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An automated walk-over-weighing system for monitoring liveweight change of sheep at pasture

Eliel González-García[1], Moutaz Alhamada[1], Ana Clara Canto Souza[2], Zuzana Holubová[3], Sébastien Douls[4], Julien Pradel[4], Sara Parisot[4]

[1]INRA-SELMET, Montpellier, France, [2]Universidade Estadual de Londrina, Londrina, Brazil, [3]University, Praga, Czech Republic, [4]INRA-La Fage, Roquefort-sur-Soulzon, France

E-mail: eliel.gonzalez-garcia@inra.fr

Take home message: A daily, accurate, and fully automatic monitoring of individual liveweight of grazing sheep is feasible.

Introduction: Measurement of body weight (BW) is an established method for monitoring the performance of intensive and extensively managed farm animals. There are few reports of essaying automated BW recording of sheep (Brown *et al*., 2012 & 2013). The objective of this work was to develop and evaluate an automated walk-over-weighing (WoW) system for a remote and close BW monitoring in grazing sheep.

Materials & methods: The prototype (Figure 1) was conceived to be light, mobile, autonomous in energy and resistant to outdoor conditions. It was designed in collaboration with Trutest (New Zealand) and Marechale Pessage (France) and has been evaluated between 2015 and 2017 in 3 consecutive experiments with Romane ewes at INRA Experimental Unit "La Fage" (43°54'54.52"N; 3°05'38.11"E; Roquefort-sur-Soulzon, France). Firstly, and indoor trial (IND), secondly a first grazing test under intensive grazing conditions (OUTin) and finally a first assay in an extensive rangeland (OUText) have been carried out. The IND trial calibrated the device under controlled conditions (González-García *et al*., 2017). Twenty-four were fed good-quality hay and monitored for 1 month. The OUTin test was carried out in spring (April-June). A rotational grazing system was established in 1 ha (280 m² paddocks; 2-3 days stay) with 15 naïve ewe-lambs fed only the good-quality mix of herbage available at pasture. The OUText evaluated the prototype for the first time under real free-rangeland conditions during 1 month in winter (November-December). One hundred sheep (99 adult ewes at early pregnancy and 1 ram) grazed in a 15-ha paddock with native grasses and were supplemented silage (4.5 kg/head) and *ad libitum* hay. Water and mineral salts were always used as attractants for training ewes in a logical circuit to stimulate their individual voluntarily cross through the WoW device. For the 3 experiments the accuracy in the individual daily BW values recorded by the WoW prototype was evaluated by comparison with frequent static BW measured with a conventional weight scale balance. In parallel, we started to study the feasibility of estimating daily individual feed intake by using differences between BW measurements points during the day. An evaluation of the level of agreement between WoW and BW measured statically was made using Lin's concordance correlation coefficient (Lin, 1989).

Results & discussion The 100 % of ewes were well-adapted after 2-3 wk of familiarization with the WoW device. Thus, ewes voluntarily crossed several times (~ 6-8/ ewe/ d) and, overall, more than 65% of BW values recorded by the WoW in the three experiments were useful for interpretation. The rest of the observations (around 35%) were considered as outliers and removed from the database to be interpreted. Interestingly, more the conditions were extensive more concordant were the WoW BW values when compared with static BW. The Figure 1 illustrate the excellent fit of static *vs.* WoW BW on pooled grazing ewes groups (i.e. concordance correlation = 0.97).

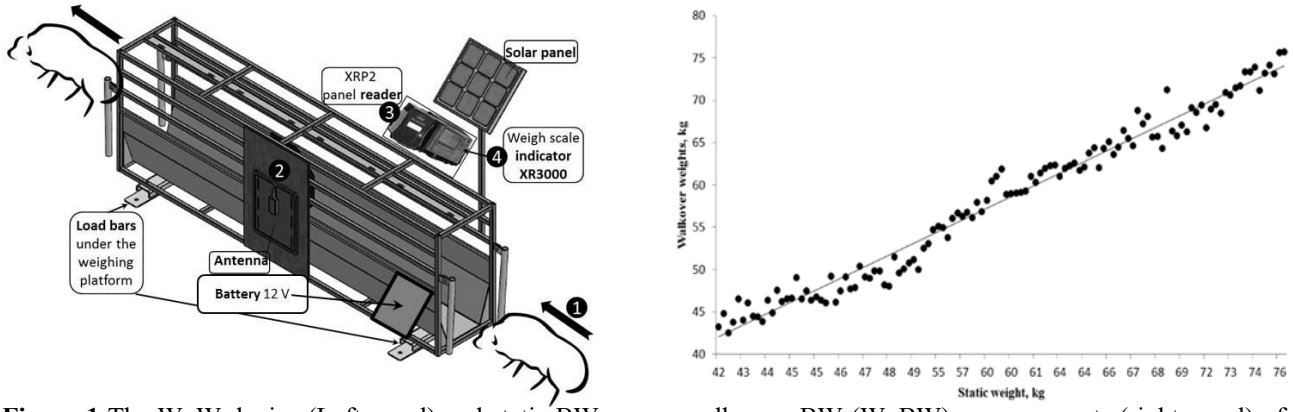

Figure 1 The WoW device (Left panel) and static BW versus walk-over BW (WoBW) measurements (right panel) of pooled groups of grazing Romane ewes weighed in spring and winter of 2017.

Conclusion: Our results demonstrate the feasibility of using this device as a promising option for the automatization of BW monitoring of sheep under a range of farming conditions. Its use would contribute to the animal welfare and to save labor without compromising the quality of BW measurement. Beyond the autoweighing objective, this experimental setting is also conceived for indirect estimation of daily individual feed intake from frequent BW variations during the day. Results from IND trial are promising and have been already reported (González-García *et al*., 2017).

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