BIOSYSTEMS & AGRICULTURAL ENGINEERING
UNIVERSITY OF MINNESOTA

Minnesota/Wisconsin
Engineering Notes

BIOLOGICAL SYSTEMS ENGINEERING
University of Wisconsin - Madison
College of Agricultural and Life Sciences

P103-2004-09

Costs for Overdrying Crops

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The purpose of this brief article is to describe overdrying and to illustrate the cost of overdrying. More information about managing dryers and storage, and about reconditioning overdry soybeans can be found on the University of Minnesota Biosystems and Agricultural Engineering extension postharvest website at www.bae.umn.edu/extens/postharvest.

What is "overdrying"?

Intentional or accidental drying of crops to a lower moisture content than is necessary for safe storage, for marketing purposes, or for the intended use of the crop is considered to be overdrying. For example, shelled corn buyers usually ask for corn at 15% moisture. With proper aeration to cool corn in storage, corn can be safely stored at 15% moisture through the winter months. This means that drying corn that will be sold by spring to a moisture content lower than 15% would be considered overdrying. Oilseeds generally need to be a little drier than corn to reduce chances of mold growth in storage. Grain and oilseed crops that will be stored for longer periods of time and/or during warmer weather also need to be a little drier than 15% moisture. Recommended storage moistures for different crops and different storage periods are listed in Table 1.

Why is overdrying considered to be a problem?

Because most crops are sold based on total weight of the crop (dry matter weight plus weight of water in the crop), selling a crop at a lower moisture content than is specified by the buyer means that less weight is available for sale. Sellers get paid for a smaller quantity of crop than they would have been paid for if the crop had been at a higher moisture content. In addition, for crops that are artificially dried, there is a cost (energy, labor, equipment costs, etc.) for removing each percentage point of moisture, and removing extra percentage points means extra drying cost. Also, seeds of overdried crops tend to be more brittle and more likely to crack or break during handling.

Why are crops sometimes overdried?

Crops that are harvested during warm, dry weather sometimes dry to a low moisture content in the field before they can be harvested. For example, Kansas winter wheat and southern Minnesota soybeans are often harvested at moisture values that are lower than the normal market moisture. Preharvest moisture content can drop rapidly during dry, windy weather and crop conditions should be checked frequently as the moisture content approaches the target level. Preharvest moisture of some crops fluctuates with weather conditions, so in some cases, it might make sense to harvest during more humid conditions (mornings, evenings, or possibly even after dark) to obtain a moisture content that is closer to the desired level.

Sometimes crops are accidentally overdried during artificial drying. For dryers that are operated manually, take frequent moisture measurements before, during, and after drying to make sure that final moisture content is close to the target level.

Base frequency of moisture measurements on the capacity of the dryer (take more frequent samples for dryers that remove moisture rapidly) and based on the amount of moisture that needs to be removed (take more frequent samples if the crop is already fairly dry and isn't expected to be in the dryer very long). For dryers that have automatic controls, take occasional moisture measurements on wet and dry grain to make sure that controls are operating as intended. Don't forget that hot, freshly dried grain must be cooled and that grain will lose additional moisture during the cooling process. (See "Dryeration and In-Storage Cooling" at www.bae.umn.edu/extens/postharvest for more information.)

Finally, managers sometimes intentionally dry crops to less than the values listed in Table 1 to reduce the risk of spoilage in storage. It is true that the risk of mold growth in storage is reduced when grain moisture is low, but the costs associated with overdrying are usually greater than any savings brought about by overdrying. With proper storage management, which includes aeration to cool stored crops, crops can generally be stored at the levels in Table 1 without spoilage. (See "Management of Stored Grain with Aeration" at www.bae.umn.edu/extens/postharvest for more information.)

What are the costs for overdrying?

If you lack more accurate information, you can estimate gas-use for a corn dryer that uses LPG (liquefied petroleum gas, which is mostly propane) to heat the drying air as:

0.02 gallons LPG per bushel per percentage point of moisture removed

For example, if 1000 bu corn at 15% moisture is overdried three percentage points (to 12% instead of 15% moisture) and LPG costs $1.00 per gallon, the cost of gas for overdrying can be estimated as follows:

Cost per bu = 0.02 gal/bu per point x 3 points x $1.00/gal
= $0.06/bu

Cost per 1000 bu = $0.06/bu x 1000 bu = $60.00

Don't forget that gas is only part of the cost for drying corn. The total amount for the other costs of owning and operating a grain dryer can sometimes be at least as much as the cost for energy. Other costs include things like equipment costs for dryers, holding bins, conveyors, and controls (depreciation, taxes, insurance, maintenance, and repairs) and labor to operate drying systems.

To estimate the weight loss due to overdrying, apply a water shrink factor to determine the number of bushels of crop at the overdried moisture content compared to the normal market moisture. Water shrink factors for any crop are calculated as follows:

Water shrink factor, weight percent per percentage point of moisture
= 100 / (100 – final moisture content)

For example, if a seller would have been paid $2.35 per bu for 1000 bu of corn at 15% moisture, the number of bushels at 12% moisture and the loss in revenue can be calculated as follows:

Water shrink factor = 100 / (100 – 12) = 1.136% per point
Total water shrink =
3 percentage points x 1.136%/point = 3.409%
Bushels at 12% moisture = 1
000 bu x [(100 – 3.409) / 100] = 966 bu
Loss in revenue =
(1000 bu – 966 bu) x $2.35/bu = $79.90
= about $80

For this example, the cost for overdrying 1000 bu of corn from 15% to 12% moisture would be at least

$140 (about $60 for extra LPG plus about $80 due to reduced weight) or about $0.14/bu. (Extra drying costs for depreciation, taxes, insurance, maintenance, repairs, and labor would need to be added to these values.)

Can anything be done to increase the moisture content of overdried crops?

The best strategy is to try to prevent overdrying from occurring. If you find yourself in possession of overdried crops, keep in mind that it is illegal to add liquid water to increase the moisture content of a crop for marketing purposes. Crop moisture increases that are a result of other normal crop management operations are acceptable, however. For example, aeration during humid weather can potentially increase the moisture content of stored crops, but the process is very slow; the process is difficult to manage; it is possible to overshoot the target moisture and end up with wet spoiled grain; and for some crops, rewetting causes seed swelling that could lead to problems with grain flowability, or in extreme cases, seed swelling could lead to bin damage. (See *Reconditioning Overdry Soybeans* at www.bae.umn.edu/extens/postharvest for more information.)

About the Author
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Minnesota/Wisconsin Engineering Notes is a joint effort of the Department of Biological Systems Engineering at the University of Wisconsin/Madison and the Department of Biosystems and Agricultural Engineering at the University of Minnesota.

Table 1. Suggested crop storage moisture in the Midwestern U.S. (% wet basis).
Moisture values are for good quality crops that are aerated to control temperature. Reduce moisture content by about one percentage point for crops that have low quality at time of storage.

	Storage Period (months)		
Crop	**Up to 6**	**6 to 12**	**More than 12**
Barley, durum, oats, wheat	14	13	13
Buckwheat	16	13	13
Canola	10	8	8
Corn, sorghum	15	14	13
Edible beans	16	14	13
Flaxseed	9	7	7
Soybeans	13	12	11
Sunflowers (confectionery)	10	9	9
Sunflowers (oil type)	10	8	8