

CHEDDAR CHEESE PRODUCTION TECHNOLOGY AND COSTS

Conference on Profitable Production
and Marketing of Cheddar and Specialty Cheese
Cornell University

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CHEDDAR CHEESE MANUFACTURING COSTS

Basic Assumptions and Facts

PRODUCTION COSTS AND PROFITABILITY

The production costs estimates include the costs associated with the production of Cheddar cheese starting from the receipt of raw milk through and including 10 days of storage in the cheese chilling room. Fines and whey cream are removed from whey in the cheese plant and these costs are accounted for in the cheese plant.

The cheese plant does not charge the whey plant for the whey. The production costs do not include any cost of raw milk, milk assembly, whey handling other than removing fines and whey cream, cheese aging or marketing, or administration and management other than direct whey plant management.

Equipment, packaging, production materials, and structural costs all reflect late 1988 prices.

Wage Rate = \$9.75 per hour + 32% for fringe benefits

Electricity rate = .06 per KWH

Natural gas rate = .38 per therm

PLANT CONSTRUCTION

Plants are constructed to be economically and technically functional for long term, yet not plush. Functional plant production office space is provided.

Laboratory testing for quality control is done in the cheese plant laboratory.

PROCESSING CONDITIONS

Five different cheddaring technologies were evaluated:

Standard manual cheddaring	(Cheddaring tables)
Automatic cheddaring	(DMC + table salting)
Advanced automatic cheddaring	(Alf-o-matic)
Standard stirred curd	(open tables)
Advanced stirred curd	(enclosed finishing vats)

Three different hooping technologies were evaluated:

Standard 40 lbs hoops and horizontal presses
Block forming towers producing 40 lb blocks
640 lb blocks with conversion to 40 lb blocks

Six different plant capacities were evaluated:

480,000 lbs of milk per day
720,000 lbs of milk per day
960,000 lbs of milk per day
1,440,000 lbs of milk per day
1,800,000 lbs of milk per day
2,400,000 lbs of milk per day

This is the amount of milk that could be pasteurized and pumped into the cheese vats in 18.5 hours. The balance of the 24 hour day was allowed for clean-up.

Nine different operating schedules were evaluated:

5 days 18 hours	6 days 18 hours	7 days 18 hours
5 days 21 hours	6 days 21 hours	7 days 21 hours
5 days 24 hours	6 days 24 hours	7 days 24 hours

When a plant operates 24 hours there is between 18 and 18.5 hours of fill time for the vats. On the 21 hour schedule the amount of milk processed is reduced by decreasing the fill time by 3 hours. On the 18 hour schedule the amount of milk processed is reduced by decreasing the fill time by 6 hours.

PRODUCT COMPOSITIONS AND YIELDS

Milk - 3.7% fat and 3.2% protein and 2.5% casein
Fat recovery in the cheese 91.5%
Cheddar cheese - 10 lbs/cwt raw milk
Raw whey yield - 90 lbs/cwt raw milk
Separated whey composition - .05% fat and 6.5% solids
Whey cream - 40% fat, assume 90% recovery of the fat lost into the whey
as whey cream

TABLE C1 Total Initial Capital Investment for Model Cheddar Cheese Plants of Different Sizes, Fall 1988

Note: Includes investment in land, building and equipment for production only. Does not include investment for storage for cheese aging, whey handling, or organizational office space.

Plant	Plant Capacity (Pounds of Milk Per Day)					
	480,000	720,000	960,000	1,440,000	1,800,000	2,400,000
	dollars					
Automatic Cheddaring with 640/40# Cutting	5,774,000	6,629,000	7,401,000	9,069,000	10,173,000	11,980,000

TABLE C2 Percent Plant Capacity Utilization for Model Cheddar Cheese Plants With Different Production Schedules

Daily Schedule ^a	Weekly Schedule		
	7-Day	6-Day	5-Day
	percentage		
24 hours	100	86	71
21 hours	83	71	60
18 hours	67	57	48

^aThe plant milk filling time in a 24-hour day is 18.5 hours; in a 21-hour day is 15.4 hours; and in an 18-hour day is 12.3 hours.

