# POTASSIUM LEVELS AND SOURCES FOR FEEDLOT STEERS

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## Story in Brief

Three levels of potassium [.45 (basal), .65 and .8 percent of diet dry matter] with supplemental potassium from two sources (potassium chloride and potassium carbonate) were fed to 120 steer calves for 135 days. Steers averaged 772 pounds at the start of the trial and were fed a 96 percent concentrate whole shelled corn diet with 4 percent cottonseed hulls as a roughage. During the early part of the trial, potassium supplementation improved feed efficiency, but over the total trial, feed efficiency was unchanged. Effects of added potassium were apparent mainly during the first 57 days of the study. Steers fed .8 percent potassium had heavier live weight at 113 and 135 days, gained more in the latter half of the trial, and had a greater total gain than steers fed .65 percent potassium due to greater energy intake. Source of potassium (KCl versus $K_2CO_3$) had no effect except for greater feed consumption from day 29 to 57 with $K_2CO_3$ than KCl.

## Introduction

The potassium requirement for growing and finishing steers is estimated to be .6 to .8 percent (NRC, 1976). This is based largely on Canadian studies with $K_2CO_3$. Cost of $K_2CO_3$ is about twice the cost of KCl, so most supplemental potassium today is provided as KCl. Hutchinson (1980) reported that newly received cattle regain weight lost during shipment more rapidly when the diet contained levels of potassium over 1 percent (from KCl), though this advantage often disappeared when cattle were fed longer than 56 days. KCl could be considered a potential buffer, since potassium is readily converted to $KHCO_3$ in the rumen. Buffer supplements may improve daily gain and feed efficiency. In a recent trial (Ferrell et al, 1983), feedlot steers were fed 5 levels of potassium from .43 to 1 percent of diet dry matter. During the early part of this trial, KCl supplementation tended to increase the rate of gain, but over the total trial, KCl supplementation at moderate levels (.70 to .85 percent) reduced feed intake and significantly decreased energy intake and rate of gain.

The objectives of this trial were to determine the effect of various levels of potassium on performance of finishing steers and the relative value of KCl and $K_2CO_3$ as a source of potassium.

## Materials and Methods

One hundred twenty crossbred steers were randomly allotted to 20 pens with 6 steers per pen. The final diet (Table 1) was diluted with cottonseed hulls to a level of 40 percent roughage for 3 days, 30 percent roughage for 4 days, and 20 percent roughage for 4 days.

Five diets were fed. The basal diet contained no supplemental potassium but by calculation provided .45 percent potassium. The other

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four diets contained .65 or .8 percent potassium from KCl or $K_2CO_3$. The supplement containing potassium was fed in a pellet.

The steers were weighed shrunk initially and subsequently without feed and water restriction (days 28, 57, 85, and 113). Live weights are presented as measured while weight gains are calculated using a 5 percent pencil shrink for cattle weighed full. On day 135, steers were loaded and trucked to Dodge City, KS where mean carcass weights for each treatment were obtained. Dressing percentages were based on a 2 percent pencil shrink of the extrapolated 135 day live weights in Stillwater.

**Table 1. Composition of finishing diets.**

| Ingredient | Percent of Dry Matter | |
|---|---|---|
| Corn Dent #2 | 87.27 | |
| Cottonseed Hulls | 4.00 | |
| Supplement | 8.73 | |
| Soybean Meal Sol | | 4.15 |
| Cottonseed Meal Sol | | 2.00 |
| Calcium Carbonate | | 1.00 |
| Salt | | .30 |
| Urea | | .40 |
| Cane Molasses | | .25 |
| Trace Mineral | | .01 |
| Vitamin A-30 | | .01 |
| Rumensin 60 gram | | .03 |
| Tylan 10 gram | | .05 |
| Corn grain | | .0-.60 |
| Potassium Carbonate or Potassium Chloride[a] | | .0-.60 |

[a]To provide dietary potassium levels of .65% or .80 from additions of potassium carbonate (.27 and .54%) or Potassium Chloride (.3 and .6%).

## Results and Discussion

Potassium supplementation tended to increase live weight gain during the first 57 days of the trial (Table 2) with a mean shrunk weight advantage of 33 pounds at 28 days. This is similar to the consistent benefits of potassium supplementation for newly received cattle reported by Hutchinson (1980). A short term response to potassium may be due to increased fluid retention in the gut or in tissues as suggested by Zinn et al (1982). But during the remainder of this trial, the advantage at 28 days was at least partially retained from days 58 to 135, especially for steers fed 80 percent potassium (Table 2). Overall, potassium supplementation increased carcass weight by 13.5 pounds.

Average daily gain for the total feed period was increased by 6.6 percent with added potassium, most during the first 28 days. In the second half of the trial, potassium supplementation did not increase weight gain. For the total trial, gain of steers fed .8 percent potassium surpassed gain of steers fed .65 percent potassium ($P<.05$). The superiority of the .8 percent level occurred between day 58 and 135.

