EAAP 2018 *69th Annual Meeting of the European Federation of Animal Science*

Session 54: Toward an integrated system from PLF […] data to a solution or decision

Precision feeding with a decision support tool dealing with daily and individual pigs' body weight

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INRA SCIENCE & IMPACT

Feed-a-Gene

Adapting the feed, the animal and the feeding techniques to improve the efficiency and sustainability of monogastric livestock production systems

The Feed-a-Gene Project has received funding from the European Union's H2020 Programme under grant agreement no 633531.

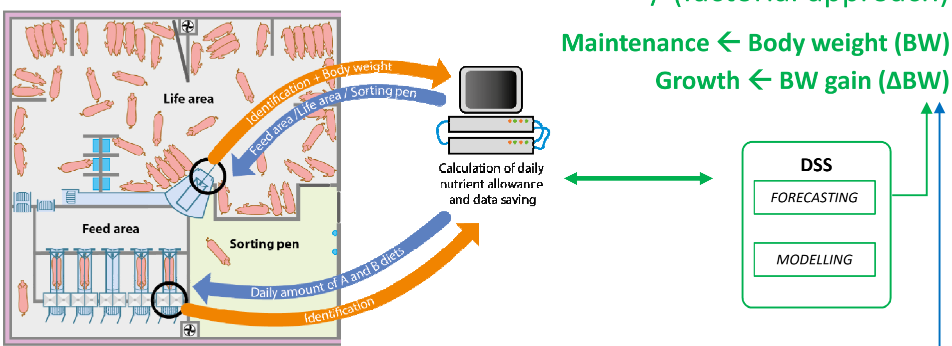
Decision support system for pigs under evaluation

Devices

Model for assessment of requirements / (factorial approach)

Maintenance ← Body weight (BW)

Growth ← BW gain (ΔBW)



Restricted feeding conditions ➔ restricted energy supply

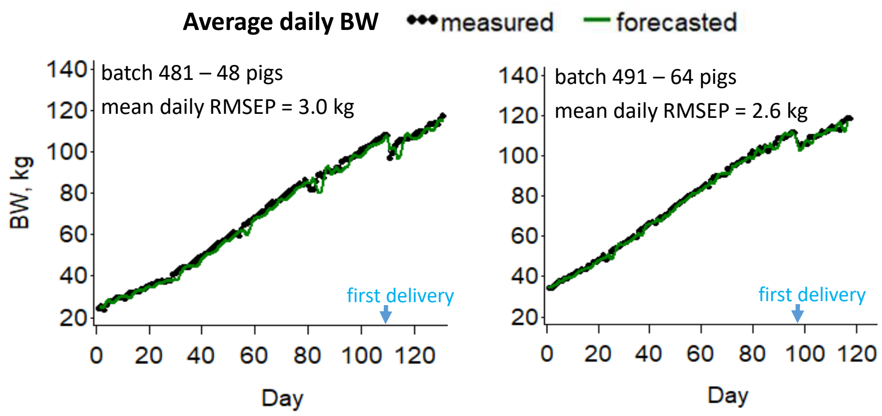
Evaluation on 2 batches of pigs either fed (within each batch) according to a 2-phase (2P) or an individual multiphase (MP)

Forecasted BW on day D+1 method used and accuracy

BW forecasting on day D+1 (D>4)[1]

with the Holt-Winters method (α = 0.6) using the 20 last data

Brossard et al. (2017), Quiniou et al., 2017)



Forecasted BW gain on day D+1 investigation on real-time definition of limit values

