Effect of some selected operations connected with machine milking on the quality of milk raw material

M. Lipinski, Z. Liszton-Gala & Z. Gala

Institute of Agricultural Engineering,
Agricultural University of Poznan, Poland

Introduction

It is essential for Poland, in her attempts to become a full member of the European Union, to take appropriate steps to be well prepared for sanitary requirements in force in this organisation. This also refers to dairy industry whose raw material varies widely with regard to its hygiene quality. Farmers, who are the main suppliers of milk raw material, have a special role to play in ensuring its appropriate hygiene quality.

Good conditions existing on the marketplace for dairy products affect the profitability of milk production in agricultural farms and decisions taken by farmers associated with their long-term planning of the size of dairy cattle herds as well as the improvement of technical conditions for dairy rearing and milk production. Opinions on milk quality tend to alter with the development of milk processing and our knowledge in the field of nutrition (Nowakowski 1996).

The maintenance of high quality in the chain of milk production, storage, transport, processing and distribution is the major prerequisite to be fulfilled in the course of manufacturing of the highest quality milk articles. These are the requirements of modern dairy processing markets and markets of dairy products distribution. Low milk shelf life as a raw material and potential changes affected by various factors make it necessary to maintain particular caution during milking, transport and processing.

Research

The objective of the investigations was the assessment of milk quality collected from individual farmers to be used by dairy industry. The experiments were carried out in the former Sieradz Voivodeship in the area covered by the activities of Wielun Dairy Cooperative. The study was supported by the PHARE fund secured in the result of an earlier decision of the EU Commission, which decided to support transformations taking place in Poland and Hungary with a special non-repayable assistance fund. The investigations comprised 76 farms specialising in milk production in which the assessment of technical condition of milking equipment and milk quality was conducted.

The evaluation of the technical equipment included:

- Measurements of the negative pressure;
- Errors in vacuometer readings;
- Pump output;
- Perviousness of pipes and valves;
- Valve leakage;
- Air consumption by milking machines;
- Stress of teat rubbers;
- Tests of pulsators;
- Evaluation of washing and disinfection of equipment;
- Quality of milk cooling.

A very simple point test was applied to evaluate the work quality of milking machines. The test consisted of eight characteristic features from the field of milking machines understood by all milk producers. One point was awarded for each positive result, i.e. whenever the machine met the appropriate ISO or factory standard. No point was awarded when the assessment was negative. The following parameters were assessed:

- Negative pressure;
- Vacuometer error;
- Pump output;
- Pipe leakage;
- Output reserve,
- Difference in negative pressure;
- Valve leakage;
- Air consumption by all milking machines.

Total of 8 points.

It is evident from the performed investigations (Table 1) that out of the examined 76 farms, only 50 reached the maximum number of points. The lowest score of 3 points occurred only in one farm.

Table 1. Point score of some selected parameters of milking machine.

No	Number of farms	Score
1	30	8
2	15	7
3	5	6
4	2	5
5	3	4
6	1	3

Milk hygiene quality was estimated after collecting milk samples of 250-300 ml at the purchase point, which were then delivered, to the Dairy Cooperative laboratory in containers cooled by ice. The following quality parameters were determined:

- Total number of micro organisms;
- Coliform count;
- Whiteside test;
- Milk acidity;
- Milk density.

The performed investigations showed that:
- none of the examined farms fulfilled standards of milk raw material required for milk extra class;
- 12 % of milk producers delivered milk whose quality allowed its classification to class I;
- 24% of milk producers delivered milk classified as class II;
- 64% of milk producers delivered milk classified as class III.

The most frequent source of contamination of raw milk with bacteria was poorly washed and disinfected equipment for machine milking. Approximately 90% of bacteria in raw milk derived from milking equipment and only 10% from other sources such as mastitis or airborne bacteria. In unwashed or poorly washed equipment used for machine-milking, bacteria adjust to such environment and multiply very rapidly between milkings and later quickly contaminate freshly obtained milk.

