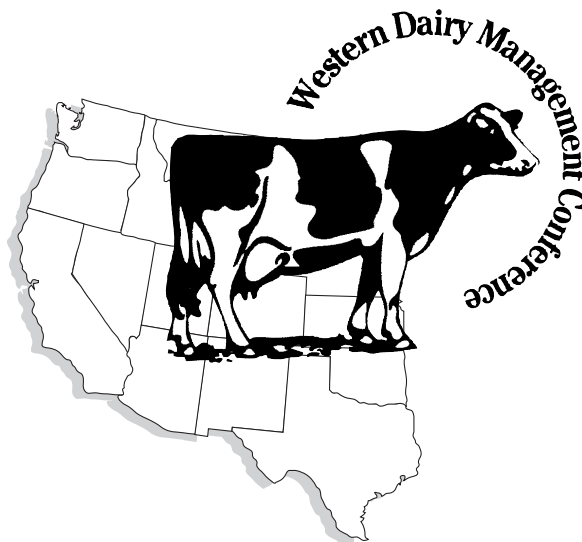


Labor Management Considerations In Selecting Milking Parlor Type & Size

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Typically, milking parlor performance has primarily been evaluated using time and motion studies. This procedure has also been used to evaluate the effect of different factors on milking parlor performance (pre-milking hygiene, level of milk production, parlor type, mechanization, type of construction).^(2, 3, 5) The information provided by these studies has been used to implement management procedures to improve parlor efficiency.

In recent years producers have shown interest in constructing larger milking parlors. double-50 parallel parlors and a double-40 herringbone parlor has been constructed. Some producers feel that operating one large parlor versus two smaller parlors simplifies the management of the milking center. However it does appear that the net parlor return over a 15 year period may favor constructing 2 smaller parlors versus one larger parlor.

(4, 6, 7, 8, 9, 10)

Although larger parlors are being constructed and operated little information has been published concerning the factors affecting parlor efficiency of large parlors or operator walking distance in different types and sizes of milking parlors. This paper will discuss how parlor size and type affect the pre-milking hygiene, milking routine, labor efficiency, and operator walking distance.

For discussion purpose in this paper pre-milking hygiene will be defined as attach, minimal or full. The definitions of the three different pre-milking hygiene procedures are listed below:

Attach = Attach milking units with no udder prep

Minimal = Strip or wipe and attach milking unit

Full = Strip, pre-dip, wipe and attach milking units

On average it will require 4-6 seconds to strip a cow,

4-5 seconds to pre-dip, 6-8 seconds to wipe and 8-10 seconds to attach the milking unit. Minimal pre-milking hygiene will require 14 sec/cow and a full pre-milking hygiene will require 25 sec/cow. The additional time needed for a full pre-milking hygiene is the time required for two additional passes by the cow to apply the pre-dip and to wipe it off. Published information would indicate that pre-dipping will reduce throughput (cows/hr) 10-20 percent.^(2, 3, 5) The total time required to prep 30 cows using a minimal versus full pre-milking hygiene will be 420 seconds (7 min) and 750 seconds (12.5 min) respectively. Table 1 lists the time required for minimal or full pre-milking hygiene, after cows have entered one side of a double-30 parlor.

As the number of operators increase the total time from when the cow is in the first stall until all units are on decreases. However, the time required to perform the pre-milking hygiene routine does not allow time for

Table 1: Time Required For Minimal Or Full Pre-Milking Hygiene On One Side, After The Cows Have Entered The Parlor (double-30)

<u>pre-milking hygiene</u>	<u>no. of operators</u>	<u>1st cow in all units (seconds)</u>
minimal (14 sec/cow)	2	210
	3	140
full (25 sec/cow)	2	375
	3	250
	4	188

the first cow to walk from the holding area In Table 2 the entrance time of the first cow and the walking distance to the first stall is presented for 19 parallel and herringbone parlors. In parallel milking parlors the time required for a cow to walk from the entrance gate to the first stall will increase from 23 seconds to 49 seconds as



the parlor size increases from a double-25 to a double-50. The significance of increasing the entry time is that the time from when the entrance gate is opened until all units are on a side increases as parlor length becomes longer.

