

## WAGENINGEN UNIVERSITY, DAIRY CAMPUS

<p><b>Research topics:</b></p>	<p>Dairy Campus is the national dairy innovation, research, training and education facility in the Netherlands. Dairy Campus not only accommodates researchers from (applied) universities including Wageningen University, but also represents the network and place where different societal and commercial stakeholders in the Dutch dairy chain join forces and cooperate. Dairy Campus has solid partnerships with all major Dutch dairy companies and companies supplying agribusiness &amp; dairy industry. Dairy Campus facilitates and supports research by providing access to state-of-the-art facilities with a total of 550 dairy cows plus young stock. Research at dairy campus focuses on nutrition, health – in particular of cows during the transition period, welfare, smart dairy farming, genetics and breeding, environmental aspects of dairy production, grazing systems, and calf rearing.</p> <p>Selected recent publications of studies performed at ‘Dairy Campus’ include:</p> <p>Chen, J., Soede, N.M., Rummelink, G.J., Bruckmaier, R.M., Kemp, B. &amp; van Knegsel, A.T.M., 2017. Relationships between uterine health and metabolism in dairy cows with different dry period lengths. <i>Theriogenology</i> 10, 8-14.</p> <p>De Mol, R.M., Andre, G., Bleumer, E.J.B., van der Werf, J.T.N., de Haas, Y. &amp; van Reenen, C.G., 2013. Applicability of day-to-day variation in behavior for the automated detection of lameness in dairy cows. <i>Journal of Dairy Science</i> 96, 3703-3712.</p> <p>De Mol, R.M., Goselink, R.M.A., van Riel, J.W., Knijn, H.M. &amp; van Knegsel, A.T.M., 2016. The relation between eating time and feed intake of dairy cows. In: <i>Proceedings of the International Conference on Precision Dairy Farming</i>, 21-23 June, Leeuwarden, The Netherlands, pp. 387-392.</p> <p>Ipema, A.H., de Mol, R.M., Hogewerf, P.H., Prins, B., Sijbrandij, F., Winden, R.P.J., Hanenberg, M.J.A. &amp; Jorritsma, R., 2015. Real time operational support in young stock rearing. In: <i>Proceedings of the 7th European Conference on Precision Livestock Farming</i>, 9-15 September, Milan, Italy, pp. 301-308.</p> <p>Klootwijk, C.W., Zom, R.L.G., van den Pol-Van Dasselaar, A., Van Middelaar, C.E., Holshof, G. &amp; de Boer, I.J.M., 2018. Amazing Grazing; N use efficiency of 60 individual dairy cows under intensive grazing. In: <i>Proceedings of the 27<sup>th</sup> EGF General Meeting on “Sustainable Meat and Milk Production from Grasslands”</i>, 17-21 June, Cork, Ireland.</p> <p>Kok, A., van Hoeij, R.J., Tolkamp, B.J., Haskell, M.J., van Knegsel, A.T.M., de Boer, I.J.M. &amp; Bokkers, E.A.M., 2017. Behavioural adaptation to a short or no dry period with associated management in dairy cows. <i>Applied Animal Behaviour Science</i> 186, 5-17.</p> <p>Van Hoeij, R.J., Dijkstra, J., Bruckmaier, R.M., Gross, J.J., Lam, T.J.G.M., Rummelink, G.J., Kemp, B. &amp; van Knegsel, A.T.M., 2017. Consequences of dietary energy source and energy level on energy balance, lactogenic hormones, and lactation curve</p>
--------------------------------	---

	<p>characteristics of cows after a short or omitted dry period. Journal of Dairy Science 100, 8544–8564.</p> <p>Van Reenen, C.G., van der Werf, J.T.N., Timmer, B., Hoeksma, D.I. &amp; Zom, R.L.G., 2016. Using behaviour in dairy cows as predictor of grass intake. In: Proceedings of the International Conference on Precision Dairy Farming, 21-23 June, Leeuwarden, The Netherlands, pp. 395-399</p>
<p><b>Activities and services currently offered by the infrastructure/installation:</b></p>	<p>Major facilities include (i) an innovation barn with the possibility to study different types of flooring and housing, as well as other husbandry factors such as regrouping strategies (ii) an environmental barn, with separate sections, for research into emissions and environmental aspects of dairy production, (iii) a transition barn with the possibility to individually feed transition cows, and (iv) a feeding barn with a total capacity for 128 cows divided into 16 groups of 8 cows each. Annex to the feeding barn is a tie-stall barn which accommodates 16 cows, and which is suitable for more intensive experiments including frequent sampling of blood, manure and urine in cull cows. There is a close collaboration with the WU facility 'Carus' in Wageningen with regard to the execution of surgical procedures.</p> <p>At Dairy Campus, both large-scale experiments as well as more intensive studies with limited numbers of animals can be performed. Inside the feeding barn, cows are loose housed with cubicles. There are 64 bins for automatically measuring individual roughage intake, as well as concentrate feeders. Bins are automatically filled by a feeding robot which is capable of mixing and dosing 5 different feeds from a feeding kitchen. All cows at Dairy Campus are equipped with leg and neck sensors automatically recording standing and lying behaviour, number of steps, and rumination. In combination with a fully automatic Cow Positioning System, the position of each cow in the barn is recorded every 10 min. Dairy Campus has a rotary milking parlour with 40 milking stalls. Cows are weighed daily with the use of an automatic weighing scale in the milking parlour. Milk composition is assessed on a weekly basis or more frequently if necessary.</p> <p>The feeding barn allows for comprehensive feeding trials with the use of fully automated feeding system, but is also used in experiments examining the effects of other experimental factors or treatments on individual feed intake.</p> <p>In addition to feed intake data (roughage and concentrates), detailed information about cow behaviour, clinical health and body condition, cow body weight, and milk yield and composition, is collected on a routine basis. Samples obtained in cows (e.g. blood, faecal samples or urine), can be centrifuged or otherwise pre-processed and stored in a freezer (-40 or -80 °C) at Dairy Campus until further analysis.</p> <p>At Dairy Campus, there are ample opportunities to study different calf rearing practices related to feeding (including colostrum, milk replacer, concentrates and roughage), and housing system.</p>

