### *Conclusion and Implications*

As predicted by the *in silico* analysis, the better growth performance of pigs fed the *Bacillus*/protease blend, could also be ascribed to the *Bacillus* production of vitamins, amino acids and peptides indirectly promoting growth and modulating the abundance of commensal and beneficial bacteria in the gut. Confirming the predictive approach, *in vitro* data based on suppression of ETEC growth direct inhibition and competitive exclusion, demonstrated that those three *Bacillus* strains have complementary probiotic properties related to gut health which may contribute in the overall growth improvement and health benefits captured in pigs.

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## O184 Early prediction of lactation persistency of multiparous dairy cows

C. Gaillard [a], M. Boutinaud [a], S. Sehested [b], J. Guinard-Flament [a]

[a] Institut Agro, PEGASE, INRAE, 35590 Saint-Gilles, France
[b] ICROFS, Aarhus University, 8830 Tjele, Denmark

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### *Introduction*

Lactation persistency affects fertility, health and feed costs (Dekkers et al., 1998). Primiparous cows have a relatively stable and high persistency (Miller et al., 2006) while it is quite variable for multiparous cows. Being able to estimate persistency early would help to optimize feeding (energy and protein contents), as feeding has been shown to affect persistency (Gaillard et al., 2016), and insemination decisions. The objective was therefore to estimate the lactation persistency of multiparous cows, based on two or three measurements early in lactation.

### *Material and Methods*

A total of 36 multiparous Holstein cows (parity average 2.4, minimum 2, maximum 4) managed for a 16 months extended lactation were involved in this study. The data set contained the average milk daily yield (MY), body weight (BW), lactose content in milk (LM) and in blood (LB), plasmatic b-hydroxybutyrate (BHBA), and glucose at week 3 of lactation. Lactation persistency (%) was calculated as the total milk produced during period P1 (from 100 to 420 days of lactation), or P2 (from 100 to 300 days), or P3 (from 300 to 420 days) over the total milk produced from calving to 100 days of lactation. Based on these percentages, the cows were equally distributed into three groups "low", "medium", or "high" persistency (Figure 1). To predict the cows' persistency group, a clustering method (packages 'factoextra' and 'cluster' on R version 4.0.2) was used. Three clusters were constructed for each combination of variables (pair or trinominal) to match the number of persistency groups. To evaluate these clustering methods, the global accuracy (proportion of correctly classified cows, in %), and the sensitivity (proportion of cows correctly predicted in a cluster, in %) were calculated and presented thereafter as accuracy|sensitivity %. Student t tests were used to compare accuracy and sensitivity between persistency groups and ways of calculating persistency.

Figure 1 - Boxplot describing each group of persistency (low, medium, high) for each way of calculating persistency (P1, P2, P3)

