Newsletter

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> EDITORIAL

A dairy cow does not make a positive contribution to net farm income until her milk receipt offsets her rearing costs (Weigel, K. A., personal communication). Further proof of this statement lies with the fact that dairy cows, especially Holstein, have been selected throughout the last decades to improve the phenotypic measures for milk production and milk components (Sonstegard et al., 2001). However, as witnessed in many farms, the increased milk yield is often accompanied by greater susceptibility to metabolic diseases, such as milk fever, ketosis and rumen acidosis, and a higher incidence of subclinical and clinical mastitis, leg problems and a decrease in reproductive performance (Fink-Gremmels, 2008). High milk yield is only accomplished when genetics are harmonized with good management, in which nutrition has a crucial role. The challenge of dairy farmers to meet the nutritional needs of their cows while minimizing weight variations, preventing digestive problems, maintaining good health and supporting high nutrients to meet their production requirements is compounded by the fact that cows vary greatly regarding their needs throughout the lactation period. In this special newsletter we'll show you the economic benefits brought by the use of the appropriate tool for mycotoxin risk management.

Enjoy!

Inês Rodrigues

Mycofix® product line

The fact that dairy animals are fed a wide variety of feed materials, such as roughage and concentrates, expose them to various different mycotoxins. In general, ruminant animals are thought to be less susceptible to mycotoxins due to the line of defense provided by ruminal population. However, although this barrier may convert some mycotoxins into less toxic compounds, other mycotoxins are not affected, such as fumonisins (Caloni *et al.*, 2000), or are converted into more toxic compounds, as in the case of zearalenone transformation into the more estrogenic alpha-zearalenol (Dänicke *et al.*, 2005).

Mycotoxin Risk Management in dairy: Supplementing for profitability

Moreover, mycotoxins may also exert adverse effects on ruminal bacteria by decreasing ruminal digestion of dry matter, acid detergent fiber and starch (Froetschel *et al.*, 1989), inhibiting the growth of rumen organisms (May *et al.*, 2000) and, in general, exerting antimicrobial, antiprotozoal and antifungal activity (Fink-Gremmels, 2008). The high amount and variety of feedstuffs (and along with that, mycotoxins) fed to dairy animals to achieve the high production they are bred for, accompanied by the incompetent rumen microflora caused by either an unbalanced nutrition (sub-clinical acidosis) or directly by mycotoxins present in the feed, are the perfect combination for mycotoxins to escape microbial degradation and, therefore, be absorbed in the intestine at the same extent than that for monogastrics. After absorption, mycotoxins will exert their negative impacts at many levels, ranging from decreased performance (decreased feed intake and milk production) (Guthrie and Bedell, 1979; Pier, 1981), reproductive problems (Guthrie and Bedell, 1979) and gastro-intestinal effects (Cook *et al.*, 1986; Dvorak *et al.*, 1977, Guthrie and Bedell, 1979) to hepatotoxic, carcinogenic and immunosuppressive effects (CAST, 2003; Diekman and Green, 1992). In dairy, the carryover of aflatoxins into the milk as aflatoxin M_1 (Pettersson, 2004) represents an additional threat for the food chain as this metabolite is listed as a possible carcinogen by the International Agency for Research on Cancer (IARC).

As far as milk production is concerned, an interesting factor remains unexplained: Why are decreased milk production records due to mycotoxicoses found only in field testimonials but cannot be found in scientific literature?

Firstly, in scientific feeding experiments, animals are usually fed a known quantity of mycotoxins since the objective is to understand the impact of one or two mycotoxins in different parameters. Moreover, animals involved in research have a disease-free status and are kept under controlled conditions in order to minimize the influence of external factors in the results. In the field, however, animals are exposed to a wider range of mycotoxins and are subject to a broader variety of stress factors. They may be in poor health, have a fragile immune status or be subjected to problematic management practices. All these factors contribute a great deal to the final susceptibility of dairy animals to mycotoxins.

One way to investigate the effects of mycotoxins in dairy cattle in a field trial is, for example, to homogeneously group animals and then supplement their feeds with an additive able to deactivate mycotoxins, while keeping a control group for comparison. It is reasonable to assume that, if all animals are kept under the same nutritional and environmental conditions, the differences between them are due to the supplementation of the product.

