Managing Dry Grain in Storage

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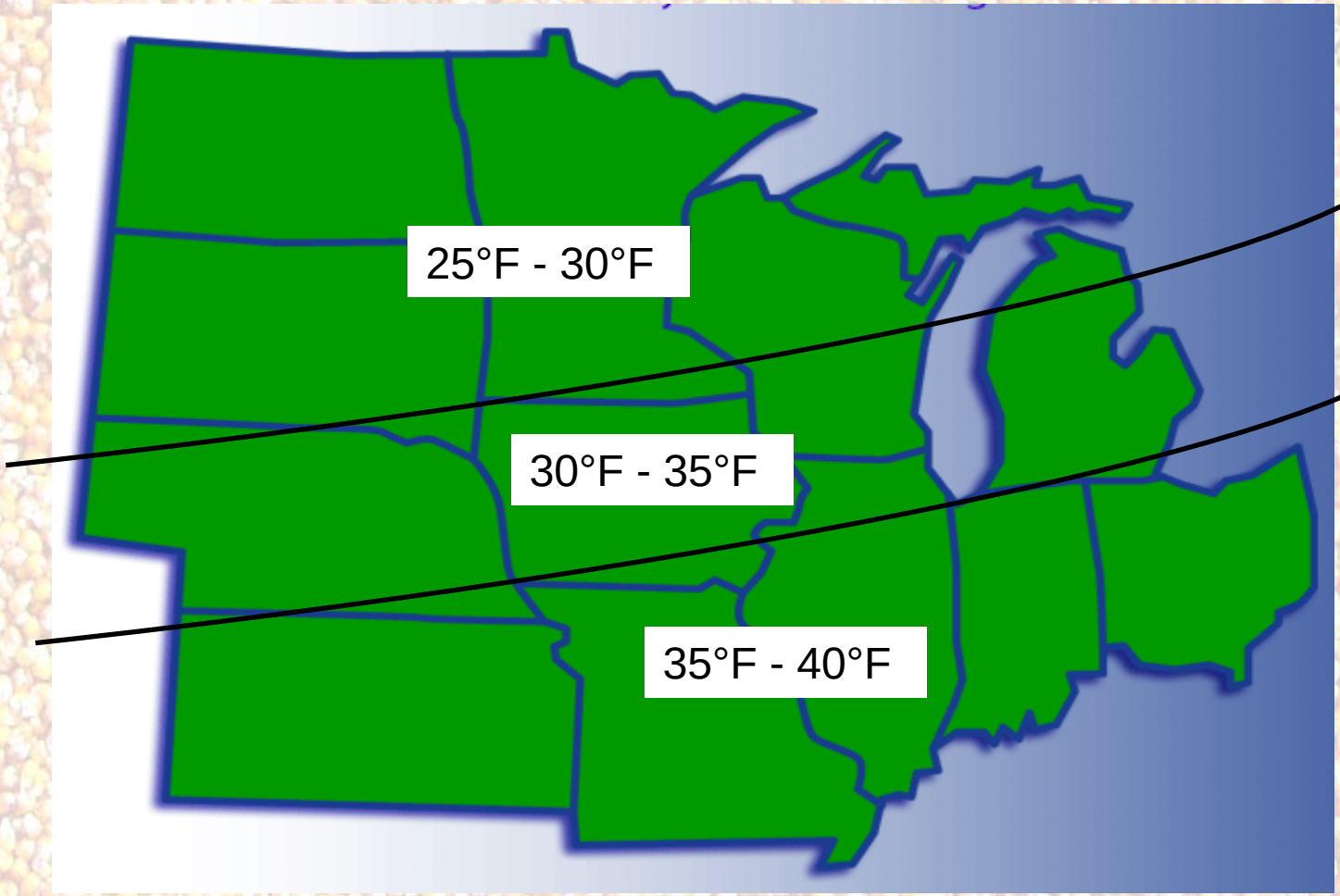
Six causes of storage problems

- Grain too Warm
- Grain too Wet
- Too much foreign matter and fines
- Uneven grain temperatures
- Storage facility not cleaned before harvest
- Grain not checked often enough

