EFFECTS OF ZEARELENONE AND DEOXYNIVALENOL COMBINATIONS FED TO PIGS

H.L. Trenholm¹, D.W. Friend¹, B.K. Thompson², and D.B. Prelusky¹

¹Animal Research Centre and Engineering and ²Statistical Research Centre
Agriculture Canada, Ottawa, K1A 0C6.

The present study was undertaken to determine if the addition of zearalenone (ZEN) to a diet containing deoxynivalenol (DON) from naturally contaminated grain would affect the nutritional and reproductive status of young growing gilts.

Material and methods.

All diets contained: barley - 11%, wheat - 70%, soybean meal - 12.2%, fat - 1.8%, minerals - 4.4%, vitamins - 0.5%, and L - lysine hydrochloride - 0.1%. Pure ZEN and naturally contaminated wheat were added to prepare 15 diets with different mycotoxin concentrations (Table 1); diet 16 was a positive control. Sixty-four Yorkshire gilts (mean: 33.9 kg BW) were allocated to a randomized block design, with each block including 16 gilts of similar body weight. During the 5 week treatment period, feed intake and body weight records were taken weekly; visual examinations of the vulva were made daily. At the end of the experiment, necropsies were performed. Analyses of variance were applied to data. All differences cited herein were significant at the 5% level, unless otherwise stated.

Results and discussion.

Gilts showed no overt signs of toxicoses other than vulvas which became red and swollen. There was a linear trend towards lower feed intake and body weight gain with increasing levels of DON in the diet. Dietary ZEN did not affect feed intake, weight gain or feed:gain ratios. The analysis of variance indicated no overall DON-ZEN interaction ($p \approx 0.35$). There were indications of trends ($P < 0.08$) towards greater reductions in feed intake and weight gain associated with dietary DON when ZEN was present in the diet at any concentration.

When evaluating estrogenic activity, namely, days to appearance of swollen vulva, data was adjusted for actual ZEN intake since the reduced feed consumption associated with dietary DON also reduced ZEN intake. In diets 2-5 prepared from clean wheat, the presence of pure ZEN at any concentration was associated with red and swollen vulva within 7.5 days. In those diets where

pure ZEN was not added (diets 1, 6, 11, 16), addition of naturally contaminated wheat to the diet seemed to reduce the time to appearance of swollen vulva. The presence of naturally contaminated wheat (diets 7, 8 and 12 to 14 inclusive) seemed to delay the onset of the estrogenism associated with pure ZEN in the diet. At higher dietary ZEN concentrations (diets 9, 10, 15), the presence of DON in the diet had little effect on the time to appearance of swollen vulvas in the gilts. The data for days to appearance of swollen vulva cannot be explained by reduced ZEN and feed intake associated with DON in the diets. At daily intakes of pure ZEN in the range of 0.035 to 0.15 mg (kg B.W.)⁻¹ the presence of DON and/or moldy wheat antagonized the estrogenic effects of ZEN. However, at higher ZEN intake, i.e., 0.15 to 0.4 mg (kg B.W.)⁻¹, the time to appearance of swollen vulva was not affected by the addition of the DON to the diet formulation. Addition of DON contaminated wheat to the diet was associated with a highly significant increase in stomach weight (Table 1). Significant linear trends with dietary DON content were also observed with relative (to body weight) uterus and adrenal weights. There was a direct correlation between ZEN content of the diet and relative uterus weight. The data from the present study suggest that the threshold estrogenic effects of ZEN may be much lower than previously envisioned. The estrogenic threshold effect was ≤ 0.88 mg ZEN kg⁻¹ diet, i.e., ≤ 0.04 mg ZEN (kg B.W.*day)⁻¹ for a 5-week period.

Table 1. Necropsy data: organ weights relative to body weight

Diet	DON ¹ mg/kg	ZEN ¹	BW ² (kg)	Weights (g/kg BW)			
				Uterus	Adrenals x 100	Ovaries x 100	Stomach
1	0.0	0.01	67.3	1.53	5.00	8.12	7.32
2	0.0	0.88	69.3	1.75	4.70	10.07	7.02
3	0.0	1.50	69.5	1.78	5.31	7.88	7.11
4	0.0	3.05	68.0	1.91	5.96	7.24	6.95
5	0.11	5.80	71.8	2.86	5.23	6.55	6.09
6	2.25	0.16	62.0	1.66	4.28	11.15	6.82
7	2.52	1.08	60.6	1.66	5.94	8.10	7.67
8	2.33	1.70	63.8	2.10	6.19	7.88	7.04
9	2.37	2.65	60.2	2.50	6.48	12.46	7.88
10	2.31	6.60	56.1	2.69	3.00	7.61	7.09
11	4.95	0.34	57.6	1.64	5.47	10.16	7.99
12	4.54	1.18	53.4	1.78	6.72	10.38	7.19
13	4.55	1.85	53.3	2.14	6.53	9.25	8.53
14	4.62	3.57	49.9	2.26	6.50	3.14	8.87
15	4.36	6.60	53.9	3.91	6.69	8.81	7.59
S.E.M. ³			2.92	0.338	0.859	1.806	0.449

¹Body weight at slaughter

²Analyses of mycotoxins in diets.

³The standard error of the mean presented here for overall means is slightly less than one-half the standard errors for individual means.