Area **Coccidia**

Zootechnical and economical evaluation of the use of a live anticoccidial vaccine in rotation with anticoccidial products in broiler chickens: results of a set of field trials from Belgium and the Netherlands

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In industrial poultry production, designing a preventive program for controlling coccidiosis is one of the most important decisions to be made in order to safeguard or improve zootechnical and financial results. Usually in-feed anticoccidials are used in these programs and traditionally were considered sufficient for controlling clinical coccidiosis. Live coccidiosis vaccines are becoming increasingly popular though, as they very often provide a solution when the in-feed anticoccidials become inefficient. In fact, live coccidiosis vaccines are able to promote the restoration of the sensitivity of Eimeria field strains towards anticoccidials.

The objective of the study was to evaluate the efficacy of a live coccidiosis vaccine (Hipracox®) given via coarse spray at day one of life to prevent and control clinical coccidiosis in broiler chickens under standard production conditions. In total, 7 houses were vaccinated during 2 (Farm 1: House 1 and 2) or 3 (Farm 2: House 3, 4, 5, 6, 7) consecutive cycles. In this trial, the impact of subclinical coccidiosis is estimated by evaluating the impact of live coccidiosis vaccination when rotating from a traditional non-rotational shuttle program using nicarbazin/narasin and salinomycin. Moreover, after returning to traditional anticoccidials, the zootechnical and financial impact of improving the sensitivity of the Eimeria field strains to the previously used anticoccidials by applying live coccidiosis vaccines is estimated.

Both farms, before vaccination, were considered by veterinary supervisors as coccidiosis attention farms. Frequently, signs of coccidiosis were evident through oocyst per gram (OPG) counts, lesion scores or presence of blood in the droppings. No obvious increased mortality due to coccidiosis was encountered though. Both sites applied thinning procedures at around 32 - 35 days of age. The birds were not sexed. The final slaughter age was 40-42 days. In the economical assessment, average slaughter age was calculated as the weighted average of both slaughter ages, taking into account the weights, number of birds slaughtered and the two slaughter ages.

All houses together contained 205,000 birds per cycle. We evaluated the performance data of approximately 495,000 birds for Farm 1, whereas Farm 2 had approximately 960,000 birds. In order to calculate the average for the seven houses in total, we assumed they had the same weight and contributed one seventh of the average.

