Water Requirements for Lactating Cows During Summer Months

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Introduction

Minimum water requirements for meeting the intake water needs of lactating cows, milk parlor usage and other needs of a functioning dairy seem to range from 40 to 50 gallons per cow per day (gal/cow/dy) (Allen el al., 1974; Bailey et al., 1993; Beede, 1992; MWPS-7, 1997). Lactating milk cows will drink from 30 to 50 gallons of water per day. Ishler (1998) notes drinking water satisfies 80 to 90 percent of the daily water requirements of a dairy cow. A summary of daily water requires for different type of dairy cattle is shown in Table 1.

Reinemann and Springman (1992) determine the drinking water requirements based on 4.5 to 5 lbs of water per lb of milk. Data collected during a study comparing the impact of fiber by Dado and Allen (1995) indicates a cow will drink about 1.5 gal of water per trip to a watering trough at a rate 1.3 gpm. They found a cow will spend about 12 to 16 minutes per day drinking water (Dado and Allen, 1995). Their measured free water intakes were lower than most studies.

Anderrson et al (1994) in Sweden studied the impact of flow rate on water intake using cups. The flow rates examined were 0.5, 1.8 and 3.2 gpm. Time spent drinking decreased from 37 to 11 to 7 minutes per day as the flow rate increased. They observed drank from the cups 40, 28 and 30 times per day. The actual water drank increased from 20.4 to 22.0 to 23.3 gal/dy/lcow as the flow rate increased, however, there was not increase in milk yield or dry matter intake. Submissive cows drank 7% less water than a dominant cow. In another European study, water troughs were compared to water cups (Castle and Thomas, 1975). Cows spent only 2 min/dy drinking from water troughs while the were at water cups 7.8 min./dy. Drinking rate range from 1.2 to 6.5 gpm/cow with lower rate being consumed from the water cups.

Table 2 summarizes the daily water usage on the five dairies in Arizona (Zuagg, 1989). Early lactating cows drank between 29 and 35 gal/dy/cow while later lactating cows utilized only 25 to 30 gal/dy/cow. This is a function of milk production and feed intake. Water consumption was reduced below 20 gal//dy/cow during the dry cow period on all of the farms. Water usage on a dairy varied from 80 to 240 gallons per lactating cow per day (gal/lcow/dy). Dairies raising replacement heifers and using calf barns utilized more than 200 gal/lcow/dy.

Zuagg (1989) also indicated the Arizona Department of Water Resources was adopting 105 gal/lcow/dy and 20 gal/nonlactating cow/dy as the maximum water usages for dairies by the end of 2000. In South Florida, dairies apply for a consumptive use permit use 40 gal/cow/dy for drinking and 130 gal/cow/dy for flush water (Bray et. al., 1994).

Other studies have looked at the impact of water temperature on water consumption. Beede (1992) summary indicate cows per warm water to cool water. Bray et al. (1990) studied the impact of water from a well (77 ^{o}F) to chilled water (59 ^{o}F). They found no difference in milk yield (61.4 to 61.8 lbs/d/lcow). Similar results were found the following year (Bray et al. 1991).

Some data indicates that cows prefer the water temperature to be near 80 ^{o}F (Beede, 1992).

The objective of this study was to determine water usage during periods of heat stress and the impact of water trough location in a freestall.

Study Procedures

Three dairies were selected in north central Kansas for the study during the summer 2000. Figure 1 shows the layout water troughs in the 4-row freestall building. Fans and a feedline sprinkler system were used for heat abatement. Holstein cows were milked 2X with a rolling herd average of 72 lbs per day. Each pen contained 84 freestalls with a stocking density of 110 percent. Water meters recorded water consumption at each water trough from July 1 to September 15, 2000. Meters were read approximately every two weeks. The water usage data included the amount of water used to refill the water troughs after dumping. The troughs were dumped twice a daily as the cows were being milked. Walking distance from the back of the milk parlor to the housing area was less than 100 feet.

Figure 2 shows the water trough location in the 2-row freestall facility. Similar procedures to those previously mentioned were utilized. The milk parlor was a double 12 parlor with two exiting lanes. Water troughs were located near the end of the exit lane and were equipped with water meters. Cows had to walk 400 to 500 feet from the milk parlor the freestall buildings. Each freestall had 108 freestalls and was stocked at 100 percent capacity. This herd was milked 3X with a rolling herd average of 78 lbs/dy/cow.

