

Which Dairy Facility is Right for You? Drylot vs. Saudi vs Freestall

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Introduction

Dairy producers in Arizona wishing to expand or build new facilities have several options for cow housing. These options include Dry lots, Freestall barns, and Saudi barns. Differences in the investment cost of these facilities make this a difficult decision. These proceedings evaluate these three options for facility types on a long term financial basis. The authors recognize the complexity of this decision and the impact of different management philosophies. The information in these proceedings is designed to supplement actual information collected on an individual dairy.

Assumptions Used in the Budget

Listed below are the assumptions used in these financial projections. It is important for individual dairy producers to study these assumptions and compare them to the respective values for their own operations.

- **Milk sales:** based on the annual production per cow times milk price.
- **Milk Price:** gross price of \$13.00.
- **Milk hauling:** \$0.40/cwt.
- **Coop fees and promotion:** \$0.25/cwt.
- **Calves sold:** based on a 92 percent calf crop and selling all calves (heifers and bulls) at birth.
- **Cull cows sold:** assumes cull income is realized on 28 percent of the herd even though 34 percent of the herd is replaced annually. The 6 percent with no income represents cow death loss and cows with zero salvage value.
- **Feed:** includes total feed for the dairy cow on an annual basis.
- **Labor:** based on 25.3 full-time persons (95 cows per employee) at an average of \$27,795 (salary + benefits) per person divided by the number of cows in the herd.
- **Land requirements:** It was assumed that all three facility types would be required to purchase 320 acres of land at \$10,000 per acre. Due to the differences in space requirements of the three types of facilities, a credit of \$135 per acre was given for land that could be used for crop production. The space requirements for a Drylot, Saudi, and Freestall dairy were assumed to be 100, 91, and 60 acres, respectively.
- **Veterinary, drugs and supplies:** costs for prevention and treatment of disease and general dairy supplies.
- **Utilities and water:** telephone, electricity, fuel and water costs allocated to the dairy enterprise.
- **Fuel, oil and auto expense:** share of the farm car and trucks plus gasoline, diesel and oil for scraping and hauling manure and for hauling feed to the dairy herd.
- **Building and equipment repairs:** annual building and equipment repairs allocated to dairy enterprise calculated as 2.5 percent of the total investment.

- **Replacements and breeding:**
 - **Capital replacement:** price of a heifer replacement times the replacement rate.
 - **Semen, A.I. services, and supplies:** includes semen, artificial insemination services and supplies.
 - **Interest:** interest is charged on the value of the breeding herd, which is based on the cost of replacement heifers entering the herd.
- **Professional fees (legal accounting, etc.):** business costs allocated to the dairy enterprise.
- **Miscellaneous:** miscellaneous costs (subscriptions, education, etc.) allocated to the dairy enterprise.
- **Depreciation on buildings and equipment:** depreciation is based on the total original cost less the salvage value of buildings and equipment on a per cow basis divided by the estimated life. The useful life is assumed to be 25 years for buildings and improvements and 10 years for equipment. A salvage value of 0 percent is assumed on buildings and improvements and 10 percent on equipment.
- **Interest on land, buildings and equipment:** interest is charged on the land investment at a rate of 5.75 percent and one-half the average investment $[(\text{initial cost} + \text{salvage value}) / 2]$ for buildings and improvements and equipment at a rate of 7 percent.
- **Insurance and taxes on land, buildings and equipment:** insurance on buildings and equipment is based on the original cost times 0.25 percent, taxes are based on 1.5 percent of the original cost for buildings and improvements and 0.50 percent for land.
- **Interest on operating costs:** calculated on one-half of operating costs at a rate of 7 percent.

Calculated Values

- **Breakeven milk price to cover total costs:** represents the price needed for milk per cwt. to cover total costs of production. Assumes government payment, calf and cull income and all costs remain constant.
- **Asset turnover:** (returns per cow divided by total assets) asset turnover is the percentage of total investment recovered by total returns. Inverting this measure allows different enterprises to be compared on the basis of capital required to generate a dollar of gross income.
- **Net return on assets:** $[(\text{returns over total costs} + \text{interest on breeding herd} + \text{interest on operating costs} + \text{interest on land, buildings and equipment}) / \text{assets}]$ net return on assets is the percentage return on investment capital (both borrowed and equity). This measure enables comparisons to be made between enterprises as well as other investment alternatives.

