

RISE Program

Risk Impact Strategy Evaluation

Clinical vomitoxin exposure. Layer health and egg production.

Country:
North Asia

Type of farm:
Poultry

Analysed animals:
Commercial Layers

Summary of the case

Risk	Impact	Strategy	Evaluation
<p>Feed:</p> <ul style="list-style-type: none"> – Deoxynivalenol (375 ppb) – Fumonisin (1,170 ppb) – Zearalenone (156 ppb) <p>Blood:</p> <ul style="list-style-type: none"> – Aflatoxin M1 – Ochratoxin A (2.26 ppb) – Zearalenone (1.55 ppb) – Tenuazonic acid (1.85 ppb) – Deoxynivalenol – Enniatin A1 – Enniatin B1 	<p>Symptoms:</p> <ul style="list-style-type: none"> – Vomits – Abnormal fecal content – Liver rupture 	<p>Escent® S (1.5kg/T) introduction</p> <p>Biomonitoring 15 days after Escent® S introduction (blood analyses with LC-MS/MS)</p>	<p>Deoxynivalenol completely removed from the blood</p> <p>Health status improved: Vomits and loose stools were reduced. Liver recovered</p> <p>Better performance: egg weight increased ~5%</p>

Risk

Layers from an egg producer presented many clinical symptoms. Veterinarians presumed that mycotoxins could be the reason of the problems, but feed analyses were only detecting a low mycotoxin risk. Then, Innovad® performed a **Myco-Marker® service** with the objective to **demonstrate the well-known limitations from feed analysis and reveal the real mycotoxin exposure through mycotoxin biomarkers analysis in blood**. So, six feed and thirty blood samples from six different farms were analysed and risk level was classified following the seven grades risk scale developed by Innovad® (Table 1). Interestingly, blood analysis could identify mycotoxin risk completely missed in feed analyses. Even, some mycotoxins like aflatoxins (the most toxic mycotoxin) and ochratoxin A were completely missed in the feed analysis.

The results clearly demonstrate the added value and importance of blood to know the real mycotoxin exposure.

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Mycotoxin	Prevalence (%)	Average ± standard deviation (ppb)	Median (ppb)	Maximum (ppb)
FEED				
Deoxynivalenol	100	374±166	372	574
Fumonisin	100	1,170±1,713	704	5,170
Zearalenone	100	156±178	66.65	456
BLOOD				
Aflatoxin M1	100	<0.5	<0.5	<0.5
Ochratoxin A	83	2.26±0.94	2.01	4.10
Tenuazonic acid	67	1.55±1.36	1.55	2.51
Beta-zearalanol	67	1.85±0.82	1.67	2.69
Alpha-zearalanol	50	<2	<2	<2
Enniatin B1	33	<0.5	<0.5	<0.5
Enniatin A1	17	<0.5	<0.5	<0.5
TOTAL NUMBER OF MYCOTOXINS				
$\bar{x} = 6 \pm 1.1$				

Color scale with risk levels



Table 1. Heatmap with the mycotoxin results in the feed and blood and total number of mycotoxins detected in the 6 different studied farm as part of the risk quantification following the color scale of risk.

Impact

The quantified risk would cause a remarkable reduction of the animal’s performance. Although poultry species are less sensitive to mycotoxins, the longer rearing period in layers increases the damage caused by mycotoxins because of the chronic exposure. Some detected mycotoxins, especially deoxynivalenol (vomitoxin) and tenuazonic acid, are especially toxic for the intestinal tissues and chronic exposure to them could explain most of the detected symptoms (vomits and loose stools).

Besides, aflatoxin (the most toxic one), fumonisins and zearalenone, all of them detected in the risk analysis, are highly hepatotoxic (toxic for the liver).

The chronic exposure to these mycotoxins ended up with liver rupture. Finally, it is important to remember a multi-mycotoxin exposure has a synergistic and additive negative effect and quantified risk in the feed and blood had up to 6 different mycotoxins in average, which could explain the severity of the overall symptoms.