Step 1. Difference between forecasted BW_{D+1} and BW_D

Step 2. Definition of the secured range of values

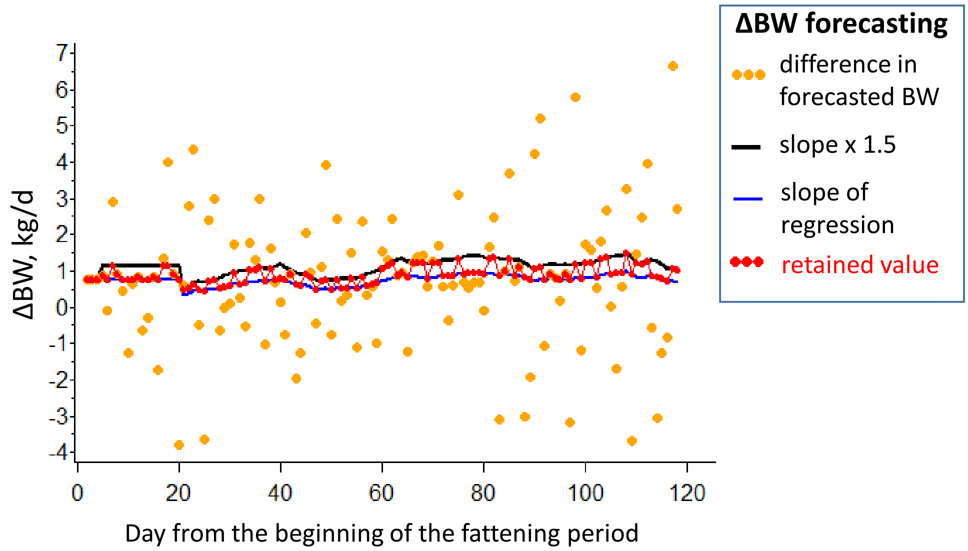
➔ two methods evaluated successively from two batches

ΔBW limit values, kg/d			batch 481	batch 491
Day	1➔4	Constant	0.75	
	4➔20	Minimum	0.75	f(BW at birth/weaning)[2]
		Maximum	0.90	min. x 1.5
	>20	Minimum	slope of the regression BW = f(day) over max. 15 days	slope of the regression BW = f(day) over max. 20 days
		Maximum	slope x 1.5	

Step 3. Comparison of BW difference to min/max values

Quiniou and Corrégé (2017)

Decision rule for determination of BW gain on daily and individually bases (example)



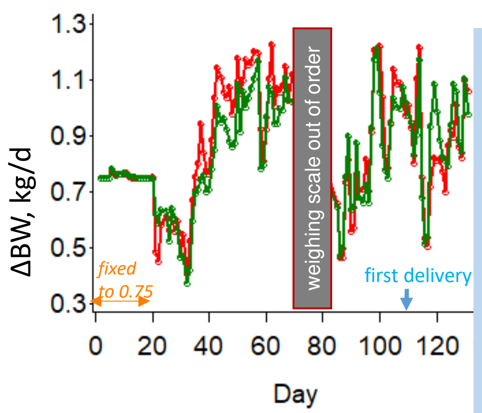
batch 491 – pig 174245

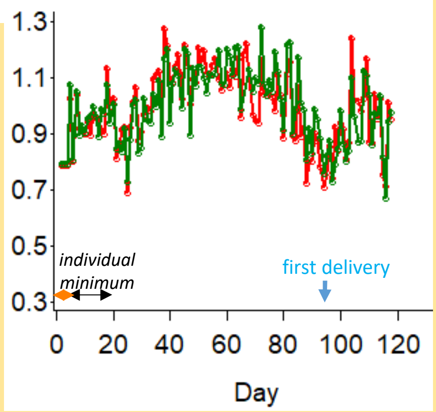
Average daily BW gain per batch per group of pigs

batch 481 – 48 pigs
(min. daily ΔBW = **slope$_{15d}$**)

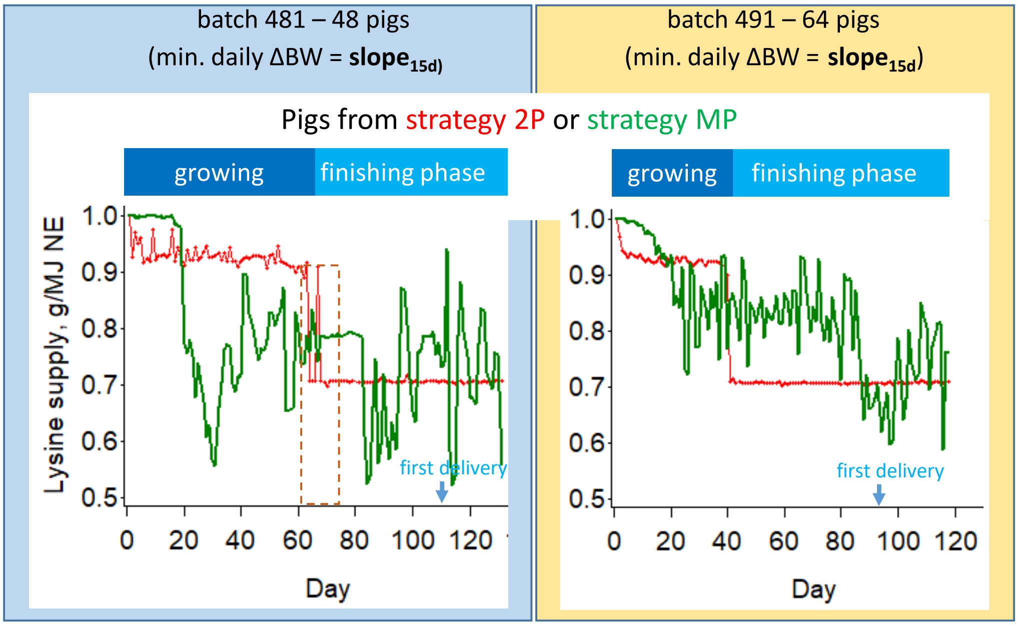
batch 491 – 64 pigs
(min. daily ΔBW = **slope$_{15d}$**)

