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NEWS RELEASE FROM IANR NEWS SERVICE, UNIVERSITY OF NEBRASKA
-- Mixing Dry Materials with Wet Ethanol Byproducts Increases Storage Life

June 27, 2006

(Editor's note: A photograph to accompany this story can be downloaded from IANR News Photos at:
http://ianrnewsphotos.unl.edu/main.php?g2_view=core.ShowItem&g2_itemId=1250. If you have questions about this photo, contact IANR News Photographer Brett Hampton at (402) 472-5839 or e-mail bhampton1@unl.edu.)

Mixing Dry Materials with Wet Ethanol Byproducts Increases Storage Life

LINCOLN, Neb. -- Wet byproducts from ethanol production are tricky to store for later use as cattle feed because of their high moisture content and threat of spoilage, but mixing them with drier, bulkier feeds improves storability, according to University of Nebraska-Lincoln research.

UNL animal scientists have just completed research that devised formulas for mixing several widely available dry forages with wet distillers grains. Their findings could help feedlot managers and cow-calf producers purchase wet distillers grains during the summer when their plentiful supply can mean lower prices and safely store them for use later in the season, or for winter feeding.

The relatively short shelf life of wet distillers grains has been a key obstacle to their use as feed in some situations, said Galen Erickson, a UNL beef nutritionist. Feedlots need to have the material delivered frequently and use it within a few days to avoid spoilage; for smaller operations, that's not economically feasible. Cow-calf operators, meantime, have greatest use for the feed during the winter, but that's when supplies tend to be lower than during the summer.

At 65 percent moisture content, wet distillers grains alone cannot be stored in silage bags or bunkers like corn silage or bulkier feeds. Compressing them in bags to push out air and prevent spoilage splits the bags, and they're too wet to be compacted by tractors in bunkers.

UNL animal scientists experimented with mixing grass hay, alfalfa hay and wheat straw with the wet distillers grains to determine how much dry material would be needed for successful storage. For bagging, they compressed them at standard pressure, 300 pounds per square inch.

"Other fiber sources would presumably work, but we chose these three because of their availability this time of year," said Erickson, who worked with Terry Klopfenstein, a UNL beef nutrition researcher on the project.

When bagging silage, the Institute of Agriculture and Natural Resources researcher said, the research established the following minimal levels of dry material: 15 percent for grass hay; 22.5 percent, alfalfa hay; and 12.5 percent, wheat straw. Erickson noted that those percentages are on a dry basis, which is different than the amounts actually weighed out when mixing.

Researchers also experimented with mixing dry distillers grains and wet corn gluten feed, another ethanol byproduct, with the wet distillers grains. A 50-50 blend of dry and wet distillers grain bagged up well, while a 60-40 mixture of wet corn gluten and wet distillers grains seemed to work.

Erickson noted that two ethanol plants in Nebraska -- in Central City and Plainview -- produce modified wet distillers grains, which has a moisture content of 50 to 55 percent. That material is dry enough to bag without mixing in other materials.

For bunker storage, Erickson said, a mix of 40 percent grass hay and 60 percent wet distillers grains was firm enough to allow enough packing. With wheat straw, he recommends 25 to 32 percent of the dry material. There may be a 2-3 inch layer of spoilage at the top of the pile, but what's underneath seems to be fine.

More information on the use of ethanol byproducts for feed is available in "Utilization of Corn Co-products in the Beef Industry," a joint publication of the university's Institute of Agriculture and Natural Resources and the Nebraska Corn Board. It's on the Web at UNL's beef cattle production site, http://beef.unl.edu. Click on the By-product Feeds link on the left side.

UNL's byproduct feeds research is conducted in cooperation with the university's Agricultural Research Division with funding from the Nebraska Corn board and ethanol/corn processors Cargill, Abengoa Bioenergy and Dakota Gold. The current storage trials were conducted with Chief Ethanol, Hastings; ADM Milling, Columbus; and Platte Valley Fuel Ethanol, Central City. For more information, contact Erickson at gerickson4@unl.edu, or (402) 472-6402, or consult your local UNL Extension educator.

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RESEARCH PROJECT RESULTS

Date: June 28, 2006

Study Title: **Evaluation of storage methods for wet distillers grains plus solubles with added forages and byproducts in silo bags and bunker silos.**

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Rationale

Wet distillers grains plus solubles is an excellent feed for feedlot cattle and as a supplement for cows or calves on forage. However, usage must occur as delivered with semi-load quantities used on a weekly basis. As a result, smaller operations are limited on using wet distillers grains plus solubles. Similarly, most cow-calf operations that would like to purchase and store feeds cannot utilize wet distillers grains because feeding rates are too low to avoid spoilage and there is disconnect between needs (winter) versus greatest supply (summer).

