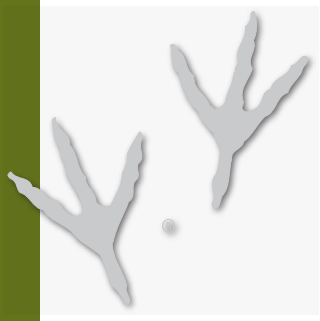
MSD ANIMAL HEALTH
TECHNICAL SERVICES BULLETIN



Optimizing Broiler Performance: Progressive Improvement During Multiple Flock Cycles of Coccivac®-B Vaccination With Enradin®

INTRODUCTION

Intestinal health for optimum broiler performance requires both the control of coccidiosis and the proper balance of bacterial microflora.

The imbalance of microflora often begins as a consequence of intestinal irritation. The initial irritant, often coccidiosis, causes cell damage and the production of excess mucous in response to the cytokines produced as part of the intestinal immune response. The cellular debris and mucous become a nutrient source for undesirable intestinal microflora, such as *Clostridium perfringens.* The clostridia continue the cycle of intestinal damage and mucous production by releasing powerful toxins, resulting in wet feces from excessive mucous production, or in the worst case, causing necrotic enteritis.

While *clinical* coccidiosis outbreaks are easily controlled with vaccination, effective subclinical coccidiosis control for maximum performance requires multiple vaccinated flock grow-out cycles. In the initial vaccinated flock, wild strain *Eimeria* challenge is often severe, despite farm cleanout and disinfection. With each successive vaccinated flock, the challenge becomes less severe until the vaccine becomes the dominant *Eimeria* population in the poultry house. Flock performance progressively improves over two to four flock cycles of coccidiosis vaccination.

This study was designed to improve intestinal health in two ways: improved coccidiosis control through vaccination with Coccivac®-B and improved *Clostridium perfringens* control with Enradin®. Flocks were compared to two previous flock cycles using ionophore anticoccidials with generic feed antibiotics, and to concurrent coccidiosis vaccinated flock cycles using BMD® (bacitracin methylene disalicylate) as a comparison to Enradin.

STUDY DESIGN

One hundred twenty thousand broilers were divided into Groups A, B, C and D in two environmentally controlled, double-deck commercial broiler houses located in Taiwan.

The study was conducted over six successive flock grow-out cycles as summarized in Table 1. Basic feed formulation was the same, except for medication changes indicated.

CONCLUSIONS

- Late subclinical coccidiosis is detrimental to performance. But changing the timing and level of coccidiosis insult on a farm with vaccination takes some time.
- In this multi-flock study, broiler performance improved with each successive flock vaccinated with Coccivac-B.
- Each successive vaccinated flock improved even more when Enradin was used vs BMD.
- The Performance Index stabilized at > 370 with Coccivac-B + Enradin after three consecutive flock cycles (bird age 34.5 days, weight 2.0 kg, FCR 1.55).
- Despite higher program cost, net profit improved with each successive flock that used Coccivac-B + Enradin, rising US$0.071/kg vs the best ionophore flock in the trial.

Table 1: Study Design

Flock	Group	Pre-Starter	Starter	Grower
1st	A	Maduramicin Generic AGP	Maduramicin Generic AGP	Monensin
	B	Lasalocid + Nicarbazin + Generic AGP	Lasalocid + Amrolium + Generic AGP	Monensin
	C	Lasalocid + Organic arsenic + Generic AGP	Lasalocid +. Organic arsenic + Generic AGP	Monensin
	D	Maduramicin Generic AGP	Maduramicin Generic AGP	Monensin
2nd	A B	Lasalocid Generic AGP	Lasalocid Generic AGP	Monensin
	C D	Maduramicin Generic AGP	Maduramicin Generic AGP	Monensin
3rd	A	Coccivac-B, Enradin 20 ppm*		
	B	Coccivac-B, BMD 110 ppm*		
	C	Coccivac-B, Enradin 20 ppm*		
	D	Coccivac-B, BMD 110 ppm*		
4th	A	Coccivac-B, Enradin 10 ppm		
	B	Coccivac-B, BMD 55 ppm		
	C	Coccivac-B, Enradin 10 ppm		
	D	Coccivac-B, BMD 55 ppm		
5th	A	Coccivac-B, Enradin 10 ppm		
	B	Coccivac-B, Enradin 10 ppm		
	C	Coccivac-B, Enradin 10 ppm		
	D	Coccivac-B, BMD 55 ppm		
6th	A,B,C,D	Coccivac-B, Enradin 10 ppm		

