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**Nutrient Composition of Spoiled and Non-Spoiled Wet Byproducts Mixed and Stored With Straw**

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**Summary**

Wet corn byproducts were mixed with straw and stored in 55 gallon barrels for 56 days to simulate bunker storage. The spoilage process caused a decrease in fat content and an increase in pH, NDF, ash, and CP. Covering with plastic or distillers solubles reduced the amount of spoilage and the change in nutrient composition.

**Introduction**

Mixing wet distillers grains plus solubles (WDGS) or distillers solubles (DS) with straw allows storage in bunkers (2008 Nebraska Beef Cattle Report, pp. 23-25; 2010 Nebraska Beef Cattle Report, pp. 21-25). When the surface of WDGS is exposed to air it will spoil. As previous research shows, spoilage process will result in loss of DM at the surface of the bunker (2010 Nebraska Beef Cattle Report, pp. 21-25). To minimize the amount of spoilage to surfaces exposed to oxygen, several cover treatments may be applied.

Along with a loss of DM, nutrient composition of stored mixes may change during spoilage. In most cases, producers feed the spoiled material along with the unspoiled. The purpose of this experiment was to determine the nutritional composition of the spoiled feed fractions and how different covers affect these nutritional changes.

**Procedure**

**Storage**

To simulate bunker storage, 55 gallon barrels were packed with one of two mixes: 70% WDGS and 30% straw mixture or 60% DS and 40% straw (both on a DM basis). Barrels were filled to approximately the same weight (300 lb) and packed to similar heights. All barrels (except DS: straw open-outside) were stored inside the Animal Science building at the University of Nebraska–Lincoln in a temperature-controlled room. Table 1 describes the barrel covers that were assigned randomly to barrels with two replications per treatment.

**Opening Barrels**

After 56 days of storage, each barrel was opened by carefully removing the solubles layer (if applied), the spoiled portion, and then the nonspoiled portion. When salt was used as a cover,

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Table 1. Cover treatments.

<table>
<thead>
<tr>
<th>Cover Treatment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WDGS: Straw</td>
<td>Barrels left uncovered.</td>
</tr>
<tr>
<td>Open</td>
<td>Uncovered with water added at a rate of 0.6 in weekly to mimic average Nebraska precipitation.</td>
</tr>
<tr>
<td>Open + H₂O</td>
<td>Six mil plastic covering the surface of the mixture, weighed down with sand, and the edges sealed with tape. This treatment would be comparable to plastic and tires in a bunker setting.</td>
</tr>
<tr>
<td>Plastic</td>
<td>Salt was sprinkled over the surface of the mixture at a rate of 1 lb/ft².</td>
</tr>
<tr>
<td>Salt</td>
<td>DS were poured over the surface of the mixture to make a 3-inch layer (45 lb as-is).</td>
</tr>
<tr>
<td>Distillers solubles (DS)</td>
<td>DS and salt added at rates previously discussed and mixed together before application.</td>
</tr>
<tr>
<td>DS + Salt</td>
<td>DS and salt added at rates previously discussed and water added at 0.6 inch weekly.</td>
</tr>
<tr>
<td>DS + Salt + H₂O</td>
<td>Barrels left uncovered and stored inside.</td>
</tr>
<tr>
<td>DS: Straw</td>
<td>Barrels left uncovered and stored outside at the University of Nebraska Feedlot near Mead, Neb., and exposed to any rainfall.</td>
</tr>
</tbody>
</table>

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Figure 1. Picture of a portion of the spoiled material removed from an open barrel. Layers of moisture loss, mold, and decomposition can be seen.
Wiley Mill (1 mm screen) and ana-
freeze-dried and ground through a
obtain DM. Additional samples were
ed on a DM basis. Fiber (NDF), ash, and CP, and report-
lyzed for pH, fat, neutral detergent
140°F forced air oven for 48 hours to
for analysis. Subsamples were dried in
itive samples were collected and used
each layer was removed, representa-
spoilage occurred from the top down
research, it was assumed that all of the
spoilage layer for pH, fat, NDF, ash, and CP. The most impor-
table to consider is the loss of
spoilage. This is closely associated
contact and were found to be the
best covers, resulting in the smallest
amount of spoilage (Tables 2 and
The results for ash content of the
mixtures showed the largest increase with
salt covering, but again
The CP content generally
increased with each cover. This is due to the microbes utilizing the fat and
soluble carbohydrates, thus increasing the
ash and CP contents.

