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# Cull Dry Edible Beans in Growing Calf Rations

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# Cull Dry Edible Beans in Growing Calf Rations

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Cull dry edible beans included directly into the diets of growing calves may decrease intake and daily gain but improve feed efficiency.

**Summary**

*Including cull dry edible beans into diets for steer calves in two yearly trials produced slightly different results. In the first year, calculated net energy levels were higher in diets with 5 or 10% dry beans and daily gains were equal or better than for the no-bean diets. In the second year, with equal net energy values in rations containing 0, 7.5 or 15% dry beans, daily gains and feed intake decreased linearly with dry bean additions. Feed efficiency was improved as bean level increased.*

**Introduction**

Dry edible beans, either great northern or pinto beans, are a major cash crop in western Nebraska. Cracked and discolored beans, which are sorted out and not acceptable for human consumption, are available for animal feed. In some years an early frost or freeze stops bean growth before maturity, and although yields may be high, the beans are unacceptable for domestic markets. Other environmental factors, such as bean diseases or excessive rain at harvest time, can adversely affect bean quality for human consumption.

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Because of these factors, large quantities of cull beans are available each year. Dry edible beans have 22-24% crude protein, very little fat and are a relatively good source of energy. They contain undesirable proteins called phytohemagglutinins or lectins, and if fed uncooked, cause severe growth inhibition to non-ruminants. Lectins apparently cause problems in protein digestion in the small intestine. It is unclear how much, if any, of the lectins are destroyed by the rumen microorganisms and whether or not protein digestion is affected. It is known, however, that when large quantities of dry edible beans are fed to ruminants, severe scouring will occur.

The feed industry has used cull beans for years in range supplements, both as a protein source and a pellet binder. Because limited data is available on the nutritive value of dry edible beans, two trials were conducted to evaluate performance of steer calves fed cull dry edible beans.

## Procedure

In a 1996 trial, 96 predominately black Angus steers weighing approximately 625 pounds each were randomly divided into 12 pens and one of three treatments was randomly assigned to each pen. The three treatments were 0, 5 and 10% dry edible beans. The rations, as shown in Table 1, consisted primarily of corn silage, alfalfa hay, corn and supplement. When utilizing an NEg value of 64 Mcal/cwt for dry beans, the calculated NEg of the rations were 49.0, 51.7 and 55.1 respectively for 0, 5 and 10% bean levels. At first, when the rations were balanced, the NEg level of the beans was not considered and as a consequence more corn was added to the 10% bean ration. The calculated level of crude protein in the rations varied from 12.1% with 5% dry edible beans to 12.6% for rations containing 0 and 10% dry beans. Actual bunk sample analyses revealed that the crude protein was slightly higher for all rations and averaged approximately 13% (Table 1). All rations were supplemented with 16 g of Rumensin per ton of ration dry matter.

In a 1997 trial, 95 black steer calves weighing approximately 572 pounds

**Table 1. Rations for steer calves fed two levels of cull dry edible beans, 1996 trial.**

| | Dry beans in diet, % of DM | | |
|---|---|---|---|
| | 0 | 5 | 10 |
| Ingredients, % of DM | | | |
| Corn silage | 40 | 47 | 35 |
| Alfalfa hay | 26 | 14 | 11 |
| Corn | 30 | 30 | 40 |
| Cull dry beans | 0 | 5 | 10 |
| Additive supplement[a] | 4.0 | 4.0 | 4.0 |
| Calculated DM Composition | | | |
| Crude protein, % | 12.6 | 12.1 | 12.6 |
| UIP, % | 3.9 | 4.0 | 4.3 |
| NEm, Mcal/cwt | 76.4 | 80.3 | 84.3 |
| NEg Mcal/cwt | 49.0 | 51.7 | 55.1 |
| Ca, % | .77 | .64 | .58 |
| P, % | .29 | .30 | .33 |
| Bunk sample crude protein, % | 13.9 | 13.5 | 12.6 |

[a]Contained 420 g of Rumensin per ton of supplement.

**Table 2. Rations for steer calves fed two levels of cull dry edible beans, 1997 trial.**

| | Dry beans in diet, % of DM | | |
|---|---|---|---|
| | 0 | 7.5 | 15 |
| Ingredients, % of DM | | | |
| Corn silage | 25.6 | 40.8 | 56.1 |
| Alfalfa hay | 46.9 | 37.0 | 27.1 |
| Corn | 25.7 | 12.9 | 0 |
| Cull dry beans | 0 | 7.5 | 15.0 |
| Additive supplement[a] | 1.8 | 1.8 | 1.8 |
| Calculated DM Composition | | | |
| Crude protein, % | 13.0 | 13.0 | 13.0 |
| NEm, Mcal/cwt | 73.9 | 73.6 | 73.2 |
| NEg, Mcal/cwt | 46.0 | 46.0 | 46.0 |
| Ca, % | .80 | .71 | .62 |
| P, % | .29 | .30 | .32 |
| Bunk sample crude protein, % | 13.9 | 13.1 | 15.7 |

[a]Contained 1,200 g Rumensin per ton of supplement.

