# Feedlot Performance and Carcass Traits of Steers Fed "Rawson" Two-Rowed Barley vs. Six-Rowed Barley and Corn

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**Introduction**

A new large kernel two-rowed barley named "Rawson" has been developed at NDSU that has potential as a feed barley. Rawson barley kernels weigh 47 mg vs. 32 mg for six-rowed barley. Kernels of Rawson barley are 15% larger in seed size and have 1% more starch. The grain protein levels are about 1% below those of other barley cultivars. This variety is not considered malting barley due to loose hulls. Rawson barley has good resistance to leaf spot diseases that are common in North Dakota.

The objectives of this study are to determine the effects of Rawson two-rowed barley on: a) growing and finishing performance of feedlot cattle including feed intake, gain, and efficiency; b) carcass quality measure in dressing percent, ribeye area, fat thickness, KPH, marbling, yield grade, and USDA quality grade. The Rawson barley used for this feeding study was contract-grown by a producer in the Carrington area. It yielded 83 bushels per acre.

**Materials and Methods**

One hundred-thirteen preconditioned steer calves from two sources were blocked by source and allotted to 12 identical feeding pens with four pens assigned to each of the three treatments. Calves were from the research cow herd at the Carrington Research Extension Center and from a retained ownership producer feedout program of the Eastern Dakota Feeder Calf Club. The three diet treatments were based on: 1) corn (control), 2) Rawson two-rowed barley, and 3) six-rowed barley (variety unspecified) (Table 1).

**Table 1. Feedlot diets of steers fed "Rawson" barley.**

| | Treatment | | |
|---|---|---|---|
| | Corn | Rawson Barley | Six-Rowed Barley |
| | ---------- Percent, Dry matter basis ---------- | | |
| Grower Diet | | | |
| Corn grain | 48 | - | - |
| Rawson two-rowed barley | - | 54 | - |
| Six-rowed barley | - | - | 54 |
| Wet distillers grains | 30 | 25 | 25 |
| Chopped straw | 19 | 18 | 18 |
| Ionophore supplement | 2 | 2 | 2 |
| Nutrient Content | | | |
| Dry Matter, % | 76 | 72 | 72 |
| Net Energy Gain, Mcal/cwt | 53 | 53 | 53 |
| Crude protein, % | 13.8 | 14.1 | 14.1 |
| | | | |
| Finisher Diet | | | |
| Corn grain | 65 | | |
| Rawson two-rowed barley | | 73 | 73 |
| Six-rowed barley | | | |
| Wet distillers grains | 20 | 13 | 13 |
| Chopped straw | 12 | 11 | 11 |
| Ionophore supplement | 3 | 3 | 3 |
| Nutrient Content | | | |
| Dry Matter, % | 69 | 73 | 73 |
| Net Energy Gain, Mcal/cwt | 60 | 60 | 60 |
| Crude protein, % | 12.5 | 13.5 | 13.5 |

The barley and corn were dry-rolled at the Carrington Center feed mill using a Roskamp 24" single-stage roller with 8 grooves per inch. Wet distillers grains with solubles from the Archer Daniels Midland plant in Walhalla, ND, were used as the protein source. The diets also included chopped straw and an ionophore (Rumensin®) supplement with extra calcium carbonate to achieve a calcium to phosphorous ratio of 1.5:1. Calves were weighed individually at the start of the study and every 28 days with a final weight taken prior to loading and shipping. Growing diets were formulated at 53 Mcal NEg (60% concentrate) and fed for two weigh periods (56 days). Diets were transitioned to finishing formulations containing 60 Mcal/cwt (85% concentrate) and fed until calves were ready for market. The totally-mixed diets met or exceeded NRC requirements for feedlot cattle to gain 3.4 lbs. or more during the finishing phase. Diets were assembled, mixed, and distributed by treatment to respective pens in a three-auger, truck-mounted Knight LA-9 mixer wagon equipped with a digital scale. Calves were fed once daily to appetite based on morning bunk readings, with feed recorded daily. Research pens were 32' by 76' allowing approximately 240 square feet per head. Pens were equipped with fenceline automatic water fountains and fenceline concrete bunks with a minimum of two feet per head. There were concrete aprons from the bedding mounds to the water fountain and feedbunks. Bedding was added uniformly to all pens as determined by weather conditions. Pens were protected by a six-row shelterbelt to the northwest and 8 foot wind fences on three sides of the bedded loafing area. Feed intake and gain were summarized by weigh period. All calves were marketed at the same time when cattle were visually estimated to grade 60% choice or better and have 0.5 inches of backfat. Calves

were slaughtered at Tyson Fresh Foods in Dakota City, NE. Carcasses were graded by a qualified industry grader after a 48-hour chill.

