Tell 'Em Cattle are Upcyclers

Would shifting from using grain as feed for livestock to using it as food for humans be more efficient?

by Troy Smith, field editor

Ever run across one of those people who loves to decry the ills of modern agriculture in general; the beef industry in particular? Surely, you're acquainted with at least one of their kind. Maybe it's your goofy brother-in-law or that smart-alecky insurance guy — the one from your high school class. It's that certain person that likes to get under your skin by waxing long and loud about how much better off the world would be if all the grain used to feed cattle were used as human food instead.

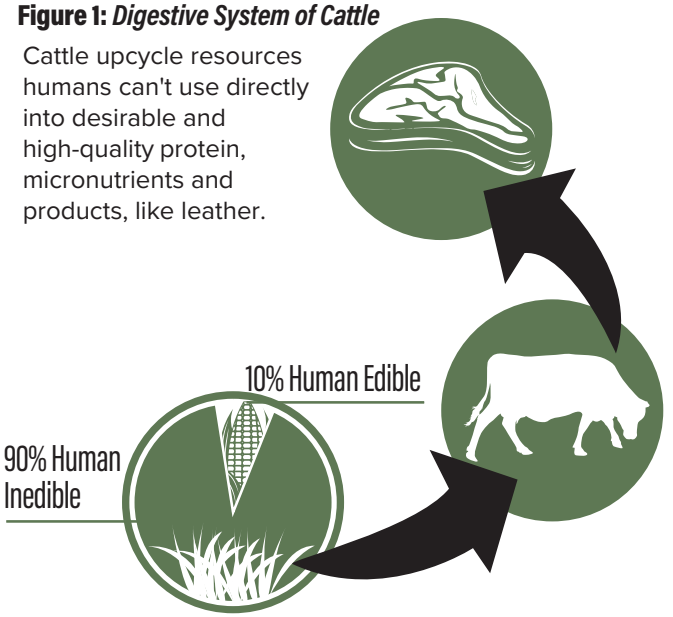
Here's an idea. The next time that person launches into another rant, ask them to answer the following question: How many 3-year-old children could derive their protein requirements, for a period of one year, from the amount of corn needed to finish a market steer? Go ahead and ask.

Of course, you may not know the answer either, but Tryon Wickersham has done the math. An animal nutritionist at Texas A&M University, Wickersham says the answer surprises a lot of people.

Noting that it typically takes about 1,400 pounds (lb.) of corn to finish a steer, Wickersham says, "From that much corn, 0.53 3-year-old children could satisfy their protein requirements for one year. One half of a kid could do it, if it could eat that much corn."

Figure 1: ***Digestive System of Cattle***

Cattle upcycle resources humans can't use directly into desirable and high-quality protein, micronutrients and products, like leather.



It has been alleged, repeatedly, that shifting from using grain as feed for livestock to using it as food for humans would be more efficient and yield more food per acre of cropland. Champions for adoption of plant-based human diets, at the global level, claim it simultaneously optimizes the food supply, health, environmental and social justice outcomes. Systems for raising animals for meat, they continuously claim, are unsustainable.

Joan Sabate and the late Sam Soret, professors at California's Loma Linda University School of Public Health, say as much in an article they co-authored for the 2014 issue of the *American Journal of Clinical Nutrition*. The plant protein proponents recommended policy action favoring global adoption of plant-based diets, calling it "perhaps the most rational, scientific, and moral path for a sustainable future of the human race and other living creatures of the biosphere we share."

Tryon Wickersham says optimization of the food supply, health, environmental and social justice outcomes are worthy goals. He can't agree, however, that any could be readily achieved by making human food out of the grain otherwise fed to livestock. It's just not that simple.

A case for animal protein

Complicating the turn-feed-to-food idea is the matter of dietary protein. According to Wickersham, it's pretty hard to meet the essential amino acid requirements of humans with the protein available in grains. The presence and availability of essential amino acids is the basis for evaluating protein quality and plant proteins generally lack one or more amino acids. Soybeans come close, but animal proteins offer complete

amino acid profiles. Beef provides high-quality protein plus minerals and vitamins.

And beef is a result of the bovine beast's real claim to fame. Wickersham thinks the ruminant's role is often ignored in discussions of beef industry sustainability, when it should be celebrated. Cattle have the ability to convert low-value feedstuffs into high-quality human food. And advocates for plant-based human diets often fail to recognize or appreciate that the largest portion of cattle diets consists of feedstuffs inedible, or unpalatable, to people. Beef is a product of upcycling.

