

Teach Cows to Eat Weeds: The Science, the Steps and the Reasons Why Cows Should Eat Weeds

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In 2004, I taught a small herd of shorthorns, longhorns, Herefords and Angus cross heifers to eat Canada thistle, leafy spurge and spotted knapweed. What began as a two-grazing-season pilot project at Grant-Kohrs Ranch National Historic Site in Deer Lodge, Montana, has turned into a mission to change the way we think about forage and weeds, and to increase awareness of how flexible our livestock can be when it comes to food.

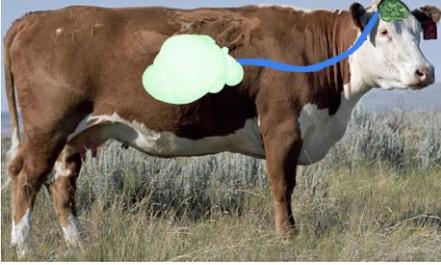
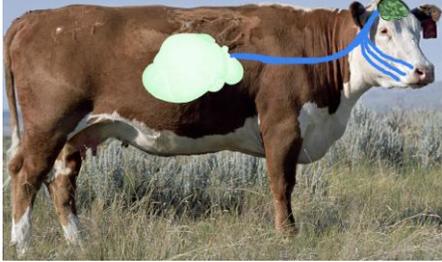
Over the past nine grazing seasons I've taught over 1,000 cattle, a flock of sheep, and the bison on one of Ted Turner's Montana ranches to eat many of our most problematic weeds. The steps I use are based on decades of research about how animals learn, and how they choose what to eat. Working in California, Colorado, Montana, Oregon, Vermont, New Hampshire, Utah, and British Columbia and Alberta, Canada on a wide variety of farming and ranching operations, I've learned what it takes to adapt the process so that anyone, anywhere can use it.

It's now possible to teach a cow to eat a new weed in as little as 8 to 10 hours spread over seven days. Educated cows teach their offspring and herd mates, breed back and calve at expected rates, and gain weight as well as, and sometimes better than, non-weed-eating cattle. Once cows learn that a weed is tasty, they continue to eat it the rest of their lives. Even better, the training process seems to result in "open-mindedness" about what food might be, so educated cows try other weeds in pasture on their own. The result is that by mixing educated animals with untrained animals and moving them through a variety of weedy pastures, in as little as one grazing season a producer could have a herd that eats just about everything found in pasture. In fact, my experience is that cows can eat just as many weeds and as much brush as the herd of goats I managed for my seven-year research project on fire danger mitigation.

Some Science

The breakthroughs in science that are at the foundation of teaching cows to eat weeds came from Dr. Fred Provenza and his colleagues at Utah State University. Over the past three decades they did research on how animals choose what to eat. What they learned is:

- Young animals learn from their mothers what to eat. They will add foods they see herd mates eating, but we will always be able to trace their primary food preferences back to what mother ate. It follows, then, that cows usually don't eat weeds because Mom didn't eat them and herd mates don't eat them. (You can watch a demonstration of this here: http://www.youtube.com/watch?v=nx5-2N-tjN0&list=PL110C96F913F016F2&index=4&feature=plpp_video)
- Animals also choose foods based on "palatability." When there just isn't enough of what Mom ate to make a meal, animals will sample new foods. They choose whether to keep on eating that food based on feedback from nutrients and toxins in the food. Here's how it works:

	
<p>When an animal takes a bite of food, nerves in the mouth and nose take information about the food's flavor and odor to the brain.</p>	<p>Nerves running from the rumen to the brain constantly send signals about the nutritional value of what was just eaten.</p>
	
