FIELD DATA FROM FARM AND ELEVATOR OPERATORS USING DRYERATION DURING 1964 HARVEST

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Data prepared originally in January, 1965, during Farm Science Days for the Agricultural Engineering Day program; Flow diagram prepared in September, 1964, for the Farm Progress Show. The second page is a discussion of field experiences and a perspective of the dryeration process in the future of grain drying.

A Projection of Dryeration From 1964 Field Experiences

During the summer of 1964, a number of farm and elevator operators installed dryeration process equipment in conjunction with their conventional drying system. Several of these operators cooperated with the Agricultural Engineering Department by keeping field data on their daily drying operation during the 1964 harvest and marketing season. This data was needed to document the use of dryeration under field conditions with little supervision from agricultural engineers.

Of the eight farms and two commercial elevator installations which were observed, data was obtained from six farms and both elevators. Valuable experience was also gained from the two farm installations who did not record data. Each of the eight installations recording data were visited by Purdue agricultural engineers from two to four times during harvest to discuss operating experiences.

It can now be specifically stated that the dryeration process on a farm or elevator installation can fulfill the research performance estimates. A well designed dryeration installation will easily give a 60% increase in capacity over conventional drying and cooling. The potential capacity increase is 100% with corn out of the field at 25% or less, and if down time for grain handling is reduced or eliminated. These capacity statements assume a reasonably good, ready-to-go handling system and a normal harvest moisture range.

Fuel savings over conventional high speed drying appear to be considerable - at least 20% at high moisture; more at low moistures. Corn quality is <u>superior</u> to that dryed under the same conditions by conventional methods.

A good handling system is essential. Either hopper bins or sweep unloaders (with a grain shield to increase and stabilize delivery) in flat bottom bins with drying floors have worked well for dryeration bins. Some have let the grain form its own hopper in the cooling bin, not removing all the grain until the end of the season. This works well with solid floor flat bins which have aeration ducts on the floor.

The operation of a dryeration process is not complicated. Some method of fast cooling corn samples for moisture test is superior to attempting measurement on hot samples. Hot samples cool fast, and temperature at the actual time of reading is moisture is unpredictable. A grain pan with screen bottom section over a small blower fan has been used successfully. Can a sample of the grain from the dryer until it reaches room temperature (75 - 80° F.), then test the sample to calibrate your fast-cool-system.

Condensate during cooling of hot grain caused no serious problems, provided grain was transferred to storage. Condensate in gravity spouts, distributor head, leg, and drainage down gravity spouts to other bins needs consideration. An automatic back-draft valve or a by-pass exhause in the hot grain spout may be in order.

In conclusion, the dryeration process has been reserached, and now field demonstrated. The performance has been excellent. It remains for the farmer, the elevator operator, the grain terminal, to put these research facts to work for them. At this point, Indiana power suppliers will be called upon to assist in developing well mechanized dryeration systems.

The implications of dryeration are so specific and significant that no one drying quantities of corn with high speed methods can afford to disregard it. The process should be considered in either up-rating capacity and performance quality of existing dryer installations, or in planning new dryer units.

Agricultural Engineering Department
Purdue University, Lafayette, Indiana
January 21, 1965

DRYERATION FIELD STUDY[1/]

