Barley Storage
Best Management Practices

Great Lakes Barley Conference
March 6, 2020

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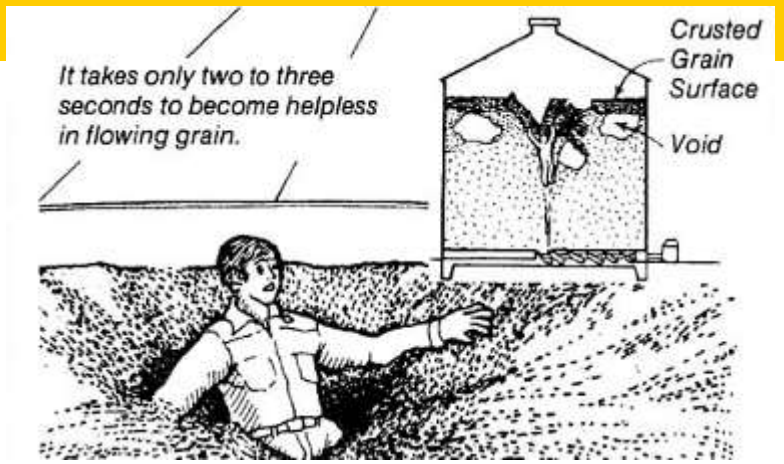
EXTENDING KNOWLEDGE ›› CHANGING LIVES

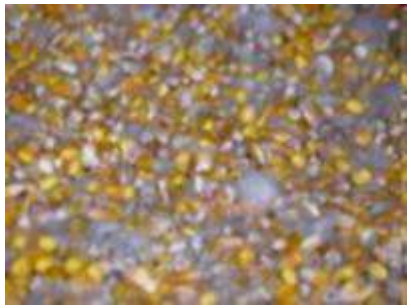
NDSU | EXTENSION

Grain Hazards

Bridging transfers load to the bin wall



CAUGHT IN THE GRAIN!
AE-1102



Moldy Grain Health Hazard

Recommended Long-Term Storage Moisture Content

Mold Growth > 70% RH

Grain	EMC @ 70°F, 60% RH	Moisture
Barley	11.8%	12%
Canola	8.0%	8%
Corn	12.8%	13%
Flaxseed	8.3%	8%
Soybeans	10.2%	11%
Sunflower		
Non-Oil	9.6%	10%
Oil	7.4%	7- 8%
Wheat	13.3%	13.5%

"Approximate" Allowable Storage Time for Cereal Grains (Days)

Cumulative

* Exceeds 300 days

Moisture	----- Grain Temperature (°F) -----					
Content	30°	40°	50°	60°	70°	80°
(%)	Approximate Allowable Storage Time (Days)					
14	*	*	*	*	200	140
15	*	*	*	240	125	70
16	*	*	230	120	70	40
17	*	280	130	75	45	20
18	*	200	90	50	30	15
19	*	140	70	35	20	10
20	*	90	50	25	14	7
22	190	60	30	15	8	3
24	130	40	15	10	6	2
26	90	35	12	8	5	2
28	70	30	10	7	4	2
30	60	25	5	5	3	1

"Estimated" Allowable Storage Time for Malting Barley (Weeks) (Criterion: Germinability)

Temperature		Barley Moisture Content (%w.b.)								
		11%	12%	13%	14%	15%	16%	17%	18%	19%
(°C)	(°F)	Allowable Storage Time (weeks)								
27	80	32	25	16	10	5	3	1.5	1	1
21	70	80	60	38	25	14	7	3.5	2.5	2
16	60	*	*	94	61	37	18	9	6	3.5
10	50	*	*	*	*	90	50	20	14	8

* Allowable storage time exceeds 100 weeks.

Source: Drying Cereal Grains by Brooker, Bakker-Arkema & Hall

Table developed by Kenneth Hellevang, Ph.D., P.E., 07/16/07

Storability

- Cracked, broken, immature grain spoils easier
- Test weight generally is an indicator of storability
- Variety variation