These results agree with Hutchinson (1980) and Zinn et al. (1982) who concluded added potassium was most beneficial in the early portion of feeding trials. Maintaining the early advantage in gain does not

**Table 2. Performance of steers fed various potassium levels and sources.**

| | K Level and Source, Percent of Dry Matter | | | | |
|---|---|---|---|---|---|
| | Control | .65 $K_2CO_3$ | .80 $K_2CO_3$ | .65 KCl | .80 KCl |
| Weights, lb | | | | | |
| Initial | 773 | 772 | 773 | 773 | 770 |
| 57 days[a] | 932 | 978 | 974 | 964 | 963 |
| 113 days[ab] | 1074 | 1114 | 1131 | 1093 | 1130 |
| 135 days[c] | 1125 | 1150 | 1165 | 1119 | 1156 |
| Total Gain | 352 | 378 | 392 | 346 | 386 |
| Daily Gain, lb/day | | | | | |
| 0-57 days[a] | 1.96 | 2.75 | 2.68 | 2.51 | 2.54 |
| 58-135 days[c] | 3.11 | 2.87 | 3.11 | 2.64 | 3.13 |
| 0-135 days[c] | 2.61 | 2.80 | 2.90 | 2.57 | 2.86 |
| Daily Feed, lb/day | | | | | |
| 0-57 days[a] | 18.73 | 22.04 | 21.77 | 21.27 | 21.14 |
| 58-135 days[a] | 19.49 | 21.77 | 22.25 | 21.52 | 23.04 |
| 0-135 days[a] | 19.17 | 21.88 | 22.05 | 21.41 | 22.23 |
| Feed/lb gain | | | | | |
| 0-57 days[a] | 9.90 | 8.23 | 8.18 | 8.50 | 8.35 |
| 58-135 days[b] | 8.34 | 9.20 | 8.42 | 9.76 | 8.29 |
| 0-135 days[b] | 8.85 | 8.68 | 8.32 | 9.17 | 8.30 |
| ME Content of Feed mcal/kg[ab] | 2.65 | 2.62 | 2.67 | 2.56 | 2.66 |
| ME Intake mcal/day | 23.05 | 25.99 | 26.73 | 24.88 | 26.86 |
| Carcass Data | | | | | |
| Dressing %[d] | 63.9 | 63.8 | 63.9 | 63.4 | 64.0 |
| Carcass Wt. | 698 | 713 | 722 | 694 | 717 |
| Live Weights | 1114 | 1140 | 1152 | 1116 | 1144 |

[a] Significant difference between potassium supplementation and no potassium supplementation ($P<.05$).

[b] Significant difference between .65 and .8% levels of potassium supplementation ($P<.05$).

[c] These weights were computed based on carcass weights assuming a 62% dress.

[d] Dressing percent is based on 2% pencil shrink of live weights.

agree with the results of Ferrell, et al (1983) in which KCl supplementation tended to increase rate of gain early in the trial but later reduced feed intake and gains.

Daily feed consumption was increased with potassium supplementation by 14 percent. Intake was increased both during the first (15 percent) and second half (14 percent) of the trial. Steers fed $K_2CO_3$ consumed 1 percent more feed than the steers fed KCl over the total trial, due mainly to 3.2 percent greater intake during the first half of the trial. This conflicts with the earlier findings of Zinn et al (1982) and Ferrell et al (1983) in which 1 percent KCl or .70 to .85 percent potassium from KCl reduced feed intake. Potassium supplementation improved feed conversion by 16 percent during the first

57 days but had little effect (- 1 percent) during the second half of the trial, for an overall advantage of 2.6 percent. $K_2CO_3$ improved efficiency slightly more than KCl (4.0 percent vs 1.3 percent).

Metabolizable energy value of the feed was not increased with potassium supplementation. This means that the gain and efficiency advantages are due to increased feed intake, not increased diet digestibility or energetic efficiency. But ME intake was increased with added potassium, and ME intake was greater with .80 percent potassium than .65 percent potassium. This conflicts with findings of Ferrell et al, (1983) that ME intake decreased at .7 to .85 percent potassium, and ME intake was greatest with .43 percent potassium.

The average dressing percentage calculated from extrapolated live weight and hot carcass weight, was 63.8 percent, and no decrease in dressing percent with elevated dietary potassium was observed. Potassium level had no significant effect ($P<.05$) on the average carcass weights.

Results of this trial suggest that for steers under 950 pounds or fed less than two months, gain and efficiency will by increased by feeding more than .5 percent potassium. This response appeared to be associated with increased feed intake. No advantage in gain or efficiency to added potassium beyond two months was apparent, though added potassium did not depress feed intake as it did in a previous trial, and the early advantage in gain and in feed intake was partly maintained. Whether withdrawal of supplemental potassium at 56 days would reduce feed intake or efficiency remains to be determined.

## Literature Cited


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