Grain too Warm

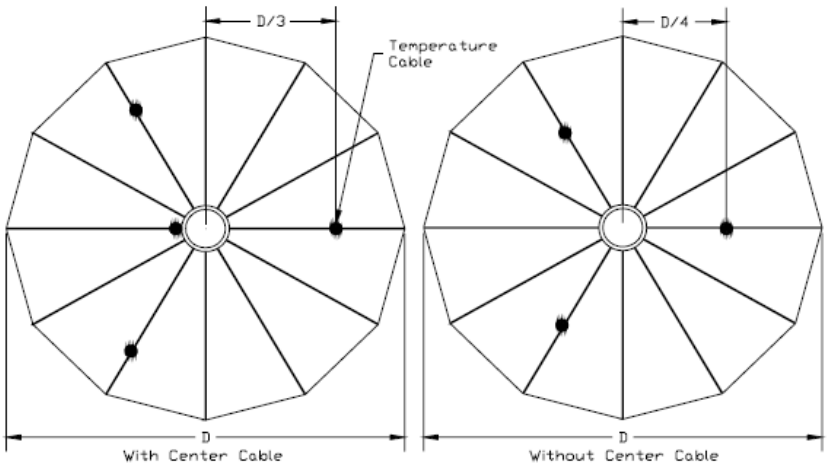
- Grain temperature within 10 – 15F of average daily temperature
- Summer Storage temperature
  - 50°F in upper midwest
  - 60°F in southern US
- Winter storage temperature
  - 30 to 35°F in southern WI
  - 25 to 30°F in northern WI

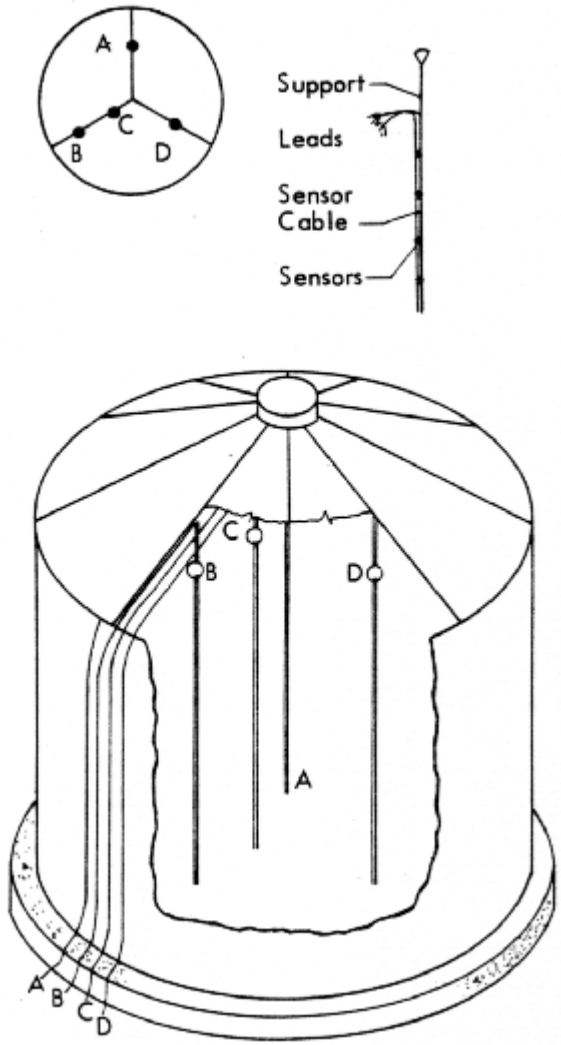
Suggested Winter Grain Storage Temperatures



Temperature Measurement

Temperature Cable locations





- Temperature changes can be small and indicate a problem (1-2°F)
- Log data for reference
- Compare same locations over time to detect problem areas

Temperature monitoring

Normal Temperature Profile**

			Sensor							
Date	**Bin**	**Cable**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
5 Dec	1	1	26	26	27	27	25	27	32	32
11 Dec	1	1	26	25	26	27	27	27	25	26
17 Dec	1	1	27	25	27	28	27	28	34	34
23 Dec	1	1	27	26	27	27	27	29	32	33