Materials and Methods

Twenty-four, multiparous Holstein Friesian crossbred dairy cows were enrolled in a study. Average body weight of the experimental animals was 420 kg, and average daily milk production was 13.7 kg. Days in milk (DIM) at the beginning of the experiment ranged from 63 to 93 days. The experiment was a randomized complete block design (RCBD) with four dietary treatments (no Mycofix® Plus (MPL) inclusion (negative control), 15, 30 and 45 g MPL/cow/day, respectively) and six animals per treatment. Cows were blocked into six blocks of four animals each according to DIM and previous lactation. Within a block, each individual animal was randomly allotted to one of the four dietary treatments. The trial consisted of a 2-week adaptation period followed by a 10-week experimental period. Diets were fed as a total mixed ration (TMR), according to NRC (2001), containing a blend of feedstuffs naturally contaminated with multiple mycotoxins: 38 ppb aflatoxin B_1, 541 ppb zearalenone, 720 ppb deoxynivalenol, 701 ppb fumonisins, 270 ppb T-2 toxin and 74 ppb ochratoxin A. In the course of this study several parameters were evaluated: - Rumen ecology (bacteria and protozoa counts); – Rumen environment (pH and temperature); – Blood and milk urea nitrogen; – Volatile fatty acid production; – Microbial yield; – Feed intake and body weight change; – Digestion coefficients and nutrient utilization; – Milk production and composition; – Hematological parameters; – Serum immunoglobulin concentrations; – Somatic cell counts and Aflatoxin M_1 (AfM_1) in milk (Kiyothong, submitted).

Milk payment formulas vary worldwide and amongst milk collecting companies. Therefore it was impossible to get exact figures from milk collecting companies that would suit all cases. For this data analysis and economic calculation, one example was taken and used. The baseline price for milk was set at 0.30 €/kg. The baseline milk protein and milk fat standards were set at 34.0 and 37.0 g/kg, respectively (German thresholds). Penalties of 0.01 €/kg were given to milk not fulfilling these requirements. Somatic cell count (SCC) standard was set at 300 x 10^3 cell/ml. From 300 to 400 x 10^3 cell/ml, a penalty of 0.015 €/kg was applied. For SCC above 400 x 10^3 cell/ml, this penalty was increased to 0.02 €/kg. Calculations were done for a herd with 100 cows in milk for a production period of 30 days. This period was considered to ease and to make the calculations more realistic since, for example, in the case of SCC, repeated analysis results exceeding the baseline (300 x 10^3 cell/ml) will lead to extra penalty points.

Results

MPL inclusion had positive impacts on ruminal pH (maintenance of normal range, whereas control was below 6.2), ruminal microflora, ruminal fermentation efficiency and microbial protein synthesis, immune function (decrease of white blood cells, increase IgA's) and milk yield and quality. Although all these parameters influence the well-being and the productivity and health status of the animals, only some of them can be measured in terms of economic benefit to the farmer and these are the ones related to daily milk production (kg of milk produced per cow per day) and milk quality (fat and protein content,

Table 1 *– Performance parameters of dairy animals enrolled in the study*

Treatments	Milk yield [kg/cow/day]	Fat [g/kg]	Protein [g/kg]	AfM1 [ppb]	Somatic Cell Count [x 10^3 cell/ml]	Fresh matter intake (kg/d/cow)
Negative Control (0 g MPL)	12.6[a]	34.1	31.0	0.7	547	10,2
Treatment 2 (15 g MPL)	14.7[b]	37.2	34.2	n.d.	385	12,1

[a,b] - Values on the same row with different superscripts differ significantly (P<0.05)
n.d. – not detected (detection limit 0.06 ppb).

somatic cell count and AfM_1 content). The results are shown in *Table 1*. At the mycotoxins level found and considering the field conditions the animals were subjected to, the increased dosage to 30 or 45 g MPL per cow per day did not bring statistically significant results when compared to the group with 15 g/cow/day on milk parameters therefore, for the economic calculations subsequently done only the second treatment group was considered (Negative control vs. Treatment 2).

Economic Analysis

Figure 1 shows the profits obtained with milk considering three different milk prices, with and without Mycofix® inclusion. Without the feed additive and at the baseline price considered for the calculations (0.30 €/kg), a farmer could expect a monthly profit of 9 828 € per 100 cows. Extra 2 373 € could be earned with the use of Mycofix®, when the cost of the product has been taken into account.

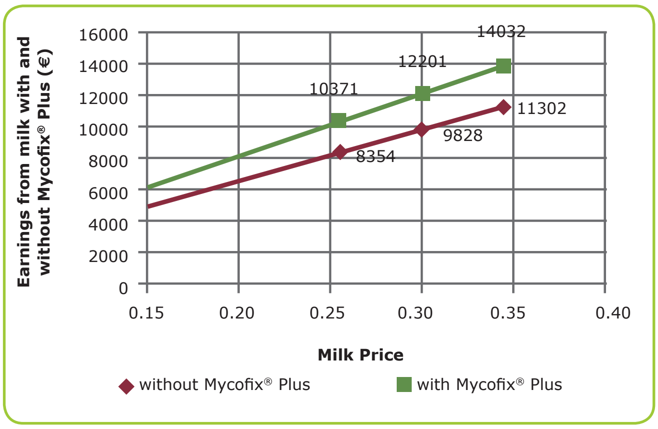

Figure 1 *- Earnings from milk with and without Mycofix® Plus inclusion. Calculations were done for a herd with 100 cows in milk for a production period of 30 days. Baseline price for milk was set at 0.30 €/kg. The baseline milk protein and milk fat standards were set at 34.0 and 37.0 g/kg, respectively (German thresholds). Penalties of 0.01 €/kg were given to milk not fulfilling these requirements. Somatic cell count (SCC) standard was set at 300 x 10^3 cell/ml. From 300 to 400 x 10^3 cell/ml, a penalty of 0.015 €/kg was applied. For SCC above 400 x 10^3 cell/ml, this penalty was increased to 0.02 €/kg. A product price of 7 €/kg was considered.*