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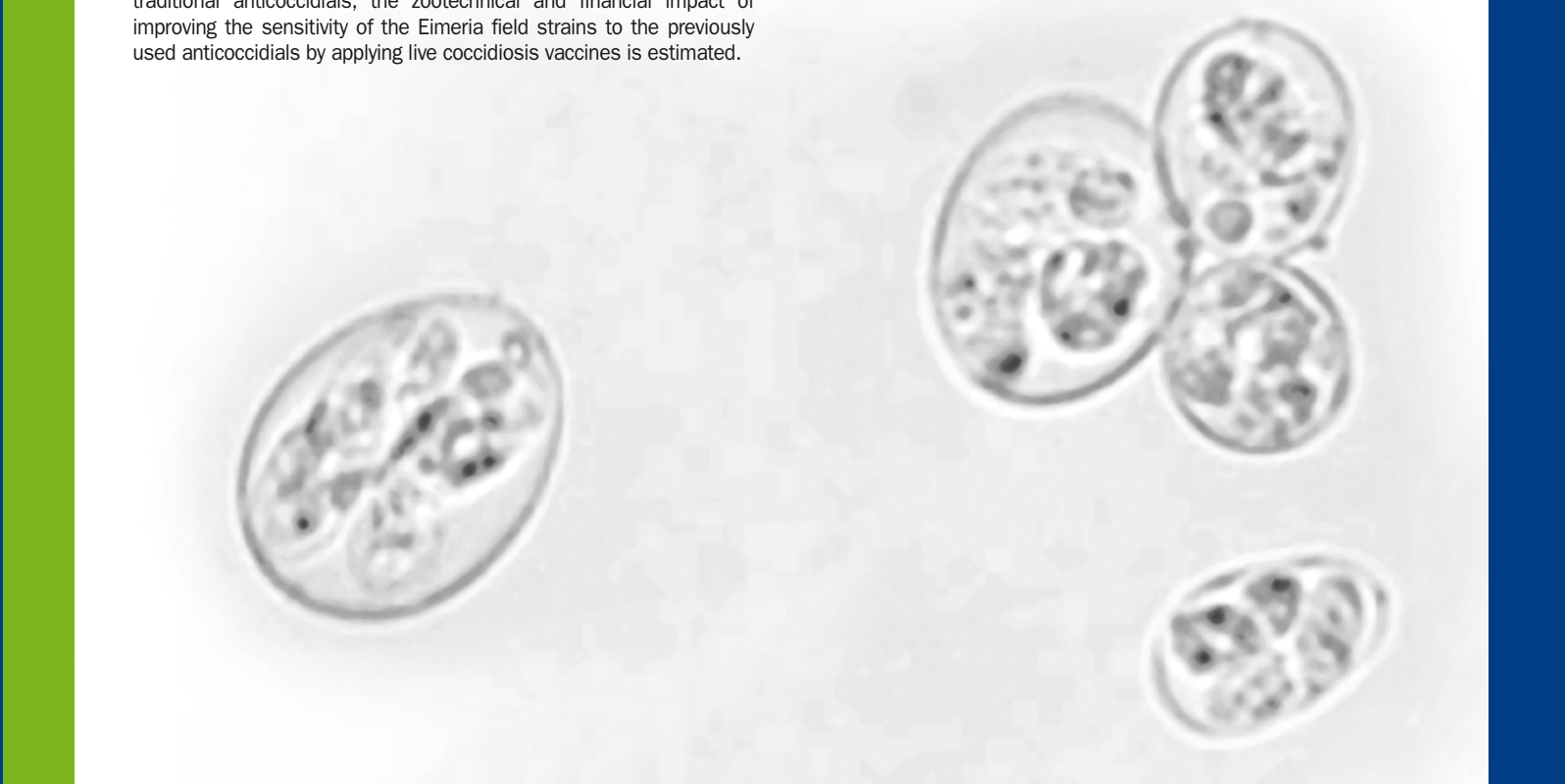


Table 1. Farm History: Site 1 - Belgium

Flock Set Up Date	Cycle	Anticoccidial		
Flock Set Up Date	Cycle	Starter	Grower	Finisher
18/12/2009	1	Nicarbazin-Narasin	Salinomycin	-
5/02/2010	2	Nicarbazin-Narasin	Salinomycin	-
7/04/2010	3	Anticoccidial vaccine	-	-
25/06/2010	4	Nicarbazin-Narasin	Salinomycin	-
20/08/2010	5	Nicarbazin-Narasin	Salinomycin	-
25/11/2010	6	Decoquinate	Decoquinate	-
13/01/2011	7		HIPRACOX®	
28/03/2011	8		HIPRACOX®	
23/05/2011	9	Salinomycin	Salinomycin	-
18/07/2011	10 - House 1	Decoquinate	Decoquinate	-
18/07/2011	10 - House 2	Salinomycin	Salinomycin	-
15/09/2011	11 - House 1	Lasalocid	Lasalocid	-
15/09/2011	11 - House 2	Decoquinate	Decoquinate	-