**Extra-label dose of the in-feed antibiotics was the choice of the field cooperator's veterinarian.*

The oocysts per gram of feces (Figure 1a – 1c), Performance Index (Figure 2), production cost and net profit (Table 2, 3 and Figure 3, 4) were calculated for each of the flocks in the study.

I. PROGRESSIVE IMPROVEMENT IN COCCIDIOSIS CONTROL

Figure 1 (a,b,c,d) shows sequential counts of *Eimeria spp.* oocysts per gram of feces from the ionophore flocks (flock 1 and 2), the first Coccivac-B (flock 3) and Coccivac-B after three cycles (flock 5).

Figure 1a and b are typical of ionophore anticoccidial programs, which allow subclinical coccidiosis multiplication late in the life of the broiler flock. The subclinical coccidiosis near the end of the growth cycle adversely impacts growth rate without time for compensatory gain before slaughter.

Rotation of ionophores may reduce the challenge (flock 1 vs flock 2), but the late position of the challenge (after 28 days of age) hurts the flock because it occurs during peak growth.

Figure 1c shows flock 3 (first cycle of Coccivac-B vaccination) demonstrating a shift to the left of peak oocyst shedding. When subclinical *Eimeria spp*. multiplication occurs earlier, it has less impact on the maximum growth phase of the broiler growth curve.

The oocyst shedding curve in Figure 1d (flock 5, the third Coccivac-B flock cycle) is typical of an established Coccivac-B vaccination program. The peak of oocyst shedding is lower and much earlier than the ionophore program, enabling the broilers to achieve better growth.