- | Symptoms |
|-----------------|
| ✓ Vomits |
| ✓ Loose stools |
| ✓ Liver rupture |



Figure 1. Layers from studied farms were suffering a lot of vomits (remarked by circles) and mycotoxins were the reason of this symptom. Some mycotoxins highly dangerous for the intestinal tissues (for example vomitoxin/deoxynivalenol) were identified in the risk analysis.

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Strategy

After evaluating the impact of the mycotoxin exposure, the producer chose to follow the **RISE Program**. Typically, the strategies followed in the **RISE Program** have two parts:

- **Mitigation of the risk:** establishment of measures to reduce the exposure and the impact of mycotoxins, while supporting animals to combat stress
- **Monitoring the risk:** build a plan to evaluate the efficacy of the strategy through biomonitoring programs.

To mitigate risk, the technological feed additive **Escent® S** (1.5 kg/T) was introduced to detoxify and reduce stress impact. To control the effectiveness of the strategy, some animals were not under **Escent® S** but received a similar technology (2kg/T). Throughout the testing phase, Innovad planned to evaluate efficacy through a biomonitoring plan. The biomonitoring plan consisted of the collection of 5 blood (5 animals) before **Escent® S** introduction and repeat the blood collection (5 animals) two weeks later (Figure 2). Blood samples (collected through FTA cards) were analysed for 36 different mycotoxin biomarkers.

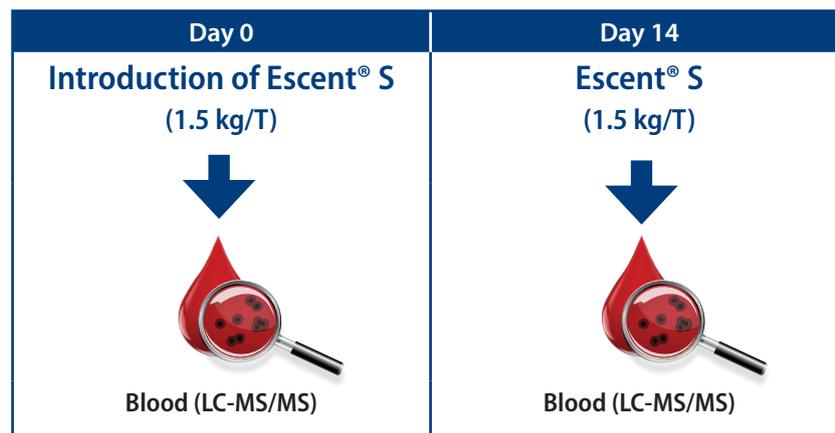


Figure 2. Sample collection program to evaluate RISE program efficacy. Blood (5 animals) was collected just before **Escent® S** introduction and collection was repeated 2 weeks after **Escent® S** introduction at 1.5 kg/T.

Evaluation

Comparison between the samples collected before and after **Escent® S** introduction was performed to evaluate **Escent® S** detoxification efficacy (Table 2).

Before Escent® S introduction	After Escent® S introduction
Tenuazonic acid (\bar{x} = 1,652)	Tenuazonic acid (\bar{x} = 114)
Deoxynivalenol-sulphate (Detected)	

Table 2. Heatmap with the mycotoxin results in the feed and blood and total number of mycotoxin detected in the two different studied farms (1 and 2) after 14 and 21 days of using **Escent® S** (1.5 kg/T).

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Evaluation

Exposure to two mycotoxins, tenuazonic acid and deoxynivalenol (deoxynivalenol-sulphate is deoxynivalenol metabolite from poultry species), were detected before **Escent® S** introduction. **Two weeks after Escent® S introduction, blood results demonstrated a clear reduction of the systemic exposure.**

Deoxynivalenol was completely removed and tenuazonic acid drastically reduced from the blood stream. The reduction of the systemic exposure to deoxynivalenol and tenuazonic acid is significant as it confirms that **Escent® S can reduce the systemic exposure to mycotoxins and protect the animals from it.**

These results are consistent with previous findings that **Escent® S is the only technology that has scientifically demonstrated the capacity to significantly reduce mycotoxins**, even deoxynivalenol, from the biological fluids under a multi-mycotoxin scenario (Lauwers et al., 2019). Regarding tenuazonic acid, [in the previous RISE case of the month](#), tenuazonic acid was removed from the blood after 3 weeks under **Escent® S**. In this current case, due to the significant decrease already detected after just two weeks, we would expect complete removal within the next few weeks.