Table 2. Farm History: Site 2 - The Netherlands

Flock Set Up Date	Cycle	Anticoccidial		
Flock Set Up Date	Cycle	Starter	Grower	Finisher
29/09/2009	1	Nicarbazin-Narasin	Salinomycin	-
30/11/2009	2	-	Salin./Nicarb.-Nar	Narasin
1/02/2010	3	Salinomycin	Diclazuril	Narasin
19/04/2010	4	Salinomycin	Diclazuril	Narasin
8/06/2010	5	Robenidine	Salinomycin	Salinomycin
8/08/2010	6	Robenidine	Salinomycin	Salinomycin
15/10/2010	7	Salinomycin	Monensin	Diclazuril
10/12/2010	8	Nicarbazin-Narasin	Salinomycin	Diclazuril
4/02/2011	9		HIPRACOX®	
1/04/2011	10		HIPRACOX®	
26/05/2011	11		HIPRACOX®	
29/07/2011	12	Nicarbazin-Narasin	Salinomycin	-
27/10/2011	13	Decoquinate	Decoquinate	Narasin

Table 3.Overall Averages of each investigated parameter of CBV, CDV and CAV

Group	Mortality	Body Weight	FCR2000	ADG	EPEF
CBV	3,13±0,87^{a}	2408±72,3^{a}	1,56±0,04^{a}	58,38±0,71^{a}	362,14±12,2^{a}
CDV	2,66±0,42^{a}	2354±100,5^{a}	1,53±0,05^{a}	58,04±0,76^{a}	369,57±12,8^{a}
CAV	2,91±1,05^{a}	2491±107,0^{a}	1,47±0,03^{b}	60,54±2,23^{b}	398,71±21,8^{b}

Data presented as mean ± standard deviation. Values in each column with different superscript letters are statistically significantly different at P ≤ 0.05 by a one-way analysis of variance (ANOVA) test.

RESULTS & DISCUSSION

All zootechnical results are divided in three major groups (Table 3):

1.Cycles before vaccination (CBV) (Table 1 and 2)
- a.For Farm 1: cycles 1- 6
- b.For Farm 2: cycle 8

2.Cycles during vaccination (CDV) (Table 1 and 2)
- a.For Farm 1: cycles 7 and 8
- b.For Farm 2: cycles 9, 10 and 11

3.Cycles after vaccination (CAV) (Table 1 and 2)
- a.For Farm 1: cycles 9, 10 and 11
- b.For Farm 2: cycles 12 and 13

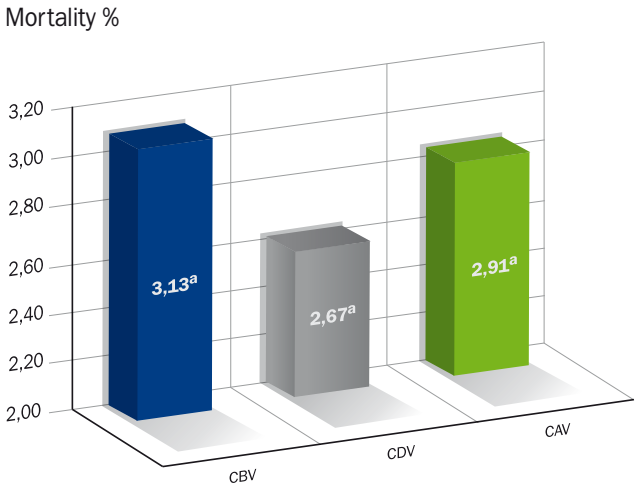
1 MORTALITY

Mortality was recorded on a daily basis by the farmer. Before vaccination there was no apparent disease other than coccidiosis on the farms which presumably had an impact on mortality. On Farm 1, cycles 8 and 9 (second vaccination and first after vaccination), ORT (Ornitobacterium rhinotracheale) problems were encountered, but we assume this did not affect the total mortality of the flock.

As the houses did not suffer from heavy clinical outbreaks of coccidiosis, it seems difficult to attribute the lower mortality to an improvement in its control. In spite of this, there had been no other indication for an improved mortality rate during or after the vaccination cycles. On the other hand, Farm 1 encountered ORT problems during cycle 7 and 8 (2nd vaccination and 1st post-vaccination). There had been no correction for these mortalities.

