RISE®
CASE OF THE MONTH
02.2022

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RISE® Program

Risk Impact Strategy Evaluation

Country:
South-East Asia

Type of farm:
swine farm

Analysed animals:
lactating sows

Summary of the case

Risk

Mycotoxins detected in raw materials (rapid test):
- Aflatoxin B1
- Zearalenone
- Deoxynivalenol
- T-2
- Fumonisins

Impact

Symptoms in the sows:
- Dysgalactia
- Reproductive disorders
- Prolapses
- Reduced feed intake

Strategy

Replacement of the mycotoxin binder by Escent® S (1kg/T)

Weekly biomonitoring (feed and blood analyses with LC-MS/MS)

Evaluation

Reduction of the total mycotoxin exposure

Mycotoxins levels reduced in blood

Clinical symptoms disappeared

Risk

Lactating sows presented some severe symptoms that were having a huge economic impact. Veterinarians believed that the symptoms identified were caused by mycotoxins, even though they were already using a mycotoxin binder. **As mycotoxin control strategy was failing, producers took the decision to trust in the RISE® program to manage mycotoxin risk.**

A risk assessment, based on analyses from raw materials using rapid test technology, was performed. In total, 60 analyses from different grains, mainly corn, soya and wheat, were classified following the seven grades risk scale developed by Innovad® (figure 1). **Results revealed the presence of many mycotoxins: deoxynivalenol, zearalenone, aflatoxins, fumonisins and T-2 toxin.**

It is important to mention that zearalenone and aflatoxin B1 concentrations reached levels of concern (risk 5 and 6) in corn and soya (data not shown).

Color scale with risk levels
Risk 1 - Low
Risk 2
Risk 3
Risk 4 - Moderate
Risk 5
Risk 6
Risk 7 - High

Fig 1. Color scale with risk levels. The different levels mainly depend on mycotoxins detected (considering synergistic effects), concentration of the mycotoxins, type of animal and moment of the cycle.

Impact

Without a doubt mycotoxin risk detected would significantly reduce the animal's productivity and the risk identified by zearalenone and aflatoxin B1 was high enough to cause acute toxicity.

Zearalenone could explain most of the detected symptoms (dysgalactia, prolapses and reproductive alterations) as it is an estrogenic mycotoxin and sows are very sensitive to zearalenone. The detected levels could easily produce all the described reproductive problems. Additionally, the reduction of the feed intake could also be linked to the mycotoxins detected. For example, different studies demonstrated that deoxynivalenol, even at low concentrations, causes a significant reduction in the feed intake.

Finally, it is important to remember a multi-mycotoxin exposure has a synergistic and additive negative effect and analysed raw materials had up to 5 different mycotoxins, which could explain the severity of the overall symptoms.

Symptoms
✓ Dysgalactia
✓ Reproductive disorder
✓ Prolapses
✓ Reduced feed intake

Strategy

After evaluating the impact of the mycotoxin exposure, the following step was to build a strategy. Typically, the strategies followed in the **RISE® program** has 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 assess periodically the real mycotoxin threat combining raw material, feed and blood analysis

To mitigate risk, **the technological feed additive Escent® S (1kg/T) was introduced** to **detoxify and reduce stress impact**. Simultaneously, Innovad® established a **weekly biomonitoring plan** through **Myco-Marker® service**. The biomonitoring plan consisted of the collection of 5 blood (5 animals) + 1 feed sample from 2 different farms every week. Blood samples (collected through FTA cards, figure 3) were analysed for 36 different mycotoxin biomarkers, while feed samples were analysed for 16 different key mycotoxins. The sampling collection began 14 days after **Escent®** was introduced and it was repeated weekly.

