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Whole-Shelled Corn Rations for Beef Cattle

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Grinding will not improve dry, whole-shelled corn in high-concentrate rations for beef cattle. Whole-shelled corn usually is slightly superior to ground, rolled or crimped corn in rations that have less than 20 percent of the dry matter furnished by roughage. This is indicated by the experiences of cattle feeders and by numerous trials at college and industry experiment stations.

Corn kernels appearing in the feces of cattle fed whole-shelled corn have led cattle producers to think whole corn is much less digestible than ground corn. Some of the ground grain passes through the digestive tract, too, but it is less noticeable than whole grain in the feces. Tests at Ohio State University found little difference in the digestibility of whole- and ground-shelled corn fed to steers on high-concentrate rations.

Yearling cattle of 800 or more pounds and lightweight calves tend to do better when dry shelled corn is left whole in high-concentrate rations. Whole corn appears to have a roughage or "scratching effect," which helps maintain healthy tissue in the rumen wall of cattle and lowers the incidence of liver abscesses that are often a problem when cattle are fed high-concentrate rations. Cattle with abscessed livers usually have a reduction in rate and efficiency of gain in the feedlot.

Better feed conversion when cattle are fed dry, whole corn in high-concentrate rations can lower the cost of beef gains. Also, feeding whole-shelled corn can reduce the processing and handling cost of beef rations. Whole-shelled corn is well suited for use in self-feeders, a system of feeding that many small-scale corn belt feeders have adopted for high-grain finishing rations.

When does it pay to grind corn?

There is no clear answer for when it pays to break up kernels of shelled corn. In general, corn between 14 and 19 percent in moisture is not improved by dry-rolling or grinding when fed in low roughage rations.

These conclusions were drawn from studies at college experiment stations on processing corn in growing and finishing rations fed beef cattle:

- Better performance is expected when cattle are fed dry, whole corn rather than dry, crimped corn when up to 17 pounds of corn silage is fed daily (Ohio State University).

- Considering crimping costs, it is questionable if dry corn should be processed unless at least 20 pounds of corn silage are fed daily, or more than 23 percent of the ration dry matter is roughage (Ohio State University).
- Primarily due to processing charges, whole corn gave cheaper feed costs than ground or rolled corn when steers were fed rations in which sorghum silage made up 20 percent of the dry matter (Oklahoma State University).
- Grinding dry shelled corn did not pay with cattle fed two pounds of alfalfa or grass hay a head daily (Pennsylvania State University).
- Whole corn below 12 percent moisture should be processed (Iowa State University).
- It was somewhat harder to keep cattle on feed with whole corn compared to rolled or ground corn (Oklahoma State University).
- Whole-corn and rolled-corn supplementation should be the same when fed in equivalent roughage rations.
- Processing of dry, shelled corn has little effect on carcass composition of slaughter cattle.

High-moisture corn

Grinding or rolling typically has improved the use of high-moisture shelled corn more than that of dry corn. A summary of 12 corn belt experiment station trials showed cattle gained slightly faster and required 6 percent less feed for gain when high-moisture shelled corn was rolled or ground.

Conversely, studies at the South Dakota Experiment Station showed little if any advantage for rolling high-moisture shelled corn fed with low levels of roughage. When roughage levels were 20 percent or more of ration dry matter, they found more advantage for rolling high-moisture corn than for rolling dry corn.

Starting cattle on feed

Management for starting cattle on shelled corn rations is similar to that used with other rations. Cattle unaccustomed to grain should have 40 to 60 percent roughage in the ration at the beginning. Roughages that are satisfactory for mixing with whole-shelled corn in self-feeders to start cattle include cottonseed hulls, corn cobs, ground hay, rice hulls, and pelleted roughages.

A system used to start cattle on shelled-corn rations in a large feedlot started with 35 percent of the ration dry-matter roughage and rapidly decreased to 5 percent, remaining at that level until the cattle were finished. The roughage was decreased to 25, 15, and 5 percent of the ration at 7-day intervals to convert the cattle to the final ration in about three weeks.

