



OptiBarn Project Annual Meeting

January 18th – 19th 2017, Polytechnic University Valencia, Spain

Participants

Thomas Amon, Sabrina Hempel, Severino Pinto (ATB)
Christoph Menz (PIK)
Agustin del Prado, Elena Galan (BC3)
Salva Calvet, Fernando Estelle, Elena Sanchis Jimenez (UPV)
Ilan Halachmi, Harel Levit (ARO)
Guoqiang Zhang, Li Rong (AU)
Tom Misselbrook, Nico Ogink, Melynda Hassouna (Advisory Board)
and external scientists

Meeting agenda

Day 1 - open results workshop – OptiBarn consortium, advisory board, invited external speaker (farmer, stakeholder, and companies ?)

- 09:00 Opening Session
- Welcome
 - Introduction: The OptiBarn project – defining the problem and expected results (Sabrina Hempel, Leibniz institute for agricultural engineering and bioeconomy, Germany)
 - Parallel experiences on climate change adaptation: The “Pig Change” project (Melynda Hassouna, Institut National de la Recherche Agronomique, France)
- 10:00 Session 1: Expected Climatic Changes
- IPCC Scenarios and accuracy of prediction models (María José Estrela, Universitat de València, Spain)
 - OptiBarn models for regional climate – risk factors in OptiBarn focus regions (Christoph Menz, Potsdam institute for climate impact research, Germany)
 - Microclimate in NVB – case studies and modeling for OptiBarn focus regions (Sabrina Hempel, Leibniz institute for agricultural engineering and bioeconomy, Germany)
 - Open discussion
- 11:00 Coffee Break
- 11:30 Session 2: Animal Welfare and Climate Change
- Animal responses to Heat Stress (Pol Llonch. Universitat Autònoma de Barcelona, Spain)
 - Influence of barn climate on physiological parameters and behavior of dairy cows considering cow-related factors (Severino Pinto, Leibniz institute for agricultural engineering and bioeconomy, Germany)
 - OptiBarn experiments – body temperature monitoring (Harel Levit & Ilan Halachmi, Agricultural Research Organization - Volcani Center, Israel)
 - Open discussion
- 12:30 Lunch
- 13:30 Session 3: Impacts of environmental conditions on dairy farming
- General overview on environmental impacts from dairy farming (Nico Ogink. Wageningen UR, The Netherlands)
 - Modelling framework in Optibarn (Agustín del Prado, Basque Center for Climate Change, Spain)
 - Modelling gaseous emissions in OptiBarn (Fernando Estellés, Universitat Politècnica de València, Spain)
 - Open discussion
- 14:30 Session 4: Adaptation strategies
- Farm-scale strategies (Thomas Bartzanas, The Centre for Research and Technology, Greece)
 - System-scale strategies (Tom Misselbrook, Rothamsted Research, UK)

Summary of the second annual meeting

- Genetics as a tool for climate change adaptation (María Jesús Carabaño, Instituto Nacional de Investigación y Tecnología Agraria y Agroalimentaria, Spain)
- Precision Zone Ventilation – OptiBarn adaptation strategies (Guoqiang Zhang, Aarhus University, Denmark)
- Open discussion

15:45 Round Table and Final Conclusions, Opportunity to start discussion on new projects ideas

Day 2 - internal status & next steps

08:45 Visit at the farm in Bétera

10:45 coffee break

11:00 Milestones / Deliverables WP1-4

13:00 Lunch

14:00 Dissemination and Publication strategy

15:30 coffee break

16:00 Continue Discussion on New Projects , Next steps / next meeting

Summary

The two-days meeting was subdivided into two parts – an open results workshop and the internal status evaluation:

On the first day, we had the open results workshop with presentations from the OptiBarn consortium, members of the OptiBarn advisory board and external scientists from Spain and Greece. After an introduction four thematic sessions were organized.

Presentations in session 1 “Expected Climatic Changes” covered climate projections for the OptiBarn focus regions (particularly for Spain and Germany), the linkage between meteorological parameters indoor and outdoor (with focus on statistical modelling) and uncertainties in meteorological measurements and climate projections. It was shown for the Valencia region that a modification in the humidity pattern is expected under climate change which will affect the temperature-humidity-index (THI) in the barn. Projections for the evolution of the average THI for the two German pilot barns taking into account outdoor THI, wind components and cloudiness were presented and the variability in the barn (approximately +/- 2 THI scores) was discussed.

In session 2 “Animal Welfare and Climate Change” the focus was on animal responses to variation in the microclimate including behavioral changes (e.g. less feed intake, more water intake, less lying vs. more standing), increased respiration rate, decreased rumination activity, higher body temperature, increased level of stress hormones in blood and milk, immunodepression, reduced reproduction and changes in the rumen microbiota. The case study experiments conducted in OptiBarn and the derived animal-response models for respiration frequency and bolus temperature were presented. Moreover, it was shown for different physiological parameters (e.g., activity behavior, rumination activity) that the change with increasing THI is particularly prominent during the day. The effect of cooling strategies on various physiological parameters was discussed. Data analysis related to this topic is on-going.

