Stall Selection Behavior of Lactating Cows and Effects of Cow Characteristics on Them in Two-row Free Stall Housing

メタデータ	言語: eng 出版者: 公開日: 2019-03-22 キーワード (Ja): キーワード (En): Cow, Free stall, Lying behavior, Stall location, Stall selection 作成者: 早坂, 貴代史, 加茂, 幹男, 河本, 英憲, 下名迫, 寛 メールアドレス: 所属:
URL	https://doi.org/10.24514/00001931

Stall Selection Behavior of Lactating Cows and Effects of Cow Characteristics on Them in Two-row Free Stall Housing

Kiyoshi HAYASAKA[1)], Mikio KAMO, Hidenori KAWAMOTO and Hiroshi SHIMONASAKO

Department of Animal Feeding and Management

[1)] National Agricultural Research Center for Western Region

Abstract

Studies were conducted of 16 free stall utilization by 15 lactating Holstein cows in the temperature range of the thermo-neutral zone to determine cows' selection qualities and cows' characteristics for stall location. The free stall barn observed had two head-to-head rows with 8 stalls each. Stall location chosen and lying behavior were recorded at one minute intervals for six days. Daily mean lying time for each cow and for each stall were subjected to principal component analysis. The first principal component with a 27% contribution was the differences in use of either interior or end stalls of the rows, and the second with a 23% contribution was the differences in use of either the east (edge of the barn) or the west (center of the barn) stalls. The third and fourth components could not be clearly accounted for. Cows that used interior stalls rather than stalls at the end of rows tended to be characterized as cows of an older age and heavier body weight. Cows that used the east stalls (near the start point of feeding) longer than the west stalls (near the end point of feeding) were characterized as cows of a higher social order.

Key words: Cow, Free stall, Lying behavior, Stall location, Stall selection

Introduction

The lying behavior of cows in a free stall (FS) housing system generally occurs in the stalls, and rarely in the alleyways. This is influenced by a variety of factors such as cow characteristics (social order, age, etc.)[2-4,12)], housing system (stall structure, location and bedding, etc.)[1,4-6,9,12)], management (crowding density, feeding, etc.)[3,10,11,12)] and environment (season, etc.)[11,12)].

Among the factors contributing to FS, the qualities that motivate cows to choose their stall location have been only studied qualitatively so far, and thus their quality size and the relative importance of selection qualities have not been clarified in detail. Therefore, certain small factors might have been overlooked. There is also little information about the relationship between selection qualities and cow characteristics such as social order and age, because the selection qualities that have been studied to date have been qualitative ones.

In order to examine these problems in a previous paper[4)], three stall selection qualities that ranged from thermo-neutral to hot temperatures were studied by using principal component (PC) analysis by which each quality factor was quantitatively detected. However, the study allowed the cows to select stalls easily because the observations were performed not for 24 hours but at a fixed time during the day, and clear relationships during a 24-hour period between quality factors and cow characteristics were not shown.

Therefore, to consider increased efficiency of stall use and reasonable stocking density (stalls needed per cow), this study has been made to detect some of the selection qualities for FS location quantitatively by means of PC analysis by using the daily lying time for each FS with each cow in the temperature ranges of the thermo-neutral zone. This study has further highlighted the relationships between the selection qualities and cow characteristics.

Materials and Methods

A group of 15 lactating Holstein cows was used and maintained in a FS barn at the former National

Received 2001. 10. 25

Present Address: 768 Senbonmatsu, Nishinasuno, Tochigi 329-2793 Japan
[1)] Kawai, Ohda, Shimane, 694-0013 Japan

Grassland Research Institute. This group consisted of 11 cows (Nos. 1-11) introduced from the headquarters of the National Livestock Breeding Center 10 months before the study and four primiparous cows (Nos. 12-15) introduced as heifers from Hokkaido (Table 1). The cows had no experience of being kept in this barn and were moved there soon after calving. Correlations between cow characteristics are highly significant (r=0.55 ~ 0.81), except that correlations between daily milk yield and the other characteristics, or body weight and dominance value (DV) are not significant (r=-0.16 ~ 0.27).