Values with the same superscript letters are not statistically significantly different at P > 0.05 by a one-way analysis of variance (ANOVA) test.

Figure 1. Overall Average Mortality of CBV, CDV and CAV



2 BODY WEIGHT

Slaughter age has an impact on the performance parameters. There were slight differences in slaughter age between Farm 1 and Farm 2 before vaccination.

Table 4. Average Slaughter Age per house

	Farm 1		Farm 2					
	House 1	House 2	House 3	House 4	House 5	House 6	House 7	Overall
Before vaccination (CBV)	39,8	39,6	41,6	41,6	41,7	41,7	41,7	41,100
During vaccination (CDV)	40,8	41,1	40,7	40,7	40,4	40,5	40,8	40,860
After vaccination (CAV)	41,5	41,5	40,8	40,8	40,9	40,9	41,4	41,114

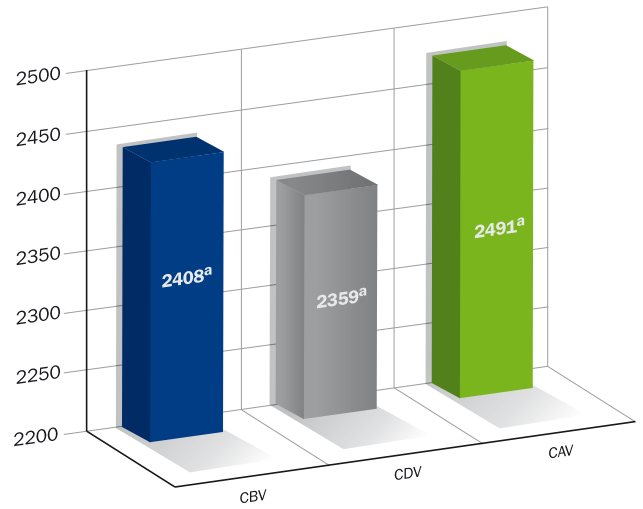
Average live body weights corrected at the same age (41 days) are presented per house according to the grouping before, during and after coccidiosis vaccination (Table 5).

Table 5. Average Final Weights per house corrected at 41 days

	Farm 1		Farm 2					
	House 1	House 2	House 3	House 4	House 5	House 6	House 7	Overall
Before vaccination (CBV)	2518	2479	2382	2327	2386	2389	2429	2409
During vaccination (CDV)	2445	2502	2276	2270	2289	2285	2446	2359
After vaccination (CAV)	2668	2590	2377	2376	2492	2476	2458	2491
Difference before/after	150	111	49	49	106	87	29	82

When analyzing the data of overall average BW of CBV, CDV and CAV (Figure 2) using a one-way analysis of variance (ANOVA) test, we found no statistically significant difference at P > 0.05.

Figure 2. Overall Average Body Weight of CBV, CDV and CAV



Values with same superscript letters are not statistically significantly different at P > 0.05 by one-way analysis of variance (ANOVA) test.

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3 FEED CONVERSION RATIO

Feed Conversion Ratio (FCR) was corrected for the weight to result in a FCR_{2000}, which is the FCR corrected to 2000 gram birds. The formula used was:

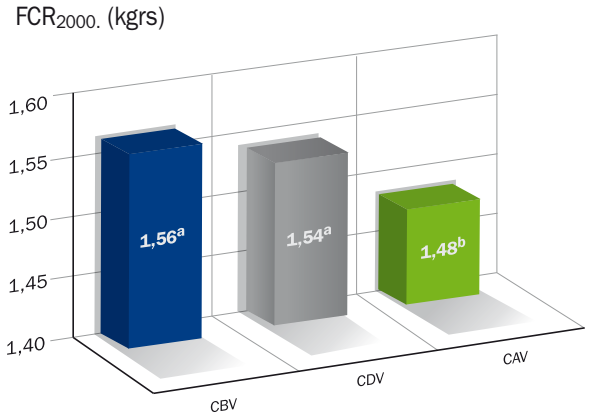
(Average Slaughter Weight – 2000) x 0.33 = Y
FCR2000 = FCR - Y