Production Level

Costs per unit and net returns in a dairy enterprise are highly dependent on the level of milk production. Production levels vary for a number of reasons such as livestock genetics, weather, input levels, and management. Budgeting at multiple production levels can help producers examine the financial risk of a livestock enterprise that is directly related to production risk. Milk production levels of 23,000 and 27,000 pounds of milk sold per cow per year were used in these budgets. Projected budgets at the two production levels are presented on a cow and hundredweight (cwt) basis.

Capital Requirements

Capital invested in dairy facilities varies greatly depending on herd size and degree of mechanization. The capital needed to establish a new 2000 lactating cow dairy operation with modern equipment is

estimated to be \$9,564,021 with freestalls, \$9,252,375 with Saudi housing and \$8,412,375 with dry lot housing. An additional \$3,840,000 is invested in the cows. A partial breakdown of the investment assumptions used for the cost return projections is shown in Table 3. This budget is based on a total herd size of 2400 cows, with 2000 lactating cows. Investment amounts are given as total for farm and per cow in the herd.

Feed Costs

Dairy cows require high quality forage and grain. Concentrates and grain requirements increase as milk production increases. Feed costs are based on market prices, thus, for dairy operations that produce some, or all, of their grain and forage requirements this allocates the cost of producing the feed to the dairy enterprise.

Returns

Producers receive income primarily from the sale of milk. Additional income is received from the sale of calves and culled breeding stock. In this budget it is assumed that replacement heifers are purchased and thus all calves are sold. It is further assumed that roughly one-third (34 percent) of the cows are replaced each year due to culling and death loss. Cull income is assigned to 28 percent of the herd annually. The other 6 percent represents death loss and cows with no salvage value. Table 1 shows cost-return projections for alternative facility types on a per cow basis and Table 2 shows cost-return projections on a per cwt basis. Because milk sales make up the majority of income, returns are very sensitive to milk prices. Sensitivity analyses for milk production, milk price, investment in cooling and cull rate are presented in Tables 4-7.

Summary

Net return on assets ranged from 7.54 to 13.92%. At both production levels (23,000 and 27,000 pounds/year) dry lot dairies had the highest net return on assets followed by the Saudi and freestall dairies, respectively. This is due to lower investment per cow in dry lot facilities. Sensitivity analysis for milk production levels ranging from 21,000 to 27,000 pounds/cow/year are presented in Table 4 and Figure 1. Net return on assets increases with increased production per cow. Figure 1 reveals the required milk production levels to achieve a given level of return on investment for the different facility types. For example, to achieve a 12% return, freestall dairies need just under 27,000 pounds/year compared to about 26,500 pounds for the Saudi, and about 25,500 pounds for a dry lot dairy. Return on investment increases as milk price increases and as cull rate decreases (Tables 5 and 7). A sensitivity analysis for the investment in cow cooling is displayed in Table 6. As the investment in cooling is increased, the net return on assets decreases. However, an additional investment in cooling may be needed in Arizona to obtain the higher level of milk production.

Decisions concerning how much capital to invest in dairy facilities are difficult for dairy producers. The information presented in these proceedings is to only be used as a tool to help producers make these decisions. It is impossible to predict the impact of management ability. An individual dairy operation will have to use the set of assumptions and parameters that fit their individual situation.