Figure 1a

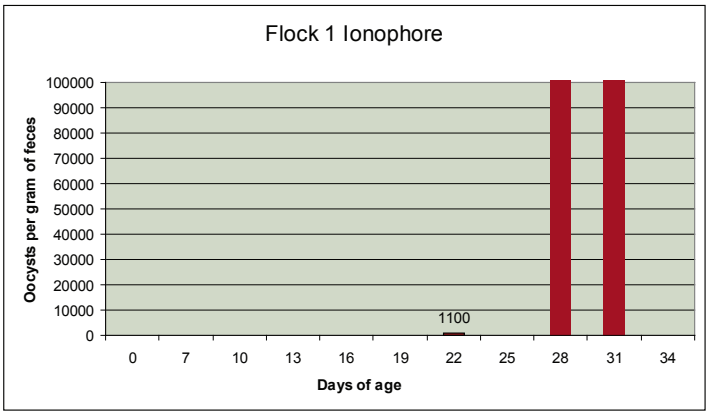


Figure 1b

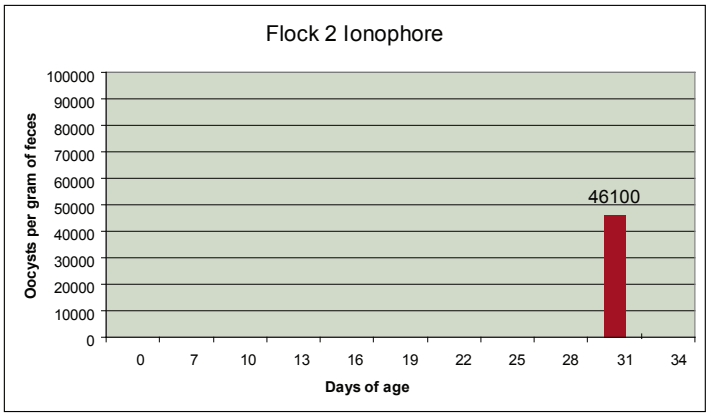


Figure 1c

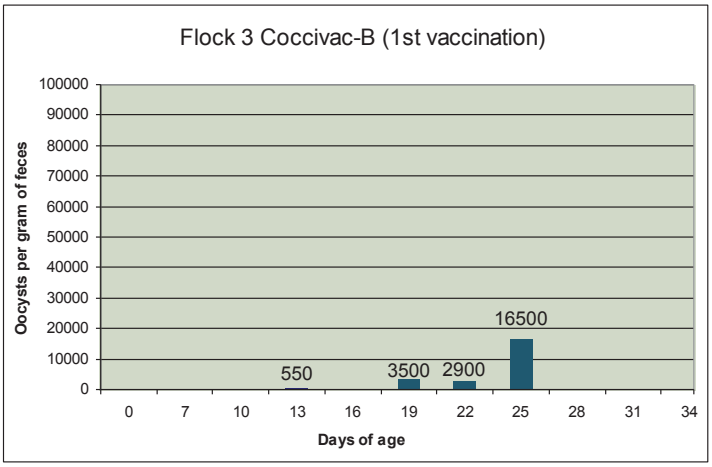
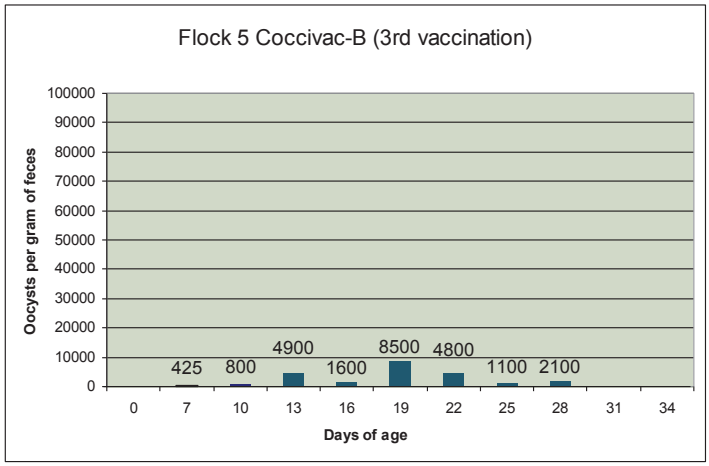


Figure 1d



II. PROGRESSIVE IMPROVEMENT IN PERFORMANCE INDEX

Improved coccidiosis control contributes to improved performance in the vaccinated flocks. But the use of Enradin to enhance protection against *C. perfringens* and to maintain healthy intestinal microflora further improves the performance of coccidiosis-vaccinated flocks.

