Dairy Nutrition Fact Sheet
October 27, 2003

Feeding Wheat Containing Vomitoxin to Dairy and Beef Cattle

L. E. Chase and W. C. Stone
Department of Animal Science
Cornell University

The 2003 wheat crop in New York has the potential to contain vomitoxin as a result of the growing and harvesting conditions and diseases, primarily Fusarium head blight (scab). Some of the wheat originally intended for milling may not meet the required quality standards and has become available as an animal feed.

Summary

DON in wheat is a mycotoxin of concern in rations of animals. The primary effects are potential decreases in feed intake, growth and milk production. There is no "safe" feeding level for wheat containing DON. However, the guidelines that follow appear reasonable based on available research data. Consult with your nutritionist to assure that balanced rations are fed. You should also work with your nutritionist to make sure the quantity, form and method of feeding of the wheat do not result rumen acidosis.

The following information should be helpful as individuals assess the potential use of this wheat on their farms.

1. What is vomitoxin?

   Vomitoxin is a mycotoxin in the trichothecene family. This compound may also be listed as DON (deoxynivalenol) in some articles. DON is most commonly produced by molds of the *Fusarium* species.

2. What Are The Current Guidelines for Diet DON Levels When Wheat is Fed?

   There is not a universally accepted guideline for "safe" DON levels in beef and dairy cattle rations. The guidelines will also be different for beef feedlot steers versus dairy cattle due to differences in the quantity of feed consumed. The following guidelines are proposed based on the research papers cited below. These guidelines assume that the wheat does not contain any other mycotoxins except DON.

   a. Feedlot steers -

      The FDA advisory level of 10 ppm or less for DON in wheat seems reasonable. The following guidelines can be used for feeding

wheat containing DON to feedlot steers. You need to work with your nutritionist to make sure the final ration is balanced for the energy and protein levels to support the targeted average daily gain.

DON, ppm	Wheat, maximum %[a]	Wheat, maximum %[b]
20	30-35	10-12
15	45-50	15-17
10 or less	60-70	20-30

[a] Assumes DON is the only mycotoxin in the wheat

[b] "Estimated" feeding level assuming that other mycotoxins may be present in the wheat.

b. Dairy cattle –

The FDA advisory level of 5 ppm DON is used in developing the following guidelines. This level is actually lower than some of the research trials cited below. In addition, it is important to remember that DON fed in the ration does not appear to transfer to milk.

The quantity of wheat fed in dairy rations is usually limited to 10-15% of a TMR (total mixed ration) due to the level of starch and the rapid rate of starch breakdown in the rumen. From the research data cited below, it appears that this maximum feeding rate for dairy cattle can be used when feeding wheat-containing DON. If wheat contains 20 ppm DON and is fed at 10% of the total TMR, them the DON level in the total ration is 2 ppm DON assuming no other feeds also contain DON. Given the potential interaction of DON and the immune system, it may be advisable to not use wheat-containing DON in rations for close-up dry cows and early lactation cows.

The following information forms the basis for the above guidelines

3. How does DON affect animals?

DON can elicit a number of responses in animals. These include:

- Depressed feed intake
- Decreased growth rate
- Decreased milk production
- Impaired reproductive performance
- Decreased milk fat test
- Depressed immune system function
- Increased somatic cell counts

4. What guidelines can be used to interpret laboratory reports?

FDA (Food and Drug Administration) has provided the following advisory guidelines:

Product	DON, ppm
Finished wheat products	1
Grains and grain by-products for ruminating beef and feedlot cattle older than 4 months and chickens. These ingredients should not be more than 50% of the diet.	10
Grains and grain by-products fed to swine. These ingredients should not be more than 20% of the diet.	5
Grains and grain by-products for all other animals. These products should not be more than 40% of the diet. This guideline should apply to dairy cattle.	5

It is important to remember that these are "advisory" levels rather than action levels. These guidelines also **are for DON** and may not be appropriate when other mycotoxins are also present in the grain or grain by-product.

5. DON as a marker for other mycotoxins

There are hundreds of mycotoxins that exist in nature. However, only 3-6 have tests developed that commercial laboratories can use. It appears that feeds with elevated DON levels may often contain higher levels of other mycotoxins. Most research trials have been conducted using various levels of only DON. The FDA guidelines also are built using only DON. It appears that field recommendations should be more conservative than the guidelines listed above.

