

## **ANALYSIS OF THE INSEMINATION EFFECTIVENESS OF DAIRY CATTLE WITH THE SEMEN FROM SPECIALIZED BULLS BREEDS IN THE CROSS BREEDING SYSTEM**

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**Abstract.** The materials of the study were the results of insemination effectiveness of dairy cattle with the semen from 12 specialized bulls breeds: Belgian Blue, Charolais, Limousine, Simentaler. Inseminations were conducted on Mazowieckie, Warmińsko-Mazurskie and Podlaskie Voivodships of Poland. Data gathered in database involved the breed, genotype of the bull's father and, the inseminator. The influence of three factors on insemination effectiveness was analyzed. Within the Project "The optimisation of beef production in Poland in accordance with a fork-to-farm strategy" 1678 dairy cattles were inseminated out of which 442 were inseminated effectively. Insemination was performed by 24 inseminators. No significant dependence of bull's breed, bull's father genotype or inseminator on effectiveness of conducted inseminations was observed. However the influence of the inseminator's sex on effectiveness of inseminations were observed. Basing on conducted analysis, it was found that there is a need for further detailed studies on other factors which might affect the effectiveness of artificial insemination. The factors that may have an impact on reproductive rate are: individual inseminator's characteristics (education, experience, inseminator's behavioral traits, including scrupulousness and reliability), as well as inseminated of cross calves (age, the last successful insemination, etc.).

**Keywords:** cross breeding, insemination

### **INTRODUCTION**

The changes observed on the beef cattle market suggest that there are currently high chances to increase the headage of the beef cattle in Poland [Grodzki 2000, Grodzki et al. 2009, Przysucha 2009]. These changes have great significance due to the current milk quotas and the fact that small farms, whose alternative could be the production of dual-purpose cattle, currently withdraw from milk production. Milk is still the basic product of herds that apply commercial crossbreeding. At the same time, the quality of dual-purpose calves being born is of considerable importance as it can affect final economic results [Przysucha 2009].

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Commercial crossbreeding of Black and White breed with beef bulls is a breeding method utilizing mainly the effects of indirect inheritance of parental features. Application of the method enables a significant improvement of qualitative and quantitative features of newborn dual-purpose calves.

Taking into account the small population of purebred beef cattle in Poland, it is very likely that commercial crossbreeding will be a main trend in the production of high-quality beef livestock in the upcoming years. Commercial crossbreeding allows considerable improvement of fattening capacity of dual-purpose calves thereby increasing daily body weight gains and better use of pasture [Grodzki 2000, Grodzki and Przysucha 2004, Grodzki et al. 2009, Przysucha 2009, Grodzki and Przysucha 2010].

Another advantage resulting from commercial crossbreeding is considerably higher level of muscle conformation of dual-purpose breeds which, in consequence, leads to increased slaughter value, higher content of valuable components in the carcass and better meat quality [Grodzki et al. 2009]. Farmers' wrong conviction about the low effectiveness of artificial insemination is a factor substantially reducing the scale of commercial crossbreeding on Polish farms, which are mainly oriented at milk production. Thus the opportunity to improve the parturition by the right choice of beef bulls can enhance fattening performance through providing carcasses fulfilling high requirements of processors and consumers. [Piech and Tarkowski 2003, Przysucha 2009]. It will be of significant importance in the future improvement of beef quality on Polish tables and the optimization of the whole production process.

Artificial insemination (A.I.) is a procedure of the deliberate insertion of the semen, collected, examined and selected beforehand, into the female's vagina or oviduct. Following Boryczko et al. [2010], an efficiency of cattle reproduction depends on many factors, the basic being proper nutrition, the early detection of oestrus through the observation of the cow, the choice of the optimal time of insemination and the early diagnosis of pregnancy.

The aim of this paper was to determine if factors such as bull's breed, bull's genotype and chosen features of the inseminator affect the conception rate through artificial insemination.

