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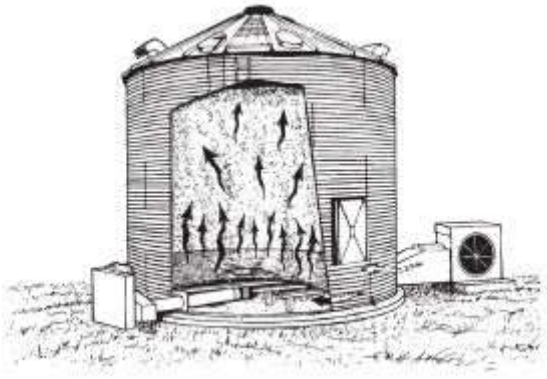
Grain Drying Energy Efficiency Checklist and Tips

Grain Drying is part of a series of Efficiency Checklists and Topics that can help you to assess all areas of your farming operation for energy efficiency and find ideas to save energy and reduce costs. For links to other articles in the Efficiency Checklists and Topics series, see Additional Resources at the end of this article.



Grain Drying Energy

A grain drying system may be the most energy-intensive operation in your cropping system. For some crops, more energy is used to dry the crop than for producing. Any improvements that reduce energy needs make a major difference in total farm fuel needs. Reducing overdrying, recovering heat, or using natural air for drying will reduce energy costs. There is something that can be done to cut back on energy costs for every type of dryer.

Questions to ask

- Do you use field drying as much as possible?
- Is your moisture tester accurate?
- Are dryer burners adjusted for maximum efficiency?
- Do you avoid over-drying?
- Do you clean the grain before drying?
- Is a natural air/low temperature drying system appropriate for you?
- Do you level the grain in a bin drying system?

- Is the transition from the fan to the bin large enough to allow unrestricted airflow from the fan to the bin?

- Would a combination high temperature/natural air system or dryeration be appropriate for your operation?

- Are you using maximum drying temperatures that will not damage the grain?

Facts and Actions: Grain Drying

- Planting earlier maturing varieties and drying corn in the field is generally more energy efficient and economical until mid-October, but by mid-to-late October, mechanical drying is recommended. When deciding to field dry or to use mechanical drying, consider the potential for grain damage while the grain is in the field and harvest efficiency benefits gained by mechanically drying the grain.

- Don't remove moisture to levels below those required for storage or marketing, which reduces the quantity available to sell and increases drying costs. Ensure your moisture meter is accurate by comparing its reading to one at an elevator or to a reference. Apply a temperature adjustment to the meter reading if it is not done automatically. Some moisture testers are not accurate when the grain is measured at elevated temperatures so make sure you know what the requirements are for your tester to get an accurate result.

- Remove broken kernels and weed seeds because they reduce dryer airflow, and it costs money to dry the material. If you can't sell it or use it, then there is no reason to dry it or store it. Many storage problems can be linked to fines in the storage bin.

- Natural air/low temperature drying (up to 10°F above ambient air temperature) is a slow drying system but very efficient, if designed and operated correctly. Keep the depth of wheat less than 18 feet and corn less than 22 feet to limit the resistance to airflow, enabling efficient airflow delivery. Select the fan type that provides the most airflow per horsepower at the expected operating static pressure. The maximum moisture level that can be safely dried in this type dryer is about 24 percent depending on time of year. The air flow required will vary with location but range from 1 to 1.5 cfm per bushel.

- Level the grain to create the same pressure drop across the bin and result in more uniform drying, which is more energy efficient and economical.

- Transitions from the fan to the bin should have a cross-sectional area larger than the fan to keep the frictional losses low.

- The most energy-efficient high-temperature drying uses the maximum drying temperature that will not damage grain. The higher the drying temperature, the more energy efficient it is. For continuous flow dryers the temperature can be in the 180 to 220 degree F. range, while a batch-type dryer will typically use a temperature of about 140 degrees F. Use vacuum cooling or a heat recovery system to increase the energy efficiency of a continuous cross-flow heat and cool dryer by about 20%.

- Use dryeration to reduce the energy requirement of high temperature drying by about 25%. Corn at about 130 degrees F. coming from the dryer is steeped in a bin without airflow for 4 to 12 hours. Two to 2.5 percentage points of moisture are removed during cooling in the bin. Then the corn is moved to a storage bin. Do not leave the corn in a bin used for steeping because condensation will occur inside the bin on the walls, and if the corn is not removed spoilage will occur.

- Consider combination drying, which uses about half the energy of a high-temperature cross-flow dryer. Combination drying uses a high temperature dryer to reduce the corn to 20% moisture and then the grain is transferred hot to a low temperature/natural air dryer to finish drying. The fans must be turned on as soon as filling starts to prevent condensation on the bin walls.

- Consider replacing your current dryer. Continuous-flow in-bin dryers and mixed flow dryers may be about 10 to 20% more efficient than a typical high-temperature cross-flow dryer.

Additional Resources

- Available from Midwest Plan Service Publications. Low cost agricultural publications available through Iowa State University:
    - Managing Dry Grain in Storage, AED20, 2004

    - Dry Grain Aeration Systems Design Handbook, MWPS-29, 1999
    - Grain Drying, Handling and Storage Handbook, MWPS-13, 1987

- Dryeration and combination drying for increased capacity and efficiency. Iowa State University.
- Managing High-Temperature Grain Dryers for Energy Efficiency. Iowa State University.
- Reduce Grain Drying Costs. University of Wisconsin.
- Crop Dryeration and In-Storage Cooling AE-808, North Dakota State University Extension, 1983
- Optimizing Grain Dryer Operations. Purdue University.
- Grain Drying Systems. Comprehensive 30 page guide. Purdue University and Michigan State University.
- Introduction to Energy Efficiency and Conservation on the Farm

Efficiency Checklist and Topics:

- Farm Energy Efficiency Checklist and Tips
- Farm Lighting Energy Efficiency Checklist and Tips
- Farm Shop Energy Efficiency Checklist and Tips
- **Grain Drying Energy Efficiency Checklist and Tips**
- Greenhouse Energy Conservation Checklist
- Home Energy Efficiency Checklist and Tips
- Irrigation Energy Efficiency Checklist and Tips
- Livestock Buildings Energy Efficiency Checklist and Tips
- Livestock Watering Systems Energy Efficiency Checklist and Tips
- Tractor and Field Operations Energy Efficiency Checklist and Tips

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