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Effects of *Fusarium* toxin contaminated wheat grain and of a detoxifying agent on rumen physiological parameters and *in sacco* dry matter degradation of wheat straw and lucerne hay in wethers

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ABSTRACT

Wethers equipped with a rumen fistulae were subjected to four dietary treatments in consecutive experiments. The treatments consisted of rations containing wheat grain and pasture hay at a ratio of 1 to 1 on a dry matter basis. Two wheat grain batches were fed either in the absence or presence of a detoxifying agent (Mycofix®Plus, Biomin GmbH, Herzogenburg, Austria). One wheat grain batch served as the uncontaminated control wheat whereas the other batch contained the *Fusarium* toxins deoxynivalenol (DON) and zearalenone (ZON) at concentrations of approximately 10 and 0.76 mg per kg dry matter, respectively.

Parameters of rumen fermentation such as the molar ratios of short chained volatile fatty acids and ammonia concentration in rumen fluid remained unchanged in response to dietary treatments whereas the detoxifying agent exerted a rumen pH-buffering effect. This effect was independent of the mycotoxin contamination of the wheat. The pH-differences in rumen fluids collected from wethers fed the MP-supplemented and unsupplemented rations amounted 0.2 to 0.3 on average in the time period between 1.5 and 5 h after feeding.

The kinetic profile of the *in sacco* dry matter degradation revealed a reduced degradation rate for wheat straw incubated in wethers fed the mycotoxin contaminated rations whereas no changes were obvious when lucerne hay was incubated. The detoxifying agent had no effect on the kinetics of dry matter degradation.

It can be concluded that feeding of rations containing approximately 4.6 mg of DON and 0.34 mg ZON per kg of complete ration at a reference dry matter content of 88% does not impair rumen fermentation although there was a trend for a decrease in the rate of dry matter degradation of the slowly degradable wheat straw. The pH-buffering effects of the detoxifying agent were mycotoxin independent.

KEY WORDS: *Fusarium* toxin, rumen parameters, *in sacco*, degradability

INTRODUCTION

Among farm animals, ruminants are regarded as relatively resistant to the *Fusarium* toxin deoxynivalenol (DON). The critical dietary DON-concentrations at a reference dry matter content of 88% are 1 mg per kg for pigs, 2 mg per kg for pre-ruminant calves and 5 mg per kg for gallinaceous poultry and ruminants (BML, 2000). *In vitro* studies using rumen fluid have shown that rumen microbes are capable of degrading DON (King et al., 1984; Swanson et al., 1987; Razzazi et al., 2000) by cleaving the epoxide group of the molecule which means a loss in toxicity. Therefore, the rumen is regarded as a pre-systemic protection mechanism in ruminants. On the other hand, it is also well known that mycotoxins are able to exert anti-microbial properties (for review Trenholm et al., 1989). This in turn, could have an impact on the profile and/or activity of rumen microbes and consequently on ruminal nutrient utilization.

So-called detoxifying agents, which are added to the diet, are supposed to avoid absorption of mycotoxins from the gastro-intestinal tract by strong binding on their surface (adsorption). Although certain mycotoxins are degraded by rumen microbes there could also be a need for using such adsorbents in ruminant nutrition. Since several mycotoxin degradation products still exert toxic properties, they bear the danger of being transferred to milk. Hence, several efforts have been made to block the transfer of Aflatoxin M_1 (AFM_1), a ruminal degradation metabolite of Aflatoxin B_1, to milk. The results are somewhat conflicting. Blüthgen and Heeschen (1990) and Blüthgen and Schwertfeger (2000) were not able to substantially decrease the AFM_1 transfer to milk by feeding bentonite or glucomannans, whereas Diaz et al. (1997) were able to demonstrate a reduction in carry over by feeding bentonite and a yeast preparation.

On the other hand, several adsorbing clays are also known to increase rumen pH due to their capability for ion exchange and their proton attracting properties. Thus, both an adsorbent, and *Fusarium* toxins such as DON could influence the rumen characteristics and consequently the capacity of microbes for nutrient utilization.

Therefore, the aim of the present study was to examine the effects of feeding an uncontaminated control wheat and of a *Fusarium* toxin contaminated wheat both in the absence and in the presence of a detoxifying agent on rumen fermentation parameters and on *in sacco* dry matter degradability.