FCR_{2000} (Table 6) during vaccination had 2 points of improvement and after vaccination it improved by 8 points. None of the houses in the trial had a higher FCR_{2000} during vaccination and all of them had an improvement between 1 and 20 points after vaccination. When analyzing data of overall average FCR_{2000} of CBV, CDV and CAV using a one-way analysis of variance (ANOVA) test, we found a statistically significant difference at $P \leq 0.05$ (Figure 3).

Table 6. Average FCR_{2000} per house

	Farm 1		Farm 2					
	House 1	House 2	House 3	House 4	House 5	House 6	House 7	Overall
Before vaccination (CBV)	1,62	1,63	1,53	1,55	1,52	1,56	1,53	1,56
During vaccination (CDV)	1,60	1,61	1,50	1,51	1,51	1,51	1,53	1,54
After vaccination (CAV)	1,47	1,43	1,51	1,50	1,46	1,46	1,52	1,48
Difference before/after	-0,15	-0,20	-0,02	-0,05	-0,06	-0,10	-0,01	-0,08

Figure 3. Overall FCR_{2000} of CBV, CDV and CAV



Values with different superscript letters show a statistically significant difference at $P \leq 0.05$ by using a one-way analysis of variance (ANOVA) test.

4 AVERAGE DAILY GAIN

Average daily gain (ADG) was calculated by dividing the average slaughter weight (taking into account the average weights of thinning and final slaughter) with the average number of days when birds were slaughtered (taking into account thinning and final slaughter age).

Figure 4. Overall ADG of CBV, CDV and CAV

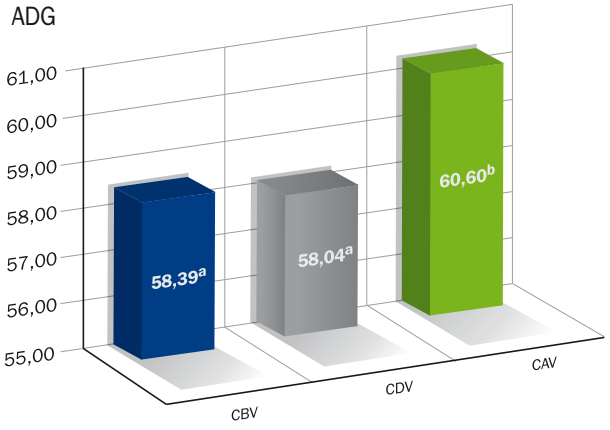


Table 7. Average ADG per house

	Farm 1		Farm 2					
	House 1	House 2	House 3	House 4	House 5	House 6	House 7	Overall
Before vaccination (CBV)	59,26	58,09	57,51	57,46	58,76	58,82	58,82	58,39
During vaccination (CDV)	57,44	57,27	57,65	57,50	59,18	58,84	58,39	58,04
After vaccination (CAV)	64,05	62,84	58,25	58,22	60,93	60,53	59,36	60,60
Difference before/after	4,79	4,76	0,74	0,76	2,17	1,71	0,54	2,21

When analyzing the data of overall ADG of CBV, CDV and CAV using a one-way analysis of variance (ANOVA) test, we found a statistically significant difference at $P \leq 0.05$ (Figure 4).