Research has shown that wet distillers grains will not spoil over time if oxygen is removed. The issue is that wet distillers grains are wet and cannot be stored in a bunker silo or be packed. Similarly, WDGS does not store well in silo bags because pressure cannot be applied. As a result, WDGS does not store well or requires burdensome areas for storage.

Based on some small-scale mixing and evaluation of WDGS amended with dry forages, dry byproducts, or dry grain, it has been determined that adding small amounts of dry, bulky feedstuffs to WDGS may solve these challenges with storage in silo bags and/or bunkers. However, we need to evaluate this on a larger scale so that it is applicable to commercial situations. This project is very timely, as we would like to have answers for producers prior to May when supply of WDGS may be larger than supply of feedlot cattle that can use large enough quantities of WDGS. By doing this research project, we will be able to give producers guidelines about how to store wet distillers grains over a period of time. We will be able to help producers determine which feed stuffs to use and

at what inclusion levels to ensure WDGS can be stored and used by these operations at a later date or by smaller operations.

The objective of this research project was to evaluate three common forage sources available in the summer which include: alfalfa hay, grass hay, and wheat straw, as well as DDGS and corn gluten feed. Within each source, the appropriate inclusion of amendment was determined that will allow for packing in a silo bag without breaking bags. Bunker storage was also evaluated (which presumably requires more forage addition) that would allow for packing equipment to appropriately compact the bunker silo.

Description of Research Project:

Successful outcome will be adequate storage (no spoilage) and packing density in either silo bags or bunker storage. Bunker storage will be evaluated based on packing pressure allowed with equipment packing WDGS without loss or equipment sinking into pile. The only risk is that spoilage will occur and render the bags or bunkers unfit for feeding. Pictures and visual observation will be the key determinant. When bagging these different mixes, the bagger was held at a constant pressure of 300 PSI.

During the experiment, different adjustments were made based on how the different products were bagging. Grass hay was the first forage that was tested. It was tested at the 12.5 %, 10%, and 7.5% of the mix on a dry matter basis. Next, alfalfa hay was mixed in at 20%, 17.5%, and 15% of the mix on a dry matter basis. During the night time, our bag split open at the 7.5% and 10% grass hay levels. The next day, wheat straw was mixed at 12.5% and 15% on a dry matter basis. After the straw, dry distillers grains were mixed in at 50% and 60% on a dry matter basis. The last product that was tested was wet corn gluten feed. It was mixed in at 40%, 50%, and 60% of the mix on a dry matter basis. After this was all done, there was still wet distillers grain left over, therefore two more levels of grass hay and alfalfa hay were bagged. Grass hay was bagged at 15% and 17.5% while alfalfa was then bagged at 22.5% and 25% all on a dry matter basis. During the next night, the bag split open again at the 40% and 50% wet corn gluten feed.

Based on how the different products bagged, a small bunker experiment was conducted using wheat straw. This product required the least amount for bagging, therefore should require the least amount for bunker silo storage of wet distiller's grains. With the small amount of distillers that was left, a mix of 25% wheat straw on a dry matter basis was used. It then was packed into a bunker with a skid loader because of the small amount. Based on the visual appraisal, more than 25% will be required.

Four loads were brought in at a separate time and mixed with either 30 or 40% (DM basis) of grass hay used in the bagging project. A skid loader with rubber tracks was used for packing as well as a payloader.

Results

Grass Hay
We concluded that the minimum level of grass hay in a mixture with WDGS for bagging would be 15% on a dry matter basis. At this level, the bag was 4 feet and 7 inches high and 14 feet wide. It did not seem to put much pressure on the sides of the bag.

Alfalfa Hay
Alfalfa hay is recommended at 22.5% (DM basis) when mixing it with wet distillers grains to be stored in a silo bag. At this level, the bag was 4 feet and 5 inches tall and 13 feet wide. At this level, the dry matter of the product is 41.26%.

Wheat Straw
Wheat straw required the least amount of forage on a dry matter basis compared to the other two forages used in this experiment. The recommended level for bagging is 12.5% on a dry matter basis. At this level, the bag was 4 feet and 11 inches high by 13 feet and 8 inches wide. The dry matter of this mixed product was 36.87%.

Dry Distillers Grains
The mixture of dry distillers grains and wet distillers grains appeared to do a very nice job of bagging during this experiment. The recommended level of bagging dry distiller grains is 50% on a dry matter basis. This had a mixture dry matter of 49.35%. When bagged, it was 4 feet and 11 inches high. It was 13 feet and 6 inches wide. This bagged just a littler better than the wheat straw did.

Wet Corn Gluten Feed
Because the bag split open for this product, a recommend level would be 60% wet corn gluten feed on a dry matter basis. For this to work, the pressure on the bagger would have to be decreased from what was used during this experiment. What that pressure should be set at is not known as of now. This is something that could be further studied in the future.

