Influence of fusarium toxins on growth and carcass characteristics of turkeys

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Einfluß von Fusarientoxinen auf die Mast- und Schlachtleistung von Puten

1. Introduction

Austria is because of its climate one of the most successful European countries for maize production. Due to the frequently occuring of frost in autumn maize is often infected with fusariums that produce toxins and have deleterious effects on corn. Possible negative effects of fusarium toxins in maize are of great importance for turkey farmers and animal feed industry, since maize is one of the most important components of turkey diets. The level of fusarium toxin contamination is considered as an important parameter for feeding value of maize. The effect of naturally contaminated maize on growth and carcass characteristics can be measured reliably only in feeding trials. For this experiment maize was specially selected from maize ears with higher levels of mycotoxins. In this experiment, the effects of highly naturally fusarium toxin contaminated maize on fattening and carcass characteristics as well as on biochemical blood parameters were studied.

2. Literature review

Natural maize samples can have moniliformin contents in the range of 2 mg/kg (Lew et al., 1991). The toxicity of deoxynivalenol and zearalenone for poultry is relatively low

Zusammenfassung

In einem Putenmastversuch wurde der Einfluß von unterschiedlichen Anteilen an mykotoxinkontaminiertem Futtermais in den Phasenfuttermischungen auf die Mast- und Schlachtleistung, die chemische Zusammensetzung des Schlachtkörpers, die organoleptischen Eigenschaften des Brustfleisches und spezifische biochemische Blutparameter untersucht. Im Versuch wurden 60 Puten in 4 Futtergruppen gehalten. In Futtergruppe 1 wurde unkontaminierter Futtermais, in Futtergruppe 2, 3 und 4 wurden 1/3, 2/3 und 3/3 des unkontaminierten Futtermaises durch mykotoxinkontaminierten Futtermais ersetzt. In Phasenfutter 1 waren bei allen Futtergruppen 36,8, im Phasenfutter 2 48,9 und im Phasenfutter 3 59,3 % Futtermais enthalten. Der belastete Futtermais war mit 4,94 mg Moniliformin, 3,24 mg Beauvericin, 2,02 mg Desoxynivalenol und 0,35 mg Fumonisin B1/kg kontaminiert. Die Mastdauer betrug 11 Wochen. Bei Mastende waren die Tiere in den Futtergruppen 1, 2, 3 und 4 6,71, 6,26, 6,33 und 6,27 kg schwer. Der Futteraufwand/kg LM-Zuwachs lag analog bei 2,07, 2,16, 2,23 und 2,19 kg. Beim prozentuellen Anteil der ohne Darm-Ware (OD-Ware) und grillfertigen Ware (OD-Ware ohne Kopf, Hals, Ständer und Innereien) am Nüchterngewicht traten zwischen den Futtergruppen keine nennenswerten Unterschiede auf. Auf die Organgewichte (Herz, Leber, Bursa fabricii und Milz) und die Anteile wertvoller Teilstücke am Schlachtkörper hatte der mykotoxinkontaminierte Futtermais keinen signifikant negativen Einfluß. Der TM-Gehalt in der OD-Ware nahm allerdings mit höherer Mykotoxinkontamination mit P=0,10 sigifikant von 31,5 auf 31,1, 30,9 und 30,1 % ab. Die organoleptischen Eigenschaften des Brustfleisches (Zartheit, Saftigkeit, Geschmack) wurden durch den mykotoxinkontaminierten Futtermais nicht beeinflußt. In der Tendenz wurden die belasteten Futtergruppen hinsichtlich der organoleptischen Eigenschaften besser bewertet als die unbelastete Futtergruppe 1. Auf den biochemischen Status der Tiere bei Mastende hatte der kontaminierte Futtermais ebenfalls keinen Einfluß. Aus dem Versuch kann der Schluß gezogen werden, daß mykotoxinkontaminierter Mais nur in den ersten 8 Lebenswochen die LM-Entwicklung und den Futteraufwand/kg LM-Zuwachs negativ beeinflußt.