The shady northeast FS area (pen) observed in the barn had two head-to-head rows of respective 8 stalls with a floor space of 222 m^2 (Fig. 1). The pen had 16 individual feed troughs along the central drive-through alley, two water troughs at both sides of the rows, a concentrates feed station (CFS) at the center of the north row and a salt feeder on the east side of the stall alley. An inverse L-shaped brush, which was used to scrub the cows' bodies, was installed at the fence of the west cross alley. The feed alley on the south side was 3.7 m wide, and the stall alley on the north side was 2.7 m wide.

Table 1. Cow characteristics in the herd observed

Cow No.	Age (month)	BW[a] (kg)	MY[b] (kg)	DV[c]	Days post-partum[d]	Stay in pen[d](day)
1	113	724	19.9	0.57	174	174
2	113	745	30.4	0.71	216	216
3	103	666	34.6	0.29	121	121
4	102	670	34.0	0.43	138	138
5	101	702	24.9	0.86	259	259
6	99	689	31.4	0.36	100	100
7	90	740	35.5	0.43	186	186
8	86	673	39.4	0.57	119	119
9	70	776	37.2	0.43	132	132
10	70	744	33.4	0.36	137	137
11	65	902	22.9	0.21	210	210
12	34	586	24.2	0.29	199	24
13	30	542	19.0	0.07	58	24
14	29	566	31.2	0.14	42	24
15	29	538	28.0	0.43	34	24
Average	76	684	29.7	0.41	142	126
sd	32	98	6.3	0.21	66	76

Note [a] Mean body weight before and after each observation period
[b] Daily mean milk yield through observation periods
[c] Dominance value
[d] At the first day of obeservation periods

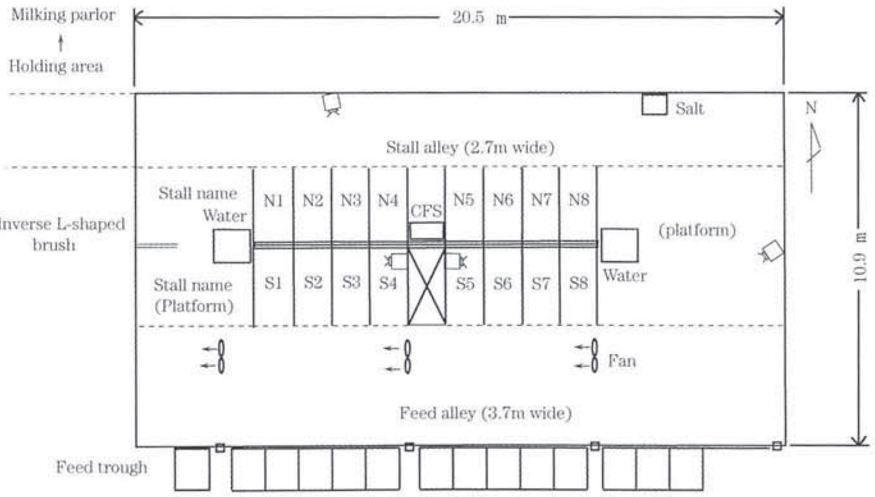

Fig. 1. Overhead view of observation pen in which the herd was kept
Note : CFS : Concentrates feed station : Camera mounted

Each stall had a brisket board and Michigan type side partitions with 6% slope. The dimensions of the body space area in the stalls were 120 cm wide by 168 cm long, but end stalls such as N1, N8, S1, and S8 (Fig. 1) and stalls without an adjacent stall on one side such as N4, N5, S4, and S5 (Fig. 1) were 113 cm wide because of the presence of side curbs. Stalls N4, N5, S4, and S5 did not have a side lunge space for the cows' head on one side.