## MATERIAL AND METHODS

The results of effectiveness rate through A.I. were collected using a questionnaire within two weeks after calving. The study was conducted within the Task 2a of the Project: Optimizing of beef production in Poland according to "from fork to farm strategy" (Optymalizacja produkcji wołowiny w Polsce, zgodnie ze strategią "od widelca do zagrody"). A.I. were carried out in Mazovia, Warmińsko-Mazurskie and Podlaskie Voivodships by 24 inseminators. Semen from 12 bulls of 4 dual-purpose breeds were used in this study: 3 Belgian Blue bulls (Eclat, Endurant, Marauder), 3 Charolais bulls (Sprinter, Indompte, Club), 3 Limousine bulls (Mendel, Saxum, Ulysse), 3 Simentaler bulls (Hugin, Elit, Eugen). Evaluation of the semen quality was carried out by the National Research Institute of Animal Production in Balice in order to eliminate the influence of semen quality on the results of the study. The evaluation confirmed that the semen met all standards

of quality. In the study, Black and White breeds with different proportion of HF genes in genotype were inseminated in two cycles: Cycle I took place from the 1st of October 2009 to the 15th of February 2010; Cycle II – from 15th of April 2010 to 15th of June 2010. Oestrus was detected by careful observation by the farmers. The cows were, on average,  $69 \pm 24.9$  months old. 25 inseminators took part in the study – 20% female and 80% male.

After every finished cycle, the inseminators delivered Artificial Insemination Certificates on the basis of which the data about the cow, the bull, the time of insemination and the potential date of calving were collected.

A total of 1678 Artificial Insemination Certificates were provided by the inseminators. The collected data formed the basis for statistical calculations. In addition, pregnancies were diagnosed in cooperation with veterinarians. 442 cows were confirmed pregnant. Successfully inseminated cows were monitored until the moment of calving. The inseminators filled in the so-called “Cow Calving Form” which included detailed information about the pregnancy, the calving, the survival rate and liveliness of dual-purpose calves.

Statistical analysis with the use of a chi-squared test was carried out in Statistica<sup>®</sup>10 (StatSoft, Inc.) software. In determining significance of differences the accepted significance level equaled  $P \leq 0.05$ .  $P \leq 0.1$  was accepted as close to statistical significance.

## RESULTS AND DISCUSSION

The diagram below presents the influence of the bull's breed on the effectiveness rate of artificial insemination that is the percentage of successful A.I. resulting in pregnancy and calving, and the percentage of unsuccessful A.I. (Fig. 1). The statistical analysis did not prove the influence of the bull's breed on the effectiveness rate through artificial insemination ( $P = 0.64$ ;  $\chi^2$  test). Effectiveness rate through A.I. depending on the bull's breed equaled about 25%. It is worth pointing out that the artificial inseminations were carried out with cows previously unsuccessfully inseminated with the semen of dairy bulls. Other researchers also achieved similar outcomes (29%) in their studies on the influence of chosen factors on the effectiveness rate through A.I. [Anzar et al. 2003].

The effectiveness rate of artificial insemination depending on the bull's genotype was also analyzed (Fig. 2). The performed analysis did not show a significant influence of the bull's genotype on the effectiveness rate of artificial insemination ( $P = 0.92$ ;  $\chi^2$  test). As can be inferred from the above-mentioned data, neither the bull's breed nor genotype did not affect the conception rate in the experiment. Thus, taking into account different values of effectiveness rate of A.I., the influence of the inseminators was analysed.

The inseminator's influence on the effectiveness rate of A.I. is presented in Fig. 3. The performed analysis did not show the relationship between the inseminators and the effectiveness rate of inseminations carried out by them ( $P = 1.00$ ;  $\chi^2$  test). Following the research on effectiveness rate of A.I. conducted in Brazil on three different farms, effectiveness rate of A.I. by different inseminators equaled 12% to 57%. In the presented study, the outcomes of the effectiveness rate of A.I. was within 6% to 53% (Fig. 3). The achievement of a satisfactory value of effectiveness rate of A.I. can be affected by many factors, including

semen motility – for the successful insemination there should be no less than  $10 \times 10^6$  sperm cells moving properly [Morstin 1998, Jaśkowski and Szenfeld 1999], and the right detection of oestrus which can be difficult in case of silent oestruses. Therefore this factor can be significantly affected by the qualifications of people conducting observations and their levels of motivation [Kozdrowski et al. 2005]. In this study, the observations were conducted by farmers and upon perceiving characteristic symptoms – humping and the tolerance to the behavior – the readiness for insemination was stated and the date of A.I. was arranged with the inseminator taking into consideration the time of oestrus.