"Upcycling" is a term heard more often since society as a whole became concerned about sustainability. It is generally defined as the process of transforming low-quality substances, byproducts and even waste materials into products of higher quality or increased environmental value.

Think about the crop residues and byproducts from corn, wheat, rice, soy, sugar beet, cotton and peanut production, and even the cull vegetables and bakery waste that find their way into cattle diets. Just think about the grazed forages that represent some 90% of the average beef critter's total diet, and one will see why cattle rank among the original upcyclers.

According to Wickersham, cattle industry critics often evaluate the desirability of beef production on the basis of gross calorie or protein intake and output values. But understanding the protein quality of beef — its greater biological value relative to other sources of protein for human diets — is important to fully understanding the impacts beef production has on the human food supply as well as sustainability in the beef industry.

Along with his Texas A&M colleagues, Wickersham has tried to get a better handle on beef's role

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Table 1: ***Daily recommended dietary nutrients supplied by consuming one serving of beef***

Nutrient	Purpose	Content of a 3-oz Serving*	% Daily Value**
Protein (g)	helps preserve, build and repair muscle	25.4	51%
Vitamin B_{12} (mcg)	helps maintain brain function and gives energy	2.4	41%
Zinc (mg)	helps maintain a healthy immune system	5.9	39%
Selenium (mcg)	helps protect cells from damage	26.6	38%
Niacin (mg)	supports energy production and metabolism	4.9	25%
Vitamin B_6 (mg)	helps maintain brain function and gives energy	0.48	24%
Phosphorus (mg)	helps build bone and teeth	201	20%
Riboflavin (mg)	helps convert food into fuel	0.24	14%
Iron (mg)	helps your body use oxygen	2.5	14%
Choline (mg)	supports nervous system development	73.1	13%
Calories***	provide energy	173	9%
Carbohydrates (g)	provide energy	0	0%

***Percent of calories is based on a 2000-calorie daily diet. V refers to Daily Value, the amount of a nutrient needed for a healthy adult on a 2,000-calorie diet. The %DV is the percent of a nutrient's DV supplied by a particular food. **D USDA National Nutrient Database for Standard Reference, NDB# 13364.*Nutrient content of a 3 oz serving of beef is based on the Reference Amount Customarily Consumed (RACC) of beef established by USDA.

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as a source of quality protein for the human diet. They developed a "protein quality ratio" to describe how human-edible plant proteins in feedstuffs used as inputs to beef production compare with the output of higher-quality protein in beef. Thus, the researchers determined the net protein contribution for each sector — cow-calf, stocker and feedlot — and the total beef production system.

"Cow-calf production on grass looks like a hero," Wickersham states, noting that sector's high net protein contribution. It stems from little input of human-edible protein and results in the greatest efficiency of human-edible protein conversion.

The net protein contribution is lower for the stocker sector and lower still for the feedlot sector, because both incorporate more human-edible plant protein in animal diets. Still, both of these sectors produce more human-edible protein than is consumed in production; and both were more efficient at protein conversion than non-ruminant animal production systems (pork or poultry).

When evaluated as a whole, the beef industry is a net contributor of human-edible protein, meaning more is made available for human consumption, as beef, than is used in its production. And the quality of human edible protein is enhanced throughout the beef value chain, because of upcycling the protein.

Wickersham says that while cattle shine on grass, from a net protein contribution perspective, grazing doesn't optimize everything. Looking at methane production of the various cattle sectors, researchers saw that the cow-calf sector was associated with the highest methane emissions. Placed in confinement and fed diets including more human-edible plant protein, methane emissions from cow-calf herds are reduced, but net protein contribution suffers.

"There are trade-offs between the costs and benefits. Sustainability is a balancing act," Wickersham says. "But the current beef production system is a net contributor to the human protein supply. It's because ruminants take low-value inputs and turn them into higher-value products — high-quality protein for humans."

So, rather than expecting a 3-year-old child to meet its protein needs by eating corn, we could feed the corn to cattle. That 1,400 lb. of grain needed to finish a steer will be turned into 117 lb. of high-quality protein. According to Wickersham, that's just about the right amount to meet the protein requirements for two kids.

What will they say to that? AJ