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FEEDING PRACTICES IN SOUTH DAKOTA CATTLE FEEDLOTS

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Summary

During March 1989, a mail survey of South Dakota cattle feedlot managers was undertaken. The purposes of the survey were to characterize the nature of the cattle feeding industry in South Dakota and to determine the relationships between (i) each of size-of-feedlot and geographic location within the state and (ii) management practices followed by cattle feeders. Direct relationships exist between size-of-feedlot and the following: (1) rate of feedlot utilization in each quarter of the year ($P<.10$); (2) percentage grain relative to roughage in both growing and finishing diets ($P<.10$); (3) percentage of feedlots feeding high moisture grain, cracked grain, and ground hay ($P<.01$); (4) percentage of feedlots using rumen stimulants and growth implants ($P<.01$); and (5) percentages of managers testing feeds for nutrient composition, using feed scales to control feeding rates, maintaining feed records for separate pens of cattle, and hiring consultants to formulate rations ($P<.01$). On the other hand, inverse relationships exist between size-of-feedlot and the following: (6) days on feed for heifer calves, yearling steers, and yearling heifers ($P<.10$); (7) slaughter weight of steers ($P<.10$); (8) percentage of home-raised hay and dry grain ($P<.10$); (9) percentage of feedlots feeding ground grain and unprocessed hay ($P<.01$); and (10) percentage of feedlots not using feed additives ($P<.10$). Average days on feed for steer and heifer calves are lower ($P<.05$) in the West than in other areas of the state. More milo is fed in the West; more barley is fed in the North Central region; and less home-raised corn silage and haylage are fed in the West than in other regions ($P<.05$).

(Key Words: Feedlot, Survey, Size, Technology, Management Practices, Diet Ingredients.)

Introduction

The cattle feeding industry has undergone tremendous change in recent years. There has been a shift in the location of the industry from small, farmer feedlots located in the corn belt toward larger, more specialized feeding operations located in the central and southern plains regions of Nebraska, Kansas, Colorado, Oklahoma, and Kansas.

Tremendous technological advances have been associated with this shift in size and location of the feeding industry. Growth promotants, feed additives, feed testing, the electronic media, and microcomputers have radically impacted the industry.

Cattle feeding is an important segment of the South Dakota economy. Approximately 600,000 fed cattle are marketed annually. In order to more effectively plan and conduct extension, research, and teaching activities, a more thorough understanding of the cattle feeding industry in South Dakota is needed.

The objectives of this research were to characterize the nature of the cattle feeding industry in South Dakota and to determine the relationships between (1) each of size-of-feedlot and geographic location within the state and (2) the feeding and other management practices followed by cattle feeders. In this paper, that part of the research dealing with steer and heifer feeding practices is covered. For a comprehensive report of the study findings, contact the senior author, SDSU Economics Department, Box 504A, Brookings, SD.

Materials and Methods

During March 1989, a mail survey of South Dakota cattle feedlots was conducted. The mail questionnaire was sent to the managers of feedlots with a capacity of 499 head or less (a 12% sample) and all the state's

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150 feedlots with a capacity of 500 head or more. Taking into account feedlots reported to be no longer in operation, the overall survey response rate was 35.5%. This includes 145 and 30 usable questionnaires for cattle finishing and cattle backgrounding operations, respectively. For the cattle finishing feedlots, the response rate for <500 head capacity feedlots was about 17%; for >500 head capacity feedlots, it was 45%. The responses cover about 1.4% of the state's feedlots with <500 head capacity and 32% of the state's feedlots with >500 head capacity.

The cattle finishing survey responses were analyzed for all 145 feedlot respondents collectively and then by region within the state and size-of-feedlot. Five regions were defined as shown in Figure 1. Size-of-feedlot was defined by feedlot design capacity (total reported feed bunk space divided by 1.5 foot per head), and four feedlot size categories were established:

- "Small" with < 200 head;
- "Intermediate I" with 200-999 head;
- "Intermediate II" with 1,000-2,499 head; and
- "Large" with 2,500 head or more.