Schlagworte: Puten, Mykotoxine, Mastleistung, Schlachtleistung, Blut.

Summary

In a feeding trial with 60 turkeys in 4 feeding groups the effects of mycotoxin contaminated maize on growing performance and carcass traits, chemical composition of eviscerated carcass, organoleptic traits and biochemical parameters of blood were investigated. Four diets with different levels of mycotoxin contamination were tried. In feeding group 1 uncontaminated maize was used, in feeding group 2, 3 and 4; 1/3, 2/3 and 3/3 of uncontaminated maize were substituted by mycotoxin contaminated maize. The percentage of maize in starter feed, grower diet I and II was 36.8, 48.9 and 59.3 %, respectively. The contaminated maize contained 4.94 mg moniliformin, 3.24 mg beauvericin, 2.02 mg deoxynivalenol, and 0.35 mg fumonisines B1 per kg. At the end of the growing period (77 days) live weight of the turkeys of group 1, 2, 3 and 4 was 6.71, 6.26, 6.33 and 6.27 kg and feed conversion rate was 2.07, 2.16, 2.23 and 2.19, respectively. The dressing percentages of eviscerated carcass and roast carcass, the weight of heart, liver, Bursa fabricii, spleen and the valuable parts of carcass showed no significant differences between the feeding groups. The DM content of eviscerated carcass was significantly (P=0.10) decreasing from 31.5 to 31.1, 30.9 and 30.1 % for feeding group 1, 2, 3 and 4, respectively. The organoleptic traits (tenderness, juiciness and taste) of breast meat and the biochemical parameters of blood were not at all influenced by the contaminated feed. The experiment shows, that maize contaminated with fusarium toxins had negative effects on growing performance only in the first 8 weeks of age, but not further on.

Key words: turkey, mycotoxin, growth, carcass, blood.

(PRELUSKY et al., 1994; ROTTER et al., 1996). LEW (1999) published a non effect level of 1.5 mg deoxynivalenol per kg compound feed for broilers. There is little published data on the toxicity of beauvericin and moniliformin for poultry. PIETRI et al. (1997) reported that the mycotoxin content appeared to have only little effect on body weight gain, while feed conversion ratio is influenced more negatively. BERGSJO and KALDHUSDAL (1994) found no negative effects on growth and carcass characteristics of broilers when they were fed diets with 3.4 mg deoxynivalenol per kg. TRENHOLM et al. (1986) determined 5 mg per kg diet as no effect level of deoxynivalenol for broilers. This value was also confirmed later in an experiment by LEITGEB et al. (1999) with broilers. HUFF et al. (1986) recorded negative influences on fattening and carcass characteristics of female broilers at a value of 16 mg deoxynivalenol per kg feed whereas KUBENA et al. (1985) with similar contaminations found no negative effects on growth performance of broilers. BOSTON et al. (1996) fed wheat with 5.8 mg deoxynivalenol to mallard ducks for 14 days and found no negative effects on serum protein, calcium, glucose, aspartate aminotransferase, blood packed cell volume, or body or organ weight.

3. Materials and Methods

Practical part of this research work was carried out at poultry trial station, Äußere Wimitz 3, A-9311 Kraig. 60 Big 6 BUT turkey chicks, (30 male and 30 female) were used in the experiment. The experimental design is given in table 1.