** Sensor 7 & 8 not covered with grain

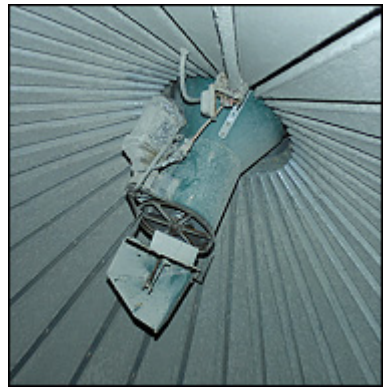
Hot Spot Temperature Profile

			Sensor							
Date	**Bin**	**Cable**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
5 Dec	1	1	29	28	29	30	31	30	31	32
11 Dec	1	1	29	28	29	32	31	31	32	29
17 Dec	1	1	30	29	30	33	32	31	33	32
23 Dec	1	1	31	29	30	35	32	31	33	35

Max. Grain Storage Moisture Percentage

	Storage Period (months)		
Crop	Up to 6 mos	6 to 12 mos	> 12 mos
Cereal Grains	14%	13%	13%
Canola	10	8	8
Corn	15	14	13
Soybeans	13	12	11
Sunflowers (oil type)	10	8	8
Edible Beans	16	14	13
Buckwheat	16	13	13

Clean Grain



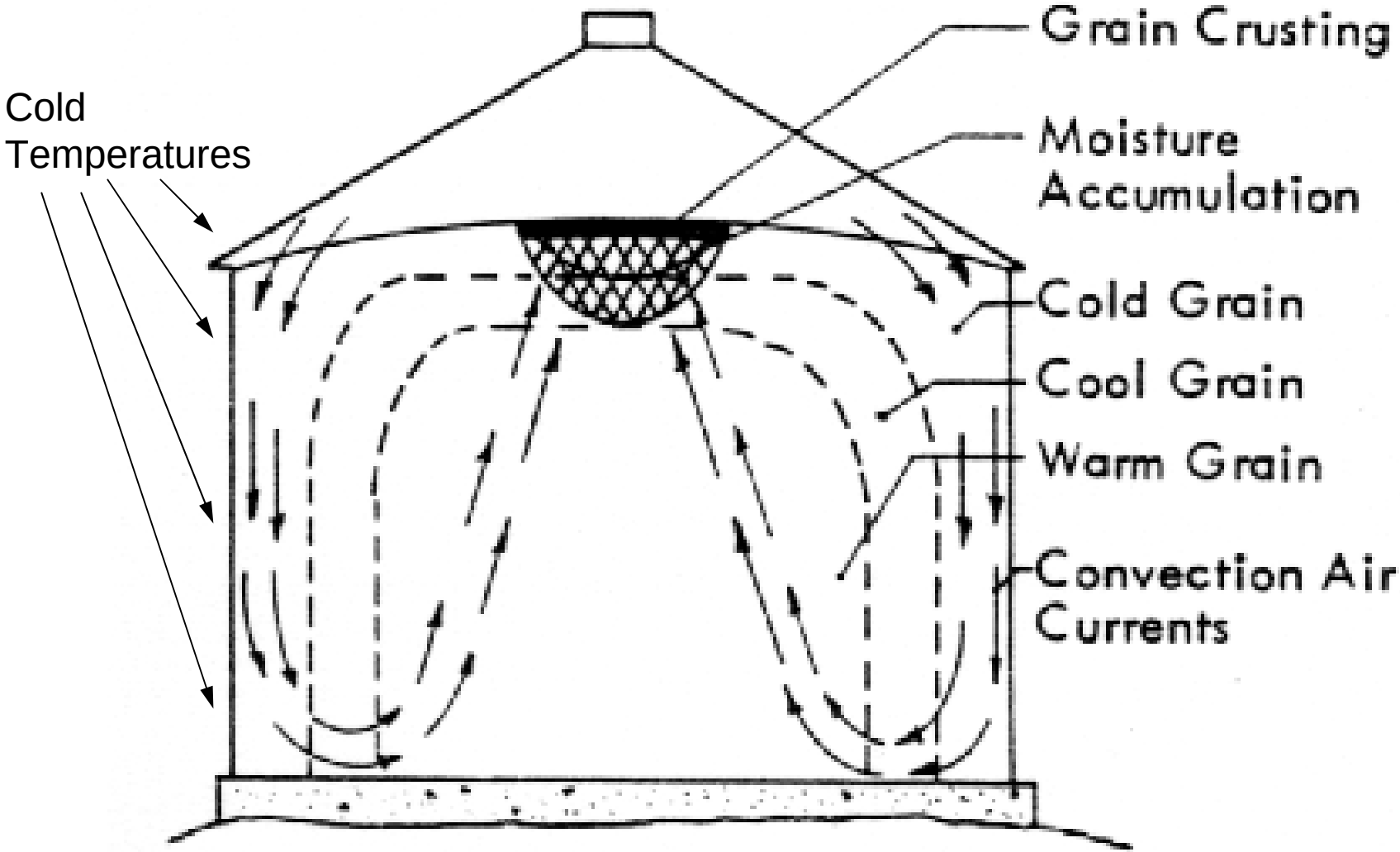
- Screen before drying
- Screen before storage
  - Less volume to dry
  - Increased air flow in dryer
  - Fines plug screens and aeration floors
  - Insect / Mold growth in fines