Summary Sheet - 1964

ITEM	FARM OPERATORS 1	2	3	4	5	ELEVATORS 6	7
DRYER SPECIFICATIONS							
1. Type	Batch	Batch	Batch	Batch	Batch	Cont.Flow	Batch
2. Size (Bu.)	350	340	600	350	700	---	1500 Bu.
OPERATING CONDITIONS							
3. Initial Moisture Content, % (Ave.)	23.30	25.20	20.10	17.42	22.52	22.20	19.50
4. Plenum Temperature, °F (Low/High)	190/200	200/220	180/200	210	193	160/170	190/205
5. Heat Time, Hrs./Batch or Day (Ave.)	1.80	2.22	2.10	1.10	2.63	4.5/Day	2.02
6. Total Dryer Operating Time, Hrs./Day	9.13	12.25	7.50	8.15	.7.90	4.5	---
7. Cooling Time, Hrs./Day (Ave.)	15.40	24	9.75	12.35	13.80	13.75	---
RESULTS							
8. Bushels Dried by Dryeration, Reported	28,000	22,350	10,300	35,700	25,900	17,500	24,000
9. Batches/Day, Reported (Ave./Max.)	5/2/7.0	4.25/6.0	1.8/3.0	4.4/6.0	1.9/3.0	---	3.2/4.0
10. Bushels/Day, Reported (Ave./Max.)	1820/2400	1335/2040	1030/1700	1550/2100	1310/2100	5800/6500	4800/6000
11. Hot Corn Temp., Out of Dryer, °F	129	141.5	135.0	123	130	115	119
12. Cooled Corn Temp., into Storage, °F	49.0	49.8	49.3	54.1	50.0	---	48
13. Moisture - Hot Corn Out of Dryer, %	13.04	13.98	15.70	13.48	14.76	15.28	14.81
14. Moisture - Cool Corn into Storage, %	13.00	13.30	12.59	12.16	14.20	13.31	14.46
15. Moisture Reduction during Heating, %	10.26	11.32	4.40	3.94	7.76	6.92	4.69
16. Moisture Reduction during Cooling, %	+.04	+.58	+3.11	+1.32	+.48	+1.97	+.35
17. Total Moisture Reduction, %	10.30	11.90	7.51	5.26	8.24	8.89	5.04

* See Back of sheet for dryeration installation specifications.

[1/] Data presented at Farm Science Days Program on "DRYERATION - QUALITY, High Speed Corn Drying" sponsored by Agricultural Engineering Department, Purdue University, Lafayette, Indiana, January 21, 1965.

GENERAL OPERATOR DATA

1. Bill and Erland Rothenberger, Frankfort, Indiana, Clinton County
   ALDRICH Batch Dryer - 350 Bu. capacity - PTO Powered - 4,200,000 BTU heater - 36 in. dia. fan - BUTLER hopper bottom bulkomatic cooling tank - 12 ft. dia., 2500 bu., 1½ hp. ROLFES fan with 14 in. blade - 3400 RPM. - Dryer and cooling tank unload to 6" return auger to 1200 Bu./hr. MEYER. Max. Drying Increase/Day = 56% - Saved 1 to 1½ hours per batch by separate cooling.

2. Frank Gorski, Monticello, Indiana, White County
   HABCO Recirculating batch dryer - 340 Bu. capacity - PTO powered fan - BEHLEN 22 ft. dia. cooling bin - 5800 bu. capacity - Aeration Floor Channel - Behlen A-18, 1-1/2 HP fan pushes airflow up through grain. 1963 - 4 batches from 4:30 a.m. to 10:00 p.m. 1964 - 6 batches from 6:00 a.m. to 10:00 p.m. Max. Drying Increase/day = 64%

3. Bob Maxwell, Delphi, Indiana, Carroll County
   LENNOX recirculating batch dryer - 600 bu. capacity powered by 15 HP - three phase motor - 20 HP rotary phase converter for three phase motors - Wet Holding Hopper over dryer - 700 to 800 bushel capacity.
   COLUMBIAN 18 ft. dia. bin with false floor
   BUTLER, AF1A, 1-1/2 HP, 4 blade 18 in. dia. cooling fan. Saved 1-1/2 to 1-3/4 hours per batch by separate cooling.

4. Richard Ward, Route 5, Crawfordsville, Indiana, Montgomery County
   AEROVENT batch dryer, 350 bushel capacity - powered by 10 HP fan, single phase - 1,500,000 BTU burner at 15 lbs. gas pressure
   BUTLER 12' dia. bulkomatic hopper cooling tank - 2100 bu.
   ROLFES 1-1/2 HP Fan, 3,400 RPM, 14" dia.

5. Robert Redman, Route 1, Dana, Indiana, Vermillion County
   CAMPBELL 700 bu. tower batch dryer - powered by 15 hp, three phase fan. 3 HP cooling fan connected to two CLAYTON-LAMBERT 21 ft. dia tanks with false floor - Controls airflow by manometer and inlet orifice opening.