Table 1: Experimental design
Tabelle 1: Versuchsplan

Trait	Feeding group			
	1	2	3	4
Animals, n	15	15	15	15
Pens, n	3	3	3	3
Mycotoxin concentration	free	low	middle	high
Uncontaminated maize	3/3	2/3	1/3	0
Contaminated maize	0	1/3	2/3	3/3
Feeding	ad libitum			
Growing period, weeks	11	11	11	11

Birds were assigned to 4 groups (3 pens of 5 birds each per group) and offered diets in 3 stages (starter, grower I and II). All feed mixtures were mixed at the trial station. Starter with 27 % crude protein was fed from start until day 28; grower I with 23 % crude protein from day 29 until day 56 and grower II with 21 % crude protein from day 59 until day 77 (end of growing period). The composition of the different diets is shown in table 2. Food was offered ad libitum. In feeding group 1 was used only uncontaminated maize in all diets and in feeding groups 2, 3 and 4 the uncontaminated maize was replaced in all diets through 1/3, 2/3 and 3/3 of highly mycotoxin contaminated maize.

Table 2: Composition of diets
Tabelle 2: Rezepturen der Alleinfutter

Feed stuff		Starter	Grower I	Grower II
Maize	kg/dt	36.8	48.9	59.3
Soyabean meal, hp	kg/dt	43.7	32.8	24.4
Grass meal, dehydrated	kg/dt	6	6	6
Animal by products, Regau	kg/dt	5	5	5
Oil	kg/dt	5.7	4.7	3.0
Calcium carbonate	kg/dt	0.78	0.65	0.53
Dicalciumphosphate	kg/dt	1.20	1.10	0.95
Salt	kg/dt	0.18	0.19	0.19
Vitamin conc.-WHG[1)]	g/dt	20	16	12
Trace elements conc.-WHG[2)]	g/dt	50	45	40
L-Lysine-HCl	g/dt	154	247	320
DL-methionine, feed grade	g/dt	153	150	135
Choline chloride, Silica	g/dt	120	100	80
Antioxidans (Loxidan)	g/dt	10	10	10
Amprol plus[3)]	g/dt	50	50	-

[1)] Vitamin concentrate-G of the Warenhandels GmbH., Abt. Mischfutter, A-9020 Klagenfurt. 50,000.000 IE vitamin A, 10,000.000 IE vitamin D, 150.000 mg vitamin E, 5.410 mg vitamin K, 10.000 mg thiamine, 30.000 mg riboflavin, 20.000 mg pyridoxine, 100 mg vitamin B_{12}, 150.000 mg nicotinic acid, 60.000 mg Ca-pantothenate, 5.000 mg folic acid, 300 mg biotin/kg.
[2)] Trace elements concentrate-G of the Warenhandels Ges.mb.H., Abt. Mischfutter, A-9020 Klagenfurt. 120.000 mg Fe, 180.000 mg Mn, 120.000 mg Zn, 40.000 mg Cu, 2.000 mg I, 800 mg Se, 2.000 mg Co/kg.
[3)] Commercial product containing 20 % of Åmproliumethopabat. 100 mg Amproliumethopabat/kg diet till the 21[th] growing day.

3.1 Data collection

Live weight (LW): Recorded at the beginning of the experiment as average per pen and individually on day 28, 56 and 77.

Feed conversion rate (feed/LW gain): Calculated per pen by dividing the feed consumption by LW gain per pen.

Empty body weight: The weight until they were fastened for 12 h before slaughtering.

Eviscerated carcass: Slaughtered animal without blood, feather and intestinal tract.

Roast carcass: Carcass without head, neck, legs, gizzard, liver, heart and abdominal fat, recorded immediately after slaughtering (roast carcass warm) and once again after 15 hours in a cooling chamber at +3° C (cold roast carcass).

Carcass parts: Cold roast carcass was dissected into breast, legs, wings and remainder of carcass.

Chemical analysis: Cold roast carcass was homogenised and analysed for dry matter, crude protein, ether extract and ash.

Organoleptic traits: Breast meat was roasted for 6 minutes at 180°C on both sides, then graded by 4 judges for tenderness, juiciness and taste. Subjective scores for these traits ranged from 1 to 6 as shown in table 3.