MATERIAL AND METHODS

Experimental design and procedure

Two wheat grain batches were used in the experiments. The first batch contained only small amounts of the *Fusarium* toxins DON and zearalenone (ZON)

and served as control wheat whereas the second batch was naturally contaminated, especially with DON (Table 1).

TABLE 1

Chemical composition of ration components and of incubated feedstuffs

	Ration components			Incubated feedstuffs	
	control wheat grain	*Fusarium* toxin contaminated wheat grain	pasture hay	wheat straw	lucerne hay
Dry matter, g/kg	870	865	872	935	924
Nutrients, g/kg DM					
crude protein	124	145	135	64	157
crude fat	18	10	10	13	9
crude fibre	23	41	279	471	284
ADF	33	45	285	514	308
NDF	111	148	544	801	393
N-free extractives	816	782	477	386	391
Mycotoxins					
Deoxynivalenol, mg/kg DM	0.2	10.3	<0.04	<0.04	<0.04
Zearalenone, µg/kg DM	3	764	n.a.	n.a.	n.a.

n.a. = not analyzed

The additive Mycofix®Plus (MP), (Biomin GmbH, Herzogenburg, Austria), was used as detoxifying agent. It is a combination product and contains enzymatic activities for degradation of DON in addition to the adsorbing component according to the manufacturer (Pasteiner, 1998).

Three 3-years old Black-Faced mutton sheep wethers weighing 89 kg ± 4 kg were used. Animals were equipped with a permanent rumen fistulae with an inner diameter of 35 mm. Each of the 4 experiments consisted of 35 days in total. The first 21 days served for adaptation to the respective rations whereas the remaining 14 days were used for the *in sacco* trials and rumen fluid sampling.

The rations were composed of hay and of the respective wheat grain batch at a ratio of 1 to 1 on a dry matter basis. Wheat grain was ground on a hammer mill whereas hay was coarsely cut into pieces of approximately 5 to 15 cm length. Rations were completed by the addition of 30 g of a mineral premix and daily dry matter intake was restricted to approximately 1.2 kg to avoid refusals. Consequently, rations were not balanced for differences in nutrient composition of the control and contaminated wheat. Daily ration was fed in two equal portions at 7.00 a.m. and at 2.30 p.m.

Uncontaminated wheat was fed during the first two experiments with the addition of 5 g of MP supplemented per 1 kg of wheat during the following two expe-

riments. After finishing the second experiment, a re-creation period of 28 days was intercalated in which only hay was fed before the *Fusarium* toxin contaminated wheat was tested without or with addition of MP.

Rumen fluid samples were taken *via* the fistula at day 21 of feeding a particular ration by using a syringe connected to a rubber probe. Samples were taken just before the morning feeding and following at 0.5, 1, 1.5, 2, 2.5, 3 and 5 h after the begin of the meal; pH was immediately measured in all samples (digital pH-measurement device, pH525, WTW) whereas the sample which was taken after 3 h was further processed for measurement of ammonia and volatile fatty acids.

Nylon bag technique was carried out according to the principles outlined by Mehrez and Ørskov (1977) and Flachowsky et al. (1988). The nylon bag incubations for determination of dry matter degradation kinetics started at day 22 of each experiment. Lucerne hay and wheat straw were used as quickly- and slowly-degradable material, respectively. Incubation material was milled (Retsch) to pass a 3 mm screen before being used for incubations. Nylon bags with a size of 50 mm x 130 mm (Bar Diamond Inc., Idaho, USA) had a mean pore size of 53 µm ± 10 µm. Air dried feedstuff samples of approximately 1.5 g were weighed in the bags, which resulted in a sample density of 10 to 15 mg per 1 cm^2 bag surface. Bags were sealed with plastic cable binders. Eight bags in total were fixed on a 50 cm long and flexible wire insulated with plastic in such a way that bags filled with wheat and lucerne hay were alternately fixed. Samples were incubated for 8, 16, 24, 48, 72 and 96 h according to the batch mode, which meant that fistulae remained sealed during incubations. After incubations, bags were rinsed with cold tap water and subsequently washed twice using an automatic washing machine. In addition, 12 non-incubated samples of each feedstuff were treated in a similar way in order to determine the washing losses. Weight of bags was recorded after drying to a constant weight at 105°C.