The third dairy selected was a 4-row freestall housing Jerseys with a rolling herd average of 65 lbs milk per day. Building layout was similar to Figure 1 except the pens housed cows in different stages of lactation. The walking distance from the milk parlor to the freestall housing area was 30 feet. The herd milk production was 65 lbs/dy/cow.

Water temperature was not recorded during the study period. The water was supplied from deep wells. Each water trough was connected to the main distribution line using a ¾ inch hose.

Drinking Water Requirements

Figure 3 shows the average daily water usage per cow collected during summer, 2000 in the 4-row freestall building. The average water consumption was 35.1 gal/cow/dy including the water used to refill the tanks after dipping. Figure 4 shows the water consumption at the different troughs in each of the pens. Over 40% of the water was consumed from the water trough located in the center cross alley (Figure 5). The water trough located farthest from the travel lane to the milk parlor had lower usage. However, the 3 to 5 percent differences may be attributed to lack of water trough at the exit lanes from the milk parlor. The water trough nearest the travel lane is less than 100 ft from the milk parlor.

Figure 6 shows the daily water usage for the 2-row freestall buildings. Data from the north pen

more accurately reflects the water consumption of this herd at 40.2 gal/dy/cow plus an additional 3.5 gal/cow/day at the milk parlor water tank. Data from the south pen shows the impact of a leaking water line (Figure 7). Average water usage per cow increased from 40.2 to 58.9 gal/dy/cow. This represented nearly a 50 percent increase in water consumption during the study period. Figure 7 shows the water usage at the individual water troughs in the north and south buildings. The water meter reveals the impact of the leaking water line at the water trough farthest from the travel lane in the south building. Water usage at the center water trough and water trough near the travel lane were similar.

Figure 8 shows the water usage at the water troughs located in the milk parlor exit lanes. There was no difference between the usages of water in the west or east exit parlor lane. The total water usage at the exit lane was approximately 3.5 gal/dy/cow or about 3.5 gal/day or about 8% of their daily consumption.

The third site found Jersey cows required significantly less water. Data collected during summer, 2000 found late lactation cows, early lactation cows and 2-year old heifers drank 20, 24.5, and 21.4 gal/dy/cow.

Summary

The farms with Holstein cows used 4 to 4.5 lbs of water per lb of milk produced. The Jersey cows used 3.1 lbs of water per lb of milk production with the water trough. The data from this study compares with data presented by McFarland (1998). He reported 35 to 45 percent of the water consumed was from a water station in the central crossover. The data shows the importance maintenance may have on reducing water usage on a dairy. Water usage in freestalls for drinking increased as milk production increase. Adequate water rights are needed to make allowances for future increases in milk production.

References

Allen, J.B., J.F. Beatty, S.P. Crockett and B.L. Arnold. 1974. An analysis of the water usage and waste treatment at a modern dairy. ASAE Paper No. 74-4038. American Society of Agricultural Engineers. St. Joseph. MI.

Anderrson, M.J., J. Schaar and H. Wiktorsson. 1984. Effects of drinking water flow rates and social rank on performance and drinking behavior of tied-up dairy cows. Livest. Prod. Sci. 11:599.

Bailey, K., M. Bennett, J. Garrett, D. Hardin, J. Hoehne, J. Spain, B. Steevens and J. Zulovich. 1993. Missouri Dairy Plan - The Missouri System of Dairy Production 500 Cow Plan. Unpublished Extension Manual. Diary Focus Team, Commercial Agriculture Program, University of Missouri Extension, Columbia, MO.

Beede, D.K. 1992. Water for Dairy Cattle. Large Dairy Herd Management: Chapter 28. H.H. Van Horn and C.J. Wilcox (eds.). Management Services, American Dairy Association. Champaign, IL.

Castle, M.E. and T.P. Thomas. 1975. The water intake of British Friesian cows on rations containing various forages. Animal Prod. 20:181.