Table 3: Organoleptic test
Tabelle 3: Organoleptische Untersuchung

Points	Tenderness	Juiciness	Taste
6	very tender	very juicy	tasteful
5	tender	juicy	tasty
4	above average	above average	above average
3	below average	below average	below average
2	tough	dry	tasteless
1	very tough	very dry	untypical

Weight of gizzard without feed content, liver without gall bladder and heart.

Blood: Samples were taken at slaughter time and were analysed for indicators of liver and metabolic disorders.

3.2 Analysis of mycotoxins

B-trichothecenes: Clean up with mycrosep #227 column according to T. R. ROMER (1986) and capillary-GC with trimethylsylilderivate with ECD. Sylilation according to SCOTT et al. (1986).

A-trichothecenes: Clean up with mycrosep #227 column (Rom Labs, Inc.) and capillary-GC with HFBI-derivate with ECD. Halogenising according to SCOTT et al. (1986).

Zearalenone: Clean up with $CHCl_3$/NaOH-distribution with reversed phase-HPLC and flourescence detection (MIROCHA et al., 1974; SCHUHMACHER et al., 1998).

Moniliformin: Clean up with ionpair extraction and ionpair chromatogaphy and UV-detection (LEW et al., 1996).

Beauvericin: Clean up with solid phase extraction, followed by reversed phase-HPLC and UV-detection (KRSKA et al., 1996; JOSEPHS et al., 1999).

Fumonisines: Clean up with SAX-anion changing column, followed by HPLC and OPA-derivate and flourescence detection (LEW et al., 1996).

4. Statistical analysis

Data of growth performance, carcass characteristics and blood measurements were analysed using the LSMLMW computer program (HARVEY, 1987). Data of organoleptic traits was analysed using Friedman Test (EßL, 1987).

Model for growth performance
$Y_{ij} = \mu + G_i + e_{ij}$

Y_{ij} is a dependent variable, μ is over all means, G_i is a fixed effect of treatment i, i = 1, 2, 3 and 4 and e_{ij} is the residual error.

Model for live weight gain and carcass traits

$$Y_{ijk} = \mu + G_i + S_j + e_{ijk}$$

Y_{ijk} is a dependent variable, μ is over all means, G_i is a fixed effect of treatment i, i = 1, 2, 3 and 4, S_j is a fixed effect of sex j, j = 1, 2 and e_{ijk} is the residual error.

5. Results

5.1 Chemical analysis of feed

The results of the chemical analysis for the uncontaminated and contaminated maize are shown in table 4. Uncontaminated maize contained a little more protein than the contaminated maize. The mycotoxin content of the contaminated maize was 4.94, 2.02 and 3.24 mg/kg moniliformin, deoxynivalenol and beauvericin, respecitvely. The results of the chemical analysis of the diets are shown in table 5. There were no considerable differences between the diets of the different treatment groups.

Table 4: Chemical composition and mycotoxin content of maize
Tabelle 4: Chemische Zusammensetzung und Mykotoxingehalte des Maises

Nutrient	Maize	
	uncontam.	contam.
Dry matter, g/kg	900	899
Crude protein, g/kg	90	81
Ether extract, g/kg	44	43
Crude fiber, g/kg	33	31
Ash, g/kg	14	14
Starch[1], g/kg	630	641
Sugar[2], g/kg	15	21
ME[3], MJ/kg	13.62	13.70
Moniliformin, μg/kg	<50	4940
Beauvericin, μg/kg	<100	3240
Deoxynivalenol, μg/kg	<50	2020
15-A deoxynivalenol, μg/kg	<50	330
Nivalenol, μg/kg	<50	285
Zearalenone, μg/kg	<20	200
Fumonisines B_1, μg/kg	<50	345
Fumonisines B_2, μg/kg	<50	260
T-2 Toxin, μg/kg	<50	<50
HAT-2 Toxin, μg/kg	<50	<50
Diacetoxyscirpenol, μg/kg	<50	<50