<p>The brain matches feedback from the rumen to the taste and smell of a food, then categorizes tastes and smells as good or bad based on the food's nutritional value.</p>	<p>Other nerves throughout the body send their own signals to the brain, indicating that maybe a little more protein might be necessary, or a little less, or that the belly is full now and it's time to stop eating.</p>
	<p>This gives us a new definition for palatability. Foods taste good or bad based on a combination of nutrients and toxins in the plant, and the animal's physical condition. As an animal's physical state changes, so do the kinds of foods it likes best.</p>
<p>The brain considers the changing nutritional needs of the animal and adjusts how much and what the animal eats to take advantage of the nutrients and toxins in a food. In general, an animal eats more of foods high in nutrients, and less of foods low in nutrients or high in toxins.</p>	

(This Youtube video shows the effect of nutrients on what animals will or won't eat: http://www.youtube.com/watch?v=cIR_5362qQc&list=PL110C96F913F016F2&index=1&feature=plpp_video)

Since all plants contain toxins, researchers were interested in how the feedback system would respond. What they found is that if a food contains nutrients that are useful to the animal, plant toxins simply reduce the amount it eats. The higher the level of toxins, the less the animal eats. Further, they found that both nutrients and toxins could offset the effects of other toxins and that animals could figure out how to mix foods to their best advantage. This is important to producers because it explains why we can expect that animals can safely choose what to eat in pasture. (This video shows animals learning from experience with toxins:

http://www.youtube.com/watch?v=7bD00znhBw8&list=PL110C96F913F016F2&index=7&feature=plpp_video.)

How good is a cow's ability to mix its own diet?

Researchers at Utah State University ran an experiment with 2 groups of steers. One group was fed a Total Mixed Ration. The other group was served all the ingredients in the TMR in separate boxes so they could choose what and how much they wanted to eat. Both groups of steers gained weight at similar rates, but the steers mixing their own diet gained weight for 20% less cost.

The steers' message to us: Letting animals mix their own diets can save us a lot of time and money.

The Steps

The first step in my training process is based on this new understanding of palatability. I knew that if a plant is nutritious and toxins are not a problem, if my trainee tries it, she will get good feedback and then continue eating it. Fortunately, weeds are very nutritious. Over the last nine years I've learned that most weeds are more nutritious than grass, and often are the equivalent of, or better than, alfalfa in protein. I've also found very few that are dangerous to livestock. (For more on nutrients and toxins in weeds, visit my website at:

<http://www.livestockforlandscapes.com/edible.htm>. I have also put a list of plants farmers and ranchers should be taking advantage of on my blog site at: <http://thetaoofcow.com>.)

The second step of the process is to choose trainees. Which animals and how many you'll train depends on how your operation functions. Some producers choose to train their replacement heifers because they are pastured separately. Others have several herds of cow-calf pairs in various pastures. They choose the herd that is most accessible by vehicle. Of the two dairies I've worked with, both chose to train in the barn because animals were used to being fed there. I recommend doing whatever is easiest for you. As you choose, consider where the weeds are and be

sure the group you train will have access to that pasture. The number you choose is also based on how you operate, but keep the following in mind:

- The process works best when trainees compete with one another for the feeds we give them during the training process. I've found that when I train less than 10 animals, there is not as much competition. This doesn't mean you have to train more than 10 animals. You just have to pay more attention and make adjustments if necessary.
- You don't have to train all the animals you have. I've trained as many as 110 cow-calf pairs because that worked best for the Montana rancher I was helping. In the west where the scale is larger, I typically train herds of about 50 cow-calf pairs. It takes about 30 minutes per feeding on days 1 through 4 to feed a group of 50, and about 45 minutes to gather enough weeds for days 5 through 7. The further east I go, the smaller the trainee group becomes, until I'm working with 10 to 20 animals at most.

Once I know my plant is safe to eat and I've picked my trainees and training location, I'm ready to start the training process. Since animals develop expectations based on their experiences and then respond accordingly, I want to create an expectation that everything I bring them is good to eat, even if it looks a little strange. In effect, what I'm doing is creating a "language" that includes visual and audio cues that tell my trainees, "Here she comes again! I bet she's bringing good stuff! We should run over there and eat whatever it is!" Here's how it works:

- **Morning and afternoon for 4 days I bring the trainees an unfamiliar, but very nutritious food.** This is as simple as going to your local feed store and picking up 8 different bags of feed. It doesn't really matter what you choose as long as it's got good protein. Be sure to pick things that have different flavors, sizes, shapes and smells. By trying lots of different things they get used to the idea that food can come in all shapes and sizes, so when you bring them the target weed to try, it's just one more strange looking thing in a series of strange things. I use one 50-pound bag of feed per 25 animals per feeding. So if you have 25 trainees, you'll need 8 bags of feed for these 4 days.