Figure 2: Performance Index

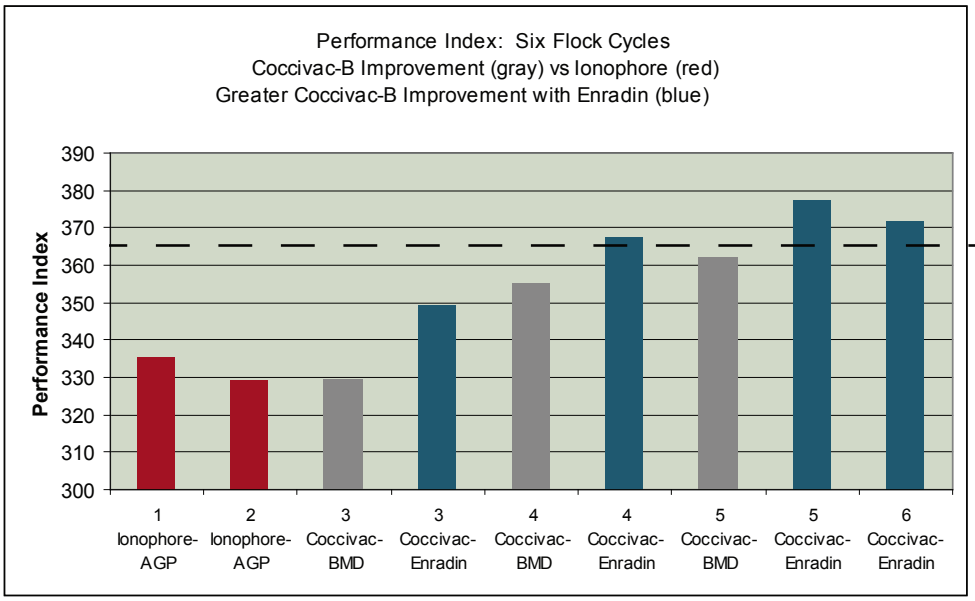


Table 2: Performance Results

Flock	Group	Livability	F.C.R.	Weight (kg)	Days	Performance Index	Cost US$/kg	Revenue US$/kg	Net Profit US$/kg
1st	Ionophore + Generic AGP								
	A,B,C,D	96.00%	1.63	2.11	37.00	335.47	3.036	3.348	0.312
2nd	Ionophore + Generic AGP								
	A,B,C,D	92.72%	1.59	1.92	34.00	329.31	2.839	3.046	0.207
3rd	Coccivac-B + Enradin 20 ppm								
	A,C	97.20%	1.56	1.95	34.75	349.64	2.807	3.094	0.287
	Coccivac-B + BMD 110 ppm								
	B,D	99.60%	1.60	1.84	34.75	329.61	2.724	2.920	0.195
4th	Coccivac-B + Enradin 10 ppm								
	A,C	96.45%	1.58	2.07	34.50	367.43	2.945	3.284	0.339
	Coccivac-B + BMD 55 ppm								
	B,D	98.80%	1.60	1.99	34.50	355.29	2.871	3.149	0.278
5th	Coccivac-B + Enradin 10 ppm								
	A,B,C	97.00%	1.55	2.08	34.50	377.30	2.918	3.300	0.383
	Coccivac-B + BMD 55 ppm								
	D	98.30%	1.58	1.92	33.00	361.98	2.790	3.046	0.256

III. ECONOMICS OF PERFORMANCE: PROGRESSIVE IMPROVEMENT OF NET PROFIT

The production costs of this operation are summarized in Table 3.

Table 3: Production Costs (fixed for comparison)

Chicks costs US$/chick	0.68	Feed costs US$/kg	0.600	Vaccine costs excluding Coccivac-B US$/chick	0.03
Treatments costs US$/chick	Coccivac-B 1 dose	Enramycin 10 ppm BMD 55 ppm	Anticoccidial + Generic AGP	Water, gas, electricity costs	0.068 US$/chick
	0.041	0.017	0.0272	Labor costs NT$/chick	0.068 NT$/chick
Other costs	0.0163 (US$/chick)				
Live bird price	1.587 (US$/kg)				

Farm average net profitability after cost is summarized in Figure 3. Net profitability of Coccivac-B + BMD vs Coccivac-B + Enradin for flocks 3, 4 and 5 are summarized in Figure 4.