**Table 3. Performance of steer calves fed two levels of cull dry edible beans, 1996 trial.**

| | Dry beans in diet, % of DM | | |
|---|---|---|---|
| | 0 | 5 | 10 |
| No. pens | 4 | 4 | 4 |
| No. steers | 32 | 32 | 32 |
| Initial weight, lb | 622 | 627 | 624 |
| Final weight, lb | 955 | 966 | 993 |
| ADG, lb | $2.98^a$ | $3.03^b$ | $3.3^c$ |
| DM intake, lb | $20.1^a$ | $21.8^b$ | $20.0^a$ |
| Feed/gain | $6.73^a$ | $7.18^b$ | $6.04^c$ |
| NEg/gain, MCal/lb | 3.31 | 3.72 | 3.34 |

[a,b,c]Means with different superscripts on the same line are different ($P < .01$).

**Table 4. Performance of steer calves fed two levels of cull dry edible beans, 1997 trial.**

| | Dry beans in diet, % of DM | | |
|---|---|---|---|
| | 0 | 7.5 | 15 |
| No. pens | 4 | 4 | 4 |
| No. steers | 31 | 32 | 32 |
| Initial weight, lb | 568 | 573 | 574 |
| Final weight, lb | 863 | 843 | 829 |
| ADG, lb | $2.42^a$ | $2.26^{bc}$ | $2.15^c$ |
| DM intake, lb | $19.6^a$ | $17.2^{ac}$ | $14.8^{bc}$ |
| Feed/gain | 8.07 | 7.62 | 6.92 |
| NEg/gain, MCal/lb | 3.71 | 3.51 | 3.18 |

[a,b,c]Means with different superscripts on the same line are different ($P < .01$).

each were randomly assigned to 12 pens for three treatments: 0, 7.5 and 15% dry edible beans. Rations are shown in Table 2 and were calculated to be similar in crude protein (13%) and net energy for gain (46 Mcal/cwt) by varying the levels of corn silage, corn, alfalfa hay and dry edible beans. In this trial, it was assumed the dry edible beans had an NEg value of 64 Mcal/cwt (1984 NRC). It was decided to balance the diets to be isonitrogenous and isocaloric. Consequently, it was necessary to alter the level of ingredients in each ration. Analyses of bunk feed samples showed crude protein levels similar or higher than the calculated values. Rumensin was included at 23 g per ton of ration dry matter.

In both trials, calves were weighed in the morning before feeding on two consecutive days at the start and termination of the trial. These weights were averaged to determine the starting and ending weights. The trials were conducted for 112 and 121 days in 1996 and 1997, respectively. In 1996 the calves grazed cornstalks with alfalfa hay supplementation before the trial; in 1997, calves were fed a high roughage ration between purchase and the start of the trial.

The source of beans was a local bean processor selling cull dry edible beans. They contained 24.7% crude protein, .20% calcium and .51% phosphorus (on dry matter basis). The beans were either cracked or had discolored seed coats.

**Results**

In the 1996 trial, cattle receiving 10% cull beans gained faster than those fed 0 or 5% beans (Table 3). This might be expected, as the estimated energy concentration of the ration was higher for the ration containing 10% beans. It is unclear, however, why the gain of the cattle consuming 5% beans was not directly between those cattle consuming 0 and 10% beans. One likely reason: the rations containing 0 and 5% beans contained 30% corn, while the 10% bean ration contained 40% corn. Perhaps the additional corn provided more utilizable energy and the 5% beans did not provide the quantity of available energy the ration NEg would predict. When the quantity of net energy needed per unit of gain was calculated, there was no difference in the amounts required in the control and 10% bean rations. The ration containing 5% beans, however, appeared to require more net energy to produce a pound of gain. The steers fed 5% cull beans consumed more total ration than those fed either of the other diets. Feed required per pound of gain was lowest for cattle fed 10% cull beans and highest for the controls. Perhaps the added corn offset any objectionable qualities the 10% beans may have provided. It is not clear why the cattle fed 5% cull beans consumed more than controls and yet when 10% beans were fed, intake was the same as the control. Also, there were no apparent digestive problems with 10% cull beans as evaluated by feed intake and consistency of feces.

In 1997, as the level of beans increased in the ration, the gains and feed intakes decreased linearly ($P < .01$). Feed efficiency, however, improved as level of beans increased. Decrease in performance could have been from the possible effect of lectins on protein destruction in the small intestine, lower levels of energy in beans than was assumed or some other attribute that decreased the palatability of the rations containing beans. The levels of corn, corn silage and alfalfa also varied and it is possible that different combinations or levels affected palatability and cattle performance. It is questionable if this caused problems, however, because all of these ingredients are highly palatable. Based on calculations of feed utilization, it appears the energy value of beans is much higher than the assumed 64 Mcal/cwt. Because feed efficiency was improved, it appears the largest effect of the beans was related to ration intake. Perhaps cull dry edible beans could be used as an appetite inhibitor and may be beneficial in rations where limit feeding is desired. The 1997 trial indicates incorporation of these beans into growing rations results in intake and daily gain decreases along with improved feed efficiency.

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