Stall Surfaces—Is Sand Still the Gold Standard? *by Larry Tranel, ISU Extension Dairy Field Specialist, NE/SE Iowa*

Comfortable cows tend to be more profitable. Currently, producers tend to use sand, mattresses or waterbeds for stall surfaces. These bases can all be successfully used with proper bedding management. Each has their benefits (effect on cows) and associated costs over time that need to be evaluated. Dairy cows prefer surfaces with more cushion. Surface cushion can be improved by significant additions of bedding, but properly sloped stalls have difficulty retaining significant amounts of bedding. If significant bedding is used to increase lying times, bedding bacterial counts and udder health require frequent removal of bedding.

Sand, properly managed, is still the gold standard due to its ability to help cows, especially lame ones, traction and cushion for rising and lying. Sand also has hygiene improvements with udders 50% cleaner (Cook and Nordlund, 2004). However, some research reported no difference in milk production or SCC with sand or mattress stalls (Bewley et al., 2000; Fulwider et al. 2007). But, we know there is a relationship with cleanliness and there is a stronger relationship between SCC and hind limb hygiene than between SCC and udder hygiene (Reneau, 2005). Sand appears to act as a cleaning agent, removing manure from the legs, udder and flanks (Cook and Nordlund, 2004). Thus, sand gets the edge in the debate of cow cleanliness and SCC.

Cows on mattress stalls tend to have more hock and other lesions than cows on sand or waterbeds (Fulwider et al., 2007). Sand bedded cows have more dorsal lesions (below hock) than cows on mattresses or waterbeds likely due to the abrasion of concrete curb (Fulwider et al., 2007.) Curb width should not be considered as part of the stall length in sand stalls which can cause an unfair comparison in stall length studies.

Stall length is correlated with lesions across all stalls. **Stall width** also has some correlation with lesion score 3 (Fulwider et al., 2007). Hygiene scores are correlated with neck rail height for mattress stalls but not sand stalls (Fulwider, et al. 2007). Though this same research shows no significant difference between base types for percent lame or annual death rate, waterbed dairies had more mature cows in fourth lactation or greater. Producers who provided waterbeds for their cows were more satisfied with longetivity than mattresses or sand. Producers who provided sand or waterbeds were more satisfied with lameness prevalence than those with mattresses. Satisfaction with manure management was highest for mattresses or waterbeds when compared to sand. However, this author feels that two-stage sand laden manure handling systems on several Iowa farms may significantly increase the satisfaction levels of producers using sand. In addition, newer mattresses like the Pack Mat™ which is designed as a mattress with 2" of sand over the mattress can assist in saving sand use while still achieving the lying time benefits of deep sand for lame cows (Marin S. et al., 2007). Extra foam padded mattresses may also increase milk production and cow comfort and need further consideration.

The greatest effect of poor stall design may be on lame cows within and given herd. Cook et al. (2004) demonstrated how lame cows housed in barns with rubber crumb filled mattress freestalls stood longer in the stalls—two or three times longer than non-lame cows, depending on the severity of the lameness, and lay for less time than non-lame cows. In contrast, lame cows housed in similar barns with deep bedded sand stalls showed no significant change in stall use behavior. We have suggested deep sand facilitates the rising and lying movements of lame dairy cows, allowing them to maintain normal stall resting times in excess of 12 hours/day. This may explain, at least in part, the much lower prevalence of lameness observed in sand stalls compared with mattress stalls (Cook, 2003; Espejo et al., 2006). Mattress products tend to harden and lose cushion over time.

Stall design is as or more important than stall base. Stall length, width, base cushion effects, neck rail, physical and social obtrusions, etc. all effect the traction, rising and lying behaviors of cows. In open front head-to-head stalls with properly designed neck rails (high) physical obstructions to lunging forward should be avoided. If felt necessary, a deterrent wire covered in polypropylene tubing mounted 40-42" above the stall surface so above the "bob" space but not solid enough to cause injury to the cow should she venture beneath it. (Cook, Nordlund, 2004)

Conclusion

Sand is still the gold standard due to its ability to help cows, especially lame ones, traction and cushion for rising and lying. New technology for sand laden manure systems may improve producer satisfaction for handling sand laden manure. Other stall bases that can achieve sand stall properties for comfort can and have been as successful. Proper stall design is also a very important factor. But, when put together, a well designed and managed sand freestall provides the optimal resting space for dairy cows.