6. Raymond Ortman, Kokomo Grain and Feed Elevator Company, Kokomo, Indiana
   Combined two CAMPBELL Continuous flow tower dryers - Heats entire grain column. Cools in 3 - 7,500 bu. (18 ft. dia.) tanks with 7-1/2 HP, 3 phase, 3,450 RPM, CHICAGO BLOWERS (#13-1-10) rated at 4,000+ cfm at 10 inch static pressure; plus 1-5,500 bu. tank with 1-1/2 HP (3 HP air over) fan. Pulls 5,500 bu. from two tanks by truck drawoff spouts, then refills with hot corn. Dried 300,000 bushels and was getting 1,300 to 1,400 bu/hr. in place of 900 bu/hr. in 1963.

7. Bill Conard, State Line Elevator Company, State Line, Indiana
   STORMOR 1500 bu. batch dryer, 25 hp fan. Cools in 23 ft., 6in. dia. 65 ft. high stave silo, approx. 23,000 bu. capacity.
   FARM FAN, 3 hp (4.5 hp Air Over), 16 in. dia, 3450 RPM, three phase
   Duct in silo - 36 lineal feet in "Y" pattern, 12 in. dia.
   Dry for 2 hrs, unload in 1 hour = 500 bu/hr. Was 4-1/2 hr. heat, 1 hour cool, 1 hr. unload = 250 bu/hr. Double Capacity.

Agricultural Engineering Department
Purdue University
Lafayette, Indiana
January 21, 1965

Summary of Corn Drying Operation 1963-64[1/]

Bill Congleton and Don Kinsler, Frankfort, Indiana

General Drying Data

Dryer - Behlen 500 bushel batch	1963 Conventional Drying	1964 Dryeration
Drying Period	Oct. 7 - Nov. 12	Sept. 23 - Oct. 25
Total Days	37	33
Batches	56	76
Bushels	28,000	38,000
Average Initial Moisture	22.5	21.7
Average Dry Moisture	12.9	14.0
Average Moisture Removed	9.6%	7.7%
Cooling Time, Average	41 min.	3.5 hrs./500 Bu.

Dryer Operation

	1963 Conventional	1964 Dryeration
Hot Air Temperature	180°F	205°-208°F
Corn Temperature Out of Dryer	---	145°-147°F
Loading Time	11 min.	11 min.
Heat Time	156 min.	67 min.
Cooling Time	41 min.	---
Unload Time	20 min.	11 min.
Total Time	228 min.	89 min.
CAPACITY INCREASE		156% (2.56 times '63 Ave.)

1/ Data presented at Farm Science Days Program on "DRYERATION - QUALITY, High-Speed Corn Drying" sponsored by Agricultural Engineering Department, Purdue University, Lafayette, Indiana, January 21, 1965.

Drying Operating Costs

Cost Per Bushel	1963 Conventional Cents/Bushel		1964 Dryeration Cents/Bushel
L. P. Gas	2.330		1.620
Diesel Fuel	.350		.135
Electricity			
Cooling	---		.010
Handling	.006		.017
Total Operating Cost/Bushel	2.686		1.782
Savings/Bushel		.904	
Savings/500 Bu. Batch		$4.52	

Investment

Year	Item	Cost	Quantity Ear Corn	Storage Shelled Corn
1949	Crib Constructed	$9,600	10,000 Bu.	8,500 Bu.
1958	Crib Sealed	1,100	------	28,500 Bu.
1958	Behlen 500 Batch Dryer	4,000		
1964	New Wiring	386	------	34,500 Bu.
	Cooling Bin with Augers, False Floor and Fan	4,428		
	Aeration of Crib	100		
	Dryer Refill Auger	81		
	Auto-Temp. Control for Dryer	52		
Total Grain Processing Investment		$19,747		

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Purdue University
Lafayette, Indiana
January 21, 1965

Dryeration Data Sample, 1964[1/]

Richard H. Ward, Route 5, Crawfordsville, Indiana

General Data

Harvested 35,700 bushels, 102 dryer batches, from 400 acres. Began harvesting on October 16 and finished on November 13, for 29 total days. His average drying production was 1552 bushels per day over 23 drying days, or 1231 bushels per day over his total harvest period.