TABLE C3 Cheddar Cheese Manufacturing Costs, Model Plants, Fall 1988^a

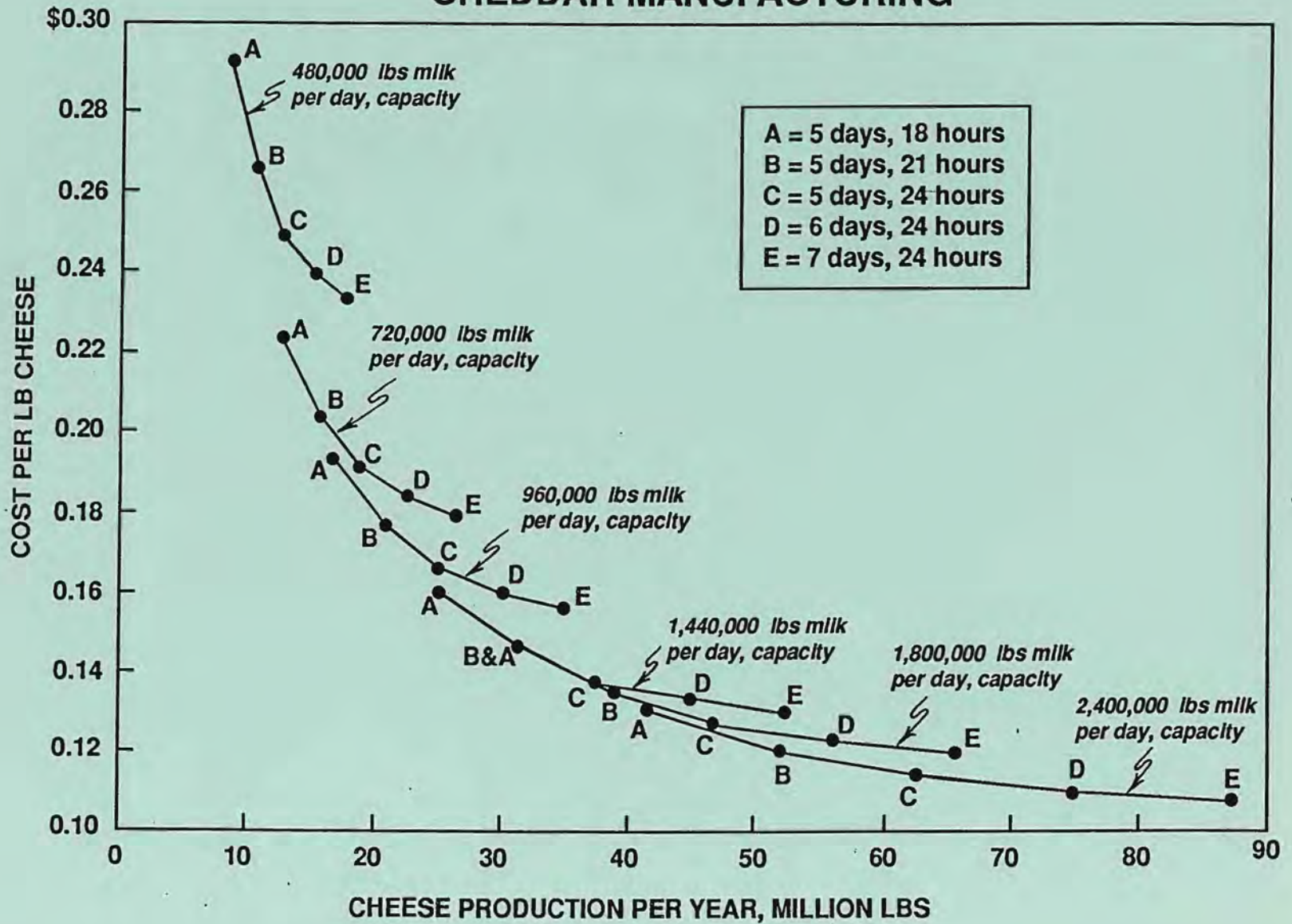
Cost Item	Cost Per Pound of Cheese ^b	Percentage of Total Costs	Cost Range for Different Size Plants & Operating Schedules ^c
	cents	percent	cents/pound
Labor			
Supervisory	0.6	3.4	(0.2 - 1.3)
Direct Fixed	0.6	3.7	(0.3 - 1.4)
Direct Variable	<u>5.6</u>	<u>33.1</u>	<u>(2.7 - 9.9)</u>
Total Labor	6.8	40.2	(3.2 - 12.6)
Capital Costs			
Depreciation & Interest	2.7	16.2	(1.3 - 6.3)
Utilities			
Electricity	0.2	1.2	(0.1 - 0.3)
Fuel	1.0	5.6	(0.8 - 1.3)
Water & Sewage	<u>0.1</u>	<u>0.6</u>	<u>(0.1 - 0.2)</u>
Total Utilities	1.3	7.4	(1.0 - 1.8)
Materials			
Production	2.6	15.3	(2.6 - 2.6)
Packaging	1.4	8.1	(1.4 - 1.4)
Cleaning	0.4	2.4	(0.2 - 1.0)
Laboratory	<u>0.1</u>	<u>0.4</u>	<u>(0.1 - 0.1)</u>
Total Materials	4.5	26.2	(4.3 - 5.1)
Repair & Maintenance	0.2	1.5	(0.1 - 0.4)
Property Tax & Insurance	0.9	5.6	(0.4 - 2.2)
Production Inventory	0.2	1.3	(0.2 - 0.2)
Other Expenses	<u>0.3</u>	<u>1.5</u>	<u>(0.1 - 0.4)</u>
TOTAL	16.9	100.0	(10.6 - 29.0)
Lbs of Cheddar Per Year	25 million		(87.4 - 8.3)