ISU Extension Publication LT 11-02

Partial Budget - Mattress to Sand Conversion

Nigel B. Cook, MRCVS, Ken Nordlund, DVM, & Rebecca Brotzman, DVM
School of Veterinary Medicine, University of Wisconsin-Madison

The Dairyland Initiative

Fill in the BLUE cells in the Assumptions table below

POSITIVE IMPACTS		NEGATIVE ECONOMIC IMPACTS	
Increased Income		**Increased Costs**	
Improved milk production	$ 148,920	Increased feed costs	$ 48,180
Improved SCC premium	$ 19,657	Amortized cost of stall modifications	$ 35,827
		Amortized cost of manure system modifications	$ 71,654
		Cost of sand bedding	$ 24,638
Total Increased Incomes	$ 168,577	Total Increased Costs	$ 180,299
Reduced Costs		**Reduced Incomes**	
Reduced number clinical mastitis cases	$ 5,022	Reduction in cull cow sales	$ 14,400
Reduced number of lameness treatments	$ 3,900		
Reduced cost of replacement heifers	$ 31,200		
Reduced cost of bedding on mattresses	$ 49,275		
Total Reduced Costs	$ 89,397	Total Reduced Incomes	$ 14,400
Total Positive Impacts	$ 257,974	**Total Negative Impacts**	$ 194,699
		NET ANNUAL IMPACT	$ 63,276

Herd Assumptions		Units	Instructions or reference values
Herd size	300	# cows	*Enter herd size*
Number of stalls	270	# stalls	*Enter # stalls*
Current bedding usage	10	lbs/stall/day	*Estimate organic bedding use at 5-15 lb per stall per day*
Cost of current bedding	100	$/ton	*Typical range $50-250 per ton*
Anticipated sand usage per stall per day	50	lbs/stall/day	*Typical range 30-80 lb per stall per day*
Cost of sand bedding	10	$/ton	*Typical range $7-14 per ton*
Milk price ($ per lb)	$ 0.17	$ per lb milk	*Typical range $0.12-0.18*
Lbs TMR dry matter per lb of milk	$ 0.55	lb DM/lb milk	*Expected range 0.5-0.6*
Cost per lb of TMR dry matter	0.10	$ per lb DM	*Typical range $0.085 to 0.11 per lb of TMR dry matter*
Lbs of milk per cow per day, past yr	80	lbs	*Enter lbs milk per cow per day, past year*
Projected change in milk per cow per day	8	lbs	*Usual response 5-9 lbs per cow per day*
	88	lbs	*Projected milk yield per cow per day*
Milk production		2686	lbs, estimated change in milk yield per cow per year
SCC premium per 1,000 SCC reduction	$ 0.003	$/cwt	*Estimate from creamery rates, usually $0.002-.004/cwt per 1,000 SCC*
Current annual bulk tank average SCC	340,000	scc/ml	*Enter annual average bulk tank SCC*
Estimated % reduction in SCC	20	%	*Expected reduction of 15-25%*
	272,000	scc/ml	*Projected SCC after change*
Bulk tank SCC		68,000	reduction in herd average SCC
Direct cost of a case of clinical mastitis	$ 90	$ per case	*Enter average cost of treatment*
Current clinical mastitis rate, %	62	cases/100 cows	*Enter average # of clinical cases per 100 cows per year*
Estimated reduction in clinical mastitis rate	30	%	*Expected reduction of ~25-35%*
	43	cases/100 cows	*Projected clinical mastitis rate after change*
Clinical mastitis		55.8	reduced cases of mastitis in herd per year
Direct cost of a case of lameness ($ per case)	$ 50	$ per case	*Enter average cost to treat lameness*
Current lameness rate, %	65	cases/100 cows	*Enter average # of lameness treatments per 100 cows per year*
Estimated reduction in lameness treatment rate	40	%	*Expected reduction of clinical lameness by 25-50%*
	39	cases/100 cows	*Projected clinical lameness rate after change*
Clinical lameness		78	reduced cases of lameness in herd per year
Cost of replacement heifer ($)	$ 1,300	$ per heifer	*Enter estimate for heifer purchase*
Cull price per cow ($)	$ 600	$ per cull	*Enter average cull price*
Turnover rate before change (%)	45	%	*Enter annual herd turnover rate*
Expected reduction in annual turnover rate	8	%	*Enter expected reduction of 5-8 points*
	37	%	*Projected annual turnover rate after change*
Culling		24	reduced culls from herd per year
Financial Assumptions			
Cost of stall changes ($)	$ 200,000		*Enter cost of proposed stall changes*
Cost of manure handling system change ($)	$ 400,000		*Enter cost of proposed manure handling changes*
		$600,000	*Total cost of conversion*
Repayment Period (years)	7	yr	*Suggest 3-7 years*
Interest Rate of Loan	0.06	interest rate	