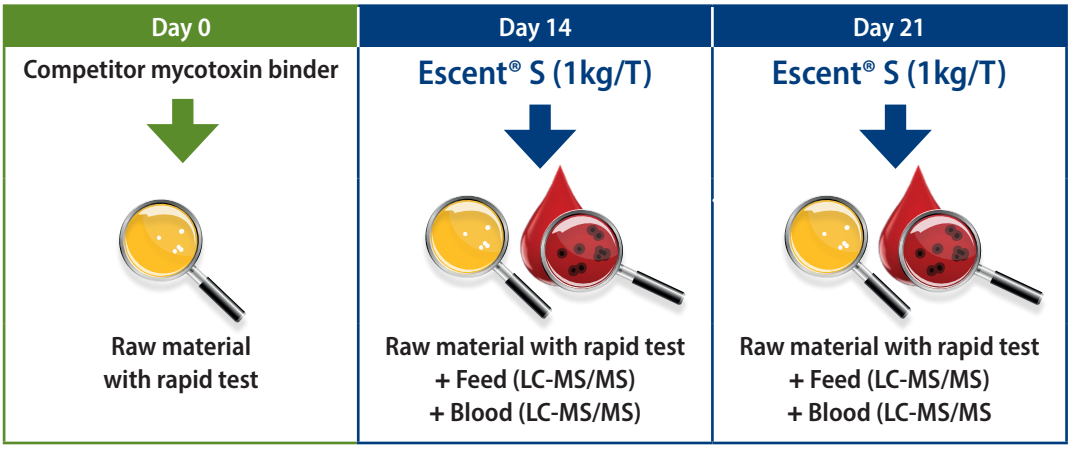

Fig 2. Sample collection program to monitor risk as part of the strategy in the **RISE® program**.
Feed (2 samples) and blood (10 animals) from two different farms were weekly collected to monitor the real mycotoxin risk.

Evaluation

The two first set of samples (collected after **14 and 21 days of Escent® S introduction**) from the biomonitoring strategy were evaluated. These results were used to measure the efficacy of **RISE®**.

Feed samples from the two analysed farms (1 and 2) did not present any differences between them (table 1). Fumonisins ($\bar{x} = 108 \pm 17$ ppb, max. 159 ppb) and deoxynivalenol ($\bar{x} = 26 \pm 3$ ppb, max. 32 ppb) were detected in all the feed samples at very similar concentrations. Aflatoxin B1 (1 ppb) was only detected at the first sampling point (14 days) from both farms. Mycotoxin concentrations detected in the feed were considered to impose a low risk (Risk level = 1, on Innovad® risk scale).

Farms	Days using Escent® S (1kg/T)	Feed (ppb)	Blood (ppb)	Total number of mycotoxins
Farm 1	14	Deoxynivalenol (29) Fumonisins (100) Aflatoxin B1 (1)	Tenuazonic Acid (Traces) Ochratoxin A (Traces)	5
	21	Deoxynivalenol (24) Fumonisins (106)	Ochratoxin A (Traces)	3
Farm 2	14	Deoxynivalenol (25) Fumonisins (100) Aflatoxin B1 (1)	Tenuazonic Acid (Traces) Ochratoxin A (Traces)	5
	21	Deoxynivalenol (31) Fumonisins (126)	Ochratoxin A (Traces)	3

Table 1. 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** (1kg/T).

Blood samples from 10 different animals were collected twice (14 and 21 days since **Escent® S** was introduced). Blood analyses identified 2 mycotoxins (tenuazonic acid and ochratoxin A) at traces level (table 1).

The relatively few mycotoxins detected at low concentration detected in blood could be attributed to the effects of **Escent® S**. That could also explain why tenuazonic acid was detected at the first sampling point and was not detected at the last collection (21 days). Additionally, the attending veterinarians reported a significant improvement in the symptoms of mycotoxication.

The removal of tenuazonic acid from the blood stream in only 7 days is highly important as it demonstrates that Escent® S can reduce the systemic exposure to tenuazonic acid and protect the animals from it. This reduction could also contribute to the disappearance of the detected symptoms initially.

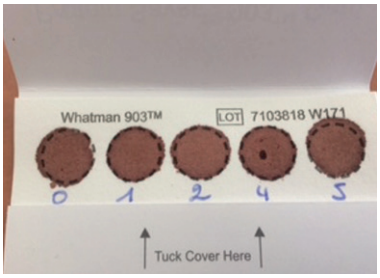

Fig 3. Blood samples are collected using FTA cards. Only 60 µL of blood per animal are necessary to quantify 36 mycotoxin biomarkers.