[1] Method 7.2.1, NAUMANN und BASSLER, 1976.
[2] Method 7.2.2 by EWERS, NAUMANN und BASSLER, 1976.
[3] Metabolisable energy (MJ) = g protein × .01551 + g fat × .03431 + g starch × .01669 + g sugar × .01301

Table 5: Nutrient content of diets
Tabelle 5: Nährstoffgehalt der Alleinfutter

Nutrient	Feeding group			
	1	2	3	4
Phase feed-1				
DM, g/kg	891	897	896	897
Protein, g/kg	272	274	271	267
Fat, g/kg	73	74	72	71
Starch, g/kg	284	284	279	276
Sugar, g/kg	60	65	56	60
ME, MJ/kg	12.24	12.37	12.06	11.94
Ca, g/kg	10.0	9.6	9.5	9.8
P, g/kg	6.6	6.9	6.8	7.0
Na, g/kg	1.1	1.1	1.0	1.1
Phase feed-2				
DM, g/kg	904	905	904	904
Protein, g/kg	232	230	229	230
Fat, g/kg	90	90	89	89
Starch, g/kg	328	328	328	328
Sugar, g/kg	38	37	37	36
ME, MJ/kg	12.65	12.61	12.56	12.56
Ca, g/kg	9.1	8.3	7.8	8.7
P, g/kg	6.1	5.7	5.3	5.7
Na, g/kg	1.2	1.1	1.1	1.1
Phase feed-3				
DM, g/kg	896	892	896	891
Protein, g/kg	213	208	216	215
Fat, g/kg	70	69	70	68
Starch, g/kg	424	413	410	413
Sugar, g/kg	32	33	36	36
ME, MJ/kg	13.20	12.92	13.06	13.03
Ca, g/kg	8.3	8.4	8.7	8.5
P, g/kg	5.8	6.0	6.0	6.0
Na, g/kg	1.1	1.2	1.1	1.2

5.2 Growth performance

All animals survived the experiment and were weighed individually on day 28, 56 and 77. Feed conversion rates and live weights are shown in table 6 and 7. Average body weight for groups 1, 2, 3 and 4 was 53, 52, 52 and 53 g at the beginning, and 6.71, 6.26, 6.33 and 6.27 kg at the end of the experiment, respectively. The effect of mycotoxins on LW gain was independent of the dosage in the diets. With low or higher content of mycotoxins in diets, the depression on liveweight gain was similar. There was only a little difference in body weight between the feeding groups 2, 3 and 4. As shown in table 7, feed conversion rates till day 56 were higher in all experimental groups when compared to feeding group 1. In the last 3 weeks of the experiment, feed conversion rates were nearly equal in all feeding groups. This means that growing performance of turkeys was sensitive to mycotoxins only in the first 8 weeks of life, but not afterwards.

Table 6: LW gain
Tabelle 6: LM-Entwicklung

Trait	Feeding group				s_x	P
	1	2	3	4		
Animals, n	15	15	15	15	-	-
LW at start, g	53	52	52	53	1	0,92
28th growing day, g	783	755	754	764	30	0,90
56th growing day, kg	3.42	3.18	3.21	3.24	0.12	0.52
77th growing day, kg	6.71	6.26	6.33	6.27	0.25	0.55

Table 7: Feed conversion rate
Tabelle 7: Futteraufwand

Trait	Feeding group				s_x	P
	1	2	3	4		
Pens, n	3	3	3	3	-	-
1th to 28th growing day	1.64	1.67	1.76	1.81	0.05	0.14
29th to 56th growing day	2.01	2.20	2.28	2.23	0.09	0.24
57th to 77th growing day	2.22	2.24	2.30	2.24	0.08	0.91
1th to 77th growing day	2.07	2.16	2.23	2.19	0.07	0.46

5.3 Slaughter performance

Carcass characteristics are shown in table 8. The differences in empty body weight between feeding group 1, 2, 3 and 4 were found again for eviscerated and roast carcass weight. The ratios between empty body weight and eviscerated and roast carcass weight were the same for all 4 groups. Heart weight linearly decreased when the percentage of contaminated maize in diets increased. No influence at all was observed on weight of liver, gizzard, bursa fabricius and spleen.