Why 8 different new foods?

When I looked at the data from experiments with animals trying new foods, it seemed to take them a little over a week to become comfortable with a new food.

I translated this into trying 8 different foods. I condensed it into 4 days because trainees showed me they were quick learners, and to make it easier for human schedules.

- **It's important that the same person bring the food at about the same time every day.** I've learned that each person does things in a slightly different way so animals have a hard time developing solid expectations.

• **I let them know I'm coming before they can actually see me by honking the horn on my truck as I drive to the training area.** I honk a lot because I want them to come in from wherever they're grazing, and because it is the first cue telling them, "Something great is coming!" (See Pavlov's Dog.)

• **I use empty 250-pound supplement tubs as my feeders.** The feeders are just another cue saying "Look! Here's something good!" and their depth creates competition.

Two cows or three heifers can put their heads in one tub at a time, but one animal can't really see what the other is eating, so they all grab whatever they can get. I assume they're each thinking, "Well, she's eating it, so it must be good! I'm going to grab whatever I can get before she eats it all!"

• **On Day 5, I introduce the target weed for the first time.** I skip the morning feeding and feed weeds in the afternoon, mixed with about a ½ bag of a feed they've eaten on one of the first 4 days. On day 6, I provide another afternoon feeding of the target weed mixed with about a ¼ bag of feed. On day 7, I feed the weed plain. I don't pick a lot of weeds, because this is just a snack, and trainees may not finish all I bring them. That's fine. All I want is for at least one cow to swallow one bite of my target weed so that they will get the good feedback from the weed's nutrients. When that happens, I know they will eat the weed in pasture.

• **Trainees in pasture may start eating the target weed after their very first snack.** By paying attention to what I see them doing and eating in pasture, I can often reduce the number of times I feed weeds. I look

Pavlov's dog

Animal behaviorist Ivan Pavlov noticed that his dog salivated when he was fed. Pavlov began ringing a bell before feeding the dog. Eventually the dog associated the ringing of the bell with being fed, and he would begin to drool when he heard the bell.

I've found that when I honk, cows begin to salivate, so they're ready to try whatever I bring them to eat.

Why skip the morning feeding?

First, I want the animals to come to the tubs whenever I show up so that I can always use them as a tool. Research shows us that when animals get intermittent feedback for something they do, they will keep on trying until they get the feedback. For example, if a rat gets a pellet every time he presses a lever, when he stops getting the pellet, he stops pressing the lever. But if he gets the pellet sometimes when he presses, and not other times, he will always press the lever on the off chance that this is the time he gets a pellet. Translated to the cow training, when I skip the morning feedings, I start the process of ensuring that they don't quit coming to the tubs when I stop putting things in them.

Second, I don't really like picking weeds any more than the next person, so once a day works for me and for the animals.

for bent over and bitten off stems and leaves. I also take time to sit down in pasture with my trainees in a patch of the target weed. Because they are accustomed to being fed by me, they come over to see what I'm doing. When I do nothing, they get bored and begin grazing, often sampling the target weed. As soon as I see evidence of grazed weeds, I end the training.

• **If you have more than one target weed, you can introduce it to your trainees as soon as they've finished the first weed.** You don't have to start again from the beginning. If your trainees are in a pasture with that weed, you can wait to see if they try it on their own, and if they don't, you can always bring the tubs back out, and throw a bit of the second weed in the tubs to show them that it is good to eat.