From previous research focusing on
shelfage and DM loss, covers
like plastic and DS minimized the
air contact and were found to be the
best covers, resulting in the greatest amount of
spoilage. This is closely associated
with the difference in nutritional
composition. The plastic and DS
covers allowed for the least amount
of air to reach the surface of the mix,
and resulted in the least amount of
spoilage.

In conclusion, the loss of fat and
increase in ash and NDF reduce
available energy in spoiled feed. The
spoiled feed is not as nutrient dense as
nonspoiled material.

| Table 2.  WDGS: Straw nutrient composition and losses. |
|------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|            | Open | H₂O | Plastic | Salt | DS ¹ | DS + Salt | DS + Salt + H₂O |
| DM %¹¹ | SP ² | 44.0 | 25.3 | 39.0 | 43.6 | 37.4 | 39.3 | 32.3 |
|          | N³  | 36.3 | 33.7 | 41.2 | 39.4 | 39.3 | 38.0 | 34.2 |
| pH        | SP  | 8.1  | 7.6  | 7.2  | 8.5  | 6.5  | 5.4  | 6.0  |
|          | N   | 4.1  | 4.5  | 3.9  | 4.0  | 3.9  | 4.1  | 4.0  |
| Fat %     | SP  | 4.9  | 6.0  | 7.2  | 4.1  | 10.0 | 7.4  | 9.5  |
|          | N   | 10.6 | 10.5 | 10.1 | 10.2 | 10.1 | 10.5 | 9.4  |
| NDF %     | SP  | 52.9 | 55.3 | 49.3 | 50.5 | 38.1 | 35.2 | 41.7 |
|          | N   | 42.2 | 43.0 | 45.4 | 48.3 | 44.3 | 40.9 | 43.7 |
| Ash, %    | SP  | 12.0 | 14.2 | 12.0 | 19.1 | 13.9 | 20.0 | 17.7 |
|          | N   | 8.1  | 8.7  | 8.2  | 8.3  | 8.8  | 11.0 | 11.4 |
| CP, %     | SP  | 28.7 | 25.9 | 29.3 | 24.0 | 29.9 | 25.6 | 26.1 |
|          | N   | 27.6 | 27.9 | 27.5 | 25.5 | 23.7 | 25.5 | 24.7 |
| DM loss, %|     | 3.4  | 3.4  | 0    | .82  | 0.07 | 0    | 0    |
| Spoilage, %|   | 3.9  | 3.9  | 0.61 | 3.8  | 2.0  | 2.1  | 1.5  |

¹¹140°F forced air oven DM%
²Spoiled material
³Nonspoiled material
⁴Distillers solubles

It was collected and analyzed as part of the spoiled layer. As in previous
research, it was assumed that all of the spoilage occurred from the top down
as it was exposed to the air. The spoil-
age was determined by appearance and texture as seen in Figure 1. As each
layer was removed, representa-
tive samples were collected and used
for analysis. Subsamples were dried in
140°F forced air oven for 48 hours to
obtain DM. Additional samples were
freeze-dried and ground through a
Wiley Mill (1 mm screen) and anal-
alyzed for pH, fat, neutral detergent
fiber (NDF), ash, and CP, and report-
ed on a DM basis.

The nonspoiled material was assumed to be unchanged and, therefore,
equivalent to the starting mix. Data were analyzed using the mixed
procedures of SAS using barrel as the
experimental unit.

Results

Interactions (P < 0.01) resulted between the cover treatment and
spoilage layer for pH, fat, NDF, ash, and CP with the WDGS: Straw mix-
ture and CP for the DS: Straw mixture (Tables 2 and 3). Overall, there was a
decrease in fat and increases in pH, NDF, ash, and CP. The most important
of these to consider is the loss of
fat content. The greatest loss of fat
resulted when salt was used as a cover or when barrels were left uncovered.
Fat decreased from 10.2 to 4.1% DM
and 10.6 to 4.9% DM, respectively.

The microbes that are causing the
spoilage process. Therefore, the used fat is lost for the
animals’ use when it is time to feed.

Using DS as a cover resulted in no
change in fat content for the spoiled
fraction. The other treatments were
intermediate in terms of fat loss in the
spoilage material. The CP content generally
increased with the salt covering, but again
the salt was included in the spoiled
material. The CP content generally
increased with each cover. This is due to the microbes utilizing the fat and
soluble carbohydrates, thus increasing the
ash and CP contents.

From previous research focusing on
shelfage and DM loss, covers
like plastic and DS minimized the
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best covers, resulting in the smallest
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3). The mixes left uncovered (open)
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