

Andrea Galli ¹, Valeria Bornaghi ¹, Giulia Pozzato ²

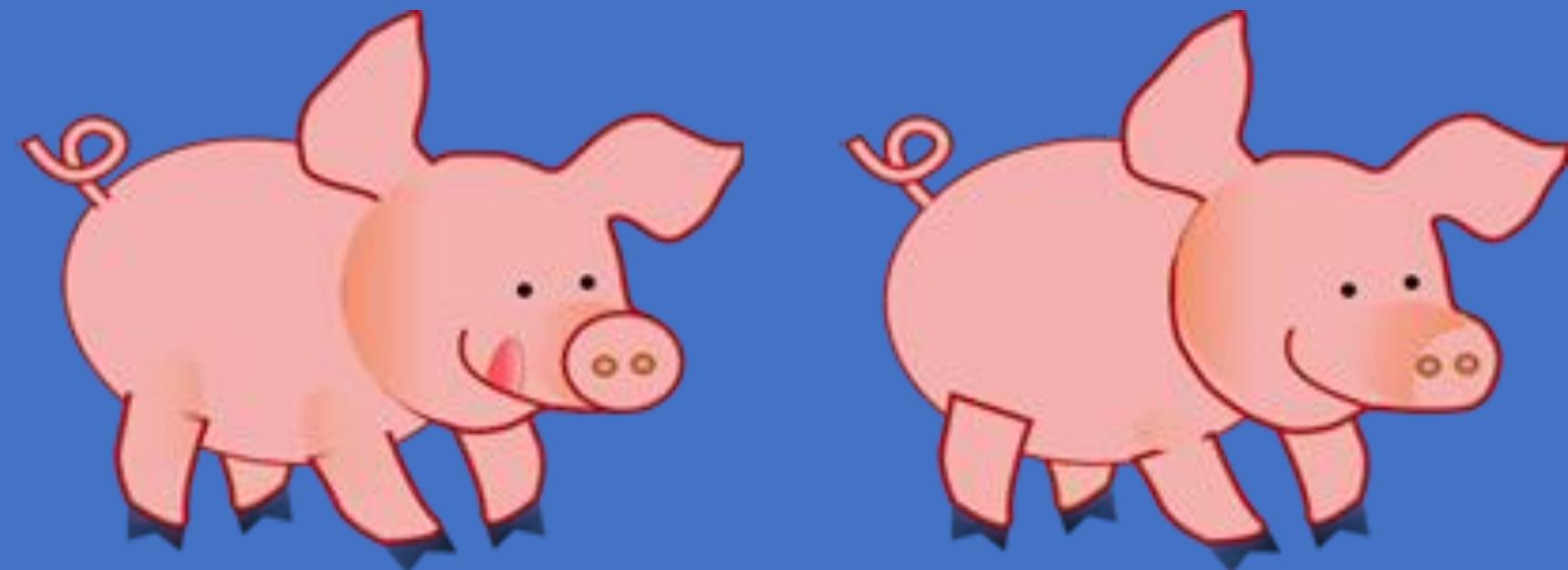
¹ Istituto Sperimentale Italiano "Lazzaro Spallanzani" - Rivolta d'Adda (CR)

² Associazione Nazionale Allevatori Suini - Santa Vittoria di Gualtieri (RE)