If the goal is to have all units on a side in 4 minutes the turns per hour will be 4 for 2x milking, 5 for 3x milking and 6 for 4x milking. Managers of large parlors can calculate the time required for the first cow to enter and pre-milking hygiene per side using the formula listed as follows:

$$\frac{(\text{No. of Stalls Per Side} \times \text{Time Required for Pre-milking Hygiene}) + \text{First cow entry time}}{\text{Number Of Operators}}$$

Many times operators of parlors are put in difficult situations when the pre-milking hygiene is changed from minimal to full. Calculated below is an example for a double-40 milking parlor with 4 operators using a minimal or full pre-milking hygiene routine:

Minimal Pre-milking Hygiene:

$$\frac{(40 \times 14) + 34}{4} = 149 \text{ seconds} / 2 \text{ minutes } 29 \text{ seconds}$$

Table 2: Walking Time of Cows From Entrance Gate to First Stall^a

parlor type	cows /hour	no. of operators	pre-milk hygiene	milking frequency	stall length (inches)	walking distance to 1st stall (feet)	entrance time 1st cow (seconds)	range (seconds)
double-25 parallel	255	4	Full ^a	3x	28	58	23	17-49
double-25 parallel*	208	4	Full ^a	3x	28	58	29	16-57
double-28 herringbone	252	3	Min ^b	3x	45	105	39	29-94
double-30 parallel ^a	272	3	Full ^a	3x	27	68	25	19-51
double-30 parallel*	275	3	Min ^b	3x	28	70	33	26-53
double-30 parallel	285	3	Min ^b	3x	28	68	25	20-42
double-32 parallel	268	3	Full ^a	2x	27	72	28	23-51
double-35 parallel	352	3	Min ^b	3x	27	79	30	26-55
double-35 parallel	280	2.5	dip, strip no wipe	2x	28	82	31	27-59
double-40 herringbone	408	4	attach ^d	3x	38	127	51	44-121
double-40 herringbone	392	7	Full ^a	3x	38	127	47	27-81
double-40 parallel	491	4	Min ^b	4x	27	90	33	25-76
double-40 parallel	385	4	Full ^a	3x	29	93	34	27-69
double-45 parallel	395	5	Full ^a	3x	27	101	49	29-75
double-45 parallel	395	5	Full ^a	3x	27	101	40	36-81
double-45 parallel	399	5	Full ^a	3x	27	101	63	30-101
double-50 parallel	608	5	Min ^b	4x	27	112	42	37-71
double-50 parallel*	460	5	Full ^a	3x	28	117	49	39-61
double-50 parallel	610	5	Min ^b	4x	27	112	43	36-76

*: Cow identification at cow entry gate
a: Smith, Armstrong and Gamroth 1996
b: Strip, attach
c: Strip, pre-dip, wipe, attach
d: Attach units
e: No detachers

Table 3: Comparison of Milking Procedure in a Double-40 Herringbone Milking Parlor^a

Pre-milking Hygiene	Number of Operators	Cows/hr	cows per Operator Hr.	Operator Walking Distance (ft)/Cow	Total Walking Distance (ft)/Cow	Operator Walking Distance (ft)/Hr.	Operator Walking Distance miles/shift
Attach ^b	4	408	102	9	36	3684	4.9
Full ^c	7	392	56	9.5	66.5	3743	4.9

a: Smith & Armstrong 1996; stall width = 38 inches
b: Attach units with no udder prep
c: Strip, pre-dip, wipe, attach

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Full Pre-milking Hygiene:

$$\frac{(40 \times 25) + 34}{4} = 259 \text{ seconds/4 minutes 19 seconds}$$

If the goal was to have all the units on a side 4 minutes after the first cow starts entering the parlor the operators would be put in an impossible situation when a full pre-milking hygiene routine was implemented. Producers can be satisfied with a reduction in the number of cows milked per hour or add additional operators to maintain the number of cows that were milked with a minimal pre-milking routine. In table 3 is an example of a double-40 herringbone in which the milking procedure was increased from attaching units (requires 9 sec/cow) to a full pre-milking routine (requires 25 sec/cow). Notice that to maintain throughput the number of operators was increased from 4 to 7. The negative affect is that labor efficiency was decreased from 102 to 56 cows/labor hour. It is crucial that producers wishing to construct large parlors realize the additional labor cost associated with implementing a full pre-milking routine. This information should not be interpreted that only a minimal pre-milking hygiene should be used. We would all agree that if your going to milk cows there will be times the pre-milking procedure is altered to improve or maintain udder health. Milking parlors should be designed and managed to include the possibility of using a full pre-milking routine.