5 EPEF

European Production Efficiency Factor is a way of estimating the performance of a flock combining the information of mortality, slaughter age, body weight and feed conversion ratio. Different formulas are used and in this study the formula applied was:

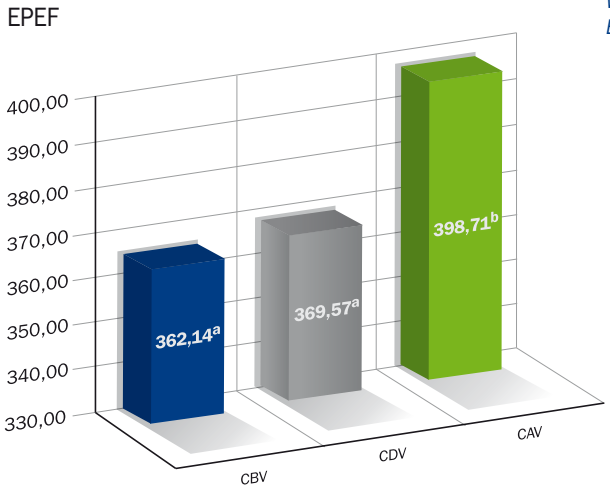
EPEF = [(live weight, kg X livability, %)/(feed conversion ratio$_{2000}$ X age, days)] X 100

Table 8. Average EPEF per house

	Farm 1		Farm 2					
	House 1	House 2	House 3	House 4	House 5	House 6	House 7	Overall
Before vaccination (CBV)	353	344	362	355	376	369	376	362
During vaccination (CDV)	354	350	375	372	382	381	372	370
After vaccination (CAV)	417	427	378	376	411	407	375	399
Difference before/after	64	82	16	21	35	38	-1	37

When analyzing with a one-way analysis of variance (ANOVA) test, we found the data of overall EPEF of CBV, CDV and CAV to have a statistically significant difference at P ≤ 0.05 (Figure 5).

Figure 5. Overall EPEF of CBV, CDV and CAV



6 ANTIBIOTIC USE DURING VACCINATION

Antibiotic use was not higher in terms of kg of active product during vaccination on both farms compared to cycles before vaccination. Furthermore, the use was also not higher in regard to days of treatment. This is illustrated with details for Farm 1 (Table 9): number of treatments for Bacterial Enteritis (dysbacteriosis) is for cycle 5 (See Table 1) similar to the chemical program before vaccination (cycle 6). On the other hand, when taking into account all the treatments for intestinal problems, including the coccidiosis treatments, the total number of treatments while vaccinating is even lower compared to cycles before vaccination. The main difference between before and during vaccination was the age treatments were given: about one week earlier for the vaccinated cycles compared to those non-vaccinated. Thus, the total amount of antibiotics is reduced by earlier treatment age.

Table 9. Number of Intestinal Treatments for Farm 1 (both houses)

Nº	Cycle	Coccidiosis	Bacterial Enteritis	Nº Total Intestinal	Age 1st Treatment
5	Nicarb.-Naras./Salin.	4	4	8	21
6	DecoquinatE	0	6	6	18
7	Hipracox®	0	6	6	14
8	Hipracox®	0	3	3	10
9	Salinomicyn	3	5	8	25
10	Decoq. (H1)/Salin. (H2)	2	8	10	16

CONCLUSIONS

Anticoccidial vaccination applied in problematic farms for coccidiosis, proved to improve productive performances and financial parameters, especially when returning to in-feed anticoccidials: lower FCR and mortality, higher ADG final body weight and EPEF. In general, we can conclude that there were no statistical differences between pre- and inter-vaccination in any case. On the contrary, absolute results of mortality, FCR_{2000} and EPEF improved while vaccinating. The post-vaccination situation is very relevant: absolute results for all parameters, except for mortality, are better compared to those of vaccination, while ADG, FCR_{2000} and EPEF are statistically better than before and during vaccination. As a consequence, it seems clear that anticoccidial vaccination promotes the restoration of the sensitivity of Eimeria field strains towards anticoccidials. Finally, it is interesting to observe that anticoccidial vaccination seems to reduce mortality better than when using anticoccidials. In conclusion, for the type of farms encountered during the trial, vaccination against coccidiosis with Hipracox® proved to be a valid economical approach, both during and especially after returning to in-feed anticoccidials.

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