CORRELATIONS OF FIRST PERIOD AND SECOND PERIOD AVERAGE DAILY GAINS OF CATTLE FED ALL-CONCENTRATE RATIONS

by

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CHAPTER I

INTRODUCTION

Cattle feeders' profit margins have been declining rapidly, therefore ways of cutting costs are constantly being sought. One costly item to the feeder is slow gaining cattle. Their lower rate of daily gain means less profit is being made each day from the conversion of grain to beef. Too, the extra time required to obtain the desired finish on these animals costs the feeder in both extra interest on his investment and extra feed for maintenance. Evidence of a high positive correlation between the early short term gains and the later long term gains would enable the feeder to cull the slow gainers after the short period and replace them, hopefully, with faster gainers.

The objective of this study was to determine if there is any significant correlation between the early short term gains and the later longer term gains of cattle fed high concentrate rations.

Data analyzed in this study were collected from experiments conducted at Texas Tech Feedlot, Lubbock, Texas, and Texas Tech Research Farm, Amarillo, Texas, in which high concentrate rations were fed.

CHAPTER II

REVIEW OF LITERATURE

The literature contained limited references pertaining to correlations of gains made at different feeding periods by cattle.

Koger and Knox (1951) and Durham and Knox (1953) reported a statistically significant ($P<.01$) correlation of 0.173 for yearling gains and feedlot gains. Koger and Knox showed other correlations of 0.17 for growth on the range and feedlot gains, 0.04 for weaning weight and yearling gains, and 0.28 for weaning weight and feedlot gains. Knox and Koger (1946) reported a statistically significant ($P<.01$) correlation of 2.44 for starting weight and feedlot gain.

Hale et al. (1965) conducted two-period studies using first period lengths of 28 and 56 days. In the 28 day work, they reported decreased average daily gain from first period to second period of 0.62 and 0.10 for high and medium gaining, respectively, and an increase of 0.27 for the low gaining pens. In the 56 day work, decreases in average daily gains from first to second period were listed as 0.88, 0.75, and 0.32 for high, medium, and low gaining pens, respectively.

Maynard and Loosli (1965) stated in their text that feed requirement for maintenance is proportional to body size. Buchanan-Smith et al. (1966) reported a rumen pH of 4.0 to 6.1 for cattle fed all-concentrate rations.

CHAPTER III

MATERIALS AND METHODS

Data used in this study were collected from seven experiments involving 1,192 steers and heifers fed high concentrate rations. All the animals received at least 90% concentrate rations and most received 100% concentrate rations. The basic all-concentrate ration contained 89% milo, 10% cottonseed meal, and 1% vitamin A, salt and minerals. The high-concentrate ration contained the same proportion of concentrates with up to 10% hulls added.

A total of 37 treatments were administered in 93 pens; however in this study, each pen was considered as a separate treatment. In the analysis no distinction was made between steers and heifers.

The data were analyzed by a computer program written by Gary L. Gann, Graduate Student, Animal Husbandry Department, Texas Technological College, to obtain correlations between first period and second period average daily gain. Part of the program was written to remove the covariation due to treatment effect, in order to obtain only within or individual effects of the two period correlation.

First period average daily gain was computed from initial weight and midpoint weight and days. Midpoint was considered to be the weight taken nearest to fifty-six days on feed. Second period average daily gain was computed from midpoint weight and days on feed and final weight and days on feed. Total feeding periods varied from 116 to 190 days on feed.

CHAPTER IV

RESULTS AND DISCUSSION

Table I contains the 93 pen means of average daily gains for the first period and pen means of average daily gains for the second period. The pens are numbered consecutively from 1 to 93.

The overall mean of average daily gain for the first period was 2.86, and the overall mean of average daily gain in the second period was 2.44. This is a 0.42 pounds per day decrease in average daily gain from the first period to the second period.

Results presented in Table II are sums of squares and correlations of first period average daily gains and second period average daily gains. (Appendix Table 1 contains a list of the statistical formulas used to calculate the results in this table.)

The total uncorrected correlation (0.344865) is relatively high but not reliable since it contains both treatment effects and individual effects. The high correlation (0.580565) of treatment effects is highly significant ($P<.01$) statistically and indicates that the ration greatly affected the correlation between the two periods.

The within or individual correlation of 0.159286 is also highly significant ($P<.01$) statistically. It is closely related to the 0.173 correlation Durham and Knox (1953) reported for yearling gain and feedlot gain.