- Distributor in Bin
  - Evenly distributes seed and fines

Perforated augers

Rotary Drum Screen

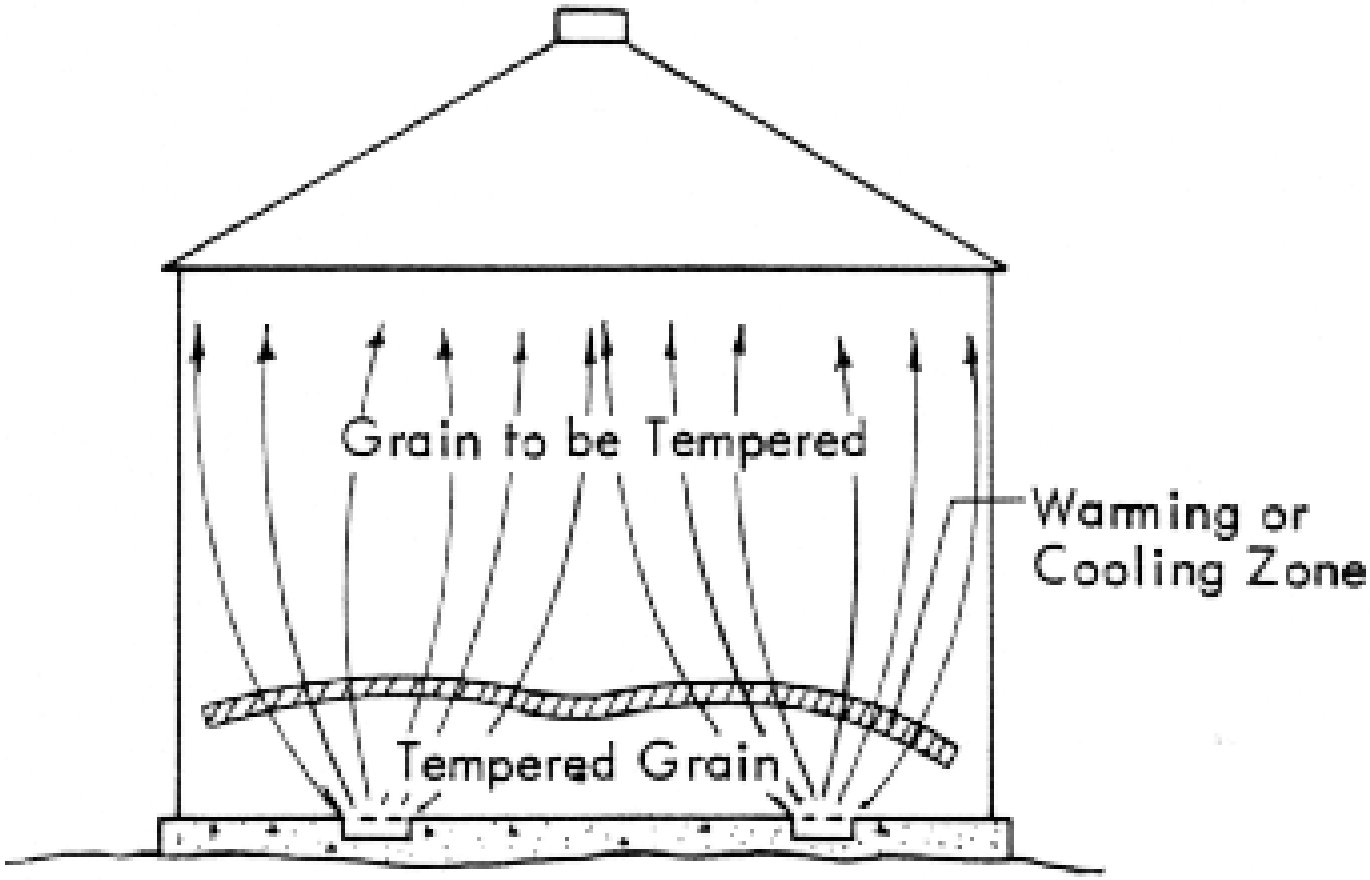
Uneven Grain Temperatures Convection Air Movement