Specifications - Drying Equipment

Dryer - Aerovent 350 bushel batch
10 HP, single phase fan
1,500,000 BTU burner @ 15 lbs. gas pressure

Cooling Tank - 12' dia. BUTLER bulkomatic, 7 rings high, 2100 bu. capacity.
1½ HP Rolfes fan, 14' diameter, 3400 RPM
Filled by 6 in. horizontal auger from elevator leg
Unloaded by 6 in. inclined auger to elevator leg

Field Data

Date	Batch	Heat Time Hr.	Heat Time Min.	Initial M. C.	M. C. Hot Out of Dryer	M. C. Cool	Diff. (Cooling)
				%	%	%	%
10/16/64	1	2	10	26.5	14.2		
	2	2	50	26.5	13.1		
	3	2	0	18.5	13.5	13.1	11.5	+1.6
	4	1	30	21.3	11.8		
	5	1	30	19.2	13.1		
10/17/64	6	1	30	19.7	12.6		
	7	1	15	19.7	13.4	13.0	11.8	+1.2
	8	1	15	19.6	13.0		
10/19/64	9	1	40	19.7	11.2		
	10	1	20	19.0	12.6		
	11	1	15	17.1	14.3	13.1	11.1	+2.0
	12	1	15	17.9	13.7		
	13	1	10	17.9	13.7		
10/20/64	14	1	15	20.0	14.7		
	15	1	25	18.0	12.2		
	16	2	05	18.4	13.0	13.8	12.1	+1.7
	17	1	15	18.5	14.7		
10/21/64	18	1	20	17.8	14.3		
	19	1	15	17.8	14.3		
	20	1	15	18.1	13.1	13.8	12.3	+1.5
	21	1	10	17.2	14.7		
	22	1	15	17.9	12.6		
10/22/64	23	1	15	17.1	13.6		
	24	1	10	17.7	13.1		
	25	1	05	18.1	13.4	13.3	11.3	+2.0
	26	1	05	17.7	13.5		
	27	1	05	17.8	13.1		

[1/] Data presented at Farm Science Days Program on "DRYERATION - QUALITY, High-Speed Corn Drying" sponsored by Agricultural Engineering Department, Purdue University, Lafayette, Indiana, January 21, 1965.