^aAssuming automatic cheddaring, 640 lb block with conversion to 40 lb blocks.

^bCost per pound in a cheese plant with a capacity 960,000 pounds of milk per day, operating 21 hours per day and 6 days per week.

^cThe lower end of range is cost in a cheese plant with capacity of 2,400,000 pounds of milk per day, operating 24 hours per day, 7 days per week. The higher cost figures are for a cheese plant with capacity of 480,000 pounds of milk per day, operating 18 hours per day, 5 days per week.

**FIGURE C1. ECONOMIES OF SCALE,
CHEDDAR MANUFACTURING**



**FIGURE C2. CHEDDAR ECONOMIES OF SCALE
COMPONENTS OF MANUFACTURING COST**

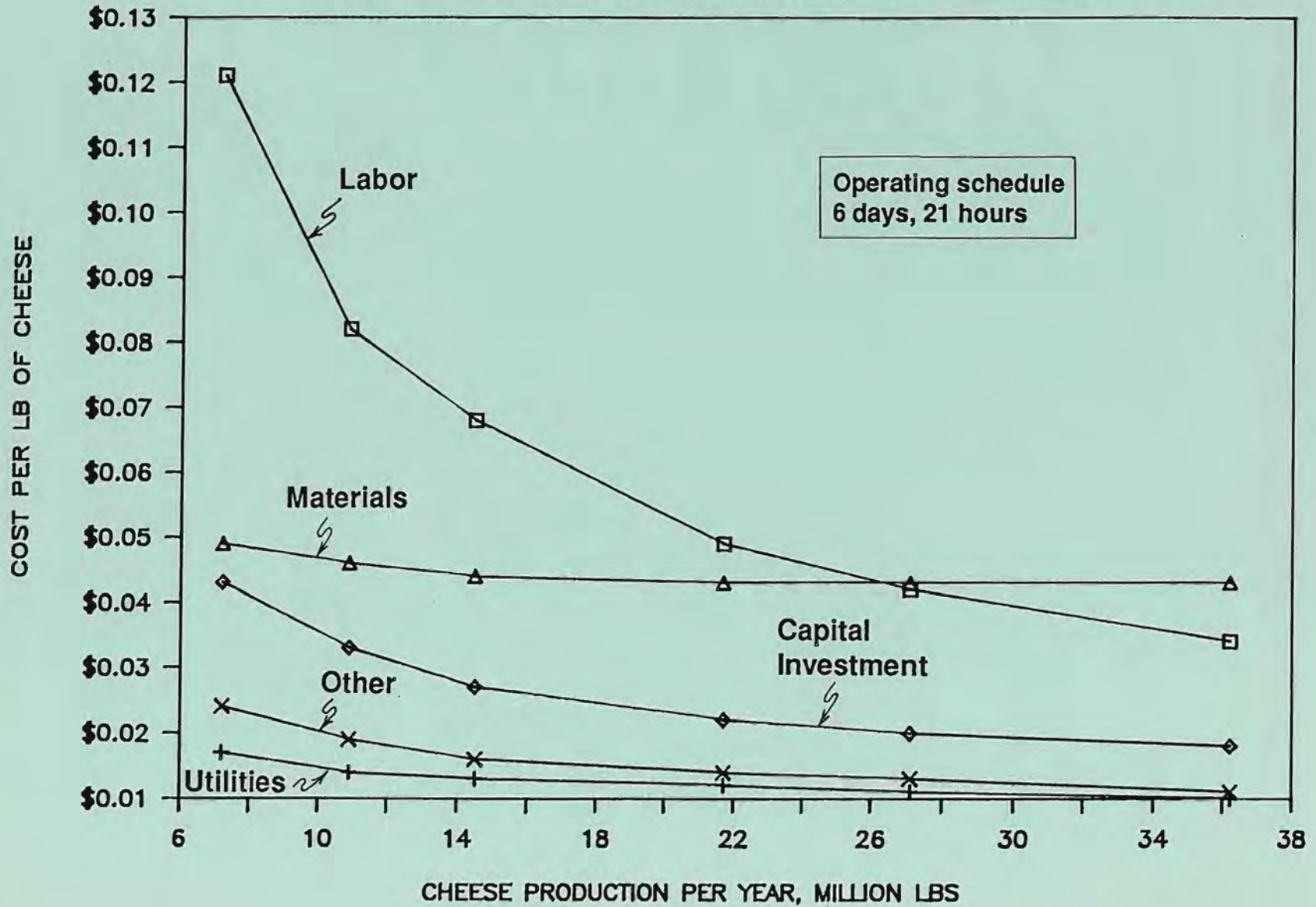


TABLE C4 Cheddar Cheese Manufacturing Costs, Six Model Plants, Operating With Different Production Schedules and Various Levels of Capacity Utilization, Fall 1988

Operating Days	Schedule Hours	Cheese Plant Capacity (Lbs of Milk Per Day)					
		480,000	720,000	960,000	1,440,000	1,800,000	2,400,000
5	18	29.0	22.3	19.3	16.0	14.7	13.1
	21	26.5	20.3	17.6	14.6	13.5	12.0
	24	24.8	19.1	16.6	13.8	12.7	11.4
6	18	27.7	21.2	18.3	15.2	13.9	12.4
	21	25.4	19.5	16.9	14.0	12.9	11.5
	24	23.9	18.3	16.0	13.3	12.3	11.0
7	18	26.7	20.4	17.6	14.6	13.5	12.0
	21	24.6	18.9	16.4	13.6	12.6	11.2
	24	23.3	17.9	15.6	13.0	12.0	10.6

TABLE C5 Cost Savings of Various Cheesemaking Technologies Over Standard Manual Cheddaring System, Different Size Model Cheddar Plants Operating at 100 Percent Capacity With Regular 40-Pound Hooping