Table 1. Cost-Return Projection for Alternative Facility Types—2,400 Cow Dairy (2,000 Lactating Cows)—Per Cow Basis

Facility type =====>	Freestall		Drylot		Saudi Style	
	Production level (lbs milk sold per cow per year)					
	23000	27000	23000	27000	23000	27000
RETURNS PER COW						
1. Milk sales @ \$13.00/cwt.	\$2,990.79	\$3,510.93	\$2,990.79	\$3,510.93	\$2,990.79	\$3,510.93
2. Credit for crop land	14.63	14.63	12.38	12.38	12.90	12.90
3. Calves sold: 92% x \$150/head	138.00	138.00	138.00	138.00	138.00	138.00
4. Cull cows: 1,400 lbs x 28% x \$45/cwt.	176.40	176.40	176.40	176.40	176.40	176.40
A. GROSS RETURNS	\$3,319.82	\$3,839.96	\$3,317.57	\$3,837.71	\$3,318.10	\$3,838.24
VARIABLE COSTS PER COW:						
5. Feed (from Table 3)	\$1,268.56	\$1,471.39	\$1,268.56	\$1,471.39	\$1,268.56	\$1,471.39
6. Labor	292.58	292.58	292.58	292.58	292.58	292.58
7. Veterinary and drugs	20.00	25.00	20.00	25.00	20.00	25.00
8. Supplies	120.00	130.00	120.00	130.00	120.00	130.00
9. Utilities and water	109.41	120.08	113.44	124.11	113.44	124.11
10. Fuel, oil, and auto expense	52.50	52.50	52.50	52.50	52.50	52.50
11. Hauling, coop, and promotion costs	149.50	175.50	149.50	175.50	149.50	175.50
12. Building and equipment repairs	79.70	79.70	70.10	70.10	77.10	77.10
13. Replacements and breeding charge:						
a. Capital replacement:	544.00	544.00	544.00	544.00	544.00	544.00
b. Semen, A.I. services, and supplies	40.00	45.00	40.00	45.00	40.00	45.00
c. Interest	112.00	112.00	112.00	112.00	112.00	112.00
d. Insurance	0.00	0.00	0.00	0.00	0.00	0.00
14. Professional fees (legal, accounting, etc.)	22.00	22.00	22.00	22.00	22.00	22.00
15. Miscellaneous	20.00	25.00	20.00	25.00	20.00	25.00
16. Depreciation on buildings and equipment	140.48	140.48	118.27	118.27	132.27	132.27
17. Interest on land, bldgs., and equip.	174.80	174.80	159.04	159.04	171.29	171.29
18. Ins. and taxes on land, bldgs, and equip.	39.93	39.93	31.22	31.22	37.35	37.35
B. SUB TOTAL	\$3,185.46	\$3,449.96	\$3,133.23	\$3,397.73	\$3,172.60	\$3,437.10
19. Interest on 1/2 operating costs @ 7.0%	70.87	79.21	70.67	79.02	70.92	79.26
C. TOTAL COSTS PER COW	\$3,256.33	\$3,529.18	\$3,203.90	\$3,476.75	\$3,243.52	\$3,516.37
D. RETURNS OVER TOTAL COSTS (A - C)	\$63.49	\$310.78	\$113.67	\$360.96	\$74.58	\$321.87
E. BREAK-EVEN MILK PRICE, \$/cwt:	\$12.73	\$11.85	\$12.51	\$11.67	\$12.68	\$11.81
20. Lactating cow feed cost, \$/head/day	\$3.81	\$4.40	\$3.81	\$4.40	\$3.81	\$4.40
21. Dry cow feed cost, \$/head/day	\$1.39	\$1.68	\$1.39	\$1.68	\$1.39	\$1.68
F. ASSET TURNOVER (A/Assets)¹	59.4%	68.8%	65.0%	75.2%	60.8%	70.4%
G. NET RETURN ON ASSETS						
((D + 13c + 17 + 19)/Assets) ¹	7.54%	12.12%	8.92%	13.93%	7.86%	12.55%

¹ Assets equal total value of breeding herd and land, buildings, and equipment.