Two types of averages for various feedlot characteristics and management practices were calculated: (1) "feedlot" averages, in which the unit of analysis is the individual feedlot, and (2) "head-day" averages, in which the unit of analysis is the estimated average number of head of cattle on feed during 1988. In calculating the latter, of course, greater weight is given to larger feedlots. Readers with a primary interest in feedlot managers will find the "feedlot" averages of most interest. Those with a primary interest in cattle feeding industry economics will find the "head-day" averages of greater interest.

The statistical significance of differences among regions and among sizes-of-feedlot categories was determined using the standard Pearson Chi-Square statistic or the GLM (general linear model) LSMEANS test and an associated Waller-Duncan test. Resulting from these tests was a determination of whether the value for a particular variable for one or more regions (or size-of-feedlot categories) differs significantly from the values for that same variable in other regions (size-of-feedlot categories).

In the ensuing discussion, attention is drawn to all pertinent instances in which differences were shown

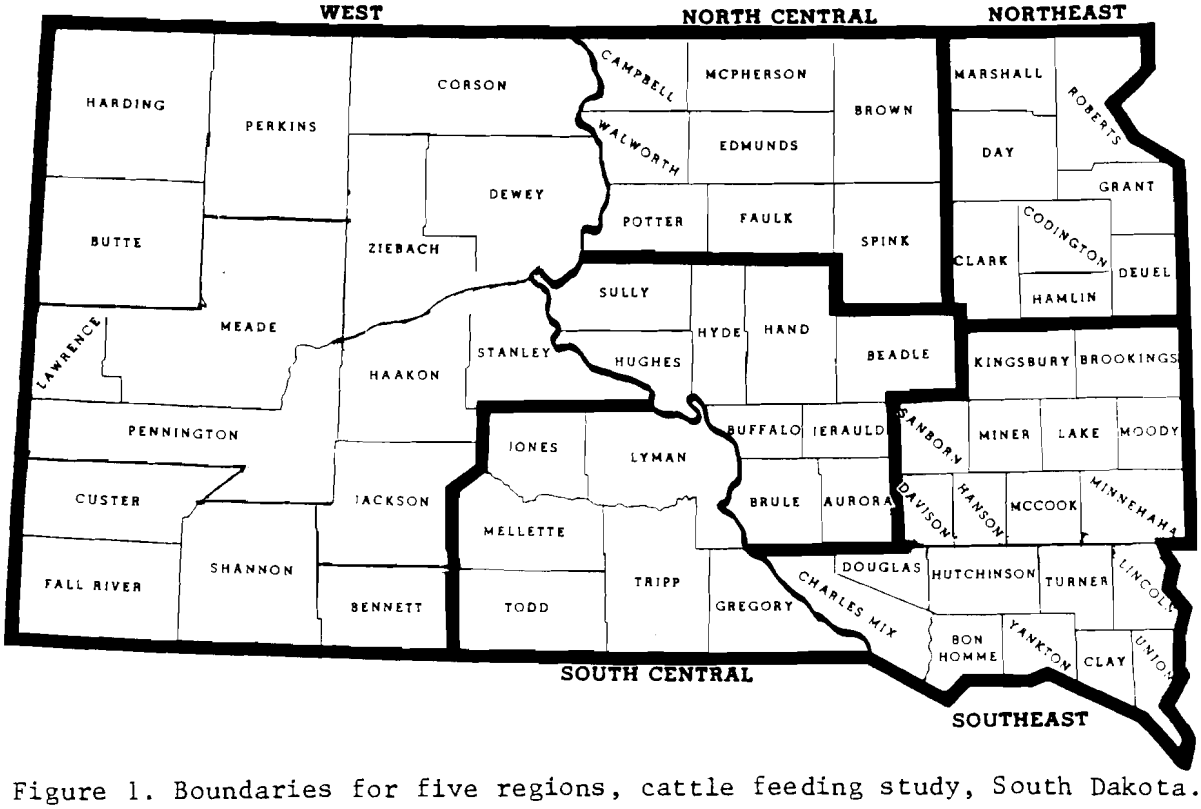

Figure 1. Boundaries for five regions, cattle feeding study, South Dakota.