Dado, R.G., and M.S. Allen. 1995. Intake limitations, feeding behavior, and rumen function of cows challenged with rumen fill from dietary fiber or inert bulk. Journal of Dairy Science. 78:118-133.

Bray, D.R., R.A. Bucklin, R. Montoya and R. Giesy. 1994. Means to reduce environmental stress on dairy cows in hot, humid climates. Proceedings of Third International Dairy Housing Conference: Dairy Systems for the 21st Century. American Society of Agricultural Engineers. Pp. 589-597.

MWPS-7. 1999. Dairy Housing and Equipment Handbook. 4th Edition. Midwest Plan Service, Iowa State University, Ames, IA.

Reinemann, D.J. and R. Springman. 1992. Water quality, quantity and distribution. NRAES-66. Proceedings from National Milking Center Design Conference. Northeast Regional Agricultural Engineering Service, Cornell University, Ithaca, NY.

Smith, J.F., J.P. Harner, M.J. Brouk, D.V. Armstrong, M.J. Gamroth, M.J. Meyer, G. boomer, G. Bethrad and D. Putnam. 2000. Relocation and expansion planning for dairy producers. Publication no. MF-2424. Cooperative Extension Service. Kansas State University.

Wiersma, F. 1988. Water requirements for an Arizona dairy. Personnel correspondence.

Zaugg, N.L. 1989. Water usage on dairies in the southwestern desert. Unpublished report

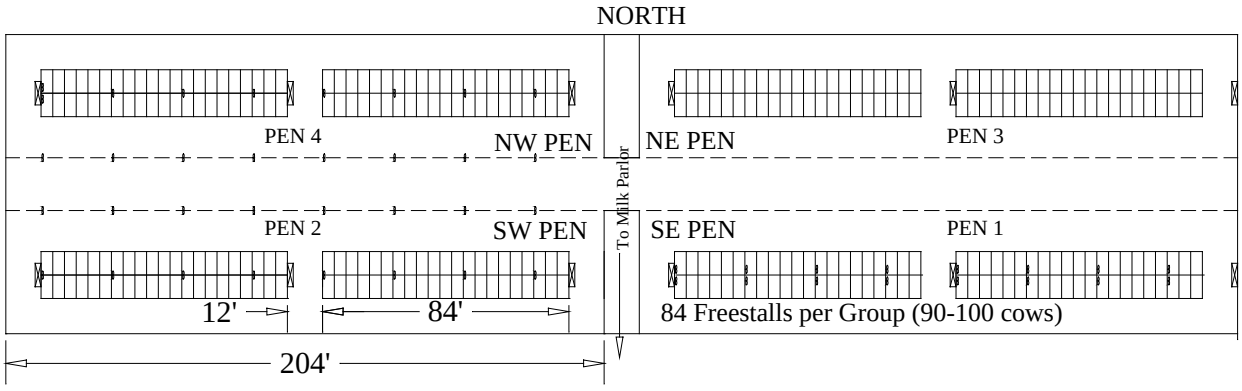

Figure 1. Layout of pens and location of water troughs in 4-row freestall building.

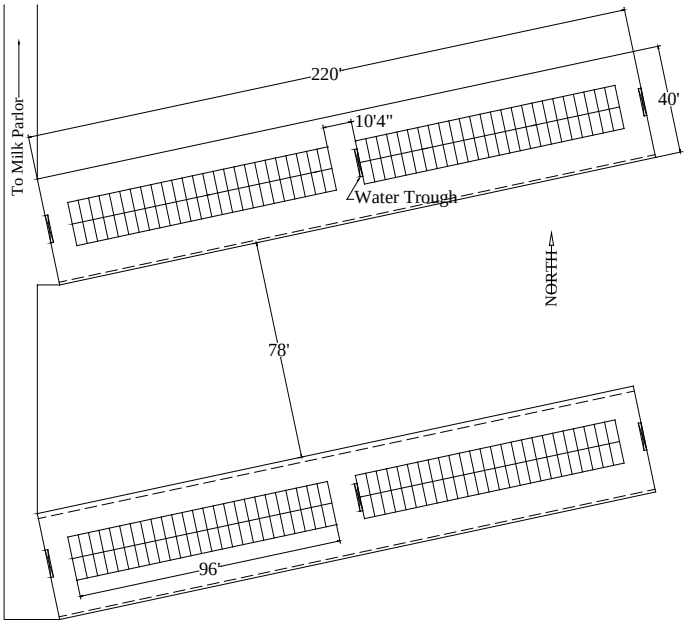

Figure 2. Layout of 2-row freestall buildings and location of water troughs.

