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Utilization of crop residues for livestock feed

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Quick Facts

Crop residue is the portion of the harvested crop that remains after the grain or marketable portion of the plant is removed.

Corn, sorghum, and sugar beet residues are some of the highest quality residues and provide an excellent feed source for gestating beef cows, when supplemented.

Cereal grain residues generally are low quality and probably best utilized after treatment with anhydrous ammonia.

Due to their low energy value, maximum utilization of residues is with feeding programs designed for maintenance of animals rather than weight gain.

Maintenance of minimal amounts of residue in the field is important to provide soil erosion control.

Large amounts of crop residues are produced annually in Colorado. Crop residue is the portion of the harvested crop that remains after the grain or marketable portion of the plant is removed. The most common is cereal grain straw from wheat, barley, and rye, followed by corn stalks, grain sorghum residue, and sugar-beet tops. Dry bean and other crop residue are of lesser importance.

These residues can and do provide a sizeable contribution to the total available feed-supply for livestock production in Colorado.

Quantity and Quality

The quantity of residue produced by various crops is found in Table 1. Using estimates from

Table 1: Crop residue production.

Crop	Unit	Lbs. Residue/Unit
Rye	bu	100
Wheat	bu	80
Barley	bu	50
Oats	bu	40
Corn or Sorghum	bu	50
Sugar beets	ton	150

this table, a grower could expect approximately 7,500 lbs/acre of residue from corn producing 150 bu/acre or 2,800 lbs/acre of residue from winter wheat producing 35 bu/acre.

The quality of various crop residues is determined by the protein and energy or digestible dry matter (DDM) content of the particular residue, since these are the nutrients most important to livestock performance. Corn and sorghum residue and sugar beet tops typically have the highest quality as indicated by greater DDM values (Table 2). The cereal grain residues generally are lower in quality, with oat and barley residue providing the greatest quality. All crop residues possess their highest quality at the time of grain harvest and de-

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cline in quality the longer they remain in the field. Sorghum residue does not decrease in quality as rapidly as corn.

Table 2: Crop residue quality at maturity.

Crop	% Crude Protein	% Digestible Dry Matter
Rye	3.0	31
Wheat	3.6	45
Barley	4.1	48
Oats	4.4	50
Corn	4.2	52
Sorghum	6.0	52
Sugar beets	12.7	52

Utilization

The primary problems with crop residues are: 1) low quality and, 2) harvesting. An advantage to use crop residues is that the cost to produce generally is associated with the production of the grain or marketable product.

Crop residues are most economically used by grazing. Because of their lower quality, cereal grain residues do not lend themselves well to grazing. Whereas, corn and sorghum residues are well utilized in forage systems, particularly for beef cows. Sugar-beet tops also are frequently utilized by sheep producers for grazing purposes.

In general, gestating beef cows can be maintained for approximately 40 days per acre per cow (weather permitting) when grazing irrigated corn or sorghum residues. Livestock also require 1/2 to 1 pound per day of a 40-percent protein supplement in addition to vitamin and mineral supplements.

A Nebraska study involving the grazing of gestating cows during fall and early winter on corn and sorghum residues indicates that cows perform equally well on both residues (Table 3). However, beef cow performance can be expected to decline if grazing is allowed to continue beyond early winter, since feed availability and quality decline as the season progresses. This is because livestock typically graze the highest quality residue first and leave the lower quality stalks until last. Nutritionally, this is contrary to the needs of the cow.

In midgestation, the cow's needs increase as the fetus grows, with the last trimester as the most critical period. Thus, little supplementation is needed during the first 30 days of grazing, but some protein supplement should be fed thereafter. An excellent practice is grazing of corn or sorghum fields with alfalfa fields after the fall-hardening period for alfalfa to provide protein supplementation.

Table 3: Beef cow performance while grazing corn or sorghum.

Residue	No. of Cows	Wt. gain	72 days Avg. gain
Corn	46	135	1.87
Sorghum	45	142	1.96

The quality of crop residues generally is considered inadequate to provide for much weight gain in young cattle or sheep, unless significant grain remains in the field after harvest. Otherwise, supplement young livestock at all times with protein and energy in order to insure adequate performance.