to be statistically significant. Sometimes instances of no statistically significant differences are noted in the text. If so, the test of significance is always $P<.10$. If mention about the significance of differences for a particular variable is omitted in the text, one should conclude that the differences among the means being tested are insignificant for $P<.10$.

Results and Discussion

The design capacities of the 145 feedlots studied range from 20 to 12,000 head and average 900 head per feedlot (Table 1). By region, the mean feedlot sizes range from 690 in the Southeast to 1,585 in the West. Within-region variations are sufficiently great, however, that differences among regions in the mean feedlot design capacities are not collectively significant.

On the average throughout 1988, the reported feedlot utilization was 72% to 80% of design capacity, depending on whether calculations are based on averages with respect to feedlots or head-days. The quarter of highest utilization is January-March (average utilization rates of 84% to 90%, respectively) and of lowest utilization is July-September (54% to 67%). About 62% of all feedlot managers reported their 1988 utilization to be typical of the past 5 years. Almost identical percentages of managers reported their utilization rates in 1988 to be either higher or lower than typical.

Differences among regions in quarterly feedlot utilization rates are not statistically significant. Differences among sizes of feedlots in quarterly utilization rates, however, are statistically significant ($P<.05$ for the first three quarters and $P<.10$ for the fourth quarter), with a direct relationship between size-of-feedlot and rate of utilization. Rates of feedlot utilization in "large" feedlots are from 20 to 35 percentage points higher than in "small" feedlots in the respective quarters.

Feeding practices

Days cattle on feed. Steer calves and yearling steers are reported to be on feed typically for averages of 208 to 229 days and 129 to 145 days, respectively, with the shorter average period lengths being head-day based and the longer period lengths feedlot-based (Table 2). Steer calves are typically kept on feed for 4 to 5 days longer than heifer calves and yearling steers for 10 to 13 days longer than yearling heifers.

The feeding periods are widely variant among feedlots, but generally they are somewhat greater than the normally recommended practice. At the long end of the ranges, about 25% of the feedlots keep steer and heifer calves on feed for 275 days or longer and 20% and 14% of feedlots keep yearling steers and heifers, respectively, on feed for 180 days or longer.

Differences among regions in typical average feeding periods are quite substantial, but only the average days that steer and heifer calves are on feed in the West (133 days each) are significantly ($P<.05$) different from those in the other regions. In general, feeding periods vary inversely with size-of-feedlot, with the clearest statistically significant ($P<.10$) pattern being for heifer calves, namely, average days of 255, 229, 208, and 176 for "small," "intermediate I," "intermediate II," and "large" feedlots, respectively. For both yearling steers and yearling heifers, differences in the average feeding period among sizes-of-feedlot are statistically significant ($P<.01$), with the greatest differences being between "small" feedlots in which the average days on feed exceed 190 and the "intermediate II" feedlots in which the average days on feed are less than or equal 125. While the pattern for

TABLE 1. NUMBER AND SIZE OF FEEDLOTS BY REGION IN SOUTH DAKOTA, 1989 CATTLE FEEDER SURVEY

Region	Number of feedlots	Design capacity of feedlot (head)	
		Mean	Range
West	4	1,585	135 - 3,000
South Central	20	1,220	20 - 12,000
Northeast	22	1,145	85 - 5,335
North Central	16	1,080	135 - 2,000
Southeast	83	690	30 - 5,335
State	145	900	20 - 12,000

TABLE 2. AVERAGE DAYS CATTLE ARE TYPICALLY ON FEED BY TYPE OF CATTLE AND REGION, SOUTH DAKOTA FEEDLOTS

Region	Average days on feed by type of cattle			
	Steer calves	Heifer calves	Yearling steers	Yearling heifers
West	133	133	110	115
North Central	203	206	123	121
South Central	201	210	121	120
Northeast	248	238	138	142
Southeast	241	237	159	135
State averages				
Feedlot-based	229	225	145	132
Head-days-based	208	203	129	119

steer calves is very similar to that for heifer calves, differences among size-of-feedlot categories in feeding period lengths for steer calves are not statistically significant.