Plant Size ^a	Cheesemaking Technology							
	Automatic Cheddaring		Advanced Cheddaring		Standard Stirred Curd		Advanced Stirred Curd	
	c/lb.	% Saving	c/lb.	% Saving	c/lb.	% Saving	c/lb.	% Saving
480,000	1.2	4.7	1.3	5.0	1.8	7.1	2.2	8.6
720,000	1.1	5.5	1.4	7.0	1.6	8.1	1.9	9.6
960,000	1.1	6.4	1.3	7.5	1.5	8.7	1.7	9.8
1,440,000	1.1	7.5	1.2	8.2	1.2	8.2	1.4	9.5
1,800,000	0.8	6.0	0.9	6.8	1.0	7.6	1.0	7.6
2,400,000	0.7	6.0	0.8	6.8	0.7	6.0	n.a.	

^aPounds of milk per day.

n.a. = not applicable.

TABLE C6 Cost Savings of Various Hooping/Packaging Technologies Over Regular 40-Pound Hooping System, Different Size Model Cheddar Cheese Plants Operating at 100 Percent Capacity and Using Standard Cheddaring Technology

Plant Size ^a	Hooping/Packaging Technology			
	<u>Block Former</u>		<u>640/40-Pound & Cutting Line</u>	
	Saving Over Reg. 40-Pound Hooping		Saving Over Reg. 40-Pound Hooping	
	Cents/lb.	Percentage	Cents/lb.	Percentage
480,000	2.4	9.4	1.8	7.0
720,000	1.2	6.0	1.3	6.6
960,000	0.8	4.6	0.9	5.2
1,440,000	0.6	4.1	0.8	5.4
1,800,000	0.5	3.8	0.4	3.0
2,400,000	0.3	2.5	0.3	2.5

^aPounds of milk per day.

TABLE C7 Effects of Different Wage Rates, Utility Rates & Capital Investments on Cheddar Manufacturing Costs, Six Model Plants Operating 21 Hours Per Day, 6 Days Per Week, Fall 1988

Level of Cost Factor	Plant Capacity (lbs of milk per day)					
	480,000	720,000	960,000	1,440,000	1,800,000	2,400,000
	cents per pound of cheese					
<u>Wage Rate Per Hour</u>						
\$ 7.75	23.0	17.8	15.5	13.1	12.1	10.9
9.75	25.4	19.5	16.9	14.0	12.9	11.5
11.75	27.9	21.1	18.3	15.0	13.8	12.2
<u>Utility Rate</u>						
Fall 1988	25.4	19.5	16.9	14.0	12.9	11.5
+ 25%	25.8	19.8	17.2	14.3	13.2	11.8
+ 50%	26.2	20.1	17.5	14.6	13.4	12.0
<u>Initial Capital Investment</u>						
Study Base	25.4	19.5	16.9	14.0	12.9	11.5
+ 35%	27.5	21.0	18.2	15.1	13.9	12.4
+ 70%	29.5	22.6	19.5	16.1	14.8	13.2

TABLE C8 Production Costs for a Selected Group of Model Cheddar Cheese Plants With Different Cheese Yield Efficiencies With Lost Revenues From Lower Yields Considered^a

Plant Type	Cheese ^b Yield	Plant Size (Pounds of Milk Per Day)					
		480,000	720,000	960,000	1,440,000	1,800,000	2,400,000
	(#/cwt)	----- (cents per pound of cheese) -----					
Automatic Cheddaring & 640/40#	10.0	25.4	19.5	16.9	14.0	12.9	11.5
Cutting	9.5	34.1	28.0	25.2	22.2	21.0	19.6
Daily Change in Cheese Production Per 1% Change in Cheese Yield (Pounds)		400	600	800	1,200	1,500	2,000

^aPlants operating 21 hours per day and 6 days per week. Lost revenue from lower yields (i.e., wholesale price less packaging costs) assumed to be \$1.38 per pound.

^bA 9.5#/cwt yield would correspond to a 95% efficiency of recovery of cheese yield potential assuming all plants use a milk with a cheese yield potential of 10#/cwt.