TABLE I

PEN MEANS OF AVERAGE DAILY GAINS FOR FIRST AND SECOND PERIOD

Pen Number	First Period	Second Period
1	2.68	1.85
2	2.59	1.82
3	2.67	2.23
4	2.28	1.80
5	3.42	3.35
6	3.35	3.17
7	3.42	3.32
8	3.57	3.20
9	3.23	3.60
10	3.27	3.25
11	3.59	3.37
12	3.29	2.67
13	3.46	3.14
14	3.44	3.49
15	2.95	3.23
16	3.22	3.13
17	2.95	2.92
18	3.37	3.14
19	3.26	2.93
20	2.23	1.71
21	2.48	1.70
22	2.22	1.75
23	2.35	1.79
24	2.83	2.16
25	2.62	1.94
26	3.24	2.05
27	2.93	2.17
28	2.68	2.19
29	2.68	2.03
30	3.01	2.34
31	3.11	2.05
32	3.12	2.26
33	2.98	1.70
34	3.10	2.41
35	3.02	2.38
36	3.04	1.96
37	3.30	2.16
38	2.44	2.41
39	2.99	2.44
40	2.77	2.41
41	3.24	2.35
42	3.40	2.55
43	3.58	2.58
44	3.41	2.52
45	3.46	2.76
46	3.37	2.42
47	3.98	2.43
48	3.15	2.41

TABLE I (continued)

Pen Number	First Period	Second Period
49	3.25	2.36
50	3.47	3.14
51	3.44	2.58
52	3.44	2.65
53	3.29	2.58
54	3.39	2.91
55	3.27	2.43
56	3.25	2.90
57	3.74	3.02
58	3.73	2.79
59	3.57	3.01
60	3.35	2.52
61	3.20	2.69
62	3.73	2.29
63	3.08	2.78
64	3.07	2.74
65	3.74	2.93
66	3.11	2.63
67	3.50	2.91
68	2.19	2.36
69	1.79	2.31
70	1.63	2.19
71	2.11	2.51
72	2.43	2.37
73	2.16	2.67
74	1.64	2.40
75	1.85	2.09
76	1.89	2.48
77	2.32	2.51
78	2.52	2.43
79	2.38	2.40
80	2.51	2.51
81	2.15	2.46
82	2.43	2.59
83	2.51	2.52
84	2.52	2.49
85	2.30	2.59
86	2.25	1.96
87	2.44	2.03
88	2.18	1.86
89	2.27	1.88
90	2.34	2.05
91	2.24	1.80
92	2.40	2.06
93	2.26	1.89
Overall Means	2.86	2.44

TABLE II

CORRELATIONS OF FIRST AND SECOND PERIOD AVERAGE DAILY GAINS

Source of Variation	Degrees of Freedom	Sum of Squares First Period	Sums of Cross-Products	Sums of Squares Second Period	Correlations
Total	1191	765.7185	233.0829	596.6660	0.344865
Between or treatment effects	92	354.8112	172.9961	250.2497	0.580565**
Within or individual	1099	410.9073	60.0868	346.3053	0.159286**

**$P < 0.01$

A correlation that is statistically significant is not necessarily practically significant. This is the case in this study. A cattle feeder would not be justified in culling slow gaining animals after the short term on the basis of this low correlation (0.159286).

From these results, it appears that a good ration effects the correlation of gains between the two periods more than the animal's inherent capacity. Using the coefficient of determination, only 2.5% of the individual variation in the first period gains is associated with the individual variation in the second period gains. On the other hand, 33.7% of the treatment effects variation in the first period gains is associated with the treatment effects variation in the second period gains.

Several factors may cause an animal's performance to be down in the first period. Shipping fever is a major cause of this low performance. It is common in animals shipped in from some distant point. Animals brought in from range areas that have never been fed before

have to learn to eat the concentrates from a trough. The all-concentrate ration itself causes a problem for a short while. The rumen environment of the animal must be altered to digest the concentrates. This means the rumen microflora have to change from cellulose to starch digesters and the pH of the rumen must be lowered to an acidic 5.5 to 5 (Buchanan-Smith et al., 1966).

While the animal has suffered these hardships or change, it may have lost weight and the performance for that period will be low. Then, the animal will generally gain extremely fast in the second period and compensate for the low first period gains, as Table III illustrates.

TABLE III

MEANS OF THE TEN SLOWEST GAINING PENS, FIRST PERIOD

Pen Number	First Period	Second Period
70	1.63	2.19
74	1.64	2.40
69	1.79	2.31
75	1.85	2.09
76	1.89	2.48
71	2.11	2.51
81	2.15	2.46
73	2.16	2.67
88	2.18	1.86
68	2.19	2.36
Ten Pen Means	1.96	2.33

Table III contains the means of the first period's ten slowest gaining pens. Nine out of the 10 pens gained better the second period than the first period. The means for the ten pens were 1.96 and 2.33 pounds per day, respectively, for the first and second periods. This was a 0.37 pound per day increase from first period to second period

as compared to a 0.42 pound per day decrease for the 93 pen overall mean.

On the other hand, healthy animals that have been fed in the past, or have been on a limited ration will gain rapidly at first then slow down in the second period. One reason the rate of gain slows down in the second period is the increased requirements for maintenance of the larger body (Maynard and Loosli, 1965).

Means of the ten fastest gaining pens of the first period are presented in Table IV. In the second period, all ten of these pens had a relatively large reduction in the rate of gain from the first period. The ten pen mean for the first period was 3.67 pounds per day and 2.85 pounds per day for the second period. The 0.82 pound per day decrease in rate of gain from the first period to the second period was almost twice the decrease of the overall mean (0.42).