However, it is well known that the dairy industry is suffering a huge breakdown in prices; therefore it seemed important to predict a 15 % decrease on the milk price. In this case, it is obvious that profits will be lower but nonetheless, farms investing on a daily supplementation with 15 g of Mycofix® per cow per day may expect 2 017 € more per 100 cows at the end of the month. In the case that the milk price would increase by 15 %, extra profits would equal 2 730 €.

For more realistic calculations, feed costs should also take part in these calculations. *Figure 2* gives an overview of three distinct situations. The actual one, with current feed and milk prices, a pessimistic situation, predicting an increase of the feed price and a decrease on the milk price and an optimistic situation (lower feed price and higher milk price). The increase of profit is obvious between the groups with and without Mycofix®: 1 048, 1 233 and 1 419 € extra profit per 100 cows, respectively, in a pessimistic, actual and optimistic situation.

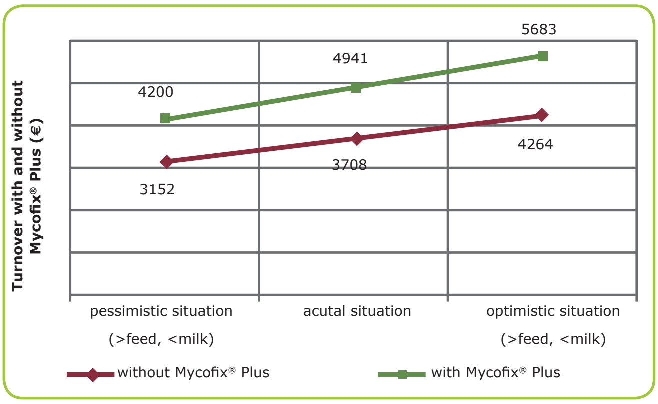

Figure 2 *- Profitability in the use of 15 g of Mycofix® Plus according to the variation of milk price and feed cost. Calculations were done for a herd with 100 cows in milk for a production period of 30 days. Baseline price for milk was set at 0.30 €/kg. The baseline milk protein and milk fat standards were set at 34.0 and 37.0 g/kg, respectively (German thresholds). Penalties of 0.01 €/kg were given to milk not fulfilling these requirements. Somatic cell count (SCC) standard was set at 300 x 10^3 cell/ml. From 300 to 400 x 10^3 cell/ml, a penalty of 0.015 €/kg was applied. For SCC above 400 x 10^3 cell/ml, this penalty was increased to 0.02 €/kg. A product price of 7 €/kg was considered. Feed price was set at 200 €/ton of dry matter TMR for the actual situation.*

AfM1 in milk

Besides differences in profits due to the increase of the milk production, milk fat, milk protein and reduction of SCC another factor should not be disregarded. AfM_1 was found at a prohibitive level of 0.7 ppb in the control group (Commission Regulation (EC) No 1881/2006 sets the maximum tolerated levels for this metabolite at 0.05 ppb) but was not detected in the milk of animals supplemented with Mycofix® Plus.

Conclusion

The objective of this report was to provide a practical point of view and to determine the feasibility of the use of a mycotoxin deactivator product (Mycofix® Plus), in the diets of dairy animals. Data was collected on the field (Kiyothong, submitted) in an up-to-date and concrete situation and after a market evaluation for feed, milk and product prices, expected profits were calculated.

Besides the other benefits experienced in this trial which cannot be translated into economic terms, such as maintenance of ruminal pH at normal range (vs. control which was below 6.2), increased count of ruminal viable bacteria, increase of ruminal fermentation efficiency and microbial protein synthesis and decrease of white blood cells and increased amount of IgA, other benefits brought from the use of MPL were not considered in this analysis, such as reduced mastitis problems, which would lead to reduced veterinary treatment costs. Nevertheless, taking

into consideration milk, feed and product prices, the extra revenue generated by the use of Mycofix® Plus is reason enough to invest in such a mycotoxin risk management solution.
The results of this trial must be taken into account together with the conclusions of Rauw *et al* (1988) "when a population is genetically driven towards high production (…) less resources will be left to respond adequately to other demands like coping with (unexpected) stressors" and not forgetting the high yielding animals which are being farmed worldwide. If one reflects about this, then we have the explanation why modern dairy farmers are losing great amounts of money due to mycotoxin contamination of feeds.

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> IMPRESSUM

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