Table 2. Cost-Return Projection for Alternative Facility Types—2,400 Cow Dairy (2,000 Lactating Cows)—Per CWT Basis

Facility type =====>	Freestall		Drylot		Saudi Style	
	Production level (lbs milk sold per cow per year)					
	23000	27000	23000	27000	23000	27000
RETURNS PER CWT						
1. Milk sales @ \$13.00/cwt.	\$13.00	\$13.00	\$13.00	\$13.00	\$13.00	\$13.00
2. Credit for crop land	0.06	0.05	0.05	0.05	0.06	0.05
3. Calves sold: 92% x \$150/head	0.60	0.51	0.60	0.51	0.60	0.51
4. Cull cows: 1,400 lbs x 28% x \$45/cwt.	0.77	0.65	0.77	0.65	0.77	0.65
A. GROSS RETURNS	\$14.43	\$14.22	\$14.42	\$14.21	\$14.43	\$14.22
VARIABLE COSTS PER CWT:						
5. Feed (from Table 3)	\$5.52	\$5.45	\$5.52	\$5.45	\$5.52	\$5.45
6. Labor	1.27	1.08	1.27	1.08	1.27	1.08
7. Veterinary and drugs	0.09	0.09	0.09	0.09	0.09	0.09
8. Supplies	0.52	0.48	0.52	0.48	0.52	0.48
9. Utilities and water	0.48	0.44	0.49	0.46	0.49	0.46
10. Fuel, oil, and auto expense	0.23	0.19	0.23	0.19	0.23	0.19
11. Milk hauling, coop, and promotion costs	0.65	0.65	0.65	0.65	0.65	0.65
12. Building and equipment repairs	0.35	0.30	0.30	0.26	0.34	0.29
13. Replacements and breeding charge:						
a. Capital replacement:	2.37	2.01	2.37	2.01	2.37	2.01
b. Semen, A.I. services, and supplies	0.17	0.17	0.17	0.17	0.17	0.17
c. Interest	0.49	0.41	0.49	0.41	0.49	0.41
d. Insurance	0.00	0.00	0.00	0.00	0.00	0.00
14. Professional fees (legal, accounting, etc.)	0.10	0.08	0.10	0.08	0.10	0.08
15. Miscellaneous	0.09	0.09	0.09	0.09	0.09	0.09
16. Depreciation on buildings and equipment	0.61	0.52	0.51	0.44	0.58	0.49
17. Interest on land, bldgs., and equip.	0.76	0.65	0.69	0.59	0.74	0.63
18. Ins. and taxes on land, bldgs, and equip.	0.17	0.15	0.14	0.12	0.16	0.14
B. SUB TOTAL	\$13.85	\$12.78	\$13.62	\$12.58	\$13.79	\$12.73
19. Interest on 1/2 operating costs @ 7.0%	0.31	0.29	0.31	0.29	0.31	0.29
C. TOTAL COSTS PER CWT	\$14.16	\$13.07	\$13.93	\$12.88	\$14.10	\$13.02
D. RETURNS OVER TOTAL COSTS (A - C)	\$0.28	\$1.15	\$0.49	\$1.34	\$0.32	\$1.19
E. BREAKEVEN MILK PRICE, \$/cwt:	\$12.73	\$11.85	\$12.51	\$11.67	\$12.68	\$11.81
20. Lactating cow feed cost, \$/head/day	\$3.81	\$4.40	\$3.81	\$4.40	\$3.81	\$4.40
21. Dry cow feed cost, \$/head/day	\$1.39	\$1.68	\$1.39	\$1.68	\$1.39	\$1.68
F. ASSET TURNOVER (A/Assets)¹	59.4%	68.8%	65.0%	75.2%	60.8%	70.4%
G. NET RETURN ON ASSETS						
((D + 13c + 17 + 19)/Assets) ¹	7.54%	12.12%	8.92%	13.93%	7.86%	12.55%

¹ Assets equal total value of breeding herd and land, buildings, and equipment.

Table 3. Land, Building, and Equipment Investment (2,400 cow dairy).