Aeration

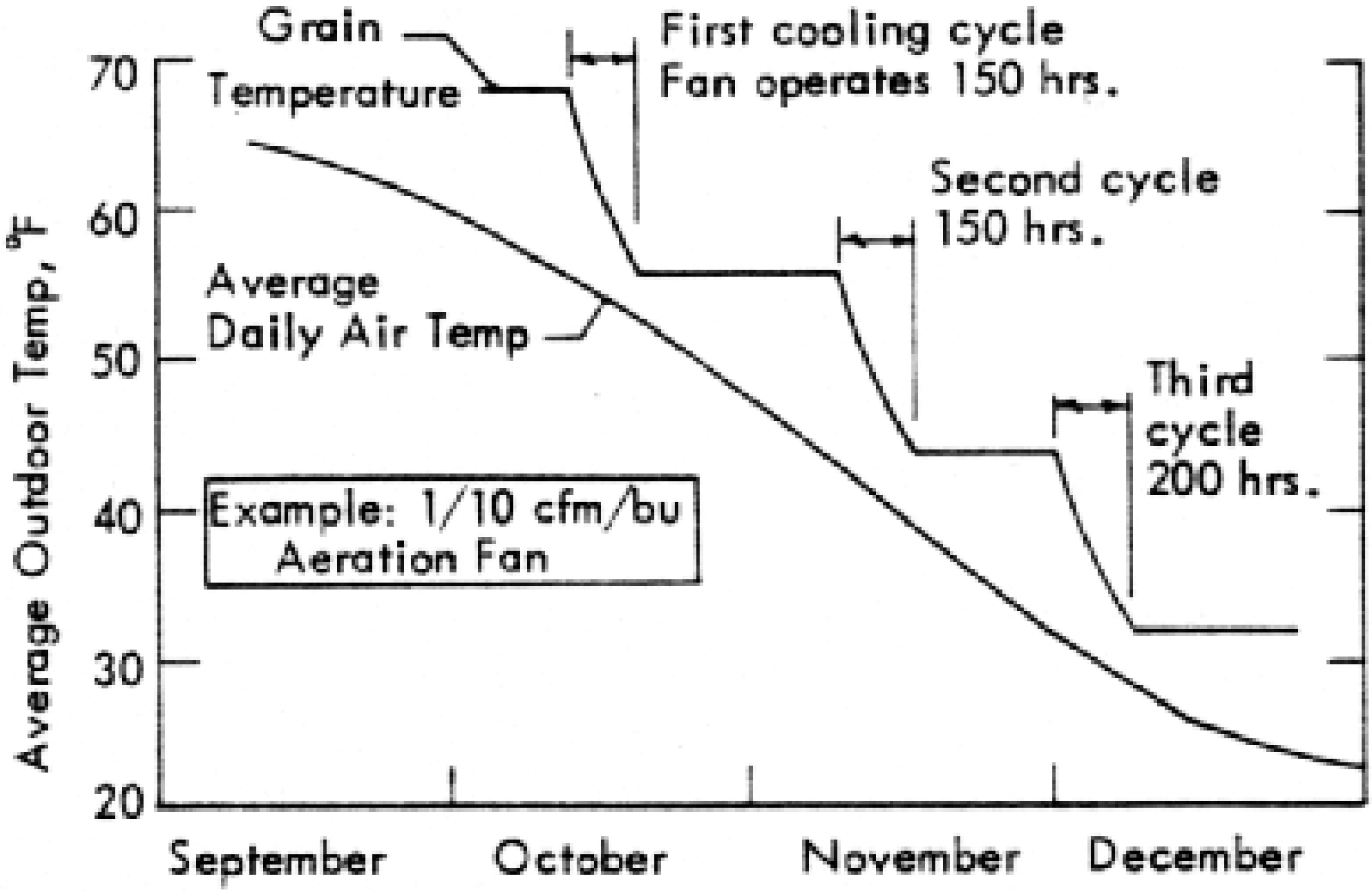
- Level grain surface
  - Distance of airflow path
- Aeration rate
  - Determines time requirement to change temperature
  - 0.01 cfm/bu (minimum)
  - Higher aeration rates – take advantage of short periods of cool temperatures
- Cover fans when not in use
  - Rodent control, reduces convection air flow

