Zearalenone in Freshly Harvested Corn

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ABSTRACT

Zearalenone, an estrogenic lactone produced by *Gibberella zeae*, was assayed in naturally infected corn ears harvested in December 1972 in Indiana. Of 31 kernel samples, 27 contained zearalenone (0.1-10.0 μg/g). Production was greatest in kernels at the tip of the ears where *G. zeae* infection was most severe. Low zearalenone levels (1.5 μg/g or less) were detected in 10 freshly harvested commercial corn samples. Cob and husk samples contained 4.5 to 12.5 μg/g of zearalenone. We have concluded that zearalenone in freshly harvested corn in Indiana is not an important threat to feeder cattle.

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Gibberella zeae (Sch.) Petch produces emetic and refusal factors that affect swine and other nonruminants (5, 6, 13), and zearalenone, an estrogenic lactone (3, 9, 12). The emetic and refusal factors are produced on developing grain (4); whereas, estrogenic upsets due to zearalenone have usually been reported from feeding infected corn stored until the spring or summer following harvest (3, 7, 8).

Epidemics of Gibberella ear rot in Indiana are relatively rare. In 1957, this ear rot was common in northern Indiana; the following year many estrogenic upsets appeared among swine. A severe epidemic of the disease occurred in 1965 in northern Indiana and led to widespread refusal by swine, but with few verified estrogenic upsets. An unusually wet summer and fall in 1972 was associated with a severe outbreak of the ear rot. Fifty-one of 92 counties reported refusal of corn by swine.

The epidemic year of 1972 was a unique opportunity to assess the production of zearalenone in standing corn. The mild fall and the delay of much of the corn harvest until December or January due to rain raised the possibility that the growth of *G. zeae* might continue on unharvested ears and result in significant amounts of zearalenone. Earlier research had indicated that when ears were artificially inoculated at full silk only low levels (10 μg/g or less) were produced, and that still lower levels (0.1 μg/g) occurred in naturally infected corn in the field (1). We report here the levels of zearalenone in naturally-infected corn ears from the 1972 crop.

On December 12, 1972, 31 ear samples were collected from northern Indiana fields. Kernels, 50 g/sample, were shelled from the tips of heavily invaded ears where infection was greatest. Most samples contained shrunken kernels that were reddish due to the extensive development of *G. zeae*. Samples were dried at 40 C, brought up to ~30% moisture content, and assayed for zearalenone. The recovery efficiency of the assay was about 70% and the sensitivity 0.1 μg/g based on corn containing 12% moisture (2).

Of 31 samples assayed, 27 contained zearalenone (Table 1). Nearly 10% of the samples approached a concn (10 μg/g) that is detectable by the sensitive ovariectomized mouse bioassay. The significance of these amounts is lessened because the growth of *G. zeae* rarely extends over more than 50% of the ear and rarely are all ears molded. After shelling and bulking, a 5- to 20-fold dilution might be expected.

To ascertain what levels of zearalenone might be found in freshly harvested commercial grain, 10 samples of visibly *G. zeae*-damaged corn were obtained from a feed manufacturer in October. Four of the samples were negative and the other 6 contained 0.1 to 1.5 μg/g of zearalenone.

In addition to its estrogenic effects (vulvular hypertrophy, enlarged mammary glands, etc.) in nonruminants, zearalenone has been associated with infertility in ruminants (10). Since ear corn silage is fed to cattle, husk and cob samples were assayed for zearalenone. Two severely infected samples were collected on 23 January 1973 and separated into cob, husk, butt kernel, and tip kernel lots. Kernels taken from the butt of the ear showed few signs of fungal invasion and yielded 0.8 μg/g of zearalenone; those from the tip were badly molded and yielded 8.1 μg/g of zearalenone. Cob and husk samples were visibly damaged and contained 4.5 to 12.5 μg/g of zearalenone.

We have concluded that zearalenone in freshly harvested corn in Indiana is not an important threat to livestock, thus confirming an earlier report (1). Caution should be exercised, however, in feeding *G. zeae*-molded corn, particularly to breeding stock, since data are not available on the effects of long term consumption of low levels of zearalenone. In addition, toxin levels can markedly increase in storage if conditions are favorable. Higher levels of zearalenone probably did not develop in the field in November and December because temp were generally too low for substantial production (3, 9, 11).

TABLE 1. Zearalenone in corn kernels severely infected with *Gibberella zeae*

	Zearalenone (μg/g corn)				
	0	0.1-0.5	0.6-1.0	1.1-5.5	5.6-10.0
No. of samples	4	8	5	11	3
Percent	12.9	25.8	16.1	35.5	9.7

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