ADDITIONAL PAPER / SESSION 11 / ABSTRACT 4956

Walloon Breeding Association
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ASSOCIATIONS AMONG BCS, MILK PRODUCTION AND DAYS-OPEN IN WALLOON PRIMIPAROUS DAIRY COWS

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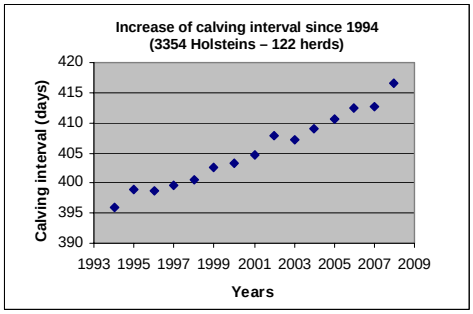
The overall objective is to be able to evaluate the fertility of a cow according to its BCS variation and the data from milk recordings.

Context

- **Increased calving interval & days-open**
- Short days-open = key objective for profitability even with high productive dairy cows
- However profitability decreases too when number of inseminations increases



AWE 2008

The calving interval and the days-open of high productive dairy cows have increased continuously for 15 years because of delayed and/or silent post-partum cyclicity, and decreased success rate of artificial insemination.

Context

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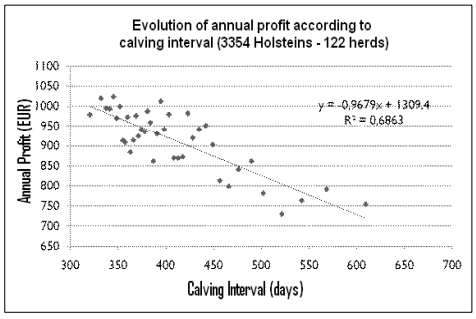
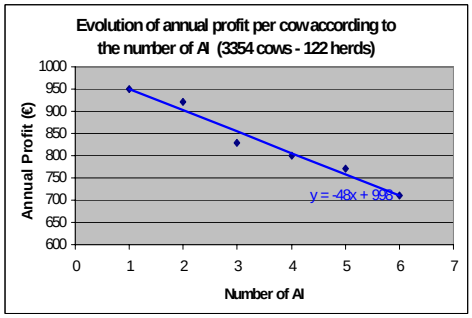


AWE 2008

Anyway, targeting a short days-open increases the profitability and should remain a key objective in breeding management, even with high productive dairy cows

Context

- Increased calving interval & days-open
- Short days-open = key objective for profitability even with high productive dairy cows
- **However profitability decreases too when number of inseminations increases**



AWE 2008

If the profitability decreases when the calving interval increases, the profitability decreases according to the number of inseminations as well.

Productivity = optimum between "insemination as soon as possible" and "insemination as less as possible"

↓

Objective of the study

To have an indicator of the pregnancy likelihood

↓

Estimate the likelihood for a cow to be pregnant at early lactation regarding the cow's characteristics and their variation

The breeders should therefore find an optimum between insemination as soon as possible and insemination as less as possible. They would need an indicator of the pregnancy likelihood helping them in fertility management.

Modus Operandi

→ LOGISTIC REGRESSION

Dependent variable (explained variable)

1. To be pregnant between DIM 35 and 79 (DO 35-79)
2. To be pregnant between DIM 80 and 120 (DO 80-120)

→ qualitative and binary

QUANTITATIVE → **QUALITATIVE**

Days Open	35 < DIM < 80	80 < DIM < 120
55	1	-
108	0	1
145	0	0

We use multiple logistic regression through SAS 9.2

The explained variable in our logistic model is the state of pregnancy at early lactation.

Actually we've defined 2 ranges of days-open to match this period:
1. Days-open ranging from DIM 35 to 79
2. Days-open ranging from DIM 80 to 120

Then we transform the quantitative information into qualitative and binary information (1 or 0) in order to fit the logistic model.

Modus Operandi

→ LOGISTIC REGRESSION

Independent variables (explanatory variables)

- Might explain why the cow is pregnant
- Indicators of the NEB → affects reproductive performances
- **Body Condition Score (BCS), lactose, fat, proteins and milk yields as well as their variation during the lactation**
- Modelled data for the whole lactation with the raw data of the 2 or 3 first recordings
- **Average days-open of the farm (herd effect)**
- Significance level of at least 0.05 to be in the model

Independent variables might explain why the response is 1 or 0, why the cow is pregnant or not.

We look for variables that could be indicators of the Negative Energy Balance (NEB) in early lactation as it affects the reproductive performances.

We therefore include in the model BCS, lactose, fat, proteins contents and milk yields as well as their variation during the lactation: they might be the effects to explain the state of pregnancy during the 2 ranges of days-open defined.

All those data are modelled for the whole lactation with the raw data of the 2 or 3 first recordings.

The average days-open of the farm is included in the model too aiming at identifying if there is a herd effect.