The drastic reduction of the systemic exposure achieved by **Escent® S** translated into a significantly improved health status and animal performance. **The intensive vomiting detected in the animals started to reduce already 1 week after Escent® S introduction** and was completely gone 2 weeks later (figure 3). The stop in vomiting due to the inclusion of **Escent® S** is clearly correlated with the detected reduction of deoxynivalenol levels in blood, as this mycotoxin (also called vomitoxin) is well-known to cause vomiting. Other intestinal symptoms such as loose feces were also ceased two weeks later. In contrast **animals under another similar technology (2kg/T) were still suffering intestinal issues with vomiting and looses feces.**

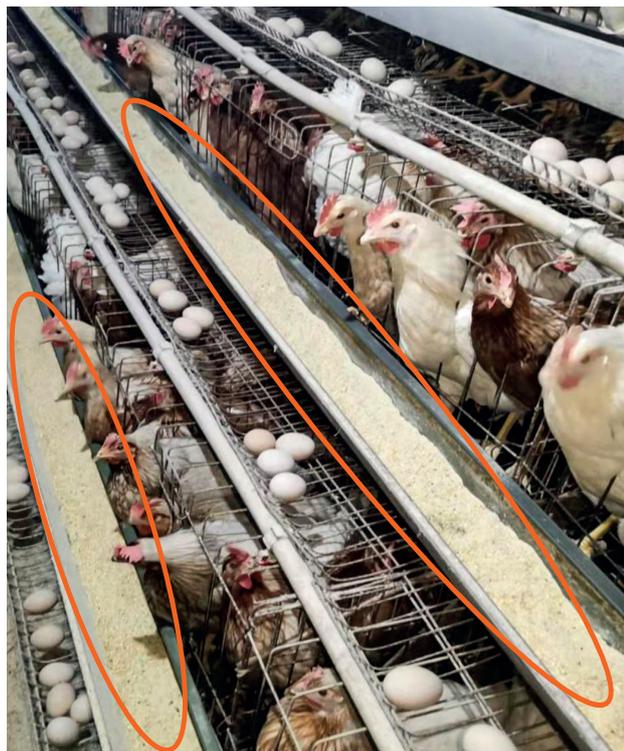


Figure 3. Vomits were stopped after **Escent®** introduction. The reduction of systemic exposure to deoxynivalenol/vomitoxin caused by **Escent®** stopped the vomits.

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Evaluation

Surprisingly, within just 2 weeks, the liver rupturing symptoms that were detected as consequence of the long chronic exposure to mycotoxins was remedied as autopsy has shown (Figure 4). **The reduction of the mycotoxin exposure plus liver support provided by Escent® offered a quick recovery of this key organ for layers.** Liver condition is extremely important to improve egg production and this positive impact in the liver was translated into a **better performance as the egg weight significantly increased (4.8%) in only 2 weeks** compared to control group (under another similar technology at 2kg/T) (Figure 5).