	<p>Dairy Campus has more than 300 ha of grassland, allowing for a wide variety of experiments related to grazing and grazing systems in dairy cows.</p>
<p><b>Description of the access to be provided under SmartCow TNA calls:</b></p>	<p>Access includes animals, animal housing, preparation of the experiment, feeding and daily care. In addition, within the SmartCow TNA programme, experienced staff provides full technical and logistical support. The unit of access for this installation is defined as one cow.week, with a total of 48 cows being in a full experiment for 21 weeks. One typical access (1008 units) covers preparatory work (in particular the definition of the protocol, approval of the Animal Ethics Committee, and the planning of the experiment on site), assistance and support with the practical realisation of the experiment, data management and data analysis, and reporting. Approval of Animal Ethics committee requires at least 6 months in advance.</p> <p>At Dairy Campus, a team of experienced and qualified farms staff – 9 animal caretakers together with the herd manager – are responsible for taking care of the animals and for the practical execution of the experiments. Experiments are designed and planned in close collaboration with a research coordinator based at Dairy Campus. Scientific researchers from WUR-DLO from various disciplines, including dairy cow nutrition, precision dairy farming and data analysis, will provide scientific support during all stages of an experiment, i.e. planning, experimental design, data collection, data analysis and reporting.</p> <p>The data collected will respect the SmartCow data management plan to allow their integration into the cloud-based database. Offices and meeting rooms with internet connection are available. Assistance with finding short-term accommodation can be provided.</p>
<p><b>Animal types, diets, housing and experimental conditions that can be worked on in this infrastructure/installation:</b></p>	<p>At Dairy Campus, in the context of the SmartCow project, dry and lactating cattle as well as youngstock (from the time of birth onwards) can be included in experimental or applied studies. Housing of dairy cattle is in various barns with loose housing, either with or without cubicles, or in a tie-stall unit annex to the feeding barn. The innovation and environmental barns allow for the study of different housing and flooring types for dairy cattle. A wide variety of diets and dietary factors and ingredients may be studied, in accordance with the specific requirements of the experiment.</p>
<p><b>Travel and subsistence costs:</b></p>	<p>Travel/subsistence costs for applicants in WUR-DLO experiments at Dairy Campus is available. Reimbursement is limited to one person per application for travel and 10-day stay. Travel and subsistence costs of applicants can be reimbursed on production of original receipts.</p>
<p><b>Infrastructure/installation ethical rules:</b></p>	<p>WUR-DLO has animal facilities that are licensed by the Dutch Government to perform studies with animals for experimental purposes. Animal experimental work is carried out at WUR-DLO in accordance with the European Directive 2010/63/EU on the protection of animals used for scientific purposes</p>

regulation, S.I. 543/2012. The EU Directive aims for better protection of animals involved in scientific research; fair competitive conditions for businesses and scientific research within the EU; encouraging the application of the 3R's (i.e., replacement, reduction and refinement). The Dutch legislation is available at <http://wetten.overheid.nl/BWBR0003081/2014-12-18>. In the Netherlands, the EU Guidelines are incorporated in the Experiments on Animals Act (WOD, 2014). The principle behind this Act is that no experiments should be conducted on animals unless there are good reasons for doing so, and no alternatives are available that would produce the result without using animals.

At WUR-DLO, the procedure for animal experiments is as follows. A research project proposal is submitted to the local Animal Welfare Body (AWB) of WUR-DLO. After approval by AWB, WUR-DLO sends the application to the Animal Experiment Committee (AEC) of Wageningen University & Research. The AEC will review the scientific quality of the proposal and makes an ethical decision based on the potential discomfort in relation to the importance of the experiment. The AEC then submits a recommendation to the national Central Authority for Scientific Procedures on Animals (CCD) (see: <https://www.centralecommissiedierproeven.nl/>). If granted, the CCD issues the license for the project. Subsequently, every animal experiment in the authorized project has to be approved by the AWB of WUR-DLO. Only after approval by AWB, the experiment can start. The application of the 3Rs is considered at WUR-DLO: i) replace animal experiments by in vitro investigations or in silico simulations whenever possible; ii) reduce the number of animals involved to the necessary minimum for each experiment; and iii) refine experimental protocols in order to diminish to a minimum the amount of stress imposed on those animals that will be used.

In compliance to the legislation, all researchers, assistant researchers and technicians employed at WU possess the necessary qualifications to perform experiments with (farm) animals, and hold a certificate of competence required by law, that was obtained after satisfactory completion of an official course on Laboratory and Farm Animal Science.