Cooling / Warming Zone

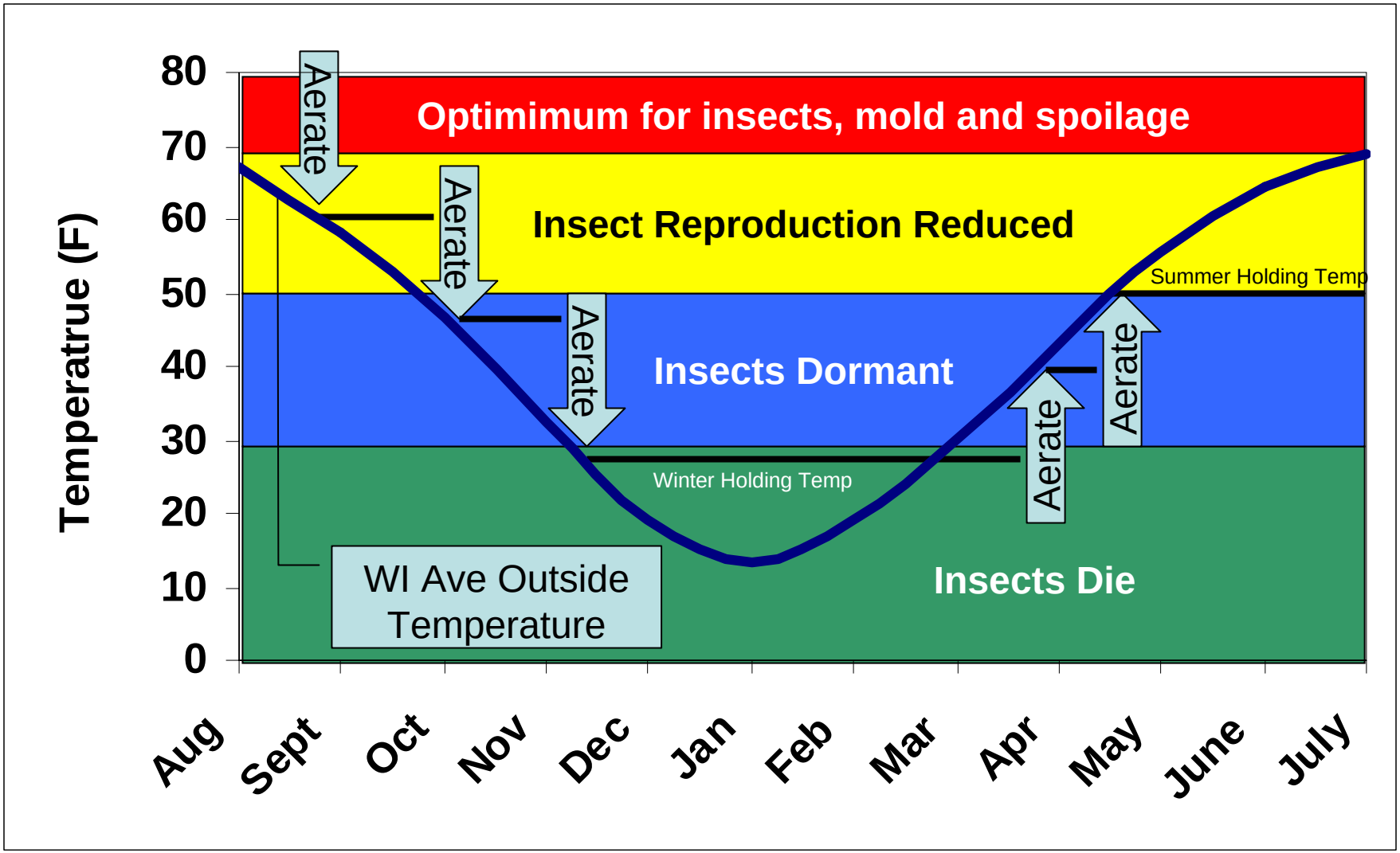


Positive pressure—cooling or warming zone moves up through the grain.