	Total for Dairy			Total per Cow		
	Freestall	Drylot	Saudi	Freestall	Drylot	Saudi
Land	\$3,200,000	\$3,200,000	\$3,200,000	\$1,333	\$1,333	\$1,333
Water rights	\$276,360	\$394,800	\$394,800	\$115	\$165	\$165
SUBTOTAL	\$3,476,360	\$3,594,800	\$3,594,800	\$1,448	\$1,498	\$1,498
Buildings and Corrals						
Milk barn	\$452,525	\$552,439	\$552,439	\$189	\$230	\$230
Freestall barn	\$2,280,000	\$0	\$0	\$950	\$0	\$0
Corral and shades	\$0	\$960,000	\$1,800,000	\$0	\$400	\$750
Other ¹	\$145,200	\$145,200	\$145,200	\$61	\$61	\$61
SUBTOTAL	\$2,877,725	\$1,657,639	\$2,497,639	\$1,199	\$691	\$1,041
Other buildings ²	\$350,000	\$350,000	\$350,000	\$146	\$146	\$146
Other facilities ³	\$122,510	\$122,510	\$122,510	\$51	\$51	\$51
Miscellaneous ⁴	\$108,236	\$108,236	\$108,236	\$45	\$45	\$45
Site improvements ⁵	\$756,227	\$756,227	\$756,227	\$315	\$315	\$315
SUBTOTAL	\$1,336,973	\$1,336,973	\$1,336,973	\$557	\$557	\$557
Dairy Related Fixtures						
Milking parlor equipment	\$516,548	\$516,548	\$516,548	\$215	\$215	\$215
Other milking parlor equipment ⁶	\$136,415	\$136,415	\$136,415	\$57	\$57	\$57
Cooling (fans/mist)	\$720,000	\$720,000	\$720,000	\$300	\$300	\$300
Rolling equipment	\$500,000	\$450,000	\$450,000	\$208	\$188	\$188
SUBTOTAL	\$1,872,963	\$1,822,963	\$1,822,963	\$780	\$760	\$760
TOTAL	\$9,564,021	\$8,412,375	\$9,252,375	\$3,985	\$3,505	\$3,855

¹ Hospital/work area, dry cow corrals² Housing, office/scale house, shop, commodity barn³ Truck scale, light towers, waste water system⁴ Surveys, permits, taxes, contractor fees, etc.⁵ Site leveling, excavation, lagoons, well work, feed mill installation-site, electrical, etc.⁶ Generator, water tanks, etc.**Table 4. Sensitivity Analysis of Return on Investment (Line G) to Milk Production for Alternative Facility Types.**

Facility type ==>	Freestall		Drylot		Saudi Style	
Milk production (lbs/cow/year)	\$13.00	\$12.00	Average Milk Price, \$/cwt		\$13.00	\$12.00
			\$13.00	\$12.00		
21,000	5.25%	1.49%	6.42%	2.30%	5.52%	1.67%
22,000	6.40%	2.46%	7.67%	3.36%	6.69%	2.66%
23,000	7.54%	3.42%	8.92%	4.41%	7.86%	3.64%
24,000	8.69%	4.39%	10.17%	5.47%	9.03%	4.63%
25,000	9.83%	5.35%	11.42%	6.53%	10.20%	5.62%
26,000	10.97%	6.32%	12.68%	7.58%	11.37%	6.61%
27,000	12.12%	7.28%	13.93%	8.64%	12.55%	7.60%

Table 5. Sensitivity Analysis of Return on Investment (Line G) to Milk Price for Alternative Facility Types.

Facility type ==>	Freestall		Drylot		Saudi Style	
Milk price (\$/cwt)	Production level (lbs milk sold per cow per year)					
	23,000	27,000	23,000	27,000	23,000	27,000
\$14.00	11.66%	16.95%	13.43%	19.22%	12.08%	17.50%
\$13.50	9.60%	14.54%	11.17%	16.57%	9.97%	15.02%
\$13.00	7.54%	12.12%	8.92%	13.93%	7.86%	12.55%
\$12.50	5.48%	9.70%	6.67%	11.28%	5.75%	10.07%
\$12.00	3.42%	7.28%	4.41%	8.64%	3.64%	7.60%
\$11.50	1.36%	4.87%	2.16%	5.99%	1.54%	5.12%

Table 6. Sensitivity Analysis of Return on Investment (Line G) to Investment in Cooling Equipment.

Facility type ==>	Freestall		Drylot		Saudi Style	
Investment per cow*	Production level (lbs milk sold per cow per year)					
	23000	27000	23000	27000	23000	27000
\$200	7.91%	12.57%	9.35%	14.46%	8.25%	13.02%
\$300	7.54%	12.12%	8.92%	13.93%	7.86%	12.55%
\$400	7.18%	11.68%	8.50%	13.41%	7.49%	12.09%
\$500	6.84%	11.26%	8.10%	12.92%	7.13%	11.65%
\$600	6.51%	10.85%	7.72%	12.45%	6.79%	11.23%

* Investment for total cows in herd (dry and lactating cows)

Table 7. Sensitivity Analysis of Return on Investment (Line G) to Culling Percent.