Analysis

Chemical composition of feedstuffs was analyzed according to the methods of the VDLUFA (Naumann and Bassler, 1993). Deoxynivalenol in feedstuffs was analyzed by HPLC with diode array according to a modified sample preparation procedure as advised by Coring System Diagnostix GmbH (Gernsheim, Germany) (Mycosep™ trichothecene). The mean recovery rate for feedstuffs was 72% and results of analysis were not corrected for this recovery. Zearalenone was determined by HPLC with fluorescence detection after treatment with 2 U β-glucosidase (E.C. 3.2.1.21, Sigma, Deisenhofen, Germany, No. G-0395) according to Ueberschär (1999). Results were not corrected for recovery, which was 95%.

Ammonia-N in fresh rumen fluid was analyzed by a modified Conway-method as described by Voigt and Steeger (1967), using a micro diffusion vessel. Volatile fatty acids in rumen fluid were determined according to Geissler et al. (1976) using

a gas chromatograph (Hewlett Packard 5580, Avondale, PA, USA) equipped with a flame ionization detector. Fatty acids were separated by a column containing 15% dioctyl-debacinate and sebacinic acid on fused silica as the stationary phase.

Statistics

All data were analyzed by a two-way analysis of variance (ANOVA) using the model:

$$y_{ijk} = \mu + a_i + b_j + (axb)_{ij} + e_{ijk}$$

where y_{ijk} = parameter of an observation k, subjected to wheat type i and detoxifying agent j; a_i = wheat type (not contaminated, mycotoxin-contaminated); b_j = detoxifying agent (without, with Mycofix®Plus); $(axb)_{ij}$ = interactions; e_{ijk} = error term.

The relative dry matter loss of wheat straw and lucerne hay was fitted to the regression equation of Ørskov and McDonald (1979):

$$P = a + b\,(1-e^{-ct}) \qquad (1)$$

where P = the dry matter degradation at time t, a = soluble fraction or washing loss, b = potential degradable fraction, c = rate constant of fraction b

Experimentally determined dry matter washing losses of wheat straw or lucerne hay coincide with the intercept of the regression on ordinate at time zero (parameter "a"). Consequently, these measures are independent of the 4 examined rumen conditions induced by feeding of wheat, wheat + MP, contaminated wheat or contaminated wheat + MP. Hence, a multiple approach of the regression was applied which enabled the simultaneous estimation of the parameters "b" and "c" separately for each of the 4 dietary treatments and of the common intercept on ordinate, i.e. all 4 treatments were forced through the same intercept and contributed to this estimate.

Effective dry matter degradation was calculated according to Ørskow and McDonald (1979):

$$\text{Effective degradability} = a + ((b \times c)/(c + k)) \qquad (2)$$

where parameters a, b and c as above and k = the rumen particle outflow rate.

The Statistica for the Windows™ operating system (StatSoft Inc., 1994) was used for all statistical evaluations. The non-linear curve fitting module was applied to fit the *in sacco* dry matter degradation data to the equation (1).

RESULTS

Chemical composition and mycotoxin contents of feedstuffs

The crude protein and the N-free extractives content of the *Fusarium* contaminated wheat was approximately 17% higher and 4% lower, respectively, compared to the uncontaminated control wheat (Table 1). The *Fusarium* contaminated wheat contained approximately 10 mg DON and 0.76 mg ZON per kg dry matter. Traces of these *Fusarium* toxins were also detected in the control wheat.