Closely related to days on feed is the targeted finishing weight for animals placed on feed. The average (head-based) targeted finishing weights for steers and heifers in the feedlot are 1,220 lb and 1,100 lb, respectively. These weights, too, are somewhat greater than normally expected (e.g., one recent report indicates an average slaughter weight for steers in the Great Plains of 1,140 lb). The slaughter weights of cattle in "small" feedlots are somewhat higher than those for the other three size-of-feedlot categories. For steers, however, the differences (34-38 lb) are statistically significant ($P<.10$).

Grains versus roughages in cattle diets. Feedlot managers report an average of 34% to 39% grain--relative to the total dry matter weight of feed--in the diets of cattle during the growing period. At the extremes, 10% of the feedlots report less than 20% grain being fed during the growing period and 11% more than 60% grain.

The average percentages of grain in the total diets range from 27% in the South Central region to 45% in the West, but differences among regions are not statistically significant. A direct, statistically significant ($P<.10$) relationship exists between size-of-feedlot and percentage of grain in growing cattle diets, however, with about 10 percentage points difference between cattle in "small" and in "large" feedlots.

During the finishing period, the percentages of grain in cattle diets average 75% to 80% of total feed intake. At the extremes, 12% of the feedlots report feeding less than 60% grain during the finishing period and 20% of the feedlots more than 90% grain.

The average percentages of grain in the total finishing diets vary from 69% in the South Central region to 85% in the West, but interregional differences are not statistically significant. Size-of-feedlot differences are again statistically significant ($P<.10$), however, with the proportion of grain fed cattle in "large" feedlots being about 11 percentage points higher than that in "small" feedlots.

Types of grain fed. Total grains typically fed to cattle average 91-92% corn, followed by 3-4% barley, 2-3% milo, 1-2% oats, and 0.1-0.3% wheat. About 60% of the feedlot managers report corn as the only grain used in their cattle rations. As little as 20% and 30% corn are reported by two feedlot managers. The other grains individually represent more than 40% of total grains fed for only 3% of the feedlots for milo and 2% of the feedlots for barley. At the other extreme, the following percentages of feedlot managers report using none of the following grains in their rations: 79% barley, 83% oats, 94% milo, and 97% wheat.

The mean percentages of different grains fed to cattle do not vary significantly among regions or sizes-of-feedlot except for the following. (1) The 11.6% barley fed in the North Central region is significantly ($P<.05$) higher than the corresponding

percentage in any other region. (2) The 2.5% barley fed cattle in the West and in the South Central region and the 1.8% barley fed in the Southeast are significantly ($P<.05$) lower than the corresponding percentage fed in either other region. (3) The 15.0% milo fed in the West is significantly ($P<.01$) higher than the corresponding percentage in any other region. (4) The 4.1% oats fed in "small" feedlots, the 1.8% oats in "intermediate I" feedlots, the 0.2% oats in "intermediate II" feedlots, and the 0% oats in "large" feedlots differ significantly ($P<.05$) with each other.

Types of roughage fed. The following percentages of feedlot managers report feeding the respective types of roughages: 91% hay, 85% corn silage, 40% haylage, 17% grazing pasture, 8% grazing residues, and 13% other (oatlage and milo/sorghum/sudan silage).