Each group of trainees behaves differently, so I observe what they're doing and adjust the process here and there to meet their needs. More information about challenges I've encountered and how I've solved them is available in my book, "Cows Eat Weeds" and the DVD, "Teaching Cows to Eat Weeds." Both are available on my website. You can see a condensed version of the training here:

http://www.youtube.com/watch?v=sVk-YKq_xNo&list=UUTLRnl4QeHrvHMrHLTsVAeg&index=1&feature=plcp. Other videos are available on my youtube channel at <http://www.youtube.com/kathyvoth>.

Why Cows Should Eat Weeds

Forage quantity, quality and cost limit how many cattle a producer can raise, and how much money he makes doing it. When cows eat weeds, producers can potentially raise more cattle, and spend less money doing it. Let's break it down:

Forage Quantity

Economist John Morley found that, based on average pasture weed populations, if a producer's cattle ate just 70% of the weeds available, that producer would have about 43% more forage. This is just an average; your percentage will be different based on your past weed management practices.

One of the questions most producers have about weeds is whether they will regrow after being grazed once like grass does. The answer in many cases is "Yes." Depending on the time of year, every weed I've seen grazed by cattle has responded by producing more stems or buds of some kind.

Nevada Rancher Lance Knudsen, who trained his cows to eat Russian Knapweed says that "Knapweed has become a really good source of feed this year when the grass isn't doing much because of drought. We graze it before it seeds out and it just keeps growing back. After just a week and a half we have 6 to 7 inches of regrowth and we can put the cattle in again." This is in an area receiving little to no precipitation. He said he'd already grazed that pasture three times for the 2012 grazing season, when typically he can only get one week's worth of feed from it. His

cattle began eating all the thistles in his pastures as well without any additional training. He noted that as soon as the cattle graze the buds off the tops of the musk thistle stems, the branches below produce buds, and when the cattle eat those buds, the branches below them produce more buds. “So feed is being created as they graze it,” he said.

Forage Quality

Weeds are high quality forage, maintaining much higher levels of protein through the growing season than typical pasture grasses. Because they have a higher leaf to stem ratio than grasses, they generally have better digestibility numbers as well. A maintenance ration for cattle requires 8% protein, so when grasses dry in mid-summer and drop below 8%, weeds can provide the protein cattle need to maintain, or even to gain weight. Higher levels of protein in weeds can also provide the nutrients rumen microbes need to process lower quality forages, so we can take advantage of forage that might not otherwise have been useful.

Examples of 15-20% Protein Weeds

Canada Thistle	Leafy Spurge
Spotted Knapweed	Russian thistle
Russian Knapweed	Distaff thistle
Whitetop	Musk thistle
Pigweed	Bindweed
Wild licorice	Ragweed

Typical protein values of grasses run between 2 and 11%

Cost

Weeds are a free and widely available forage. In addition to being nutritious, they are often available when other forages aren't either because of the time of year, or due to drought conditions. They reseed themselves with ease, and require no effort at all to raise.

What's Next?

I've done the easy part. I translated the science available into easy steps that anyone can use to teach their livestock to eat weeds. To make sure it works, I've trained lots of animals in a wide variety of places and circumstances. What I've found is that educated cattle teach their offspring and herd mates, breed back and calve at expected rates, and gain weight as well as, and sometimes better than, non-weed-eating cattle.

The rest of my mission is much more difficult. The weight of centuries of prejudice about weeds is difficult to throw off. Even when I outline the benefits of these misunderstood, much maligned plants, my audience members shake their heads skeptically. Yet, little by little, I am making progress. The numbers of people asking me to speak at conferences is increasing dramatically, sales of my instructional materials are increasing slowly but surely, and the number of people calling me about the success they're having with their weed-eating cattle is on the rise.

Research into how farmers and ranchers adopt new things tells me that it takes about 10 years of background work before a few will begin to consider it, and 20 years total for an idea to become old hat. With that in mind, I'm planning a huge celebration in 2023, when most of you will have forgotten that weed-eating cows was ever a new idea.

(For links to scientific articles and more background on the work done by researchers at Utah State University, visit <http://www.behave.net>.)