All animals in this study were managed according to NDSU standard operation procedures for pen-fed cattle and the research study was approved by the NDSU Institutional Animal Care and Use Committee.

Data were analyzed using SAS Mixed procedures (SAS Inst, Crary, NC) with pen as the experimental unit. Significance was reported when P values were calculated at equal or less than 0.05. This is interpreted as an indication that the effect of treatment on respective variables was "real" and not due to chance.

**Results and Discussion**

In general, the larger kernel barley did not perform to expectations. Feed intake (Table 2) tended to favor the corn diet (P<.10) overall and more differences were observed during some of the feeding periods. During the growing phase (period 1 and 2), calves ate an average of 19.68 lbs. of the corn diet (dry matter) daily vs. 18.16 and 18.46 for the Rawson and six-row barley diets, respectively. During the finishing phase (periods 3-6), calves on the corn diet consumed 24.95 lbs. per day vs. 23.05 and 23.56 for the Rawson and six-row barley diets, respectively. Gains followed the feed intake patterns with greater gains observed for the corn diet during the growing phase (3.60 lbs./hd/day) vs. Rawson and six-row barley diets (3.15 lbs. per head per day for both treatments) (Table 2). Overall, gains were greater for corn (3.71 lbs./hd/day; P<.01) than Rawson (3.41 lbs.) with six-row barley intermediate (3.50 lbs./hd/day).

**Steers from the Rawson barley study.**

**Table 2. Feedlot performance of steers fed "Rawson" barley.**

| | Treatment | | | | |
|---|---|---|---|---|---|
| | Control Corn | Rawson Barley | Six-Row Barley | St. Error | P Value |
| Weight, lbs. | | | | | |
| Nov. 21, 2004 | 744.0 | 759.0 | 764.6 | 17.17 | 0.40 |
| Dec. 21, 2004 | 842.4 | 852.7 | 855.3 | 17.50 | 0.71 |
| Jan. 18, 2005 | 953.7 | 941.0 | 945.3 | 16.83 | 0.76 |
| Feb. 15, 2005 | 1073.9 | 1056.8 | 1073.1 | 17.65 | 0.59 |
| Mar. 15, 2005 | 1188.8 | 1163.4 | 1170.8 | 18.02 | 0.42 |
| Apr. 19, 2005 | 1299.8 | 1267.7 | 1289.2 | 18.20 | 0.30 |
| May. 04, 2005 | 1357.6 | 1314.9 | 1331.7 | 16.93 | 0.16 |
| Dry Matter Intake, lbs./hd/day | | | | | |
| Period 1 | 19.10 | 18.18 | 18.88 | 0.44 | 0.35 |
| Period 2 | 20.27[a] | 18.14[b] | 18.04[b] | 0.44 | 0.01 |
| Period 3 | 23.75 | 22.02 | 22.89 | 0.73 | 0.28 |
| Period 4 | 25.10 | 23.71 | 22.81 | 0.67 | 0.10 |
| Period 5 | 25.14 | 22.87 | 24.13 | 0.66 | 0.11 |
| Period 6 | 26.49 | 24.18 | 24.84 | 0.85 | 0.20 |
| Growing (P1-2) | 19.68 | 18.16 | 18.46 | 0.42 | 0.06 |
| Finishing (P3-6) | 24.95 | 23.05 | 23.56 | 0.64 | 0.15 |
| Overall | 22.98 | 21.23 | 21.66 | 0.53 | 0.10 |
| Avg Daily Gain, lb./hd/day | | | | | |
| Period 1 | 3.30 | 3.10 | 3.06 | 0.14 | 0.43 |
| Period 2 | 3.94[a] | 3.18[b] | 3.25[b] | 0.16 | 0.01 |
| Period 3 | 4.28 | 4.17 | 4.52 | 0.11 | 0.08 |
| Period 4 | 4.09[a] | 3.82[ab] | 3.50[b] | 0.17 | 0.01 |
| Period 5 | 3.14[ab] | 3.01[a] | 3.42[b] | 0.13 | 0.05 |
| Period 6 | 3.76[a] | 3.31[ab] | 2.89[b] | 0.29 | 0.01 |
| Growing (P1-2) | 3.60[a] | 3.15[b] | 3.15[b] | 0.12 | 0.01 |
| Finishing (P3-6) | 3.81 | 3.59 | 3.71 | 0.07 | 0.10 |
| Overall | 3.71[a] | 3.41[b] | 3.50[ab] | 0.07 | 0.01 |

[ab] Values with different superscripts differ P< .05.