Therefore, effective washing and disinfection of milking machines is essential if farmers want to maintain the number of bacteria in milk at a low level. In addition, it helps to reduce the danger of transferring microorganisms, which cause udder diseases. The performed investigations showed that the majority of milk suppliers washed and disinfected their milking machines properly and only in 14 dairy farms parts of milking machines were found to have been washed poorly.

The performed investigations also evaluated milking techniques, i.e. such activities as:
- udder training;
- pre-milking;
- hand stripping;
- machine stripping with udder training.

It is well known that udder training causes irritation of nerve ends sensitive to touch. They receive outside stimuli and transmit them to the central nervous system from which signals are sent to the udder stimulating milk secretion. When teat cups are mounted onto non-stimulated teats, then

they are sucked deep into cups. This leads to a premature closure of the outlet of the teat cistern into the teat canal and hence to more milk being left in the udder which may result in mastitis (Winnicki, 1995).

The proper milking begins with pre-milking, which prevents mixing of the milk from teats, and the teat cistern left from the previous milking with milk practically free from micro organisms coming from milk bearing ducts and secretion tissues.

In order to perform mechanical milking dry, it is necessary to load the milking machine with one hand and train the udder with the other. As a rule, if machine stripping is performed quickly and efficiently, hand stripping is not necessary.

The performed investigations showed that;
- udder training was used at 60% of farms;
- pre-milking was used at 40% of farms;
- hand milking dry was used at 36% of farms;
- machine stripping with udder training was used at 39% of farms.

From the point of view of milk technological suitability as a raw material delivered to a dairy plant, its chilling and transport are also very important. According to current purchase standards, milk can be accepted for processing at the dairy plant if its temperature does nor exceed 8 °C. As it is well known, the temperature of milk directly after milking ranges from 25-30 °C. At this temperature, the speed of bacteria multiplication in milk is so rapid that their numbers double every 25 minutes (Janicki, 1996). The most common cooling systems among the examined farms were basin coolers (52% farms), while the remaining 48% of farms used can coolers.

Polish standards [PN 1992] indicate that the final temperature of cooled milk from the evening milking should not exceed 4°C, while that from the morning milking - 10 °C. This difference in the required milk temperature is associated with the time the obtained milk must stay on the farm. In the case of evening milking, this period amounts to approximately 14 hours, while in the case of morning milking – only about 2 hours. According to the above-mentioned standard, the cooling time to the temperature of 10 °C should not be longer than 2 hours. Farms equipped in basin milk coolers fulfilled the requirements of the PN standard, while those, which had only can coolers were capable of cooling their milk to the temperature of 15 °C. Average distance of the examined farms from purchase points was 1.97 km and 43% of the dairy farms delivered their milk to purchase points using their own transport and the remaining producers used services of haulage firms.

Conclusions

1. The technical and hygiene conditions of components of milking machines in the examined farms situated in the area of operation of the Dairy Cooperative in Wielun was found satisfactory.

2. The majority of the examined dairy farms did not carry out treatments associated with pre-milking and hand and mechanical stripping. Only 60% of the examined farms conducted udder training.

3. The milk cooling conditions found on the examined farms as well as its transport to purchase points was evaluated as unsatisfactory.

References

Janicki A. 1996: Jakosc i sklad mleka surowego a wymagania i przydatnosc przetwórcza mleka. FSM Warszawa

Nowakowski S. 1996: Nowa norma oceny mleka surowego w Polsce. Produkcja mleka wysokiej jakosci. FSM Warszawa

Polskie Normy 1992: Instalacja dojarek mechanicznych. Wymagania konstrukcyjne i charakterystyki techniczne. 92 / R – 36603

Winnicki S. 1995: Zapalenie wymienia a wydajnosc i jakosc mleka. Uwarunkowania produkcji mleka wysokiej jakosci. FAPA Kraków