Rumen physiological parameters

The molar proportions of volatile fatty acids in the rumen fluid collected 3 h after the begin of the morning feeding were not affected by dietary treatments (Table 2). The molar proportions were on average 64, 22, 10, 0.7, 1.8 and 1.5% for acetic, propionic, butyric, iso-butyric, valeric and iso-valeric acid, respectively. The ratio between acetic and propionic acid was found to be approximately 3 to 1. The concentration of total volatile fatty acids was slightly higher in wethers fed

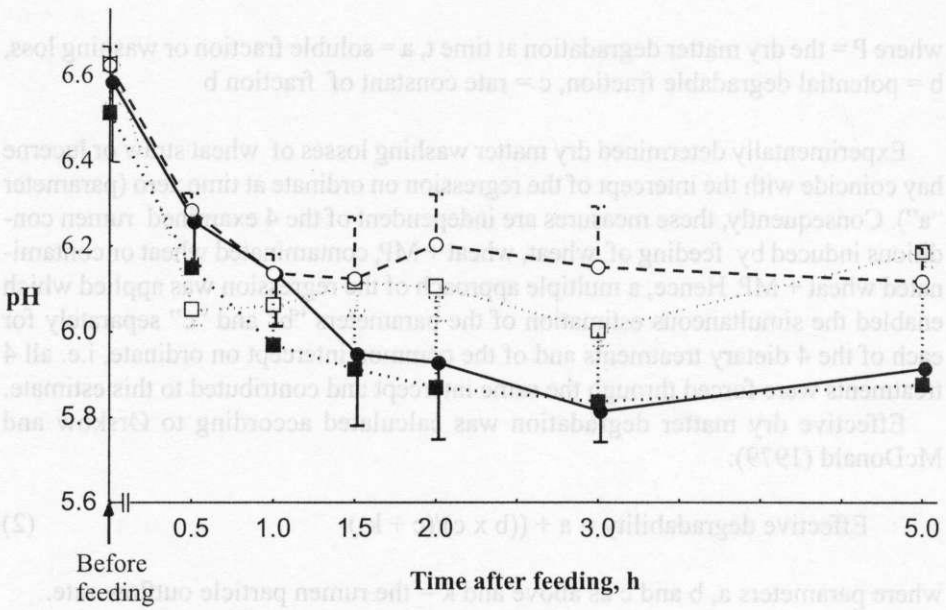

Figure 1. pH of the rumen fluid in response to control wheat and *Fusarium* toxin contaminated wheat in the absence and presence of Mycofix®Plus (MP)

Wheat; Wheat + Mycofix®Plus; Contaminated wheat; Contaminated wheat + Mycofix®Plus

Table 2

Rumen physiological parameters (3 h after start of feeding) in response to control wheat and *Fusarium* toxin contaminated wheat in the absence and presence of Mycofix®Plus (MP)

Wheat	Mycofix® Plus (MP) g/kg wheat	Acetic acid Mol %	Propionic acid Mol %	Acetic acid to propionic acid ratio	Butyric acid Mol %	Iso-butyric acid Mol %	Valeric acid Mol %	Iso-valeric acid Mol %	Total volatile fatty acids mMol/l	NH_3-N mg/100 ml	pH
Control	...	63.3	21.8	3.0	11.0	0.7	1.8	1.5	88.7	14.7	6.0
Contaminated	...	63.8	22.2	2.9	10.1	0.6	1.8	1.4	110.7	15.9	5.9
	–	63.4	22.1	3.0	10.7	0.6	1.9	1.3	102.0	15.7	5.8
	5	63.7	21.9	2.9	10.4	0.6	1.8	1.6	97.4	14.9	6.1
Control	–	63.6	21.5	3.1	11.2	0.7	1.7	1.2	82.1	15.2	5.8
Control	5	63.1	22.0	2.9	10.7	0.6	1.9	1.7	95.2	14.2	6.2
Contaminated	–	63.3	22.6	2.8	10.1	0.6	2.0	1.4	121.8	16.2	5.8
Contaminated	5	64.4	21.8	3.0	10.0	0.7	1.7	1.5	99.6	15.6	6.0
Probability											
Wheat		0.684	0.840	0.701	0.570	0.177	0.416	0.889	0.058	0.691	0.486
MP		0.807	0.929	0.935	0.841	0.885	0.307	0.396	0.656	0.790	0.060
Wheat x MP		0.513	0.749	0.618	0.861	0.146	0.014	0.493	0.115	0.955	0.594
PSEM		1.2	2.1	0.3	1.5	0.05	0.1	0.3	10.1	2.9	0.1

"..." denotes that these main effects were pooled, PSEM – pooled standard error of means

the *Fusarium* toxin contaminated wheat (P=0.058). The pH in rumen fluid measured 3 h after the beginning of the morning feeding was slightly higher when the MP-supplemented rations were fed (P=0.06). This effect was consistent over the first 5 h after the start of the morning meal (Figure 1). The ammonia concentration in rumen fluid was not influenced by dietary treatments.