The percentage of feedlots feeding corn silage differs significantly ($P<.01$) among size-of-feedlot categories, but not with a clear pattern relative to size-of-feedlot: 70% for "small" feedlots, 91% for "intermediate I" feedlots, 100% for "intermediate II" feedlots, and 67% for "large" feedlots. In addition, a statistically significant ($P<.05$) direct relationship exists between size-of-feedlot and the percentages of other roughages fed, ranging from 2% of "small" feedlots to 44% of "large" feedlots feeding other roughages.

Source of roughages and grains. The percentages of feeds typically home-raised (i.e., raised on the farm that has the feedlot) are as follows[4]:

- Corn silage: 97% to 99%;
- Haylage: 95% to 97%;
- Hay: 83% to 58%;
- High moisture grain: 75% to 53%; and
- Dry grain: 65% to 43%.

The percentages of feedlots that home-raise 100% of their feedstuffs are as follows: 95% corn silage, 94% haylage, 70% hay, 54% high moisture grain, and 40% dry grain. At the other extreme, the percentages of feedlots that home-raise none of their feedstuffs are as follows: 15% dry grain, 7% high moisture grain, 4% haylage, 4% hay, and 2% corn silage.

The mean percentages of home-raised roughages and grains do not differ significantly among regions or sizes-of-feedlot except as follows. (1) The percentages of home-raised corn silage (48%) and haylage (50%) in the West are significantly ($P<.05$) lower than in any other region. (2) A clear pattern of a statistically significant ($P<.01$) inverse relationship exists between size-of-feedlot and the percentage of home-raised hay, with a difference of over 40 percentage points in home-raised hay between the "small" and the "large" feedlots. (3) Statistically significant ($P<.01$) differences exist among sizes-of-feedlot in percentages of home-raised dry grain, with the percentages for the respective feedlot-sizes as follows: 91% "small", 65% "intermediate I," 35% "intermediate II," and 38% "large." (4) A statistically significant ($P<.01$) generally inverse relationship exists between the percentages of home-raised high moisture grain and size-of-feedlot, with the range of differences between "small" and "large" feedlots being about 40 percentage points.

Forms of feeds fed to cattle. About 90% of the feedlot managers report feeding dry grain and 57% high moisture grain. The relationship between the percentage of high moisture grain and size-of-feedlot is direct and statistically significant ($P<.01$), with the relative importance of high moisture grain 67 percentage points greater for "large" than "small" feedlots. Further, less than 12% of "small" and "intermediate I" feedlots use both dry and high moisture grain, whereas between 87% and 89% of "intermediate II" and "large" feedlots do.

The following percentages of feedlot managers report feeding dry grain in the following forms: 59% cracked, 44% ground, 36% whole kernel, 3% steam flaked, and 1.4% reconstituted. Only for cracked and ground grain do the percentages differ significantly ($P<.10$) for different sizes of feedlots. Cracked grain tends to be more common for larger feedlots, as evidenced by the following percentages of cracked grain use for different sizes-of-feedlots: 26% "small," 66% "intermediate I," 84% "intermediate II," and 80% "large." Ground grain, on the other hand, is most common with the "small" feedlots (63% of them feed ground grain) in contrast

[4]In the following pairs of average figures, the first one is calculated with feedlots as the unit of analysis and the second one with head-days as the unit of analysis.

with 38 to 40% for the other three size-of-feedlot categories.

The following percentages of feedlot managers report feeding hay in the following forms: 67% ground, 49% unprocessed, and 4% other (haylage, green chop). For both ground and unprocessed hay, the percentages differ significantly (P<.01) for different sizes-of-feedlots. Ground hay tends to be more common with larger feedlots, as evidenced by the following incidences of ground hay feeding for different sizes-of-feedlots: 26% "small," 78% "intermediate I," 96% "intermediate II," and 90% "large." The converse tends to hold with unprocessed hay: 84% "small," 46% "intermediate I," 7% "intermediate II," and 30% "large."