Starting with a full feed of corn silage and gradually adding corn and reducing silage for 20 to 30 days is another popular way to start cattle on feed. Sometimes it is difficult to get young calves to eat silage at first. Feeding good quality legume, mixed, or grass hay for a few days before changing to silage is the way some cattle producers like to start small calves on silage. See MU publication G2102, *Care of Newly Purchased Feeder Cattle*, for inoculations and other tips for new cattle.

Some Missouri feeders who use whole-shelled corn in self-feeders to finish beef cattle do not include any roughage. A pelleted supplement and whole corn are mixed for self-feeding. Founder usually is not a problem with all-concentrate, shelled-corn rations if cattle are comfortable and close to feed and water at all times.

In a winter study in outside lots at the University of Illinois, however, about one-fourth of the cattle on all-concentrate rations of either whole-shelled corn or ground-shelled corn were foundered enough to affect performance. Cattle were not eating regularly during severe weather. On the basis of these results they advised providing one to two pounds of roughage per head daily with either cracked or whole corn to reduce founder when cattle are fed in open lots during winter.

Systems for growing and finishing

A number of shelled corn and roughage combinations can be used successfully to finish calves and yearlings for slaughter. Silage is used better in relation to grain in the growing phase. Programs that emphasize silage in the first part of the feeding period are preferred if considerable silage is to be fed. Some possible feeding programs for 400- to 600-pound feeders are:

- A full-feed of corn silage only until cattle weigh 750 to 850 pounds, then a full feed of shelled corn only or corn with 5 to 15 pounds of silage a head daily for finishing. Grass-legume haylage or hay could be substituted for corn silage. At least a half pound of grain for each 100 pounds of body weight will be needed with haylage or hay for rates of gain comparable to a full feed of corn silage.
- Corn silage and one pound of shelled corn for each 100 pounds of body weight of the cattle for the entire feeding period.
- Shelled corn alone or with a limited amount of roughage for the entire feeding period.

Protein supplements

Shelled corn is deficient in protein, calcium and potassium; but adequate, or nearly so, in phosphorus for beef cattle. Supplements fed with shelled corn should correct these nutrient deficiencies. Vitamin A, trace minerals, antibiotics and growth stimulants are other ration components that should be supplied by the protein supplement or by other means.

Feed 20,000 to 30,000 I.U. of Vitamin A and 225 to 300 mg of an ionophore (Rumensin® or Bovatec®) per head daily. Tylan® is an antibiotic approved to be fed with Rumensin for reduction of liver abscesses. Feeding one of the ionophores will reduce founder and other digestive disorders that are often problems with high-concentrate rations.

Growth-stimulating implants like Synovex®, Ralgro®, STEER-oid®, Finaplex-S® and Compudose® will increase rate and efficiency of gains of feedlot cattle from 7 to 15 percent. MGA®, a feed additive, improves the performance of heifers.

The level of protein in the ration that gives the most economical performance of beef cattle is influenced by the age and weight of cattle and the energy level in the ration. Higher protein rations are needed for younger, lighter weight cattle and for higher energy rations.

Calves fed high-concentrate shelled-corn rations should have about 11.5 percent crude protein in their ration (13 percent dry matter basis). After the cattle reach 850 pounds in weight, the protein level can be reduced to 10 percent (11 percent dry matter basis) or lower. Yearling cattle should have 10 to 10.5 percent protein (11 percent to 11.7 percent dry basis) in these high-concentrate rations.

Table 1 gives some supplement formulae to be fed with shelled-corn rations that contain little or no roughage. These supplements are formulated to correct the mineral deficiencies of shelled corn when used to formulate rations with 11 to 12 percent crude protein. It would be advisable, however, to feed a free-choice mineral mixture of one part plain salt and two parts dicalcium phosphate with these supplements. This combination supplies the proper ratio of calcium to phosphorus for adding to a beef ration that is balanced for these minerals. Supplements in Table 1 will not supply adequate calcium and potassium when mixed with corn to make less than a 10.2 percent crude protein ration (as fed).

Table 1. Supplement compositions.