Bunker
From this experiment, 25% wheat straw was mixed with WDGS. Because the scale was too small, it is unclear what the optimum wheat straw level is, but appeared to be greater than 25%.

With the larger-scale experiment with two loads of WDGS with grass hay, 30% grass hay (DM basis) worked okay and required less bulk or storage space. However, 40% worked even better and would pack better with larger, heavier equipment. In our experiment, a skid-loader with tracks was used and probably resulted in a lower level of grass hay than in a commercial setting.

SUMMARY
This first experiment for determining what levels of different forages and byproducts can be mixed with wet distiller's grains to be able store in silo bags and bunkers has been

successful and provided the necessary information. It has helped determine what the minimal levels are for each of the 5 products used in the bagging experiment. It has also provided a starting point for finding a minimal level needed to be able to pack WDGS into a bunker by mixing it with a forage. Table 1 provides the different measurements that were taken during this experiment. For bagging, 12.5% wheat straw, 15% grass hay, 22.5% alfalfa hay, or 50% DDGS all worked well with 300 psi pressure on the bagger.

For bunker storage methods, 30% grass hay worked, but we would recommend 40% grass hay (DM basis). At this point, our conclusion is that wheat straw would be optimum between 25 and 32% based on how the bagging results.

Pictures are provided that help show how the different levels of the different products bagged and how bunker storage looked with grass hay.

IMPACT: If adequate storage methods can be elucidated, then more product can be moved in the summer, allows for more product to be stored and used by cow-calf operations and forage situations in the winter, and allows for use by smaller feedlots where limits exist on using up semi-load quantities in the summer months.

Table 1. This table shows the different measurements that were taken after the bagging experiment was done. The bold numbers are the recommended levels. We can provide "as-is" mixes as well as the product DM we used here for producers.

PRODUCT	**% OF PRODUCT**	**% DM for the**	**HEIGHT**	**WIDTH**	**OTHER COMMENTS**
	on a dry matter basis	**Mixed Ration**	feet. inches	feet. Inches	
Grass Hay	17.5	38.15	4.8	13.9	
	15	37.5	4.7	14	
	12.5	36.87	4.4	14	
	10	36.26	-	-	Bag split open
	7.5	35.66	-	-	on the side
Alfalfa Hay	25	40.26	4.8	13.6	
	22.5	41.26	4.5	13	
	20	38.83	4.2	14.9	
	17.5	38.15	4	15.8	
	15	37.5	3.11	16	
Wheat Straw	15	37.5	5.1	13	
	12.5	36.87	4.11	13.8	
DDGS	**50**	49.35	4.1	13.6	
	60	54.26	5.2	12.5	
ADM CGF	**60**	39.37	-	-	
	50	38.36	-	-	Bag split open
	40	37.4	-	-	on the side

Appendix: Select pictures of bag, treatments, process, splits, and bunker tests.

Figure 1. Bag of traditional WDGS at 65% moisture with different added forages. The numbers depict amount of forage added on a DM basis. As is observed, the bag did split when too low of levels were tested.

Figure 2. Bagging process whereby WDGS and forages were mixed in feed trucks with mixing capability, and then fed into the bagger.

Figure 3. Depiction of bag with different levels of forages and DDGS at 50 and 60% of the mixture. The bag was quite different in height and width depending on ability of forage or dry feed to pack easily with WDGS.

Figure 4. This picture illustrates the problem with bagging traditional WDGS alone with pressure. The bag has split due to too much pressure. Success is easily measured by maintaining bag integrity. However, when split, spoilage is inevitable and needs to be rebagged.

Figure 5. Picture illustrates the different height and width of silo bags depending on forage or dry feed added. We evaluated the lower limits required and did break the bag with too little forage was added.

Figure 6. Modified wet distillers grains at 45% DM (55% moisture) will bag with normal pressure as the picture illustrates.

Figure 7. After testing different levels of grass hay, alfalfa hay, and wheat straw, one bag was packed with 15% grass hay to ensure that bagging would work when just one forage was used at the recommended level. The bag did hold with 15% grass hay in this picture.

Figure 8. Bunker storage was evaluated using grass hay. More hay is required to be able to pack and store this mixture in a bunker. In this picture, 40% grass hay (DM basis) was tested and worked well.

Figure 9. Grass hay at 30% of DM and WDGS at 70% of DM. This mixture packed fairly well, but was more challenging to drive on.

Figure 10. A side-by-side comparison of 40% grass hay and WDGS (left) and 30% grass hay and WDGS (right). Bunker sizes are not identical, but more bulk is produced with the 40% grass hay mixture as expected.