The following percentages of feedlot managers report feeding protein supplements in the following forms: 66% dry only, 18% liquid only, and 16% both dry and liquid. In general, patterns of relationship appear to exist between size-of-feedlot and the form of protein supplement fed, with smaller feedlots more commonly using dry protein supplement and larger feedlots using relatively more liquid protein supplement. However, the apparent patterns of difference are not statistically significant.

Feed additives and growth promotants. About 73% of the feedlot managers report the continuous use of rumen stimulants (e.g., Rumensin, Bovatec) and 59% the continuous use of growth implants (e.g., Ralgro, Compudose, Synovex) [Table 3]. Fewer than 14% of the feedlots report not using either rumen stimulants or growth implants.

Between about 45% and 70% of the feedlot managers report using, at selected times only, each of (1) antibiotics at therapeutic levels, (2) antibiotics at sub-therapeutic levels, and (3) coccidiosis control (e.g., Deccox, Bovatec, Amprollium). About 47% of the feedlot managers report not using antibiotics at sub-therapeutic levels, 40% not controlling coccidiosis, and 30% not using antibiotics at therapeutic levels.

For none of the various feed additives and growth promotants do incidences of usage differ significantly by region of the state. In several cases, however, usage levels are significantly related to size-of-feedlot.

Clear direct relationships exist between size-of-feedlot and the continuous use of (1) rumen stimulants, with 43 percentage points more for "large" than "small" feedlots (P<.01) and (2) growth implants, with 65 percentage points more for "large" than "small" feedlots (P<.01). A clear direct relationship also exists between size-of-feedlot and the use at selected times only of antibiotics at therapeutic levels, with 43 percentage points more for "large" than "small" feedlots (P<.01).

On the other hand, clear inverse relationships exist between size-of-feedlot and not using each of (1) rumen stimulants, with 29 percentage points more

TABLE 3. USE OF FEED ADDITIVES AND GROWTH PROMOTANTS SOUTH DAKOTA FEEDLOTS

Feed additive and growth promotant	Percent of reporting feedlots indicating feed additives and growth promotants		
	Used continuously	Used at selected times only	Not used
Rumen stimulants (e.g., Rumensin, Bovatec)	72.9	13.2	13.9
Growth implants (e.g, Ralgro, Compudose, Synovex)	59.1	29.5	11.4
Coccidiosis control (e.g., Deccox, Bovatec, Amprollium)	15.7	45.4	38.9
Antibiotics at sub-therapeutic levels	8.3	44.9	46.8
Antibiotics at therapeutic levels	.9	69.1	30.0

for "small" than "Intermediate I" and "large" feedlots (P<.01), (2) antibiotics at sub-therapeutic levels, with 23 percentage points more for "small" than "large" feedlots (P<.10), and (3) antibiotics at therapeutic levels, with 43 percentage points more for "small" than "large" feedlots (P<.01).

Other feed management practices. Feedlot managers indicate the following usage of six other feed management practices (Table 4): 64% test for nutrient composition at least once each year, 57% use feed scales to monitor and control feeding rates, 34% keep feed records for separate pens of cattle, 27% hire consultants to formulate rations, 14% use microcomputers to formulate rations, and 14% use microcomputers to keep feed records. A statistically significant direct relationship exists between use of the first four practices and size-of-feedlot (P<.01).

TABLE 4. OTHER FEED MANAGEMENT PRACTICES, SOUTH DAKOTA FEEDLOTS

	Percent of reporting feedlots that follow practice					
Management practice	Small	Inter I	Inter II	Large	State	Signif level
Feeds tested for nutrient composition at least once a year	40	66	84	100	64	.01
Feed scales used to monitor and control feeding rates	19	64	84	90	57	.01
Feed records kept for separate pens of cattle	7	25	65	90	34	.01
Consultants hired to formulate rations	14	14	61	50	27	.01
Microcomputers used for formulating rations	5	9	36	20	14	n.t.
Microcomputers used for keeping feed records	0	9	36	40	14	n.t.

n.t. = not tested statistically.