Dr. Sandra Steingraber

I'm not sure when it appeared that we farm regeneratively, but at some point in the past couple of years the management practices we are following sort of fell into that box. I wasn't sure how to present them, but here is a list of what we do. I've also included things that I'd like to do in the future. Some of these are notions put into practice, while other strategies are pervasive in the literature.

Something I have noticed, and it's consistent with most of the practices below, is that the management practices adopted to sequester carbon, to decrease methane emissions, to optimize water use, and to improve wildlife habitat are generally also practices that lead to long term profitability. I have also noticed that many of the practices are scalable for implementation in a variety of farm sizes.

It should also be mentioned that all farms are different, and many of these items will not be appropriate for farms with different management challenges than ours. So that you know, we are located near the shore of Lake Huron in Bruce County, Ontario, Canada.

When you hear about regenerative agriculture, much of the discussion is focused on soil.

1. Graze cattle rotationally. Lately this is called adaptive multipaddock grazing (AMP) which sounds complicated but it's not. Move cattle into a new pasture every 1 to 3 days, and don't return until the grass has grown back. Good contacts would include Paige Stanley at UC Berkeley, or Jason Rowntree at Michigan State. David Johnson in New Mexico would be a good soil science contact.

Requirements

- electric fencing (in the future virtual fencing may allow extensive rangelands to use AMP effectively; see the Norwegian company "No Fence")
- access to water, salt, minerals

Rationale for 1.

Carbon sequestration through the combined action of photosynthesis, grazing, and soil organisms (invertebrates, bacteria, fungus, protists). You may read that % soil organic matter will peak after a number of years, and I suspect that is true, but total soil organic *content* likely continues over decades. For example, native tall grass prairie had enormous total organic content not because of a high %SOM but because of the great depths of soil.

Improved productivity of pastures.

Improved water infiltration.

Improved water retention and drought tolerance.

Decreased erosion.

Preservation of agricultural grassland habitat for species at risk (on our farm we treat paddocks like a checker board and skip paddocks in the middle that have nesting Bobolinks and Meadowlarks; we graze them harder when we come by on the next rotation) I think that habitat preservation is not emphasized enough.

The next few strategies focus on bringing cattle to their feed, instead of the feed to the cattle.

2. Graze longer into the end of the season by stockpiling forage. Locally, the end of October marks the end of the grazing season but keeping some acres with forage that is ready to graze can give the herd a couple more weeks or so.

3. Plant cover crops and graze them.

4. Graze standing 2nd cut hay during the driest mid-summer period in order to stay off the AMP paddocks for a couple of weeks. This seems to be the break that the paddocks need.

5. Bale graze in winter. The twine is removed in the fall and the herd are allowed access to bales set out in the field. Bale grazing is a challenge in our climate until the ground is thoroughly frozen.

6. Mix trefoil seeds and red clover seeds in the mineral on pasture. Some of these seeds will survive digestion and are spread throughout the pasture. Both are legumes and provide nitrogen, and trefoil has the advantage of being non-bloating. Similarly, if spreading solid manure with a spreader, I always throw a coffee can of seed on top of each load.

7. Don't creep feed grain. I find my calves are too heavy in the fall anyway.

8. A feed additive called 3NOP is currently being developed. It is a competitive inhibitor of the enzyme that is used when rumen microbes produce methane. It is a 15 atom molecule that gets in the way of the bacteria's methyl coenzyme M reductase. I'm going to take a closer look at this when it is available…reductions in enteric methane are reported to be significant.

   Some other unrelated research is being conducted that compares the microbiome of cattle to panda and Canadian beaver which have the ability to digest very poor quality food efficiently. Similarly, rumen content transfers from bison to cattle have been performed. There is a lot of other interesting stuff like this.

Rationale for 2-8.

GHG emissions from mechanization may be reduced while simultaneously amending the soil with compost, manure, and urine.

The benefits of using cover crops and never having bare soil are pretty well known.

3NOP may greatly reduce methane emissions.

The next strategy applies to finishing cattle.