Cooling steps



Cool Grain Prevents Storage Problems



Adapted from K. Hellevang, NDSU

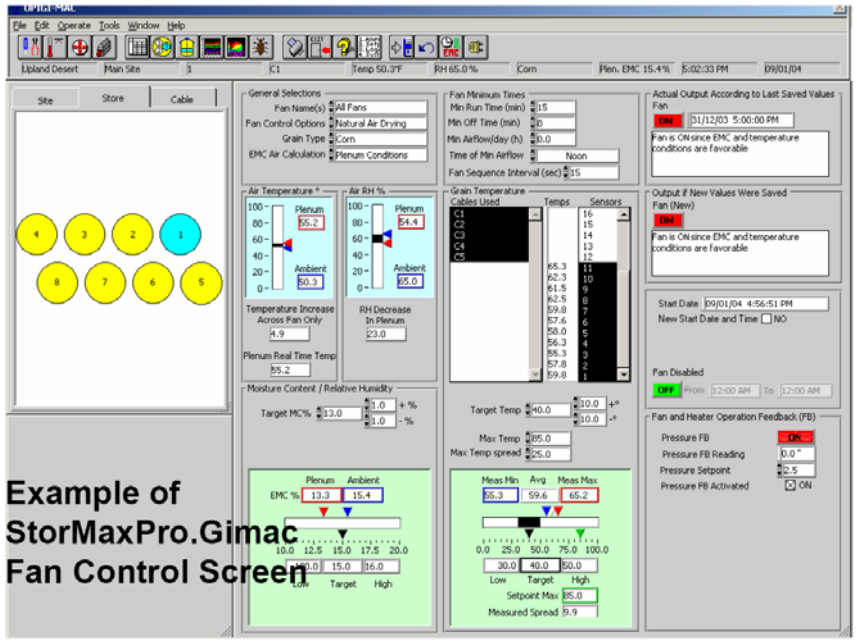
Controlling Insects

- Sanitation before filling bins – Clean out bins
- Temperature control
- Detection
  - Probe Traps – 5 per bin
  - Sticky Traps
  - Pitfall traps

- Insecticides / Fumigants
  - Contact your buyer before applying
  - Phil Pellitteri – Next!!
- Reference
  - www.oznet.ksu.edu/library/entml2/MF726.pdf
  - www.oznet.ksu.edu/library/entml2/MF916.pdf
  - www.oznet.ksu.edu/library/entml2/MF917.pdf

