Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 1 *Cattleman's Day (1993-2014)*

Article 485

1998

Characteristics of pelleted wheat middlings that affect summer storage

Carl R. Reed

Dionisia M. Trigo-Stockli

Dale A. Blasi

See next page for additional authors

Recommended Citation

Reed, Carl R.; Trigo-Stockli, Dionisia M.; Blasi, Dale A.; and Fairchild, Fred J. (1998) "Characteristics of pelleted wheat middlings that affect summer storage," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 1. https://doi.org/10.4148/2378-5977.1888

Characteristics of pelleted wheat middlings that affect summer storage

Abstract

Pelleted wheat middlings samples were collected from four Kansas flour mills in March, April, and May, 1997 to characterize their moisture content and bulk density as they would be purchased directly from the mills by a livestock producer. The average moisture content of pelleted wheat middlings was 14% as they left the mills but declined during the spring to 13.6%. Pellets purchased from Kansas mills during the summer months are likely to contain 13.0 to 13.5% moisture. The average bulk density was approximately 40 lb/ft3 , which is equivalent to about 50 lb/bu. Based on the equilibrium moisture contents determined from the collected samples, if air at typical Kansas summertime temperatures is above 65% relative humidity, pellets will absorb moisture during storage.

Keywords

Kansas Agricultural Experiment Station contribution; no. 97-309-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 804; Cattlemen's Day, 1998; Beef; Wheat middlings; Storage

Authors

Carl R. Reed, Dionisia M. Trigo-Stockli, Dale A. Blasi, and Fred J. Fairchild

CHARACTERISTICS OF PELLETED WHEAT MIDDLINGS THAT AFFECT SUMMER STORAGE

C. R. Reed[1], D. M. Trigo-Stockli[1], D. A. Blasi, and F. J. Fairchild[1]

Summary

Pelleted wheat middlings samples were collected from four Kansas flour mills in March, April, and May, 1997 to characterize their moisture content and bulk density as they would be purchased directly from the mills by a livestock producer. The average moisture content of pelleted wheat middlings was 14% as they left the mills but declined during the spring to 13.6%. Pellets purchased from Kansas mills during the summer months are likely to contain 13.0 to 13.5% moisture. The average bulk density was approximately 40 lb/ft^3, which is equivalent to about 50 lb/bu. Based on the equilibrium moisture contents determined from the collected samples, if air at typical Kansas summertime temperatures is above 65% relative humidity, pellets will absorb moisture during storage.

(Key Words: Wheat Middlings, Storage.)

Introduction

Wheat middlings (WM) are by-products of flour milling and have nutritional value in cattle rations. Ground WM are difficult to handle and quickly lose their flowability in bulk bins. However, pelleted WM are gaining acceptance with cattle feeders because of greater density and improved handling and flowability characteristics. During summer months, the price of pelleted WM declines, thereby creating an excellent feed ingredient value. However, when pelleted WM are stored on-farm through the summer months, many Kansas producers have observed heating, which has resulted in caking, discoloration, and loss of flowability (Blasi et al., 1997 Cattlemens Day Report of Progress, p 37).

This study was initiated in March, 1997 to investigate the characteristics of pelleted WM that relate to their storability, especially during summer months. Our objective was to describe moisture and bulk density characteristics of the pelleted WM as they would be purchased from Kansas mills. Our long-term goal is to develop practical recommendations for on-farm storage of WM during summer months.

Experimental Procedures

Pelleted WM were collected from four Kansas mills on four occasions in March, April, and May, 1997. Sealable containers were supplied to the millers with instructions that samples should be taken randomly from the pellet stream on three occasions during a selected day. The samples, weighing 30 to 80 lb each, were sealed, identified, and collected on the following day. Thus, the pellets collected were no more than one day old, and were to be representative of pellets purchased directly by livestock producers. They were transported to a university labo-

[1]Department of Grain Science and Industry.

ratory, where portions for moisture content and equilibrium moisture content were removed immediately, sealed, and stored at 40°F for later analysis. Moisture content (MC) was determined by a two-step air-oven method, and bulk density (BD) was determined with a 1-cubic-meter container.

To determine the relationship between the air temperature and moisture content and the tendency of the WM to gain or lose moisture (equilibrium moisture content), small quantities of pellets were weighed precisely and placed in sealed chambers over saturated salt solutions that produce known relative humidities. The sealed chambers then were placed in controlled temperature rooms at 75°F or 85°F, where the weight of the pellets was checked periodically until no change was observed over several days. The pellet moisture content at this equilibrium condition then was determined.

Results and Discussion

Forty-one samples of 1/4 in. and 3/4 in. pelleted WM were collected from Kansas mills. The average BD of the two types of pellets was not noticeably different and ranged from 37.7 to 42.2 lb/ft^3, with an average of 39.9 ± 0.9 lb/ft^3 (Table 1). Most pelleted WM, regardless of the sampling time, weighed 38 to 41 lb/ft^3, which is equivalent to approximately 50 lb/bu. In contrast, the ground middlings from which the pellets were manufactured weighed only about 20 lb/ft^3.