Milking Routine

Typically 3 types of milking routines

(Batch, Territory, and Rotating) are used in large parlors. Batch milking occurs when both sides of the parlor are loaded at the same time. When all the cows have been milked on both sides, all the cows are released at the same time. Territory milking occurs when milkers are assigned a number of stalls to milk and they do not work as a team. For example in a double-20 with 2 operators, milker 1 would milk the first ten stalls and milker 2 would milk the ten stalls closest to the holding pen.

A rotating routine requires that the operators work as a team. For example (minimal routine, Double-20) when a cow enters the first stall the first milker will begin stripping cows and work towards the holding pen. The second milker would follow the first milker and attach units. Milking of the two sides of the parlor would be alternated. Batch or Territorial milking routines can reduce throughput (cows/hr) by 20-30 percent when compared to a rotating routine.^(3, 5)

In table 4 the performance of a double-16 and a double-50 parallel operated under different milking routines is presented. In the double-50, switching from a rotating to a territory milking routine reduced throughput (545 to 431 cows/hr), decreased labor efficiency (136 to 107 cows/operator/hr), and increased the time until all units

Table 4: Effect of Different Routines in Parallel Parlors.

parlor type	pre-milking hygiene	number of operators	cows per operator hr.	turns/hr.	cows/hr.	1st cow in (sec.)	1st cow on (min.)
Double-50P ^a	Rotating	4	136	5.45	545	46	4.01
	Territory	4	107	4.31	431	53	5.81
Double-16P ^b	Rotating	2	68	4.31	135	19	4.21
	Batch	2	52	3.24	104	18	4.19

a: Fritz Tumm data, Babson Bros. Co.

b: D. Armstrong, Univ. of Ariz.

Table 5: Operator Walking Distance in Auto-Tandem (side-opening) Milking Parlors^a

parlor type	number of operators	pre-milking hygiene	cows/hr	operator walking distance (ft)/cow	total walking distance (ft)/cow	operator walking distance (ft)/hour	operator walk dist. (miles) per 7-hr. shift
double-3	1	minimal ^b	58	66	66	3,828	5.1
double-4 (2X)	1	minimal ^b	53	46	46	2,332	3.1
double-5	1	minimal ^b	66	74	74	4,884	6.5
double-5	1	minimal ^b	65	76	76	4,940	6.5

a: Armstrong, Smith and Gamroth 1996

b: Strip or wipe and attach



are on (4.01-5.81 minutes). The throughput and labor efficiency is also reduced in the double-16 when the milking routine is changed from a territorial to a batch milking routine. A rotating milking routine will increase throughput and labor efficiency. However, operators must work as a team and not independently. As parlors become larger and the number of operators increase, training teams of operators may become more difficult.

Parlor Type

Operator walking distance for rotary, auto tandem, parallel and herringbone milking parlors was collected. The range of operator walking distances per hour and shift are listed as follows:

auto tandem	2,332-4,940	3.1-6.5
rotary	1,010-1,543	1.4-2.0
herringbone	2,154-3,684	2.9-4.9
parallel	2,500-3,251	3.3-4.3

Operator walking distances tended to be highest in auto tandem parlors and lowest in rotary parlors with 2 operators. The specific data for individual parlors is presented in tables 5-8. A comparison of walking distances of operators working in double-10 and 40 parallel and herringbone parlors is presented in table 9. Operator walking distance is 300-400 ft/hr less in double-10 and 40 parallels than herringbone parlors of the same size. The difference is equal to .4-.6 miles in a 7 hr shift. This difference can be explained by the length of the stalls (27 vs 38 inches). It is also very clear in table 9 that as

$\frac{\text{ft/hr/operator}}{\text{miles/7 hr shift}}$
 $\frac{\text{operator}}{\text{operator}}$