The absolut weight of the different parts of roast carcass and also the relative proportions of roast carcass body are shown in table 9. The average weight of breast meat and legs was 24.3 and 29.5 % of roast carcass weight. There were no significant differences between the 4 feeding groups.

The results of eviscerated carcass analysis are shown in table 10. The dry matter content decreased linearly from group 1 to 4 from 31.5 to 30.1 %. Mycotoxin content in the diets showed no effects on protein and fat content of eviscerated carcasses.

Table 8: Slaughtering performance
Tabelle 8: Schlachtleistung

Trait	Feeding group				s_x	P
	1	2	3	4		
Animals, n	15	15	15	15	-	-
Empty body weight (EBW), kg	6.84	6.38	6.40	6.42	0.25	0.53
Eviscerated carcass, kg	6.17	5.76	5.76	5.80	0.24	0.56
Eviscerated carcass in % of EBW	90.2	90.2	90.0	90.4	0.47	0.94
RCB[1)] warm, kg	5.09	4.75	4.75	4.80	0.20	0.56
RCB[1)] warm in % of EBW	74.5	74.4	74.3	74.7	0.44	0.90
RCB[1)] cold, kg	5.05	4.70	4.72	4.76	0.19	0.55
RCB[1)] cold in % of EBW	73.9	73.6	73.9	74.1	0.41	0.85
Abdominal fat, g	68	48	47	56	7	0.11
Head and neck, g	285	270	275	274	13	0.87
Legs, g	212	212	214	203	14	0.93
Heart, g	27	24	24	24	1	0.21
Liver, g	101	97	97	99	5	0.91
Gizzard, g	136	136	135	133	7	0.98
Bursa fabricius, g	7.4	7.5	7.5	7.5	0.5	0.99
Spleen, g	5.0	4.8	4.6	4.7	0.3	0.78

[1)] Roast carcass body

Table 9: Parts of roast carcass body
Tabelle 9: Teilstücke des Schlachtkörpers

Trait	Feeding group				s_x	P
	1	2	3	4		
Animals, n	6	6	6	6	-	-
Roast carcass body (RCB), kg	5.07	4.49	4.50	4.58	0.25	0.32
Breast meat, kg	1.21	1.08	1.11	1.10	0.05	0.35
Breast meat in % of RCM	24.0	24.1	24.8	24.1	0.72	0.84
Legs, kg	1.51	1.34	1.32	1.33	0.08	0.35
Legs in % of RCB	29.6	30.0	29.4	29.0	0.43	0.47
Wings, kg	0.68	0.64	0.62	0.63	0.04	0.65
Remainder of carcass, kg	1.68	1.43	1.45	1.51	0.09	0.26

Table 10: Chemical analyses of eviscerated carcass
Tabelle 10: Chemische Zusammensetzung der OD-Ware

Trait	Feeding group				s_x	P
	1	2	3	4		
Animals, n	6	6	6	6	-	-
Eviscerated carcass, kg	6.23	5.95	5.85	6.07	0.51	0.96
DM, %	31.5	31.1	30.9	30.1	0.36	0.10
Protein, %	20.0	20.4	20.3	19.7	0.31	0.42
Fat, %	8.7	8.0	8.0	7.7	0.53	0.58
Ash, %	2.8	3.0	2.8	3.0	0.12	0.43

5.4 Organoleptic traits

Tenderness and juiciness showed low and the taste of breast meat showed higher variations between the groups, but there were no obvious trends noticable (table 11). Group 2 had the best result for taste, whereas feeding group 1 came out worst.