Ingredients (percent)	**Soybean meal**	**Soybean meal – urea**
Ground shelled corn		19.5
Soybean meal, 50 percent	79.0	55.0
Urea, 281 percent		4.0
Limestone	13.0	13.0
Trace-mineral salt	3.5	3.5
Potassium carbonate	4.0	4.5
Antibiotic, vitamin mixture	0.5	0.5
Chemical composition (as fed)		
Protein (percent)	39.5	40.4
Calcium (percent)	4.9	4.8
Phosphorus (percent)	0.5	0.4
Potassium (percent)	3.6	3.6

The pounds of shelled corn to mix with one pound of a 40 percent supplement to make rations with various percentages of protein are given in Table 2.

Table 2. Pounds of shelled corn to mix with one pound of a 40 percent crude protein supplement to supply various percentages of crude protein.

Shelled corn (lbs.)	Percent crude protein in mixture	
	As fed basis	Dry matter basis
9	11.7	13.0
10	11.4	12.6
12	11.0	12.2
14	10.7	11.9
16	10.4	11.6
18	10.2	11.4
20	10.1	11.2

When properly managed, urea supplements work well with high-energy feeds like shelled corn. A number of pelleted or liquid high-urea commercial supplements are available. Formulae for urea supplements are given in MU publication G2071, *Urea Supplements for Beef Cattle*. In studies at Louisiana State University a urea-molasses (6 percent urea) supplement fed in a lick-wheel feeder gave results similar to oil meals when fed with shelled corn. Regulating intake is often a problem when liquid supplements are fed separately from the remainder of the ration.

Complete rations

A complete ration is to feed 1.5 pounds of a 40 percent protein supplement and 5 to 10 pounds of corn silage or 2 to 4 pounds of hay per head daily with all the shelled corn the cattle will clean up. The protein level will decrease some as cattle get heavier and increase their daily feed of shelled corn. See Tables 3 and 4 for other complete-mixed rations using shelled corn.

Table 3. Complete mixed rations (mixture for 100 pounds as-fed basis).

Ingredient	Ration number			
	1	**2**	**3**	**4**
Whole shelled corn	91.0	52.0	81.0	77.5
Protein supplement[1] (40.5)	9.0	8.0	9.0	
Soybean meal (45 percent)				5.5
Corn silage (33 percent D.M.)		40.0		
Grass hay			10.0	
Alfalfa hay				15.0
Limestone				0.5
Trace mineral salt				0.35
Potassium carbonate				0.15
Vitamin – antibiotic[2]				0.5
Total	100.0	100.0	100.0	100.0
Composition, DM basis (percent)				
Protein	13.4	13.6	13.1	13.2
TDN	88.5	83.8	83.8	83.6
Calcium	0.52	0.66	0.56	0.52
Phosphorus	0.32	0.31	0.31	0.31
Potassium	0.6	0.87	0.84	0.74

[1]Protein supplements listed in Table 1.
[2]Supply 25,000 I.U. of Vitamin A, 80 mg of antibiotics and 225 to 300 mg of ionophore per head daily.

Table 4. Complete mixed rations (mixture for 100 pounds as-fed basis).

Ingredient	Ration number			
	1	2	3	4
Whole shelled corn	94.35	55.20	84.25	84.95
Soybean meal (45 percent)	3.10	3.10	3.50	1.00
Corn silage (33 percent D.M.)		40.00		
Grass hay			10.00	
Alfalfa hay				12.00
Limestone	1.20	0.80	1.10	0.80
Trace mineral salt	0.35	0.25	0.35	0.35
Potassium carbonate	0.50	0.30	0.30	0.40
Vitamin — antibiotic[1]	0.50	0.35	0.50	0.50
Totals	100.00	100.00	100.00	100.00
Composition, DM basis (percent)				
Protein	11.1	10.0	11.1	11.1
TDN	88.6	75.7	84.6	84.8
Calcium	0.53	0.38	0.53	0.52
Phosphorus	0.31	0.30	0.30	0.29
Potassium	0.69	0.64	0.72	0.76

[1]Supply 25,000 I.U. Vitamin Q, 80 mg antibiotics and 225 to 300 mg of ionophore per head daily.

Rations in Table 3 have 11.5 percent crude protein (as fed) for use with calves in the first part of the feeding period. Rations in Table 4 have 10 percent crude protein and are suitable for yearlings or for calves during the last part of the feeding period.

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