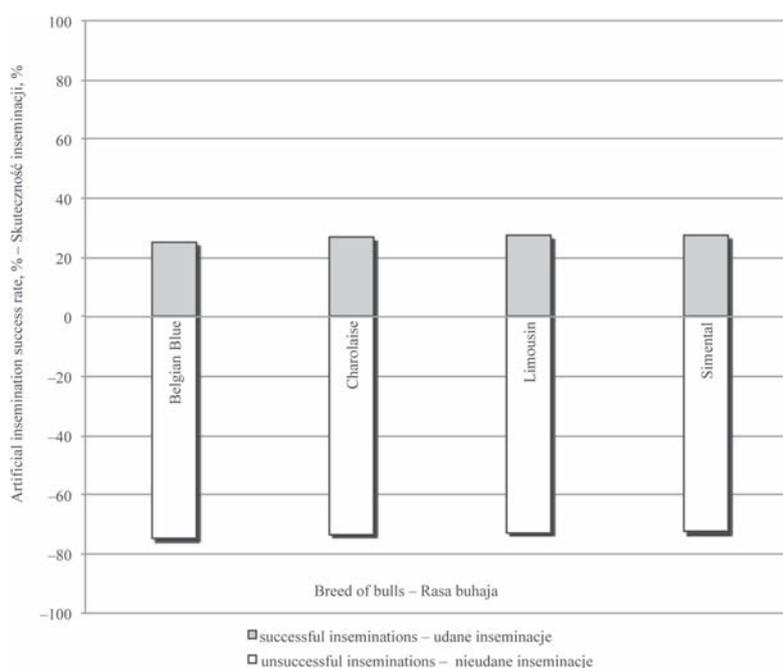


Fig. 1. Successful and unsuccessful insemination share highlighting bull's breed influence  
Rys. 1. Udział udanych i nieudanych inseminacji z uwzględnieniem rasy buhaja

In their study, the authors claimed that effectiveness rate greatly depends on inseminator and his/her experience may be significant factor in the procedure role in the procedure [Russi et al. 2010].

The next diagram presents the influence of the inseminator's sex on the effectiveness rate of the artificial inseminations they carried out (Fig. 4). While male inseminators achieved lower effectiveness rate (25%), female inseminators reached about 34% of successful A.I. The statistical significance of the influence of the inseminator's sex on the effectiveness rate of A.I. was perceived ( $P 0.03$ ;  $\chi^2$  test).

In the context of the conducted study, it is supposed that women may have a set of personal characteristics allowing them to achieve better effectiveness rate of artificial insemination. Such thesis can be supported by the results of the study "Professional role of women

in the civil society”. The study was carried out at the end of November and at the beginning of December 2010 in companies in Zachodniopomorskie Voivodship. As much as 54% of the questioned entrepreneurs agreed that women are more meticulous in their work than men and only 11% of the respondents disagreed [WUP Szczecin 2011]. Such outcomes may be due to the fact that in a household (joint business activity), women, apart from artificial insemination, deal with all the paper work while men work in the field and have more time.