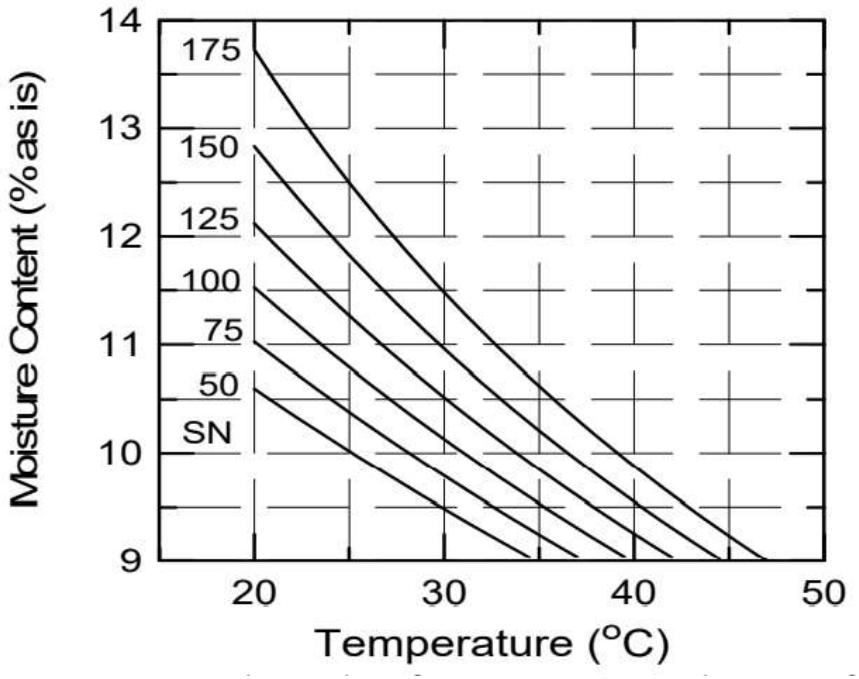


Storability

- Can germination energy (GE) be used to predict storability?
  - High GE desired
- Germination Capacity – dormant is okay for storage.

Mixing Number

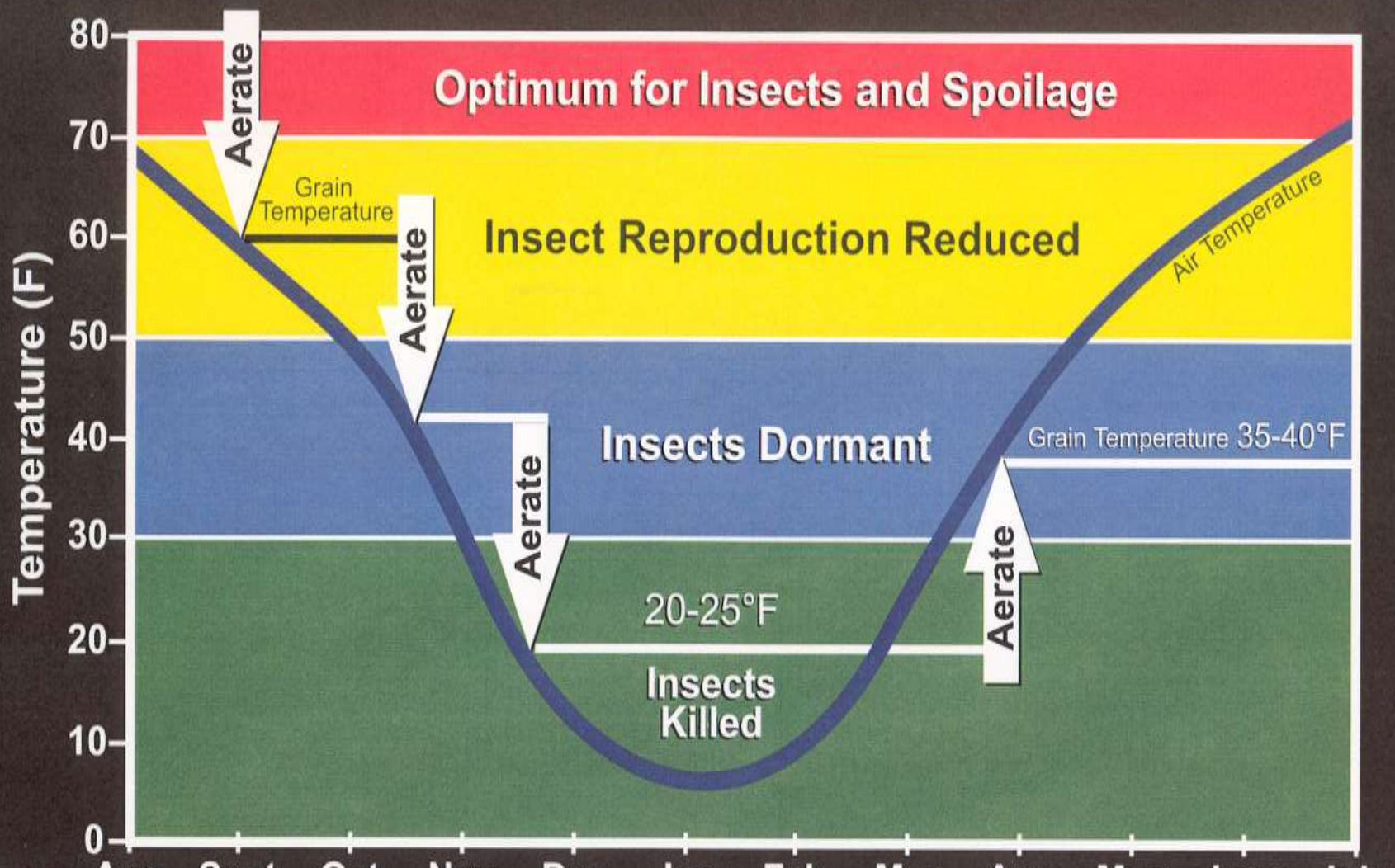
Germination Enzyme impacts Mixing Number & Falling Number