Dry matter degradation of wheat straw and lucerne hay

The *in sacco* dry matter degradation of wheat straw was significantly reduced after 24 and 48 h incubation in the rumen as a result of feeding the *Fusarium* contaminated wheat (Table 3). The relative changes compared to the control were approximately -10 and -4%, respectively. For lucerne, the effects were not consistent and differences between treatments were smaller. A decrease in dry matter degradation of approximately 3% was shown for lucerne hay incubated for 24 h in wethers fed the contaminated wheat whereas a 2% increase was observed after 48 h of incubation. An increased dry matter degradation of lucerne hay as a result of MP-supplementation was detected after 24 h incubation which resulted mainly from higher degradability in wethers fed the MP-supplemented *Fusarium* toxin contaminated wheat.

Table 3

Dry matter degradation of wheat straw and lucerne hay in response to control wheat and *Fusarium* toxin contaminated wheat in the absence and presence of Mycofix®Plus (MP)

Wheat	Mycofix® Plus (MP) g/kg wheat	Wheat straw		Lucerne hay	
		24 h	48 h	24 h	48 h
Control	...	28.4	37.0	71.5	73.4
Contaminated	...	25.4	34.8	69.5	74.5
	–	26.8	36.3	69.7	74.0
	5	27.0	35.5	71.3	73.9
Control	–	29.3	36.9	71.9	73.6
Control	5	27.4	37.1	71.0	73.2
Contaminated	–	24.4	35.7	67.5	74.3
Contaminated	5	26.5	33.9	71.5	74.6
Probability					
Wheat		<0.001	0.008	<0.001	<0.001
MP		0.848	0.325	0.001	0.681
Wheat x MP		<0.001	0.210	<0.001	0.156
PSEM		0.6	0.8	0.4	0.2

"..." denotes that these main effects were pooled, PSEM – pooled standard error of means

Mean values of dry matter degradation were fitted to equation (1) according to the procedure outlined in the "Statistics" section. The estimated regressions are shown in Figure 2 for both incubated feedstuffs. The respective regression parameters are summarized in Table 4. The multiple determination measure was greater than 0.99 and corresponded to a residual standard deviation of approximately 1.7% dry matter degradation which could not be explained by the applied regression approach.

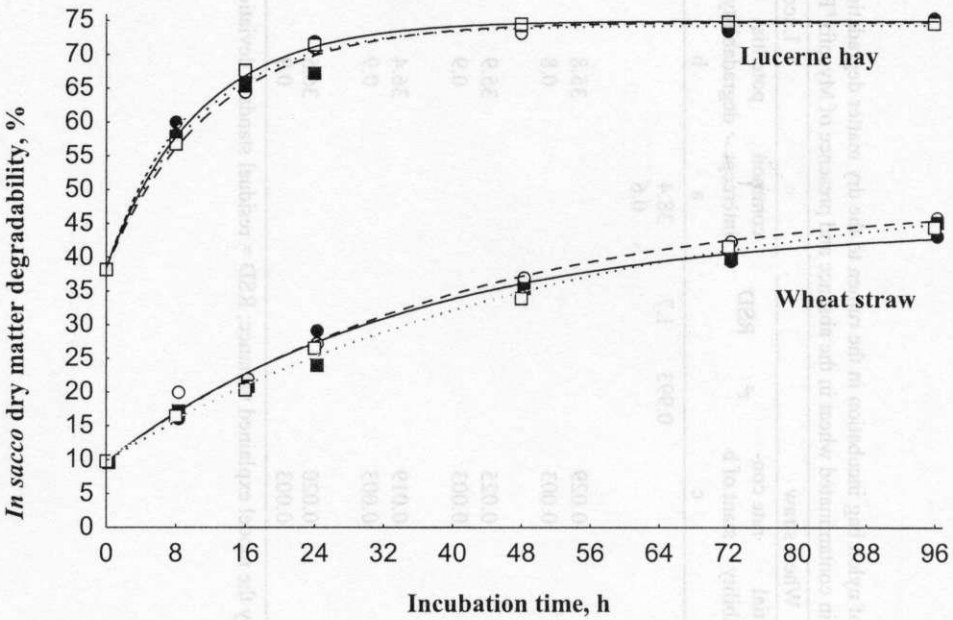

Figure 2. Dry matter degradability of wheat straw and lucerne hay in response to control wheat and *Fusarium* toxin contaminated wheat in the absence and presence of Mycofix®Plus (MP)
Wheat; Wheat + Mycofix®Plus; Contaminated wheat; Contaminated wheat + Mycofix®Plus