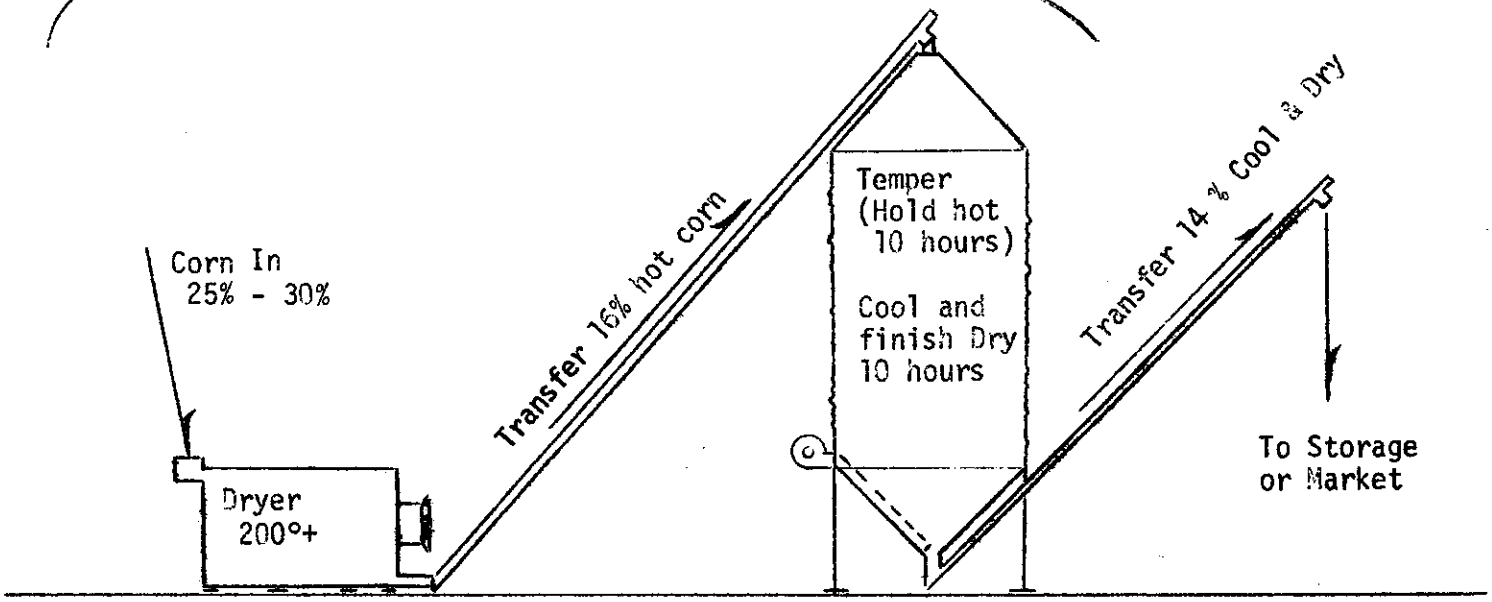
Date	Batch	Heat Hr.	Time Min.	Initial M. C.	M. C. Hot Out of Dryer		M. C. Cool	Diff. (Cooling)
						%	%	%
10/23/64	28	1	20	17.6	13.8	13.6	12.4	+1.2
	29	1	05	17.3	13.5			
10/24/64	30	1	05	18.1	13.1			
	31	1	05	19.0	15.8			
	32	1	05	17.8	12.0	13.4	11.7	+1.7
	33	1	05	17.0	13.0			
	34	1	05	17.2	12.9			
10/27/64	35	1	05	17.7	14.7			
	36	1	05	17.7	13.3			
	37	1	05	17.2	13.5	13.6	11.6	+2.0
	38	1	05	17.1	13.3			
	39	1	08	17.2	13.1			
	40	1	05	17.4	13.4			
10/28/64	41	1	05	18.0	13.4	13.8	12.3	+1.5
	42	1	05	17.2	14.2			
10/29/64	43	1	05	16.9	14.8	14.1	13.0	+1.1
	44	1	05	16.8	13.3			
10/30/64	45	1	10	18.4	14.5			
	46	1	13	19.0	13.7	14.4	13.5	+0.9
	47	1	10	18.0	14.5			
	48	1	10	18.2	14.8			
11/2/64	49	1	15	17.8	13.3			
	50	1	08	17.6	13.2			
	51	1	07	17.6	13.6	13.4	12.3	+1.1
	52	1	05	17.1	13.6			
	53	1	05	17.1	13.3			
11/3/64	54	1	10	17.2	14.0			
	55	1	05	17.1	14.3			
	56	1	05	18.2	13.8	13,6	12.1	+1.5
	57	1	00	16.2	12.4			
	58	1	00	15.9	13.4			
	59	1	05	15.8	13.8			

Average Moisture Removed by Cooling Process = 1.54%
Average Cooled Corn Temperature into Storage = 54°F

Farm Progress Show Special
September 22 - 24, 1964

Agricultural Engineering Department
Purdue University

THIS IS DRYERATION



Dryeration

1. What is it? A combination of high speed drying and aeration.
2. What it does: Improves corn quality; increases drying capacity.
3. How it operates:
   a. Dry at 200°F+ to 16% moisture, transfer hot to holding bin.
   b. Accumulate hot corn in bin, hold (temper) approximately 10 hours.
   c. Then, finish dry and cool with aeration, about 10 hours.
   d. Transfer, cool and dry, to storage or market load out.

Information:

Please send additional information on:

1. Dryeration
2. Fitting Drying System to Farm (Available Winter '64-'65)
3. Grain Handling System Planning Guide (Available Winter '64-65)
4. _____
5. _____

Return to:

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