Table 1. Estimate of drinking water requirements for different dairy animal types (MWPS, 1999).

Animal Type	Water Usage (gallon/day/head)
Calves (1 to 1.5 gal/100 lbs)	6 to 10
Heifers	10 to 15
Dry Cows	20 to 30
Lactating Cows	25 to 50

Table 2. Summary of daily water usage on five dairies in southwestern United States (Zaugg, 1989).

	Dairy Identification and Milking				
	A(3X)	B(3X)	C(2X)	D(2X)	E(3X)
Daily Water Usage					
Total Gallons per Lactating Cow*	186	101	95	72	182
Drinking					
Early Lactation	34	31	30	29	35
Late Lactation	27	28			25
Dry Cow	16	13			17
Close-up		16			17
Calves (hutches or barns)		3	2	2	25**
2-6 months		3	4	4	5
7-15 months					10
16-22 months					11

* Total water usage divided by the number of lactating cows.
** Includes cleaning and sanitizing wire cages, concrete floors and alleys.

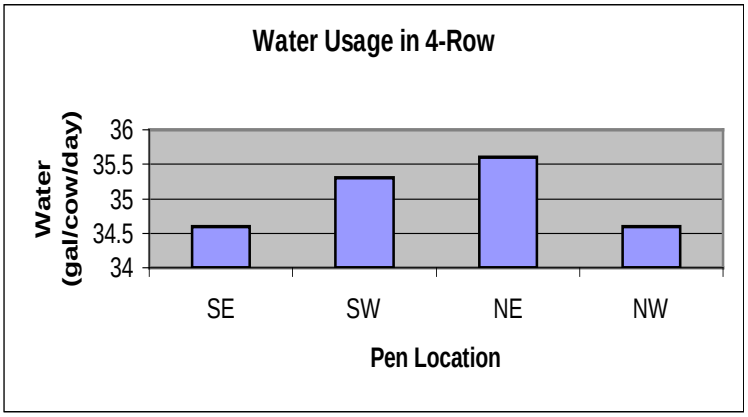

Figure 3. Total daily water (gal/dy/cow) used at water troughs in different pens in 4-row freestall building.

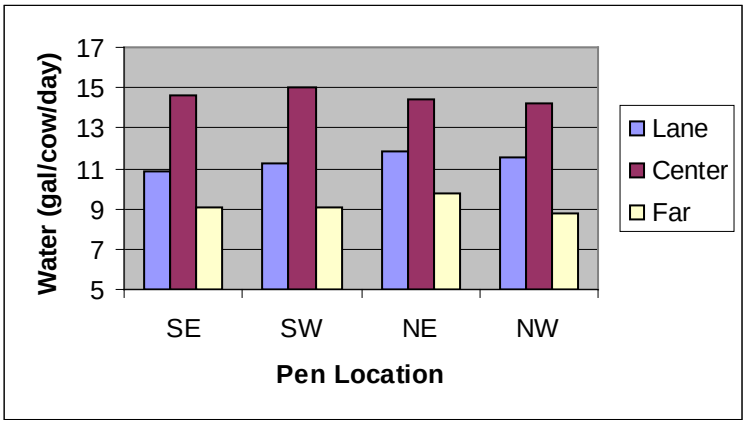

Figure 4.