Feed efficiency (pounds of dry matter consumed per pound of weight gain) and gain efficiency (lbs. gained per lb. of feed intake) did not differ (Table 3).

**Table 3. Feed and gain efficiency of feedlot steers fed "Rawson" barley.**

| | Treatment | | | | |
|---|---|---|---|---|---|
| | Control Corn | Rawson Barley | Six-Row Barley | St. Error | P Value |
| Feed per Gain (Feed efficiency) | | | | | |
| Period 1 | 5.78 | 5.97 | 6.20 | 0.29 | 0.61 |
| Period 2 | 5.19 | 5.77 | 5.53 | 0.33 | 0.47 |
| Period 3 | 5.55 | 5.26 | 5.10 | 0.22 | 0.24 |
| Period 4 | 6.17 | 6.34 | 6.48 | 0.31 | 0.78 |
| Period 5 | 8.06 | 7.59 | 7.04 | 0.33 | 0.16 |
| Period 6 | 7.33 | 7.64 | 8.74 | 0.81 | 0.27 |
| Growing (P1-2) | 5.46 | 5.85 | 5.84 | 0.02 | 0.38 |
| Finishing (P3-6) | 6.56 | 6.42 | 6.32 | 0.15 | 0.57 |
| Overall | 6.20 | 6.24 | 6.18 | 0.14 | 0.95 |
| Gain per Feed (Gain efficiency) | | | | | |
| Period 1 | 0.173 | 0.168 | 0.161 | 0.29 | 0.61 |
| Period 2 | 0.193 | 0.173 | 0.181 | 0.33 | 0.47 |
| Period 3 | 0.180 | 0.190 | 0.196 | 0.22 | 0.24 |
| Period 4 | 0.162 | 0.158 | 0.154 | 0.31 | 0.78 |
| Period 5 | 0.124 | 0.132 | 0.142 | 0.33 | 0.16 |
| Period 6 | 0.136 | 0.131 | 0.114 | 0.81 | 0.27 |
| Growing (P1-2) | 0.183 | 0.171 | 0.171 | 0.02 | 0.38 |
| Finishing (P3-6) | 0.152 | 0.156 | 0.158 | 0.15 | 0.57 |
| Overall | 0.161 | 0.160 | 0.162 | 0.14 | 0.95 |

Carcass traits were predictably different (Table 4) based on feed intake and gain response. Hot carcass weights were heavier (P<.05) for the corn diet than the Rawson diet with the six-row barley diet intermediate. Marbling scores also favored the corn diet (P<.05), but there was more KPH (internal fat) (P<.05) associated with corn vs. either of the barley diets.

**Table 4. Carcass traits of steers fed "Rawson" barley.**

| | Treatment | | | | |
|---|---|---|---|---|---|
| | Control Corn | Rawson Barley | Six-Row Barley | St. Error | P Value |
| Hot carcas wt, lbs. | 814.5[a] | 778.5[b] | 785.8[ab] | 11.64 | 0.03 |
| Dressing percent | 62.5[a] | 61.8[ab] | 61.5[a] | 0.02 | 0.02 |
| Ribeye area, sq in. | 12.99 | 12.55 | 12.88 | 0.16 | 0.13 |
| Fat thickness, in | 0.55 | 0.53 | 0.55 | 0.04 | 0.88 |
| Marbling score | 476[a] | 438[a] | 433[a] | 12.10 | 0.04 |
| KPH, % | 2.64[a] | 2.46[b] | 2.42[b] | 0.06 | 0.01 |
| Yield Grade | 3.38 | 3.33 | 3.37 | 0.02 | 0.88 |

[ab] Values with different superscripts differ P< .05.

The large kernel, two-rowed Rawson barley was processed and formulated in the diets in the same manner as the six-rowed barley. The rate of starch digestion may have been faster than the corn diet

and the rumen pH decreased to a point where intake was comparatively reduced. A metabolism study would identify the rate, site, and extent of digestion of this new barley variety and may offer additional data on its feeding potential. Rawson may be best utilized as a portion of the grain ration in combination with corn or possibly with co-products that contain highly-digestible fiber such as soyhulls, beet pulp, or wheat midds. When fed in limited amounts (4 lbs. per hd per day or less), it may also provide necessary energy and protein to enhance forage digestion in beef cows consuming low quality forage.

*Reprinted from the 2006 NDSU Carrington Research Extension Center Feedlot Research Report. Volume 29. Oct 10, 2006*