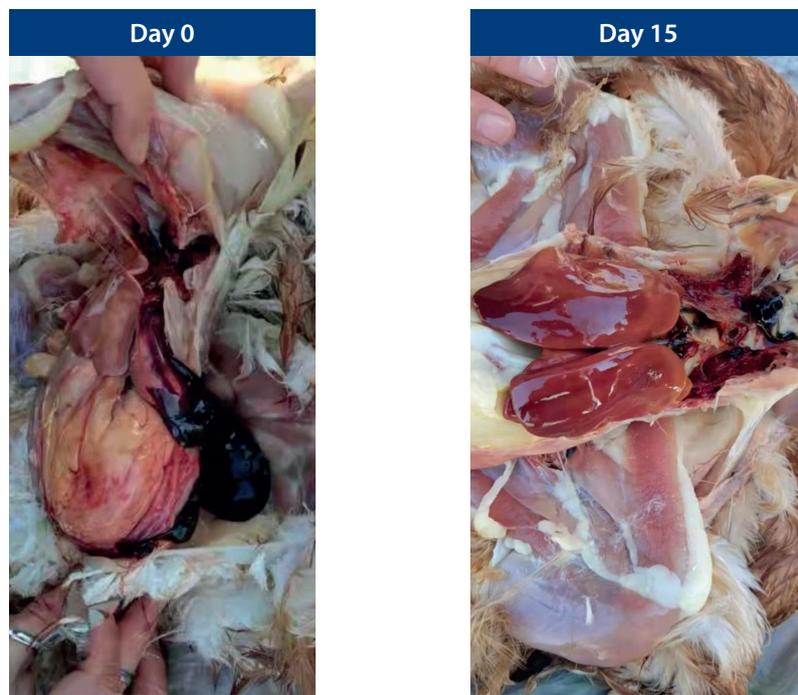


Figure 4. Liver picture from the autopsy before and 15 days after Escent® S (1.5kg/T) introduction. Escent® S repaired in only 15 days the acute liver damage caused by a long chronic exposure.

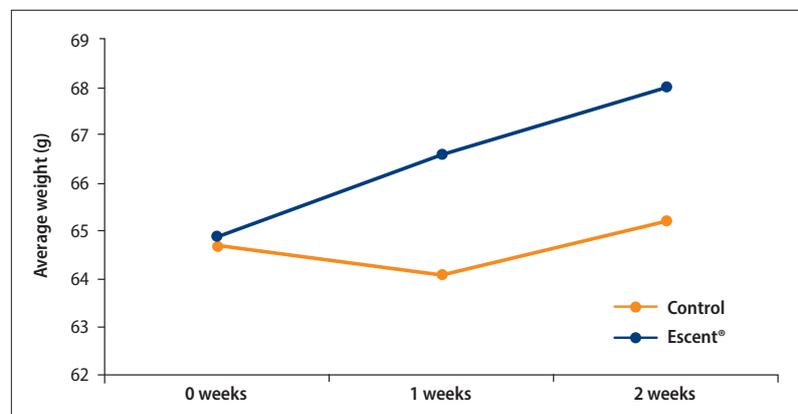


Figure 5. Average egg weight from the Escent® group and the control group (under a similar technology) before Escent® introduction, 1 week later and 2 weeks later after Escent® introduction.

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Evaluation

All in all, the RISE Program successfully improved animal health status and performance in a very short period (2 weeks). Despite the high impact caused by long chronic exposure, Escent® provided a fast recovery and improvement due to the drastic reduction of mycotoxins levels in blood and support of the animal to stress factors.

The biomonitoring strategy confirmed the effectivity of the program as Escent® completely removed deoxynivalenol and significantly reduced tenuazonic acid levels in blood in only 15 days. The importance of significantly reducing the mycotoxin exposure was clearly observed with the disappearance of the intestinal issues, as the vomiting stopped once vomitoxin/deoxynivalenol were removed from the blood thanks to the effect of Escent®.

The significant impact of the RISE Program in just 15 days translated into a better animal health status (liver recovery, stop vomiting and loose feces) and a better performance (increase of egg weight by ~5%).

Main conclusions

- RISE Program could elucidate the real mycotoxin risk/impact completely ignored in the feed analysis.
- The ability to reduce mycotoxins levels in blood Escent® S was confirmed. For example, deoxynivalenol, a mycotoxin otherwise known for its difficulties to bind, was completely removed from the blood after using Escent® S for 15 days.
- The reduction of the exposure to mycotoxins improved the health status. The vomiting was completely stopped once deoxynivalenol/vomitoxin was removed from the blood.
- Escent® S could reverse in just 15 days the damage caused by a long chronic exposure. For instance, the liver status was recovered after using Escent® for 15 days.
- Escent® improved the performance and egg weight significantly increased (~5%).

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