The intercepts on ordinate (a) were estimated simultaneously by inclusion of all 4 treatment data pairs for either wheat straw or lucerne hay and were 10.2 and 38.4%, respectively. These estimates were close to the measured washing losses (Figure 2). The regressions were forced through a common intercept on ordinate (= estimated washing losses, parameter "a") since washing losses, either measured or estimated, were not dependent on dietary treatments.

The potential degradable insoluble fraction (b) was approximately 11 % higher when wheat straw was incubated in wethers fed the contaminated wheat whereas practically no difference was observed when lucerne hay was incubated. The

Table 4

Summary of regression analysis relating the time of nylon bag incubation in the rumen to the dry matter degradation of wheat straw and lucerne hay in response to control wheat and *Fusarium* toxin contaminated wheat in the absence and presence of Mycofix®Plus (MP)

Wheat	Mycofix® Plus (MP) g/kg wheat	Wheat straw					Lucerne hay				
		common intercept a	potential degradability b	rate constant of b c	r^2	RSD	common intercept a	potential degradability b	rate constant of b c	r^2	RSD
		10.2			0.993	1.7	38.4			0.994	1.6
SE		0.5					0.6				
Control	–		34.9	0.029				35.8	0.107		
SE			1.6	0.003				0.8	0.009		
Control	5		38.9	0.025				35.9	0.091		
SE			1.9	0.003				0.9	0.007		
Contaminated	–		41.5	0.019				36.4	0.083		
SE			3.0	0.003				0.9	0.007		
Contaminated	5		40.5	0.020				36.5	0.094		
SE			2.8	0.003				0.9	0.007		

SE = standard error of parameter estimation; r^2 = by the model explained variance; RSD = residual standard deviation of the regression

corresponding rate constants (c) were approximately 28 and 11% lower for wheat straw and lucerne hay, respectively, when incubated in wethers fed the mycotoxin containing wheat.

The effective dry matter degradation was estimated assuming 2 different rumen outflow rates (Figure 3) for evaluation of possible consequences of different levels of feed intake on dry matter degradation. It was clearly lower for wheat straw than for lucerne hay and decreased with increasing feed passage rate.