INTRODUCTION

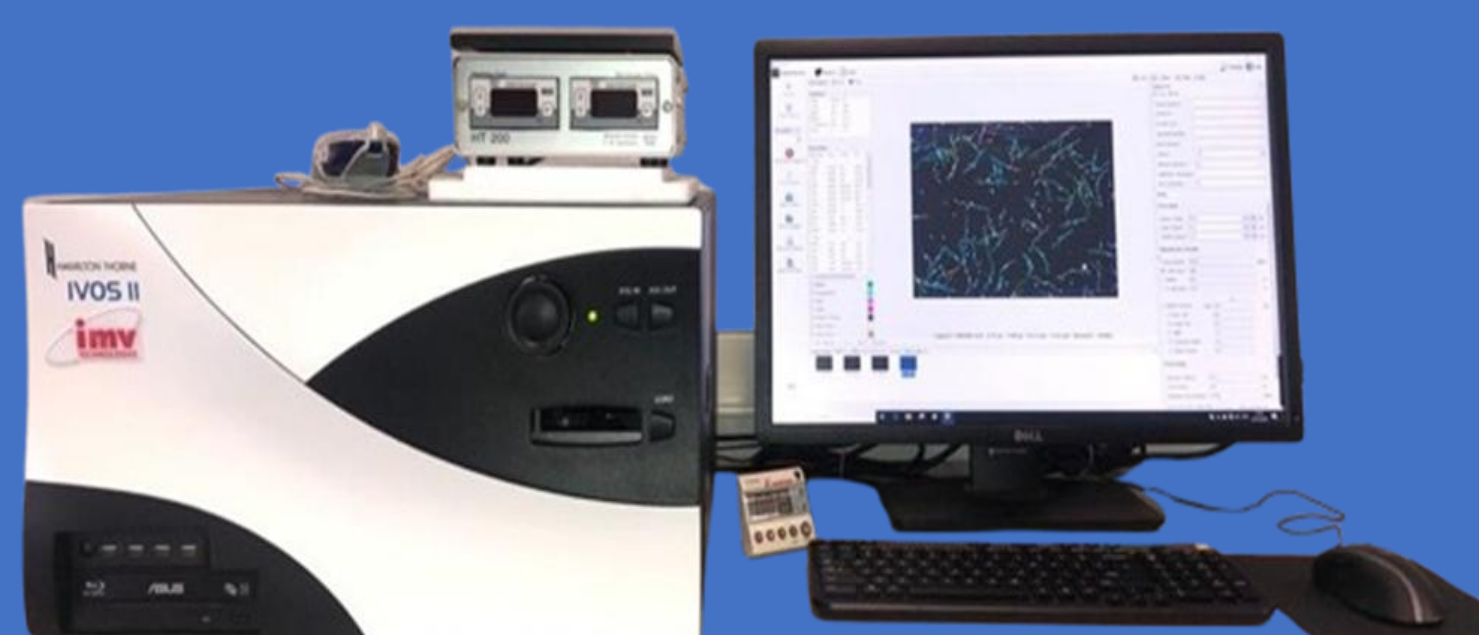
The Boar Semen Production Centre (SPC) of the National Pig Breeders Association (ANAS) allows the valorization of its mission through the maximum diffusion of the results of genetic selection through the production of refrigerated boar semen. Therefore, it is essential to manage the SPC with maximum efficiency to ensure both high quantity and quality of the doses produced. To this end, statistical quality control (SQC) techniques represent valuable tools at various levels of the production process.

MATERIAL AND METHODS



Once the production **TARGET** was defined, related to the doses of the refrigerated boar semen (80 mL volume with 1.7 billion sperm), the following steps were taken: identification of critical points, study of stability and capability of the process, evaluation of the reproducibility of analytical measurements and documentation of the qualitative attributes of the doses.

Process control was implemented through daily batch sampling (at least 5 doses of diluted semen), with concentration assessed by CASA (which for diluted semen was verified more accurate and precise than the spectrophotometer, using the NucleoCounter SP100 as gold standard). Process stability was verified by: box and whisker plot; X-bar chart with mean=target (1,700 million/dose) and moving range control limits; R-bar chart. Capacity was verified by histogram.