6. What About Research with beef cattle?

Two trials were recently conducted at the University of Minnesota with feedlot steers to examine the influence of DON on animal performance.

Trial 1 – (Windels,H.F. et. Al., 1995 Minnesota Cattle Feeders Report B-417, pp. 1-5)

- Used barley grains containing < 1 ppm and 30 ppm of DON
- The 2 barley grains were blended to provide total ration DON levels of 0,7, 14 and 21 ppm.
- Rations fed were 21% corn silage and 79% barley (dry matter basis). A protein-mineral mix was also fed at 2 lbs. per day.

- Crossbred steer calves with an initial weight of 870 lbs. were used. The feeding period was 144 days.
- Average daily gains ranged from 3.2 – 3.3 lbs. per day.
- No effects of DON on feed intake or animal performance were observed in this trial.
- Daily DON intake was 221 mg. for the diet with 21 ppm DON.

Trial 2 – (DeCostanzo, A. et. Al., 1995 Minnesota Cattle Feeders Report B-417, pp,6-8)

- Barley grains containing 0 or at least 22 ppm of DON were used.
- Total ration DON levels were 0, 6, 12 or 18 ppm DON.
- Crossbred steers with an initial weight of 914 lbs. were used. The feeding period was 135 days.
- Average daily gains ranged from 2.53 – 2.72 lbs. per day.
- No effects of DON on feed intake or animal performance were observed in thus trial.
- Daily DON intake was 190 mg. for the diet containing 18 ppm DON.

7. <u>What About Research with Dairy Cattle?</u>

There have been a limited number of controlled trials conducted evaluating the effect of DON in dairy rations.

Trial 1 – (Trenholm, H.L. et.al., J.Dairy Science, 68:1000-1005, 1985)

- Used nonlactating dairy cows
- Wheat was the source of DON
- Feeding period was about 12 weeks
- Total ration DON levels of 1.5 and 6.4 ppm were used.
- There was a slight decrease in grain consumption in cows fed the higher DON (6.4 ppm) ration.
- No effects on animal health were detected.
- Daily DON intake for the 6.4 ppm diet was 43 mg.

Trial 2 – (Charmley, E. et. Al., J. Dairy Science, 76:3580-3587, 1993)

- Used lactating dairy cows in a 10-week study.
- Wheat (5.6 ppm DON) and corn grain (144 ppm) DON were used
- Grain mix used contained 64% wheat, 2-7% corn and 22% roasted soybeans
- Total ration contained 0, 6 or 12 ppm DON
- There was no effect on intake of grain or forage in this trial.
- There was no effect of ration DON level on milk production (average milk production was 45-50 lbs. per day)

– Milk fat% was depressed in cows fed rations with 6 or 12 ppm DON.

- No transfer of DON to milk was observed.
- Daily DON intake was 104 mg. for the ration with 12 ppm DON.

Trial 3 – (Ingalls, J.R., Animal Feed Science Technology, 60:297-300, 1996)

- Lactating dairy cows averaging 75 lbs. of milk were used.
– Barley containing either 0 and 24 ppm DON was used.
– The grain mix was 60% barley.
– DON content of the 4 grain mixes was 0, 3.6, 10.9 and 14.6 ppm.
– Rations were fed for a 3 week period.
– Total ration DON levels were 0, 2.1, 6.3 and 8.5 ppm DON.
– There were no effects of DON on feed intake, milk production or milk composition.
- Daily DON intake was 195 mg. for the ration with 14.6 ppm DON.

8. <u>What About Field Observations?</u>

There have been a number of field reports relating the relationship of DON and performance in dairy cattle. Dr. Lon Whitlow at North Carolina State University reported decreases in milk production in dairy herds when total diet DON levels were > 0.3 – 0.5 ppm. The author cautions that the DON may have been a marker for other mycotoxins that could also have been in these rations. Additional field observations have been reported of depressed dry matter intake or milk production when DON was detected in corn silage or corn grain. None of these field reports were in herds feeding wheat or barley. This makes it difficult to interpret this data in terms of field recommendations.