After a 7-day adjustment period, observations on a 24 hour basis were made for three days from October 11 to 13, 1998, when compacted soil was used as the stall base, and for the other three days from October 21 to 23, when rubber chip mats were used. Moreover, prior to this, observations of how cows Nos. 1-11 had used these stalls had been made for two consecutive days immediately before the introduction of Nos. 12-15 in order to examine the effects of seniority on stall selection behavior. Estrous cows were not used during these observation periods.

Composts as thin as 1 cm (about 0.022 m^3 per stall) were regularly placed as a bedding material in the stalls and levelled once a day. The air temperature and relative humidity 2.2 m above the central ground of the pen averaged 14.1℃ and 86% during the observation periods, and these conditions were within the range of the thermo-neutral zone.

An automatic continual mixing feeder was used to feed a total mixed ration (TMR), and the CFS to feed a commercial formula. The TMR feeding was five times daily at 9 : 15, 13 : 15, 16 : 15, 19 : 15, and 22 : 15, and started westward from the east-end feed trough. Rate of residuals to feedings averaged 14.1% on a dry matter basis. Daily 2-5 kg of formula feed at the CFS were administered according to individual milk yield and all were ingested. Drinking water and salt licks were supplied *ad libitum*. The cows were removed from the barn area to a milking parlor twice daily, once from 8 : 45 to 9 : 10 and once from 18 : 00 to 18 : 20, and an automatic alley scraper was operated five times daily to collect manure.

Observations were made by the use of two CCD cameras with super-wide lenses mounted on the ceiling above the pen and two with wide lenses which covered dead angle areas (Fig. 1). The pen was always lighted so that behavior could be recorded during the night period.

The lying and eating behavior of each cow was observed at one or two minute intervals with a time-lapse video because of the fact that the perspective switched between four camera reflexes at 30 second intervals, and recorded every one minute. The cows were identified by numbers painted on their flanks and from photos of both sides of their bodies. Daily lying time and frequency of lying bouts for each cow were calculated from these observations. Daily eating time was totaled according to three position groups of the 15 feed troughs.

Milk was weighed at each milking throughout the observation periods, and body weights were taken at the beginning and end of each observation period in order to calculate their average.

The DV of each cow, expressed as the ratio of the number of subordinate cows to the total number of relationships of that cow (= total cows − 1=14), was calculated from 492 competitive or agonistic behavior incidents that occurred around feed bunks and other locations during observation periods. The agonistic behavior unit consisted of threatening, displacement (butting) and avoiding[8]. The outcome of any agonistic interaction resulted in 76 uni-directional relationships, 11 bi-directional ones with prevalence of one cow of a pair, 5 bi-directional ones with equivalence of both cows of a pair and 13 absence of observed dominance relationships out of a total of 105 pairs. The DV ranged from 0.07 to 0.86 with an average of 0.41 (Table 1).

In a manner similar to that of a previous paper[4], PC analysis[7] using the variance-covariance matrix was performed in relation to daily lying time in each stall per cow in order to determine some stall selectivity. The Pearson's and partial correlation coefficients between principal component scores and cow characteristics were calculated to examine the effects of cow characteristics on stall selectivity.

Relationship between DV of cows and position of feed troughs was analyzed by the chi-square test to confirm the reason that high-DV cows tended to use the east stalls.

Results

No difference was found in stall selectivity between the two stall base materials of soil and rubber chip mats because no PC could extract the quality of stall base materials from PC analysis by tabulating data according to the two stall base materials. Six-day pooled data were, therefore, subjected to the analysis.

Daily lying time per cow averaged 646 min. (383-847 min.), not including lying time in the alleys (Table 2). Daily frequency of lying bouts averaged 8.1 times (2.8-13.5 times). Stall utilization was examined by analyzing the daily lying time because the Pearson's correlation coefficients (r) between daily lying time per stall and daily frequency of lying bouts per stall was significantly ($P< .01$) high with a value of 0.85.

Table 2 shows the daily mean lying time for each stall and for each cow. Daily lying time differed between individuals, and the selection of stall location seemed to be clear.