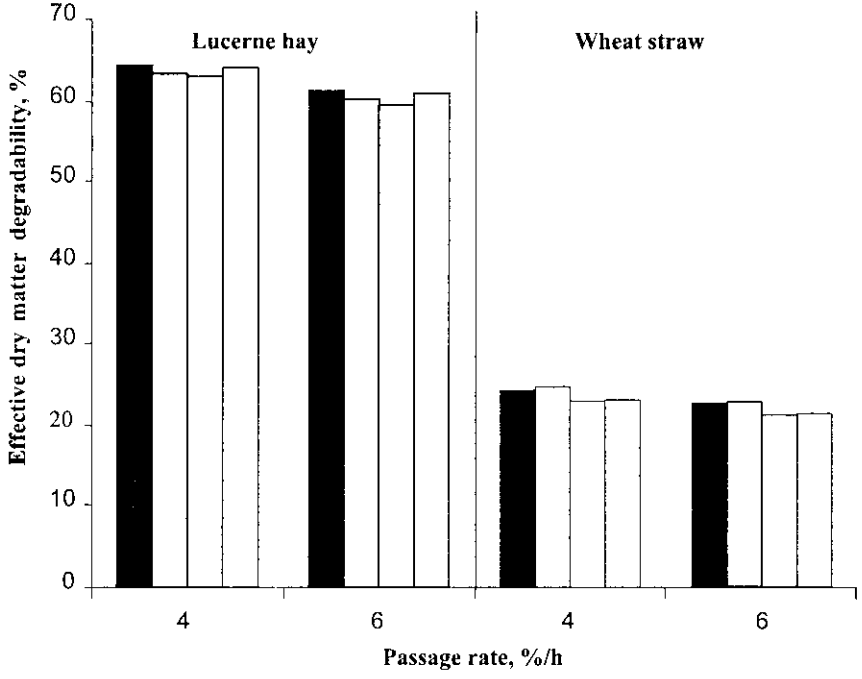

Figure 3. Effective dry matter degradability of wheat straw in response to control wheat and *Fusarium* toxin contaminated wheat in the absence and presence of Mycofix®Plus (MP) modeled for different rumen particle outflow rates

Wheat; Wheat + Mycofix®Plus; Contaminated wheat; Contaminated wheat + Mycofix®Plus

DISCUSSION

The *in situ* technique is extensively used for evaluation of roughages and many attempts have been made to relate the results of *in sacco* degradation kinetics to nutrient digestibility and feed intake in order to predict performance (for review see Ørskov, 2000). The primary aim of the present study was to examine how a ruminal environment highly "enriched" with *Fusarium* toxins and their metaboli-

tes influences the microbial capacity for dry matter breakdown of lucerne hay and wheat straw. These feedstuffs were used as roughages with known marked differences in degradation kinetics. Mycotoxins are known to exert anti-microbial properties (Trenholm et al., 1989). Therefore, the hypothesis was tested if possible mycotoxin induced changes in the rumen microbial profile and/or microbial activity could also modify the ruminal capacity for dry matter degradation of lucerne hay and wheat straw as quickly and slowly degradable roughages, respectively. Generally, feeding of the contaminated wheat variants resulted in a significantly lower dry matter degradation. This depression was more pronounced for wheat straw than for lucerne, especially at the beginning of the incubation during the first 24 h. The latter time-dependent effect is clearly reflected by the differences in the rate constants of the exponential regression (c) which were 28 and 11% lower when estimated for wheat straw and lucerne hay, respectively, incubated in wethers fed the contaminated wheat and neglecting the MP-effect. The potential insoluble degradable fraction (b) was increased at the same time; an effect which is closely linked to the lower degradation rate. Therefore, the parameter "b" could be overestimated due to a less pronounced plateau of degradation (Figure 2, wheat straw) as a result of a too short total incubation duration for the slowly degradable wheat straw.

The lower rate constants due to feeding of the contaminated wheat resulted also in a lower effective dry matter degradability (Figure 3). Although degradability of lucerne hay and wheat straw was only approximately 1% lower when incubated in wethers fed the contaminated wheat, the relative decrease was approximately 6% for wheat straw when compared to lucerne hay (1% relative decrease) at a passage rate of 6%. Increasing the passage rate from 4 to 6% (Figure 3) also decreases the dry matter degradability of wheat straw to a greater extent than that of lucerne hay (14 and 5% relative decrease, respectively) when treatment effects (wheat batch, MP addition) are neglected.

It could be shown that the correlations between *in sacco* dry matter and NDF degradation were higher than 0.99 for maize residues (Parys, 2001). Therefore, it might be deduced for the present study that the differences in dry matter degradation kinetics of wheat straw were mainly due to differences in NDF or cell wall degradation. This is substantiated by the fact that wheat straw is composed of approximately 80% NDF (Table 1). Thus, neither a *Fusarium* toxin nor a nutrient mediated depression of cellulolytic microorganisms and/or their activity can be excluded since wheat batches differed not only in mycotoxin concentration but also in protein and other nutrient content (Table 1).

Wethers were in a steady feeding state and consumed 6.2 mg DON and 0.46 mg ZON daily which is equivalent to a DON- and ZON-concentration of 4.6 and 0.34 mg/kg at a reference dry matter content of 88%. No reduction in feed intake was seen at these mycotoxin levels. On the other hand, crude protein intake was

18% higher when the *Fusarium* toxin contaminated wheat was fed because wheat was fed at a constant amount of 600 g dry matter per day. Therefore, it can not be differentiated between mycotoxin and nutrient effects in interpreting the differences in wheat straw degradation.