Results

Sample = 1103 primiparous cows to build the model

MODEL 1 / DO 35-79

EFFECT	Identified variables	Significance level	
HERD EFFECT	Medium farm DO (3 lactations taken in account)	< 0,0001	***
FAT	Cumulative quantity of fat at the end of lactation	0,0005	***
FAT	Fat content at peak	0,0052	**
PROTEINS	Proteins content at DIM 15	0,0057	**
MILK	Milk yield at peak	0,0083	**
LACTOSE	Medium lactose content from DIM 75 to 120	0,0141	*
BCS			

MODEL 2 / DO 80-120

EFFECTS	Identified variables	Significance level	
MILK	Cumulative milk yield at the end of lactation	< 0,0001	* * *
MILK	Medium milk yield from DIM 75 to 120	< 0,0001	* * *
BCS	BCS at DIM 120	0,0009	* * *
PROTEINS	Medium proteins content from DIM 15 to 60	0,0015	* *
LACTOSE	DIM when lactose content is minimum	0,0113	*
BCS	BCS loss from DIM 30 to 75	0,0424	*
HERD EFFECT			
FAT			

Here are in the tables the effects identified to explain the pregnancy state during the 2 ranges of days-open.

For DO 35-79 we highlighted the fact that :

1. No BCS effect has been retained
2. The most significant effect is the average days-open of the farm → it could translate the Voluntary Waiting Period

For DO 80-120 we highlighted the fact that:

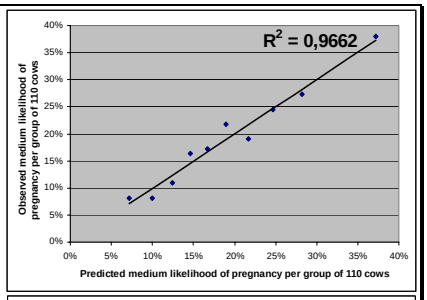
1. Two BCS effects have been retained
2. The average days-open of the farm is not in the model

Validation

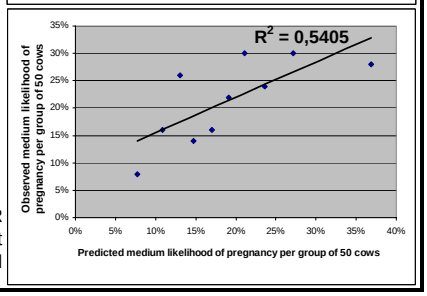
MODEL 1 / DO 35-79

Global null hypothesis test
P-value < 0,0001 → ***

DESCRIPTIVE POWER
Hosmer – Lemeshow adequacy test with **1103** cows used to build model



PREDICTIVE POWER
Hosmer – Lemeshow adequacy test with **500** cows **not** used to build model



The Global Null Hypothesis test gives an extremely significant P-value

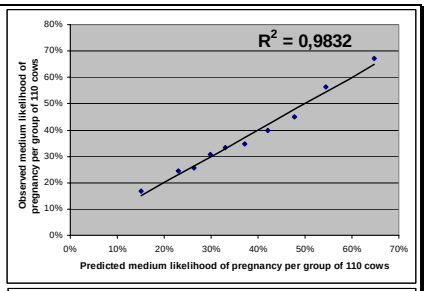
We use Hosmer – Lemeshow adequacy test to evaluate the descriptive power and the predictive power of the models. Actually if we compare predicted likelihoods with observed likelihoods per group of cows we can see the model is relevant for descriptive and predictive purpose.

Validation

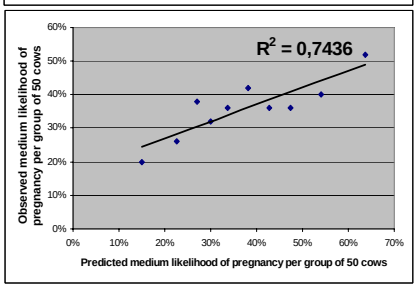
MODEL 2 / DO 80-120

Global null hypothesis test
P-value < 0,0001 → ***

DESCRIPTIVE POWER
Hosmer – Lemeshow adequacy test with **784** cows used to build model



PREDICTIVE POWER
Hosmer – Lemeshow adequacy test with **500** cows **not** used to build model



The results of the test are similar for the second model but even better regarding the predictive power.

Application

Tool pointing the cows having the highest and the lowest pregnancy likelihood at early lactation (when the average likelihood is low)

MODEL 1 / DO 35-79

	N° cows	Expected	Observed
Cows with an expected likelihood < 10,6% (Mean – SD)	73	8,5%	11%
Cows with an expected likelihood > 27,6% (Mean + SD)	69	35%	26%

MODEL 2 / DO 80-120

	N° cows	Expected	Observed
Cows with an expected likelihood < 23,1% (Mean – SD)	80	17,5%	22,5%
Cows with an expected likelihood > 51,8% (Mean + SD)	91	60%	47%

From those results a tool pointing the cows having the highest and the lowest pregnancy likelihood at early lactation, meaning a period when the average likelihood is globally low, could be built.

In red are the cows having a pregnancy likelihood lower than the mean minus the standard deviation. With such warning the breeder could choose:

1. Not to inseminate and wait for the next service
2. To inseminate with a cheaper straw

In green are the cows having a pregnancy likelihood higher than the mean minus the standard deviation. With such warning the breeder could choose to inseminate with a more expensive straw.

Conclusion

1. It is possible to predict if the likelihood for a cow to have a short days-open is higher or lower than the average
2. BCS identified as an effect for DO 80-120 but not for DO 35-79
3. Herd effect identified as an effect for DO 35-79 but not for DO 80-120 → indicator of management and Voluntary Waiting Period
4. **Pregnancy likelihood could be used to predict the insemination success rate**

Offing studies

Similar models for pluriparous cows should be developed:

- First tests show a better concordance among expected & observed likelihoods
- But need for more cows with third and fourth calving

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