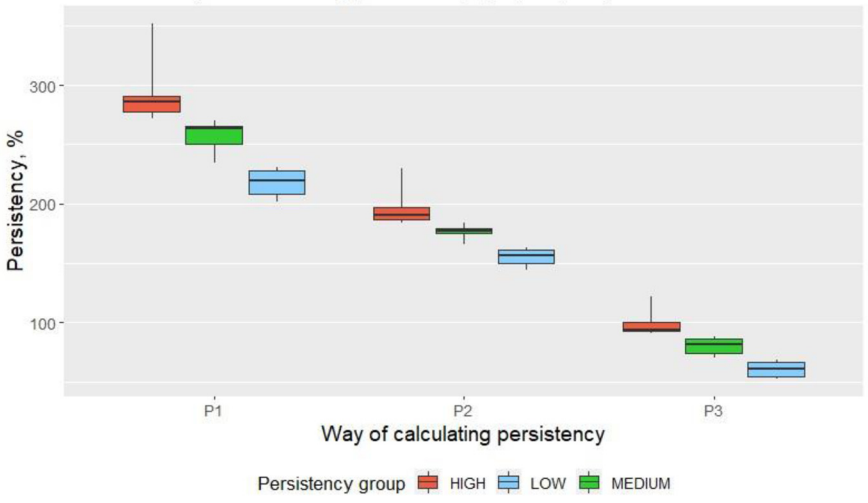
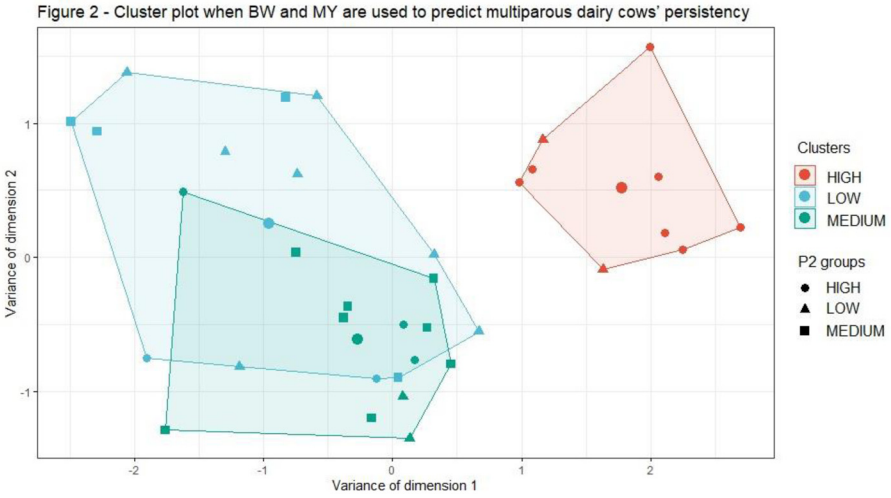


Figure 2 - Cluster plot when BW and MY are used to predict multiparous dairy cows' persistency




***Results and Discussion***

The accuracy and sensitivity were similar when clustering was done based on a pair or a trinominal of variables. Persistency predictions based on P2 tended to have a higher accuracy than those based on P1 and P3 (47.7 vs. 44.2 and 41.9% respectively, $P = 0.07$) and a higher sensitivity (55.2 vs. 52.6 and 45.6% respectively, $P = 0.01$). There was a significant difference of sensitivity between the three persistency groups, the "low" group having the highest sensitivity, followed by the "high" group, and the "medium" group (60.8, 49.3, and 36.6%, respectively, for a prediction based on two variables; 72.0, 49.9, and 38.0% for a prediction based on three variables, $P < 0.05$).

For P2 calculations, the best predictive pair was MY-BW (62.9|70.2%, Figure 2), two production variables easily measured on farm, while the worst pair was glucose-MY (20.0|18.5%). The best predictive trinominal for P2 was MY-BW-BHBA (60.0|78.5%), and the worst LM-glucose-BHBA (39.3|54.49%). When predicting P1 and P3 groups, the best predictive pairs were BHBA-glucose (48.6|63.6%) and LM-BHBA (53.6|67.8%), respectively, while the worst were MY-LM (39.3|42.0%) and BHBA-MY (28.6|35.7%). The best predictive trinominal for P1 and P3 groups was LM-glucose-BHBA (53.6|65.4% and 57.1|59.6%) and the worst were MY-LM-glucose (32.1|36.9%) and MY-LM-BHBA (28.6|34.3%), respectively.

***Conclusion and Implications***

Up to 300 days of lactation, the persistency level of a cow could be predicted using the weekly average of milk yield and body weight at week 3 of lactation, with an accuracy of 62.9% and a sensitivity of 70.2%. To predict the late persistency (>300 days), two or eventually three metabolites (lactose in milk, BHBA in blood and eventually glucose in blood) measured once during the third week of lactation could be used. Knowing and improving the estimation of the late persistency level will help the farmer to decide when to inseminate the cows (i.e. going for extended lactation or not), or maybe plan for a different feeding strategy to support milk production in late lactation if the cow insemination has been involuntarily delayed and if her late persistency has been predicted low. To improve the accuracy of these predictions, the number of measurements could be increased regarding the type of variable (i.e. maybe several weekly measurements for production variables automatically recorded). This method should also be evaluated on a larger data set, to determine if the same set of variables will be relevant to predict the persistency of different herds.

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