TABLE IV

MEANS OF THE TEN FASTEST GAINING PENS, FIRST PERIOD

Pen Number	First Period	Second Period
47	3.98	2.43
57	3.74	3.02
65	3.74	2.93
58	3.73	2.79
62	3.73	2.29
11	3.59	3.37
43	3.58	2.58
8	3.57	3.20
59	3.57	3.01
67	3.50	3.91
Ten Pen Means	3.67	2.85

Means of ten average gaining pens in the first period are shown in Table V. Nine out of the ten pens follow the general overall trend of dropping down in the second period. The ten pen average daily gain means drop from 2.95 in the first period to 2.37 in the second. This drop of 0.58 pounds per day between the two periods is very close to the overall mean drop of 0.42 pounds per day. These results follow the same trends as those reported by Hale et al. (1965).

TABLE V

MEANS OF TEN AVERAGE GAINING PENS, FIRST PERIOD

Pen Number	First Period	Second Period
24	2.83	2.16
27	2.93	2.17
15	2.95	3.23
17	2.95	2.92
40	2.77	2.41
33	2.98	1.70
39	2.99	2.44
30	3.01	2.34
35	3.02	2.38
36	3.04	1.96
Ten Pen Means	2.95	2.37

There seems to be a definite compensating effect between the two periods. If an animal gains extremely well the first period, its performance will generally drop in the second period. However, if an animal gains extremely slow the first period, it will generally gain better the second period.

It seems that an animal that gains above average in the first period will gain about average in the second period. Therefore, the low within or individual correlation between the first period average daily gains and the second period average daily gains is explained, at

least partially, by this compensating effect.

The standard deviations of the statistical breakdowns, by periods, are shown in Table VI.

TABLE VI

STANDARD DEVIATIONS OF THE TWO PERIODS

Statistical Breakdown	First Period	Second Period
Total	0.80	0.71
Between or treatment effects	1.96	1.65
Within or individual	0.61	0.56

CHAPTER V

SUMMARY

Correlations were obtained by computer analysis for first period and second period average daily gains of 1,192 steers and heifers fed high concentrate rations.

A statistically significant correlation ($P<.01$) was found between first and second period gains, however, this was not considered practically significant enough to use as a basis for selecting cattle after the first period.

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APPENDIX

TABLE 1

SUBSCRIPTS AND DEFINITIONS

N = total number of animals (1192)

n = number of animals in that pen

X = first period observation

Y = second period observation

XY = crossproducts of the two periods

x,y,xy = corrected values

r = correlation

t = total

b = between or treatment effects

w = within or individual effects

1-93 = pen numbers

Formulas:

$$\Sigma x_t = \Sigma X_t^2 - \frac{(\Sigma X_t)^2}{N}$$

$$\Sigma y_t = \Sigma Y_t^2 - \frac{(\Sigma Y_t)^2}{N}$$

$$\Sigma xy_t = \Sigma XY_t - \frac{(\Sigma X_t)(\Sigma Y_t)}{N}$$

$$\Sigma x_b = \frac{(\Sigma X_1)^2}{n} + \frac{(\Sigma X_2)^2}{n} + \text{---------} + \frac{(\Sigma X_{93})^2}{n} - \frac{(\Sigma X_t)^2}{N}$$

$$\Sigma y_b = \frac{(\Sigma Y_1)^2}{n} + \frac{(\Sigma Y_2)^2}{n} + \text{---------} + \frac{(\Sigma Y_{93})^2}{n} - \frac{(\Sigma Y_t)^2}{N}$$

$$\Sigma xy_b = \frac{(\Sigma X_1)(\Sigma Y_1)}{n} + \frac{(\Sigma X_2)(\Sigma Y_2)}{n} + \text{---} + \frac{(\Sigma X_{93})(\Sigma Y_{93})}{n} - \frac{(\Sigma X_t)(\Sigma Y_t)}{N}$$

$$\Sigma x_w = \Sigma x_t - \Sigma x_b$$

$$\Sigma y_w = \Sigma y_t - \Sigma y_b$$

$$\Sigma xy_w = \Sigma xy_t - \Sigma xy_b$$

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x \cdot \Sigma y}}$$

TABLE 2

ANALYSIS OF VARIANCE OF FIRST PERIOD AVERAGE DAILY GAINS

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Square	F
Total	1191	765.7185		
Between or treatment effect	92	354.8112	3.8566	10.3145**
Within or individual	1099	410.9073	0.3739	

**P<0.01

TABLE 3

ANALYSIS OF VARIANCE OF SECOND PERIOD AVERAGE DAILY GAINS

Source of Variation	Degrees of Freedom	Sums of Squares	Mean Square	F
Total	1191	596.5550		
Between or treatment effects	92	250.2497	2.7201	8.6325**
Within or individual	1099	346.3035	0.3151	

**P<0.01