Table 11: Results of organoleptic test
Tabelle 11: Ergebnisse der Verkostung

Trait	Feeding group				χ^2
	1	2	3	4	
Animals, n	6	6	6	6	-
Tenderness, points	3.54	3.75	3.50	3.67	2.03
juiciness, points	3.54	3.63	3.50	3.58	1.50
Taste, points	2.75	3.96	3.08	3.17	9.24

$\chi^2 > 13.85 = P < 0.05$

5.5 Biochemical blood parameters

As shown in table 12 blood parameters of the 4 feeding groups showed no significant differences. It is very important to note that the effect of mycotoxins on aspartate aminotransferase was slightly positive, it decreased from group 1 to 4 from 167 to 150 U/l. This result confirms among other things the low impact of mycotoxins on growing and slaughtering performance at the age of 11 weeks.

Table 12: Blood parameter
Tabelle 12: Blutparameter

Trait	Feeding group				s_x	P
	1	2	3	4		
Animals, n	10	10	10	10	-	-
Haematokrit, %	35.1	31.9	37.5	35.6	1.4	0.05
Leukocytes/ml, n	7222	7400	7900	6667	510	0.41
Alkali phosphatase, U/l	2357	2254	2100	2485	127	0.20
Aspartate aminotransferase, U/l	167	165	147	150	8	0.14
Lactate dehydrogenase, U/l	73	80	71	72	5	0.59
Triglycerol, mg/dl	68	49	50	63	11	0.53
Cholesterol, mg/dl	140	131	153	143	6	0.08
Total protein, g/dl	332	326	345	317	9	0.19
Albumin, g/dl	150	146	153	142	4	0.32
Globulin, g/dl	182	181	192	175	5	0.20

6. Discussion

Contradicting results have been published in the literature concerning the effects of mycotoxins on growth and carcass characteristics of poultry (PRELUSKY et al., 1994; ROTTER et al., 1996). This is not surprising since the effects of mycotoxins are influenced by several factors, e. g. maize breeds, yield performance, time of harvesting, geographical conditions and also the nutrient content of diets (LEW et al., 1991). As mentioned by LEW et al. (1991), naturally contaminated maize contains many different kinds of mycotoxins. The maize used in the trial of LEITGEB et al. (1999) had high contents of deoxynivalenol, whereas the maize in the present trial shows higher contamination with moniliformin and beauvericin. PIETRI et al. (1997) found that the natural mycotoxin content of feed stuffs appeared to have only negligible effects. 1.5 mg deoxynivalenol/kg compound feed were published by LEW (1999) as no effect level for broilers. LEITGEB et al. (1999) measured no effects on body weight gain of broilers with even higher levels of natural mycotoxin content in diets. In the present trial there were noticable practical effects on live weight gain in the 3 contaminated groups independent of mycotoxin concentration in the diets. Otherwise the effects on feed conversion rate of broilers as published by PIETRI et al. (1997) and those obtained in the present trial in the first 8 weeks correspond very well. As BERGSJO and KALDHUSDAL (1994) mentioned and the results in the present investigation show, the toxicity of deoxynivalenol for broilers may be higher than for turkeys and the no effect level of deoxynivalenol published by TRENHOLM et al. (1986) for broilers may not be valid for turkeys during the first 8 weeks of life. The different effect level measured by HUFF et al. (1986) and KUBENA et al. (1985) also shows that the sensitivity to fusariotoxins is different between broilers and young turkeys. Growth and blood parameters of mallard ducks showed (BOSTON et al., 1996) similar reaction to mycotoxins as in the present experiment. Literature and results of the present trial show that different kinds of poultry react differently to mycotoxins. A general no effect level for all different kinds of poultry can not be stated.

Acknowlegement

The autors thank the Austrian Federal Ministry of Agriculture and Forestry, A-1012 Vienna, for the financial support.

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Eingelangt am 8. Februar 2000
Angenommen am 26. März 2000