20 C = 68 F

Predicted safe storage conditions for barley variety Grimmett with various levels of soundness as indicated by the Stirring Number (SN). Storage period is 15 months. Safe storage conditions lie to the lower left of the relevant lines. Apply a safety margin (e.g. 0.6% moisture or more) on use.

Cool Grain to Prevent Storage Problems



* Prevent crusting due to moisture migration by cooling grain to within 15°F of average outdoor temperatures.
* Cooling grain by 10°F doubles its allowable storage time

Dr. Kenneth J. Hellevang, PE
NDSU Extension Service

Spring Grain Cooling

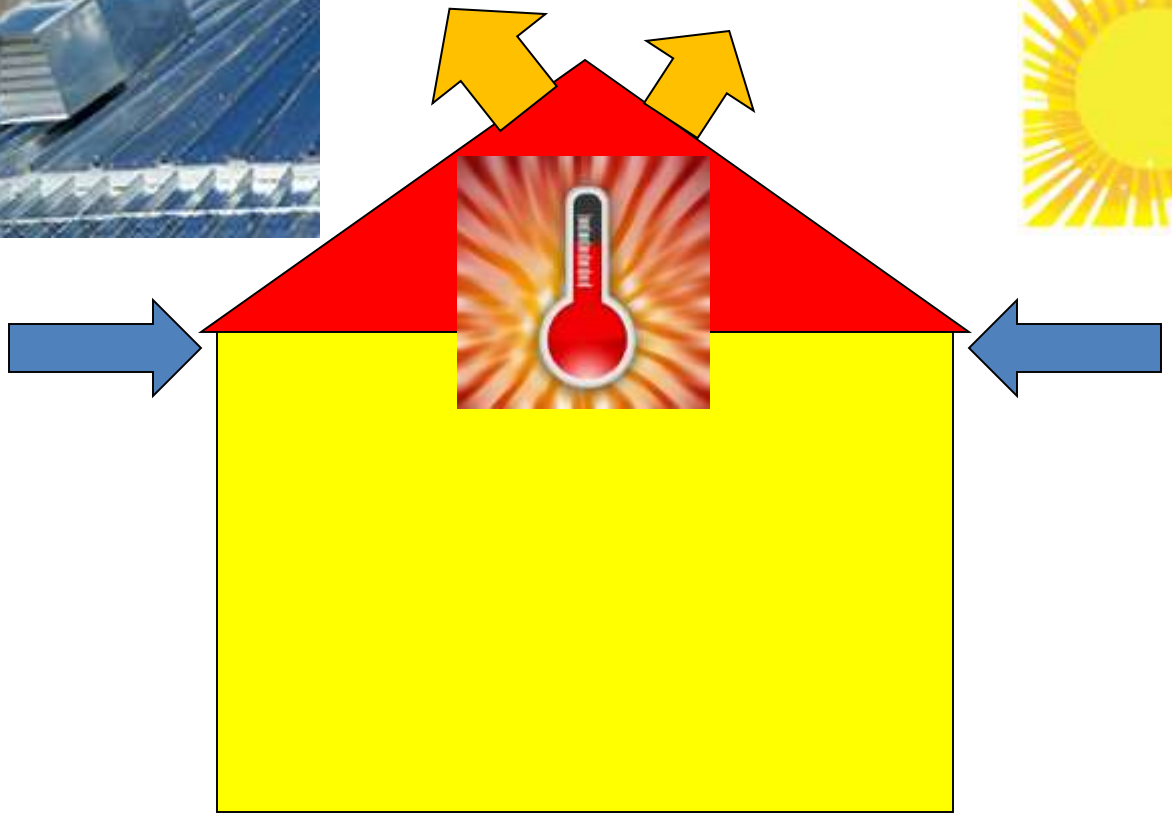
Solar Radiation (Btu/ft^2-day)