Pigs from strategy 2P or strategy MP





Average daily supply of lysine (g/MJ NE)



Average growth and environmental performance

	batch 481 (24-113 kg)				batch 491 (34-117 kg)			
Strategy	**2P**		**MP**	P-value	**2P**		**MP**	P-value
ADG, g	740		742	0.88	803		814	0.46
FCR	2.64		2.66	0.58	2.66		2.64	0.30
N intake	5.51	↘	5.30	0.05	5.08	↗	5.36	0.01
N retention*	2.30		2.29	0.84	2.14		2.17	0.32
N output*	3.21	↘	3.00	0.08	2.94	↗	3.18	0.005
			(-6.5%)				(+8.0%) ☹	

** retention calculated by the simplified method, based on carcass leanness*
DFI: daily feed intake, ADG: average daily gain, FCR: feed conversion ratio

Conclusion

- This study is a part of an ongoing research program on DSS validation and refinement (Feed-a-Gene - task 4.4)

- Forecasting method Holt-Winters$_{0.6}$ of BW
  - Prediction is accurate
- Forecasting of BW gain is rather difficult
  - Due to erratic BW changes from day to day, even after BW smoothing
  - More investigations are required to parameterise in real-time the individual range of secured values

    Minimum based on regression BW=f(age)

    Maximum = minimum x factor?

Abstract

EAAP Annual Meeting 2018, Dubrovnik, Croatia

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Author: Quiniou, N., Marcon, M., Brossard, L.
Presentation: Theatre
Session 54: Towards an integrated system from data to a solution or decision

Abstract:

Nutritionists, feed companies and equipment manufacturers look for solutions that help farmers to improve sustainability of pig production. Based on experimental results obtained *in silico* or *in vivo*, a better adequacy between amino acid supplies and requirements increases feed efficiency and farmer's income and reduces the environmental impact of growing pigs, highlighting the interest for precision feeding. Data are collected to characterize daily animal traits (e.g., body weight, BW) and their variation from one day to another (e.g., growth rate, ΔBW). They are used to determine the requirement for maintenance and growth on the next day, respectively. Therefore, adequacy between requirements and supplies depends on these predicted BW and ΔBW. The double exponential smoothing (Holt-Winters) method with a smoothing parameter $\alpha = 0.6$ (HW$_{0.6}$), presents a low sensitivity to the number of latest values used to forecast BW. It seems to allow for a secured prediction of BW soon after the beginning of the growing phase (at least after 4 days). A group of pigs was used in restricted feeding conditions to compare results obtained either with a 2-phase feeding strategy, considered as the control treatment, or a precision feeding strategy based on BW forecasting with the HW$_{0.6}$ method. Pigs allocated to both treatments were group-housed in the same pen, equipped with the decision support system built in the Feed-a-Gene project to manage the data, to determine in real-time the corresponding nutritional requirements, and to adapt the feed characteristics provided to each pig through the blend of two diets (9.75 MJ net energy/kg, 0.5 or 1.0 g of digestible lysine per MJ). Available results from 24 pigs per treatment indicate that overall average growth performance were not influenced by the feeding strategy ($P > 0.58$ for both average daily gain and feed conversion ratio) but digestible lysine intake was reduced by 6% (1774 vs 1879 g, $P < 0.01$) and N output by 7% ($P < 0.01$) with precision feeding. Results will be completed by a second group using the same treatments. This study is part of the Feed-a-Gene project and received funding from the European Union's H2020 program under grant agreement no. 633531.