Facility type ==>	Freestall		Drylot		Saudi Style	
Culling rate*	Production level (lbs milk sold per cow per year)					
	23000	27000	23000	27000	23000	27000
32%	7.89%	12.47%	9.30%	14.31%	8.22%	12.90%
34%	7.54%	12.12%	8.92%	13.93%	7.86%	12.55%
36%	7.19%	11.77%	8.54%	13.55%	7.50%	12.19%
38%	6.85%	11.42%	8.16%	13.17%	7.15%	11.84%
40%	6.50%	11.08%	7.78%	12.79%	6.79%	11.48%

* Culls realizing income is this value less 6% (e.g., with a culling rate of 34% cull income is only received on 28% due to death loss of cows with no salvage value)

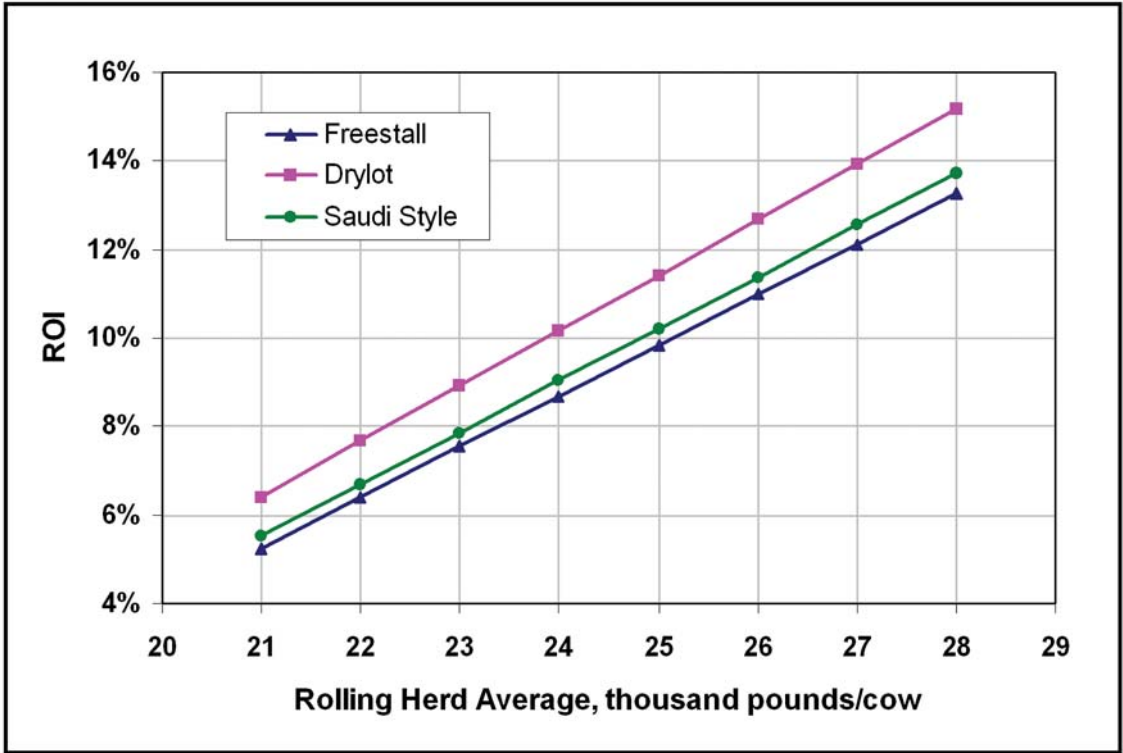


Figure 1. Sensitivity Analysis of Return on Investment to Milk Production (\$13/cwt milk).

Acknowledgements:

Steven Reiley, Manager
 Farm Credit Services Southwest
 Tempe, AZ