	Wall	Roof
Feb. 21	1725	1800
Jun. 21	800	2425

ND	Average Temperature	Minimum Temperature
Mar	25	16
Apr	41	29
May	55	43

Periodically Cool!

Ventilate Bin Headspace



Fans Off During Snow/Rain/Fog

Cover Fans When Not Operating

- Keep snow & pests out
- Prevents spring warm-up
- Keep damp air out

Manage - to direct with a degree of skill

Monitor:

- Temperature
- Moisture
- Insects
- Mold

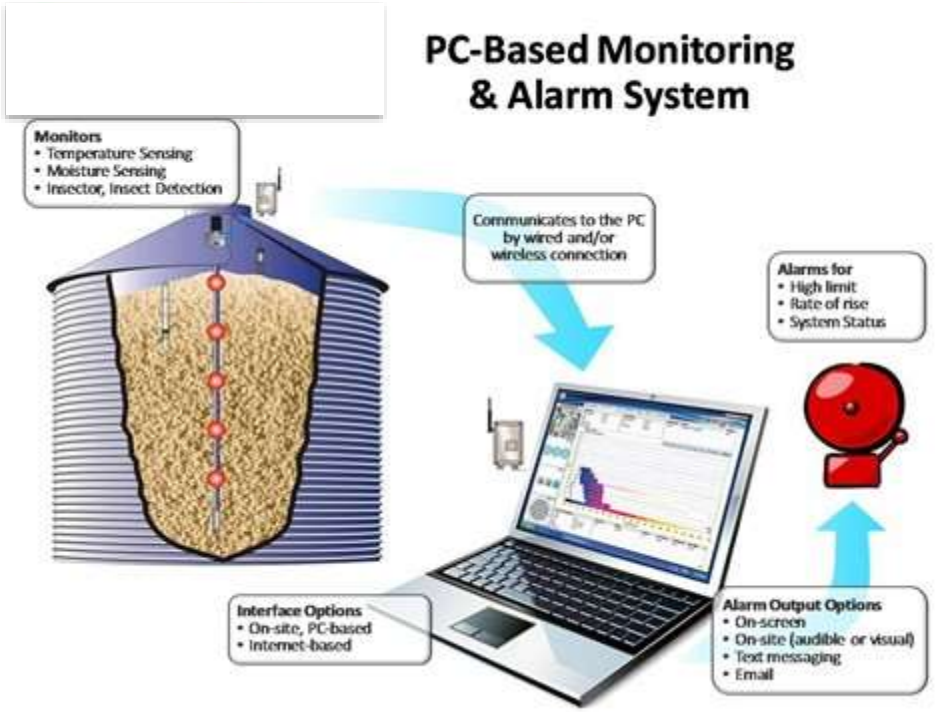
Check Grain

- 2-weeks until cooled
- 2-3 weeks during winter
- 2-weeks spring & summer

Manage: Aerate & Dry

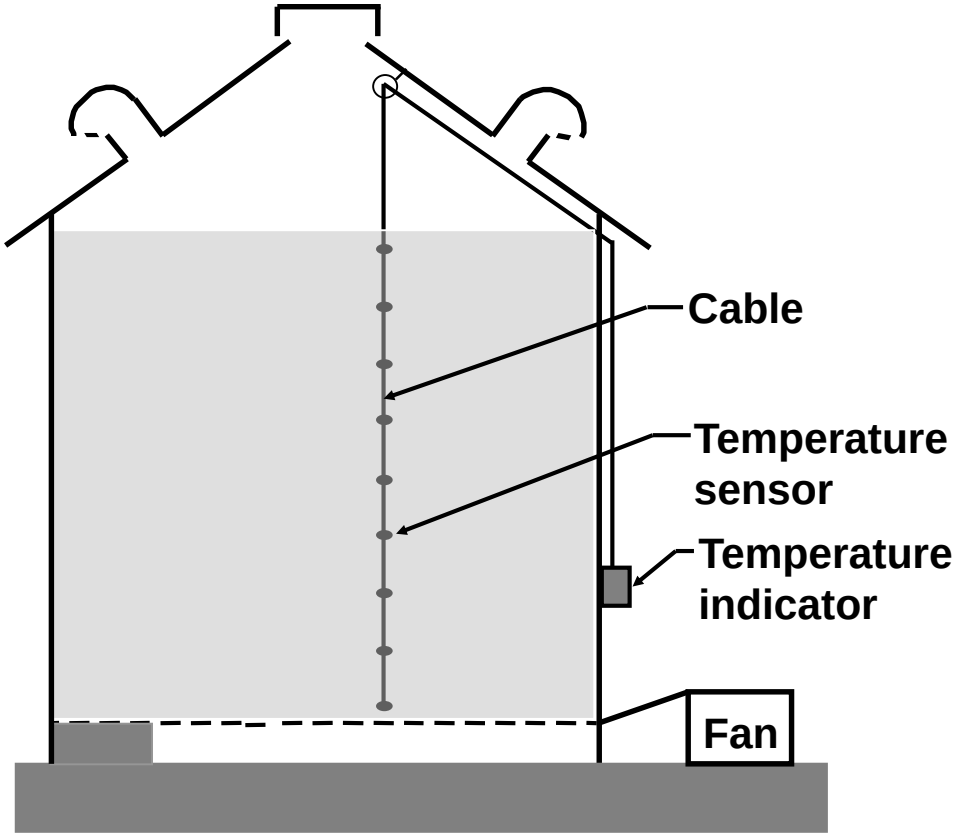
- Temperature
- Moisture
- Insects

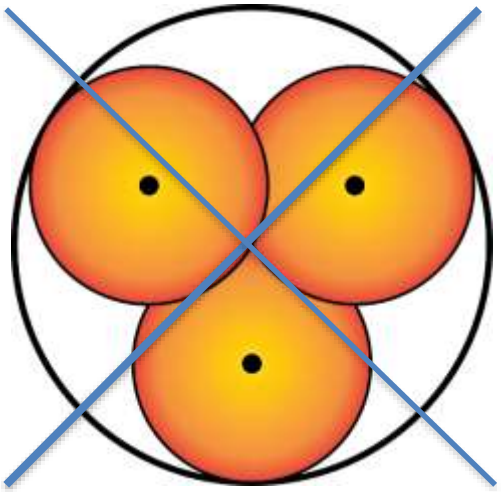
Sensors & Fan Controllers



Technology does not replace Management!

Senses only grain near cable





Carbon Dioxide

For More Information

Internet Search: NDSU Grain Drying and Storage