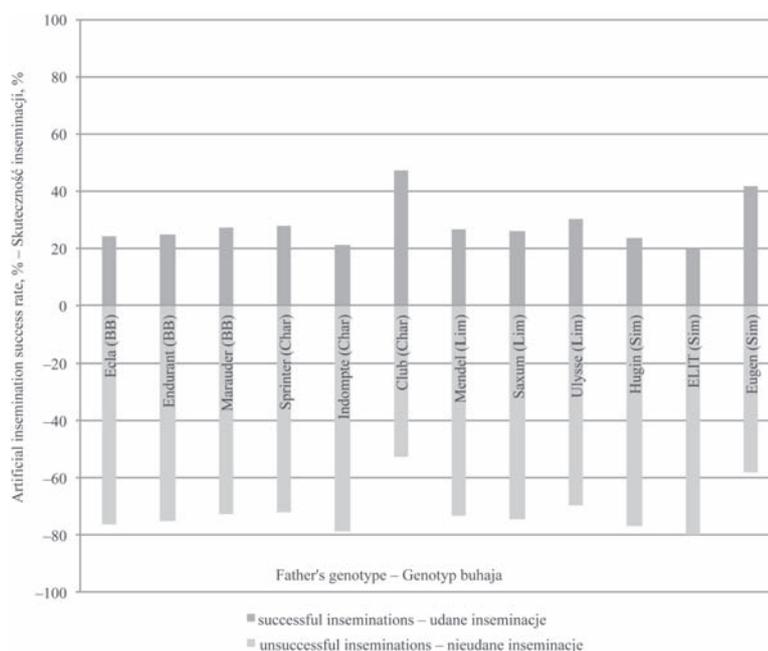


Fig. 2. Successful and unsuccessful insemination share highlighting father's genotype influence  
Rys. 2. Udział udanych i nieudanych inseminacji z uwzględnieniem genotypu ojca cielęcia

This paper dealt with the inseminator's influence on the effectiveness rate of artificial inseminations carried out by them. The influence of the inseminator's sex on the effectiveness of the procedure was also established. The presented results indicate the need for other studies dealing with effectiveness rate of A.I. in commercial crossbreeding of dairy cows with beef bulls. The analysis of the results lead to the conclusion that personal characteristics of inseminators (age, work experience, education, etc.) should be investigated in order to establish a set of characteristics that affect the effectiveness rate of carried out artificial insemination.

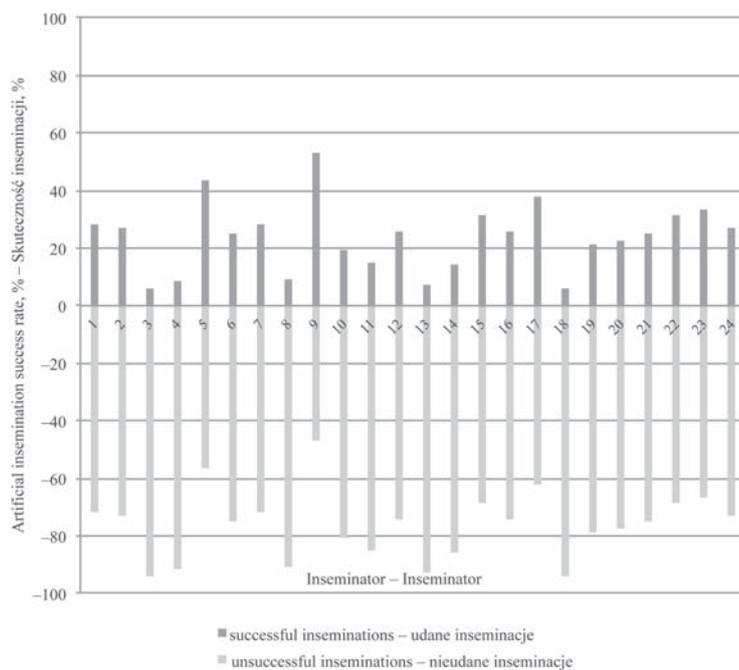


Fig. 3. Successful and unsuccessful insemination share highlighting inseminator's influence  
Rys. 3. Udział udanych i nieudanych inseminacji z uwzględnieniem inseminatora