While raw materials and feed analyses originally showed high concentrations of zearalenone and aflatoxin B1 and a persistent presence of deoxynivalenol and fumonisins, these mycotoxins could not be detected in the blood analyses. The lack of these mycotoxins in blood may also be because of **Escent® S**. These results would be consistent with previous findings that **Escent® S is the only technology that it has scientifically demonstrated the capacity to significantly reduce mycotoxins from the biological fluids** under a multi-mycotoxin scenario (Lauwers et al., 2019).

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RISE® Program

All in all, the **RISE® program successfully reduced the mycotoxin exposure and improved animal health status and performance**. Although, initial raw materials indicating a high mycotoxin risk, Escent® S appears to have protected the animals.

The weekly biomonitoring assessment confirmed the effectivity of the program. Whilst 14 days after **Escent® S** introduction 5 mycotoxins (3 feed + 2 blood) were detected, only 3 mycotoxins (2 feed + 1 blood) could be identified after 21 days using **Escent® S**. Exposure to 3 mycotoxins at low concentration is a low risk if it is compared with the blood and feed survey conducted by Innovad after analysing 1,000 animals (figure 4) where 50% of the cases had exposure to 6 or more mycotoxins. Moreover, only ochratoxin A at very low concentration (traces) could be detected in blood.

The significant impact of the **RISE®** program translated into a better animal health status as commented by the producer of the studied animals stated **"clinical symptoms started to disappear 5 days after Escent® S started to be used"**.

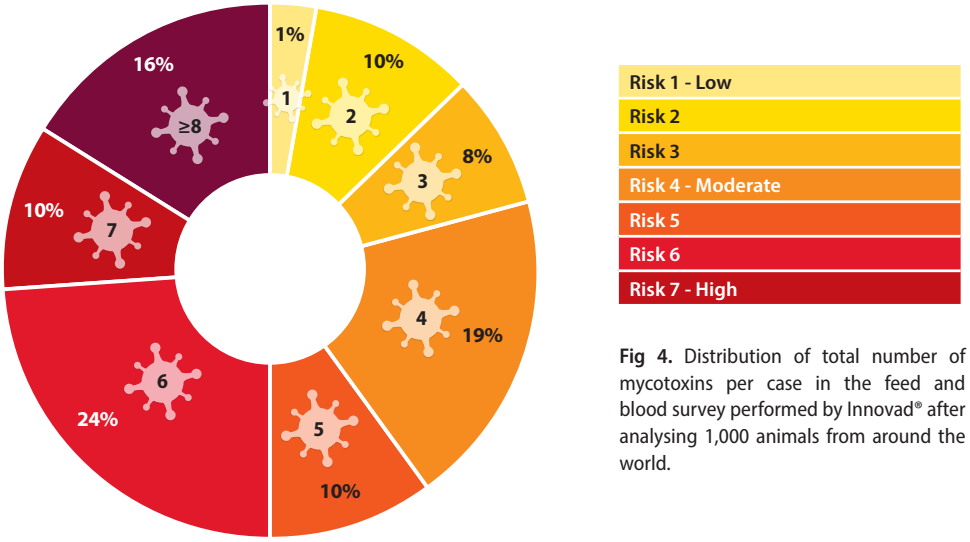

Fig 4. Distribution of total number of mycotoxins per case in the feed and blood survey performed by Innovad® after analysing 1,000 animals from around the world.

Main conclusions

- **RISE® program reduced mycotoxin exposure and improved farm productivity.**
- **The ability to reduce mycotoxins levels in blood Escent® S was confirmed. For example, tenuazonic acid, a highly frequent emerging mycotoxin, was completely removed from the blood after using Escent® S.**
- **Escent® S (1kg/T) removed the clinical symptoms (prolapses, dysgalactia, reproductive alterations and reduced feed intake) and it improved the health status of the sows.**
- **RISE® program offers, for the first time, the possibility to evaluate the efficacy of the mycotoxin control strategy specifically for each farm in relation to live performance, combining analysis from raw materials, finished feed, and blood. The data generated from raw material intake to on farm results are combined providing superior diagnostics and informed decision making.**

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