TECHNOLOGIES ASSOCIATED TO THE PRECISION LIVESTOCK FARMING IN BEEF CATTLE

BIBLIOGRAPHIC REVIEW

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OBJECTIVES

- Collect the main technologies of Precision Livestock Farming (PLF) in beef cattle
- Compare the different technologies and analyze their applicability in different areas
- Raise problems that may exist in PLF
- Evaluate the current and future profitability of these technologies

METHODOLOGY

- **Database:** Web Of Science.
- **Keywords:** "precision OR smart AND livestock" and "cattle OR bovine OR beef".
- **Initial inclusion criteria:** English language, articles and revisions published during the last 10 years.
- **Exclusion criteria:** text not available and title unrelated to objectives.
- **Number of articles included:** 61

AMBIT	TECHNOLOGY	USEFULNESS
Identification	**Injectable**	It identifies the animal (electronic ID)
	Electronic ear tag	It identifies the animal (electronic ID)
	Ruminal bolus	It identifies the animal using boluses with transponders inside (electronic ID)
	Biometric methods	It identifies the animal based on distinguishable internal or external characteristics (iris and retina images, fur pattern, muzzle identification, facial recognition)
Feeding	**Feeder and electronic trough**	It monitors changes in the intake and changes in the eating and drinking behavior (kg/d, L/d)
	Triaxial accelerometer	It assess intake deducing the occurrence, duration and daily variation of eating behaviors (based on the rhythmicity and chronology of mandibular movements)
Feeding and Rumination	**Acoustic signal**	It identifies grazing, rumination and resting (acoustic signals and mandibular movements)
Body condition	**2 dymension (2D) sensor**	It measures body parameters and extracts characteristics from them (rear or top view information: 2D images)
	3 dymension (3D) sensor	It measures body parameters and extracts features (3D images)
	2D + 3D sensor	It obtains the body condition by measuring morphological features (2D and 3D images of height of the withers, thoracic circumference, body length and the waist height)
	Automatic weighing scale	It allows to obtain the body weight of the animal (kg/d)
Management and Geolocation	**Virtual fence**	It tracks and monitors the animal position in real time within established limits using acoustic signals and electric shocks of low energy (location using Global Positioning System (GPS) device)
Geolocation	**Surveillance camera**	It locates the animal in space (location using videos)
	Thermal camera	It locates the animal in space (location using infrared radiation)
	Snapshot camera	It locates the animal in space (location using snapshots)
	Quadcopters	It recognizes the animal, estimates the posture and direction of its movements and allows it to be tracked (location using videos)
Health	**Injectable microchip**	It monitors internal body temperature (T)
	Infrared thermography	It estimates the internal body T (T)
	Infrared thermometer	It estimates the internal body T (T)
	Ruminal sensor	It measures the T and the pH of the rumen (rumen T and pH)
Health and Rumination	**Microphone**	It distinguishes noises and their frequency (acoustic signals)
	Accelerometer	It measures physiological and behavioral parameters (activity and number of steps)
Rumination	**Pressure sensor**	It recognizes rumination (mandibular movements)

Table 1. Technologies associated to Precision Livestock Farming in beef cattle. *Adaptation of the original. (Paula Manchón, 2023)*

CONCLUSIONS

Technologies associated to PLF are a viable and effective alternative to methods that have traditionally involved a great physical effort and work time. They provide plenty of different advantages for the ranchers, improving both animal welfare and productivity, and can lead a path to a more profitable and sustainable livestock industry. However, there is a need to lower costs and increase its accuracy, as well as studies that investigate its applicability in beef cattle.