Table 6: Operator Walking Distance in Rotary Milking Parlors^a

parlor type	number of operators	pre-milking hygiene	cows/hr	operator walking distance (ft)/cow	total walking distance (ft)/cow	operator walking distance (ft)/hour	operator walk dist. (miles) per 7-hr. shift
22-stall (2X)	1	minimal ^b	92	17	17	1,543	2.0
40-stall (4X)	2	minimal ^b	203	6	12	1,276	1.7
48-stall (3X)	3	full ^c	192	5	15	1,010	1.4

a: Armstrong, Smith and Gamroth 1996

b: Strip, attach

c: Strip, pre-dip, wipe, attach

Table 7: Operator Walking Distance in Herringbone Milking Parlors^a

parlor type	number of operators	thruput cows/hr.	cows per operator hour	operator walking distance (ft)/cow	total walking distance (ft)/cow	operator walking distance (ft)/hour	operator walk dist. (miles) per 7-hr. shift
double-8	1	67	67	37	35	2,479	3.3
double-10	1	80	80	35	35	2,812	3.7
double-16 (2X) ^b	2	120	60	18	36	2,154	2.9
double-40 ^d	4	408	102	9	36	3,684 ^e	4.9
					aggressive operator	4,370	5.8
					non-aggressive operator	1,627	2.2

a: Armstrong, Smith and Gamroth 1996

b: Full pre-milking hygiene = strip, pre-dip, wipe and attach

d: Attach only, no udder prep

e: Average of aggressive and non-aggressive operator

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parlor length is increased, operator walking distance increased 700-800 feet per hour in both parallel and herringbone parlors. This equals to a difference of 1.0-1.2 miles per 7 hour shift. Changing the milking routine in a double-40 herringbone and increasing the number of operators had little effect on operator walking distance but increased total walking distance per cow 31 feet.

Summary

As the length of milking parlors increases developing management techniques to maintain parlor efficiency will become more challenging. Managers of large parlors can maintain throughout when using a full pre-milking hygiene regimen by adding additional operators to compensate for the additional time required to pre-dip and wipe. The total time required to carry out a pre-milking routine can be calculated to estimate the number of operators that will be needed. In large milking parlors it is essential to train teams of milkers to use a rotating milk-

ing routine. As parlors become larger and the number of operators increases, training teams of milkers may become more difficult. Operator walking distance is the highest in auto-tandem milking parlors and lowest in rotary parlors. The walking distance in parallel parlors is 300-400 ft/hr less in parallel vs herringbone parlors. As the length of parallel & herringbone parlors increases the operator walking distance increases 700-800 ft/hr.

When planning to construct a large milking parlor, managers need to be aware of how entrance time of the first cow and using a full pre-milking hygiene will effect labor efficiency and parlor performance. Management can minimize those affects, however, training teams of skilled milkers will be essential. Milking facilities need to be sized to allow the use of a full pre-milking hygiene when needed to maintain or improve udder health.

Table 8: Operator Walking Distance in Parallel Milking Parlors^a

<u>parlor type</u>	<u>number of operators</u>	<u>thruput cows/hr.</u>	<u>cows per operator hour</u>	<u>operator walking distance (ft)/cow</u>	<u>total walking distance (ft)/cow</u>	<u>operator walking distance (ft)/hour</u>	<u>operator walk dist. (miles) per 7-hr. shift</u>
double-10	1	100	100	25	25	2,500	3.3
double-40	4	465	116	7	28	3,251	4.3
double-45 ^b	5	399	80	6.5	33	2,604	3.5
double-45 ^d	5	395	79	6.8	34	2,690	3.6

a: Armstrong, Smith and Gamroth 1996

b: Full pre-milking hygiene = strip, pre-dip, wipe and attach

Table 9: Comparison of Operator Walking Distance for Herringbone (H) & Parallel (P) Parlors^a

<u>parlor type</u>	<u>milking frequency</u>	<u>number of operators</u>	<u>thruput cows/hr.</u>	<u>cows per operator hour</u>	<u>operator walking distance (ft)/cow</u>	<u>total walking distance (ft)/cow</u>	<u>operator walking distance (ft)/hour</u>	<u>operator walk dist. (miles) per 7-hr. shift</u>
double-10 H	3X	1	80	80	35	35	2,812	3.7
double-10 P	3X	1	100	100	25	25	2,500	3.3
double-40 H ^b	3X	4	408	102	9	36	3,684	4.9
double-40 H ^c	3X	7	392	56	9.5	67	3,743	4.9
double-40 P	4X	4	465	116	7	28	3,251	4.3

a: Smith, Armstrong and Gamroth 1996

b: Pre-milking hygiene = attach units

c: Pre-milking hygiene = full (strip, dip, wipe & attach)



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