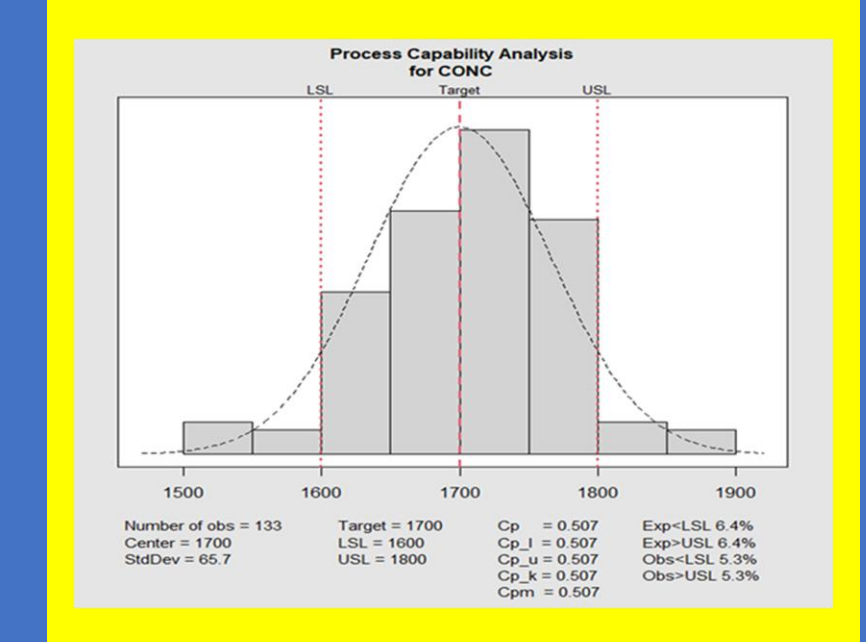
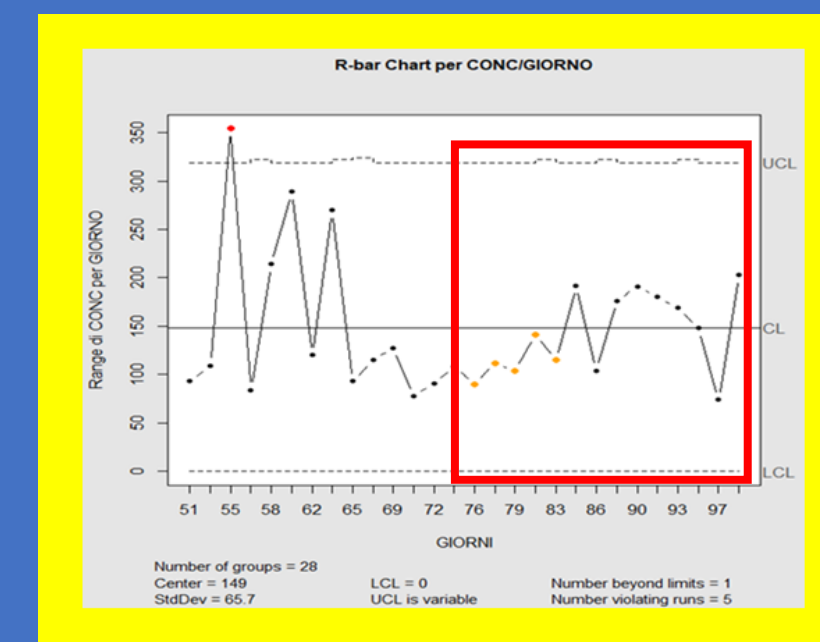
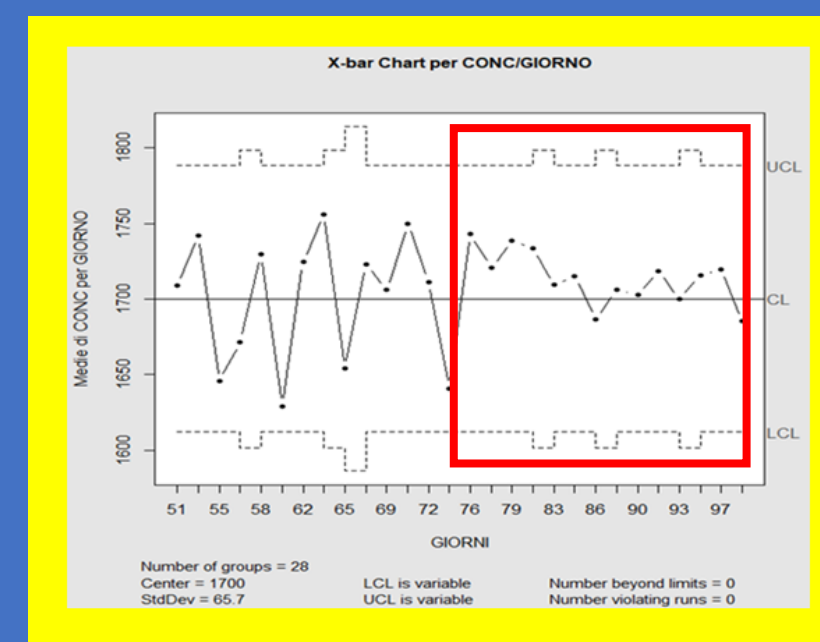
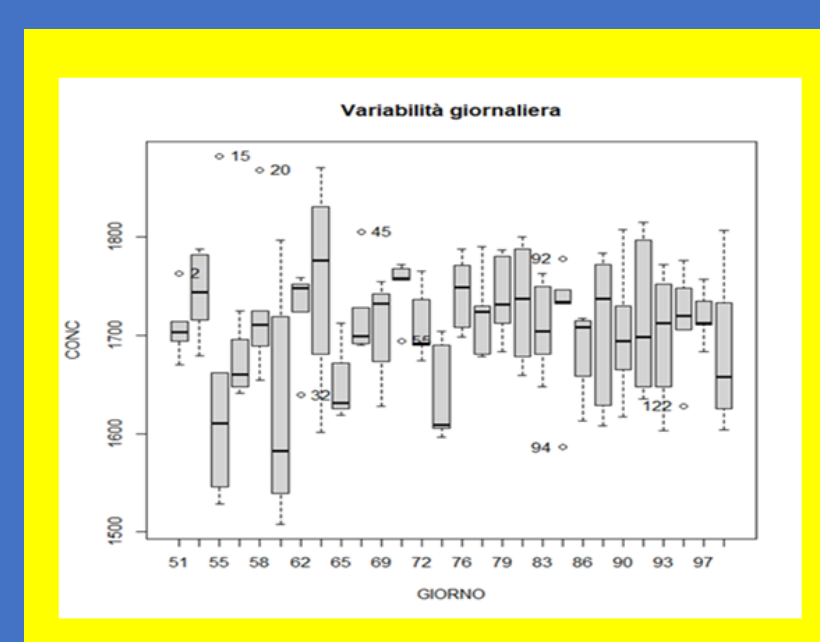