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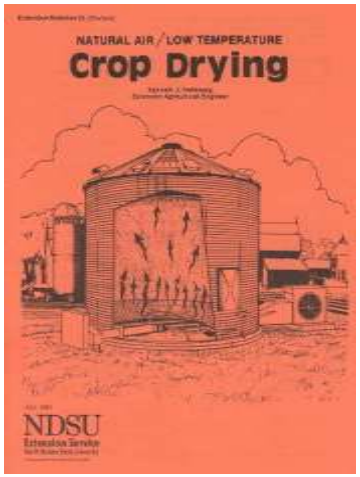
Airflow Rates and Drying Times

natural air drying wheat

air at 69˚ and 60% relative humidity, average North Dakota condition for August.

Moisture Content	Airflow (cfm/bu)	Fan Time	
		Hours	Days
18%	1.25	480	20
	1.00	600	25
17%	1.00	552	23
	0.75	744	31
16%	1.00	504	21
	0.75	672	28
	0.50	1,008	42
15%	1.00	480	20
	0.75	648	27
	0.50	960	40
14%	1.00	408	17
	0.75	544	23
	0.50	816	34



Barley Drying Time: 48/60 ≈ 0.8 wheat

0.8 X 31 = 25 days AST 17% = 25 days

Wheat Drying Time

17% initial M.C., 0.75 cfm/bu, +3° F fan

Month	Temp.	RH	+3° Temp	+3° RH	EMC (Barley)	Days	%↑
Aug.	69	60%	72	54%	12.6% (11.1)	26	
Sep/ May	58 56	65% 60%	61	58%	13.5% (11.6)	31	20%
Oct/ Apr	47 42	65% 65%	50	58%	13.9% (11.8)	39	50%
Nov/ Mar	27 24	73% 73%	30	63%	15.6% (13.0)	75	300%