The results of PC analysis of the data from Table 2 provided four PCs with more than a 10% proportion (Table 3). The first PC provided integrated characteristics which were broken down into two categories of interior

Table 2. Daily mean lying time (min.) per cow for each stall and for each cow through six-day observations

	Stall name	Stall alley side								Feed alley side								Total in stalls	Lying on alleys	Total
		Northwest side				Northeast side				Southwest side				Southeast side						
		N1	N2	N3	N4	N5	N6	N7	N8	S1	S2	S3	S4	S5	S6	S7	S8			
Cow No.	1			38				54	29		242	54	49		74			540	28	568
	2	25	26		14	96	47	133	238	40		84	26	47				775		775
	3		39	110	15		14	3	7		159	308	73		17			745		745
	4			29	5	85		30	65	20	56	15	6	118	77		10	516		516
	5		104			14	307	45	69		30	1			71			640		640
	6		104	3			54	22				32	30		23	82	34	383	332	715
	7		66	96	14		9	112	5		44	19			142	181	12	699		699
	8		1	34		12	58	83	40		19	19			224	92		581		581
	9		73	21			55	173	35			64			14	142		577	208	785
	10			18	25	37	204	138	155		46			10	18	34	33	717		717
	11		2	34				32		73	348	145			37	125	52	847		847
	12	115	42	36	305	103		7					22					628		628
	13	186	24	22	85	27				212	16	25	71	45				712		712
	14	10	126	54	212	57	2	30	8	20			133	61				713		713
	15	257	4	22	24	36	31	15					16	8	7	54	149	624		624
	Average	39	41	34	47	31	52	58	43	24	64	51	28	19	47	47	19	646	38	684

Table 3. Eigenvectors and eigenvalues of covariance matrix

Stall name	Principal component No. 1	No. 2	No. 3	No. 4	Position of stalls
		Eigenvector			
N1	− 0.34	− 0.28	− 0.25	− 0.04	Northwest, end
N2	− 0.10	0.05	0.03	− 0.23	Northwest, interior
N3	0.08	− 0.11	− 0.04	0.01	Northwest, interior
N4	− 0.44	− 0.35	0.20	− 0.17	Northwest, end
N5	− 0.18	− 0.03	0.17	0.20	Northeast, end
N6	− 0.05	0.55	0.26	− 0.64	Northeast, interior
N7	0.06	0.32	− 0.04	0.34	Northeast, interior
N8	− 0.03	0.33	0.42	0.45	Northeast, end
S1	− 0.05	− 0.19	0.03	0.13	Southwest, end
S2	0.64	− 0.31	0.15	− 0.23	Southwest, interior
S3	0.40	− 0.24	0.33	0.10	Southwest, interior
S4	− 0.07	− 0.17	0.16	− 0.01	Southwest, end
S5	− 0.07	− 0.03	0.10	0.23	Southeast, end
S6	0.15	0.19	− 0.37	0.02	Southeast, interior
S7	0.17	0.11	− 0.52	0.08	Southeast, interior
S8	− 0.02	− 0.04	− 0.18	− 0.08	Southeast, end
Eigenvalue	17117	14249	7183	6373	
Proportion (%)	27	23	12	10	
Cumulative proportion (%)	27	50	62	72	

stalls with large PCs and end stalls of rows with small PCs, and this component contributed 27% of the total information. The second PC with a contribution of 23% was based on differences in use of the east stall area with large PCs and the west stall area with small PCs. The qualities of the third and fourth PC were uncertain.