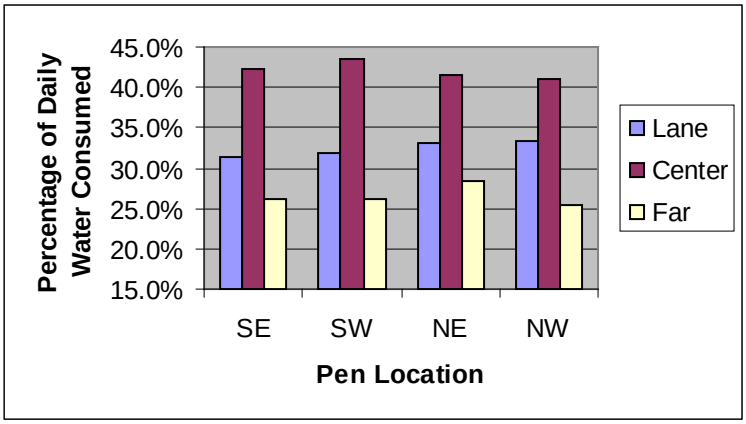

Figure 5. . Water used (gal/dy/cow) at water troughs located in different selections of a 4-row freestall building.

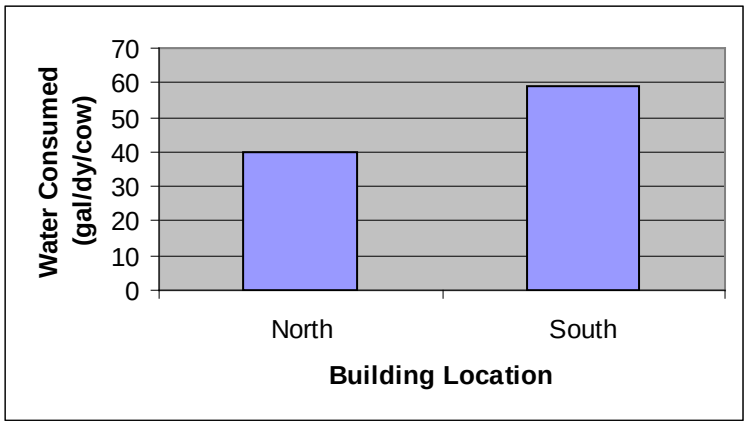

Figure 6. Total daily water (gal/dy/cow) used in 2-row freestall building.

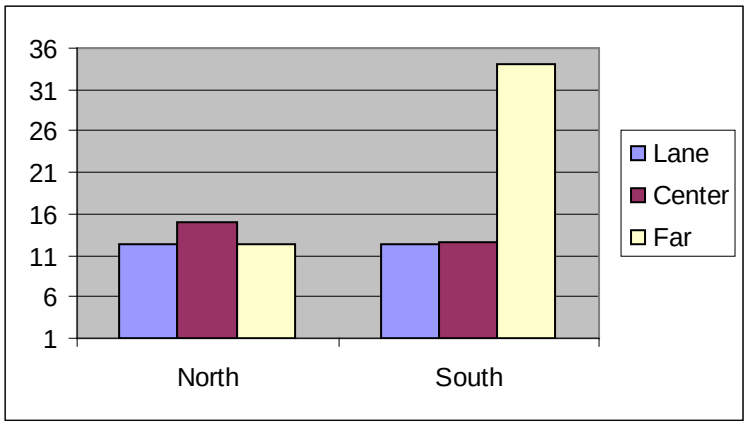

Figure 7. Water used (gal/dy/cow) at water troughs located in different selections of a 2-row freestall building.

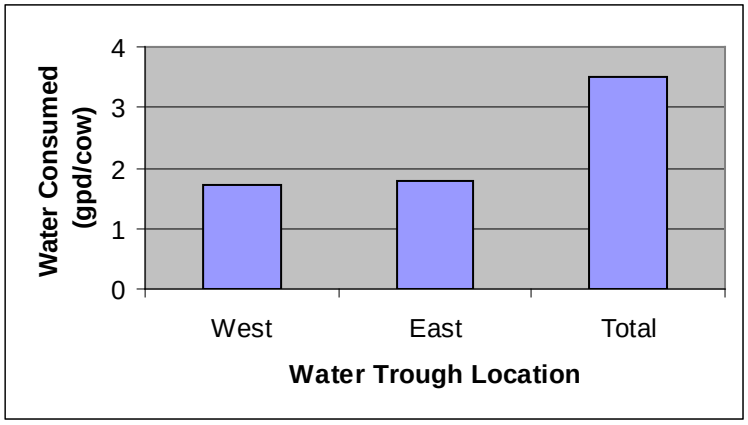

Figure 8. Water used at water troughs located at milk parlor exit lanes.