The overall average MC of the pellets was 14.0±0.5 %, and individual samples ranged from 12.8 % to 14.9 %. The MCs of the 3/4 in. pellets showed the greatest variability between sampling times. However, they contained about the same average MC as the smaller pellets. All pellets, regardless of size, were about 1% wetter than the ground middlings from which they were manufactured. As the ambient air warmed during the spring, the pellets arrived drier, with the average MC in May being 0.4 percent lower than the overall average. This trend continued into the summer. In August, we received pelleted WM for a separate study that contained only 13.3 % MC. Thus, WM pellets purchased from Kansas mills in June, July, or August likely will contain 13.0 to 13.5 % MC.

WM pellets swell and soften significantly when they gain moisture, losing their ability to flow. Storage practices must ensure that moisture is not transferred from the air to the pellets. Pelleted WM at 13.5% MC are in equilibrium with air containing 68% relative humidity (RH) at 75°F and with air contain- ing 69% RH at 85°F. (Figure 1). This indicates that in air at the temperature range encountered during summer storage (60°F - 95°F), pellets will absorb moisture if RH is greater than 65%. Studies currently underway will allow the development of specific recommendations for aeration management to minimize mold growth and maintain maximum pellet flowability.

Table 1. Moisture Content (MC) and Bulk Density (BD) of Pelleted Middlings Collected from Four Kansas Flour Mills in 1997

Mill Number	Physical Parameter	Sampling Date			
		March 25	April 2	April 29	May 7
1	Avg. MC.	13.9	14.4	14.1	13.9
	Avg. BD.	40.1	40.0	38.6	40.2
2	Avg. MC	14.6	14.1		12.8
	Avg. BD	40.6	41.0		
3	Avg. MC	14.4	14.8		14.2
	Avg. BD	41.2	40.6		40.6
4	Avg. MC	13.9	14.2	13.5	13.6
	Avg. BD	38.5	39.1	39.0	39.0
Overall Average	MC	14.2 ± 0.31	14.4 ± 0.27	13.8 ± 0.30	13.6 ± 0.52
	BD	40.1 ± 1.0	40.2 ± 0.7	38.8 ± 0.2	39.9 ± 0.7

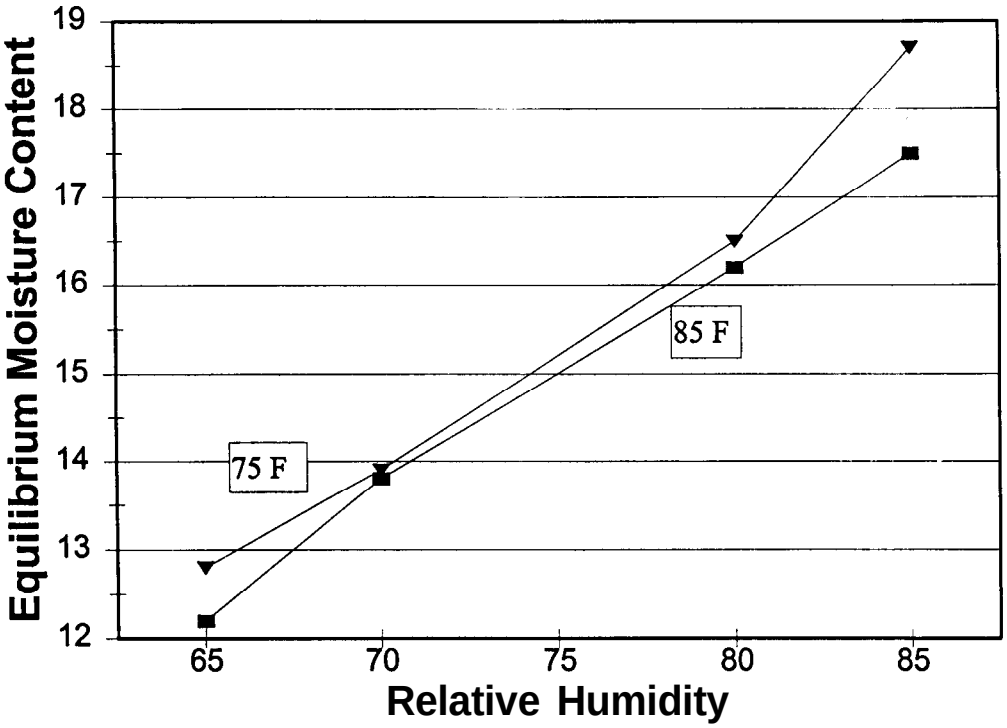

Figure 1. Observed Equilibrium Moisture Content of Pelleted Wheat Middlings at 75°F and 85°F.