Rumen pH, concentrations of NH_3 and volatile fatty acids or their molar proportions were not affected by the two wheat batches. Therefore, the recorded changes in wheat straw dry matter degradation were not reflected by rumen physiological parameters and could consequently be of limited importance under practical feeding conditions, which is supported by an unchanged liveweight gain of growing bulls fed the same wheat batches as used in the present study (Dänicke et al., 2002).

The most striking effect in the present study was the pH-buffering effect of the detoxifying agent which was independent of *Fusarium* toxins since it was observed for both wheat batches. According to the manufacturer, the used detoxifying agent is composed of an adsorbing and an enzymatic component (Pasteiner, 1998). Beneficial effects of natural adsorbing substances such as bentonite and zeolite in buffering the pH in the rumen and in prophylaxis of rumen acidosis have been reported (Hampel and Jacobi, 1986). These effects are caused by the affinity of such adsorbents to protons. Thus, the pH-increasing effects of MP could be related to its adsorbing component. The typical fall in pH due to feeding was buffered by MP and was consistent from 1.5 h after the beginning of feeding up to the end of measurements after 5 h (Figure 1). The pH-differences in rumen fluids collected from wethers fed the MP-supplemented and unsupplemented rations amounted 0.2 to 0.3 on average in the time period between 1.5 and 5 h after feeding. The pH-buffering effect of MP was not accompanied by changes in the concentration of total volatile fatty acids or by shifts in their molar proportions, which might be an indication that the pH-buffering MP-effects were of little physiological importance. This is supported by the fact that only little or no effect of MP on *in sacco* dry matter degradation were observed since literature reports have revealed that a sub-optimal low rumen pH decreases the digestibility of organic matter due to a depression in fibre digestibility (e.g., de Veth and Kolver, 2001).

Summing up, the effects of a wheat batch contaminated with the dominating *Fusarium* toxins DON and ZON on rumen fermentation were rather low with the exception that the rate of dry matter degradation of wheat straw was slowed down. The main effect of the detoxifying agent was a mycotoxin-independent buffering of the rumen pH. Practical consequences of these findings need to be examined further.

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STRESZCZENIE

Wpływ skażenia ziarna toksynami *Fusarium* oraz czynnika odkażającego na fizjologiczne wskaźniki w żwaczu oraz rozkład *in sacco* suchej masy słomy pszennej i siana z lucerny, oznaczane na skopach

Przeprowadzono 4 doświadczenia na skopach z trwałymi przetokami żwacza, stosując dawki zawierające ziarno pszenicy i siano łąkowe w stosunku 1:1 w przeliczeniu na suchą masę (s.m.). Skarmiano 2 partie ziarna pszenicy, bez lub z dodatkiem czynnika odkażającego (Mycofix®Plus, Biomin GmbH, Herzogenburg, Austria). Jedna partia pszenicy niezanieczyszczona traktowana była jako kontrolna, druga zawierała toksyny *Fusarium*: deoxynivalent (DON) i zearalenon (ZON) w stężeniu około 10 i 0,76 mg/kg s.m., odpowiednio.

Nie stwierdzono zmian w proporcji krótkołańcuchowych lotnych kwasów tłuszczowych i stężeniu amoniaku w płynie żwacza jako reakcji na czynniki doświadczalne, natomiast czynnik odkażający buforował pH treści żwacza, lecz efekt ten był niezależny od zanieczyszczenia ziarna pszenicy mykotoksynami. Różnice pH płynu żwacza między 1,5 a 5 godz. po odpasie skopów kontrolnych i doświadczalnych wynosiły średnio 0,2 do 0,3.

Tempo rozkładu s.m. słomy pszennej inkubowanej w żwaczu skopów otrzymujących dawkę zanieczyszczoną mykotoksynami było wolniejsze niż u kontrolnych, nie stwierdzono natomiast różnic w przypadku siana z lucerny. Czynnik odkażający nie miał wpływu na kinetykę rozkładu s.m.

W podsumowaniu stwierdzono, że skarmianie dawek zawierających około 4,6 mg DON i 0,34 mg ZON/kg s.m. dawki nie zakłóca przebiegu fermentacji w żwaczu, choć wystąpiła tendencja zmniejszenia tempa rozkładu s.m. wolno rozkładalnej słomy pszennej i nie wpływa na pH treści żwacza.