Session 3 “Impacts of Environmental Conditions on Dairy Farming” highlighted the interdependence of dairy farming and climate change. On the one hand, dairy farming causes a large part of the worldwide emissions of green house gases, ammonia and consequently secondary particles (fine dust). On the other hand, there is a positive feedback on short time-scales since heat stress can increase emission rates (e.g. via TAN concentration for ammonia or indirectly via changes in the rumen microbiota for methane). Quantitative estimation of the impact of climate change on the emissions from dairy barns is, however, only possible for ammonia at the moment. At the farm-scale aspects of nutrition, barn, manure storage, soil and plants are currently included to model the environmental and economic effects of climate change and potential adaptation strategies.

In session 4 “Adaption Strategies” the potential of different adaptation strategies to climate change was discussed including building design and ventilation, system-scale strategies (e.g. grazing at fields with different plants), genetics (problematic for highly selected high-yielding Holstein cows). It was highlighted that all solutions must be region-specific. At the barn-scale precision zone ventilation was presented as a potential

adaptation strategy. It was, however, discussed that for hot and dry regions frequent fogging might be a more effective adaptation strategy.

On the morning of the second day, the OptiBarn consortium and members of the advisory board visited a farm in Bétera near Valencia which is one of the pilot farms included in the OptiBarn case study measurements. Details of the measurements in summer 2016 conducted at this farm were discussed.

Afterwards, the status of milestones and deliverables in the four thematic work packages was presented and discussed together with the scientific advisory board.

In work package 1, a list of barn concepts and various barn-scale CFD models are available. CFD simulation is, however, delayed since the validation results for LES simulations are still not fully convincing. The initially scheduled publication on through-flow characteristics is thus pending. The consortium discussed to focus on the results of the already calibrated models at AU and ATB that focus on the RANS turbulence parametrization which can be combined with statistical analysis of measurements under on-farm conditions (intensive case studies) and with experiments in the boundary layer wind tunnel (only for air flow). Additional temperature-humidity measurements in Israel and Spain in spring / summer 2017 were scheduled to validate the developed statistical model for the indoor-outdoor relation of temperature and humidity. An overview of climate impact factors on housing is available and first risk factors were identified.

In work package 2, studies about the integrated climate sensing have been finished and a manuscript was submitted. The guideline / manuscript for emission source ventilation is published. The guideline / report on animal occupied zone ventilation is delayed. An integrated thermal index model (effective temperature) was developed. CFD simulations related to earth-air heat exchange are done. But the analysis of effects of local zone air supply on heat release is on-going. A cooperative work between WP 2 and 3 was discussed to couple the thermal model with cow effects (Li Rong plans CFD simulations on convective heat transfer using data from WP3 about cow core and skin temperatures).

In work package 3, the experimental setup was set and a preliminary list of thresholds and models of the animal-response are available. Data about the effect of cooling was collected, but the analysis is on-going. The scheduled journal publications are pending. It is planned to collect additional data 2017.

In work package 4, first simulations with MANURE-DNDC were performed. It was decided that they are not as useful as initially assumed so the evaluation of environmental impacts at the barn and house level will be based on a meta-model instead. For the evaluation of environmental and economic impacts without adaptation first simulations with SIMSDAIRY were performed with un-bias-corrected data (bias-corrected data will be available soon). First costing scenarios (feed / milk price sensitivity) have been running. The calibration of heat stress thresholds to modify the animal welfare index in SIMSDAIRY is on-going.

After lunch, the publication strategy was updated with a particular focus on cooperative papers. A list of potential topics was collected including responsible first authors and contributing institutes. The consortium agreed that if the publication plan works well, it would be worthwhile to apply for a Marie-Curie funding to continue the OptiBarn studies.

In the final session "next steps" different conference contributions of OptiBarn for 2017 were discussed. These include participation in a MACSUR conference and the MACSUR session at ECAA as well as COISTA, ECPLF and EMILI.

Moreover, an OptiBarn session at EAAP shall be organized again (as already the year before). This time more contributions are expected (so far 1 from BC3, 2 from ATB, 2 from ARO, 1 from AU). At least 12 abstracts should be submitted by members of the OptiBarn consortium and/or other colleagues.

At the end of the project a final conference shall be organized. ATB as coordinator will check if it is possible to extend the project duration to spring 2018 (based on this a common project end for all partners will be scheduled either for 31th of December 2017 or 31th of March 2018). If it is not possible to extend the project into 2018, we will probably have the final conference in November. Potsdam and Brussels were discussed as potential locations (possibilities will be checked). EU officers, local funding agencies, stakeholders and companies shall be invited. Students involved in the OptiBarn project are expected to present their results and chair sessions during the conference to promote early career scientists.