Table 4 shows the first to fourth PC scores of each cow and stall selection qualities of cows. Interior stalls were used more than end stalls as the first PC scores increased: Nos. 1, 3 and 11 showed a tendency to prefer an interior stall, but Nos. 12-15, which were newly introduced, showed the opposite tendency. East stalls around the edge of the barn were used more than west stalls in the central vicinity of the barn as the second PC scores increased: Nos. 5 and 10 showed a tendency to use east stalls longer than west stalls, although Nos. 3, 12 and 13 showed the opposite

Table 4. Component scores of each cow and stall selection qualities

Cow No.	Principal component score				Stall selection qualities[a)]
	No. 1	No. 2	No. 3	No. 4	
1	1.11	− 0.40	0.15	− 0.05	Interior stalls
2	− 0.42	0.86	1.75	0.67	End or east stalls
3	1.45	− 1.22	1.09	− 0.61	Interior or west stalls
4	− 0.17	0.01	0.42	0.16	Neither trend
5	− 0.20	1.64	0.65	0.18	East stalls
6	− 0.07	0.26	− 0.55	− 0.36	Neither trend
7	0.69	0.53	− 1.90	− 1.32	Interior stalls
8	0.52	0.94	− 1.36	− 0.60	Interior or east stalls
9	0.33	0.94	− 0.71	− 0.62	East stalls
10	− 0.08	1.52	0.76	0.69	East stalls
11	1.94	− 0.90	− 0.51	0.60	Interior or west stalls
12	− 1.72	− 1.17	0.48	− 0.76	End or west stalls
13	− 1.10	− 1.43	0.12	1.46	End or west stalls
14	− 1.32	− 0.94	0.96	− 1.70	End or west stalls
15	− 0.95	− 0.64	− 1.37	2.26	End stalls

Note [a)] judged from Nos. 1 and 2 principal component scores

Table 5. Simple correlation coefficients (r) between principal component scores and cow characteristics (n=15)

Cow characteristics	Principal component score			
	No. 1	No. 2	No. 3	No. 4
Age (month)	0.60* (0.44)[b)]	0.51 (- 0.38)	0.16 (0.24)	- 0.19 (0.24)
BW (kg)	0.77** (0.45)	0.43 (0.19)	-0.17 (- 0.30)	- 0.12 (0.18)
MY (kg)	0.16 (- 0.12)	0.48 (0.55)	-0.22 (- 0.11)	- 0.44 (- 0.57)
DV	0.14 (- 0.30)	0.73** (0.61)	0.05 (- 0.26)	0.06 (0.39)
Days postpartum	0.34 (- 0.38)	0.41 (- 0.17)	0.20 (0.25)	- 0.15 (- 0.51)
Days of stay in pen[a)]	0.63* (0.19)	0.61* (0.18)	0.09 (0.09)	- 0.05 (0.09)

Note [a)] shows seniority * P< .05 ** P< .01

[b)] partial correlation coefficient between a principal component score and any of cow characteristics

tendency.

As mentioned above, the PC scores of each cow show the quantitative significance of stall selection. Hence, simple and partial correlation coefficients between PC scores and cow characteristics in Table 5 showed that cows of an older age (P< .05) and heavier body weight (P< .01) tended to use interior stalls rather than end stalls. The coefficients also showed that cows of higher ranking (P< .01) used east stalls rather than west stalls.

High-DV cows tended to use east stalls and to use significantly (P<0.01) the east feed troughs with higher priority to TMR eating (Table 6).

Prior observations of how Nos. 1-11 had used the stalls had been made for two days before the introduction of Nos. 12-15, since the later introduction of Nos. 12-15 into the pen seemed to affect stall selectivity, particularly in terms of seniority.

As a result, the daily lying time of the 11 cows (Nos. 1-11) averaged 582 min., of which 16% was in the northwest stall area of N1-N4, showing the least stall utilization in the other stall areas, whereas after introducing Nos. 12-15, the use of N1-N4 increased to 25%, of which 63% was accounted for by the use of Nos. 12-15.