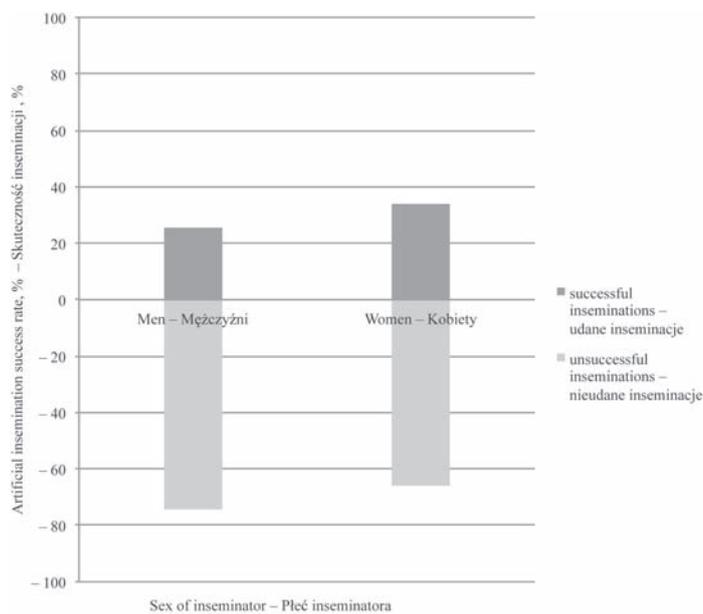


Fig. 4. Successful and unsuccessful insemination share highlighting inseminator's sex influence  
Rys. 4. Udział udanych i nieudanych inseminacji z uwzględnieniem płci inseminatora

The research conducted previously proved that the inseminator can significantly affect the effectiveness rate of A.I. especially in commercial crossbreeding [Reurink et al. 1990, Russi et al. 2010]. However, not many researchers discuss in detail issues connected with an inseminator's personal features such as sex, age, education and work experience which determine the influence of factors connected with the inseminator's personal characteristics on effectiveness rate of A.I.

## CONCLUSIONS

In the examined sample of artificially inseminated dairy cows, the influence of bull's breed and genotype on the effectiveness rate of A.I. was not found.

The effectiveness rate of A.I. was not affected by the inseminator. However, the inseminator's sex influenced the effectiveness rate. It was proven that cows inseminated by female inseminators achieved higher values of effectiveness rate.

There is a need of further research on other factors that can affect effectiveness rate of artificial insemination, especially those connected with the inseminator's personal features (education, experience and the inseminator's personal characteristics).

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## **ANALIZA SKUTECZNOŚCI UNASIENIEŃ KRÓW MLECZNYCH NASIENIEM BUHAJÓW RAS MIĘSNYCH W KRZYŻOWANIU TOWAROWYM**

**Streszczenie.** Materiał badawczy stanowiły wyniki oceny skuteczności unasiennień krów mlecznych krytych nasieniem 12 buhajów ras mięsnych, tj. Belgian Blue, Charolaise, Limousine,

Simentaler. Inseminacje były prowadzone na terenach województw: mazowieckiego, warmińsko-mazurskiego oraz podlaskiego. W bazie danych zgromadzono informacje dotyczące: rasy buhaja, genotypu ojca oraz inseminatora przeprowadzającego inseminację. Analizowano wpływ tych czynników na skuteczność inseminacji. Wszystkie unasiennienia zostały wykonane w ramach Projektu „Optymalizacja produkcji wołowiny w Polsce zgodnie ze strategią *od widełca do zagrody*”. W ramach badań poddano inseminacji 1678 krów mlecznych, z czego skutecznie unasienniono 442 krowy. Zabiegi inseminacyjne zostały wykonane przez 24 inseminatorów. Nie stwierdzono istotnej statystycznie zależności między rasą buhaja, genotypem buhaja, jak i inseminatorem a skutecznością wykonywanych zabiegów. Stwierdzono wpływ płci inseminatora na skuteczność unasienniania. Uzyskane wyniki wskazują na potrzebę dalszych szczegółowych badań dotyczących wpływu cech indywidualnych inseminatora (wykształcenie, doświadczenie, cechy charakterologiczne inseminatora, w tym sumienność i rzetelność) na podstawowe wskaźniki rozrodu.

**Słowa kluczowe:** krzyżowanie towarowe, skuteczność inseminacji

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