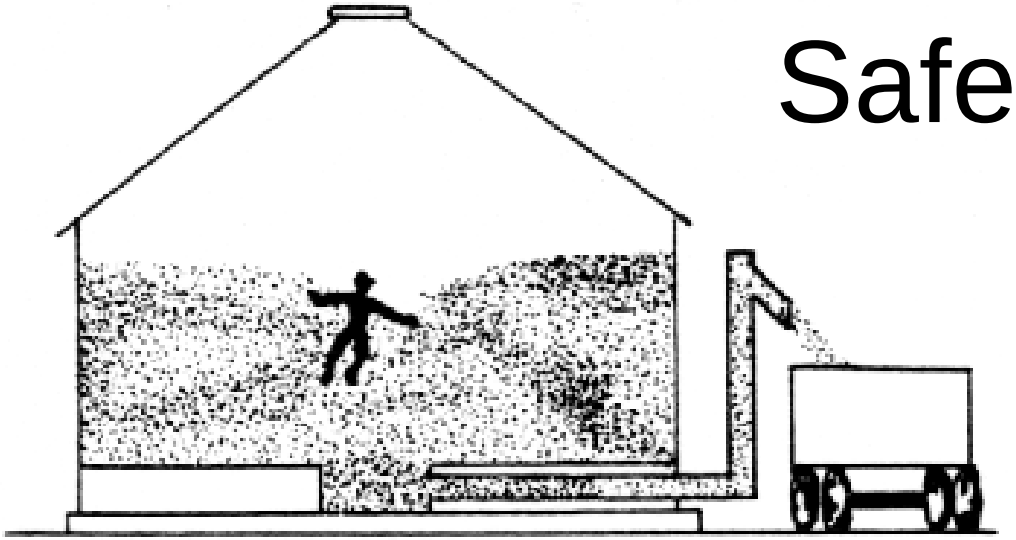
Temperature / Fan Controls

- Thermostats
  - Time clock – run time
- Microprocessor controls
- Computer-based controls
  - Archive data
  - Plot data
  - Accurate temperature settings
  - Monitor temperatures from office
  - Range of features and cost
  - Does NOT eliminate the need to check bins



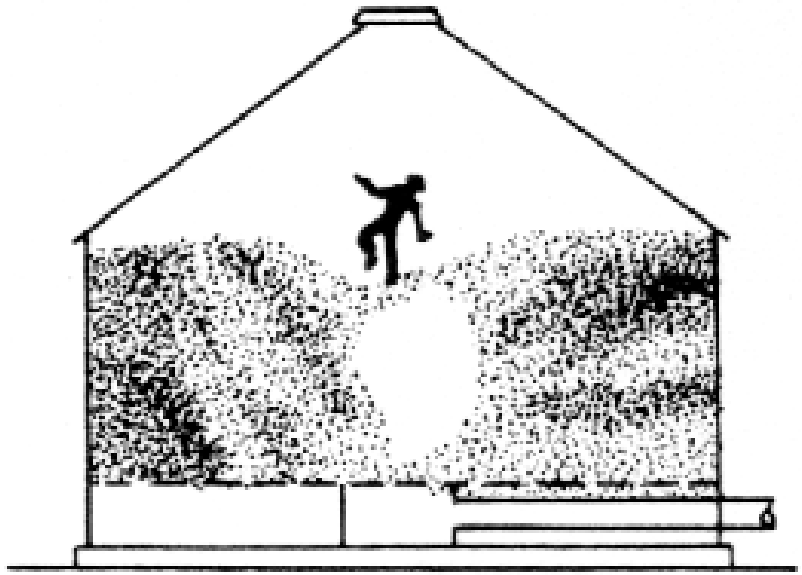
Inspection Monitoring Checklist

- Inspection frequency
  - 1 to 2 weeks during warm weather
  - 3 to 4 weeks during winter
- Turn on aeration fans
  - Ensure proper operation
  - Check static pressure in plenum
- Climb up and look inside bin
  - Condensation under roof, wet grain near hatches
  - Snow cover – run fans until sublimated
  - Check for off-odors
  - Check grain surface – crusting, mold
  - Measure grain temperatures at several locations
- Check for signs of insect, mold, rodent activity
- Record observations in logbook
- Compare observations with previous findings
- Take any corrective action required



Safety First!!!!

- Never enter a bin while unloading equipment is operating
- Lockout controls before entering bins
- Beware of cavities under crusted grain
- Use safety equipment
  - Harness
  - Respirator



Energy Efficiency Grants

Focus on Energy

- Utility must be participating in program
  - All investor owned utilities, Alliant, WPS, WE Energies…
- Free energy audits
- www.focusonenergy.com
- Contact Agricultural consultant
  - 1-800-762-7077

- 2002 Farm Bill Energy Efficiency Grants
  - Application period typically - March to June
  - Minimum grant $2500 – up to 25% of project cost

Other Resources

- Managing Dry Grain in Storage, AED20, Midwest Plan Service, Ames, IA, 2004.
- Dry Grain Aeration Systems Design Handbook, MWPS-29, Midwest Plan Service, Ames, IA, 1999.
- Grain Drying, Handling and Storage Handbook, MWPS-13, Midwest Plan Service, Ames, IA, 1987.
- North Dakota State U. – Post harvest resource links
  - www.ag.ndsu.nodak.edu/abeng/postharvest.htm
- Purdue U. – Grain Extension Publications links (all N.A. universities and gov.)
  - http://pasture.ecn.purdue.edu/~grainlab//exten-pubs.htm
- U. of Minnesota – Post Harvest Crop Handling
  - www.bae.umn.edu/extens/postharvest/

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Wisconsin Energy Efficiency and Renewable Energy

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