Table 6. Eating time (min.) by feed trough positions in the higher and lower cow groups of DV

Feed trough position[a)]	DV	
	Higher (n=8)	Lower (n=7)
East side (n=5)	97 (40%)	62 (25%)
Central (n=5)	70 (29%)	93 (36%)
West side (n=5)	75 (31%)	101 (38%)
Daily eating time	242 (100%)	256 (100%)

Note [a)] TMR are dispensed in order from east side

Discussion

There were 49 observations of cows standing in alleys tried to push other cows on stalls into alleys or to make recumbent cows stand up throughout the observation periods. These cows, however, appeared to exert little influence on lying behavior since the ratio of observations to daily mean lying bouts per cow was as low as 2.1%. The acts of cows evicting a FS occupant have also been observed by Friend *et al.*[3].

A number of observations have been made of cows preferring centrally located or interior stalls to end stalls because of the disturbance caused by cow traffic or by the vicinity of the water trough[4,6,9,12]. A similar finding was confirmed as the biggest factor affecting stall utilization in this study, in which end stalls consisted of stalls of not only N1, N8, S1 and S8 but also N4, N5, S4 and S5 from the first PC (Table 3). The 7 cm narrower width of end stalls than interior stalls might have made them uncomfortable, because of low utilization of stalls S4 and S5 which could not have cows passing on one side (Fig. 1). Stalls of N4, N5, S4 and S5 might have been uncomfortable stalls because of no side lunge space for the cow's head on one side.

Trends in the selection of either east or west stalls by cows from the second PC might have been attributed to three main causes.

One might be the difference in access time to feed troughs at feeding since the automatic continuous mixing feeder started to feed the TMR westward from the east end feed trough and finished after 10 min.: High-DV cows seem to have used east stalls so as to get TMR as fast as possible (Tables 5, 6) .

Another might be the difference in air condition[4]: the east stall area at the end of the barn might have had better air quality with more fresh air and less air contaminant than the west stall area near the center of the barn, because the fresh air from fans was introduced from the east side of the barn and then forced to move westward (Fig. 1).

The other might be due to the fact that low-DV or newly introduced cows tended to use west stalls that are subject to disturbance by the passage of cows or people to the milking parlor. Morita *et al.*[5] reported that the comings and goings of cows around gateways of barns cause low stall utilization.

The consideration of factors which influences the use of these stalls has possible application to increase the use of unpopular stalls.

Usui *et al.*[11] have shown that 24-hour stall use opposite to stalls with high use was low in low stocking density such as 3.1 stalls/cow, but that such a tendency was not found in relative high density such as 1.4-1.5 stalls/cow. Also in the present study of 1.1 stalls/cow, the relation in use between mutually opposite stalls was not extracted as a PC.

The results in Table 5 indicate that cows of an older age, heavier body weight, higher seniority or higher social order (DV) tended to use more comfortable and favorable stalls, such as the interior or east stalls mentioned above.

The reason why seniority especially affected stall utilization in this study seems to have been the later introduction of Nos. 12-15 into the pen. Prior observations showed that the northwest stall area was used least frequently (16% of the total) by Nos. 1-11 cows, but showed that the new comers Nos. 12-15 often used the unpopular northwest stall area longer than senior cows.

The data on stall selection and cow characteristics in this paper mostly confirmed the previous observations[4] which showed that the interior stalls and the southeast stalls were often used and that cow characteristics might have affected these stall selections. However, the previous observation features that the selection of the south stalls near the feed troughs in which blowers were operating, were the most important factor in stall utilization characteristics in a comparatively high temperature environment.

Recommended number of stalls per cow are reported to be from 0.7 where stalls are used without waste and evenly to 1.0[3]. However, at least 1.0 stalls per cow are recommended, because stalls were not used evenly but selectively and 50% of stall selectivity was quantitatively extracted as two qualities on the condition of 1.1 stalls per cow in this study.

The results of this study are for one group of 15 cows with wide ranges in age, at different stages of lactation and with different histories, and therefore the relationship between selection qualities and cow characteristics might have been observed clearly, perhaps compared with those of some groups of cows categorized according to milk production and so on. It is necessary to study further the effects of cow characteristics on stall utilization by using herds of cows of various compositions.