Figure 3

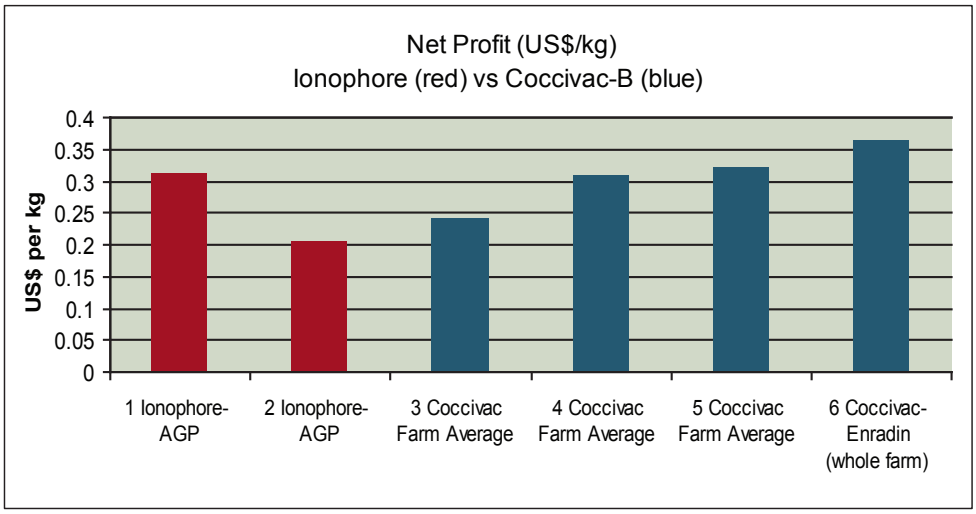
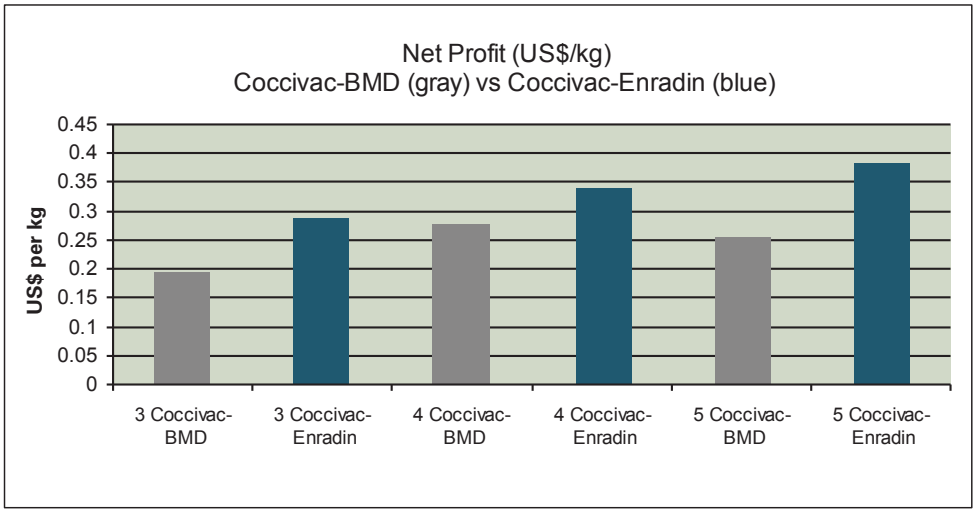


Figure 4



Despite a higher input cost for Coccivac-B + Enradin compared to ionophore, the net profitability of these flocks showed a high return for the input cost investment compared to the lower ionophore flock, and a pattern of improvement that exceeded the profitability of the best ionophore flock by US$0.07/kg or US$0.14/chick.

CONCLUSIONS AND DISCUSSION

Feed medication with anticoccidials has been a highly effective method of coccidiosis control for decades. However, as resistance to in-feed medication increases, more subclinical coccidiosis lesions and oocyst shedding occurs.

In-feed programs effectively suppress subclinical coccidiosis early, but when birds reach 28 to 35 days of age, the increased fecal volume and house moisture level promote the multiplication of *Eimeria spp*. populations. Thus, the peak subclinical challenge occurs during the most critical time for meat yield growth, and flocks are often slaughtered when the number of oocysts in the litter is at peak. The high litter counts will carry over, even after cleanout, to increase the challenge in the next flock. Performance progressively declines.

Coccidiosis vaccination is an investment that changes the coccidiosis dynamics in a flock. Peak oocyst shedding is earlier, protection is improved, and without late oocyst shedding, carryover and farm challenge are reduced. The full positive impact may require three grow-out periods.

Enradin protects the flock during the critical immunity-building period when subclinical coccidiosis exposure is necessary. The superior efficacy against *Clostridium perfringens* enhances the already improved performance of Coccivac-B vaccinated flocks compared to flocks protected by BMD.

In this sequential flock study, performance steadily improved with successive Coccivac-B vaccinated flocks compared to the previous flocks fed ionophores. The net profit and Performance Index were incrementally better when Enradin was included with Coccivac-B compared to Coccivac-B with BMD.

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