A Note on the Selection of Swine Ration Ingredients with an Aflatoxin Contamination Level Below 1 μg/kg

by BERNARD H. AMBRECHT, WESLEY C. JACOBSON, and HERBERT G. WISEMAN[1]

Bureau of Veterinary Medicine
Food and Drug Administration
U.S. Department of Health, Education, and Welfare
Rockville, Md. 20852

Aflatoxins are naturally occurring contaminants sometimes found in the ingredients used to prepare swine rations (ARMBRECHT, 1971). A maximum limit of 1 μg of total aflatoxins/kg of feed was arbitrarily set for the swine basal diet used in an aflatoxin residue study. The problems associated with obtaining and storing aflatoxin-free shelled corn in tonnage quantity, the principal ingredient in Beltsville swine diets, are described.

Materials and Methods

Corn, soy, linseed, and fishmeals and tankage were analyzed for aflatoxin content by the method of JACOBSON et al. (1971). Meal products in bags were sampled with a trier probe; two insertions, proceeding diagonally through the bag from adjacent corners, were made with the probe. Samples of commerce shelled corn contained in railroad box-cars were withdrawn according to standard methods (ANONYMOUS, 1964); bin-dried corn samples were collected and prepared by procedures similar to the method described by JOHNSON et al. (1968).

Prior to the preparation of a test diet, the box-car unloading equipment, chutes, conveyors, silo, hammer mill, and mixer drum were scoured with a fore run of shelled corn selected for examination. The holding bins and mixer drum were swept free of residual dust and the meal contact surfaces were further cleaned with a vacuum cleaner. Required amounts of ingredients were introduced into the mixer drum from the bins or directly from bags as appropriate.

After mixing, a 100 to 120 g specimen of feed was withdrawn from each 50 pound bag of feed, prior to final closure, as loaded out from a 3-ton lot. The ground mash diet specimen was quartered by the usual procedure on a mat of new kraft paper and reduced to a 3-kg laboratory sample for analysis as described above.

Results and Discussion

Lots of bagged soy, linseed, and fish meals and tankage, with analyses less than 1.5 μg of total aflatoxins/kg, were readily found. Corn, however, presented problems as described below. In order to meet the specification, the analysis for corn ought to be less than 0.8 μg/kg.

[1]Retired.

Bulletin of Environmental Contamination & Toxicology,
Vol. 14, No. 4 © 1975 by Springer-Verlag New York Inc.

U.S. No. 1 yellow corn, Maryland 1966 crop, was examined and found to contain 12 to 15 μg/kg. Maryland 1966 crop seed corn was found to contain 5 to 7 μg/kg. These contamination levels are consistent with levels in 3,545 samples collected by the Grain Division, U.S. Department of Agriculture (ARMBRECHT, 1971) but clearly could not be used for the preparation of the special diet for the residue study.

A car-load (40 tons) of Iowa 1966 crop, U.S. No. 1 yellow, commerce corn was sampled; the analysis was 0.8 μg/kg. Two lots of feed (each weighing 3 tons) were prepared; all other ingredients analyzed below 1 μg/kg. To our disappointment, the laboratory sample analyzed at 4.4 μg B_1/kg, 2.9 μg B_2/kg, 6.7 μg G_1/kg, and a trace of G_2. Evidently a highly contaminated pocket of shelled corn was present in the car load and was missed by the sampling method. We abandoned commerce corn and turned to corn where the history could be traced to the field.

A specimen of Indiana field shelled corn (1966 crop) which had been hot air-dried as a stationary load was obtained. The analysis was 1.5 μg of B_1/kg and 3.3 μg of G_1/kg. An examination of the field records indicated a wet harvest season, and the base of the corn stalks was still green at harvest. Next, because the harvest season was dry, a specimen of Iowa 1966 corn crop, picker-shelled in the field and dried with hot air as a static load, was obtained from a bin near Creston, Iowa. The analysis of this corn was 0.6 μg of B_1/kg and 0.7 μg of G_1/kg but a shortage of local labor prevented us from obtaining this corn.

In 1967, 20 tons of yellow corn were obtained from the Iowa State University Farm. The relative humidity preceding harvest was 25-35%. The corn was harvested when its moisture content was 20-25%, dried overnight at 62-64°C in a bin where the load was turned with screw augers, and contained 8% moisture. The analysis of this corn was 0.1 μg B_1 and 0.1 μg G_1/kg. The identity of the aflatoxins was confirmed by the technique described by WISEMAN et al. (1967). The corn was bagged in 4 ply kraft paper bags containing a 4 mil polyethylene-sealed liner for shipment from Ames to Beltsville. Swine diet prepared when local humidity was 35-40% was completely satisfactory.

The shelled corn, which had been stored in a shed exposed to ambient air, was examined for moisture content change. In 1969, the moisture analysis was 10% and in 1970 the value increased to 11%. Thus, the polyethylene liner appeared to be adequate and an aluminum foil layer over the polyethylene liner (moisture barrier) was not necessary as originally considered desirable for 1-2 years of storage.

This experience indicated that a very small contamination level of aflatoxin can be expected in corn. Direct contamination of corn in the field has been demonstrated by the work of LILLEHOJ et al. (1975) and KNAKE and DEVOE (1973).

Acknowledgments

We express our thanks to Mr. Meyers L. Miller, Agricultural Research Center Granary, for his generous cooperation and assistance with diet formulation; Mr. Woodrow S. Harrison, Chesapeake Feed Co., Inc., Beltsville, for obtaining Maryland corn, and Mr. Russel Selim, Creston, Iowa, Mr. Ralph A. Thompson, Purdue University, Lafayette, Indiana, and Mr. Maurice Caldwell, Farm Services, Iowa State University, Ames, Iowa, for supplying specimens of bin-dried corn. Thanks are also due to Dr. A. C. Pier, National Animal Disease Laboratory, Ames, Iowa, for services and information and Dr. R. M. Johnson for moisture analyses.

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