 1 and 4 marks were 7, 6 and 5.5, respectively. Welfare rank of these farms was assessed and farms were ranked, as it is given in Table 2.

Table 1. Score ANI points (minimum -9.5, maximum 45 points)

Parameter	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>
Possibility of movement	5	5	9	4.5	4.5	2.5
Type and quality of floor	4.5	4.5	6	4.5	3	2.5
Lighting and air quality in the accommodation facility	4.5	5.5	7	5	5	2.5
Possibility of social contacts with other cows	2.5	3	5	2	3.5	1.5
Interaction of stockman with cattle	6	7.5	7	5.5	8	7.5
Score ANI points	22.5	25.5	34	21.5	24	16.5
<i>total discriminating effect</i>	7.116	10.568	17.871	6.039	9.345	2.257
<i>rank</i>	IV	II	I	V	III	VI

Table 2. Farm ranking according to ANI-welfare categories (Bartussek, 2000)

Sum of ANI points	Names of categories of housing conditions with respect to welfare	Verbal school grades	Farm	Farm score ANI points	Rank
< 11	Not suitable	Insufficient	-	-	-
11-16	Scarcely suitable	Sufficient	-	-	-
16.5-21	Little suitable (mediocre)	Satisfactory	Farm 6	16.5	VI
21.5 -24	Fairly suitable	Good	Farm 5,	24	III
			Farm 1	22.5	IV
			Farm 4	21.5	V
24.5-28	Suitable	Very good	Farm 2	25.5	II
> 28	Very suitable	Excellent	Farm 3	34	I

Occurrence of reproductive disorders is presented in Table 3. According to 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%).

Comparison of the results given in all three tables points out that, according total discriminating effect in respect to the welfare protection level of lowest ranked farm (farm 6), farms 1, 2, 3, 4, 5 and 6 were ranked as 4th, 2nd, 1st, 5th, 3rd, 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, with rather low coefficient of correlation ($r = 0.218$).

Table 3. *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 cows	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. Heat 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>	22.4513	16.58309	22.42150	16.16071	5.68021	17.38789
<i>rank</i>	<i>I</i>	<i>IV</i>	<i>II</i>	<i>VI</i>	<i>V</i>	<i>III</i>

The dairy cows fertility is influenced by many factors. These factors include management regime, environment, genetics, nutrition, and biological and health status. 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 calved cows 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).

Although there was rather low coefficient of correlation and discrepancy between estimated ranks of reached welfare level and reproductive parameters of the observed farms obvious,

there is much evidence that animals in poor condition (e.g. those that are ill or suffering from chronic stress) are less likely to reproduce successfully. Established discrepancy derived from the fact that reproduction data were collected for entire year, while reached welfare protection level, although consequently from the previous efforts and work done, describes obtained level of welfare in on particular moment of time and do not cover all potential causes of reproductive disorders. Critics of animal agriculture often argue that the low reproductive rate of dairy cattle is an indicator of poor welfare. However, while poor welfare may indeed lead to lower reproductive success, it does not follow that high reproductive success indicates a lack of welfare problems (Rushen et al., 2008).

Reproductive disorders risk identification and reproductive disorders risk management, as primary preventive issues are pivotal in modern animal health care in all size types dairy farms. Welfare protection 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. Cows with reproductive-related diseases have been associated with impaired reproductive performance (Dubuc et al., 2011). Oltenacu et al. (1990) found that cystic ovarian disease and silent heat syndrome each increased the day open interval by 40 days. They also found that metritis prolonged the interval by 20 days and retained placenta by seven days. 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.

The most common reproductive disease in dairy cattle is metritis, an inflammation of the uterine wall caused by bacterial infection and usually diagnosed by elevated body temperature, vaginal discharge, and a large, flaccid uterus. The latter is usually determined by rectal palpation, although it appears to be a poorer diagnostic tool than examining vaginal discharge directly (Le Blanc et al., 2002).

Herd managing staff that performs inseminations themselves instead of using specialized technicians risk reduced herd reproductive performance (Buckley et al., 2003), 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 (Pettersson et al., 2006). When examining the effects of automatic milking on fertility, Kruip 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.

Calving difficulty (dystocia) is another common disorder with clear implications for animal welfare. Calving difficulties can be a leading cause of calf death. Among dairy cattle, dystocia is a major cause of stillbirths (Meyer et al., 2001). The welfare of surviving calves is also affected: calves that needed assistance during delivery developed enteritis at an earlier age

than calves that did not need such assistance (Sivula et al., 1996). Dairy herds with a high incidence of dystocia also tend to have a higher incidence of health problems in calves (Sanderson and Dargatz, 2000). Calving difficulties appear to have less of an impact on the cow than on the calf; although dystocia can cause reproductive problems in the cows, this appears to have only moderate effects on milk production or feed intake (Bareille et al., 2003). However, dystocia is associated with increased incidence of metritis and retained placenta (Gröhn et al., 2003), as it increases trauma to the uterine wall and increases the susceptibility to disease by increasing the risk of harmful bacteria entering the reproductive tract (Bruun et al., 2002) and it increases the likelihood that the cow will be culled (Rogers et al., 2004). One barrier to research in this area is of measuring calving difficulty. However, farms likely vary greatly in when they feel that some assistance is needed and measures of calving assistance may reflect the farmer's attitudes rather than anything else (Nix et al., 1998).

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.

Many forms of illness, such as calving difficulties, lameness, and metritis can lead to reproductive failure, and so measures of reproductive success may be indirect measures of these health problems. Furthermore, considerable research on a number of mammalian species has also shown the depressive effects of stress on reproductive capacity of both males and females and has described the physiological mechanisms underlying these effects. Such suppressive effects of stress have been found in cattle (Dobson and Smith, 2000) and a number of studies show that stressors reduce reproductive efficiency in cows.

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 (parity; milk yield; breed; lactation stage), the level of cows environment and management (barn climate; housing conditions; feed quality), and collected data (milk recording; feedstuff analysis).

Welfare protection plans refer to health management strategies and comprise key components like disease or injury risk identification. Good hygiene is crucial at calving to reduce risk of genital infections (EFSA, 2009). Proper use of the issues goes through a set of so-called working instructions or protocols (Noordhuizen and da Silva, 2009). Therefore, dairy cows welfare 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 the following can be concluded:

- according to total discriminating effect in respect to the welfare protection level of lowest ranked farm (farm 6), farms 1, 2, 3, 4, 5 and 6 were ranked as 4th, 2nd, 1st, 5th, 3rd, 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;

- although there was rather low coefficient of correlation and discrepancy between estimated ranks of reached welfare level and reproductive parameters of the observed farms obvious, there is much evidence that animals in poor condition are less likely to reproduce successfully. However, it should be bear in mind that reduced reproductive success would seem promising in providing information about poor welfare, although good reproductive results often do not stand related to high welfare of the farm, making this relationship more indirect;
- nevertheless, assessed welfare protection level provides important information about herd health, and potential reproduction problems;
- there are many opportunities for improving the quality of the welfare of dairy cows, mostly through improving the housing conditions of dairy cows in terms of providing adequate space, comfort and hygiene.

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