References

1) Albright, L. D. and Timmons, M. B. (1984). Behavior of dairy cattle in free stall housing. Trans. ASAE., 27: 1119-1126.

2) Friend, T. H. and Polan, C. E. (1974). Social rank, feeding behavior, and free stall utilization by dairy cattle. J. Dairy Sci., 60: 108-116.

3) Friend, T. H., Polan, C. E. and McGilliard, M. L. (1977). Free stall and feed bunk requirements relative to behavior, production and individual feed intake in dairy cows. J. Dairy Sci., 60: 108-116.

4) Hayasaka, K., Dohi, T. and Kawamoto, H. (2000). The stall utilization of lactating cows in the daytime in a two-row free-stall barn. Jpn. J. Livest. Management., 35: 65-71. (in Japanese)

5) Morita, S., Sugita, S., Yaguchi, T. and Hoshiba, S. (1999). Stall layout evaluated for its effect on the cows' use of trough and stalls in free-stall housing. J. Rakuno Gakuen Univ., 24(1): 81-87. (in Japanese)

6) Natzke, R. P., Bray, D.R. and Everett, R. W. (1982). Cow preference for free stall surface material. J. Dairy Sci., 65: 146-153.
7) Okuno, T. (1982). Ouyou toukei handobukku (Applied statistics handbook) 3rd ed., Youkendo, Tokyo, 328-377. (in Japanese)
8) Sato, S., Kondo, S., Tanaka, T. and Kusunose, R. (1995). Kachiku koudou zusetu (Explanatory diagrams of animal behaviour). Asakura shoten, Tokyo, 57-58. (in Japanese)
9) Sugita, S. (1999). Evaluation of cattle management systems by duration of lying period. Master Thesis, Department of Dairy Science Research, Rakuno Gakuen University Graduate School, 1-99. (in Japanese)
10) Sugita, S., Morita, M., Kobari, T. and Hoshiba, S. (1999). The effects of the density of cows in free-stall housing on duration of the lying periods. J. Rakuno Gakuen Univ., 24: 39-43.
11) Usui, M., Sakazume, A., Morita, K., Oobu, Y., Kawana, T. and Matsuzawa, Y. (1992). Effects of season and stocking density on the behavior of lactating cows under free-stall housing. Jpn. J. Livest. Management, 28: 55-61.(in Japanese)
12) Wierenga, H. K. and Hopster, H (1990). The significance of cubicles for the behavior of dairy cows. Appl. Anim. Behav. Sci., 26: 309-337.

対頭二列式フリーストール牛舎における泌乳牛によるストール選択特性とそれに関わる個体属性因子

早坂貴代史[1)]・加茂幹男・河本英憲・下名迫寛

家畜生産管理部
[1)] 近畿中国四国農業研究センター

摘　要

熱的中性圏におけるホルスタイン種泌乳牛 15 頭のフリーストール（FS）の横臥による利用性を調査し，主成分分析による選択特性とそれに関わる個体属性因子を検討した。調査施設は床面積 222m^2 で対頭二列式の 16 の FS を設備し，南側に給飼槽が設置されている。1 分間隔でビデオカメラによる計 6 日間記録し，各個体の横臥したストール位置を集計した。各牛各ストール別の平均日横臥時間を分散共分散行列による主成分分析を行った結果，第一主成分は列央域と列端のストールに分けられる総合特性値を示し，27% の寄与率を占めた。第二主成分は牛舎中央付近の西側と端付近の東側のストールに区分される総合特性値を示し，23% の寄与率を占めた。第三，第四主成分は特性としての意味づけはできなかった。個体の第一，第二主成分スコアと個体の属性値との単相関から，列央域ストールは列端ストールに比べ，特に高齢（P< .05），体重の重い（P< .01）個体が横臥し，牛舎の端に近い東側ストールは，牛舎中央付近の西側ストールに比べ，特に社会的順位が高い（P< .01）個体が横臥する傾向が認められた。

キーワード：乳用牛，フリーストール，横臥行動，ストールの位置，ストール選択