9. It's not realistic for a farm that is heavily invested in feeding cattle to follow 1-8 above; grass finished operations will however. The challenge then, is to decrease the percentage of annual crops in the ration and increase the percentage of perennials. Is there an advantage for a large finishing operation to lean more heavily on timothy-alfalfa haylage, stored in a bunker and mixed into their TMR? Could smaller finishers wrap more bales (with biodegradable wrap) and feed them as baleage? Haylage can be high protein, high quality feed and the fields where it is grown can sequester carbon.
   Perennial wheat (Kernza), developed by The Land Institute, has possibilities in a finishing ration and is something to watch.

Manage manure to reduce emissions and the purchase of nutrient inputs.

10. This topic is extremely important and I'm not sure where to start. Manure management is key to nutrient cycling and the elimination of commercial fertilizers. At the same time, when not properly handled, it can release large quantities of GHG. This is a huge topic.

The question of vaccines, antibiotics, fly repellants, and deworming.

11. I view the health care of my cattle in a similar way that I view my own and my kids'. For example, I vaccinate. I administer an antibiotic, if necessary, and under the direction of a veterinarian. That being said my herd is super

healthy, but my number one issue has been sore hooves in summer. To prevent this all the cows and bulls have their hooves trimmed each July. This seems trivial but it has a huge impact on herd health.

Rationale.

Aside from ethical reasons, any cow that has a sore hoof will not graze well and her calf will not grow well; she and her calf will still emit GHG however. If a cow were to die from a preventable condition before weaning a calf, then all of her GHG emissions to that point in the year are a total waste.

12. Do not use Ivermectin dewormers on pasture. Dung beetles need to do their job, and the are killed by Ivomec products. But yes…have a deworming plan.
13. Make fly repellent for your pasture oilers using essential oils. You will find the recipes online. They work.

Rationale for 12-13

Cows and calves that have a parasite load or who are bothered by flies will not graze or convert feed efficiently. It is surprising how poorly calves will grow if they are bothered by flies in summer. Any inefficiency results in a lower ratio of weaned calves : GHG emitted.

Reproductive efficiencies have a huge impact on GHG.

14. There are expected progeny difference (EPD) statistics available for purebred cattle. EPDs inform us as we improve our herd. They suggest the genetic strengths and weaknesses of an animal compared to the dataset as a whole. You should know that the use of EPD data is currently widespread. Here are some useful traits that are reported for cows and bulls.
    - calving ease – knowing that a bull sires calves that are born without assistance prevents calf and cow mortality. Rationale is higher weaned calves : GHG emitted
    - milk production – in general, more efficient cattle on pasture are not heavy milk producers
    - relative feed efficiency (RFI) – does an animal grow but use less feed than other animals. Research in this area is extremely important
    - docility – bad tempered cows get culled because they cause problems…I select for “easy doers”. Having to cull cows early for any reason is an inefficiency that should be avoided. That being said, in some range conditions tough cows might be selected for due to pressure from predators. So this depends.
    - weaning weight, yearling weight, etc, etc there are many useful EPDs
15. All purebred bulls (Simmental) registered in Canada must have a DNA test. This results in genomic enhanced EPDs. This means that the bulls traits have the statistical strength of a bull with numerous progeny…even when he hasn’t even sired a calf yet. This is huge for GHG emissions, because cattle reproductive cycles normally require years to evaluate a bull. Compare this to poultry, where in a few months thousands of progeny can be evaluated. And so, the potential to breed for efficient cattle quickly is possible.
16. All cows should be pregnancy checked after breeding by a vet or ultrasound. The rationale is that if, for example 3 out of 100 cows are open, then they would otherwise be fed all winter and release GHG without weaning a calf. This is an avoidable GHG source.
17. Have a 100% weaning rate. Every calf that dies for any reason makes all of the cows GHG emissions a waste. This seems like a no brainer that if your rate is 95% then your farm has 5% avoidable GHG.
18. Use artificial insemination to take advantage of the best bulls available. Use “sexed semen” from your AI source…this allows you to choose heifer or bull calves which is a GHG efficiency if you think about it. Flush your best moderate framed cows and use surrogate cows to accelerate the breeding of efficient cattle.

Well Dr. Steingraber that’s all I have time for tonight…I could continue for hours. I hope this helps you get started with regenerative agriculture. At least the way I am doing it, it’s sort of eclectic and pragmatic.

Tom Franklin

Environmentalist Farmer Teacher Coach