The **characterization** of the **qualitative attributes** of the **doses** was done by verifying the preservability up to four days (by CASA motility). The experiment lasted eight weeks (44 batches with 41 boars) and a general linear mixed model was used, which included the random effect of the boar and the fixed effects: day (1-4), operator (1,2) and season ("summer" vs "autumn").

RESULTS AND DISCUSSION

The **critical point** verified as the most important was the qualitative evaluation of semen (before and after dilution) performed exclusively with the CASA system (CEROS, Hamilton Thorne, USA). Therefore, the CASA was optimized in terms of settings for motility and morphology, while concentration was done with a calibration of a more accurate and precise spectrophotometer ($R^2 = 0.97$; $P < 0.001$), with verification of measurement reproducibility, using only two cuvettes to eliminate the operator effect ($P < 0.001$). It has been found, using DIC microscopy, that the most reliable parameter for assessing morphology with CASA was the percentage of intact spermatozoa.

The **process** became **stable** and capable after 3 months of monitoring.



The **effects** of **day** and **season** were significant ($P < 0.01$), but with estimated effects on motility very small: -5.3% (SE = 0.8) for the fourth day of storage and + 4% (SE = 1.37) for the "winter" season, without compromising usability of doses. The **operator** effect was not significant ($\chi^2 = 1.69$; $P = 0.1933$).

In the same experiment **reproducibility** of the **CASA concentration** was tested (4 days of storage are 4 measurements for the same batch): although statistically significant, the estimated fixed effects were minimal and did not affect reproducibility.

CONCLUSION

In conclusion, the SQC allows the monitoring and the optimization of an SPC, ensuring a stable and capable process of production of high-quality diluted semen doses.

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