When grazing corn and sorghum residues, it is important to exercise caution regarding management of livestock. Often times, 60 to 150 pounds per acre of grain may remain in the field after harvest. While the grain is an excellent feed for livestock, overconsumption may produce acidosis or founder in cattle. There is less problem with grain remaining in the field with sorghum than corn.

Additionally, the regrowth that occurs after grain harvest of sorghum may be high in prussic acid or nitrates, particularly after a frost. Both compounds can be lethal to livestock if ingested in significant quantities. For further information regarding these potential problems, contact your county Cooperative Extension office for Service in Action sheet 1.610, *Nitrate poisoning in livestock* and 1.612, *Prussic acid poisoning in livestock*.

Sugar beet tops have long been utilized as a crop residue, with very little being wasted. Most beet tops are grazed or harvested in the field after topping and digging of beets is complete. Typically, the topper windrower is used prior to digging of beets to remove the tops from the beet. This residue remains in the field for grazing purposes. The best use of beet tops is with sheep, but cattle also perform well grazing beet tops. Beet tops also provide a desirable supplementation for cattle grazing corn or sorghum residue, since the beet tops can possess additional protein that may lack in corn and sorghum residue (Table 2).

Harvesting

During late winter and early spring, it is necessary to feed harvested forage to livestock in Colorado. Grazing of crop residue usually is not feasible after February 1 and pasture is not available until May. This is an expensive period for feeding livestock because feed must be harvested and the livestock nutrient needs are high, particularly for gestating or lactating cows. The low quality of harvested crop residues generally will not meet the energy needs of the beef cow.

Two possibilities to enhance the quality of residues are: 1.) management schemes to increase residue quality, or 2.) chemical treatment, primarily with ammonia. corn and sorghum residue are of good quality when the grain is harvested. If the grain is harvested at greater than 20 percent moisture, the residue will likely contain more than 50 percent moisture. These residues, if harvested immediately, can be chopped and ensiled. The resulting silage has good feeding value and probably will suffice to meet the energy needs of the beef cow. As with grazing, some protein supplementation is required.

Anhydrous ammonia treatment of dry-harvested crop residues holds potential for increasing the feeding value of low quality residues. In general, this treatment is accomplished by placing bales of residues into a stack, covering the stack with a sheet of plastic, and sealing the edges of the

plastic. Anhydrous ammonia is injected underneath the plastic cover. Depending upon ambient temperatures, two to three weeks are needed to complete the reaction.

Treatment of residues results in doubling of protein content for cereal grain residues, while only a 5 percent increase in protein is seen for other residue such as corn and sorghum. Digestibility of all crop residues can be expected to increase by as much as 20 percent. Thus, treatment of cereal grain residues results in greater increases in quality than treatment of corn or sorghum residues. In general, treated residues probably are equivalent to average-quality hay, depending on the quality of residue treated and effectiveness of treatment.

Either early-harvested corn or sorghum residues or ammonia-treated residues have potential to decrease the cost of beef cow feeding during the harvested-feed period. While residues might make up the majority of the feed supply, some supplemental feed in the form of high-quality hay or concentrates may be needed. Cows should gain weight during this period to help rebreeding.

Protein Supplement

The type of protein supplements referred to are the naturally occurring proteins such as those from soybean, cottonseed, and sunflower. Other protein supplements may contain non-protein forms of nitrogen that must be converted into protein in the rumen. To accomplish this, the rumen must have readily available forms of energy. Low quality crop residues do not have large amounts of available energy to facilitate this conversion. Thus, use of natural occurring protein supplementation with crop residue utilization programs are encouraged to maximize animal performance.

Residue Management for Soil Erosion Control

When grazing or harvesting crop residues in Colorado, it is important to keep some residue in the field to protect the soil from wind and water erosion. The amount of residue required depends on the type of residue and soil type. However, in general, a minimum of 1,200 pounds per acre of cereal grain residue and 2,550 pounds per acre of corn or sorghum residue is required to provide soil erosion control. Using the residue production figures in Table 1, dryland crops of wheat (35 bu/acre), corn (60 bu/acre), and sorghum (50 bu/acre) will not provide much opportunity for grazing or harvesting these crop residues and provide soil erosion control at the same time. Therefore, most residue utilization programs should make use of crop residues produced on irrigated land, where residue production levels are much greater. For further information regarding crop residue and soil erosion, consult the Soil Conservation Service (SCS).

References

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